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# Contents

Intell	ectual Property Rights	2
Forev	vord	2
Moda	al verbs terminology	2
	word	
1	Scope	
	•	
2	References	
3	Definitions, symbols and abbreviations	
3.1	Definitions	
3.2	Symbols	
3.3	Abbreviations	28
4	General	
4.1	Relationship between minimum requirements and test requirements	30
4.2	Applicability of minimum requirements	
4.3	Void	
4.3A	Applicability of minimum requirements (CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE	
	category M1, UE category NB1)	
4.4	RF requirements in later releases	31
5	Operating bands and channel arrangement	32
5.1	General	
5.2	Void	32
5.3	Void	32
5.4	Void	32
5.5	Operating bands	32
5.5A	Operating bands for CA	
5.5B	Operating bands for UL-MIMO	
5.5C	Operating bands for Dual Connectivity	
5.5D	Operating bands for ProSe	
5.5E	Operating bands for UE category 0 and UE category M1	
5.5F	Operating bands for NB-IoT	
5.6	Channel bandwidth	
5.6.1 5.6A	Channel bandwidth for CA	
5.6A.1	Channel bandwidth for CA	
5.6B	Channel bandwidth for UL-MIMO	
5.6B.1		
5.6C	Channel bandwidth for Dual Connectivity	
5.6C.1		
5.6D	Channel bandwidth for ProSe	
5.6D.		
5.6F	Channel bandwidth for category NB1	
5.7	Channel arrangement	
5.7.1	Channel spacing	73
5.7.1 <i>A</i>	A Channel spacing for CA	73
5.7.1F		
5.7.2	Channel raster	
5.7.2 <i>A</i>		
5.7.2F		
5.7.3	Carrier frequency and EARFCN	
5.7.3F		
5.7.4	TX-RX frequency separation	
5.7.4 <i>F</i> 5.7.4F		
J. I .4F	1 A-NA HEQUEICY SEPARATION FOR CATEGORY ND 1	/ /

Transmitter characteristics	77
General	77
Transmit power	78
Void	78
UE maximum output power	78
1 1 1	
Minimum requirement	127
	127
	127
UE Minimum output power for UL-MIMO	127
.1 Minimum requirement	128
Void	128
UE Minimum output power for ProSe	128
UE Minimum output power for category NB1	128
Transmit OFF power	128
. Minimum requirement	128
.1 Minimum requirement for CA	129
*	
<u>.</u>	
1 0 1	
	General Transmit power Void UE maximum output power for CA UE maximum output power for CA UE maximum output power for UL-MIMO Void UE maximum output power for ProSe UE maximum output power for Category MI UE UE maximum output power for category MI UE UE maximum output power for modulation / channel bandwidth for CA UE maximum output power for modulation / channel bandwidth for CA UE maximum output power for modulation / channel bandwidth for CA UE maximum output power for modulation / channel bandwidth for CA UE maximum output power for modulation / channel bandwidth for CA UE maximum output power for modulation / channel bandwidth for category MI UE maximum output power for modulation / channel bandwidth for category MI UE maximum output power with additional requirements. UE maximum output power with additional requirements for CA A-MPR for CA_NS_01 for CA_1C A-MPR for CA_NS_03 for CA_1C A-MPR for CA_NS_03 for CA_1C A-MPR for CA_NS_03 for CA_1C A-MPR for CA_NS_04 A-MPR for CA_NS_05 for CA_1C A-MPR for CA_NS_05 for CA_1C A-MPR for CA_NS_06 A-MPR for CA_NS_06 A-MPR for CA_NS_06 A-MPR for CA_NS_07 A-MPR for CA_NS_07 A-MPR for CA_NS_08 UE maximum output power with additional requirements for UL-MIMO UE maximum output power with additional requirements for CA_06 UE maximum output power with additional requirements for CA_07 Configured transmitted power for UL-MIMO Configured transmitted power for Dual Connectivity. Configured transmitted power for Dual

6.3.4A	ON/OFF time mask for CA	134
6.3.4B	ON/OFF time mask for UL-MIMO	
6.3.4D	ON/OFF time mask for ProSe	
6.3.4D.1	General time mask for ProSe	
6.3.4D.2	PSSS/SSSS time mask	
6.3.4D.3	PSSS / SSSS / PSBCH time mask	
6.3.4D.4	PSSCH / SRS time mask	
6.3.4F	ON/OFF time mask for category NB1	
6.3.4F.1	General ON/OFF time mask	
6.3.4F.2	NPRACH time mask	
6.3.5	Power Control	
6.3.5.1		
	Absolute power tolerance	
6.3.5.1.1	Minimum requirements	
6.3.5.2	Relative Power tolerance	
6.3.5.2.1	Minimum requirements	
6.3.5.3	Aggregate power control tolerance	
6.3.5.3.1	Minimum requirement	
6.3.5A	Power control for CA	
6.3.5A.1	Absolute power tolerance	
6.3.5A.1.1	1	
6.3.5A.2	Relative power tolerance	140
6.3.5A.2.1	Minimum requirements	140
6.3.5A.3	Aggregate power control tolerance	141
6.3.5A.3.1	Minimum requirements	141
6.3.5B	Power control for UL-MIMO	141
6.3.5D	Power Control for ProSe	141
6.3.5D.1	Absolute power tolerance	141
6.3.5F	Power Control for category NB1	
6.3.5F.1	Absolute power tolerance	
6.3.5F.2	Relative power tolerance	
	Void	
	Transmit signal quality	
6.5.1	Frequency error	
6.5.1A	Frequency error for CA	
6.5.1B	Frequency error for UL-MIMO	
6.5.1D	Frequency error for ProSe.	
6.5.1F	Frequency error for UE category NB1	
6.5.2	Transmit modulation quality	
6.5.2.1	Error Vector Magnitude	
6.5.2.1.1	Minimum requirement	
	1	
6.5.2.2	Carrier leakage	
6.5.2.2.1	Minimum requirements	
6.5.2.3	In-band emissions	
6.5.2.3.1	Minimum requirements	
6.5.2.4	EVM equalizer spectrum flatness	
6.5.2.4.1	Minimum requirements	
6.5.2A	Transmit modulation quality for CA	
6.5.2A.1	Error Vector Magnitude	
6.5.2A.2	Carrier leakage for CA	
6.5.2A.2.1	1	
6.5.2A.3	In-band emissions	
6.5.2A.3.1	1	
6.5.2B	Transmit modulation quality for UL-MIMO	
6.5.2B.1	Error Vector Magnitude	150
6.5.2B.2	Carrier leakage	
6.5.2B.3	In-band emissions	
6.5.2B.4	EVM equalizer spectrum flatness for UL-MIMO	
6.5.2D	Transmit modulation quality for ProSe	
6.5.2D.1	Error Vector Magnitude	
6.5.2D.2	Carrier leakage	
6.5.2D.3	In-band emissions	
6.5.2D.3	FVM equalizer spectrum flatness for ProSe	151

Transmit modulation quality for category M1  6.5.2E.1 Error Vector Magnitude  6.5.2E.2 Carrier leakage  6.5.2E.3 In-band emissions  6.5.2E.3.1 Minimum requirements  6.5.2E.3.1 Minimum requirements  6.5.2E.3 Iransmit modulation quality for Category NB1  6.5.2E.1 Error Vector Magnitude  6.5.2E.2 Carrier leakage  6.5.2E.3 In-band emissions  6.6.2 Carrier leakage  6.6.1 Occupied bandwidth  6.6.1A Occupied bandwidth for CA  6.6.1B Occupied bandwidth for UL-MIMO  6.6.1F Occupied bandwidth for category NB1  6.6.2 Out of band emission  6.6.2 Spectrum emission mask  6.6.2.1 Spectrum emission mask  6.6.2.1.1 Minimum requirement	
6.5.2E.2 Carrier leakage 6.5.2E.2.1 Minimum requirements 6.5.2E.3 In-band emissions 6.5.2E.3.1 Minimum requirements 6.5.2F Transmit modulation quality for Category NB1 6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.1 Spectrum emission mask	
6.5.2E.2.1 Minimum requirements 6.5.2E.3.1 In-band emissions 6.5.2E.3.1 Minimum requirements 6.5.2F Transmit modulation quality for Category NB1 6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2E.3 In-band emissions 6.5.2E.3.1 Minimum requirements 6.5.2F Transmit modulation quality for Category NB1 6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2E.3.1 Minimum requirements 6.5.2F Transmit modulation quality for Category NB1 6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2F Transmit modulation quality for Category NB1 6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2F.1 Error Vector Magnitude 6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2F.2 Carrier leakage 6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions 6.6.1 Occupied bandwidth 6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO 6.6.1F Occupied bandwidth for category NB1 6.6.2 Out of band emission 6.6.2.1 Spectrum emission mask	
6.5.2F.3 In-band emissions 6.6 Output RF spectrum emissions. 6.6.1 Occupied bandwidth	
6.6 Output RF spectrum emissions. 6.6.1 Occupied bandwidth	
6.6.1 Occupied bandwidth	
6.6.1A Occupied bandwidth for CA 6.6.1B Occupied bandwidth for UL-MIMO	154 154
6.6.1B Occupied bandwidth for UL-MIMO	154
6.6.1F Occupied bandwidth for category NB1	
6.6.2 Out of band emission	155
6.6.2.1 Spectrum emission mask	133
	155
	155
6.6.2.1A Spectrum emission mask for CA	
6.6.2.2 Additional spectrum emission mask	
6.6.2.2.1 Minimum requirement (network signalled value "NS_03", "NS_11", "NS_20	
6.6.2.2.2 Minimum requirement (network signalled value "NS_04")	
6.6.2.2.3 Minimum requirement (network signalled value "NS_06" or "NS_07")	
6.6.2.2A Additional Spectrum Emission Mask for CA	
6.6.2.2A.1 Minimum requirement (network signalled value "CA_NS_04")	
6.6.2.3 Adjacent Channel Leakage Ratio	
6.6.2.3.1 Minimum requirement E-UTRA	
6.6.2.3.1A Void	
6.6.2.3.1Aa Void	
6.6.2.3.2 Minimum requirements UTRA	
6.6.2.3.2A Minimum requirement UTRA for CA	
6.6.2.3.3A Minimum requirements for CA E-UTRA	
6.6.2.4 Void	
6.6.2.4.1 Void	163
6.6.2A Void	163
6.6.2B Out of band emission for UL-MIMO	163
6.6.2C Void	163
6.6.2D Out of band emission for ProSe	163
6.6.2F Out of band emission for category NB1	164
6.6.2F.1 Spectrum emission mask	164
1	
6.6.2F.2 Void	164
6.6.2F.2 Void	164 164
6.6.2F.2 Void	
6.6.2F.2Void6.6.2F.3Adjacent Channel Leakage Ratio for category NB16.6.3Spurious emissions6.6.3.1Minimum requirements6.6.3.1AMinimum requirements for CA6.6.3.2Spurious emission band UE co-existence6.6.3.2ASpurious emission band UE co-existence for CA6.6.3.3Additional spurious emissions6.6.3.3.1Minimum requirement (network signalled value "NS_05")6.6.3.3.2Minimum requirement (network signalled value "NS_08")6.6.3.3.3Minimum requirement (network signalled value "NS_09")6.6.3.3.4Minimum requirement (network signalled value "NS_09")6.6.3.3.5Minimum requirement (network signalled value "NS_12")6.6.3.3.6Minimum requirement (network signalled value "NS_13")6.6.3.3.7Minimum requirement (network signalled value "NS_13")6.6.3.3.8Minimum requirement (network signalled value "NS_14")6.6.3.3.9Minimum requirement (network signalled value "NS_15")Minimum requirement (network signalled value "NS_16")	
6.6.2F.2 Void	
6.6.2F.2 Void	
6.6.2F.2Void	
6.6.2F.2 Void	

6.6.3.3.15	1 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
6.6.3.3.16	1 \ \ \ \ \ = /	
6.6.3.3.17	1 \ - /	
6.6.3.3.18		
6.6.3.3.19	1	
6.6.3.3.20	1 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
6.6.3.3.21	1 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
6.6.3.3.22	2 Minimum requirement (network signalled value "NS_26")	186
6.6.3.3A	Additional spurious emissions for CA	
6.6.3.3A.		
6.6.3.3A.		187
6.6.3.3A.	Minimum requirement for CA_1C (network signalled value "CA_NS_03")	187
6.6.3.3A.	4 Minimum requirement for CA_38C (network signalled value "CA_NS_05")	188
6.6.3.3A.:		188
6.6.3.3A.	6 Minimum requirement for CA_39C and CA_39C-41A (network signalled value "CA_NS_07")	188
6.6.3.3A.		
6.6.3A	Void	
6.6.3B	Spurious emission for UL-MIMO	
6.6.3C	Void	
6.6.3D	Spurious emission for ProSe	
6.6.3F	Spurious emission for category NB1	
6.6A	Void	
6.6B	Void	
6.7	Transmit intermodulation	
6.7.1	Minimum requirement	
6.7.1A	Minimum requirement for CA	
6.7.1B	Minimum requirement for UL-MIMO.	
6.7.1F	Minimum requirement for category NB1	
6.8	Void	
6.8.1	Void	
6.8A	Void	
6.8B	Time alignment error for UL-MIMO	
6.8B.1	Minimum Requirements	
	•	
	eceiver characteristics	
7.1	General	
7.2	Diversity characteristics	
7.3	Reference sensitivity power level	
7.3.1	Minimum requirements (QPSK)	
7.3.1A	Minimum requirements (QPSK) for CA	
7.3.1B	Minimum requirements (QPSK) for UL-MIMO	
7.3.1D	Minimum requirements (QPSK) for ProSe	
7.3.1E	Minimum requirements (QPSK) for UE category 0 and M1	
7.3.1F	Minimum requirements for UE category NB1	
7.3.1F.1	Reference sensitivity for UE category NB1	
7.3.1F.2	Sensitivity with repetitions for UE category NB1	
7.3.2	Void	
7.4	Maximum input level	
7.4.1	Minimum requirements	
7.4.1A	Minimum requirements for CA	
7.4.1B	Minimum requirements for UL-MIMO	
7.4.1D	Minimum requirements for ProSe	
7.4.1F	Minimum requirements for category NB1	
7.4A	Void	
7.4A.1	Void	
7.5	Adjacent Channel Selectivity (ACS)	
7.5.1	Minimum requirements	
7.5.1A	Minimum requirements for CA	
7.5.1B	Minimum requirements for UL-MIMO	257
7.5.1D	Minimum requirements for ProSe	257
7.5.1F	Minimum requirements for category NB1	257

7.6	Blocking characteristics	
7.6.1	In-band blocking	258
7.6.1.1	Minimum requirements	
7.6.1.1A	Minimum requirements for CA	259
7.6.1.1D	Minimum requirements for ProSe	
7.6.1.1F	Minimum requirements for category NB1	
7.6.2	Out-of-band blocking	
7.6.2.1	Minimum requirements	
7.6.2.1A	Minimum requirements for CA	
7.6.2.1D	Minimum requirements for ProSe	
7.6.2.1F	Minimum requirements for category NB1	
7.6.3	Narrow band blocking	
7.6.3.1	Minimum requirements	
7.6.3.1A	Minimum requirements for CA	
7.6.3.1D	Minimum requirements for ProSe	
7.6A	Void	
7.6B	Blocking characteristics for UL-MIMO	
7.7	Spurious response	
7.7.1	Minimum requirements	
7.7.1A	Minimum requirements for CA	
7.7.1B	Minimum requirements for UL-MIMO	
7.7.1D	Minimum requirements for ProSe	
7.7.1F	Minimum requirements for UE category NB1	
7.8	Intermodulation characteristics	
7.8.1	Wide band intermodulation	
7.8.1.1	Minimum requirements	
7.8.1A	Minimum requirements for CA	
7.8.1B	Minimum requirements for UL-MIMO	
7.8.1D	Minimum requirements for ProSe	
7.8.1F	Minimum requirements for category NB1	
7.8.2	Void	
7.9	Spurious emissions	
7.9.1	Minimum requirements	
7.9.1A	Minimum requirements	
7.10	Receiver image	
7.10.1	Void	
7.10.1A	Minimum requirements for CA	281
8 Pe	erformance requirement	282
8.1	General	
8.1.1	Receiver antenna capability	
8.1.1.1	Simultaneous unicast and MBMS operations	
8.1.1.2	Dual-antenna receiver capability in idle mode	
8.1.2	Applicability of requirements	
8.1.2.1	Applicability of requirements for different channel bandwidths	
8.1.2.2	Definition of CA capability	
8.1.2.2A	Definition of dual connectivity capability	
8.1.2.3	Applicability and test rules for different CA configurations and bandwidth combination sets	
8.1.2.3A	Applicability and test rules for different dual connectivity configuration and bandwidth	
	combination set	289
8.1.2.3B	Applicability and test rules for different TDD-FDD CA configurations and bandwidth	
	combination sets	290
8.1.2.4	Test coverage for different number of component carriers	
8.1.2.5	Applicability of performance requirements for Type B receiver	
8.1.2.6	Applicability of performance requirements for 4Rx capable UEs	
8.1.2.6.1	Applicability rule and antenna connection for single carrier tests with 2Rx	
8.1.2.6.2	Applicability rule and antenna connection for CA and DC tests with 2Rx	
8.1.2.6.3	Applicability rule and antenna connection for single carrier tests with 4Rx	
8.1.2.6.4	Applicability rule for 256QAM tests	
8.1.2.7	Applicability of Enhanced Downlink Control Channel Performance Requirements	
8.1.3	UE category and UE DL category	
8.2	Demodulation of PDSCH (Cell-Specific Reference Symbols)	294

8.2.1	FDD (Fixed Reference Channel)	
8.2.1.1	Single-antenna port performance	295
8.2.1.1.1	Minimum Requirement	295
8.2.1.1.2	Void	300
8.2.1.1.3	Void	300
8.2.1.1.4	Minimum Requirement 1 PRB allocation in presence of MBSFN	300
8.2.1.2	Transmit diversity performance	
8.2.1.2.1	Minimum Requirement 2 Tx Antenna Port	
8.2.1.2.2	Minimum Requirement 4 Tx Antenna Port	
8.2.1.2.3	Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)	
8.2.1.2.3A	Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)	
8.2.1.2.4	Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model	
8.2.1.2.5	Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model	
8.2.1.2.6	Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model	
8.2.1.3	Open-loop spatial multiplexing performance	
8.2.1.3.1	Minimum Requirement 2 Tx Antenna Port	
8.2.1.3.1B	Enhanced Performance Requirement Type C –2Tx Antenna Ports	
8.2.1.3.1C	Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference	
8.2.1.3.1	Minimum Requirement 4 Tx Antenna Port	
8.2.1.3.3	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)	
8.2.1.3.4	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)	
8.2.1.4	Closed-loop spatial multiplexing performance	
8.2.1.4.1	Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port	
8.2.1.4.1A	Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port	
8.2.1.4.1B	Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx  Antenna Port with TM4 interference model	
8.2.1.4.1C	Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)	
8.2.1.4.1D	Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx  Antenna Port with TM4 interference model	
8.2.1.4.1E	Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports with CRS assistance information	
8.2.1.4.2	Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port	330
8.2.1.4.2A	Enhanced Performance Requirement Type C – Multi-layer Spatial Multiplexing 2Tx Antenna Ports	
8.2.1.4.3	Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port	
8.2.1.4.3A	Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity	
8.2.1.5	MU-MIMO	
8.2.1.6	[Control channel performance: D-BCH and PCH]	
8.2.1.7	Carrier aggregation with power imbalance	
8.2.1.7.1	Minimum Requirement	
8.2.1.8	Intra-band non-contiguous carrier aggregation with timing offset	
8.2.1.8.1	Minimum Requirement	
8.2.2	TDD (Fixed Reference Channel)	
8.2.2.1	Single-antenna port performance	
8.2.2.1.1	Minimum Requirement	
8.2.2.1.1	Void	
8.2.2.1.3	Void	
8.2.2.1.4	Minimum Requirement 1 PRB allocation in presence of MBSFN	
8.2.2.2	Transmit diversity performance	
8.2.2.2.1	Minimum Requirement 2 Tx Antenna Port	
8.2.2.2.2 8.2.2.2.3	Minimum Requirement 4 Tx Antenna Port	544
0.2.2.2.3	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)	345

8.2.2.2.3A	1 66	
	cell ABS and CRS assistance information are configured)	346
8.2.2.2.4	Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference	246
00005	model	348
8.2.2.2.5	Minimum Requirement 2 Tx Antenna Port (when EIMTA-MainConfigServCell-r12 is	250
8.2.2.2.6	configured)	330
8.2.2.2.0	model	350
8.2.2.2.7	Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference	550
0.2.2.7	model	352
8.2.2.3	Open-loop spatial multiplexing performance	
8.2.2.3.1	Minimum Requirement 2 Tx Antenna Port	
8.2.2.3.1A	<u>*</u>	
8.2.2.3.1B	· ·	
8.2.2.3.1C		
8.2.2.3.2	Minimum Requirement 4 Tx Antenna Port	
8.2.2.3.3	Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor	
	cell ABS)	358
8.2.2.3.4	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	
	cell ABS and CRS assistance information are configured)	
8.2.2.4	Closed-loop spatial multiplexing performance	
8.2.2.4.1	Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port	
8.2.2.4.1A		363
8.2.2.4.1B		266
0 2 2 4 10	Antenna Port with TM4 interference model	
8.2.2.4.1C	subframe overlaps with aggressor cell ABS and CRS assistance information are configured)	
8.2.2.4.1D	1 66	307
0.2.2.4.1D	Antenna Port with TM4 interference model	360
8.2.2.4.1E		507
0.2.2.4.12	assistance information	371
8.2.2.4.2	Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port	
8.2.2.4.2A		
	Port	373
8.2.2.4.3	Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port	
8.2.2.4.3A	Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual	
	connectivity	377
8.2.2.4.4	Void	
8.2.2.5	MU-MIMO	
8.2.2.6	[Control channel performance: D-BCH and PCH]	
8.2.2.7	Carrier aggregation with power imbalance	
8.2.2.7.1	Minimum Requirement	
8.2.2.8	Intra-band contiguous carrier aggregation with minimum channel spacing	
8.2.2.8.1	Minimum Requirement	
8.2.3	TDD FDD CA (Fixed Reference Channel)	
8.2.3.1	Single-antenna port performance	
8.2.3.1.1	Minimum Requirement for FDD PCell	
8.2.3.1.2 8.2.3.2	Minimum Requirement for TDD PCell  Open-loop spatial multiplexing performance 2Tx Antenna port	
8.2.3.2.1	Minimum Requirement for FDD PCell	
8.2.3.2.1 8.2.3.2.1A	1	
8.2.3.2.1 <i>A</i>	Minimum Requirement for TDD PCell	
8.2.3.2.2A		
8.2.3.2.2 <i>A</i>	Closed-loop spatial multiplexing performance 4Tx Antenna Port	
8.2.3.3.1	Minimum Requirement for FDD PCell	
8.2.3.3.2	Minimum Requirement for TDD PCell	
8.2.3.4	Minimum Requirement for Closed-loop spatial multiplexing performance 4Tx Antenna Port for	
= : -	dual connectivity	400
8.3	Demodulation of PDSCH (User-Specific Reference Symbols)	
8.3.1	FDD	402
8.3.1.1	Single-layer Spatial Multiplexing	402

8.3.1.1A	Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9	404
8.3.1.1B	interference model	404
6.5.1.1 <b>D</b>	CRS assistance information are configured)	406
8.3.1.1C	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9	+00
6.5.1.1C	interference model	408
8.3.1.1D	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS	+00
0.5.1.1D	interference model	410
8.3.1.1E	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3	71(
0.3.1.12	interference model	411
8.3.1.1F	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10	711
0.3.1.11	serving cell configuration and TM9 interference model	412
8.3.1.1G	Single-layer Spatial Multiplexing (CRS assistance information is configured)	
8.3.1.2	Dual-Layer Spatial Multiplexing	
8.3.1.2A	Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing	
8.3.1.3	Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports	
8.3.1.3.1	Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)	
8.3.1.3.2	Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)	
8.3.1.3.3	Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS	720
0.3.1.3.3	resource)	422
8.3.1.3.4	Minimum requirement with Different Cell ID and non-colliding CRS (with single NZP CSI-	422
6.5.1.5.4	RS resource and CRS assistance information is configured)	12/
8.3.1.3.5	Minimum requirements with different Cell ID and non-colliding CRS (with multiple NZP	424
0.3.1.3.3	CSI-RS resources and CRS assistance information is configured)	126
8.3.2	TDD	
8.3.2.1	Single-layer Spatial Multiplexing	
8.3.2.1A		
8.3.2.1A 8.3.2.1B	Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)	431
8.3.2.1D	Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9	122
0 2 2 1 0	interference model	433
8.3.2.1C	Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and	125
0 2 2 1 D	CRS assistance information are configured)	433
8.3.2.1D	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9	125
0 2 2 1E	interference	437
8.3.2.1E	interference model	120
0 2 2 1E	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3	435
8.3.2.1F	interference	441
02210	Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10	441
8.3.2.1G		4.40
8.3.2.1H	serving cell configuration and TM9 interference model	
	Single-layer Spatial Multiplexing (CRS assistance information is configured)	
8.3.2.2	Dual-Layer Spatial Multiplexing	
8.3.2.2A	Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing	
8.3.2.3	Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)	
8.3.2.4	Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports	
8.3.2.4.1	Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)	
8.3.2.4.2	Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)	450
8.3.2.4.3	Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS	450
00011	resource)	452
8.3.2.4.4	Minimum requirement with Different Cell ID and non-Colliding CRS (with single NZP CSI-	
	RS resource and CRS assistance information is configured)	454
8.3.2.4.5	Minimum requirements with different Cell ID and non-colliding CRS (with multiple NZP	
0.4	CSI-RS resources and CRS assistance information is configured)	
8.4	Demodulation of PDCCH/PCFICH	
8.4.1	FDD	
8.4.1.1	Single-antenna port performance	
8.4.1.2	Transmit diversity performance	
8.4.1.2.1	Minimum Requirement 2 Tx Antenna Port	
8.4.1.2.2	Minimum Requirement 4 Tx Antenna Port	
	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)	460
8.4.1.2.4	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	
	cell ABS and CRS assistance information are configured)	464

8.4.1.2.5	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port	
	under Asynchronous Network	.468
8.4.1.2.6	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port	
	with Non-Colliding CRS Dominant Interferer	.469
8.4.1.2.7	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Colliding CRS Dominant Interferer	470
8.4.1.2.8	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port	
0.4.1.2.0	with Non-Colliding CRS Dominant Interferer	.471
8.4.2	TDD	
8.4.2.1	Single-antenna port performance	.473
8.4.2.2	Transmit diversity performance	.473
8.4.2.2.1	Minimum Requirement 2 Tx Antenna Port	.473
8.4.2.2.2	Minimum Requirement 4 Tx Antenna Port	
8.4.2.2.3	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	
8.4.2.2.4	cell ABS)	.4/4
0.4.2.2.4	cell ABS and CRS assistance information are configured)	179
01225	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port	.4/0
8.4.2.2.5	with Colliding CRS Dominant Interferer	.482
8.4.2.2.6	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port	
0.1.2.2.0	with Non-Colliding CRS Dominant Interferer	483
8.4.2.2.7	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port	. 402
0.4.2.2.7	with Colliding CRS Dominant Interferer	.484
8.4.2.2.8	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port	
	with Non-Colliding CRS Dominant Interferer	.485
8.5	Demodulation of PHICH.	
8.5.1	FDD	
8.5.1.1	Single-antenna port performance	
8.5.1.2	Transmit diversity performance	
8.5.1.2.1	Minimum Requirement 2 Tx Antenna Port	
8.5.1.2.1	Minimum Requirement 4 Tx Antenna Port	
		.40/
8.5.1.2.3	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)	107
8.5.1.2.4	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	.407
0.3.1.2.4	cell ABS and CRS assistance information are configured)	100
05105	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna	.40>
8.5.1.2.5	Ports under Asynchronous Network	401
05106	·	.491
8.5.1.2.6	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna	400
0.5.1.0.7	Ports with Non-Colliding CRS Dominant Interferer	.492
8.5.1.2.7	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna	400
	Ports with Colliding CRS Dominant Interferer	.493
8.5.1.2.8	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna	
	Ports with Non-Colliding CRS Dominant Interferer	
8.5.2	TDD	
8.5.2.1	Single-antenna port performance	
8.5.2.2	Transmit diversity performance	
8.5.2.2.1	Minimum Requirement 2 Tx Antenna Port	.496
8.5.2.2.2	Minimum Requirement 4 Tx Antenna Port	.497
8.5.2.2.3	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	
	cell ABS)	.497
8.5.2.2.4	Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor	
	cell ABS and CRS assistance information are configured)	.499
8.5.2.2.5	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna	
	Ports with Colliding CRS Dominant Interferer	.501
8.5.2.2.6	Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna	
	Ports with Non-Colliding CRS Dominant Interferer	.502
8.5.2.2.7	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna	
	Ports with Colliding CRS Dominant Interferer	.503
8.5.2.2.8	Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna	
	Ports with Non-Colliding CRS Dominant Interferer	.504
8.6	Demodulation of PBCH	
8.6.1	FDD	

8.6.1.1	Single-antenna port performance	505
8.6.1.2	Transmit diversity performance	506
8.6.1.2.1	Minimum Requirement 2 Tx Antenna Port	506
8.6.1.2.2	Minimum Requirement 4 Tx Antenna Port	506
8.6.1.2.3	Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource	
	Restriction with CRS Assistance Information	
8.6.2	TDD	
8.6.2.1	Single-antenna port performance	
8.6.2.2	Transmit diversity performance	
8.6.2.2.1 8.6.2.2.2	Minimum Requirement 2 Tx Antenna Port	
8.6.2.2.3	Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource	500
0.0.2.2.3	Restriction with CRS Assistance Information	500
8.7	Sustained downlink data rate provided by lower layers	
8.7.1	FDD (single carrier and CA).	
8.7.2	TDD (single carrier and CA)	
8.7.3	FDD (EPDCCH scheduling)	
8.7.4	TDD (EPDCCH scheduling)	
8.7.5	TDD FDD CA	
8.7.5.1	Minimum Requirement FDD PCell	523
8.7.5.2	Minimum Requirement TDD PCell	527
8.7.6	FDD (DC)	
8.7.7	TDD (DC)	
8.7.8	TDD FDD (DC)	
8.8	Demodulation of EPDCCH	
8.8.1	Distributed Transmission	
8.8.1.1	FDD	
8.8.1.1.1 8.8.1.2	Void	
8.8.1.2.1	TDD Void	
8.8.2	Localized Transmission with TM9	
8.8.2.1	FDD	
8.8.2.1.1	Void	
8.8.2.1.2	Void	
8.8.2.2	TDD	
8.8.2.2.1	Void	
8.8.2.2.2	Void	545
8.8.3	Localized transmission with TM10 Type B quasi co-location type	545
8.8.3.1	FDD	545
8.8.3.2	TDD	
8.8.4	Enhanced Downlink Control Channel Performance Requirements Type A - Localized Transmission	
	with CRS Interference Model	
8.8.4.1	FDD	
8.8.4.2	TDD	550
8.8.5	Enhanced Downlink Control Channel Performance Requirements Type A - Distributed	
0051	Transmission with TM9 Interference Model	
8.8.5.1	TDD Enhanced Downlink Control Channel Performance Requirements Type A - Distributed	332
8.8.6	Transmission with TM3 Interference Model	553
8.8.6.1	FDD	
8.9	Demodulation (single receiver antenna).	
8.9.1	PDSCH	
8.9.1.1	FDD and half-duplex FDD (Fixed Reference Channel)	
8.9.1.1.1	Transmit diversity performance (Cell-Specific Reference Symbols)	
8.9.1.1.2	Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)	
8.9.1.1.3	Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)	
8.9.1.2	TDD (Fixed Reference Channel)	
8.9.1.2.1	Transmit diversity performance (Cell-Specific Reference Symbols)	
8.9.1.2.2	Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)	
8.9.1.2.3	Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)	
8.9.2	PHICH	
8921	FDD and half-dupley FDD	560

8.9.2.1.1	Transmit diversity performance	.560
8.9.2.2	TDD	
8.9.2.2.1	Transmit diversity performance	
8.9.3	PBCH	
8.9.3.1	FDD and half-duplex FDD	
8.9.3.1.1	Transmit diversity performance	
8.9.3.2	TDD	
8.9.3.2.1	Transmit diversity performance	
8.10	Demodulation (4 receiver antenna ports)	
8.10.1	PDSCH	
8.10.1.1	FDD (Fixed Reference Channel)	
8.10.1.1 8.10.1.1.1	Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)	
8.10.1.1.2		
0.10.1.1.2	Reference Symbols)	562
8.10.1.1.3	Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-	
0.10.1.1.0	Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific	
	Reference Symbols)	563
8.10.1.1.4	•	
0.10.1.1.	Antenna Port (Cell-Specific Reference Symbols)	564
8.10.1.1.5		.50 .
0.10.1.1.5	interference model (User-Specific Reference Symbols)	564
8.10.1.1.6	• • • • • • • • • • • • • • • • • • • •	
8.10.1.1.7	Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific	.507
0.10.1.1.7	Reference Symbols)	569
8.10.1.1.8	•	.507
0.10.1.1.0	(Cell-Specific Reference Symbols)	569
8.10.1.1.9		
8.10.1.1. <i>9</i> 8.10.1.2	TDD (Fixed Reference Channel)	
8.10.1.2.1	Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)	
8.10.1.2.1 8.10.1.2.2	• • • • • • • • • • • • • • • • • • • •	.512
0.10.1.2.2	Reference Symbols)	573
8.10.1.2.3	Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-	.575
0.10.1.2.3	Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific	
	Reference Symbols)	573
8.10.1.2.4	•	.575
0.10.1.2.4	Antenna Ports (Cell-Specific Reference Symbols)	57/
8.10.1.2.5		.574
0.10.1.2.3	interference model (User-Specific Reference Symbols)	575
8.10.1.2.6	• • • • • • • • • • • • • • • • • • • •	
8.10.1.2.0 8.10.1.2.7	Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific	.511
0.10.1.2.7	Reference Symbols)	570
8.10.1.2.8		
8.10.1.2.8 8.10.1.2.9	4 Layer Spatial Multiplexing (User-Specific Reference Symbols)	
8.10.1.2. <i>9</i> 8.10.2	PDCCH/PCFICH	
8.10.2.1	FDD	
8.10.2.1 8.10.2.1.1		
8.10.2.1.1 8.10.2.1.2	Single-antenna port performance	.302
0.10.2.1.2	Transmit diversity performance with 2 Ty Antonne Ports	500
8.10.2.1.3	Transmit diversity performance with 4 Tx Antenna Ports	.582
8.10.2.1.3 8.10.2.2	Transmit diversity performance with 4 Tx Antenna Ports	.582 .583
8.10.2.1.3 8.10.2.2 8.10.2.2.1	Transmit diversity performance with 4 Tx Antenna Ports	.582 .583 .583
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2	Transmit diversity performance with 4 Tx Antenna Ports	.582 .583 .583
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3	Transmit diversity performance with 4 Tx Antenna Ports  TDD	.582 .583 .583 .583
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH	.582 .583 .583 .583 .584
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3 8.10.3.1	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD.	.582 .583 .583 .584 .584
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3 8.10.3.1 8.10.3.1.1	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance	.582 .583 .583 .584 .584 .584
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3.1 8.10.3.1.1 8.10.3.1.1	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports	.582 .583 .583 .584 .584 .584 .584
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3.3 8.10.3.1.1 8.10.3.1.2 8.10.3.1.3	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports	.582 .583 .583 .584 .584 .584 .584 .585
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3 8.10.3.1 8.10.3.1.1 8.10.3.1.2 8.10.3.1.3	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  TDD	.582 .583 .583 .584 .584 .584 .585 .585
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3.1 8.10.3.1.1 8.10.3.1.2 8.10.3.1.3 8.10.3.2 8.10.3.2	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single Tx Antenna Port performance	.582 .583 .583 .584 .584 .584 .585 .585
8.10.2.1.3 8.10.2.2 8.10.2.2.1 8.10.2.2.2 8.10.2.2.3 8.10.3 8.10.3.1 8.10.3.1.1 8.10.3.1.2 8.10.3.1.3	Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single-antenna port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  PHICH  FDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  Transmit diversity performance with 4 Tx Antenna Ports  TDD  Single Tx Antenna Port performance  Transmit diversity performance with 2 Tx Antenna Ports	.582 .583 .583 .584 .584 .584 .585 .585 .586

8.10.4.1	Distributed Transmission with 4Rx	587
8.10.4.1.1	FDD	587
8.10.4.1.2	TDD	588
8.10.4.2	Localized Transmission with TM9 and 4Rx	589
8.10.4.2.1		
8.10.4.2.2		
8.11	Demodulation (UE supporting coverage enhancement)	
8.11.1	PDSCH	
8.11.1.1	FDD and half-duplex FDD (Fixed Reference Channel)	
8.11.1.1		
8.11.1.2	TDD (Fixed Reference Channel)	392
8.11.1.2.1		
8.11.2	MPDCCH	
8.11.2.1	FDD and half-duplex FDD	
8.11.2.1.1		
8.11.2.2	TDD	
8.11.2.2.1		
8.11.3	PBCH	
8.11.3.1	FDD and half-duplex FDD	
8.11.3.1.1	<b>√</b> 1	
8.11.3.2	TDD	597
8.11.3.2.1	Transmit diversity performance	597
9 Re	eporting of Channel State Information	500
9.1	General	
9.1.1	Applicability of requirements	
9.1.1.1	Applicability of requirements for different channel bandwidths	
9.1.1.2	Applicability and test rules for different CA configurations and bandwidth combination sets	598
9.1.1.2A	Applicability and test rules for different TDD-FDD CA configurations and bandwidth	<b>=</b> 0.6
	combination sets	
9.1.1.3	Test coverage for different number of componenet carriers	
9.1.1.4	Applicability of performance requirements for 4Rx capable UEs	
9.1.1.4.1	Applicability rule and antenna connection for single carrier tests with 2Rx	
9.1.1.4.2	Applicability rule and antenna connection for CA and DC tests with 2Rx	
9.1.1.4.3	Applicability rule and antenna connection for single carrier tests with 4Rx	
9.2	CQI reporting definition under AWGN conditions	601
9.2.1	Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)	601
9.2.1.1	FDD	601
9.2.1.2	TDD	602
9.2.1.3	FDD (CSI measurements in case two CSI subframe sets are configured)	603
9.2.1.4	TDD (CSI measurements in case two CSI subframe sets are configured)	605
9.2.1.5	FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance	
	information)	607
9.2.1.6	TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance	
,	information)	609
9.2.1.7	FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)	
9.2.1.8	TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)	
9.2.2	Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)	
9.2.2.1	FDD	
9.2.2.1	TDD	
9.2.2.2	Minimum requirement PUCCH 1-1 (CSI Reference Symbols)	
9.2.3	1 ' '	
	FDD.	
9.2.3.2	TDD	
9.2.4	Minimum requirement PUCCH 1-1 (With Single CSI Process)	
9.2.4.1	FDD.	
9.2.4.2	TDD	619
9.2.5	Minimum requirement PUCCH 1-1 (when csi-SubframeSet –r12 and EIMTA-MainConfigServCell-	
	r12 are configured)	
9.3	CQI reporting under fading conditions	
9.3.1	Frequency-selective scheduling mode	
9.3.1.1	Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)	
9.3.1.1.1	FDD	623

9.3.1.1.2	TDD	624
9.3.1.1.3	FDD (CSI measurements in case two CSI subframe sets are configured and with CRS	
	assistance information)	625
9.3.1.1.4	TDD (CSI measurements in case two CSI subframe sets are configured and with CRS	
	assistance information)	
9.3.1.1.5	TDD (when <i>csi-SubframeSet –r12</i> is configured)	630
9.3.1.2	Minimum requirement PUSCH 3-1 (CSI Reference Symbol)	
9.3.1.2.1	FDD	
9.3.1.2.2	TDD	
9.3.1.2.3	FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)	
9.3.1.2.4	TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)	
9.3.1.2.5	Void	
9.3.1.2.6	TDD (when <i>csi-SubframeSet –r12</i> is configured with one CSI process)	
9.3.2	Frequency non-selective scheduling mode	
9.3.2.1	Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)	
9.3.2.1.1	FDD	640
9.3.2.1.2	TDD	
9.3.2.2	Minimum requirement PUCCH 1-1 (CSI Reference Symbol)	
9.3.2.2.1	FDD	
9.3.2.2.2	TDD	
9.3.3	Frequency-selective interference	
9.3.3.1	Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)	
9.3.3.1.1	FDD	
9.3.3.1.2	TDD	
9.3.3.2	Void	
9.3.3.2.1	Void	649
9.3.3.2.2	Void	649
9.3.4	UE-selected subband CQI	
9.3.4.1	Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)	649
9.3.4.1.1	FDD	649
9.3.4.1.2	TDD	650
9.3.4.2	Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)	
9.3.4.2.1	FDD	
9.3.4.2.2	TDD	
9.3.5	Additional requirements for enhanced receiver Type A	
9.3.5.1	Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)	
9.3.5.1.1	FDD	
9.3.5.1.2	TDD	
9.3.5.2	Minimum requirement PUCCH 1-1 (CSI Reference Symbol)	658
9.3.5.2.1	FDD	658
9.3.5.2.2	TDD	
9.3.6	Minimum requirement (With multiple CSI processes)	662
9.3.6.1	FDD	
9.3.6.2	TDD	
9.3.7	Minimum requirement PUSCH 3-2	669
9.3.7.1	FDD	669
9.3.7.2	TDD	
9.3.8	Additional requirements for enhanced receiver Type B	
9.3.8.1	Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)	
9.3.8.1.1	FDD	
9.3.8.1.2	TDD	
9.3.8.2	Minimum requirement PUCCH 1-1 (CSI Reference Symbols)	
9.3.8.2.1	FDD	
9.3.8.2.2	TDD	
9.3.8.3	Minimum requirement with CSI process	
9.3.8.3.1	FDD	
9.3.8.3.2	TDD	
9.4	Reporting of Precoding Matrix Indicator (PMI)	
9.4.1	Single PMI	
9.4.1.1	Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)	
9.4.1.1.1	FDD	
9/11/2	TDD	685

9.4.1.2	Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)	
9.4.1.2.1	FDD	
9.4.1.2.2	TDD	
9.4.1.3	Minimum requirement PUSCH 3-1 (CSI Reference Symbol)	
9.4.1.3.1	FDD	
9.4.1.3.2	TDD	
9.4.1.3.3	FDD (with Class A 12Tx codebook)	
9.4.1.3.4	TDD (with Class A 12Tx codebook)	
9.4.1.4 9.4.1.4.1	FDD (with 4Tx enhanced codebook)	
9.4.1.4.1	TDD (with 4Tx enhanced codebook)	
9.4.1.4.3	FDD (with Class B alternative codebook for one CSI-RS resource configured)	
9.4.1.4.4	TDD (with Class B alternative codebook for one CSI-RS resource configured)	
9.4.1a	Void	
9.4.1a.1	Void	
9.4.1a.1.1	Void	704
9.4.1a.1.2	Void	704
9.4.2	Multiple PMI	704
9.4.2.1	Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)	
9.4.2.1.1	FDD	
9.4.2.1.2	TDD	
9.4.2.2	Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)	
9.4.2.2.1	FDD	
9.4.2.2.2	TDD	
9.4.2.3	Minimum requirement PUSCH 1-2 (CSI Reference Symbol)	
9.4.2.3.1	FDD	
9.4.2.3.2	TDD.	
9.4.2.3.3 9.4.2.3.4	FDD (with 4Tx enhanced codebook)	
9.4.2.3.4	FDD (with Class A 16Tx codebook)	
9.4.2.3.6	TDD (with Class A 16Tx codebook)	
9.4.3	Void	
9.4.3.1	Void	
9.4.3.1.1	Void	
9.4.3.1.2	Void	
9.5	Reporting of Rank Indicator (RI)	
9.5.1	Minimum requirement (Cell-Specific Reference Symbols)	
9.5.1.1	FDD	720
9.5.1.2	TDD	
9.5.2	Minimum requirement (CSI Reference Symbols)	
9.5.2.1	FDD	
9.5.2.2	TDD	
9.5.3	Minimum requirement (CSI measurements in case two CSI subframe sets are configured)	
9.5.3.1	FDD	
9.5.3.2	TDD	/28
9.5.4	Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)	720
9.5.4.1	FDD	
9.5.4.1	TDD	
9.5.5	Minimum requirement (with CSI process)	
9.5.5.1	FDD	
9.5.5.2	TDD	
9.6	Additional requirements for carrier aggregation	
9.6.1	Periodic reporting on multiple cells (Cell-Specific Reference Symbols)	
9.6.1.1	FDD	
9.6.1.2	TDD	742
9.6.1.3	TDD-FDD CA with FDD PCell	
9.6.1.4	TDD-FDD CA with TDD PCell	
9.7	CSI reporting (Single receiver antenna)	
9.7.1	CQI reporting definition under AWGN conditions	
9.7.1.1	FDD and half-duplex FDD	
9.7.1.2	TDD	752

9.7.2	CQI reporting under fading conditions	
9.7.2.1		753
9.7.2.2		
9.8	CSI reporting (UE supporting coverage enhancement)	755
9.8.1	CQI reporting definition under AWGN conditions	755
9.8.1.1	FDD and half-duplex FDD.	755
9.8.1.2		
9.9	CSI reporting for 4Rx UE	757
9.9.1	CQI reporting definition under AWGN conditions	757
9.9.1.1	Minimum requirement PUCCH 1-0 with Rank 1 (Cell-Specific Reference Symbols)	757
9.9.1.1	.1 FDD	757
9.9.1.1	.2 TDD	758
9.9.1.2	Minimum requirement PUCCH 1-1 with Rank 2 (CSI Reference Symbols)	759
9.9.1.2	.1 FDD	759
9.9.1.2	.2 TDD	760
9.9.1.3		
9.9.1.3	· · · · · · · · · · · · · · · · · · ·	
9.9.1.3		
9.9.1.4		
9.9.1.4	•	
9.9.1.4		
9.9.2	CQI reporting definition under fading conditions	
9.9.2.1	Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol) for enhanced receiver	
, , , , <u>_ , , , , , , , , , , , , , , ,</u>	Type A	765
9.9.2.1	**	
9.9.2.1		
9.9.2.2		
9.9.2.2		
9.9.2.2		
9.9.3	Reporting of Precoding Matrix Indicator (PMI) for 4Rx UE	
9.9.3.1	Minimum requirement PUSCH 3-1 (CSI Reference Symbol)	
9.9.3.1	· · · · · · · · · · · · · · · · · · ·	
9.9.4	Reporting of Rank Indicator (RI).	
9.9.4.1	1 0	
9.9.4.1	· · · · · · · · · · · · · · · · · · ·	
9.9.3.1		
9.9.3.1		
9.9.4.2	1 ' '	
9.9.4.2		
9.9.4.2	.1 100	/81
10	Performance requirement (MBMS)	783
10.1	FDD (Fixed Reference Channel)	
10.1.1	Minimum requirement	
10.2	TDD (Fixed Reference Channel)	
10.2.1	Minimum requirement	
	•	
11	Performance requirement (ProSe Direct Discovery)	
11.1	General	
11.1.1	Applicability of requirements	785
11.1.2	Reference DRX configuration	
11.2	Demodulation of PSDCH (single link performance)	785
11.2.1	FDD	786
11.2.2	TDD	786
11.3	Power imbalance performance with two links	787
11.3.1	FDD	787
11.3.2	TDD	788
11.4	Multiple timing reference test	789
11.4.1	FDD	
11.5	Maximum Sidelink processes test	791
11.5.1	FDD	
11.5.2	TDD	
10		
12	Performance requirement (ProSe Direct Communication)	794

12.1	General	794
12.1.1	Applicability of requirements	794
12.1.2	Reference DRX configuration	794
12.2	Demodulation of PSSCH	794
12.2.1	FDD	794
12.3	Demodulation of PSCCH	795
12.3.1	FDD	796
12.4	Demodulation of PSBCH	
12.4.1	FDD	
12.5	Power imbalance performance with two links	
12.5.1	FDD	
12.6	Multiple timing reference test	
12.6.1	FDD	
12.7	Maximum Sidelink processes test	
12.7.1	FDD	
12.7.1	Sustained downlink data rate with active Sidelink	
12.8	Sustained downlink data rate with active Sidellik	802
Annex A	A (normative): Measurement channels	805
A.1 G	eneral	805
A.2 U	L reference measurement channels	
A.2.1	General	805
A.2.1.1	Applicability and common parameters	805
A.2.1.2	Determination of payload size	805
A.2.1.3	Overview of UL reference measurement channels	806
A.2.2	Reference measurement channels for FDD	814
A.2.2.1	Full RB allocation	814
A.2.2.1.1	QPSK	
A.2.2.1.2		
A.2.2.1.3		
A.2.2.2	Partial RB allocation	
A.2.2.2.1	QPSK	
A.2.2.2.2		
A.2.2.2.3		
A.2.2.3 A.2.2.3	· ·	
	Void	
A.2.3	Reference measurement channels for TDD	
A.2.3.1	Full RB allocation	
A.2.3.1.1	QPSK	
A.2.3.1.2		
A.2.3.1.3		
A.2.3.2	Partial RB allocation	
A.2.3.2.1	QPSK	
A.2.3.2.2		829
A.2.3.2.3	64-QAM	831
A.2.3.3	Void	832
A.3 D	L reference measurement channels	922
A.3.1	General	
A.3.1.1	Overview of DL reference measurement channels	
A.3.2	Reference measurement channel for receiver characteristics	
A.3.3	Reference measurement channels for PDSCH performance requirements (FDD)	
A.3.3.1	Single-antenna transmission (Common Reference Symbols)	
A.3.3.2	Multi-antenna transmission (Common Reference Symbols)	
A.3.3.2.1	Two antenna ports	
A.3.3.2.2	Four antenna ports	869
A.3.3.3	Reference Measurement Channel for UE-Specific Reference Symbols	
A.3.3.3.0	<u> </u>	
A.3.3.3.1	Two antenna port (CSI-RS)	
A.3.3.3.2	± ', '	
A.3.3.3.3		
A.3.3.3.4		
л.э.э.э. <del>т</del> ЛЗЛ	Pafaranca massurament channels for PDSCH parformance requirements (TDD)	

A.3.4.1	Single-antenna transmission (Common Reference Symbols)	
A.3.4.2	Multi-antenna transmission (Common Reference Signals)	
A.3.4.2.1	Two antenna ports	
A.3.4.2.2	Four antenna ports	894
A.3.4.3	Reference Measurement Channels for UE-Specific Reference Symbols	
A.3.4.3.1	Single antenna port (Cell Specific)	896
A.3.4.3.2	Two antenna ports (Cell Specific)	
A.3.4.3.3	Two antenna ports (CSI-RS)	
A.3.4.3.4	Four antenna ports (CSI-RS)	
A.3.4.3.5	Eight antenna ports (CSI-RS)	904
A.3.4.3.6	Twelve antenna ports (CSI-RS)	906
A.3.4.3.7	Sixteen antenna ports (CSI-RS)	907
A.3.5	Reference measurement channels for PDCCH/PCFICH performance requirements	909
A.3.5.1	FDD	909
A.3.5.2	TDD	909
A.3.6	Reference measurement channels for PHICH performance requirements	909
A.3.7	Reference measurement channels for PBCH performance requirements	910
A.3.8	Reference measurement channels for MBMS performance requirements	911
A.3.8.1	FDD	911
A.3.8.2	TDD	912
A.3.9	Reference measurement channels for sustained downlink data rate provided by lower layers	914
A.3.9.1	FDD	914
A.3.9.2	TDD	917
A.3.9.3	FDD (EPDCCH scheduling)	920
A.3.9.4	TDD (EPDCCH scheduling)	921
A.3.10	Reference Measurement Channels for EPDCCH performance requirements	
A.3.10.1	FDD	
A.3.10.2	TDD	922
A.3.11	Reference Measurement Channels for MPDCCH performance requirements	
A.3.11.1	FDD and half-duplex FDD	
A.3.11.2	TDD	
	SI reference measurement channels	
A.5 Ol	FDMA Channel Noise Generator (OCNG)	933
A.5.1	OCNG Patterns for FDD	933
A.5.1.1	OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern	933
A.5.1.2	OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern	934
A.5.1.3	OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz	
A.5.1.4	OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission	935
A.5.1.5	OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern	
A.5.1.6	OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks	936
A.5.1.8	OCNG FDD pattern 8: One sided dynamic OCNG FDD pattern for TM10 transmission	
A.5.2	OCNG Patterns for TDD	
A.5.2.1	OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern	938
A.5.2.2	OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern	
A.5.2.3	OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz	
A.5.2.4	OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission	
A.5.2.5	OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern	940
A.5.2.6	OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks	
A.5.2.8	OCNG TDD pattern 8: One sided dynamic OCNG TDD pattern for TM10 transmission	
		0.46
	delink reference measurement channels	
A.6.1	General	
A.6.2	Reference measurement channel for receiver characteristics	
A.6.3	Reference measurement channels for PSDCH performance requirements	
A.6.4	Reference measurement channels for PSCCH performance requirements	
A.6.5	Reference measurement channels for PSSCH performance requirements	
A.6.6	Reference measurement channels for PSBCH performance requirements	947
A.7 Si		0.46
	delink reference resource pool configurations	943
A.7.1	delink reference resource pool configurations	

A.7.1.		
A.7.2	Reference resource pool configurations for ProSe Direct Communication demodulation tests	952
A.7.2.	1 FDD	952
Anne	ex B (normative): Propagation conditions	958
B.1	Static propagation condition	958
B.1.1	UE Receiver with 2Rx	
B.1.2	UE Receiver with 4Rx	
B.2	Multi-path fading propagation conditions	050
B.2.1	Delay profiles	
B.2.1 B.2.2	Combinations of channel model parameters	
B.2.3	MIMO Channel Correlation Matrices	
B.2.3.		
B.2.3.		
B.2.3A	A MIMO Channel Correlation Matrices using cross polarized antennas	966
B.2.3	A.1 Definition of MIMO Correlation Matrices using cross polarized antennas	966
B.2.3	$\mathcal{C}$	
B.2.3	1	
B.2.3		
B.2.3	8 11	970
B.2.3E		070
B.2.3E	polarized antennas at UE	
D.2.31	cross polarized antennas at UE	
B.2.3E	•	9 / 1
D.2.31	polarized antennas at UE	972
B.2.3E	1	
B.2.3E	•	
B.2.3E	•	
	polarized antennas at UE	972
B.2.3E	B.4 Beam steering approach	975
B.2.4	Propagation conditions for CQI tests	
B.2.4.	T - 8 T	
B.2.5	Void	
B.2.6	MBSFN Propagation Channel Profile	
B.3	High speed train scenario	977
B.4	Beamforming Model	978
B.4.1	Single-layer random beamforming (Antenna port 5, 7, or 8)	
B.4.2	Dual-layer random beamforming (antenna ports 7 and 8)	
B.4.3	Generic beamforming model (antenna ports 7-14)	
B.4.4	Random beamforming for EPDCCH distributed transmission (Antenna port 107 and 109)	
B.4.5	Random beamforming for EPDCCH localized transmission (Antenna port 107, 108, 109 or 110)	980
B.5	Interference models for enhanced performance requirements Type-A	981
B.5.1	Dominant interferer proportion	
B.5.2	Transmission mode 3 interference model	
B.5.3	Transmission mode 4 interference model	
B.5.4	Transmission mode 9 interference model	982
B.6	Interference models for enhanced performance requirements Type-B	982
B.6.1	Transmission mode 2 interference model	983
B.6.2	Transmission mode 3 interference model.	
B.6.3	Transmission mode 4 interference model	
B.6.4	Transmission mode 9 interference model	
B.6.5	CRS interference model	
B.6.6	Random interference model	984
B.7	Interference models for enhanced downlink control channel performance requirements Type A	005
B.7.1	and B	
ມ./.L	1 DCC11, 1 CL 1C11 and 1 HICH INCHEIGHG HIUGH	20.7

Anne	ex C (normative):	Downlink Physical Channels	987
C.1	General		987
C.2	Set-up		987
C.3			
C.3.1		eceiver Characteristics	
C.3.2 C.3.3		erformance requirementsver allocation for Measurement of Performance Requirements when ABS is	988
C.3.4	Configured	or Measurement of Performance Requirements when Quasi Co-location Type B:	989
C.J. <del>T</del>		or ineasurement of refformance Requirements when Quasi co-tocation Type B.	990
C.3.5	Simplified CA testi	ing method	990
Anne	ex D (normative):	Characteristics of the interfering signal	992
D.1	General		992
D.2	Interference signals		992
Anne	ex E (normative):	Environmental conditions	993
E.1	General		993
E.2			
E.2.1			
E.2.2			
E.2.3	Vibration		994
Anne	ex F (normative):	Transmit modulation	995
F.1	Measurement Point.		995
F.2	Basic Error Vector N	Magnitude measurement	995
F.3	Basic in-band emissi	ions measurement	996
F.4	Modified signal unde	er test	996
F.5	Window length		998
F.5.1			
F.5.2		LOD	
F.5.3 F.5.4		normal CP Extended CP.	
F.5.5	9	PRACH	
F.5.F		for category NB1	
F.6	Averaged EVM		1000
F.6.F		I for category NB1	
F.7	Spectrum Flatness		1001
Anne	ex G (informative):	Reference sensitivity level in lower SNR	1002
G.1	General		1002
G.2	Typical receiver sens	sitivity performance (QPSK)	1002
G.3		nent channel for REFSENSE in lower SNR	
Anne	ex H (normative):	Modified MPR behavior	1009
H.1	· · · · · · · · · · · · · · · · · · ·	ed MPR behavior	
	ex I (informative):	Change history	
Histo	rv		1036

#### **Foreword**

This Technical Specification (TS) has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

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- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

## 1 Scope

The present document establishes the minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE).

#### 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.
  - 3GPP TR 21.905: "Vocabulary for 3GPP Specifications". [1] [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain" ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the [3] terrestrial component of International Mobile Telecommunications-2000". [4] 3GPP TS 36.211: "Physical Channels and Modulation". [5] 3GPP TS 36.212: "Multiplexing and channel coding". [6] 3GPP TS 36.213: "Physical layer procedures". 3GPP TS 36.331: "Requirements for support of radio resource management". [7] [8] 3GPP TS 36.307: "Requirements on User Equipments (UEs) supporting a release-independent frequency band". [9] 3GPP TS 36.423: "X2 application protocol (X2AP) ". 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based [10] services (ProSe); Stage 2". 3GPP TS36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal [11] Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

# 3 Definitions, symbols and abbreviations

#### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply in the case of a single component carrier. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**Aggregated Channel Bandwidth:** The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

**Aggregated Transmission Bandwidth Configuration:** The number of resource block allocated within the aggregated channel bandwidth.

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band:** A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

**Carrier aggregation bandwidth class:** A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

Carrier aggregation configuration: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

Channel edge: The lowest and highest frequency of the carrier, separated by the channel bandwidth.

**Channel bandwidth:** The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

**Composite spectrum emission mask:** Emission mask requirement for intraband non-contiguous carrier aggregation which is a combination of individual sub-block spectrum emissions masks.

**Composite spurious emission requirement:** Spurious emission requirement for intraband non-contiguous carrier aggregation which is a combination of individual sub-block spurious emission requirements.

**Contiguous carriers:** A set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

**Contiguous resource allocation:** A resource allocation of consecutive resource blocks within one carrier or across contiguously aggregated carriers. The gap between contiguously aggregated carriers due to the nominal channel spacing is allowed.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

**Enhanced downlink control channel performance requirements type A:** This defines performance requirements for downlink control channel assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining plus CRS interference cancellation.

Enhanced downlink control channel performance requirements type B: This defines performance requirements for downlink control channel assuming as baseline receiver reference symbol based enhanced linear minimum mean square error interference rejection combining plus CRS interference cancellation.

**Enhanced performance requirements type A:** This defines performance requirements assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining.

**Enhanced performance requirements type B:** This defines performance requirements assuming as baseline receiver using network assisted interference cancelation and suppression.

**Enhanced performance requirements type C:** This defines performance requirements assuming as baseline receiver inter-stream interference cancellation.

**Inter-band carrier aggregation:** Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

Intra-band contiguous carrier aggregation: Contiguous carriers aggregated in the same operating band.

Intra-band non-contiguous carrier aggregation: Non-contiguous carriers aggregated in the same operating band.

**Lower** sub-block **edge:** The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

**NB-IoT stand-alone operation**: a NB-IoT is operating standalone when it utilizes its own spectrum, for example the spectrum used by GERAN systems as a replacement of one or more GSM carriers, as well as scattered spectrum for potential IoT deployment.

**NB-IoT guard band operation:** NB-IoT is operating in guard band when it utilizes the unused resource block(s) within a E-UTRA carrier's guard-band.

**NB-IoT in-band operation:** NB-IoT is operating in-band when it utilizes the resource block(s) within a normal E-UTRA carrier.

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

ProSe-enabled UE: A UE that supports ProSe requirements and associated procedures.

NOTE: As defined in TS 23.303 [10].

ProSe Direct Communication: A communication between two or more UEs in proximity that are ProSe-enabled.

NOTE: As defined in TS 23.303 [10].

**ProSe Direct Discovery**: A procedure employed by a ProSe-enabled UE to discover other ProSe-enabled UEs in its vicinity.

NOTE: As defined in TS 23.303 [10].

**Sub-block:** This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

**Sub-block gap:** A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Synchronized operation: Operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

**Unsynchronized operation:** Operation of TDD in two different systems, where the conditions for synchronized operation are not met.

**Upper sub-block edge:** The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

### 3.2 Symbols

 $F_{C} \\$ 

 $F_{C_agg}$ 

 $F_{C,block,\;high}$ 

For the purposes of the present document, the following symbols apply:

Frequency of the carrier centre frequency

$egin{array}{ll} BW_{Channel} \ BW_{Channel,block} \ BW_{Channel\_CA} \ BW_{GB} \end{array}$	Channel bandwidth Sub-block bandwidth, expressed in MHz. $BW_{Channel,block} = F_{edge,block,high} - F_{edge,block,low}$ . Aggregated channel bandwidth, expressed in MHz. Virtual guard band to facilitate transmitter (receiver) filtering above / below edge CCs.
$E_{RS}$	Transmitted energy per RE for reference symbols during the useful part of the symbol, i.e.
	excluding the cyclic prefix, (average power normalized to the subcarrier spacing) at the eNode B transmit antenna connector
$\hat{E}_{s}$	The averaged received energy per RE of the wanted signal during the useful part of the symbol,
	i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical channels (including user specific RSs when present), divided by the number of REs within the set, and normalized to the subcarrier spacing
F	Frequency
$F_{agg\_alloc\_low}$	Aggregated Transmission Bandwidth Configuration. The lowest frequency of the simultaneously transmitted resource blocks.
$F_{agg\_alloc\_high}$	Aggregated Transmission Bandwidth Configuration. The highest frequency of the simultaneously transmitted resource blocks.
F <sub>Interferer</sub> (offset)	Frequency offset of the interferer
F <sub>Interferer</sub>	Frequency of the interferer

Center frequency of the highest transmitted/received carrier in a sub-block.

Aggregated Transmission Bandwidth Configuration. Center frequency of the aggregated carriers.

$F_{C,block, low}$	Center frequency of the lowest transmitted/received carrier in a sub-block.
$F_{C_{-low}}$	The centre frequency of the <i>lowest carrier</i> , expressed in MHz.
$F_{C\_high}$	The centre frequency of the <i>highest carrier</i> , expressed in MHz.
$F_{ m DL\_low}$	The lowest frequency of the downlink operating band
$F_{ m DL\_high}$	The highest frequency of the downlink operating band
$F_{ m UL\_low}$	The lowest frequency of the uplink operating band The highest frequency of the uplink operating band
$F_{ ext{UL\_high}}$	The linguist frequency of the upfilik operating band.  The lower sub-block edge, where $F_{\text{edge,block,low}} = F_{\text{C,block,low}} - F_{\text{offset.}}$
$F_{ m edge,block,low} \ F_{ m edge,block,high}$	The upper sub-block edge, where $F_{\text{edge,block,ligh}} = F_{\text{C,block,ligh}} + F_{\text{offset}}$ .
$F_{\mathrm{edge\_low}}$	The lower edge of aggregated channel bandwidth, expressed in MHz.
$F_{\text{edge\_high}}$	The <i>higher edge</i> of aggregated channel bandwidth, expressed in MHz.
F <sub>offset</sub>	Frequency offset from $F_{C \text{ high}}$ to the <i>higher edge</i> or $F_{C \text{ low}}$ to the <i>lower edge</i> .
$F_{\rm offset,block,low}$	Separation between lower edge of a sub-block and the center of the lowest component carrier
	within the sub-block
$F_{offset,block,high}$	Separation between higher edge of a sub-block and the center of the highest component carrier
	within the sub-block
$F_{\text{offset\_NS\_23}}$	Frequency offset in MHz needed if NS_23 is used
$F_{OOB}$	The boundary between the E-UTRA out of band emission and spurious emission domains.
$I_o$	The power spectral density of the total input signal (power averaged over the useful part of the
	symbols within the transmission bandwidth configuration, divided by the total number of RE for
	this configuration and normalised to the subcarrier spacing) at the UE antenna connector,
	including the own-cell downlink signal
$I_{or}$	The total transmitted power spectral density of the own-cell downlink signal (power averaged over
	the useful part of the symbols within the transmission bandwidth configuration, divided by the
	total number of RE for this configuration and normalised to the subcarrier spacing) at the eNode B
	transmit antenna connector
$\hat{I}_{or}$	The total received power spectral density of the own-cell downlink signal (power averaged over
OI .	the useful part of the symbols within the transmission bandwidth configuration, divided by the
	total number of RE for this configuration and normalised to the subcarrier spacing) at the UE
	antenna connector
$I_{ot}$	The received power spectral density of the total noise and interference for a certain RE (average
Oī	power obtained within the RE and normalized to the subcarrier spacing) as measured at the UE
	antenna connector
$L_{CRB}$	Transmission bandwidth which represents the length of a contiguous resource block allocation
CALD	expressed in units of resources blocks
$N_{cp}$	Cyclic prefix length
$N_{ m DL}$	Downlink EARFCN
$N_{oc}$	The power spectral density of a white noise source (average power per RE normalised to the
	subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as
	measured at the UE antenna connector
$N_{oc1}$	The power spectral density of a white noise source (average power per RE normalized to the
	subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that
	are not defined in a test procedure, as measured at the UE antenna connector.
$N_{oc2}$	The power spectral density of a white noise source (average power per RE normalized to the
**-	subcarrier spacing), simulating interference in CRS symbols in ABS subframe from all cells that
	are not defined in a test procedure, as measured at the UE antenna connector.
$N_{oc3}$	The power spectral density of a white noise source (average power per RE normalised to the
003	subcarrier spacing), simulating interference in non-ABS subframe from cells that are not defined
	in a test procedure, as measured at the UE antenna connector
$N_{oc}$	The power spectral density (average power per RE normalised to the subcarrier spacing) of the
TV oc	
	summation of the received power spectral densities of the strongest interfering cells explicitly
	defined in a test procedure plus $N_{oc}$ , as measured at the UE antenna connector. The respective
	power spectral density of each interfering cell relative to $N_{oc}$ is defined by its associated DIP
	value, or the respective power spectral density of each interfering cell relative to $N_{oc}$ is defined by
	its associated Es/Noc value.
$N_{\rm Offs-DL}$	Offset used for calculating downlink EARFCN
→ ¹UΠS-DL	Chief and for emoting downing Little Cit

N<sub>Offs-UL</sub> Offset used for calculating uplink EARFCN

 $N_{otx}$  The power spectral density of a white noise source (average power per RE normalised to the

subcarrier spacing) simulating eNode B transmitter impairments as measured at the eNode B

transmit antenna connector

N<sub>RB</sub> Transmission bandwidth configuration, expressed in units of resource blocks

 $N_{RB\_agg}$  The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth.  $N_{RB\_alloc}$  Total number of simultaneously transmitted resource blocks in Channel bandwidth or Aggregated

Channel Bandwidth.

 $N_{RB,c}$  The transmission bandwidth configuration of component carrier c, expressed in units of resource

blocks

 $N_{RB,largest\;BW}$  The largest transmission bandwidth configuration of the component carriers in the bandwidth

combination, expressed in units of resource blocks

N<sub>RX</sub> Number of receiver antennas

N<sub>UL</sub> Uplink EARFCN.

 $\begin{array}{ll} Rav & Minimum \ average \ throughput \ per \ RB. \\ P_{CMAX} & The \ configured \ maximum \ UE \ output \ power. \end{array}$ 

 $P_{CMAX}$ , c The configured maximum UE output power for serving cell c.

 $P_{EMAX}$  Maximum allowed UE output power signalled by higher layers. Same as IE *P-Max*, defined in [7].  $P_{EMAX.c}$  Maximum allowed UE output power signalled by higher layers for serving cell c. Same as IE

*P-Max*, defined in [7].

 $P_{Interferer}$  Modulated mean power of the interferer

 $\begin{array}{ll} P_{PowerClass} & P_{PowerClass} \ is \ the \ nominal \ UE \ power \ (i.e., \ no \ tolerance). \\ P_{UMAX} & The \ measured \ configured \ maximum \ UE \ output \ power. \end{array}$ 

Puw Power of an unwanted DL signal Pw Power of a wanted DL signal

RB<sub>start</sub> Indicates the lowest RB index of transmitted resource blocks.
RB<sub>end</sub> Indicates the highest RB index of transmitted resource blocks.

 $\Delta f_{OOB}$   $\Delta$  Frequency of Out Of Band emission.

 $\Delta R_{IB,c}$  Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving

cell c.

 $\Delta T_{IB,c}$  Allowed maximum configured output power relaxation due to support for inter-band CA

operation, for serving cell c.

 $\Delta T_{\rm C}$  Allowed operating band edge transmission power relaxation.

 $\Delta T_{C,c}$  Allowed operating band edge transmission power relaxation for serving cell c.

 $\Delta T_{ProSe}$  Allowed operating band transmission power relaxation due to support of E-UTRA ProSe on an

operating band.

σ Test specific auxiliary variable used for the purpose of downlink power allocation, defined in

Annex C.3.2.

W<sub>gap</sub> Sub-block gap size

#### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ABS Almost Blank Subframe

ACLR Adjacent Channel Leakage Ratio
ACS Adjacent Channel Selectivity

A-MPR Additional Maximum Power Reduction

AWGN Additive White Gaussian Noise

BS Base Station

CA Carrier Aggregation

CA\_X Intra-band contiguous CA of component carriers in one sub-block within Band X where X is the

applicable E-UTRA operating band

CA\_X-X Intra-band non-contiguous CA of component carriers in two sub-blocks within Band X where X is

the applicable E-UTRA operating band

CA\_X-Y Inter-band CA of component carrier(s) in one sub-block within Band X and component carrier(s)

in one sub-block within Band Y where X and Y are the applicable E-UTRA operating band

CA\_X-X-Y CA of component carriers in two sub-blocks within Band X and component carrier(s) in one sub-

block within Band Y where X and Y are the applicable E-UTRA operating bands

CC Component Carriers CG Carrier Group

CPE Customer Premise Equipment

CPE\_X Customer Premise Equipment for E-UTRA operating band X

CW Continuous Wave DC Dual Connectivity

DC\_X-Y Inter-band DC of component carrier(s) in one sub-block within Band X and component carrier(s)

in one sub-block within Band Y where X and Y are the applicable E-UTRA operating band

DL Downlink

DIP Dominant Interferer Proportion

EARFCN E-UTRA Absolute Radio Frequency Channel Number

EPRE Energy Per Resource Element

E-UTRA Evolved UMTS Terrestrial Radio Access

EUTRAN Evolved UMTS Terrestrial Radio Access Network

EVM Error Vector Magnitude
FDD Frequency Division Duplex
FRC Fixed Reference Channel
HD-FDD Half- Duplex FDD

MCS Modulation and Coding Scheme

MCG Main Carrier Group
MOP Maximum Output Power
MPR Maximum Power Reduction
MSD Maximum Sensitivity Degradation
OCNG OFDMA Channel Noise Generator

OFDMA Orthogonal Frequency Division Multiple Access

OOB Out-of-band PA Power Amplifier

PCC Primary Component Carrier

P-MPR Power Management Maximum Power Reduction

ProSe Proximity-based Services

PSBCH Physical Sidelink Broadcast CHannel
PSCCH Physical Sidelink Control CHannel
PSDCH Physical Sidelink Discovery CHannel
PSS Primary Synchronization Signal

PSS\_RA PSS-to-RS EPRE ratio for the channel PSS PSSCH Physical Sidelink Shared CHannel

PSSS Primary Sidelink Synchronization Signal

RE Resource Element

REFSENS Reference Sensitivity power level

r.m.s Root Mean Square

SCC Secondary Component Carrier SCG Secondary Carrier Group

SINR Signal-to-Interference-and-Noise Ratio

SNR Signal-to-Noise Ratio

SSS Secondary Synchronization Signal

SSS\_RA SSS-to-RS EPRE ratio for the channel SSSSSSS Secondary Sidelink Synchronization Signal

TDD Time Division Duplex UE User Equipment

UL Uplink

UL-MIMO Up Link Multiple Antenna transmission
UMTS Universal Mobile Telecommunications System

UTRA UMTS Terrestrial Radio Access

UTRAN UMTS Terrestrial Radio Access Network

xCH\_RA xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS xCH\_RB xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols containing RS

#### 4 General

# 4.1 Relationship between minimum requirements and test requirements

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 36.521-1 Annex F defines Test Tolerances. These Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum Requirements in this specification to create Test Requirements.

The measurement results returned by the Test System are compared - without any modification - against the Test Requirements as defined by the shared risk principle.

The Shared Risk principle is defined in ITU-R M.1545 [3].

#### 4.2 Applicability of minimum requirements

- a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios
- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The reference sensitivity power levels defined in subclause 7.3 are valid for the specified reference measurement channels.
- d) NOTE: Receiver sensitivity degradation may occur when:
  - 1) The UE simultaneously transmits and receives with bandwidth allocations less than the transmission bandwidth configuration (see Figure 5.6-1), and
  - 2) Any part of the downlink transmission bandwidth is within an uplink transmission bandwidth from the downlink center subcarrier.
- e) The spurious emissions power requirements are for the long term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.
- f) The requirements in this specification for TDD operating bands apply for downlink and uplink operations using Frame Structure Type 2 [4] except for Band 46 operating with Frame Structure Type 3.

#### 4.3 Void

# 4.3A Applicability of minimum requirements (CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1, UE category NB1)

The requirements in clauses 5, 6 and 7 which are specific to CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1, and UE category NB1 are specified as suffix A, B, C, D, E, and F where;

- a) Suffix A additional requirements need to support CA
- b) Suffix B additional requirements need to support UL-MIMO
- c) Suffix C additional requirements need to support Dual Connectivity

- d) Suffix D additional requirements need to support ProSe
- e) Suffix E additional requirements need to support UE category 0 and category M1
- f) Suffix F additional requirements need to support UE category NB1

A terminal which supports the above features needs to meet both the general requirements and the additional requirement applicable to the additional subclause (suffix A, B, C, D, E and F) in clauses 5, 6 and 7. Where there is a difference in requirement between the general requirements and the additional subclause requirements (suffix A, B, C, D, E and F) in clauses 5, 6 and 7, the tighter requirements are applicable unless stated otherwise in the additional subclause.

A terminal which supports more than one feature (CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1 and UE category NB1) in clauses 5, 6 and 7 shall meet all of the separate corresponding requirements.

For a terminal supporting CA, compliance with minimum requirements for non-contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for contiguous intra-band carrier aggregation in the same operating band.

For a terminal supporting CA, compliance with minimum requirements for contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for non- contiguous intra-band carrier aggregation in the same operating band.

A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.

A terminal which supports CA, for each supported CA configuration, shall support Pcell transmissions in each of the aggregated Component Carriers unless indicated otherwise in clause 5.6A.1.

Terminal supporting Dual Connectivity configuration shall meet the minimum requirements for corresponding CA configuration (suffix A), unless otherwise specified.

For a terminal that supports ProSe Direct Communication and/or ProSe Direct Discovery, the minimum requirements are applicable when

- the UE is associated with a serving cell on the ProSe carrier, or
- the UE is not associated with a serving cell on the ProSe carrier and is provisioned with the preconfigured radio parameters for ProSe Direct Communications and/or ProSe Direct Discovery that are associated with known Geographical Area, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and the radio parameters for ProSe Direct Discovery on the ProSe carrier are provided by the serving cell, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and has a non-serving cell selected on the ProSe carrier that supports ProSe Direct Discovery and/or ProSe Direct Communication.

When the ProSe UE is not associated with a serving cell on the ProSe carrier, and the UE does not have knowledge of its geographical area, or is provisioned with preconfigured radio parameters that are not associated with any Geographical Area, ProSe transmissions are not allowed, and the requirements in Section 6.3.3D apply.

A terminal that supports simultaneous E-UTRA ProSe sidelink transmissions and E-UTRA uplink transmissions for the inter-band E-UTRA ProSe/E-UTRA bands specified in Table 5.5D-2, shall meet the minimum requirements for the corresponding inter-band UL CA configuration (suffix A), unless otherwise specified. For transmitter characteristics specified in clause 6, the terminal is required to meet the conformance tests for the corresponding inter-band UL CA configuration and is not required to be retested with simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions.

# 4.4 RF requirements in later releases

The standardisation of new frequency bands and carrier aggregation configurations (downlink and uplink aggregation) may be independent of a release. However, in order to implement a UE that conforms to a particular release but supports a band of operation or a carrier aggregation configuration that is specified in a later release, it is necessary to

specify some extra requirements. TS 36.307 [8] specifies requirements on UEs supporting a frequency band or a carrier aggregation configuration that is independent of release.

NOTE: For UEs conforming to the 3GPP release of the present document, some RF requirements of later releases may be mandatory independent of whether the UE supports the bands specif or carrier aggregation configurations ied in later releases or not. The set of RF requirements of later releases that is also mandatory for UEs conforming to the 3GPP release of the present document is determined by regional regulation.

# 5 Operating bands and channel arrangement

#### 5.1 General

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

NOTE: Other operating bands and channel bandwidths may be considered in future releases.

- 5.2 Void
- 5.3 Void
- 5.4 Void

### 5.5 Operating bands

E-UTRA is designed to operate in the operating bands defined in Table 5.5-1.

Table 5.5-1 E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) op BS rec UE trar F <sub>UL_low</sub> –	eive	Downlink (DL) operating band BS transmit UE receive FDL_low - FDL_high	Duplex Mode
1	1920 MHz -	1980 MHz	2110 MHz — 2170 MHz	FDD
2	1850 MHz –	1910 MHz	1930 MHz — 1990 MHz	FDD
3	1710 MHz –	1785 MHz	1805 MHz — 1880 MHz	FDD
4				
	17 10 1711 12	1700 111112	2110 MHz — 2155 MHz	FDD
5 6 <sup>1</sup>	824 MHz –		869 MHz — 894MHz	FDD
	830 MHz –	840 MHz	875 MHz — 885 MHz	FDD
7	2500 MHz –		2620 MHz — 2690 MHz	FDD
8	880 MHz –	915 MHz	925 MHz - 960 MHz	FDD
9	1749.9 MHz <sup>—</sup>	1784.9 MHz	1844.9 MHz <sup>-</sup> 1879.9 MHz	FDD
10	1710 MHz -	1770 MHz	2110 MHz - 2170 MHz	FDD
11	1427.9 MHz –	1447.9 MHz	1475.9 MHz — 1495.9 MHz	FDD
12	699 MHz -		729 MHz - 746 MHz	FDD
13	777 MHz -		746 MHz — 756 MHz	FDD
14	788 MHz –	798 MHz	758 MHz — 768 MHz	FDD
15	Reser		Reserved	FDD
16	Reser		Reserved	FDD
17	704 MHz -		734 MHz — 746 MHz	FDD
18	815 MHz –		860 MHz - 875 MHz	FDD
19	830 MHz -		875 MHz — 890 MHz	FDD
20	832 MHz -		791 MHz — 821 MHz	FDD
21	1447.9 MHz –	1462.9 MHz	1495.9 MHz — 1510.9 MHz	FDD
22	3410 MHz –		3510 MHz - 3590 MHz	FDD
23	2000 MHz -	2020 MHz	2180 MHz — 2200 MHz	FDD
24	1626.5 MHz –		1525 MHz — 1559 MHz	FDD
25	1850 MHz –		1930 MHz - 1995 MHz	FDD
26				FDD
27	814 MHz – 807 MHz –	824 MHz		FDD
28				FDD
	703 MHz –		758 MHz — 803 MHz	FDD <sup>2</sup>
29	N/A		717 MHz — 728 MHz 2350 MHz — 2360 MHz	
30	2305 MHz –		2000 1111 12 2000 1111 12	FDD
31	452.5 MHz –		462.5 MHz — 467.5 MHz	FDD <sup>2</sup>
32	N//		1452 MHz — 1496 MHz	FDD <sup>2</sup>
33	1900 MHz -		1900 MHz — 1920 MHz	TDD
34	2010 MHz –	2025 MHz	2010 MHz — 2025 MHz	TDD
35	1850 MHz –		1850 MHz — 1910 MHz	TDD
36	1930 MHz –		1930 MHz — 1990 MHz	TDD
37	1910 MHz –		1910 MHz — 1930 MHz	TDD
38	2570 MHz –		2570 MHz — 2620 MHz	TDD
39	1880 MHz –	1920 MHz	1880 MHz — 1920 MHz	TDD
40	2300 MHz -	2400 MHz	2300 MHz — 2400 MHz	TDD
41	2496 MHz	2690 MHz	2496 MHz 2690 MHz	TDD
42	3400 MHz -		3400 MHz - 3600 MHz	TDD
43	3600 MHz -		3600 MHz - 3800 MHz	TDD
44	703 MHz -	803 MHz	703 MHz - 803 MHz	TDD
45	1447 MHz –	1467 MHz	1447 MHz – 1467 MHz	TDD
46 	5150 MHz –	5925 MHz	5150 MHz - 5925 MHz	TDD <sup>8,9</sup>
64		Rese	rved	
65	1920 MHz -	2010 MHz	2110 MHz - 2200 MHz	FDD
66	1710 MHz -	1780 MHz	2110 MHz - 2200 MHz	FDD⁴
67	N/A	A	738 MHz – 758 MHz	$FDD^2$

NOTE 1: Band 6 is not applicable

NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the

carrier aggregation configuration that is supporting the configured Pcell.

NOTE 3: A UE that complies with the E-UTRA Band 65 minimum requirements in this specification shall also comply with the E-UTRA Band 1 minimum requirements.

NOTE 4: The range 2180-2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured.

NOTE 5: A UE that supports E-UTRA Band 66 shall receive in the entire DL operating band NOTE 6: A UE that supports E-UTRA Band 66 and CA operation in any CA band shall also comply with the minimum requirements specified for the DL CA configurations CA\_66B, CA\_66C and CA\_66A-66A.

NOTE 7: A UE that complies with the E-UTRA Band 66 minimum requirements in this specification shall also comply with the E-UTRA Band 4 minimum requirements.

NOTE 8: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3

NOTE 9: In this version of the specification, restricted to E-UTRA DL operation when carrier

# 5.5A Operating bands for CA

aggregation is configured.

E-UTRA carrier aggregation is designed to operate in the operating bands defined in Tables 5.5A-1, 5.5A-2, 5.5A-2a and 5.5A-3.

Table 5.5A-1: Intra-band contiguous CA operating bands

E-UTRA	E-UTRA	Uplink (UL) operating band			Downlink (DL) operating band			Duplex Mode
CA Band	Band	BS receive / UE transmit			BS transr	BS transmit / UE receive		
		F <sub>UL_low</sub>	-	F <sub>UL_high</sub>	F <sub>DL_lo</sub>	w –	F <sub>DL_high</sub>	
CA_1	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
CA_2	2	1850 MHz	-	1910 MHz	1930 MHz	ı	1990 MHz	FDD
CA_3	3	1710MHz	-	1785MHz	1805MHz	ı	1880MHz	FDD
CA_5	5	824 MHz	-	849 MHz	869 MHz	ı	894 MHz	FDD
CA_7	7	2500 MHz	_	2570 MHz	2620 MHz	-	2690 MHz	FDD
CA_8	8	880 MHz	-	915 MHz	925 MHz	ı	960 MHz	FDD
CA_12	12	699 MHz	_	716 MHz	629 MHz	-	746 MHz	FDD
CA_23	23	2000 MHz	-	2020 MHz	2180 MHz	ı	2200 MHz	FDD
CA_27	27	807 MHz	-	824 MHz	852 MHz	ı	869 MHz	FDD
CA_38	38	2570 MHz	-	2620 MHz	2570 MHz	ı	2620 MHz	TDD
CA_39	39	1880 MHz	-	1920 MHz	1880 MHz	ı	1920 MHz	TDD
CA_40	40	2300 MHz	-	2400 MHz	2300 MHz	ı	2400 MHz	TDD
CA_41	41	2496 MHz	-	2690 MHz	2496 MHz	ı	2690 MHz	TDD
CA_42	42	3400 MHz	-	3600 MHz	3400 MHz	-	3600 MHz	TDD
CA_66	66	1710 MHz	_	1780 MHz	2110 MHz	-	2200 MHz	FDD

Table 5.5A-2: Inter-band CA operating bands (two bands)

E-UTRA	E-UTRA	Uplink (UL) operating band BS receive / UE transmit			Downlink (DL) operating band BS transmit / UE receive			Duplex Mode
CA Band	Band							
			$F_{UL\_low} - F_{UL\_high}$		F <sub>DL_low</sub> - F <sub>DL_high</sub>			<u> </u>
CA_1-3	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	-	1880 MHz	100
CA_1-3-3	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	ı	1880 MHz	FDD
CA_1-5	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	- FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	רטט
CA_1-7	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_1-8	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_1-11	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-18	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz		2170 MHz	
CA_1-19 CA_1-20	19	830 MHz		845 MHz	875 MHz	_	890 MHz	FDD
			_			_		
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
CA_1-21	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	
CA_1-26	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	
CA_1-28	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
CA_1-40	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	FDD
	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA_1-41	1	1920 MHz	_	1980 MHz	2110 MHz	1	2170 MHz	FDD
	41	2496 MHz	_	2690 MHz	2496 MHz	-	2690 MHz	TDD
CA_1-42	1	1920 MHz	-	1980 MHz	2110 MHz	_	2170 MHz	FDD
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_1-46	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
CA_2-4	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
CA_2-4-4 CA_2-5	2	1850 MHz	_		1930 MHz		1990 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
	5	824 MHz		849 MHz	869 MHz	_	894 MHz	FDD
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
CA_2-2-5	5		_	849 MHz		_	894 MHz	FDD
	2	824 MHz	_	1910 MHz	869 MHz	_		
CA_2-7	7	1850 MHz	_		1930 MHz	_	1990 MHz	FDD
		2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_2-2-	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_2-13	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	. 55
CA_2-2- 13	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	1	756 MHz	י טט
CA_2-17	2	1850 MHz	_	1910 MHz	1930 MHz	ı	1990 MHz	EDD
	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	FDD
04 0 55	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	- EDD
CA_2-28	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_2-29	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
	_	. 555 1111 12			. 300 1111 12		728 MHz	FDD

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CA_2-30	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
- O7 (_2 00	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
CA_2-46	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
OA_2-40	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
CA_3-5	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-3	5	824 MHz	_	849 MHz	869 MHz	–	894 MHz	FDD
CA 2.2.5	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	EDD
CA_3-3-5	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
04.07	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	-
CA_3-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
04.00	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	<b>500</b>
CA_3-8	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-3-8	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-19	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
	3	1710 MHz		1785 MHz	1805 MHz	_	1880 MHz	
CA_3-20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	
CA_3-26	26	814 MHz		849 MHz	859 MHz		894 MHz	FDD
	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	
CA_3-27	27		_			_		FDD
		807 MHz	_	824 MHz	852 MHz	_	869 MHz	
CA_3-28	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
_	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
CA_3-31	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	31	452.5 MHz	_	457.5 MHz	462.5 MHz	_	467.5 MHz	
CA_3-38	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
<u> </u>	38	2570 MHz	_	2620 MHz	2570 MHz	_	2620 MHz	TDD
CA_3-40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
UA_5-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA_3-41	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
CA_3-42	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA 2.40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-46	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
04.45	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	-
CA_4-5	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-5	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-12	12	699 MHz		716 MHz	729 MHz		746 MHz	FDD
CA 4.4	4		_			_		
CA_4-4- 12		1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_4-13	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	
CA_4-17	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	
CA_4-27	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
J. (_ 1 Z1	27	807 MHz	_	824 MHz	852 MHz	_	869 MHz	. 55
CA_4-28	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
UA_4-20	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	טטו
CA_4-29	4	1710 MHz		1755 MHz	2110 MHz	_	2155 MHz	FDD
U/\_+*23	29		N/	'A	717 MHz	_	728 MHz	טטי

		1		T	I			T
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	-	2155 MHz	FDD
29	29		N/		717 MHz	_	728 MHz	
CA_4-30	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	100
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
30	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	ו טט
CA 4.40	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
CA_4-46	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
04.5.7	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-17	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz		894 MHz	
CA_5-25	25	1850 MHz	_	1915 MHz	1930 MHz	_	1995 MHz	FDD
						_		
CA_5-29	5	824 MHz		849 MHz	869 MHz	_	894 MHz	FDD
	29	004 1411	N/		717 MHz	_	728 MHz	
CA_5-30	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
_	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
CA_5-38	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD
	38	2570 MHz	_	2620 MHz	2570 MHz	_	2620 MHz	TDD
CA_5-40	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
OA_3-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA_7-8	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_1-0	8	880 MHz	_	915 MHz	925 MHz	-	960 MHz	רטט
CA 7.40	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	רסס
CA_7-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
04 7 00	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	<b>500</b>
CA_7-20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_7-22	22	3410 MHz	_	3490 MHz	3510 MHz	_	3590 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_7-28	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_7-40	40	2300 MHz		2400 MHz	2300 MHz		2400 MHz	TDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_7-42	42		_	3600 MHz	3400 MHz	_		TDD
04 7 40		3400 MHz	_			_	3600 MHz	
CA_7-42-	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_7-46	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
CA_8-11	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	100
CA_8-20	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
OA_0-20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	100
CA 9 40	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
04 0 11	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
04 5 15	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	
CA_11-18	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_12-25	25	1850 MHz		1915 MHz	1930 MHz	_	1995 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz		746 MHz	-
CA_12-30			_			_		FDD
	30	2305 MHz		2315 MHz	2350 MHz		2360 MHz	l .

CA_18-28	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
0/(_10 20	28	703 MHz	_	733 MHz <sup>1</sup>	758 MHz	-	788 MHz <sup>1</sup>	100
CA_19-21	19	830 MHz	_	845 MHz	875 MHz	-	890 MHz	FDD
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	. 55
CA_19-28	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
0/\_10 20	28	718 MHz <sup>1</sup>	_	748 MHz	773 MHz <sup>1</sup>	_	803 MHz	
CA_19-42	19	830 MHz	_	845 MHz	875 MHz	-	890 MHz	FDD
OA_13-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_20-31	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-31	31	452.5 MHz	_	457.5 MHz	462.5 MHz	_	467.5 MHz	100
CA_20-32	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-32	32		N/		1452 MHz	_	1496 MHz	טטו
CA 20 29	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-38	38	2570 MHz	-	2620 MHz	2570 MHz	_	2620 MHz	TDD
CA 20 40	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA 20 40	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_20-	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
42-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
04 00 07	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	<b>EDD</b>
CA_20-67	67		N/	'A	738 MHz	_	758 MHz	FDD
04 04 40	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	FDD
CA_21-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
0	23	2000 MHz	_	2020 MHz	2180 MHz	_	2200 MHz	
CA_23-29	29		N/		717 MHz	_	728 MHz	FDD
	25	1850 MHz	_	1915 MHz	1930 MHz	_	1995 MHz	
CA_25-26	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	FDD
	25	1850 MHz	_	1915 MHz	1930 MHz	_	1995 MHz	FDD
CA_25-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	FDD
CA_26-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	29	0 100 1111 12	N/		717 MHz	_	728 MHz	
CA_29-30	30	2305 MHz	- I	2315 MHz	2350 MHz	_	2360 MHz	FDD
	38	2570 MHz		2620 MHz	2570 MHz	_	2620 MHz	
CA_38-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	39	1880 MHz	_	1920 MHz	1880 MHz	_	1920 MHz	
CA_39-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	41	2496 MHz	<del>                                     </del>	2690 MHz	2496 MHz	_	2690 MHz	
CA_41-42	42	3400 MHz	<del>                                     </del>	3600 MHz	3400 MHz	_	3600 MHz	TDD
	41	2496 MHz		2690 MHz	2496 MHz	_	2690 MHz	
CA_41-46	46	5150 MHz		5925 MHz	5150 MHz		5925 MHz	TDD
	42	3400 MHz		3600 MHz	3400 MHz	_		
CA_42-46	46	5150 MHz		5925 MHz	5150 MHz		3600 MHz 5925 MHz	TDD
NOTE 1: T			28 :			inati		<u> </u>
NOTE 1: T	ne nequency	range in band i	20 K	s restricted for this	CA Dania COIIID	ırıall	OH.	

Table 5.5A-2a: Inter-band CA operating bands (three bands)

E-UTRA CA	E-UTRA			erating band			perating band	Duplex Mode
Band	Band			JE transmit			UE receive	wode
			<u>v – </u>	F <sub>UL_high</sub>			F <sub>DL_high</sub>	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-5	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-7	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	-	2690 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	
CA_1-3-8	3	1710 MHz	_	1785 MHz	1805 MHz	ı	1880 MHz	FDD
	8	880 MHz	_	915 MHz	925 MHz	-	960 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-19	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
_	19	830 MHz	_	845 MHz	875 MHz	-	890 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-20	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	1
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-26	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
OA_1-3-20	26	814 MHz	_	849 MHz	859 MHz		894 MHz	100
	1	1920 MHz	_	1980 MHz	2110 MHz		2170 MHz	
CA 1 2 20	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	FDD
CA_1-3-28	28		_	748 MHz		_		FUU
	1	703 MHz	_		758 MHz	_	803 MHz	
04 4 0 40	3	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-3-40		1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	<b>TDD</b>
	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-3-42	3	1710 MHz	_	1785 MHz	1805 MHz	-	1880 MHz	
	42	3400 MHz	_	3600 MHz	3400 MHz	-	3600 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-5-7	5	824 MHz	_	849 MHz	869 MHz	-	894 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	FDD
CA_1-5-40	5	824 MHz	_	849 MHz	869 MHz	-	894 MHz	וסטו
	40	2300 MHz	-	2400 MHz	2300 MHz	ı	2400 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	
CA_1-7-8	7	2500 MHz	_	2570 MHz	2620 MHz	-	2690 MHz	FDD
	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-7-20	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
_	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-7-28	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
_	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-8-11	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
0,1_1 0 11	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	1
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-8-40	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
UA_1-0 <del>-4</del> 0	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	TDD
CA 1 11 10	11		_					EDD
CA_1-11-18		1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	FDD
	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	-
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-18-28	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
	28	703 MHz	_	733 MHz <sup>1</sup>	758 MHz	_	788 MHz <sup>1</sup>	
CA_1-19-21	11	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	

	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	I _	1510.9 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
04 440 00			_			_		
CA_1-19-28	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
	28	718 MHz <sup>1</sup>	_	748 MHz	773 MHz <sup>1</sup>	_	803 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-19-42	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-21-42	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	100
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-5	4	1710 MHz	1	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-2-4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	1
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-7	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	FDD
O/(_Z + /	7	2500 MHz		2570 MHz	2620 MHz		2690 MHz	100
	2	1850 MHz	=	1910 MHz	1930 MHz		1990 MHz	
CA_2-4-12	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	FDD
CA_2-4-12	12		_	716 MHz		_		FDD
	2	699 MHz	_		729 MHz	_	746 MHz	
04 0 4 40		1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-13	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	13	777 MHz	-	787 MHz	746 MHz	_	756 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-29	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	FDD
	29		N/		717 MHz	_	728 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-30	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	30	2305 MHz	-	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-12	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-2-5-12	5	824 MHz	1	849 MHz	869 MHz	-	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-13	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD
	13	777 MHz	-	787 MHz	746 MHz	_	756 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-29	5	824 MHz	_	849 MHz	869 MHz	_	894MHz	FDD
	29	-	N/A		717 MHz	_	728 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-30	5	824 MHz		849 MHz	869 MHz	_	894 MHz	FDD
O/ (_2 0 00	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
CA_2-7-12	7	2500 MHz		2570 MHz	2620 MHz		2690 MHz	FDD
CA_2-1-12	12	699 MHz	_	716 MHz		_	746 MHz	- 100
			_		729 MHz	_		
CA 0.40.00	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-12-30	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-29-30	29		N//		717 MHz	_	728 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
CA_3-5-40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
O/ \_O O ¬O	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	. 55

	40		_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-7-8	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	8	880	_	915	925	_	960	
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-7-20	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	-	821 MHz	
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-7-28	7	2500 MHz	-	2570 MHz	2620 MHz	_	2690 MHz	FDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-8-40	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
0.000	40		_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	3		_	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-19-42	19		_	845 MHz	875 MHz	_	890 MHz	FDD
OA_5-15-42	42		-	3600 MHz	3400 MHz	_	3600 MHz	TDD
	3	1710 MHz						100
CA 2.7.20	7		— N1//	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-7-38			N/A		2620 MHz	_	2690 MHz	TDD
	38		N/		2570 MHz	_	2620 MHz	TDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-28-40	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
	40		_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_3-41-42	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	100
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-5-12	5	824 MHz	1	849 MHz	869 MHz	-	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-5-12	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-5-13	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
0,1_1010	13		_	787 MHz	746 MHz	_	756 MHz	. 55
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-5-29	5		_	849 MHz	869 MHz	_	894 MHz	FDD
UA_4-3-29	29		_ N//		717 MHz	_	728 MHz	100
	4	1710 MHz	IN//				2155 MHz	
04 45 00	•		_	1755 MHz	2110 MHz	_		EDD
CA_4-5-30	5		_	849 MHz	869 MHz	_	894 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-5-30	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	30	-	_	2315 MHz	2350 MHz	_	2360 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-7-12	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-12-30	12	699 MHz	_	716 MHz	729 MHz	-	746 MHz	FDD
	30	2305 MHz	-	2315 MHz	2350 MHz	-	2360 MHz	
04 4 4 4 0	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-12-	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
30	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-29-30	29		N/A		717 MHz	_	728 MHz	FDD
5.1 20 00	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-29-	29		_ N/		717 MHz	_	728 MHz	FDD
30	30	2305 MHz	- N//	2315 MHz	2350 MHz	_	2360 MHz	טטו
<del> </del>	7		-					
CA_7-8-20		2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	8	880 MHz	-	915 MHz	925 MHz	_	960 MHz	l

	20	832 MHz	-	862 MHz	791 MHz	_	821 MHz		
	7		N/A	4	2620 MHz	-	2690 MHz	FDD	
CA_7-20-38	20	832 MHz	ı	862 MHz	791 MHz	-	821 MHz	רטט	
	38		N/A	4	2570 MHz	-	2620 MHz	TDD	
	19	830 MHz	ı	845 MHz	875 MHz	-	890 MHz	FDD	
CA_19-21-42	21	1447.9 MHz	ı	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	רטט	
	42	3400 MHz	ı	3600 MHz	3400 MHz	-	3600 MHz	TDD	
NOTE 1: The frequency range in band 28 is restricted for this CA band combination.									

Table 5.5A-2b: Inter-band CA operating bands (four bands)

E-UTRA CA	E-UTRA	Uplink (UL)	ор	erating band	Downlink (D	L) c	perating band	Duplex
Band	Band			JE transmit			UE receive	Mode
		F <sub>UL_low</sub>	_	F <sub>UL_high</sub>		w –	F <sub>DL_high</sub>	
	1	1920 MHz -	-	1980 MHz	2110 MHz	-	2170 MHz	
1-3-5-40	3	1710 MHz -	-	1785 MHz	1805 MHz	ı	1880 MHz	FDD
1-3-3-40	5	824 MHz -	_	849 MHz	869 MHz	ı	894 MHz	
	40	2300 MHz -	-	2400 MHz	2300 MHz	ı	2400 MHz	TDD
	1	1920 MHz   -	-	1980 MHz	2110 MHz	-	2170 MHz	
1270	3	1710 MHz -	-	1785 MHz	1805 MHz	-	1880 MHz	FDD
1-3-7-8	7	2500 MHz -	-	2570 MHz	2620 MHz	-	2690 MHz	טטיז
	8	880 MHz -	-	915 MHz	925 MHz	-	960 MHz	
	1	1920 MHz -	-	1980 MHz	2110 MHz	-	2170 MHz	
1 2 7 20	3	1710 MHz -	-	1785 MHz	1805 MHz	-	1880 MHz	FDD
1-3-7-28	7	2500 MHz -	_	2570 MHz	2620 MHz	_	2690 MHz	יטט
	28	703 MHz -	_	748 MHz	758 MHz	-	803 MHz	
	1	1920 MHz -	_	1980 MHz	2110 MHz	-	2170 MHz	
4 0 0 40	3	1710 MHz -	_	1785 MHz	1805 MHz	-	1880 MHz	FDD
1-3-8-40	8	880 MHz -	_	915 MHz	925 MHz	-	960 MHz	
	40	2300 MHz -	_	2400 MHz	2300 MHz	-	2400 MHz	TDD
	1	1920 MHz -	_	1980 MHz	2110 MHz	-	2170 MHz	
4 0 40 40	3	1710 MHz -	_	1785 MHz	1805 MHz	-	1880 MHz	FDD
1-3-19-42	19	830 MHz -	_	845 MHz	875 MHz	-	890 MHz	
	42	3400 MHz -	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz -	_	1980 MHz	2110 MHz	_	2170 MHz	
	19	830 MHz -	_	845 MHz	875 MHz	_	890 MHz	FDD
1-19-21-42	21	1447.9 MHz -	_	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	
	42	3400 MHz -	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	2	1850 MHz -	_	1910 MHz	1930 MHz	-	1990 MHz	
0.45.40	4	1710 MHz -	_	1755 MHz	2110 MHz	-	2155 MHz	
2-4-5-12	5	824 MHz -	_	849 MHz	869 MHz	-	894 MHz	FDD
	12	699 MHz -	_	716 MHz	729 MHz	-	746 MHz	
	2	1850 MHz -	_	1910 MHz	1930 MHz	-	1990 MHz	
0.45.00	4	1710 MHz -	_	1755 MHz	2110 MHz	_	2155 MHz	
2-4-5-29	5	824 MHz -	_	849 MHz	869 MHz	-	894 MHz	FDD
	29	1	N//	A	717 MHz	-	728 MHz	
	2	1850 MHz -	_	1910 MHz	1930 MHz	-	1990 MHz	
0.45.00	4	1710 MHz -	_	1755 MHz	2110 MHz	-	2155 MHz	
2-4-5-30	5	824 MHz -	_	849 MHz	869 MHz	-	894 MHz	FDD
	30	2305 MHz -	-	2315 MHz	2350 MHz	-	2360 MHz	
	2	1850 MHz -	_	1910 MHz	1930 MHz	-	1990 MHz	
0.4740	4	1710 MHz -	_	1755 MHz	2110 MHz	-	2155 MHz	
2-4-7-12	7	2500 MHz -	_	2570 MHz	2620 MHz	-	2690 MHz	FDD
	12	699 MHz -	-	716 MHz	729 MHz	_	746 MHz	]
	2	1850 MHz -	-	1910 MHz	1930 MHz	_	1990 MHz	
0.440.00	4	1710 MHz -	-	1755 MHz	2110 MHz	_	2155 MHz	
2-4-12-30	12	699 MHz -	-	716 MHz	729 MHz	ı	746 MHz	FDD
	30	2305 MHz -	-	2315 MHz	2350 MHz	-	2360 MHz	]
	2	1850 MHz -	-	1910 MHz	1930 MHz	_	1990 MHz	
2 4 20 20	4	1710 MHz -	-	1755 MHz	2110 MHz	_	2155 MHz	
2-4-29-30	29	1	N//	A	717 MHz	_	728 MHz	FDD
	30	2305 MHz -	_	2315 MHz	2350 MHz	_	2360 MHz	

Table 5.5A-3: Intra-band non-contiguous CA operating bands (with two sub-blocks)

E-UTRA	E-UTRA	Uplink (UL)	оре	erating band	Downlink (D	L) c	perating band	Duplex Mode	
CA Band	Band	BS receive	BS receive / UE transmit			BS transmit / UE receive			
		F <sub>UL_low</sub>	F <sub>UL_low</sub> - F <sub>UL_high</sub>			F <sub>DL_low</sub> - F <sub>DL_high</sub>			
CA_2-2	2	1850 MHz	_	1910 MHz	1930 MHz	-	1990 MHz	FDD	
CA_3-3	3	1710 MHz	-	1785 MHz	1805 MHz	_	1880 MHz	FDD	
CA_4-4	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	FDD	
CA_5-5	5	824 MHz	-	849 MHz	869 MHz	-	894 MHz	FDD	
CA_7-7	7	2500 MHz	-	2570 MHz	2620 MHz	_	2690 MHz	FDD	
CA_23-23	23	2000 MHz	-	2020 MHz	2180 MHz	_	2200 MHz	FDD	
CA_25-25	25	1850 MHz	_	1915 MHz	1930 MHz	-	1995 MHz	FDD	
CA_40-40	40	2300 MHz	-	2400 MHz	2300 MHz	_	2400 MHz	TDD	
CA_41-41	41	2496 MHz	-	2690 MHz	2496 MHz	_	2690 MHz	TDD	
CA_42-42	42	3400 MHz	ı	3600 MHz	3400 MHz	-	3600 MHz	TDD	
CA_66-66	66	1710 MHz	ı	1780 MHz	2110 MHz	-	2200 MHz	FDD	

# 5.5B Operating bands for UL-MIMO

E-UTRA UL-MIMO is designed to operate in the operating bands defined in Table 5.5-1.

Table 5.5B-1: Void

# 5.5C Operating bands for Dual Connectivity

E-UTRA dual connectivity is designed to operate in the operating bands defined in Table 5.5C-1.

Table 5.5C-1: Inter-band dual connectivity operating bands (two bands)

E-UTRA	E-		•	erating band			perating band	Duplex
DC Band	UTRA			JE transmit			UE receive	Mode
	Band		, –	F <sub>UL_high</sub>		<u>,                                    </u>	F <sub>DL_high</sub>	
DC_1-3	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	. 55
DC_1-5	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
DO_1-3	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	100
DC_1-7	1	1920 MHz	_	1980 MHz	2110 MHz	–	2170 MHz	FDD
DC_1-7	7	2500 MHz	-	2570 MHz	2620 MHz	_	2690 MHz	FDD
DO 4.0	1	1920 MHz	-	1980 MHz	2110 MHz	_	2170 MHz	
DC_1-8	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
DO 1 10	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
DC_1-19	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
DC_1-21	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
DC_1-42	42	3400 MHz		3600 MHz	3400 MHz		3600 MHz	FDD
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
DC_2-4	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
			_		1	_		
DC_2-5	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
DC_2-12	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
DC_2-13	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
DO_Z-13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	100
DC_3-5	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
DC_3-3	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD
DO 0.7	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
DC_3-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
DC_3-8	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
DC_3-19	19	830 MHz		845 MHz	875 MHz	_	890 MHz	FDD
	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	
DC_3-20	20	832 MHz		862 MHz	791 MHz		821 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	
DC_3-26		814 MHz	_	849 MHz	859 MHz	_	894 MHz	FDD
	26		_			_		
DC_4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
DC_4-7	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	. 55
DC_4-12	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
DO_+ 12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	100
DC_4-13	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
DC_4-13	13	777 MHz	-	787 MHz	746 MHz	_	756 MHz	FDD
DO 4.47	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
DC_4-17	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
DC_5-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
DC_5-12	12	699 MHz	_	716 MHz	729 MHz	<u> </u>	746 MHz	FDD
	7							
DC_7-20		2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
DC_7-28	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
DC_19-21	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
10	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	. 55
DC_39-41	39	1880 MHz	_	1920 MHz	1880 MHz	_	1920 MHz	TDD
DO_00-41	41	2496 MHz	_	2690 MHz	2496 MHz	l –	2690 MHz	טטו

Table 5.5C-2: Inter-band dual connectivity operating bands (three bands)

E-UTRA DC	E-UTRA	Uplink (UL	) ope	erating band	Downlink (DL) operating band			Duplex
Band Band		BS receiv	e/L	JE transmit	BS trans	mit /	UE receive	Mode
Barra	Baila	F <sub>UL_lov</sub>	<sub>w</sub> –	F <sub>UL_high</sub>	$F_{DL\_low} - F_{DL\_high}$			
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
DC_1-3-19	3	1710 MHz	-	1785 MHz	1805 MHz	-	1880 MHz	FDD
	19	830 MHz	_	845 MHz	875 MHz	-	890 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	
DC_1-19-21	19	830 MHz	1	845 MHz	875 MHz	-	890 MHz	FDD
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	

# 5.5D Operating bands for ProSe

E-UTRA ProSe is designed to operate in the operating bands defined in Table 5.5D-1.

Table 5.5D-1 E-UTRA ProSe operating band

E-UTRA	E-UTRA	ProSe UE transmit	ProSe UE receive	ProSe	ProSe Direct		
ProSe Band	Operating Band	F <sub>UL_low</sub> - F <sub>UL_high</sub>	F <sub>DL_low</sub> - F <sub>DL_high</sub>	Duplex Mode	Disc.	Comm.	
2	2	1850 MHz – 1910 MHz	1850 MHz – 1910 MHz	HD	Yes		
3	3	1710 MHz – 1785 MHz	1710 MHz – 1785 MHz	HD	Yes	Yes	
4	4	1710 MHz – 1755 MHz	1710 MHz – 1755 MHz	HD	Yes		
7	7	2500 MHz - 2570 MHz	2500 MHz - 2570 MHz	HD	Yes	Yes	
14	14	788 MHz – 798 MHz	788 MHz – 798 MHz	HD	Yes	Yes	
20	20	832 MHz – 862 MHz	832 MHz - 862 MHz	HD	Yes	Yes	
26	26	814 MHz – 849 MHz	814 MHz - 849 MHz	HD	Yes	Yes	
28	28	703 MHz - 748 MHz	703 MHz - 748 MHz	HD	Yes	Yes	
31	31	452.5 MHz - 457.5 MHz	452.5 MHz - 457.5 MHz	HD	Yes	Yes	
41	41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	HD	Yes		
68	68	698 MHz - 728 MHz	698 MHz - 728 MHz	HD	Yes	Yes	

E-UTRA ProSe is designed to operate concurrent with E-UTRA uplink/downlink on the operating bands combinations listed in Table 5.5D-2.

Table 5.5D-2 Inter-band E-UTRA ProSe / E-UTRA operating bands

E-UTRA ProSe Band Note 1	E-UTRA band / E-UTRA CA band Note					
2	4					
	CA_2-4 <sup>Note 3</sup>					
28	1					
20	CA_1-28 <sup>Note 3</sup>					
NOTE 1: As specified in Ta	ble 5.5D-1					
NOTE 2: As specified in Ta	able 5.5-1 and Table 5.5A-2					
NOTE 3: Applies when E-U	TRA uplink is assigned to one E-UTRA					
band and ProSe of	peration is restricted to the uplink					
frequencies paired	with either PCC or SCC.					
NOTE 4: The concurrency f	or E-UTRA ProSe Direct Discovery with					
E-UTRA uplink/do	wnlink applies after allowing for any					
transmission and/	or reception gap requested by the UE.					

## 5.5E Operating bands for UE category 0 and UE category M1

UE category 0 is designed to operate in the E-UTRA operating bands 2, 3, 4, 5, 8, 13, and 20 in both half duplex FDD mode and full-duplex FDD mode and in bands 39 and 41 in TDD mode. The E-UTRA bands are defined in Table 5.5-1.

UE category M1 is designed to operate in the E-UTRA operating bands 1, 2, 3, 4, 5, 7, 8, 11, 12, 13, 18, 19, 20, 21, 26, 27, 28, and 31 in both half duplex FDD mode and full-duplex FDD mode, and in bands 39 and 41 in TDD mode. The E-UTRA bands are defined in Table 5.5-1.

## 5.5F Operating bands for NB-IoT

NB-IoT is designed to operate in the E-UTRA operating bands 1, 2, 3, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28, 66 which are defined in Table 5.5-1. NB-IoT system operates in HD-FDD duplex mode.

### 5.6 Channel bandwidth

Requirements in present document are specified for the channel bandwidths listed in Table 5.6-1.

Table 5.6-1: Transmission bandwidth configuration N<sub>RB</sub> in E-UTRA channel bandwidths

Channel bandwidth BW <sub>Channel</sub> [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N <sub>RB</sub>	6	15	25	50	75	100

Figure 5.6-1 shows the relation between the Channel bandwidth ( $BW_{Channel}$ ) and the Transmission bandwidth configuration ( $N_{RB}$ ). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at  $F_C + /- BW_{Channel} / 2$ .

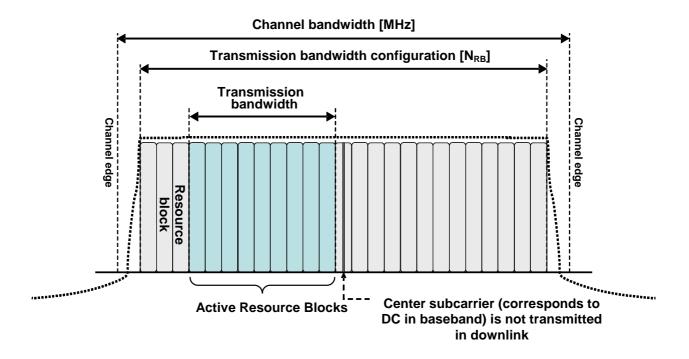


Figure 5.6-1: Definition of channel bandwidth and transmission bandwidth configuration for one E-UTRA carrier

# 5.6.1 Channel bandwidths per operating band

a) The requirements in this specification apply to the combination of channel bandwidths and operating bands shown in Table 5.6.1-1. The transmission bandwidth configuration in Table 5.6.1-1 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

Table 5.6.1-1: E-UTRA channel bandwidth

E-UTRA band / Channel bandwidth										
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz				
1			Yes	Yes	Yes	Yes				
2	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
3	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
4	Yes	Yes	Yes	Yes	Yes	Yes				
5	Yes	Yes	Yes	Yes <sup>1</sup>						
6			Yes	Yes <sup>1</sup>						
7			Yes	Yes	Yes <sup>3</sup>	Yes <sup>1, 3</sup>				
8	Yes	Yes	Yes	Yes <sup>1</sup>						
9			Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
10			Yes	Yes	Yes	Yes				
11			Yes	Yes <sup>1</sup>						
12	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>						
13			Yes <sup>1</sup>	Yes <sup>1</sup>						
14			Yes <sup>1</sup>	Yes <sup>1</sup>						
17			Yes <sup>1</sup>	Yes <sup>1</sup>						
18			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>					
19			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>					
20			Yes	Yes¹	Yes <sup>1</sup>	Yes <sup>1</sup>				
21			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>					
22			Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
23	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
24			Yes	Yes						
25	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>				
26	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>					
27	Yes	Yes	Yes	Yes <sup>1</sup>						
28		Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1, 2</sup>				
30			Yes	Yes <sup>1</sup>						
31	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>							
33			Yes	Yes	Yes	Yes				
34			Yes	Yes	Yes					
35	Yes	Yes	Yes	Yes	Yes	Yes				
36	Yes	Yes	Yes	Yes	Yes	Yes				
37			Yes	Yes	Yes	Yes				
38			Yes	Yes	Yes <sup>3</sup>	Yes <sup>3</sup>				
39			Yes	Yes	Yes <sup>3</sup>	Yes <sup>3</sup>				
40			Yes	Yes	Yes	Yes				
41			Yes	Yes	Yes	Yes				
42			Yes	Yes	Yes	Yes				
43			Yes	Yes	Yes	Yes				
44		Yes	Yes	Yes	Yes	Yes				
45			Yes	Yes	Yes	Yes				
46						Yes				
64			Rese	erved						
65			Yes	Yes	Yes	Yes				
66	Yes	Yes	Yes	Yes	Yes	Yes				
68			Yes	Yes	Yes					
NOTE 4.		1 1 1 1 1 1				<del></del>				

NOTE 1: 1 refers to the bandwidth for which a relaxation of the specified UE receiver

sensitivity requirement (subclause 7.3) is allowed. <sup>2</sup> For the 20 MHz bandwidth, the minimum requirements are specified for NOTE 2: E-UTRA UL carrier frequencies confined to either 713-723 MHz or 728-

<sup>738</sup> MHz
NOTE 3: <sup>3</sup> refers to the bandwidth for which the uplink transmission bandwidth can be restricted by the network for some channel assignments in FDD/TDD co-existence scenarios in order to meet unwanted emissions requirements (Clause 6.6.3.2).

b) The use of different (asymmetrical) channel bandwidth for the TX and RX is not precluded and is intended to form part of a later release.

#### 5.6A Channel bandwidth for CA

For intra-band contiguous carrier aggregation *Aggregated Channel Bandwidth*, *Aggregated Transmission Bandwidth Configuration* and *Guard Bands* are defined as follows, see Figure 5.6A-1.

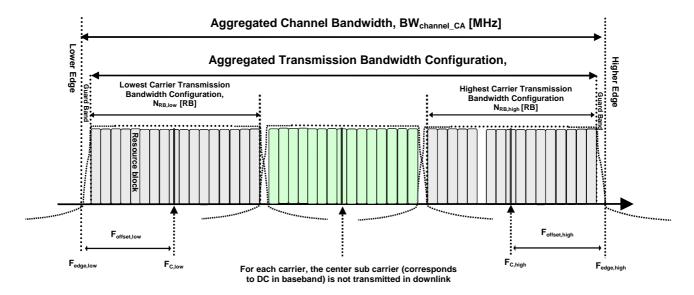


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

The aggregated channel bandwidth, BW<sub>Channel CA</sub>, is defined as

$$BW_{Channel\_CA} = F_{edge,high} - F_{edge,low}$$
 [MHz].

The lower bandwidth edge  $F_{\text{edge,low}}$  and the upper bandwidth edge  $F_{\text{edge,high}}$  of the aggregated channel bandwidth are used as frequency reference points for transmitter and receiver requirements and are defined by

$$F_{edge,low} = F_{C,low} - F_{offset,low}$$

$$F_{edge,high} = F_{C,high} + F_{offset,high}$$

The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as

$$F_{\text{offset,low}} = (0.18N_{\text{RB,low}} + \Delta f_1)/2 + BW_{\text{GB}} [\text{MHz}]$$

$$F_{offset,high} = (0.18N_{RB,high} + \Delta f_1)/2 + BW_{GB} [MHz]$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while  $N_{RB,low}$  and  $N_{RB,high}$  are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier, respectively.  $BW_{GB}$  denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

NOTE: The values of BW<sub>Channel\_CA</sub> for UE and BS are the same if the lowest and the highest component carriers are identical.

Aggregated Transmission Bandwidth Configuration is the number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth and is defined per CA Bandwidth Class (Table 5.6A-1).

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.6A-2.

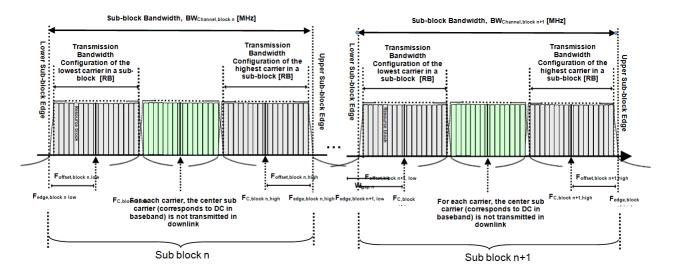


Figure 5.6A-2. Non-contiguous intraband CA terms and definitions

The lower sub-block edge of the Sub-block Bandwidth (BW  $_{Channel,block}$ ) is defined as

$$F_{\text{edge,block, low}} = F_{\text{C,block,low}} - F_{\text{offset,block, low}}$$

The upper sub-block edge of the Sub-block Bandwidth is defined as

$$F_{\text{edge,block,high}} = F_{\text{C,block,high}} + F_{\text{offset,block,high}}$$

The Sub-block Bandwidth, BW<sub>Channel,block</sub>, is defined as follows:

$$_{BWChannel,block} = F_{edge,block,high} - F_{edge,block,low}$$
 [MHz]

The lower and upper frequency offsets  $F_{\text{offset,block,low}}$  and  $F_{\text{offset,block,high}}$  depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carriers within a sub-block and are defined as

$$F_{offset,block,low} = (0.18N_{RB,low} + \Delta f_1)/2 + BW_{GB}[MHz]$$

$$F_{offset,block,high}\!=(0.18N_{RB,high}+\Delta f_1)/2+BW_{GB}\left[MHz\right]$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while  $N_{RB,low}$  and  $N_{RB,high}$  are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier within a sub-block, respectively.  $BW_{GB}$  denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

The sub-block gap size between two consecutive sub-blocks  $W_{gap}$  is defined as

$$W_{gap} = F_{edge,block n+1,low} - F_{edge,block n,high [MHz]}$$

Table 5.6A-1: CA bandwidth classes and corresponding nominal guard bands

CA Bandwidth Class	Aggregated Transmission Bandwidth Configuration	Number of contiguous CC	Nominal Guard Band BW <sub>GB</sub>
Α	N <sub>RB,agg</sub> ≤ 100	1	$a_1 \text{ BW}_{\text{Channel}(1)}$ - $0.5\Delta f_1 \text{ (NOTE 2)}$
В	25 < N <sub>RB,agg</sub> ≤ 100	2	0.05 $max(BW_{Channel(1)},BW_{Channel(2)})$ - 0.5 $\Delta f_1$
С	100 < N <sub>RB,agg</sub> ≤ 200	2	$0.05 \ max(BW_{Channel(1)},BW_{Channel(2)}) - 0.5\Delta f_1$
D	200 < N <sub>RB,agg</sub> ≤ 300	3	0.05 $max(BW_{Channel(1)},BW_{Channel(2)}, BW_{Channel(3)}) - 0.5\Delta f_1$
E	300 < N <sub>RB,agg</sub> ≤ 400	4	0.05 $max(BW_{Channel(1)},BW_{Channel(2)},BW_{Channel(3)},BW_{Channel(4)})$ - 0.5 $\Delta f_1$
F	$400 < N_{RB,agg} \le 500$	5	NOTE 3
	$700 < N_{RB,agg} \le 800$	8	NOTE 3

NOTE 1: BW<sub>Channel(j)</sub>, j = 1, 2, 3, 4 is the channel bandwidth of an E-UTRA component carrier according to Table 5.6-1 and  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing while  $\Delta f_1 = 0$  for the uplink.

NOTE 2:  $a_1 = 0.16/1.4$  for BW<sub>Channel(1)</sub> = 1.4 MHz whereas  $a_1 = 0.05$  for all other channel bandwidths.

NOTE 3: Applicable for later releases.

The channel spacing between centre frequencies of contiguously aggregated component carriers is defined in subclause 5.7.1A.

### 5.6A.1 Channel bandwidths per operating band for CA

The requirements for carrier aggregation in this specification are defined for carrier aggregation configurations with associated bandwidth combination sets. For inter-band carrier aggregation, a *carrier aggregation configuration* is a combination of operating bands, each supporting a carrier aggregation bandwidth class. For intra-band contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting a carrier aggregation bandwidth class.

For each carrier aggregation configuration, requirements are specified for all bandwidth combinations contained in a *bandwidth combination set*, which is indicated per supported band combination in the UE radio access capability. A UE can indicate support of several bandwidth combination sets per band combination.

Requirements for intra-band contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-1. Requirements for inter-band carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-2 and Table 5.6A.1-2a. Requirements for intra-band non-contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-3.

The DL component carrier combinations for a given CA configuration shall be symmetrical in relation to channel centre unless stated otherwise in Table 5.6A.1-1, Table 5.6A.1-2, Table 5.6A.1-2a and Table 5.6A.1-2b.

Table 5.6A.1-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA

	Uplink CA	E-UTF Component carr	RA CA configurat			set	
E-UTRA CA configuratio n	configurat ions (NOTE 3)	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidth s for carrier [MHz]	Maximum aggregated bandwidth [MHz]	Bandwidth combinatio n set
CA_1C	CA_1C	15	15			40	0
	0/\_10	20	20			40	0
		5	20				
CA_2C		10	15, 20			40	0
O/1_20		15	10, 15, 20			]	J
		20	5, 10, 15, 20				
CA_3C	CA_3C	5, 10, 15	20			40	0
UA_50	OA_50	20	5, 10, 15, 20			40	0
CA_5B		5, 10	10			20	0
UA_3B		10	5			20	0
CA_7B		15	5			20	0
		15	15			40	0
		20	20			40	O
		10	20				
CA_7C	CA_7C	15	15, 20			40	1
	•	20	10, 15, 20			-	
		15	10, 15				_
		20	15, 20			40	2
		5,10	10				
CA_8B	CA_8B	10	5			20	0
CA_12B	-	5	5, 10			15	0
		10	10				
CA_23B	-	5	15			20	0
		1.4, 3, 5	5				
CA_27B	-	1.4, 3	10			13	0
		15	15				
CA_38C	CA_38C	20	20			40	0
		5,10,15	20				
CA_39C	CA_39C	20	5, 10, 15			35	0
		10	20				
		15	15			40	0
<u>.</u>		20	10, 20			1	
CA_40C	CA_40C	10, 15	20				
		15	15			40	1
	,	20	10, 15, 20			1	
		10, 15, 20	20	20			
CA_40D	CA_40C	20	10, 15	20		60	0
		20	20	10, 15		1	
CA_41C	CA_41C	10	20			40	0

		15	15, 20				
		20	10, 15, 20				
		5, 10	20				
		15	15, 20			40	1
		20	5, 10, 15, 20				
		10	15, 20				
		15	10, 15, 20			40	2
		20	10, 15, 20				
		10	20				
		20	20			40	3
		10	20	15			
		10	15, 20	20			
		15	20	10, 15			
CA_41D	CA_41C	15	10, 15, 20	20		60	0
		20	15, 20	10			
		20	10, 15, 20	15, 20			
		5, 10, 15, 20	20	10, 20		40	
CA_42C	CA_42C	20	5, 10, 15			40	0
CA_42C	CA_42C	10, 15, 20	20			40	1
		20	10, 15			10	
CA_42D	CA_42C	5,10,15,20	20	20		60	0
OA_42D	UA_420	20	20	5,10,15		00	O
04.405	04 400	5,10,15,20	20	20	20	00	0
CA_42E	CA_42C	20	20	20	5,10,15	80	0
		5	5, 10, 15				
CA_66B	-	10	5, 10			20	0
		15	5				
		10	15, 20				
CA_66C	-	15	10, 15, 20			40	0
		20	5, 10, 15, 20				
	1						

NOTE 1: The CA configuration refers to an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.

NOTE 2: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.

NOTE 3: Uplink CA configurations are the configurations supported by the present release of specifications.

Table 5.6A.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (two bands)

	E-UT	RA CA c	onfigur	ation /	Bandw	idth co	mbinat	tion set	:	
E-UTRA CA Configuration	Uplink CA configurations (NOTE 4)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set
CA_1A-3A	CA_1A-3A	1			Yes	Yes	Yes	Yes	40	0
_		3			Yes	Yes	Yes	Yes		
CA_1A-3C	_	1	S00 (	N 2C	Yes	Yes	Yes nbinatio	Yes	60	0
OA_1A-30	_	3	See C		in Table			ni Set	00	O
		1				Yes			00	
00 10 50	00 40 50	5				Yes			20	0
CA_1A-5A	CA_1A-5A	1			Yes	Yes	Yes	Yes	30	1
		5			Yes	Yes			30	ı
CA_1A-7A	CA_1A-7A	1			Yes	Yes	Yes	Yes	40	0
O/\_1/\ //\	<u> </u>	7				Yes	Yes	Yes		
04 44 70		1			Yes	Yes	Yes	Yes	0.0	
CA_1A-7C	-	7	See (		in Table	5.6A.1			60	0
1		1			Yes	Yes	Yes	Yes	30	0
		8			Yes	Yes				-
CA_1A-8A	CA_1A-8A	1 8			Yes	Yes			20	1
1					Yes	Yes	Voc	Voc		
		8		Yes	Yes Yes	Yes Yes	Yes	Yes	30	2
		1		162	Yes	Yes	Yes	Yes		
CA_1A-11A	-	11			Yes	Yes	163	103	30	0
		1			Yes	Yes	Yes	Yes		
		18			Yes	Yes	Yes		35	0
CA_1A-18A	CA_1A-18A	1			Yes	Yes			00	4
1		18			Yes	Yes			20	1
CA_1A-19A	CA_1A-19A	1			Yes	Yes	Yes	Yes	35	0
CA_TA-T9A	CA_TA-T9A	19			Yes	Yes	Yes		35	U
CA_1A-20A	-	1			Yes	Yes	Yes	Yes	40	0
0/1_//120/1		20			Yes	Yes	Yes	Yes		, and the second
CA_1A-21A	CA_1A-21A	1			Yes	Yes	Yes	Yes	35	0
_		21			Yes	Yes	Yes	V		
1		1			Yes	Yes	Yes	Yes	35	0
CA_1A-26A	CA_1A-26A	26 1			Yes Yes	Yes Yes	Yes			
		26			Yes	Yes			20	1
		1			Yes	Yes	Yes	Yes		_
04 44 65	04 44 55 1	28			Yes	Yes	Yes	Yes	40	0
CA_1A-28A	CA_1A-28A	1			Yes	Yes			20	4
		28			Yes	Yes			20	1
CA_1A-40A		1			Yes	Yes	Yes	Yes	40	0
OΛ_1Λ- <del>1</del> 0Λ	-	40			Yes	Yes	Yes	Yes	40	U
CA_1A-41A	-	1			Yes	Yes	Yes	Yes	40	0
5		41			Yes	Yes	Yes	Yes		Ŭ
CA 1A 11C		1	_	CA 44	Yes	Yes	Yes	Yes	60	_
CA_1A-41C	-	41	See		C Banc 1 in Tal		Combina	สแดก	60	0
		1		361	Yes	Yes	Yes	Yes		
CA_1A-42A	CA_1A-42A	42			Yes	Yes	Yes	Yes	40	0
		1			Yes	Yes	Yes	Yes		
CA_1A-42C	-	42	See			lwidth (	Combina		60	0

						1				,
		2	Yes	Yes	Yes	Yes	Yes	Yes	40	0
		4			Yes	Yes	Yes	Yes		
CA_2A-4A	CA_2A-4A	2	-		Yes	Yes	-		20	1
_	_	4			Yes	Yes		.,		
		2			Yes	Yes	Yes	Yes	40	2
		4			Yes	Yes	Yes	Yes		
CA 2A 2A 4A		2	See				Combir	nation	00	0
CA_2A-2A-4A	-	4		Set	0 in Tal		1	Voc	60	0
		2			Yes Yes	Yes Yes	Yes Yes	Yes Yes		
CA 2A-4A-4A	_		Soot	^			Combir		60	0
UA_2A-4A-4A	_	4	See		0 in Tal			iation	00	
			See				Combir	ation		
CA_2A-2A-		2		_	0 in Tal			iation		
4A-4A	-	4	See				Combin	nation	80	0
		4			0 in Tal					
		2			Yes	Yes	Yes	Yes	20	0
CA 0A 5A	CA 0A 5A	5			Yes	Yes			30	0
CA_2A-5A	CA_2A-5A	2			Yes	Yes			20	4
		5			Yes	Yes			20	1
		2	See				Combir	ation		
CA_2A-2A-5A	-			Set	0 in Tal	ole 5.6A	\.1-3		50	0
		5			Yes	Yes				
		2	See				nbinatio	n set		
CA_2C-5A	-			0	in Table		-1	ı	50	0
		5			Yes	Yes				
CA_2A-7A	-	2			Yes	Yes	Yes	Yes	40	0
O/(_Z/(//(		7			Yes	Yes	Yes	Yes		Ů
		2			Yes	Yes	Yes	Yes	30	0
		12			Yes	Yes				Ů
CA_2A-12A	CA_2A-12A	2			Yes	Yes	Yes	Yes	30	1
0,(_2,( )2,(	O/ (//	12		Yes	Yes	Yes				·
		2			Yes	Yes			20	2
		12			Yes	Yes				_
CA_2A-2A-		2	See				Combir	nation		_
12A	-			Set	0 in Tal		\.1-3	ı	50	0
		12			Yes	Yes	Vaa	V		
CA 2A 12B		2	Caa	CA 40	Yes	Yes	Yes	Yes	25	
CA_2A-12B	-	12	See		B Band 0 in Tal		Combina	ation	35	0
			Soo				combin	ation		
CA_2A-2A-		2	366	_	0 in Tab			allon		
12B	-	4.0	See				Combina	ation	55	0
		12		_	0 in Tal					
		2	See				nbinatio	n set		
CA_2C-12A	-		ļ	0	in Table	5.6A.1	-1	,	50	0
		12	ļ		Yes	Yes	ļ			
		2			Yes	Yes	Yes	Yes	30	0
CA_2A-13A	CA_2A-13A	13	ļ			Yes	ļ			J
5/ _Z/( 15/A	5/(_Z/( 15/A	2	ļ		Yes	Yes	ļ		20	1
		13	ļ			Yes			20	'
CA_2A-2A-		2	See				Combin	nation		
13A	-	40		Set	0 in Tal	50	0			
-		13	<u> </u>			Yes	<u> </u>			
CA_2A-17A	-	2	<u> </u>		Yes	Yes	<u> </u>		20	0
_		17	<u> </u>		Yes	Yes				
CA_2A-28A	-	2			Yes	Yes	Yes	Yes	40	0
		28	<b>_</b>		Yes	Yes	Yes	Yes		
		2	ļ	.,	Yes	Yes			20	0
04 04 05		29	ļ	Yes	Yes	Yes			-	-
CA_2A-29A	-	2	ļ		Yes	Yes	ļ		20	1
		29	ļ		Yes	Yes	\			
i l		2	1	I	Yes	Yes	Yes	Yes	30	2

	ı	1								ı
		29			Yes	Yes				
		2	See 0				nbinatio	n Set		_
CA_2C-29A	-			0	in table		-1 '	ı	50	0
		29			Yes	Yes		.,		
CA_2A-30A	_	2			Yes	Yes	Yes	Yes	30	0
		30			Yes	Yes				, and the second
		2	See	_			nbinatio	n set		
CA_2C-30A	-			0	in Table		-1	ı	50	0
		30			Yes	Yes		.,		
CA_2A-46A	_	2			Yes	Yes	Yes	Yes	40	0
		46						Yes		-
		3				Yes	Yes	Yes	30	0
		5			Yes	Yes				, and the second
		3				Yes			20	1
CA_3A-5A	CA_3A-5A	5			Yes	Yes			20	'
OA_SA-SA	OA_SA-SA	3			Yes	Yes	Yes	Yes	30	2
		5			Yes	Yes			30	2
		3			Yes	Yes	Yes	Yes	30	3
		5		Yes	Yes	Yes			30	3
		2	See (	CA_3C	Bandwi	dth Cor	nbinatio	n Set		
CA_3C-5A	-	3			in Table				50	0
		5			Yes	Yes				
		3			Yes	Yes	Yes	Yes	40	
CA 2A 7A	CA 2A 7A	7				Yes	Yes	Yes	40	0
CA_3A-7A	CA_3A-7A	3			Yes	Yes	Yes	Yes	40	4
		7			Yes	Yes	Yes	Yes	40	1
		3			Yes	Yes	Yes	Yes		
CA_3A-7B	-		See C	A 7B I			bination		40	0
_		7			n table					
		3			Yes	Yes	Yes	Yes		
		7	See	CA_7C	Bandw		nbinatio	n set	60	0
CA 2A 7C	CA_3A-7A	7			in table					
CA_3A-7C	CA_7C	3			Yes	Yes	Yes	Yes		
		7	See	CA_7C	Bandw	idth cor	nbinatio	n set	60	1
		,			in table					
	CA_3A-7A	3	See 0				nbinatio	n Set		
CA_3C-7A	CA_3C			0	in table			1	60	0
	0/1_00	7			Yes	Yes	Yes	Yes		
		3	See 0				nbinatio	n Set		
CA_3C-7C	-				in Table				80	0
		7	See (				nbinatio	n Set		
		2	-	<u> 2</u>	in Table			Voc		
		3			V	Yes	Yes	Yes	30	0
		8			Yes	Yes	-			
		3			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Yes	<u> </u>		20	1
CA_3A-8A	CA_3A-8A	8			Yes	Yes	\			
		3		ļ.,-	Yes	Yes	Yes	Yes	30	2
		8		Yes	Yes	Yes				_
		3			Yes	Yes	Yes	Yes	30	3
		8			Yes	Yes	<u> </u>			
		3	See				Combir	nation	50	_
				Set	0 in tab		.1-3	1	00	0
CA_3A-3A-8A	_	8	-	<u> </u>	Yes	Yes	<u></u>	<u></u>		
		3	See C				Combin	ation	40	
		0		Se	t 1 in ta		A.1-პ 	1	40	1
		8			Yes	Yes	\/	V		
CA_3A-19A	CA_3A-19A	3			Yes	Yes	Yes	Yes	35	0
		19			Yes	Yes	Yes		-	
		3			Yes	Yes	Yes	Yes	30	0
CA_3A-20A	CA_3A-20A	20			Yes	Yes	ļ.,			, ,
55, \ 20, \		3			Yes	Yes	Yes	Yes	40	1
		20			Yes	Yes	Yes	Yes		
CA_3A-26A	CA_3A-26A	3			Yes	Yes	Yes	Yes	35	0

		00	1	1	l Vaa	V	Vaa	I		1
		26 3			Yes	Yes	Yes			
					Yes	Yes			20	1
		26 3			Yes	Yes	Vaa	V		
CA_3A-27A	-	27			Yes Yes	Yes Yes	Yes	Yes	30	0
							Vaa	V		
CA_3A-28A	-	3			Yes	Yes	Yes	Yes	40	0
		28	Coo (	24 20	Yes	Yes	Yes	Yes		
CA 2C 20A		3	See	CA_3C	in Table			n Set	60	0
CA_3C-28A	-	28		I	Yes	Yes	Yes	Yes	60	0
		3			Yes	Yes	Yes	Yes		
CA_3A-31A	-	31		Yes	Yes	163	163	163	25	0
		3		162	Yes	Yes	Yes	Yes		
CA_3A-38A	-	38			Yes	Yes	Yes	Yes	40	0
					Yes	Yes				
CA_3A-40A	-	3 40					Yes	Yes	40	0
					Yes	Yes	Yes	Yes		
CA 3A 40C		3	Coo	CA 40	Yes	Yes	Yes	Yes	60	0
CA_3A-40C	-	40	See	CA_40	1 in Tal			ation	60	0
		3		Jei	Yes	Yes	Yes	Yes		
CA_3A-41A	-	41			Yes	Yes	Yes	Yes	40	0
					Yes	Yes	Yes	Yes		
CA 2A 41C		3	Coo	CA_41					60	0
CA_3A-41C	-	41	See		0 in Tal			ation	60	0
		3		Jei	Yes	Yes	Yes	Yes		
CA_3A-42A	-	42			Yes	Yes	Yes	Yes	40	0
		3			Yes	Yes	Yes	Yes		
CA_3A-42C	_	42	800	CA_42					60	0
UA_3A-42U	_	42	366		0 in Tal			aliOH	00	0
		3		361	Yes	Yes	Yes	Yes		
CA_3A-46A	-	46			163	163	163	Yes	40	0
		4			Yes	Yes		163		
		5			Yes	Yes			20	0
CA_4A-5A	CA_4A-5A	4			Yes	Yes	Yes	Yes		
		5			Yes	Yes	165	162	30	1
		5	Sool	L CA_4A-			Combin	ation		
CA_4A-4A-5A	_	4	366		0 in tab			iation	50	0
0/1_4/14/10/1		5			Yes	Yes			00	
		4			Yes	Yes				
		7			Yes	Yes	Yes	Yes	30	0
CA_4A-7A	CA_4A-7A	4			Yes	Yes	Yes	Yes		
		7			Yes	Yes	Yes	Yes	40	1
		4			Yes	Yes	169	169		1
		4			Yes	Yes			40	0
		7			Yes	Yes	Yes	Yes	40	
CA_4A-4A-7A	-	4			Yes	Yes		Yes		+
					Yes	Yes	Yes Yes	Yes	60	4
		7							60	1
			Var	Vac	Yes	Yes	Yes	Yes		
		4	Yes	Yes	Yes	Yes			20	0
		12	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Yes	Yes	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			
		4	Yes	Yes	Yes	Yes	Yes	Yes	30	1
		12			Yes	Yes				
		4			Yes	Yes	Yes	Yes	30	2
CA_4A-12A	CA_4A-12A	12		Yes	Yes	Yes				
		4			Yes	Yes			20	3
		12			Yes	Yes				
		4			Yes	Yes	Yes	Yes	30	4
		12			Yes	Yes				
		4			Yes	Yes	Yes		20	5
		12			Yes				20	J
CA_4A-4A-	_	4	See	CA_4A-				nation	50	0
12A				Set	0 in Tal	ole 5.6 <i>P</i>	۱.1-3			

		12			Yes	Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-12B	-	12	See	CA_12	B Band	dwidth C	Combina	ation	35	0
				Set	0 in Tal	ole 5.6 <i>A</i>	۱.1-1			
		4			Yes	Yes	Yes	Yes	0.0	_
		13				Yes			30	0
CA_4A-13A	CA_4A-13A	4			Yes	Yes				
					163				20	1
		13			L	Yes	<u> </u>	L.,		
CA_4A-4A-		4	See				Combir	nation		_
13A	-			Set	0 in Tai	ole 5.6/	\.1-3	1	50	0
10/1		13				Yes				
CA 4A 47A	CA 4A 47A	4			Yes	Yes			20	_
CA_4A-17A	CA_4A-17A	17			Yes	Yes			20	0
		4			Yes	Yes	Yes	Yes		
CA_4A-27A	-	27		Yes	Yes	Yes			30	0
				163			V	V		
CA_4A-28A	-	4			Yes	Yes	Yes	Yes	40	0
_		28			Yes	Yes	Yes	Yes		
		4			Yes	Yes			20	0
		29		Yes	Yes	Yes			20	
		4			Yes	Yes				_
CA_4A-29A	-	29			Yes	Yes			20	1
		4			Yes	Yes	Yes	Yes		1
							res	res	30	2
		29		L	Yes	Yes				
CA_4A-4A-		4	See				combin	ation		
29A	-			set	<u>0 in Tal</u>	le 5.6A	<u>1-3</u>		50	0
23/1		29			Yes	Yes				
0.1.1.00.1		4			Yes	Yes	Yes	Yes		_
CA_4A-30A	-	30			Yes	Yes			30	0
		4	Saa				combin	ation		
CA_4A-4A-		7	000		0 in Tal	50	0			
30A	_	30		361			l. 1-5		50	
					Yes	Yes	.,	.,		
CA_4A-46A	_	4			Yes	Yes	Yes	Yes	40	0
0/1_1/10/1		46						Yes	10	Ŭ
		5	Yes	Yes	Yes	Yes			00	0
		7				Yes	Yes	Yes	30	0
CA_5A-7A	CA_5A-7A	5			Yes	Yes				
		7			100	Yes	Yes	Yes	30	1
					\/		162	162		
CA_5A-12A	CA_5A-12A	5			Yes	Yes			20	0
		12			Yes	Yes				
		5			Yes	Yes				
CA_5A-12B	-	12	See	CA_12	B Band	dwidth C	Combina	ation	25	0
						ole 5.6 <i>A</i>				
		5			Yes	Yes				_
CA_5A-13A	-	13			1	Yes			20	0
		5			Voc					1
CA_5A-17A	-				Yes	Yes			20	0
_		17			Yes	Yes				1
CA_5A-25A	_	5			Yes	Yes			30	0
UN_UN-20A		25	<u> </u>	<u> </u>	Yes	Yes	Yes	Yes		
04 54 004		5			Yes	Yes				
CA_5A-29A	_	29			Yes	Yes			20	0
		5			Yes	Yes				1
CA_5A-30A	-								20	0
		30			Yes	Yes				
CA_5A-38A	-	5			Yes	Yes			30	0
210, 1.00, 1		38			Yes	Yes	Yes	Yes		
		5	<u></u>	<u></u>	Yes	Yes	<u></u>		20	0
04 54 :5:		40			Yes	Yes	Yes	Yes	30	"
CA_5A-40A	-	5		Yes	Yes	Yes				
		40			Yes	Yes	Yes	Yes	30	1
							162	162		1
		5	_	<u> </u>	Yes	Yes	<u> </u>	<u> </u>	50	
CA_5A-40C	_	40	See C				Combi	nation	50	0
2200						ole 5.6 <i>P</i>	\.1-1	ı		
		5		Yes	Yes	Yes			50	1

	T	1		N 400			<u> </u>	1'		T
		40	See (		of Bar 1 in Tal		Combi	nation		
		7		<u> </u>	ıııııdı	Yes	Yes	Yes		
		8		Yes	Yes	Yes	163	163	30	0
CA_7A-8A	-	7	<del>                                     </del>	169	169	Yes	Yes	Yes		
		8			Yes	Yes	163	163	30	1
		7	-		Yes	Yes	Yes	Yes		
CA_7A-12A	-	12					162	162	30	0
		7			Yes	Yes Yes	Voc	Voc		
					Vaa		Yes	Yes	30	0
CA_7A-20A	CA_7A-20A	7			Yes	Yes	\/	\/		
						Yes	Yes	Yes	40	1
		20			Yes	Yes	Yes	Yes		
CA_7A-22A	-	7				Yes	Yes	Yes	40	0
_		22			Yes	Yes	Yes	Yes		
		7			Yes	Yes	Yes	Yes	35	0
CA_7A-28A	CA_7A-28A	28			Yes	Yes	Yes			-
0/1//120/1	0/1// 20/1	7			Yes	Yes	Yes	Yes	40	1
		28			Yes	Yes	Yes	Yes		'
		7	See C				binatior	set 0		
CA_7B-28A	-			<u>. i</u>	n table			ı	40	0
		28			Yes	Yes	Yes	Yes		
		7	See C				binatior	set 2		
CA_7C-28A	-			<u>. i</u>	n table	<u>5.6A.1-</u>	1	ı	60	0
		28			Yes	Yes	Yes	Yes		
CA_7A-40A		7			Yes	Yes	Yes	Yes	40	0
CA_7A-40A	-	40			Yes	Yes	Yes	Yes	40	U
		7			Yes	Yes	Yes	Yes		
CA_7A-40C	-	40	See	CA_40	C Band	width C	Combina	ation	60	0
		40		Set	1 in Tal	ole 5.6 <i>A</i>	۸.1-1			
04 74 404		7			Yes	Yes	Yes	Yes	40	0
CA_7A-42A	-	42			Yes	Yes	Yes	Yes	40	0
04 74 404		7			Yes	Yes	Yes	Yes		
CA_7A-42A-	-	40		See CA		12A Baı	ndwidth	ı	60	0
42A		42	Coi				le 5.6A			
04 74 404		7			Yes	Yes	Yes	Yes	40	
CA_7A-46A	-	46						Yes	40	0
		8			Yes	Yes				_
CA_8A-11A	-	11			Yes	Yes			20	0
		8			Yes	Yes				
		20			Yes	Yes			20	0
CA_8A-20A	-	8		Yes	Yes	Yes				
		20	<del>                                     </del>	163	Yes	Yes	<del>                                     </del>		20	1
		8	<del>                                     </del>		Yes	Yes	<del>                                     </del>			
	-	40	1		Yes	Yes	Yes	Yes	30	0
CA_8A-40A			-	Voc			162	168		
	-	8	-	Yes	Yes	Yes	\/a-	V	30	1
		40	\/-	\/ -	Yes	Yes	Yes	Yes		
CA_8A-41A		8	Yes	Yes	Yes	Yes	<u> </u>		30	0
_		41	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Yes		Yes		
0		8	Yes	Yes	Yes	Yes	L			_
CA_8A-41C	-	41	See 0				mbinati	on set	50	0
					in table		-1			
CA_8A-42A	-	8	Yes	Yes	Yes	Yes			30	0
UA_UA-42A		42			Yes	Yes	Yes	Yes	30	
		8	Yes	Yes	Yes	Yes				
CA_8A-42C	-			CA_42	C Band	dwidth C	Combina	ation	50	0
		42			0 in Tal					
CA 44A 40A		11			Yes	Yes			25	
CA_11A-18A	_	18			Yes	Yes	Yes		25	0
04 104 5=1		12			Yes	Yes			22	_
CA_12A-25A	-	25			Yes	Yes	Yes	Yes	30	0
		12			Yes	Yes		- 50		
CA_12A-30A	-	30	<b>†</b>		Yes	Yes	<b>†</b>		20	0
I	i	1 00	1	Ì	100	100	1	ı		Ī

CA_18A-28A	CA_18A-28A	18			Yes	Yes	Yes		25	0
	_	28			Yes	Yes				
CA_19A-21A	CA_19A-21A	19			Yes	Yes	Yes		30	0
	0.5.0	21			Yes	Yes	Yes			
CA_19A-28A	_	19			Yes	Yes	Yes		25	0
O/(_15/\(\frac{2}{2}\)		28			Yes	Yes			20	J
CA 40A 40A		19			Yes	Yes	Yes		25	0
CA_19A-42A	-	42			Yes	Yes	Yes	Yes	35	0
		19			Yes	Yes	Yes			
CA_19A-42C	-		See	CA 42			Combina	ation	55	0
		42			0 in Tal					
		20			Yes	Yes	Yes	Yes		
CA_20A-31A	-	31		Yes	Yes	100	100		25	0
		20		163		Voc				
CA_20A-32A	-				Yes	Yes			30	0
		32			Yes	Yes	Yes	Yes		
CA_20A-38A	-	20			Yes	Yes	Yes	Yes	40	0
- O/(_20/( 00/(		38			Yes	Yes	Yes	Yes	10	Ŭ
CA 20A 40A		20				Yes	Yes	Yes	40	0
CA_20A-40A	-	40				Yes	Yes	Yes	40	0
		20			Yes	Yes	Yes	Yes		
CA_20A-42A	-	42			Yes	Yes	Yes	Yes	40	0
		20			Yes	Yes	Yes	Yes		
CA_20A-42A-		20		See C			ndwidth		60	0
42A	-	42	Co				nawiain de 5.6A		60	0
		20	Col	nbinatio						
CA_20A-67A	-	20			Yes	Yes	Yes	Yes	40	0
		67			Yes	Yes	Yes	Yes		
CA_21A-42A	_	21			Yes	Yes	Yes		35	0
O/(_Z   //(   /Z //(		42			Yes	Yes	Yes	Yes		Ů
		21			Yes	Yes	Yes			
CA_21A-42C	-	40	See	CA_42	C Band	dwidth (	Combina	ation	55	0
		42		Set	0 in Tal	ble 5.6 <i>A</i>	۸.1-1			
		23			Yes	Yes	Yes	Yes	00	
		29		Yes	Yes	Yes			30	0
CA_23A-29A	-	23			Yes	Yes				
		29		Yes	Yes	Yes			20	1
		25		1			Voc	Voc		
				Yes	Yes	Yes	Yes	Yes	35	0
		26	Yes	Yes	Yes	Yes	Yes			
CA_25A-26A	_	25		Yes	Yes	Yes			20	1
071_2071 2071		26		Yes	Yes	Yes				
		25			Yes	Yes			20	2
		26			Yes	Yes			20	
04		25			Yes	Yes	Yes	Yes		_
CA_25A-41A	-	41	1	1	Yes	Yes	Yes	Yes	40	0
		25	<u> </u>	<u> </u>	Yes	Yes	Yes	Yes		
CA_25A-41C	CA_41C		800	CA 11			Combina		60	0
3/\_23/\-\-\10	0,1_410	41	366		1 in Tal			atiOi i	00	
		25		Jet	Yes	Yes	Yes	Yes		
CA 25A 44D		25	Coo	CA 44					90	0
CA_25A-41D	-	41	See				Combina	ation	80	U
		00		Set	0 in Tal			1		
CA_26A-41A	-	26	ļ	ļ	Yes	Yes	Yes		35	0
		41			Yes	Yes	Yes	Yes		
		26	<u> </u>	<u> </u>	Yes	Yes	Yes			
CA_26A-41C	-	44	See	CA_41	C Band	dwidth C	Combina	ation	55	0
		41		Set	1 in Tal	ble 5.6/	\.1-1			
04 004 104		28			Yes	Yes	Yes	Yes	40	_
CA_28A-40A	-	40	1	1	Yes	Yes	Yes	Yes	40	0
		28	<u> </u>	<u> </u>	Yes	Yes	Yes	Yes		
CA_28A-40C	_		San (	Δ 40C			mbinati		60	0
3/\_20/\-400		40	066 (		in Table			on set	00	
		28	-		Yes	Yes	Yes	Yes		
CV 30V 40D			0 -	C A 40					90	_
CA_28A-40D	-	40	See				Combina	สเเดท	80	0
04.004.44.			-	Set	0 in Tal		1.1-1	1	0.0	
CA_28A-41A	-	28			Yes	Yes			30	0

		41			Yes	Yes	Yes	Yes			
		28			Yes	Yes					
CA_28A-41C		41	See C				mbinati	on set	50	0	
				0	in Table						
CA_28A-42A	-	28			Yes	Yes	Yes	Yes	40	0	
		42			Yes	Yes	Yes	Yes			
		28			Yes	Yes	Yes	Yes		_	
CA_28A-42C	-	42	See C		: Bandv in Table		mbinati	on set	60	0	
		29		T U	Yes	Yes	-				
CA_29A-30A	-	30			Yes	Yes			20	0	
		38			103	Yes		Yes			
CA_38A-40A	-	40				Yes		Yes	40	0	
		38				Yes		Yes			
CA_38A-40A-	_	40		See C	Δ 40Δ-		ndwidth		60	0	
40A		40	Cor				le 5.6A		00		
		38			1	Yes	10 0.07 1	Yes			
CA_38A-40C	-	40	See	CA 40	C Band		Combina		60	0	
					0 in Tal						
04 004 444	04 004 444	39				Yes	Yes	Yes	40	0	
CA_39A-41A	CA_39A-41A	41						Yes	40	0	
	CA_41C	39				Yes	Yes	Yes			
CA_39A-41C	CA_39A-41A	41						Yes	60	0	
_	CA_39A-41C	41						Yes			
		39				Yes	Yes	Yes			
04 004 445	CA_41C	41						Yes			
CA_39A-41D	CA_39A-41A	41						Yes	80	0	
		41						Yes			
	CA_39C	39	See CA_39C Bandwidth Combination								
CA_39C-41A	CA_39A-41A			Set	0 in Tal	ble 5.6/	\.1-1		55	0	
	CA_39C-41A	41						Yes			
	CA_39C	39	See				Combina	ation			
CA_39C-41C	CA_33C CA_41C			Set	0 in Tal	ble 5.6/	\.1-1		75	0	
0/1_000 110	CA_39A-41A	41						Yes	70		
		41						Yes			
CA_41A-42A	-	41				Yes	Yes	Yes	40	0	
		42		ļ		Yes	Yes	Yes			
		41		1		Yes	Yes	Yes			
CA_41A-42C	-	42	See				Combina	ation	60	0	
				Set	1 in Tal	ble 5.6 <i>A</i>	\.1-1				
		41	See	_			Combina	ation			
CA_41C-42A	-			Set	0 in Tal			I	60	0	
		42				Yes	Yes	Yes			
		41	See CA_41C Bandwidth Combination								
CA_41C-42C	_		Set 0 in Table 5.6A.1-1						80	0	
07_410-420	_	42	See CA_42C Bandwidth Combination						00	0	
			Set 1 in Table 5.6A.1-1								
04 444 401		41			Yes	Yes	Yes	Yes	4.0		
CA_41A-46A	-	46						Yes	40	0	
04 451 451		42		1	Yes	Yes	Yes	Yes	4.5	-	
CA_42A-46A	-	46						Yes	40	0	

NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.

NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.

NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.

NOTE 4: Uplink CA configurations are the configurations supported by the present release of specifications.

NOTE 5: For TDD inter-band Carrier Aggregation only non-simultaneous Rx/Tx uplink CA configurations can be supported by UE supporting corresponding DL CA configuration without simultaneous Rx/Tx.

Table 5.6A.1-2a: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (three bands)

	E-U7	RA CA c	onfigur	ation /	Bandw	idth co	mbinati	on set								
E-UTRA CA Configuration	Uplink CA configurations (NOTE 5)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set						
		1			Yes	Yes	Yes	Yes								
	CA_1A-3A	3			Yes	Yes	Yes	Yes	50	0						
CA_1A-3A-5A	CA_1A-5A <sup>6</sup>	5			Yes	Yes										
	CA_3A-5A	1			Yes	Yes	V		40	4						
		<u>3</u> 5			Yes Yes	Yes Yes	Yes	Yes	40	1						
		1			Yes	Yes	Yes	Yes								
CA_1A-3A-7A	_	3			Yes	Yes	Yes	Yes	60	0						
on_intontint		7			100	Yes	Yes	Yes		J						
		1			Yes	Yes	Yes	Yes								
CA 4A 2A 7C		3				Yes	Yes	Yes	90	0						
CA_1A-3A-7C	-	7	See C		Bandwid n Table		bination 1	Set 2	80	0						
		1			Yes	Yes	Yes	Yes								
		3			Yes	Yes	Yes	Yes	50	0						
		8		Yes	Yes	Yes										
		1			Yes	Yes										
	CA_1A-3A	3			Yes	Yes	Yes	Yes	40	40	40	40	40	40	40	1
CA_1A-3A-8A	CA_1A-8A <sup>6</sup>	8		Yes	Yes	Yes										
- <u>-</u>	CA_3A-8A <sup>6</sup>	1			Yes	Yes	Yes		40	0						
		3		Voc	Yes	Yes	Yes		40	2						
		8		Yes	Yes Yes	Yes Yes	Yes	Yes								
		3			Yes	Yes	Yes	Yes	50	3						
		8			Yes	Yes	163	163	30	3						
	CA_1A-3A	1			Yes	Yes	Yes	Yes								
CA_1A-3A-19A	CA_1A-19A <sup>6</sup>	3			Yes	Yes	Yes	Yes	55	0						
	CA_3A-19A	19			Yes	Yes	Yes									
		1			Yes	Yes	Yes	Yes								
CA_1A-3A-26A	-	3			Yes	Yes	Yes	Yes	50	0						
		26			Yes	Yes										
		1			Yes	Yes	Yes	Yes								
CA_1A-3A-20A	-	3			Yes	Yes	Yes	Yes	60	0						
		20			Yes	Yes	Yes	Yes								
04 44 04 004		1			Yes	Yes	Yes	Yes	00	0						
CA_1A-3A-28A	-	3			Yes	Yes	Yes	Yes	60	0						
		28 1			Yes Yes	Yes Yes	Yes Yes	Yes Yes								
CA_1A-3A-40A	_	3			Yes	Yes	Yes	Yes	60	0						
JA-JA-40A		40	<u> </u>		Yes	Yes	Yes	Yes	00	J						
		1	<u> </u>		Yes	Yes	Yes	Yes								
CA_1A-3A-42A	_	3			Yes	Yes	Yes	Yes	60	0						
		42	1		Yes	Yes	Yes	Yes	1	_						
		1			Yes	Yes	Yes	Yes								
CA_1A-3A-42C	_	3			Yes	Yes	Yes	Yes	80	0						
OA_1A-3A-420	-	42	See (		Bandwin Table		mbinatio -1	on set	00	O						
		1			Yes	Yes	Yes	Yes								
CA_1A-5A-40A	10A -	5			Yes	Yes			50	0						
		40				Yes	Yes	Yes								
		1			Yes	Yes										
	CA_1A-5A <sup>6</sup>	5			Yes	Yes			40	0						
CA_1A-5A-7A	CA_TA-5A CA_1A-7A	7				Yes	Yes	Yes								
5/1/1/A-1/A	CA_1A-7A CA_5A-7A <sup>6</sup>	1			Yes	Yes	Yes	Yes								
	00,,	5	ļ		Yes	Yes			50	1						
		7	ļ			Yes	Yes	Yes								
CA_1A-7A-8A	-	1	<u> </u>		Yes	Yes	Yes	Yes	50	0						
<del>-</del>	]	7	L			Yes	Yes	Yes								

		8	1		Voc	Voc				
		1	<del>                                     </del>		Yes Yes	Yes Yes	Yes	Yes		
CA_1A-7A-20A	_	7	1		168	Yes	Yes	Yes	50	0
CA_1A-7A-20A	-	20			Yes	Yes	165	165	30	U
						Yes	Yes	Voc		
		7	<del>                                     </del>		Yes	Yes	Yes	Yes Yes	55	0
		28			Yes	Yes	Yes	165	55	U
CA_1A-7A-28A	-	1			Yes	Yes	Yes	Yes		
		7			165		Yes	Yes	60	4
						Yes			60	1
		28			Vaa	Yes	Yes	Yes		
		1	000	\	Yes	Yes	Yes	Yes		
CA_1A-7C-28A	-	7	See C				bination	Set 2	80	0
		28		!!	n Table I	Yes	Yes	Yes		
		1			Vaa					
00 40 00 440		1			Yes	Yes	Yes	Yes	40	0
CA_1A-8A-11A	-	8			Yes	Yes			40	0
		11			Yes	Yes		.,		
		1			Yes	Yes	Yes	Yes		
CA_1A-8A-40A	-	8		Yes	Yes	Yes			50	0
		40	<u></u>		Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
		11			Yes	Yes			45	0
CA_1A-11A-		18			Yes	Yes	Yes			
 18A	-	1			Yes	Yes	Yes	Yes		
		11			Yes	Yes			40	1
		18			Yes	Yes				
		1			Yes	Yes	Yes	Yes		
		18			Yes	Yes	Yes		45	0
CA_1A-18A-	CA_1A-18A	28			Yes	Yes	100		.0	
28A	CA_1A-28A <sup>6</sup>	1			Yes	Yes	Yes	Yes		
20/1	CA_18A-28A	18			Yes	Yes	103	100	40	1
		28			Yes	Yes			40	'
	00 40 4006	1			Yes	Yes	Yes	Yes		
CA_1A-19A-	CA_1A-19A <sup>6</sup>							res	50	0
_ 21A	CA_1A-21A CA_19A-21A <sup>6</sup>	19			Yes	Yes	Yes			0
	CA_19A-21A	21			Yes	Yes	Yes			
CA_1A-19A-		1			Yes	Yes	Yes	Yes		
28A	-	19			Yes	Yes	Yes		45	0
20/1		28			Yes	Yes				
0.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4		1			Yes	Yes	Yes	Yes		
CA_1A-19A-	-	19			Yes	Yes	Yes		55	0
42A		42			Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
CA_1A-19A-		19			Yes	Yes	Yes	100		
42C	-	19	Coo (	^ 42C			mbinatio	 	75	0
420		42	See					n set		
		1	-	l U	in Table			Yes		
CA_1A-21A-			-		Yes	Yes	Yes	res		_
42A	-	21	ļ		Yes	Yes	Yes	.,-	55	0
		42			Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
CA_1A-21A-	_	21			Yes	Yes	Yes		75	0
42C	_	42	See (	CA_420	Bandy	idth co	mbinatio	n set	73	U
		42		0	in Table	5.6A.1	-1			
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-5A	_	4	İ		Yes	Yes	Yes	Yes	50	0
		5			Yes	Yes				
			See	CA 24			Combin	ation		
CA 2A 2A 4A	Δ 2Δ-2Δ-4Δ-		566		0 in Tal			auon		
CA_2A-2A-4A-	-	4	<del>                                     </del>	Jel	Yes	Yes	Yes	Yes	70	0
5A			-				162	162		
		5			Yes	Yes	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ <u>'</u>		
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-7A		4			Yes	Yes	Yes	Yes	s 60	0
		7			Yes	Yes	Yes	Yes		
CA_2A-4A-4A-	-	2			Yes	Yes	Yes	Yes	70	0
	•									

5A		4	nation	1					
571		-	000	Set 0 in 7			iation		
		5		Yes					
	CA 2A 4A	2		Yes	Yes	Yes	Yes		
CA_2A-4A-12A	CA_2A-4A CA_4A-12A	4		Yes		Yes	Yes	50	0
	O/\_+/\ 12/\	12		Yes					
		2	See	CA_2A-2A B			nation		
CA_2A-2A-4A-	-	4		Set 0 in 7		A.1-3 Yes	Yes	70	0
12A		12		Yes		165	168	-	
		2		Yes		Yes	Yes		
CA_2A-4A-4A-		4	See	CA_4A-4A B					
12A	-		000	Set 0 in 7			iation	70	0
		12		Yes				1	
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-13A	-	4		Yes		Yes	Yes	50	0
		13			Yes				
		2		Yes		Yes	Yes	_	
CA_2A-4A-29A	-	4		Yes		Yes	Yes	50	0
		29		Yes		1,,			
04 64 44 555		2		Yes		Yes	Yes		
CA_2A-4A-30A	-	4		Yes		Yes	Yes	50	0
		30		Yes		Voc	Voo		
CA_2A-5A-12A		5		Yes Yes		Yes	Yes	40	0
CA_ZA-5A-1ZA	-	12		Yes				40	0
		2	See	CA_2A-2A B		Combin	ation		
CA_2A-2A-5A-			000	Set 0 in			iation		
12A	-	5		Yes				60	0
		12		Yes	Yes			1	
		2		Yes	Yes	Yes	Yes		
CA_2A-5A-12B	_	5		Yes	Yes			45	0
	_	12	See C	CA_12B Band			on Set	75	
					ole 5.6A.				
04 04 54 404	0.00.40.46	2		Yes		Yes	Yes		
CA_2A-5A-13A	CA_2A-13A <sup>6</sup>	5		Yes				40	0
		13 2		Yes	Yes	Yes	Yes		
CA_2A-5A-29A		5		Yes		165	168	40	0
CA_2A-3A-29A	-	29		Yes				40	0
		2		Yes		Yes	Yes		
CA_2A-5A-30A	_	5		Yes	_	1.00	100	40	0
		30		Yes				-	
		2	See (	CA_2C in Tal	ole 5.6A.		dwidth		
CA_2C-5A-30A	_			combi	nation se		1	60	0
UA_2U-0A-3UA	_	5		Yes					
		30		Yes					
0. 6		2		Yes		Yes	Yes		_
CA_2A-7A-12A	-	7		Yes		Yes	Yes	50	0
		12 2		Yes		Ver	Vac		
CA_2A-12A-		12		Yes Yes		Yes	Yes	40	
30A	-	30		Yes		1		40	0
			See (	CA_2C in Tal		1 1-1 Rand	lwidth		
CA_2C-12A-		2	066 (		nation se		avvidti		
30A				Yes				60	0
		12 30		Yes				1	
OA OA OOA		2		Yes		Yes	Yes		
CA_2A-29A- 30A	-	29		Yes				40	0
		30		Yes					
CA_2C-29A-		2	See 0	CA_2C in Tal			dwidth	60	0
30A				Combi	nation se	et O			

		29			Yes	Yes				
		30			Yes	Yes				
		3	<del> </del>	<del> </del>	Yes	Yes	Yes	Yes		
CA_3A-5A-40A	_	5			Yes	Yes	103	103	50	0
0/1_0/1 0/1 10/1		40			100	Yes	Yes	Yes	00	
		3			Yes	Yes	Yes			
		7				Yes	Yes		40	0
		8			Yes	Yes	100		.0	
CA_3A-7A-8A	-	3			Yes	Yes	Yes	Yes		
		7			100	Yes	Yes	Yes	50	1
		8			Yes	Yes	103	103	30	
	CA 2A 7A	3			Yes	Yes	Yes	Yes		
CA_3A-7A-20A	CA_3A-7A CA_3A-20A	7			163	Yes	Yes	Yes	60	0
CA_3A-7A-20A	CA_3A-20A CA_7A-20A <sup>6</sup>	20			Yes	Yes	Yes	Yes	00	
	OA_1A-20A	3								
CA 2A 7A 20A	CA_3A-7A	7			Yes	Yes	Yes	Yes	00	0
CA_3A-7A-28A	CA_7A-28A	28			Yes	Yes	Yes	Yes	60	0
					Yes	Yes	Yes	Yes		
		7	0 0	\		Yes	Yes	Yes		
CA_3A-7C-28A	-	/	See C	CA_7C E				Set 2	80	0
_		20			n rabie	5.6A.1-	Yes	Vaa		
		28	C 0 0 C	L CA_3C E	) Oppdwid	Yes		Yes		
		3	See C			5.6A.1-		i Sei u		
CA_3C-7A-28A	-	7		"	l rable	Yes	Yes	Yes	80	0
		28				Yes	Yes			
		3	S00 C	\ 2C E	Pondwid			Yes		
		3 See CA_3C Bandwidth Combination Set 0 in Table 5.6A.1-1						i Sei u		
CA_3C-7C-28A	_	7 See CA_7C Bandwidth Combination Set 2						100	0	
CA_3C-7C-26A	-	<b>'</b>	in Table 5.6A.1-1				100	0		
		28			labio	Yes	Yes	Yes		
		3			Yes	Yes	Yes	Yes		
CA_3A-7A- 38A <sup>7</sup>	_	7			103	Yes	Yes	Yes	60	0
38A'	38A'	38			Yes	Yes	Yes	Yes	00	
		3			Yes	Yes	Yes	Yes		
CA_3A-8A-40A		8		Yes	Yes	Yes	163	163	50	0
UA_3A-0A-40A	_	40		163	Yes	Yes	Yes	Yes	30	
		3			Yes		Yes			
CA_3A-19A-		19			Yes	Yes Yes	Yes	Yes	EE	0
42A	-	42			Yes			Vaa	55	0
						Yes	Yes	Yes		
04 04 404		3			Yes	Yes	Yes	Yes		
CA_3A-19A-	-	19	-	0.4 400	Yes	Yes	Yes	<u> </u>	75	0
42C		42	See	CA_420				on set		
		3		<u> </u>		5.6A.1		Voc		
CA_3A-28A-					Yes	Yes	Yes	Yes	00	
40A	-	28	<u> </u>	<u> </u>	Yes	Yes	Yes	Yes	60	0
		40	-	-	Yes	Yes	Yes	Yes		
04 04 004		3	ļ	ļ	Yes	Yes	Yes	Yes		
CA_3A-28A-	-	28	_	<u> </u>	Yes	Yes	Yes	Yes	80	0
40C		40	See	CA_40C				on set		
			<del>                                     </del>	<u> </u>		5.6A.1		\/-		
CA_3A-41A-		3			Yes	Yes	Yes	Yes		
42A	-	41	<u> </u>	<u> </u>		Yes	Yes	Yes	60	0
		42	ļ	ļ		Yes	Yes	Yes		
		4			Yes	Yes	Yes	Yes		
CA_4A-5A-12A	A-5A-12A -	5			Yes	Yes			40	0
		12			Yes	Yes				
	4	See	CA_4A				ation			
CA_4A-4A-5A-	_		ļ	Set		ole 5.6A	1	60	0	
12A	_	5			Yes	Yes			00	
		12			Yes	Yes				
CA_4A-5A-13A	CA_4A-13A <sup>6</sup>	4	ļ	ļ	Yes	Yes	Yes	Yes	40	0
J/\_ <del>-</del> /A-J/A-1J/A	O/\_ <del>T</del> /\-13/\	5	<u> </u>	<u> </u>	Yes	Yes	<u> </u>		<del></del>	

		13				Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-5A-29A	_	5			Yes	Yes			40	0
o, i_		29			Yes	Yes			.0	
		4			Yes	Yes	Yes	Yes		
CA_4A-5A-30A	_	5			Yes	Yes			40	0
		30			Yes	Yes				
		4	See	CA 4A	-4A Ban		Combin	ation		
CA_4A-4A-5A-					0 in Tal	0.0				
_ 30A	-	5			Yes	Yes			60	0
		30			Yes	Yes				
		4			Yes	Yes				
		7			Yes	Yes	Yes	Yes	40	0
00 40 70 400		12			Yes	Yes				
CA_4A-7A-12A	-	4			Yes	Yes	Yes	Yes		
		7			Yes	Yes	Yes	Yes	50	1
		12			Yes	Yes				
00 40 400		4			Yes	Yes	Yes	Yes		
CA_4A-12A- 30A	-	12			Yes	Yes			40	0
30A		30			Yes	Yes				
CA_4A-4A-		4	See		-4A Ban		ation			
				Set	0 in Tal		1.1-3		60	0
12A-30A		12			Yes	Yes			60	0
		30			Yes	Yes				
CA_4A-29A-		4			Yes	Yes	Yes	Yes		
30A	-	29			Yes	Yes			40	0
		30			Yes	Yes				
		4	See		-4A Bar			ation		
CA_4A-4A-	-			set	0 in Tal		.1-3	1	60	0
29A-30A		29			Yes	Yes			00	
		30			Yes	Yes	.,			
04 74 04 004		7			.,	Yes	Yes	Yes	40	
CA_7A-8A-20A	-	8		Yes	Yes	Yes			40	0
		20 7			Yes	Yes	.,			
CA 7A-20A-					.,	Yes	Yes	Yes	0.0	
CA_7A-20A- 38A <sup>8</sup>	-	20			Yes	Yes	Yes	Yes	60	0
		38			Yes	Yes	Yes	Yes		
CA_19A-21A-		19	-		Yes	Yes	Yes		50	
42A	-	21			Yes	Yes	Yes	V	50	0
		42	-		Yes	Yes	Yes	Yes		
OA 40A 04A		19	-		Yes	Yes	Yes			
CA_19A-21A- 42C	-	21	Cost	<u> </u>	Yes	Yes	Yes		70	0
420		42	See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1						et	
				U	III Table	3.0A.1				

- NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.
- NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.
- NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.
- NOTE 4: A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.
- NOTE 5: Uplink CA configurations are the configurations supported by the present release of specifications.
- NOTE 6: If the UE supports uplink CA for corresponding downlink CA it shall support this uplink CA configuration.
- NOTE 7: UL carrier shall be supported in Band 3 only. Power imbalance between downlink carriers on Band 7 and Band 38 is assumed to be within [6dB].
- NOTE 8: UL carrier shall be supported in Band 20 only. Power imbalance between downlink carriers on Band 7 and Band 38 is assumed to be within [6dB]

Table 5.6A.1-2b: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (four bands)

	E-U	TRA CA	configu	ration /	Bandw	idth co	nbinati	on set		
E-UTRA CA Configuration	Uplink CA configurations (NOTE 5)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-5A-		3			Yes	Yes	Yes	Yes	70	0
40A	-	5			Yes	Yes			] /0	0
		40				Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes	_	
CA_1A-3A-7A-	_	3			Yes	Yes	Yes	Yes	70	0
8A		7				Yes	Yes	Yes	, , ,	
		8			Yes	Yes				
04 44 04 74		1			Yes	Yes	Yes	Yes		
CA_1A-3A-7A-	-	3				Yes	Yes	Yes	80	0
28A		7				Yes	Yes	Yes	-	
		28				Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes	<u> </u>	
CA_1A-3A-7C-		3	C (	24 70 [		Yes	Yes	Yes	100	
28A	-	7	See	CA_7C I i	n Table	5.6A.1-	1		100	0
		28				Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes	ļ	
CA_1A-3A-8A-	_	3			Yes	Yes	Yes	Yes	70	0
40A		8		Yes	Yes	Yes				
		40			Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-	-	3			Yes	Yes	Yes	Yes	75	0
19A-42A		19			Yes	Yes	Yes			
		42			Yes	Yes	Yes	Yes		
		11			Yes	Yes	Yes	Yes	 	
CA_1A-3A-		3			Yes	Yes	Yes	Yes		
19A-42C	-	19			Yes	Yes	Yes		95	0
		42	See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1							
		1			Yes	Yes	Yes	Yes		
CA_1A-19A-		19			Yes	Yes	Yes		70	0
21A-42A	-	21			Yes	Yes	Yes		] 70	0
		42			Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes	]	
CA_1A-19A-		19			Yes	Yes	Yes			
21A-42C	-	21			Yes	Yes	Yes		90	0
217( 120		42	See 0			width combination set 0 e 5.6A.1-1		set 0		
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-5A-		4			Yes	Yes	Yes	Yes	60	0
12A	_	5			Yes	Yes			00	"
		12			Yes	Yes				
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-5A-	_	4			Yes	Yes	Yes	Yes	60	0
29A		5			Yes	Yes			]	
		29			Yes	Yes				
		2			Yes	Yes	Yes	Yes	ļ	
CA_2A-4A-5A-	_	4			Yes	Yes	Yes	Yes	60	0
30A		5			Yes	Yes			-2	
		30			Yes	Yes				
04 04 4: -:		2			Yes	Yes	Yes	Yes	-	
CA_2A-4A-7A-	-	4		ļ	Yes	Yes	Yes	Yes	70	0
12A		7		ļ	Yes	Yes	Yes	Yes	-	
		12		<u> </u>	Yes	Yes	V			
CA_2A-4A-		2			Yes	Yes	Yes	Yes	00	0
12A-30A	-	4		1	Yes	Yes	Yes	Yes	60	
		12			Yes	Yes				

		30		Yes	Yes				
	2		Yes	Yes	Yes	Yes			
CA_2A-4A-		4		Yes	Yes	Yes	Yes	60	0
29A-30A	-	29		Yes	Yes			60	U
		30		Yes	Yes				

- NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.
- NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.
- NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.
- NOTE 4: A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.
- NOTE 5: Uplink CA configurations are the configurations supported by the present release of specifications.

Table 5.6A.1-3: E-UTRA CA configurations and bandwidth combination sets defined for non-contiguous intra-band CA (with two sub-blocks)

				ntion / Bandwid	th combinatio	n set	
	Uplink CA	-	frequ	iency		Maximum	Bandwidth
E-UTRACA configuration	configurations (NOTE 1)	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	aggregated bandwidth [MHz]	combination
CA_2A-2A	-	5, 10, 15, 20	5, 10, 15, 20	-	-	40	0
		5, 10, 15, 20	5, 10, 15, 20			40	0
CA_3A-3A	-	5, 10	5, 10, 15, 20			30	1
CA 4A 4A	CA 4A 4A	5, 10, 15, 20	5, 10, 15, 20			40	0
CA_4A-4A	CA_4A-4A	5, 10	5, 10			20	1
CA_5A-5A	-	5,10	5,10			20	0
		5	15				
		10	10, 15			40	0
CA_7A-7A	-	15	15, 20			40	0
		20	20				
		5, 10, 15, 20	5, 10, 15, 20			40	1
CA_23A-23A	-	5	10			15	0
CA_25A-25A		5, 10	5, 10			20	0
CA_25A-25A	-	5, 10, 15, 20	5, 10, 15, 20			40	1
CA_40A-40A	-	10, 20	10, 20			40	0
CA_41A-41A		10, 15, 20	10, 15, 20			40	0
CA_41A-41A	-	5, 10, 15, 20	5, 10, 15, 20			40	1
CA_41A-41C	_	5, 10, 15, 20	Combination 5.6A	C Bandwidth Set 1 in Table \.1-1		60	0
5/\_\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		Combination 5.6A		5, 10, 15, 20			ŭ
CA 41A 41D	CA 41C	5, 10, 15, 20		Bandwidth Coi in Table 5.6A.1		80	0
CA_41A-41D	CA_41C		Bandwidth Coi in Table 5.6A.1		5, 10, 15, 20	80	0
CA_41C-41C	CA_41C	See CA_410	C Bandwidth Set 0 in Table	See CA_410 Combination	C Bandwidth Set 0 in Table  A.1-1	80	0
CA_42A-42A	-	5, 10, 15, 20	5, 10, 15, 20	0.07		40	0
CA_42A-42C	-	5, 10, 15, 20	See CA_420 Combination	L C Bandwidth Set 0 in Table A.1-1		60	0
CA_42A-42D	-	5, 10, 15, 20	See CA_42D	Bandwidth Colin Table 5.6A.1		80	0
CA_42C-42A	-	See CA_420 Combination	C Bandwidth Set 0 in Table A.1-1	5, 10, 15, 20		60	0
CA_42C-42C	-	See CA_420 Combination	C Bandwidth Set 0 in Table		C Bandwidth Set 0 in Table A.1-1	80	0

CA_42D-42A	-		Bandwidth Cor in Table 5.6A.1		5, 10, 15, 20	80	0			
CA_66A-66A	-	5, 10, 15, 20	5, 10, 15, 20			40	0			
NOTE 1: Uplink CA configurations are the configurations supported by the present release of specifications.										

### 5.6B Channel bandwidth for UL-MIMO

The requirements specified in subclause 5.6 are applicable to UE supporting UL-MIMO.

#### 5.6B.1 Void

## 5.6C Channel bandwidth for Dual Connectivity

For E-UTRA DC bands specified in 5.5C, the corresponding E-UTRA CA configurations in 5.6A.1, i.e., dual uplink inter-band carrier aggregation with uplink assigned to two E-UTRA bands, are applicable to Dual Connectivity.

- NOTE 1: Requirements for the dual connectivity configurations are defined in the section corresponding E-UTRA uplink CA configurations, unless otherwise specified.
- NOTE 2: For TDD inter-band dual connectivity configurations, requirements are applicable only for synchronous operation.

#### 5.6C.1 Void

**Table 5.6C.1-1: Void** 

**Table 5.6C.1-2: Void** 

#### 5.6D Channel bandwidth for ProSe

## 5.6D.1 Channel bandwidths per operating band for ProSe

The ProSe combination of channel bandwidths and operating bands is shown in Table 5.6D.1-1 and Table 5.6D.1-2. The transmission bandwidth configuration in Table 5.6D.1-1 and Table 5.6D.1-2 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

Table 5.6D.1-1 ProSe Direct Discovery channel bandwidth

	E-UTRA ProSe band / ProSe channel bandwidth						
E-UTRA ProSe Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
2			Yes	Yes	Yes	Yes	
3			Yes	Yes	Yes	Yes	
4			Yes	Yes	Yes	Yes	
7			Yes	Yes	Yes	Yes	
14			Yes	Yes			
20			Yes	Yes	Yes	Yes	
26			Yes	Yes	Yes		
28			Yes	Yes	Yes	Yes	
31			Yes				
41			Yes	Yes	Yes	Yes	

Table 5.6D.1-2 ProSe Direct Communication channel bandwidth

E-UTRA ProSe band / ProSe channel bandwidth						
E-UTRA ProSe Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
3				Yes		
7				Yes		
14				Yes		
20				Yes		
26				Yes		
28				Yes		
31			Yes			

## 5.6F Channel bandwidth for category NB1

Channel bandwidth for NB-IoT is 200 kHz.

Figure 5.6F-1 shows the relation between the NB-IoT channel bandwidth (BW<sub>Channel</sub>) and the NB-IoT transmission bandwidth configuration (N<sub>tone</sub>). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at  $F_C$  +/-  $BW_{Channel}$  /2.

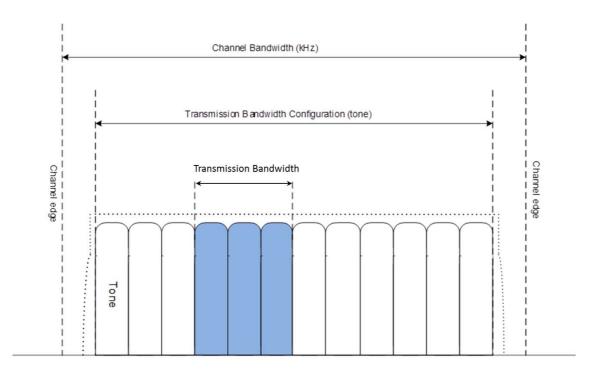


Figure 5.6F-1 Definition of Channel Bandwidth and Transmission Bandwidth configuration

### 5.7 Channel arrangement

#### 5.7.1 Channel spacing

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the channel bandwidths. The nominal channel spacing between two adjacent E-UTRA carriers is defined as following:

Nominal Channel spacing = 
$$(BW_{Channel(1)} + BW_{Channel(2)})/2$$

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA carriers. The channel spacing can be adjusted to optimize performance in a particular deployment scenario.

## 5.7.1A Channel spacing for CA

For intra-band contiguous carrier aggregation with two or more component carriers, the nominal channel spacing between two adjacent E-UTRA component carriers is defined as the following unless stated otherwise:

Nominal channel spacing = 
$$\frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1 |BW_{Channel(1)} - BW_{Channel(2)}|}{0.6}$$
 [MHz]

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA component carriers according to Table 5.6-1 with values in MHz. The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of 300 kHz less than the nominal channel spacing to optimize performance in a particular deployment scenario.

For intra-band contiguous carrier aggregation with two or more component carriers in Band 46, the requirements apply for both 19.8 MHz and 20.1 MHz nominal carrier spacing.

For intra-band non-contiguous carrier aggregation the channel spacing between two E-UTRA component carriers in different sub-blocks shall be larger than the nominal channel spacing defined in this subclause.

#### 5.7.1F Channel spacing for category NB1

Nominal channel spacing for UE category NB1 in stand-alone mode is 200 kHz. For in-band and guard-band cases the nominal channel spacing between two adjacent category NB1 carriers is 180 kHz.

#### 5.7.2 Channel raster

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

#### 5.7.2A Channel raster for CA

For carrier aggregation the channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

#### 5.7.2F Channel raster for NB-IoT

Channel raster for NB-IoT in-band, guard-band and standalone operation is 100 kHz.

#### 5.7.3 Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL\_low}$  and  $N_{Offs-DL}$  are given in Table 5.7.3-1 and  $N_{DL}$  is the downlink EARFCN.

$$F_{DL} = F_{DL \text{ low}} + 0.1(N_{DL} - N_{Offs\text{-}DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where  $F_{UL\ low}$  and  $N_{Offs\text{-}UL}$  are given in Table 5.7.3-1 and  $N_{UL}$  is the uplink EARFCN.

$$F_{UL} = F_{UL\ low} + 0.1(N_{UL} - N_{Offs\text{-}UL})$$

Table 5.7.3-1: E-UTRA channel numbers

E-UTRA		Downlink			Uplink	
Operating Band	F <sub>DL_low</sub> (MHz)	N <sub>Offs-DL</sub>	Range of N <sub>DL</sub>	F <sub>UL_low</sub> (MHz)	N <sub>Offs-UL</sub>	Range of N <sub>∪L</sub>
1	2110	0	0 – 599	1920	18000	18000 – 18599
2	1930	600	600 – 1199	1850	18600	18600 – 19199
3	1805	1200	1200 – 1949	1710	19200	19200 – 19949
4	2110	1950	1950 – 2399	1710	19950	19950 – 20399
5	869	2400	2400 – 2649	824	20400	20400 - 20649
6	875	2650	2650 – 2749	830	20650	20650 - 20749
7	2620	2750	2750 – 3449	2500	20750	20750 - 21449
8	925	3450	3450 – 3799	880	21450	21450 – 21799
9	1844.9	3800	3800 – 4149	1749.9	21800	21800 – 22149
10	2110	4150	4150 – 4749	1710	22150	22150 – 22749
11	1475.9	4750	4750 – 4949	1427.9	22750	22750 – 22949
12	729	5010	5010 - 5179	699	23010	23010 – 23179
13	746	5180	5180 - 5279	777	23180	23180 – 23279
14	758	5280	5280 - 5379	788	23280	23280 – 23379
	100					
17	734	5730	5730 - 5849	704	23730	23730 – 23849
18	860	5850	5850 - 5999	815	23850	23850 - 23999
19	875	6000	6000 - 6149	830	24000	24000 – 24149
20	791	6150	6150 - 6449	832	24150	24150 – 24449
21	1495.9	6450	6450 - 6599	1447.9	24450	24450 - 24599
22	3510	6600	6600 - 7399	3410	24600	24600 - 25399
23	2180	7500	7500 – 7699	2000	25500	25500 - 25699
24	1525	7700	7700 - 8039	1626.5	25700	25700 - 26039
25	1930	8040	8040 - 8689	1850	26040	26040 - 26689
26	859	8690	8690 - 9039	814	26690	26690 - 27039
27	852	9040	9040 - 9209	807	27040	27040 - 27209
28	758	9210	9210 - 9659	703	27210	27210 - 27659
29 <sup>2</sup>	717	9660	9660 - 9769		N/A	
30	2350	9770	9770 – 9869	2305	27660	27660 - 27759
31	462.5	9870	9870 – 9919	452.5	27760	27760 – 27809
32 <sup>2</sup>	1452	9920	9920 - 10359		N/A	
33	1900	36000	36000 - 36199	1900	36000	36000 - 36199
34	2010	36200	36200 - 36349	2010	36200	36200 - 36349
35	1850	36350	36350 - 36949	1850	36350	36350 - 36949
36	1930	36950	36950 - 37549	1930	36950	36950 - 37549
37	1910	37550	37550 – 37749	1910	37550	37550 – 37749
38	2570	37750	37750 – 38249	2570	37750	37750 – 38249
39	1880	38250	38250 - 38649	1880	38250	38250 - 38649
40	2300	38650	38650 - 39649	2300	38650	38650 - 39649
41	2496	39650	39650 -41589	2496	39650	39650 -41589
42	3400	41590	41590 – 43589	3400	41590	41590 – 43589
43	3600	43590	43590 – 45589	3600	43590	43590 – 45589
44	703	45590	45590 – 46589	703	45590	45590 – 46589
45	1447	46590	46590 – 46789	1447	46590	46590 – 46789
46 <sup>4</sup>	5150	46790	46790 - 54539	5150	46790	46790 - 54539
64			Rese			
65	2110	65536	65536 - 66435	1920	131072	131072 – 131971
66 <sup>5</sup>	2110	66436	66436 - 67335	1710	131972	131972 – 132671
67 <sup>2</sup>	738	67336	67336 – 67535		N/A	
68	753	67536	67536 - 67835	698	132672	132672 - 132971

NOTE 1: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured.

NOTE 3: For ProSe the corresponding UL channel number are also specified for the DL for the associated ProSe operating bands i.e.  $ProSe_{UL} = F_{UL}$  and  $ProSe_{DL} = F_{UL}$ .

NOTE 4: Requirements for uplink operations are not specified in this version of the specification.

NOTE 5: The range 2180-2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier

aggregation is configured.

## 5.7.3F Carrier frequency and EARFCN for category NB1

The carrier frequency of category NB1 in the downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143 and the Offset of category NB1 Channel Number to EARFCN in the range  $\{-10,-9,-8,-7,-6,-5,-4,-3,-2,-1,-0.5,0,1,2,3,4,5,6,7,8,9\}$ . The relation between EARFCN, Offset of category NB1 Channel Number to EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL}$  is the downlink carrier frequency of category NB1,  $F_{DL\_low}$  and  $F_{Offs-DL}$  are given in table 5.7.3-1,  $F_{DL}$  is the downlink EARFCN,  $F_{DL}$  is the downlink EARFCN.

$$F_{DL} = F_{DL \ low} + 0.1(N_{DL} - N_{Offs-DL}) + 0.0025*(2M_{DL}+1)$$

The carrier frequency of category NB1 in the uplink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143 and the Offset of category NB1 Channel Number to EARFCN in the range  $\{-10,-9,-8,-7,-6,-5,-4,-3,-2,-1,0,1,2,3,4,5,6,7,8,9\}$ . The relation between EARFCN, Offset of category NB1 Channel Number to EARFCN and the carrier frequency in MHz for the uplink is given by the following equation, where  $F_{UL}$  is the uplink carrier frequency of category NB1,  $F_{UL\_low}$  and  $N_{Offs-UL}$  are given in table 5.7.3-1,  $N_{UL}$  is the uplink EARFCN,  $M_{UL}$  is the Offset of category NB1 Channel Number to uplink EARFCN.

$$F_{UL} = F_{UL low} + 0.1(N_{UL} - N_{Offs-UL}) + 0.0025*(2M_{UL})$$

NOTE 1: For category NB1,  $N_{DL}$  or  $N_{UL}$  is different than the value of EARFCN that corresponds to E-UTRA downlink or uplink carrier frequency for in-band and guard band operation.

NOTE 2: For stand-alone operation, only  $M_{DL}$  = -0.5 and  $M_{UL}$  = 0 are applicable.  $M_{DL}$  = -0.5 is not applicable for inband and guard band operation.

#### 5.7.4 TX–RX frequency separation

a) The default E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation is specified in Table 5.7.4-1 for the TX and RX channel bandwidths defined in Table 5.6.1-1

TX – RX **E-UTRA Operating Band** carrier centre frequency separation 190 MHz 2 80 MHz. 3 95 MHz. 4 400 MHz 5 45 MHz 45 MHz 6 120 MHz 7 8 45 MHz 9 95 MHz 10 400 MHz 48 MHz 11 30 MHz 12 13 -31 MHz 14 -30 MHz 17 30 MHz 18 45 MHz 19 45 MHz 20 -41 MHz 21 48 MHz 22 100 MHz 180 MHz 23 24 -101.5 MHz 25 80 MHz 26 45 MHz 27 45 MHz 28 55 MHz 30 45 MHz 31 10 MHz 190 MHz 65

Table 5.7.4-1: Default UE TX-RX frequency separation

400 MHz

55 MHz

### 5.7.4A TX-RX frequency separation for CA

For intra-band contiguous carrier aggregation, the same TX-RX frequency separation as specified in Table 5.7.4-1 is applied to PCC and SCC, respectively.

## 5.7.4F TX-RX frequency separation for category NB1

66 68

For category NB1, the TX-RX frequency separation is flexible within the limits of the TX-RX frequency separation of the E-UTRA carriers as specified in table 5.7.4.1. For stand-alone operation mode the TX-RX frequency separation is the same as table 5.7.4-1.

## 6 Transmitter characteristics

#### 6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.

b) The use of other TX channel to RX channel carrier centre frequency separation is not precluded and is intended to form part of a later release.

## 6.2 Transmit power

#### 6.2.1 Void

## 6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2-1: UE Power Class

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2 ±2 <sup>2</sup>		
3					23	±2 <sup>2</sup>		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2 ±2 <sup>2</sup>		
8					23	±2 <sup>2</sup>		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2 ±2 <sup>2</sup>		
13					23	±2		
14	31	+2/-3			23	±2		
	<u> </u>	12, 0						
17					23	±2		
18					23	±2 <sup>5</sup>		
19					23	±2		
20					23	±2 <sup>2</sup>		
21					23	±2		
22					23	12/252		
23					23 <sup>6</sup>	+2/-3.5 <sup>2</sup> +2 <sup>6</sup>		
24					23	±2 .2		
						±2 ±2 <sup>2</sup>		
25					23 23	±2 ±2 <sup>2</sup>		
26								
27					23	±2		
28					23	+2/-2.5		
30					23	±2		
31					23	±2		
33					23	±2		
34					23	±2		
35					23	±2		
36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	±2 ±2 <sup>2</sup>		
41					23			
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
45					23	±2		
65					23	±2		
66					23	±2		
68					23	±2		

NOTE 1: Void

NOTE 2: <sup>2</sup> refers to the transmission bandwidths (Figure 5.6-1) confined within F<sub>UL\_low</sub> and F<sub>UL\_low</sub> + 4 MHz or

the maximum output power requirement is relaxed by reducing the low  $F_{UL\_high} - 4 \; \text{MHz} \; \text{and} \; F_{UL\_high}, \; \text{the maximum output power requirement is relaxed by reducing the lower}$ tolerance limit by 1.5 dB

- NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.
- NOTE 4: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance
  NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.
- NOTE 6: When NS\_20 is signalled, the total output power within 2000-2005 MHz shall be limited to 7 dBm.

#### 6.2.2A UE maximum output power for CA

The following UE Power Classes define the maximum output power for any transmission bandwidth within the aggregated channel bandwidth.

The maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the requirements in subclause 6.2.2 apply.

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, UE maximum output power shall be measured over all component carriers from different bands. If each band has separate antenna connectors, maximum output power is measured as the sum of maximum output power at each UE antenna connector. The maximum output power is specified in Table 6.2.2A-0.

Table 6.2.2A-0: UE Power Class for uplink interband CA (two bands)

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_1A-3A	, ,	(* )	,	(3)	23	+2/-3 <sup>2</sup>	( )	(* )
CA_1A-5A					23	+2/-3		
CA_1A-7A					23	+2/-3 <sup>2</sup>		
CA_1A-8A					23	+2/-3 <sup>2</sup>		
CA_1A-18A					23	+2/-3 <sup>5</sup>		
CA_1A-19A					23	+2/-3		
CA_1A-21A					23	+2/-3		
CA_1A-26A					23	+2/-3 <sup>2</sup>		
CA_1A-28A					23	+2/-3		
CA_1A-42A					23	+2/-3		
CA_2A-4A					23	+2/-3 <sup>2</sup>		
CA_2A-5A					23	+2/-3 <sup>2</sup>		
CA_2A-12A					23	+2/-3 <sup>2</sup>		
CA_2A-13A					23	+2/-3 <sup>2</sup>		
CA_3A-5A					23	+2/-3 <sup>2</sup>		
CA_3A-7A					23	+2/-3 <sup>2</sup>		
CA_3A-8A					23	+2/-3 <sup>2</sup>		
CA_3A-19A					23	+2/-3 <sup>2</sup>		
CA_3A-20A					23	+2/-3 <sup>2</sup>		
CA_3A-26A					23	+2/-3 <sup>2</sup>		
CA_4A-5A					23	+2/-3		
CA_4A-7A					23	+2/-3 <sup>2</sup>		
CA_4A-12A					23	+2/-3 <sup>2</sup>		
CA_4A-13A					23	+2/-3		
CA_4A-17A					23	+2/-3		
CA_5A-7A					23	+2/-3 <sup>2</sup>		
CA_5A-12A					23	+2/-3 <sup>2</sup>		
CA_5A-17A					23	+2/-3		
CA_7A-20A					23	+2/-3 <sup>2</sup>		
CA_7A-28A					23	+2/-3 <sup>2</sup>		
CA_18A-28A					23	+2/-3		
CA_19A-21A					23	+2/-3		
CA 39A-41A					23	+2/-3 <sup>2</sup>		
CA_39A-41C					23	+2/-3 <sup>2</sup>		
CA_39C-41A					23	+2/-3 <sup>2</sup>		

NOTE 1: Void

- NOTE 2: <sup>2</sup> refers to the transmission bandwidths (Figure 5.6-1) confined within F<sub>UL\_low</sub> and F<sub>UL\_low</sub> + 4 MHz or F<sub>UL\_high</sub> 4 MHz and F<sub>UL\_high</sub>, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB
- NOTE 3: PPowerClass is the maximum UE power specified without taking into account the tolerance
- NOTE 4: For inter-band carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).
- NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.

For intra-band contiguous carrier aggregation the maximum output power is specified in Table 6.2.2A-1.

Table 6.2.2A-1: CA UE Power Class for intraband contiguous CA

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_1C					23	+2/-2		
CA_3C					23	+2/-22		
CA_7C					23	+2/-2 <sup>2</sup>		
CA_8B					23	+2/-2 <sup>2</sup>		
CA_38C					23	+2/-2		
CA_39C					23	+2/-2		
CA_40C					23	+2/-2		
CA_41C					23	+2/-2 <sup>2</sup>		
CA_42C					23	+2/-3		

NOTE 1: Void

NOTE 2: If all transmitted resource blocks (Figure 5.6A-1) over all component carriers are confined within F<sub>UL\_low</sub> and F<sub>UL\_low</sub> + 4 MHz or/and F<sub>UL\_high</sub> – 4 MHz and F<sub>UL\_high</sub>, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB

NOTE 3: PpowerClass is the maximum UE power specified without taking into account the tolerance

NOTE 4: For intra-band contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.2 apply. For intra-band non-contiguous carrier aggregation with two uplink carriers the maximum output power is specified in Table 6.2.2A-2.

Table 6.2.2A-2: UE Power Class for intraband non-contiguous CA

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_4A-4A					23	+2/-2		
NOTE 1: For transmission bandwidths (Figure 5.6-1) confined within F <sub>UL_low</sub> and F <sub>UL_low</sub> + 4 MHz or F <sub>UL_high</sub> – 4 MHz and								
F <sub>UL high</sub> , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB								

NOTE 2: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance

NOTE 3: For intra-band non-contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).

#### 6.2.2B UE maximum output power for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2B-1: UE Power Class for UL-MIMO in closed loop spatial multiplexing scheme

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1	(аып)	(ub)	(ubiii)	(ub)	23	+2/-3	(ubiii)	(UB)
					23	+2/-3 +2/-3 <sup>2</sup>		
3						+2/-3 <sup>2</sup>		
					23			
4					23	+2/-3		
5					23	+2/-3		
6					23	+2/-3		
7					23	+2/-3 <sup>2</sup>		
8					23	+2/-3 <sup>2</sup>		
9					23	+2/-3		
10					23	+2/-3		
11					23	+2/-3		
12					23	+2/-3 <sup>2</sup>		
13					23	+2/-3		
14					23	+2/-3		
17					23	+2/-3		
18					23	+2/-3		
19					23	+2/-3		
20					23	+2/-3 <sup>2</sup>		
21					23	+2/-3		
22					23	+2/-4.5 <sup>2</sup>		
23					23	+2/-3		
24					23	+2/-3		
25					23	+2/-3 <sup>2</sup>		
26					23	+2/-3 <sup>2</sup>		
27					23	+2/-3		
28					23	+2/[-3]		
30					23	+2/-3		
31					23	+2/-3		
33					23	+2/-3		
34					23	+2/-3		
35					23	+2/-3		
36					23	+2/-3		
37					23	+2/-3		
38					23	+2/-3		
39					23	+2/-3		
40					23	+2/-3		
41					23	+2/-3 <sup>2</sup>		
42					23	+2/-3		-
43					23	+2/-4		-
43					23	+2/-4		
44 45								
					23	+2/-3		
 GE					22	.0/.0		
65					23	+2/-3		
66 NOTE 1:	\ <u></u>				23	+2/-3		

NOTE 1: Void
NOTE 2: <sup>2</sup> refers to the transmission bandwidths (Figure 5.6-1) confined within F<sub>UL\_low</sub> and F<sub>UL\_low</sub> + 4 MHz or  $F_{UL\_high} - 4 \; \text{MHz and} \; F_{UL\_high}, \; \text{the maximum output power requirement is relaxed by reducing the lower}$ tolerance limit by 1.5 dB

NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.

NOTE 4: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance

Table 6.2.2B-2: UL-MIMO configuration in closed-loop spatial multiplexing scheme

Transmission mode	DCI format	Codebook Index		
Mode 2	DCI format 4	Codebook index 0		

For single-antenna port scheme, the requirements in subclause 6.2.2 apply.

#### 6.2.2C Void

<reserved for future use>

#### 6.2.2D UE maximum output power for ProSe

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE maximum output power shall be as specified in Table 6.2.2A-0 in subclause 6.2.2A for the corresponding inter-band aggregation with uplink assigned to two bands.

#### 6.2.2E UE maximum output power for Category M1 UE

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2E-1: UE Power Class

EUTRA	Class 3	Tolerance	Class 5	Tolerance
band	(dBm)	(dB)	(dBm)	(dB)
1	23	±2	20	±2
2	23	±2 <sup>2</sup>	20	±2 <sup>2</sup>
2	23	±2 <sup>2</sup>	20	±2 <sup>2</sup>
4	23	(dB) ±2 ±2 <sup>2</sup> ±2 <sup>2</sup> ±2 ±2	20	(dB) ±2 ±2 <sup>2</sup> ±2 <sup>2</sup> ±2 ±2
5 7	23	±2	20	±2
	23	±2 <sup>2</sup>	20	<b>±2</b> <sup>2</sup>
8	23	+2 <sup>2</sup> +2 <sup>2</sup> +2 +2 <sup>2</sup> +2 +2 +2 +2 <sup>5</sup> +2 +2 +2 <sup>2</sup> +2 +2 <sup>2</sup>	20	±2 <sup>2</sup> ±2 <sup>2</sup> ±2 ±2 ±2 ±2 ±2 ±2 ±2 ±2 ±2 ±2 ±2 ±2
11	23	±2	20	±2
12	23	±2 <sup>2</sup>	20	<b>±2</b> <sup>2</sup>
13	23	±2	20	±2
18	23	±2 <sup>5</sup>	20	±2 <sup>5</sup>
19	23	±2	20	±2
20	23	±2 <sup>2</sup>	20	±2 <sup>2</sup>
21	23	±2	20	±2
26	23	±2 <sup>2</sup>	20	<b>±2</b> <sup>2</sup>
27	23	±2	20	±2
28	23	+2/-2.5	20	+2/-2.5
31	23	±2	20	±2
39	23	±2	20	±2
40	23	±2 ±2 <sup>2</sup>	20	±2 ±2 ±2²
41	23	±2 <sup>2</sup>	20	±2 <sup>2</sup>

NOTE 1: Void

NOTE 2: <sup>2</sup> refers to the transmission bandwidths (Figure 5.6-1) confined within F<sub>UL\_low</sub> and F<sub>UL\_low</sub> + 4 MHz or F<sub>UL\_high</sub> - 4 MHz and F<sub>UL\_high</sub>, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB

NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is

NOTE 4: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance

NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.

NOTE 6: Void

#### 6.2.2F UE maximum output power for category NB1

Category NB1 UE Power Classes are specified in Table 6.2.2F-1 and define the maximum output power for any transmission bandwidth within the category NB1 channel bandwidth.[For 3.75kHz sub-carrier spacing the maximum output power is defined as mean power of measurement which period is at least one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the maximum output power is defined as mean power of measurement which period is at least one sub-frame (1ms).]

EUTRA band	Class 3 (dBm)	Tolerance (dB)	Class 5 (dBm)	Tolerance (dB)
1	23	±2	20	±2
2	23	±2	20	±2
3	23	±2	20	±2
5	23	±2	20	±2
8	23	±2	20	±2
12	23	±2	20	±2
13	23	±2	20	±2
17	23	±2	20	±2
18	23	±2	20	±2
19	23	±2	20	±2
20	23	±2	20	±2
26	23	±2	20	±2
28	23	±2	20	±2
66	23	±2	20	±2

Table 6.2.2F-1: UE Power Class

#### 6.2.3 UE maximum output power for modulation / channel bandwidth

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1 due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

Channel bandwidth / Transmission bandwidth (NRB) Modulation MPR (dB) 1.4 3.0 5 10 15 20 MHz MHz MHz MHz MHz MHz **QPSK** > 5 > 4 > 8 > 12 > 16 > 18 **16 QAM** ≤ 5 ≤ 4 ≤ 8 ≤ 12 ≤ 16 ≤ 18 16 QAM > 4 ≤ 2 > 12 > 16 > 18 > 5 > 8 ≤ 4 64 QAM ≤ 12 ≤ 18 ≤ 2 ≤ 5 ≤ 8 ≤ 16 64 QAM > 5 > 4 > 8 > 12 > 16 > 18 ≤ 3

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1 and 3

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For transmissions with non-contiguous resource allocation in single component carrier, the allowed Maximum Power Reduction (MPR) for the maximum output power in table 6.2.2-1, is specified as follows

 $MPR = CEIL \{M_A, 0.5\}$ 

Where  $M_A$  is defined as follows

 $M_A = 8.00-10.12A$  ;  $0.00 < A \le 0.33$ 

5.67 - 3.07A ;  $0.33 < A \le 0.77$ 

3.31 ;  $0.77 < A \le 1.00$ 

Where

$$A = N_{RB \ alloc} / N_{RB}$$

CEIL{M<sub>A</sub>, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR  $\in$  [3.0, 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0]

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

## 6.2.3A UE Maximum Output power for modulation / channel bandwidth for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band (Table 5.6A-1), the requirements in subclause 6.2.3 apply.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the requirements in subclause 6.2.3 apply for each uplink component carrier.

For intra-band contiguous carrier aggregation the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1due to higher order modulation and contiguously aggregated transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3A-1. In case the modulation format is different on different component carriers then the MPR is determined by the rules applied to higher order of those modulations.

**MPR** Modulation CA bandwidth Class B and C 25 RB + 50 RB + 75 RB + 100 RB + 25 RB + 50 RB + 75 RB + (dB) **50 RB 50 RB** 100 RB 100 RB **75 RB** 100 RB 100 RB **QPSK** > 8 and ≤ > 12 and > 8 and ≤ > 12 and > 16 and > 16 and > 18 and ≤ 1 ≤ 50 ≤ 100 25 25 ≤ 50 ≤ 75 ≤ 75 **QPSK** > 25 > 50 > 25 > 75 > 75 > 100 ≤ 2 > 50 **16 QAM** ≤ 12 <u>≤</u>8 ≤ 12 ≤ 16 ≤ 16 ≤ 18 ≤ 8 ≤ 1 **16 QAM** > 8 and ≤ > 12 and > 8 and ≤ > 12 and > 16 and > 16 and > 18 and ≤ 2 25 ≤ 50 25 ≤ 50 ≤ 75 ≤ 75 ≤ 100 > 75 16 QAM > 100 > 25 > 50 > 25 > 50 > 75 ≤ 3 64 QAM ≤ 2 ≤ 8 and ≤ 12 and ≤ 8 and ≤ 12 and ≤ 16 and ≤ 16 and ≤ 18 and allocation allocation allocation allocation allocation allocation allocation wholly wholly wholly wholly wholly wholly wholly contained contained contained contained contained contained contained within a single CC 64 QAM > 8 or > 12 or > 8 or > 12 or > 16 or > 16 or > 18 or ≤ 3 allocation allocation allocation allocation allocation allocation allocation extends extends extends extends extends extends extends across across across across across across across two CC's 
Table 6.2.3A-1: Maximum Power Reduction (MPR) for Power Class 3

For PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{ min(M_A, M_{IM5}), 0.5 \}$$

Where M<sub>A</sub> is defined as follows

$$\begin{array}{lll} M_A = & 8.2 & ; 0 \leq A < 0.025 \\ & 9.2 - 40A & ; 0.025 \leq A < 0.05 \\ & 8 - 16A & ; 0.05 \leq A < 0.25 \\ & 4.83 - 3.33A & ; 0.25 \leq A \leq 0.4, \end{array}$$

$$3.83 - 0.83A$$
 ;  $0.4 \le A \le 1$ ,

and M<sub>IM5</sub> is defined as follows

$$\begin{split} M_{IM5} = \ 4.5 & ; \Delta_{IM5} < 1.5 * BW_{Channel\_CA} \\ & 6.0 & ; 1.5 * BW_{Channel\_CA} \leq \Delta_{IM5} < \ BW_{Channel\_CA} / 2 + F_{OOB} \\ & M_A & ; \Delta_{IM5} \geq BW_{Channel\_CA} / 2 + F_{OOB} \end{split}$$

For intra-band contiguous carrier aggregation bandwidth class B with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{ M_A, 0.5 \}$$

Where  $M_A$  is defined as follows

$$\begin{split} M_A = & \ 10.5 - 17.5A \ ; \ 0 \leq A < 0.2 \\ 8.5 - 7.5A & \ ; \ 0.2 \leq A < 0.6 \\ 5.5 - 2.5A & \ ; \ 0.6 \leq A \leq 1 \end{split}$$

Where

$$\begin{split} A &= N_{RB\_alloc} \, / \, N_{RB\_agg.} \\ \Delta_{IM5} &= max( \mid F_{C\_agg} - (3*F_{agg\_alloc\_low} - 2*F_{agg\_alloc\_high}) \mid, \mid F_{C\_agg} - (3*F_{agg\_alloc\_high} - 2*F_{agg\_alloc\_low}) \mid) \\ F_{C\_agg} &= (F_{edge\_high} + F_{edge\_low}) / 2 \end{split}$$

CEIL{ $M_{A}$ , 0.5} means rounding upwards to closest 0.5dB, i.e. MPR $\in$  [3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5].

For intra-band non-contiguous carrier aggregation with one uplink carrier, the requirements in subclause 6.2.3 apply.

For intra-band non-contiguous carrier aggregation with two uplink carriers MPR is specified for E-UTRA CA configurations with a maximum possible  $W_{GAP} \leq 35$  MHz; the allowed MPR is

$$MPR = CEIL \{M_N, 0.5\}$$

where  $M_N$  is defined as follows

$$M_{N} = -0.125 \text{ N} + 18.25 \qquad ; 2 \le N \le 50$$
 
$$-0.0333 \text{ N} + 13.67 \qquad ; 50 < N \le 200$$

where  $N=N_{RB\_alloc}$  is the number of allocated resource blocks. Clause 6.2.3 does not apply in addition. E-UTRA CA configurations with a maximum possible  $W_{gap} > 35$  MHz and their corresponding MPR are intended to form part of a later release.

For intra-band carrier aggregation, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the requirements specified in subclause 6.2.3 apply for the E-UTRA band supporting one component carrier, and for the E-UTRA band supporting two contiguous component carriers the requirements specified in subclause 6.2.3A apply.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5A apply.

# 6.2.3B UE maximum output power for modulation / channel bandwidth for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2B-1 is specified in Table 6.2.3-1. The requirements shall be met with UL-MIMO configurations defined in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.3 apply.

## 6.2.3D UE maximum output power for modulation / channel bandwidth for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, this subclause specifies the allowed Maximum Power Reduction (MPR) power for ProSe physical channels and signals due to higher order modulation and transmit bandwidth configuration (resource blocks).

The allowed MPR for the maximum output power for ProSe physical channels PSDCH, PSCCH, PSSCH, and PSBCH shall be as specified in subclause 6.2.3 for PUSCH for the corresponding modulation and transmission bandwidth.

The allowed MPR for the maximum output power for ProSe physical signal PSSS shall be as be as specified in subclause 6.2.3 for PUSCH QPSK modulation for the corresponding transmission bandwidth.

The allowed MPR for the maximum output power for ProSe physical signal SSSS is specified in Table 6.2.3D-1.

Table 6.2.3D-1: Maximum Power Reduction (MPR) for SSSS for Power Class 1 and 3

Channel bandwidth	MPR for SSSS (dB)
1.4 MHz	
3.0 MHz	
5.0 MHz	≤ 4
10 MHz	≤ 4
15 MHz	≤ 4
20 MHz	≤ 4

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.2.3D apply for ProSe transmission and the requirements in subclause 6.2.3 apply for uplink transmission.

# 6.2.3E UE maximum output power for modulation / channel bandwidth for category M1

For UE Power Class 3 and 5, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2E-1 and 6.2.2E-2 due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3E-1 and 6.2.2E-2.

Table 6.2.3E-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Cha	Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )							
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
QPSK	>2	>2	>1	>4	-	-	≤ 1		
QPSK	>5	>5	-	-	-	-	≤ 2		
16 QAM	≤ 2	≤2	>1	>3	-	-	≤ 1		
16QAM	>2	>2	>3	>5	-	-	≤ 2		

Table 6.2.3E-2: Maximum Power Reduction (MPR) for Power Class 5

Modulation	Cha	Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )							
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
QPSK	>2	>2	>3	>5	-	-	≤ 1		
QPSK	>5	>5	-	-	-	-	≤ 2		
16 QAM	≤ 2	≤ 2	>3	>5	-	-	≤ 1		
16QAM	>2	>2	>5	-	-	-	≤ 2		

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

No other MPR requirement than those specified in tables 6.2.3E-1 and Table 6.2.3E-2 applies to category M1 UE.

# 6.2.3F UE maximum output power for modulation / channel bandwidth for category NB1

For UE category NB1 power class 3 and 5 the allowed Maximum Power Reduction (MPR) for the maximum output power given in Table 6.2.2F-1 is specified in Table 6.2.3F-1.

Table 6.2.3F-1: Maximum Power Reduction (MPR) for UE category NB1 Power Class 3 and 5

Modulation		QP	SK		
Tone positions for 3 Tones allocation	0-2	3-5 ar	nd 6-8	9-11	
MPR	≤ 0.5 dB	≤ 0.5 dB			
Tone positions for 6 Tones allocation		0-5 an	d 6-11		
MPR	≤1 d	В	<u> </u>	1 dB	
Tone positions for 12 Tones allocation	0-11				
MPR	≤ 2 dB				

For the UE maximum output power modified by MPR, the power limits specified in sub-clause 6.2.5F apply.

#### 6.2.4 UE maximum output power with additional requirements

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N <sub>RB</sub> )	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
			3	>5	≤1
		2 4 40 22 25	5	>6	≤1
NS_03	6.6.2.2.1	2, 4,10, 23, 25,	10	>6	≤ 1
		35, 36, 66	15	>8	≤ 1
			20	>10	≤1
NS_04	6.6.2.2.2, 6.6.3.3.19	41	5, 10, 15, 20	Table	6.2.4-4
		1	10,15,20	≥ 50 (NOTE1)	≤ 1 (NOTE1)
NS_05	6.6.3.3.1		15, 20	Table 6.2.4	-18 (NOTE2)
		GE (NOTE 2)	10,15,20	≥ 50	≤ 1 (NOTE 1)
		65 (NOTE 3)	15,20	Table 6.2.4	-18 (NOTE 2)
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table	6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NC 00	66224	21	10.15	> 40	≤1
NS_09	6.6.3.3.4	21	10, 15	> 55	≤ 2
NS_10		20	15, 20	Table	6.2.4-3
NS_11	6.6.2.2.1 6.6.3.3.13	23	1.4, 3, 5, 10, 15, 20	Table	6.2.4-5
NS_12	6.6.3.3.5	26	1.4, 3, 5, 10, 15	Table	6.2.4-6
NS_13	6.6.3.3.6	26	5	Table	6.2.4-7
NS_14	6.6.3.3.7	26	10, 15	Table	6.2.4-8
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15		6.2.4-9 6.2.4-10
NS_16	6.6.3.3.9	27	3, 5, 10		, Table 6.2.4-12, 6.2.4-13
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	5	≥2	≤1
140_10	0.0.3.3.11	20	10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table	6.2.4-14
NS_20	6.2.2 6.6.2.2.1 6.6.3.3.14	23	5, 10, 15, 20	Table	6.2.4-15
NS_21	6.6.2.2.1 6.6.3.3.15	30	5, 10	Table	6.2.4-16
NS 22	6.6.3.3.16	42, 43	5, 10, 15, 20	Table 6.2.4-17	
NS_23	6.6.3.3.17	42, 43	5, 10, 15, 20		I/A
NS_24	6.6.3.3.20	65 (NOTE 4)	5, 10, 15, 20		6.2.4-19
NS_25	6.6.3.3.21	65 (NOTE 4)	5, 10, 15, 20		6.2.4-20
NS_26	6.6.3.3.22	68	5, 10, 15		6.2.4-21
	0.0.0.0.22		0, 10, 10	1 abic	J
NS_32	-	-	-	-	-

NOTE 1 Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is larger than or equal to the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as defined in subclause 5.6. A-MPR for operations below this frequency is not covered in this version of specifications except for the channel assignments in NOTE2 as the emissions requirement in 6.6.3.3.1 may not be met. For 10MHz channel bandwidth whose carrier frequency is larger than or equal to 1945 MHz or 15 MHz channel bandwidth whose carrier frequency is larger than or equal to 1947.5 MHz, no A-MPR applies.

NOTE 2 Applicable when carrier frequency is 1932.5 MHz for 15MHz channel bandwidth or 1930 MHz for 20MHz channel bandwidth case.

NOTE 3: Applicable when the E-UTRA carrier is within 1920-1980 MHz.

NOTE 4: Applicable when the upper edge of the channel bandwidth frequency is greater than 1980MHz.

Table 6.2.4-2: A-MPR for "NS\_07"

Parameters	Region A		Regio	Region C	
RB <sub>start</sub>	(	) - 12	13 – 18	19 – 42	43 – 49
L <sub>CRB</sub> [RBs]	6-8	1 to 5 and 9-50	≥8	≥18	≤2
A-MPR [dB]	≤ 8	≤ 12	≤ 12	≤ 6	≤ 3

NOTE 1; RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks

NOTE 2; LCRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a

per slot basis.

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

Table 6.2.4-2E: A-MPR for "NS\_07" for Cat-M1

BW [MHz]			10		
RB Start	[<7]	[<7]	[<7]	[>41]	
LCRB	[>4 and <7]	[>1 and <7]	[>2and <7]	[>2and <7]	
AMPR [dB]	2	1	1	1	

Table 6.2.4-3: A-MPR for "NS 10"

Channel bandwidth [MHz]	Parameters	Region A
	RB <sub>start</sub>	0 – 10
15	L <sub>CRB</sub> [RBs]	1 -20
	A-MPR [dB]	≤ 2
	RB <sub>start</sub>	0 – 15
20	L <sub>CRB</sub> [RBs]	1 -20
	A-MPR [dB]	≤ 5

NOTE 1: RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks

NOTE 2: LCRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects Region A, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersect Region A, the larger A-MPR value may be applied for both slots in the subframe

Table 6.2.4-4: A-MPR requirements for "NS\_04" with bandwidth >5MHz

Channel bandwidth [MHz]		Parameters						
5	Fc [MHz]				≤ 2499.5			> 2499.5
	RB <sub>start</sub>			0 - 8		9 -	- 24	0 - 24
	L <sub>CRB</sub> [RBs]			> 0		>	0	> 0
	A-MPR [dB]			≤ 2			0	0
10	Fc [MHz]				≤ 2504			> 2504
	RB <sub>start</sub>			0 - 8		9 - 35	36 - 49	0 - 49
	L <sub>CRB</sub> [RBs]	≤ 15	> 15	and < 25	≥ 25	N/A	> 0	> 0
	RB <sub>start</sub> + L <sub>CRB</sub>	N/A		N/A	N/A	≥ 45	N/A	N/A
	A-MPR [dB]	≤ 3		≤ 1	≤ 2	≤ 1	0	0
15	Fc [MHz]				≤ 2510.8			> 2510.8
	RB <sub>start</sub>			0 - 13		14 – 59	60 – 74	0 - 74
	L <sub>CRB</sub> [RBs]	≤ 18 o	r ≥ 36	> 18 a	and < 36	N/A	> 0	> 0
	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	N/	A	N/A		≥ 62	N/A	N/A
	A-MPR [dB]	≤ ;	≤3 ≤1			≤ 1	0	0
20	Fc [MHz]		≤ 2517.5				> 2517.5	
	RB <sub>start</sub>	·	•	0 – 22		23 – 76	77 – 99	0 - 99

L <sub>CRB</sub> [RE	3s] ≤ 18 or ≥ 40	> 18 and < 40	N/A	> 0	> 0
RB <sub>start</sub> + [RBs]	L <sub>CRB</sub> N/A	N/A	≥ 86	N/A	N/A
A-MPR	[dB] ≤ 3	≤ 1	≤ 1	0	0

NOTE 1: RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks

NOTE 2: L<sub>CRB</sub> is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for

both slots in the subframe

Table 6.2.4-5: A-MPR for "NS\_11"

Channel Bandwidth [MHz]	Parameters									
	Fc [MHz]	<20	04			≥2004				
3	L <sub>CRB</sub> [RBs]	1-1			>5					
	A-MPR [dB]	≤!				≤ 1				
	Fc [MHz]	<20	04		200	)4 ≤ Fc <	:2007	≥;	2007	
5	L <sub>CRB</sub> [RBs]	1-2	25			6 & -25	8-12		>6	
	A-MPR [dB]	≤7			≤	4	0		≤ 1	
	Fc [MHz]	200	)5 ≤	Fc <2	2015	,	<b>,</b>	2015		
40	RB <sub>start</sub>	0-49				0-49				
10	L <sub>CRB</sub> [RBs]  A-MPR [dB]		1	-50			1-50			
			≤ 12				0			
	Fc [MHz]	<2012.5					_			
	RB <sub>start</sub>	0-4	5-21			22	-56	57-74		
	L <sub>CRB</sub> [RBs]	≥1	7-	50	0-	6 & ≥50	≤25	>25	>0	
	A-MPR [dB]	≤15	≤	7		≤10	0	≤6	≤15	
15	Fc [MHz]					2012	.5			
	RB <sub>start</sub>	0-12			13-	-39	40-65		66-74	
	L <sub>CRB</sub> [RBs]	≥1		≥3	0	<30	≥ (69 RB <sub>sta</sub>		≥1	
	A-MPR [dB]	≤10		≤6	6	0	≤2		≤6.5	
	Fc [MHz]					201	0			
	RB <sub>start</sub>	0-12		1	3-29	)	30-68		69-99	
20	L <sub>CRB</sub> [RBs]	≥1	10	-60		1-9 & >60	1-24	≥25	≥1	
	A-MPR [dB]	≤15	_	≤7		≤10	0	≤7	≤15	

Table 6.2.4-6: A-MPR for "NS\_12"

Channel bandwidth [MHz]	Parameters	Regi	Region B	
	RB <sub>start</sub>	(	0	1-2
1.4	L <sub>CRB</sub> [RBs]	≤3	≥4	≥4
	A-MPR [dB]	≤3	≤6	≤3
	RB <sub>start</sub>	0	-3	4-5
3	L <sub>CRB</sub> [RBs]	1-	15	≥9
	A-MPR [dB]	≤4		≤3
	RB <sub>start</sub>	0	-6	0-9
5	L <sub>CRB</sub> [RBs]	≤	:8	≥9
	A-MPR [dB]	≤	:5	≤3
	RB <sub>start</sub>	0-	15	0-22
10	L <sub>CRB</sub> [RBs]	≤′	18	≥20
	A-MPR [dB]	≤4		≤2
	RB <sub>start</sub>	0-30		0-30
15	L <sub>CRB</sub> [RBs]	≤;	≥32	
	A-MPR [dB]	<u> </u>	≤3	

Table 6.2.4-7: A-MPR for "NS\_13"

Channel bandwidth [MHz]	Parameters	Region A		
	RB <sub>start</sub>	0-2	2	
5	L <sub>CRB</sub> [RBs]	≤5	≥18	
	A-MPR [dB]	≤3	≤2	

Table 6.2.4-8: A-MPR for "NS\_14"

Channel bandwidth [MHz]	Parameters	Region A		
	RB <sub>start</sub>	0		
10	L <sub>CRB</sub> [RBs]	≤5	=50	
	A-MPR [dB]	≤3	≤1	
	RB <sub>start</sub>	≥8	3	
15	L <sub>CRB</sub> [RBs]	≤16	≥50	
	A-MPR [dB]	≤3	≤1	

Table 6.2.4-9: A-MPR for "NS\_15" for E-UTRA highest channel edge > 845 MHz and ≤ 849 MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
1.4	RB <sub>end</sub> [RB]			4-5
1.4	A-MPR [dB]			≤3
	RB <sub>end</sub> [RB]	0-1	8-12	13-14
3	L <sub>CRB</sub> [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB <sub>end</sub> [RB]	0-4	12-19	20-24
5	L <sub>CRB</sub> [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤5	≤9
	RB <sub>end</sub> [RB]	0-12	23-36	37-49
10	L <sub>CRB</sub> [RB]	≤2	≥15	>0
	A-MPR [dB]	≤4	≤6	≤9
	RB <sub>end</sub> [RB]	0-20	26-53	54-74
15	L <sub>CRB</sub> [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Table 6.2.4-10: A-MPR for "NS\_15" for E-UTRA highest channel edge ≤ 845 MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
	RB <sub>end</sub> [RB]			19-24
5	L <sub>CRB</sub> [RB]			≥18
	A-MPR [dB]			≤2
	RB <sub>end</sub> [RB]	0-4	29-44	45-49
10	L <sub>CRB</sub> [RB]	≤2	≥24	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB <sub>end</sub> [RB]	0-12	44-61	62-74
15	L <sub>CRB</sub> [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Table 6.2.4-11: A-MPR for "NS\_16" with channel lower edge at ≥807 MHz and <808.5 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB <sub>start</sub>	0	1-2			
3 MHz	L <sub>CRB</sub> [RBs]	≥12	12			
	A-MPR [dB]	≤2	≤1			
	RB <sub>start</sub>	0-1	2	2-9	2-5	
5 MHz	L <sub>CRB</sub> [RBs]	1 - 25	12	15-18	20	
	A-MPR [dB]	≤5	≤1	≤2	≤3	
	RB <sub>start</sub>	0 - 8	0-	14	15-20	15-24
10 MHz	L <sub>CRB</sub> [RBs]	1 - 12	15-20	≥24	≥30	24-27
	A-MPR [dB]	≤5	≤3	≤7	≤3	≤1

Table 6.2.4-12: A-MPR for "NS\_16" with channel lower edge at ≥808.5 MHz and <812 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB <sub>start</sub>	0	0-1	1-5		
5 MHz	L <sub>CRB</sub> [RBs]	16-20	≥24	16-20		
	A-MPR [dB]	≤2	≤3	≤1		
	RB <sub>start</sub>	0-	-6	0-10	0-14	11-20
10 MHz	L <sub>CRB</sub> [RBs]	1-12	15-20	24-32	≥36	24-32
	A-MPR [dB]	≤5	≤2	≤4	≤5	≤1

Table 6.2.4-13: A-MPR for "NS\_16" with channel lower edge at ≥812 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D
	RB <sub>start</sub>	0 - 9	0	1-14	0-5
10 MHz	L <sub>CRB</sub> [RBs]	27-32	36-40	36-40	≥45
	A-MPR [dB]	≤1	≤2	≤1	≤3

Table 6.2.4-14: A-MPR for "NS\_19"

Channel bandwidth [MHz]	Parameters	Region A		Region B	
	RB <sub>start</sub>			0-6	
10	L <sub>CRB</sub> [RBs]			≥40	
	A-MPR [dB]			≤1	
	RB <sub>start</sub>	0-6		7-20	
15	L <sub>CRB</sub> [RBs]	≤18	≥36	≥42	
	A-MPR [dB]	≤2	≤3	≤2	
	RB <sub>start</sub>	0-	14	15-30	
20	L <sub>CRB</sub> [RBs]	≤40	≥45	≥50	
	A-MPR [dB]	≤2	≤3	≤2	

Table 6.2.4-15: A-MPR for "NS\_20"

Channel Bandwidth [MHz]	Parameters										
	Fc [MHz]	< 20	07.5		200	7.5	≤ Fc <	201	2.5	2012.5 ≤ F	c ≤ 2017.5
5	RB <sub>start</sub>	≤;	24		C	)-3			4-6	≤2	24
5	L <sub>CRB</sub> [RBs]	>	0	1	5-19	2	≥20		≥18	1-2	25
	A-MPR [dB]	≤'	17		≤1		≤4		≤2	≤	0
	Fc [MHz]										
	RB <sub>start</sub>		0-25				26-3	4		35-	49
	L <sub>CRB</sub> [RBs]	>0				3-15 >		15	>0		
10	A-MPR [dB]	≤16			≤2 ≤5			≤5	≤ 6		
10	Fc [MHz]	2015									
	RB <sub>start</sub>	0-5								6-10	
	L <sub>CRB</sub> [RBs]		≥3	2					≥40		
	A-MPR [dB]		<u>&lt;</u> 4							≤2	
	Fc [MHz]						2012.5	5			
15	RB <sub>start</sub>		0-14				15	-24		25-39	61-74
15	L <sub>CRB</sub> [RBs]	1-9 & 4	0-75	10-3	39	24	4-29		≥30	≥36	≤6
	A-MPR [dB]	≤11		≤6	6		≤1		≤7	≤5	≤6
	Fc [MHz]						2010				
20	RB <sub>start</sub>	0-21		22-31			32-3	38	39-49	50-68	69-99
20	L <sub>CRB</sub> [RBs]	>0	1-9 & 3°	1-75	10-3	30	≥15	5	≥24	≥25	>0
	A-MPR [dB]	≤17	≤12		≤6	3	≤9		≤7	≤5	≤16

NOTE 1: When NS\_20 is signaled the minimum requirements for the 10 MHz bandwidth are specified for E-UTRA UL carrier center frequencies of 2005 MHz or 2015 MHz.

NOTE 2: When NS\_20 is signaled the minimum requirements for the 15 MHz channel bandwidth are specified for E-UTRA UL carrier center frequency of 2012.5 MHz.

Table 6.2.4-16: A-MPR for "NS\_21"

Channel Bandwidth [MHz]	Parameters	Reg	ion A	Reç	gion B
	RB <sub>start</sub>	0 – 6	0 – 6	N/A	N/A
10	RB <sub>end</sub>	N/A	N/A	43 – 49	43 – 49
10	L <sub>CRB</sub> [RBs]	1 – 2	3 – 12, 32 - 50	1 – 2	3 – 12, 32 - 50
	A-MPR [dB]	≤ 4	≤ 3	≤ 4	≤ 3

Table 6.2.4-17: A-MPR for "NS\_22"

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C	Region D					
5		No A-MPR is needed for 5 MHz channel bandwidth								
10	RB <sub>start</sub>	0-13	0-17	≤ 6	≥12					
	L <sub>CRB</sub> [RBs]	> 36	33-36	≤ 32	≤ 32					
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥44					
	A-MPR [dB]	≤ 4	≤ 3	≤ 3	≤ 3					
15	RB <sub>start</sub>	0-24	0-38	≤ 14	≥ 23					
	L <sub>CRB</sub> [RBs]	> 50	37-50	≤ 36	≤ 36					
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥59					
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3					
20	RB <sub>start</sub>	0-35	0-51	≤ 21	≥ 31					
	L <sub>CRB</sub> [RBs]	> 64	49-64	≤ 48	≤ 48					
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥79					
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3					

NOTE 1; RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks NOTE 2; L<sub>CRB</sub> is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

Table 6.2.4-18: A-MPR for "NS\_05"

Channel Bandwidth [MHz]	Parameters								
	Fc [MHz]	1932.5							
	RB <sub>start</sub>	0-7	8 – 66					67-74	
15	L <sub>CRB</sub> [RBs]	≥1	≤30 31 – 5		54	>54	≤	<b>≤</b> 6	>6
	A-MPR [dB]	≤11	0	0 ≤3		≤5	≤	<u>5</u>	≤1
	Fc [MHz]	1930							
	RB <sub>start</sub>	0-23		24	4-75			7	6-99
20	L <sub>CRB</sub> [RBs]	≥1	≤24	25 – 40	41 – 5	0 >	50	≤6	>6
	A-MPR [dB]	≤11	0	≤3	≤5	≤	≦10	≤5	≤1

Table 6.2.4-19: A-MPR for "NS\_24"

Channel Bandwidth [MHz]	Parameters									
	Fc [MHz]				Fc > [1	987.5]				
5	RB <sub>start</sub>				0 -	24				
5	L <sub>CRB</sub> [RBs]				0 -	24				
	A-MPR [dB]		≤ 10							
	Fc [MHz]	1975 < Fc ≤ 1985 1985 <fc≤1995 fc=""></fc≤1995>							Fc>1995	
	RB <sub>start</sub>	0 - 1	2 - 14	15 - 26	15 - 26 36 - 49			) - 49	0 - 49	
10	L <sub>CRB</sub> [RBs]	> 10	≥ 35	N/A	≤ 2	> 11	(	) - 49	0 - 49	
	RB <sub>end</sub>	N/A	N/A	> 48	N/A	N/A		N/A	N/A	
	A-MPR [dB]	≤ 2	≤ 2	1	≤ 3	≤ 1		≤ 9	≤ 17	
	Fc [MHz]			1972.5 < Fc	≤ 1987.5	•		Fc>	1987.5	
15	RB <sub>start</sub>		0 - 11 12 - 74					0 - 74		
	L <sub>CRB</sub> [RBs]	≤ 4	-5	> 45		> 3		0 - 74		

	RB <sub>end</sub>	N/A	N/A	≥ 45	N/A			
	A-MPR [dB]	≤2	≤ 8	≤ 7	≤ 17			
	Fc [MHz]	Fc > 1970						
20	RB <sub>start</sub>	0 - 99						
20	L <sub>CRB</sub> [RBs]	0 - 99						
	A-MPR [dB]	≤ 17						

Table 6.2.4-20: A-MPR for "NS\_25"

Channel Bandwidth [MHz]		Parameters													
	Fc [MHz]		Fc > [1997.5]												
	RB <sub>start</sub>			0 -	9							10 -	24		
5	L <sub>CRB</sub> [RBs]			> 1	12							N/	Ά		
	RB <sub>end</sub>			N/	Ά							≥ 2	22		
	A-MPR [dB]			≤	5							≤	2		
	Fc [MHz]	1975 < F	c ≤ 1985	;		1985	< F	c ≤ 19	995			Fc > 1995			
	RB <sub>start</sub>	0-1	2-49		0			1 -	18	19	9-49	0-6		7-15	16-49
10	L <sub>CRB</sub> [RBs]	> 10	N/A		≤ 25	> 25	5	> 2	25	١	N/A	N/A		> 20	N/A
	RB <sub>end</sub>	N/A	> 48		N/A	N/A	١.	N/	Ά	>	42	N/A		N/A	> 35
	A-MPR [dB]	≤ 1	≤ 1		≤ 1	≤ 5		≤ :	5	:	≤ 1	≤ 10		≤ 7	≤ 11
	Fc [MHz]		·	1	1972	2.5 < F	c ≤ 1	1987.5	5					Fc>	1987.5
	RB <sub>start</sub>	0 - 4			5 - 30			31 -	31 - 62		(	63 - 74		0 - 74	
15	L <sub>CRB</sub> [RBs]	≥ 1	5		≥ 45		N/A		N/A		0 - 74				
	RB <sub>end</sub>	N/A	4		N/A		> 71		N/A			N/A			
	A-MPR [dB]	≤ ∠	1		≤ 3		≤ 1		1	≤ 1			<u> </u>	: 13	
	Fc [MHz]		•		1970 < Fc ≤ 1990							Fc > 1	990		
	RB <sub>start</sub>	0	- 13		14 - 40		41 - 99		0 - 99						
20	L <sub>CRB</sub> [RBs]	ı	N/A		≥ 32			N/A		0 - 99					
	RB <sub>end</sub>	ı	N/A			N/A			> 72		N/A				
	A-MPR [dB]	5	<u> </u>			≤ 11					≤13		≤ 13		

Table 6.2.4-21: A-MPR for "NS\_26"

Bandwidth (MHz)	RBstart	L_crb	A-MPR
5	0	≤ 1	≤ [0~1]
5	0 – 1	≥ 24	≤ [0~1]
10	0 - 10	≥ 1	≤ 1
15	0 - 17	≥ 1	≤ 1

For PRACH, PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5 apply.

#### 6.2.4A UE maximum output power with additional requirements for CA

Additional ACLR, spectrum emission and spurious emission requirements for carrier aggregation can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the CA Power Class as specified in Table 6.2.2A-1.

If for intra-band carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0dB, unless the value indicated is CA\_NS\_31. For uplink 64QAM, the applied maximum output power reduction is obtained by taking the maximum value of MPR requirements specified in Table 6.2.3A-1 and A-MPR requirements specified in Table 6.2.4A-1.

Table 6.2.4A-1: Additional Maximum Power Reduction (A-MPR) for intra-band contiguous CA

CA Network Signalling value	Requirements (subclause)	Uplink CA Configuration	A-MPR [dB] (subclause)
CA_NS_01	6.6.3.3A.1	CA_1C	6.2.4A.1
CA_NS_02	6.6.3.3A.2	CA_1C	6.2.4A.2
CA_NS_03	6.6.3.3A.3	CA_1C	6.2.4A.3
CA_NS_04	6.6.2.2A.1	CA_41C	6.2.4A.4
CA_NS_05	6.6.3.3A.4	CA_38C	6.2.4A.5
CA_NS_06	6.6.3.3A.5	CA_7C	6.2.4A.6
CA_NS_07	6.6.3.3A.6	CA_39C	6.2.4A.7
CA_NS_08	6.6.3.3A.7	CA_42C	6.2.4A.8
CA_NS_31	NOTE 1	Table 5.6A.1-1 (NOTE 1)	N/A
CA NS 32		Reserved	

NOTE 1: Applicable for uplink CA configurations listed in Table 5.6A.1-1 for which none of the additional requirements in subclauses 6.6.2.2A or 6.6.3.3A apply.

NOTE 2: The index of the sequence CA\_NS corresponds to the value of additionalSpectrumEmissionSCell-r10.

If for intra-band non-contigous carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2 4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For intra-band non-contiguous carrier aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-2 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field additionalSpectrumEmissionSCell-r10. MPR as specified in subclause 6.2.3A is not allowed in addition, unless A-MPR is N/A

Table 6.2.4A-2: Additional Maximum Power Reduction (A-MPR) for intra-band non-contiguous CA

CA Network Signalling value	Additional requirements for sub-blocks in order of increasing uplink carrier frequency  Requirements Requirements (subclause) (subclause)		Uplink CA Configuration	A-MPR for sub-blocks in order of increasing uplink carrier frequency  A-MPR [dB] (subclause)		
CA_NC_NS_01	6.6.2.2.1 (NS_03)	6.6.2.2.1 (NS_03)	CA_4A-4A	N/A		
CA_NC_NS_31	NOTE 1	NOTE 1	Table 5.6A.1-3 (NOTE 1)	N/A		
CA_NC_NS_32		Reserved				

NOTE 1: Applicable for uplink CA configurations listed in Table 5.6A.1-3 for which the additional requirements in subclause 6.6.2.1.1 (indicated by NS\_01) applies in each sub-block.

NOTE 2: The index of the sequence CA\_NC\_NS corresponds to the value of additionalSpectrumEmissionSCell-r10.

If for inter-band carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For inter-band carrier aggregation with the UE configured for transmissions on two serving cells the maximum output power reduction specified in Table 6.2.4-1 is allowed for each serving cell of the applicable uplink CA configuration according to the Network Signaling value indicated by the field *additionalSpectrumEmission* for the PCC and the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10* for the SCC. The value of *additionalSpectrumEmissionSCell-r10* is equal to that of *additionalSpectrumEmission* configured on the SCC. MPR as specified in subclause 6.2.3A is allowed in addition.

For PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band carrier aggregation, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For combinations of intra-band and inter-band carrier aggregation with the UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per band), the maximum output power reduction is specified as follows. For the band supporting one serving cell the maximum output power reduction specified in Table 6.2.4-1 is allowed according to the Network Signaling value indicated by the field *additionalSpectrumEmission* for the PCC and the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10* for the SCC. The value of *additionalSpectrumEmissionSCell-r10* is equal to that of *additionalSpectrumEmission* configured on the SCC. MPR as specified in subclause 6.2.3A is allowed in addition. For the band supporting intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0dB, unless the value indicated is CA\_NS\_31. For uplink 64QAM, the applied maximum output power reduction is obtained by taking the maximum value of MPR requirements specified in Table 6.2.4A-1.

For the UE maximum output power modified by A-MPR specified in table 6.2.4A-1, the power limits specified in subclause 6.2.5A apply.

#### 6.2.4A.1 A-MPR for CA\_NS\_01 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCC and the SCC for contiguously aggregated signals is specified in table 6.2.4A.1-1.

Table 6.2.4A.1-1: Contiguous allocation A-MPR for CA\_NS\_01

CA_1C: CA_NS_01	RB <sub>start</sub>	L <sub>CRB</sub> [RBs]	$RB_{start} + L_{CRB}$ [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 – 23 and 176 – 199	> 0	N/A	≤ 12.0
100 RB / 100 RB	24 – 105	> 64	N/A	≤ 6.0
	106 – 175	N/A	> 175	≤ 5.0
	0 – 6 and 143 – 149	0 < L <sub>CRB</sub> ≤ 10	N/A	≤ 11.0
75 RB / 75 RB		> 10	N/A	≤ 6.0
75 KB/ 75 KB	7 – 90	> 44	N/A	≤ 5.0
	91 – 142	N/A	> 142	≤ 2.0

NOTE 1: RB start indicates the lowest RB index of transmitted resource blocks

NOTE 2: L CRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A_s} 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{aligned} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{aligned}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.2 A-MPR for CA\_NS\_02 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.2-1.

Table 6.2.4A.2-1: Contiguous allocation A-MPR for CA\_NS\_02

CA_1C: CA_NS_02	RB <sub>end</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 –20	> 0	≤ 4 dB
	21 – 46	> 0	≤ 3 dB
100 RB / 100 RB	47 – 99	> RB <sub>end</sub> - 20	≤ 3 dB
	100 – 184	> 75	≤ 6 dB
	185 – 199	> 0	≤ 10 dB
	0 – 48	> 0	≤ 2 dB
	49 – 80	> RB <sub>end</sub> - 20	≤ 3 dB
75 RB / 75 RB	81 – 129	> 60	≤ 5 dB
	130 – 149	> 84	≤ 6 dB
	130 – 149	1 – 84	≤ 2 dB

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A-MPR = CEIL \{M_{A_s} 0.5\}$$

Where  $M_A$  is defined as follows

$$\begin{array}{lll} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ & -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ & -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{array}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.3 A-MPR for CA\_NS\_03 for CA\_1C

If the UE is configured to  $CA_1C$  and it receives IE  $CA_NS_03$  the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.3-1.

Table 6.2.4A.3-1: Contiguous allocation A-MPR for CA\_NS\_03

CA_1C: CA_NS_03	RB <sub>end</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 – 26	> 0	≤ 10 dB
	27 – 63	≥ RB <sub>end</sub> - 27	≤ 6 dB
100 PP / 100 PP	27 – 63	< RB <sub>end</sub> - 27	≤ 1 dB
100 RB / 100 RB	64 – 100	> RB <sub>end</sub> - 20	≤ 4 dB
	101 – 171	> 68	≤ 7 dB
	172 – 199	> 0	≤ 10 dB
	0 – 20	> 0	≤ 10 dB
	21 – 45	> 0	≤ 4 dB
75 RB / 75 RB	46 – 75	> RB <sub>end</sub> – 13	≤ 2 dB
/3 KD / /3 KD	76 – 95	> 45	≤ 5 dB
	96 – 149	> 43	≤ 8 dB
	120 – 149	1 - 43	≤ 6 dB

If the UE is configured to CA\_1C and it receives IE CA\_NS\_03 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A-MPR = CEIL \{M_{A_s} 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$M_A = -23.33A + 17.5$$
 ;  $0 \le A < 0.15$   $-7.65A + 15.15$  ;  $0.15 \le A \le 1$ 

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.4 A-MPR for CA\_NS\_04

If the UE is configured to CA\_41C or any uplink inter-band CA configuration containing CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmission on two component carriers for contiguously aggregated signals is specified in Table 6.2.4A.4-1.

Table 6.2.4A.4-1: Contigous Allocation A-MPR for CA\_NS\_04

CA Bandwidth Class C	RB <sub>Start</sub>	L <sub>CRB</sub> [RBs]	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	A-MPR for QPSK [dB]	A-MPR for 16QAM and 64QAM [dB]
50RB / 100 RB	0 – 44 and 105 – 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤3dB	≤4dB
75 RB / 75 RB	0 – 44 and 105 – 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤4dB	≤4dB
100 RB / 75 RB	0 – 49 and 125 – 174	>0	N/A	≤4dB	≤4dB
	50 - 124	N/A	>125	≤3dB	≤4dB
100 RB / 100 RB	0 – 59 and 140 – 199	>0	N/A	≤3dB	≤4dB
	60– 139	N/A	>140	≤3dB	≤4dB

NOTE 1: RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks

NOTE 2: L<sub>CRB</sub> is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA\_41C or any uplink inter-band CA configuration containing CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmissions on two serving cells assigned to Band 41 with non-contiguous resource allocation is defined as follows

A-MPR = CEIL 
$$\{M_A, 0.5\}$$

Where MA is defined as follows

$$\begin{split} M_A &= 10.5, &0 \leq A < 0.05 \\ &= -50.0A + 13.00, &0.05 \leq A < 0.15 \\ &= -4.0A + 6.10, &0.15 \leq A < 0.40 \\ &= -0.83A + 4.83, &0.40 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} \, / \, N_{RB\_agg.}$ 

#### 6.2.4A.5 A-MPR for CA\_NS\_05 for CA\_38C

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.5-1.

Table 6.2.4A.5-1: Contigous Allocation A-MPR for CA\_NS\_05

CA_38C	RB <sub>end</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 – 12	>0	≤ 5 dB
400DD/400DD	13 – 79	> RB <sub>end</sub> – 13	≤ 2 dB
100RB/100RB	80 – 180	>60	≤ 6 dB
	181 – 199	> 0	≤ 11 dB
	0 – 70	> max (0, RB <sub>end</sub> -10)	≤ 2 dB
	71- 108	> 60	≤ 5 dB
75RB/75RB	109 – 139	>0	≤ 5 dB
	140 – 149	≤ 70	≤ 2 dB
	140 – 149	>70	≤ 6 dB

NOTE 1: RB<sub>end</sub> indicates the highest RB index of transmitted resource blocks

NOTE 2: L<sub>CRB</sub> is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

A-MPR = CEIL 
$$\{M_A, 0.5\}$$

Where MA is defined as follows

$$M_A = -14.17 A + 16.50$$
 ;  $0 \le A < 0.60$ 

$$-2.50 \text{ A} + 9.50$$
 ;  $0.60 < \text{A} < 1$ 

Where  $A = N_{RB \text{ alloc}} / N_{RB \text{ agg.}}$ 

#### 6.2.4A.6 A-MPR for CA NS 06

If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.6-1.

Table 6.2.4A.6-1: Contiguous Allocation A-MPR for CA\_NS\_06

CA Bandwidth Class C	$RB_end$	L <sub>CRB</sub> [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 –22	>0	≤ 4 dB
	23 – 99	> max(0,RB <sub>end</sub> - 25)	≤ 2 dB
100RB/100RB	100 – 142	> 75	≤ 3 dB
	143 – 177	>70	≤ 5 dB
	178 – 199	> 0	≤ 10 dB
	0 – 7	>0	≤ 5 dB
	8- 74	> max(0,RB <sub>end</sub> - 10)	≤ 2 dB
75RB/75RB	75 – 109	>64	≤ 2 dB
	110 – 144	>35	≤ 6 dB
	145 – 149	>0	≤ 10 dB
	0 – 10	> 0	≤ 5 dB
50RB/100RB	11 – 75	> max(0, RB_End - 25)	≤ 2 dB
and	76 – 103	> 50	≤ 3 dB
100RB/50RB	104 – 144	> 25	≤ 6 dB
	145 – 149	> 0	≤ 10 dB
	0 – 15	> 0	≤ 5 dB
75RB/100RB	16 – 75	> max(0, RB_End - 15)	≤ 2 dB
and	76 – 120	> 50	≤ 3 dB
100RB/75RB	121 – 160	> 50	≤ 6 dB
	161 – 174	> 0	≤ 10 dB

If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A-MPR = CEIL \{M_{A,} 0.5\}$$

Where MA is defined as follows

$$\begin{array}{ll} M_A = & -23.33A + 17.5 + 10A & ; \ 0 \leq A < 0.15 \\ \\ & -7.65A + 15.15 + 1.18A + 1.32 & ; \ 0.15 \leq A \leq 1 \end{array}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.7 A-MPR for CA\_NS\_07

If the UE is configured to CA\_39C or any uplink inter-band CA configuration containing CA\_39C and it receives IE CA\_NS\_07 the allowed maximum output power reduction applied to transmission on two component carriers for contiguously aggregated signals is specified in Table 6.2.4A.7-1.

≤ 3

A-MPR for QPSK, 16-RB<sub>Start</sub> CA\_39C: CA\_NS\_07 L<sub>CRB</sub> [RBs] QAM and 64-QAM[dB] 0 – 13 > 0 ≤ 11 14 - 50≤ 60 ≤ 3 75 RB / 100 RB > 60 14 - 100and ≤ 7 100 RB / 75 RB 101 – 155 > max(155 - RBstart, 0) ≤ 2 156 – 174 > 0 ≤ 5 0 - 5> 0 ≤ 11 ≤ 25 ≤ 3 6 - 4250 RB / 100 RB > 25 ≤ 6 and 43 – 80 > 50 ≤ 5 100 RB / 50 RB 81 - 138> 20 ≤ 2 139 - 149> 0 ≤ 5 ≥ 84 ≤ 6 0 - 3225 RB / 100 RB < 84 ≤ 4 and 33 - 60> 50 ≤ 3 100 RB / 25 RB

Table 6.2.4A.7-1: Contiguous Allocation A-MPR for CA\_NS\_07

If the UE is configured to CA\_39C or any uplink inter-band CA configuration containing CA\_39C and it receives IE CA\_NS\_07 the allowed maximum output power reduction applied to transmissions on two serving cells assigned to Band 39 with non-contiguous resource allocation is defined as follows

61 - 124

$$A-MPR = CEIL \{M_{A,} 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$M_A = -16.25A + 21$$
 ;  $0 \le A < 0.80$    
  $-2.50 A + 10.00$  ;  $0.80 \le A \le 1$ 

> 20

Where  $A = N_{RB\_alloc} \, / \, N_{RB\_agg}$ 

#### 6.2.4A.8 A-MPR for CA\_NS\_08

If the UE is configured to CA\_42C and it receives IE CA\_NS\_08 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.8-1.

Table 6.2.4A.8-1: Contiguous Allocation A-MPR for CA\_NS\_08

CA_42C: CA_NS_08	RB <sub>Start</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK, 16- QAM and 64- QAM[dB]
100RB/100RB	-	-	TBD
75 RB / 100 RB and 100 RB / 75 RB	-	-	TBD
50 RB / 100 RB and 100 RB / 50 RB	-	-	TBD
25 RB / 100 RB and 100 RB / 25 RB	-	-	TBD

# 6.2.4B UE maximum output power with additional requirements for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in subclause 6.2.4 shall apply to the maximum output power specified in Table 6.2.2B-1. The requirements shall be met

with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.4 apply.

#### 6.2.4D UE maximum output power with additional requirements for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the allowed A-MPR for the maximum output power for ProSe physical channels PSDCH, PSCCH, PSSCH, and PSBCH shall be as specified in subclause 6.2.4 for PUSCH for the corresponding modulation and transmission bandwidth.

The allowed A-MPR for the maximum output power for ProSe physical signal PSSS and SSSS shall be as be as specified in subclause 6.2.4 for PUSCH QPSK modulation for the corresponding transmission bandwidth.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.2.4D apply for ProSe transmission and the requirements in subclause 6.2.4 apply for uplink transmission.

## 6.2.4E UE maximum output power with additional requirements for category M1 LIF

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2E-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 3 and 5 the specific requirements and identified subclauses are specified in Table 6.2.4E-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4E-1 and from 6.2.4-2 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3E.

Table 6.2.4E-1: Additional Maximum Power Reduction (A-MPR) for category M1 UE

Network Signalling	Requirements (subclause)	E-UTRA Band	Resources Blocks (N <sub>RB</sub> )	A-MPR (dB)
value				
NS_01	6.6.2.1.1	Table 5.5-1	Table 5.6-1	N/A
NS_03	6.6.2.2.1	2, 4	Table 5.6-1	N/A
NS_04	6.6.2.2.2	41	[TBD]	[TBD]
NS_05	6.6.3.3.1	1	Table 5.6-1	N/A
NS_06	6.6.2.2.3	12, 13	Table 5.6-1	N/A
NS_07	6.6.2.2.3	13	Table 6.2.4-2E	
	6.6.3.3.2	13	i able t	1 abie 0.2.4-2E
NS_08	6.6.3.3.3	19	Table 5.6-1	N/A
NS_09	6.6.3.3.4	21	Table 5.6-1	N/A
NS_10		20	Table 5.6-1	N/A
NS_12	6.6.3.3.5	26	[TBD]	
NS_13	6.6.3.3.6	26	Table 5.6-1	N/A
NS_14	6.6.3.3.7	26	Table 5.6-1	N/A
NS_15	6.6.3.3.8	26	Table 6.2.4-9	
NS_16	6.6.3.3.9	27	Table 5.6-1	N/A
NS_17	6.6.3.3.10	28	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	Table 5.6-1	N/A
NS_32	-	-	-	-

No other A-MPR requirement than those specified in tables 6.2.4E-1 applies to category M1 UE.

#### 6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell c. The configured maximum output power  $P_{CMAX,c}$  is set within the following bounds:

 $P_{CMAX\_L,c} \leq P_{CMAX,c} \leq P_{CMAX\_H,c}$  with

$$P_{CMAX\_L,c} = MIN \left\{ P_{EMAX,c} - \Delta T_{C,c}, \ P_{PowerClass} - MAX(MPR_c + A-MPR_c + \Delta T_{IB,c} + \Delta T_{C,c} + \Delta T_{ProSe}, P-MPR_c) \right\}$$

$$P_{CMAX\ H,c} = MIN \{P_{EMAX,c}, P_{PowerClass}\}$$

where

- $P_{\text{EMAX},c}$  is the value given by IE *P-Max* for serving cell *c*, defined in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR<sub>c</sub> and A-MPR<sub>c</sub> for serving cell c are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$  is the additional tolerance for serving cell c as specified in Table 6.2.5-2;  $\Delta T_{IB,c} = 0$  dB otherwise;
- $\Delta T_{C,c} = 1.5$  dB when NOTE 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c} = 0$  dB when NOTE 2 in Table 6.2.2-1 does not apply;
- $\Delta T_{ProSe} = 0.1$  dB when the UE supports ProSe Direct Discovery and/or ProSe Direct Communication on the corresponding E-UTRA ProSe band;  $\Delta T_{ProSe} = 0$  dB otherwise.

P-MPR<sub>c</sub> is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

The UE shall apply P-MPR  $_c$  for serving cell c only for the above cases. For UE conducted conformance testing P-MPR shall be  $0~\mathrm{dB}$ 

NOTE 1: P-MPR $_c$  was introduced in the  $P_{CMAX,c}$  equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.

NOTE 2: P-MPR<sub>c</sub> may impact the maximum uplink performance for the selected UL transmission path.

For each subframe, the  $P_{CMAX\_L,c}$  for serving cell c is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX\_L,c}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured configured maximum output power P<sub>UMAX,c</sub> shall be within the following bounds:

$$P_{CMAX\ L,c}-\ MAX\{T_{L,c},T(P_{CMAX\ L,c})\}\ \leq\ P_{UMAX,c}\leq\ P_{CMAX\ H,c}+\ T(P_{CMAX\ H,c}).$$

where the tolerance  $T(P_{CMAX,c})$  for applicable values of  $P_{CMAX,c}$  is specified in Table 6.2.5-1. The tolerance  $T_{L,c}$  is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.2-1.

Table 6.2.5-1: P<sub>CMAX</sub> tolerance

P <sub>CMAX,c</sub> (dBm)	Tolerance T(P <sub>CMAX,c</sub> ) (dB)
$23 < P_{CMAX,c} \le 33$	2.0
$21 \le P_{CMAX,c} \le 23$	2.0
20 ≤ P <sub>CMAX,c</sub> < 21	2.5
$19 \le P_{CMAX,c} < 20$	3.5
18 ≤ P <sub>CMAX,c</sub> < 19	4.0
$13 \le P_{CMAX,c} < 18$	5.0
8 ≤ P <sub>CMAX,c</sub> < 13	6.0
$-40 \le P_{\text{CMAX},c} < 8$	7.0

For the UE which supports inter-band carrier aggregation configurations with the uplink assigned to one or two EUTRA bands the  $\Delta T_{IB,c}$  is defined for applicable bands in Table 6.2.5-2, Table 6.2.5-3 and Table 6.2.5-4.

Table 6.2.5-2: ΔT<sub>IB,c</sub> (two bands)

Inter-band CA Configuration	E-UTRA Band	ΔT <sub>IB,c</sub> [dB]
CA_1A-3A	1	0.3
	3	0.3
CA_1A-3C	3	0.3
	1	0.3
CA_1A-5A	5	0.3
CA_1A-7A	1	0.5
OA_1A-1A	7	0.6
CA_1A-7C	1	0.5
	7	0.6
CA_1A-8A	8	0.3
0.4.4.4.4	1	0.3
CA_1A-11A	11	0.3
CA_1A-18A	1	0.3
OA_IA-IOA	18	0.3
CA_1A-19A	1	0.3
	19 1	0.3 0.3
CA_1A-20A	20	0.3
04 44	1	0.3
CA_1A-21A	21	0.3
CA_1A-26A	1	0.3
UA_1A-20A	26	0.3
CA_1A-28A	1	0.3
	28	0.6
CA_1A-40A	1 40	0.5 0.5
0	1	0.5
CA_1A-41A <sup>8</sup>	41	0.5
CA_1A-41C <sup>8</sup>	1	0.5
CA_TA-4TC	41	0.5
CA_1A-42A	1	0.3
<u> </u>	42	0.8
CA_1A-42C	1 42	0.3 0.8
CA_1A-46A	1	0.0
	2	0.5
CA_2A-4A	4	0.5
CA_2A-2A-4A	2	0.5
O/(_Z/\\ Z/\\ 4/\\	4	0.5
CA_2A-4A-4A	2	0.5
CA_2A-2A-4A-	2	0.5 0.5
4A	4	0.5
	2	0.3
CA_2A-5A	5	0.3
CA 2A-2A-5A	2	0.3
UN_2A-2A-UA	5	0.3
CA_2C-5A	2	0.3
	5	0.3
CA_2A-7A	7	0.5 0.5
04 04 :5:	2	0.3
CA_2A-12A	12	0.3
CA_2A-2A-12A	2	0.3
OR_2A-2A-12A	12	0.3
CA_2A-2A-12B	2	0.3
	12 2	0.3
CA_2A-12B	12	0.3
	14	0.0

04 00 404	2	0.3
CA_2C-12A	12	0.3
	2	0.3
CA_2A-13A		
_	13	0.3
CA_2A-2A-13A	2	0.3
CA_2A-2A-13A	13	0.3
	2	0.3
CA_2A-17A	17	0.8
CA_2A-28A	2	0.3
	28	0.3
CA_2A-29A	2	0.3
CA_2C-29A	2	0.3
	2	0.5
CA_2A-30A		•
	30	0.3
CA_2C-30A	2	0.5
UA_2U-3UA	30	0.3
CA_2A-46A	2	0
	3	0.3
CA_3A-5A		
	5	0.3
CA_3C-5A	3	0.3
UA_3U-3A	5	0.3
	3	0.5
CA_3A-7A	7	
		0.5
CA_3A-7B	3	0.5
O/\_O/\^/ D	7	0.5
	3	0.5
CA_3A-7C	7	0.5
CA_3C-7A	3	0.5
	7	0.5
04 00 70	3	0.5
CA_3C-7C	7	0.5
	3	0.3
CA_3A-8A		
_	8	0.3
CA_3A-3A-8A	3	0.3
UA_3A-3A-0A	8	0.3
	3	0.3
CA_3A-19A	19	
		0.3
CA_3A-20A	3	0.3
071_0712071	20	0.3
04 04 004	3	0.3
CA_3A-26A	26	0.3
	3	0.3
CA_3A-27A		
=	27	0.3
CA_3A-28A	3	0.3
UA_3A-20A	28	0.3
	3	0.3
CA_3C-28A	28	0.3
CA_3A-31A	3	0.3
20 0	31	0.6
CA 3A 33A	3	0,5
CA_3A-38A	38	0,5
	3	0.5
CA_3A-40A		
	40	0.5
CA_3A-40C	3	0.5
UN_UN-+0U	40	0.5
	3	0.5
CA_3A-41A		0.3 <sup>10</sup>
OA_3A-41A	41	
		0.8 <sup>11</sup>
	3	0.5
CA_3A-41C	44	0.3 <sup>10</sup>
=	41	0.8 <sup>11</sup>
	3	
CA_3A-42A		0.6
=	42	0.8
CA_3A-42C	3	0.6
UA_3A-42U	42	0.8
L		i

CA_3A-46A	3	0
00 40 50	4	0.3
CA_4A-5A	5	0.3
	4	0.3
CA_4A-4A-5A	5	0.3
CA_4A-7A	4	0.5
<u>-</u>	7	0.5
CA_4A-4A-7A	4	0.5
OA_ <del>1</del> A-1A	7	0.5
04 44 404	4	0.3
CA_4A-12A	12	0.8
	4	0.3
CA_4A-4A-12A	12	0.8
CA_4A-12B	4	0.3
	12	0.8
CA_4A-13A	4	0.3
OA_4A-13A	13	0.3
04 44 44 404	4	0.3
CA_4A-4A-13A	13	0.3
	4	0.3
CA_4A-17A		
	17	0.8
CA_4A-27A	4	0.3
5/\_ //\ Z//\	27	0.3
CA 4A 00A	4	0.3
CA_4A-28A	28	0.6
CA_4A-29A	4	0.3
CA_4A-4A-29A	4	0.3
UA_4A-4A-23A		
CA_4A-30A	4	0.5
	30	0.3
CA_4A-4A-30A	4	0.5
UA_4A-4A-3UA	30	0.3
CA_4A-46A	4	0
	5	0.3
CA_5A-7A	7	0.3
CA_5A-12A	5	0.8
<u>-</u>	12	0.4
CA_5A-12B	5	0.8
OA_0A-12D	12	0.4
04 54 404	5	0.5
CA_5A-13A	13	0.5
	5	0.8
CA_5A-17A	17	0.4
CA_5A-25A	5	0.3
	25	0.3
CA_5A-29A	5	0.5
CA	5	0.3
CA_5A-30A	30	0.3
··	5	0.3
CA_5A-38A	38	0.3
CA_5A-40A	5	0.3
	40	0.3
CA_5A-40C	5	0.3
UΛ_UΛ-40U	40	0.3
04 74 64	7	0.3
CA_7A-8A	8	0.6
	7	0.3
CA_7A-12A		
	12	0.3
CA 7A 20A	7	0.3
CA 7A-20A		
CA_7A-20A	20	0.3
	20 7	0.3 0.5
CA_7A-20A CA_7A-22A	7	0.5
CA_7A-22A	7 22	0.5 0.8
	7 22 7	0.5 0.8 0.3
CA_7A-22A	7 22 7 28	0.5 0.8 0.3 0.3
CA_7A-22A	7 22 7	0.5 0.8 0.3

CA_7C-28A	7	0.3
	28	0.3
CA_7A-40A	7	0.5
_	40	[0.6]
CA_7A-40C	7	0.5
_	40	[0.6]
CA_7A-42A	7	0.5
	42	0.8
CA_7A-42A-	7	0.5
42A	42	0.8
CA_7A-46A	7	0
CA_8A-11A	8	0.3
0707.1.7.	11	0.4
CA_8A-20A	8	0.4
	20	0.4
CA_8A-40A	8	0.3
	40	0.3
CA_8A-41A	8	0.3
O/(_0/( +1/(	41	0.3
CA_8A-41C	8	0.3
UA_UA-410	41	0.3
CA_8A-42A	8	0.6
UA_0A-42A	42	0.8
CA 9A 42C	8	0.6
CA_8A-42C	42	0.8
00 440 400	11	0.3
CA_11A-18A	18	0.3
04 404 054	12	0.3
CA_12A-25A	25	0.3
0.1.1.1.1.1	12	0.3
CA_12A-30A	30	0.3
	18	0.5
CA_18A-28A <sup>9</sup>	28	0.5
	19	0.3
CA_19A-21A	21	0.4
0	19	0.5
CA_19A-28A <sup>9</sup>	28	0.5
	19	0.3
CA_19A-42A	42	0.8
	19	0.3
CA_19A-42C	42	0.8
	20	0.5
CA_20A-31A	31	0.5
CA_20A-32A	20	0.3
	20	0.3
CA_20A-38A	38	0.3
	20	0.3
CA_20A-40A	40	0.3
CA_20A-42A	20	0.3
CA 20A 40A	42	0.8
CA_20A-42A-	20	0.3
42A	42	0.8
CA_20A-67A	20	0.5
CA_21A-42A	21	0.4
	42	0.8
CA_21A-42C	21	0.4
	42	0.8
CA_23A-29A	23	0.3
CA_25A-26A	25	0.3
5/ <u>2</u> 5/ 25/ 25/ 25/ 25/ 25/ 25/ 25/ 25/ 25/ 2	26	0.3
CA_25A-41A <sup>8</sup>	25	0.5
OA_23A-41A	41	0.5
CA_25A-41C <sup>8</sup>	25	0.5
	41	0.5
CA_25A-41D <sup>8</sup>	25	0.5

	41	0.5
CA_26A-41A	26	0.3
	41	0.3
CA 0CA 44C	26	0.3
CA_26A-41C	41	0.3
04 004 404	28	0.3
CA_28A-40A	40	0.3
0	28	0.3
CA_28A-40C	40	0.3
	28	0.3
CA_28A-40D	40	0.3
	28	0.3
CA_28A-41A	41	0.3
	28	0.3
CA_28A-41C	41	0.3
	28	0.5
CA_28A-42A	42	0.8
CA_28A-42C	28 42	0.5
04 004 004		0.8
CA_29A-30A	30	0.3 0 <sup>4</sup>
CA_38A-40A	38	0
	40	04
CA_38A-40A-	38	04
40A	40	04
CA_38A-40C	38	04
	40	04
CA_39A-41A	39	04
<u> </u>	41	04
CA_39A-41A	39	0.5
<u> </u>	41	0.5
CA_39A-41C	39	04
	41	04
CA_39A-41C	39	0.5
	41	0.5
CA_39A-41D	39	04
	41	04
CA_39C-41A	39	04
OA_550-41A	41	04
CA_39C-41A	39	0.5
UA_33U-41A	41	0.5
CA 20C 44C	39	04
CA_39C-41C	41	04
CA 44A 40A	41	04
CA_41A-42A	42	0.54
CA 44A 40C	41	04
CA_41A-42C	42	0.54
OA 440 404	41	04
CA_41C-42A	42	0.54
04 440 400	41	04
CA_41C-42C	42	0.54
CA_41A-46A	41	0
CA_42A-46A	42	[0.5]
	·=	[4]

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations

NOTE 2: The above additional tolerances also apply in non-aggregated operation for the supported E-UTRA operating bands that belong to the supported interband carrier aggregation configurations

NOTE 3: In case the UE supports more than one of the above 2DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 2DL inter-band carrier aggregation configurations then:

- When the E-UTRA operating band frequency range is  $\leq$  1GHz, the applicable additional tolerance shall be the average of the 2DL tolerances above, truncated to one decimal place for that operating band among the supported 2DL CA configurations. In case there is a harmonic relation

- between low band UL and high band DL, then the maximum tolerance among the different supported 2DL carrier aggregation configurations involving such band shall be applied
- When the E-UTRA operating band frequency range is >1GHz, the applicable additional 2DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 2DL CA configurations
- NOTE 4: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 5: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
  - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
  - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 6: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 7: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx.
- NOTE 8: Only applicable for UE supporting inter-band carrier aggregation with the uplink active in the FDD band.
- NOTE 9: For Band 28, the requirements only apply for the restricted frequency range specified for this CA configuration (Table 5.5A-2).
- NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.
- NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz.
- NOTE 12: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65  $\Delta T_{IB,c}$  is the max(Band 65  $\Delta T_{IB,c}$ , Band 1  $\Delta T_{IB,c}$ )
- NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE: To meet the  $\Delta T_{IB,c}$  requirements for CA\_3A-7A with state-of-the-art technology, an increase in power consumption of the UE may be required. It is also expected that as the state-of-the-art technology evolves in the future, this possible power consumption increase can be reduced or eliminated.

Table 6.2.5-3:  $\Delta T_{IB,c}$  (three bands)

Inter-band CA Configuration	E-UTRA Band	$\Delta T_{IB,c}$ [dB]
_	1	0.6
CA_1A-3A-7A	3	0.6
_	7	0.6
	1	0.6
CA_1A-3A-7C	3	0.6
	7	0.6
	1	0.3
CA_1A-3A-8A	3	0.3
	8	0.3
	1	0.3
CA_1A-3A-5A	3	0.3
	5	0.3
	1	0.3
CA_1A-3A-19A	3	0.3
	19	0.3
	1	0.3
CA_1A-3A-20A	3	0.3
	20	0.3
	1	0.3
CA_1A-3A-26A	3	0.3
_	26	0.3
	1	0.3
CA_1A-3A-28A	3	0.3
	28	0.6
	1	0.5
CA_1A-3A-40A	3	0.5
	40	0.5
	1	0.6
CA_1A-3A-42A	3	0.6
0/\_//\ 0/\ 12/\	42	0.8
	1	0.6
CA_1A-3A-42C	3	0.6
0/1_/// 0// 120	42	0.8
	1	0.5
CA_1A-5A-7A	5	0.3
0/1_/// 0// ///	7	0.6
	1	0.5
CA_1A-5A-40A	5	0.3
6/C1/(3/(40/(	40	0.5
	1	0.5
CA_1A-7A-8A	7	0.6
0A_1A-1A-0A	8	0.6
	1	0.5
CA_1A-7A-20A	7	0.6
JN_1/\ 1A-20A	20	0.3
	1	0.5
CA_1A-7A-28A	7	
υΛ_1Λ-1Λ <b>-</b> 20Λ	28	0.6
		0.6
CA 1A 7C 20A	1 7	0.5
CA_1A-7C-28A		0.6
	28	0.6
CA 1A 0A 14A	1 0	0.3
CA_1A-8A-11A	8	0.3
	11	0.4
00 40 00 400	1	0.5
CA_1A-8A-40A	8	0.3
	40	0.5
00 40 440 400	1	0.3
CA_1A-11A-18A	11	0.4
04 44 404 551	18	0.3
CA_1A-18A-28A	1	0.3

	18	0.5
	28	0.5
	1	0.3
CA_1A-19A-21A	19	0.3
	21	0.4
	1	0.3
00 40 400 000	•	
CA_1A-19A-28A	19	0.5
	28	0.5
	1	0.3
CA_1A-19A-42A	19	0.3
CA_1A-19A-42A		
	42	0.8
	1	0.3
CA_1A-19A-42C	19	0.3
	42	0.8
	_	
	1	0.3
CA_1A-21A-42A	21	0.4
	42	0.8
	1	0.3
04 44 044 400	•	
CA_1A-21A-42C	21	0.4
	42	0.8
	2	0.5
CA 2A 2A 4A 42A +		
CA_2A-2A-4A-12A	4	0.5
	12	0.8
	2	0.5
CA_2A-4A-5A	4	0.5
5/( <u>-</u> 2/( <del>-</del> 4/( 5/(		
	5	0.3
	2	0.5
CA 2A-2A-4A-5A	4	0.5
	5	0.3
	2	0.5
CA_2A-4A-4A-5A	4	0.5
	5	0.3
	2	0.5
0.00.40.70		
CA_2A-4A-7A	4	0.5
	7	0.5
	2	0.5
CA_2A-4A-12A	4	0.5
UA_2A-4A-12A		
	12	0.8
	2	0.5
CA_2A-4A-4A-12A	4	0.5
	12	0.8
	2	0.5
CA_2A-4A-13A	4	0.5
T T	13	0.3
	2	[0.5]
CA_2A-4A-29A		
	4	0.5
	2	0.5
CA_2A-4A-30A	4	0.5
	30	0.3
L	2	0.3
CA_2A-5A-12A	5	0.8
F	12	0.4
	2	0.3
CA_2A-2A-5A-12A	5	0.8
	12	0.4
	2	0.3
CA_2A-5A-12B	5	0.8
UA_2A-UA-12D		
	12	0.4
	2	0.3
CA_2A-5A-13A	5	0.5
5,, ( 5, ( 15, (		
	13	0.5
CA_2A-5A-29A	2	0.3
UA_2A-UA-28A	5	0.5
	2	0.5
CA_2A-5A-30A		
	5	0.3

	30	0.3
	2	0.5
CA_2C-5A-30A	5	0.3
CA_2C-5A-30A		
	30	0.3
	2	0.5
CA_2A-7A-12A	7	0.5
	12	0.3
	2	0.5
04 04 404 004		
CA_2A-12A-30A	12	0.3
	30	0.3
	2	0.5
CA_2C-12A-30A	12	0.3
	30	0.3
	2	
CA_2A-29A-30A		0.5
	30	0.3
CA 2C 20A 20A	2	0.5
CA_2C-29A-30A	30	0.3
	3	0.5
CA_3A-5A-40A	5	
CA_3A-5A-40A		0.3
	40	0.5
	3	0.5
CA_3A-7A-8A	7	0.5
	8	0.6
	3	0.5
04 04 74 004		
CA_3A-7A-20A	7	0.5
	20	0.3
	3	0.5
CA_3A-7A-28A	7	0.5
6/1 <u>-</u> 6/1/1/26/1	28	0.3
_	3	0.5
CA_3A-7C-28A	7	0.5
	28	0.3
	3	0.5
CA_3C-7A-28A	7	0.5
OA_50-1A-20A		
	28	0.3
	3	0.5
CA_3C-7C-28A	7	0.5
	28	0.3
	3	0.5
CA_3A-7A-38A	7	0.5
CA_3A-1A-36A		
	38	0.5
	3	0.5
CA_3A-8A-40A	8	0.3
_ <u> </u>	40	0.5
	3	0.6
0.		
CA_3A-19A-42A	19	0.3
	42	0.8
	3	0.6
CA_3A-19A-42C	19	0.3
	42	0.8
	3	0.5
CA_3A-28A-40A	28	0.3
	40	0.5
	3	0.5
CA_3A-28A-40C	28	0.3
UA_3A-20A-40U		
	40	0.5
<u> </u>	3	1
CA_3A-41A-42A	41	0.3 <sup>5</sup> /0.8 <sup>6</sup>
ļ	42	0.8
	4	0.3
CA 4A 5A 4GA		
CA_4A-5A-12A	5	0.8
	12	0.8
	4	0.3
CA_4A-4A-5A-12A	5	0.8
· · · · · · · · · · · · · · · · ·	12	0.8
	14	0.0

	4	0.3
CA_4A-5A-13A	5	0.5
	13	0.5
CA 4A 5A 30A	4	0.3
CA_4A-5A-29A	5	0.5
	4	0.5
CA_4A-5A-30A	5	0.3
Γ	30	0.3
	4	0.5
CA_4A-4A-5A-30A	5	0.3
	30	0.3
	4	0.5
CA_4A-7A-12A	7	0.5
	12	0.8
	4	0.5
CA_4A-12A-30A	12	0.8
	30	0.3
	4	0.5
CA_4A-4A-12A-30A	12	0.8
Γ	30	0.3
CA 4A 20A 20A	4	0.5
CA_4A-29A-30A -	30	0.3
CA_4A-4A-29A-30A	4	0.5
CA_4A-4A-29A-30A	30	0.3
	7	0.3
CA_7A-8A-20A	8	0.6
	20	[0.6]
	7	0.3
CA_7A-20A-38A	20	0.3
	38	0.3
	19	0.3
CA_19A-21A-42A	21	0.4
L	42	0.8
	19	0.3
CA_19A-21A-42C	21	0.4
	42	0.8
	11.1	

- NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 2: The above additional tolerances also apply in non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 3: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
  - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
  - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations
- NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order interband carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.
- NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz.

NOTE 7: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65  $\Delta T_{IB,c}$  is the max(Band 65  $\Delta T_{IB,c}$ , Band 1  $\Delta T_{IB,c}$ )

Table 6.2.5-4: ΔT<sub>IB,c</sub> (four bands)

Inter-band CA Configuration	E-UTRA Band	ΔT <sub>IB,c</sub> [dB]
	1	0.5
CA_1A-3A-5A-40A	3	0.5
	5	0.3
	40	0.5
<u> </u>	1	0.6
CA_1A-3A-7A-8A	<u>3</u> 7	0.6 0.6
<del>                                   </del>	8	0.6
	1	0.6
	3	0.6
CA_1A-3A-7A-28A	7	0.6
	28	0.6
	1	0.6
CA_1A-3A-7C-28A	3	0.6
CA_1A-3A-7C-20A	7	0.6
	28	0.6
<u> </u>	1	0.5
CA_1A-3A-8A-40A	3	0.5
	8	0.3
	<u>40</u> 1	0.5
<del> </del>	3	0.6 0.6
CA_1A-3A-19A-42A	<u>3</u> 19	0.3
<del> </del>	42	0.8
	1	0.6
	3	0.6
CA_1A-3A-19A-42C	19	0.3
	42	0.8
	1	0.3
CA_1A-19A-21A-42A	19	0.3
CA_1A-19A-21A-42A	21	0.4
	42	0.8
<u> </u>	1	0.3
CA_1A-19A-21A-42C —	19	0.3
<u> </u>	21	0.4
	<u>42</u> 2	0.8 0.5
<del> </del>	4	0.5
CA_2A-4A-5A-12A —	5	0.8
<del>                                   </del>	12	0.8
	2	0.5
CA_2A-4A-5A-29A	4	0.5
	5	0.5
	2	0.5
CA_2A-4A-5A-30A	4	0.5
CA_2A-4A-5A-50A	5	0.3
	30	0.3
	2	0.5
CA_2A-4A-7A-12A —	4	0.5
	7	0.5
	12	0.8
	2	0.5
CA_2A-4A-12A-30A —	4 12	0.5
		0.8
	30 2	0.3 0.5
CA_2A-4A-29A-30A	4	0.5
0/1_4/\_4/\_23/\_00/\	30	0.3
NOTE 1. The above addi	tional tolerances are only an	

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 2: The above additional tolerances also apply in non-aggregated operation for

the supported E-UTRA operating bands that belong to the supported interband carrier aggregation configurations.

NOTE 3: Tolerances for a UE supporting multiple 4DL inter-band CA configurations

NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.

NOTE 5: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65  $\Delta T_{IB,c}$  is the max(Band 65  $\Delta T_{IB,c}$ , Band 1  $\Delta T_{IB,c}$ )

NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and other bands are >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

# 6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell c and its total configured maximum output power  $P_{CMAX}$ .

The configured maximum output power  $P_{CMAX,c}$  on serving cell c shall be set as specified in subclause 6.2.5.

For uplink inter-band carrier aggregation, MPR<sub>c</sub> and A-MPR<sub>c</sub> apply per serving cell c and are specified in subclause 6.2.3 and subclause 6.2.4, respectively. P-MPR<sub>c</sub> accounts for power management for serving cell c. P<sub>CMAX,c</sub> is calculated under the assumption that the transmit power is increased independently on all component carriers.

For uplink intra-band contiguous and non-contiguous carrier aggregation,  $MPR_c = MPR$  and  $A-MPR_c = A-MPR$  with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR  $_c = P-MPR$ .  $P_{CMAX,c}$  is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

The total configured maximum output power P<sub>CMAX</sub> shall be set within the following bounds:

$$P_{CMAX I} \le P_{CMAX} \le P_{CMAX H}$$

For uplink inter-band carrier aggregation with one serving cell c per operating band,

$$\begin{split} P_{CMAX\_L} &= MIN \; \{ 10log_{10} \sum \; MIN \; [ \; p_{EMAX,c} / \; (\Delta t_{C,c}), \; \; p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c} \cdot \Delta t_{ProSe}) \; , \; p_{PowerClass} / pmpr_c], \\ P_{PowerClass} \} \end{split}$$

$$P_{CMAX\_H} = MIN\{10 \ log_{10} \sum p_{EMAX,c} \ , \ P_{PowerClass}\}$$

where

- $p_{EMAX,c}$  is the linear value of  $P_{EMAX,c}$  which is given by IE *P-Max* for serving cell c in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1; p<sub>PowerClass</sub> is the linear value of P<sub>PowerClass</sub>;
- mpr<sub>c</sub> and a-mpr<sub>c</sub> are the linear values of MPR<sub>c</sub> and A-MPR<sub>c</sub> as specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- pmpr<sub>c</sub> is the linear value of P-MPR<sub>c</sub>;
- $\Delta t_{C,c}$  is the linear value of  $\Delta T_{C,c}$ .  $\Delta t_{C,c} = 1.41$  when NOTE 2 in Table 6.2.2-1 applies for a serving cell c, otherwise  $\Delta t_{C,c} = 1$ ;
- $\Delta t_{IB,c}$  is the linear value of the inter-band relaxation term  $\Delta T_{IB,c}$  of the serving cell c as specified in Table 6.2.5-2; otherwise  $\Delta t_{IB,c} = 1$ ;

-  $\Delta t_{ProSe}$  is the linear value of  $\Delta T_{ProSe}$  and applies as specified in subclause 6.2.5.

For uplink intra-band contiguous and non-contiguous carrier aggregation,

$$\begin{split} P_{CMAX\_L} &= MIN\{10 \ log_{10} \sum p_{EMAX,c} \ - \Delta T_C \ , P_{PowerClass} - MAX(MPR + A-MPR + \Delta T_{IB,c} + \Delta T_C + \Delta T_{ProSe}, P-MPR \ ) \ \} \\ &P_{CMAX\_H} = MIN\{10 \ log_{10} \sum p_{EMAX,c} \ , P_{PowerClass}\} \end{split}$$

where

- $p_{\text{EMAX},c}$  is the linear value of  $P_{\text{EMAX},c}$  which is given by IE *P-Max* for serving cell *c* in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;
- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{IB,c}$  is the additional tolerance for serving cell c as specified in Table 6.2.5-2;
- P-MPR is the power management term for the UE;
- $\Delta T_{\rm C}$  is the highest value  $\Delta T_{\rm C,c}$  among all serving cells c in the subframe over both timeslots.  $\Delta T_{\rm C,c} = 1.5$  dB when NOTE 2 in Table 6.2.2A-1 applies to the serving cell c, otherwise  $\Delta T_{\rm C,c} = 0$  dB;
- $\Delta T_{\text{ProSe}}$  applies as specified in subclause 6.2.5.

For combinations of intra-band and inter-band carrier aggregation with UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per operating band),

$$\begin{split} P_{CMAX\_L} &= MIN \; \{10log_{10} \sum (p_{CMAX\_L, \; Bi}), \; P_{PowerClass} \} \\ \\ P_{CMAX\_H} &= MIN \{10 \; log_{10} \; \sum p_{EMAX,c} \; , \; P_{PowerClass} \} \end{split}$$

where

- $p_{EMAX,c}$  is the linear value of  $P_{EMAX,c}$  which is given by IE *P-Max* for serving cell *c* in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-0 without taking into account the tolerance specified in the Table 6.2.2A-0; p<sub>PowerClass</sub> is the linear value of P<sub>PowerClass</sub>;
- $p_{CMAX\_L,\,Bi}$  is the linear values of  $P_{CMAX\_L}$  as specified in corresponding operating band.  $P_{CMAX\_L,c}$  specified for single carrier in subclause 6.2.5 applies for operating band supporting one serving cell.  $P_{CMAX\_L}$  specified for uplink intra-band contiguous carrier aggregation in subclause 6.2.5A applies for operating band supporting two contiguous serving cells.

For each subframe, the  $P_{CMAX\_L}$  is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX\_L}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

If the UE is configured with multiple TAGs and transmissions of the UE on subframe i for any serving cell in one TAG overlap some portion of the first symbol of the transmission on subframe i+1 for a different serving cell in another TAG, the UE minimum of  $P_{\text{CMAX\_L}}$  for subframes i and i+1 applies for any overlapping portion of subframes i and i+1.  $P_{\text{PowerClass}}$  shall not be exceeded by the UE during any period of time.

The measured maximum output power P<sub>UMAX</sub> over all serving cells shall be within the following range:

$$\begin{split} P_{CMAX\_L} - MAX\{T_L,\,T_{LOW}(P_{CMAX\_L})~\}~\leq~P_{UMAX} \leq~P_{CMAX\_H} +~T_{HIGH}(P_{CMAX\_H}) \\ \\ P_{UMAX} = 10~log_{10}~\sum_{P_{UMAX\_c}} p_{UMAX\_c} \end{split}$$

where  $p_{UMAX,c}$  denotes the measured maximum output power for serving cell c expressed in linear scale. The tolerances  $T_{LOW}(P_{CMAX})$  and  $T_{HIGH}(P_{CMAX})$  for applicable values of  $P_{CMAX}$  are specified in Table 6.2.5A-1 and Table 6.2.5A-2 for inter-band carrier aggregation and intra-band carrier aggregation, respectively. The tolerance  $T_L$  is the absolute value of the lower tolerance for applicable E-UTRA CA configuration as specified in Table 6.2.2A-0, Table 6.2.2A-1 and Table

6.2.2A-2 for inter-band carrier aggregation, intra-band contiguous carrier aggregation and intra-band non-contiguous carrier aggregation, respectively.

Table 6.2.5A-1: P<sub>CMAX</sub> tolerance for uplink inter-band CA (two bands)

P <sub>CMAX</sub> (dBm)	Tolerance T <sub>LOW</sub> (P <sub>CMAX</sub> ) (dB)	Tolerance T <sub>HIGH</sub> (P <sub>CMAX</sub> ) (dB)
$P_{CMAX} = 23$	3.0	2.0
22 ≤ P <sub>CMAX</sub> < 23	5.0	2.0
21 ≤ P <sub>CMAX</sub> < 22	5.0	3.0
20 ≤ P <sub>CMAX</sub> < 21	6.0	4.0
16 ≤ P <sub>CMAX</sub> < 20	5.0	
11 ≤ P <sub>CMAc</sub> < 16	6.0	
-40 ≤ P <sub>CMAX</sub> < 11	7.0	

Table 6.2.5A-2: P<sub>CMAX</sub> tolerance

P <sub>CMAX</sub> (dBm)	Tolerance T <sub>LOW</sub> (P <sub>CMAX</sub> ) (dB)	Tolerance T <sub>HIGH</sub> (P <sub>CMAX</sub> ) (dB)	
$21 \le P_{CMAX} \le 23$	2.	.0	
20 ≤ P <sub>CMAX</sub> < 21	2	2.5	
$19 \le P_{CMAX} < 20$	3.5		
18 ≤ P <sub>CMAX</sub> < 19	4.	.0	
13 ≤ P <sub>CMAX</sub> < 18	5.0		
8 ≤ P <sub>CMAX</sub> < 13	6.0		
-40 ≤ P <sub>CMAX</sub> < 8	7.0		

## 6.2.5B Configured transmitted power for UL-MIMO

For UE supporting UL-MIMO, the transmitted power is configured per each UE.

The definitions of configured maximum output power  $P_{CMAX,c}$ , the lower bound  $P_{CMAX\_L,c}$ , and the higher bound  $P_{CMAX\_L,c}$  specified in subclause 6.2.5 shall apply to UE supporting UL-MIMO, where

- $P_{PowerClass}$  and  $\Delta T_{C,c}$  are specified in subclause 6.2.2B;
- MPR<sub>.c</sub> is specified in subclause 6.2.3B;
- A-MPR<sub>.c</sub> is specified in subclause 6.2.4B.

The measured configured maximum output power  $P_{UMAX,c}$  for serving cell c shall be within the following bounds:

$$P_{CMAX\_L,c} - \ MAX\{T_L, T_{LOW}(P_{CMAX\_L,c})\} \ \leq \ P_{UMAX,c} \leq \ P_{CMAX\_H,c} + \ T_{HIGH}(P_{CMAX\_H,c})$$

where  $T_{LOW}(P_{CMAX\_L,c})$  and  $T_{HIGH}(P_{CMAX\_H,c})$  are defined as the tolerance and applies to  $P_{CMAX\_L,c}$  and  $P_{CMAX\_H,c}$  separately, while  $T_L$  is the absolute value of the lower tolerance in Table 6.2.2B-1 for the applicable operating band.

For UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2.5B-1. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2.

 $P_{CMAX,c}$ Tolerance Tolerance (dBm)  $T_{LOW}(P_{CMAX\_L,c})$  (dB)  $T_{HIGH}(P_{CMAX\_H,c})$  (dB)  $P_{CMAX,c} = 23$ 3.0 2.0 5.0 2.0  $22 \le P_{CMAX,c} < 23$ 5.0 3.0  $21 \le P_{CMAX,c} < 22$  $\overline{20} \le P_{\text{CMAX},c} < 21$ 6.0 4.0  $16 \le P_{CMAX,c} < 20$ 5.0  $11 \le P_{CMAX,c} < 16$ 6.0  $-40 \le P_{\text{CMAX},c} < 11$ 7.0

Table 6.2.5B-1: P<sub>CMAX,c</sub> tolerance in closed-loop spatial multiplexing scheme

For single-antenna port scheme, the requirements in subclause 6.2.5 apply.

### 6.2.5C Configured transmitted power for Dual Connectivity

For inter-band dual connectivity with one uplink serving cell per CG, the UE is allowed to set its configured maximum output power  $P_{CMAX,c(i),i}$  for serving cell c(i) of CG i, i = 1,2, and its total configured maximum output power  $P_{CMAX}$ .

The configured maximum output power  $P_{CMAX,c(i),i}(p)$  in subframe p of serving cell c(i) on CG i shall be set within the following bounds:

$$P_{\text{CMAX\_L},c(i),i}(p) \leq P_{\text{CMAX},c(i),i}(p) \leq P_{\text{CMAX\_H},c(i),i}(p)$$

where  $P_{CMAX\_L,c(i),i}(p)$  and  $P_{CMAX\_H,c(i),i}(p)$  are the limits for a serving cell c(i) of CG i as specified in subclause 6.2.5.

The total UE configured maximum output power  $P_{CMAX}(p,q)$  in a subframe p of CG 1 and a subframe q of CG 2 that overlap in time shall be set within the following bounds for synchronous and asynchronous operation unless stated otherwise:

$$P_{\text{CMAX\_L}}(p,q) \leq P_{\text{CMAX}}(p,q) \leq P_{\text{CMAX\_H}}(p,q)$$

with

$$P_{\text{CMAX\_L}}(p,q) = \text{MIN} \{10 \log_{10} [p_{\text{CMAX\_L},c(1),1}(p) + p_{\text{CMAX\_L},c(2),2}(q)], P_{\text{PowerClass}}\}$$

$$P_{\text{CMAX H}}(p,q) = \text{MIN} \{10 \log_{10} [p_{\text{CMAX H,c(1),1}}(p) + p_{\text{CMAX H,c(2),2}}(q)], P_{\text{PowerClass}} \}$$

where  $p_{CMAX\_L,c(i),i}$  is  $p_{CMAX\_H,c(i),i}$  are the respective limits  $P_{CMAX\_L,c(i),i}$  (p) and  $P_{CMAX\_H,c(i),i}$  (p) expressed in linear scale.

If the UE is configured in Dual Connectivity and synchronous transmissions of the UE on subframe p for a serving cell in one CG overlaps some portion of the first symbol of the transmission on subframe q+1 for a different serving cell in the other CG, the UE minimum of  $P_{CMAX\_L}$  between subframes pairs (p, q) and (p+1, q+1) respectively applies for any overlapping portion of subframes (p, q) and (p+1, q+1).  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured total maximum output power P<sub>UMAX</sub> over both CGs is

$$P_{\text{UMAX}} = 10 \log_{10} [p_{\text{UMAX},c(1),1} + p_{\text{UMAX},c(2),2}],$$

where  $p_{UMAX,c(i),i}$  denotes the measured output power of serving cell c(i) of CG i expressed in linear scale.

If the UE is configured in Dual Connectivity and synchronous transmissions

$$P_{\text{CMAX\_L}}(p, q) - T_{\text{LOW}}(P_{\text{CMAX\_L}}(p, q)) \leq P_{\text{UMAX}} \leq P_{\text{CMAX\_H}}(p, q) + T_{\text{HIGH}}(P_{\text{CMAX\_H}}(p, q))$$

where  $P_{CMAX\_L}(p,q)$  and  $P_{CMAX\_H}(p,q)$  are the limits for the pair (p,q) and with the tolerances  $T_{LOW}(P_{CMAX})$  and  $T_{HIGH}(P_{CMAX})$  for applicable values of  $P_{CMAX}$  specified in Table 6.2.5C-1.  $P_{CMAX\_L}$  may be modified for any overlapping portion of subframes (p,q) and (p+1,q+1).

If the UE is configured in Dual Connectivity and asynchronous transmissions, the subframes of the leading CG are taken as reference subframes for the measurement of the total configured output power  $P_{UMAX}$ . If subframe p of CG 1 and subframe q of CG 2 overlap in time in their respective slot 0 and

- 1. if p leads in time over q, then p is the reference subframe and the (p,q) and (p,q-1) pairs are considered for determining the  $P_{CMAX}$  tolerance
- 2. if q leads in time over p, then p is the reference subframe and the (p-1,q) and (p,q) pairs are considered for determining the  $P_{CMAX}$  tolerance;

for the reference subframe p duration (when subframe p in CG 1 leads):

$$P'_{CMAX\_L} = MIN \{P_{CMAX\_L} (p,q), P_{CMAX\_L} (p,q-1)\}$$

$$P'_{CMAX H} = MAX \{P_{CMAX H} (p,q), P_{CMAX H} (p,q-1)\}$$

while for the reference subframe q duration (when subframe q in CG 2 leads):

$$P'_{CMAX L} = MIN \{P_{CMAX L} (p-1,q), P_{CMAX L} (p,q)\}$$

$$P'_{CMAX_H} = MAX \{P_{CMAX_H} (p-1,q), P_{CMAX_H} (p,q)\}$$

where  $P_{CMAX\_L}$  and  $P_{CMAX\_H}$  are the applicable limits for each overlapping subframe pairs (p,q), (p,q-1) and (p-1,q). The measured total configured maximum output power  $P_{UMAX}$  shall be within the following bounds:

$$P'_{CMAX L} - T_{LOW}(P'_{CMAX L}) \le P_{UMAX} \le P'_{CMAX H} + T_{HIGH}(P'_{CMAX H})$$

with the tolerances T<sub>LOW</sub>(P<sub>CMAX</sub>) and T<sub>HIGH</sub>(P<sub>CMAX</sub>) for applicable values of P<sub>CMAX</sub> specified in Table 6.2.5C-1.

Table 6.2.5C-1: P<sub>CMAX</sub> tolerance for inter-band Dual Connectivity

P <sub>CMAX</sub> (dBm)	Tolerance T <sub>LOW</sub> (P <sub>CMAX_L</sub> )(dB)	Tolerance T <sub>HIGH</sub> ( P <sub>CMAX_H</sub> )(dB)	
P <sub>CMAX</sub> = 23	3.0	2.0	
22 ≤P <sub>CMAX,</sub> < 23	5.0	2.0	
21 ≤ P <sub>CMAX</sub> < 22	5.0	3.0	
20 ≤ P <sub>CMAX</sub> , < 21	6.0	4.0	
16 ≤ P <sub>CMAX</sub> < 20	5.0		
11 ≤ P <sub>CMAX</sub> , < 16	6.0		
-40 ≤ P <sub>CMAX</sub> < 11		7.0	

# 6.2.5D Configured transmitted power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the configured maximum output power  $P_{CMAX,c}$  and power boundary requirement specified in subclause 6.2.5 shall apply to UE supporting ProSe, where

- MPR $_c$  is specified in subclause 6.2.3D;
- A-MPR<sub>c</sub> is specified in subclause 6.2.4D;
- $\Delta T_{ProSe} = 0.1 \text{ dB}.$

For  $P_{\mathrm{CMAX},PSSCH}$  and  $P_{\mathrm{CMAX},PSCCH}$ ,  $P_{\mathrm{EMAX},c}$  is the value given by IE P-Max for serving cell c, defined by [7], when present.  $P_{\mathrm{EMAX},c}$  is the value given by IE maxTxPower, defined by [7], when the UE is not associated with a serving cell on the ProSe carrier.

For  $P_{\mathrm{CMAX},PSDCH}$  ,  $\mathrm{P}_{\mathrm{EMAX},c}$  is the value given by the IE discMaxTxPower in [7].

For  $P_{\text{CMAX},PSBCH}$ ,  $P_{\text{EMAX},c}$  is the value given by the IE maxTxPower in [7] when the ProSe UE is not associated with a serving cell on the ProSe carrier. When the UE is associated with a serving cell, then  $P_{\text{EMAX},c}$  is the value given by the IE P-Max when PSBCH/SLSS transmissions is triggered for ProSe Direct communication as specified in [7], and is the value given by the IE discMaxTxPower in [7] otherwise.

For  $P_{\text{CMAX},SSSS}$ , the value is as calculated for  $P_{\text{CMAX},PSBCH}$  and applying the MPR for SSSS as specified in Section 6.2.3D.

When a UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE is allowed to set its configured maximum output power  $P_{CMAX,c,E-UTRA}$  and  $P_{CMAX,c,ProSe}$  for the configured E-UTRA uplink carrier and the configured E-UTRA ProSe carrier, respectively, and its total configured maximum output power  $P_{CMAX,c}$ .

The configured maximum output power  $P_{CMAX\ c,E-UTRA}(p)$  in subframe p for the configured E-UTRA uplink carrier shall be set within the bounds:

$$P_{\text{CMAX\_L},c,E\text{-}UTRA}\left(p
ight) \leq P_{\text{CMAX\_c},E\text{-}UTRA}\left(p
ight) \leq P_{\text{CMAX\_H},c,E\text{-}UTRA}\left(p
ight)$$

where P<sub>CMAX</sub> L<sub>c,E-UTRA</sub> and P<sub>CMAX</sub> H<sub>c,E-UTRA</sub> are the limits for a serving cell c as specified in subclause 6.2.5.

The configured maximum output power  $P_{CMAX\ c,ProSe}(q)$  in subframe q for the configured E-UTRA ProSe carrier shall be set within the bounds:

$$P_{CMAX,c,ProSe}(q) \leq P_{CMAX H,c,ProSe}(q)$$

where P<sub>CMAX H.c.ProSe</sub> is the limit as specified in subclause 6.2.5D.

The total UE configured maximum output power  $P_{CMAX}(p,q)$  in a subframe p of an E-UTRA uplink carrier and a subframe q of an E-UTRA ProSe sidelink that overlap in time shall be set within the following bounds for synchronous and asynchronous operation unless stated otherwise:

$$P_{CMAX L}(p,q) \le P_{CMAX}(p,q) \le P_{CMAX H}(p,q)$$

with

$$P_{CMAX L}(p,q) = P_{CMAX L.c.E-UTRA}(p)$$

$$P_{\text{CMAX\_H}}(p,q) = \text{MIN } \{10 \log_{10} \left[ p_{\text{CMAX\_H},c,E-UTRA}(p) + p_{\text{CMAX\_H},c,ProSe}(q) \right], P_{\text{PowerClass}} \}$$

where  $p_{CMAX\_H,c,ProSe}$  and  $p_{CMAX\_H,c,E-UTRA}$  are the limits  $P_{CMAX\_H,c,ProSe}$  (q) and  $P_{CMAX\_H,c,E-UTRA}$  (p) expressed in linear scale.

The measured total maximum output power P<sub>UMAX</sub> over both the E-UTRA uplink and E-UTRA ProSe carriers is

$$P_{UMAX} = 10 \log_{10} \left[ p_{UMAX,c,E-UTRA} + p_{UMAX,c,ProSe} \right],$$

where  $p_{UMAX,c,E-UTRA}$  denotes the measured output power of serving cell c for the configured E-UTRA uplink carrier, and  $p_{UMAX,c,ProSe}$  denotes the measured output power for the configured E-UTRA ProSe carrier expressed in linear scale.

When a UE is configured for synchronous ProSe and uplink transmissions,

$$\mathrm{P}_{\mathrm{CMAX\_L}}(p,\,q) \; - \; \mathrm{T}_{\mathrm{LOW}} \left( \mathrm{P}_{\mathrm{CMAX\_L}}(p,\,q) \right) \; \leq \; \mathrm{P}_{\mathrm{UMAX}} \; \leq \; \mathrm{P}_{\mathrm{CMAX\_H}}(p,\,q) \; + \; \mathrm{T}_{\mathrm{HIGH}} \left( \mathrm{P}_{\mathrm{CMAX\_H}}(p,\,q) \right)$$

where  $P_{CMAX\_L}(p,q)$  and  $P_{CMAX\_H}(p,q)$  are the limits for the pair (p,q) and with the tolerances  $T_{LOW}(P_{CMAX})$  and  $T_{HIGH}(P_{CMAX})$  for applicable values of  $P_{CMAX}$  specified in Table 6.2.5C-1.  $P_{CMAX\_L}$  may be modified for any overlapping portion of subframes (p,q) and (p+1,q+1).

When a UE is configured for asynchronous ProSe and uplink transmissions, the carrier configured for uplink transmission is taken as the reference. If subframe p for the E-UTRA uplink carrier and subframe q for the E-UTRA ProSe carrier overlap in time and

- 1. if uplink carrier leads in time over q, then p is the reference subframe and, the (p,q) and (p,q-1) pairs are considered for determining the  $P_{CMAX}$  tolerance
- 2. if ProSe carrier leads in time over p, then p is the reference subframe and, the (p,q) and (p,q+1) pairs are considered for determining the  $P_{CMAX}$  tolerance

For the reference subframe p duration when uplink carrier leads:

$$P'_{CMAX\ L} = P_{CMAX\ L..cE-UTRA}(p)$$

$$P'_{CMAX_H} = MAX \{P_{CMAX_H} (p,q-1), P_{CMAX_H} (p,q)\}$$

For the reference subframe *p* duration when ProSe carrier leads:

$$P'_{CMAX\_L} = P_{CMAX\_L,cE-UTRA}(p)$$

$$P'_{CMAX H} = MAX \{P_{CMAX H} (p,q), P_{CMAX H} (p,q+1)\}$$

where  $P_{CMAX\_L,cE-UTRA}(p)$  and  $P_{CMAX\_H}$  are the applicable limits for each overlapping subframe pairs (p,q), (p,q+1), (p,q-1). The measured total configured maximum output power  $P_{UMAX}$  shall be within the following bounds:

$$P'_{CMAX\_L} \ - \ T_{LOW} \left( P'_{CMAX\_L} \right) \ \leq \ P_{UMAX} \ \leq \ P'_{CMAX\_H} + T_{HIGH} \left( P'_{CMAX\_H} \right)$$

with the tolerances  $T_{LOW}(P_{CMAX})$  and  $T_{HIGH}(P_{CMAX})$  for applicable values of  $P_{CMAX}$  specified in Table 6.2.5C-1.

# 6.2.5F Configured transmitted Power for NB-IoT

For each slot i the NB IoT UE is allowed to set its configured maximum output power  $P_{CMAX,c}$ . The configured maximum output power  $P_{CMAX,c}$  is set within the following bounds:

$$P_{CMAX\_L,c} \leq \, P_{CMAX,c} \, \leq \, P_{CMAX\_H,c}$$

Where

- $P_{CMAX\_L,c} = MIN \{ P_{EMAX,c}, P_{PowerClass} MPR_c A-MPR_c \}$
- $P_{CMAX\ H,c} = MIN \{ P_{EMAX,c}, P_{PowerClass} \}$
- P<sub>EMAX.c</sub> is the value given to IE *P-Max*, defined in [7]
- P<sub>PowerClass</sub> is the maximum NB IoT UE power specified in Table 6.2.2F-1 without taking into account the associated tolerance
- MPR<sub>c</sub> and A-MPR<sub>c</sub> are specified in subclause 6.2.3F and subclause 6.2.4F, respectively

The measurement period for  $P_{UMAX,c}$  is at least one sub-frame (1ms) for 15 KHz channel spacing, and at least a 2ms slot (excluding the 2304Ts gap when UE is not transmitting) respectively for the 3.75 KHz channel spacing. The measured maximum output power  $P_{UMAX,c}$  shall be within the following bounds:

$$P_{CMAX\_L,c} - \ T(P_{CMAX\_L,c}) \ \leq \ P_{UMAX,c} \ \leq \ P_{CMAX\_H,c} + \ T(P_{CMAX\_H,c})$$

Where  $T(P_{CMAX})$  is defined by the tolerance table below and applies to  $P_{CMAX\_L,c}$  and  $P_{CMAX\_H,c}$  separately.

Table 6.2.5F-1: P<sub>CMAX</sub> tolerance

P <sub>CMAX</sub> (dBm)	Tolerance T(P <sub>CMAX</sub> ) (dB)
21 ≤ P <sub>CMAX</sub> ≤ 23	2.0
20 ≤ P <sub>CMAX</sub> < 21	2.5
19 ≤ P <sub>CMAX</sub> < 20	3.5
18 ≤ P <sub>CMAX</sub> < 19	4.0
13 ≤ P <sub>CMAX</sub> < 18	5.0
8 ≤ P <sub>CMAX</sub> < 13	6.0
-40 ≤ P <sub>CMAX</sub> < 8	7.0

# 6.3 Output power dynamics

### 6.3.1 (Void)

# 6.3.2 Minimum output power

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

### 6.3.2.1 Minimum requirement

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.1-1.

Channel bandwidth / Minimum output power / Measurement bandwidth 1.4 3 0 15 20 MHz MHz MHz MHz MHz MHz Minimum output -40 dBm power Measurement 9.0 MHz 1.08 MHz 2.7 MHz 4.5 MHz 13.5 MHz 18 MHz bandwidth

Table 6.3.2.1-1: Minimum output power

# 6.3.2A UE Minimum output power for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., the power in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

### 6.3.2A.1 Minimum requirement for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the minimum output power is defined per carrier and the requirement is specified in subclause 6.3.2.1. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclause 6.3.2A.1 apply for those component carriers.

For intra-band contiguous and non-contiguous carrier aggregation the minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2A.1-1.

Table 6.3.2A.1-1: Minimum output power for intra-band contiguous and non-contiguous CA UE

	CC Chan	CC Channel bandwidth / Minimum output power / Measurement bandwidth				
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power			-40 (	dBm		
Measurement bandwidth			4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

# 6.3.2B UE Minimum output power for UL-MIMO

For UE supporting UL-MIMO, the minimum controlled output power is defined as the broadband transmit power of the UE, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) at each transmit antenna connector, when the UE power is set to a minimum value.

### 6.3.2B.1 Minimum requirement

bandwidth

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2B.1-1.

Channel bandwidth / Minimum output power / Measurement bandwidth 20 1.4 3.0 5 10 15 MHz MHz MHz MHz MHz MHz Minimum output -40 dBm power Measurement 13.5 MHz 1.08 MHz 2.7 MHz 4.5 MHz 9.0 MHz 18 MHz

Table 6.3.2B.1-1: Minimum output power

For single-antenna port scheme, the requirements in subclause 6.3.2 apply.

### 6.3.2C Void

<reserved for future use>

### 6.3.2D UE Minimum output power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.3.2 apply for ProSe transmission.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.2A apply as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

# 6.3.2F UE Minimum output power for category NB1

For category NB1 UE the single-tone and multi-tone transmission minimum output power requirement for the channel bandwidth is -40 dBm. [For 3.75kHz sub-carrier spacing the minimum output power is defined as mean power in one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the minimum output power is defined as mean power in one sub-frame (1ms).]

# 6.3.3 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

### 6.3.3.1. Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3.1-1.

Table 6.3.3.1-1: Transmit OFF power

	Channel bandwidth / Transmit OFF power / Measurement bandwidth					
	1.4         3.0         5         10         15         20           MHz         MHz         MHz         MHz         MHz					
Transmit OFF power	-50 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

## 6.3.3A UE Transmit OFF power for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on all component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During measurements gaps, the UE is not considered to be OFF.

### 6.3.3A.1 Minimum requirement for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, transmit OFF power requirement is defined per carrier and the requirement is specified in subclause 6.3.3.1. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclause 6.3.3A.1 apply for those component carriers.

For intra-band contiguous and non-contiguous carrier aggregation the transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3A.1-1.

Table 6.3.3A.1-1: Transmit OFF power for intra-band contiguous and non-contiguos CA UE

	CC Channel bandwidth / Transmit OFF power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Transmit OFF power			-50 c	lBm		
Measurement bandwidth			4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

# 6.3.3B UE Transmit OFF power for UL-MIMO

For UE supporting UL-MIMO, the transmit OFF power is defined as the mean power at each transmit antenna connector when the transmitter is OFF at all transmit antenna connectors. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

### 6.3.3B.1 Minimum requirement

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3.3B.1-1.

Channel bandwidth / Transmit OFF power/ Measurement bandwidth 1.4 3.0 20 MHz MHz MHz MHz MHz MHz Transmit OFF -50 dBm power Measurement 2.7 MHz 4.5 MHz 9.0 MHz 13.5 MHz 1.08 MHz 18 MHz bandwidth

Table 6.3.3B.1-1: Transmit OFF power per antenna port

### 6.3.3D Transmit OFF power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the Prose UE shall meet the Transmit OFF power at all times when the UE is not associated with a serving cell on the ProSe carrier and does not have knowledge of its geographical area or is provisioned with pre-configured radio parameters that are not associated with any known Geographical Area.

The requirements specified in subclause 6.3.3 shall apply to UE supporting ProSe when

- the UE is associated with a serving cell on the ProSe carrier, or
- the UE is not associated with a serving cell on the ProSe carrier and is provisioned with the preconfigured radio parameters for ProSe Direct Communications and/or ProSe Direct Discovery that are associated with known Geographical Area, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and the radio parameters for ProSe Direct Discovery on the ProSe carrier are provided by the serving cell, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and has a non-serving cell selected on the ProSe carrier that supports ProSe Direct Discovery and/or ProSe Direct Communication.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on all component carriers. During measurement gaps and transmission/reception gaps for ProSe, the UE is not considered to be OFF. Transmit OFF power requirement as specified in subclause 6.3.3 apply per carrier.

# 6.3.3F Transmit OFF power for category NB1

For category NB1 UE the transmit OFF power requirement for the channel bandwidth is -50 dBm. [For 3.75kHz subcarrier spacing the transmit OFF power is defined as mean power in one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the transmit OFF power is defined as mean power in one subframe (1ms).]

#### 6.3.4 ON/OFF time mask

#### 6.3.4.1 General ON/OFF time mask

The General ON/OFF time mask defines the observation period between Transmit OFF and ON power and between Transmit ON and OFF power. ON/OFF scenarios include; the beginning or end of DTX, measurement gap, contiguous, and non contiguous transmission

The OFF power measurement period is defined in a duration of at least one sub-frame excluding any transient periods. The ON power is defined as the mean power over one sub-frame excluding any transient period.

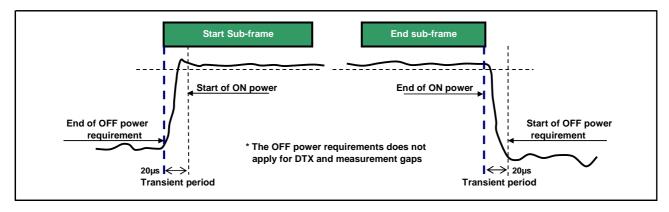


Figure 6.3.4.1-1: General ON/OFF time mask

### 6.3.4.2 PRACH and SRS time mask

### 6.3.4.2.1 PRACH time mask

The PRACH ON power is specified as the mean power over the PRACH measurement period excluding any transient periods as shown in Figure 6.3.4.2-1. The measurement period for different PRACH preamble format is specified in Table 6.3.4.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

Table 6.3.4.2-1: PRACH ON power measurement period

PRACH preamble format	Measurement period (ms)
0	0.9031
1	1.4844
2	1.8031
3	2.2844
4	0.1479

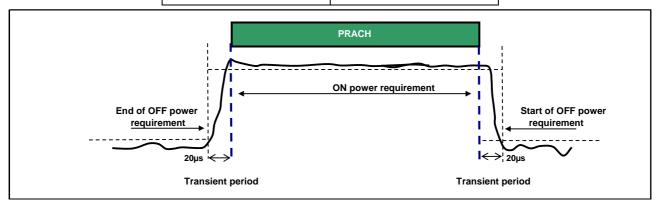


Figure 6.3.4.2-1: PRACH ON/OFF time mask

#### 6.3.4.2.2 SRS time mask

In the case a single SRS transmission, the ON power is defined as the mean power over the symbol duration excluding any transient period. Figure 6.3.4.2.2-1

In the case a dual SRS transmission, the ON power is defined as the mean power for each symbol duration excluding any transient period. Figure 6.3.4.2.2-2

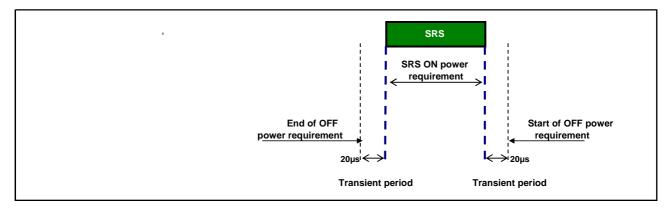


Figure 6.3.4.2.2-1: Single SRS time mask

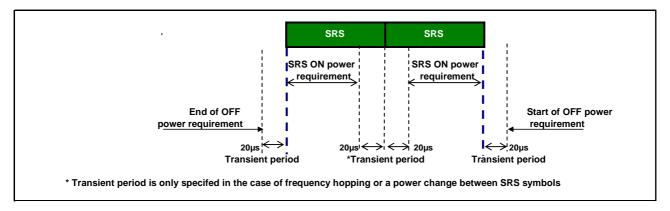


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

### 6.3.4.3 Slot / Sub frame boundary time mask

The sub frame boundary time mask defines the observation period between the previous/subsequent sub–frame and the (reference) sub-frame. A transient period at a slot boundary within a sub-frame is only allowed in the case of Intra-sub frame frequency hopping. For the cases when the subframe contains SRS the time masks in subclause 6.3.4.4 apply.

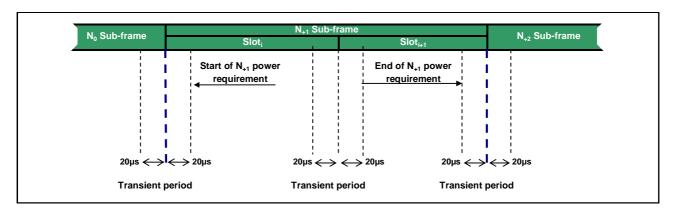


Figure 6.3.4.3-1: Transmission power template

### 6.3.4.4 PUCCH / PUSCH / SRS time mask

The PUCCH/PUSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PUSCH/PUCCH symbol and subsequent sub-frame.

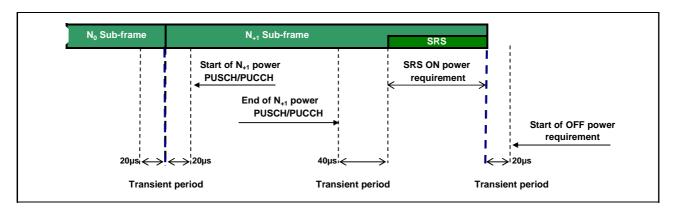


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

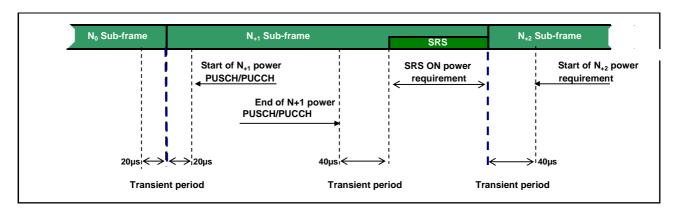


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

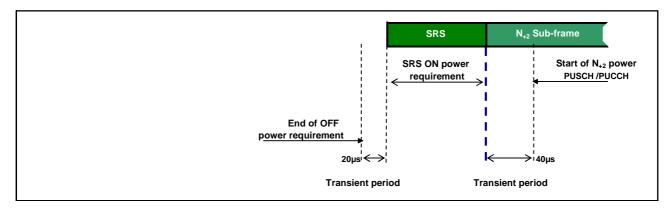


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before

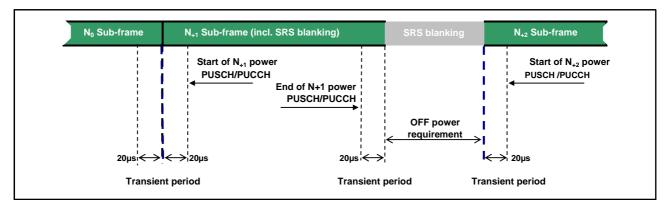


Figure 6.3.4.4-4: SRS time mask when there is FDD SRS blanking

### 6.3.4A ON/OFF time mask for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.4.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.4.1 shall only be applicable for each component carrier when all the component carriers are OFF.

### 6.3.4B ON/OFF time mask for UL-MIMO

For UE supporting UL-MIMO, the ON/OFF time mask requirements in subclause 6.3.4 apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.4.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.3.4 apply.

### 6.3.4D ON/OFF time mask for ProSe

For ProSe Direct Discovery and ProSe Direct Communications, additional requirements on ON/OFF time masks for ProSe physical channels and signals are specified in this clause.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.4D apply for ProSe transmission and the requirements in subclause 6.3.4 apply for uplink transmission.

#### 6.3.4D.1 General time mask for ProSe

The General ON/OFF time mask defines the observation period between the Transmit OFF and ON power and between Transmit ON and OFF power for PSDCH, PSCCH, and PSSCH transmissions in a subframe wherein the last symbol is punctured to create a guard period.

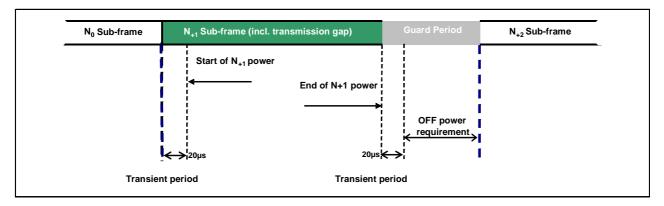


Figure 6.3.4D.1-1: PSDCH/PSCCH/PSSCH time mask

#### 6.3.4D.2 PSSS/SSS time mask

The PSSS time mask / SSSS time mask defines the observation period between the Transmit OFF and ON power and between Transmit ON and OFF power for PSSS/SSSS transmissions in a subframe when not multiplexed with PSBCH in that subframe.

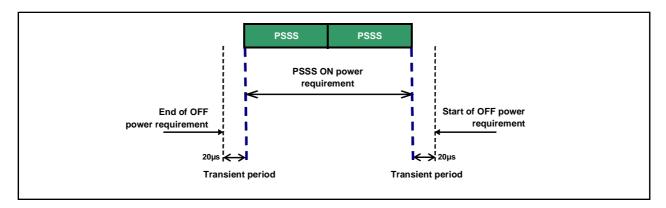


Figure 6.3.4D.2-1: PSSS time mask for normal CP transmission (when not time-multiplexed with PSBCH)

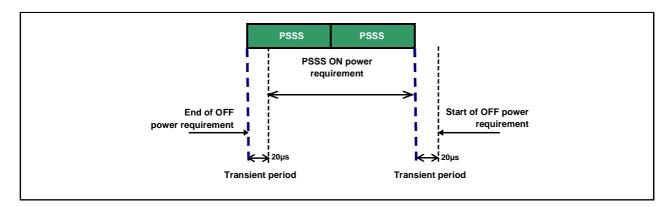


Figure 6.3.4D.2-2: PSSS time mask for extended CP transmission (when not time-multiplexed with PSBCH)

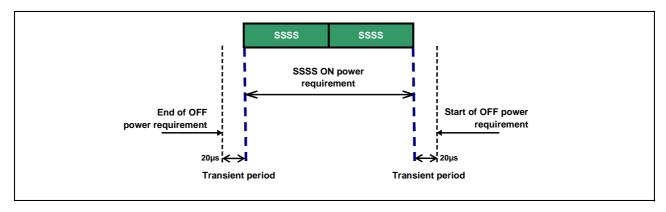


Figure 6.3.4D.2-3: SSSS time mask (when not time-multiplexed with PSBCH)

### 6.3.4D.3 PSSS / PSBCH time mask

The PSSS/SSSS/PSBCH time mask defines the observation period between SSSS and adjacent PSSS/PSBCH symbols in a subframe, with last symbol punctured to create a guard period.

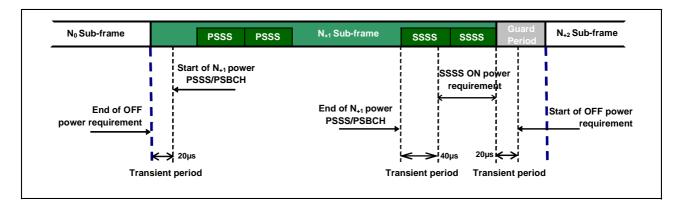


Figure 6.3.4D.3-1: PSSS/SSSS/PBCH time mask for normal CP transmission

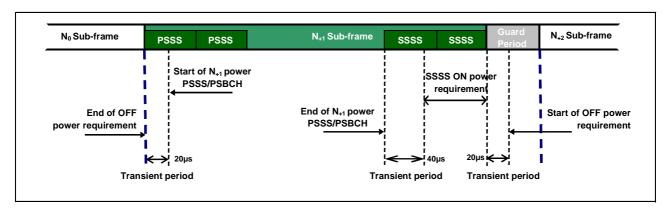


Figure 6.3.4D.3-2: PSSS/SSSS/PBCH time mask for extended CP transmission

#### 6.3.4D.4 PSSCH / SRS time mask

The PSSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PSSCH symbol and subsequent sub-frame.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3.

The PSSCH/SRS time mask shall follow the PUSCH/PUCCH/SRS time mask as specified in subclause 6.3.4.4.

### 6.3.4F ON/OFF time mask for category NB1

#### 6.3.4F.1 General ON/OFF time mask

E-UTRA general ON/OFF time mask in subclause 6.3.4.1 applies for category NB1 UE.

#### 6.3.4F.2 NPRACH time mask

The NPRACH ON power is specified as the mean power over the NPRACH measurement period excluding any transient periods as shown in Figure 6.3.4F.2-1. The measurement period for different NPRACH preamble format is specified in Table 6.3.4F.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2F and subclause 6.6.2.3F.

Table 6.3.4F.2-1: NPRACH ON power measurement period

NPRACH preamble format	Measurement period (ms)
0	5.6
1	6.4

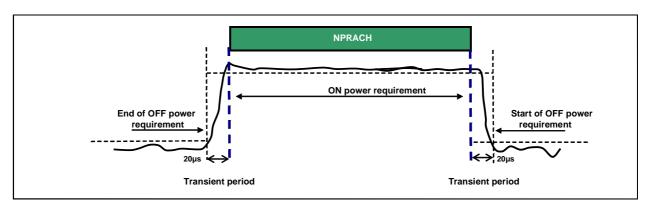


Figure 6.3.4F.2-1: NPRACH ON/OFF time mask

### 6.3.5 Power Control

### 6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133)

In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

### 6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under NOTE 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within  $F_{UL\_low}$  and  $F_{UL\_low}$  + 4 MHz or  $F_{UL\_high}$  – 4 MHz and  $F_{UL\_high}$ .

Table 6.3.5.1.1-1: Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

#### 6.3.5.2 Relative Power tolerance

The relative power tolerance is the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is  $\leq 20$  ms.

For PRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4.2-1.

#### 6.3.5.2.1 Minimum requirements

The requirements specified in Table 6.3.5.2.1-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2 and the measured PUMAX as defined in subclause 6.2.5 (i.e, the actual power as would be measured assuming no measurement error). This power shall be within the power limits specified in subclause 6.2.5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.2 and 6.2.2. For these exceptions the power tolerance limit is a maximum of  $\pm 6.0$  dB in Table 6.3.5.2.1-1

Table 6.3.5.2.1-1 Relative power tolerance for transmission (normal conditions)

Power step ΔP (Up or down) [dB]	All combinations of PUSCH and PUCCH transitions [dB]	All combinations of PUSCH/PUCCH and SRS transitions between sub- frames [dB]	PRACH [dB]
ΔP < 2	±2.5 (NOTE 3)	±3.0	±2.5
2 ≤ ΔP < 3	±3.0	±4.0	±3.0
3 ≤ ΔP < 4	±3.5	±5.0	±3.5
4 ≤ ΔP ≤ 10	±4.0	±6.0	±4.0
10 ≤ ΔP < 15	±5.0	±8.0	±5.0
15 ≤ ΔP	±6.0	±9.0	±6.0

NOTE 1: For extreme conditions an additional  $\pm$  2.0 dB relaxation is allowed NOTE 2: For operating bands under NOTE 2 in Table 6.2.2-1, the relative power tolerance is relaxed by increasing the upper limit by 1.5 dB if the transmission bandwidth of the reference sub-frames is confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high and the target sub-frame is not confined within any one of these frequency ranges; if the transmission bandwidth of the target sub-frame is confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high and the reference sub-frame is not confined within any one of these frequency ranges, then the tolerance is relaxed by reducing the lower limit by 1.5 dB.

NOTE 3: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods for TDD: for a power step  $\Delta P \le 1$  dB, the relative power tolerance for transmission is  $\pm 1.0$  dB.

The power step  $(\Delta P)$  is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames with the power setting according to subclause 5.1 of [TS 36.213]. The error is the difference between  $\Delta P$  and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5.2.1-1.

For sub-frames not containing an SRS symbol, the power change is defined as the relative power difference between the mean power of the original reference sub-frame and the mean power of the target subframe not including transient durations. The mean power of successive sub-frames shall be calculated according to Figure 6.3.4.3-1 and Figure 6.3.4.1-1 if there is a transmission gap between the reference and target sub-frames.

If at least one of the sub-frames contains an SRS symbol, the power change is defined as the relative power difference between the mean power of the last transmission within the reference sub-frame and the mean power of the first transmission within the target sub-frame not including transient durations. A transmission is defined as PUSCH, PUCCH or an SRS symbol. The mean power of the reference and target sub-frames shall be calculated according to Figures 6.3.4.1-1, 6.3.4.2-1, 6.3.4.4-1, 6.3.4.4-2 and 6.3.4.4-3 for these cases.

#### 6.3.5.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant.

### 6.3.5.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2.

Table 6.3.5.3.1-1: Aggregate power control tolerance

TPC command	UL channel	Aggregate power tolerance within 21 ms	
0 dB	PUCCH	±2.5 dB	
0 dB PUSCH		±3.5 dB	
NOTE: The UE transmission gap is 4 ms. TPC command is transmitted via PDCCH 4 subframes preceding each PUCCH/PUSCH transmission.			

### 6.3.5A Power control for CA

The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per component carrier with power setting in accordance with Clause 5.1 of [6].

### 6.3.5A.1 Absolute power tolerance

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

### 6.3.5A.1.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the absolute power control tolerance is specified on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by maximum output power as defined in subclause 6.2.2A. The requirements defined in Table 6.3.5.1.1-1 shall apply on each component carrier with all component carriers active. The requirements can be tested by time aligning any transmission gaps on all the component carriers.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation the absolute power control tolerance per component carrier is given in Table 6.3.5.1.1-1.

### 6.3.5A.2 Relative power tolerance

#### 6.3.5A.2.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the relative power tolerance is specified when the power of the target and reference sub-frames on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by  $P_{UMAX}$  as defined in subclause 6.2.5A. The requirements shall apply on each component carrier with all component carriers active. The UE transmitter shall have the capability of changing the output power independently on all component carriers in the uplink and:

- a) the requirements for all combinations of PUSCH and PUCCH transitions per component carrier is given in Table 6.3.5.2.1-1.
- b) for SRS the requirements for combinations of PUSCH/PUCCH and SRS transitions between subframes given in Table 6.3.5.2.1-1 apply per component carrier when the target and reference subframes are configured for either simultaneous SRS or simultaneous PUSCH.
- c) for RACH the requirements apply for the primary cell and are given in Table 6.3.5.2.1-1.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation, the requirements apply when the power of the target and reference sub-frames on each component carrier exceed -20 dBm and the total power is limited by  $P_{UMAX}$  as defined in subclause 6.2.5A. For the purpose of these requirements, the power in each component carrier is specified over only the transmitted resource blocks.

The UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.5.2.1-1;

- b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.5.2.1-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subrames;
- c) for RACH on the primary component carrier, the requirements given in Table 6.3.5.2.1-1 for PRACH.

For a) and b) above, the power step  $\Delta P$  between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

For a), b) and c) above, two exceptions are allowed for each component carrier for a power per carrier ranging from -20 dBm to  $P_{UMAX,c}$  as defined in subclause 6.2.5. For these exceptions the power tolerance limit is  $\pm 6.0$  dB in Table 6.3.5.2.1-1.

### 6.3.5A.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in [6] are constant on all active component carriers.

#### 6.3.5A.3.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the aggregate power tolerance is specified on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by maximum output power as defined in subclause 6.2.2A. The requirements defined in Table 6.3.5.3.1-1 shall apply on each component carrier with all component carriers active. The requirements can be tested by time aligning any transmission gaps on both the component carriers.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation, the aggregate power tolerance per component carrier is given in Table 6.3.5.3.1-1 with either simultaneous PUSCH or simultaneous PUCCH-PUSCH (if supported by the UE) configured. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

#### 6.3.5B Power control for UL-MIMO

For UE supporting UL-MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.5 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2, wherein

- The Maximum output power requirements for UL-MIMO are specified in subclause 6.2.2B
- The Minimum output power requirements for UL-MIMO are specified in subclause 6.3.2B
- The requirements for configured transmitted power for UL-MIMO are specified in subclause 6.2.5B.

For single-antenna port scheme, the requirements in subclause 6.3.5 apply.

### 6.3.5D Power Control for ProSe

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.5D apply for ProSe transmission and the requirements in subclause 6.3.5 apply for uplink transmission.

#### 6.3.5D.1 Absolute power tolerance

For ProSe transmissions, the absolute power tolerance requirements specified in subclause 6.3.5.1 shall apply for each ProSe transmission.

### 6.3.5F Power Control for category NB1

Power control requirements in this clause apply for category NB1 UE.

#### 6.3.5F.1 Absolute power tolerance

The absolute power tolerance requirements specified in subclause 6.3.5.1 apply for category NB1 UE.

### 6.3.5F.2 Relative power tolerance

Category NB1 UE relative power control requirement is defined for NPRACH power step values of 0, 2, 4 and 6 dB. For NPRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4F.2-1.

The requirements specified in Table 6.3.4F.2-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2F and and the maximum output power as defined in subclause 6.2.2F.

Table 6.3.5F.2-1: Relative power tolerance for category NB1 NPRACH transmission (normal conditions)

Power step ΔP [dB]	NPRACH [dB]			
$\Delta P = 0$	±1.5			
ΔP = 2	±2.0			
$\Delta P = 4$	±3.5			
$\Delta P = 6$	$\Delta P = 6$ ±4.0			
NOTE: For extreme conditions an additional ± 2.0 dB relaxation is allowed.				

The power step ( $\Delta P$ ) is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames. The error is the difference between  $\Delta P$  and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5F.2-1.

### 6.4 Void

# 6.5 Transmit signal quality

# 6.5.1 Frequency error

The UE modulated carrier frequency shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B

# 6.5.1A Frequency error for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the frequency error requirements defined in subclause 6.5.1 shall apply on each component carrier with all component carriers active.

For intra-band contiguous carrier aggregation the UE modulated carrier frequencies per band shall be accurate to within  $\pm 0.1$  PPM observed over a period of one timeslot compared to the carrier frequency of primary component carrier received from the E-UTRA in the corresponding band.

For intra-band non-contiguous carrier aggregation the requirements in Section 6.5.1 applies per component carrier.

### 6.5.1B Frequency error for UL-MIMO

For UE(s) supporting UL-MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

# 6.5.1D Frequency error for ProSe

The UE modulated carrier frequency for ProSe sidelink transmissions shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the synchronization source. The synchronization source can be E-UTRA Node B or a ProSe UE transmitting sidelink synchronization signals.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.5.1D apply for ProSe transmission and the requirements in subclause 6.5.1 apply for uplink transmission.

# 6.5.1F Frequency error for UE category NB1

For UE category NB1, the UE modulated carrier frequency shall be accurate to within the following limits

Table 6.5.1F-1: Frequency error requirement for UE category NB1

Carrier frequency [GHz]	Frequency error [ppm]
≤1	±0.2
>1	±0.1

[Observed over a period of one time slot (0.5 ms for 15 kHz sub-carrier spacing and 2 ms excluding the 2304Ts gap for 3.75 kHz sub-carrier spacing) and averaged over  $72/N_{tones}$  slots (where  $N_{tones} = \{1, 3, 6, 12\}$  is the number of sub-carriers used for the transmission), compared to the carrier frequency received from the E-UTRA Node B.]

# 6.5.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.5.2 are defined using the measurement methodology specified in Annex F.

### 6.5.2.1 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and is one slot for the PUCCH and PUSCH in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the EVM measurement interval is reduced by one symbol, accordingly. The PUSCH or PUCCH

EVM measurement interval is also reduced when the mean power, modulation or allocation between slots is expected to change. In the case of PUSCH transmission, the measurement interval is reduced by a time interval equal to the sum of 5 µs and the applicable exclusion period defined in subclause 6.3.4, adjacent to the boundary where the power change is expected to occur. The PUSCH exclusion period is applied to the signal obtained after the front-end IDFT. In the case of PUCCH transmission with power change, the PUCCH EVM measurement interval is reduced by one symbol adjacent to the boundary where the power change is expected to occur.

# 6.5.2.1.1 Minimum requirement

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, [all PRACH preamble formats 0-4 and] all PUCCH formats 1, 1a, 1b, 2, 2a and 2b are considered to have the same EVM requirement as QPSK modulated.

Table 6.5.2.1.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5
64QAM	%	8	8

Table 6.5.2.1.1-2: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ -40
Operating conditions		Normal conditions

# 6.5.2.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

## 6.5.2.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

Table 6.5.2.2.1-1: Minimum requirements for relative carrier leakage power

Parameters	Relative limit (dBc)	Applicable frequencies
Output power >10 dBm	-28	Carrier center frequency < 1 GHz
	-25	Carrier center frequency ≥ 1 GHz
0 dBm ≤ Output power ≤10 dBm	-25	
-30 dBm ≤ Output power ≤0 dBm	-20	
-40 dBm ≤ Output power < -30 dBm	-10	

## 6.5.2.3 In-band emissions

The in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non-allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

## 6.5.2.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2.3.1-1.

Table 6.5.2.3.1-1: Minimum requirements for in-band emissions

Parameter description	Unit	Limit (NOTE 1)		Applicable Frequencies	
General	dB	$\max \left\{ -25 - 10 \cdot \log_{10} \left( N_{RB} / L_{CRB} \right), \\ 20 \cdot \log_{10} EVM - 3 - 5 \cdot \left( \left  \Delta_{RB} \right  - 1 \right) / L_{CRB}, \\ -57 \ dBm \ / 180 \ kHz - P_{RB} \right\}$		Any non-allocated (NOTE 2)	
		-28	Image frequencies when carrier center frequency < 1 GHz and Output power > 10 dBm	Image	
IQ Image dB	-25	Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm	frequencies (NOTES 2, 3)		
		-25	Image frequencies when carrier center frequency ≥ 1 GHz	(NOTES 2, 3)	
		-28	Output power > 10 dBm and carrier center frequency < 1 GHz		
Carrier leakage		-25	Output power > 10 dBm and carrier center frequency ≥ 1 GHz	Carrier frequency	
		-25	0 dBm ≤ Output power ≤10 dBm	(NOTES 4, 5)	
		-20	-30 dBm ≤ Output power ≤ 0 dBm		
	-10		-40 dBm ≤ Output power < -30 dBm		

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of  $P_{RB}$  30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply.  $P_{RB}$  is defined in NOTE 10.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated RBs.
- NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured total power in all allocated RBs.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency if  $N_{RB}$  is odd, or in the two RBs immediately adjacent to the DC frequency if  $N_{RB}$  is even, but excluding any allocated RB. For UE of UL Category M1, the applicable frequencies shall also be the centre frequency of the supported 6RBs additionally.
- NOTE 6:  $L_{CRB}$  is the Transmission Bandwidth (see Figure 5.6-1).
- NOTE 7:  $N_{\it RB}$  is the Transmission Bandwidth Configuration (see Figure 5.6-1).
- NOTE 8: *EVM* is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 9:  $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.
  - $\Delta_{RB} = 1$  or  $\Delta_{RB} = -1$  for the first adjacent RB outside of the allocated bandwidth.
- NOTE 10:  $P_{\rm RB}$  is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

# 6.5.2.4 EVM equalizer spectrum flatness

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex F) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block. The basic measurement interval is the same as for EVM.

## 6.5.2.4.1 Minimum requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.5.2.4.1-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference

between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.5.2.4.1-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.5.2.4.1-1).

Table 6.5.2.4.1-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

Frequency range	Maximum ripple [dB]
F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> ≥ 3 MHz and F <sub>UL_High</sub> – F <sub>UL_Meas</sub> ≥ 3 MHz	4 (p-p)
(Range 1)	
F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> < 3 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 3 MHz	8 (p-p)
(Range 2)	
NOTE 1: F <sub>UL_Meas</sub> refers to the sub-carrier frequency for which evaluated	the equalizer coefficient is
NOTE 2: F <sub>UL_Low</sub> and F <sub>UL_High</sub> refer to each E-UTRA frequency 5.5-1	band specified in Table

Table 6.5.2.4.1-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple [dB]
F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> ≥ 5 MHz and F <sub>UL_High</sub> – F <sub>UL_Meas</sub> ≥ 5 MHz	4 (p-p)
(Range 1)	
F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> < 5 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 5 MHz	12 (p-p)
(Range 2)	
NOTE 1: F <sub>UL_Meas</sub> refers to the sub-carrier frequency for which	n the equalizer coefficient is
evaluated	
NOTE 2: F <sub>UL_Low</sub> and F <sub>UL_High</sub> refer to each E-UTRA frequenc	y band specified in Table
5.5-1	

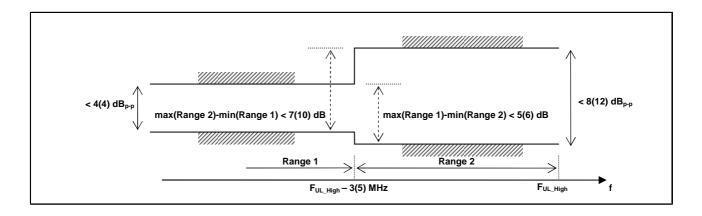


Figure 6.5.2.4.1-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement within brackets).

# 6.5.2A Transmit modulation quality for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the requirements shall apply on each component carrier as defined in clause 6.5.2 with all component carriers active. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclauses 6.5.2A.1, 6.5.2A.2, and 6.5.2A.3 apply for those component carriers.

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

# 6.5.2A.1 Error Vector Magnitude

For the intra-band contiguous and non-contiguous carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers. Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.5.2.1.

When a single component carrier is configured Table 6.5.2.1.1-1 apply.

The EVM requirements are according to Table 6.5.2A.1-1 if CA is configured in uplink.

Table 6.5.2A.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level per CC	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5
64QAM	%	8	8

## 6.5.2A.2 Carrier leakage for CA

Carrier leakage is an additive sinusoid waveform that is confined within the aggrecated transmission bandwidth configuration. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

# 6.5.2A.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2A.2.1-1.

Table 6.5.2A.2.1-1: Minimum requirements for Relative Carrier Leakage Power

Parameters	Relative Limit (dBc)
Output power >0 dBm	-25
-30 dBm ≤ Output power ≤0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

## 6.5.2A.3 In-band emissions

## 6.5.2A.3.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation bandwidth class B and C, the requirements in Table 6.5.2A.3.1-1 and 6.5.2A.3.1-2 apply within the aggregated transmission bandwidth configuration with both component carrier (s) active and one single contiguous PRB allocation of bandwidth  $L_{\it CRB}$  at the edge of the aggregated transmission bandwidth configuration.

The inband emission is defined as the interference falling into the non allocated resource blocks for all component carriers. The measurement method for the inband emissions in the component carrier with PRB allocation is specified in annex F. For a non allocated component carrier a spectral measurement is specified.

For intra-band non-contiguous carrier aggregation the requirements for in-band emissions should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers according to Table 6.5.2.3.1.

Table 6.5.2A.3.1-1: Minimum requirements for in-band emissions (allocated component carrier)

Parameter	Unit		Limit	Applicable Frequencies
General	dB	20 · log 10	$25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$ $/180  kHz - P_{RB}$	Any non-allocated (NOTE 2)
IQ Image	dB		-25	Exception for IQ image (NOTE 3)
Ca		-25	Output power > 0 dBm	
Carrier	dBc I		-30 dBm ≤ Output power ≤ 0 dBm	Exception for Carrier frequency
leakage		-10	-40 dBm ≤ Output power < -30 dBm	(NOTE 4)

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of  $P_{RB}$  30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply.  $P_{RB}$  is defined in NOTE 9. The limit is evaluated in each non-allocated RB.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs
- NOTE 3: Exceptions to the general limit are allowed for up to  $L_{\it CRBs}$  +1 RBs within a contiguous width of  $L_{\it CRBs}$  +1 non-allocated RBs. The measurement bandwidth is 1 RB.
- NOTE 4: Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs. The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in the non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5:  $L_{\it CRB}$  is the Transmission Bandwidth (see Figure 5.6-1) not exceeding  $\lfloor N_{\it RB}/2-1 \rfloor$
- NOTE 6:  $N_{\it RB}$  is the Transmission Bandwidth Configuration (see Figure 5.6-1) of the component carrier with RBs allocated.
- NOTE 7: EVM is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 8:  $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.  $\Delta_{RB}=1$  or  $\Delta_{RB}=-1$  for the first adjacent RB outside of the allocated bandwidth).
- NOTE 9:  $P_{RR}$  is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

Table 6.5.2A.3.1-2: Minimum requirements for in-band emissions (not allocated component carrier)

Para- meter	Unit	Meas BW NOTE 1		Limit	remark	Applicable Frequencies
General	dB	BW of 1 RB (180KHz rectangular)	20 · log 10	$25 - 10 \cdot \log_{10}(N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$ $e / 180  kHz - P_{RB}$	The reference value is the average power per allocated RB in the allocated component carrier	Any RB in the non allocated component carrier. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
IQ Image	dB	BW of 1 RB (180KHz rectangular)	-25 NOTE 2		The reference value is the average power per allocated RB in the allocated component carrier	The frequencies of the $L_{\it CRB}$ contiguous non-allocated RBs are unknown. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
		BW of 1 RB (180KHz		NOTE 3	The reference	The frequencies of
		rectangular)	-25	Output power > 0 dBm	value is the total power of the	the up to 2 non-allocated RBs are
Carrier leakage	dBc		-20	-30 dBm ≤ Output power ≤ 0 dBm	allocated RBs in the allocated component carrier	unknown. The frequency raster of the RBs is derived when this
			-10	-40 dBm ≤ Output power < -30 dBm		component carrier is allocated with RBs

NOTE1: Resolution BWs smaller than the measurement BW may be integrated to achieve the measurement bandwidth.

NOTE 2: Exceptions to the general limit is are allowed for up to  $L_{\it CRB}$  +1 RBs within a contiguous width of  $L_{\it CRB}$  +1 non-allocated RBs.

NOTE 3: Two Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs

NOTE 4: NOTES 1, 5, 6, 7, 8, 9 from Table 6.5.2A.3.1-1 apply for Table 6.5.2A.3.1-2 as well.

NOTE 5:  $\Delta_{RB}$  for measured non-allocated RB in the non allocated component carrier may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.

# 6.5.2B Transmit modulation quality for UL-MIMO

For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna connector.

For single-antenna port scheme, the requirements in subclause 6.5.2 apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

## 6.5.2B.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.5.2.1.1-1 which is defined in subclause 6.5.2.1 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

# 6.5.2B.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.5.2.2.1-1 which is defined in subclause 6.5.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

## 6.5.2B.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.5.2.3.1-1 which is defined in subclause 6.5.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2.2B-2.

## 6.5.2B.4 EVM equalizer spectrum flatness for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.5.2.4.1-1 and Table 6.5.2.4.1-2 which are defined in subclause 6.5.2.4 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

# 6.5.2D Transmit modulation quality for ProSe

The requirements in this clause apply to ProSe sidelink transmissions.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.5.2D apply for ProSe transmission and the requirements in subclause 6.5.2 apply for uplink transmission.

## 6.5.2D.1 Error Vector Magnitude

For ProSe sidelink physical channels PSDCH, PSCCH, PSSCH, and PSBCH, the Error Vector Magnitude requirements shall be as specified for PUSCH in subclause 6.5.2.1 for the corresponding modulation and transmission bandwidth. When ProSe transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.

For PSBCH the duration over which EVM is averaged shall be 24 subframes.

This requirement is not applicable for ProSe physical signals PSSS and SSSS.

## 6.5.2D.2 Carrier leakage

The requirements of subcaluse 6.5.2.2 shall apply for ProSe transmissions.

## 6.5.2D.3 In-band emissions

For ProSe sidelink physical channels PSDCH, PSCCH, PSSCH, and PSBCH, the In-band emissions requirements shall be as specified for PUSCH in subclause 6.5.2.3 for the corresponding modulation and transmission bandwidth. When ProSe transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the In-band emissions measurement interval is reduced by one symbol, accordingly.

# 6.5.2D.4 EVM equalizer spectrum flatness for ProSe

The requirements of subcaluse 6.5.2.4 shall apply for ProSe transmissions.

# 6.5.2E Transmit modulation quality for category M1

For UE of UL Category M1, the requirements shall apply as defined in clause 6.5.2.

# 6.5.2E.1 Error Vector Magnitude

The Error Vector Magnitude is defined in section 6.5.2.1.

# 6.5.2E.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. For UE of UL Category M1, the sinusoid waveform may also lie at the center of the 6 RB narrowband assigned for transmission. The measurement interval is one slot in the time domain.

# 6.5.2E.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

#### 6.5.2E.3 In-band emissions

The in-band emission is defined in clause 6.5.2.3.

# 6.5.2E.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2E.3.1-1

Table 6.5.2E.3.1-1: Minimum requirements for in-band emissions

Parameter description	Unit		Limit (NOTE 1)	Applicable Frequencies
General	dB	$\max \left\{ -25 - 10 \cdot \log_{10} \left( N_{RB} / L_{CRB} \right), \\ 20 \cdot \log_{10} EVM - 3 - 5 \cdot \left( \left  \Delta_{RB} \right  - 1 \right) / L_{CRB}, \\ -57 \ dBm \ / 180 \ kHz - P_{RB} \right\}$		Any non-allocated (NOTE 2)
		-28	Image frequencies when carrier center frequency < 1 GHz and Output power > 10 dBm	lmaga
IQ Image dB	-25	Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm	Image frequencies (NOTES 2, 3)	
		-25	Image frequencies when carrier center frequency ≥ 1 GHz	(1101232, 3)
		-28	Output power > 10 dBm and carrier center frequency < 1 GHz	
Carrier leakage dBc		-25	Output power > 10 dBm and carrier center frequency ≥ 1 GHz	Carrier frequency
		-25	0 dBm ≤ Output power ≤10 dBm	(NOTES 4, 5)
		-20	-30 dBm ≤ Output power ≤ 0 dBm	
		-10	-40 dBm ≤ Output power < -30 dBm	

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of  $P_{RB}$  30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply.  $P_{RB}$  is defined in NOTE 10.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated RBs. For UE of UL Category M1, applicable frequencies shall additionally include those found by reflection on the center of the assigned 6 RB narrowband, but excluding any allocated RBs.
- NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency if  $N_{RB}$  is odd, or in the two RBs immediately adjacent to the DC frequency if  $N_{RB}$  is even, but excluding any allocated RB. For UE of UL Category M1, the applicable frequencies shall also be the centre frequency of the supported 6RBs additionally.
- NOTE 6:  $L_{CRB}$  is the Transmission Bandwidth (see Figure 5.6-1).
- NOTE 7:  $N_{\it RB}$  is the Transmission Bandwidth Configuration (see Figure 5.6-1).
- NOTE 8: *EVM* is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 9:  $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.
  - $\Delta_{\it RB}=1$  or  $\Delta_{\it RB}=-1$  for the first adjacent RB outside of the allocated bandwidth.
- NOTE 10:  $P_{\rm RB}$  is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

# 6.5.2F Transmit modulation quality for Category NB1

## 6.5.2F.1 Error Vector Magnitude

The RMS average of the basic EVM measurements for  $240/N_{tones}$  slots excluding any transient period for the average EVM case, where  $N_{tones} = \{1, 3, 6, 12\}$  is the number of subcarriers for the NB-IoT transmission, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, both NPRACH formats are considered to have the same EVM requirement as QPSK modulated.

# 6.5.2F.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. The measurement interval is one slot in the time domain. The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power of category NB1 UE shall not exceed the values specified in Table 6.5.2F.2-1.

Table 6.5.2F.2-1: Minimum requirements for relative carrier leakage power

Parameters	Relative limit (dBc)
0 dBm ≤ Output power	-25
-30 dBm ≤ Output power ≤ 0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

## 6.5.2F.3 In-band emissions

The in-band emission is defined as a function of the tone offset from the edge of the allocated UL transmission tone(s) within the transmission bandwidth configuration. The in-band emission is measured as the ratio of the UE output power in a non–allocated tone to the UE output power in an allocated tone. The basic in-band emissions measurement interval is defined over one slot in the time domain.

The category NB1 UE relative in-band emission shall not exceed the values specified in Table 6.5.2F.3-1.

Parameter description	Unit		Applicable Frequencies	
General	dB	-18 -	$-15 - 10 \cdot \log_{10}(N_{tone} / L_{Ctone}),$ $-5 \cdot ( \Delta_{tone}  - 1) / L_{Ctone},$ $lBm / (3.75 kHz or 15 kHz) - P_{tone} $	Any non-allocated (NOTE 2)
IQ Image	dB		-25	Image frequencies (NOTES 2, 3)
Carrier leakage	dBc	-25 0 dBm ≤ Output power -20 -30 dBm ≤ Output power ≤ 0 dBm -10 -40 dBm ≤ Output power < -30 dBm		Carrier frequency (NOTES 4, 5)

Table 6.5.2F.3-1: Minimum requirements for in-band emissions

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated tone. For each such tone, the minimum requirement is calculated as the higher of  $P_{tone}$  30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply.  $P_{tone}$  is defined in NOTE 10.
- NOTE 2: The measurement bandwidth is 1 tone and the limit is expressed as a ratio of measured power in one nonallocated tone to the measured average power per allocated tone, where the averaging is done across all allocated tones.
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated tones.
- NOTE 4: The measurement bandwidth is 1 tone and the limit is expressed as a ratio of measured power in one nonallocated tone to the measured total power in all allocated tones.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the tones containing the DC frequency if  $N_{tone}$  is odd, or in the two tones immediately adjacent to the DC frequency if  $N_{tone}$  is even, but excluding any allocated tone.
- NOTE 6:  $L_{Ctone}$  is the Transmission Bandwidth (tones).
- NOTE 7:  $N_{tone}$  is the Transmission Bandwidth Configuration (tones).
- NOTE 8:  $\Delta_{tone}$  is the starting frequency offset between the allocated tone and the measured non-allocated tone. (e.g.  $\Delta_{tone}=1$  or  $\Delta_{tone}=-1$  for the first adjacent tone outside of the allocated bandwidth.
- NOTE 9:  $P_{tone}$  is the transmitted power per 3.75 kHz or 15 kHz in allocated tones, measured in dBm.

# 6.6 Output RF spectrum emissions

The output UE transmitter spectrum consists of the three components; the emission within the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

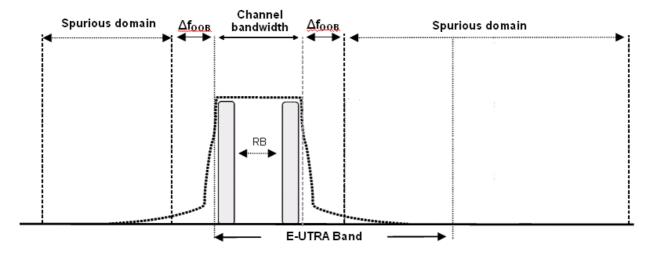


Figure 6.6-1: Transmitter RF spectrum

# 6.6.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.6.1-1

Table 6.6.1-1: Occupied channel bandwidth

# 6.6.1A Occupied bandwidth for CA

(MHz)

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands the occupied bandwidth is defined per component carrier. Occupied bandwidth is the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on assigned channel bandwidth on the component carrier. The occupied bandwidth shall be less than the channel bandwidth specified in Table 6.6.1-1.

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.6A.

For intra-band non-contiguous carrier aggregation sub-block occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the sub-block. In case the sub-block consist of one component carrier the occupied bandwidth of the sub-block shall be less than the channel bandwidth specified in Table 6.6.1-1.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the occupied bandwidth is the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on each E-UTRA band. The OBW shall be less than the channel bandwidth as specified in Table 6.6.1-1 for the E-UTRA band supporting one component carrier. The OBW shall be less than the aggregated channel bandwidth as specified in subclause 5.6A for the E-UTRA band supporting two contiguous component carriers.

# 6.6.1B Occupied bandwidth for UL-MIMO

For UE supporting UL-MIMO, the requirements for occupied bandwidth is specified at each transmit antenna connector. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in Table 6.6.1B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

Occupied channel bandwidth / Channel bandwidth 1.4 3.0 5 10 15 20 MHz MHz MHz MHz MHz MHz  $1.\overline{4}$ Channel bandwidth 15 10 20 (MHz)

Table 6.6.1B-1: Occupied channel bandwidth

For single-antenna port scheme, the requirements in subclause 6.6.1 apply.

# 6.6.1F Occupied bandwidth for category NB1

The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at the transmit antenna connector. Occupied bandwidth shall be less than the channel bandwidth of category NB1 specified in Section 5.6F.

# 6.6.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio.

## 6.6.2.1 Spectrum emission mask

The spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the  $\pm$  edge of the assigned E-UTRA channel bandwidth. For frequencies greater than ( $\Delta f_{OOB}$ ) as specified in Table 6.6.2.1.1-1 the spurious requirements in subclause 6.6.3 are applicable.

## 6.6.2.1.1 Minimum requirement

The power of any UE emission shall not exceed the levels specified in Table 6.6.2.1.1-1 for the specified channel bandwidth.

Spectrum emission limit (dBm)/ Channel bandwidth								
Δf <sub>OOB</sub> (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth	
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz	
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz	
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz	
± 2.8-5		-10	-10	-10	-10	-10	1 MHz	
± 5-6		-25	-13	-13	-13	-13	1 MHz	
± 6-10			-25	-13	-13	-13	1 MHz	
± 10-15				-25	-13	-13	1 MHz	
± 15-20					-25	-13	1 MHz	
+ 20-25						-25	1 MHz	

Table 6.6.2.1.1-1: General E-UTRA spectrum emission mask

#### NOTE:

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

## 6.6.2.1A Spectrum emission mask for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spectrum emission mask of the UE is defined per component carrier while both component carriers are active and the requirements are specified in subclauses 6.6.2.1 and 6.6.2.2. If for some frequency spectrum emission masks of component carriers overlap then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency a component carrier spectrum emission mask overlaps with the channel bandwidth of another component carrier, then the emission mask does not apply for that frequency.

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the  $\pm$  edge of the aggregated channel bandwidth (Table 5.6A-1) For intra-band contiguous carrier aggregation the bandwidth class B and C, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.1A-0 and Table 6.6.2.1A-1 for the specified channel bandwidth.

Table 6.6.2.1A-0: General E-UTRA CA spectrum emission mask for Bandwidth Class B

Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>							
<u>Δf<sub>OOB</sub></u> (MHz)	25RB+50RB (14.95 MHz)	50RB+50RB (19.9 MHz)	Measurement bandwidth				
± 0-1	-20	-21	30 kHz				
± 1-5	-10	-10	1 MHz				
± 5-14.95	-13	-13	1 MHz				
± 14.95-19.90	-25	-13	1 MHz				
± 19.90-19.95	-25	-25	1 MHz				
± 19.95-24.90		-25	1 MHz				

Table 6.6.2.1A-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C

	Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>						
Δf <sub>OOB</sub> (MHz)	25RB+100RB (24.95MHz)	50RB+100RB (29.9 MHz)	75RB+75RB (30 MHz)	75RB+100RB (34.85 MHz)	100RB+100RB (39.8 MHz)	Measurement bandwidth	
± 0-1	-22	-22.5	-22.5	-23.5	-24	30 kHz	
± 1-5	-10	-10	-10	-10	-10	1 MHz	
± 5-24.95	-13	-13	-13	-13	-13	1 MHz	
± 24.95-29.9	-25	-13	-13	-13	-13	1 MHz	
± 29.9-29.95	-25	-25	-13	-13	-13	1 MHz	
± 29.95-30		-25	-13	-13	-13	1 MHz	
± 30-34.85		-25	-25	-13	-13	1 MHz	
± 34.85-34.9		-25	-25	-25	-13	1 MHz	
± 34.9-35			-25	-25	-13	1 MHz	
± 35-39.8				-25	-13	1 MHz	
± 39.8-39.85				-25	-25	1 MHz	
± 39.85-44.8					-25	1 MHz	

For intra-band non-contiguous carrier aggregation transmission the spectrum emission mask requirement is defined as a composite spectrum emissions mask. Composite spectrum emission mask applies to frequencies up to  $\pm$   $\Delta f_{OOB}$  starting from the edges of the sub-blocks. Composite spectrum emission mask is defined as follows

- a) Composite spectrum emission mask is a combination of individual sub-block spectrum emissions masks
- b) In case the sub-block consist of one component carrier the sub-lock general spectrum emission mask is defined in subclause 6.6.2.1.1
- c) If for some frequency sub-block spectrum emission masks overlap then spectrum emission mask allowing higher power spectral density applies for that frequency
- d) If for some frequency a sub-block spectrum emission mask overlaps with the sub-block bandwidth of another sub-block, then the emission mask does not apply for that frequency.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the spectrum emission mask of the UE is defined per E-UTRA band while all component carriers are active. For the E-UTRA band supporting one component carrier the requirements in subclauses 6.6.2.1 and 6.6.2.2 apply. For the E-UTRA band supporting two contiguous component carriers the requirements specified in subclause 6.6.2.1A apply. If for some frequency spectrum emission masks of single component carrier and two contiguous component carriers overlap then spectrum emission masks allowing higher power spectral density applies for that frequency. If for some frequency spectrum emission masks of single component carrier or two contiguous component carriers overlap then the emission mask does not apply for that frequency.

## 6.6.2.2 Additional spectrum emission mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

6.6.2.2.1 Minimum requirement (network signalled value "NS\_03", "NS\_11", "NS\_20", and "NS\_21")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_03", "NS\_11", "NS\_20" or "NS\_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.1-1.

Spectrum emission limit (dBm)/ Channel bandwidth  $\Delta f_{OOB}$ 1.4 3.0 10 20 Measurement 5 15 (MHz) MHz MHz MHz MHz MHz MHz bandwidth -15 -18 30 kHz  $\pm 0-1$ -10 -13 -20 -21 ± 1-2.5 -13 -13 -13 -13 -13 -13 1 MHz -25 -13 -13 -13 -13 -13 1 MHz  $\pm 2.5 - 2.8$ 1 MHz -13 -13 -13 -13 -13  $\pm 2.8-5$  $\pm$  5-6 -25 -13 -13 -13 -13 1 MHz  $\pm 6-10$ -25 -13 -13 -13 1 MHz  $\pm$  10-15 -25 -13 -13 1 MHz -25 -13 1 MHz  $\pm 15-20$ -25 1 MHz  $\pm$  20-25

Table 6.6.2.2.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

## 6.6.2.2.2 Minimum requirement (network signalled value "NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.2-1.

	Spectrum emission limit (dBm)/ Channel bandwidth							
Δf <sub>OOB</sub> (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth			
± 0-1	-15	-18	-20	-21	30 kHz			
± 1-2.5	-10	-10	-10	-10	1 MHz			
± 2.5-2.8	-10	-10	-10	-10	1 MHz			
± 2.8-5	-10	-10	-10	-10	1 MHz			
± 5-6	-13	-13	-13	-13	1 MHz			
± 6-9	-25	-13	-13	-13	1 MHz			
± 9-10	-25	-25	-13	-13	1 MHz			
± 10-13.5		-25	-13	-13	1 MHz			
± 13.5-15		-25	-25	-13	1 MHz			
± 15-18			-25	-13	1 MHz			
± 18-20			-25	-25	1 MHz			
± 20-25				-25	1 MHz			

Table 6.6.2.2.2-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

## 6.6.2.2.3 Minimum requirement (network signalled value "NS\_06" or "NS\_07")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_06" or "NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.3-1.

Spectrum emission limit (dBm)/ Channel bandwidth  $\Delta f_{OOB}$ 3.0 Measurement MHz MHz MHz bandwidth MHz (MHz) -13 -13 -18 30 kHz -15  $\pm 0 - 0.1$ -13 -13 -13 -13 100 kHz  $\pm 0.1-1$ -13 -13 -13 -13 1 MHz  $\pm 1 - 2.5$  $\pm 2.5 - 2.8$ -25 -13 -13 -13 1 MHz -13 -13 -13 1 MHz  $\pm 2.8-5$ -25 -13 -13 1 MHz ± 5-6 -25 -13 1 MHz  $\pm$  6-10 -25 1 MHz  $\pm$  10-15

Table 6.6.2.2.3-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement

bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

## 6.6.2.2A Additional Spectrum Emission Mask for CA

This requirement is specified in terms of an "additional spectrum emission" requirement.

## 6.6.2.2A.1 Minimum requirement (network signalled value "CA\_NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "CA\_NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2A-1.

Table 6.6.2.2A-1: Additional requirements

Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>							
Δf <sub>OOB</sub> (MHz)	50+100RB (29.9 MHz)	75+75B (30 MHz)	75+100RB (34.85 MHz)	100+100RB (39.8 MHz)	Measurement bandwidth		
± 0-1	-22.5	-22.5	-23.5	-24	30 kHz		
± 1-5.5	-13	-13	-13	-13	1 MHz		
± 5.5-34.9	-25	-25	-25	-25	1 MHz		
± 34.9-35		-25	-25	-25	1 MHz		
± 35-39.85			-25	-25	1 MHz		
± 39.85-44.8				-25	1 MHz		

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

# 6.6.2.3 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirements for one E-UTRA carrier are specified for two scenarios for an adjacent E-UTRA and /or UTRA channel as shown in Figure 6.6.2.3-1.

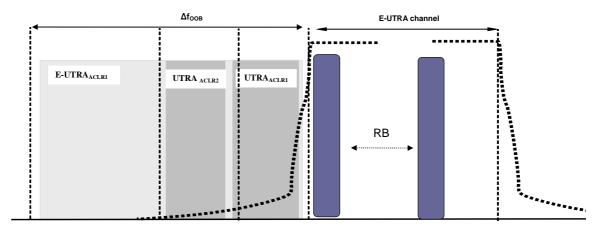


Figure 6.6.2.3-1: Adjacent Channel Leakage requirements for one E-UTRA carrier

## 6.6.2.3.1 Minimum requirement E-UTRA

E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA $_{ACLR}$ ) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2. If the measured adjacent channel power is greater than -50 dBm then the E-UTRA $_{ACLR}$  shall be higher than the value specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2.

Channel bandwidth / E-UTRA<sub>ACLR1</sub> / Measurement bandwidth 1.4 3.0 5 10 15 20 MHz MHz MHz MHz MHz MHz E-UTRA<sub>ACLR1</sub> 30 dB 30 dB 30 dB 30 dB 30 dB 30 dB E-UTRA channel 2.7 1.08 Measurement 4.5 MHz 9.0 MHz 13.5 MHz 18 MHz MHz MHz bandwidth +15 Adjacent channel +1.4 +3.0 +5 +10 +20 centre frequency -10 -3.0 -5 offset [MHz] -1.4 -15 -20

Table 6.6.2.3.1-1: General requirements for E-UTRA<sub>ACLR</sub>

Table 6.6.2.3.1-2: Additional E-UTRA<sub>ACLR</sub> requirements for Power Class 1

	Char	Channel bandwidth / E-UTRA <sub>ACLR1</sub> / Measurement bandwidth				
	1.4	3.0	5	10	15	20
	MHz	MHz	MHz	MHz	MHz	MHz
E-UTRA <sub>ACLR1</sub>			37 dB	37 dB		
E-UTRA channel						
Measurement			4.5 MHz	9.0 MHz		
bandwidth						
Adjacent channel			+5	+10		
centre frequency			/	/		
offset [MHz]			-5	-10		
NOTE 1: E-UTRA <sub>AC</sub>	NOTE 1: E-UTRA <sub>ACLR1</sub> shall be applicable for >23dBm					

6.6.2.3.1A Void

6.6.2.3.1Aa Void

## 6.6.2.3.2 Minimum requirements UTRA

UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned E-UTRA channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA $_{ACLR1}$ ) and the  $2^{nd}$  UTRA adjacent channel (UTRA $_{ACLR2}$ ). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha$  =0.22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2-1. If the measured UTRA channel power is greater than –50dBm then the UTRA $_{ACLR}$  shall be higher than the value specified in Table 6.6.2.3.2-1.

Table 6.6.2.3.2-1: Requirements for UTRA<sub>ACLR1/2</sub>

	Channel bandwidth / UTRA <sub>ACLR1/2</sub> / Measurement bandwidth					
	1.4	3.0	5	10	15	20
	MHz	MHz	MHz	MHz	MHz	MHz
UTRA <sub>ACLR1</sub>	33 dB	33 dB	33 dB	33 dB	33 dB	33 dB
Adjacent channel centre frequency offset [MHz]	0.7+BW <sub>UTRA</sub> /2 / -0.7- BW <sub>UTRA</sub> /2	1.5+BW <sub>UTRA</sub> /2 / -1.5- BW <sub>UTRA</sub> /2	+2.5+BW <sub>UTRA</sub> /2 / -2.5-BW <sub>UTRA</sub> /2	+5+BW <sub>UTRA</sub> /2 / -5-BW <sub>UTRA</sub> /2	+7.5+BW <sub>UTRA</sub> /2 / -7.5-BW <sub>UTRA</sub> /2	+10+BW <sub>UTRA</sub> /2 / -10-BW <sub>UTRA</sub> /2
UTRA <sub>ACLR2</sub>	-	-	36 dB	36 dB	36 dB	36 dB
Adjacent channel centre frequency offset [MHz]	-	-	+2.5+3*BW <sub>UTRA</sub> /2 / -2.5-3*BW <sub>UTRA</sub> /2	+5+3*BW <sub>UTRA</sub> /2 / -5-3*BW <sub>UTRA</sub> /2	+7.5+3*BW <sub>UTRA</sub> /2 / -7.5-3*BW <sub>UTRA</sub> /2	+10+3*BW <sub>UTRA</sub> /2 / -10-3*BW <sub>UTRA</sub> /2
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz
UTRA 5MHz channel Measurement bandwidth (NOTE 1)	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz
UTRA 1.6MHz channel measurement bandwidth (NOTE 2)	1.28 MHz	1.28 MHz	1.28 MHz	1.28MHz	1.28MHz	1.28MHz

NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.

NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.

## 6.6.2.3.2A Minimum requirement UTRA for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel bandwidth on the component carrier to the filtered mean power centred on an adjacent channel frequency. The UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the requirement is specified in subclause 6.6.2.3.2.

For intra-band contiguous carrier aggregation the UTRA Adjacent Channel Leakage power Ratio (UTRA $_{ACLR}$ ) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the sum of the filtered mean powers centered on the assigned sub-block frequencies to the filtered mean power centred on an adjacent(s) UTRA channel frequency. UTRA<sub>ACLR1/2</sub> requirements are applicaple for all sub-blocks and are specified in Table 6.6.2.3.2A-2. UTRA<sub>ACLR1</sub> is required to be met in the sub-block gap when the gap bandwidth Wgap is 5MHz Wgap <15MHz. Both UTRA ACLR1 and UTRA<sub>ACLR2</sub> are required to be met in the sub-block gap when the gap bandwidth Wgap is 15MHz≤Wgap.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACIR</sub>) is defined as follows. For the E-UTRA band supporting one component carrier, the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent(s) UTRA channel frequency and the requirements specified in subclause 6.6.2.3.2 apply. For the E-UTRA band supporting two contiguous component carriers the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency and the requirements specified in subclause 6.6.2.3.2A apply.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA<sub>ACLR1</sub>) and the 2<sup>nd</sup> UTRA adjacent channel (UTRA<sub>ACLR2</sub>). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha = 0.22$ . The assigned aggregated channel bandwidth power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2A-1 for intraband contiguous carrier aggregation or 6.6.2.3.2A-2 for intraband non-contiguous carrier aggregation. If the measured UTRA channel power is greater than -50dBm then the UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.2A-1 for intraband contiguous carrier aggregation or 6.6.2.3.2A-2 for intraband non-contiguous carrier aggregation.

Table 6.6.2.3.2A-1: Requirements for UTRA<sub>ACLR1/2</sub>

	CA bandwidth class / UTRA <sub>ACLR1/2</sub> / measurement bandwidth			
	CA bandwidth class B and C			
UTRA <sub>ACLR1</sub>	33 dB			
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> /2 + BW <sub>UTRA</sub> /2 / - BW <sub>Channel_CA</sub> / 2 - BW <sub>UTRA</sub> /2			
UTRA <sub>ACLR2</sub>	36 dB			
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> /2 + 3*BW <sub>UTRA</sub> /2 / - BW <sub>Channel_CA</sub> /2 - 3*BW <sub>UTRA</sub> /2			
CA E-UTRA channel Measurement bandwidth	BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>			
UTRA 5MHz channel Measurement bandwidth (NOTE 1)	3.84 MHz			
UTRA 1.6MHz channel measurement bandwidth (NOTE 2)	1.28 MHz			
NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.  NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.				

Table 6.6.2.3.2A-2: Requirements for intraband non-contiguous CA UTRA<sub>ACLR1/2</sub>

	UTRA <sub>ACLR1/2</sub> / measurement bandwidth		
UTRA <sub>ACLR1</sub>	33 dB		
Adjacent channel centre frequency offset (in MHz)	+ F <sub>edge,block,high</sub> + BW <sub>UTRA</sub> /2 / - F <sub>edge,block,low</sub> - BW <sub>UTRA</sub> /2		
UTRA <sub>ACLR2</sub>	36 dB		
Adjacent channel centre frequency offset (in MHz)	+ F <sub>edge,block,high</sub> + 3*BW <sub>UTRA</sub> /2 / - F <sub>edge,block,low</sub> - 3*BW <sub>UTRA</sub> /2		
Sub-block measurement bandwidth	BW <sub>Channel,block</sub> - 2* BW <sub>GB</sub>		
UTRA 5 MHz channel Measurement bandwidth (NOTE 1)	3.84 MHz		
UTRA 1.6 MHz channel measurement bandwidth (NOTE 2)	1.28 MHz		
NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.  NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.			

#### 6.6.2.3.3A Minimum requirements for CA E-UTRA

For intra-band contiguous carrier aggregation the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power and adjacent aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-1. If the measured adjacent channel power is greater than -50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.3A-1.

Table 6.6.2.3.3A-1: General requirements for CA E-UTRA<sub>ACLR</sub>

	CA bandwidth class / CA E-UTRA <sub>ACLR</sub> / Measurement bandwidth
	CA bandwidth class B and C
CA E-UTRA <sub>ACLR</sub>	30 dB
CA E-UTRA channel Measurement bandwidth	BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> / - BW <sub>Channel_CA</sub>

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel bandwidth on a component carrier to the filtered mean power centred on an adjacent channel frequency. The E-UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the requirement is specified in subclause 6.6.2.3.1.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA<sub>ACLR</sub>) is the ratio of the sum of the filtered mean powers centred on the assigned sub-block frequencies to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. In case the sub-block gap bandwidth Wgap is smaller than of the sub-block bandwidth then for that sub-block no E-UTRA<sub>ACLR</sub> requirement is set for the gap. In case the sub-block gab bandwidth Wgap is smaller than either of the sub-block bandwidths then no E- UTRA subblock power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-2. If the measured adjacent channel power is greater than -50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.3A-2.

CC and adjacent channel bandwidth / E-UTRA<sub>ACLR</sub> / Measurement bandwidth 1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz E-UTRA<sub>ACLR1</sub> 30 dB 30 dB 30 dB 30 dB 30 dB 30 dB CC and adjacent channel 1.08 2.7 4.5 9 13.5 18 measurement bandwidth [MHz] Adjacent channel + 3 + 5 + 15 + 1.4 +10+ 20 centre frequency / / / offset [MHz] - 3 - 5 - 10 - 15 - 20

Table 6.6.2.3.3A-2: General requirements for non-contiguous intraband CA E-UTRA<sub>ACLR</sub>

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA ACIR) is defined as follows. For the E-UTRA band supporting one component carrier, the E-UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent channel frequency and the requirements in subclause 6.6.2.3.1 apply. For the E-UTRA band supporting two contiguous component carriers the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) aggregated channel bandwidth at nominal channel spacing and the requirements of CA E-UTRA<sub>ACLR</sub> specified in subclause 6.6.2.3.3A apply.

6.6.2.4 Void

6.6.2.4.1 Void

6.6.2A Void

<reserved for future use>

#### Out of band emission for UL-MIMO 6.6.2B

- 1.4

For UE supporting UL-MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.6.3 apply.

#### 6.6.2C Void

<reserved for future use>

#### Out of band emission for ProSe 6.6.2D

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.6.2 apply.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.6.2 apply per E-UTRA ProSe sidelink and E-UTRA uplink transmission as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

# 6.6.2F Out of band emission for category NB1

# 6.6.2F.1 Spectrum emission mask

The spectrum emission mask of the category NB1 UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the  $\pm$  edge of the assigned category NB1 channel bandwidth. For frequencies greater than ( $\Delta f_{OOB}$ ) as specified in Table 6.6.2F.1-1 the spurious requirements in subclause 6.6.3 are applicable.

The power of any category NB1 UE emission shall not exceed the levels specified in Table 6.6.2F.1-1.

Table 6.6.2F.1-1: category NB1 UE spectrum emission mask

Δf <sub>OOB</sub> (kHz)	Emission limit (dBm)	Measurement bandwidth
± 0	26	30 kHz
± 100	-5	30 kHz
± 150	-8	30 kHz
± 300	-29	30 kHz
± 500-1700	-35	30 kHz

In addition to the spectrum emission mask requirement in Table 6.6.2F.1-1 a category NB1 UE shall also meet the applicable E-UTRA spectrum emission mask requirement in sub-clause 6.6.2. E-UTRA spectrum emission requirement applies for frequencies that are Foffset away from edge of NB1 channel edge as defined in Table 6.6.2F.1-2.

Table 6.6.2F.1-2: Foffset for category NB1 UE spectrum emission mask

Channel BW (MHz)	Foffset [kHz]
1.4	[165]
3	[190]
5	[200]
10	[225]
15	[240]
20	[245]

Note: Foffset in Table 6.6.F.1-2 is used to guarantee co-existence for guard-band operation.

## 6.6.2F.2 Void

<reserved for future use>

# 6.6.2F.3 Adjacent Channel Leakage Ratio for category NB1

Adjacent Channel Leakage power Ratio is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. The assigned category NB1 channel power and adjacent channel power are measured with filters and measurement bandwidths specified in Table 6.6.2F.3-1. If the measured adjacent channel power is greater than -50 dBm then the category NB1 UE ACLR shall be higher than the value specified in Table 6.6.2F.3-1. GSM<sub>ACLR</sub> requirement is intended for protection of GSM system. UTRA<sub>ACLR</sub> requirement is intended for protection of UTRA and E-UTRA systems.

Table 6.6.2F.3-1: category NB1 UE ACLR requirements

	GSM <sub>ACLR</sub>	UTRA <sub>ACLR</sub>
ACLR	20 dB	37 dB
Adjacent channel center frequency offset from category NB1 Channel edge	±200 kHz	±2.5 MHz
Adjacent channel measurement bandwidth	180 kHz	3.84 MHz
Measurement filter	Rectangular	RRC-filter α=0.22
Category NB1 channel measurement bandwidth	180 kHz	180 kHz
Category NB1 channel Measurement filter	Rectangular	Rectangular

# 6.6.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements inline with SM.329 [2] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

## 6.6.3.1 Minimum requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.6.3.1-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.1-1: Boundary between E-UTRA out of band and spurious emission domain

Channel bandwidth	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
OOB	2.8	6	10	15	20	25
boundary						
F <sub>OOB</sub> (MHz)						

NOTE Frequency Range Maximum Measurement Level bandwidth -36 dBm 9 kHz ≤ f < 150 kHz 1 kHz -36 dBm 10 kHz  $150 \text{ kHz} \le f < 30 \text{ MHz}$ 30 MHz ≤ f < 1000 MHz -36 dBm 100 kHz -30 dBm 1 MHz 1 GHz ≤ f < 12.75 GHz 12.75 GHz ≤ f < 5<sup>th</sup> harmonic of the upper frequency edge of the -30 dBm 1 MHz 1 UL operating band in GHz NOTE 1: Applies for Band 22, Band 42 and Band 43

Table 6.6.3.1-2: Spurious emissions limits

# 6.6.3.1A Minimum requirements for CA

This clause specifies the spurious emission requirements for carrier aggregation.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spurious emission requirement Table 6.6.3.1-2 apply for the frequency ranges that are more than  $F_{OOB}$  as defined in Table 6.6.3.1-1 away from edges of the assigned channel bandwidth on a component carrier. If for some frequency a spurious emission requirement of individual component carrier overlaps with the spectrum emission mask or channel bandwidth of another component carrier then it does not apply.

NOTE: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the requirements in Table 6.6.3.1-2 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.6.3.1-2 would be considered to be verified by the measurements verifying the one uplink inter-band CA spurious emission requirement.

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth (Table 5.6A-1). For frequencies  $\Delta$ fOOB greater than FOOB as specified in Table 6.6.3.1A-1 the spurious emission requirements in Table 6.6.3.1-2 are applicable.

Table 6.6.3.1A-1: Boundary between E-UTRA out of band and spurious emission domain for intraband contiguous carrier aggregation

CA Bandwidth Class	OOB boundary F <sub>OOB</sub> (MHz)
A	Table 6.6.3.1-1
В	BW <sub>Channel_CA</sub> + 5
С	BW <sub>Channel_CA</sub> + 5

For intra-band non-contiguous carrier aggregation transmission the spurious emission requirement is defined as a composite spurious emission requirement. Composite spurious emission requirement applies to frequency ranges that are more than  $F_{OOB}$  away from the edges of the sub-blocks. Composite spurious emission requirement is defined as follows

- a) Composite spurious emission requirement is a combination of individual sub-block spurious emission requirements
- b) In case the sub-block consist of one component carrier the sub-lock spurious emission requirement and  $F_{OOB}$  are defined in subclause 6.6.3.1

c) If for some frequency an individual sub-block spurious emission requirement overlaps with the general spectrum emission mask or the sub-block bandwidth of another sub-block then it does not apply

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the spurious emission requirement is defined as follows. For the E-UTRA band supporting one component carrier the requirements in Table 6.6.3.1-2 apply for frequency ranges that are more than FOOB (MHz) from the edges of assigned channel bandwidth as defined in Table 6.6.3.1-1. For the E-UTRA band supporting two contiguous component carriers the requirements in Table 6.6.3.1-2 apply for frequency ranges that are more than FOOB (MHz) from the edges of assigned aggregated channel bandwidth as defined in Table 6.6.3.1A-1. If for some frequency a spurious emission requirement of a single component carrier or two contiguous component carriers overlap with the spurious emission requirement or channel bandwidth of another component carrier or two contiguously aggregated carriers then it does not apply.

# 6.6.3.2 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.2-1: Requirements

		Spurious	s em	ission			
E-UTRA Band	Protected band		ency MHz	range 2)	Maximum Level (dBm)	MBW (MHz)	NOTE
1	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 45, 65, 67, 68	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 3, 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	15
	Frequency range	1839.9	-	1879.9	-50	1	15
	Frequency range	1880		1895	-40	1	15, 27
	Frequency range	1895		1915	-15.5	5	15, 26, 27
	Frequency range	1915		1920	+1.6	5	15, 26, 27
2	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 2, 25	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
3	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 41, 43, 44, 45, 65, 67, 68	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 3	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	15
	E-UTRA Band 11, 18, 19, 21	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	13
	E-UTRA Band 22, 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	13
4	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 41, 43, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 42	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
5	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 23, 24, 25, 28, 29, 30, 31, 34, 38, 40, 42, 43, 45, 65, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 26	859	-	869	-27	1	
	E-UTRA Band 41	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
6	E-UTRA Band 1, 9, 11, 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	860	-	875	-37	1	
	Frequency range	875	-	895	-50	1	
	Frequency range	1884.5	-	1919.6	-41	0.3	7
	, , ,	1884.5	-	1915.7		0.0	8
7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 66, 67, 68	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
8	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 45, 65, 67, 68	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 3, 7, 22, 41, 42, 43	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 8	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 11, 21	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	23
	Frequency range	860	-	890	-40	1	15, 23
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 23
9	E-UTRA Band 1, 11, 18, 19, 21, 26, 28, 34	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	L-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	

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10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 41, 43, 66	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 22, 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
11	E-UTRA Band 1, 11, 18, 19, 21, 28, 34, 42, 65	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
12	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 30, 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 4, 10, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	E-UTRA Band 12	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	15
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 26, 27, 29, 41, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 14	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	15
	E-UTRA Band 24, 30	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	-	805	-35	0.00625	11, 15
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 30, 41, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	769	-	775	-35	0.00625	12, 15
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
17	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 30, 41	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 4, 10, 66	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 12	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	15
18	E-UTRA Band 1, 11, 21, 34, 42, 65	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1	
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
19	E-UTRA Band 1, 11, 21, 28, 34, 42, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	945	_	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50 -50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
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20	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 65, 67	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 20	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 38, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	758	-	788	-50	1	
21	E-UTRA Band 1, 18, 19, 28, 34, 42, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
22	E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 43, 65, 67	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	3510	-	3525	-40	1	15
	Frequency range	3525	-	3590	-50	1	
23	E-UTRA Band 4, 5, 10, 12, 13, 14, 17,	_				4	
24	23, 24, 26, 27, 29, 30, 41, 66 E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	23, 24, 25, 26, 29, 30, 41, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
25	E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 2	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
26	E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 41	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	703	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	_	1879.9	-50	1	
	Frequency range	1884.5	_	1915.7	-41	0.3	8
27	E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13, 14, 17, 23, 25, 26, 27, 29, 30, 31, 38, 40, 41, 42, 43, 65, 66	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 28	F <sub>DL low</sub>	-	790	-50	1	
	Frequency range	799	-	805	-35	0.00625	
28	E-UTRA Band 1, 4, 10, 22, 42, 43, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 1	F <sub>DL_low</sub>	_	F <sub>DL_high</sub>	-50	1	19, 25
	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20,	_					.0, 20
	25, 26, 27, 31, 34, 38, 40, 41, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 11, 21	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	19, 24
	Frequency range	470	-	694	-42	8	15, 35
	Frequency range	470	-	710	-26.2	6	34
	Frequency range	662		694	-26.2	6	15
	Frequency range	758		773	-32	1	15
	Frequency range	773	-	803	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 19
30	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 30, 38, 41, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
31	E-UTRA Band 1, 5, 7, 8, 20, 22, 26, 27, 28, 31, 32, 33, 34, 38, 40, 42, 43, 65, 67	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 3	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
		320.1					
33	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32,	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	5
	34, 38, 40, 42, 43, 65, 67 E-UTRA Band 3	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20,						
	21, 22, 26, 28, 31, 32, 33, 38,39, 40, 41, 42, 43, 44, 45, 65, 67	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	5
	Frequency range	1884.5		1915.7	-41	0.3	8
	Frequency range	1839.9	-	1879.9	-50	1	-
35							

36							
37			_				
38	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 66, 67, 68	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22
39	E-UTRA Band 1, 8, 22, 26, 34, 40, 41, 42, 44, 45	$F_{DL\_low}$	1	$F_{DL\_high}$	-50	1	
	Frequency range	1805		1855	[-40]	1	33
	Frequency range	1855		1880	[-15.5]	5	15,26,33
40	E-UTRA Band 1, 3, 5, 7, 8, 20, 22, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 65, 67, 68	$F_{DL_{low}}$	1	F <sub>DL_high</sub>	-50	1	
41	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 42, 44, 45, 65, 66	$F_{DL_{low}}$	1	$F_{DL\_high}$	-50	1	
	E-UTRA Band 9, 11, 18, 19, 21	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	30
	Frequency range	1839.9		1879.9	-50	1	30
	Frequency range	1884.5		1915.7	-41	0.3	8, 30
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11, 18, 19, 20, 21, 25, 26, 27, 28, 31, 32, 33, 34, 38, 40, 41, 44, 45, 65, 66, 67	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 31,32, 33, 34, 38, 40, 65, 66, 67	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 22	F <sub>DL low</sub>	-	F <sub>DL high</sub>	[-50]	[1]	3
44	E-UTRA Band 1, 40, 42, 45	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1	2
	E-UTRA Band 3, 5, 8, 34, 39, 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
45	E-UTRA Band 1, 3, 5, 8, 34, 39, 40, 41, 42.44	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
65	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 38, 40, 42, 43, 65	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 3	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	15
	E-UTRA Band 5, 11, 18, 19, 21, 26, 27, 41	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	36
	Frequency range	1884.5	-	1915.7	-41	0.3	37
	Frequency range	1900	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
66	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 38, 41, 43, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
68	E-UTRA Band 3, 7, 8, 28, 38, 40	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 1	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2

NOTE 1: F<sub>DL low</sub> and F<sub>DL high</sub> refer to each E-UTRA frequency band specified in Table 5.5-1

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3, 4, [5] for the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 4: N/A

NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 6: N/A

NOTE 7: Applicable when co-existence with PHS system operating in 1884.5-1919.6MHz. NOTE 8: Applicable when co-existence with PHS system operating in 1884.5-1915.7MHz.

NOTE 9: N/A NOTE 10: N/A

NOTE 11: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation <

0.5 dB

- NOTE 13: This requirement applies for 5, 10, 15 and 20 MHz E-UTRA channel bandwidth allocated within 1744.9MHz and 1784.9MHz.
- NOTE 14: N/A
- NOTE 15: These requirements also apply for the frequency ranges that are less than F<sub>OOB</sub> (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.
- NOTE 16: N/A
- NOTE 17: N/A
- NOTE 18: N/A
- NOTE 19: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
- NOTE 20: N/A
- NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 22: This requirement is applicable for any channel bandwidths within the range 2570 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

  For carriers with channel bandwidth overlapping the frequency range 2615 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE *P-Max*.
- NOTE 23: This requirement is applicable only for the following cases: 
   for carriers of 5 MHz channel bandwidth when carrier centre frequency ( $F_c$ ) is within the range 902.5 MHz  $\leq F_c <$  907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB for carriers of 5 MHz channel bandwidth when carrier centre frequency ( $F_c$ ) is within the range 907.5 MHz  $\leq F_c \leq$  912.5 MHz without any restriction on uplink transmission bandwidth. for carriers of 10 MHz channel bandwidth when carrier centre frequency ( $F_c$ ) is  $F_c =$  910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RB<sub>start</sub> > 3.
- NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 2<sup>nd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3<sup>rd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3<sup>rd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
- NOTE 27: This requirement is applicable for any channel bandwidths within the range 1920 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 28: N/A
- NOTE 29: N/A
- NOTE 30: This requirement applies when the E-UTRA carrier is confined within 2545-2575MHz or 2595-2645MHz and the channel bandwidth is 10 or 20 MHz
- NOTE 31: N/A
- NOTE 33: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to [54 RB] for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 1903 MHz.
- NOTE 34: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart < 48.
- NOTE 35: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
- NOTE 36: This requirement is applicable for E-UTRA channel bandwidth allocated within 1920-1980 MHz.
- NOTE 37: Applicable when the upper edge of the channel bandwidth frequency is greater than 1980MHz.

# 6.6.3.2A Spurious emission band UE co-existence for CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For inter-band carrier aggregation with the uplink assigned to two E-UTRA bands, the requirements in Table 6.6.3.2A-0 apply on each component carrier with all component carriers are active.

NOTE: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the requirements in Table 6.6.3.2A-0 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.6.3.2A-0 would be considered to be verified by the measurements verifying the one uplink inter-band CA UE to UE co-existence requirements.

Table 6.6.3.2A-0: Requirements for uplink inter-band carrier aggregation (two bands)

		Spurio	us	emission			
E-UTRA CA Configuration	Protected band		ency MH	/ range z)	Maximum Level (dBm)	MBW (MHz)	NOTE
CA_1A-3A	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 38, 40, 41, 43, 44, 65, 67	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50		
	E-UTRA band 3, 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA band 11,18,19, 21	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	10
	E-UTRA band 22, 42	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	7, 10
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
CA_1A-5A	E-UTRA Band 1, 5, 7, 8, 22, 28, 31, 38, 40, 42, 43, 65	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 3,34	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
	E-UTRA band 26	859	-	869	-27	1	
	E-UTRA band 41	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
CA_1A-7A	E-UTRA Band 1, 5, 7, 8, 20, 22, 26, 27, 28, 31,32, 40, 42, 43, 65, 67	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA band 3, 34	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_1A-8A	E-UTRA Band 1, 20, 26, 28, 31, 32, 38, 40, 65, 67	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 3	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	2,3
	E-UTRA band 7, 22, 41, 42, 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	E-UTRA Band 8, 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA band 11, 21	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	11
	Frequency range	860	-	890	-40	1	3, 11
	Frequency range	1884.5	-	1915.7	-41	0.3	7, 11
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
CA_1A-18A	E-UTRA Band 1, 11, 21, 42, 65	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 34	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	3
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 7
	Frequency range	1839.9	-	1879.9	-50	1	3
	Frequency range	2545		2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
CA_1A-19A	E-UTRA Band 1, 11, 21, 28, 42, 65	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 34	$F_{DL\_low}$		$F_{DL\_high}$	-50	1	3
	Frequency range	860	-	890	-40	1	3, 8
	Frequency range	945		960	-50	1	
	Frequency range	1884.5	<u> </u>	1915.7	-41	0.3	3, 7
	Frequency range	1839.9	-	1879.9	-50	1	3
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	Ŀ	2645	-50	1	
CA_1A-21A	E-UTRA Band 11	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-35	1	3, 16
I	E-UTRA Band 1, 18, 19, 28, 34,	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	

1	42, 65	İ	l			]	1
	E-UTRA Band 21	F <sub>DL_low</sub>	_	F <sub>DL_high</sub>	-50	1	16
	Frequency range	1884.5	_	1915.7	-41	0.3	7
	Frequency range	945	_	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	2545	_	2575	-50	1	
	Frequency range	2595	_	2645	-50	1	
CA_1A-26A	E-UTRA Band 1,5, 7, 11, 18, 19, 20, 21, 22, 26, 27, 31, 38, 40, 42, 43, 44, 65	F <sub>DL low</sub>		F <sub>DL high</sub>	-50	1	
	Frequency range	1880	-	1895	-40	1	3, 12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915	_	1920	+1.6	5	3, 12, 13
	Frequency range	1884.5	-	1915.7	-41	0.3	7
	Frequency range	945	_	960	-50	1	
	E-UTRA Band 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 3, 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	Frequency range	703	-	799	-50	1	
	, , ,	799	-	803	-40	1	3
	Frequency range	1839.9	-	1879.9	-50	1	3
CA_1A-28A	E-UTRA Band 5, 7, 8, 18, 19, 20,	1000.0		1073.3			
0.1_1,120,1	26, 27, 31, 32, 38, 40, 41	F <sub>DL_low</sub>		F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 22, 42, 43	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	2
	E-UTRA Band 3, 34	F <sub>DL_low</sub>		F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 11, 21	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	5, 21
	E-UTRA Band 1, 65	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	5, 6
	Frequency range	470	-	694	-42	8	3, 22
	Frequency range	470	-	710	-26.2	6	23
	Frequency range	758	-	773	-32	1	3
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	3
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
	Frequency range	1839.9	-	1879.9	-50	1	3
	Frequency range	1884.5	-	1915.7	-41	0.3	5, 7
CA_1A-42A	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 44, 65, 67	$F_{DL\_low}$	_	$F_{DL\_high}$	-50	1	
	E-UTRA Band 3, 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
	Frequency range	1839.9	-	1879.9	-50	1	3
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 7
CA_2A-4A	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, 30, 41, 66	F <sub>DL low</sub>	_	F <sub>DL high</sub>	-50	1	,
	E-UTRA Band 2, 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
CA_2A-5A	E-UTRA Band 4, 5, 10, 12, 13,	_			-50	1	
	14, 17, 23, 24, 28, 29, 30, 42	F <sub>DL_low</sub>		F <sub>DL_high</sub>			
	E-UTRA Band 2, 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 26	859	-	869	-27	1	
CA_2A-12A	E-UTRA Band 41, 43 E-UTRA Band 5, 13, 14, 17, 23,	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
CA_2A-12A	24, 26, 27, 30, 41 E-UTRA Band 2, 12, 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50 -50	1	3
	E-UTRA Band 4, 10	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
CA_2A-13A	E-UTRA Band 4, 5,10,12,13,17, 22, 23, 26, 27, 29, 41, 42, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 2,14, 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 24, 30, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	769	-	775	-35	0.00625	3

	Frequency range	799	-	805	-35	0.00625	3, 9
CA_3A-5A	E-UTRA Band 1, 5, 7, 8, 22, 28,	$F_{DL\_low}$		F <sub>DL high</sub>	-50	1	,
	31, 38, 40, 42, 43, 65			- 5			
	E-UTRA band 3,34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
CA 2A 7A	E-UTRA band 26 E-UTRA Band 1, 5, 7, 8, 20, 26,	859	-	869	-27	1	
CA_3A-7A	27, 28, 31, 32, 33, 34, 40, 43, 44, 65, 67	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA band 3	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
	E-UTRA band 22, 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_3A-8A	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 44, 65, 67	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 3, 8	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2, 3
	E-UTRA band 11, 21	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	10,11
	E-UTRA band 7, 22, 41, 42, 43	$F_{DL_{low}}$	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	4, 10, 11
	Frequency range	860	-	890	-40	1	3,11,17
CA_3A-19A	E-UTRA Band 1, 11, 21, 28, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	860	-	890	-40	1	3, 8
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 4
	Frequency range	1839.9	-	1879.9	-50	1	3
	Frequency range	2545	-	2575	-50	1	
04.04.004	Frequency range	2595	-	2645	-50	1	
CA_3A-20A	E-UTRA Band 1, 7, 8, 31, 32, 33, 34, 40, 43, 65, 67	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 3, 20	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA Band 22, 38, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
CA 2A 2CA	Frequency range E-UTRA Band 1, 5, 7, 26, 34, 39,	758	-	788	-50	1	
CA_3A-26A	40, 43, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 3	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
	E-UTRA band 11, 18, 19, 21	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	10
	E-UTRA band 22, 41, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	4, 10
	Frequency range	703	-	799	-50	1	-
	-	799	-	803	-40 -52	0.00605	3
	Frequency range	851	-	859	-53	0.00625	15
	Frequency range	945	-	960	-50 -50	1	
CA_4A-5A	Frequency range E-UTRA Band 2, 4, 5, 7, 10, 12,	1839.9	-	1879.9	-50	'	
CA_4A-3A	13, 14, 17, 23, 24, 25, 28, 29, 30, 43	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 26	859	-	869	-27	1	
	E-UTRA band 41, 42	$F_{DL_{low}}$		F <sub>DL_high</sub>	-50	1	2
CA_4A-7A	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 26, 27, 28, 29, 30, 43, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 42	F <sub>DL_low</sub>	<del> </del>	F <sub>DL_high</sub>	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_4A-12A	E-UTRA Band 2, 5, 7,13, 14, 17, 22, 23, 24, 25, 26, 27, 30, 41, 43	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 4, 10. 42, 66	$F_{DL\_low}$	L-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 12	$F_{DL\_low}$	_	F <sub>DL_high</sub>	-50	1	3
CA_4A-13A	E-UTRA Band 2,4, 5, 7, 10,12,13,17, 22, 23,25, 26, 27, 29, 41, 43, 66	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA Band 14	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	3
I	L	DL_10#		9''	<u> </u>	<u> </u>	

	E-UTRA Band 24, 30, 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	Frequency range	769	-	775	-35	0.00625	3
	Frequency range	799	-	805	-35	0.00625	3, 9
CA_4A-17A	E-UTRA Band 2, 5, 7,13, 14, 17, 22, 23, 24, 25, 26, 27, 30, 41, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 4, 10. 42, 66	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 12	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	3
CA_5A-7A	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 22, 28, 29, 30, 31, 40, 42, 43, 65, 66	F <sub>DL_low</sub>	-	$F_{DL\_high}$	-50	1	
	E-UTRA band 26	859	-	869	-27	1	
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_5A-12A	E-UTRA Band 2, 5, 13, 14, 17, 22, 23, 24, 25, 30, 31, 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 4, 10, 41, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	E-UTRA band 26	859	-	869	-27	1	
	E-UTRA band 12	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	3
CA_5A-17A	E-UTRA Band 2, 5, 13, 14, 17, 22, 23, 24, 25, 30, 31, 42, 43	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA band 4, 10, 41, 66	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	E-UTRA band 26	859	_	869	-27	1	
	E-UTRA band 12	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
CA_7A-20A	E-UTRA Band 1,3, 7, 8, 22, 28, 31, 32, 33, 34, 40, 43, 65, 67	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 20	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	3
	E-UTRA Band 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_7A-28A	E-UTRA Band 2, 3, 5, 7, 8, 20, 26, 27, 31, 34, 40	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 1, 4, 10, 22, 42, 43, 65, 66	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 1	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	5, 6
	Frequency range	758	-	773	-32	1	3
	Frequency range	773	-	803	-50	1	
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14
	Frequency range	2595	-	2620	-40	1	3, 14
CA_18A-28A	E-UTRA Band 11, 21	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	5, 21
	E-UTRA Band 1, 65	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	5, 6
	E-UTRA Band 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2
	E-UTRA Band 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	23
	Frequency range	470 758	-	710 773	-26.2 -32	6	3
	Frequency range	773	-	799	-32 -50		3
	Frequency range		-			1	2
	Frequency range	799	<u> </u>	803	-40	1	3
	Frequency range	860	-	890	-40	1	_
	Frequency range	945	<u> </u>	960	-50	1	3
	Frequency range	1884.5	-	1915.7	-41	0.3	4
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	2545	<u> </u>	2575	-50	1	
CA_19A-21A	Frequency range E-UTRA Band 1, 18, 19, 28, 34,	2595 F <sub>DL_low</sub>	-	2645 F <sub>DL high</sub>	-50 -50	1	
	42, 65		-	- 0	-50	1	3, 16
	E-UTRA Band 11	F <sub>DL_low</sub>	<del>-</del>	F <sub>DL_high</sub>			
	E-UTRA Band 21 Frequency range	F <sub>DL_low</sub>	<del>-</del>	F <sub>DL_high</sub>	-50 40	1	16
	Frequency range Frequency range	860	Ι-	890	-40 50	1	3, 8
	Frequency range Frequency range	945	Ι-	960	-50	1	A
	Frequency range Frequency range	1884.5	<u> </u>	1915.7	-41	0.3	4
	_ · · · ·	1839.9	<u> </u>	1879.9	-50	1	
	Frequency range	2545	-	2575	-50	1	<u> </u>

	Frequency range	2595	-	2645	-50	1	
CA 39A-41A	E-UTRA Band 1, 8, 26, 34, 40, 42, 44	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	1805	•	1855	[-40]	1	20
	Frequency range	1855	_	1880	[-15.5]	5	3, 13, 20
CA_39A-41C	E-UTRA Band 1, 8, 26, 34, 40, 42, 44	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	1805	-	1855	[-40]	1	20
	Frequency range	1855	-	1880	[-15.5]	5	3, 13, 20
CA_39C-41A	E-UTRA Band 34, 40, 42, 44	$F_{DL\_low}$		F <sub>DL_high</sub>	-50	1	

- NOTE 1: F<sub>DL\_low</sub> and F<sub>DL\_high</sub> refer to each E-UTRA frequency band specified in Table 5.5-1
- NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. In case the exceptions are allowed due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3 or 4 for the 2<sup>nd</sup>, 3<sup>rd</sup> or 4<sup>th</sup> harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
- NOTE 3: These requirements also apply for the frequency ranges that are less than F<sub>OOB</sub> (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.
- NOTE 4: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.
- NOTE 5: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
- NOTE 6: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3<sup>rd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3<sup>rd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 7: Applicable when NS\_05 in section 6.6.3.3.1 is signalled by the network.
- NOTE 8: Applicable when NS\_08 in subclause 6.6.3.3.3 is signalled by the network
- NOTE 9: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD.
- NOTE10: This requirement applies for 5, 10, 15 and 20 MHz E-UTRA channel bandwidth allocated within 1744.9MHz and 1784.9MHz.
- NOTE 11: This requirement is applicable only for the following cases:
  - for carriers of 5 MHz channel bandwidth when carrier centre frequency ( $F_c$ ) is within the range 902.5 MHz  $\leq F_c < 907.5$  MHz with an uplink transmission bandwidth less than or equal to 20 RB for carriers of 5 MHz channel bandwidth when carrier centre frequency ( $F_c$ ) is within the range 907.5 MHz  $\leq F_c \leq 912.5$  MHz without any restriction on uplink transmission bandwidth.
  - an uplink transmission bandwidth less than or equal to 32 RB with RB<sub>start</sub> > 3.
- NOTE 12: This requirement is applicable for any channel bandwidths within the range 1920 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE13: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
- NOTE 14: This requirement is applicable for any channel bandwidths within the range 2500 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 15: Applicable when NS\_15 in subclause 6.6.3.3.8 is signalled by the network.
- NOTE 16: Applicable when NS\_09 in subclause 6.6.3.3.4 is signalled by the network
- NOTE 17: This requirement is applicable only when Band 3 transmission frequency is less than or equal to 1765 MHz.
- NOTE 18: This requirement applies when the E-UTRA carrier is confined within 2545-2575MHz or 2595-2645MHz and the channel bandwidth is 10 or 20 MHz
- NOTE 20: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to [54 RB] for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 1903 MHz.
- NOTE 21: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the

- transmission bandwidth (see Figure 5.6-1) for which the 2<sup>nd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 22: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
- NOTE 23: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart < 48.

Table 6.6.3.2A-1: Requirements for intraband carrier aggregation

E-	Spurious emission									
UTRA CA Config uration	Protected band	Protected band Frequency range (MHz)		_	Maximum Level (dBm)	MBW (MHz)	NOTE			
CA_1C	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 65, 67	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1				
	Frequency range	1839.9	-	1879.9	-50	1				
CA_3C	E-UTRA Band 1, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 41, 43, 44, 65, 67	F <sub>DL_low</sub>	1	$F_{DL\_high}$	-50	1				
	E-UTRA Band 3	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	10			
	E-UTRA Band 22, 42	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	2			
CA_7C	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 30. 31, 32, 33, 34, 40, 42, 43, 65, 67	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1				
CA_8B	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40	F <sub>DL_low</sub>	-	F <sub>DL high</sub>	-50	1				
	E-UTRA band 3	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1	2			
	E-UTRA band 7	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2			
	E-UTRA Band 8	F <sub>DL_low</sub>	-	F <sub>DL high</sub>	-50	1	10			
	E-UTRA Band 22, 41, 42, 43	$F_{DL\_low}$		F <sub>DL_high</sub>	-50	1	2			
CA_38C	E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 67	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1				
CA_39C	E-UTRA Band 22, 34, 40, 41, 42, 44	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1				
CA_40C	E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 32, 33, 34, 38, 39, 41, 42, 43, 44, 65, 67	F <sub>DL_low</sub>		F <sub>DL high</sub>	-50	1				
CA_41C	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 42, 44, 65, 66	$F_{DL_{low}}$	-	$F_{DL\_high}$	-50	1				
CA_42C	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11, 18, 19, 20, 21, 25, 26, 27, 28, 31, 32, 33, 34, 38, 40, 41, 44, 65, 66, 67	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1				
	Frequency range	1884.5	-	1915.7	-41	0.3				
NOTE	Ed. EDI Javand EDI bish refer to each E LIDA for many sub-and an effect in Table E.S.A.									

NOTE 1: FDL\_low and FDL\_high refer to each E-UTRA frequency band specified in Table 5.5-1

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3, 4, [5] for the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval

NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 4: N/A

NOTE 5: N/A

NOTE 6: N/A

NOTE 7: N/A

NOTE 8: N/A

NOTE 9: N/A

NOTE 10: The requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

NOTE 11: N/A

NOTE 12: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

NOTE 13: N/A

NOTE 14: N/A

Spurious emission E-UTRA CA Protected band Frequency range **MBW** NOTE Maximum Configur (MHz) Level (MHz) ation (dBm) E-UTRA Band 2, 4, 5, 7, 10, 12, CA\_4A-13, 14, 17, 22, 23, 24, 25, 26, 27, -50 1  $F_{DL\_low}$ F<sub>DL\_high</sub> 28, 29, 30, 41, 43, 66 4A E-UTRA Band 42  $F_{DL\_low}$ F<sub>DL\_high</sub> -50

Table 6.6.3.2A-2: Requirements for intraband non-contiguous CA

F<sub>DL\_low</sub> and F<sub>DL\_high</sub> refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 1:

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd or 3rd harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2 or 3 for the 2nd or 3rd harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

#### 6.6.3.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

#### 6.6.3.3.1 Minimum requirement (network signalled value "NS 05")

When "NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band Channel bandwidth / Spectrum Measurement NOTE (MHz) emission limit (dBm) bandwidth 5 20 10 15 MHz MHz MHz MHz 1884.5 ≤ f ≤1915.7 -41 -41 -41 -41 300 KHz 1

Table 6.6.3.3.1-1: Additional requirements (PHS)

Table 6.6.3.3.1-2: Void

#### 6.6.3.3.2 Minimum requirement (network signalled value "NS 07")

When "NS 07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.2-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz	
769 ≤ f ≤ 775	-57	6.25 kHz
NOTE: The emissions measurement shall be sufficiently pow		er averaged to ensure
standard standard deviation < 0.5 dB.		

#### 6.6.3.3.3 Minimum requirement (network signalled value "NS\_08")

When "NS 08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.3-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.3-1: Additional requirement

Frequency band	Channel bandwidth / Spectrum emission limit (dBm)		Measurement bandwidth	
(MHz)	5MHz	10MHz	15MHz	
860 ≤ f ≤ 890	-40	-40	-40	1 MHz

#### 6.6.3.3.4 Minimum requirement (network signalled value "NS\_09")

When "NS 09" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.4-1: Additional requirement

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)		Measurement bandwidth	
	5MHz	10MHz	15MHz	
1475.9 ≤ f ≤ 1510.9	-35	-35	-35	1 MHz

NOTE 1: Void.

NOTE 2: To improve measurement accuracy, A-MPR values for NS\_09 specified in Table 6.2.4-1 in subclause 6.2.4 are derived based on 100 kHz RBW.

#### 6.6.3.3.5 Minimum requirement (network signalled value "NS\_12")

standard deviation < 0.5 dB.

When "NS 12" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.5-1: Additional requirements

Channel bandwidth / Spectrum emission limit (dBm)  1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz	Measurement bandwidth
-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower chan above 814.2 MHz.  NOTE 2: The emissions measurement shall be sufficiently power average.	
	Spectrum emission limit (dBm)  1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz  -42  ant applies for E-UTRA carriers with lower chan lHz.

#### 6.6.3.3.6 Minimum requirement (network signalled value "NS\_13")

When "NS 13" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.6-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.6-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	1.4, 3, 5 MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirer above 819 M	nnel edge at or	
NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		aged to ensure a

#### 6.6.3.3.7 Minimum requirement (network signalled value "NS\_14")

When "NS 14" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.7-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.7-1: Additional requirements

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
		10 MHz, 15 MHz	
806	≤ f ≤ 816	-42	6.25 kHz
NOTE 1:	NOTE 1: The requirement applies for E-UTRA carriers with lower chan above 824 MHz.		nnel edge at or
NOTE 2:	NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

### 6.6.3.3.8 Minimum requirement (network signalled value "NS\_15")

When "NS 15" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.8-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.8-1: Additional requirements

Frequency band	Channel bandwidth /	Measurement
(MHz)	Spectrum emission limit	bandwidth
	(dBm)	
	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz	
851 ≤ f ≤ 859	-53	6.25 kHz
NOTE 1: The emissions measurement shall be sufficiently power avera standard deviation < 0.5 dB.		aged to ensure a

#### 6.6.3.3.9 Minimum requirement (network signalled value "NS\_16")

When "NS\_16" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.9-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.9-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10 MHz	Measurement bandwidth	NOTE
790 ≤ f ≤ 803	-32	1 MHz	

#### 6.6.3.3.10 Minimum requirement (network signalled value "NS\_17")

When "NS\_17" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.10-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.10-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10 MHz	Measurement bandwidth	NOTE
470 ≤ f ≤ 710	-26.2	6 MHz	1
NOTE 1: Applicable when the assigned E-UTRA carrier is confined within 718 MHz			3 MHz
and 74	and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.		

#### 6.6.3.3.11 Minimum requirement (network signalled value "NS\_18")

When "NS\_18" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.11-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.11-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth	NOTE
692-698	-26.2	6 MHz	

#### 6.6.3.3.12 Minimum requirement (network signalled value "NS\_19")

When "NS\_19" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.12-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.12-1: Additional requirements

	Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 3, 5, 10, 15, 20 MHz	Measurement bandwidth	NOTE
ĺ	662 ≤ f ≤ 694	-25	8 MHz	

#### 6.6.3.3.13 Minimum requirement (network signalled value "NS\_11")

When "NS\_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.13-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.13-1: Additional requirements

Frequency band	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
(MHz)	1.4, 3, 5, 10, 15, 20 MHz	
E-UTRA Band 2	-50	1 MHz
1998 ≤ f ≤ 1999	-21	1 MHz
1997 ≤ f < 1998	-27	1 MHz
1996 ≤ f < 1997	-32	1 MHz
1995 ≤ f < 1996	-37	1 MHz
1990 ≤ f < 1995	-40	1 MHz

#### 6.6.3.3.14 Minimum requirement (network signalled value "NS\_20")

When "NS\_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.14-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.14-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth						
1990 ≤ f < 1999	-40	1 MHz						
1999 ≤ f ≤ 2000	-40	NOTE 1						
	NOTE 1: The measurement bandwidth is 1% of the applicable E-UTRA channel bandwidth.							

#### 6.6.3.3.15 Minimum requirement (network signalled value "NS\_21")

When "NS\_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.15-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.15-1: Additional requirements

Frequency band	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
(MHz)	5, 10 MHz	
2200 ≤ f < 2288	-40	1 MHz
2288 ≤ f < 2292	-37	1 MHz
2292 ≤ f < 2296	-31	1 MHz
2296 ≤ f < 2300	-25	1 MHz
2320 ≤ f < 2324	-25	1 MHz
2324 ≤ f < 2328	-31	1 MHz
2328 ≤ f < 2332	-37	1 MHz
2332 ≤ f ≤ 2395	-40	1 MHz

### 6.6.3.3.16 Minimum requirement (network signalled value "NS\_22")

When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.16-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.16-1: Additional requirement

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	MBW					
	5, 10, 15, 20 MHz						
3400 ≤ f ≤ 3800	-23 (NOTE 1, NOTE 3)	5 MHz					
	-40 (NOTE 2)	1 MHz					
NOTE 1: This requirer	nent applies within an offset between 5 MHz a	and 25 MHz					
from the low	er and from the upper edge of the channel band	dwidth,					
whenever the	se frequencies overlap with the specified frequencies	uency band.					
NOTE 2: This requirer	nent applies from 3400 MHz to 25 MHz below	the lower					
E-UTRA cha	E-UTRA channel edge and from 25 MHz above the upper E-UTRA						
channel edge to 3800 MHz.							
	n limit might imply risk of harmful interference to ed operating band	o UE(s) operating					

### 6.6.3.3.17 Minimum requirement (network signalled value "NS\_23")

When "NS 23" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.17-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.17-1: Additional requirement

	ency band MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	MBW		
3400	≤ f ≤ 3800	-23 (NOTE 1, NOTE 4)	5 MHz		
		-40 (NOTE 2)	1 MHz		
	NOTE 1: This requirement applies within an offset between 5 MHz + 25 MHz + F <sub>offset_NS_23</sub> from the lower and from the upper edg channel bandwidth, whenever these frequencies overlap wit frequency band.				
NOTE 2:	<ol> <li>This requirement applies from 3400 MHz to 25 MHz + F<sub>offset_NS_23</sub> below the lower E-UTRA channel edge and from 25 MHz + F<sub>offset_NS_23</sub> above the upper E-UTRA channel edge to 3800 MHz.</li> </ol>				
	Foffset_NS_23 is: 0 MHz for 5 M 5 MHz for 10 9 MHz for 15 12 MHz for 20 This emission		e to UE(s)		

#### 6.6.3.3.18 Void

Table 6.6.3.3.18-1: Void

### 6.6.3.3.19 Minimum requirement (network signalled value "NS\_04")

When "NS 04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.19-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.19-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth
2490.5 ≤ f < 2496	-13	1 MHz
0 < f < 2490.5	-25	1 MHz

#### 6.6.3.3.20 Minimum requirement (network signalled value "NS\_24")

When "NS\_24" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.20-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.20-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5 MHz, 10 MHz, 15 MHz, 20 MHz	Measurement bandwidth			
Band 34	-50	MHz			
NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.					

### 6.6.3.3.21 Minimum requirement (network signalled value "NS\_25")

When "NS\_25" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.21-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.21-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5 MHz, 10 MHz, 15 MHz, 20 MHz	Measurement bandwidth			
Band 34	-40	MHz			
NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from					

NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.

### 6.6.3.3.22 Minimum requirement (network signalled value "NS\_26")

When "NS\_26" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.22-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.22-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit	Measurement bandwidth
(111112)	(dBm)	Danawidin
	5 MHz, 10 MHz, 15 MHz	
686 ≤ f ≤ 694	-25	8MHz

### 6.6.3.3A Additional spurious emissions for CA

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell reconfiguration message.

NOTE:

For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

#### 6.6.3.3A.1 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_01")

When "CA\_NS\_01" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.1-1: Additional requirements (PHS)

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE		
E-UTRA band 34	FDL_low	-	FDL_high	-50	1			
Frequency range	1884.5	-	1915.7	-41	0.3	1		
NOTE 1: Applicable v	1 7 0 100.00							

#### 6.6.3.3A.2 Minimum requirement for CA 1C (network signalled value "CA NS 02")

When "CA\_NS\_02" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.2-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	
Frequency range	1900	•	1915	-15.5	5	1, 2
Frequency range	1915	-	1920	+1.6	5	1, 2

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

#### 6.6.3.3A.3 Minimum requirement for CA 1C (network signalled value "CA NS 03")

When "CA\_NS\_03" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.3-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Protected band	Frequenc	cy ra	nge (MHz)	Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34	$F_{DL_{low}}$	ı	F <sub>DL_high</sub>	-50	1	
Frequency range	1880	ı	1895	-40	1	
Frequency range	1895	-	1915	-15.5	5	1, 2
Frequency range	1915	-	1920	+1.6	5	1, 2

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

### 6.6.3.3A.4 Minimum requirement for CA\_38C (network signalled value "CA\_NS\_05")

When "CA\_NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth. This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570 - 2615 MHz.

Table 6.6.3.3A.4-1: Additional requirements

Protected band	Frequenc	y rar	nge (MHz)	Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2620	-	2645	-15.5	5	1, 2, 3
Frequency range	2645	-	2690	-40	1	1, 3

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

NOTE 3: This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570-2615 MHz.

#### 6.6.3.3A.5 Minimum requirement for CA\_7C (network signalled value "CA\_NS\_06")

When "CA\_NS\_06" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.5-1: Additional requirements

Protected band	Frequenc	Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2570	-	2575	+1.6	5	1, 2
Frequency range	2575	-	2595	-15.5	5	1, 2
Frequency range	2595	-	2620	-40	1	

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

# 6.6.3.3A.6 Minimum requirement for CA\_39C and CA\_39C-41A (network signalled value "CA\_NS\_07")

When "CA\_NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.6-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.6-1: Additional requirements

Protected band	Frequency range (MHz)		ge (MHz)	Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	1805	•	1855	[-40]	1	1
Frequency range	1855	-	1880	[-15.5]	5	1, 2, 3
NOTE 1: This requ	NOTE 1: This requirement is applicable for carriers with aggregated channel bandwidths confined					confined
in 1885-1920 MHz.						
NOTE 2: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in						

Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth. NOTE 3: For these adjacent bands, the emission limit could imply risk of harmful interference to

UE(s) operating in the protected operating band.

#### 6.6.3.3A.7 Minimum requirement for CA\_42C (network signalled value "CA\_NS\_08")

When "CA\_NS\_08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.7-1. This requirement also applies for the frequency ranges that are less than F<sub>OOB</sub> (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.6-1: Additional requirements

Protected band	Frequency range (MHz)		nge (MHz)	Maximum Level (dBm)	MBW (MHz)
43	$F_{DL_{low}}$	-	F <sub>DL_high</sub>	[-50]	1
NOTE: The [-50] dBm/MHz in 6.6.3.3A.6-1 is for unsynchronized operation. To meet these					
requirements some re	requirements some restriction will be needed for either the operating band or protected band.				

#### 6.6.3A Void

<reserved for future use>

#### 6.6.3B Spurious emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.3 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-1.

For single-antenna port scheme, the general requirements in subclause 6.6.3 apply.

#### 6.6.3C Void

<reserved for future use>

#### 6.6.3D Spurious emission for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.6.3 apply.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE co-existence requirements in Table 6.6.3.2A-0 in subclause 6.6.3.2A apply as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

#### 6.6.3F Spurious emission for category NB1

When UE is configured for category NB1 uplink transmissions the requirements in subclause 6.6.3 apply with an exception that boundary between category NB1 out of band and spurious emission domain shall be F<sub>OOB</sub> = 1.7 MHz. 6.6A Void

6.6B Void

### 6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

## 6.7.1 Minimum requirement

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through E-UTRA rectangular filter with measurement bandwidth shown in Table 6.7.1-1.

The requirement of transmitting intermodulation is prescribed in Table 6.7.1-1.

BW Channel (UL) 5MHz 10MHz 15MHz 20MHz Interference Signal 10MHz 5MHz 10MHz 20MHz 15MHz 30MHz 20MHz 40MHz Frequency Offset Interference CW Signal -40dBc Level Intermodulation Product -29dBc -35dBc -29dBc -35dBc -29dBc -35dBc -29dBc -35dBc Measurement bandwidth 4.5MHz 4.5MHz 9.0MHz 9.0MHz 13.5MHz 13.5MHz 18MHz 18MHz

**Table 6.7.1-1: Transmit Intermodulation** 

## 6.7.1A Minimum requirement for CA

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product on both component carriers when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1A-1.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the requirement is specified in Table 6.7.1-1 which shall apply on each component carrier with both component carriers active.

For intra-band contiguous carrier aggregation the requirement of transmitting intermodulation is specified in Table 6.7.1A-1.

Table 6.7.1A-1: Transmit Intermodulation

CA bandwidth class(UL)	Ва	and C	
Interference Signal Frequency Offset	BW <sub>Channel_CA</sub>	2*BW <sub>Channel_CA</sub>	
Interference CW Signal Level	-40dBc		
Intermodulation Product	-29dBc	-35dBc	
Measurement bandwidth	BW <sub>Channel_</sub>	<sub>CA</sub> - 2* BW <sub>GB</sub>	

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band) transmit intermodulations is defined as follows. For the E-UTRA band supporting one component carrier the requirement specified in Table 6.7.1-1 apply. For the E-UTRA band supporting two contiguous component carriers the requirements specified in Table 6.7.1A-1 apply.

### 6.7.1B Minimum requirement for UL-MIMO

For UE supporting UL-MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.7.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.7.1 apply.

## 6.7.1F Minimum requirement for category NB1

The UE category NB1 transmitter intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product as defined in Table 6.7.1F-1 when an interfering CW signal is added at a level below the wanted signal at the transmitter antenna port. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1F-1.

Table 6.7.1F-1: UE category NB1 transmitter IM requirement

Parameters for transmitter intermodulation			
BW Channel (UL)	15 kHz	(1 tone)	
Interference Signal Frequency Offset	180 kHz	360 kHz	
Interference CW Signal Level	-40dBc		
Intermodulation Product	-20 dBc	-39 dBc	
Measurement bandwidth	180 kHz	180 kHz	

- 6.8 Void
- 6.8.1 Void
- 6.8A Void

## 6.8B Time alignment error for UL-MIMO

For UE(s) with multiple transmit antenna connectors supporting UL-MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

### 6.8B.1 Minimum Requirements

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

## 7 Receiver characteristics

### 7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sections below.

With the exception of subclause 7.3, the requirements shall be verified with the network signalling value NS\_01 configured (Table 6.2.4-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks, an in-gap test refers to the case when the interfering signal is located at a negative offset with respect to the assigned lowest channel frequency of the highest sub-block and located at a positive offset with respect to the assigned highest channel frequency of the lowest sub-block.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks, an out-of-gap test refers to the case when the interfering signal(s) is (are) located at a positive offset with respect to the assigned channel frequency of the highest carrier frequency, or located at a negative offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks with channel bandwidth larger than or equal to 5 MHz, the existing adjacent channel selectivity requirements, in-band blocking requirements (for each case), and narrow band blocking requirements apply for in-gap tests only if the corresponding interferer frequency offsets with respect to the two measured carriers satisfy the following condition in relation to the sub-block gap size  $W_{gap}$  for at least one of these carriers j=1,2, so that the interferer frequency position does not change the nature of the core requirement tested:

 $Wgap \ge 2 \cdot |FInterferer (offset)_{ij}| - BWChannel(_{i})$ 

where  $F_{Interferer\ (offset),j}$  for a sub-block with a single component carrier is the interferer frequency offset with respect to carrier j as specified in subclause 7.5.1, subclause 7.6.1 and subclause 7.6.3 for the respective requirement and  $BW_{Channel(j)}$  the channel bandwidth of carrier j.  $F_{Interferer\ (offset),j}$  for a sub-block with two or more contiguous component carriers is the interference frequency offset with respect to the carrier adjacent to the gap is specified in subclause 7.5.1A, 7.6.1A and 7.6.3A. The interferer frequency offsets for adjacent channel selectivity, each in-band blocking case and narrow- band blocking shall be tested separately with a single in-gap interferer at a time.

For a ProSe UE that supports both ProSe Direct Discovery and ProSe Direct Communication, the receiver characteristics specified in clause 7 for ProSe Direct Communication shall apply.

For ProSe Direct Discovery and ProSe Direct Communication on E-UTRA ProSe operating bands that correspond to TDD E-UTRA operating bands as specified in subclause 5.5D, the only additional requirement for ProSe specified in subclause 7.4.1D is applicable.

## 7.2 Diversity characteristics

The requirements in Section 7 assume that the receiver is equipped with two Rx port as a baseline. These requirements apply to all UE categories unless stated otherwise. Additional requirements apply for UE(s) equipped with four Rx ports. These additional requirements also apply for supported band combinations for which the UE can operate using up to four Rx ports while configured with carrier aggregation. With the exception of subclause 7.9 all requirements shall be verified by using both (all) antenna ports simultaneously.

NOTE: for an operating band in which the UE can operate using up to four Rx ports, it suffices to verify for conformance the additional requirements applicable for four Rx ports [except for REFSENS].

NOTE: Implementation of 4 antenna ports for all operating bands supported by the UE is not mandated.

For a category 0, a category [M 1] and category NB1 UE the requirements in Section 7 assume that the receiver is equipped with single Rx port.

## 7.3 Reference sensitivity power level

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories except category 0 and category [M1], or to the single antenna port for UE category 0 and UE category [M1], at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

## 7.3.1 Minimum requirements (QPSK)

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2

Table 7.3.1-1: Reference sensitivity QPSK PREFSENS

		Ch	annel bar	ndwidth			
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1			-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6			-100	-97			FDD
7			-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD
9			-99	-96	-94.2	-93	FDD
10			-100	-97	-95.2	-94	FDD
11			-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14			-97	-94			FDD
17			-97	-94			FDD
18			-100 <sup>7</sup>	-97 <sup>7</sup>	-95.2 <sup>7</sup>		FDD
19			-100	-97	-95.2		FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97	-95.2	-94	FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
26	-102.7	-99.7	-97.5 <sup>6</sup>	-94.5 <sup>6</sup>	-92.7 <sup>6</sup>		FDD
27	-103.2	-100.2	-98	-95			FDD
28		-100.2	-98.5	-95.5	-93.7	-91	FDD
30			-99	-96			FDD
31	-99.0	-95.7	-93.5				FDD
33			-100	-97	-95.2	-94	TDD
34			-100	-97	-95.2	_	TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37	100.2	102.2	-100	-97	-95.2	-94	TDD
38			-100	-97	-95.2	-94	TDD
39			-100	-97	-95.2	-94	TDD
40			-100	-97	-95.2	-94	TDD
41			-98	-95	-93.2	-92	TDD
42			-99	-96	-94.2	-93	TDD
43			-99	-96 -96	-94.2	-93	TDD
43		[_100 2]	[-98]		[-93.2]	[-92]	
		[-100.2]		[-95]			TDD
45			-100	-97	-95.2	-94	TDD
 GE			00.5	06.5	04.7	02.5	רטי
65	4040	404.0	-99.5	-96.5	-94.7	-93.5	FDD
66	-104.2	-101.2	-99.5	-96.5	-94.7	-93.5	FDD
68		1 11 1	-98.5	-95.5	-93.7	0.0.5	FDD

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5 NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

The signal power is specified per port

NOTE 4: For the UE which supports both Band 3 and Band 9 the reference sensitivity

NOTE 5: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

<sup>6</sup> indicates that the requirement is modified by -0.5 dB when the carrier NOTE 6: frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.

NOTE 7: For a UE that support both Band 18 and Band 26, the reference sensitivity level

for Band 26 applies for the applicable channel bandwidths.

For UE(s) equipped with 4 antenna ports the following additional requirements apply. The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1a and Table 7.3.1-2.

Table 7.3.1-1a: Reference sensitivity QPSK PREFSENS

	Channel bandwidth						
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1			-102.7	-99.7	-97.9	-96.7	FDD
2	[-105.4]	[-102.4]	[-100.7]	[-97.7]	[-95.9]	[-94.7]	FDD
3	[-104.4]	[-101.4]	[-99.7]	[-96.7]	[-94.9]	[-93.7]	
7			[-100.7]	[-97.7]	[-95.9]	[-94.7]	FDD
20			[-99.7]	[-96.7]	[-93.9]	[-92.7]	FDD
39			[-102.7]	[-99.7]	[-97.9]	[-96.7]	TDD
41			[-100.7]	[-97.7]	[-95.9]	[-94.7]	TDD
42			[-101.2]	[-98.2]	[-96.4]	[-95.2]	TDD

NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

The signal power is specified per port

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1-1 (two antenna ports) and Table 7.3.1-1a (four antenna ports) shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1-2.

Table 7.3.1-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative). For the UE which supports inter-band carrier aggregation configuration with the uplink in one or two E-UTRA bands, the minimum requirement for reference sensitivity in Table 7.3.1-1 and Table 7.3.1-1a shall be increased by the amount given in  $\Delta R_{IB,c}$  in Table 7.3.1-1A, Table 7.3.1-1B and Table 7.3.1-1C for the applicable E-UTRA bands.

Table 7.3.1-1A: ΔR<sub>IB,c</sub> (two bands)

Inter-band CA Configuration	E-UTRA Band	ΔR <sub>IB,c</sub> [dB]
CA_1A-3A	1 3	0
CA_1A-3C	1	0
	<u>3</u> 1	0 0
CA_1A-5A	5	0
CA_1A-7A	<u> </u>	0 0
CA_1A-7C	<u>1</u> 7	0
CA_1A-8A	1	0
	<u>8</u> 1	0 0
CA_1A-11A	11	0
CA_1A-18A	1 18	0 0
CA_1A-19A	<u>1</u> 19	0 0
CA_1A-20A	1	0
	20 1	0 0
CA_1A-21A	21 1	0
CA_1A-26A	26	0
CA_1A-28A	<u>1</u>	0 0.2
CA_1A-40A	1	0
CA_1A-41A <sup>8</sup>	<u>40</u> 1	0 0
	<u>41</u> 1	0
CA_1A-41C <sup>8</sup>	41	0
CA_1A-42A	<u>1</u> 42	0 0.5
CA_1A-42C	1	0
CA_2A-4A	42 2	0.5 0.3
	<u>4</u> 2	0.3 0.3
CA_2A-2A-4A	4	0.3
CA_2A-4A-4A	<u>2</u> 4	0.3 0.3
CA_2A-2A-4A- 4A	2 4	0.3 0.3
CA_2A-5A	2	0
	5 2	0 0
CA_2A-2A-5A	5	0
CA_2C-5A	<u>2</u> 5	0 0
CA_2A-7A	2 7	0
CA_2A-12A	2	0
	12 2	0 0
CA_2A-2A-12A	12 2	0
CA_2A-2A-12B	12	0
CA_2A-12B	<u>2</u> 12	0 0
CA_2C-12A	2	0

	10	0
	12	0
CA_2A-13A	2	0
	13 2	0
CA_2A-2A-13A		
<del>-</del>	13	0
CA_2A-17A	2	0
- <del>-</del>	17	0.5
CA_2A_28A	2	0
	28	0
CA_2A-30A	2	0.4
071_271 0071	30	0.5
CA_2C-30A	2	0.4
UA_2U-3UA	30	0.5
CA_3A-5A	3	0
CA_SA-SA	5	0
04 00 54	3	0
CA_3C-5A	5	0
	3	0
CA_3A-7A	7	0
	3	0
CA_3A-7B	7	0
CA_3A-7C	<u>3</u>	0
		0
CA_3C-7A	3	0
	7	0
CA_3C-7C	3	0
0/(_00 / 0	7	0
CA_3A-8A	3	0
OA_3A-0A	8	0
CA 2A 2A 0A	3	0
CA_3A-3A-8A	8	0
04 04 404	3	0
CA_3A-19A	19	0
	3	0
CA_3A-20A	20	0
	3	0
CA_3A-26A	26	0
CA_3A-27A	3	0
	27	0
CA_3A-28A	3	0
	28	0
CA_3C-28A	3	0
O/1_00 20/1	28	0
CA_3A-31A	3	0
UA_3A-31A	31	0.2
CV 3V 30V	3	0
CA_3A-38A	38	0
CA 2A 42A	3	0
CA_3A-40A	40	0
04 24 22 2	3	0
CA_3A-40C	40	0
	3	0
CA_3A-41A		010
OA_3A-+1A	41	0.5 <sup>11</sup>
	3	
CA_3A-41C	ა	0 0 <sup>10</sup>
	41	U 1
		0.5 <sup>11</sup>
CA_3A-42A	3	0.2
O. (_O. ( 12.) (	42	0.5
CA_3A-42C	3	0.2
UA_3A-42U	42	0.5
CA 4A 5A	4	0
CA_4A-5A	5	0
<b>0.1</b> = :	4	0
CA_4A-4A-5A	5	0
	v	•

	4	0.5
CA_4A-7A	7	0.5
	4	0.5
CA_4A-4A-7A	7	0.5
	4	0.3
CA_4A-12A	12	0.5
	4	0.5
CA_4A-12B	12	
		0.5
CA_4A-4A-12A	4	0
	12	0.5
CA_4A-13A	4	0
	13	0
CA_4A-4A-13A	4	0
_	13	0
CA_4A-17A	4	0
	17	0.5
CA_4A-27A	4	0
	27	0
CA_4A-28A	4	0
O/\_1/\ 20/\	28	0.2
CA_4A-30A	4	0.4
U/\_ <del>1</del> /\-30/\	30	0.5
CA_4A-4A-30A	4	0.4
UA_+A-4A-3UA	30	0.5
CA 5A 7A	5	0
CA_5A-7A	7	0
00 50 400	5	0.5
CA_5A-12A	12	0.3
04 54 405	5	0.5
CA_5A-12B	12	0.3
04 54 404	5	0
CA_5A-13A	13	0
	5	0.5
CA_5A-17A	17	0.3
	5	0
CA_5A-25A	25	0
	5	0
CA_5A-30A	30	0
	5	0
CA_5A-38A	38	0
	5	0
CA_5A-40A	40	0
	5	0
CA_5A-40C	40	
		<u> </u>
CA_7A-8A	7	
	8 7	0.2
CA_7A-12A		0
	12	0
CA_7A-20A	7	0
	20	0
CA_7A-22A	7	0
_	22	0.5
CA_7A-28A	7	0
	28	0
CA_7B-28A	7	0
	28	0
CA_7C-28A	7	0
5/\_/ 0-20/\	28	0
CA_7A-40A	7	0
U / A-40A	40	0.5
CA_7A-40C	7	0
UA_1A-40U	40	0.5
CA 7A 40A	7	0
CA_7A-42A	42	0.5
CA_7A-42A-	7	0
	1	-

42A	42	0.5
CA_8A-11A	8	0
	11	0
CA_8A-20A	8	0
	20	0
CA_8A-40A	8	0
OA_0A-+0A	40	0
CA_8A-41A	8	0
CA_0A-41A	41	0
CA 0A 44C	8	0
CA_8A-41C	41	0
04 04 404	8	0.2
CA_8A-42A	42	0.5
04 04 400	8	0.2
CA_8A-42C	42	0.5
	11	0
CA_11A-18A	18	0
	12	0
CA_12A-25A		0
	25	
CA_12A-30A	12	0
-	30	0
CA_18A-28A <sup>9</sup>	18	0
	28	0
CA_19A-21A	19	0
ON_10A-21A	21	0
CA_19A-28A <sup>9</sup>	19	0
CA_19A-20A	28	0
04 404 404	19	0
CA_19A-42A	42	0.5
01 101 100	19	0
CA_19A-42C	42	0.5
	20	0
CA_20A-31A	31	0
CA_20A-38A	20	0
	38 20	0
CA_20A-40A		0
	40	0
CA_20A-42A	20	0
	42	0.5
CA_20A-42A-	20	0
42A	42	0.5
CA_21A-42A	21	0
UA_21A-42A	42	0.5
CA_21A-42C	21	0
CA_21A-42C	42	0.5
OA 054 004	25	0
CA_25A-26A	26	0
04 0548	25	0
CA_25A-41A <sup>8</sup>	41	0
	25	0
CA_25A-41C <sup>8</sup>	41	0
	25	0
CA_25A-41D <sup>8</sup>	41	0
CA_26A-41A	26	0
	41	0
CA_26A-41C	26	0
	41	0
CA_28A-40A	28	0
5. <u>L</u> 20. ( 40. (	40	0
CA_28A-40C	28	0
OA_20A-400	40	0
CV 36V 40D	28	0
CA_28A-40D	40	0
CA 20A 44A	28	0
CA_28A-41A	41	0
		<u> </u>

04 004 440	28	0
CA_28A-41C	41	0
CA 20A 42A	28	0.2
CA_28A-42A	42	0.5
CA 28A 42C	28	0.2
CA_28A-42C	42	0.5
CA 20A 40A	38	0.54
CA_38A-40A	40	$0.5^{4}$
CA_38A-40A-	38	0.54
40A	40	0.54
CA_38A-40C	38	0.54
CA_36A-40C	40	0.54
CA_39A-41A	39	0.24
CA_39A-41A	41	0.24
CA 20A 41A	39	0.27
CA_39A-41A	41	0.27
CA 30A 41C	39	0.24
CA_39A-41C	41	0.24
CA 30A 41C	39	0.27
CA_39A-41C	41	0.2'
CA 20A 44D	39	0.24
CA_39A-41D	41	0.24
CA 39C-41A	39	0.24
CA_39C-41A	41	0.24
CA 20C 44A	39	0.27
CA_39C-41A	41	0.2
CA 20C 44C	39	0.24
CA_39C-41C	41	0.24
CA 44A 42A	41	0.44
CA_41A-42A	42	0.54
CA 44A 42C	41	0.44
CA_41A-42C	42	0.54
CA 41C 42A	41	0.44
CA_41C-42A	42	0.54
CA 41C 42C	41	0.44
CA_41C-42C	42	0.54
CA_42A-46A	42	[0]

- NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 2: The above additional tolerances also apply in intra-band and non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 3: In case the UE supports more than one of the above 2DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 2DL inter-band carrier aggregation configurations then:
  - When the E-UTRA operating band frequency range is ≤ 1GHz, the applicable additional tolerance shall be the average of the 2DL tolerances in Table 7.3.1-1A, truncated to one decimal place that would apply for that operating band among the supported 2DL CA configurations. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 2DL carrier aggregation configurations involving such band shall be applied
  - When the E-UTRA operating band frequency range is >1GHz, the applicable additional tolerance shall be the maximum 2DL tolerance in Table 7.3.1-1A that would apply for that operating band among the supported 2DL CA configurations
- NOTE 4: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 5: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
  - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances

- are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
- When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 6: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 7: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx.
- NOTE 8: Only applicable for UE supporting inter-band carrier aggregation with the uplink active in the FDD band.
- NOTE 9: For Band 28, the requirements only apply for the restricted frequency range specified for this CA configuration (Table 5.5A-2).
- NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.
- NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz.

Table 7.3.1-1B:  $\Delta R_{IB,c}$  (three bands)

Inter-band CA Configuration	E-UTRA Band	$\Delta R_{IB,c}$ [dB]
	1	0
CA_1A-3A-5A	3	0
	5	0
	1	0
CA_1A-3A-7A	3	0
	7	0
	1	0
CA_1A-3A-7C	3	0
	7	0
	1	0
CA_1A-3A-8A	3	0
	8	0
	1	0
CA_1A-3A-19A	3	0
	19	0
-	1	0
CA_1A-3A-20A	3	0
	20	0
	1	0
CA_1A-3A-26A	3	0
	26	0
-	1	0
CA_1A-3A-28A	3	0
	28	0.2
CA 1A 2A 10A	1	0
CA_1A-3A-40A	3	0
	40	0
OA 4A OA 4OA	1	0.2
CA_1A-3A-42A	3	0.2
	42	0.5
CA_1A-3A-42C	3	0.2 0.2
CA_1A-3A-42C	42	0.5
	1	0.5
CA_1A-5A-7A	5	0
CA_1A-3A-7A	7	0
	1	0
CA_1A-5A-40A	5	0
CA_1A-3A-40A	40	0
	1	0
CA_1A-7A-8A	7	0
CA_1A-7A-6A	8	0.2
	1	0
CA_1A-7A-20A	7	0
J	20	0
	1	0
CA_1A-7A-28A	7	0
	28	0.2
	1	0
CA_1A-7C-28A	7	0
J. 1. 1 J 2011	28	0.2
	1	0.2
CA_1A-8A-11A	8	0
J	11	0
	1	0
CA_1A-8A-40A	8	0
5	40	0
	1	0
CA_1A-11A-18A	11	0
5	18	0
CA_1A-18A-28A	1	0
2	•	<b>~</b>

	18	0
	28	0
	1	0
CA_1A-19A-21A	19	0
	21	0
	1	0
CA_1A-19A-28A	19	0
	28	0
	1	0
	<u> </u>	•
CA_1A-19A-42A	19	0
	42	0.5
	1	0
0.4 4.4 4.0 4.0 0		
CA_1A-19A-42C	19	0
	42	0.5
	1	0
00 40 040 400		
CA_1A-21A-42A	21	0
	42	0.5
	1	0
00 40 040 400		
CA_1A-21A-42C	21	0
	42	0.5
	2	0.3
CA 2A CA 4A 4CA		
CA_2A-2A-4A-12A	4	0.3
	12	0.5
	2	0.3
CA 2A 4A 5A		
CA_2A-4A-5A	4	0.3
	5	0
	2	0.3
CA 2A 2A 4A 5A		
CA_2A-2A-4A-5A	4	0.3
	5	0
	2	0.3
CA 2A 4A 4A 5A		
CA_2A-4A-4A-5A	4	0.3
	5	0
	2	0.3
CA_2A-4A-7A	4	0.5
CA_2A-4A-7A		
	7	0.5
	2	0.3
CA_2A-4A-12A	4	0.3
UA_2A-4A-12A		
	12	0.5
	2	0.3
CA_2A-4A-4A-12A	4	0.3
	 12	0.5
	2	0.3
CA_2A-4A-13A	4	0.3
_	13	0
	2	0.4
CA_2A-4A-30A	4	0.4
	30	0.5
+		
	2	0
CA_2A-5A-12A	5	0.5
	12	0.3
O4 04 61 71 /71	2	0.3
CA_2A-2A-5A-12A	5	0.5
	12	0.3
	2	0
04 04 54 105		_
CA_2A-5A-12B	5	0.5
	12	0.3
	2	0
CA 2A 5A 42A		
CA_2A-5A-13A	5	0
	13	0
	2	0.4
04 04 54 004		
CA_2A-5A-30A	5	0
1	30	0.5
	2	0.4
CA 2C 5A 2CA		
CA_2C-5A-30A	5	0
	30	0.5

CA_2A-7A-12A         7         0           CA_2A-12A-30A         12         0           2         0.4           2         0.4           30         0.5           2         0.4           CA_2C-12A-30A         12         0           30         0.5           1         0         0           CA_3A-5A-40A         5         0           40         0         0           CA_3A-7A-8A         7         0           CA_3A-7A-8A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7A-3BA         7         0           CA_3A-7A-3BA         7         0           CA_3A	CA_2A-7A-12A         7         0           CA_2A-12A-30A         12         0           CA_2C-12A-30A         12         0           CA_2C-12A-30A         12         0           CA_3A-5A-40A         12         0           CA_3A-5A-40A         5         0           CA_3A-7A-8A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-28A-40A<			-
12	12		2	0
CA_2A-12A-30A	CA_2A-12A-30A         2         0.4           12         0         30         0.5           CA_2C-12A-30A         12         0           12         0         0           30         0.5         0           1         0         0           CA_3A-5A-40A         5         0           CA_3A-7A-8A         7         0           CA_3A-7A-8A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3A-7A-28A         7         0           CA_3A-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19 <td>CA_2A-7A-12A</td> <td></td> <td></td>	CA_2A-7A-12A		
CA_2A-12A-30A	CA_2A-12A-30A         12         0           30         0.5           2         0.4           2         0.4           30         0.5           1         0           CA_3A-5A-40A         5           0         0 </td <td></td> <td></td> <td></td>			
CA_2C-12A-30A	30		2	0.4
CA_2C-12A-30A	CA_2C-12A-30A	CA_2A-12A-30A	12	0
CA_2C-12A-30A	CA_2C-12A-30A		30	0.5
CA 2C-12A-30A	CA_2C-12A-30A         12         0           30         0.5           1         0         0           CA_3A-5A-40A         5         0           40         0         0           CA_3A-7A-8A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         20         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7C-28A         7         0			
CA_3A-5A-40A	30	CA 2C-12A-30A		
CA_3A-5A-40A         1         0           5         0           40         0           3         0           CA_3A-7A-8A         7         0           CA_3A-7A-20A         7         0           20         0         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-2BA         7 <td>CA_3A-5A-40A         1         0           S         0           40         0           3         0           CA_3A-7A-8A         7           0         0           CA_3A-7A-20A         7           0         0           CA_3A-7A-28A         7           0         0           CA_3A-7C-28A         7           0         0           3         0           CA_3A-7C-28A         7           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           3         0           0         0           3         0           0         0           0         0           0         0           0         0           0         0           0         0</td> <td>0/(_20 12/( 00/(</td> <td></td> <td></td>	CA_3A-5A-40A         1         0           S         0           40         0           3         0           CA_3A-7A-8A         7           0         0           CA_3A-7A-20A         7           0         0           CA_3A-7A-28A         7           0         0           CA_3A-7C-28A         7           0         0           3         0           CA_3A-7C-28A         7           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           3         0           0         0           3         0           0         0           0         0           0         0           0         0           0         0           0         0	0/(_20 12/( 00/(		
CA_3A-5A-40A         5         0           40         0         0           3         0         0           CA_3A-7A-8A         7         0           8         0.2         3           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-3BA         3         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           42         0.5	CA_3A-5A-40A         5         0           40         0         0           3         0         0           CA_3A-7A-8A         7         0           8         0.2         0           3         0         0           CA_3A-7A-20A         7         0           20         0         0           CA_3A-7A-28A         7         0           28         0         0           3         0         0           CA_3A-7C-28A         7         0           28         0         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A			
CA_3A-7A-8A	CA_3A-7A-8A	04 04 54 404	•	
CA_3A-7A-8A         3         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A	CA_3A-7A-8A         3         0           CA_3A-7A-20A         7         0           CA_3A-7A-20A         7         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A	CA_3A-5A-40A		
CA_3A-7A-8A         7         0           8         0.2           3         0           CA_3A-7A-20A         7         0           20         0           3         0         0           CA_3A-7A-28A         7         0           28         0         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           28         0         0           CA_3C-7C-28A         7         0           28         0         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           3         0         0           CA_3C-7C-28A         7         0           3         0         0           28         0         0           3         0         0           CA_3A-7A-38A         7         0           3         0         0           28         0         0           40         0         0           CA_3A-8A-40A         8         0 <t< td=""><td>CA_3A-7A-8A         7         0           8         0.2           3         0           CA_3A-7A-20A         7         0           20         0           3         0           CA_3A-7A-28A         7         0           28         0           CA_3A-7C-28A         7         0           28         0         0           CA_3C-7A-28A         7         0           28         0         0           CA_3C-7C-28A         7         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           3         0         0           28         0         0           33         0         0           28         0         0           3         0         0           2A_3A-8A-40A         8         0           42         0.5         0</td><td></td><td></td><td></td></t<>	CA_3A-7A-8A         7         0           8         0.2           3         0           CA_3A-7A-20A         7         0           20         0           3         0           CA_3A-7A-28A         7         0           28         0           CA_3A-7C-28A         7         0           28         0         0           CA_3C-7A-28A         7         0           28         0         0           CA_3C-7C-28A         7         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           3         0         0           28         0         0           33         0         0           28         0         0           3         0         0           2A_3A-8A-40A         8         0           42         0.5         0			
B         0.2           3         0           CA_3A-7A-20A         7           0         0           CA_3A-7A-28A         7           0         0           CA_3A-7C-28A         7           0         0           CA_3A-7C-28A         7           0         0           CA_3C-7A-28A         7           0         0           CA_3C-7C-28A         7           0         0           CA_3C-7C-28A         7           0         0           CA_3C-7C-28A         7           0         0           CA_3A-7A-38A         7           0         0           CA_3A-7A-38A         7           0         0           CA_3A-8A-40A         8           0         0           0         3           0         0           0         3           0         0           0         0           0         0           0         0           0         0           0         0           0	B         0.2           3         0           CA_3A-7A-20A         7           20         0           CA_3A-7A-28A         7           0         0           28         0           3         0           CA_3A-7C-28A         7           0         3           CA_3C-7A-28A         7           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         3           0         0           3         0           0         3           0         0           3         0           0         0           3         0           0         0           3         0			
CA_3A-7A-20A         3         0           CA_3A-7A-28A         7         0           CA_3A-7A-28A         7         0           28         0         3           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-2C-2C-3         3	CA_3A-7A-20A	CA_3A-7A-8A	7	0
CA_3A-7A-20A         3         0           CA_3A-7A-28A         7         0           CA_3A-7A-28A         7         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3	CA_3A-7A-20A		8	0.2
CA_3A-7A-20A         7         0           20         0           3         0           CA_3A-7A-28A         7         0           28         0           3         0           CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           0         38         0.2           3         0         0           0         3         0.2           0         3         0.2           0         42         0.5           3         0.2         0.5           3         0         0.2           0         42         0	CA_3A-7A-20A         7         0           20         0         0           3         0         0           CA_3A-7A-28A         7         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           28         0         0           3         0         0           28         0         0           23         0         0           24         0.5         0           3         0.2         0           24         0.5         0           3         0.2         0           24         0.5         0			0
20	CA_3A-7A-28A	CA 3A-7A-20A		_
CA_3A-7A-28A         3         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-2A-28A-40A         8         0.2           CA_3C-2A-2A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-28A-40A         28         0           CA_3A-28A	CA_3A-7A-28A         3         0           CA_3A-7C-28A         7         0           CA_3A-7C-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-28A-40C         28         0	O/(_0/( //( 20/(		
CA_3A-7A-28A         7         0           28         0           3         0           CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           CA_3C-7C-28A         7         0           28         0           CA_3C-7C-28A         7         0           28         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2           CA_3A-19A-42A         19         0           42         0.5           3         0.2           CA_3A-19A-42C         19         0           42         0.5           3         0.2           CA_3A-28A-40A         28         0           40         0           CA_3A-28A-40C         28         0	CA_3A-7A-28A         7         0           28         0           3         0           CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A-7A-38A         7         0           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2           CA_3A-19A-42A         19         0           42         0.5           3         0.2           CA_3A-19A-42C         19         0           42         0.5           3         0.2           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0			
28         0           3         0           CA_3A-7C-28A         7           0         28           0         0           28         0           28         0           0         3           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           28         0           0         0           3         0           0         0           3         0           0         0           3         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0	CA_3A-7C-28A			
CA_3A-7C-28A         3         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0'70.5's           CA_4A-5A-12A         41         0'70.5's           CA_4A-5A-12A         5         0.5           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A         5         0           CA_4A-5A-13A         5         0           CA_4A-5A-30A         5         0	CA_3A-7C-28A         3         0           CA_3C-7A-28A         7         0           CA_3C-7A-28A         7         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0.5           CA_3A-41A-5A-12A         5         0.5 <tr< td=""><td>CA_3A-7A-28A</td><td></td><td></td></tr<>	CA_3A-7A-28A		
CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           40         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0 <td>CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0°/0.5°           CA_4A-5A-12A         4         0           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A<!--</td--><td></td><td>28</td><td>0</td></td>	CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0°/0.5°           CA_4A-5A-12A         4         0           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A </td <td></td> <td>28</td> <td>0</td>		28	0
CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           40         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0 <td>CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0°/0.5°           CA_4A-5A-12A         4         0           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A<!--</td--><td></td><td>3</td><td>0</td></td>	CA_3A-7C-28A         7         0           28         0           3         0           CA_3C-7A-28A         7         0           28         0           3         0         0           CA_3C-7C-28A         7         0           28         0         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0°/0.5°           CA_4A-5A-12A         4         0           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A </td <td></td> <td>3</td> <td>0</td>		3	0
CA_3C-7A-28A	CA_3C-7A-28A	CA 3A-7C-28A		0
CA_3C-7A-28A         3         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         3         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0           CA_3A-41A-42A         41         0           CA_3A-4A-5A-12A         5         0.5           CA_4A-5A-12A         5         0.5           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A         5         0           CA_4A-5A-30A         5         0           CA_4A-5A-30A         5         0           A         0         0.5           A         0         0           CA_4A-5A-30A         5         0           CA_4A-5A-30A         5         0           A <td< td=""><td>CA_3C-7A-28A         3         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0</td><td></td><td>28</td><td></td></td<>	CA_3C-7A-28A         3         0           CA_3C-7C-28A         7         0           CA_3C-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0		28	
CA_3C-7A-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0         0           CA_3A-7A-38A         7         0           38         0.2         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         3           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         3           0         42         0.5           3         0         0           CA_3A-28A-40A         28         0           40         0         0           0         3         0           0         3         0           0         3         0           0         0         0           0         0         0           0         0         0           0	CA_3C-7A-28A         7         0           28         0           3         0           CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0         0           CA_3A-19A-42A         19         0           42         0.5         3           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         0           42         0.5         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0.5           42         0.5      <			
CA_3C-7C-28A	CA_3C-7C-28A	CA 2C 7A 20A		
CA_3C-7C-28A         3         0           CA_3A-7A-38A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0.2           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0           CA_3A-41A-42A         41         0           CA_4A-5A-12A         5         0.5           CA_4A-5A-12A         5         0.5           CA_4A-5A-12A         5         0.5           CA_4A-5A-13A         5         0           CA_4A-5A-30A         5         0           CA_4A-5A-30A         5         0           A         0.4         0.4           CA_4A-5A-30A         5         0           A         0.4         0.4           CA_4A-5A-3	CA_3C-7C-28A         3         0           CA_3A-7C-28A         7         0           CA_3A-7A-38A         7         0           CA_3A-8A-40A         8         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0 <tr< td=""><td>CA_3C-7A-26A</td><td></td><td></td></tr<>	CA_3C-7A-26A		
CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         0           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         0           3         0.2         0           CA_3A-28A-40A         28         0           0         3         0           0         3         0           0         3         0           0         3         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0	CA_3C-7C-28A         7         0           28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           CA_3A-8A-40A         8         0           40         0         0           CA_3A-19A-42A         19         0           42         0.5         3           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         0           3         0.2         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           3         0.5         0           40         0         0           CA_3A-28A-40C         28         0           40         0.5         0			
28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         3         0.2           CA_3A-19A-42C         19         0         0           42         0.5         3         0.2           CA_3A-28A-40A         28         0         0           CA_3A-28A-40A         28         0         0           CA_3A-28A-40C         28         0         0           CA_3A-28A-40C         28         0         0           40         0         0         0           CA_3A-28A-40C         28         0         0           40         0         0         0           CA_3A-28A-40C         28         0         0           40         0         0         0           40         0         0         0           42         0.5	28         0           3         0           CA_3A-7A-38A         7         0           38         0.2           3         0         0           CA_3A-8A-40A         8         0           CA_3A-19A-42A         19         0           CA_3A-19A-42A         19         0           CA_3A-19A-42C         19         0           CA_3A-28A-40A         28         0           CA_3A-28A-40A         28         0           CA_3A-28A-40C         28         0           CA_3A-28A-40C         28         0           CA_3A-41A-42A         41         0           CA_3A-41A-42A         41         0           CA_3A-41A-42A         41         0           CA_4A-5A-12A         4         0           CA_4A-5A-12A         5         0.5           12         0.5           4         0           CA_4A-5A-13A         5         0           CA_4A-5A-30A         5         0           CA_4A-5A-30A         4         0.4           CA_4A-5A-30A         4         0.5		3	
CA_3A-7A-38A         3         0           CA_3A-8A-40A         38         0.2           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         3           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         0           3         0         0           CA_3A-28A-40A         28         0           40         0         0           CA_3A-28A-40A         28         0           40         0         0           3         0.5         0           40         0         0           3         0.5         0           40         0         0           6         40         0           0.5         42         0.5           42         0.5         0           42         0.5         0           44         0         0           6 </td <td>CA_3A-7A-38A         3         0           CA_3A-8A-40A         8         0.2           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         0           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         0           3         0         0           CA_3A-28A-40A         28         0           0         3         0           CA_3A-28A-40C         28         0           0         3         0           CA_3A-28A-40C         28         0           0         0         0           3         0.5           CA_3A-28A-40C         28         0           0         0         0           3         0.5           0         0         0           0         0         0           0         0         0           0         0</td> <td>CA_3C-7C-28A</td> <td>7</td> <td>0</td>	CA_3A-7A-38A         3         0           CA_3A-8A-40A         8         0.2           3         0         0           CA_3A-8A-40A         8         0           40         0         0           3         0.2         0           CA_3A-19A-42A         19         0           42         0.5         0           3         0.2         0           CA_3A-19A-42C         19         0           42         0.5         0           3         0         0           CA_3A-28A-40A         28         0           0         3         0           CA_3A-28A-40C         28         0           0         3         0           CA_3A-28A-40C         28         0           0         0         0           3         0.5           CA_3A-28A-40C         28         0           0         0         0           3         0.5           0         0         0           0         0         0           0         0         0           0         0	CA_3C-7C-28A	7	0
CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0           3         0.2           CA_3A-19A-42A         19         0           42         0.5           3         0.2           CA_3A-19A-42C         19         0           42         0.5           3         0         0           CA_3A-28A-40A         28         0           0         3         0           0         3         0           0         3         0           0         0         0           0         3         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0	CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0           0         40         0           0         3         0.2           CA_3A-19A-42A         19         0           42         0.5         3           0         42         0.5           3         0         0           42         0.5         0           3         0         0           42         0.5         0           3         0         0           40         0         0           3         0         0           40         0         0           3         0.5         0           40         0         0           3         0.5         0           40         0         0           3         0.5         0           42         0.5         0           42         0.5         0           44         0         0           5         0.5		28	0
CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0           3         0.2           CA_3A-19A-42A         19         0           42         0.5           3         0.2           CA_3A-19A-42C         19         0           42         0.5           3         0         0           CA_3A-28A-40A         28         0           0         3         0           0         3         0           0         3         0           0         0         0           0         3         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0         0           0         0	CA_3A-7A-38A         7         0           38         0.2           3         0           CA_3A-8A-40A         8         0           40         0           0         40         0           0         3         0.2           CA_3A-19A-42A         19         0           42         0.5         3           0         42         0.5           3         0         0           42         0.5         0           3         0         0           42         0.5         0           3         0         0           40         0         0           3         0         0           40         0         0           3         0.5         0           40         0         0           3         0.5         0           40         0         0           3         0.5         0           42         0.5         0           42         0.5         0           44         0         0           5         0.5		3	0
CA_3A-8A-40A  CA_3A-8A-40A  B CA_3A-8A-40A  B CA_3A-19A-42A  19 CA_3A-19A-42A  19 CA_3A-19A-42C  19 CA_3A-19A-42C  19 CA_3A-28A-40A  CA_3A-28A-40A  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-41A-42A  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-13A  CA_4A-5A-30A  CA_3A-8A-40A  CA_4A-5A-30A  CA_3A-8A-40A  CA_4A-5A-30A  CA_3A-8A-40A  CA_4A-5A-30A	CA_3A-8A-40A  CA_3A-8A-40A  CA_3A-19A-42A  CA_3A-19A-42C  CA_3A-19A-42C  CA_3A-19A-42C  CA_3A-28A-40A  CA_3A-28A-40A  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-41A-42A  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-13A  CA_4A-5A-13A  CA_4A-5A-30A  CA_3A-3A-3A-3A  CA_4A-5A-30A	CA 3A-7A-38A		
CA_3A-8A-40A     3     0       CA_3A-19A-42A     19     0       CA_3A-19A-42C     19     0       CA_3A-19A-42C     19     0       CA_3A-28A-40A     28     0       CA_3A-28A-40A     28     0       CA_3A-28A-40C     28     0       CA_3A-41A-42A     41     0       CA_3A-41A-42A     41     0       CA_4A-5A-12A     5     0.5       CA_4A-5A-12A     5     0.5       CA_4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A	CA_3A-8A-40A     3     0       CA_3A-8A-40A     8     0       40     0     0       3     0.2       CA_3A-19A-42A     19     0       42     0.5       3     0.2       CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5     0       40     0     0       3     0.5     0       42     0.5     0       44     0     0       CA_4A-5A-12A     5     0.5       4     0     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     0.5     0       CA_4A-5A-30A     0.5 <td< td=""><td>0/1_0/1/100/1</td><td></td><td></td></td<>	0/1_0/1/100/1		
CA_3A-8A-40A       8       0         40       0         3       0.2         CA_3A-19A-42A       19       0         42       0.5         3       0.2         CA_3A-19A-42C       19       0         42       0.5         3       0         CA_3A-28A-40A       28       0         CA_3A-28A-40C       28       0         40       0       0         3       0.5       0         CA_3A-41A-42A       41       0.5/0.5 <sup>6</sup> 42       0.5       0         CA_4A-5A-12A       5       0.5         12       0.5       0         CA_4A-4A-5A-12A       5       0.5         12       0.5       0         CA_4A-5A-13A       5       0         CA_4A-5A-13A       5       0         CA_4A-5A-30A       5       0         0       0.4       0.4         0       0.4       0.4	CA_3A-8A-40A       8       0         40       0         3       0.2         CA_3A-19A-42A       19       0         42       0.5         3       0.2         CA_3A-19A-42C       19       0         42       0.5         3       0         CA_3A-28A-40A       28       0         40       0       0         3       0       0         CA_3A-28A-40C       28       0         40       0       0         3       0.5       0         CA_3A-28A-40C       28       0         40       0       0         3       0.5       0         40       0       0         6       40       0         7       42       0.5         42       0.5       0         42       0.5       0         42       0.5       0         44       0       0         6       0.5       0         12       0.5       0         12       0.5       0         13       0       0 <td></td> <td></td> <td></td>			
CA_3A-19A-42A	CA_3A-19A-42A	04 04 04 404		
CA_3A-19A-42A     3     0.2       42     0.5       3     0.2       CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0       3     0       CA_3A-28A-40C     28     0       40     0     0       5     0.5       41     0°/0.5°       42     0.5       6     42     0.5       6     42     0.5       6     42     0.5       6     0.5     0.5       7     12     0.5       8     0     0       9     0     0       12     0.5       12     0.5       12     0.5       12     0.5       12     0.5       13     0       0     0       13     0       0     0.4       0     0.4       0     0.5       0     0.5       0     0.5       0     0.5       0     0.5       0     0.5       0     0.5       0 <t< td=""><td>CA_3A-19A-42A     3     0.2       42     0.5       3     0.2       CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0       CA_3A-28A-40C     28     0       40     0     0       CA_3A-28A-40C     28     0       40     0     0       5     0     0       6     42     0.5       6     42     0.5       7     42     0.5       8     0     0       9     0     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13</td><td>CA_3A-8A-40A</td><td></td><td></td></t<>	CA_3A-19A-42A     3     0.2       42     0.5       3     0.2       CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0       CA_3A-28A-40C     28     0       40     0     0       CA_3A-28A-40C     28     0       40     0     0       5     0     0       6     42     0.5       6     42     0.5       7     42     0.5       8     0     0       9     0     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       12     0.5     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13     0     0       13	CA_3A-8A-40A		
CA_3A-19A-42A       19       0         42       0.5         3       0.2         CA_3A-19A-42C       19       0         42       0.5         3       0         CA_3A-28A-40A       28       0         CA_3A-28A-40C       28       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0         0       0       0 <t< td=""><td>CA_3A-19A-42A       19       0         42       0.5         3       0.2         CA_3A-19A-42C       19       0         42       0.5         3       0         CA_3A-28A-40A       28       0         40       0         CA_3A-28A-40C       28       0         40       0       0         CA_3A-28A-40C       28       0         40       0       0         CA_3A-28A-40C       28       0         40       0       0         5       0.5       0         40       0       0         6       0.5       0         6       0.5       0         6       0.5       0         7       0.5       0         6       0.5       0         7       0.5       0         7       0.5       0         7       0.5       0         8       0       0         9       0.5       0         12       0.5       0         13       0       0         13       0</td><td></td><td></td><td></td></t<>	CA_3A-19A-42A       19       0         42       0.5         3       0.2         CA_3A-19A-42C       19       0         42       0.5         3       0         CA_3A-28A-40A       28       0         40       0         CA_3A-28A-40C       28       0         40       0       0         CA_3A-28A-40C       28       0         40       0       0         CA_3A-28A-40C       28       0         40       0       0         5       0.5       0         40       0       0         6       0.5       0         6       0.5       0         6       0.5       0         7       0.5       0         6       0.5       0         7       0.5       0         7       0.5       0         7       0.5       0         8       0       0         9       0.5       0         12       0.5       0         13       0       0         13       0			
CA_3A-19A-42C	CA_3A-19A-42C		3	0.2
CA_3A-19A-42C	CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0       CA_3A-28A-40C     28     0       40     0     0       CA_3A-41A-42A     41     0.5       42     0.5       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA_3A-19A-42A	19	0
CA_3A-19A-42C	CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       40     0       CA_3A-28A-40C     28     0       40     0     0       CA_3A-41A-42A     41     0.5       42     0.5       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4		42	0.5
CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5       CA_3A-41A-42A     41     05/0.5 <sup>8</sup> 42     0.5       42     0.5       44     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       0     0.5       0	CA_3A-19A-42C     19     0       42     0.5       3     0       CA_3A-28A-40A     28     0       CA_3A-28A-40C     28     0       CA_3A-28A-40C     28     0       CA_3A-41A-42A     40     0       CA_3A-41A-42A     41     05/0.56       42     0.5       CA_4A-5A-12A     5     0.5       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4		3	
CA_3A-28A-40A  CA_3A-28A-40A  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-41A-42A  CA_3A-41A-42A  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-13A  CA_4A-5A-13A  CA_4A-5A-30A	CA_3A-28A-40A  CA_3A-28A-40A  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-28A-40C  CA_3A-28A-40C  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-12A  CA_4A-5A-13A  CA_4A-5A-30A	CA 3A-19A-42C		
CA_3A-28A-40A     3     0       CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       CA_3A-41A-42A     40     0       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0     0.4       0     0.4	CA_3A-28A-40A     28     0       CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       CA_3A-28A-20C     30     0.5       CA_3A-28A-20C     41     0       CA_3A-24A-5A-30A     5     0       CA_3A-24A-5A-30A     5     0       CA_3A-24A-5A-30A     5     0       CA_3A-24A-5A-30A     4     0.4       CA_3A-24A-5A-30A     4     0.4       CA_3A-24A-5A-30A     4     0.4	0.1_0.1.10.1.120		
CA_3A-28A-40A     28     0       40     0       CA_3A-28A-40C     28     0       CA_3A-41A-42A     3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       44     0       CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0.5     0.5       0.5     0.5       0.5     0.4	CA_3A-28A-40A       28       0         40       0         3       0         CA_3A-28A-40C       28       0         40       0         0       0         3       0.5         41       0.5         42       0.5         4       0         CA_4A-5A-12A       5       0.5         12       0.5         4       0         CA_4A-4A-5A-12A       5       0.5         12       0.5         4       0         CA_4A-5A-13A       5       0         0       0.4         CA_4A-5A-30A       5       0         0.5       0.5         0       0.5         0       0.5			
CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5       CA_3A-41A-42A     41     0*/0.5*       42     0.5       CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       CA_4A-5A-30A     5     0       0     0.5       0     0.5       0     0.5	CA_3A-28A-40C     28     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5       CA_3A-41A-42A     41     0°/0.5°       42     0.5       4     0       CA_4A-5A-12A     5     0.5       12     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA 2A 20A 40A		
CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5       CA_3A-41A-42A     41     0.5/0.56       42     0.5       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.4     0	CA_3A-28A-40C     3     0       CA_3A-28A-40C     28     0       40     0     0       3     0.5       CA_3A-41A-42A     41     0 <sup>5</sup> /0.5 <sup>6</sup> 42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA_3A-28A-40A		
CA_3A-28A-40C     28     0       40     0       3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       CA_4A-5A-30A     5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0	CA_3A-28A-40C     28     0       40     0       3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4			
40     0       3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       0     0.5     0       0     0.4     0.4       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.4     0.4	40     0       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0.5       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4			
CA_3A-41A-42A     3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.4     0.4	CA_3A-41A-42A     3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA_3A-28A-40C	28	
CA_3A-41A-42A     3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0     0.4     0.4       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.5     0       0     0.4     0.4	CA_3A-41A-42A     3     0.5       CA_3A-41A-42A     41     05/0.56       42     0.5       4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4		40	0
CA_3A-41A-42A       41       05/0.56         42       0.5         CA_4A-5A-12A       5       0.5         12       0.5         CA_4A-4A-5A-12A       5       0.5         12       0.5         12       0.5         4       0         CA_4A-5A-13A       5       0         13       0         CA_4A-5A-30A       5       0         0       0.5         0       0.5	CA_3A-41A-42A     41     05/0.56       42     0.5       CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4		3	0.5
42     0.5       CA_4A-5A-12A     5     0.5       12     0.5       CA_4A-4A-5A-12A     5     0.5       12     0.5       12     0.5       12     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       0.5     0.4       0.5     0.4       0.5     0.4       0.6     0.6       0.7     0.4       0.6     0.6	42     0.5       CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA 3A-41A-42A		$0^{5}/0.5^{6}$
CA_4A-5A-12A     4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       A     0.4     0.4       CA_4A-5A-30A     5     0       A     0.5     0.5	CA_4A-5A-12A     4     0       CA_4A-5A-12A     5     0.5       CA_4A-4A-5A-12A     5     0.5       CA_4A-5A-13A     5     0       CA_4A-5A-30A     4     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4			
CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5       4     0.4       0     0.5	CA_4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4			
12     0.5       4     0       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5       4     0.4	12     0.5       CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4	CA 4A EA 40A		
CA_4A-4A-5A-12A     4     0       5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5       4     0.4	CA_4A-4A-5A-12A     4     0       5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       CA_4A-5A-30A     5     0       0.5     0.5       0.4     0.4       0.5     0.4	CA_4A-5A-12A		
CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5	CA_4A-4A-5A-12A     5     0.5       12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     5     0       CA_4A-5A-30A     4     0.4       CA_4A-5A-30A     4     0.4			
12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5       4     0.4	12     0.5       4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       CA_4A-4A-5A-30A     4     0.4			_
CA_4A-5A-13A	CA_4A-5A-13A     4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       CA_4A-4A-5A-30A     4     0.4	CA_4A-4A-5A-12A		
CA_4A-5A-13A	CA_4A-5A-13A     4     0       CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       CA_4A-4A-5A-30A     4     0.4		12	0.5
CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5	CA_4A-5A-13A     5     0       13     0       4     0.4       CA_4A-5A-30A     5     0       30     0.5       CA_4A-5A-30A     4     0.4		4	
13 0 4 0.4 CA_4A-5A-30A 5 0 30 0.5	13 0 4 0.4 CA_4A-5A-30A 5 0 30 0.5 CA_4A-5A-30A 4 0.4	CA 4A-5A-13A		
CA_4A-5A-30A	CA_4A-5A-30A			
CA_4A-5A-30A	CA_4A-5A-30A     5     0       30     0.5       CA_4A-5A-30A     4     0.4		_	
30 0.5	30 0.5 CA 4A-4A-5A-30A 4 0.4	CA 44 54 334		
4 0.4	CA 4A-4A-5A-30A 4 0.4	UA_4A-5A-3UA		
0.4			_	
	5 0	CA 4A-4A-5A-30A		0.4
5 0			5	0

	30	0.5
	4	0.5
CA_4A-7A-12A	7	0.5
	12	0.5
	4	0.4
CA_4A-12A-30A	12	0.5
	30	0.5
	4	0.4
CA_4A-4A-12A-30A	12	0.5
	30	0.5
	7	0
CA_7A-8A-20A	8	0.2
	20	[0.2]
	7	0
CA_7A-20A-38A	20	0
	38	0.2
	19	0
CA_19A-21A-42A	21	0
	42	0.5
	19	0
CA_19A-21A-42C	21	0
	42	0.5

- NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE 2: The above additional tolerances also apply in intra-band and non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE 3: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
  - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
  - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz. NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz.

Table 7.3.1-1C:  $\Delta R_{IB,c}$  (four bands)

		ΔR <sub>IB,c</sub> [dB]
	1	0
CA_1A-3A-5A-40A	3	0
CA_1A-3A-3A-40A	5	0
	40	0
	1	0
CA_1A-3A-7A-8A	3	0
	7	0
	8	0.2
	1	0
CA_1A-3A-7A-28A	3	0
	7	0
	28	0.2
	1	0
CA_1A-3A-7C-28A	3	0
CA_1A-3A-10-20A	7	0
	28	0.2
	1	0
CA_1A-3A-8A-40A	3	0
CA_1A-3A-6A-40A	8	0
	40	0
	1	0.2
CA 1A 3A 10A 13A	3	0.2
CA_1A-3A-19A-42A	19	0
	42	0.5
	1	0.2
0.0 4.0 0.0 40.0	3	0.2
CA_1A-3A-19A-42C	19	0
	42	0.5
	1	0
0.4.4.4.0.4.0.4.4.0.4	19	0
CA_1A-19A-21A-42A	21	0
	42	0.5
	1	0
0.0 4.0 4.0 04.0 4.0 0	19	0
CA_1A-19A-21A-42C	21	0
	42	0.5
	2	0.3
CA 2A 4A 5A 4CA	4	0.3
CA_2A-4A-5A-12A	5	0.5
	12	0.5
	2	0.4
04 04 44 54 004	4	0.4
CA_2A-4A-5A-30A	5	0
	30	0.5
	2	0.3
	4	0.3
CA_2A-4A-7A-12A	7	0.5
	12	0.5
	2	0.4
	4	0.4
	4	
CA_2A-4A-12A-30A	12	0.5

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 2: The above additional tolerances also apply in intra-band and non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 3: Tolerances for a UE supporting multiple 4DL inter-band CA configurations

NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier

aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.

NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and other bands are >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

Table 7.3.1-2: Uplink configuration for reference sensitivity

E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode							
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1			25	50	75	100	FDD
2	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
3	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
4	6	15	25	50	75	100	FDD
5	6	15	25	25 <sup>1</sup>			FDD
6			25	25 <sup>1</sup>			FDD
7			25	50	75	75 <sup>1</sup>	FDD
8	6	15	25	25 <sup>1</sup>			FDD
9			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
10			25	50	75	100	FDD
11			25	25 <sup>1</sup>			FDD
12	6	15	20 <sup>1</sup>	20 <sup>1</sup>			FDD
13			20 <sup>1</sup>	20 <sup>1</sup>			FDD
14			15 <sup>1</sup>	15 <sup>1</sup>			FDD
17			20 <sup>1</sup>	20 <sup>1</sup>	1		FDD
18			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
19			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
20			25	20 <sup>1</sup>	20 <sup>3</sup>	20 <sup>3</sup>	FDD
21			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
22			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
23	6	15	25	50	75	100	FDD
24			25	50			FDD
25	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
26	6	15	25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
27	6	15	25	25 <sup>1</sup>			FDD
28		15	25	25 <sup>1</sup>	25 <sup>1</sup>	25 <sup>1</sup>	FDD
30		4	25	25 <sup>1</sup>			FDD
31	6	5⁴	5⁴				FDD
33			25	50	75	100	TDD
34			25	50	75		TDD
35	6	15	25	50	75	100	TDD
36	6	15	25	50	75	100	TDD
37			25	50	75	100	TDD
38			25	50	75	100	TDD
39			25	50	75	100	TDD
40			25	50	75	100	TDD
41			25	50	75	100	TDD
42			25	50	75	100	TDD
43			25	50	75	100	TDD
44		15	25	50	75	100	TDD
45			25	50	75	100	TDD
	1					4.6	
65			25	50	75	100	FDD
66	6	15	25	50	75 1	100	FDD
68	refers to th	- 111	25	25 <sup>1</sup>	25 <sup>1</sup>	-1	FDD

NOTE 1: 1 refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2:	For the UE which supports both Band 11 and Band 21 the uplink
	configuration for reference sensitivity is FFS.
NOTE 3:	refers to Band 20; in the case of 15MHz channel bandwidth, the UL
	resource blocks shall be located at RB <sub>start</sub> 11 and in the case of 20MHz
	channel bandwidth, the UL resource blocks shall be located at RB <sub>start</sub> 16
NOTE 4:	<sup>4</sup> refers to Band 31; in the case of 3 MHz channel bandwidth, the UL
	resource blocks shall be located at RB <sub>start</sub> 9 and in the case of 5 MHz
	channel bandwidth, the UL resource blocks shall be located at RB <sub>start</sub> 10.

Unless given by Table 7.3.1-3, the minimum requirements specified in Tables 7.3.1-1 and 7.3.1-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

Table 7.3.1-3: Network signalling value for reference sensitivity

E-UTRA Band	Network Signalling value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03
30	NS_21
66	NS_03

## 7.3.1A Minimum requirements (QPSK) for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1, Table 7.3.1-1a and Table 7.3.1-2. The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active. The uplink resource blocks shall be located as close as possible to the primary downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1). The primary downlink operating band is the downlink band of the active uplink operating band. The UE shall meet the requirements specified in subclause 7.3.1 with the following exceptions.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0a, exceptions to the aforementioned requirements are allowed when the uplink is active in a lower-frequency band and is within a specified frequency range such that transmitter harmonics fall within the downlink transmission bandwidth assigned in a higher band as noted in Table 7.3.1A-0a. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0a and Table 7.3.1A-0b.

Table 7.3.1A-0a: Reference sensitivity for carrier aggregation QPSK P<sub>REFSENS, CA</sub> (exceptions)

		Cha	annel band	lwidth				
EUTRA CA	EUTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex
Configuration	band	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	mode
	1			-100	-97	-95.2	-94	
456	3			N/A	N/A	N/A	N/A	
CA_1A-3A-7A-8A <sup>4,5,6</sup>	7				-87.4	-87	-86.7	FDD
	8			-96.8	-93.8	- 01	00.1	
						00	00.7	
	1			-89.8	-89.4	-89	-88.7	
CA_1A-3A-7A-28A <sup>5,6</sup>	3				-94	-92.2	-91	FDD
G/ _ // G/ / // 26/ (	7				-95	-93.2	-92	
	28				-95.3	-93.5	-90.8	
	1			-100	-97	-95.2	-94	
4	3			N/A	N/A	N/A	N/A	FDD
CA_1A-3A-8A-40A <sup>4</sup>	8		-99.2	-97	-94			
	40		-33.2	-100	-97	-95.2	-94	TDD
	1			-99.8	-96.8	-95.2 -95	-9 <del>4</del> -93.8	טטו
	- '			-99.8	-90.8	-95 -92	-93.8	
0.40	3			-96.8	[-96.5] <sup>20</sup>	-92 [-	[-93.5] <sup>20</sup>	FDD
CA_1A-3A-19A-42A <sup>9,10</sup>	3			99.5] <sup>20</sup>	[-30.3]	94.7] <sup>20</sup>	[-33.3]	טטו
	19			-100	-97	-95.2		
	42			-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95	-93.8	
				-96.8	-93.8	-92	-90.8	
CA_1A-3A-19A-42A <sup>11</sup>	3			[-	$[-96.5]^{20}$	[-	$[-93.5]^{20}$	FDD
CA_1A-3A-19A-42A				99.5] <sup>20</sup>	-	94.7] <sup>20</sup>	-	
	19			-100	-97	-95.2		
	42			-97.1	-94.7	-93.2	-92.5	TDD
	1			-99.8	-96.8	-95	-93.8	
	_			-96.8	<b>-93.8</b>	-92	-90.8	
CA_1A-3A-19A-42C <sup>9,10</sup>	3			[-	[-96.5] <sup>20</sup>	[-	[-93.5] <sup>20</sup>	FDD
0/1_// 0// 10// 120	4.0			99.5] <sup>20</sup>	07	94.7] <sup>20</sup>		
	19			-100	-97	-95.2		TD.D
	42			-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95 -92	-93.8	
	3			-96.8	-93.8 [-96.5] <sup>20</sup>	-92 [-	-90.8 [-93.5] <sup>20</sup>	FDD
CA_1A-3A-19A-42C <sup>11</sup>	3			[- 99.5] <sup>20</sup>	[-96.5]	94.7] <sup>20</sup>	[-93.5]	רטט
	19			-100	-97	-95.2		
	42			-97.1	-94.7	-93.2	-92.5	TDD
	1			-89.8	-89.4	-89	-88.7	טטו
	-							
CA_1A-3A-28A	3		1	-97	-94	-92.2	-91 [-93.7] <sup>20</sup>	FDD
ON_1A-0A-20A				[- 99.7] <sup>20</sup>	[-96.7] <sup>20</sup>	[- 94.9] <sup>20</sup>	[- <del>9</del> 3./]	טטו
	28			-98.3	-95.3	-93.5	-90.8	
	1			-96.3	-95.3 -96.8			
	1			-99.8 -96.8	-96.8 -93.8	-95 -92	-93.8 -90.8	
CA_1A-3A-42A <sup>9,10</sup>	3				[-96.5] <sup>20</sup>	-92 [-	[-93.5] <sup>20</sup>	FDD
υπ_ ι <i>π</i> -υπ- <del>4</del> ΔΜ	3			[- 99.5] <sup>20</sup>	[-30.5]	94.7] <sup>20</sup>	[-93.5]	
	42		<u> </u>	-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95	-93.8	.00
	<u> </u>			-96.8	-93.8	-92	-90.8	F
CA_1A-3A-42A <sup>11</sup>	3				[-96.5] <sup>20</sup>	[-	[-93.5] <sup>20</sup>	FDD
<del>-</del>				[- 99.5] <sup>20</sup>		94.7] <sup>20</sup>		
	42			-97.1	-94.7	-93.2	-92.5	TDD
	1			-100	-97	-95.2	-94	
CA_1A-7A-8A <sup>5,6</sup>	7				-87.4	-87	-86.7	FDD
5	-			_06.0			55.7	. 23
	8		-	-96.8	-93.8	00	00.7	
CA_1A-7A-28A <sup>5,6</sup>	1			-89.8	-89.4	-89	-88.7	FDD
J	7		ĺ	Ì	-95	-93.2	-92	FDD

				[-97.7] <sup>20</sup>	[- 95.9] <sup>20</sup>	[-94.7] <sup>20</sup>	
	28		-98.3	-95.3	-93.5	-90.8	
	1		N/A	N/A	N/A	N/A	
CA_1A-19A-28A <sup>14</sup>	19		N/A	N/A	N/A		FDD
	28		N/A	N/A			
CA_1A-28A <sup>5,6,14</sup>	1		-89.8	-89.4	-89	-88.7	
CA_1A-28A	28		-98.3	-95.3	-93.5	-90.8	FDD
			-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-12A <sup>5,6</sup>	2		[- 100.4]	[-97.4] <sup>20</sup>	[- 95.6] <sup>20</sup>	[-94.4] <sup>20</sup>	FDD
-	4		-90	-89.5	-89	-88.5	
	12		-96.5	-93.5	00.0	04.7	
	2		-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-7A-12A <sup>5,6</sup>	4		-90	-89.5	-89	-88.5	FDD
	7		-97.5	-94.5	-92.7	-91.5	
	12		-96.5	-93.5			
04 04 74 04456	3		N/A	N/A	N/A	N/A	
CA_3A-7A-8A <sup>4,5,6</sup>	7			-87.4	-87	-86.7	FDD
	8		-96.8	-93.8			
CA_3A-8A <sup>4</sup>	3		N/A	N/A	N/A	N/A	FDD
OA_0A-0A	8	N/A	N/A	N/A			100
	_		-96.8	-93.8	-92	-90.8	,
CA_3A-19A-42A <sup>9,10</sup>	3		[- 99.5] <sup>20</sup>	[-96.5] <sup>20</sup>	[- 94.7] <sup>20</sup>	[-93.5] <sup>20</sup>	FDD
CA_3A-19A-42A	19		-100	-97	-95.2		
	42		-71.7	-71.7	-71.7	-71.7	TDD
			-96.8	-93.8	-92	-90.8	
CA_3A-19A-42A <sup>11</sup>	3		[- 99.5] <sup>20</sup>	[-96.5] <sup>20</sup>	[- 94.7] <sup>20</sup>	[-93.5] <sup>20</sup>	FDD
	19		-100	-97	-95.2		
	42		-97.1 -97	-94.7 -94	-93.2 -92.2	-92.5 -91	TDD
CA_3A-28A-40A <sup>15,16</sup>	3		[- 99.7] <sup>20</sup>	[-96.7] <sup>20</sup>	[- 94.9] <sup>20</sup>	[-93.7] <sup>20</sup>	FDD
	28		-60.7	-60.7	-60.7	-60.7	
	40		-100	-97	-95.2	-94	TDD
CA_3A-28A-40C <sup>15,16</sup>	3		-97 [- 99.7] <sup>20</sup>	-94 [-96.7] <sup>20</sup>	-92.2 [- 94.9] <sup>20</sup>	-91 [-93.7] <sup>20</sup>	FDD
	28		-60.7	-60.7	-60.7	-60.7	TDD
	40 3	<del>                                     </del>	-100 -86.9	-97 -86.4	-95.2 -86	-94 -85.6	TDD
CA_3A-31A <sup>12,13</sup>	31	-95.5	-93.3	-00.4	-00	-00.0	FDD
	31	-90.0	-96.8	-93.8	-92	-90.8	
CA_3A-42A <sup>9,10</sup>	3		[- 99.5] <sup>20</sup>	[-96.5] <sup>20</sup>	[- 94.7] <sup>20</sup>	[-93.5] <sup>20</sup>	FDD
	42		-71.7	-71.7	-71.7	-71.7	TDD
			-96.8	-93.8	-92	-90.8	
CA_3A-42A <sup>11</sup>	3		[- 99.5] <sup>20</sup>	[-96.5] <sup>20</sup>	[- 94.7] <sup>20</sup>	[-93.5] <sup>20</sup>	FDD
	42		-97.1	-94.7	-93.2	-92.5	TDD
	4		-90	-89.5	-89	-88.5	
CA_4A-5A-12A <sup>5,6</sup>	5		-97.5	-94.5			FDD
	12		-96.5	-93.5	00	00.5	
CA_4A-4A-5A-12A <sup>5,6</sup>	5		-90 -97.5	-89.5 -94.5	-89	-88.5	FDD
UA_4A-4A-5A-1ZA	12		-97.5 -96.5	-94.5 -93.5			רטט
CA_4A-7A-12A <sup>5,6</sup>	4		[-90]	[-89.5]	[-89]	[-88.5]	
							FDD

				[-	[-97.2] <sup>20</sup>			
				100.2]				
	12			-96.5	-93.5			
CA_4A-12A <sup>5,6</sup>	4	-89.2	-89.2	-90	-89.5	-89	-88.5	FDD
CA_4A-12A	12		-98.2	-96.5	-93.5			רטט
	4			-90	-89.5	-89	-88.5	
CA_4A-4A-12A-30A <sup>5,6</sup>	12			-96.5	-93.5			FDD
	30			-98.5	-95.5			
CA_4A-17A <sup>5,6</sup>	4			-90	-89.5			FDD
UA_4A-17A	17			-96.5	-93.5			100
CA_4A-28A <sup>5,6</sup>	4			-89.8	-89.4	-89	-88.7	FDD
OA_ <del>1</del> A-20A	28			-98.3	-95.3	-93.5	-90.8	
CA_5A-38A <sup>19</sup>	5			N/A	N/A			FDD
<u> </u>	38			N/A	N/A	N/A	N/A	TDD
CA_7A-8A <sup>5,6</sup>	7				-87.4	-87	-86.7	FDD
	8		-99	-96.8	-93.8			100
	7				-87.4	-87	-86.7	FDD
- 56	8		-99	-96.8	-93.8			
CA_7A-8A-20A <sup>5,6</sup>				[-96.8]	[-93.8]			
	20			[- 99.5] <sup>20</sup>	[-96.5] <sup>20</sup>			
CA_8A-41A <sup>8</sup>	8	N/A	N/A	N/A	N/A			FDD
<u> </u>	41				N/A	N/A	N/A	TDD
CA_8A-42A <sup>12,13</sup>	8	-102	-99	-96.8	-93.8			FDD
	42			-84.8	-84.7	-84.6	-84.5	TDD
CA_8A-42C <sup>12,13</sup>	8	-102	-99	-96.8	-93.8			FDD
<u> </u>	42			-84.8	-84.7	-84.6	-84.5	TDD
CA_20A-40A <sup>15,16</sup>	20			-60.7	-60.7	-60.7	-60.7	FDD
	40			-100	-97	-95.2	-94	TDD
CA_26A-41A <sup>8</sup>	26			N/A	N/A	N/A		FDD
	41			N/A	N/A	N/A	N/A	TDD
CA_28A-40A <sup>15,16</sup>	28			-60.7	-60.7	-60.7	-60.7	FDD
071_2071 1071	40			-100	-97	-95.2	-94	TDD
CA_28A-40C <sup>15,16</sup>	28			-60.7	-60.7	-60.7	-60.7	FDD
0/(_20/\ 100	40			-100	-97	-95.2	-94	TDD
CA_28A-40D <sup>15,16</sup>	28			-60.7	-60.7	-60.7	-60.7	FDD
	40			-100	-97	-95.2	-94	TDD
CA_28A-42A <sup>17,18</sup>	28			-98.3	-95.3	-93.5	-92.3	FDD
	42			-85.7	-85.4	-85.1	-84.9	TDD
CA_28A-42C <sup>17,18</sup>	28			-98.3	-95.3	-93.5	-92.3	FDD
IOTE 4 The second	42			-85.7	-85.4	-85.1	-84.9	TDD

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3: The signal power is specified per port

NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).

NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a high band.

NOTE 6: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that  $f_{UL}^{LB} = \left| f_{DL}^{HB} / 0.3 \right| 0.1 \text{ in MHz and } F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL}^{LB} < F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2 \text{ with } f_{DL}^{HB} \text{ the carrier frequency of a high band in MHz and } BW_{Channel}^{LB} \text{ the channel bandwidth configured in the low band.}$ 

NOTE 7: Void.

NOTE 8: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).

NOTE 9: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range  $\Delta F_{HD}$  above and below the edge of this downlink transmission bandwidth. The value  $\Delta F_{HD}$  depends on the E-UTRA configuration:  $\Delta F_{HD} = 10$ 

- MHz for CA\_3A-42A, CA\_3A-42C, CA\_1A-3A-42A, CA\_1A-3A-42C, CA\_3A-19A-42C, CA\_1A-3A-19A-42A, CA\_3A-19A-42C.
- NOTE 10: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that  $f_{UL}^{LB} = \left\lfloor f_{DL}^{HB} / 0.2 \right\rfloor 0.1$  in MHz and  $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB} / 2$  with  $f_{DL}^{HB}$  carrier frequency in the victim (higher) band in MHz and  $BW_{Channel}^{LB}$  the channel bandwidth configured in the lower band.
- NOTE 11: The requirements are only applicable to channel bandwidths with a carrier frequency at  $\pm \left(20 + BW_{Channel}^{HB}/2\right)$  MHz offset from  $2f_{UL}^{LB}$  in the victim (higher band) with  $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB}/2$ , where  $BW_{Channel}^{LB}$  and  $BW_{Channel}^{HB}$  are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.
- NOTE 12: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 4<sup>th</sup> transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 13: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that  $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.4 \right\rfloor 0.1 \, \text{in MHz and} \ F_{\scriptscriptstyle UL\_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 < f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} < F_{\scriptscriptstyle UL\_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \, \text{ with } f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \, \text{ the carrier frequency of a high band in MHz and} \ BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} \, \text{ the channel bandwidth configured in the low band.}$
- NOTE 14: For the UE that supports CA\_1A-19A-28A, no requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity should only be verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 15: These requirements apply when there is at least one individual RE within the downlink transmission bandwidth of the victim (lower) band for which the 3<sup>rd</sup> harmonic is within the uplink transmission bandwidth or the uplink adjacent channel's transmission bandwidth of an aggressor (higher) band.
- NOTE 16: The requirements should be verified for UL EARFCN of the aggressor (higher) band (superscript HB) such that  $f_{DL}^{LB} = \left \lfloor f_{UL}^{HB} / 0.3 \right \rfloor 0.1$  in MHz and  $F_{UL\_low}^{HB} + BW_{Channel}^{HB} / 2 < f_{UL}^{HB} < F_{UL\_high}^{HB} BW_{Channel}^{HB} / 2$  with  $f_{DL}^{LB}$  the carrier frequency in the victim (lower) band and  $BW_{Channel}^{HB}$  the channel bandwidth configured in the higher band.
- NOTE 17: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 5<sup>th</sup> transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 18: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that  $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.5 \right\rfloor 0.1 \, \text{in MHz and} \ F_{\scriptscriptstyle UL\_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 < f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} < F_{\scriptscriptstyle UL\_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \, \text{ with } f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \, \text{ the carrier frequency of a high band in MHz and} \ BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} \, \text{ the channel bandwidth configured in the low band.}$
- NOTE 19: No requirements apply for the case that there is at least one individual RE within the uplink transmission bandwidth of the relative higher band and when the frequency range of relative higher band's uplink channel bandwidth or uplink 1<sup>st</sup> adjacent channel bandwidth is fully or partially overlapped with the 3 times of the frequency range of the relative lower band's downlink channel bandwidth. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 20: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0b: Uplink configuration for the low band (exceptions)

E-UTRA Band / Channel bandwidth of the high band / N <sub>RB</sub> / Duplex mode										
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duple x mode		
CA_1A-3A-7A-8A	8				16	25	25	FDD		
CA_1A-3A-7A-28A	28				16	25	25	FDD		
CA_1A-3A-19A-42A	3			12	25	36	50	FDD		
CA_1A-3A-19A-42C	3			12	25	36	50	FDD		
CA_1A-3A-28A	28			8	16	25	25	FDD		
CA_1A-3A-42A	3			12	25	36	50	FDD		
CA_1A-7A-8A	8				16	25	25	FDD		
CA_1A-7A-28A	28			8	16	25	25	FDD		
CA_1A-28A	28			8	16	25	25	FDD		
CA_2A-4A-12A	12			8	16	20	20	FDD		
CA_3A-7A-8A	8				16	25	25	FDD		
CA_3A-19A-42A	3			12	25	36	50	FDD		
CA_3A-42A	3			12	25	36	50	FDD		
CA_4A-4A-5A-12A	12			8	16			FDD		
CA_4A-4A-12A-30A	12			8	16			FDD		
CA_4A-5A-12A	12			8	16	20	20	FDD		
CA_4A-7A-12A	12			8	16	20	20	FDD		
CA_4A-12A	12	2	5	8	16	20	20	FDD		
CA_4A-17A	17			8	16			FDD		
CA_4A-28A	28			[8]	[16]	[25]	[25]	FDD		
CA_7A-8A	8				16	25	25	FDD		
CA_7A-8A-20A	8				16	25	25	FDD		
CA_8A-42A	8			8	16	25	25	FDD		
CA_8A-42C	8			8	16	25	25	FDD		
CA_20A-40A <sup>3</sup>	40			25	50	75	100	FDD		
CA_28A-40A	40			25	50	75	100	TDD		
CA_28A-40C	40			25	50	75	100	TDD		

NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

NOTE 3: <sup>3</sup> refers to the UL resource blocks shall be located between 2373-2400MHz.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bA, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bA. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bA and Table 7.3.1A-0bB.

Table 7.3.1A-0bA: Reference sensitivity for carrier aggregation QPSK P<sub>REFSENS, CA</sub> (exceptions for two bands)

Channel bandwidth										
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode		
CA_1A-3A <sup>4</sup>	1			-100	-97	-95.2	-94	FDD		
	3			-94	-91.5	-90	-89			
CA_1A-3A <sup>5</sup>	1			-100	-97	-95.2	-94	FDD		
	3			-97	-94	-92.2	-91			
				[- 99.7] <sup>8</sup>	[-96.7] <sup>8</sup>	[-94.9] <sup>8</sup>	[-93.7] <sup>8</sup>			
CA_1A-3C <sup>4</sup>	1			-100	-97	-95.2	-94	FDD		
	3			-94	-91.5	-90	-89			
CA_1A-3C <sup>5</sup>	1			-100	-97	-95.2	-94	. FDD		
	3			-97	-94	-92.2	-91			
				[- 99.7] <sup>8</sup>	[-96.7] <sup>8</sup>	[-94.9] <sup>8</sup>	[-93.7] <sup>8</sup>			
CA_18A-28A <sup>6</sup>	18			-100	-97	-95.2		FDD		
	28			-94	-92.5					
CA_19A-28A <sup>7</sup>	19			-100	-97	-95.2		FDD		
	28			-94	-92					

- NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 6: These requirements apply when the uplink is active in Band 18 and the downlink channels in Band 28 are confined within the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 18.
- NOTE 7: These requirements apply when the uplink is active in Band 19 and the downlink channels in Band 28 are allocated at the middle of the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 19.
- NOTE 8: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0bB: Uplink configuration for the uplink band (exceptions for two bands)

	E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode											
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode				
CA_1A-3A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3C <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3C <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_18A-28A <sup>4</sup>	18			18	18	18		FDD				
CA_19A-28A <sup>4</sup>	19			18	18	18		FDD				

- NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.
- NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz
- NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.
- NOTE 4: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 28 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bC, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bC. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bC and Table 7.3.1A-0bD.

Table 7.3.1A-0bC: Reference sensitivity for carrier aggregation QPSK  $P_{\text{REFSENS, CA}}$  (exceptions for three bands)

		Cha	annel band	lwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
	1	•	, ,	-100	-97	-95.2	-94	
CA_1A-3A-5A <sup>4</sup>	3			-94	-91.5	-90	-89	FDD
	5			-98	-95			
	1			-100	-97	-95.2	-94	
_				-97	-94	-92.2	-91	
CA_1A-3A-5A <sup>5</sup>	3			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[-93.7] <sup>11</sup>	FDD
	5			-98	-95			
	1			-100	-97	-95.2	-94	
0	3			-94	-91.5	-90	-89	
CA_1A-3A-7A <sup>9</sup>					-95	-93.2	-92	FDD
	7				[-97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[-94.7] <sup>11</sup>	
	1			-100	-97	-95.2	-94	
				-97	-94	-92.2	-91	
CA_1A-3A-7A <sup>10</sup>	3			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[-93.7] <sup>11</sup>	FDD
					-95	-93.2	-92	
	7				[-97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[-94.7] <sup>11</sup>	
	1			-100	-97	-95.2	-94	
CA_1A-3A-7C <sup>9</sup>	3				-91.5	-90	-89	FDD
	7				-95	-93.2	-92	
CA_1A-3A-7C <sup>10</sup>	1			-100	-97	-95.2	-94	
	3				-94	-92.2	-91	FDD
	7				-95	-93.2	-92	
	1			-100	-97	-95.2	-94	
CA_1A-3A-8A <sup>4</sup>	3			-94	-91.5	-90	-89	FDD
	8		-99.2	-97	-94			
	1			-100	-97	-95.2	-94	
CA_1A-3A-8A <sup>5</sup>	3			-97	-94	-92.2	-91	FDD
	8		-99.2	-97	-94			
	1			-100	-97	-95.2	-94	
CA_1A-3A-19A <sup>4</sup>	3			-94	-91.5	-90	-89	FDD
	19			-100	-97	-95.2		
	1			-100	-97	-95.2	-94	
				-97	-94	-92.2	-91	
CA_1A-3A-19A <sup>5</sup>	3			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[-93.7] <sup>11</sup>	FDD
	19			-100	-97	-95.2		
	1			-100	-97	-95.2	-94	
,	3			-94	-91.5	-90	-89	
CA_1A-3A-20A <sup>4</sup>				-97	-94	-91.2	-90	FDD
	20			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 93.9] <sup>11</sup>	[-92.7] <sup>11</sup>	
	1			-100	-97	-95.2	-94	
				-97	-94	-92.2	-91	
CA_1A-3A-20A <sup>5</sup>	3			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[-93.7] <sup>11</sup>	FDD
				-97	-94	-91.2	-90	
	20			[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 93.9] <sup>11</sup>	[-92.7] <sup>11</sup>	

	1		-100	-97	-95.2	-94	
CA_1A-3A-26A <sup>4</sup>	3		-94	-91.5	-90	-89	FDD
	26		-97.5 <sup>7</sup>	-94.5 <sup>7</sup>			
	1		-100	-97	-95.2	-94	
_			-97	-94	-92.2	-91	
CA_1A-3A-26A <sup>5</sup>	3		[,	[-96.7] <sup>11</sup>	[,	[-93.7] <sup>11</sup>	FDD
			99.7] <sup>11</sup>	7	94.9] <sup>11</sup>		
	26		-97.5 <sup>7</sup>	-94.5 <sup>7</sup>			
	1		-100	-97	-95.2	-94	
CA_1A-3A-28A <sup>4</sup>	3		-94	-91.5	-90	-89	FDD
	28		-98.3	-95.3	-93.5	-90.8	
	1		-100	-97	-95.2	-94	
-			-97	-94	-92.2	-91	
CA_1A-3A-28A <sup>5</sup>	3		[- 99.7] <sup>11</sup>	[-96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[-93.7] <sup>11</sup>	FDD
	28		-98.3	-95.3	-93.5	-90.8	
	1		-99.8	-96.8	-95	-93.8	FD5
	3		-93.8	-91.3	-89.8	-88.8	FDD
CA 1A-3A-42A <sup>4</sup>			-98.5	-95.5	-93.7	-92.5	
0/1_// 0// 12/	42		[-	[-97.7] <sup>11</sup>	[	[-94.7] <sup>11</sup>	TDD
	72		100.7]		95.9] <sup>11</sup>		100
	1		-99.8	-96.8	-95	-93.8	
			-96.8	-93.8	-92	-90.8	FDD
	3		[	[-96.5] <sup>11</sup>	[	[-93.5] <sup>11</sup>	יטט ו
CA_1A-3A-42A <sup>5</sup>			99.5] <sup>11</sup>		94.7] <sup>11</sup>		
			-98.5	-95.5	-93.7	-92.5	
	42		[- 100.7]	[-97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[-94.7] <sup>11</sup>	TDD
	1		-99.8	-96.8	-95	-93.8	
	3		-93.8	-91.3	-89.8	-88.8	FDD
CA_1A-3A-42C <sup>4</sup>			-98.5	-95.5	-93.7	-92.5	
6/1_//\ 6/\ 126	42		[- 100.7]	[-97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[-94.7] <sup>11</sup>	TDD
	1		-99.8	-96.8	-95	-93.8	
			-96.8	-93.8	-92	-90.8	FDD
CA 1A-3A-42C <sup>5</sup>	3		[- 99.5] <sup>11</sup>	[-96.5] <sup>11</sup>	[- 94.7] <sup>11</sup>	[-93.5] <sup>11</sup>	. 55
O/(_//\ 0/\ 420			-98.5	-95.5	-93.7	-92.5	
	42		[- 100.7]	[-97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[-94.7] <sup>11</sup>	TDD
	1		-100	-97	-95.2	-94	
CA_1A-18A-28A <sup>6</sup>	18		-100	-97	-95.2		FDD
	28		-94	-92.5			
	1		-100	-97	-95.2	-94	-
CA_1A-19A-28A <sup>8</sup>	19		-100	-97	-95.2		FDD
	28		-94	-92			

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.

NOTE 3: The signal power is specified per port

NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3 and Band 5 or Band 8 or Band 19 or Band 20 or Band 26 or Band 28 or Band 42, the requirement applies regardless of channel bandwidth in Band 1.

NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

- MHz. For each channel bandwidth in Band 3 and Band 5 or Band 8 or Band 19 or Band 20 or Band 26 or Band 28 or Band 42, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 6: These requirements apply when the uplink is active in Band 18 and the downlink channels in Band 28 are confined within the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 18.
- NOTE 7: <sup>7</sup> indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.
- NOTE 8: These requirements apply when the uplink is active in Band 19 and the downlink channels in Band 28 are allocated at the middle of the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 19.
- NOTE 9: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3 and Band 7, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 10: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3 and Band 7, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 11: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0bD: Uplink configuration for the uplink band (exceptions for three bands)

	E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode											
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode				
CA_1A-3A-5A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-5A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-7A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-7A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-7C <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-7C <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-8A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-8A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-19A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-19A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-20A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-20A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-26A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-26A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-28A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-28A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-42A <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-42A <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-3A-42C <sup>1, 2</sup>	1			25	25	25	25	FDD				
CA_1A-3A-42C <sup>1, 3</sup>	1			25	45	45	45	FDD				
CA_1A-18A-28A <sup>4</sup>	18			18	18	18		FDD				
CA_1A-19A-28A <sup>4</sup>	19			18	18	18	-	FDD				

NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.

NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz

NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.

NOTE 4: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 28 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1)

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bD1, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bD1. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bD1 and Table 7.3.1A-0bD2.

Table 7.3.1A-0bD1: Reference sensitivity for carrier aggregation QPSK  $P_{\text{REFSENS, CA}}$  (exceptions for four bands)

		Ch	annel ban	dwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
	1			-100	-97	-95.2	-94	
	3 <sup>4</sup>			-94	-91.5	-90	-89	
				-97	-94	-92.2	-91	FDD
CA_1A-3A-5A-40A	3 <sup>5</sup>			[- 99.7] <sup>6</sup>	[-96.7] <sup>6</sup>	[-94.9] <sup>6</sup>	[-93.7] <sup>6</sup>	100
	5			-98	-95			
	40				-91.9	-90.4	-89.4	TDD
	1			-100	-97	-95.2	-94	
	3 <sup>4</sup>			-94	-91.5	-90	-89	
				-97	-94	-92.2	-91	
CA_1A-3A-7A-8A	3 <sup>5</sup>			[- 99.7] <sup>6</sup>	[-96.7] <sup>6</sup>	[-94.9] <sup>6</sup>	[-93.7] <sup>6</sup>	FDD
	_				-95	-93.2	-92	- -
	7				[-97.7] <sup>6</sup>	[-95.9] <sup>6</sup>	[-94.7] <sup>6</sup>	
	8			-96.8	-93.8			
	1			-100	-97	-95.2	-94	
	3 <sup>4</sup>				[-91.5]	[-90]	[-89]	
CA_1A-3A-7A-28A	3 <sup>5</sup>				-94	-92.2	-91	FDD
0/1_// 0// /// 20//	7				-95	-93.2	-92	. 55
	28				-95.3	-93.5	-90.8	
	1			-100	-97	-95.2	-94	
	3 <sup>4</sup>			-100	[-91.5]	[-90]	[-89]	
CA_1A-3A-7C-28A	3 <sup>5</sup>				-94	-92.2	-91	FDD
	7				-9 <del>4</del> -95	-92.2	-92	FDD
	28				-95.3	-93.2	-92.8	
	1			-100	-93.3	-95.2	-90.8	
	3 <sup>4</sup>			-94		-90		
-	3			-94	-91.5 -94	-90	-89 -91	
CA_1A-3A-8A-40A	3 <sup>5</sup>			[- 99.7] <sup>6</sup>	[-96.7] <sup>6</sup>	[-94.9] <sup>6</sup>	[-93.7] <sup>6</sup>	FDD
	8		-99.2	-97	-94			
	40		-33.2	[-93.4]	-91.9	-90.4	-89.4	TDD
	1			-99.8	-96.8	-95	-93.8	100
	3 <sup>4</sup>			-93.8	-90.8	-89.8	-88.8	
	3			-96.8				
	3 <sup>5</sup>			[- 99.5] <sup>6</sup>	-93.8 [-96.5] <sup>6</sup>	-92 [-94.7] <sup>6</sup>	-90.8 [-93.5] <sup>6</sup>	FDD
CA_1A-3A-19A-42A	19			-100	-97	-95.2		
-				-98.5	-95.5	-93.7	-92.5	
	42			[- 100.7]	[-97.7] <sup>6</sup>	[-95.9] <sup>6</sup>	[-94.7] <sup>6</sup>	TDD
	4				00.0	05	00.0	
	1			-99.8	-96.8	-95	-93.8	
-	3 <sup>4</sup>			-93.8	-91.3	-89.8	-88.8	
	3 <sup>5</sup>			-96.8	-93.8	-92	-90.8	FDD
CA_1A-3A-19A-42C				[- 99.5] <sup>6</sup>	[-96.5] <sup>6</sup>	[-94.7] <sup>6</sup>	[-93.5] <sup>6</sup>	
	19			-100	-97	-95.2		
	42			-98.5 [- 100.7]	-95.5 [-97.7] <sup>6</sup>	-93.7 [-95.9] <sup>6</sup>	-92.5 [-94.7] <sup>6</sup>	TDD

- NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 6: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0bD2: Uplink configuration for the low band (exceptions for four bands)

E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode										
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode		
CA_1A-3A-5A-40A	1 <sup>1,2</sup>			25	25	25	25			
CA_1A-3A-7A-8A CA_1A-3A-7A-28A CA_1A-3A-7C-28A CA_1A-3A-8A-40A CA_1A-3A-19A-42A	1 <sup>1,3</sup>			25	45	45	45	FDD		
CA 1A 2A 10A 12C	1 <sup>1,2</sup>			25	25	25	25	FDD		
CA_1A-3A-19A-42C	1 <sup>1,3</sup>			25	45	45	45	רטט		

- NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.
- NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz
- NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bE, UE shall meet the reference sensitivities specified in Table 7.3.1A-0bE and Table 7.3.1A-0bF.

Table 7.3.1A-0bE: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA

	EUTR		C	hannel b	andwidth			Duple	Applicat
EUTRA CA Configuration	A band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	x mode	e active UL band
	1			-100	-97	-95.2	-94		
	_			-97	-94	-92.2	-91		
CA_1-3A-5A-40A	3			[- 99.7] <sup>11</sup>	[- 96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[- 93.7] <sup>11</sup>	FDD	3
	5			-98	-95				
	40				-92.9	-91.3	-90.2	TDD	
	1			-91.7	[-89.5]	[-87.9]	[-86.9]		
CA_1-3A-5A-40A	3			-94.2	-91.2	-89.5	-88.3	FDD	40
0/(_1 0/1 0/1 10/1	5			-98	-95				
	40				-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94		
				-97	-94	-92.2	-91		
CA_1-3A-8A-40A	3			[- 99.7] <sup>11</sup>	[- 96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[- 93.7] <sup>11</sup>	FDD	3
	8		-99.2	-97	-94				
	40			-95.4	-92.9	-91.3	-90.2	TDD	
	1			-91.7	[-89.5]	[-87.9]	[-86.9]		
CA_1-3A-8A-40A	3			-94.2	-91.2	-89.5	-88.3	FDD	40
0/1_1 0/1 0/1 10/1	8		-99.2	-97	-94				
	40			-100	-97	-95.2	-94	TDD	TDD
CA_1A-3A-40A	1			-100	-97	-95.2	-94		
				-97	-94	-92.2	-91	FDD	
	3			[- 99.7] <sup>11</sup>	[- 96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[- 93.7] <sup>11</sup>		3
	40			-100	-92.9	-91.3	-90.2	TDD	
	1			-91.7	[-89.5]	[-87.9]	[-86.9]	FDD	40
CA_1A-3A-40A	3			-94.2	-91.2	-89.5	-88.3	ו טט	
	40			-100	-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94		
				-97	-94	-92.2	-91	FDD	
CA_1A-3A-40A	3			[-	[-	[-	[-		1
	40			99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>	TDD	
	40			[-93.4]	-91.3	-90	-88.9	TDD	
CA_1A-5A-40A	5			-100 -08	-97 -95	-95.2	-94	FDD	1
UA_1A-0A-40A	40			-98	-95 -91.9	-90.4	-89.4	TDD	1
	1			-91.7	[-89.5]	[-87.9]		טטו	
CA_1A-5A-40A	5			-91.7 -98	[-89.5] -95	[-07.9]	[-86.9]	FDD	40
UA_1A-0A-40A	40			-90	-95 -97	-95.2	-94	TDD	40
	1			-100	-97 -97	-95.2	-94	טטו	
CA_1A-8A-40A	8		-99.2	-100	-97 -94	-90.2	-94	FDD	1
UA_1A-UA-4UA	40		-99.∠	[-93.4]	-94 -91.9	-90.4	-89.4	TDD	'
	1			-91.7	[-89.5]	[-87.9]	[-86.9]	טטו	
CA_1A-8A-40A	8		-99.2	-91.7 -97	-94	[-01.8]	[-00.8]	FDD	40
OA_1A-0A-40A	40		-33.2	-100	-94	-95.2	-94	TDD	
	1			-100	-97 -97	-95.2	-94	FDD	
CA_1A-40A	40			[-93.4]	-91.9	-90.4	-89.4	TDD	1
	1			-91.7					
	1 1	1	1	-91./	[-89.5]	[-87.9]	[-86.9]	-	40
CA_1A-40A	40			-100	-97	-95.2	-94	TDD	40

	1	ı							
				[- 99.7] <sup>11</sup>	[- 96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[- 93.7] <sup>11</sup>		
	5			-98	-95	34.0]	30.7]		
	40				-92.9	-91.3	-90.2	TDD	
	3			-94.2	-91.2	-89.5	-88.3	,,,,	
CA_3A-5A-40A	5			-98	-95	00.0	00.0	FDD	40
O/(_O/( O/( 10/(	40			- 00	-97	-95.2	-94	TDD	10
	10			-97	-94	-92.2	-91	100	
	3			[-	[-	[-	[-		
CA_3A-7A-38A				99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>	FDD	3
	7			[-93.8]	[-91.2]	[-89.7]	[-88.6]		
	38			[-93.8]	[-91.2]	[-89.7]	[-88.6]	TDD	
				-97	-94	-92.2	-91		
	3			[	[	[	[-	FDD	
CA_3A-8A-40A				99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>	FDD	3
	8		-99.2	-97	-94				
	40			-95.4	-92.9	-91.3	-90.2	TDD	
	3			-94.2	-91.2	-89.5	-88.3	FDD	
CA_3A-8A-40A	8		-99.2	-97	-94			FDD	40
	40			-100	-97	-95.2	-94	TDD	
				-97	-94	-92.2	-91		
	3			[	[	[	[	FDD	
CA_3A-28A-40A				99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>	FDD	3
	28			-98.5	-95.5	-93.7	-91		
	40			-95.4	-92.9	-91.3	-90.2	TDD	
	3			-94.2	-91.2	-89.5	-88.3	FDD	
CA_3A-28A-40A	28			-96.8	-94.1	-92.5	-89.8	40	40
	40			-100	-97	-95.2	-94	TDD	
	3			-97	-94	-92.2	-91		
			[- ,,	[,	[- ,,	[,		FDD	
CA_3A-28A-40A			99.7]11	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>		100	28
	28			-98.5	-95.5	-93.7	-91		
	40			-95.1	-92.9	-91.4	-90.5	TDD	
	3			-97	-94	-92.2	-91		
			[-	[-	[-	[-		FDD	
CA_3A-28A-40C	20		99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup> -93.7	-91		3
	28			-98.5	-95.5			TDD	
	40			-95.4	-92.9	-91.3	-90.2	TDD	
	3			-97	-94 r	-92.2	-91		
CA_3A-28A-40C				[- 99.7] <sup>11</sup>	[- 96.7] <sup>11</sup>	[- 94.9] <sup>11</sup>	[- 93.7] <sup>11</sup>	FDD	28
OA_3A-20A-40C	28			-98.5	-95.5	-93.7	-91		20
	40			-95.1	-92.9	-91.4	-90.5	TDD	
	3			-94.2	-91.2	-89.5	-88.3		
CA_3A-28A-40C	28			-96.8	-94.1	-92.5	-89.8	FDD	40
0/1_0/120/100	40			-100	-97	-95.2	-94	TDD	10
	10			-97	-94	-92.2	-91	100	
	3			[-	[-	[-	[-	FDD	
CA_3A-40A				99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>		3
	40			-95.4	-92.9	-91.3	-90.2	TDD	
04 54 45	3			-94.2	-91.2	-89.5	-88.3	FDD	
CA_3A-40A	40			-100	-97	-95.2	-94	TDD	40
	<del>                                     </del>			-97	-94	-92.2	-91		
04 04 450	3			[-	[-	[-	[-	FDD	•
CA_3A-40C				99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>		3
	40			-95.4	-92.9	-91.3	-90.2	TDD	
CA_3A-40C	3			-94.2	-91.2	-89.5	-88.3	FDD	40

	40	100	07	-95.2	-94	TDD	
	40	-100	-97		_	TDD	
	3	[-94] -97.5	[-91]	[-89.2]	[-87.9]	FDD	
	41	-97.5 [-	-94.5 [- 97.2] <sup>11</sup>	-92.7 [- 95.4] <sup>11</sup>	-91.5 [- 94.2] <sup>11</sup>	TDD	41
CA_3A-41A <sup>5</sup>		100.2]1		_	_		
	3	-97 [-	-94 [-	-92.2 [-	-91 [-	FDD	3
-	41	99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>	TDD	
	3	[-93.3] [-94]	[-90.7] [-91]	[-89.2] [-89.2]	[-88.1] [-87.9]	FDD	
•	3	-94j -97.5	-94.5	-92.7	-91.5	FDD	
	41	[- 100.2] <sup>1</sup>	[- 97.2] <sup>11</sup>	[- 95.4] <sup>11</sup>	[- 94.2] <sup>11</sup>	TDD	41
CA_3A-41C <sup>5</sup>		-97	-94	-92.2	-91		
	3	-97 [-	-94 [-	-92.2	[-	FDD	
		99.7] <sup>11</sup>	96.7] <sup>11</sup>	94.9] <sup>11</sup>	93.7] <sup>11</sup>		3
	41	[-93.3]	[-90.7]	[-89.2]	[-88.1]	TDD	
	3	-96.5	-93.5	-91.7	-90.5	FDD	
CA_3A-41A-42A <sup>5,6,7,8</sup>	41	[-93.3]	[-90.7]	[-89.2]	[-88.1]	TDD	3
	42	-71.7	-71.7	-71.7	-71.7		
	3	-96.5	-93.5	-91.7	-90.5	FDD	
CA_3A-41A-42A <sup>5,6,9</sup>	41	[-93.3]	[-90.7]	[-89.2]	[-88.1]	TDD	3
	42	-97.1	-94.7	-93.2	-92.5	100	
	3	-96.5	-93.5	-91.7	-90.5	FDD	
		-97.5	-94.5	-92.7	-91.5		
CA_3A-41A-42A <sup>5,6,10</sup>	41	[- 100.2] <sup>1</sup>	[- 97.2] <sup>11</sup>	[- 95.4] <sup>11</sup>	[- 94.2] <sup>11</sup>		42
_		-98.5	-95.5	-93.7	-92.5	TDD	
	42	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 96.9] <sup>11</sup>	[- 94.7] <sup>11</sup>		
	3	[-93.5]	[-90.5]	[-88.7]	[-87.4]	FDD	
	-	-97.5	-94.5	-92.7	-91.5		
CA_3A-41A-42A <sup>5,6,10</sup>	41	[- 100.2] <sup>1</sup>	[- 97.2] <sup>11</sup>	[- 95.4] <sup>11</sup>	[- 94.2] <sup>11</sup>	TDD	41
	42	-98.5	-95.5	-93.7	-92.5		
		-98	-95	-93.2	-92		
04.74.404	7	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	FDD	7
CA_7A-40A	40	-96.3	-93.6	-92	-90.9	TDD	
	7	-97.1	-94.3	-92.7	-91.5	FDD	10
	40	-99.5	-96.5	-94.7	-93.5	TDD	40
		-98	-95	-93.2	-92		
	7	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	FDD	7
CA_7A-40C	40	-96.3	-93.6	-92	-90.9	TDD	
}	7	-90.3	-94.3	-92.7	-90.9	FDD	
•	40	-99.5	-96.5	-94.7	-93.5	TDD	40
		-98	-95	-93.2	-92	.55	
CA_7A-42A	7	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	FDD	7
	42	-95.6	-93	-91.5	-90.4	TDD	
	7	-96.2	-93.2	-91.5 -91.5	-90.4	FDD	42
	1	-90.2	-93.2	-91.5	-90.3	טטרו	42

		-98.5	-95.5	-93.7	-92.5		
	42	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 96.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	TDD	
		-98	-95	-93.2	-92		
	7	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 95.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	FDD	7
CA_7A-42A-42A	42	-95.6	-93	-91.5	-90.4	TDD	
CA_1A-42A-42A	7	-96.2	-93.2	-91.5	-90.3	FDD	42
		-98.5	-95.5	-93.7	-92.5		42
	42	[- 100.7] <sup>1</sup>	[- 97.7] <sup>11</sup>	[- 96.9] <sup>11</sup>	[- 94.7] <sup>11</sup>	TDD	
CA 20A 40A	28	-98.5	-95.5	-93.7	-91	FDD	20
CA_28A-40A	40	-95.1	-92.9	-91.4	-90.5	TDD	28
CA_28A-40A	28	-96.8	-94.1	-92.5	-89.8	FDD	40
CA_20A-40A	40	-100	-97	-95.2	-94	TDD	40
CA_28A-40C	28	-98.5	-95.5	-93.7	-91	FDD	28
CA_20A-40C	40	-95.1	-92.9	-91.4	-90.5	TDD	20
CA_28A-40C	28	-96.8	-94.1	-92.5	-89.8	FDD	40
CA_20A-40C	40	-100	-97	-95.2	-94	TDD	40
CA_28A-40D	28	-98.5	-95.5	-93.7	-91	FDD	28
CA_20A-40D	40	-95.1	-92.9	-91.4	-90.5	-00	20
CA_28A-40D	28	-96.8	-94.1	-92.5	-89.8	FDD	40
CA_20A-40D	40	-100	-97	-95.2	-94	רטט	40

- NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply regardless of the channel bandwidth and the location of UL band.
- NOTE 5: The B41 requirements are modified by -0.5dB when carrier frequency of the assigned E-UTRA channel bandwidth is within 2545-2690 MHz.
- NOTE 6: The antenna isolation for MSD calculation is assumed as 10 dB. For conducted mode REFSENS test such antenna isolation is not observed as the antennas are disconnected. Additionally antenna isolation assumption is under discussion depending on the frequency range
- NOTE 7: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range  $\Delta F_{HD}$  above and below the edge of this downlink transmission bandwidth. The value  $\Delta F_{HD}$  depends on the E-UTRA configuration:  $\Delta F_{HD} = 10$  MHz for CA\_3A-42A, CA\_3A-42C, CA\_1A-3A-42A, CA\_1A-3A-42C, CA\_3A-19A-42A and CA\_1A-3A-19A-42A, CA\_3A-41A-42A.
- NOTE 8: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that  $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.2 \right \rfloor 0.1$  in MHz and  $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL\_high}^{LB} BW_{Channel}^{LB} / 2$  with  $f_{DL}^{HB}$  carrier frequency in the victim (higher) band in MHz and  $BW_{Channel}^{LB}$  the channel bandwidth configured in the lower band
- NOTE 9: The requirements are only applicable to channel bandwidths with a carrier frequency at  $\pm \left(20 + BW_{Channel}^{HB} / 2\right) \text{ MHz offset from } 2f_{UL}^{LB} \text{ in the victim (higher band) with } \\ F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB} / 2 \text{ , where } BW_{Channel}^{LB} \text{ and } BW_{Channel}^{HB} \text{ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.}$
- NOTE 10: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 11: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0bF: Uplink configuration for reference sensitivity

E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode												
EUTRA CA Configuration	E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode				
	1			25	50	75	100	FDD				
CA_1A-3A-40A	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
	40			25	50	75	100	TDD				
CA_1A-5A-40A	1			25	50	75	100	FDD				
	1			25	50	75	100	FDD				
CA_1A-8A-40A	8		15	25	25 <sup>1</sup>			FDD				
	40			25	50	75	100	TDD				
CA 4A 40A	1			25	50	75	100	FDD				
CA_1A-40A	40			25	50	75	100	TDD				
CA_3A-7A-38A	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
CA_3A-8A-40A	8		15	25	25 <sup>1</sup>			FDD				
	40			25	50	75	100	TDD				
CA_3A-40A	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
CA_3A-40C CA_3A-5A-40A CA_3A-28A-40A CA_3A-28A- 40C CA_1A-3A-5A- 40A CA_1A-3A-8A- 40A	40			25	50	75	100	TDD				
CA 2A 44A	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
CA_3A-41A	41			25	50	75	100	TDD				
CA 2A 44C	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
CA_3A-41C	41			25	50	75	100	TDD				
	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
CA_3A-41A-42A	41			25	50	75	100	TDD				
	42			25	50	75	100	TDD				
CA_7A-40A,	7			25	50	75	75 <sup>1</sup>	FDD				
CA_7A-40C	40			25	50	75	100	TDD				
CA_7A-42A,	7			25	50	75	75 <sup>1</sup>	FDD				
CA_7A-42A-42A	42			25	50	75	100	TDD				
CA_28A-40A,	28			25	25 <sup>1</sup>	25 <sup>1</sup>	25 <sup>1</sup>	FDD				
CA_28A-40C	40			25	50	75	100	TDD				

NOTE 1: 1 refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

For band combinations including operating bands without uplink band (as noted in Table 5.5-1), the requirements are specified in Table 7.3.1A-0d and Table 7.3.1A-0e.

Table 7.3.1A-0d: Reference sensitivity QPSK PREFSENS

			annel ban		T		1	
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
<b>J</b>		,		-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-5A-29A	2			[- 100.4]	[-97.4] <sup>4</sup>	[-95.6] <sup>4</sup>	[-94.4] <sup>4</sup>	FDD
CA_2A-4A-5A-29A	4			-99.7	-96.7	-94.9	-93.7	עטיז ו
	5			-98	-95			-
	29			-97	-94			
				-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-29A	2			[- 100.4]	[-97.4] <sup>4</sup>	[-95.6] <sup>4</sup>	[-94.4] <sup>4</sup>	FDD
	4			-99.7	-96.7	-94.9	-93.7	
	29			-97	-94			
				-97.6	-94.6	-92.8	-91.6	
CA_2A-4A-29A-30A	2			[- 100.3]	[-97.3] <sup>4</sup>	[-95.5] <sup>4</sup>	[-94.3] <sup>4</sup>	FDD
0, <u>-</u> 2, 1, 1, 20, 1, 00, 1	4			-99.6	-96.6	-94.8	-93.6	
	29			-97	-94			
	30			-98.5	-95.5			
				-98	-95	-93.2	-92	
CA_2A-5A-29A	2			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	5			-98	-95			
	29			-97	-94			1
				-98	-95	-93.2	-92	
CA_2A-29A	2			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	29		-98.7	-97	-94			1
				-98	-95	-93.2	-92	
CA_2C-29A	2			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	29			-97	-94			
				-97.6	-94.6	-92.8	-91.6	
CA_2A-29A-30A	2			[- 100.3]	[-97.3] <sup>4</sup>	[-95.5] <sup>4</sup>	[-94.3] <sup>4</sup>	FDD
	29			-97	-94			1
	30			-98.5	-95.5			<u></u>
				-97.6	-94.6	-92.8	-91.6	
CA_2C-29A-30A	2			[- 100.3]	[-97.3] <sup>4</sup>	[-95.5] <sup>4</sup>	[-94.3] <sup>4</sup>	FDD
Ì	29			-97	-94			1
	30			-98.5	-95.5			1
00 40 40 000	4			-100	-97	-95.2	-94	
CA_4A-4A-29A	29			-97	-94			FDD
	4			-99.6	-96.6	-94.8	-93.6	
CA_4A-4A-29A-30A	29			-97	-94			FDD
	30			-98.5	-95.5			
CA_4A-5A-29A	4			-100	-97	-95.2	-94	FDD

	5			-98	-95			
	29			-97	-94			
CA 4A-29A	4			-100	-97	-95.2	-94	FDD
CA_4A-29A	29		-98.7	-97	-94			ם שר
	4			-99.6	-96.6	-94.8	-93.6	
CA_4A-29A-30A	29			-97	-94			FDD
	30			-98.5	-95.5			
CA	5			-98	-95			FDD
CA_5A-29A	29			-97	-94			FUU
CA_20A-32A	20			-97	-94			FDD
CA_20A-32A	32			-100	-97	-95.2	-94	FUU
CA 20A 67A	20			-97	-94	-91.2	-90	FDD
CA_20A-67A	67			-100	-97	-95.2	-94	FUU
CA 22A 20A	23			-100	-97	-95.2	-94	FDD
CA_23A-29A	29		-98.7	-97	-94			טטיז
CA 20A 20A	29			-97	-94			FDD
CA_29A-30A	30			-99	-96			ן רטט
		_						

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3: The signal power is specified per port.

NOTE 4: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-0e: Uplink configuration for reference sensitivity

		Band / Char						
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
<b>J</b>	2	()	()	25	50	50 <sup>1</sup>	50 <sup>1</sup>	
	4			25	50	75	100	
CA_2A-4A-5A-29A	5			25	25 <sup>1</sup>		100	FDD
	29			N/A	N/A			1
	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	
CA_2A-4A-29A	4			25	50	75	100	FDD
UA_2A-4A-23A	29			N/A	N/A	, 0	100	100
	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	
	4			25	50	75	100	
CA_2A-4A-29A-30A	29			N/A	N/A	73	100	FDD
}				25	25 <sup>1</sup>			-
	30					= 01	= 01	
<b>2</b>	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	
CA_2A-5A-29A	5			25	25 <sup>1</sup>			FDD
	29			N/A	N/A			
CA_2A-29A	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
O/(_Z/\ Z0/\	29		N/A	N/A	N/A			100
CA_2C-29A	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
UA_2U-29A	29			N/A	N/A			100
	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	
CA_2A-29A-30A	29			N/A	N/A			FDD
Ì	30			25	25 <sup>1</sup>			
	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	
CA_2C-29A-30A	29			N/A	N/A			FDD
	30			25	25 <sup>1</sup>			1
	4			25	50	75	100	
CA_4A-4A-29A-30A	29			N/A	N/A			FDD
	30			25	25 <sup>1</sup>			
	4			25	50	75	100	
CA_4A-4A-29A	29			N/A	N/A		100	FDD
	4			25	50	75	100	
CA_4A-5A-29A	5			25	25 <sup>1</sup>	, ,	100	FDD
OA_ <del>1</del> A-3A-23A	29			N/A	N/A			100
	4			25	50	75	100	
CA_4A-29A	29		N/A	N/A	N/A	75	100	FDD
	4		IN/A	25	50	75	100	-
CA 4A 20A 20A	29			N/A	N/A	73	100	
CA_4A-29A-30A				25	25 <sup>1</sup>			FDD
	30							
CA_5A-29A	5			25	25 <sup>1</sup>			FDD
	29			N/A	N/A			
CA_20A-32A	20			25	20 <sup>1</sup>			FDD
	32			N/A	N/A	N/A	N/A	
CA_20A-67A	20			25	20 <sup>1</sup>	20 <sup>2</sup>	20 <sup>2</sup>	FDD
5. (_25. ( 5.7 (	[67]			N/A	N/A	N/A	N/A	. 55
CA_23A-29A	23			25	50	75	100	FDD
UN_2UN-2UN	29		N/A	N/A	N/A			100
CA 20A 20A	29			N/A	N/A			EDD
CA_29A-30A	30	<del></del>		25	25			FDD

NOTE 1: <sup>1</sup> refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: <sup>2</sup> refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RBstart 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 16

For band combinations including operating band 46 (Table 5.5-1), the requirements are specified in Table 7.3.1A-0eA and Table 7.3.1A-0eB.

Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS

			Channel b	andwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
CA 1A-46A	1			-100	-97	-95.2	-94	FDD
CA_1A-46A	46						-90	TDD
				-98	-95	-93.2	-92	
CA_2A-46A	2			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	46						-90	TDD
04 04 404	3			-97	-94	-92.2	-91	FDD
CA_3A-46A	46						-90	TDD
04 44 404	4			-100	-97	-95.2	-94	FDD
CA_4A-46A	46						-90	TDD
				-98	-95	-93.2	-92	
CA_7A-46A	7			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	46						-90	TDD
				-98	-95	-93.2	-92	
CA_41A-46A	41			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	46						-90	TDD
				-99	-96	-94.2	-93	
CA_42A-46A	42			[- 100.7]	[-97.7] <sup>4</sup>	[-95.9] <sup>4</sup>	[-94.7] <sup>4</sup>	FDD
	46						FFS	TDD

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: The signal power is specified per port.

NOTE 4: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

NOTE 5: The requirements do not apply when there is at least one individual RE within the uplink transmission bandwidth of the lower band for which the transmitter harmonic is within the downlink transmission bandwidth of the higher band and a range  $\Delta F_{HD}$  above and below the edge of this downlink transmission bandwidth. The value  $\Delta F_{HD}$  depends on the E-UTRA configuration:  $\Delta F_{HD} = [15]$  MHz for CA\_xA-46A (x=1, 2, 3 and 4) for 3rd harmonic. FFS MHz for the other configurations listed.

Table 7.3.1A-0eB: Uplink configuration for reference sensitivity

	E-UT	RA Band / Ch	annel ban	dwidth / N	I <sub>RB</sub> / Duple	x mode		
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
CA_1A-46A	1			25	50	75	100	FDD
CA_2A-46A	2			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
CA_3A-46A	3			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
CA_4A-46A	4			25	50	75	100	FDD
CA_7A-46A	7			25	50	75	75 <sup>1</sup>	FDD
CA_41A-46A	41			25	50	75	100	TDD
CA_41A-46A	42			25	50	75	100	TDD

NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

In all cases for single uplink inter-band CA, unless given by Table 7.3.1-3 for the band with the active uplink carrier, the applicable reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to two E-UTRA bands the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2. The reference sensitivity is defined to be met with all downlink component carriers active and both of the uplink carriers active.

For E-UTRA CA configurations with uplink and downlink assigned to two E-UTRA bands given in Table 7.3.1A-0f the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3.1A-0f. For E-UTRA CA configurations with uplink assigned to two E-UTRA bands and downlink assigned to three E-UTRA bands given in Table 7.3.1A-0g the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3.1A-0g. For these test points the reference sensitivity requirement specified in Table 7.3.1-1 is relaxed by the amount of parameter MSD given in Table 7.3.1A-0f.

The allowed exceptions defined in Table 7.3.1A-0a and Table 7.3.1A-0b for inter-band carrier aggregation with a single active uplink are also applicable for dual uplink operation.

Table 7.3.1A-0f: 2 UL and 2 DL interband Reference sensitivity QPSK P<sub>REFSENS</sub> and uplink/downlink configurations

E-U	E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode									
EUTRA CA Configuration	EUTRA band	UL F <sub>c</sub> (MHz)	UL/DL BW (MHz)	UL C <sub>LRB</sub>	DL F <sub>c</sub> (MHz)	MSD (dB)	Duplex mode			

CA 1A 2A	1	1950	5	25	2140	23	FDD
CA_1A_3A	3	1760	5	25	1855	N/A	רטט
CA_1A_8A	1	1965	5	25	2155	6	FDD
CA_TA_6A	8	887.5	5	25	932.5	N/A	רטט
CA 2A 4A	2	1860	20	50 <sup>2</sup>	1940	5	FDD
CA_2A-4A	4	1752.5	5	25	2152.5	N/A	רטט
CA 2A 4A	2	1868.3	5	25	1948.3	N/A	FDD
CA_2A-4A	4	1735	5	25	2135	5	רטט
CA_3A-5A	3	1771	10	50	1866	4	FDD
CA_3A-5A	5	838	5	25	883	N/A	רטט
CA_3A-5A	3	1721	10	50	1816	N/A	FDD
CA_SA-SA	5	838	5	25	883	24	רטט
CA_3A-7A	3	1730	5	25	1825	N/A	FDD
CA_3A-7A	7	2535	10	50	2655	13	רטט
CA_3A-8A	3	1755	10	50	1850	N/A	FDD
CA_SA-6A	8	900	5	25	945	8	רטט
CA 3A 10A	3	1771	5	25	1866	4	FDD
CA_3A-19A	19	838	5	25	883	N/A	רטט
CA 3A 10A	3	1721	5	25	1816	N/A	FDD
CA_3A-19A	19	838	5	25	883	27	רטט
CA-3A-20A	3	1775	5	25	1870	4	FDD
CA-3A-20A	20	840	5	25	799	N/A	רטט
CA 2A 20A	3	1735	5	25	1830	N/A	FDD
CA-3A-20A	20	847	5	25	806	9	רטט
CA 2A 2CA	3	1771	5	25	1866	4	FDD
CA_3A-26A	26	838	5	25	883	N/A	רטט
CA 2A 26A	3	1721	5	25	1816	N/A	FDD
CA_3A-26A	26	838	5	25	883	26	רטט
CA 4A 5A	4	1721	5	25	2121	N/A	EDD
CA_4A-5A	5	838	5	25	883	26	FDD
CA 4A 7A	4	1730	5	25	1825	N/A	EDD
CA_4A-7A	7	2535	5	25	2655	15	FDD
CA 5A 7A	5	834	5	25	879	12	EDD
CA_5A-7A	7	2547	10	50	2667	N/A	FDD
CA 7A 20A	7	2512	10	50	2632	N/A	FDD
CA_7A-20A	20	851	5	25	810	12	ן רטט
						• .	-

NOTE 1: Both of the transmitters shall be set min(+20 dBm, P<sub>CMAX\_L,c</sub>) as defined in subclause 6.2.5A NOTE 2: RB<sub>START</sub> = 0

Table 7.3.1A-0g: 2 UL and 3 DL interband Reference sensitivity QPSK P<sub>REFSENS</sub> and uplink/downlink configurations

	E	-UTRA Ba	nd / Chann	el bandwid	th / NRB / D	uplex mode	•		
EUTRA CA	EUTRA CA	EUTRA	UL F <sub>c</sub>	UL BW	UL	DL F <sub>c</sub> (MHz)	DL BW	MSD	Duploy
DL Configuration	UL Configurati on	band	(MHz)	(MHz)	C <sub>LRB</sub>	(MHz)	(MHz)	(dB)	- Duplex mode
		1	1968	5	25	2158	5	NA	
CA_1A-5A-7A	CA_1A-7A	7	2512	10	50	2632	10	NA	FDD
		5	835	5	25	880	5	1.0	
		3	1737	5	25	1832	5	NA	
	CA_3A-7A	7	2543	10	50	2663	10	NA	FDD
CA_3A-7A-20A		20	847	10	20	806	10	10.5	
CA_3A-7A-20A		3	1775	10	50	1870	10	NA	
	CA_3A-20A	20	855	5	25	896	5	NA	FDD
		7	2510	10	50	2630	10	26.0	
		3	1747	5	25	1842	5	NA	
	CA_3A-7A	7	2543	5	25	2663	5	NA	FDD
CA 2A 7A 29A		28	741	5	25	796.0	5	20	<u> </u>
CA_3A-7A-28A		7	2543	5	25	2663	5	NA	
	CA_7A-28A	28	710.5	5	25	765.5	5	NA	FDD
		3	1737.5	5	25	1832.5	5	26	

For intra-band contiguous carrier aggregation the throughput of each component carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1, Table 7.3.1-1a, Table 7.3.1-1A, Table 7.3.1-1B, Table 7.3.1-1C, Table 7.3.1A-0h and Table 7.3.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the power levels in Table 7.3.1-1 and Table 7.3.1-1a also apply for an SCC assigned in the unpaired part. The requirement is verified using an uplink CA configuration with the largest number of carriers supported by the UE. Table 7.3.1A-1 specifies the maximum number of allocated uplink resource blocks for which the intra-band contiguous carrier aggregation reference sensitivity requirement shall be met. The PCC and SCC allocations as defined in Table 7.3.1A-1 form a contiguous allocation where TX–RX frequency separations of the component carriers are as defined in Table 5.7.4-1. In case downlink CA configuration has additional SCC(s) compared to uplink CA configuration those are configured furthers away from uplink band. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than any of the downlink SCC center frequency. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

Table 7.3.1A-0h: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwith Class B

CA	configuration / 0	CC comb	ination / I	N <sub>RB_agg</sub> / [	Duplex m	ode		
Holink C	A configuration	50RB-	+25RB	50RB-	+50RB	Duplex		
Opinik C/	4 configuration	PCC	SCC	PCC	SCC	Mode		
(	CA_8B	25	0	25	0	FDD		
NOTE 1:	The carrier centr	e frequen	cy of SCC	in the U	L operatin	ng band is		
	configured close							
NOTE 2:	The transmitted	power over	er both PC	CC and So	CC shall b	e set to		
	Oma at a second	in subclause 6.2.5A.						
NOTE 3:		blocks in both PCC and SCC shall be confined						
	within the transm		ndwidth c	onfigurati	on for the	channel		
	bandwidth (Table	,						
NOTE 4:	The UL resource							
	possible to the d							
	blocks in SCC sh		ated as fa	ar as poss	ible from	the		
	downlink operati	0						
NOTE 5:	In case a CA configuration consists of CC channel bandwidths							
	which are unequ					dwidth		
	shall be the large	er one for	reterence	sensitivit	y test.			

Table 7.3.1A-1: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwidth

			CA confi	guratior	/ CC co	ombinat	ion / N <sub>R</sub>	B_agg / D	uplex m	ode			
Uplink CA	100RB	+25RB	100RB	+50RB	75RB-	+75RB	75RB-	+50RB	100RB	+75RB	100RB-	+100RB	Duplex
configuration	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	Mode
CA_1C	N/A	N/A	N/A	N/A	75	54	N/A	N/A	N/A	N/A	100	30	FDD
CA_3C	50	0	50	0	N/A	N/A	N/A	N/A	50	0	50	0	FDD
CA_7C	N/A	N/A	75	0	75	0	N/A	N/A	75	0	75	0	FDD
CA_38C	N/A	N/A	N/A	N/A	75	75	N/A	N/A	N/A	N/A	100	100	TDD
CA_39C	100	25	100	50	N/A	N/A	N/A	N/A	100	75	N/A	N/A	TDD
CA_40C	N/A	N/A	100	50	75	75	N/A	N/A	100	75	100	100	TDD
CA_41C	N/A	N/A	100	50	75	75	N/A	N/A	100	75	100	100	TDD
CA_42C	100	25	100	50	N/A	N/A	N/A	N/A	100	75	100	100	TDD

NOTE 1: The carrier centre frequency of SCC in the UL operating band is configured closer to the DL operating band.

NOTE 2: The transmitted power over both PCC and SCC shall be set to PUMAX as defined in subclause 6.2.5A.

NOTE 3: The UL resource blocks in both PCC and SCC shall be confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 4: The UL resource blocks in PCC shall be located as close as possible to the downlink operating band, while the UL resource blocks in SCC shall be located as far as possible from the downlink operating band.

NOTE 5: In case a CA configuration consists of CC channel bandwidths which are unequal in bandwidth the PCC channel bandwidth shall be the larger one for reference sensitivity test.

NOTE 6: Void. NOTE 7: Void

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the throughput of each downlink component carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.1-1, Table 7.3.1-1a, Table 7.3.1-1A, Table 7.3.1-1B, Table 7.3.1-1C and Table 7.3.1A-3 with the reference sensitivity power level increased by  $\Delta R_{IBNC}$  given in Table 7.3.1A-3 for the SCC(s). The requirements apply with all downlink carriers active. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

Table 7.3.1A-3: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity

CA configuration	Aggregated channel bandwidth (PCC+SCC)	W <sub>gap</sub> /[MHz]	UL PCC allocation	ΔR <sub>IBNC</sub> (dB)	Duplex mode
	(1.00.000)	$30.0 < W_{gap} \le 50.0$	12 <sup>1</sup>	5.3	
	25RB+25RB	$[30.0 < W_{gap} \le 50.0]$	[12 <sup>1</sup> ]	[8.0] <sup>17</sup>	
		$0.0 < W_{gap} \le 30.0$	25 <sup>1</sup>	0	 
		$25.0 < W_{gap} \le 45.0$	12 <sup>1</sup>	4.4	-
	25RB+50RB	$[25.0 < W_{gap} \le 45.0]$	[12 <sup>1</sup> ]	[7.1] <sup>17</sup>	-
		$0.0 < W_{gap} \le 25.0$	25 <sup>1</sup>	0	
		$20.0 < W_{gap} \le 40.0$	12 <sup>1</sup>	4.2	
	25RB+75RB	$[20.0 < W_{gap} \le 40.0]$	[12 <sup>1</sup> ]	[6.9] <sup>17</sup>	
		$0.0 < W_{gap} \le 20.0$	25 <sup>1</sup>	0	_
		$15.0 < W_{gap} \le 35.0$	12 <sup>1</sup>	3.8	
	25RB+100RB	$[30.0 < W_{gap} \le 50.0]$	[12 <sup>1</sup> ]	[6.5] <sup>17</sup>	
		$0.0 < W_{gap} \le 15.0$	25 <sup>1</sup>	0	
		$15.0 < W_{gap} \le 45.0$	12 <sup>1</sup>	5.9	
	50RB+25RB	$[15.0 < W_{gap} \le 45.0]$	[12 <sup>1</sup> ]	[8.6] <sup>17</sup>	
		$0.0 < W_{gap} \le 15.0$	32 <sup>1</sup>	0	
		$10.0 < W_{gap} \le 40.0$	12 <sup>1</sup>	4.6	j
	50RB+50RB	$[10.0 < W_{gap} \le 45.0]$	[12 <sup>1</sup> ]	[7.3] <sup>17</sup>	
		$0.0 < W_{gap} \le 10.0$	321	0	<u> </u>
		$5.0 < W_{gap} \le 35.0$	12 <sup>1</sup>	4.1	
	50RB+75RB	$[5.0 < W_{gap} \le 35.0]$	[12 <sup>1</sup> ]	[6.8] <sup>17</sup>	
CA 2A 2A		$0.0 < W_{gap} \le 5.0$	32 <sup>1</sup>	0	
CA_2A-2A	50RB+100RB	$0.0 < W_{gap} \le 30.0$	12 <sup>1</sup>	4.0	FDD
		$[0.0 < W_{gap} \le 30.0]$	[12 <sup>1</sup> ]	[6.7] <sup>17</sup>	
		$10.0 < W_{gap} \le 40.0$	12 <sup>12</sup>	6.7	
	75RB+25RB	$[10.0 < W_{gap} \le 40.0]$	[12 <sup>1</sup> ]	[9.4] <sup>17</sup>	
		$0.0 < W_{gap} \le 10.0$	36 <sup>1</sup>	0	
		$5.0 < W_{gap} \le 35.0$	12 <sup>12</sup>	5.4	-
	75RB+50RB	$[5.0 < W_{gap} \le 35.0]$	[12 <sup>12</sup> ]	[8.1] <sup>17</sup>	
		$0.0 < W_{gap} \le 5.0$	36 <sup>1</sup>	0	
		$0.0 < W_{gap} \le 30.0$	12 <sup>12</sup>	4.6	
	75RB+75RB	$[0.0 < W_{gap} \le 30.0]$	[12 <sup>12</sup> ]	[7.3] <sup>17</sup>	
		$0.0 < W_{gap} \le 25.0$	12 <sup>12</sup>	4.2	
	75RB+100RB	$[0.0 < W_{gap} \le 25.0]$	[12 <sup>12</sup> ]	[6.9] <sup>17</sup>	1
		$0.0 < W_{gap} \le 35.0$	16 <sup>13</sup>	7.2	1
	100RB+25RB	$[0.0 < W_{gap} \le 35.0]$	[16 <sup>12</sup> ]	[9.9] <sup>17</sup>	1
		$0.0 < W_{gap} \le 30.0$	16 <sup>13</sup>	5.8	1
	100RB+50RB	$[0.0 < W_{gap} \le 30.0]$	[16 <sup>13</sup> ]	[8.5] <sup>17</sup>	1
		$0.0 < W_{gap} \le 30.0$	16 <sup>13</sup>	5.0	
	100RB+75RB	$[0.0 < W_{gap} \le 25.0]$	[16 <sup>13</sup> ]	5.0 [7.7] <sup>17</sup>	-
		$0.0 < W_{\text{gap}} \le 20.0$	16 <sup>13</sup>	4.6	
	100RB+100RB	$[0.0 < W_{gap} \le 20.0]$	[16 <sup>13</sup> ]	[7.3] <sup>17</sup>	1
			12 <sup>1</sup>	4.7	
	4 47				$\dashv$
CA 2A 2A	25RB+25RB	$[45.0 < W_{gap} \le 65.0]$	25 <sup>1</sup>		EDD
CA_3A-3A		$0.0 < W_{gap} \le 45.0$		0	FDD
	25RB+50RB	$40.0 < W_{gap} \le 60.0$	12 <sup>1</sup>	3.8	
		$[40.0 < W_{gap} \le 60.0]$	[12 <sup>1</sup> ]	[6.5] <sup>17</sup>	

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		$0.0 < W_{gap} \le 40.0$	25 <sup>1</sup>	0	
		$35.0 < W_{gap} \le 55.0$	12 <sup>1</sup>	3.6	
	25RB+75RB	$[35.0 < W_{gap} \le 55.0]$	[12 <sup>1</sup> ]	[6.3] <sup>17</sup>	
		$0.0 < W_{gap} \le 35.0$	25 <sup>1</sup>	0	
		$30.0 < W_{gap} \le 50.0$	12 <sup>1</sup>	3.4	
	25RB+100RB	$[30.0 < W_{gap} \le 50.0]$	[12 <sup>1</sup> ]	[6.1] <sup>17</sup>	
		$0.0 < W_{gap} \le 30.0$	25 <sup>1</sup>	0	
		$30.0 < W_{gap} \le 60.0$	12 <sup>9</sup>	5.1	
	50RB+25RB	$[30.0 < W_{gap} \le 60.0]$	[12 <sup>9</sup> ]	[7.8] <sup>17</sup>	
		$0.0 < W_{gap} \le 30.0$	32 <sup>1</sup>	0	
		25.0 < W <sub>gap</sub> ≤ 55.0	12 <sup>9</sup>	4.3	
	50RB+50RB	[25.0 < W <sub>gap</sub> ≤ 55.0]	[12 <sup>9</sup> ]	[7.0] <sup>17</sup>	
		$0.0 < W_{gap} \le 25.0$	32 <sup>1</sup>	0	
		$20.0 < W_{gap} \le 50.0$	12 <sup>9</sup>	3.8	
	50RB+75RB	$[20.0 < W_{gap} \le 50.0]$	[12 <sup>9</sup> ]	[6.5] <sup>17</sup>	
	JUNDALIND	$0.0 < W_{gap} \le 50.0$	32 <sup>1</sup>	0	
		• • • • • • • • • • • • • • • • • • • •	12 <sup>9</sup>	3.4	
	FORD LACORD	$15.0 < W_{gap} \le 45.0$			
	50RB+100RB	$[15.0 < W_{gap} \le 45.0]$	[12 <sup>9</sup> ]	[6.1] <sup>17</sup>	
		$0.0 < W_{gap} \le 15.0$	32 <sup>1</sup>	0	
		$25.0 < W_{gap} \le 55.0$	12 <sup>10</sup>	6.0	
	75RB+25RB	$[25.0 < W_{gap} \le 55.0]$	[12 <sup>10</sup> ]	[8.7] <sup>17</sup>	
		$0.0 < W_{gap} \le 25.0$	32 <sup>1</sup>	0	
		$20.0 < W_{gap} \le 50.0$	12 <sup>10</sup>	4.7	
	75RB+50RB	$[20.0 < W_{gap} \le 55.0]$	[12 <sup>10</sup> ]	[7.4] <sup>17</sup>	
		$0.0 < W_{gap} \le 20.0$	32 <sup>1</sup>	0	
		$15.0 < W_{gap} \le 45.0$	12 <sup>10</sup>	4.2	
	75RB+75RB	$[15.0 < W_{gap} \le 45.0]$	[12 <sup>10</sup> ]	[6.9] <sup>17</sup>	
		$0.0 < W_{gap} \le 15.0$	32 <sup>1</sup>	0	
		$10.0 < W_{gap} \le 40.0$	12 <sup>10</sup>	3.8	
	75RB+100RB	$[10.0 < W_{gap} \le 40.0]$	[12 <sup>10</sup> ]	[6.5] <sup>17</sup>	
		$0.0 < W_{gap} \le 10.0$	32 <sup>1</sup>	0	
		$15.0 < W_{gap} \le 50.0$	16 <sup>11</sup>	6.5	
	100RB+25RB	$[15.0 < W_{gap} \le 50.0]$	[16 <sup>11</sup> ]	[9.2] <sup>17</sup>	
		0.0 < W <sub>gap</sub> ≤ 15.0	32 <sup>1</sup>	0	
		10.0 < W <sub>gap</sub> ≤ 45.0	16 <sup>11</sup>	5.1	
	100RB+50RB	$[10.0 < W_{gap} \le 45.0]$	[16 <sup>11</sup> ]	[7.8] <sup>17</sup>	
		$0.0 < W_{gap} \le 10.0$	32 <sup>1</sup>	0	
		$5.0 < W_{\text{gap}} \le 40.0$	16 <sup>11</sup>	4.5	
	100RB+75RB	$5.0 < W_{\text{gap}} \le 40.0$ [5.0 < W <sub>gap</sub> $\le 40.0$ ]	[16 <sup>11</sup> ]	[7.2] <sup>17</sup>	
	1001017010	$0.0 < W_{\text{gap}} \le 40.0$	32 <sup>1</sup>	0	
		$0.0 < W_{gap} \le 35.0$ $0.0 < W_{gap} \le 35.0$	16 <sup>11</sup>	4.1	
	100RB+100RB	• • • • • • • • • • • • • • • • • • • •	[16 <sup>11</sup> ]	[6.8] <sup>17</sup>	
CA_4A-4A	NOTE 6	$[0.0 < W_{gap} \le 35.0]$ NOTE 7	NOTE 8	0.0	FDD
∪∧ <u>+</u> ∧-4∧	25RB+25RB	NOTE 7	12 <sup>1</sup>	5.3	טטו
CA_5A-5A	25RB+50RB	NOTE 7	12 <sup>1</sup>	4.4	FDD
J. (_J. ( J. ( )	50RB+25RB	NOTE 7	12 <sup>1</sup>	5.9	, 55
	50RB+50RB 25RB+25RB	$\frac{\text{NOTE 7}}{0 < W_{gap} \leqslant 60}$	12 <sup>1</sup> 25	4.6 0.0	
	25RB+50RB	$0 < W_{\text{gap}} \le 55$	25	0.0	
CA_7A-7A	25RB+75RB	$0 < W_{gap} \le 50$	25	0.0	FDD
	25RB+100RB	$0 < W_{gap} \le 45$	25	0.0	

	50DB   25DB	$30 < W_{gap} \leqslant 55$	32 <sup>1</sup>	0.0	
	50RB+25RB	$0 < W_{gap} \leqslant 30$	50	0.0	
	50RB+50RB	$25.0 < W_{gap} \le 50.0$	32 <sup>1</sup>	0.0	
		$0.0 < W_{gap} \le 25.0$	50	0.0	
		20 < W <sub>gap</sub> ≤ 45	32 <sup>1</sup>	0.0	
	50RB+75RB	$0 < W_{\text{gap}} \le 20$	50	0.0	
			32 <sup>1</sup>		
	50RB+100RB	15 < W <sub>gap</sub> ≤ 40	+	0.0	
		$0 < W_{gap} \leqslant 15$	50	0.0	
	75RB+25RB	$20.0 < W_{gap} \le 50.0$	32 <sup>1</sup>	0.0	
		$0.0 < W_{gap} \le 20.0$	50'	0.0	
	75RB+50RB	$20.0 < W_{gap} \le 45.0$	321	0.0	
		$0.0 < W_{gap} \le 20.0$	50 <sup>1</sup>	0.0	
	75RB+75RB	$15.0 < W_{gap} \le 40.0$	32 <sup>1</sup>	0.0	
		$0.0 < W_{gap} \le 15.0$	50 <sup>1</sup>	0.0	
	75DD : 100DD	$10 < W_{gap} \leqslant 35$	32 <sup>1</sup>	0.0	
	75RB+100RB	0 < W <sub>gap</sub> ≤ 10	50 <sup>1</sup>	0.0	
		25 < W <sub>gap</sub> ≤ 45	32 <sup>1</sup>	0.0	
	100RB+25RB	$0 < W_{\text{gap}} \le 25$	45 <sup>1</sup>	0.0	
	100RB+50RB	$20 < W_{gap} \le 40$	32 <sup>1</sup>	0.0	
		0 < W <sub>gap</sub> ≤ 20	45 <sup>1</sup>	0.0	
	100RB+75RB	$15.0 < W_{gap} \le 35.0$	36 <sup>1</sup>	0.0	
		$0.0 < W_{gap} \le 15.0$	50 <sup>1</sup>	0.0	
	100RB+100RB	$15.0 < W_{gap} \le 30.0$	32 <sup>1</sup>	0.0	
		$0.0 < W_{gap} \le 15.0$	45 <sup>1</sup>	0.0	
CA_23A-23A	NOTE 6	NOTE 7	NOTE 8	0.0	FDD
	25RB+25RB	$30.0 < W_{gap} \le 55.0$	10 <sup>1</sup>	5.0	
	23KD+23KD	$0.0 < W_{gap} \le 30.0$	25 <sup>1</sup>	0.0	
	0500.5000	$25.0 < W_{gap} \le 50.0$	10 <sup>1</sup>	4.5	
	25RB+50RB	$0.0 < W_{gap} \le 25.0$	25 <sup>1</sup>	0.0	
	0500 7500	20 < W <sub>gap</sub> ≤ 45	10 <sup>1</sup>	4.3	
	25RB+75RB	0 < W <sub>gap</sub> ≤ 20	25 <sup>1</sup>	0	
		15 < W <sub>gap</sub> ≤ 40	10 <sup>1</sup>	4.1	
	25RB+100RB	0 < W <sub>gap</sub> ≤ 15	25 <sup>1</sup>	0	
		$15.0 < W_{gap} \le 50.0$	10 <sup>4</sup>	5.5	
	50RB+25RB	$0.0 < W_{gap} \le 15.0$	32 <sup>1</sup>	0.0	
		$10.0 < W_{gap} \le 45.0$	10 <sup>4</sup>	5.0	
	50RB+50RB	$0.0 < W_{gap} \le 10.0$	32 <sup>1</sup>	0.0	
CA 25A-25A		$5 < W_{gap} \le 40$	10 <sup>4</sup>	4.5	FDD
0/1_20/120/1	50RB+75RB	$0 < W_{gap} \le 5$	32 <sup>1</sup>	0	100
	50RB+100RB	$0 < W_{gap} \le 35$	10 <sup>4</sup>	4.2	
	JOND 1 TOOKD	$10 < W_{\text{gap}} \le 45$	10 <sup>14</sup>	7.6	
	75RB+25RB	$0 < W_{gap} \le 10$	32 <sup>1</sup>	0	
		$5 < W_{\text{gap}} \le 40$	10 <sup>14</sup>	6.7	
	75RB+50RB	27-1	32 <sup>1</sup>	0.7	
	75RB+75RB	$0 < W_{gap} \le 5$ $0 < W_{gap} \le 35$	10 <sup>14</sup>	5.6	
	75RB+100RB	$0 < VV_{gap} \le 30$ $0 < W_{gap} \le 30$	10 <sup>14</sup>	4.8	
	100RB+25RB	$0 < VV_{gap} \le 30$ $0 < W_{gap} \le 40$	10 12 <sup>15</sup>	8	
			12 <sup>15</sup>	6.7	
	100RB+50RB	$0 < W_{gap} \le 35$	12 12 <sup>15</sup>		
	100RB+75RB	$0 < W_{gap} \le 30$	12 <sup>15</sup>	6.1	
CA 40A 40A	100RB+100RB	0 < W <sub>gap</sub> ≤ 25		5.7	TDD
CA_40A-40A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41D	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41C-41C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42D	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42C-42A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42C-42C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42D-42A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_66A-66A	NOTE 6	NOTE 7	NOTE 8,	0.0	FDD
_			NOTE 16		

- NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.
- NOTE 2: W<sub>gap</sub> is the sub-block gap between the two sub-blocks.
- NOTE 3: The carrier center frequency of PCC in the UL operating band is configured closer to the DL operating band.
- NOTE 4: refers to the UL resource blocks shall be located at RB<sub>start</sub>=33.
- NOTE 5: For the TDD intra-band non-contiguous CA configurations, the minimum requirements apply only in synchronized operation between all component carriers.
- NOTE 6: All combinations of channel bandwidths defined in Table 5.6A.1-3.
- NOTE 7: All applicable sub-block gap sizes.
- NOTE 8: The PCC allocation is same as Transmission bandwidth configuration N<sub>RB</sub> as defined in Table 5.6-1. In case of uplink sub-block is TDD intra-band contiguous CA then the uplink PCC and SCC allocations are the same as N<sub>RB\_agg</sub> defined in Table 7.3.1A-1.
- <sup>9</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=25.
- NOTE 10: <sup>10</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=35.
- NOTE 11: 11 refers to the UL resource blocks shall be located at RB<sub>start</sub>=50.
- NOTE 12: <sup>12</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=50.
- NOTE 13: <sup>13</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=57.
- NOTE 14: <sup>14</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=44.
- NOTE 15: <sup>15</sup> refers to the UL resource blocks shall be located at RB<sub>start</sub>=62.
- NOTE 16: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band.
- NOTE 17: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

For intra-band non-contiguous carrier aggregation with two uplink and downlink carriers the reference sensitivity is defined to be met with both downlink and uplink carriers activated. The downlink PCC and SCC minimum requirements for reference sensitivity power level as specified in Table 7.3.1-1, Table 7.3.1-1A, Table 7.3.1-1B and Table 7.3.1-1C are increased by amount of  $\Delta R_{2UL\_PCC}$  and  $\Delta R_{2UL\_SCC}$  which are defined in Table 7.3.1A-4 when uplink PCC and SCC allocations are according to the Table 7.3.1A-4.

Table 7.3.1A-4: Intra-band non-contiguous CA with two uplinks configuration for reference sensitivity

CA configuration	Aggregated channel bandwidth (PCC+SCC)	W <sub>gap</sub> / [MHz]	UL PCC allocation	UL SCC allocation	ΔR <sub>2UL_PCC</sub> (dB)	ΔR <sub>2UL_SCC</sub> (dB)	Duplex mode
CA_4A-4A	NOTE 2	NOTE 3	NOTE 4	NOTE 5	0.0	0.0	FDD

- NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5A.
- NOTE 2: All combinations of channel bandwidths defined in Table 5.6A.1-3.
- NOTE 3: All applicable sub-block gap sizes.
- NOTE 4: The PCC allocation is same as Transmission bandwidth configuration N<sub>RB</sub> as defined in Table 5.6-1.
- The SCC allocation is same as Transmission bandwidth configuration N<sub>RB</sub> as defined in Table 5.6-1.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two noncontiguous sub-blocks per band and up to four contiguously aggregated carriers per band) and up to three uplink carriers (up to two contiguously aggregated carriers per band), the requirement is defined with an uplink configuration in accordance with Table 7.3.1A-3 when the uplink is active in a band supporting two non-contigous component carriers, Table 7.3.1A-1 when the uplink (up to two contiguously aggregated uplink carriers) is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when an uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. The carrier center frequency of PCC in the UL operating band is configured closer to the DL operating band when the uplink is active in band(s) supporting non-contiguous aggregation of up to two sub-blocks. For these uplink configurations, the UE shall meet the reference sensitivity requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.3.1. For the two component carriers within the same band,  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) when the uplink is active in another band. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with all uplink carriers active in each band capable of UL operation. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of downlink carriers are replaced by the requirements in Table 7.3.1A-0eA and Table 7.3.1A-0eB.

Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

For the UE that supports any of combinations of intra-band and inter-band carrier aggregation given in Table 7.3.1A-5, exceptions to the aforementioned requirements are allowed when the uplink is active in a lower-frequency band and is within a specified frequency range such that transmitter harmonics fall within the downlink transmission bandwidth assigned in a higher band as noted in Table 7.3.1A-5. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-5 and Table 7.3.1A-6.

Table 7.3.1A-5: Reference sensitivity for carrier aggregation QPSK P<sub>REFSENS, CA</sub> (exceptions)

		C	hannel bar	ndwidth				
EUTRA CA	EUTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex
Configuration	band	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	mode
	1			-89.8	-89.4	-89	-88.7	
CA_1A-3A-7C-28A <sup>5,6</sup>	3				-94	-92.2	-91	FDD
O/\_1/\ O/\ / O ZO/\	7				-95	-93.2	-92	100
	28				-95.3	-93.5	-90.8	
	1			-99.8	-96.8	-95	-93.8	
				-96.8	-93.8	-92	-90.8	FDD
CA_1A-3A-42C <sup>8,9</sup>	3			[-	[-96.5] <sup>11</sup>	[-	[-93.5] <sup>11</sup>	. 55
				99.5] <sup>11</sup>		94.7] <sup>11</sup>		
	42			-71.7	-71.7	-71.7	-71.7	TDD
56	1			-89.8	-89.4	-89	-88.7	
CA_1A-7C-28A <sup>5,6</sup>	7				-95	-93.2	-92	FDD
	28				-95.3	-93.5	-90.8	
	1			-99.8	-96.8	-95	-93.8	
<b> -1</b> 0	_			-96.8	-93.8	-92	-90.8	FDD
CA_1A-3A-42C <sup>10</sup>	3			[-	[-96.5] <sup>11</sup>	[-	[-93.5] <sup>11</sup>	
				99.5] <sup>11</sup>		94.7] <sup>11</sup>		
	42			-97.1	-94.7	-93.2	-92.5	TDD
			-	-97.7	-94.7	-92.9	-91.7	
	2			[-	[-97.4] <sup>11</sup>	[-	[-94.4] <sup>11</sup>	
CA_2A-2A-4A-12A <sup>5,6</sup>				100.4]		95.6] <sup>11</sup>		FDD
	4				00.5	00	00.5	
	4			-90	-89.5	-89	-88.5	
	12			-96.5	-93.5	00.0	04.7	
				-97.7	-94.7	-92.9	-91.7	
	2			[-	[-97.4] <sup>11</sup>	[- 95.6] <sup>11</sup>	[-94.4] <sup>11</sup>	
CA_2A-4A-4A-12A <sup>5,6</sup>				100.4]		95.6]		FDD
_					00.5	00	00.5	
	4 12			-90	-89.5	-89	-88.5	
				-96.5	-93.5	NI/A	NI/A	
_	3			N/A	N/A	N/A	N/A	
CA_3A-3A-8A <sup>4</sup>	3			N/A	N/A	N/A	N/A	FDD
	8			N/A	N/A			
				-96.8	-93.8	-92	-90.8	
	3			[	[-96.5] <sup>11</sup>	[-	[-93.5] <sup>11</sup>	
CA_3A-19A-42C <sup>8,9</sup>				99.5] <sup>11</sup>	[ 00.0]	94.7] <sup>11</sup>	[ 00.0]	FDD
	19			-100	-97	-95.2		
	42			-71.7	-71.7	-71.7	-71.7	TDD
				-96.8	-93.8	-92	-90.8	
04 04 404 40010	3			[-	[-96.5] <sup>11</sup>	[-	[-93.5] <sup>11</sup>	
CA_3A-19A-42C <sup>10</sup>				99.5] <sup>11</sup>		94.7] <sup>11</sup>		FDD
	19			-100	-97	-95.2		
				-96.8	-93.8	-92	-90.8	
	3			[- ,,	[-96.5] <sup>11</sup>	[	[-93.5] <sup>11</sup>	FDD
CA_3A-42C <sup>8,9</sup>				99.5] <sup>11</sup>	[ 00.0]	94.7] <sup>11</sup>	[ 00.0]	
	42			-71.7	-71.7	-71.7	-71.7	TDD
	74			-96.8	-93.8	-92	-90.8	טטו
								EDD.
CA_3A-42C <sup>10</sup>	3			[-	[-96.5] <sup>11</sup>	[-	[-93.5] <sup>11</sup>	FDD
				99.5] <sup>11</sup>	0.4 =	94.7] <sup>11</sup>	20.5	
	42			-97.1	-94.7	-93.2	-92.5	TDD
CA_4A-4A-12A <sup>5,6</sup>	4			-90	-89.5	-89	-88.5	FDD
IJΛ_ <del>Τ</del> Λ⁻₹Λ⁻ΙΖΛ	12			-96.5	-93.5			טטי
CA_4A-12B <sup>5,6</sup>	4			-90	-89.5	-89	-88.5	FDD
VΛ_ <del>1</del> Λ-12D	12			-96.5	-93.5			טט ו
	8	N/A	N/A	N/A	N/A			FDD
	41				N/A	N/A	N/A	TDD
CA_8A-41C <sup>7</sup>				1	NI/A	NI/A	NI/A	טטו
CA_8A-41C <sup>'</sup>	41				N/A	N/A	N/A	
	41 26			N/A	N/A N/A	N/A N/A	IN/A	FDD
CA_8A-41C <sup>7</sup> CA_26A-41C <sup>7</sup>				N/A N/A			N/A N/A	FDD TDD

- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 6: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that  $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.3 \right \rfloor 0.1 \text{ in MHz and } F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB} / 2 \text{ with } f_{DL}^{HB} \text{ the carrier frequency of a high band in MHz and } BW_{Channel}^{LB} \text{ the channel bandwidth configured in the low band}$
- NOTE 7: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 8: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range  $\Delta F_{HD}$  above and below the edge of this downlink transmission bandwidth. The value  $\Delta F_{HD}$  depends on the E-UTRA configuration:  $\Delta F_{HD} = 10$  MHz for CA\_3A-42C, CA\_1A-3A-42C and CA\_3A-19A-42C.
- NOTE 9: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that  $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.2 \right \rfloor 0.1$  in MHz and  $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB} / 2$  with  $f_{DL}^{HB}$  carrier frequency in the victim (higher) band in MHz and  $BW_{Channel}^{LB}$  the channel bandwidth configured in the lower band.
- NOTE 10: The requirements are only applicable to channel bandwidths with a carrier frequency at  $\pm \left(20 + BW_{Channel}^{HB}/2\right) \text{ MHz offset from } 2f_{UL}^{LB} \text{ in the victim (higher band) with}$   $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 < f_{UL}^{LB} < F_{UL\_high}^{LB} BW_{Channel}^{LB}/2 \text{ , where } BW_{Channel}^{LB} \text{ and } BW_{Channel}^{HB} \text{ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.}$
- NOTE 11: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

Table 7.3.1A-6: Uplink configuration for the low band (exceptions)

E-UTRA B	E-UTRA Band / Channel bandwidth of the high band / N <sub>RB</sub> / Duplex mode									
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duple x mode		
CA_1A-3A-7C-28A	28				16	25	25	FDD		
CA_1A-3A-42C	3			12	25	36	50	FDD		
CA_1A-7C-28A	28				16	25	25	FDD		
CA_2A-2A-4A-12A	12			8	16	20	20	FDD		
CA_2A-4A-4A-12A	12			8	16	20	20	FDD		
CA_3A-19A-42C	3			12	25	36	50	FDD		
CA_3A-42C	3			12	25	36	50	FDD		
CA_4A-4A-12A	12			8	16	20	20	FDD		
CA_4A-12B	12			8	16	20	20	FDD		

NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

## 7.3.1B Minimum requirements (QPSK) for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.3.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{UMAX}$  is the total transmitter power over the two transmits power over the two transmit antenna connectors.

## 7.3.1D Minimum requirements (QPSK) for ProSe

When UE is configured for E-UTRA ProSe reception non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2 with parameters specified in Table 7.3.1D-1 and Table 7.3.1D-2.

Table 7.3.1D-1: Reference sensitivity for ProSe Direct Discovery QPSK PREFSENS

	Channel bandwidth								
E-UTRA ProSe Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode		
2			-104.1	-104.1	-104.1	-104.1	HD		
3			-103.1	-103.1	-103.1	-103.1	HD		
4			-106.1	-106.1	-106.1	-106.1	HD		
7			-103.8	-103.8	-103.8	-103.8	HD		
14			-103.1	-103.1			HD		
20			-103.2	-103.2	-102.2	-102.2	HD		
26			-103.5 <sup>5</sup>	-103.5 <sup>5</sup>	-103.5 <sup>5</sup>		HD		
28			-104.4	-104.4	-104.4	-102.9	HD		
31			-99.5				HD		

- NOTE 1: Reference measurement channel is A.6.2
- NOTE 2: The signal power is specified per port
- NOTE 3: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.
- NOTE 4: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 5: <sup>5</sup> indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.
- NOTE 6: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.

Table 7.3.1D-2: Reference sensitivity for ProSe Direct Communication QPSK PREFSENS

	Channel bandwidth								
E-UTRA ProSe Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode		
3				-97.6			HD		
7				-98.3			HD		
14				-97.6			HD		
20				-97.7			HD		
26				-98.0 <sup>5</sup>			HD		
28				-98.9			HD		
31			-96.7				HD		

NOTE 1: Reference measurement channel is A.6.2

NOTE 2: The signal power is specified per port

NOTE 3: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

NOTE 4: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS

NOTE 5: <sup>5</sup> indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.

NOTE 6: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.

NOTE: Table 7.3.1D-1/ Table 7.3.1D-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of allocated resource blocks will be practically constrained by other factors.

For the UE which supports ProSe in an operating band as specified in Section 5.5D, and the UE also supports a E-UTRA downlink inter-band carrier aggregation configuration in Table 7.3.1-1A or Table 7.3.1-1B, the minimum requirement for reference sensitivity in Table 7.3.1D-1 and Table 7.3.1D-2 shall be increased by the amount given in  $\Delta R_{IB,c}$  in Table 7.3.1-1A and Table 7.3.1-1B for the corresponding E-UTRA ProSe band.

When UE is configured for E-UTRA ProSe reception on PCC for the inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, there are no further requirements for reference sensitivity beyond those specified above when only PCC is configured in Table 7.3.1D-1 and Table 7.3.1D-2.

When UE is configured for E-UTRA ProSe reception on SCC or a non-serving carrier concurrent with E-UTRA uplink for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, E-UTRA ProSe throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2 with parameters specified in Table 7.3.1D-1 and Table 7.3.1D-2. The reference sensitivity is defined to be met with E-UTRA uplink assigned to one band (that differs from the ProSe operating band) and all E-UTRA downlink carriers active. The E-UTRA uplink resource blocks shall be located as close as possible to E-UTRA ProSe operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1). The uplink configuration for the E-UTRA operating band is specified in Table 7.3.1D-3.

NOTE: The E-UTRA uplink channel bandwidth and transmission bandwidth specified in this Table 7.3.1D-3 are intended for conformance tests and does not restrict the operating conditions of the network.

Table 7.3.1D-3: Uplink configuration for E-UTRA band / E-UTRA CA band

Inter-band E-UTF config	E-UTRA UL band / Channel BW / N <sub>RB</sub> / Duplex mode				
E-UTRA ProSe band	E-UTRA band / E- UTRA CA band	E-UTRA UL band	Channel Bandwidth (MHz)	N <sub>RB</sub>	Duplex Mode
2	4	4	5	25	FDD
2	CA_2-4	4	5	25	FDD
28	1	1	5	25	FDD
28	CA_1-28	1	5	25	FDD

NOTE 1: For E-UTRA ProSe reception on SCC, the channel bandwith of the E-UTRA downlink SCC is set same as the ProSe channel bandwidth for which reference sensitivity is being measured.

## 7.3.1E Minimum requirements (QPSK) for UE category 0 and M1

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1E-1A/Table 7.3.1E-1B and Table 7.3.1E-2 for category 0 and Table 7.3.1E-3/Table 7.3.1E-4 for category [M1].

Table 7.3.1E-1A: Reference sensitivity for FDD and TDD UE category 0 QPSK PREFSENS

	Channel bandwidth								
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode		
2	-100.2	-97.2	-95.5	-92.5	-90.7	-89.5	FDD		
3	-99.2	-96.2	-94.5	-91.5	-89.7	-88.5	FDD		
4	-102.2	-99.2	-97.5	-94.5	-92.7	-91.5	FDD		
5	-100.7	-97.7	-95.5	-92.5			FDD		
8	-99.7	-96.7	-94.5	-91.5			FDD		
13			-94	-91			FDD		
20			-94.5	-91.5	-88.2	-87	FDD		
39			-97.5	-94.5	-92.7	-91.5	TDD		
41			-95.5	-92.5	-90.7	-89.5	TDD		

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5 NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG

Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

Table 7.3.1E-1B: Reference sensitivity for HD-FDD UE category 0 QPSK PREFSENS

	Channel bandwidth								
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode		
2	-101	-98	-96.3	-93.3	-91.5	-90.3	HD-FDD		
3	-100	-97	-95.3	-92.3	-90.5	-89.3	HD-FDD		
4	-103	-100	-98.3	-95.3	-93.5	-92.3	HD-FDD		
5	-101.5	-98.5	-96.3	-93.3			HD-FDD		
8	-100.5	-97.5	-95.3	-92.3			HD-FDD		
13			-95.3	-92.3			HD-FDD		
20			-95.3	-92.3	-89.5	-88.3	HD-FDD		

NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1E-1A/Table 7.3.1E-1B shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1E-2.

NOTE: Table 7.3.1E-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

Table 7.3.1E-2: FDD and TDD UE category 0 Uplink configuration for reference sensitivity

	E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode								
E-UTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode		
Band									
2	6	15	25	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	FDD and HD-FDD		
3	6	15	25	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	FDD and HD-FDD		
4	6	15	25	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	FDD and HD-FDD		
5	6	15	25	[25 <sup>1</sup> ]			FDD and HD-FDD		
8	6	15	25	25 <sup>1</sup>			FDD and HD-FDD		
13			20 <sup>1</sup>	[20 <sup>1</sup> ]			FDD and HD-FDD		
20			25	20 <sup>1</sup>	20 <sup>2</sup>	20 <sup>2</sup>	FDD and HD-FDD		
39			25	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	TDD		
41			25	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	[36 <sup>1</sup> ]	TDD		
NOTE 1.	refers to th	e UL resc	urce bloc	ks shall be	located as	close as n	ossible to the		

NOTE 1: <sup>1</sup> refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 16.

Table 7.3.1E-3: Reference sensitivity for FDD and TDD UE category [M1] QPSK PREFSENS

E-UTRA Band	REFSENS (dBm)	Duplex Mode		
1	-102.2	FDD		
2	-100.2	FDD		
3	-99.2	FDD		
4	-102.2	FDD		
5	-100.7	FDD		
7	[-100.2]	FDD		
8	-99.7	FDD		
11	[-102.2 <sup>3</sup> ]	FDD		
12	-99.2	FDD		
13	[-98.7]	FDD		
18	[-102.2 <sup>4</sup> ]	FDD		
19	[-102.2]	FDD		
20	[-99.7]	FDD		
21	[-102.2 <sup>3</sup> ]	FDD		
26	-100.2	FDD		
27	-100.7	FDD		
28	[-100.7]	FDD		
31	-96.5	FDD		
39	[-103.7]	TDD		
41	[-101.7]	TDD		

- NOTE 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in subclause 6.2.5
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 4: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.
- NOTE 5: For cat [M1] the same RF bandwidth applies for all applicable channel bandwidths as specified in Table 5.6.1-1
- NOTE 6: The reference receive sensitivity shall be met for an uplink transmission bandwidth less than or equal to [6] RB except for band 31. For band 31; in the case of 3 MHz channel bandwidth [5] RB applies and the UL resource blocks shall be located at RB<sub>start</sub> 9. In case of 5 MHz channel bandwidth [5] RB applies and the UL resource blocks shall be located at RB<sub>start</sub> 10.
- NOTE 7: The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth.

Table 7.3.1E-4: Reference sensitivity for HD-FDD UE category [M1] QPSK PREFSENS

E-UTRA Band	REFSENS (dBm)	Duplex Mode						
1	[-103]	HD-FDD						
2	-101	HD-FDD						
3	-100	HD-FDD						
4	-103	HD-FDD						
5	-101.5	HD-FDD						
7	[-101]	HD-FDD						
8	-100.5	HD-FDD						
11	[-103 <sup>3</sup> ]	HD-FDD						
12	-100	HD-FDD						
13	[-100]	HD-FDD						
18	[-103 <sup>4</sup> ]	HD-FDD						
19	[-103]	HD-FDD						
20	[-100.5]	HD-FDD						
21	[-103 <sup>3</sup> ]	HD-FDD						
26	-101	HD-FDD						
27	-101.5	HD-FDD						
28	[-101.5]	HD-FDD						
31	[-97.3] HD-FDD							
NOTE 1: The transmitte	OTE 1: The transmitter shall be set to P <sub>UMAX</sub> as defined in subclause 6.2.5							

- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 4: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.
- NOTE 5: For cat [M1] the same RF bandwidth applies for all applicable channel bandwidths as specified in Table 5.6.1-1

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1E-3/Table 7.3.1E-4 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1E-5.

Table 7.3.1E-5 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

Table 7.3.1E-5: FDD and TDD UE category M1 Uplink configuration for reference sensitivity

E-UTRA Band	N <sub>RB</sub>	Duplex Mode
1	6 <sup>1</sup>	FDD and HD-FDD
2	6 <sup>1</sup>	FDD and HD-FDD
3	6 <sup>1</sup>	FDD and HD-FDD
4	6 <sup>1</sup>	FDD and HD-FDD
5	6 <sup>1</sup>	FDD and HD-FDD
7	6 <sup>1</sup>	FDD and HD-FDD
8	6 <sup>1</sup>	FDD and HD-FDD
11	6 <sup>1</sup>	FDD and HD-FDD
12	6 <sup>1</sup>	FDD and HD-FDD
13	6 <sup>1</sup>	FDD and HD-FDD
18	6 <sup>1</sup>	FDD and HD-FDD
19	6 <sup>1</sup>	FDD and HD-FDD
20	6 <sup>1</sup>	FDD and HD-FDD
21	6 <sup>1</sup>	FDD and HD-FDD
26	6 <sup>1</sup>	FDD and HD-FDD
27	6 <sup>1</sup>	FDD and HD-FDD
28	6 <sup>1</sup>	FDD and HD-FDD
31	6 <sup>1</sup>	FDD and HD-FDD
39	6 <sup>1</sup>	TDD
41	61	TDD

NOTE 1: <sup>1</sup> refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

# 7.3.1F Minimum requirements for UE category NB1

#### 7.3.1F.1 Reference sensitivity for UE category NB1

The category NB1 UE throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with received signal level as specified in Table 7.3.1F.1-1. Requirement in Table 7.3.1F.1-1 applies for any uplink configuration.

Table 7.3.1F.1-1: Reference sensitivity for UE category NB1

Operating band	REFSENS [dBm]
1, 2, 3, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28, 66	- 108.2

#### 7.3.1F.2 Sensitivity with repetitions for UE category NB1

In order to guarantee the UE performance in extreme coverage scenario enabled by usage of repetitions additional repetition sensitivity requirement is defined. Repetition sensitivity requirement applies only for normal conditions as defined in Annex E.2. Other category NB1 receiver requirements are not applicable for repetition sensitivity defined in Table 7.3.1F.2-1.

The category NB1 UE throughput shall be  $\geq$  TBD% of the maximum throughput of the repetition reference measurement channel as specified in Annex A.3.2 with received signal level and parameters as specified in Table 7.3.1F.2-1. Requirement in Table 7.3.1F.2-1 applies for any uplink configuration.

Table 7.3.1F.2-1: Repetition sensitivity for UE category NB1

Operating band	Sensitivity [dBm]	$\begin{array}{c} {\sf NB-PDSCH}\\ {\sf repetitions}\\ N_{\rm Rep} \end{array}$
1, 2, 3, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28, 66	TBD	TBD

#### 7.3.2 Void

# 7.4 Maximum input level

This is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

## 7.4.1 Minimum requirements

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.4.1-1: Maximum input level

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission	dDm	-25 <sup>2</sup>					
Bandwidth Configuration	dBm	-27 <sup>3</sup>					

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.

NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: Reference measurement channel is Annex A.3.2: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

# 7.4.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the maximum input level is defined with the uplink active on the band(s) other than the band whose downlink is being tested. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part, the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The UE shall meet the requirements specified in subclause 7.4.1 for each component carrier while all downlink carriers are active.

For intra-band contiguous carrier aggregation maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier.

The downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.4.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels over each component carrier as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1A-1. For operating bands

with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Table 7.4.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the maximum input level requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in Table 7.4.1-1 and Table 7.4.1A-1 for one component carrier and two component carriers per sub-block, respectively. The throughput of each downlink component carrier shall be  $\geq$  95% of the maximum throughput of the specified reference measurement channel as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1). The requirements apply with all downlink carriers active.

Table 7.4.1A-1: Maximum input level for intra-band contiguous CA

Rx Parameter	Units	CA Bandwidth Class					
		Α	В	С	D	E	F
Power in largest			-28 <sup>2</sup>	-25 <sup>2</sup>	-25 <sup>2</sup>	-26 <sup>2</sup>	
Transmission Bandwidth Configuration CC	dBm		-30 <sup>3</sup>	-27 <sup>3</sup>	-27 <sup>3</sup>	[-28] <sup>3</sup>	
Power in each other CC			-28+ 10log(N <sub>RB,c</sub>	-25 + 10log(N <sub>RB,c</sub>	-25 + 10log(N <sub>RB,c</sub>	-26 + 10log(N <sub>RB,c</sub>	
	dBm		/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	
	dbiii		-30+ 10log(N <sub>RB,c</sub>	-27 + 10log(N <sub>RB,c</sub>	-27 + 10log(N <sub>RB,c</sub>	[-28] + 10log(N <sub>RB,c</sub>	
			/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	/N <sub>RB,largest</sub>	

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: Reference measurement channel is Annex A.3.2: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguous sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the maximum input-level requirements for intra-band noncontiguous carrier aggregation of two downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the the requirements specified in subclause 7.4.1. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

# 7.4.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements in Clause 7.4.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{\text{CMAX\_L}}$  is defined as the total transmitter power over the two transmit antenna connectors.

# 7.4.1D Minimum requirements for ProSe

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2.

Table 7.4.1D-1: Maximum input level for ProSe

Rx Parameter	Units	1.4 3 5 10 15 20					
			3 MHz	5 MHz	. •		20 MHz
Power in Transmission Bandwidth Configuration	dBm			-2	2		
NOTE 1: Reference measure	ment chan	nel is Anr	nex A.6.2				

## 7.4.1F Minimum requirements for category NB1

Category NB1 UE maximum input level requirement is -25 dBm. For this input level the throughput shall be  $\ge 95\%$  of the maximum throughput of the reference measurement channel as specified in Annex A.3.2.

#### 7.4A Void

#### 7.4A.1 Void

## 7.5 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

## 7.5.1 Minimum requirements

The UE shall fulfil the minimum requirement specified in Table 7.5.1-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1-2 and Table 7.5.1-3 where the throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.5.1-1: Adjacent channel selectivity

			Channel bandwidth								
Rx Parameter	Units	1	1.4 3 5 10 15 20								
		MHZ	MHz MHz MHz MHz MHz MHz								
ACS	dВ	33.0	33.0	33.0	33.0	30	27				

Table 7.5.1-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units			Channel b	andwidth		
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in	dBm						
Transmission Bandwidth Configuration				REFSENS	S + 14 dB		
	dBm	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS
P <sub>Interferer</sub>		+45.5dB	+45.5dB	+45.5dB	+45.5dB	+42.5dB	+39.5dB
BW <sub>Interferer</sub>	MHz	1.4	3	5	5	5	5
F <sub>Interferer</sub> (offset)	MHz	1.4+0.0025	3+0.0075	5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025
		/	/	/	/	/	/
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-
							0.0025

- NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration and P<sub>Interferer</sub>.
- NOTE5: For DL category M1 UE, only the requirements under Channel bandwidth of 1.4MHz apply.

Table 7.5.1-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units			Channel b	andwidth		
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	-56.5	-56.5	-56.5	-56.5	-53.5	-50.5
P <sub>Interferer</sub>	dBm			-2	5		
BW <sub>Interferer</sub>	MHz	1.4	3	5	5	5	5
F <sub>Interferer</sub> (offset)	MHz	1.4+0.0025 / -1.4-0.0025	3+0.0075 / -3-0.0075	5+0.0025 / -5-0.0025	7.5+0.0075 / -7.5-0.0075	10+0.0125 / -10-0.0125	12.5+0.0025 / -12.5- 0.0025

NOTE 1: The transmitter shall be set to 24dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

## 7.5.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band, the adjacent channel requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.5.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For a component carrier configured in Band 46, the requirements specified in subclause 7.5.1 are replaced by the requirements in Table 7.5.1A-0a with test parameters in Table 7.5.1A-0b and Table 7.5.1A-0c.

Table 7.5.1A-0a: Adjacent channel selectivity

E-UTRA band	Rx Parameter	Units		(	Channel b	andwidth		
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46	ACS	dB						27

Table 7.5.1A-0b: Test parameters for Adjacent channel selectivity, Case 1

E-UTRA Band	Rx	Units			Channel	bandwidth		
	Parameter		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
	Power in Transmission Bandwidth Configuration	dBm			REFSEN	NS + 14 dB		
46	P <sub>Interferer</sub>	dBm						REFSENS +39.5dB
	BW <sub>Interferer</sub>	MHz						20
	F <sub>Interferer</sub> (offset)	MHz						20+0.0025 / -20-0.0025

NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

Table 7.5.1A-0c: Test parameters for Adjacent channel selectivity, Case 2

E-UTRA band	Rx	Units			Channel	bandwidth		
	Parameter		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
	Power in Transmission Bandwidth Configuration	dBm						-50.5
46	P <sub>Interferer</sub>	dBm			-2	25		
	BW <sub>Interferer</sub>	MHz						20
	F <sub>Interferer</sub> (offset)	MHz						20+0.0025 / -20-0.0025

NOTE 1: In a band capable of unplink operation, the transmitter shall be set to 24dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the adjacent channel requirements of subclause 7.5.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.5.1A-2 and Table 7.5.1A-3 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement specified in Table 7.5.1A-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.5.1 and 7.5.1A for one component carrier and two component carriers per sub-block, respectively. The UE shall fulfil the minimum requirements all values of a single adjacent channel interferer in-gap and out-of-gap up to a –25 dBm interferer power while all downlink carriers are active. For the lower range of test parameters (Case 1), the interferer power P<sub>interferer</sub> shall be set to the maximum of the levels given by the carriers of the respective sub-blocks as specified in Table 7.5.1-2 and Table 7.5.1A-2 for one component carrier and two component carriers per sub-block, respectively. The wanted signal power levels for the carriers of each sub-block shall then be

adjusted relative to  $P_{interferer}$  in accordance with the ACS requirement for each sub-block (Table 7.5.1-1 and Table 7.5.1A-1). For the upper range of test parameters (Case 2) for which the interferer power  $P_{interferer}$  is -25 dBm (Table 7.5.1-3 and Table 7.5.1A-3) the wanted signal power levels for the carriers of each sub-block shall be adjusted relative to  $P_{interferer}$  like for Case 1.

Table 7.5.1A-1: Adjacent channel selectivity

			CA Bandwidth Class							
Rx Parameter	Units	В	B							
ACS	dB	27	24	22.2	21					

Table 7.5.1A-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units		CA	Bandwidth C	lass	
		В	С	D	E	F
Pw in Transmission Bandwidth		REFSENS	REFSENS	REFSEN	REFSENS	
Configuration, per CC		+ 14 dB	+ 14 dB	S + 14 dB	+ 14 dB	
	dBm	Aggregated	Aggregated	Aggregat	Aggregate	
		power +	power +	ed power	d power +	
P <sub>Interferer</sub>		25.5 dB	22.5 dB	+ 20.7 dB	19.5 dB	
BW <sub>Interferer</sub>	MHz	5	5	5	5	
F <sub>Interferer</sub> (offset)	MHz		2.5 + F <sub>offset</sub>	2.5 +	2.5 + F <sub>offset</sub>	
		2.5 + F <sub>offset</sub>	/	Foffset	/	
		/	-2.5 - F <sub>offset</sub>	/	-2.5 - F <sub>offset</sub>	
		-2.5 - F <sub>offset</sub>		-2.5 -		
				Foffset		

- NOTE 1: The transmitter shall be set to 4dB below P<sub>CMAX\_L,c</sub> or P<sub>CMAX\_L</sub> as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1
- NOTE 3: The F<sub>interferer</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to  $[F_{interferer}/0.015 + 0.5] 0.015 + 0.0075 \, \text{MHz} \text{ to be offset from the sub-carrier raster}.$

Table 7.5.1A-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units		CA	Bandwidth C	lass	
		В	С	D	E	F
Pw in Transmission Bandwidth Configuration, per CC	dBm	-50.5 +10log <sub>10</sub> (N <sub>RB,c</sub> / N <sub>RB</sub> <sub>agg</sub> )	-47.5 +10log <sub>10</sub> (N <sub>RB</sub> , <sub>o</sub> /N <sub>RB agg</sub> )	- 45.7+10log <sub>10</sub> (N <sub>RB,c</sub> /N <sub>R</sub> <sub>B agg</sub> )	-44.5 +10log <sub>10</sub> (N <sub>RB,c</sub> /N <sub>RB agg</sub> )	
P <sub>Interferer</sub>	dBm			-25		
BW <sub>Interferer</sub>	MHz	5	5	5	5	
F <sub>Interferer</sub> (offset)	MHz	2.5+ F <sub>offset</sub>	2.5+ F <sub>offset</sub>	2.5+ F <sub>offset</sub>	2.5+ F <sub>offset</sub>	
		/	/	/	/	
		-2.5- F <sub>offset</sub>	-2.5- F <sub>offset</sub>	-2.5- F <sub>offset</sub>	-2.5- F <sub>offset</sub>	

- NOTE 1: The transmitter shall be set to 24dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1
- NOTE 3: The  $F_{interferer}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to  $\begin{bmatrix} F_{interferer} / 0.015 + 0.5 \end{bmatrix} 0.015 + 0.0075$  MHz to be offset from the sub-carrier raster.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to four non-contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in each band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is

active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the adjacent channel selectivity requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.5.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of downlink carriers are replaced by requirements in Table 7.5.1A-4 with test parameters in Table 7.5.1A-5 and Table 7.5.1A-6. All downlink carriers shall be active throughout the tests and the requirements for downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

Table 7.5.1A-4: Adjacent channel selectivity

E-UTRA band	Rx Parameter	Units		CA	Bandwidth Cl	ass	
			В	С	D	E	F
46	ACS	dB		24	22.2	21	

Table 7.5.1A-5: Test parameters for Adjacent channel selectivity, Case 1

E-UTRA Band	Rx Parameter	Units		CA	Bandwidth C	lass	
			В	С	D	E	F
	Pw in Transmission Bandwidth Configuration, per CC			REFSENS + 14 dB	REFSENS + 14 dB	REFSENS + 14 dB	
46	PInterferer	dBm		Aggregate d power + 22.5 dB	Aggregate d power + 20.7 dB	Aggregate d power + 19.5 dB	
	BW <sub>Interferer</sub>	MHz		20	20	20	
	F <sub>Interferer (offset)</sub>	MHz		10 + F <sub>offset</sub> / -10 - F <sub>offset</sub>	10 + F <sub>offset</sub> / -10 - F <sub>offset</sub>	10 + F <sub>offset</sub> / -10 - F <sub>offset</sub>	

NOTE 1\*: In a band capable of uplink operation, the transmitter shall be set to 4dB below P<sub>CMAX\_L,c</sub> or P<sub>CMAX\_L</sub> as defined in subclause 6.2.5A.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

NOTE 3: The  $F_{interferer}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to  $|F_{interferer}|/0.015 + 0.5|0.015 + 0.0075$  MHz to be offset from the sub-carrier raster.

Table 7.5.1A-6: Test parameters for Adjacent channel selectivity, Case 2

E-UTRA band	Rx Parameter	Rx Parameter Units CA Bandwidth C					
			В	С	D	E	F
	Pw in Transmission			-47.5	-45.7	-44.5	
	Bandwidth Configuration,	dBm		+10log10( <sub>NRB</sub>	+10log10( <sub>N</sub>	+10log10( <sub>N</sub>	
	per CC			,c/N <sub>RB agg</sub> )	RB,c/NRB agg)	RB,c/NRB agg)	
46	P <sub>Interferer</sub>	dBm			-25		
40	BW <sub>Interferer</sub>	MHz		20	20	20	
	F <sub>Interferer</sub> (offset)	MHz		10 + F <sub>offset</sub>	10 + F <sub>offset</sub>	10 + F <sub>offset</sub>	
				/	/	/	
				-10 - F <sub>offset</sub>	-10 - F <sub>offset</sub>	-10 - F <sub>offset</sub>	

NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 24dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

NOTE 3: The  $F_{interferer}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to  $|F_{interferer}|/0.015 + 0.5|0.015 + 0.0075$  MHz to be offset from the sub-carrier raster.

### 7.5.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.5.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{\text{CMAX\_L}}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.5.1D Minimum requirements for ProSe

The UE shall fulfil the minimum requirement specified in Table 7.5.1D-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1D-2 and Table 7.5.1D-3 where the throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annex A.6.2.

Table 7.5.1D-1: Adjacent channel selectivity for ProSe

		Channel bandwidth					
Rx Parameter	Units	1.4	3	5	10	15	20
		MHz	MHz	MHz	MHz	MHz	MHz
ACS	dB			33.0	33.0	30	27

Table 7.5.1D-2: Test parameters for Adjacent channel selectivity for ProSe, Case 1

Rx Parameter	Units		Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in	dBm								
Transmission Bandwidth Configuration				P <sub>REFSENS_Pro</sub>	<sub>Se</sub> + 14 dB				
	dBm			REFSENS	REFSENS	REFSENS	REFSENS		
P <sub>Interferer</sub>				+45.5dB	+45.5dB	+42.5dB	+39.5dB		
BW <sub>Interferer</sub>	MHz			5	5	5	5		
F <sub>Interferer</sub> (offset)	MHz			5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025		
,				/	/	/	/		
				-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-		
							0.0025		

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211.

Table 7.5.1D-3: Test parameters for Adjacent channel selectivity for ProSe, Case 2

Rx Parameter	Units		Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in Transmission Bandwidth Configuration	dBm			-56.5	-56.5	-53.5	-50.5		
P <sub>Interferer</sub>	dBm			-2	5				
BW <sub>Interferer</sub>	MHz			5	5	5	5		
F <sub>Interferer</sub> (offset)	MHz			5+0.0025 / -5-0.0025	7.5+0.0075 / -7.5-0.0075	10+0.0125 / -10-0.0125	12.5+0.0025 / -12.5- 0.0025		

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211.

## 7.5.1F Minimum requirements for category NB1

Category NB1 UE shall fulfil the minimum requirement specified in Table 7.5.1F-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper

range of test parameters are chosen in Table 7.5.1F-1 where the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2.

Table 7.5.1F: Adjacent channel selectivity parameters for category NB1

ACS1 test Parameters							
Interferer	GSM (GMSK)	E-UTRA					
Category NB1 signal power (P <sub>wanted</sub> ) / dBm	REFSENS + 14 dB						
interferer signal power (P <sub>Interferer</sub> ) / dBm	REFSENS + 42 dB	REFSENS + 47 dB					
Interferer bandwidth	200 kHz	5 MHz					
Interferer offset from category NB1 chanel edge	±200 kHz	±2.5 MHz					
ACS2 test Par	ameters						
Interferer	GSM (GMSK)	E-UTRA					
Category NB1 signal power (P <sub>wanted</sub> ) / dBm	-25 dBm -28 dB	-25 dBm -33 dB					
interferer signal power (P <sub>Interferer</sub> ) / dBm	-25 dBm						
Interferer bandwidth	200 kHz	5 MHz					
Interferer offset from category NB1 chanel edge	±200 kHz	±2.5 MHz					

## 7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

## 7.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

For CA configurations including Band 46, in-band blocking in Band 46 is defined for a 20 MHz unwanted interfering signal falling into the UE receive band or into the first 60 MHz below or above the UE receive band (Table 7.6.1.1A-0a and Table 7.6.1.1A-0b).

#### 7.6.1.1 Minimum requirements

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1-1 and 7.6.1.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.6.1.1-1: In band blocking parameters

Rx parameter	Units		Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in			REFSENS + channel bandwidth specific value below						
Transmission Bandwidth Configuration	dBm	6	6	6	6	7	9		
BW <sub>Interferer</sub>	MHz	1.4	3	5	5	5	5		
Floffset, case 1	MHz	2.1+0.0125	4.5+0.0075	7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125		
F <sub>loffset, case 2</sub>	MHz	3.5+0.0075	7.5+0.0075	12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007		
					5	5	5		

- NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
- NOTE5: For DL category M1 UE, only the requirements under Channel bandwidth of 1.4MHz apply.

Table 7.6.1.1-2: In-band blocking

E-UTRA	Parameter	Unit	Case 1	Case 2	Case 3	Case 4	Case 5
band	P <sub>Interferer</sub>	dB m	-56	-44			-38
	F <sub>Interferer</sub> (offset)	1011 1	=-BW/2 - F <sub>loffset,case 1</sub> & =+BW/2 + F <sub>loffset,case 1</sub>	≤-BW/2 − F <sub>loffset,case 2</sub> & ≥+BW/2 + F <sub>loffset,case 2</sub>			-BW/2 - 11
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 65, 66, 68	Finterferer	MHz	(NOTE 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15	Void	Void	
30	F <sub>Interferer</sub>	MHz	(NOTE 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15			F <sub>DL_low</sub> – 11

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

- a. the carrier frequency -BW/2  $F_{\text{loffset, case 1}}$  and
- b. the carrier frequency +BW/2 + F<sub>loffset, case 1</sub>

NOTE 3: F<sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.1.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the in-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier while all downlink carriers are active. For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{\text{Interferer}}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{\text{IB,c}}$  in Table 7.3.1-1A. For E-UTRA

CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The requirements for the component carrier configured in the operating band without uplink operation are specified in Table 7.6.1.1A-0, Table 7.6.1.1A-0a and Table 7.6.1.1A-0b.

Table 7.6.1.1A-0: In-band blocking for additional operating bands for carrier aggregation

E-UTRA band	Parameter	Unit	Case 1	Case 2	
	P <sub>Interferer</sub>	dBm	-56	-44	
	F <sub>Interferer</sub> (offset)	MHz	=-BW/2 - F <sub>loffset,case 1</sub> & =+BW/2 + F <sub>loffset,case 1</sub>	≤-BW/2 − F <sub>loffset,case 2</sub> & ≥+BW/2 + F <sub>loffset,case 2</sub>	
29, 32, 67	F <sub>Interferer</sub>	MHz	(NOTE 2)	$F_{DL\_low} - 15$ to $F_{DL\_high} + 15$	

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - F<sub>loffset, case 1</sub> and

b. the carrier frequency +BW/2 + F<sub>loffset, case 1</sub>

NOTE 3: F<sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies

Table 7.6.1.1A-0a: In band blocking parameters for additional operating bands for carrier aggregation

E-UTRA band	Rx parameter	Units	Channel bandwidth						
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
	Power in		REFSENS + channel bandwidth specific value below						
46 (NOTE 8)	Transmission Bandwidth Configuration	dBm						9	
(NOTE 3)	BW <sub>Interferer</sub>	MHz						20	
	F <sub>loffset, case 1</sub>	MHz						30+0.0125	
	F <sub>loffset, case 2</sub>	MHz						50+0.0075	

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax\_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

NOTE 3: The interferer consists of the Reference measurement channel specified in Annex A.3.2 (TBD)

Table 7.6.1.1A-0b: In-band blocking for additional operating bands for carrier aggregation

E-UTRA band	Parameter	Unit	Case 1	Case 2
	P <sub>Interferer</sub>	dBm	-50	-44
	F <sub>Interferer</sub> (offset)	MHz	=-BW/2 - F <sub>loffset,case 1</sub> &	≤-BW/2 − F <sub>loffset,case 2</sub> &
	(011001)		=+BW/2 + F <sub>loffset,case 1</sub>	≥+BW/2 + F <sub>loffset,case 2</sub>
46	F <sub>Interferer</sub>	MHz	(Note 2)	$F_{DL\_low} - 60$ to $F_{DL\_high} + 60$

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz or 60 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - F<sub>loffset, case 1</sub> and b. the carrier frequency +BW/2 + F<sub>loffset, case 1</sub>

NOTE 3: F<sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the in-band blocking requirements of subclause 7.6.1.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.1.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.1.1A-1 and Tables 7.6.1.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1A-1 and 7.6.1.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclause 7.6.1.1 and in this subclause for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

Rx Parameter	Units	CA Bandwidth Class					
		В	С	D	E	F	
Pw in Transmission		REFSENS + CA Bandwidth Class specific value below					
Bandwidth Configuration, per CC	dBm	9	12	13.8	15		
BW <sub>Interferer</sub>	MHz	5	5	5	5		
F <sub>loffset, case 1</sub>	MHz	7.5	7.5	7.5	7.5		
Floffset case 2	MHz	12.5	12.5	12.5	12.5		

Table 7.6.1.1A-1: In band blocking parameters

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

CA configuration	Parameter	Unit	Case 1	Case 2
	P <sub>Interferer</sub>	dBm	-56	-44
	E		=-F <sub>offset</sub> F <sub>loffset,case 1</sub>	≤-F <sub>offset</sub> - F <sub>loffset,case 2</sub>
		F <sub>Interferer</sub> (offset) MHz =-	&	&
	(Oliset)		=+F <sub>offset</sub> + F <sub>loffset,case 1</sub>	≥+F <sub>offset</sub> + F <sub>loffset,case 2</sub>
CA_1C, CA_2C, CA_3C, CA_5B, CA_7C, CA_8B, CA_12B, CA_23B, CA_27B, CA_38C, CA_39C, CA_40C, CA_41C, CA_40D, CA_41D, CA_42C, CA_42D, CA_42E, CA_66B, CA_66C	F <sub>Interferer</sub> (Range)	MHz	(NOTE 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15

Table 7.6.1.1A-2: In-band blocking

- NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band
- NOTE 2: For each carrier frequency the requirement is valid for two frequencies:
  - a. the carrier frequency -Foffset Floffset, case 1 and
  - b. the carrier frequency +F<sub>offset</sub> + F<sub>loffset</sub>, case 1
- NOTE 3: F<sub>offset</sub> is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.
- NOTE 4: The  $F_{interferer}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to  $\begin{bmatrix} F_{interferer} / 0.015 + 0.5 \end{bmatrix} 0.015 + 0.0075$  MHz to be offset from the sub-carrier raster.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in the band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a

band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the in-band blocking requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.6.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intraband contiguous carrier aggregation of downlink carriers are replaced by requirements in Table 7.6.1.1A-3 and 7.6.1.1A-4. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of uplink operation.

Table 7.6.1.1A-3: In band blocking parameters

E-UTRA Band	Rx Parameter	Units		CA Bandwidth Class				
			В	С	D	E	F	
	Pw in Transmission		REF	SENS + CA B	andwidth Class	specific value b	oelow	
40	Bandwidth Configuration, per CC	dBm		12	13.8	15		
46	BW <sub>Interferer</sub>	MHz		20	20	20		
	Floffset, case 1	MHz		30	30	30		
	Floffset, case 2	MHz		50	50	50		

NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

Table 7.6.1.1A-4: In-band blocking

E-UTRA Band	Parameter	Unit	Case 1	Case 2
	P <sub>Interferer</sub>	dBm	-50	-44
	F <sub>Interferer</sub> (offset)	MHz	=-F <sub>offset</sub> F <sub>loffset,case 1</sub> & =+F <sub>offset</sub> + F <sub>loffset,case 1</sub>	≤-F <sub>offset</sub> - F <sub>loffset,case 2</sub> & ≥+F <sub>offset</sub> + F <sub>loffset,case 2</sub>
46	F <sub>Interferer</sub> (Range)	MHz	(Note 2)	F <sub>DL_low</sub> – 60 to F <sub>DL_bigh</sub> + 60

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -  $F_{\text{offset}}$  -  $F_{\text{loffset, case 1}}$  and

b. the carrier frequency +F<sub>offset</sub> + F<sub>loffset, case 1</sub>

NOTE 3: F<sub>offset</sub> is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.

NOTE 4: The  $F_{interferer}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to  $|F_{interferer}|/0.015 + 0.5|0.015 + 0.0075$  MHz to be offset from the sub-carrier raster.

#### 7.6.1.1D Minimum requirements for ProSe

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2.

Table 7.6.1.1D-1: In band blocking parameters for ProSe Direct Discovery

Rx parameter	Units		Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
Power in		$P_{R}$	REFSENS_ProSe +	channel bandwid	dth specific val	ue below + Pof	fset			
Transmission Bandwidth Configuration	dBm			6	6	7	9			
BW <sub>Interferer</sub>	MHz			5	5	5	5			
Floffset, case 1	MHz			7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125			
F <sub>loffset, case 2</sub>	MHz			12.5+0.0075	12.5+0.012 5	12.5+0.002 5	12.5+0.007 5			
Poffset	dB			10.9	13.9	15.7	16.9			

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

Table 7.6.1.1D-2: In band blocking parameters for ProSe Direct Communication

Rx parameter	Units		Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in			P <sub>REFSENS_ProSe</sub> + channel bandwidth specific value below						
Transmission Bandwidth Configuration	dBm			6	6	7	9		
BW <sub>Interferer</sub>	MHz			5	5	5	5		
Floffset, case 1	MHz			7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125		
Floffset, case 2	MHz			12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007		
					5	5	5		

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

Table 7.6.1.1D-3: In-band blocking for ProSe

E-UTRA	Parameter	Unit	Case 1	Case 2
ProSe	P <sub>Interferer</sub>	dBm	-56	-44
band	E		=-BW/2 - F <sub>loffset,case 1</sub>	≤-BW/2 − F <sub>loffset,case 2</sub>
	F <sub>Interferer</sub> (offset)	MHz	&	&
	(Oliset)		=+BW/2 + F <sub>loffset,case 1</sub>	≥+BW/2 + F <sub>loffset,case 2</sub>
2,3,4,7,14,				F <sub>DL_low</sub> – 15
20,26,28,31	F <sub>Interferer</sub>	MHz	(NOTE 2)	to
20,20,20,31				F <sub>DL_high</sub> + 15

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 -  $F_{\text{loffset, case 1}}$  and

b. the carrier frequency +BW/2 + F<sub>loffset, case 1</sub>

NOTE 3: F<sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1D-3 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.1.1F Minimum requirements for category NB1

Category NB1 UE throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with parameters specified in Table 7.6.1.1F-1.

**IBB1 test Parameters** Category NB1 signal power REFSENS + 6 dB (P<sub>wanted</sub>) / dBm Interferer E-UTRA interferer signal power - 56 dBm (P<sub>Interferer</sub>) / dBm Interferer bandwidth 5 MHz Interferer offset from category NB1 chanel edge ±7.5 MHz+0.0075 **IBB2 test Parameters** Category NB1 signal power REFSENS + 6 dB (Pwanted ) / dBm E-UTRA Interferer interferer signal power - 44 dBm (P<sub>Interferer</sub>) / dBm 5 MHz Interferer bandwidth From +12.5 MHz + 0.0075 to F<sub>DL\_high</sub> + 15 and Interferer offset range from category NB1 chanel edge From -12.5 MH z- 0.0075 to F<sub>DL high</sub> - 15

Table 7.6.1.1F-1: In-band blocking parameters for category NB1

## 7.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1 and subclause 7.6.1 shall be applied.

For CA configurations including Band 46, out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 60 MHz below or above the UE receive band (see Table 7.6.2.1A-0a). For the first 60 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1A and subclause 7.6.1A shall be applied.

#### 7.6.2.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \lceil (N_{RB}+2\cdot L_{CRBs})/8 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and  $L_{CRBs}$  is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Table 7.6.2.1-1: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth						
		1.4 3 MHz 5 MHz 10 15 20 MHz MHz MHz MHz						
Power in	dBm	REFSENS + channel bandwidth specific value below						
Transmission	автт	6	6	6	6	7	9	

Bandwidtl	h									
Configura	tion									
NOTE 1:	The transmit	The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink								
	configuration	specified i	in Table 7	7.3.1-2 wit	th Pcmax_L	as define	d in subcla	ause		
	6.2.5.									
NOTE 2:	Reference m	easuremei	nt channe	el is specif	fied in Anr	nex A.3.2	with one s	ided		
	dynamic OCI	lynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.								
NOTE 3:	The REFSEN	he REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for								
	two and four	antenna p	orts, resp	ectively.						
NOTE 4:	For DL categ	ory M1 UE	, the refe	erence ser	nsitivity for	category	M1 in tab	le		
	7.3.1E-3 sho	7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth								
	Configuration	Configuration.								
NOTE5:	For DL categ	ory M1 UE	, only the	e requirem	nents unde	er Channe	l bandwid	th of		
	1.4MHz appl	y.		•						

Table 7.6.2.1-2: Out of band blocking

E-UTRA band	Parameter	Units	Frequency						
			Range 1	Range 2	Range 3	Range 4			
	P <sub>Interferer</sub>	dBm	-44	-30	-15	-15			
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,			F <sub>DL_low</sub> -15 to F <sub>DL_low</sub> -60	F <sub>DL_low</sub> -60 to F <sub>DL_low</sub> -85	F <sub>DL_low</sub> -85 to 1 MHz	-			
12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 (NOTE 2), 43 (NOTE 2), 44, 45, 65, 66, 68	Finterferer (CW)	MHz	F <sub>DL_high</sub> +15 to F <sub>DL_high</sub> + 60	F <sub>DL_high</sub> +60 to F <sub>DL_high</sub> +85	F <sub>DL_high</sub> +85 to +12750 MHz	-			
2, 5, 12, 17	F <sub>Interferer</sub>	MHz	-	-	-	Ful_low - Ful_high			

NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.

NOTE 2: The power level of the interferer (P<sub>Interferer</sub>) for Range 3 shall be modified to -20 dBm for F<sub>Interferer</sub> > 2800 MHz and F<sub>Interferer</sub> < 4400 MHz.

NOTE 3: For the UE that supports both Band 4 and Band 66, the out-of-blocking frequency range for Band 4 is defined relative to F<sub>DL\_low</sub> and F<sub>DL\_high</sub> of Band 66.

#### 7.6.2.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band, the out-of-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The throughput in the downlink measured shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1A-0. For E-UTRA CA configurations including an operating band without uplink operation (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the uplink active in the band(s) capable of UL operation. For the E-UTRA CA configurations listed in Table 7.6.2.1A-0a, the parameters specified in Table 7.6.2.1A-0 are replaced by those specified in Table 7.6.2.1A-0a. The UE shall meet these requirements for each component carrier while all downlink carriers are active.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the out-of-band blocking requirements specified above shall be met with the transmitter power for the uplink set to 7 dB below  $P_{CMAX\_L,c}$  for each serving cell c.

For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the out-of-band blocking requirements of subclause 7.6.2.1A do not apply.

Table 7.6.2.1A-0: out-of-band blocking for inter-band carrier aggregation

Parameter	Unit	Range 1	Range 2	Range 3					
$P_{w}$	dBm	Table 7.6	Table 7.6.2.1-1 for all component carriers						
P <sub>interferer</sub>	dBm	$-44 + \Delta R_{IB,c}$	-30 + ∆R <sub>IB,c</sub>	$-15 + \Delta R_{IB,c}$					
F <sub>interferer</sub>	MHz	$-60 < f - F_{DL\_Low(j)} < -15$	$-85 < f - F_{DL\_Low(j)} \le -60$	$1 \le f \le F_{DL\_Low(1)} - 85$					
(CW)		or	or	or					
		$15 < f - F_{DL\_High(j)} < 60$	$60 \le f - F_{DL\_High(j)} < 85$	F <sub>DL_High(j)</sub> + 85 ≤ f					
				$\leq$ $F_{DL\_Low(j+1)} - 85$ with					
				<i>j</i> < X					
				or					
				$F_{DL\_High(X)} + 85 \le f$					
				≤ 12750					

- NOTE 1:  $F_{DL\_Low(j)}$  and  $F_{DL\_High(j)}$  denote the respective lower and upper frequency limits of the operating band containing carrier j, j = 1,...,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X  $\leq$  5 for the present version of this specification).
- NOTE 2: For  $F_{DL\_Low(j+1)} F_{DL\_High(j)} < 145$  MHz and  $F_{Interferer}$  in  $F_{DL\_High(j)} < f < F_{DL\_Low(j+1)}$  with j < X,  $F_{Interferer}$  can be in both Range 1 and Range 2. Then the lower of the  $P_{Interferer}$  applies.
- NOTE 3: For F<sub>DL\_Low(j)</sub> − 15 MHz ≤ f ≤ F<sub>DL\_High(j)</sub> + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier *j*.
- NOTE 4:  $\Delta R_{IB,c}$  according to Table 7.3.1-1A applies when serving cell c is measured.
- NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level ( $P_{Interferer}$ ) for Range 3 modified to -20 +  $\Delta R_{IB,c}$  dBm for  $F_{Interferer}$  > 2800 MHz and  $F_{Interferer}$  < 4400 MHz.
- NOTE 6: For inter-band CA combinations containing Bands 7 and 38 simultaneously, for  $F_{Interferer}$  Bands 7 and 38 are considered as one single band as follows:  $F_{DL\_Low} = 2570$  MHz and  $F_{DL\_High} = 2690$  MHz. For Range 2, the following applies for  $F_{DL\_Low}$ : -95 or  $F_{DL\_Low} \le$  -60 or  $60 \le f F_{DL\_High} < 85$ . For Range 3 the following applies  $1 \le f \le F_{DL\_Low}$  -95 or  $F_{DL\_High} + 85 \le f \le 12750$ .

Table 7.6.2.1A-0a: out-of-band blocking for inter-band carrier aggregation with one active uplink

E-UTRA CA	Parameter	Unit	Range 1	Range 2	Range 3
Configuration					
CA 1A 16A	P <sub>wanted</sub>	dBm	Table 7.6	.2.1-1 for all component of	arriers
CA_1A-46A, CA_2A-46A,	P <sub>interferer</sub>	dBm	$-44 + \Delta R_{IB,c}$	$-30 + \Delta R_{IB,c}$	-15 + ΔR <sub>IB,c</sub> (NOTE 5)
CA_3A-46A, CA_4A-46A, CA_7A-46A,	F <sub>interferer</sub> (CW)	MHz	$-60 < f - F_{DL\_Low(j)} < -15$ with $j \le K$	$-85 < f - F_{DL\_Low(j)} \le -$	$1 \le f \le F_{DL\_Low(j)} - 85$ or
CA_41A-46A, CA_42A-46A			or $15 < f - F_{DL\_High(j)} < 60$ with $i \le K$	or $60 \le f - F_{DL\_High(j)} < 85$	F <sub>DL_High(<i>i</i>)</sub> + 85 ≤ f ≤ 12750

- NOTE 1: F<sub>DL\_Low(j)</sub> and F<sub>DL\_High(j)</sub>, j = 1,...,K,...N, denote the respective lower and upper frequency limits of the (non-overlapping) operating bands of the CA configuration numbered in increasing order of frequency, with N the number of bands in the band combination and K the number of bands with F<sub>DL\_High</sub> ≤ 3600 MHz (K = 1 and N = 2 in the present version of this specification).
- NOTE 2: For  $F_{DL\_Low(j)} 15$  MHz  $\le f \le F_{DL\_High(j)} + 15$  MHz the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j = 1.
- NOTE 3: For  $F_{DL\_Low(N)} 60$  MHz  $\leq$  f  $\leq$   $F_{DL\_High(N)} + 60$  MHz the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier N = 2.
- NOTE 4:  $\Delta R_{IB,c}$  according to Table 7.3.1-1A applies when serving cell c is measured.
- NOTE 5: The power level (P<sub>Interferer</sub>) for Range 3 is modified to -20 dBm for F<sub>Interferer</sub> > 4400 MHz except for band combinations with Band 42 for which P<sub>Interferer</sub> for Range 3 is modified to -20 dBm for F<sub>Interferer</sub> > 2800 MHz...

For Table 7.6.2.1A-0 and Table 7.6.2.1A-0b in frequency ranges 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per downlink are allowed for spurious response frequencies for one active uplink when measured using a step size of 1 MHz.

For Table 7.6.2.1A-0 in frequency ranges 1, 2 and 3, up to  $2 \cdot \max(24.6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per downlink are allowed for spurious response frequencies for two active uplinks when measured using a step size of 1 MHz. For these exceptions the requirements in clause 7.7.1A apply.

For intra-band contiguous carrier aggreagations the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.2.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.2.1A-1 and Tables 7.6.2.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For Table 7.6.2.1A-2 in frequency range 1, 2 and 3, up to  $\max(24.6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

Rx Parameter	Units	CA Bandwidth Class				
		В	С	D	E	F
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSE	NS + CA B	andwidth C below	lass specific	c value
		9	9	9	9	

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1

FDD/TDD as described in Annex A.5.1.1/A.5.2.

Table 7.6.2.1A-2: Out of band blocking

		,		
		Range 1	Range 2	Range 3
P <sub>Interferer</sub>	dBm	-44	-30	-15
F <sub>Interferer</sub> (CW)	MHz	F <sub>DL_low</sub> - 15 to F <sub>DL_low</sub> - 60 F <sub>DL_high</sub> +15 to	F <sub>DL_low</sub> - 60 to F <sub>DL_low</sub> - 85 F <sub>DL_high</sub> +60 to	F <sub>DL_low</sub> - 85 to 1 MHz F <sub>DL_high</sub> +85 to
		F <sub>DL_high</sub> + 60	F <sub>DL_high</sub> +85	+12750 MHz
	(CW)	F <sub>Interferer</sub> (CW) MHz	P <sub>Interferer</sub>   P <sub>Interferer</sub>   dBm   -44	P <sub>Interferer</sub> dBm         -44         -30           F <sub>DL_low</sub> -         F <sub>DL_low</sub> -         60 to           F <sub>DL_low</sub> -         F <sub>DL_low</sub> -         60 to           F <sub>DL_low</sub> -         60         85           F <sub>DL_high</sub> -         F <sub>DL_high</sub> -         +60 to           F <sub>DL_high</sub> -         +60 to         F <sub>DL_high</sub> -           F <sub>DL_high</sub> -         +50 to         F <sub>DL_high</sub> -

NOTE 1: The power level of the interferer (P<sub>Interferer</sub>) for this CA configuration for Range 3 shall be modified to -20 dBm for F<sub>Interferer</sub> > 2800 MHz and F<sub>Interferer</sub> < 4400 MHz.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the out-of-band blocking requirements are defined with the uplink configuration in accordance with table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.2.1 and 7.6.2.1A for one component carrier and two component carriers per sub-block, respectely. The requirements apply with all downlink carriers active.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24,6\cdot\lceil N_{RB}\cdot/6\rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for one active uplink when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for one active uplink when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

For intra-band non-contiguous carrier aggregation with two uplink carriers and two downlink carriers, the out-of-band blocking requirements are defined with the uplink configuration of the PCC and SCC being in accordance with Table 7.3.1A-4 and powers of both carriers set to  $P_{CMAX\_L,c} - 7$  dBm. The UE shall meet the requirements specified in subclause 7.6.2.1 for each component carrier while both downlink carriers are active.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $2 \cdot \max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for two active uplinks in the same operating band when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $2 \cdot \max(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for two active uplinks in the same operating band when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two noncontiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and the uplink assigned to one E-UTRA band, the requirement is defined with the uplink active a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For the two non-contiguous component carriers within the same band,  $P_{wanted}$  in Table 7.6.2.1A-0 is set using  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) while a band supporting contiguously aggregated carriers the out-of-band blocking parameters in Table 7.6.2.1-1 are replaced by those specified in Table 7.6.2.1A-1. For each downlink the UE shall meet the out-of-band blocking requirements applicable for inter-band carrier aggregation with one component carrier per operating band but with up to four component carriers assigned to the same band with the following exception. For each component carrier of the E-UTRA CA Configurations CA 1A-46A, CA 2A-46A, CA 3A-46A, CA 4A-46A, CA 7A-46A, CA 41A-46A, CA 42A-46A the requirements specified in Table 7.6.2.1A-0 are replaced by those in 7.6.2.1A-0a. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

#### 7.6.2.1D Minimum requirements for ProSe

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Tables 7.6.2.1D-1, 7.6.2.1D-2 and 7.6.2.1D-3.

For Table 7.6.2.1D-3 in frequency range 1, 2 and 3, up to  $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1D-3 in frequency range 4, up to  $\max(8, \lceil (N_{RB}+2\cdot L_{CRBs})/8 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and  $L_{CRBs}$  is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Table 7.6.2.1D-1: Out-of-band blocking parameters for ProSe Direct Discovery

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission	dBm	P <sub>REFSENS_ProSe</sub> + channel bandwidth specific value below + P <sub>offset</sub>					
Bandwidth Configuration	ubili			6	6	7	9
Poffset	dB			10.9	13.9	15.7	16.9
NOTE 2: Reference	measurem	easurement channel is specified in Annex A.6.2.					

Table 7.6.2.1D-2: Out-of-band blocking parameters for ProSe Direct Communication

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		Prefsens Prose + channel bandwidth specific value below					ue below
Transmission Bandwidth	dBm			6	6	7	9
Configuration							
NOTE 1: Reference measurement channel is specified in Annex A.6.2.							

Table 7.6.2.1D-3: Out of band blocking for ProSe

E-UTRA	Parameter	Units	Frequency				
ProSe			Range 1	Range 2	Range 3		
band	P <sub>Interferer</sub>	dBm	-44	-30	-15		
			F <sub>DL_low</sub> -15 to	F <sub>DL_low</sub> -60 to	F <sub>DL_low</sub> -85 to		
2,3,4,7,14,	F <sub>Interferer</sub>	MHz	F <sub>DL_low</sub> -60	F <sub>DL_low</sub> -85	1 MHz		
20,26,28,31	(CW)	IVITZ	F <sub>DL_high</sub> +15 to	F <sub>DL_high</sub> +60 to	F <sub>DL_high</sub> +85 to		
			F <sub>DL_high</sub> + 60	F <sub>DL_high</sub> +85	+12750 MHz		
NOTE 1: For	the UE which su	pports both	n Band 11 and Band	21 the out of blockir	ng is FFS.		

## 7.6.2.1F Minimum requirements for category NB1

The category NB1 UE throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.3.2 with parameters specified in Table 7.6.2.1F-1.

For Table 7.6.2.1F-1 in frequency range 1, 2 and 3, up to 24 exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7.1F spurious response are applicable.

Parameter	Units	Frequency					
Parameter	Uiilis	Range 1	Range 2	Range 3			
P <sub>wanted</sub>	dBm		REFSENS + 6 dB				
Pinterferer	dBm	dBm -44 -30		-15			
MHz		F <sub>DL_low</sub> - 15 to F <sub>DL_low</sub> - 60	F <sub>DL_low</sub> - 60 to F <sub>DL_low</sub> - 85	F <sub>DL_low</sub> - 85 to 1 MHz			
F <sub>interferer</sub> range	MHz	F <sub>DL_high</sub> + 15 to F <sub>DL_high</sub> + 60	F <sub>DL_high +</sub> 60 to F <sub>DL_high</sub> + 85	F <sub>DL_high +</sub> 85 to 12750 MHz			

Table 7.6.2.1F-1: Out-of-band blocking parameters for category NB1 UE

- NOTE 1: For operating bands which downlink band frequency range is between 729 MHz < 1 GHz the power level of the interferer (P<sub>Interferer</sub>) for Range 3 shall be modified to: [– 18] dBm for the frequency range which is bounded by F<sub>DL\_low</sub> [150] MHz of the lowest band that UE supports in frequency range 729 MHz < 1 GHz and F<sub>DL\_high</sub> + [150] MHz of the lowest band that UE supports in frequency range 729 MHz < 1 GHz.
- NOTE 2: For operating bands which downlink band frequency range is between 1805 MHz < f < 2200 MHz the power level of the interferer (P<sub>Interferer</sub>) for Range 3 shall be modified to: [– 20] dBm for the frequency range which is bounded by F<sub>DL\_low</sub> [200] MHz of the lowest band that UE supports in frequency range 1805 MHz < f < 2200 MHz and F<sub>DL\_high</sub> + [200] MHz of the lowest band that UE supports supports in frequency range 1805 MHz < f < 2200.

### 7.6.3 Narrow band blocking

This requirement is measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

#### 7.6.3.1 Minimum requirements

The relative throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

**Channel Bandwidth Parameter** Unit 1.4 MHz 3 MHz 5 MHz | 10 MHz | 15 MHz | 20 MHz P<sub>REFSENS</sub> + channel-bandwidth specific value below dBm  $P_w$ 18 16 13 14 16 P<sub>uw</sub> (CW) dBm -55 -55 -55 -55 -55 -55 Fuw (offset for 2.7075 MHz 0.9075 1.7025 5.2125 7.7025 10.2075  $\Delta f = 15 \text{ kHz}$ Fuw (offset for MHz  $\Delta f = 7.5 \text{ kHz}$ 

Table 7.6.3.1-1: Narrow-band blocking

- NOTE 1: The transmitter shall be set a 4 dB below Pcmax L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The P<sub>REFSENS</sub> power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as P<sub>REFSENS</sub> for P<sub>w</sub>.
- NOTE5: For DL category M1 UE, only the requirements under Channel bandwidth of 1.4MHz apply.

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{UW}$  power defined in Table 7.6.3.1-1 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.3.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the narrow-band blocking requirements are defined with the uplink active on the band(s) other than the

band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the narrow-band blocking requirements of subclause 7.6.3.1A do not apply. For E-UTRA CA configurations with a component carrier assigned in Band 46, narrow-band blocking requirements do not apply in the presence of a narrow-band interferer in Band 46.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.3.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Table 7.6.3.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.3.1 and 7.6.3.1A for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

**CA Bandwidth Class Parameter** Unit R Ε F D Pw in Transmission Bandwidth REFSENS + CA Bandwidth Class specific value below dBm Configuration, per CC 16 16 16 dBm P<sub>uw</sub> (CW) -55 -55  $\mathsf{F}_{\mathsf{offset}}$  $F_{\text{offset}}$ - F<sub>offset</sub> – 0.2 0.2 0.2 Fuw (offset for MHz / /  $\Delta f = 15 \text{ kHz}$ + F<sub>offset</sub> + 0.2 + F<sub>offset</sub> + 0.2 + Foffset + + Foffset + 0.2 0.2 Fuw (offset for MHz  $\Delta f = 7.5 \text{ kHz}$ 

Table 7.6.3.1A-1: Narrow-band blocking

- NOTE 1: The transmitter shall be set to 4dB below PCMAX\_L,c or PCMAX\_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The  $F_{uw}$  (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to  $[F_{interferer}/0.015+0.5]0.015+0.0075$  MHz to be offset from the sub-carrier raster.
- NOTE 4: The requirement is applied for the band combinations whose component carriers' BW≥5 MHz.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the narrow-band blocking requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.6.3. For E-UTRA CA configurations with a component carriers assigned in Band 46, narrow-band blocking

requirements do not apply in the presence of a narrow-band interferer in Band 46. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

#### 7.6.3.1D Minimum requirements for ProSe

The relative throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Table 7.6.3.1D-1 and Table 7.6.3.1D-2.

Table 7.6.3.1D-1: Narrow-band blocking for ProSe Direct Discovery

Parameter	Unit	Channel Bandwidth						
Faranietei	Onit	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Pw	dBm	P <sub>REFSENS_ProSe</sub> + channel-bandwidth specific value below + P <sub>offset</sub>						
Fw	UDIII			16	13	14	16	
P <sub>uw</sub> (CW)	dBm			-55	-55	-55	-55	
Poffset	dB			10.9	13.9	15.7	16.9	
$F_{uw}$ (offset for $\Delta f = 15 \text{ kHz}$ )	MHz			2.7075	5.2125	7.7025	10.2075	
$F_{uw}$ (offset for $\Delta f = 7.5 \text{ kHz}$ )	MHz							
NOTE 1: Reference measurement channel is specified in Annex A.6.2.								

Table 7.6.3.1D-2: Narrow-band blocking for ProSe Direct Communication

Parameter	Unit	Channel Bandwidth					
Farameter	Onit	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
В	dBm	P <sub>REF</sub>	SENS_ProSe + C	hannel-band	width spec	ific value b	elow
Pw	UDIII			16 13 14	14	16	
P <sub>uw</sub> (CW)	dBm			-55	-55	-55	-55
$F_{uw}$ (offset for $\Delta f = 15 \text{ kHz}$ )	MHz			2.7075	5.2125	7.7025	10.2075
$F_{uw}$ (offset for $\Delta f = 7.5 \text{ kHz}$ )	MHz						
NOTE 1: Reference measurement channel is specified in Annex A.6.2.							

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{UW}$  power defined in Table 7.6.3.1D-1 and Table 7.6.3.1D-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6A Void

<Reserved for future use>

## 7.6B Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.6 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{\text{CMAX\_L}}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.7 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in subclause 7.6.2 is not met.

## 7.7.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.7.1-1: Spurious response parameters

Rx parameter	Units		Channel bandwidth				
		1.4 MHz	3 MHz	10 MHz	15 MHz	20 MHz	
Power in		REF	dwidth speci	fic value bel	ow		
Transmission Bandwidth Configuration	dBm	6	6	6	6	7	9

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2.

N OTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.

Table 7.7.1-2: Spurious response

Parameter	Unit	Level
P <sub>Interferer</sub> (CW)	dBm	-44
F <sub>Interferer</sub>	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{interferer}$  power defined in Table 7.7.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.7.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the spurious response requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The throughput measured in each downlink with  $F_{interferer}$  in Table 7.6.2.1A-0 and Table 7.6.2.1A-0a at spurious response frequencies shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. The UE shall meet these requirements for each component carrier while all downlink carriers are active.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spurious response requirements applicable specified above shall be met with the transmitter power for the uplink set to 7 dB below  $P_{CMAX\_L,c}$  for each serving cell c.

For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the spurious response requirements of subclause 7.7.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active

throughout the test. The uplink output power shall be set as specified in Table 7.7.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The throughput of each carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the spurious response requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.7.1 and 7.7.1A for one component carrier and two component carriers per sub-block, respectively. The requirements apply with all downlink carriers active.

For intra-band non-contiguous carrier aggregation with two uplink carriers and two downlink carriers, the spurious response requirements applicable specified above shall be met with the transmitter powers for the uplinks set to  $P_{CMAX\_L,c} - 7 \text{ dBm}$ .

Rx Parameter	Units		CA	Bandwidth C	lass	
		В	С	D	E	F
Pw in Transmission Bandwidth	dBm	REFSE	NS + CA Bar	ndwidth Class	specific value	below
Configuration, per CC	ubili	a	a	a	a	

Table 7.7.1A-1: Spurious response parameters

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L, or Pcmax\_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern
OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

Parameter	Unit	Level
P <sub>Interferer</sub> (CW)	dBm	-44
Finterferer	MHz	Spurious response frequencies

Table 7.7.1A-2: Spurious response

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For the two non-contiguous component carriers within the same band,  $P_{\text{wanted}}$  in Table 7.6.2.1A-0 is set using  $\Delta R_{\text{IBNC}} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) while a band supporting contiguously aggregated carriers the out-of-band blocking parameters in Table 7.7.1-1 are replaced by those specified in Table 7.7.1A-1. For each downlink the UE shall meet the spurious-response requirements applicable for inter-band carrier aggregation with one component carrier per operating band but with up to three component carriers assigned to the same band. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

## 7.7.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P<sub>CMAX\_L</sub> is defined as the total transmitter power over the two transmit antenna connectors.

## 7.7.1D Minimum requirements for ProSe

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Tables 7.7.1D-1, 7.7.1D-2, and 7.7.1D-3.

Table 7.7.1D-1: Spurious response parameters for ProSe Direct Discovery

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		Prefsens	ProSe + cha	nnel bandw	idth specific	value belov	v+ P <sub>offset</sub>
Transmission	dBm						
Bandwidth	UBIII			6	6	7	9
Configuration							
Poffset	dB			10.9	13.9	15.7	16.9
NOTE 1: Reference measurement channel is specified in Annex A.6.2.							

Table 7.7.1D-2: Spurious response parameters for ProSe Direct Communication

Rx parameter	Units	Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in		P <sub>REFS</sub>	Prefsens_Prose + channel bandwidth specific value below						
Transmission	dBm								
Bandwidth	ubili			6	6	7	9		
Configuration									
NOTE 1: Reference measurement channel is specified in Annex A.6.2.									

Table 7.7.1D-3: Spurious response for ProSe

Parameter	Unit	Level
P <sub>Interferer</sub> (CW)	dBm	-44
F <sub>Interferer</sub>	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{interferer}$  power defined in Table 7.7.1D-3 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.7.1F Minimum requirements for UE category NB1

The category NB1 UE throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channel as specified in Annexe A.3.2 with parameters specified in Tables 7.7.1F-1.

Table 7.7.1F-1: Spurious response parameters for UE category NB1

Parameter	Unit	Level
P <sub>signal</sub>	dBm	REFSENS+6
P <sub>Interferer</sub> (CW)	dBm	-44
F <sub>Interferer</sub>	MHz	Spurious response frequencies
Number of spurious		24 (in OOB range 1, 2, 3)
response frequencies		
NOTE 1: Reference me	ed in Annex FFS.	
NOTE 2: The REFSENS	S power level is specified in 7	′.3.1F.1-1.

7.8 Intermodulation characteristics

7.8 Intermodulation characteristics

OOB range 1, 2, 3 refers to Table 7.6.2.1F-1.

#### 7.8.1 Wide band intermodulation

The wide band intermodulation requirement is defined following the same principles using modulated E-UTRA carrier and CW signal as interferer.

#### 7.8.1.1 Minimum requirements

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1.1 for the specified wanted signal mean power in the presence of two interfering signals. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Units Channel bandwidth **Rx Parameter** 1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz Power in REFSENS + channel bandwidth specific value below Transmission dBm Bandwidth 9 12 8 6 6 7 Configuration dBm PInterferer 1 -46 (CW)  $P_{\text{Interferer 2}}$ dBm -46 (Modulated) BW<sub>Interferer 2</sub> 1.4 MHz -BW/2 -2.1 -BW/2 -4.5 -BW/2 - 7.5 F<sub>Interferer 1</sub> (Offset) +BW/2+ 2.1 +BW/2 + 4.5 +BW/2 + 7.5MHz F<sub>Interferer 2</sub> 2\*F<sub>Interferer 1</sub> (Offset)

Table 7.8.1.1-1: Wide band intermodulation

- NOTE 1: The transmitter shall be set to 4dB below Pcmax L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz.
- NOTE 4: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 5: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
- NOTE6: For DL category M1 UE, only the requirements under Channel bandwidth of 1.4MHz apply.

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{interferer1}$  and  $P_{interferer2}$  powers defined in Table 7.8.1.1-1 are increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.8.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For a component carrier configured in Band 46, the requirements specified in subclause 7.8.1.1 are replaced by the requirements in Table 7.8.1-1A-0.

Table 7.8.1.1A-0: Wide band intermodulation

E-UTRA band	Rx Parameter	Units	Channel bandwidth						
			1.4 MHz	3	MHz	5 MHz	10 MHz	15 MHz	20 MHz
	Power in		REF	REFSENS + channel bandwidth specific value below					
	Transmission Bandwidth Configuration	dBm							9
	P <sub>Interferer 1</sub> (CW)	dBm	-46 -46						
46	P <sub>Interferer 2</sub> (Modulated)	dBm							
40	BW <sub>Interferer 2</sub>								20
	F <sub>Interferer 1</sub> (Offset)	MHz							-BW/2 - 30 / +BW/2 + 30
	F <sub>Interferer 2</sub> (Offset)	MHz	2*F <sub>Interferer 1</sub>						

NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the wideband intermodulation requirements of subclause 7.8.1A do not apply.

For intra-band contiguous carrier aggegation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC, For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.8.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggreagation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.8.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.8.1A-1.

Table 7.8.1A-1: Wide band intermodulation

Rx parameter	Units		CA Bandwidth Class							
		В	С	D	E	F				
P <sub>w</sub> in		RE	REFSENS + CA Bandwidth Class specific value below							
Transmission Bandwidth Configuration, per CC	dBm	9	12	13.8	15					
P <sub>Interferer 1</sub> (CW)	dBm		-46							
P <sub>Interferer 2</sub> (Modulated)	dBm			-46						
BW <sub>Interferer 2</sub>	MHz	5	5	5	5					
F <sub>Interferer 1</sub> (Offset)	MHz	-F <sub>offset</sub> -7.5 / + F <sub>offset</sub> +7.5	-F <sub>offset</sub> -7.5 / + F <sub>offset</sub> +7.5	-F <sub>offset</sub> -7.5 / + F <sub>offset</sub> +7.5	-F <sub>offset</sub> -7.5 / + F <sub>offset</sub> +7.5					
F <sub>Interferer 2</sub> (Offset)	MHz		2*FInterferer 1							

- NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1.
- NOTE 4: The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz:
- NOTE 5: The F<sub>interferer 1</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and F<sub>interferer 2</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.8.1.1 and in this subclause for one component carrier and two component carriers per sub-block, respectively. The requirements apply for out-of-gap interferers while all downlink carriers are active.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. For these uplink configurations, the UE shall meet the wide-band intermodulation requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with  $\Delta R_{IBNC} = 0$  dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.8.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of two downlink carriers are replaced by requirements in Table 7.8.1A-2. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

Table 7.8.1A-2: Wide band intermodulation

E-UTRA Band	Rx parameter	Units		CA	Bandwidth C	lass	
	-		В	С	D	E	F
	Power per CC in		REF	SENS + CA Ba	andwidth Class	specific value l	oelow
	Aggregated Transmission Bandwidth Configuration	dBm		12	13.8	15	
	P <sub>Interferer 1</sub> (CW)	dBm			-46		
46	P <sub>Interferer 2</sub> (Modulated)	dBm			-46		
	BW <sub>Interferer 2</sub>	MHz		20	20	20	
	F <sub>Interferer 1</sub> (Offset)	MHz		-F <sub>offset</sub> -30 / + F <sub>offset</sub> +30	-F <sub>offset</sub> -30 / + F <sub>offset</sub> +30	-F <sub>offset</sub> -30 / + F <sub>offset</sub> +30	
	F <sub>Interferer 2</sub> (Offset)	MHz		- Chiaet + GG	2*FInterferer 1	1 Shaet VOO	

- NOTE 1: The transmitter shall be set to 4dB below Pcmax\_L,c or Pcmax\_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1.
- NOTE 4: The interfering modulated signal is 20 MHz E-UTRA signal as described in Annex D interference setting 2;
- NOTE 5: The F<sub>interferer 1</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and F<sub>interferer 2</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

### 7.8.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P<sub>CMAX\_L</sub> is defined as the total transmitter power over the two transmit antenna connectors.

## 7.8.1D Minimum requirements for ProSe

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Table 7.8.1D-1, Table 7.8.1D-2, and Table 7.8.1D-3 for the specified wanted signal mean power in the presence of two interfering signals

Table 7.8.1D-1: Wide band intermodulation parameters for ProSe Direct Discovery

Rx parameter	Units		Channel bandwidth					
		1.4 MHz	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MH					
Poffset	dB			10.9	13.9	15.7	16.9	

Table 7.8.1D-2: Wide band intermodulation for ProSe Direct Communication

Rx parameter	Units		Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Poffset	dB			0	0	0	0		

Units Channel bandwidth **Rx Parameter** 15 MHz 1.4 MHz 3 MHz 5 MHz 10 MHz 20 MHz PREFSENS\_ProSe + channel bandwidth specific value below+ Poffset Power in Transmission dBm 7 Bandwidth 12 6 6 9 8 Configuration dBm P<sub>Interferer 1</sub> -46 (CW) P<sub>Interferer 2</sub> dBm -46 (Modulated) BW<sub>Interferer 2</sub> 1.4 MHz -BW/2 -2.1 -BW/2 -4.5 -BW/2 - 7.5 F<sub>Interferer 1</sub> (Offset) +BW/2+ 2.1 +BW/2 + 4.5 +BW/2 + 7.5MHz F<sub>Interferer 2</sub> 2\*F<sub>Interferer 1</sub> (Offset)

Table 7.8.1D-3: Wide band intermodulation for ProSe

NOTE 1: Reference measurement channel is specified in Annex A.6.2

NOTE 2: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{interferer1}$  and  $P_{interferer2}$  powers defined in Table 7.8.1D-3 are increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.8.1F Minimum requirements for category NB1

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with parameters specified in Table 7.8.1F-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8.1F-1: Wide band intermodulation for category NB1

Parameters for wideband intermodulation						
Category NB1 Signal power REFSENS +						
CW interferer signal power	- 46 dBm					
1.4 MHz E-UTRA interferer signal power	- 46 dBm					
CW interferer offset	± 2.2 MHz					
1.4 MHz E-UTRA interferer	± 4.4 MHz					

#### 7.8.2 Void

## 7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

### 7.9.1 Minimum requirements

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1-1

Table 7.9.1-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	NOTE
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 5 <sup>th</sup> harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	1

NOTE 1: Applies only for Band 22, Band 42 and Band 43

NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given

by PDCCH\_RA/RB as defined in Annex C.3.1.

## 7.9.1A Minimum requirements

For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1A-1.

Table 7.9.1A-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	NOTE
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	

NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH\_RA/RB as defined in Annex C.3.1.

NOTE 2: The requirements apply when the UE is configured for carrier aggregation but is not transmitting.

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## 7.10 Receiver image

#### 7.10.1 Void

## 7.10.1A Minimum requirements for CA

Receiver image rejection is a measure of a receiver's ability to receive the E-UTRA signal on one component carrier while it is also configured to receive an adjacent aggregated carrier. Receiver image rejection ratio is the ratio of the wanted received power on a sub-carrier being measured to the unwanted image power received on the same sub-carrier when both sub-carriers are received with equal power at the UE antenna connector.

For intra-band contiguous carrier aggregation the UE shall fulfil the minimum requirement specified in Table 7.10.1A-1 for all values of aggregated input signal up to -22 dBm.

Table 7.10.1A-1: Receiver image rejection

		CA bandwidth class							
Rx parameter	Units	Α	В	С	D	E	F		
Receiver image rejection	dB		25	25	25	25			

## 8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

NOTE: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

#### 8.1 General

### 8.1.1 Receiver antenna capability

The performance requirements are based on UE(s) that utilize one or more antenna receivers.

For all test cases, the SNR is defined as

$$SNR = \frac{\sum_{j=1}^{N_{RX}} \hat{E}_{s}^{(j)}}{\sum_{i=1}^{N_{RX}} N_{oc}^{(j)}}$$

where  $N_{RX}$  denotes the number of receiver antenna connectors and the superscript receiver antenna connector j. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

For enhanced performance requirements type A, the SINR is defined as

$$SINR = \frac{\sum_{j=1}^{N_{RX}} \hat{E}_{s}^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

where  $N_{RX}$  denotes the number of reciver antenna connectors and the superscript receiver antenna connector j. The above SINR definition assumes that the REs are not precoded. The SINR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SINR requirement applies for the UE categories given for each test.

For the performance requirements specified in this clause, it is assumed that  $N_{RX}$ =2 unless otherwise stated.

**Table 8.1.1-1: Void** 

#### 8.1.1.1 Simultaneous unicast and MBMS operations

#### 8.1.1.2 Dual-antenna receiver capability in idle mode

### 8.1.2 Applicability of requirements

#### 8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

#### 8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1. The definition with respect to CA capabilities for 3CCs is given in Table 8.1.2.2-3.

Table 8.1.2.2-1: Definition of CA capability with 2DL CCs

CA Capability Description Capability	
CA2_C	Intra-band contiguous CA
CA2_A2	Inter-band CA (two bands)
CA2_N2	Intra-band non-contiguous CA (with two sub-blocks)
con CA: con CA:	2_C corresponds to E-UTRA CA configurations and bandwidth abination sets defined in Table 5.6A.1-1 for 2 DL CCs. 2_A2 corresponds to E-UTRA CA configurations and bandwidth abination sets defined in Table 5.6A.1-2 for 2 DL CCs. 2_N2 corresponds to E-UTRA CA configurations and bandwidth abination sets defined in Table 5.6A.1-3 for 2 DL CCs.

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

CA Capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA
CA2_C	5+5MHz, 5+10MHz,	20+20MHz, 15+20MHz	NA
	5+15MHz, 10+10MHz,		
	20+20MHz		
CA2_A2	10+10MHz, 20+5MHz,	20+20MHz	10(FDD)+20(TDD)MHz,
	10+15MHz, 10+20MHz,		15(FDD)+20(TDD)MHz,
	15+20MHz, 20+20MHz		20(FDD)+20(TDD)MHz
CA2_N2	5+10MHz, 10+10MHz,	20+20MHz	NA
	20+20MHz		
NOTE 1: This table is only for information and applicability and test rules of CA performance			

Table 8.1.2.2-3: Definition of CA capability with 3 DL CCs

CA	CA Capability Description
Capability	
CA3_C	Intra-band contiguous CA
CA3_A2	Inter-band CA (two bands)
CA3_A3	Inter-band CA (three bands)
CA3_N2	Intra-band non-contiguous CA (with two sub-blocks)
NOTE 1: CA	3_C corresponds to E-UTRA CA configurations and bandwidth
cor	nbination sets defined in Table 5.6A.1-1 for 3 DL CCs.
CA3_A2 corresponds to E-UTRA CA configurations and bandwidth	
combination sets defined in Table 5.6A.1-2 for 3 DL CCs.	
CA3_A3 corresponds to E-UTRA CA configurations and bandwidth	
combination sets defined in and Table 5.6A.1-2a for 3 DL CCs.	
CA	3_N2 corresponds to E-UTRA CA configurations and bandwidth
cor	nbination sets defined in Table 5.6A.1-3 for 3 DL CCs.

The supported testable largest aggregated CA bandwidth combinations for 3CCs for each CA capability are listed in Table 8.1.2.2-4.

Table 8.1.2.2-4: Supported largest aggregated CA bandwidth combinations for different CA capability with 3 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD	Bandwidth combination for TDD-FDD CA
		CA	
CA3_C	NA	20+20+20MHz	NA
CA3_A2	5+10+20MHz,	15+20+20MHz,	15(FDD)+20(TDD)+20(TDD)MHz,
	5+15+20MHz,	20+20+20MHz	20(FDD)+20(TDD)+20(TDD)MHz
	10+10+20MHz,		
	10+20+20MHz,		
	20+20+20MHz		
CA3_A3	10+10+20MHz,	NA	2×20(FDD)+20(TDD)MHz,
	10+15+15MHz,		20(FDD)+15(FDD)+20(TDD)MHz,
	10+15+20MHz,		20(FDD)+10(FDD)+20(TDD)MHz
	10+20+20MHz,		
	15+15+20MHz,		
	15+20+20MHz,		
	20+20+20MHz		
CA3_N2	NA	20+20+20MHz	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

Table 8.1.2.2-5: Definition of CA capability with 4 DL CCs

CA	CA Capability Description	
Capability		
CA4_C	Intra-band contiguous CA	
CA4_A2	Inter-band CA (two bands)	
CA4_A3	Inter-band CA (three bands)	
CA4_A4	Inter-band CA (four bands)	
CA4_N2	Intra-band non-contiguous CA (with two sub-blocks)	
NOTE 1: CA	4_C corresponds to E-UTRA CA configurations and bandwidth	
con	nbination sets defined in Table 5.6A.1-1 for 3 DL CCs.	
CA	4_A2 corresponds to E-UTRA CA configurations and bandwidth	
con	nbination sets defined in Table 5.6A.1-2 for 3 DL CCs.	
CA4_A3 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in and Table 5.6A.1-2a for 3 DL CCs.		
CA4_A4 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in and Table 5.6A.1-2b for 4 DL CCs		
CA	4_N2 corresponds to E-UTRA CA configurations and bandwidth	
con	nbination sets defined in Table 5.6A.1-3 for 3 DL CCs.	

The supported testable largest aggregated CA bandwidth combinations for 4CCs for each CA capability are listed in Table 8.1.2.2-6.

Table 8.1.2.2-6: Supported largest aggregated CA bandwidth combinations for different CA capability with 4 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA
CA4_C	NA	NA	NA
CA4_A2	20+20+20+20MHz	NA	20(FDD)+20(TDD)+20(TDD)+20(TDD)MHz
CA4_A3	20+20+20+10MHz 20+20+10+10MHz	NA	2×20(FDD)+2×20(TDD)MHz, 20(FDD)+15(FDD)+2×20(TDD)MHz, 2×15(FDD)+2×20(TDD)MHz
CA4_A4	20+20+10+10MHz	NA	2×20(FDD)+15(FDD)+20(TDD)MHz, 2×15(FDD)+20(FDD)+20(TDD)MHz
CA4_N2	NA	NA	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

Table 8.1.2.2-7: Definition of CA capability with 5 DL CCs

CA	CA Capability Description	
Capability		
CA5_C	Intra-band contiguous CA	
CA5_A2	Inter-band CA (two bands)	
CA5_A3	Inter-band CA (three bands)	
CA5_A4	Inter-band CA (four bands)	
CA5_A5	Inter-band CA (five bands)	
CA5_N2	Intra-band non-contiguous CA (with two sub-blocks)	
NOTE 1: CA	5_C corresponds to E-UTRA CA configurations and bandwidth	
con	nbination sets defined in Table 5.6A.1-1 for 5 DL CCs.	
CA5_A2 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in Table 5.6A.1-2 for 5 DL CCs.		
CA5_A3 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in and Table 5.6A.1-2a for 5 DL CCs.		
CA5_A4 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in and Table 5.6A.1-2b for 5 DL CCs		
CA5_A5 corresponds to E-UTRA CA configurations and bandwidth		
combination sets defined in and Table 5.6A.1-xx for 5 DL CCs		
	S_N2 corresponds to E-UTRA CA configurations and bandwidth	
com	bination sets defined in Table 5.6A.1-3 for 5 DL CCs.	

The supported testable largest aggregated CA bandwidth combinations for 5CCs for each CA capability are listed in Table 8.1.2.2-8.

Table 8.1.2.2-8: Supported largest aggregated CA bandwidth combinations for different CA capability with 5 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD	Bandwidth combination for TDD-FDD CA
		CA	
CA5_C	NA	NA	NA
CA5_A2	NA	NA	NA
CA5_A3	5×20MHz	NA	NA
CA5_A4	5×20MHz	NA	15+2×20(FDD)+2×20(TDD)MHz 2×15+20(FDD)+2×20(TDD)MHz
CA5_A5	NA	NA	
CA5_N2	NA	NA	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers, unless otherwise stated.

#### 8.1.2.2A Definition of dual connectivity capability

The definition with respect to dual connectivity capabilities for configurations with 2CCs is given as in Table 8.1.2.2A-1. The definition with respect to dual connectivity capabilities for configurations with 3CCs is given as in Table 8.1.2.2A-3.

Table 8.1.2.2A-1: Definition of dual connectivity capability with 2DL CCs

Dual connectivity Capability	Dual connectivity capability Description
DC_A_2	Inter-band dual connecitivty (two bands)
NOTE 1: DC	A_2 corresponds to E-UTRA dual connectivity configurations and
ban	dwidth combination sets defined for inter-band dual connecitivty (two
ban	ds) as specified in 5.6C.

The supported testable dual connectivity bandwidth combinations for 2CCs for each dual connectivity capability are listed in Table 8.1.2.2A-2.

Table 8.1.2.2A-2: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 2DL CCs

Dual connectivity capability	Bandwidth combination for FDD dual connectivity	Bandwidth combination for TDD dual connectivity	Bandwidth combination for TDD-FDD dual connectivity
DC_A_2	10+10MHz, 10+20MHz, 15+15MHz,15+20MHz, 20+20MHz,15+5MHz	20+20MHz	20(FDD)+20(TDD)MHz
NOTE 1: This table is only for information and applicability and test rules of dual connectivity performance requirements are specified in 8.1.2.3A			

Table 8.1.2.2A-3: Definition of dual connectivity capability with 3DL CCs

Dual connectivity Capability	Dual connectivity capability Description
DC_A_3	Inter-band dual connecitivty (three bands)
	_A_3 corresponds to E-UTRA dual connectivity configurations and dwidth combination sets defined for inter-band dual connectivity (three
ban	ds) in Table 5.6C.1-2.

The supported testable dual connectivity bandwidth combinations for 3CCs for each dual connectivity capability are listed in Table 8.1.2.2A-4.

Table 8.1.2.2A-4: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 3DL CCs

Dual connectivity	Bandwidth combination	Bandwidth combination
capability	for FDD dual connectivity	for TDD dual connectivity
DC_A_3	20+20+15MHz,	NA
	20+15+15MHz	
NOTE 1: This table is only for information and applicability and test rules of dual		
connectivity performance requirements are specified in 8.1.2.3A		

# 8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1 and 3 or more DL CCs in Table 8.2.2.3-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3-1: Applicability and test rules for CA UE demodulation tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.1.1.1, 8.2.1.4.3	Any one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, 15MHz+5MHz
CA tests with 2CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, other combinations
CA tests with 2CCs in Clause 8.2.1.3.1A, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.1.7.1	CA_C	Supported FDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.2.1.1, 8.2.2.4.3	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1A, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in 8.2.2.7.1	CA_C	Supported TDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.1.8.1	CA_N	CA_3A-3A defined in Table 5.6A.1-3	10+10 MHz
CA tests with 2CCs in Clause 8.2.2.8.1	CA2_C	CA_41C defined in Table 5.6A.1-1	20+20 MHz

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 3: A single Uplink CC is configured for all tests

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1.

Table 8.1.2.3-2: Applicability and test rules for CA UE demodulation tests with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 3 or more CCs in Clause 8.2.1.1.1, 8.2.1.4.3, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.2.1.1, 8.2.2.4.3, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.2.8.1	CA3_C	CA_41D defined in Table 5.6A.1-1	20+20+20 MHz

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected

CA configuration is 1.

NOTE 3: A single Uplink CC is configured for all tests

## 8.1.2.3A Applicability and test rules for different dual connectivity configuration and bandwidth combination set

The performance requirement for dual connectivity UE demodulation tests in Clause 8 are defined independent of dual connectivity configurations and bandwidth combination sets specified in Clause 5.6C.1. For UEs supporting different dual connectivity configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for the configurations with 2CCs in Table 8.1.2.3A-1 and 3 DL CCs in Table 8.1.2.3A-2. For simplicity, dual connectivity configuration below refers to combination of dual connectivity configuration and bandwidth set.

Both CA performance requirements and dual connectivity performance requirements are applied for dual connectivity capable UE.

Table 8.1.2.3A-1: Applicability and test rules for dual connectivity UE demodulation tests with 2DL CCs

Tests	Dual connectivity capability where the tests apply	Dual connectivity configuration from the selected CA capbility where the tests apply	Dual connectivity Bandwidth combination to be tested in priority order		
Dual connectivity test with 2CCs in Clause 8.2.1.4.3A, 8.7.6	Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination	Any one of the supported FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combimation	Largest dual connectivity aggregated bandwidth combination		
Dual connectivity test with 2CCs in Clause 8.2.2.4.3A, 8.7.7	Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination	Any one of the supported TDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combination	Largest dual connectivity aggregated bandwidth combination		
Dual connectivity test with TDD FDD 2CCs in Clause 8.2.3.4, 8.7.8  Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination  Any one of the supported TDD FDD dual connectivity aggregated bandwidth combination  Largest dual connectivity aggregated dual connectivity bandwidth combination					
	test rules are specified in this ta rted bandwidth combinations to		C or CA configuration is 1.		

Table 8.1.2.3A-2: Applicability and test rules for dual connectivity UE demodulation tests with 3DL CCs

Tests	Dual connectivity capability where the tests apply	Dual connectivity configuration from the selected CA capbility where the tests apply	Dual connectivity Bandwidth combination to be tested in priority order			
Dual connectivity test with 3CCs in Clause 8.2.1.4.3A, 8.7.6  Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination		Any one of the supported FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combimation	Largest dual connectivity aggregated bandwidth combination			
NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.  NOTE 2: Number of the supported bandwidth combinations to be tested from each selected DC or CA configuration is 1.						

## 8.1.2.3B Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL TDD-FDD CA in Table 8.1.2.3B-1 and in Table 8.1.2.3B-2 for 3 or more DL TDD-FDD CA. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3B-1: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.3.1.1, 8.2.3.2.1A, 8.2.3.3.1, 8.7.5.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.2.1	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.1.2, 8.2.3.2.2A, 8.2.3.3.2, 8.7.5.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.2.2	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is

1.

NOTE 3: A single Uplink CC is configured for all tests.

Table 8.1.2.3B-2: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 3CCs in Clause 8.2.3.1.1, 8.2.3.2.1A, 8.2.3.3.1, 8.7.5.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.2.1	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.1.2, 8.2.3.2.2A, 8.2.3.3.2, 8.7.5.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.2.2	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is

1.

NOTE 3: A single Uplink CC is configured for all tests.

### 8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD FDD tests specified in 8.2.3.1, 8.2.3.2, 8.2.3.3, and 8.7.5, if corresponding TDD FDD CA tests are tested, the test coverage can be considered fulfilled without executing both FDD and TDD single carrier tests.

For FDD CA tests specified in 8.2.1.1.1, 8.2.1.4.3, and 8.7.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For FDD CA tests specified in 8.2.1.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.1.1, 8.2.2.4.3, and 8.7.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.1, 8.2.3.3, and 8.7.5, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.2, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For FDD CA power imbalance tests specified in 8.2.1.7.1, if they are are tested with FDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with FDD intra-band contiguous CA configurations with 3 or more DL CCs supported by the UE.

For TDD CA power imbalance tests specified in 8.2.2.7.1, if they are are tested with TDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with TDD intra-band contiguous CA configurations with 3 or more DL CCs supported by the UE.

For FDD DC tests specified in 8.2.1.4.3 and 8.7.6, among all supported DC capabilities, if corresponding DC tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the DC tests with less than the largest number of CCs supported by the UE.

For TDD FDD DC tests specified in 8.2.3.4 and 8.7.8, among all supported DC capabilities, if corresponding DC tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the DC tests with less than the largest number of CCs supported by the UE.

### 8.1.2.5 Applicability of performance requirements for Type B receiver

For TM10 capable UE, if corresponding tests specified in 8.3.1.1F, 8.3.2.1G, 9.3.8.3 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.3.1.1C, 8.3.2.1D, 9.3.8.2. For a UE which does not have TM10 capability, the tests specified in sections 8.3.1.1C, 8.3.2.1D, 9.3.8.2 should be used.

#### 8.1.2.6 Applicability of performance requirements for 4Rx capable UEs

#### 8.1.2.6.1 Applicability rule and antenna connection for single carrier tests with 2Rx

For 4Rx capable UEs all single carrier tests specified in 8.2 to 8.8 with 2Rx are tested on any of the 2 Rx supported bands by connecting 2 out of the 4Rx with data source from system simulator, and the other 2 Rx are connected with

zero input, depending on UE's declaration and AP configuration. Same requirements specified with 2Rx should be applied.

For 4Rx capable UEs, if corresponding tests listed from the 4Rx test lists from Table 8.1.2.6.1-1are tested, the test coverage can be considered fulfilled without executing the corresponding tests listed from the 2Rx test lists from Table 8.1.2.6.1-1.

Table 8.1.2.6.1-1: Applicability rules for single carrier tests with 2Rx

4Rx test lists	2Rx test lists
8.10.1.1.1 Test 1	8.2.1.2.1 Test 1
8.10.1.1.2 Test 1	8.2.1.3.1 Test 1
8.10.1.1.3 Test 1	8.2.1.4.1B Test 1
8.10.1.1.4 Test 1	8.2.1.4.2 Test 1
8.10.1.1.4 Test 2	8.2.1.4.2 Test 3
8.10.1.1.5 Test 1	8.3.1.1A Test 1
8.10.1.1.6 Test 1	8.3.1.2 Test 1
8.10.1.2.1 Test 1	8.2.2.2.1 Test 1
8.10.1.2.2 Test 1	8.2.2.3.1 Test 1
8.10.1.2.3 Test 1	8.2.2.4.1B Test 1
8.10.1.2.4 Test 1	8.2.2.4.2 Test 1
8.10.1.2.4 Test 2	8.2.2.4.2 Test 3
8.10.1.2.5 Test 1	8.3.2.1B Test 1
8.10.1.2.6 Test 1	8.3.2.2 Test 2
8.10.2.1.1 Test 1	8.4.1.1 Test 1
8.10.2.1.2 Test 1	8.4.1.2.1 Test 1
8.10.2.1.3 Test 1	8.4.1.2.2 Test 1
8.10.2.2.1 Test 1	8.4.2.1 Test 1
8.10.2.2.2 Test 1	8.4.2.2.1 Test 1
8.10.2.2.3 Test 1	8.4.2.2.2 Test 1
8.10.3.1.1 Test 1	8.5.1.1 Test 1
8.10.3.1.2 Test 1	8.5.1.2.1 Test 1
8.10.3.1.3 Test 1	8.5.1.2.2 Test 1
8.10.3.2.1 Test 1	8.5.2.1 Test 1
8.10.3.2.2 Test 1	8.5.2.2.1 Test 1
8.10.3.2.3 Test 1	8.5.2.2.2 Test 1
8.10.4.1.1 Test 1	8.8.1.1 Test 1
8.10.4.1.1 Test 2	8.8.1.1 Test 2
8.10.4.1.2 Test 1	8.8.1.2 Test 1
8.10.4.1.2 Test 2	8.8.1.2 Test 2
8.10.4.2.1 Test 1	8.8.2.1 Test 1
8.10.4.2.1 Test 2	8.8.2.1 Test 2
8.10.4.2.2 Test 1	8.8.2.2 Test 1
8.10.4.2.2 Test 2	8.8.2.2 Test 2

#### 8.1.2.6.2 Applicability rule and antenna connection for CA and DC tests with 2Rx

### 8.1.2.6.3 Applicability rule and antenna connection for single carrier tests with 4Rx

For 4Rx capable UEs all single carrier tests specified in 8.10 with 4Rx are tested on any of the 4 Rx supported bands by connecting all 4Rx with data source from system simulator.

### 8.1.2.6.4 Applicability rule for 256QAM tests

For 256QAM capable UE, if corresponding tests specified in 8.10.1.1.4 Test 2 and 8.10.1.2.4 Test 2 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.10.1.1.4 Test 1 and 8.10.1.2.4 Test 1. For a UE which does not have 256QAM capability, the test specified in 8.10.1.1.4 Test 1 and 8.10.1.2.4 Test 1 should be used.

# 8.1.2.7 Applicability of Enhanced Downlink Control Channel Performance Requirements

For enhanced Downlink Control Channel Type A receiver capable UE the tests from the Type A receiver test lists from Table 8.1.2.7-1 should be applied and for enhanced Downlink Control Channel Type B receiver capable UE the tests from the Type B receiver test lists Table 8.1.2.7-1 should be applied.

For enhanced Downlink Control Channel Type B receiver capable UE if the tests from the Type B receiver test lists are tested, the test coverage can be considered fulfilled without executing the corresponding tests from the Type A receiver test lists.

Table 8.1.2.7-1: Applicability rules for enhanced downlink control channel performance requirements

Test category	1	Type A receiver test list	Type B receiver test list
FDD Tests	PDCCH/PCFICH	8.4.1.2.5 Test 1	8.4.1.2.5 Test 1 8.4.1.2.7 Test 1
		8.4.1.2.6 Test 1	8.4.1.2.8 Test 1
	PHICH	8.5.1.2.5 Test 1	8.5.1.2.5 Test 1 8.5.1.2.7 Test 1
		8.5.1.2.6 Test 1	8.5.1.2.8 Test 1
	EPDCCH	8.8.4.1 Test 1	8.8.4.1 Test 1
		8.8.6.1 Test 1	8.8.6.1 Test 1
TDD Tests	PDCCH/PCFICH	8.4.2.2.5 Test 1	8.4.2.2.7 Test 1
		8.4.2.2.6 Test 1	8.4.2.2.8 Test 1
	PHICH	8.5.2.2.5 Test 1	8.5.2.2.7 Test 1
		8.5.2.2.6 Test 1	8.5.2.2.8 Test 1
	EPDCCH	8.8.4.2 Test 1	8.8.4.2 Test 1
		8.8.5.1 Test 1	8.8.5.1 Test 1

### 8.1.3 UE category and UE DL category

UE category and UE DL category refer to *ue-Category* and *ue-CategoryDL* define in 4.1 and 4.1A from [12]. A UE that belongs to either a UE category or a UE DL category indicated in UE performance requirements in subclause 8, 9, 10 shall fulfil the corresponding requirements.

### 8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

### 8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

**Parameter** Unit Value Inter-TTI Distance 1 Number of HARQ 8 processes per **Processes** component carrier Maximum number of 4 HARQ transmission {0,1,2,3} for QPSK and 16QAM Redundancy version {0,0,1,2} for 64QAM and 256QAM coding sequence 4 for 1.4 MHz bandwidth, 3 for 3 MHz and Number of OFDM 5 MHz bandwidths, symbols for PDCCH per OFDM symbols 2 for 10 MHz, 15 MHz and 20 MHz component carrier bandwidths unless otherwise stated Cyclic Prefix Normal Cell\_ID 0 Cross carrier scheduling Not configured

Table 8.2.1-1: Common Test Parameters (FDD)

### 8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

#### 8.2.1.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-6, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-7, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-8, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.1.1-1: Test Parameters

Parameter		Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
5 " 1	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)				
aooa.io	σ	dB	0	0	0	0	0
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98	-98	-98	-98
Symbols for unused PRBs			OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)
Modulation			QPSK	16QAM	64QAM	16QAM	QPSK
PDSCH transmiss	ion mode		1	1	1	1	1

NOTE 1:  $P_{\rm B}=0$ .

NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

NOTE 3: Void. NOTE 4: Void.

Table 8.2.1.1.1-2: Minimum performance (FRC)

				Propa-		Correlation	Reference	value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	cate gory	
1	10 MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥1	
2	10 MHz	R.2 FDD	OP.1 FDD	ETU70	1x2 Low	70	-0.4	≥1	
3	10 MHz	R.2 FDD	OP.1 FDD	ETU300	1x2 Low	70	0.0	≥1	
4	10 MHz	R.2 FDD	OP.1 FDD	HST	1x2	70	-2.4	≥1	
5	1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	0.0	≥1	
	10 MHz	R.3 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	≥2	
6	5 MHz	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	1	
6	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	≥2	
	10 MHz	R.3 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	≥2	
7	5 MHz	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	1	
'	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	≥2	
	10 MHz	R.3 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2	
8	5 MHz	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	1	
0	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2	
9	3 MHz	R.5 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥1	
10	5 MHz	R.6 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.4	≥2	
10	5 MHz	R.6-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.5	1	
11	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2	
- 11	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1	
12	10 MHz	R.7 FDD	OP.1 FDD	ETU70	1x2 Low	70	19.0	≥2	
12	10 MHz	R.7-1 FDD	OP.1 FDD	ETU70	1x2 Low	70	18.1	1	
13	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 High	70	19.1	≥2	
13	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 High	70	17.8	1	
14	15 MHz	R.8 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2	
14	15 MHz	R.8-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.8	1	
	20 MHz	R.9 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥3	
15	20 MHz	R.9-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.3	2	
	20 MHz	R.9-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1	
16	3 MHz	R.0 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1	
17	10 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1	
18	20 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1	
19	10 MHz	R.41 FDD	OP.1 FDD	EVA5	1x2 Low	70	-5.4	≥1	

NOTE 1: Void.

NOTE 2: Void.

NOTE 3: Void.

NOTE 4: Test case applicability is defined in 8.1.2.1.

Table 8.2.1.1.1-3: Test Parameters for CA

Parameter		Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
allocation	σ	dB	0
$N_{oc}$ at a	$N_{oc}$ at antenna port		-98
Symbols fo	Symbols for unused PRBs		OCNG (NOTE 2)
Modulation			QPSK
PDSCH tran	nsmission mode		1

NOTE 1:  $P_B = 0$ .

NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

NOTE 3: PUCCH format 1b with channel selection is used to feedback ACK/NACK for Tests in Table 8.2.1.1.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.1.1-6.

NOTE 4: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA with 2DL CCs

				Propa	Correlatio	Reference	e value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	n matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.2 FDD	OP.1 FDD (NOTE 1)	EVA5	1x2 Low	70	-1.1	≥3 (NOTE 2)
2	2x20 MHz	R.42 FDD	OP.1 FDD (NOTE 1)	EVA5	1x2 Low	70	-1.3	≥5
	2x5	D 40 0 500	OP.1 FDD	<b>5</b> ) (4.5	4.01	70	-1.0	. 0
3	MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥2
	10MHz	R.2 FDD for 10MHz CC	OP.1 FDD			70	-1.7	
4	+5MHz	R.42-2 FDD for 5MHz CC	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥3
5	15MHz	R.42-3 FDD for 15MHz CC	OP.1 FDD	EVA5	1x2 Low	70	-1.6	≥3
5	+5MHz	R.42-2 FDD for 5MHz CC	OP.1 FDD	EVAS	1XZ LUW	70	-1.0	23

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: 30usec timing difference between two CCs is applied in inter-band CA case.

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.1.1-5: Single carrier performance for multiple CA configurations

				Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	Propagation condition	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	
1.4MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3	
3MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1	
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7	
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6	
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7	

Table 8.2.1.1.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	3x20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5

NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

NOTE 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.1.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	4x20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
	the applicability of requirements for ets is defined in 8.1.2.3	different CA configurations and bandwidth co	ombination

NOTE 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.1.1.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5DL CCs

Test num. CA Band-width combination		Requirement	UE category					
1	5x20MHz	As specified in Table 8.2.1.1.1-5 per CC	8, ≥11					
NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination								
_	sets is defined in 8.1.2.3  NOTE 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where							
	Cell can be assigned on any CC.	от аптину с от то тррито						

8.2.1.1.2 Void

8.2.1.1.3 Void

### 8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.1.1.4-1: Test Parameters for Testing 1 PRB allocation

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	σ	dB	0
$N_{oc}$ at antenna	port	dBm/15kHz	-98
Symbols for MBSFN portion of MBSFN subframes (NOTE 2)			OCNG (NOTE 3)
PDSCH transmission	on mode		1

NOTE 1:  $P_B = 0$ 

NOTE 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

first slot.

NOTE 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes,

QPSK modulated MBSFN data is used instead.

Table 8.2.1.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.29 FDD	OP.3 FDD	ETU70	1x2 Low	30	2.0	≥1

### 8.2.1.2 Transmit diversity performance

### 8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)			
	σ	dB	0			
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98			
PDSCH transmission	on mode		2			
NOTE 1: $P_B = 1$ .						

Table 8.2.1.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	Category
1	10 MHz	R.11 FDD	OP.1 FDD	EVA5	2x2 Medium	70	6.8	≥2
	5 MHz	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	1
	5 MHz (NOTE 1)	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	≥2
2	10 MHz	R.10 FDD	OP.1 FDD	HST	2x2	70	-2.3	≥1
NOTE 1:	Test case a	pplicability is de	efined in 8.1.2.	1.				

### 8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.1.2.2-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)			
	σ	dB	0			
$N_{oc}$ at antenna	port	dBm/15kHz	-98			
PDSCH transmission	on mode		2			
NOTE 1: $P_B = 1$ .						

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	1.4 MHz	R.12 FDD	OP.1 FDD	EPA5	4x2 Medium	70	0.6	≥1
2	10 MHz	R.13 FDD	OP.1 FDD	ETU70	4x2 Low	70	-0.9	≥1

8.2.1.2.3 Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (NOTE 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (NOTE 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (NOTE 4)	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.1.2.3-2	6
BW <sub>Channel</sub>		MHz	10	10
Subframe Configura	tion		Non-MBSFN	Non-MBSFN
Time Offset between	Cells	μѕ	2.5 (synchror	nous cells)
Cell Id			0	1
ABS pattern (NOTE	E 5)		N/A	11000100 11000000 11000000 11000000 11000000
RLM/RRM Measurement Pattern (NOTE 6			10000000 N/A 10000000 10000000 10000000 10000000	
CSI Subframe Sets	C <sub>CSI,0</sub>		11000100 11000000 11000000 11000000 11000000	N/A
(NOTE7)	C <sub>CSI,1</sub>		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDM			2	2
PDSCH transmission	mode		2	N/A
Cyclic prefix			Normal	Normal

- NOTE 1:  $P_B = 1$ .
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
- NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- NOTE 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel		NG tern	Cond	agation ditions OTE 1)	Correlation Matrix and Antenna	Reference Value		Matrix and Categor Antenna	UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Fraction of Maximum Throughput (%) NOTE 5	SNR (dB) (Note 2)		
1	R.11-4 FDD (NOTE 4)	OP.1 FDD	OP.1 FDD	EVA5	EVA 5	2x2 Medium	70	3.4	≥2	

NOTE 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

NOTE 2: SNR corresponds to  $\widehat{E}_s/N_{oc2}$  of cell 1.

NOTE 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

NOTE 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

NOTE 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

### 8.2.1.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.2.3A-2, with the addition of parameters in Table 8.2.1.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3 (NOTE 1)	-3 (NOTE 1)	
	σ	dB	0	N/A	N/A	
	$N_{oc1}$	dBm/15kHz	-98 (NOTE 2)	N/A	N/A	
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (NOTE 3)	N/A	N/A	
$N_{oc3}$		dBm/15kHz	-93 (NOTE 4)	N/A	N/A	
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table8.2.1.2.3 A-2	12	10	
BW <sub>Channel</sub>		MHz	10	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset betwee	n Cells	μs	N/A	3	-1	
Frequency shift between	en Cells	Hz	N/A	300	-100	
Cell Id			0	126	1	
ABS pattern (NO	ΓE 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000	
RLM/RRM Measur Subframe Pattern (N			1000000 1000000 1000000 1000000 1000000	N/A	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A	
(NOTE 7)  Ccsl,1			00111111 00111111 00111111 00111111 00111111	N/A	N/A	
Number of control of symbols	OFDM		2	NOTE 8	NOTE 8	
	PDSCH transmission mode		2	NOTE 9	NOTE 9	
Cyclic prefix			Normal	Normal	Normal	

- NOTE 1:  $P_B = 1$ .
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
- NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- NOTE 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- NOTE 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- NOTE 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.2.3A-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OC	NG Patte	ern	11		Propagation Conditions (NOTE 1)		Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (NOTE 2)	Fraction of Maximum Throughput (%) NOTE 5	SNR (dB) (NOTE 3)	gory
1	R.11-4 FDD NOTE 4	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.4	≥2

- NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- NOTE 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- NOTE 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.
- NOTE 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- NOTE 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

### 8.2.1.2.4 Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.1.2.4-2, with the addition of parameters in Table 8.2.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.1.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (NOTE 2)		dB	N/A	-2.23	-8.06
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	_		2	N/A	N/A
Interference mod	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	%	N/A	20	20	
Reporting interva	ms	5	N/A	N/A	
Reporting mode		PUCCH 1-0	N/A	N/A	
Physical channel for CQI	Physical channel for CQI reporting			N/A	N/A
cqi-pmi-Configuration	Index		5)	N/A	N/A

NOTE 1:  $P_B = 1$ 

NOTE 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

NOTE 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

NOTE 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms and Cell 3 transmission is delayed with respect to Cell 1 by 0.67 ms.

Note 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

Table 8.2.1.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (NOTE 3)	Fraction of Maximum Throughput (%)	SINR (dB) (NOTE 2)	gory
1	R.46 FDD	OP. 1 FD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.1	≥1

NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

NOTE 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

#### 8.2.1.2.5 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.1.2.5-2, with the addition of parameters in Table 8.2.1.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.1.2.5-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.5-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

Para	meter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power alloc	cation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
		σ	dB	0	0	0
Cell-specific reference	ce signals	<b>.</b>		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz			
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	6	1
Number of control Ol	FDM sym	bols		3	3	3
CFI indicated in PCF	TCH			3	3	3
PDSCH transmission	n mode			2	2	2
Interference model				N/A	As specified in clause B.6.1	As specified in clause B.6.1
MBSFN				Not configured	Not configured	Not configured
Time offset to cell 1			us	N/A	2	3
Frequency offset to o	cell 1		Hz	N/A	200	300
NeighCellsInfo- r12	• I ·			N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 3) transmissionModeList -r12			N/A	{2,3,4,8,9}	{2,3,4,8,9}	
Note 1: $P_{x} = 1$						

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 3:

Table 8.2.1.2.5-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-10 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	15.5	≥1

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

SNR corresponds to  $E_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1. Note 2:

Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. Note 3:

### 8.2.1.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.1.2.6-2, with the addition of parameters in Table 8.2.1.2.6-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.1.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

Para	ameter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	-3	0	0
Downlink power allo	cation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0	0
		σ	dB	0	-3	-3
Cell-specific referen	Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	3.28	0.74
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control O	FDM syı	mbols		3	3	3
CFI indicated in PCF	FICH			3	Random from set {1,2,3}	Random from set {1,2,3}
PDSCH transmissio	n mode		2		9	9
Interference model				N/A	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signa	ls			N/A	Antenna ports 15,16	Antenna ports 15,16
CSI-RS periodicity a T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	and subfr	ame offset	Subframes	N/A	10 / 1	10 / 1
CSI reference signa	I configu	ration		N/A	6	7
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	6 / 01000000000 00000	6 / 0010000000 000000	
Time offset to cell 1		us	N/A	5	-5	
Frequency offset to cell 1		Hz	N/A	600	-600	
MBSFN	-			Not configured	Not configured	Not configured
NeighCellsInfo- r12				N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) transmissionMode r12		sionModeList-		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.1.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-9 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	8.4	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

### 8.2.1.3 Open-loop spatial multiplexing performance

#### 8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CC, the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.3.1-6, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.1.3.1-7, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.1.3.1-8, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1-4
Daniel al acces	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation	Downlink power allocation $\rho_{\scriptscriptstyle B}$		-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3
	•	•	·

NOTE 1:  $P_B = 1$ . NOTE 2: Void. NOTE 3: Void.

Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC)

				Propa-	Correlation	Reference	value	
Test num	Bandwidt h	Referenc e channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate gory
1 (NOTE 4)	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.0	≥2
2 (NOTE 3)	5 MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.7	≥2
3	10 MHz	R.35 FDD	OP.1 FDD	EVA200	2x2 Low	70	20.2	≥2
4	10 MHz	R.35-4 FDD	OP.1 FDD	ETU600	2x2 Low	70	20.8	≥2

NOTE 1: Void.

NOTE 2: Test 1 may not be executed for UE-s for which Test 1 or 2 in Table 8.2.1.3.1-4 is applicable.

NOTE 3: Test case applicability is defined in 8.1.2.1.

NOTE 4: For UE that supports CRS interference handling, the CRS assistance information defined in [7] is provided. The CRS assistance information includes two aggressor cells with 2 CRS ports and cell ID of agressor cells are 1 and 128. For UE that does not support CRS interference handling, CRS assistance information is not provided.

Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parametei	•	Unit	Value
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmissi	on mode		3

NOTE 1:  $P_{B} = 1$ .

NOTE 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-6.

NOTE 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.3.1-4: Minimum performance Large Delay CDD (FRC) for CA with 2DL CCs

				Propa-	Correlation	Referenc	e value	
Test num	Bandwidth	Referenc e channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE category
1 (NOTE 2)	2x10 MHz	R.11 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.7	≥3
2 (NOTE 2)	2x20 MHz	R.30 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.2	≥5
3	2x5 MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.7	≥2
4	10MHz+5	R.11 FDD for 10MHz CC,	OP.1 FDD (NOTE 1)	E\/\\ 70	2021 200	70	13.0	,
4	MHz	R.11-2 FDD for 5MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	12.7	≥3
5	15MHz+5	R.11-7 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	12.8	≥3
5 MHz	R.11-2 FDD for 5MHz CC	OP.1 FDD (NOTE 1)			70	12.7		

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: Void

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.3.1-5: Single carrier performance for multiple CA configurations

	D.		Propa-	Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	gation condition	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	
1.4MHz	R.11-5 FDD	OP. 1 FDD	EVA70	2x2 Low	70	13.6	
3MHz	R.11-6 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.3	
5MHz	R.11-2 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.3	
10 MHz	R.11 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.9	
15MHz	R.11-7 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.8	
20MHz	R.30 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.9	

Table 8.2.1.3.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	3x20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5

NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

Table 8.2.1.3.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

Test num.	CA Band-width combination	Requirement	UE category			
1	4x20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8			
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8			
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8			
NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination						
S	ets is defined in 8.1.2.3					

Table 8.2.1.3.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

Test num. CA Band-width combination		Requirement	UE category				
1	5x20MHz	As specified in Table 8.2.1.3.1-5 per CC	8, ≥11				
NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination							
S	sets is defined in 8.1.2.3						

### 8.2.1.3.1A Soft buffer management test

For CA, the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.2.1.3.1A-3.

Table 8.2.1.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Parameter		Unit	Test 1-7
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmission	on mode		3

NOTE 1:  $P_{B} = 1$ .

NOTE 2: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.

NOTE 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

						Reference value	
Test num	Bandwi dth	Reference channel	OCNG pattern	Propa- gation condition	Correlation matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)
1	2x20 MHz	R.30 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.2
2	15MHz +	R.35-2 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.1
2	10MHz	R.35-3 FDD for 10MHz CC	OP.1 FDD (NOTE 1)	LVAS	ZXZ LOW	70	15.1
3	20MHz +	R.30 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.5
3	10MHz	R.11 FDD for 10MHz CC	OP.1 FDD (NOTE 1)	EVATO	EVA70 2x2 LOW	70	13.5
4	20MHz +	R.30 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.5
4	15MHz	R.30-1 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVATO	ZXZ LOW	70	13.5
5	2x20 MHz	R.35-1 FDD	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.8
6	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.9
U	10MHz	R.35-3 FDD for 10MHz CC	OP.1 FDD (NOTE 1)	EVAO	A5 2X2 LOW	70	15.9
7	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	E)/A <i>E</i>		70	15.9
/	15MHz	R.35-2 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.9

NOTE 1: For CA test cases, the OCNG pattern applies for each CC.

NOTE 2: For Test 2, 3, 4, 6, 7 the Fraction of maximum Throughput applies to each CC.

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.3.1A-3: Test points for soft buffer management tests for CA

LIE ootogory	Bandwidth combination with maximum aggregated bandwidth (NOTE 1)							
UE category	2x20MHz	15MHz+10MHz	20MHz+10MHz	20MHz+15MHz				
3	1	2	3	4				
4	4 5		6	7				
NOTE 1: Maximum over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1-								
1and Table	1and Table 5.6A.1-2.							

### 8.2.1.3.1B Enhanced Performance Requirement Type C –2Tx Antenna Ports

The requirements are specified in Table 8.2.1.3.1B-2, with the addition of the parameters in Table 8.2.1.3.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

Table 8.2.1.3.1B-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3		
	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)		
	σ	dB	0		
$N_{oc}$ at antenna	port	dBm/15kHz	-98		
PDSCH transmission	on mode		3		
NOTE 1: $P_p = 1$ .					

Table 8.2.1.3.1B-2: Enhanced Performance Requirement Type C for Large Delay CDD (FRC)

				Propa- Correlation		Reference		
Test num	Bandwidt h	Referenc e channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate gory
1	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Medium	70	17.8	≥2

### 8.2.1.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.1.3.1C-2, with the addition of parameters in Table 8.2.1.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.1.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.1.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

Parameter		Unit	Cell 1	Cell 2
Bandwid	dth	MHz	10 M	Hz
Downlink	$ ho_{\scriptscriptstyle A}$		-3	0
power	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	0
allocation	σ		0	0
Cell-spec reference s			Antenna ports 0,1	Antenna port 0
Cyclic Pr			Normal	Normal
Cell IE			0	1
Transmis: mode			3	NOTE 2
$N_{\!oc}$ at anteni	$N_{\!oc}$ at antenna port		-98	N/A
$\hat{E}_s/N_{oc}$ (NC	$\hat{E}_s/N_{oc}$ (NOTE 3)		Reference Value in Table 8.2.1.3.1C-2	12.95
Correlation and antenna configuration			Medium (2x2)	Medium(1x 2)
Number of OFDM symbols for PDCCH			2	N/A
HARC	Max number of HARQ transmissions		4	N/A
Redundancy version coding sequence			{0,1,2,3}	N/A

NOTE 1:  $P_B = 1$ 

NOTE 2: Downlink physical channel setup in Cell 2 in

accordance with Annex C.3.2 applying OCNG pattern

OP.5 FDD as defined in Annex A.5.1.5.

NOTE 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

NOTE 4: All cells are time-synchronous.

NOTE 5: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

Test Number	Reference Channel		NG tern	Propag Condi (NOT	itions	Reference Value		UE Categor y
		Cell 1	Cell 2	Cell 1	Cell 2	Fraction of Maximum Throughpu t (%)	SNR (dB) (NOTE 2)	
1	R.11-8	OP.1	OP.5	EVA7	EVA7	70	19.9	≥2
	FDD	FDD	FDD	0	0			

NOTE 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

NOTE 2: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1.

### 8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.1.3.2-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
D 11 1	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (NOTE 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3
NOTE 1: $P_B = 1$			

Table 8.2.1.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation			UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 FDD	OP.1 FDD	EVA70	4x2 Low	70	14.3	≥2

### 8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (NOTE 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (NOTE 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (NOTE 4)	N/A
$\widehat{E}_s/N_{oc2}$		dB	dB Reference Value in Table 8.2.1.3.3-2	
BW <sub>Channel</sub>		MHz	10	10
Subframe Configura	ation		Non-MBSFN	Non-MBSFN
Cell Id			0	1
Time Offset between	Cells	μs	2.5 (synchro	nous cells)
ABS pattern (NOT	E 5)		N/A	11000100, 11000000, 11000000, 11000000, 11000000
RLM/RRM Measurement Pattern(NOTE 6			1000000 1000000 1000000 1000000 1000000	N/A
CSI Subframe Sets	$C_{\text{CSI,0}}$		11000100 11000000 11000000 11000000	N/A
(NOTE 7)	C <sub>CSI,1</sub>		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDN			2	2
PDSCH transmission	mode		3	N/A
Cyclic prefix			Normal	Normal

- NOTE 1:  $P_B = 1$ .
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
  NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- NOTE 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference \	Reference Value	
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 FDD Note 4	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	13.3	≥2
Note 1:	The propagati	The propagation conditions for Cell 1 and Cell2 are statistically inc							
Note 2:	SNR correspo	nds to $\widehat{E}$	$N_{oc2}$	of cell 1.					

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) - MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (Note 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.1.3.3-4	6
BW <sub>Channel</sub>		MHz	10	10
Subframe Configura	ation		Non-MBSFN	MBSFN
Cell Id			0	126
Time Offset between	Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Note	: 5)		N/A	0001000000 0100000010 0000001000 0000000
RLM/RRM Measurement Pattern (Note 6			0001000000 0100000010 0000001000 0000000	N/A
CSI Subframe Sets (Note	C <sub>CSI,0</sub>		0001000000 0100000010 0000001000 0000000	N/A
7)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111111	N/A
MBSFN Subframe Allocation			N/A	001000 100001 000100 000000
Number of control OFDN			2	2
PDSCH transmission	mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1:  $P_{\rm B}=1$ .
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS.
- Note 4:
- This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS. ABS pattern as defined in [9]. The 4<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup> and 27<sup>th</sup> subframes indicated by ABS pattern are Note 5: MBSFN ABS subframes.
- Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 6:
- As configured according to the time-domain measurement resource restriction pattern for CSI Note 7: measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.
- The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel Note 11: transmission is in a subframe protected by MBSFN ABS in this test.

Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 2)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 FDD Note 4	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	12.0	≥2

- Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.
- Note 2: SNR corresponds to  $\hat{E}_s/N_{ac2}$  of cell 1.
- Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 4 subframes, averaged over 40ms.

## 8.2.1.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.4-2, with the addition of parameters in Table 8.2.1.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 ad Cell3.

Table 8.2.1.3.4-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	N/A	N/A	
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A	
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A	
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A	
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2	
BW <sub>Channel</sub>		MHz	10	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset between Cells		μs	μs N/A 3		-1	
Frequency shift between	een Cells	Hz	N/A	300	-100	
Cell Id			0	1	126	
ABS pattern (Not	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000	
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A	
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A	
Number of control of symbols	OFDM		2	Note 8	Note 8	
PDSCH transmissio			3	Note 9	Note 9	
Cyclic prefix			Normal	Normal	Normal	

Note 1:  $P_{B} = 1$ .

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.

Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.

Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.3.4-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Refer ence Chan nel	$\hat{E}_s/N_{oc2}$		OCNG Pattern		Propagation Conditions (Note1)		Correlation Matrix and	Reference Value		UE Cate		
		Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughp ut (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 FDD Note 4	9	7	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	13.9	≥2
2	R.35 FDD Note 4	9	1	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	22.6	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

### 8.2.1.4 Closed-loop spatial multiplexing performance

### 8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

	Unit	Test 1	Test 1A	Test 2
$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
σ	dB	0	0	0
oort	dBm/15kHz	-98	-98	-98
arity	PRB	6	4	50
2)	ms	8	8	8
/al	ms	1	1	1
le		PUSCH 1-2	PUSCH 1-2	PUSCH 3-1
estricti		001111	001111	001111
on bitmap PDSCH transmission		4	4	4
	ρ <sub>B</sub> σ cort arity (2) val e estricti	$ ho_A$ dB $ ho_B$ dB $ ho$ dB $ ho$ dB $ ho$ dB $ ho$ ort dBm/15kHz $ ho$ arity PRB $ ho$ 2) ms $ ho$ ral ms $ ho$ e estricti	$ ho_A$ dB -3 $ ho_B$ dB -3 (Note 1) $ ho_B$ dB 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE	
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Catego ry	
1	10 MHz	R.10 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.5	≥1	
1A (Note 1)	5 MHz	R.10-2 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.9	≥1	
2	10 MHz	R.10 FDD	OP.1 FDD	EPA5	2x2 High	70	-2.3	≥1	
Note 1: Tes									

### 8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98
Precoding granula	arity	PRB	6
PMI delay (Note	elay (Note 2)		8
Reporting interv	al	ms	1
Reporting mod	е		PUSCH 1-2
CodeBookSubsetRe	estricti		000000000000000000000000000000000000000
on bitmap			0000000000000000
			0000000000000000
			11111111111111111
PDSCH transmiss	sion		4
mode			
11 4 5 4			·

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.13 FDD	OP.1 FDD	EVA5	4x2 Low	70	-3.2	≥1

### 8.2.1.4.1B Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1B-2, with the addition of the parameters in Table 8.2.1.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined

in clause B.5.3. In Table 8.2.1.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		6	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granula	rity	PRB	50	6	6
PMI delay (Note 4	1)	ms	8	N/A	N/A
Reporting interva	ıl	ms	5	N/A	N/A
Reporting mode		PUCCH 1-1	N/A	N/A	
CodeBookSubsetRestricti		1111	N/A	N/A	
Physical channel for CQI		PUSCH(Note 6)	N/A	N/A	
cqi-pmi-Configuration	Index		2	N/A	N/A

Note 1:  $P_B = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Note 6: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

Table 8.2.1.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 FDD	OP. 1 FD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	0.8	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

# 8.2.1.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.4.1C-2, with the addition of parameters in Table 8.2.1.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.1.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
anocation	σ	dB	0	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.1.4.1C-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control symbols	Number of control OFDM		2	Note 8	Note 8
Symbols PDSCH transmission mode			6	Note 9	Note 9
Precoding granularity		PRB	50	N/A	N/A
PMI delay (Note	10)	ms	8	N/A	N/A
Reporting inter		ms	1	N/A	N/A
Peporting mod			PUSCH 3-1	N/A	N/A
CodeBookSubsetRestriction bitmap			1111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

Reference Value

**SNR** 

Fraction of

UE

Cate

gory

Test

Number

Note 5:

Reference

Channel

**OCNG Pattern** 

Cell 2

Cell 3

Note 1:	$P_B = 1$ .
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9].
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
Note 10:	·
Note 11:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

Propagation

Conditions (Note1)

Cell 2

Cell 3

Cell 1

Correlation

Matrix and

Antenna

								on (Note 2)	Throughput (%) Note 5	(0B) (Note 3)		
1	R.11 FDD	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 High	70	6.1	≥2	
	Note 4	FDD FDD FDD										
Note 1:	The propagat	propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.										
Note 2:	The correlation	ne correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										
Note 3:	SNR correspo	onds to $\hat{I}$	$\hat{E}_s/N_{oc2}$	of cell 1.								
Note 4:	transmitted in	1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are mitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell he subframe is available in the definition of the reference channel.										

### 8.2.1.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

The requirements are specified in Table 8.2.1.4.1D-2, with the addition of the parameters in Table 8.2.1.4.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.1.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Parame	eter	Unit	Cell 1	Ce	ell 2	Ce	II 3		
	$ ho_{\scriptscriptstyle A}$	dB	-3	-	-3	-	3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-	-3	-	3		
	σ	dB	0		0	0			
Cell-specific referen	ce signals		Antenna ports 0,1	Antenna	ports 0,1	Antenna	ports 0,1		
$N_{oc}$ at antenna port		dBm/15 kHz		-98					
Test number (Note 4	1)			Test 1	Test 2	Test 1	Test 2		
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.28	3.34	0.74		
Cell Id				6	1	1	6		
CFI indicated in PCFICH				3	Random from set {1,2,3}	3	Random from set {1,2,3}		
BW <sub>Channel</sub>	innel		10	1	10	1	0		
Cyclic Prefix			Normal	No	rmal	No	rmal		
Number of control O	FDM symbols		3		3		3		
PDSCH transmission	n mode		4		4		4		
Interference model			N/A		ed in clause 6.3		ed in clause 6.3		
Precoding			Random wideband precoding per TTI	As specified in clause B.6.3			ed in clause 6.3		
Time offset to cell 1		us	N/A		2		3		
Frequency offset to	cell 1	Hz	1						
MBSFN			Not configured		nfigured		nfigured		
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, d	B-3, dB0}	{dB-6, d	B-3, dB0}		
r12 (Note 3)	transmissionM odeList-r12		N/A	{2,3,	4,8,9}	{2,3,4,8,9}			

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Note 4: Test 1 and Test 2 are defined in Table 8.2.1.4.1D-2.

Table 8.2.1.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Test Num	Referenc e	ОС	NG Patt	ern	Propagation Conditions		Correlation Matrix and				
	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SNR (dB) (Note 2)	у
1	R.11-10 FDD	OP.1 FDD	N/A	N/A	EVA 5	EVA 5	EVA 5	2x2 Low	85	17.0	≥1
2	R.11-9 FDD	OP.1 FDD	N/A	N/A	EPA 5	EPA 5	EPA 5	2x2 Low	85	10.1	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

## 8.2.1.4.1E Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports with CRS assistance information

The requirements are specified in Table 8.2.1.4.1E-2, with the addition of parameters in Table 8.2.1.4.1E-1. The purpose is to verify the closed loop rank-one performance with wideband precoding when CRS assistance information [7] is configured. In Table 8.2.1.4.1E-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.4.1E-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0	0
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
Ê <sub>s</sub> /N <sub>oc</sub>		dB	Reference Value in Table 8.2.1.4.1E-2	10.45	4.6
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ıration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset to Ce	II 1	μs	N/A	3	-1
Frequency shift to	Cell 1	Hz	N/A	300	-100
Cell Id			0	128	
Cell-specific refer	ence signals		Ante	enna ports 0,1	
Number of control symbols	OFDM		2	2	2
PDSCH transmiss	sion mode		4	N/A	N/A
Precoding granula		PRB	50	N/A	N/A
PMI delay (Note 2		ms	8	N/A	
Reporting interval		ms	1	N/A	N/A
Peporting mode			PUSCH 3-1	N/A	N/A
CodeBookSubset bitmap	Restriction		001111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal
Interference mode			N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occu transmission in in		%	N/A	20	20
Probability of occurrence of transmission Rank 1		%	N/A	80	80
rank in interfering Rank 2 cells		%	N/A	20	20

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1E-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)

Test Number	Reference Channel	OC	NG Patt	ern	Propagation Conditions (Note1)			Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory

1	R.10-3 FDD	OP.1 FDD	N/A	N/A	EVA5	EVA5	EVA5	2x2 low	70	10.8	≥2	
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.											
Note 2:	The correlation	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										
Note 3:	SNR corresponds to $\hat{\mathbb{E}}_{s}/N_{od}$ of cell 1.											

#### 8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2, with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter	•	Unit	Test 1-2	Test 2A	Test 3
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	-98	-98
Precoding granularity		PRB	50	25	6
PMI delay (Not	e 2)	ms	8	8	8
Reporting inte	rval	ms	1	1	1
Reporting mo	de		PUSCH 3-1	PUSCH 3-1	PUSCH 1-2
CodeBookSubsetRo bitmap	estriction		110000	110000	110000
PDSCH transmission mode			4	4	4
Number of OFDM symbols for PDCCH per component carrier		OFDM symbol	2	3	1

Note 1:  $P_R = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE	UE DL			
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	category			
1	10 MHz	R.35 FDD	OP.1 FDD	EPA5	2x2 Low	70	18.9	≥2	≥6			
2	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.3	≥2	≥6			
2A (Note 1)	5 MHz	R.11-2 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.0	≥2	≥6			
3	10MHz 256QAM	R. 65 FDD	OP.1 FDD	EVA5	2x2 Low	70	25.3	11-12	≥11			
Note 1:	Note 1: Test case applicability is defined in 8.1.2.1.											

### 8.2.1.4.2A Enhanced Performance Requirement Type C – Multi-layer Spatial Multiplexing 2Tx Antenna Ports

The requirements are specified in Table 8.2.1.4.2A-2, with the addition of the parameters in Table 8.2.1.4.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband precoding.

Table 8.2.1.4.2A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\scriptscriptstyle oc}$ at antenna	$N_{oc}$ at antenna port		-98
Precoding granu	Precoding granularity		50
PMI delay (Not	e 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 3-1
CodeBookSubsetRe	estriction		110000
bitmap			
PDSCH transmission	on mode		4

Note 1:  $P_R = 1$ .

Note 2: If the UE reports in an available uplink reporting instance

at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.2A-2: Enhanced Performance Requirement Type C for Multi-Layer Spatial Multiplexing with TM4 (FRC)

	Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
	number	width	Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
						Antenna	Maximum	(dB)	
						Configuration	Throughput		
							(%)		
ĺ	1	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Medium	70	18.3	≥2

#### 8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.4.3-6, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with4 DL CCs, the requirements are specified in Table 8.2.1.4.3-7, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.1.4.3-8, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98		
Precoding granu	Precoding granularity		6		
PMI delay (Not	e 2)	ms	8		
Reporting inte	rval	ms	1		
Reporting mo	de		PUSCH 1-2		
CodeBookSubsetRe	estriction		000000000000000000000000000000000000000		
bitmap			00001111111111111111100000000		
·			0000000		
PDSCH transmission	on mode		4		

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Void. Note 4: Void. Note 5: Void.

Table 8.2.1.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

			Reference OCNG channel pattern	Brono (	Correlation	Reference value		
Test num.	Band- width			Propa- gation condi- tion	Correlation matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x2 Low	70	14.7	≥2
Note 1	: Void.							

Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Value
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-6
allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	$N_{oc}$ at antenna port		-98
Precoding granularity		PRB	4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
PMI delay (Not	e 2)	ms	8
Reporting inter	rval	ms	1
Reporting mo	de		PUSCH 1-2
CodeBookSubsetRe bitmap	estriction		00000000000000000000000000000000000000
CSI request field (	Note 3)		'10'
PDSCH transmission	on mode		4

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported

PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1<sup>st</sup> set of serving cells by higher

layers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 1b with channel selection configured for Tests in Table 8.2.1.4.3-4, and with PUCCH

format 3 for Tests in Table 8.2.1.4.3-6.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA with 2DL CCs

				Propa-	Correlation	Reference Fraction of	e value	
Test num	Band- width	Reference channel	OCNG pattern	gation condi- tion	gation matrix and condi- antenna		SNR (dB)	UE cate- gory
1	2x10 MHz	R.14 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.8	≥3
2	2x20 MHz	R.14-3 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.9	≥5
3	2x5 MHz	OP.1 FDD (Note 1) OP.1 FDD (Note 1)	FDD (Note 1)	4x2 Low	70	9.5	≥2	
3	233 1011 12		FDD (Note 1)	LVAS	IXE LOW	70	9.5	22
4	R.14 FDD OP.1 for 10MHz FDD		EV/A6	4x2 Low	70	10.1	≥3	
4	MHz	R.14-6 FDD for 5MHz CC	OP.1 FDD (Note 1)	EVA5	4X2 LOW	70	9.5	ล
5	15MHz+5	R.14-7 FDD for 15MHz CC	OP.1 FDD (Note 1)	EVA5	4v2 L ov	70	10.1	≥3
5	MHz	R.14-6 FDD for 5MHz CC	OP.1 FDD (Note 1)	EVAS	4x2 Low	70	9.5	23

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.4.3-5: Single carrier performance for multiple CA configurations

				Correlation	Reference	e value
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10 MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.1.4.3-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
	Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3							

Table 8.2.1.4.3-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

Test num.	CA Band-width combination	Requirement	UE category				
1	4x20MHz	As specified in Table 8.2.1.4.3-5 per CC	≥8				
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8				
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8				
NOTE 1: T	NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination						
s	ets is defined in 8.1.2.3						

Table 8.2.1.4.3-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

Test num.	CA Band-width combination	Requirement	UE category						
1	5x20MHz	As specified in Table 8.2.1.4.3-5 per CC	8, ≥11						
	NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is								

# 8.2.1.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.1.4.3A-3 for 2DL CCs and Table 8.2.1.4.3A-4 for 3DL CCs, based on single carrier requirement specified in Table 8.2.1.4.3A-2, with the addition of the parameters in Table 8.2.1.4.3A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity transmission.

Table 8.2.1.4.3A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Parameter		Unit	Values
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{oc}$ at antenna	port	dBm/15kHz	-98
Precoding granularity		PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs
PMI delay (Not	te 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 1-2
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000
PDSCH transmissi	on mode		4
ACK/NACK transi	mission		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG
CSI feedbad	k		Separate PUSCH feedbacks on the MCG and SCG
Time offset between and SCG Co		μѕ	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 4)
Note 1. D 1			·

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Note 4: As defined in TS36.300 [11].

Note 5: If the UE supports both SCG bearer and Split bearer, the SCG bearer is configured.

Table 8.2.1.4.3A-2: Single carrier performance for multiple dual connectivity configurations

			Propa-	Correlation	Reference	value
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.14-4 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.36
3MHz	R.14-5 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
10 MHz	R.14 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.1.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity with 2 DL CCs

Test num.	Band-width combination	Requirement	UE category
1	2x20 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
2	15+20 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
3	10+20MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
4	2x15 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
5	2x10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥3
6	15+5 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥3

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different dual connectvity configurations and bandwidth combination sets is defined in 8.1.2.3A.

Table 8.2.1.4.3A-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity with 3DL CCs

Test num.	Band-width combination	Requirement	UE category			
1 20+20+15MHz		As specified in Table 8.2.1.4.3A-2 per CC	≥5			
2	20+15+15MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5			
	OCNG pattern applies for each					
Note 2: The	Note 2: The applicability of requirements for different dual connectvity configurations and bandwidth					
cor	nbination sets is defined in 8.1.2	2.3A.				

#### 8.2.1.5 MU-MIMO

#### 8.2.1.6 [Control channel performance: D-BCH and PCH]

#### 8.2.1.7 Carrier aggregation with power imbalance

For CA, the requirements in this section verify the ability of an intraband adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

#### 8.2.1.7.1 Minimum Requirement

The requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

**Parameter** Unit Test 1 **Test 2-3** dB  $\rho_{\scriptscriptstyle A}$ Downlink power dΒ 0 (Note 1) 0 (Note 1)  $\rho_{\scriptscriptstyle B}$ allocation dΒ 0 0 σ  $N_{oc}$  at antenna port dBm/15kHz Off (Note 2) Off (Note 2) OCNG **OCNG** Symbols for unused PRBs (Note 3) (Note 3) Modulation 64 QAM 64 QAM Maximum number of HARQ 1 transmission Redundancy version coding {0} {0} sequence PDSCH transmission mode 1 3 of PCell PDSCH tramsmission mode 3 1 of SCell OP.1 FDD OP.5 FDD **PCell OCNG Pattern SCell** OP.5 FDD OP.1 FDD Propagation **PCell** Clause B.1 Clause B.1 Conditions **SCell** Clause B.1 Clause B.1 Correlation Matrix **PCell** 1x2 2x2

Table 8.2.1.7.1-1: Test Parameters for CA

Note 1:  $P_B = 0$ .

and Antenna

Note 2: No external noise sources are applied

**SCell** 

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated.

2x2

1x2

pseudo random data, which is QPSK modulated.

Note 4: Void

Table 8.2.1.7.1-2: Minimum performance (FRC) for CA

Test Number	Bandwid	dth (MHz)	Reference channel		Power at port (dBr	antenna n/15KHz)	Referen Fraction of Through		UE Category
	PCell	SCell	PCell	SCell	$\hat{E}_{s\_PCell}$ for PCell	$\hat{E}_{s\_SCell}$ for Scell	PCell	SCell	
1	20	20	R.49 FDD	NA	-85	-79	85	NA	≥5
2	10	10	NA	R.49-1 FDD	-79	-85.8	NA	85	≥5
3	5	5	NA	R.49-2 FDD	-79	-85.9	NA	85	≥5

Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

#### 8.2.1.8 Intra-band non-contiguous carrier aggregation with timing offset

The requirements in this section verify the ability of an intraband non-contiguous carrier aggregation UE to demodulate the signal transmitted by the PCell and SCell in the presence of timing offset between the cells. Throughput is measured on both cells.

#### 8.2.1.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.8.1-2, with the addition of the parameters in Table 8.2.1.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.8.1-1: Test Parameters for CA

Paramete	r	Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenn	a port	dBm/15kHz	-98
Modulatio	n		64 QAM
Maximum number	of HARQ		4
transmission	on		
Redundancy version	on coding		{0,0,1,2}
sequence	)		
PDSCH transmiss	ion mode		3
of PCell			
PDSCH tramsmiss of SCell	sion mode		3
Note 1: P - 1		·	·

Note 1:

Note 2: The OCNG pattern is used to fill unused control

channel and PDSCH.

Table 8.2.1.8.1-2: Minimum performance (FRC) for CA

Test	Cell	Band-	Referenc	OCNG	Propagati	Correlati	Refence va	alue	Timing	UE
Numbe r		width	e Channel	Patter n	on Condition s	on Matrix and Antenna	Fraction of Maximum Throughput (%)	SNR (dB)	relative to PCell (µs)	Catego ry
4	PCell	10MH z	R.35-4 FDD	OP.1	EPA200	2x2 Low	70	21.15	N/A	≥3
'	SCell	10MH	R.35-3	FDD	EPA200	2x2 Low	60	15.18	-30.26	≥3

The EPA200 propagation channels applied to PCell and SCell are statistically independent. Note 1:

The applicability and test rules of requirements for different CA configurations and bandwidth combination sets Note 2: are defined in 8.1.2.3.

#### TDD (Fixed Reference Channel) 8.2.2

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.2.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value				
Uplink downlink configuration (Note 1)		1				
Special subframe configuration (Note 2)		4				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ processes per component carrier	Processes	7				
Maximum number of HARQ transmission		4				
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM				
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated				
Cross carrier scheduling		Not configured				
I						

#### 8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

#### 8.2.2.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.1.1-7, based on single carrier requirement specified in Table 8.2.2.1.1-5, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.1.1-1: Test Parameters

Parameter		Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
Downlink	$\rho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
a	σ	dB	0	0	0	0	0
$N_{oc}$ at antenna	a port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for un PRBs	used		OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)
Modulation	ı		QPSK	16QAM	64QAM	16QAM	QPSK
ACK/NACK feedback			Multiplexing	Multiplexin	Multiplexin	Multiplexin	Multiplexing
mode				g	g	g	
PDSCH transmission mode			1	1	1	1	1

 $P_B = 0$ Note 1:

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. Note 2:

Void Note 3: Note 4: Void

Table 8.2.2.1.1-2: Minimum performance (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2	≥1
2	10 MHz	R.2 TDD	OP.1 TDD	ETU70	1x2 Low	70	-0.6	≥1
3	10 MHz	R.2 TDD	OP.1 TDD	ETU300	1x2 Low	70	-0.2	≥1
4	10 MHz	R.2 TDD	OP.1 TDD	HST	1x2	70	-2.6	≥1
5	1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	0.0	≥1
6	10 MHz	R.3 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	1
9	3 MHz	R.5 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥1
10	5 MHz	R.6 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	5 MHz	R.6-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
11	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
12	10 MHz	R.7 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	1
13	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	1
14	15 MHz	R.8 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	≥2
	15 MHz	R.8-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	1
15	20 MHz	R.9 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	≥3
	20 MHz	R.9-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	2
	20 MHz	R.9-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	1
16	3 MHz	R.0 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
17	10 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.0	≥1
18	20 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
19	10 MHz	R.41 TDD	OP.1 TDD	EVA5	1x2 Low	70	-5.3	≥1
Note 1:	Void.		_ = <del>-</del>	4.2. Test Des	1		1	

Table 8.2.2.1.1-3: Test Parameters for CA

	Parameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
N	$_{oc}$ at antenna port	dBm/15kHz	-98
Symb	ols for unused PRBs		OCNG (Note 2)
	Modulation		QPSK
ACK/NACK feedback mode			PUCCH format 1b with channel selection for Tests in Table 8.2.2.1.1-4; PUCCH format 3 for Tests in Table 8.2.2.1.1-7
PDSC	H transmission mode		1

Note 1:  $P_B = 0$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one

PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.1.1-4: Minimum performance (FRC) for CA with 2DL CCs

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20MHz	R.42 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	-1.2	≥5
2	20MHz+ 15MHz	R.42 TDD for 20MHz CC R.42-3	OP.1 TDD (Note 1) OP.1	EVA5	1x2 Low	70 70	-1.4	≥5
		TDD for 15MHz CC	TDD (Note 1)					

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in

Table 8.2.2.1.1-5: Single carrier performance for multiple CA configurations

				Correlation	Reference	value
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.2.1.1-6: Void

Table 8.2.2.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category
-----------	---------------------------	-------------	-------------

1		3x20MHz	As specified in Table 8.2.2.1.1-5 per CC	≥5
2		20MHz+20MHz+15MHz	As specified in Table 8.2.2.1.1-5 per CC	≥5
Note 1:	The 8.1.	• • • • • • • • • • • • • • • • • • • •	nt CA configurations and bandwidth combination s	ets is defined in

8.2.2.1.2 Void

8.2.2.1.3 Void

#### 8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

Parameter		Unit	Test 1			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)			
	σ	dB	0			
$N_{oc}$ at antenna	port	dBm/15kHz	-98			
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		1			
Note to $P_p = 0$						

Note 1:  $P_B = 0$ 

Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

first slot.

Note 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN

subframes, QPSK modulated MBSFN data is used instead.

Table 8.2.2.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.29 TDD	OP.3 TDD	ETU70	1x2 Low	30	2.0	≥1

#### 8.2.2.2 Transmit diversity performance

#### 8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2					
	$ ho_{\scriptscriptstyle A}$	dB	-3					
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)					
	σ	dB	0					
$N_{oc}$ at antenna	port	dBm/15kHz	-98					
ACK/NACK feedba	ck mode		Multiplexing					
PDSCH transmission	on mode		2					
Note 1: $P_B = 1$	Note 1: $P_B = 1$							

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference	UE	
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	≥2
l	5 MHz	R.11-2 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	1
2	10 MHz	R.10 TDD	OP.1 TDD	HST	2x2	70	-2.3	≥1

#### 8.2.2.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.2.2.1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{oc}$ at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$						

Table 8.2.2.2.2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	1.4 MHz	R.12 TDD	OP.1 TDD	EPA5	4x2 Medium	70	0.2	≥1
2	10 MHz	R.13 TDD	OP.1 TDD	ETU70	4x2 Low	70	-0.5	≥1

# 8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.2.3-2, with the addition of parameters in Table 8.2.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2	
Uplink downlink conf	iguration		1	1	
Special subframe con	figuration		4	4	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	
	$\begin{array}{c c} \text{configuration} & & & & & & & \\ \hline & \rho_A & & & & & \\ \hline & \rho_B & & & & \\ \hline & \sigma & & & & \\ \hline & \sigma & & & & \\ \hline & N_{oc1} & & & & \\ \hline & N_{oc2} & & & & \\ \hline & N_{oc3} & & & & \\ \hline & N_{oc3} & & & & \\ \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$	dB	0	N/A	
	$N_{oc1}$	dBm/15kHz	-102 (Note 2)	N/A	
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	
, and the second	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A	
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.2.3-2	6	
BW <sub>Channel</sub>		MHz	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	
Time Offset between	n Cells	μs	2.5 (synch	chronous cells)	
Cell Id			0	1	
ABS pattern (No	te 5)		N/A	0000010001 0000000001	
RLM/RRM Measuremer Pattern (Note			0000000001 0000000001	N/A	
CSI Subframe Sets	_		0000010001 0000000001	N/A	
(Note 7)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A	
Number of control OFD	M symbols		2	2	
ACK/NACK feedbac	k mode		Multiplexing	N/A	
PDSCH transmission	n mode		2	N/A	
Cyclic prefix			Normal	Normal	

Note 1:  $P_B = 1$ .

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.

Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11-4 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Medium	70	3.8	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

# 8.2.2.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.2.3A-2, with the addition of parameters in Table 8.2.2.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi	guration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.2.3A-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	en Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	e 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			0000000001 0000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
(Note7)	C <sub>CSI,1</sub>	_	1100111000 1100111000	N/A	N/A
Number of control of symbols	OFDM		2	Note 8	Note 8
ACK/NACK feedbac	k mode		Multiplexing	N/A	N/A
PDSCH transmissio	n mode		2	Note 9	Note 9
Cyclic prefix			Normal	Normal	Normal

- Note 1:  $P_{p} = 1$ .
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.2.2.3A-2: Minimum Performance Transmit Diversity (FRC)

	est mber	Reference Channel	oc	NG Patt	ern		ropagati itions (N		Correlation Matrix and	Reference '	Value	UE Cate
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
	1	R.11-4 TDD Note 4	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.5	≥2
Note					,				lly independent.			

- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3...
- Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

# 8.2.2.2.4 Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.2.2.4-2, with the addition of parameters in Table 8.2.2.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.2.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		2	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Reporting interva	ıl	ms	5	N/A	N/A
Reporting mode			PUCCH 1-0	N/A	N/A
ACK/NACK feedback	mode		Multiplexing	N/A	N/A
Physical channel for CQI reporting			PUSCH(Note 5)	N/A	N/A
cqi-pmi-Configuration	Index		4	N/A	N/A

Note 1:  $P_B = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: All cells are time-synchronous.

Note 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 8.2.2.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.46 TDD	OP. 1 TD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.4	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

# 8.2.2.2.5 Minimum Requirement 2 Tx Antenna Port (when *EIMTA-MainConfigServCell-r12* is configured)

The requirements are specified in Table 8.2.2.2.5-2 with the addition of the parameters in Table 8.2.2.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The test purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas in case of using eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI on a PCell.

Table 8.2.2.2.5-1: Test Parameters for Transmit diversity Performance (FRC) when EIMTA-MainConfigServCell-r12 is configured

Parameter		Unit	Value
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{oc}$ at antenna port		dBm/15kHz	-98
Uplink downlink configuration in SIE	31 (Note 2)		0
Downlink HARQ reference configur HarqReferenceConfig-r12) (Note 2)			5
Set of dynamic TDD UL-DL configu 2,3)			{0, 1, 2, 3, 4, 5, 6}
Periodicity of monitoring the L1 received (eimta-CommandPeriodicity-r12)	onfiguration DCI	ms	10
Set of subframes to monitor the L1 (eimta-CommandSubframeSet-r12)			{0,1,5,6}
Number of DL HARQ processes	•	Processes	15
PDSCH transmission mode			2
ACK/NACK feedback mode (Note 5	5)		Multiplexing

Note 1:  $P_{p} = 1$ 

Note 2: As specified in Table 4.2-2 in TS 36.211.

Note 3: UL/DL configuration in PDCCH with eIMTA-RNTI is randomly selected from the given set on a per-DCI basis with equal probability.

Note 4: The set of subframes to monitor PDCCH with eIMTA-RNTI for frame n includes subframes {1,5,6} in frame n-1 and subframe 0 in frame n. Subframes for reconfiguration DCI transmission are chosen in a random way on a per-DCI basis with equal probability.

Note 5: PUCCH Format 3 is used for DL HARQ feedback.

Table 8.2.2.2.5-2: Minimum performance Transmit diversity when EIMTA-MainConfigServCell-r12 is configured

				Correlation	Reference v		
Test	Reference channel	OCNG Propagation Conditions		Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	UE Category
1	R.67 TDD	OP.1 TDD	EVA5	2x2 Medium	70	5.0	≥1

## 8.2.2.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.2.2.6-2, with the addition of parameters in Table 8.2.2.2.6-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.2.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

Paran	neter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Config	guration			1	1	1
Special subframe conf	figuratio	n		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power alloca	ation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
		σ	dB	0	0	0
Cell-specific reference signals				Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	6	1
Number of control OFDM symbols in normal subframes				3	3	3
CFI indicated in PCFIC subframes	CH in no	ormal		3	3	3
Number of control OF special subframes				2	2	2
CFI indicated in PCFI subframes	CH in sp	ecial		2	2	2
PDSCH transmission	mode			2	2	2
Interference model				N/A	As specified in clause B.6.1	As specified in clause B.6.1
MBSFN				Not configured	Not configured	Not configured
Time offset to cell 1			us	N/A	2	3
Frequency offset to cell 1			Hz	N/A	200	300
NeighCellsInfo- r12 p-aList-r12				N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
,	transmis -r12	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: $P_B = 1$ Note 2: Cell 1 is the	e servino	rcell Cell 2 3	are the interferir	na cells		

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.2.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-12 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	15.3	≥1

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1. Note 2:

Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. Note 3:

### 8.2.2.2.7 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.2.2.7-2, with the addition of parameters in Table 8.2.2.2.7-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.2.2.7-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.7-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

	ameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Cor	nfiguration	1		1	1	1
Special subframe co	onfiguratio	n		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	-3	0	0
Downlink power allo	cation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0	0
		σ	dB	0	-3	-3
Cell-specific referen	Cell-specific reference signals			Antenna ports 0,1		
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	3.28	0.74
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control C normal subframes	FDM sym	nbols in		3	3	3
CFI indicated in PCF	FICH in no	ormal		3	Random from	Random from
subframes	EDM				set {1,2,3}	set {1,2,3}
special subframes	Number of control OFDM symbols in special subframes			2	2	2
CFI indicated in PCF	FICH in sp	pecial		2	Random from	Random from
subframes	_				set {1,2}	set {1,2}
PDSCH transmissio	n mode			2	9	9
Interference model				N/A	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signa	ls			N/A	Antenna ports 15,16	Antenna ports 15,16
CSI-RS periodicity a T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	ınd subfra	me offset	Subframes	N/A	10 / 4	10 / 4
CSI reference signa	l configura	ation		N/A	6	7
Zero-power CSI-RS	Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap			N/A	9 / 010000000000 0000	9 / 001000000000 0000
Time offset to cell 1		us	N/A	5	-5	
Frequency offset to cell 1		Hz	N/A	600	-600	
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- r12	p-aList-r	12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4)	transmis	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: D 1			•	•	•	

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.2.2.7-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-11 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	8.1	≥1
Note 1:											

Note 2: SNR corresponds to  $E_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

#### 8.2.2.3 Open-loop spatial multiplexing performance

#### 8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.3.1-7, based on single carrier requirement specified in Table 8.2.2.3.1-5, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

	Unit	Test 1-3
$ ho_{\scriptscriptstyle A}$	dB	-3
$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
σ	dB	0
port	dBm/15kHz	-98
ck mode		Bundling
on mode		3
	$ ho_A$ $ ho_B$ $ ho$ port ck mode	$ ho_{A}$ dB dB $ ho_{B}$ dB or dB port dBm/15kHz

Note 1:  $P_B = 1$ Note 2: Void.

Note 3: Void.

Table 8.2.2.3.1-2: Minimum performance Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation			/alue	UE
num ber		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Cate gory
1 (Note 2)	10 MHz	R.11-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.1	≥2
2	10 MHz	R.35 TDD	OP.1 TDD	EVA200	2x2 Low	70	20.3	≥2
3	10 MHz	R.35-2 TDD	OP.1 TDD	ETU600	2x2 Low	70	21.1	≥2

Note 1: Void.

Note 2: For UE that supports CRS interference handling, the CRS assistance information defined in [7] is provided. The CRS assistance information includes two aggressor cells with 2 CRS ports and cell ID of agressor cells are 1 and 128. For UE that does not support CRS interference handling, CRS assistance information is not provided.

Table 8.2.2.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Develiels news	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ		0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		PUCCH format 1b with channel selection for Tests in Table 8.2.2.3.1-4; PUCCH format 3 for Tests in Table 8.2.2.3.1-7
PDSCH transmission	on mode		3

Note 1:  $P_B = 1$ Note 2: Void

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA with 2DL CCs

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
num ber		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categ ory
1	2x20 MHz	R.30-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.7	≥5
2	20MHz+15M Hz	R.30-1 TDD for 20MHz CC	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.0	≥5
		R.11-9 TDD for 15MHz CC	OP.1 TDD (Note 1)	EVA70		70	12.9	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.2.3.1-5: Single carrier performance for multiple CA configurations

			Propa-	Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum	SNR (dB)	

					throughput (%)	
1.4MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10 MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP. 1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.2.3.1-6: Void

Table 8.2.2.3.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL

Test num.	CA Band-width combination	Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.2.3.1-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.2.3.1-5 per CC	≥5					

#### 8.2.2.3.1A Soft buffer management test

For CA, the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Parameter	Parameter		Test 1-2
Deventint never	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedback mode			- (Note 2)
PDSCH transmission mode			3
Nata di D. 1		•	

Note 1:  $P_B = 1$ 

Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Note 3: For CA test cases, the same PDSCH transmission mode is applied to each

component carrier.

Table 8.2.2.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	value	UE
num		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Cate
ber					Antenna	Maximum	(dB)	gory
					Configuration	Throughput		
						(%)		

1	2x20 MHz	R.30-2 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2	3
			(Note 1)					
2	2x20 MHz	R.35-1	OP.1	EVA5	2x2 Low	70	15.7	4
		TDD	TDD					
			(Note 1)					

Note 1: For CA test cases, the OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

#### 8.2.2.3.1B Enhanced Performance Requirement Type C - 2Tx Antenna Ports

The requirements are specified in Table 8.2.2.3.1B-2, with the addition of the parameters in Table 8.2.2.3.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

Table 8.2.2.3.1B-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
December to a constant	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Bundling
PDSCH transmission	on mode		3
Note 1: $P_B = 1$	·	·	`

Table 8.2.2.3.1B-2: Enhanced Performance Requirement Type C for Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
num ber		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Cate gory
1	10 MHz	R.11-1	OP.1	EVA70	2x2 Medium	70	17.4	≥2

## 8.2.2.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.2.3.1C-2, with the addition of parameters in Table 8.2.2.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.2.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.2.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

Parameter		Unit	Cell 1	Cell 2				
Bandwid	lth	MHz	10 M	Hz				
Downlink	$ ho_{\scriptscriptstyle A}$		-3	0				
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0				
anooanon	σ		0	0				
Cell-spec reference si			Antenna ports 0,1	Antenna port 0				
Cyclic Pr	efix		Normal	Normal				
Cell ID	)		0	1				
Transmission	n mode		3	Note 2				
$N_{\!oc}$ at anten	na port	dBm/15kHz	-98	N/A				
$\widehat{E}_s/N_{oc}$ (No	ote 3)	dB	Reference Value in Table 8.2.2.3.1C-2	12.95				
Correlation antenn configura	а		Medium (2x2)	Medium(1x2)				
Number of 0 symbols for F			2	N/A				
Max numb HARQ transm			4	N/A				
	Redundancy version coding sequence		{0,1,2,3}	N/A				
Note 2: D	Note 1: $P_B = 1$							

Table 8.2.2.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

Cell 1 is the serving cell. Cell 2 is the interfering cell. All cells are time-synchronous. SIB-1 will not be transmitted in Cell2 in this test.

Test Number	Reference Channel	OCNG	OCNG Pattern Propagation Conditions (Note 1)		· Value	UE Category		
		Cell 1	Cell 2	Cell 1	Cell 2	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	
1	R.11-10 TDD	OP.1 TDD	OP.5 TDD	EVA70	EVA70	70	19.6	≥2
Note 1:	1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.							
Note 2:	SNR correspond	ds to $\hat{E}_s/\hbar$	$N_{oc}$ of Ce	II 1.				

#### 8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

Note 3:

Note 4: Note 5:

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.2.3.2-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba			Bundling
PDSCH transmission	on mode		3
Note 1: $P_B = 1$ .			

Table 8.2.2.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 TDD	OP.1 TDD	EVA70	4x2 Low	70	14.2	≥2

# 8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink config	guration		1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (Note 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A
$\hat{E}_s/N_{oc2}$		dB Reference Value in Table 8.2.2.3.3-2 6		6
BW <sub>Channel</sub>	BW <sub>Channel</sub>		10	10
Subframe Configur	ation	Non-MBSFN No		Non-MBSFN
Cell Id			0	1
Time Offset between	n Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Not	e 5)		N/A	0000010001, 0000000001
RLM/RRM Measuremen Pattern (Note 6			000000001, 000000001	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000010001, 0000000001	N/A
(Note 7)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A
Number of control OFDI	// symbols		2	2
ACK/NACK feedback	k mode		Multiplexing	N/A
PDSCH transmission	mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1:  $P_B = 1$
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference \	/alue	UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	14.0	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

SNR corresponds to  $\widehat{E}_s/N_{oc2}$  of cell 1. Note 2:

Note 3:

The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated Note 4: PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. Note 5:

Table 8.2.2.3.3-3: Test Parameters for Large Delay CDD (FRC) - MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink confi	guration		1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (Note 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.3.3-4	6
BW <sub>Channel</sub>		MHz	10	10
Subframe Configu	ration		Non-MBSFN	MBSFN
Cell Id			0	126
Time Offset between	n Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Not	e 5)		N/A	000000001 000000001
RLM/RRM Measuremen Pattern (Note 6			000000001 000000001	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		000000001 000000001	N/A
(Note 7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A
MBSFN Subframe Allocation (Note 10)			N/A	000010
Number of control OFDM symbols			2	2
ACK/NACK feedbac			Multiplexing	N/A
PDSCH transmission	n mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1:  $P_B = 1$ .
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10,#11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9]. The 10<sup>th</sup> and 20<sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes.
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.

Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) - MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern		gation itions te 1)	Correlation Matrix and Antenna	Reference \	/alue	UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	12.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

# 8.2.2.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.4-2, with the addition of parameters in Table 8.2.2.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.3.4-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi	guration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	1	126
ABS pattern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 0000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		000000001 0000000001	N/A	N/A
(Note7) C <sub>CSI,1</sub>			1100111000 1100111000	N/A	N/A
Number of control OFDM symbols			2	Note 8	Note 8
ACK/NACK feedback mode			Multiplexing	N/A	N/A
PDSCH transmissio	n mode		3	Note 9	Note 9
Cyclic prefix			Normal	Normal	Normal

Note 1:  $P_{R} = 1$ .

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.

Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.

Note 10: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.

Note 11: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.

Table 8.2.2.3.4-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Refer ence	$\hat{E}_s/N_{oc2}$		OCNG Pattern			Propagation Conditions (Note1)			Correlation Matrix and	Reference	Value	UE Cate
	Chan nel	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughp ut (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD Note 4	9	7	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	14.2	≥2
2	R.35 TDD Note 4	9	1	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	22.7	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

#### 8.2.2.4 Closed-loop spatial multiplexing performance

#### 8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	Test 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	-98
Precoding granular	rity	PRB	6	50
PMI delay (Note 2	2)	ms	10 or 11	10 or 11
Reporting interva	ıl	ms	1 or 4 (Note 3)	1 or 4 (Note 3)
Reporting mode			PUSCH 1-2	PUSCH 3-1
CodeBookSubsetRest	riction		001111	001111
bitmap				
ACK/NACK feedback mode			Multiplexing	Multiplexing
PDSCH transmission	mode		4	4

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput	SNR (dB)	Category
						(%)		
1	10 MHz	R.10 TDD	OP.1 TDD	EVA5	2x2 Low	70	-3.1	≥1
2	10 MHz	R.10 TDD	OP.1 TDD	EPA5	2x2 High	70	-2.8	≥1

#### 8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note	2)	ms	10 or 11
Reporting interv	val	ms	1 or 4 (Note 3)
Reporting mod	le		PUSCH 1-2
CodeBookSubsetR	estricti		0000000000000000
on bitmap			0000000000000000
			0000000000000111
			1111111111111
ACK/NACK feed	oack		Multiplexing
mode			
PDSCH transmis	sion		4
mode			
Note 1: $P_B = 1$ .			
N ( 0 )(1)			

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE	
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	
1	10 MHz	R.13 TDD	OP.1 TDD	EVA5	4x2 Low	70	-3.5	≥1	

### 8.2.2.4.1B Enhanced Performance Requirement Type A – Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1B-2, with the addition of the parameters in Table 8.2.2.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-

one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.2.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		6	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granular	rity	PRB	50	6	6
PMI delay (Note 4	1)	ms	10 or 11	N/A	N/A
Reporting interva	ıİ	ms	5	N/A	N/A
Reporting mode		PUCCH 1-1	N/A	N/A	
CodeBookSubsetRestricti		1111	N/A	N/A	
ACK/NACK feedback		Multiplexing	N/A	N/A	
Physical channel for CQI		PUSCH(Note 6)	N/A	N/A	
cqi-pmi-Configuration	Index		4	N/A	N/A

- Note 1:  $P_{B} = 1$
- Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.
- Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.
- Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 5: All cells are time-synchronous.
- Note 6: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 8.2.2.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	OCNG Pattern			opagat onditio		Correlation Matrix and	Reference	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 TDD	OP. 1 TD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	1.1	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

# 8.2.2.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.4.1C-2, with the addition of parameters in Table 8.2.2.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi	guration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.4.1C-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		000000001 000000001	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		2	Note 8	Note 8
ACK/NACK feeback	c mode		Multiplexing	N/A	N/A
PDSCH transmission mode			6	Note 9	Note 9
Precoding granularity		PRB	50	N/A	N/A
PMI delay (Note 10)		ms	10 or 11	N/A	N/A
Reporting interval		ms	1 or 4 (Note 11)	N/A	N/A
Peporting mode			PUSCH 3-1	N/A	N/A
CodeBookSubsetRe bitmap	striction		1111	N/A	N/A
Cyclic prefix	•		Normal	Normal	Normal

- Note 1:  $P_{p} = 1$ .
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- Note 10: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 11: For Uplink downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.
- Note 12: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.2.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

Test Numbe	Reference r Channel	oc	OCNG Pattern			ropagations (N		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD Note 4	OP.1 TDD	OP.1 FDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 High	70	6.4	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

### 8.2.2.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1D-2, with the addition of the parameters in Table 8.2.2.4.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.2.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Para	meter	Unit	Cell 1	Се	ell 2	Ce	ell 3
Uplink downlink Co	onfiguration		1		1		1
Special subframe	configuration		4		4		4
	$\rho_{\scriptscriptstyle A}$	dB	-3	-	3	-	3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-	3	-	3
	σ	dB	0	(	0	1	0
Cell-specific refere	nce signals		Antenna ports 0,1	Antenna	ports 0,1	Antenna	ports 0,1
$N_{oc}$ at antenna po	rt	dBm/15 kHz			-98		
Test number (Note	: 4)			Test 1	Test 2	Test 1	Test 2
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.28	3.34	0.74
Cell Id				6	1	1	6
CFI indicated in PCFICH in normal subframes		al		3	Random from set {1,2,3}	3	Random from set {1,2,3}
CFI indicated in PC subframes	CFICH in specia	al		2	Random from set {1,2}	2	Random from set {1,2}
BW <sub>Channel</sub>		MHz	10	10		10	
Cyclic Prefix			Normal	Noi	rmal	Normal	
Number of control normal subframes			3	3		3	
Number of control special subframes		s in	2	:	2		2
PDSCH transmissi	on mode		4		4		4
Interference mode			N/A		cified in e B.6.3		cified in e B.6.3
Precoding			Random wideband precoding per TTI	As specified in clause B.6.3			cified in e B.6.3
Time offset to cell 1		us	N/A		2		3
Frequency offset to cell 1		Hz	N/A		00		00
MBSFN			Not configured		nfigured		nfigured
NeighCellsInfo- r12	p-aList-r12 transmissionM	lodo	N/A		B-3, dB0}		B-3, dB0}
(Note 3)	List-r12	ioue	N/A	{2,3,	4,8,9}	{2,3,	4,8,9}

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 4: Test 1 and Test 2 are defined in Table 8.2.2.4.1D-2.

Table 8.2.2.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Test Num	Referenc e	OCNG Pattern				opagati onditior		Correlation Matrix and	Reference Value		UE Categor
	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SNR (dB) (Note 2)	у
1	R.11-12 TDD	OP.1 TDD	N/A	N/A	EVA 5	EVA 5	EVA 5	2x2 Low	85	16.1	≥1
2	R.11-11 TDD	OP.1 TDD	N/A	N/A	EPA 5	EPA 5	EPA 5	2x2 Low	85	9.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

### 8.2.2.4.1E Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports with CRS assistance information

The requirements are specified in Table 8.2.2.4.1E-2, with the addition of parameters in Table 8.2.2.4.1E-1. The purpose is to verify the closed loop rank-one performance with wideband precoding when CRS assistance information [7] is configured. In Table 8.2.2.4.1E-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.4.1E-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter	•	Unit	Cell 1	Cell 2	Cell 3
Uplink downlink config	guration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0	0

$N_{oc}$ at antenna port		dBm/15kHz	-98	N/A	N/A
Ê <sub>s</sub> /N <sub>oc</sub>		dB	Reference Value in Table 8.2.2.4.1E-2	10.45	4.6
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset to C	ell 1	μs	N/A	3	-1
Frequency shift	to Cell 1	Hz	N/A	300	-100
Cell Id			0	1	128
Cell-specific refe	rence signals		Ante	enna ports 0,1	
Number of contr symbols	ol OFDM		2	2	2
Interference mod	del		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of octransmission in i	currence of nterference cells	%	N/A	20	20
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
ACK/NACK feeb	ack mode		Multiplexing	N/A	N/A
PDSCH transmis			4	N/A	N/A
Precoding granu	larity	PRB	50	N/A	N/A
PMI delay (Note 2)		ms	10 or 11	N/A	N/A
Reporting interval		ms	1 or 4 (Note 3)	N/A	N/A
Peporting mode			PUSCH 3-1	N/A	N/A
CodeBookSubse bitmap	etRestriction		001111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal
1					

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1E-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)

Test Number	Reference Channel	00	OCNG Pattern			ropagations (N		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.10-3 TDD	OP.1 TDD	N/A	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.2	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 3: SNR corresponds to  $\hat{E}_{\mathbf{s}}/N_{og}$  of cell 1.

### 8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter	1	Unit	Test 1-2	Test 3
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	-98
Precoding grant	ılarity	PRB	50	8
PMI delay (Not	e 2)	ms	10 or 11	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)	1 or 4 (Note 3)
Reporting mo	de		PUSCH 3-1	PUSCH 1-2
ACK/NACK feedba	ck mode		Bundling	Bundling
CodeBookSubsetRo bitmap	estriction		110000	110000
PDSCH transmission mode			4	4
Number of OFDM sy PDCCH per compon		OFDM symbol	2	1

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test number	Band- width	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference of Fraction of Maximum Throughput (%)	/alue SNR (dB)	UE Category	UE DL category
1	10 MHz	R.35 TDD	OP.1 TDD	EPA5	2x2 Low	70	19.5	≥2	≥6
2	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Low	70	13.9	≥2	≥6
3	20 MHz 256QA M	R. 65 TDD	OP.1 TDD	EVA5	2x2 Low	70	24.9	11-12	≥11

### 8.2.2.4.2A Enhanced Performance Requirement Type C Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2A-2, with the addition of the parameters in Table 8.2.2.4.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband precoding.

Table 8.2.2.4.2A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	50
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 3-1
ACK/NACK feedba	ck mode		Bundling
CodeBookSubsetRe bitmap			110000
PDSCH transmission	on mode		4

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF

not later than SF#(n-4), this reported PMI cannot be

applied at the eNB downlink before SF#(n+4). For Uplink - downlink configuration 1 the reporting interval Note 3:

will alternate between 1ms and 4ms.

Table 8.2.2.4.2A-2: Enhanced Performance Requirement Type C for Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Medium	70	17.8	≥2

#### 8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.4.3-4, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.4.3-7, based on single carrier requirement specified in Table 8.2.2.4.3-5, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-6
allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	6
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
ACK/NACK feedba	ck mode		Bundling
CodeBookSubsetRe	estriction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
			0000000
PDSCH transmission	on mode		4
		·	·

Note 1:  $P_B = 1$ .

If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this Note 2:

reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Note 4: Void. Note 5: Void. Note 6: Void.

Table 8.2.2.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagatio	Correlation	Reference	value	UE
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.36 TDD	OP.1 TDD	EPA5	4x2 Low	70	15.7	≥2
Note 1:	Void							

Table 8.2.2.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter	Parameter		Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	8
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
ACK/NACK feedba	ck mode		PUCCH format 1b with channel
			selection for Tests in Table
			8.2.2.4.3-4; PUCCH format 3 for
			Tests in Table 8.2.2.4.3-7
CodeBookSubsetRe	estriction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
	, and the second		00000000
CSI request field (	Note 4)		'10'
PDSCH transmission	on mode		4

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Note 4: Multiple CC-s under test are configured as the 1st set of serving cells by high

layers.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA with 2DL CCs

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20 MHz	R.43 TDD	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	11.1	≥5
2	20MHz +15MH z	R.43 TDD for 20MHz CC	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	10.7	≥5
		R.43-5 TDD for 15MHz CC	OP.1 TDD (Note 1)				10.6	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.2.4.3-5: Single carrier performance for multiple CA configurations

			Propa-	Correlation	Referenc	e value
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.2.4.3-6: Void

Table 8.2.2.4.3-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num. CA Band-width combination		Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.2.4.3-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.2.4.3-5 per CC	≥5					

## 8.2.2.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.2.4.3A-3, based on single carrier requirement specified in Table 8.2.2.4.3A-2, with the addition of the parameters in Table 8.2.2.4.3A-1 and the downlink physical channel setup according to Annex C.3.2.The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity.

Table 8.2.2.4.3A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Parameter		Unit	Value			
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-6			
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB	-6 (Note 1)			
	σ	dB	3			
$N_{oc}$ at antenna port		dBm/15kHz	-98			
Precoding granularit	у	PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs			
PMI delay (Note 2)		ms	10 or 11			
Reporting interval		ms	1 or 4 (Note 3)			
Reporting mode			PUSCH 1-2			
CodeBookSubsetRe bitmap	CodeBookSubsetRestriction bitmap		00000000000000000000000000000000000000			
PDSCH transmission	n mode		4			
ACK/NACK transmis	ACK/NACK transmission		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG			
CSI feedback			Separate PUSCH feedbacks on the MCG and SCG			
Time offset between MCG CC and SCG CC		μѕ	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 5)			
Note 1: $P_B = 1$ .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)						

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

The same PDSCH transmission mode is applied to each component carrier. Note 4:

Note 5: As defined in TS36.300 [11].

If the UE supports both SCG bearer and Split bearer, the SCG bearer is Note 6:

configured.

Table 8.2.2.4.3A-2: Single carrier performance for multiple dual connectivity configurations

			Propa-	Correlation	Reference	value
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.2.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

1	2x20 MHz	As specified in Table 8.2.2.4.3A-2 per CC	≥5			
Note 1:	The OCNG pattern applies for each	CC.				
Note 2:	te 2: The applicability of requirements for different dual connectivity configurations and bandwidth					
	combination sets is defined in 8.1.2.3	3A.				

8.2.2.4.4 Void

#### 8.2.2.5 MU-MIMO

#### 8.2.2.6 [Control channel performance: D-BCH and PCH]

#### 8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

#### 8.2.2.7.1 Minimum Requirement

For CA, the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.7.1-1: Test Parameters for CA

Paramete	Parameter		Test 1	Test 2
Daniel III and	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)
	σ	dB	0	0
$N_{\it oc}$ at antenna poi	t	dBm/15kHz	Off (Note 2)	Off (Note 2)
Symbols for unused	d PRBs		OCNG (Note 3)	OCNG (Note 3)
Modulation			64 QAM	64 QAM
Maximum number of transmission	of HARQ		1	1
Redundancy versio sequence	n coding		{0}	{0}
PDSCH transmission of PCell	on mode		1	3
PDSCH transmission of SCell	on mode		3	1
OCNG Pattern	PCell		OP.1 TDD	OP.5 TDD
OCING Fallelli	SCell		OP.5 TDD	OP.1 TDD
Propagation	Propagation PCell		Clause B.1	Clause B.1
Conditions	Conditions SCell		Clause B.1	Clause B.1
Correlation Matrix	PCell		1x2	2x2
and Antenna	SCell		2x2	1x2

Note 1:  $P_B = 0$ .

Note 2: No external noise sources are applied.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data

transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data.

Note 4: Void.

Table 8.2.2.7.1-2: Minimum performance (FRC) for CA

Test Number	Bandwid	dth (MHz)	Reference channel			Power at antenna port (dBm/15KHz)		Reference value Fraction of Maximum Throughput (%)	
	PCell	SCell	PCell	SCell	$\hat{E}_{s\_PCell}$	$\hat{E}_{s\_SCell}$	PCell	SCell	
					for PCell	for Scell			
1	20	20	R.49 TDD	NA	-85	-79	85	NA	≥5
2	20	15	NA	R.49-1 TDD	-79	-85.8	NA	85	≥5

Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

#### 8.2.2.8 Intra-band contiguous carrier aggregation with minimum channel spacing

The requirements in this section verify the ability of an UE supporting intraband contiguous carrier aggregation with minimum channel spacing to demodulate the signal transmitted by the PCell and SCell(s). Throughput is measured on each cell. The minimum channel spacing of intra-band contiguous carrier aggregation refers to the possible minimum channel spacing as any multiple of 300 kHz less than the nominal channel spacing defined in 5.7.1A.

#### 8.2.2.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.8.1-2, with the addition of the parameters in Table 8.2.2.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.8.1-1: Test Parameters for CA

	Parameter	Unit	Test 1-2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
$N_{\it oc}$ at anten	$N_{oc}$ at antenna port		-98
Symbols for	unused PRBs		OCNG (Note 2)
Modulation			64QAM
ACK/NACK feedback mode			PUCCH format 1b with channel selection for Test 1; PUCCH format 3 for Test 2
PDSCH trans	smission mode		1

Note 1:  $P_B = 0$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.8.1-2: Minimum performance (FRC) for intra-band CA with minimum channel spacing

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	Reference value	
number		Channel	Pattern	Condition	Matrix and Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20MHz	R.9 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	17.16	≥5
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	
2	3x20MHz	R.9 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	17.16	≥5
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3.

### 8.2.3 TDD FDD CA (Fixed Reference Channel)

The parameters specified in Table 8.2.3-1 are valid for all the TDD FDD CA tests unless otherwise stated.

**Table 8.2.3-1: Common Test Parameters** 

Parameter		Unit	Value
Uplink downlink configuration TDD CC only			1
Special subframe configu 2) for TDD CC only	ration (Note		4
Inter-TTI Distance			1
Maximum number of HARQ processes per	FDD PCell	Processes	8 for FDD and TDD CCs
component carrier	TDD PCell	Processes	11 for FDD CC; 7 for TDD CC
Maximum number of HAF transmission	RQ		4
Redundancy version codi	ng sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbo PDCCH per component of		OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
Cyclic Prefix			Normal
Cell_ID			0
Cross carrier scheduling			Not configured
ACK/NACK feedback mo	de		PUCCH format 3
Downlink HARQ-ACK	FDD PCell		As specified in Clause 7.3.3 in TS36.213 [6]
timing	TDD PCell		As specified in Clause 7.3.4 in TS36.213 [6]
Note 1: as specified in Note 2: as specified in			

The applicability of ther requirements are specified in Clause 8.1.2.3. The single carrier performance with different bandwidths for multiple CA configurations specified in Clause 8.2.3 cannot be applied for UE single carrier test.

#### 8.2.3.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS.

#### 8.2.3.1.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.1-4 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.1.1-5 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.1.1-6 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.1.1-7 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.1.1-1: Test Parameters for CA

Par	ameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	0
$N_{oc}$ at $\epsilon$	antenna port	dBm/15kHz	-98
Symbols fo	r unused PRBs		OCNG (Note 2)
Modulation			QPSK
PDSCH trai	nsmission mode		1

Note 1:  $P_{R} = 0$ .

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.1.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3
3 MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7

assigned on any CC.

Table 8.2.3.1.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3 MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.3.1.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test numbe	CA Band	dwidth com (MHz)	bination	Minimum performance requirement	UE Category		
r	Total	FDD CC	TDD CC				
1	2x20	20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5		
2	20+10	10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5		
3	20+15	15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5		
Note 1:							
Note 2:	30usec tim	ina differenc	e between P	Cell and any SCell is applied in inter-band CA case, where PC	Cell can be		

Table 8.2.3.1.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test number				UE Category	
	Total	FDD CC	TDD CC		
1	3x20	20	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	
2	20+20+15	15	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.3.1.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test numbe	CA Band	dwidth combi							
r	Total	FDD CC	TDD CC						
1	4x20	20	3x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
2	4x20	2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8				
Note 1:	The applica 8.1.2.3B.	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in							
Note 2:	30usec tim	ing difference	between I	PCell and any SCell is applied in inter-band CA case, where P	Cell can be				

assigned on any CC

Table 8.2.3.1.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test number	CA Bandwidth combination (MHz)		nation	Minimum performance requirement	UE Category			
	Total	FDD CC	TDD CC					
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11			
2	2×15+3×20							
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.							
Note 2:	30usec timing	difference be	etween PC	ell and any SCell is applied in inter-band CA case, where PCell of	an be			

#### Minimum Requirement for TDD PCell 8.2.3.1.2

assigned on any CC.

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.2-4 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 3DL CCs, the requirements are specified in Table 8.2.3.1.2-5 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 4DL CCs, the requirements are specified in Table 8.2.3.1.2-6 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 5DL CCs, the requirements are specified in Table 8.2.3.1.2-7 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.1.2-1: Test Parameters for CA

Par	ameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	0
$N_{oc}$ at $\epsilon$	$N_{oc}$ at antenna port		-98
Symbols fo	r unused PRBs		OCNG (Note 2)
Mod	dulation		QPSK
PDSCH tran	nsmission mode		1

Note 1:  $P_{B} = 0$ .

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.1.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-			Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3
3 MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7

Table 8.2.3.1.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference value	
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3 MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.3.1.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Test Aggregated Bandwidth		Aggregated Bandwidth (MHz) Minimum performance requirement		UE
numbe r	Total	FDD CC	TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
Note 1:	The application 8.1.2.3B	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in
Note 2:	30usec tim assigned o	•	e between P	Cell and any SCell is applied in inter-band CA case, where PC	ell can be

Table 8.2.3.1.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregate	d Bandwi	dth (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
Note 1:	The applicat 8.1.2.3B.	oility of requ	uirements for	different CA configurations and bandwidth combination sets is	defined in
Note 2:	30usec timir assigned on	•	e between P	Cell and any SCell is applied in inter-band CA case, where PC	Cell can be

Table 8.2.3.1.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test numbe	CA Bandwidth combination (MHz)		•			
r	Total	FDD CC	TDD CC			
1	4x20	20	3x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	
2	4x20	2×20	2×20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8	

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8 1 2 3B

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.3.1.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE	
number	Total FDD CC TDD CC				Category	
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11	
2	2×15+3×20 2×15+20 2×20		2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11	
Note 1:						
Note 2:	30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.					

#### 8.2.3.2 Open-loop spatial multiplexing performance 2Tx Antenna port

#### 8.2.3.2.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.1-4 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.1-5 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.2.1-6 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.2.1-7 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.2.1-1: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	n mode		3

Note 1:  $P_B = 0$ .

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.6
3 MHz	R.11-6 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
5MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
10MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9
15MHz	R.11-7 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.8
20MHz	R.30 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9

Table 8.2.3.2.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3 MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.3.2.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggrega	ted Bandwi	dth (MHz)	Minimum performance requirement	UE		
numbe r	Total FDD CC TDD CC		TDD CC		Category		
1	2x20	20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5		
2	20+10	10	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5		
3	20+15	15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5		
Note 1:	The applica 8.1.2.3B	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in					

Table 8.2.3.2.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregate	d Bandwi	dth (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
Note 1:	The applicat 8.1.2.3B.	oility of req	uirements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.2.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregate	d Bandwidth	(MHz)	Minimum performance requirement	UE
numb er	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
4	2×15+2×2 0	2×15	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
6	2×15+2x2 0	2x15+20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
Note 1:	The applica 8.1.2.3B.	ability of requi	rements fo	or different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.2.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

UE	Minimum performance requirement	Aggregated Bandwidth (MHz)  Total FDD CC TDD CC		Test	
Category				number	
0.14	A 1 " 1: T 11 000440		45 0 00	45 4 00	
8, ≥11	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	2×20	15+2×20	15+4×20	1
8, ≥11	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	2×20	2×15+20	2×15+3×20	2
The applicability of requirements for different CA configurations and bandwidth combination sets is defined in					
	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	2×20	2×15+20	2×15+3×20	2 Note 1:

#### 8.2.3.2.1A Soft buffer management test for FDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.1A-2, with the addition of the parameters in Table 8.2.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation for FDD as PCell.

Table 8.2.3.2.1A-1: Test Parameters for CA

Parameter		Unit	Value		
			FDD Carrier	TDD Carrier	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
power	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	
allocation	σ	dB	0	0	
$N_{oc}$	at antenna port	dBm/15kHz	-98	-98	
PDSCH	transmission mode		3	3	

Note 1:  $P_{R} = 1$ .

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.1A-2: Minimum performance (FRC) for CA

						Correl	Reference v	alue	
Test num.	Band	l-width	Reference channel	OCNG pattern	Propa- gation condi-tion	ation matrix and anten na config	Fraction of maximum throughput (%)	SNR (dB)	UE cate gory
1	PCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.4	3
'	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA70	Low	70	16.3	9
2	PCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.3	4
2	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVATO	Low	70	16.3	•
3	PCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	3
3	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVATO	Low	70	16.3	7
4	PCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	4
4	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVATO	Low	70	16.3	4
5	PCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	3
5	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA/U	Low	70	16.3	3
6	PCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	4
0	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA/U	Low	70	16.3	4

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B.

#### 8.2.3.2.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.2-4 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.2-5 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.2.2-6 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.2.2-7 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.2.2-1: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Daniel a a a a a a	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3

Note 1:  $P_{n} = 0$ .

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-			Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.6
3 MHz	R.11-6 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
5MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
10MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9
15MHz	R.11-7 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.8
20MHz	R.30 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9

Table 8.2.3.2.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3 MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.3.2.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE		
numbe r	Total	FDD CC	TDD CC		Category		
1	2x20	20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5		
2	20+10	10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5		
3	20+15	15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B						

Table 8.2.3.2.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)		th (MHz)	Minimum performance requirement	UE
number	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
Note 1:	The applicabil	lity of require	ments for dif	ferent CA configurations and bandwidth combination sets is	s defined in

Table 8.2.3.2.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregated Bandwidth (MHz) Minimum performance requirement		UE		
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
Note 1:	The applica	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.2.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	33 3 3 4 4 7		(MHz)	Minimum performance requirement	UE			
number	Total	FDD CC	TDD		Category			
			CC					
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11			
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11			
Note 1:	The applicabili	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in						

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

#### 8.2.3.2.2A Soft buffer management test for TDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.2A-2, with the addition of the parameters in Table 8.2.3.2.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation for TDD as PCell.

Table 8.2.3.2.2A-1: Test Parameters for CA

Parameter		Unit	Value		
			FDD Carrier	TDD Carrier	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	0	
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98	
PDSCH	transmission mode		3	3	

Note 1:  $P_{R} = 1$ .

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.2A-2: Minimum performance (FRC) for CA

						Correl	Reference v	alue	
Test num.	Band	l-width	Reference channel	OCNG pattern	Propa- gation condi-tion	ation matrix and anten na config	Fraction of maximum throughput (%)	SNR (dB)	UE cate gory
1	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1))	EVA70	2x2	70	16.3	3
'	SCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1	EVA/U	Low	70	16.2	3
2	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	16.2	4
2	SCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1)	LVATO		70	16.2	
3	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	16.1	3
3	SCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)			70	16.0	
4	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	E)/A70	2x2	70	16.2	4
4	SCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	4
_	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	E)/A70	2x2	70	16.2	2
5	SCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	3
6	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	F)/A70	2x2	70	16.2	4
6 <b>s</b>	SCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	4

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B.

#### 8.2.3.3 Closed-loop spatial multiplexing performance 4Tx Antenna Port

#### 8.2.3.3.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.1-4 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.1-5 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.3.1-6 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.3.1-7 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.3.1-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Paramete	r	Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenn	a port	dBm/15kHz	-98
Precoding gran	ularity	PRB	Wideband precoding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
DMI dolov (Noto 2)	FDD CC	ms	8
PMI delay (Note 2)	TDD CC	ms	10 or 11
Reporting interval	FDD CC	ms	1
Reporting interval	TDD CC	ms	1 or 4 (Note 3)
Reporting m	ode		PUSCH 1-2
CodeBookSubsetF	Restriction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
			0000000
CSI request field	(Note 3)		'10'
PDSCH transmiss	ion mode		4

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this

reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1<sup>st</sup> set of serving cells by higher

lavers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.3.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference value	
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3 MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.3.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3 MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.3.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
Note 1:	The applica	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.3.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	33 3 3 4 4 7		dth (MHz)	MHz) Minimum performance requirement			
number	Total	FDD CC	TDD CC		Category		
1	3x20	20	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
2	20+20+15	15	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
3	20+20+10	10	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
4	3x20	2x20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
5	20+20+15	20+15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
6	20+20+10	20+10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in						
	8.1.2.3B.						

Table 8.2.3.3.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregat	ed Bandwidt	h (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
Note 1:	The application 8.1.2.3B.	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.3.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	33 3 4 4 7		(MHz)	Minimum performance requirement	UE
number	Total	FDD CC	TDD CC		Category
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
Note 1:	The applicabili	ity of requirer	nents for d	lifferent CA configurations and bandwidth combination sets is def	ined in

#### 8.2.3.3.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.2-4 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.2-5 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.3.2-6 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.3.2-7 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.3.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Paramete	Parameter		Value
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenn	$N_{oc}$ at antenna port		-98
Precoding gran	Precoding granularity		Widelband pre-coding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
DMI dolov (Noto 2)	FDD CC	ms	8
PMI delay (Note 2)	TDD CC	ms	10 or 11
Departing interval	FDD CC	ms	1
Reporting interval	TDD CC	ms	1 or 4 (Note 3)
Reporting m	ode		PUSCH 1-2
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000
CSI request field	(Note 3)		'10'
PDSCH transmiss	ion mode		TM4
NI ( A D )			

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this

reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1<sup>st</sup> set of serving cells by higher layers

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.3.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3 MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.3.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3 MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.3.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
Note 1:	The applica 8.1.2.3B	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.3.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregat	ted Bandwid	dth (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
2	20+20+1 5	15	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
3	20+20+1 0	10	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
5	20+20+1 5	20+15	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
6	20+20+1 0	20+10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
Note 1:	The applica 8.1.2.3B.	ability of requ	uirements for	different CA configurations and bandwidth combination sets is	s defined in

Table 8.2.3.3.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

		ed Bandwidt	h (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
Note 1:	The application 8.1.2.3B.	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.3.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	33 3 3 4 4 7		` '	UE	
number	Total	FDD CC	TDD CC		Category
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
Note 1:	The applicabili 8.1.2.3B.	ty of requirer	ments for c	different CA configurations and bandwidth combination sets is def	fined in

### 8.2.3.4 Minimum Requirement for Closed-loop spatial multiplexing performance 4Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.3.4-4, based on single carrier requirement specified in Table 8.2.3.4-2 and Table 8.2.3.4-3, with the addition of the parameters in Table 8.2.3.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity transmission.

Table 8.2.3.4-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for TDD-FDD dual connectivity

Parameter		Unit	Values
D 11 1	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	-3

$N_{oc}$ at antenna port	dBm/15kHz	-98
Precoding granularity	PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs
PMI delay (Note 2)	ms	8 for FDD CC 10 or 11 for TDD CC
Reporting interval	ms	1 for FDD CC 1 or 4 for TDD CC (Note 3)
Reporting mode		PUSCH 1-2
CodeBookSubsetRestriction bitmap		00000000000000000000000000000000000000
PDSCH transmission mode		4
ACK/NACK transmission		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG
CSI feedback		Separate PUSCH feedbacks on the MCG and SCG
Time offset between MCG CC and SCG CC	μ\$	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 5)

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Note 4: The same PDSCH transmission mode is applied to each component carrier.

Note 5: As defined in TS36.300 [11].

Note 6: If the UE supports both SCG bearer and Split bearer, the SCG bearer is

configured.

Table 8.2.3.4-2: FDD single carrier performance for multiple dual connectivity configurations

			Drono	Correlation	Reference	value
Bandwidth	Reference channel	OCNG pattern	Propa- gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.14-4 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.36
3MHz	R.14-5 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
10 MHz	R.14 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.4-3: TDD single carrier performance for multiple dual connectivity configurations

			Brons-	Correlation	Reference v	/alue
Bandwidth	Reference channel	OCNG pattern	Propa- gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)

1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.4-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Test num.	Bandwidth combination	Requirement	UE category					
1	2x20 MHz  As specified in Table 8.2.3.4-2 8.2.3.4-3 per CC		≥5					
Note 1: The	Note 1: The OCNG pattern applies for each CC.							
Note 2: The applicability of requirements for different dual connectvity configurations and bandwidth combination sets is defined in 8.1.2.3A.								

# 8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

#### 8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms
Note 1: Void. Note 2: Void.		

#### 8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

parameter		Unit	Test 1	Test 2	Test 3
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3	-3
Beamforming mo	del		Annex B.4.1	Annex B.4.1	Annex B.4.1
Cell-specific refere	ence			Antenna ports 0,1	
CSI reference sign	nals		Antenna ports 15,,18	Antenna ports 15,,18	Antenna ports 15, , 18
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5/2	5/2	5/2
CSI reference sig configuration	nal		0	3	0
Zero-power CSI-RS configuration lcsi-Rs / ZeroPowerCSI-RS bitmap		Subframes / bitmap	3 / 00010000000000000	3 / 00010000000000000	3 / 00010000000000000
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	-98
Symbols for unus PRBs	ed		OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)
Number of allocated resource blocks (Note 2)		PRB	50	50	50
Simultaneous transmission			No	Yes (Note 3, 5)	No
PDSCH transmission mode			9	9	9
Number of MBSF subframes	-N	Subframes	6 (Note 6)	NA	NA

Note 1:  $P_B = 1$ .

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities  $n_{\rm SCID}$  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test number	Bandwidt h and MCS	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference Fraction of Maximum Throughpu t (%)	value SNR (dB)	UE Category	UE DL Cat- egory
1	10 MHz QPSK 1/3	R.43-1 FDD	OP.1 FDD	EVA5	2x2 Low	70	[-1.2]	≥1	≥6
3	10MHz 256QAM	R. 66 FDD	OP.1 FDD	EPA5	2x2 Low	70	24.3	11-12	≥11

Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
2	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x2 Low	70	21.9	≥2
Note 1: The reference channel applies to both the input signal under test and the interfering signal.								

### 8.3.1.1A Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1A-2, with the addition of the parameters in Table 8.3.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.1.1A-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.3.1.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

parameter		Unit	Cell 1	Cell 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s	signals		Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset $T_{CSI}$	$_{ extsf{-RS}}$ / $\Delta_{ extsf{CSI-RS}}$	Subframes	5/2	N/A
CSI reference configuration			0	N/A
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note	2)	dB	N/A	-1.73
BW <sub>Channe</sub>	l	MHz	10	10
Cyclic Pref	ïx		Normal	Normal
Cell Id			0	126
Number of contro symbols	ol OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming ı	Beamforming model		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference n	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	Ms	8	N/A
Reporting into	erval	Ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetRestriction bitmap			0000000000000000 00000000000000000 00000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous transmission			No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			5	N/A

Note 1:  $P_B = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

Table 8.3.1.1A-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference V	UE Categor	
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	Maximum (dB)	
1	R.48 FDD	OP.1 FDD	N/A	EVA5	EVA5	4x2 Low	70	-1.1	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

### 8.3.1.1B Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.1.1B-2, with the addition of parameters in Table 8.3.1.1B-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.1.1B-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.1.1B-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)
anocation	σ	dB	-3	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.3.1.1B-2	12	10
$BW_Channel$		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	en Cells	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific reference	e signals		A	ntenna ports 0,1	
CSI reference sig			Antenna ports 15,16	N/A	N/A
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et s	Subframes	5/2	N/A	N/A
CSI reference si configuration			8	N/A	N/A
Zero-power CSI- configuration I <sub>CSI-RS</sub> / ZeroPowe bitmap		Subframes / bitmap	3 / 00100000000000 00	N/A	N/A
ABS pattern (Not	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control of symbols	OFDM		2	Note 8	Note 8
PDSCH transmissio	n mode		TM9-1layer	Note 9	Note 9
Precoding granul			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming mo	odel		Annex B.4.1	N/A	N/A
Cyclic prefix		<u> </u>	Normal	Normal	Normal

Note 1:	$P_B = 1$ .
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
Note 11:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 12: Note 13:	

Table 8.3.1.1B-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) - Non-MBSFN ABS

Test Number	Reference Channel	OC	NG Patte	ern	n Propagation Conditions (Note1)			Correlation Matrix and	Reference	Value	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory	
1	R.51 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD		EVA5		2x2 Low	70	7.8	≥2	
Note 1: Note 2:		The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										

Note 2: The correlation matrix and antenna configurations Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

# 8.3.1.1C Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1C-2, with the addition of the parameters in Table 8.3.1.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7, 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.1.1C-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1C-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

Paramet	er	Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	n $ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Cell-specific reference sign	gnals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM	symbols		3	3	3
CFI indicated in PCFICH			3	3	3
PDSCH transmission mo	de		9	9	9
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
Precoding			Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity and sure $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ıbframe offset	Subframes	10 / 1	10 / 1	10 / 1
CSI reference signal conf	iguration		5	6	7
Zero-power CSI-RS confi I <sub>CSI-RS</sub> /ZeroPowerCSI-RS		Subframes / bitmap	6 / 10000000000 00000	6 / 010000000000 0000	6 / 00100000000 00000
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- p-al	ist-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) tran	smissionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1C-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

Test Num	Referenc e	ОС	NG Patt	ern		opagat onditio				trix and guration	Reference	UE Categ	
ber	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	ory
1	R.69 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.3.1.1D Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.1.1D-2, with the addition of the parameters in Table 8.3.1.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.1.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

Paran	neter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloca	ation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
		σ	dB	-3	-3	-3
Cell-specific reference	e signa	ls		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control OF	DM sy	mbols		3	3	3
CFI indicated in PCFI	CH			3	3	3
PDSCH transmission	mode			8	N/A	N/A
Interference model				N/A	As specified in clause B.6.5	As specified in clause B.6.5
Precoding				Random wideband precoding per TTI	N/A	N/A
Time offset to cell 1	me offset to cell 1		us	N/A	2	3
Frequency offset to ce	ell 1		Hz	N/A	200	300
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- r12				N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
, ,	ransm ·r12	issionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_{R} = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

Test Number	Reference Channel	OCNG Pattern				opagat onditio		Correlation Matrix and	Reference	Reference Value		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory	
1	R.71 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	14.3	≥2	

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_{s}/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

# 8.3.1.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference model

The requirements are specified in Table 8.3.1.1E-2, with the addition of the parameters in Table 8.3.1.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.1.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

Pai	rameter	Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3	-3
	σ	dB	-3	0	0
Cell-specific referen	nce signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna por	t	dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	3.28	0.74
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control (	OFDM symbols		3	3	3
CFI indicated in PC	FICH		3	Random from {1,2,3}	Random from {1,2,3}
PDSCH transmission	on mode		8	3	3
Interference model			N/A	As specified in clause B.6.2	As specified in clause B.6.2
Precoding			Random wideband precoding per TTI	As specified in clause B.6.2	As specified in clause B.6.2
Time offset to cell 1		us	N/A	2	3
Frequency offset to	cell 1	Hz	N/A	200	300
MBSFN	SFN Not configured Not con			Not configured	Not configured
NeighCellsInfo- r12	p-aList-r12	_	N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4)	transmissionModeList -r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1. D 1					

Note 1:  $P_R = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

Test Number	Reference Channel	OCNG Pattern				opagat onditio		Correlation Reference Value Matrix and			UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.70 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	11.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

### 8.3.1.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.1.1F-2, with the addition of the parameters in Table 8.3.1.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the

serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.1.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM10 serving cell configuration and TM9 interference model

Para	meter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloc	ation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
		σ	dB	-3	-3	-3
Cell-specific reference	e signals	3		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control OF	FDM sym	bols		3	3	3
CFI indicated in PCF				3	3	3
PDSCH transmission	mode			10	9	9
Interference model				N/A	As specified in clause B.6.4	As specified in clause B.6.4
Precoding				Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals	3			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity an $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	nd subfra	me offset	Subframes	10 / 1	10 / 1	10 / 1
CSI reference signal	configura	ation		5	6	7
Zero-power CSI-RS of I <sub>CSI-RS</sub> /ZeroPowerCS			Subframes / bitmap	6 / 10000000000 00000	6 / 01000000000 0000	6 / 00100000000 00000
Time offset to cell 1			us	N/A	2	3
Frequency offset to c	ell 1		Hz	N/A	200	300
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- r12	nfo- p-aList-r12			N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
,	transmis -r12	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM10 serving cell configuration and TM9 interference model

Test Number	Referenc e Channel				opagat onditio		Correlation Reference Value Matrix and Antenna Configuration			e Value	UE Cate gory		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	
1	R.69 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.2	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

#### 8.3.1.1G Single-layer Spatial Multiplexing (CRS assistance information is configured)

The requirements are specified in Table 8.3.1.1G-2, with the addition of parameters in Table 8.3.1.1G-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell with CRS assistance information. In Table 8.3.1.1G-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1, Cell2 and Cell 3 is according to Annex C.3.2. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.1.1G-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports)

Parameter	•	Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3	-3
N <sub>oc</sub> at antenna port		dBm/15kHz	-98	N/A	N/A
Ê <sub>s</sub> /N <sub>oc</sub>		dB	Reference Value in Table 8.3.1.1G-2	10.45	4.6
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configuration	on		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset to Cell 1		μs	N/A	3	-1
Frequency shift to Ce	II 1	Hz	N/A	300	-100
Cell Id			0	1	128
Cell-specific reference	e signals		A	Antenna ports 0,1	
CSI reference signals			Antenna ports 15,16	N/A	N/A
CSI-RS periodicity an offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	d subframe	Subframes	5/2	N/A	N/A
CSI reference signal configuration			8	N/A	N/A
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowe bitmap		Subframes / bitmap	3 / 0010000000000 000	N/A	N/A
Number of control OF symbols	DM		2	2	2
PDSCH transmission	mode		TM9-1layer	N/A	N/A
Precoding granularity			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming model			Annex B.4.1	N/A	N/A
Interference model			N/A	As specified in clause B.5.4	As specified in clause B.5.4
	Probability of occurrence of transmission in interference cells		N/A	20	20
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Cyclic prefix			Normal	Normal	Normal
Note 1: D = 1					

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 4: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Note 5: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.1.1G-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports)

		oc	NG Patt	ern	Propagation Conditions (Note1)  Correlation Reference Value		Value	115			
Test Number	Reference Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Matrix and Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	UE Cate gory
1	R.51-1 FDD	OP.1 FDD	N/A	N/A		EVA5		2x2 Low	70	11.6	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to  $\mathbb{E}_{\mathfrak{s}}/N_{\mathfrak{o}\mathfrak{o}}$  of cell 1.

#### 8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1			
		Onit	Cell 1	Cell 2		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	4	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0		
	σ	dB	-3	-3		

Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1
Cell ID		0	126
CSI reference signals		Antenna ports 15,16	NA
Beamforming model		Annex B.4.2	NA
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5/2	NA
CSI reference signal configuration		8	NA
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	3 / 00100000000000000	NA
$N_{\it oc}$ at antenna port	dBm/15kHz	-98	-98
$\hat{E}_s/N_{oc}$		Reference Value in Table 8.3.1.2-2	7.25dB
Symbols for unused PRBs		OCNG (Note 2)	NA
Number of allocated resource blocks (Note 2)	PRB	50	NA
Simultaneous transmission		No	NA
PDSCH transmission mode		9	Blanked

Note 1:  $P_R = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	Correlation Matrix and	Reference	value	UE Categ
			Cell1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	ory
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	N/A	ETU5	ETU5	2x2 Low	70	14.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1.

### 8.3.1.2A Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing

The requirements are specified in Table 8.3.1.2A-2, with the addition of the parameters in Table 8.3.1.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of this test is to verify rank two performance for full RB allocation upon antenna ports 7 and 8.

Table 8.3.1.2A-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Cell-specific reference signals	ence		Antenna ports 0 and 1
CSI reference sig	nals		Antenna ports 15,16
Beamforming mo	del		Annex B.4.2
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et	Subframes	5/2
CSI reference sig configuration	ınal		8
Zero-power CSI- configuration I <sub>CSI-RS</sub> / ZeroPowerCSI- bitmap		Subframes / bitmap	3 / 00100000000000000
$N_{oc}$ at antenna p	oort	dBm/15kHz	-98
Symbols for unus PRBs	sed		OCNG (Note 2)
Number of alloca resource blocks (N		PRB	50
Simultaneous transmission			No
PDSCH transmis mode	sion		9
Note 1: D = 1			

Note 1:  $P_B = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per

virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.2A-2: Enhanced Performance Requirement Type C for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	EPA5	2x2 Medium	70	17.4	≥2

### 8.3.1.3 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.1.3.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.1-3, with the additional parameters in Table 8.3.1.3.1-1 and Table 8.3.1.3.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the

'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.1.3.1-2. In Tables 8.3.1.3.1-1 and 8.3.1.3.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.1-1: Test Parameters for quasi co-location type B: same Cell ID

Paramete	r	Unit	TP 1	TP 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	(Note 2)
CSI-RS 0 anteni	na ports		NA	Port {15,16}
qcl-CSI-RS-Configli CSI-RS 0 period subframe offset $T_{CS}$	icity and I-RS / ∆csi-RS	Subframes	NA	5/2
qcl-CSI-RS-Configl CSI-RS 0 config	uration		NA	8
csi-RS-ConfigZPId power CSI-RS 0 co I <sub>CSI-RS</sub> / ZeroPower CSI-R	nfiguration		NA	2/ 0000010000000000
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	-98
$\widehat{E}_s/N_{oc}$		dB	Reference point in Table 8.3.1.3.1-3	Reference point in Table 8.3.1.3.1-3
BW <sub>Channe</sub>	ı	MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	0
Number of contro symbols	ol OFDM		2	2
PDSCH transmiss	ion mode		Blanked	10
Number of alloca	ted PRB	PRB	NA	50
qcl-Operation, PE Mapping and Qu Location Indic	ıasi-Co-		Туре	B, '00'
Time offset between	een TPs	μs	NA	Reference point in Table 8.3.1.3.1-3
Frequency error be	tween TPs	Hz	NA	0
Beamforming I	eamforming model NA		NA	Port 7 as specified in clause B.4.1
Symbols for unus	ed PRBs		NA	OCNG (Note 3)

Note 1:  $P_B = 1$ 

Noet 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	s in each PQI set	hypothesi	smission is for each Set
	NZP CSI-RS Index (For quasi	ZP CSI-RS configuration	TP 1	TP 2

	co-location)			
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.1.3.1-3: Minimum performance for quasi co-location type B: same Cell ID

Test Number	Reference Channel		iCN tern	Time offset between	Propag Cond (No	itions	Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 FDD	NA	OP.1 FDD	2	EPA5	EPA5	2x2 Low	70	12.1	≥2
2	R.52 FDD	NA	OP.1 FDD	-0.5	EPA5	EPA5	2x2 Low	70	12.6	≥2

Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of TP 2 as defined in clause 8.1.1.

#### 8.3.1.3.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.1.3.2-3, with the additional parameters in Tables 8.3.1.3.2-1 and 8.3.1.3.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In Tables 8.3.1.3.2-1 and 8.3.1.3.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.2-1: Test Parameters for timing offset compensation with DPS transmission

parameter		Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

	1	T	T
Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals		Antenna ports 0,1	(Note 2)
CSI reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5/2	N/A
CSI reference signal 0 configuration		0	N/A
CSI reference signals 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/2
CSI reference signal 1 configuration		N/A	8
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	2/ 001000000000000000	N/A
Zero-power CSI-RS1 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap <sub>S</sub>	Subframes /bitmap	N/A	2/ 00000100000000000
$\widehat{E}_s/N_{oc}$	dB	Reference Value in Table 8.3.1.3.2-3	Reference Value in Table 8.3.1.3.2-3
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98
BW <sub>Channel</sub>	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	0
Number of control OFDM symbols		2	2
Timing offset between TPs		N/A	Reference Value in Table 8.3.1.3.2-3
Frequency offset between TPs	Hz	N/A	0
Number of allocated resource blocks	PRB	50	50
PDSCH transmission mode		10	10
Probability of occurrence of PDSCH transmission(Note 3)	%	30	70
Symbols for unused PRBs		OCNG (Note 4)	OCNG (Note 4)

Note 1:  $P_{p} = 1$ 

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3:

Table 8.3.1.3.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	s in each PQI set	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2	
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked	
PQI set 3	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH	

Table 8.3.1.3.2-3: Performance Requirements for timing offset compensation with DPS transmission

Test Number	Timing offset(us)	Reference Channel		NG tern		gation litions	Correlation Matrix and	Reference \	Reference Value	
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	2	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.2	≥2
2	-0.5	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.5	≥2
Note 1:	The propaga	ation conditions	for TP 1	and TP	2 are stat	istically in	dependent.			
Note 2:	Correlation r	natrix and ante	nna conf	figuratior	n paramet	ters apply	for each of TP 1 and	TP 2.		

### 8.3.1.3.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

SNR corresponds to  $E_s/N_{ac}$  of both TP 1 and TP 2 as defined in clause 8.1.1.

The requirements are specified in Table 8.3.1.3.3-2, with the additional parameters in Table 8.3.1.3.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In Table 8.3.1.3.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

paramete	r	Unit	TP 1	TP 2	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	

Beamforming model		N/A	As specified in clause B.4.2	
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1	
CSI reference signals 0		N/A	Antenna ports {15,16}	
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/2	
CSI reference signal 0 configuration		N/A	0	
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	2/ 00100000000000000	
$\hat{E}_s/N_{oc}$	dB	Reference point in Table 8.3.1.3.3-2 + 4dB	Reference Value in Table 8.3.1.3.3-2	
$N_{\it oc}$ at antenna port	dBm/15kH z	-98	-98	
BW <sub>Channel</sub>	MHz	10	10	
Cyclic Prefix		Normal	Normal	
Cell Id		0	126	
Number of control OFDM symbols		1	2	
Timing offset between TPs	us	N/A	0	
Frequency offset between TPs	Hz	N/A	200	
qcl-Operation, PDSCH RE Mapping and Quasi-Co- Location Indicator'		Type B, '00'		
PDSCH transmission mode		Blank	10	
Number of allocated resource block		N/A	50	
Symbols for unused PRBs		N/A	OCNG(Note2)	

Note 1:  $P_B = 1$ 

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs Note 2: shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.3-2: Performance Requirements for quasi co-location type B with different Cell ID and **Colliding CRS** 

Test Number	Reference Channel	OCNG Pattern		Cond	gation itions te1)	Correlation Matrix and Antenna			UE Category
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 FDD	N/A	OP.1 FDD	EPA5	ETU5	2x2 Low	70	14.4	≥2

Note 1:

The propagation conditions for TP.1 and TP.2 are statistically independent.

Correlation matrix and antenna configuration parameters apply for each of TP.1 and TP.2. Note 2:

SNR corresponds to  $\hat{E}_{s}/N_{oc}$  of TP.2 as defined in clause 8.1.1. Note 3:

8.3.1.3.4 Minimum requirement with Different Cell ID and non-colliding CRS (with single NZP CSI-RS resource and CRS assistance information is configured)

The requirements are specified in Table 8.3.1.3.4-3, with the additional parameters in Table 8.3.1.3.4-1 and Table 8.3.1.3.4-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and time difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Table 8.3.1.3.4-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, transmission point 2 (TP 2) transmits PDSCH with different Cell ID, and Transmission point 3 (TP 3) is the aggressor transmission point. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.1.3.4-1: Test Parameters for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

paramete	er	Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Beamforming mode	el		N/A	Port 7 as specified in clause B.4.1	N/A
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference signa	als 0		N/A	Antenna ports {15,16}	N/A
CSI-RS 0 periodicit subframe offset $T_{CS}$	$_{ ext{SI-RS}}$ / $\Delta_{ ext{CSI-RS}}$	Subframes	N/A	5/2	N/A
CSI reference signal 0 configuration			N/A	0	N/A
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap		Subframes /bitmap	N/A	2/ 00100000000000000	N/A
$\hat{E}_s/N_{oc}$	·	dB	10.45	Reference Value in Table 8.3.1.3.4-3	8.45
$N_{\it oc}$ at antenna por	t	dBm/15kH z	-98	-98	N/A
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id	Cell Id		0	0 1	
Number of control ( symbols	OFDM		1	2	2
Timing offset to TP	1	us	N/A	-0.5	3
Frequency offset to		Hz	N/A	200	-100
qcl-Operation, PDS Mapping and Quasi Location Indicator			Туре	B, '00'	N/A
PDSCH transmission			Blank	10	9
Number of allocated block	d resource		N/A	50	N/A
Symbols for unused	d PRBs		N/A	OCNG(Note2)	N/A
Interference model			N/A	N/A	As specified in clause B.5.4
Probability of occur transmission in inte cells		%	N/A	N/A	20
Probability of occurrence of	Rank 1	%	N/A	N/A	80
transmission rank in interfering cells	Rank 2	%	N/A	N/A	20

Note 1:  $P_B = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.4-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	Parameters in each PQI set						
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2				
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH				

Table 8.3.1.3.4-3: Performance Requirements for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

Refere	Refere	OCNG Pattern			Propagation Conditions (Note1)			Correlation	Reference Value		UE
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Matrix and Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 FDD	N/A	OP.1 FDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	10.8	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of TP.2 as defined in clause 8.1.1.

### 8.3.1.3.5 Minimum requirements with different Cell ID and non-colliding CRS (with multiple NZP CSI-RS resources and CRS assistance information is configured)

The requirements are specified in Table 8.3.1.3.5-3, with the additional parameters in Tables 8.3.1.3.5-1 and 8.3.1.3.5-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Tables 8.3.1.3.5-1 and 8.3.1.3.5-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, Transmission point 2 (TP 2) has different Cell ID as TP 1, and Transmission point 3 (TP 3) is the aggressor transmission point. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between TP 1 and TP 2 with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.5-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.1.3.5-1: Test Parameters DPS transmission with CRS assistance information

parar	neter	Unit	TP 1	TP 2	TP 3
Downlink nowo	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Beamforming m	odel		As specified in clause B.4.1	As specified in clause B.4.1	N/A
Cell-specific ref	erence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference s			Antenna ports {15,16}	N/A	N/A
CSI-RS 0 period subframe offset		Subframes	5/2	N/A	N/A
CSI reference s configuration	ignal 0		0	N/A	N/A
CSI reference s	ignals 1		N/A	Antenna ports {15,16}	N/A
CSI-RS 1 period subframe offset		Subframes	N/A	5/2	N/A
CSI reference s configuration			N/A	8	N/A
Zero-power CS configuration I <sub>CSI-RS</sub> / ZeroPower CSI		Subframes /bitmap	2/ 001000000000000000	N/A	N/A
Zero-power CS configuration $I_{\text{CSI-RS}}$ /	p-power CSI-RS1 iguration		N/A	2/ 0000010000000000	N/A
$\widehat{E}_s/N_{oc}$ (Note	•	dB	Reference Value in Table 8.3.1.3.5-3	Reference Value in Table 8.3.1.3.5-3	8.45
$N_{\it oc}$ at antenna	port	dBm/15kH z	-98	-98	N/A
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	128
Number of cont symbols	rol OFDM		2	2	2
Timing offset to	TP 1		N/A	-0.5	3
Frequency offse		Hz	N/A	200	-100
Number of alloc blocks	ated resource	PRB	50	50	N/A
PDSCH transm	ission mode		10	10	9
Probability of oc PDSCH transm		%	30	70	N/A
Symbols for unu	•		OCNG (Note 4)	OCNG (Note 4)	N/A
Interference mo			N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells		%	N/A	N/A	20
Probability of occurrence of transmission	Rank 1	%	N/A	N/A	80
rank in interfering cells	Rank 2	%	N/A	N/A	20

Note 1:  $P_B = 1$ 

Note 2:  $\hat{E}_s/N_{oc}$  of TP1 is set the same as that of TP2.

Note 3: PDSCH transmission from TP 1 and TP 2 shall be randomly determined independently for each subframe.

Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per

virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data,

which is QPSK modulated.

Table 8.3.1.3.5-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	Parameters in each PQI set						
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2				
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked				
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH				

Table 8.3.1.3.5-3: Performance Requirements DPS transmission with CRS assistance information

Refere	OCNG Pattern			Propagation Conditions (Note1)			Correlation	Reference Value			
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Configurati on (Note 2)  Antenna Maxim Throug	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	UE Cate gory
1	R.52-1 FDD	OP.1 FDD	OP.1 FDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	10.7	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of both TP.1 and TP.2 as defined in clause 8.1.1.

#### 8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value  1  4  Normal  0  1  7  4  {0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM  2  Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission modes 9 and 10					
Uplink downlink configuration (Note 1)		1					
Special subframe configuration (Note 2)		4					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Number of HARQ processes	Processes	7					
Maximum number of HARQ transmission		4					
Redundancy version coding sequence							
Number of OFDM symbols for PDCCH	OFDM symbols	2					
Precoder update granularity		Transmission mode 8, 1 PRG for					
ACK/NACK feedback mode		Multiplexing					
Note 1: as specified in Table 4.2-2 in TS 36.211 [4] Note 2: as specified in Table 4.2-1 in TS 36.211 [4]							

#### 8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

Table 8.3.2.1-1: Test Parameters for Testing DRS

Parameter	Parameter		Test 1	Test 2	Test 3	Test 4		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0		
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	0	0	0	0		
Cell-specific reference Antenna port 0								
Beamforming mo	del		Annex B.4.1					
$N_{oc}$ at antenna port		dB/15kHz	-98	-98	-98	-98		
Symbols for unused PRBs			OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)		
PDSCH transmission mode			7	7	7	7		

Note 1:  $P_{R} = 0$ .

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.1-2: Minimum performance DRS (FRC)

Test	Bandwidth	Reference		Propagation	Correlation	Reference value		UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.25 TDD	OP.1 TDD	EPA5	2x2 Low	70	-0.8	≥1
2	10 MHz 16QAM 1/2	R.26 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	≥2
	5MHz 16QAM 1/2	R.26-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	1
3	10 MHz 64QAM 3/4	R.27 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	≥2
	10 MHz 64QAM 3/4	R.27-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	1
4	10 MHz 16QAM 1/2	R.28 TDD	OP.1 TDD	EPA5	2x2 Low	30	1.7	≥1

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	Test 5		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0		
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	-3	-3	-3	-3	-3		
Cell-specific reference signals	е			Antenna port 0 and antenna port 1					
Beamforming mode			Annex B.4.1						
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	-98	-98	-98	-98		
Symbols for unused PRBs			OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)		
Simultaneous transmission			No	No	No	Yes (Note 3, 5)	Yes (Note 3, 5)		
PDSCH transmission mode			8	8	8	8	8		

Note 1:  $P_R = 1$ .

Note 2: The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities  $n_{\rm SCID}$  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

Test	Bandwidt	Reference	OCNG	Propagation			Reference value		
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category	
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	-1.0	≥1	
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	≥2	
	5MHz 16QAM 1/2	R.32-1 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	1	
3	10 MHz 64QAM 3/4	R.33 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	≥2	
	10 MHz 64QAM 3/4	R.33-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	1	

Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

Test				Propagation	Correlation	Reference v	UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
4	10 MHz	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.9	≥2		
	16QAM 1/2	(Note 1)								
5	10 MHz	R.34 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.0	≥2		
	64QAM 1/2	(Note 1)								
Note 1:	Note 1: The reference channel applies to both the input signal under test and the interfering signal.									

#### 8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1	Test 2	Test 3				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)				
	σ	dB	-3	-3	-3				
Cell-specific refere	ence			Antenna ports 0,1					
CSI reference sign	nals		Antenna ports 15,,22	Antenna ports 15,,18	Antenna ports 15,,18				
Beamforming mo	del		Annex B.4.1	Annex B.4.1	Annex B.4.1				
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5 / 4	5 / 4	5 / 4				
CSI reference sig configuration	nal		1	3	3				
Zero-power CSI- configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-F bitmap		Subframes / bitmap	4 / 0010000100000000	4 / 001000000000000000	4/ 0010000000000000000000000000000000000				
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	-98				
Symbols for unus PRBs	ed		OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)				
Number of alloca resource blocks (No		PRB	50	50	100				
Simultaneous transmission			No	Yes (Note 3, 5)	No				
PDSCH transmiss mode			9	9	9				
Number of MBSF subframes	-N	Subframes	2 (Note 6)	NA	NA				

Note 1:  $P_R = 1$ .

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities  $n_{\rm SCID}$  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Note 6: For TDD mode, 2 subframes (#4/9) are allocated as MBSFN subframes.

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference	value	UE	UE DL
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category	Cat- egory
1	10 MHz QPSK 1/3	R.50-1 TDD	OP.1 TDD	EVA5	2x2 Low	70	[-0.73]	≥1	≥6
3	20MHz 256QAM	R. 66 TDD	OP.1 TDD	EPA5	2x2 Low	70	24.3	11-12	≥11

Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category			
2	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.1	≥2			
Note 1:											

### 8.3.2.1B Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.2.1B-2, with the addition of the parameters in Table 8.3.2.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.2.1B-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.3.2.1B-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

paramete	r	Unit	Cell 1	Cell 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s	signals		Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset $T_{CSI}$	$_{ extsf{-RS}}$ / $\Delta_{ extsf{CSI-RS}}$	Subframes	5 / 4	N/A
CSI reference configuration			0	N/A
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note	2)	dB	N/A	-1.73
BW <sub>Channe</sub>	I	MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	126
Number of control symbols	ol OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming ı	model		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference n	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	ms	10 or 11	N/A
Reporting into	erval	ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetF bitmap	Restriction		0000000000000000 00000000000000000 00000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous tran	nsmission		No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			4	N/A

Note 1:  $P_B = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

Table 8.3.2.1B-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference Value		UE Categor
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	у
1	R.48 TDD	OP.1 TDD	N/A	EVA5	EVA5	4x2 Low	70	-1.0	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

# 8.3.2.1C Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.2.1C-2, with the addition of parameters in Table 8.3.2.1C-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.2.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.2.1C-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Conf	iguration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	-3	N/A	N/A
	$N_{oc1}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.3.2.1C-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	en Cells	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific reference	e signals		A	ntenna ports 0,1	
CSI reference sig			Antenna ports 15,16	N/A	N/A
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et s	Subframes	5 / 4	N/A	N/A
CSI reference sign configuration			8	N/A	N/A
Zero-power CSI- configuration I <sub>CSI-RS</sub> / ZeroPower bitmap	-RS	Subframes / bitmap	4 / 00100000000000 00	N/A	N/A
ABS pattern (Not	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		000000001 0000000001 0000000001	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control of symbols	OFDM		2	Note 8	Note 8
PDSCH transmissio	n mode		TM9-1layer	Note 9	Note 9
Precoding granul			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming mo			Annex B.4.1	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

Note 1:	$P_B = 1$ .
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a
	subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the
	definition of the reference channel.
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined
	in [7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
Note 11:	For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.
Note 12:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 13:	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.
Note 14:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.2.1C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Test Number	Reference Channel	oc	NG Patt	ern		ropagations (N		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.51 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD		EVA5		2x2 Low	70	8.5	≥2
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.										

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

#### Enhanced Performance Requirement Type B - Single-layer Spatial 8.3.2.1D Multiplexing with TM9 interference

The requirements are specified in Table 8.3.2.1D-2, with the addition of the parameters in Table 8.3.2.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.2.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Configurati			1	1	1
Special subframe configura	tion		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Cell-specific reference sign	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM synormal subframes			3	3	3
CFI indicated in PCFICH in subframes	normal		3	3	3
Number of control OFDM syspecial subframes	ymbols in		2	2	2
CFI indicated in PCFICH in	special		2	2	2
subframes			0	9	0
PDSCH transmission mode	!		9 N/A	As specified in	9 As specified in
Interference model			·	clause B.6.4	clause B.6.4
Precoding			Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity and sub- $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	frame offset	Subframes	10 / 4	10 / 4	10 / 4
CSI reference signal config	uration		5	6	7
Zero-power CSI-RS configu I <sub>CSI-RS</sub> /ZeroPowerCSI-RS b	Subframes / bitmap	9 / 10000000000 00000	9 / 010000000000 0000	9 / 00100000000 00000	
Time offset to cell 1	us	N/A	2	3	
Frequency offset to cell 1	Hz	N/A	200	300	
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- p-aLis r12	t-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) transn	nissionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_{p} = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.2.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

Test Numb	Reference Channel	OCNG Pattern			Propagation Conditions				tion Mat		Reference Value		UE Cate
er		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.69 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.0	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_{s}/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

# 8.3.2.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.2.1E-2, with the addition of the parameters in Table 8.3.2.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.2.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

Para	meter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Conf	iguration	1		1	1	1
Special subframe cor	nfiguratio	n		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloc	ation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
		σ	dB	-3	-3	-3
Cell-specific reference	e signals	3		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control OF normal subframes	DM sym	bols in		3	3	3
CFI indicated in PCF subframes	ICH in no	ormal		3	3	3
Number of control OF special subframes	DM sym	bols in		2	2	2
CFI indicated in PCF subframes	ICH in sp	pecial		2	2	2
PDSCH transmission	mode			8	N/A	N/A
Interference model				N/A	As specified in clause B.6.5	As specified in clause B.6.5
Precoding				Random wideband precoding per TTI	N/A	N/A
Time offset to cell 1			us	N/A	2	3
Frequency offset to c	ell 1		Hz	N/A	200	300
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- r12	eighCellsInfo- p-aList-r12			N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
` ,	transmis	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: D = 1			•	•		

Note 1:  $P_B = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.2.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.71 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	14.0	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

# 8.3.2.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference

The requirements are specified in Table 8.3.2.1F-2, with the addition of the parameters in Table 8.3.2.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.2.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

Parameter	Unit	Cell 1	Cell 2	Cell 3	
Uplink downlink Configurati			1	1	1
Special subframe configura		4	4	4	
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3	-3
	σ	dB	-3	0	0
Cell-specific reference sign	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	3.28	0.74
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM symbols in normal subframes			3	3	3
CFI indicated in PCFICH in subframes	normal		3	Random from set {1,2,3}	Random from set {1,2,3}
Number of control OFDM si special subframes	ymbols in		2	2	2
CFI indicated in PCFICH in subframes	•		2	Random from set {1,2}	Random from set {1,2}
PDSCH transmission mode			8	3	3
Interference model			N/A	As specified in clause B.6.2	As specified in clause B.6.2
Precoding			Random wideband precoding per TTI	As specified in clause B.6.2	As specified in clause B.6.2
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- p-aLis	t-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) transn	nissionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_{R} = 1$ 

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.2.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.70 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	11.3	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_{s}/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

## 8.3.2.1G Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.2.1G-2, with the addition of the parameters in Table 8.3.2.1G-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.2.1G-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1G-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) Multiplexing with TM10 serving cell configuration and TM9 interference model

Para	ameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Con				1	1	1
Special subframe co	nfiguratio	n		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloc	cation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
		σ	dB	-3	-3	-3
Cell-specific reference signals				Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port			dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$			dB	N/A	13.91	3.34
BW <sub>Channel</sub>			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control O normal subframes	•			3	3	3
CFI indicated in PCF subframes				3	3	3
Number of control O special subframes	-			2	2	2
CFI indicated in PCF subframes	TICH in sp	pecial		2	2	2
PDSCH transmission	n mode			10	9	9
Interference model				N/A	As specified in clause B.6.4	As specified in clause B.6.4
Precoding				Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signal	s			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity a $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	nd subfra	me offset	Subframes	10 / 4	10 / 4	10 / 4
CSI reference signal configuration				5	6	7
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> /ZeroPowerCSI-RS bitmap			Subframes / bitmap	9 / 1000000000 00000	9 / 010000000000 0000	9 / 00100000000 00000
Time offset to cell 1			us Hz	N/A	2	3
	Frequency offset to cell 1			N/A	200	300
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- r12 p-aList-r12				N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4)	transmis	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:  $P_{B} = 1$ 

Note 2:

Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. CSI-RS configurations are according to [4] subclause 6.10.5.2. Note 3:

NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 4:

Table 8.3.2.1G-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS Multiplexing with TM10 serving cell configuration and TM9 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Ma A	Correlation Matrix and Antenna Configurati on		Reference Value		UE Cate gory
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	C ell 1	C ell 2	C ell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	
1	R.69 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	4x 2 Lo w	2x 2 Lo w	2x 2 Lo w	85	18.0	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_{s}/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

#### 8.3.2.1H Single-layer Spatial Multiplexing (CRS assistance information is configured)

The requirements are specified in Table 8.3.2.1H-2, with the addition of parameters in Table 8.3.2.1H-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell with CRS assistance information. In Table 8.3.2.1H-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1, Cell 2 and Cell 3 is according to Annex C.3.2. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.2.1H-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports)

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink	Configuration		1	1	1
Special subframe	e configuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3	-3
$N_{oc}$ at antenna p	$V_{oc}$ at antenna port		-98	N/A	N/A
Ê₅/N₀₀		dB	Reference Value in Table 8.3.2.1H-2	10.45	4.6
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset to C	ell 1	μs	N/A	3	-1
Frequency shift	to Cell 1	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific refe	erence signals		A	Antenna ports 0,1	
CSI reference si	-		Antenna ports 15,16	N/A	N/A
CSI-RS periodic subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	ity and	Subframes	5 / 4	N/A	N/A
CSI reference si configuration	gnal		8	N/A	N/A
bitmap	PowerCSI-RS	Subframes / bitmap	4 / 0010000000000 000	N/A	N/A
Number of control symbols	ol OFDM		2	2	2
PDSCH transmis	ssion mode		TM9-1layer	N/A	N/A
Interference mod	Interference model		N/A	As specified in clause B.5.4	As specified in clause B.5.4
transmission in i	Probability of occurrence of cansmission in interference cells		N/A	20	20
Probability of occurrence of transmission	poccurrence of Rank 1 transmission		N/A	80	80
rank in interfering cells	interfering Rank 2		N/A	20	20
Precoding granu	Precoding granularity		Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming mo	odel		Annex B.4.1	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

Note 1:  $P_{R} = 1$ 

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms

Note 4: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 5: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Note 6: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.2.1H-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports)

		oc	NG Patt	ern		Propagation Conditions (Note1)  Correlation Reference Value		· · · · · · · · · · · · · · · · · · ·		Value	UE
Test Number	Reference Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.51-1 TDD	OP.1 TDD	N/A	N/A		EVA5		2x2 Low	70	11.9	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to  $\mathbb{E}_{\mathfrak{s}}/N_{\mathfrak{o}\mathfrak{o}}$  of cell 1.

### 8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Parame	ter	Unit	Test 1	Test 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0	
power allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
allocation	σ	dB	-3	-3	
Cell-spec reference symbol	ce		Antenna port 0 and antenna p		
Beamforn mode			Annex	B.4.2	
$N_{oc}$ at ant	enna	dBm/15kHz	-98	-98	
Symbols unused P			OCNG (Note 2)	OCNG (Note 2)	
Number allocate resource b	ed	PRB	50	50	
PDSCI transmiss mode	sion		8	8	

Note 1:  $P_B = 1$ .

Note 2: These physical resource blocks are assigned to an arbitrary

number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo

random data, which is QPSK modulated.

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	4.5	≥2
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.7	≥2

# 8.3.2.2A Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing

The requirements are specified in Table 8.3.2.2A-2, with the addition of the parameters in Table 8.3.2.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation upon antenna ports 7 and 8.

Table 8.3.2.2A-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Parame	ter	Unit	Test 1
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	-3
Cell-spec reference symbol	ce		Antenna port 0 and antenna port 1
Beamforn mode	_		Annex B.4.2
$N_{oc}$ at ant	enna	dBm/15kHz	-98
Symbols unused P			OCNG (Note 2)
Number allocate resource b	ed	PRB	50
PDSCI transmiss mode	sion		8
Note 1:	D = 1		

Note 1:  $P_{R} = 1$ .

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one

an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.2A-2: Enhanced Performance Requirement Type C for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	17.0	≥2

#### 8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

Doromotor		l lmi4	Te	est 1
Parameter		Unit	Cell 1	Cell 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	4	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0

σ	dB	-3	-3
Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1
Cell ID		0	126
CSI reference signals		Antenna ports 15,16	NA
Beamforming model		Annex B.4.2	NA
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5/4	NA
CSI reference signal configuration		8	NA
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	4 / 001000000000000000	NA
$N_{\it oc}$ at antenna port	dBm/15kHz	-98	-98
$\hat{E}_s/N_{oc}$		Reference Value in Table 8.3.2.3-2	Test specific, 7.25dB
Symbols for unused PRBs		OCNG (Note 2)	NA
Number of allocated resource blocks (Note 2	) PRB	50	NA
Simultaneous transmission		No	NA
PDSCH transmission mode		9	Blanked

Note 1:  $P_B = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	Correlation Matrix and	Reference	value	UE Cate
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	gory
1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	N/A	ETU5	ETU5	2x2 Low	70	14.8	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1.

# 8.3.2.4 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.2.4.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.1-3, with the additional parameters in Table 8.3.2.4.1-1 and Table 8.3.2.4.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the

test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.2.4.1-2. In Tables 8.3.2.4.1-1 and 8.3.2.4.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.1-1: Test Parameters for quasi co-location type B: same Cell ID

Parameter		Unit	TP 1	TP 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referen	ce signals		Antenna ports 0,1	(Note 2)
CSI-RS 0 antenr	a ports		NA	Port {15,16}
qcl-CSI-RS-ConfigN CSI-RS 0 periodi subframe offset T <sub>CSI</sub>	city and RS / \Delta CSI-RS	Subframes	NA	5/4
qcl-CSI-RS-ConfigN CSI-RS 0 config	uration		NA	8
csi-RS-ConfigZPId- power CSI-RS 0 con I <sub>CSI-RS</sub> / ZeroPower CSI-R	nfiguration		NA	4/ 0000010000000000
$N_{oc}$ at antenna port		dBm/15kH z	-98	-98
$\widehat{E}_s/N_{oc}$		dB	Reference point in Table 8.3.2.4.1-3	Reference point in Table 8.3.2.4.1-3
BW <sub>Channel</sub>		MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	0
Number of contro symbols	I OFDM		2	2
PDSCH transmissi	on mode		Blanked	10
Number of allocat	ed PRB	PRB	NA	50
Mapping and Qu	qcl-Operation, 'PDSCH RE Mapping and Quasi-Co- Location Indicator'		Туре	B, '00'
Time offset between	en TPs	μs	NA	Reference point in Table 8.3.2.4.1-3
Frequency error bet	ween TPs	Hz	NA	0
Beamforming model			NA	Port 7 as specified in clause B.4.1
Symbols for unuse	ed PRBs		NA	OCNG (Note 3)

Note 1:  $P_{B} = 1$ 

Noet 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set	Parameters in each PQI set	DL transmission
		hypothesis for each

index			PQI	Set
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.2.4.1-3: Minimum performance for quasi co-location type B: same Cell ID

Test Number	Reference Channel		CN tern	Time offset between	Propag Cond (No	itions	Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 TDD	NA	OP.1 TDD	2	EPA5	EPA5	2x2 Low	70	12	≥2
2	R.52 TDD	NA	OP.1 TDD	-0.5	EPA5	EPA5	2x2 Low	70	12.4	≥2

Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{ac}$  of TP 2 as defined in clause 8.1.1.

#### 8.3.2.4.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.2.4.2-3, with the additional parameters in Tables 8.3.2.4.2-1 and 8.3.2.4.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In Tables 8.3.2.4.2-1 and 8.3.2.4.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.2-1: Test Parameters for timing offset compensation with DPS transmission

parameter		Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

	1		
Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals		Antenna ports 0,1	(Note 2)
CSI reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5 / 4	N/A
CSI reference signal 0 configuration		0	N/A
CSI reference signals 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5 / 4
CSI reference signal 1 configuration		N/A	8
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	4/ 001000000000000000	N/A
Zero-power CSI-RS1 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap <sub>S</sub>	Subframes /bitmap	N/A	4/ 00000100000000000
$\widehat{E}_s/N_{oc}$	dB	Reference Value in Table 8.3.2.4.2-3	Reference Value in Table 8.3.2.4.2-3
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98
BW <sub>Channel</sub>	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	0
Number of control OFDM symbols		2	2
Timing offset between TPs		N/A	Reference Value in Table 8.3.2.4.2-3
Frequency offset between TPs	Hz	N/A	0
Number of allocated resource blocks	PRB	50	50
PDSCH transmission mode		10	10
Probability of occurrence of PDSCH transmission(Note 3)	%	30	70
Symbols for unused PRBs		OCNG (Note 4)	OCNG (Note 4)

Note 1:  $P_{p} = 1$ 

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	hypoth	smission esis for PQI Set	
	NZP CSI-RS Index (For quasi co-location)	TP 1	TP 2	
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	Blanked	PDSCH	

Table 8.3.2.4.2-3: Performance Requirements for timing offset compensation with DPS transmission

Test Number	Timing offset(us)	Reference Channel		NG tern		gation itions	Correlation Matrix and	Reference V	/alue	UE Category
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	2	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.3	≥2
2	-0.5	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.5	≥2
Note 1: Note 2: Note 3:	Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.									

### 8.3.2.4.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.3-2, with the additional parameters in Table 8.3.2.4.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In Table 8.3.2.4.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

parameter		Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		N/A	As specified in clause B.4.2
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference signals 0		N/A	Antenna ports {15,16}
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5 / 4
CSI reference signal 0 configuration		N/A	0
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	4/ 00100000000000000
$\hat{E}_s/N_{oc}$	dB	Reference point in Table 8.3.2.4.3-2 + 4dB	Reference Value in Table 8.3.2.4.3-2
$N_{\it oc}$ at antenna port	dBm/15kH z	-98	-98
BW <sub>Channel</sub>	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	126
Number of control OFDM symbols		1	2
Timing offset between TPs	us	N/A	0
Frequency offset between TPs	Hz	N/A	200
qcl-Operation, PDSCH RE Mapping and Quasi-Co- Location Indicator'		Type	B, '00'
PDSCH transmission mode		Blank	10
Number of allocated resource block		N/A	50
Symbols for unused PRBs		N/A	OCNG(Note2)

Note 1:  $P_B = 1$ 

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs Note 2: shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.3-2: Performance Requirements for quasi co-location type B with different Cell ID and **Colliding CRS** 

Test Number	Reference Channel	OCNG Pattern		Cond	gation itions te1)	Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 TDD	N/A	OP.1 TDD	EPA5	ETU5	2x2 Low	70	14.7	≥2

Note 1:

The propagation conditions for TP 1 and TP 2 are statistically independent.

Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2. Note 2:

SNR corresponds to  $\hat{E}_{s}/N_{oc}$  of TP 2 as defined in clause 8.1.1. Note 3:

8.3.2.4.4 Minimum requirement with Different Cell ID and non-Colliding CRS (with single NZP CSI-RS resource and CRS assistance information is configured)

The requirements are specified in Table 8.3.2.4.4-3, with the additional parameters in Table 8.3.2.4.4-1 and Table 8.3.2.4.4-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and time difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Table 8.3.2.4.4-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, transmission point 2 (TP 2) transmits PDSCH with different Cell ID, and Transmission point 3 (TP 3) is the aggressor transmission point. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.2.4.4-1: Test Parameters for quasi co-location type B with different Cell ID and non-colliding CRS when CRS assistance information is configured

param	eter	Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Beamforming mo	odel		N/A	Port 7 as specified in clause B.4.1	N/A
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference sig	gnals 0		N/A	Antenna ports {15,16}	N/A
CSI-RS 0 period subframe offset	$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5 / 4	N/A
CSI reference sign configuration			N/A	0	N/A
Zero-power CSI- configuration I <sub>CSI-RS</sub> / ZeroPower CSI-		Subframes /bitmap	N/A	4/	N/A
$\hat{E}_s/N_{oc}$		dB	10.45	Reference Value in Table 8.3.2.4.4-3	8.45
$N_{\it oc}$ at antenna $_{ m I}$	oort	dBm/15kH z	-98	-98	N/A
BW <sub>Channel</sub>	1		10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	128
Number of contro symbols	ol OFDM		1	2	2
Timing offset to 7	TP 1	us	N/A	-0.5	3
Frequency offset		Hz	N/A	200	-100
qcl-Operation, P Mapping and Qu Location Indicate	asi-Co-		Туре	B, '00'	N/A
PDSCH transmis	sion mode		Blank	10	9
Number of alloca block	ited resource		N/A	50	N/A
Symbols for unus	sed PRBs		N/A	OCNG(Note2)	N/A
Interference mod	lel		N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells		%	N/A	N/A	20
Probability of occurrence of Rank 1		%	N/A	N/A	80
transmission	nsmission k in Rank 2		N/A	N/A	20

Note 1:  $P_B = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.4-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.2.4.4-3: Performance Requirements for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

	Refere	OCNG Pattern			Propagation Conditions (Note1)			Correlation Matrix and	Reference Value		UE
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 TDD	N/A	OP.1 TDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.1	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of TP.2 as defined in clause 8.1.1.

### 8.3.2.4.5 Minimum requirements with different Cell ID and non-colliding CRS (with multiple NZP CSI-RS resources and CRS assistance information is configured)

The requirements are specified in Table 8.3.2.4.5-3, with the additional parameters in Tables 8.3.2.4.5-1 and 8.3.2.4.5-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission point have the different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Tables 8.3.2.4.5-1 and 8.3.2.4.5-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, Transmission point 2 (TP 2) has different Cell ID as TP 1, and Transmission point 3 (TP3) is the aggressor transmission point. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between TP 1 and TP 2 with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.5-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2

Table 8.3.2.4.5-1: Test Parameters for DPS transmission with CRS assistance information

paramete	<u> </u>	Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3 N/A
Beamforming model			As specified in clause B.4.1	As specified in clause B.4.1	
Cell-specific reference	ce signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference signal	s 0		Antenna ports {15,16}	N/A	N/A
CSI-RS 0 periodicity subframe offset $T_{CSI}$ .		Subframes	5 / 4	N/A	N/A
CSI reference signal configuration			0	N/A	N/A
CSI reference signal	s 1		N/A	Antenna ports {15,16}	N/A
CSI-RS 1 periodicity subframe offset $T_{CSI}$ .		Subframes	N/A	5 / 4	N/A
CSI reference signal configuration			N/A	8	N/A
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS I		Subframes /bitmap	4/ 00100000000000000	N/A	N/A
Zero-power CSI-RS <sup>2</sup> configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS I	1	Subframes /bitmap	N/A	4/ 0000010000000000	N/A
$\widehat{E}_s/N_{oc}$ (Note 2)	•	dB	Reference Value in Table 8.3.2.4.5-3	Reference Value in Table 8.3.2.4.5-3	8.45
$N_{\it oc}$ at antenna port		dBm/15kH z	-98	-98	N/A
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	128
Number of control O symbols	FDM		2	2	
Timing offset to TP 1			N/A	-0.5	3
Frequency offset to	ΓP 1	Hz	N/A	200	-100
Number of allocated blocks	resource	PRB	50	50	N/A
PDSCH transmission	n mode		10	10	9
Probability of occurre PDSCH transmission		%	30	70	N/A
Symbols for unused	,		OCNG (Note 4)	OCNG (Note 4)	N/A
Interference model			N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells  Probability of occurrence of transmission  Rank 1		%	N/A	N/A	20
		%	N/A	N/A	80
rank in interfering Rar cells	nk 2	%	N/A	N/A	20

Note 2:	E /	$N_{\rm as}$ of TP 1 is set the same as that of TF	22
NOLG Z.	L . /		۷.

Note 3: PDSCH transmission from TP 1 and TP 2 shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.5-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH

Table 8.3.2.4.5-3: Performance Requirements for DPS transmission with CRS assistance information

	Refere	OCNG Pattern		Propagation Conditions (Note1)			Correlation Matrix and	Reference Value		UE	
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 TDD	OP.1 TDD	OP.1 TDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.2	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of both TP.1 and TP.2 as defined in clause 8.1.1.

### 8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH

#### 8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

Parame	ter	Unit	Single antenna port	Transmit diversity
Number of PDC	CH symbols	symbols	2	2
PHICH Ng (	Note 1)		1	1
PHICH du	ration		Normal	Normal
Unused RE-s a	and PRB-s		OCNG	OCNG
Cell II	)		0	0
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	-98
Cyclic pr	efix		Normal	Normal
Note 1: According	g to Clause 6.9	in TS 36.211 [4]	_	

#### 8.4.1.1 Single-antenna port performance

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Reference value	
						and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x2 Low	1	-1.7

#### 8.4.1.2 Transmit diversity performance

#### 8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 2 Low	1	-0.6

#### 8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 2 Medium	1	6.3

### 8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{\it oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A
$\hat{E}_s/N_{oc}$		dB	Reference Value in Table 8.4.1.2.3-	1.5
BW <sub>Channe</sub>	el	MHz	10	10
Subframe Confi	guration		Non-MBSFN	Non-MBSFN
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	1
ABS pattern (N	Note 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		00000100 00000100 00000100 01000100 00000100	N/A
(Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 10111011 11111011	N/A
Number of control Of			3	3
PHICH Ng (N			1	N/A
PHICH dura			Extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pre	Normal	Normal		

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging
- are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]:
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Numb er	Aggregati on Level	Referen ce Channel	OCNG Pattern		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value	
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-3.9

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A
$\hat{E}_s/N_{oc}$		dB	Reference Value in Table 8.4.1.2.3-	1.5
BW <sub>Chann</sub>	el	MHz	10	10
Subframe Conf	iguration		Non-MBSFN	MBSFN
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	126
ABS pattern (	ABS pattern (Note 4)		N/A	0001000000 0100000010 0000001000 0000000
RLM/RRM Measuren Pattern (No			0001000000 0100000010 0000001000 0000000	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0001000000 0100000010 0000001000 0000000	N/A
(Note 6)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111111	N/A
MBSFN Subframe Allocation (Note 9)			N/A	001000 100001 000100 000000
Number of control O	FDM symbols	-	3	3
PHICH Ng (N			1	N/A
PHICH dura			extended	N/A
Unused RE-s ar			OCNG	OCNG
Cyclic pre	etix		Normal	Normal

- This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 Note 1: of a subframe overlapping with the aggressor ABS.
- This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS. Note 2:
- Note 3:
- This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS ABS pattern as defined in [9]. The 4<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup> and 27<sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated Note 4: PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- SIB-1 will not be transmitted in Cell2 in this test. Note 8:
- MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN Note 9: subframe allocation.
- The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel Note 10: transmission is in a subframe protected by MBSFN ABS in this test.
- Note 11: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH – MBSFN ABS

Test Numb er	Aggregati on Level	Reference Channel		NG tern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Referer	nce Value
			Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-4.2

The propagation conditions for Cell 1 and Cell2 are statistically independent. Note 1:

SNR corresponds to  $\widehat{E}_s/N_{ac2}$  of cell 1. Note 2:

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

#### 8.4.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-4.

In Tables 8.4.1.2.4-1 and 8.4.1.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.1.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Douglink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98(Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\hat{E}_s/N$		dB	Reference Value in Table 8.4.1.2.4-2	5	3
BW <sub>Ch</sub>	annel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	Id		0	126	1
ABS pattern	n (Note 4)		N/A	00000100 00000100 00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100
RLM/RRM Me Subframe Patt			00000100 00000100 00000100 00000100 00000100	N/A	N/A
CSI Subframe	C <sub>CSI,0</sub>		00000100 00000100 00000100 00000100 00000100	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 11111011	N/A	N/A
Number of control OFDM symbols			2	Note 7	Note 7
PHICH Ng	(Note 10)		1	N/A	N/A
PHICH d			Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic	orefix		Normal	Normal	Normal

Note 1.	This point is applied in OEDM symbols #4, #2, #2, #6, #6, #0, #0, #40, #42, #42 of a sylbfrome
Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe
	overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.
Note 9:	SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.
Note 10	According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG Pattern				ropagations (N		Correlation Matrix and	Referer	nce Value
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.2

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 1:

Note 2:

SNR corresponds to  $\hat{E}_{s}/N_{oc2}$  of cell 1. Note 3:

Table 8.4.1.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Douglink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98(Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\hat{E}_s/l$		dB	Reference Value in Table 8.4.1.2.4-4	5	3
BW <sub>CI</sub>	nannel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	MBSFN	MBSFN
Time Offset b	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cel	l ld		0	126	1
ABS patter	n (Note 4)		N/A	0001000000 0100000010 0000001000 0000000	0001000000 0100000010 0000001000 0000000
RLM/RRM Measu Pattern (			0001000000 0100000010 0000001000 0000000	N/A	N/A
CSI Subframe	C <sub>CSI,0</sub>		0001000000 0100000010 0000001000 0000000	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111111	N/A	N/A
MBSFN Subframe Allocation (Note 7)			N/A	001000 100001 000100 000000	001000 100001 000100 000000
	Number of control OFDM symbols		2	Note 8	Note 8
PHICH Ng			1	N/A	N/A
PHICH (			Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic	prenx		Normal	Normal	Normal

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of
	a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. The 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> subframes indicated by ABS pattern
	are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped
	with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition
	of the reference channel.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7].
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 7:	MBSFN Subframe Allocation as defined in [7], four frames with 24 bits are chosen for MBSFN
	subframe allocation.
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
	indicated by "0" of ABS pattern.
Note 9:	The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel
	transmission is in a subframe protected by MBSFN ABS in this test.
Note 10:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 11:	

Table 8.4.1.2.4-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG Pattern Propagation Conditions (Note 1)		. •		Reference Value				
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.0

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 12: According to Clause 6.9 in TS 36.211 [4]

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

# 8.4.1.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port under Asynchronous Network

The test purpose is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with interference model defined in clause B.5.2. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.5-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.5-2 for the Enhanced Downlink Control Channel Performance Requirement Type A. In Table 8.4.1.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.4.1.2.5-1: Test Parameters for PDCCH/PCFICH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
Cell-specific refere	nce signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	rt	dBm/15kHz			
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Subframe Configu	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL con OFDM symbols	Number of DL control region OFDM symbols		3	3	3
PHICH Ng (Note 1	)		1	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
DCI Format			2	N/A	N/A
Interference mode			N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of PDSCH transmissi	Rank 1	%	N/A	80	80
rank in interfering cells	Rank 2	%	N/A	20	20
Unused RE-s and			OCNG	OCNG	OCNG
Time offset relative		ms	N/A	0.33	0.67
Frequency shift relative to Cell 1		Hz	N/A	0	0
Note 1: Accordi	ng to Clause 6.9	in TS 36.211 [4]			

Table 8.4.1.2.5-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel					. •		Refere	ence Value
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm- dsg (%)	SNR (dB) (Note 4)	
1	2 CCE	R.16-1 FDD	OP.1 FDD	EVA70	EVA70	EVA70	2x2 Low	1	[16.4]	

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.4.1.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.6-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.6-2. In Table 8.4.1.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.6-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA OCNG_RA	dB	-3	-3	-3	
Downlink	PHICH_RA	dB	-3	N/A	N/A	
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3	
	PHICH_RB	dB	-3	N/A	N/A	
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
$N_{oc}$ at antenna p	oort	dBm/15kHz		-98		
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34	
BW <sub>Channel</sub>		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell Id			0	1	6	
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of DL co OFDM symbols	ntrol region		3	3	3	
CFI indicated in F	PCFICH		3	3	3	
PHICH Ng (Note	1)		1/6	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
PDSCH TM			4	N/A	N/A	
DCI Format			2	N/A	N/A	
Interference mod	lel		NA	As specified in clause B.7.1	As specified in clause B.7.1	
Unused RE-s and	d PRB-s (Note 2)		OCNG	OCNG	OCNG	
Time Offset relati	ive to Cell 1	μs	N/A	2	3	
Frequency shift relative to Cell 1		Hz	N/A	200	300	
	ding to Clause 6.9 i			o control ragion DE		

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs

Table 8.4.1.2.6-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-2 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	[12.9]

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $E_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.4.1.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.7-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.7-2. In Table 8.4.1.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.7-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna p	oort	dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	6	1
Subframe Config	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ntrol region		1	1	1
CFI indicated in I	PCFICH		1	1	1
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
DCI Format			2	N/A	N/A
Interference mod	lel		NA	As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s and	d PRB-s (Note 2)		OCNG	OCNG	OCNG
Time Offset relat	ive to Cell 1	μs	N/A	2	3
Frequency shift r		Hz	N/A	200	300
	ding to Clause 6.9 in a sell 2 and Cell 3 unus			e control region RF	is ·

Table 8.4.1.2.7-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-3 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	[12.9]

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $E_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.4.1.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.8-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.8-2. In Table 8.4.1.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.8-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna ${ m p}$	oort	dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ontrol region		1	1	1
CFI indicated in I	PCFICH		1	1	1
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
DCI Format			2	N/A	N/A
Interference mod	del			As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG
Time Offset relat	ive to Cell 1	μs	N/A	2	3
Frequency shift r	elative to Cell 1	Hz	N/A	200	300
	ding to Clause 6.9 i ell 2 and Cell 3 unu			e control region RF	······································

Table 8.4.1.2.8-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Refere	ence Value	
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-4 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	[10.6]

**Performance Requirement Type B** 

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.4.2 TDD

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

Parame	eter	Unit	Single antenna port	Transmit diversity
Uplink downlink (	•		0	0
Special subframe (Note	•		4	4
Number of PDC	CH symbols	symbols	2	2
PHICH Ng (	Note 3)		1	1
PHICH du	ration		Normal	Normal
Unused RE-s a	and PRB-s		OCNG	OCNG
Cell ID			0	0
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98
Cyclic pi	refix		Normal	Normal
ACK/NACK feed	back mode		Multiplexing	Multiplexing
Note 1: as speci	fied in Table 4.2	?-2 in TS 36.211 [4	].	

Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4]. Note 3: According to Clause 6.9 in TS 36.211 [4]

### 8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		level	Channel	Pattern	Condition	configuration	Pm-dsg (%)	SNR (dB)
						and correlation Matrix		
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x2 Low	1	-1.6

### 8.4.2.2 Transmit diversity performance

### 8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	ce value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 2 Low	1	0.1

#### 8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 2 Medium	1	6.5

### 8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Uplink downlink co	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A
$\widehat{E}_s/N_{oc2}$	2	dB	Reference Value in Table 8.4.2.2.3-2	1.5
BW <sub>Channe</sub>	I	MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μS	2.5 (synchro	nous cells)
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	0000010001 0000000001
RLM/RRM Measurement Pattern(Note			000000001 000000001	N/A
CSI Subframe	C <sub>CSI,0</sub>		0000010001 000000001	N/A
Sets(Note 6) C <sub>CSI,1</sub>			1100101000 1100111000	N/A
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (Note 9)			1	N/A
PHICH dura	tion		extended	N/A
Unused RE-s and			OCNG	OCNG
Cyclic pref	ix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Numbe r	Aggregatio n Level	Referenc e Channel	OCNG	Pattern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value	
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-3.9

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Uplink downlink co	nfiguration		1	1
Special subframe co	onfiguration		4	4
Dourslink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{oc}$ at antenna port	$N_{oc}$ at antenna port $N_{oc2}$		-98 (Note 2)	N/A
	$N_{oc3}$		-95.3 (Note 3)	N/A
$\hat{E}_s/N_{oc}$	$\hat{E}_s/N_{oc2}$		Reference Value in Table 8.4.2.2.3-4	1.5
BW <sub>Channe</sub>	BW <sub>Channel</sub>		10	10
Subframe Confi	guration		Non-MBSFN	MBSFN
Time Offset between	een Cells	μs	2.5 (synchro	onous cells)
Cell Id			0	126
ABS pattern (N	lote 4)		N/A	000000001 000000001
RLM/RRM Measurem Pattern(Note			000000001 000000001	N/A
CSI Subframe	C <sub>CSI,0</sub>		000000001 000000001	N/A
Sets(Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A
MBSFN Subframe Allo	MBSFN Subframe Allocation (Note 9)		N/A	000010
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (Note 10)			1	N/A
PHICH dura	tion		extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pre	fix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 10<sup>th</sup> and 20<sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in this test.
- Note 9: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG	Pattern		Propagation Conditions(Note 1)		Referen	ce Value
			Cell 1	Cell 2	Cell 1	Cell 1 Cell 2		Pm-dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-4.1

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to  $\hat{E}_s/N_{ac2}$  of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

### 8.4.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-4.

In Tables 8.4.2.2.4-1 and 8.4.2.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.2.2.4-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Uplink downlink	configuration		1	1	1
Special subframe	configuration		4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98(Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port $N_{oc3}$		dBm/15kHz	-93 (Note 3)	N/A	N/A
$\hat{E}_s/N$	$\hat{E}_s/N_{oc2}$		Reference Value in Table 8.4.2.2.4-2	5	3
$BW_Channel$		MHz	10	10	10
Subframe Co	nfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	tween Cells	μs	N/A	3	-1
Frequency shift I	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS pattern	(Note 4)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Me Subframe Patt			0000000001 0000000001	N/A	N/A
CSI Subframe	C <sub>CSI,0</sub>		000000001 000000001	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control OFDM symbols			2	Note 7	Note 7
ACK/NACK feedback mode			Multiplexing	N/A	N/A
PHICH Ng (	(Note 10)		1	N/A	N/A
PHICH d	uration		Normal	N/A	N/A
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG
Cyclic p	orefix		Normal	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
- Note 7: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 8: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	oc	NG Patt	ern		ropagations (N		Correlation Matrix and	Referer	nce Value
			Cell 1	Cell 2	Cell 3	Cell 1	1 Cell 2 Cell3		Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.0

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

Table 8.4.2.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3	
Uplink downlink	configuration		1	1	1	
Special subframe	e configuration		4	4	4	
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3	
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3	
	$N_{oc1}$		-98 (Note 1)	N/A	N/A	
$N_{oc}$ at antenna	7 oc2		-98 (Note 2)	N/A	N/A	
port	$N_{oc3}$		-93 (Note 3)	N/A	N/A	
$\hat{E}_s/N$		dB	Reference Value in Table 8.4.2.2.4-4	5	3	
<b>BW</b> <sub>Channel</sub>		MHz	10	10	10	
Subframe Co	onfiguration		Non-MBSFN	MBSFN	MBSFN	
Time Offset be	etween Cells	μs	N/A	3	-1	
Frequency shift	between Cells	Hz	N/A	300	-100	
Cell	ld		0	126	1	
ABS pattern	` ,		N/A	0000000001 0000000001	0000000001 0000000001	
RLM/RRM Me Subframe Patt			0000000001 0000000001	N/A	N/A	
CSI Subframe	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A	
Sets (Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A	
MBSFN Subframe Allocation (Note 7)			N/A	000010	000010	
`	Number of control OFDM symbols		2	Note 8	Note 8	
ACK/NACK feedback mode			Multiplexing	N/A	N/A	
PHICH Ng (Note 11)			1	N/A	N/A	
PHICH d	PHICH duration		Normal	N/A	N/A	
Unused RE-s			OCNG	OCNG	OCNG	
Cyclic	orefix		Normal	Normal	Normal	

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 10<sup>th</sup> and 20<sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 10: SIB-1 will not be transmitted in Cell2 in this test.
- Note 11: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.4-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	oc	NG Patt	ern		ropagations (N		Correlation Matrix and	Referer	nce Value
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-1.8

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc2}$  of cell 1.

# 8.4.2.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.5-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.5-2. In Table 8.4.2.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.5-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA OCNG_RA	dB	-3	-3	-3	
Downlink	PHICH_RA	dB	-3	N/A	N/A	
power	PCFICH_RB					
allocation	PDCCH_RB	dB	-3	-3	-3	
	OCNG_RB					
	PHICH_RB	dB	-3	N/A	N/A	
Call-specific refe	ranca signals		Antenna ports	Antenna ports	Antenna ports	
Cell-specific reference signals			0,1	0,1 0,1 7411c1 1		
$N_{oc}$ at antenna port		dBm/15kHz				
$\hat{E}_s/N_{oc}$	$\hat{E}_s/N_{oc}$		N/A	13.91	3.34	
BW <sub>Channel</sub>		MHz	10			
Cyclic Prefix			Normal	Normal	Normal	
Cell Id			0	6	1	
UL/DL Configura	ition		0	0	0	
Special Subfram	e Configuration		4	4	4	
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of DL co OFDM symbols	ontrol region		3	3	3	
CFI indicated in	PCFICH		3	3	3	
PHICH Ng (Note	1)		1/6	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
PDSCH TM			4	N/A	N/A	
DCI Format			2	N/A	N/A	
Interference model				As specified in	As specified in	
				clause B.7.1	clause B.7.1	
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG	
Time Offset relat	ive to Cell 1	μs	N/A	2	3	
Frequency shift i	relative to Cell 1	Hz	N/A	200	300	
Note 1: Accor	ding to Clause 6.9 i	n TS 36 211 [4]				

Note 1: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.2.2.5-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern		Propagation Conditions (Note 2)		Antenna Configuration	Refere	ence Value
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-1 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	[16.2]

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

# 8.4.2.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.6-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.6-2. In Table 8.4.2.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.6-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power	PCFICH_RB				
allocation	PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna p	oort	dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
UL/DL Configura	ition		0	0	0
Special Subfram	e Configuration		4	4	4
Subframe Config	juration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ontrol region		3	3	3
CFI indicated in	PCFICH		3	3	3
PHICH Ng (Note	: 1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
DCI Format			2	N/A	N/A
Interference model				As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG
Time Offset relat	ive to Cell 1	μs	N/A	2	3
Frequency shift i		Hz	N/A	200	300
Note 1: Accor	ding to Clause 6.9 i	n TC 26 211 [4]	·	·	

Note 1: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.2.2.6-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-2 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	[13.5]

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

# 8.4.2.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.7-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.7-2. In Table 8.4.2.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.7-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA OCNG_RA	dB	-3	-3	-3	
Downlink	PHICH_RA	dB	-3	N/A	N/A	
power	PCFICH_RB					
allocation	PDCCH_RB OCNG_RB	dB	-3	-3	-3	
	PHICH_RB	dB	-3	N/A	N/A	
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
$N_{oc}$ at antenna p	oort	dBm/15kHz		-98		
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34	
BW <sub>Channel</sub>		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell Id			0	6	1	
UL/DL Configura			0	0	0	
Special Subfram	e Configuration		4	4	4	
Subframe Config	juration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of DL co OFDM symbols	ontrol region		1	1	1	
CFI indicated in	PCFICH		1	1	1	
PHICH Ng (Note	1)		1/6	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
PDSCH TM			4	N/A	N/A	
DCI Format			2	N/A	N/A	
Interference model				As specified in clause B.7.1	As specified in clause B.7.1	
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG	
Time Offset relat	ive to Cell 1	μs	N/A	2	3	
Frequency shift r		Hz	N/A	200	300	
	ding to Clause 6 0 i					

Note 1: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.2.2.7-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-3 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	[13.7]

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

# 8.4.2.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.8-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.8-2. In Table 8.4.2.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.8-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA OCNG_RA	dB	-3	-3	-3	
Downlink	PHICH_RA	dB	-3	N/A	N/A	
power	PCFICH_RB					
allocation	PDCCH_RB OCNG_RB	dB	-3	-3	-3	
	PHICH_RB	dB	-3	N/A	N/A	
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
$N_{oc}$ at antenna $\mu$	oort	dBm/15kHz		-98		
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34	
BW <sub>Channel</sub>		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell Id			0	1	6	
UL/DL Configura	ition		0	0	0	
Special Subfram			4	4	4	
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of DL co	ontrol region		1	1	1	
CFI indicated in	PCFICH		1	1	1	
PHICH Ng (Note	: 1)		1/6	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
PDSCH TM			4	N/A	N/A	
DCI Format			2	N/A	N/A	
Interference model				As specified in clause B.7.1	As specified in clause B.7.1	
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG	
Time Offset relat		μs	N/A	2	3	
Frequency shift i		Hz	N/A	200	300	
Note 1: Accor	ding to Clause 6.9 i	n TC 26 211 [4]	•		·	

Note 1: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.2.2.8-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-4 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	[11.2]
Note 1: Note 2: Note 3:	The OCNG pattern applies for Cell 1, Cell 2 and Cell 3. The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.								

Note 4: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### 8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

### 8.5.1 FDD

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.5.1-1: Test Parameters for PHICH

Paramo	eter	Unit	Single antenna port	Transmit diversity	
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3	
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3	
PHICH du	uration		Normal	Normal	
PHICH Ng	(Note 1)		Ng = 1	Ng = 1	
PDCCH C	Content		UL Grant should be included with the proper information aligned with A.3.6		
Unused RE-s	and PRB-s		OCNG	OCNG	
Cell ID			0	0	
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98	
Cyclic p	refix		Normal	Normal	
Note 1: according	g to Clause 6.9 in	TS 36.211 [4]	_		

### 8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 2 Low	0.1	5.5
2	10 MHz	R.24	OP.1 FDD	ETU70	1 x 2 Low	0.1	0.6

### 8.5.1.2 Transmit diversity performance

### 8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 2 Low	0.1	4.4
1A	5MHz (Note 1)	R.19-1	OP.1 FDD	EVA 70	2x2 Low	0.1	4
Note 1: Te	est case applicabil	ity is defined in	8.1.2.1.				

#### 8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 2 Medium	0.1	6.1

# 8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.1.2.3-1: Test Parameters for PHICH

Paramete	er	Unit	Cell 1	Cell 2
Downlink power allocation	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
$N_{oc}$ at antenna port	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A
$\hat{E}_s/N_{oc}$	2	dB	Reference Value in Table 8.5.1.2.3-2	1.5
BW <sub>Channe</sub>	el	MHz	10	10
Subframe Confi	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchror	nous cells)
Cell Id			0	1
ABS pattern (N	Note 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets (Note 6)	C <sub>CSI,0</sub>		00000100 00000100 00000100 01000100 00000100	N/A
	C <sub>CSI,1</sub>		11111011 11111011 11111011 10111011 11111011	N/A
Number of control OF			3	3
PHICH Ng (N			1	N/A
PHICH dura			extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pre	tix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26<sup>th</sup> subframe indicated by the ABS pattern.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.1.2.3-2: Minimum performance PHICH

Test Number	Reference Channel	OCNG	Pattern Propagation Antenna Reference Value Conditions Configuration (Note 1) and		Conditions Configuration		nce Value	
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)
1	R.19	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	0.1	4.6
Note 1:					ell 2 are s	tatistically independ	dent.	
Note 2:	SNR correspor	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.						
Note 3:	The correlation	matrix ar	d antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.	

# 8.5.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.4-2. In Table 8.5.1.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.1.2.4-1: Test Parameters for PHICH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98 (Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\hat{E}_s/N$		dB	Reference Value in Table 8.5.1.2.4-	5	3
BW <sub>Ch</sub>	annel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	Id		0	126	1
PDCCH (	PDCCH Content		UL Grant should be included with the proper information aligned with A.3.6.	N/A	N/A
ABS pattern	n (Note 4)		N/A	00000100 00000100 00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100
RLM/RRM Me Subframe Patt			00000100 00000100 00000100 00000100 00000100	N/A	N/A
CSI Subframe	C <sub>CSI,0</sub>		00000100 00000100 00000100 00000100 00000100	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 11111011 11111011	N/A	N/A
	Number of control OFDM symbols		2	Note 7	Note 7
PHICH Ng (Note 10)			1	N/A	N/A
PHICH d			Normal	N/A	N/A
Unused RE-s Cyclic p			OCNG Normal	OCNG Normal	OCNG Normal
Cyclic	NOUV		inuillai	inoilliai	inoillai

Note 10:

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 3:	This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26 <sup>th</sup> subframe indicated by the ABS pattern.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 9:	SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test

Table 8.5.1.2.4-2: Minimum performance PHICH

According to Clause 6.9 in TS 36.211 [4].

Test Number	Reference Channel	OC	OCNG Pattern Propagation Conditions (Note 1)		Antenna Configuration	Refere	ence Value			
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.0
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_s/N_{ac2}$ of Cell 1.									

# 8.5.1.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports under Asynchronous Network

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.5-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.5-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells and applying interference model defined in clause B.5.2. In Table 8.5.1.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.5.1.2.5-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3			
Downlink power allocation	PCFICH_RB PHICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
Cell-specific reference signa	ls		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
$N_{oc}$ at antenna port		dBm/15kHz		-98				
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34			
BW <sub>Channel</sub>		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model			N/A	As specified in clause B.5.2	As specified in clause B.5.2			
Probability of occurrence of PDSCH transmission rank in	Rank 1	%	N/A	80	80			
interfering cells	Rank 2	%	N/A	20	20			
Unused RE-s and PRB-s	•		OCNG	OCNG	OCNG			
Time offset relative to Cell 1		ms	N/A	0.33	0.67			
Frequency offset relative to	Hz	N/A	0	0				
Note 1: According to Clau	se 6.9 in TS 36.	211 [4].						

Table 8.5.1.2.5-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Reference Channel	00	NG Patte	ern		Propagation Conditions (Note 1)		Antenna Configuration	Refere	ence Value
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA7 0	EVA7 0	EVA7 0	2x2 Low	0.1	[17.7]
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									

### 8.5.1.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.6-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.6-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.6-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
	PHICH_RA	dB	-3	N/A	N/A		
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
$N_{oc}$ at antenna port	$N_{oc}$ at antenna port			-98			
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34		
BW <sub>Channel</sub>		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of control OFDM sy	mbols		1	1	1		
PHICH Ng (Note 1)			1	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (N		OCNG OCNG		OCNG			
Time offset to cell 1	us	N/A 2		3			
Frequency offset to cell 1	· · · · · · · · · · · · · · · · · · ·	Hz	N/A	200	300		
Note 1: According to Clar	use 6.9 in TS 36.2	211 [4].					

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.1.2.6-2: Minimum performance PHICH for Enhanced Downlink Control Channel **Performance Requirement Type A** 

Test Number	Reference Channel	oc	NG Patte	ern	Propagation Conditions (Note 1)		Antenna Configuration			
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	[15.9]

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

SNR corresponds to  $\hat{E}_{s}/N_{oc2}$  of Cell 1 as defined in clause 8.1.1. Note 3:

#### 8.5.1.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.7-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.7-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.7-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.7-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
	PHICH_RA	dB	-3	N/A	N/A
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port	dBm/15kHz	-98			
$\hat{E}_s/N_{oc}$	$\hat{E}_s/N_{oc}$			N/A 13.91	
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell ID			0	6	1
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of control OFDM sy	mbols		1	1	1
PHICH Ng (Note 1)			1	N/A	N/A
PHICH duration			Normal	N/A	N/A
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG
Time offset to cell 1	us	N/A	2	3	
Frequency offset to cell 1		Hz	N/A	200	300
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].		·	

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs. Note 2:

Table 8.5.1.2.7-2: Minimum performance PHICH for Enhanced Downlink Control Channel **Performance Requirement Type B** 

Test Number	Reference Channel	oc	NG Patte	ern	Propagation Conditions (Note 1)		Antenna Configuration	Reference Value		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	[13.5]

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

SNR corresponds to  $\hat{E}_{s}/N_{oc2}$  of Cell 1 as defined in clause 8.1.1. Note 3:

#### 8.5.1.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.8-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.8-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.8-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.8-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
	PHICH_RA	dB	-3	N/A	N/A		
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
$N_{oc}$ at antenna port		dBm/15kHz	-98				
$\hat{E}_s/N_{oc}$		dB	N/A	N/A 13.91			
BW <sub>Channel</sub>		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of control OFDM sy	mbols		1	1	1		
PHICH Ng (Note 1)			1	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG		
Time offset to cell 1	us	N/A	2	3			
Frequency offset to cell 1	·	Hz	N/A	200	300		
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].					

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs. Note 2:

Table 8.5.1.2.8-2: Minimum performance PHICH for Enhanced Downlink Control Channel **Performance Requirement Type B** 

Test Number	Reference Channel	oc	NG Patte	ern	Propagation Conditions (Note 1)		. •		Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	[15.2]

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

SNR corresponds to  $\hat{E}_s/N_{oc2}$  of Cell 1 as defined in clause 8.1.1. Note 3:

#### 8.5.2 **TDD**

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.5.2-1: Test Parameters for PHICH

Parame	eter	Unit	Single antenna port	Transmit diversity
Uplink downlink cor 1)	nfiguration (Note		1	1
Special subframe (Note			4	4
	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
PHICH du	ıration		Normal	Normal
PHICH Ng	(Note 3)		Ng = 1	Ng = 1
PDCCH C	Content			I be included with the on aligned with A.3.6.
Unused RE-s	and PRB-s		OCNG	OCNG
Cell ID			0	0
$N_{oc}$ at ante	nna port	dBm/15kHz	-98	-98
Cyclic p			Normal	Normal
ACK/NACK fee	dback mode		Multiplexing	Multiplexing
Note 1: as specif	ied in Table 4.2-2	in TS 36.211 [4	.]	

Note 1: as specified in Table 4.2-2 in TS 36.211 [4]
Note 2: as specified in Table 4.2-1 in TS 36.211 [4]
Note 3: according to Clause 6.9 in TS 36.211 [4]

### 8.5.2.1 Single-antenna port performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 2 Low	0.1	5.8
2	10 MHz	R.24	OP.1 TDD	ETU70	1 x 2 Low	0.1	1.3

### 8.5.2.2 Transmit diversity performance

### 8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.1-1: Minimum performance PHICH

Ī	Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
	number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
ſ	1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 2 Low	0.1	4.2

#### 8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 2 Medium	0.1	6.2

# 8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.2.2.3-1: Test Parameters for PHICH

Paramete	r	Unit	Cell 1	Cell 2
Uplink downlink cor	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.5.2.2.3-2	1.5
BW <sub>Channel</sub>	I	MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchronous cells)	
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	0000010001 0000000001
RLM/RRM Measureme Pattern (Note			000000001 000000001	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000010001 000000001	N/A
(Note 6) C <sub>CSI,1</sub>			1100101000 1100111000	N/A
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (Note 9)			1	N/A
PHICH dura			extended	N/A
Unused RE-s and			OCNG	OCNG
Cyclic pref	ΪX		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.2.2.3-2: Minimum performance PHICH

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Antenna Configuration and	Refere	nce Value		
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)		
1	R.19	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	0.1	4.6		
Note 1:					ell 2 are s	tatistically independ	dent.			
Note 2:	SNR correspor	nds to $\widehat{E}_{s}$	ds to $\widehat{E}_s/N_{oc2}$ of cell 1.							
Note 3:	The correlation	matrix ar	d antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.			

# 8.5.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.4-2. In Table 8.5.2.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.2.2.4-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink	configuration		1	1	1
Special subfram			4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98 (Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\widehat{E}_s/l$		dB	Reference Value in Table 8.5.2.2.4-2	5	3
BW <sub>CI</sub>	nannel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non- MBSFN
Time Offset b	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cel	l ld		0	0 126	
PDCCH	Content		UL Grant should be included with the proper information aligned with A.3.6.	N/A	N/A
ABS patter	n (Note 4)		N/A	0000000001 0000000001	0000000001
RLM/RRM Measu Pattern (			000000001 000000001	N/A	N/A
CSI Subframe	C <sub>CSI,0</sub>		000000001 000000001	N/A	N/A
Sets (Note 6) C <sub>CSI,1</sub>			1100111000 1100111000	N/A	N/A
Number of control OFDM symbols			2	Note 7	Note 7
ACK/NACK feedback mode			Multiplexing	N/A	N/A
PHICH Ng			1	N/A	N/A
PHICH o			Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic			Normal	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 8: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 9: SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.2.2.4-2: Minimum performance PHICH

Test Number	Reference Channel	OC	NG Patt	ern		ropagations (N		Antenna Configuration	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 TDD	OP.1 TDD	OP.1 TDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.7
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_s/N_{ac2}$ of Cell 1.									

### 8.5.2.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.2.2.5-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.5-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.5-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.5-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
Uplink downlink configuration	n		1	1	1		
Special subframe configuration	tion		4	4 4			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
	PHICH_RA	dB	-3	N/A	N/A		
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
$N_{oc}$ at antenna port		dBm/15kHz	-98				
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34		
BW <sub>Channel</sub>		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	6	1		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of control OFDM sy	mbols		1	1	1		
PHICH Ng (Note 1)			1	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (N	ote 2)		OCNG	OCNG	OCNG		
Time offset to cell 1		us	N/A	2	3		
Frequency offset to cell 1		Hz	N/A	200	300		
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].					

Table 8.5.2.2.5-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test	Reference	OC	NG Patt	ern	Pı	Propagation		Antenna	Refere	ence Value
Number	Channel				Cond	itions (N	ote 1)	Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	[16.2]
		FDD	FDD	FDD						
Note 1:	The propagation	n conditio	onditions for Cell 1, Cell 2 and Cell 3 are statistically independent.							
Note 2:			rix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.							
Note 3:	SNR correspond	ds to $\widehat{E}_{\mathfrak{s}}$ /	$N_{ac2}$ of C	Cell 1 as	defined ir	n clause 8	3.1.1.			

### 8.5.2.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.2.2.6-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.6-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.6-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink configuration	n		1	1	1			
Special subframe configura	tion		4	4	4			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
$N_{oc}$ at antenna port		dBm/15kHz		-98				
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34			
BW <sub>Channel</sub>		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1				
Unused RE-s and PRB-s (N	lote 2)		OCNG	OCNG	OCNG			
Time offset to cell 1	•	us	N/A	2	3			
Frequency offset to cell 1		Hz	N/A	200	300			
Note 1: According to Cla			not include control	rogion PEo				

Table 8.5.2.2.6-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test	Reference	OC	NG Patt	ern	Pı	Propagation		Antenna	Refere	ence Value
Number	Channel				Cond	itions (N	ote 1)	Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	[16.2]
		FDD	FDD	FDD						
Note 1:	The propagation	n conditio	onditions for Cell 1, Cell 2 and Cell 3 are statistically independent.							
Note 2:			rix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.							
Note 3:	SNR correspond	ds to $\widehat{E}_{\mathfrak{s}}$ /	$N_{ac2}$ of C	Cell 1 as	defined ir	n clause 8	3.1.1.			

# 8.5.2.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.2.2.7-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.7-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.7-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.7-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink configuration	n		1	1	1			
Special subframe configuration			4	4	4			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
$N_{oc}$ at antenna port		dBm/15kHz		-98				
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34			
BW <sub>Channel</sub>		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	6	1			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1			
Unused RE-s and PRB-s (N	lote 2)		OCNG	OCNG	OCNG			
Time offset to cell 1	•	us	N/A	2	3			
Frequency offset to cell 1		Hz	N/A	200	300			
Note 1: According to Clar			not include control	region PEs				

Table 8.5.2.2.7-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test	Reference	00	NG Patt	ern	Propagation		Antenna	Reference Value		
Number	Channel				Cond	itions (N	ote 1)	Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1			and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	[14.1]
		FDD	FDD	FDD						
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.									
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									
Note 3:	SNR correspond	ds to $\widehat{E}_{arepsilon}$ /	$N_{ac2}$ of C	Cell 1 as	defined ir	n clause 8	3.1.1.			

# 8.5.2.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.2.2.8-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.8-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.8-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.8-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink configuration	n		1	1	1			
Special subframe configura	tion		4	4	4			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
$N_{oc}$ at antenna port		dBm/15kHz		-98				
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34			
BW <sub>Channel</sub>		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1			
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG			
Time offset to cell 1	us	N/A	2	3				
Frequency offset to cell 1	Hz	N/A	200	300				
Note 1: According to Clause 6.9 in TS 36.211 [4].								

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.2.2.8-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Reference Channel	OC	NG Patt	ern	Cell 1 Cell 2 Cell 3 ar		Antenna Configuration	Reference Value		
		Cell 1	Cell 2	Cell 3			and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)	
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	[15.7]
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									

## 8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the Number of transmitted MIB PDUs (Redundancy versions for the same MIB are not counted separately).

#### 8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

Parame	ter	Unit	Single antenna port	Transmit diversity
Downlink power	PBCH_RA	dB	0	-3
allocation	allocation PBCH_RB		0	-3
$N_{\it oc}$ at anter	nna port	dBm/15kHz	-98	-98
Cyclic pr	efix		Normal	Normal
Cell II	)		0	0
Note 1: as specif	fied in Table 4.2	2-2 in TS 36.211 [4	.]	
Note 2: as speci	fied in Table 4.2	?-1 in TS 36.211 [4	]	

## 8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.1-1: Minimum performance PBCH

I	Test	Bandwidth	Reference	Propagation	Antenna	Referen	nce value	
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)	
					and			
					correlation			
					Matrix			
	1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.1	

## 8.6.1.2 Transmit diversity performance

## 8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

#### 8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.2-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and		
					correlation		
l					Matrix		
	1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-3.5

# 8.6.1.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.1.2.3-1 and Table 8.6.1.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, repectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.1.2.3-1: Test Parameters for PBCH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power OCNG_RA		dB	-3	-3	-3
allocation	PBCH_RB OCNG_RB	dB	-3	-3	-3
$N_{oc}$ at ante	enna port	dBm/15kHz	-98	N/A	N/A
$\frac{\hat{E}_3}{N_{ac}}$		dB	Reference Value in Table 8.6.1.2.3-2	4	2
BW <sub>Ch</sub>	annel	MHz	1.4	1.4	1.4
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	Id		0	126	1
ABS Pattern (Note 4)			N/A	01000000 01000000 01000000 01000000 01000000	01000000 01000000 01000000 01000000 01000000
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG
Cyclic			Normal	Normal	Normal

Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.

Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.

Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.

Note 4: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Table 8.6.1.2.3-2: Minimum performance PBCH

Test	Reference	Propagation	pagation Conditions (Note 1) ell 1		Antenna Configuration	Reference Value		
Number	Channel	Cell 1			and Correlation Matrix (Note 2)	Pm-bch (%)	SNR (dB) (Note 3)	
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0	
Note 1:	The propagation	on conditions for	or Cell 1, C	Cell 2 and Cell	3 are statistically independent	i.		
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.							
Note 3:	SNR correspon	nds to $\hat{E}_s/N_o$	$_{c}$ of cell 1.					

#### 8.6.2 TDD

Table 8.6.2-1: Test Parameters for PBCH

Parame	ter	Unit	Single antenna port	Transmit diversity	
Uplink downlink o	•		1	1	
Special subframe (Note 2	•		4	4	
Downlink power	PBCH_RA	dB	0	-3	
allocation	PBCH_RB	dB	0	-3	
$N_{\it oc}$ at anter	nna port	dBm/15kHz	-98	-98	
Cyclic pr	efix		Normal	Normal	
Cell II	)		0	0	
Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4].					

## 8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.1-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and		
					correlation		
					Matrix		
ſ	1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.4

## 8.6.2.2 Transmit diversity performance

#### 8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation Matrix		
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

#### 8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.2-1: Minimum performance PBCH

	Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
ı	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and correlation		
					Matrix		
	1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-4.1

## 8.6.2.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.2.2.3-1 and Table 8.6.2.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.2.2.3-1: Test Parameters for PBCH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power	PBCH_RA OCNG_RA	dB	-3	-3	-3
allocation	PBCH_RB OCNG_RB	dB	-3	-3	-3
$N_{oc}$ at ante	enna port	dBm/15kHz	-98	N/A	N/A
$\frac{\widehat{E}_s}{N_{oc}}$		dB	Reference Value in Table 4 8.6.2.2.3-2		2
BW <sub>Ch</sub>	annel	MHz	1.4 1.4		1.4
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift I	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS Patterr	n (Note 4)		N/A	0000000001 0000000001	0000000001 0000000001
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG
Cyclic p	orefix		Normal	Normal	Normal

Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.

Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.

Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.

Note 4: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Table 8.6.2.2.3-2: Minimum performance PBCH

Test	Reference	Propagation	n Conditio	ons (Note 1)	Antenna Configuration	Reference Value				
Number	Channel	Cell 1	Cell 1 Cell 2 Cell 3		and Correlation Matrix	Pm-bch	SNR (dB) (Note			
					(Note 2)	(%)	3)			
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0			
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.									
Note 2:	The correlation	n matrix and ar	ntenna con	figuration appl	y for Cell 1, Cell 2 and Cell 3					

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of cell 1.

## 8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available.

Test case is selected according to table 8.7-1 depending on UE capability for CA and EPDCCH.

Single carrier UE Single carrier UE CA UE not **CA UE supporting** not supporting supporting supporting **EPDCCH EPDCCH EPDCCH EPDCCH FDD** 8.7.1 8.7.1 8.7.3 8.7.1, 8.7.3 **TDD** 8.7.4 8.7.2, 8.7.4 8.7.2 8.7.2

Table 8.7-1: SDR test applicability

## 8.7.1 FDD (single carrier and CA)

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

Parameter	Unit	Value				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ processes per component carrier	Processes	8				
Maximum number of HARQ transmission		4				
Redundancy version coding sequence		{0,0,1,2} for 64QAM and 256QAM				
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1				
Cross carrier scheduling		Not configured				
Propagation condition		Static propagation condition No external noise sources are applied				

Table 8.7.1-1: Common Test Parameters (FDD)

For UE not supporting 256QAM, the requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.1-6, with the addition of the parameters in Table 8.7.1-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-7, the TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.1-3 is not applicable.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.1-2: test parameters for sustained downlink data rate (FDD 64QAM)

Test	Bandwidth	Transmission	Antenna	Codebook subset		nlink p		$\hat{E}_{\scriptscriptstyle s}$ at	Symbols for
1631	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3A	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3B, 4A	2x10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6A	2x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6B	10+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6C	10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6D	15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6E	2x15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6F	15+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6G	20+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7	3x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7A	15+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7B	10+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7C	15+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7D	10+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7E	10+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7F	10+15+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7G	5+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7H	5+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8	4x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8A	20+20+20+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8B	20+20+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
9	5x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD

NOTE 1: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK for Test 1-6E, and PUCCH format 3 is used to feedback ACK/NACK for Test 7-7G.

Table 8.7.1-3: Minimum requirement (FDD 64QAM)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value		
	block received within a TTI		TB success rate [%]		
11	10296	R.31-1 FDD	95		
2	25456	R.31-2 FDD	95		
3	51024	R.31-3 FDD	95		
3A	36696 (Note 2)	R.31-3A FDD	85		
3B	25456	R.31-2 FDD	95		
3C	51024	R.31-3C FDD	85		
4	75376 (Note 3)	R.31-4 FDD	85		
4A	36696 (Note 2)	R.31-3A FDD	85		
4B	55056 (Note 5)	R.31-4B FDD	85		
6	75376 (Note 3)	R.31-4 FDD	85		
6A	75376 (Note 3)	R.31-4 FDD	85		
6B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC			
6C	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
6D	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
6E	55056 (Note 5) for two 15MHz CCs	R.31-4B FDD for two 15MHz CCs	85		
6F	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85		
	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC			
6G	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	85		
	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC			
7	75376 (Note 3)	R.31-4 FDD	85		
7A	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7C	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7D	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC			
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7E	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7F	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC			
7G	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85		
	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC			
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
7H	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85		
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC			
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
8	75376 (Note 3)	R.31-4 FDD	85		
8A	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
8B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85		
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC			
9	75376 (Note 3)	R.31-4 FDD	85		

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: 35160 bits for sub-frame 5.

Note 3: 71112 bits for sub-frame 5.

Note 4: The TB success rate is defined as TB success rate =  $100\%*N_{DL\_correct\_rx}/(N_{DL\_newtx} + N_{DL\_retx})$ , where  $N_{DL\_newtx}$  is the number of newly transmitted DL transport blocks,  $N_{DL\_retx}$  is the number of retransmitted DL transport blocks, and  $N_{DL\_correct\_rx}$  is the number of correctly received DL transport blocks.

Note 5: 52752bits for sub-frame 5. Note 6: 15840bits for sub-frame 0.

Table 8.7.1-4: Test points for sustained data rate (FRC 64QAM)

CA config	Maximum supported Bandwidth/ Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,7	Cat. 9,10	Cat 11, 12 DL Cat. 11,12	DL Cat. 15
<u> </u>	10	1	2	3A	3A	-	-	-	-
Single	15	-	-	3C	4B	-	-	-	-
carrier	20	-	-	3	4	6	-	-	-
	10+10	-	-	3B	4A	4A	4A	-	-
	10+15	-	-	3B	4A	6B	6B	-	-
	10+20	-	-	3B	4A	6C	6C	-	-
CA	15+15	-	-	3B	4A	6E	6E	-	-
with	15+5			3B	4A	6F	6F	-	-
2CCs	20+5	-	-	3	4	6G	6G	-	-
	15+20	-	-	3B	4A	6D	6D	-	-
	20+20	-	-	3B or 3 (Note 4)	4A or 4 (Note 4)	6A	6A	-	-
	3x20	-	-	-	-	6A	7	7	-
	15+20+20	-	-	-	-	6A	7A	7A	-
	10+20+20	-	-	-	-	6A	7B	7B	-
CA	15+15+20					6D	7C	7C	-
with	10+15+20	-	-	-	-	6D	7D	7D	-
3CCs	10+10+20	-	-	-	-	7E	7E	7E	-
	10+15+15	-	-	-	-	7F	7F	7F	-
	5+10+20	-	-	-	-	7G	7G	7G	-
	5+15+20	-	-	-	-	7H	7H	7H	-
CA	4x20	-	-	-	-	-	7	8	8
with	20+20+20+10	-	-	-	-	-	7	8A	8A
4CCs	20+20+10+10	-	-	-	-	-	8B	8B	8B
CA with 5CCs	5x20	-	-	-	-	-	-	8	9

Note 1: Void.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single carrier test is selecte, i.e., Test 3 for UE category 3 and Test 4 for UE category 4. Otherwise, Test 3B applies for category 3 UE and Test 4A applies for category 4 UE.

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Note 6: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.1-5: test parameters for sustained downlink data rate (FDD 256QAM)

Test	Bandwidth	Transmission mode	Antenna	Codebook subset		nlink p cation		$\hat{E}_{\scriptscriptstyle S}$ at	Symbols for
1621	(MHz)		configuration	restriction	$\rho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	antenna port (dBm/15kHz)	unused PRBs
1	20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
2	2x15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
2A	15+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3	10+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3A	20+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
4	10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6	15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7	2x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8	3x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
9	15+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
10	10+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
11	15+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
12	10+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
13	10+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
14	10+15+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
15	5+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
15A	5+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
16	4x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
17	20+20+20+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
18	20+20+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
19	5x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
Note 1	: For CA test of	ases, PUCCH forn	nat 3 is used to fe	edback ACK/I	NACK.				

Table 8.7.1-6: Minimum requirement (FDD 256QAM)

Test	Measurement channel	Reference value							
		TB success rate [%]							
1	R.68 FDD	85							
2	R.68-1 FDD	85							
2.4	R.68-1 FDD for 15MHz CC	85							
2A	R.68-3 FDD for 5MHz CC								
3	R.68-2 FDD for 10MHz CC	85							
3	R.68-1 FDD for 15MHz CC								
3A	R.68 FDD for 20MHz CC	85							
3A	R.68-3 FDD for 5MHz CC								
4	R.68-2 FDD for 10MHz CC	85							
4	R.68 FDD for 20MHz CC								
6	R.68-1 FDD for 15MHz CC	85							
0	R.68 FDD for 20MHz CC								
7	R.68 FDD	85							
8	R.68 FDD	85							
9	R.68-1 FDD for 15MHz CC	85							
9	R.68 FDD for 20MHz CC								
10	R.68-2 FDD for 10MHz CC	85							
10	R.68 FDD for 20MHz CC								
11	R.68-1 FDD for 15MHz CC	85							
11	R.68 FDD for 20MHz CC								
	R.68-2 FDD for 10MHz CC	85							
12	R.68-1 FDD for 15MHz CC								
	R.68 FDD for 20MHz CC								
13	R.68-2 FDD for 10MHz CC	85							
	R.68 FDD for 20MHz CC								
14	R.68-2 FDD for 10MHz CC	85							
	R.68-1 FDD for 15MHz CC								
	R.68-3 FDD for 5MHz CC	85							
15	R.68-2 FDD for 10MHz CC								
	R.68 FDD for 20MHz CC								
4=4	R.68-3 FDD for 5MHz CC	85							
15A	R.68-1 FDD for 15MHz CC								
	R.68 FDD for 20MHz CC								
16	R.68 FDD	85							
17	R.68-2 FDD for 10MHz CC	85							
	R.68 FDD for 20MHz CC								
18	R.68-2 FDD for 10MHz CC	85							
40	R.68 FDD for 20MHz CC	0.5							
19	R.68 FDD	85							
Note 1:	For 2 layer transmissions, 2 transport blo	ocks are received within a							
Nata O		TTI.							
Note 2:	The TB success rate is defined as TB su								
	100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), v								
number of newly transmitted DL transport blocks, N <sub>DL_retx</sub> is the									

number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks.

Table 8.7.1-7: Test points for sustained data rate (FRC 256QAM)

CA	Maximum supported Bandwidth/	Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.	
config	Bandwidth combination (MHz)	DL Cat. 11, 12	13	15	16	
Single carrier	20	-	1	-	-	
	2x15	2	2		-	
	15+5	2A	2A	1	-	
CA	10+15	3	3	-	-	
with	20+5	3A	3A	-	-	
2CCs	10+20	4	4	-	-	
	15+20	6	6	-	-	
	20+20	7	7	-	-	
	3x20	8	7	8	-	
	15+20+20	9	7	9	-	
	10+20+20	10	7	10	-	
CA	15+15+20	11	6	11	-	
with	10+15+20	12	6	12	-	
3CCs	10+10+20	13	13	13	-	
	10+15+15	14	14	14	-	
	5+10+20	15	15	15	-	
	5+15+20	15A	15A	15A	-	
CA	4x20	8	-	16	16	 
with	20+20+20+10	8	-	17	17	
4CCs	20+20+10+10	18	-	18	18	
CA with 5CCs	5x20	-	-	16	19	

NOTE 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

## 8.7.2 TDD (single carrier and CA)

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

**Table 8.7.2-1: Common Test Parameters (TDD)** 

Parameter	Unit	Value					
Special subframe configuration (Note 1)		4					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Maximum number of HARQ transmission		4					
Redundancy version coding sequence		{0,0,1,2} for 64QAM and 256QAM					
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1					
Cross carrier scheduling		Not configured					
Propagation condition		Static propagation condition  No external noise sources are applied					
Note 1: as specified in Table 4.2-1 in TS 36.211 [4].							

For UE not supporting 256QAM, the requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.2-6, with the addition of the parameters in Table 8.7.2-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-7. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.2-3 is not applicable.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.2-2: test parameters for sustained downlink data rate (TDD 64QAM)

Test	Bandwidth (MHz)	Transmission mode	Antenna configuration	Codebook subset		ownlin power ation (		$\hat{E}_{\scriptscriptstyle S}$ at antenna	ACK/NACK feedback	Symbols for unused
1001				restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	port (dBm/15 kHz)	mode	PRBs
1	10	1	1 x 2	N/A	0	0	0	-85	Bundling	OP.6 TDD
2	10	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD
3	20	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD
3A	15	3	2 x 2	10	-3	-3	0	-85	Muliplexing	OP.2 TDD
4,6	20	3	2 x 2	10	-3	-3	0	-85	Multiplexing	OP.1 TDD
6A	2x20	3	2 x 2	10	-3	-3	0	-85	- (Note 1)	OP.1 TDD
6B	20+15	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
7	3x20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD
7A	15+20+20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD

Note 1: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Note 2: PUCCH format 3 is used to feedback ACK/NACK.

Table 8.7.2-3: Minimum requirement (TDD 64QAM)

Test	Number of bits of a DL-SCH transport block received within	Measurement channel	Reference value TB success rate [%]
	a TTI for normal/special sub- frame		
1	10296/0	R31-1 TDD	95
2	25456/0	R31-2 TDD	95
3	51024/0	R31-3 TDD	95
3A	51024/0	R31-3A TDD	85
4	75376/0 (Note 2)	R31-4 TDD	85
6	75376/0 (Note 2)	R.31-4 TDD	85
6A	75376/0 (Note 2)	R.31-4 TDD	85
6B	55056/0 for 15MHz CC	R31-5 TDD for 15MHz CC	85
	75376/0 for 20MHz CC (Note 2)	R.31-4 TDD for 20MHz CC	
7	75376/0 (Note 2)	R.31-4 TDD	85
7A	55056/0 for 15MHz CC 75376/0 for 20MHz CC (Note 2)	R.31-5 TDD for 15MHz CC R.31-4 TDD for 20MHz CC	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: 71112 bits for sub-frame 5.

Note 3: The TB success rate is defined as TB success rate =  $100\%*N_{DL\_correct\_rx}/(N_{DL\_newtx} + N_{DL\_retx})$ , where  $N_{DL\_newtx}$  is the number of newly transmitted DL transport blocks,  $N_{DL\_retx}$  is the number of retransmitted DL transport blocks, and  $N_{DL\_correct\_rx}$  is the number of correctly received DL transport blocks.

Table 8.7.2-4: Test points for sustained data rate (FRC 64QAM)

CA config	Bandwidth/ Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,7	Cat. 9, 10	Cat. 11, 12 DL Cat. 11, 12	DL Cat. 15
Cinala	10	1	2	-	-	ı	-	-	-
Single	15	-	-	3A	3A	-	-	-	-
carrier	20	-	-	3	4	6	-	-	-
CA with	20+20	-		3(Note 4)	4 (Note 4)	6A	6A	-	-
2CCs	15+20	-	-	3(Note 4)	4 (Note 4)	6B	6B	-	-
CA with 3	3x20	-	-	-	-	6A	7	7	-
CCs	15+20+20	-	-	-	-	6A	7A	7A	-

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category.

Otherwise, select the test point according to the UE category signalled.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, single carrier

test is selected.

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in

8.1.2.3.

Table 8.7.2-5: test parameters for sustained downlink data rate (TDD 256QAM)

Test	Bandwidth Transmission Antenna		Codebook subset	Downlink power allocation (dB)			$\hat{E}_{\scriptscriptstyle s}$ at antenna	ACK/NACK feedback	Symbols for unused	
1000	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	port (dBm/15 kHz)	mode	PRBs
1	20	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD
2	15+20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
3	2x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
4	3x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
5	15+20+20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
Note 1	1: For CA to	est cases, PUCCI	I format 3 is used	to feedback	ACK/N	IACK.	·	•	•	

Table 8.7.2-6: Minimum requirement (TDD 256QAM)

Test	Measurement channel	Reference value
		TB success rate [%]
1	R.68 TDD	85
2	R.68-1 TDD for 15MHz CC R.68 TDD for 20MHz CC	85
3	R.68 TDD	85
4	R.68 TDD	85
5	R.68-1 TDD for 15MHz CC R.68 TDD for 20MHz CC	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: The TB success rate is defined as TB success rate =  $100\%*N_{DL\_correct\_rx}/(N_{DL\_newtx} + N_{DL\_retx})$ , where  $N_{DL\_newtx}$  is the number of newly transmitted DL transport blocks,  $N_{DL\_retx}$  is the number of retransmitted DL transport blocks, and  $N_{DL\_correct\_rx}$  is the number of correctly received DL transport blocks.

Table 8.7.2-7: Test points for sustained data rate (FRC 256QAM)

CA config	Bandwidth/ Bandwidth combination (MHz)	Cat. 11, 12 DL Cat. 11, 12	DL Cat. 13	DL Cat. 15	DL Cat. 16	
Single carrier	20	-	1	-	-	
CA with	15+20	2	2	-	-	
2CCs	2x20	3	3	-	ı	
CA with 3	3x20	4	3	4	ı	
CCs	15+20+20	5	3	5	ı	

## 8.7.3 FDD (EPDCCH scheduling)

The parameters specified in Table 8.7.3-1 are valid for all FDD tests unless otherwise stated.

Table 8.7.3-1: Common test parameters (FDD)

Parameter	Unit	Value				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ						
processes per	Processes	8				
component carrier						
Maximum number of		4				
HARQ transmission		4				
Redundancy version		{0,0,1,2} for 64QAM				
coding sequence		{0,0,1,2} 101 04QAM				
Number of OFDM						
symbols for PDCCH per	OFDM symbols	1				
component carrier						
Cross carrier scheduling		Not configured				
Number of EPDCCH		1				
sets		ı				
EPDCCH transmission		Localized				
type						
Number of PRB per		2 PRB pairs				
EPDCCH set and		10MHz BW: Resource blocks n <sub>PRB</sub> = 48, 49				
EPDCCH PRB pair		15MHz BW: Resource blocks n <sub>PRB</sub> = 70, 71				
allocation		20MHz BW: Resource blocks n <sub>PRB</sub> = 98, 99				
EPDCCH Starting		Derived from CFI (i.e. default behaviour)				
Symbol						
ECCE Aggregation		2 ECCEs				
Level						
Number of EREGs per		4				
ECCE						
EPDCCH scheduling		EPDCCH candidate is randomly assigned in each subframe				
EPDCCH precoder						
(Note 1)		Fixed PMI 0				
EPDCCH monitoring SF		111111111 000000000				
pattern		111111111 000000000				
Timing advance	μs	100				
	r.··	Static propagation condition				
Propagation condition		No external noise sources are applied				
Note 1: EPDCCH precoder parameters are defined for tests with 2 x 2 antenna						
configuration						

The requirements are specified in Table 8.7.3-3, with the addition of the parameters in Table 8.7.3-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and

bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.3-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.3-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (FDD)

Test	Bandwidth	Transmission	Antenna	Antenna Codebook subset			k powe on (dB)		$\hat{E}_{\scriptscriptstyle S}$ at	Symbols for
Test	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
ЗА	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD

Table 8.7.3-3: Minimum requirement (FDD)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value
	block received within a TTI		TB success rate [%]
1	10296	R.31E-1 FDD	95
2	25456	R.31E-2 FDD	95
3	51024	R.31E-3 FDD	95
3A	36696 (Note 2)	R.31E-3A FDD	85
3C	51024	R.31E-3C FDD	85
4	75376 (Note 3)	R.31E-4 FDD	85
4B	55056 (Note 5)	R.31E-4B FDD	85
6	75376 (Note 3)	R.31E-4 FDD	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: 35160 bits for sub-frame 5.

Note 3: 71112 bits for sub-frame 5.

Note 4: The TB success rate is defined as TB success rate =  $100\%*N_{DL\_correct\_rx}/(N_{DL\_newtx} + N_{DL\_retx})$ , where  $N_{DL\_newtx}$  is the number of newly transmitted DL transport blocks,  $N_{DL\_retx}$  is the number of retransmitted DL transport

blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks.

Note 5: 52752 bits for sub-frame 5.

Table 8.7.3-4: Test points for sustained data rate (FRC)

CA config	Bandwidth (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7		
Cinalo	10	1	2	3A	3A	-	-		
Single	15	-	-	3C	4B	-	-		
carrier	20	-	-	3	4	6	6		
Note 1: T	Note 1: The test is selected for maximum supported bandwidth.								

## 8.7.4 TDD (EPDCCH scheduling)

The parameters specified in Table 8.7.4-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.4-1: Common test parameters (TDD)

Parameter	Unit	Value					
Special subframe		4					
configuration (Note 1)		·					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Maximum number of		4					
HARQ transmission		·					
Redundancy version		{0,0,1,2} for 64QAM					
coding sequence		(-,-,-,-)					
Number of OFDM	OFDM I I	_					
symbols for PDCCH per	OFDM symbols	1					
component carrier		NI-4 fi mun-d					
Cross carrier scheduling Number of EPDCCH		Not configured					
		1					
Sets							
EPDCCH transmission		Localized					
type		2 PRB pairs					
		10MHz BW: Resource blocks n <sub>PRB</sub> = 48,					
Number of PRB per		49					
EPDCCH set and		15MHz BW: Resource blocks n <sub>PRB</sub> = 70,					
EPDCCH PRB pair		71					
allocation		20MHz BW: Resource blocks n <sub>PRB</sub> = 98,					
		99					
EPDCCH Starting		Derived from CFI (i.e. default behaviour)					
Symbol		Berryou from er r (i.e. default beriaviour)					
ECCE Aggregation		2 ECCEs					
Level							
Number of EREGs per		4 for normal subframe and 8 for special					
ECCE		subframe					
EPDCCH scheduling		EPDCCH candidate is randomly assigned in each subframe					
EPDCCH precoder		in each subframe					
(Note 2)		Fixed PMI 0					
(		UL-DL configuration 1: 1101111111					
EPDCCH monitoring SF		000000000					
pattern		UL-DL configuration 5: 1100111001					
		000000000					
Timing advance	μs	100					
<u> </u>		Static propagation condition					
Propagation condition	No external noise sources are applied						
Note 1: As specified in	Table 4.2-1 in TS 36	i.211 [4].					
	Note 2: EPDCCH precoder parameters are defined for tests with 2 x 2 antenna						
configuration							

The requirements are specified in Table 8.7.4-3, with the addition of the parameters in Table 8.7.4-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.4-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.4-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (TDD)

Test	Bandwidth (MHz)	Transmission mode	Antenna configuration	Codebook subset		nlink catio			$\hat{E}_{\scriptscriptstyle s}$ at antenna port	Symbols for unused	ACK/NACK feedback
	(1411 12)	mode	Comiguration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	(dBm/15kHz)	PRBs	mode
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 TDD	Bundling
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Bundling
3	20	3	2 x 2	10	ფ	-3	0	3	-85	OP.1 TDD	Bundling
ЗА	15	3	2 x 2	10	-3	-3	0	3	-85	OP.2 TDD	Multiplexing
4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Multiplexing

Table 8.7.4-3: Minimum requirement (TDD)

Test	Number of bits of a DL-SCH	Measurement channel	Reference value
	transport block received within a TTI for normal/special sub-		TB success rate [%]
	frame		
1	10296/0	R.31E-1 TDD	95
2	25456/0	R.31E-2 TDD	95
3	51024/0	R.31E-3 TDD	95
3A	51024/0	R.31E-3A TDD	85
4	75376/0 (Note 2)	R.31E-4 TDD	85
6	75376/0 (Note 2)	R.31E-4 TDD	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: 71112 bits for sub-frame 5.

Note 3: The TB success rate is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL correct\_rx</sub> is the number of correctly received DL transport blocks.

Table 8.7.4-4: Test points for sustained data rate (FRC)

CA config	Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7			
Cinalo	10	1	2	-	-	-	-			
Single	15	-	-	3A	3A	-	-			
carrier	20	-	-	3	4	6	6			
Note 1: T	Note 1: The test is selected for maximum supported bandwidth.									

## 8.7.5 TDD FDD CA

The parameters specified in Table 8.7.5-1 are valid for all TDD FDD CA tests unless otherwise stated.

Table 8.7.5-1: Common Test Parameters (TDD FDD CA)

Parameter		Unit	Value
Uplink downlink configuration TDD CC			1
Special subframe configuration for TDD CC	ation (Note 2)		4
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0
Cyclic prefix			Normal
Cell ID			0
Inter-TTI Distan	се		1
Maximum number of HARQ processes per	FDD PCell	Processes	8 for FDD and TDD CCs
component carrier	TDD PCell	Processes	11 for FDD CC; 7 for TDD CC
Maximum number of HARO	transmission		4
Redundancy version coding sequence			{0,0,1,2} for 64QAM, 256QAM
Number of OFDM symbol per component ca		OFDM symbols	1
Cross carrier schee	duling		Not configured
Propagation cond	lition		Static propagation condition No external noise sources are applied
Transmission mo	ode		ТМЗ
Codebook subset res	striction		10
Antenna configura	ation		2 x 2
$\hat{E}_{\scriptscriptstyle s}$ at antenna port (dB	m/15kHz)		-85
Symbols for unused	I PRBs		OP.1 FDD for FDD CC, OP.1 TDD for TDD CC
ACK/NACK feedbac	k mode		PUCCH format 3
Downlink HARQ-ACK	FDD PCell		As specified in Clause 7.3.3 in TS36.213 [6]
timing	TDD PCell		As specified in Clause 7.3.4 in TS36.213 [6]

#### 8.7.5.1 Minimum Requirement FDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.1-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with the maximum aggregated bandwidth as specified in Table 8.7.5.1-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.5.1-1 is not applicable.

The applicability of the requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.1-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

Test num ber	Ban	dwidth (MH	lz)	SCH trans received w (for norm subframe	oits of a DL- port block vithin a TTI al/special e for TDD, ubframe #5)	Measureme	nt channel	Reference value
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
2	10+20	10	20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
2A	15+20	15	20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
3	10+10	10	10	36696	36696/0	R.31-3A FDD	R.31-6 TDD	85
4	3x20	20	2x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
5	15+20+20	15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
6	10+20+20	10	2x20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
7	3x20	2x20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
8	20+20+15	20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
9	20+20+10	20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
10	4x20	20	3x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
11	4x20	2×20	2×20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
12	3x20+15	20+15	2×20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
13	2×15+2x20	2×15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
14	3x20+15	2×20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15	2×15+2x20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
16	4x20+15	2x20+15	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
17	2x15+3x20	2x15+20	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85

Table 8.7.5.1-2: Test points for sustained data rate (FRC 64QAM)

CA		Maximum supported Bandwidth/ Bandwidth combination (MHz)			Cat. 2	Cat. 3	Cat. 4	Cat. 6, 7	Cat. 9,10	Cat 11, 12	DL Cat.
config	Total	FDD CC	TDD CC	Cat. 1	Cat. 2	Cat. 3	Cat. 4	DL Cat. 6, 7	DL Cat. 9, 10	DL Cat. 11, 12	15
CA	2x20	20	20	-	-	3	3	1	1	-	-
with	10+20	10	20	-	-	3	3	2	2	-	-
2CCs	15+20	15	20	-	-	3	3	2A	2A	-	-
	3x20	20	2x20	-	-	-	-	1	4	4	-
CA	15+20+20	15	2x20	-	-	-	-	2A	5	5	-
CA with	10+20+20	10	2x20	-	-	-	-	2	6	6	-
3CCs	3x20	2x20	20	•	-	-	-	1	7	7	-
3003	20+20+15	20+15	20	1	-	-	-	1	8	8	-
	20+20+10	20+10	20	-	-	-	-	1	9	9	-
	4x20	20	3x20	-	-	-	-	-	4	10	10
C A	4x20	2×20	2×20	-	-	-	-	-	4 or 7	11	11
CA with	3x20+15	20+15	2×20	-	-	-	-	-	4	12	12
4CCs	2×15+2x20	2×15	2x20	•	-	-	-	-	5	13	13
4008	3x20+15	2×20+15	20	-	-	-	-	-	7	14	14
	2×15+2x20	2x15+20	20	-	-	-	-	-	8	15	15
CA	4x20+15	2x20+15	2x20	-	-	-	-	-	•	11	16
with 5 CCs	2x15+3x20	2x15+20	2x20	-	-	-	-	-	-	12	17

Note 1: Void. Note 2: Void.

Note 3: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.5.1-3: Minimum requirement (TDD FDD CA 256QAM)

Test	Bar	ndwidth (MF	lz)	Measureme	ent channel	Reference value
number	Total	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	R.68 FDD	R.68 TDD	85
2	10+20	10	20	R.68-2 FDD	R.68 TDD	85
3	15+20	15	20	R.68-1 FDD	R.68 TDD	85
4	3x20	20	2x20	R.68 FDD	R.68 TDD	85
5	15+20+20	15	2x20	R.68-1 FDD	R.68 TDD	85
6	10+20+20	10	2x20	R.68-2 FDD	R.68TDD	85
7	3x20	2x20	20	R.68 FDD	R.68 TDD	85
8	20+20+15	20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
9	20+20+10	20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD for 10MHz CC	R.68 TDD	85
10	4x20	20	3x20	R.68-2 FDD	R.68TDD	85
11	4x20	2×20	2×20	R.68 FDD	R.68 TDD	85
12	3x20+15	20+15	2×20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R 68 TDD	85
13	2×15+2×2 0	2×15	2x20	R.68-1 FDD	R.68 TDD	85
14	3x20+15	2×20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
15	2x15+2x2 0	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
16	4x20+15	2x20+15	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
17	2x15+3x20	2x15+20	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85

Table 8.7.5.1-4: Test points for sustained data rate (FRC 256QAM)

CA	Maximum su Bandwidth	ipported Ba combinatio		Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.	
config	Total	FDD CC	TDD CC	DL Cat. 11, 12	13	15	16	
CA	2x20	20	20	1	1	-	ı	
with	10+20	10	20	2	2			
2CCs	15+20	15	20	3	3	-	ı	
	3x20	20	2x20	4	1	4	ı	
<b>Ο</b> Λ	15+20+20	15	2x20	5	3	5	-	
CA	10+20+20	10	2x20	6	2	6	-	
with 3CCs	3x20	2x20	20	7	1	7	-	
3008	20+20+15	20+15	20	8	1	8	-	
	20+20+10	20+10	20	9	1	9	-	
	4x20	20	3x20	4	-	10	10	
O 4	4x20	2×20	2×20	4 or 7	-	11	11	
CA	3x20+15	20+15	2×20	8	-	12	12	
with 4CCs	2×15+2x20	2×15	2x20	5	-	13	13	
4005	3x20+15	2×20+15	20	7	-	14	14	
	2×15+2x20	2x15+20	20	8	-	15	15	
CA	4x20+15	2x20+15	2x20	-	-	14 or 12	16	
with 5CCs	2x15+3x20	2x15+20	2x20	-	-	15 or 12	17	

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

#### 8.7.5.2 Minimum Requirement TDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with TDD PCell are specified in Table 8.7.5.2-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.2-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.2-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.2-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.5.2-1 is not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.2-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

Test num ber	Bar	ndwidth (MH	z)	SCH trans received w (for norm	oits of a DL- port block vithin a TTI al/special for TDD, ubframe #5)	5)		Referenc e value
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
2	10+20	10	20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
2A	15+20	15	20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
3	10+10	10	10	36696	36696/0	R.31-3A FDD	R.31-6 TDD	85
4	3x20	20	2x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
5	15+20+20	15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
6	10+20+20	10	2x20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
7	3x20	2x20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
8	20+20+15	20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
9	20+20+10	20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
10	4x20	20	3x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
11	4x20	2×20	2×20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
12	3x20+15	20+15	2×20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
13	2×15+2x20	2×15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
14	3x20+15	2×20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15	2×15+2x20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
16	4x20+15	2x20+15	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
17	2x15+3x20	2x15+20	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85

Table 8.7.5.2-2: Test points for sustained data rate (FRC 64QAM)

CA		Maximum supported Bandwidth/ Bandwidth combination (MHz)			Cat. 2	Cat. 3	Cat. 4	Cat. 6, 7	Cat. 9,10	Cat 11, 12	DL Cat.
config	Total	FDD CC	TDD CC	Cat. 1	Cat. 2	Cat. 3	Cat. 4	DL Cat. 6, 7	DL Cat. 9, 10	DL Cat. 11, 12	15
CA	2x20	20	20	-	-	3	3	1	1	-	-
with	10+20	10	20	-	-	3	3	2	2	-	-
2CCs	15+20	15	20	-	-	3	3	2A	2A	-	-
	3x20	20	2x20	-	-	-	-	1	4	4	-
CA	15+20+20	15	2x20	-	-	-	-	2A	5	5	-
CA with	10+20+20	10	2x20	-	-	-	-	2	6	6	-
3CCs	3x20	2x20	20	•	-	-	-	1	7	7	-
3003	20+20+15	20+15	20	1	-	-	-	1	8	8	-
	20+20+10	20+10	20	-	-	-	-	1	9	9	-
	4x20	20	3x20	-	-	-	-	-	4	10	10
C A	4x20	2×20	2×20	-	-	-	-	-	4 or 7	11	11
CA with	3x20+15	20+15	2×20	-	-	-	-	-	4	12	12
4CCs	2×15+2x20	2×15	2x20	•	-	-	-	-	5	13	13
4008	3x20+15	2×20+15	20	-	-	-	-	-	7	14	14
	2×15+2x20	2x15+20	20	-	-	-	-	-	8	15	15
CA	4x20+15	2x20+15	2x20	-	-	-	-	-	•	11	16
with 5 CCs	2x15+3x20	2x15+20	2x20	-	-	-	-	-	-	12	17

Note 1: Void. Note 2: Void.

Note 3: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.5.2-3: Minimum requirement (TDD FDD CA 256QAM)

Test	Ban	dwidth (MH	z)	Measureme	nt channel	Reference value
number	Total	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	R.68 FDD	R.68 TDD	85
2	10+20	10	20	R.68-2 FDD	R.68 TDD	85
3	15+20	15	20	R.68-1 FDD	R.68 TDD	85
4	3x20	20	2x20	R.68 FDD	R.68 TDD	85
5	15+20+20	15	2x20	R.68-1 FDD	R.68 TDD	85
6	10+20+20	10	2x20	R.68-2 FDD	R.68TDD	85
7	3x20	2x20	20	R.68 FDD	R.68 TDD	85
8	20+20+15	20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
9	20+20+10	20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD for 10MHz CC	R.68 TDD	85
10	4x20	20	3x20	R.68-2 FDD	R.68TDD	85
11	4x20	2×20	2×20	R.68 FDD	R.68 TDD	85
12	3x20+15	20+15	2×20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
13	2×15+2x20	2×15	2x20	R.68-1 FDD	R.68 TDD	85
14	3x20+15	2×20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
15	2×15+2x20	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
16	4x20+15	2x20+15	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
17	2x15+3x20	2x15+20	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85

Table 8.7.5.2-4: Test points for sustained data rate (FRC 256QAM)

CA		upported Ba		Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.	
config	Total	FDD CC	TDD CC	DL Cat. 11, 12	13	15	16	
CA	2x20	20	20	1	1	-	-	
with	10+20	10	20	2	2			
2CCs	15+20	15	20	3	3	-	-	
	3x20	20	2x20	4	1	4	-	
	15+20+20	15	2x20	5	3	5	-	
CA	10+20+20	10	2x20	6	2	6	-	
with 3CCs	3x20	2x20	20	7	1	7	-	
3008	20+20+15	20+15	20	8	1	8	-	
	20+20+10	20+10	20	9	1	9	-	
	4x20	20	3x20	4	-	10	10	
	4x20	2×20	2×20	4 or 7	-	11	11	
CA with	3x20+15	20+15	2×20	8	-	12	12	
4CCs	2×15+2x20	2×15	2x20	5	-	13	13	
4008	3x20+15	2×20+15	20	7	-	14	14	
	2×15+2x20	2x15+20	20	8	-	15	15	
CA	4x20+15	2x20+15	2x20	-	-	14 or 12	16	
with 5CCs	2x15+3x20	2x15+20	2x20	-	-	15 or 12	17	

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

## 8.7.6 FDD (DC)

The parameters specified in Table 8.7.6-1 are valid for all FDD DC tests unless otherwise stated.

Table 8.7.6-1: Common Test Parameters (FDD)

Para	meter	Unit	Value
Cyclic	prefix		Normal
Cel	I ID		0
Inter-TTI	Distance		1
compone	Q processes per ent carrier	Processes	8
	nber of HARQ nission		4
Redundancy version	n coding sequence		{0,0,1,2} for 64QAM and 256QAM
	symbols for PDCCH nent carrier	OFDM symbols	1
Cross carrie	r scheduling		Not configured
Propagatio	n condition		Static propagation condition No external noise sources are applied
Transmiss	sion mode		ТМ3
Codebook sul	oset restriction		10
Antenna co	onfiguration		2x2
$\hat{E}_{\scriptscriptstyle s}$ at antenna p	ort (dBm/15kHz)		-85
Symbols for t	unused PRBs		OP.1 FDD
ACK/NACK fe	edback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG
Time offset between MCG CC and SCG CC		μs	0 for UE under test supporting synchronous dual connectivity; 500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0 ity are defined in TS36.300 [11].

If the UE supports both SCG bearer and Split bearer, the Split bearer is configured. Note 2:

For UE not supporting 256QAM, the requirements are specified in Table 8.7.6-2, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.6-3. The TB success rate across CGs shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.6-4, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.6-5. The TB success rate across CGs shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.6-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.6-2: Minimum requirement (DC 64QAM)

Test number	Bandwidth combination (MHz)	Number of bits of a DL-SCH transport block received	Measurement channel		rence value ccess rate(%		
		within a TTI		DRB type of Split bearer		oe of SCG (Note 3)	
				(Note 2)	MCG	SCG	
1	2x10	25456	R.31-2 FDD	95	95	95	
2	2x10	36696 (Note 4)	R.31-3A FDD	85	85	85	
3	10+20	36696 (Note 4) for 10MHz CC 75376 (Note 5) for 20MHz CC	R.31-3A FDD for 10MHz CC R.31-4 FDD for 20MHz CC	85	85	85	
4	2x15	55056 (Note 6)	R.31-4B FDD	85	85	85	
5	15+20	55056 for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85	
6	2x20	75376 (Note 5)	R.31-4 FDD	85	85	85	
7	15+5	55056 for 15MHz CC 18336 for 5MHz CC	R.31-5 FDD for 15MHz CC R.31-6 FDD for 5MHz CC	85	85	85	
8	15+20+20	55056 for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85	
9	15+15+20	55056for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85	

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks , N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Note 4: 35160 bits for sub-frame 5. Note 5: 71112 bits for sub-frame 5. Note 6: 52752 bits for sub-frame 5.

Table 8.7.6-3: Test points for sustained data rate (FRC DC 64QAM)

DC	Maximum supported	Cat. 3 Cat. 4 Cat. 6		Cat 6 7	Cat 0 40	Cat. 11, 12	
config	Bandwidth combination (MHz)	Cat. 3	Cat. 4	Cat. 6, 7	Cat. 9, 10	DL Cat. 11,12	
	2x10	1	2	2	2	-	
	10+20	1	2	3	3	-	
DC with	2x15	1	2	4	4	-	
2CCs	15+20	1	2	5	5	-	
	2x20	1	2	6	6	-	
	15+5	7	7	7	7	-	
DC with	15+20+20	-	-	8	8	8	
DC with 3 CCs	15+15+20	-	-	9	9	9	
3 008		-	-				

Table 8.7.6-4: Minimum requirement (DC 256QAM)

Test number	Bandwidth combination (MHz)	Measurement channel	Reference value TB success rate (%)					
			DRB type of Split bearer		e of SCG (Note 3)			
			(Note 2)	MCG	SCG			
1	2x10	R.68-2 FDD	85	85	85			
2	10+20	R.68-2 FDD for 10MHz CC R.68 FDD for 20MHz CC	85	85	85			
3	2x15	R.68-1 FDD	85	85	85			
4	15+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85			
5	2x20	R.68 FDD	85	85	85			
6	15+5	R.68-1 FDD for 15MHz CC R.68-3 FDD for 5MHz CC	85	85	85			
7	15+20+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85			
8	15+15+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85			
Note 1: Note 2:	For 2 layer transmissions, 2 transport blocks are received within a TTI.  For the configuration of DRB type of Split bearer, the TB success rate across CGs is							

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks , N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_certx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Table 8.7.6-5: Test points for sustained data rate (FRC DC 256QAM)

DC	Maximum supported	Cat. 11, 12	DL Cat.		
config	Bandwidth combination (MHz)	DL Cat. 11,12	13		
	2x10	1	1		
	10+20	2	2		
DC with	2x15	3	3		
2CCs	15+20	4	4		
	2x20	5	5		
	15+5	6	6		
DC with	15+20+20	7	5		
3CCs	15+15+20	8	4		

#### 8.7.7 TDD (DC)

The parameters specified in Table 8.7.7-1 are valid for all TDD DC tests unless otherwise stated.

Table 8.7.7-1: Common Test Parameters (TDD)

Para	meter	Unit	Value						
Uplink downlir	nk configuration		2 (Note 2)						
Special subfra	me configuration		4						
Cyclic	c prefix		Normal						
Ce	ell ID		0						
Inter-TT	I Distance		1						
	RQ processes per ent carrier	Processes	7						
Maximum number o	of HARQ transmission		4						
Redundancy version	on coding sequence		{0,0,1,2} for 64QAM and 256QAM						
	symbols for PDCCH onent carrier	OFDM symbols	1						
Cross carrie	er scheduling		Not configured						
Propagation	on condition		Static propagation condition  No external noise sources are applied						
Transmis	sion mode		TM3						
Codebook su	bset restriction		10						
Antenna c	onfiguration		2x2						
$\hat{E}_{\scriptscriptstyle s}$ at antenna p	oort (dBm/15kHz)		-85						
Symbols for	unused PRBs		OP.1 TDD						
ACK/NACK f	eedback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG						
	n MCG CC and SCG CC	μѕ	O for UE under test supporting synchronous dual connectivity;     500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)						
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3						
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3						
	σ	dB	0						
	Note 1: Asynchronous and synchrous dual connectivity are defined in TS36.300 [11].								

For UE not supporting 256QAM, the requirements are specified in Table 8.7.7-2, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.7-3. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.7-4, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.7-5. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.7-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Note 4: 71112 bits for sub-frame 5.

Table 8.7.7-2: Minimum requirement (DC 64QAM)

Test number	Bandwidth combinatio n (MHz)	Number of bits of a DL-SCH transport block received within	Measurement channel	Reference value TB success rate across CGs(%)		CGs(%)			
		a TTI		DRB type of SCG Split bearer (Note 3)					
				(Note 2)	MCG	SCG			
1	2x20	75376/0 (Note 4)	R.31-4A TDD	85	85	85			
Note 1:	For 2 layer transmissions, 2 transport blocks are received within a TTI.								
Note 2:	For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), where N <sub>DL_newtx</sub> is the number of newly transmitted DL transport blocks, N <sub>DL_retx</sub> is the number of retransmitted DL transport blocks, and N <sub>DL_correct_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.								
Note 3:	rate = 100%*N blocks, N <sub>DL_reb</sub> received DL tr transport block	uration of DRB type of SC $_{\text{DL\_correct\_rx}}$ /( $\text{N}_{\text{DL\_newtx}}$ + $\text{N}_{\text{DI}}$ , is the number of retransn ansport blocks. All the above are calculated as the subtraction, separately.	_retx), where N <sub>DL_newtx</sub> is th nitted DL transport blocks ove numbers of transmitte	ne number of newly , and N <sub>DL_correct_rx</sub> is d, retransmitted or	transmitted D the number o correctly rece	L transport of correctly ived DL			

Table 8.7.7-3: Test points for sustained data rate (FRC DC 64QAM)

DC config	Maximum supported Bandwidth combination (MHz)	Cat. 3	Cat. 4	Cat. 6, 7	Cat. 9, 10	Cat. 11, 12	
DC with 2CCs	2x20	-	-	1	1	-	

Table 8.7.7-4: Minimum requirement (DC 256QAM)

Test number	Bandwidth combination (MHz)	Measurement channel	Reference value TB success rate (%)		
			DRB type of SCC Split bearer (Note 3)		
			(Note 2)	MCG	SCG
1	2x20	R.68-3 TDD	85	85	85
Note 1: Note 2: Note 3:	For the configured defined as TB s is the number of retransmitted DL transport blockers of the configured fined as TB s is the number of retransmitted DL transport blockers of the configured fined as TB s is the number of retransmitted DL transport bloreceived DL transpo	asmissions, 2 transport blocks a ration of DRB type of Split bear success rate = 100%*N <sub>DL_correct_</sub> of newly transmitted DL transport blocks, and N <sub>DL_correct_</sub> ocks. All the above numbers of ansport blocks are calculated as es across all the CGs used for I ration of DRB type of SCG bear success rate = 100%*N <sub>DL_correct_</sub> of newly transmitted DL transport blocks, and N <sub>DL_correct_</sub> ocks. All the above numbers of ansport blocks are calculated as es per CG used for DC transmises per CG used for DC transmises.	er, the TB success rx/ (NDL_newtx + NDL rt blocks, NDL_retx is pect_rx is the number transmitted, retrar the sum of the nu DC transmission o rer, the TB succes rx/ (NDL_newtx + NDL rt blocks, NDL_retx is pect_rx is the number transmitted, retrar the sum of the nu	s rate across  [retx], where I  is the number of correctly in is mitted or combers of DL is reception. Is rate across [retx], where I  is the number of correctly in is mitted or combers of DL is mitted or combers of DL	NDL_newtx of received correctly s CGs is NDL_newtx of received correctly

Table 8.7.7-5: Test points for sustained data rate (FRC DC 256QAM)

DC	Maximum supported	Cat. 11, 12	DL Cat. 13		
config	Bandwidth combination (MHz)	DL Cat. 11, 12	DE Gat. 13		
DC with 2CCs	2x20	1	1		

## 8.7.8 TDD FDD (DC)

The parameters specified in Table 8.7.8-1 are valid for all TDD FDD DC tests unless otherwise stated.

Table 8.7.8-1: Common Test Parameters (TDD FDD DC)

	meter	Unit	Value					
(	onfiguration for TDD CC		2 (Note 2)					
I	configuration for TDD CC		4					
Cycli	c prefix		Normal					
Ce	ell ID		0					
Inter-TT	I Distance		1					
	RQ processes per ent carrier	Processes	8 for FDD CC; 7 for TDD CC					
Maximum number o	of HARQ transmission		4					
Redundancy versi	on coding sequence		{0,0,1,2} for 64QAM and 256QAM					
	symbols for PDCCH onent carrier	OFDM symbols	1					
Cross carrie	er scheduling		Not configured					
Propagation	on condition		Static propagation condition  No external noise sources are applied					
Transmis	sion mode		TM3					
Codebook su	bset restriction		10					
Antenna c	onfiguration		2x2					
$\hat{E}_{\scriptscriptstyle s}$ at antenna $_{\scriptscriptstyle  m I}$	oort (dBm/15kHz)		-85					
Symbols for	unused PRBs		OP.1 TDD for TDD CC; OP.1 FDD for FDD CC					
ACK/NACK f	eedback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG					
	n MCG CC and SCG CC	μѕ	0 for UE under test supporting synchronous dual connectivity; 500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)					
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3					
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3					
	σ	dB	0					
Note 1: Asynchronous and synchrous dual connectivity are defined in TS36.300 [11].  Note 2: If the UE supports both SCG bearer and Split bearer, the Split bearer is configured.								

For UE not supporting 256QAM, the requirements are specified in Table 8.7.8-2, with the addition of the parameters in Table 8.7.8-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.8-3. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.8-4, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.8-5. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.8-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.8-2: Minimum requirement (TDD FDD DC 64QAM)

			Number of bits of a DL-SCH transport block received within				Reference value TB success rate across CGs(%)			
Test num ber	Ban	a TTI (for normal/special subframe for TDD, except for subframe		Measurement channel		DRB type of Split	DRB type of SCG bearer (Note 3)			
				#5				bearer (Note 2)		
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC	FDD CC TDD CC		MCG	SCG
1	2x20	20	20	75376 (Note 4)	75376/0 (Note 4)	R.31-4 FDD	R.31-4A TDD	85	85	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Note 4: 71112 bits for sub-frame 5.

Table 8.7.8-3: Test points for sustained data rate (FRC TDD FDD DC 64QAM)

CA config	Maximum s	upported Bandwi combination (MI		Cat. 6,	Cat. 9.10	
	Total	FDD CC	TDD CC	<b>'</b>	9,10	
DC with 2CCs	2x20	20	20	1	1	

Table 8.7.8-4: Minimum requirement (TDD FDD DC 256QAM)

Test I						Reference value TB success rate across CGs(%)		
	Band	Bandwidth (MHz)		Measurement channel		DRB type of Split	DRB type of SCG bearer (Note 3)	
	Total FDD TDD CC CC		FDD CC	TDD CC	(Note 2)	MCG	SCG	

1	2x20	20	20	R.68 FDD	R.68-3 TDD	85	85	85												
Note 1:	Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.																			
Note 2:																				
is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), where																				
N <sub>DL newtx</sub> is the number of newly transmitted DL transport blocks, N <sub>DL retx</sub> is the																				
number of retransmitted DL transport blocks, and N <sub>DL_correct_rx</sub> is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum																				
											of the numbers of DL transport blockes across all the CGs used for DC									
												transmission or reception.								
Note 3:	For th	For the configuration of DRB type of SCG bearer, the TB success rate across CGs																		
	is def	is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), where																		
		N <sub>DL newtx</sub> is the number of newly transmitted DL transport blocks, N <sub>DL retx</sub> is the																		
		number of retransmitted DL transport blocks, and N <sub>DL_correct_rx</sub> is the number of																		
		correctly received DL transport blocks. All the above numbers of transmitted,																		
	retrar	retransmitted or correctly received DL transport blocks are calculated as the sum																		
	ansmission o																			
	reception, separately.																			

Table 8.7.8-5: Test points for sustained data rate (FRC TDD FDD DC 256QAM)

CA config	Maximum su Bandwidth	ipported Ba combinatio		Cat. 11,	DL Cat. 13		
	Total	FDD CC	TDD CC	DL Cat. 11, 12			
DC	2x20	20	20	1	1		
with							
2CCs							

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

## 8.8 Demodulation of EPDCCH

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.8.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

## 8.8.1 Distributed Transmission

### 8.8.1.1 FDD

The parameters specified in Table 8.8.1.1-1 are valid for all FDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.1-1: Test Parameters for Distributed EPDCCH

Parame	Parameter						
Number of PDCCH syr	mbols	symbols	2 (Note 1)				
PHICH duration			Normal				
Unused RE-s and PRE	3-s		OCNG				
Cell ID			0				
	$ ho_{\scriptscriptstyle A}$	dB	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3				
allocation	σ	dB	0				
	δ	dB	3				
$N_{\it oc}$ at antenna port	dBm/15 kHz	-98					
Cyclic prefix		Normal					
Subframe Configuratio		Non-MBSFN					
Precoder Update Gran	PRB	1					
	-	ms	1				
Beamforming Pre-Cod	er		Annex B. 4.4				
Cell Specific Reference			Port 0 and 1				
Number of EPDCCH S	ets Configured		2 (Note 2)				
Number of PRB per EF	PDCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)				
EPDCCH Subframe M	onitoring		NA				
PDSCH TM			TM3				
DCI Format			2A				
	PCFICH. RRC signalling epdcch-StartSymbol-r11 is not						
Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.							

For the parameters specified in Table 8.8.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.1-2: Minimum performance Distributed EPDCCH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.60
2	10 MHZ	16 ECCE	R.56 FDD	OP.7 FDD	EVA70	2 x 2 Low	1	-3.20

8.8.1.1.1 Void

Table 8.8.1.1.1-1: Void

#### 8.8.1.2 TDD

The parameters specified in Table 8.8.1.2-1 are valid for all TDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.2-1: Test Parameters for Distributed EPDCCH

		Unit	Value			
f PDCCH syn	nbols	symbols	2 (Note 1)			
ıration			Normal			
E-s and PRB	-S		OCNG			
			0			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
	$ ho_{\scriptscriptstyle B}$	dB	-3			
	σ	dB	0			
	δ	dB	3			
tenna port	dBm/15 kHz	-98				
fix		Normal				
Configuration		Non-MBSFN				
Undata Grani	PRB	1				
Opuale Grani	ms	1				
		Annex B. 4.4				
		Port 0 and 1				
f EPDCCH Se		2 (Note 2)				
f PRB per EP	DCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)			
Subframe Mo	onitoring		NA			
М			TM3			
at			2A			
			0			
			1 (Note 3)			
PCFICH. RR						
Note 2: The two sets are distributed EPDCCH sets and non- overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured. Note 3: Demodulation performance is averaged over normal and						
	power  tenna port fix Configuration Update Grand ining Pre-Code ific Reference f EPDCCH So f PRB per EP Subframe Mo at DL Configurati cial Subframe The starting PCFICH. RR configured. The two sets overlapping PRB = {0, 7, EPDCCH is set for Test 2 Demodulation	power $ \begin{array}{c c} \rho_A \\ \rho_B \\ \hline \sigma \\ \hline \delta \\ \hline \end{array} $ tenna port $ \begin{array}{c c} fix \\ \hline Configuration \\ \hline Update Granularity \\ \hline ning Pre-Coder \\ \hline ific Reference Signal \\ \hline f EPDCCH Sets Configured \\ \hline f PRB per EPDCCH Set \\ \hline Subframe Monitoring \\ \hline M \\ \hline at \\ DL Configuration \\ \hline Signal \\ \hline Configuration \\ \hline C$	ration  E-s and PRB-s $\rho_{A} \qquad dB$ $\rho_{B} \qquad dB$ $\sigma \qquad dB$ $\delta \qquad dB$ tenna port  fix  Configuration  Update Granularity  ning Pre-Coder iffic Reference Signal f EPDCCH Sets Configured f PRB per EPDCCH Set  Subframe Monitoring M  at DL Configuration  The starting symbol for EPDCCH is derived PCFICH. RRC signalling epdcch-StartSymbolic Configured.  The two sets are distributed EPDCCH sets overlapping with PRB = {3, 17, 31, 45} for the PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the set of Test 2, respectively. Both sets are all Demodulation performance is averaged over			

For the parameters specified in Table 8.8.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.2-2: Minimum performance Distributed EPDCCH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation	Pm-dsg (%)	SNR (dB)
						Matrix	( /0)	(ub)
1	10 MHz	4 ECCE	R.55 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.80
2	10 MHZ	16 ECCE	R.56 TDD	OP.7 TDD	EVA70	2 x 2 Low	1	-3.10

8.8.1.2.1 Void

Table 8.8.1.2.1-1: Void

### 8.8.2 Localized Transmission with TM9

#### 8.8.2.1 FDD

The parameters specified in Table 8.8.2.1-1 are valid for all FDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.1-1: Test Parameters for Localized EPDCCH with TM9

Parame	eter	Unit	Value
Number of PDCCH syr	nbols	symbols	1 (Note 1)
EPDCCH starting sym	ool	symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRE	3-s		OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	$\sigma$	dB	-3
	δ	dB	0
$N_{oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuratio	Subframe Configuration		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
		ms	1
Beamforming Pre-Cod			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sig			Port 15 and 16
CSI-RS reference sign configuration	al resource		0
CSI reference signal su configuration I <sub>CSI-RS</sub>	ubframe		2
ZP-CSI-RS configuration	on bitmap		000001000000000
ZP-CSI-RS subframe of			2
CSI-RS			0 (11 ( 0)
Number of EPDCCH S			2 (Note 2)
EPDCCH Subframe M			111111110 1111111101 1111111011
subframePatternConfig-r11			1111110111 (Note 3)
PDSCH TM			TM9
Note 1: The starting	symbol for EPDCC	JH is signalled	with epdcch-StartSymbol-r11. However, CFI is

- Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.
- Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.
- Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.

For the parameters specified in Table 8.8.2.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.1-2: Minimum performance Localized EPDCCH with TM9

Ī	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
l	1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	12.2
ſ	2	10 MHZ	8 ECCE	R.58 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.5

8.8.2.1.1 Void

Table 8.8.2.1.1-1: Void

8.8.2.1.2 Void

Table 8.8.2.1.2-1: Void

Table 8.8.2.1.2-2: Void

Table 8.8.2.1.2-3: Void

### 8.8.2.2 TDD

The parameters specified in Table 8.8.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.2-1: Test Parameters for Localized EPDCCH with TM9

Parameter		Unit	Value
Number of PDCCH symbol	s	symbols	1 (Note 1)
EPDCCH starting symbol		symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRB-s			OCNG
Cell ID			0
$\rho$	A	dB	0
Downlink power $\rho_{i}$	В	dB	0
allocation $\sigma$		dB	-3
$\delta$		dB	0
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuration			Non-MBSFN
Precoder Update Granulari	itv	PRB	1
•	ity	ms	1
Beamforming Pre-Coder			Annex B.4.5
Cell Specific Reference Sig	gnal		Port 0 and 1
CSI-RS Reference Signal			Port 15 and 16
CSI-RS reference signal re configuration	source		0
CSI reference signal subfraction $I_{CSI-RS}$			0
ZP-CSI-RS configuration b	itmap		000001000000000
ZP-CSI-RS subframe confi	guration I <sub>ZP</sub> .		0
Number of EPDCCH Sets			2 (Note 2)
EPDCCH Subframe Monitoring pattern subframePatternConfig-r11			1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)
PDSCH TM			TM9 TM9
TDD UL/DL Configuration			0
TDD Special Subframe			1 (Note 4)

- The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. However, CFI is Note 1: set to 1.
- Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.
- EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search Note 3: space only in SFs configured by subframePatternConfig-r11. Legacy PDCCH is not scheduled.

Demodulation performance is averaged over normal and special subframe. Note 4:

For the parameters specified in Table 8.8.2.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.2.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.2-2: Minimum performance Localized EPDCCH with TM9

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference value	
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	12.8
2	10 MHZ	8 ECCE	R.58 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.0

8.8.2.2.1 Void

Table 8.8.2.2.1-1: Void

8.8.2.2.2 Void

Table 8.8.2.2.2-1: Void

Table 8.8.2.2.2: Void

Table 8.8.2.2.2-3: Void

### 8.8.3 Localized transmission with TM10 Type B quasi co-location type

#### 8.8.3.1 FDD

For the parameters specified in Table 8.8.3.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.1-2. In Table 8.8.3.1-1, transmission point 1 (TP 1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.1-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

Parameter		Unit Test 1			Test 2		
		Unit	TP 1	TP 2	TP 1	TP 2	
PHICH durati					rmal		
Downlink	$\rho_{\scriptscriptstyle A}$	dB			0		
power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	$\sigma$	dB			-3		
	δ	dB	OdP rower				
$\hat{E}_s/N_{oc}$		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.1-	Reference value in Table 8.8.3.1-2	Reference value in Table 8.8.3.1-	
$N_{oc}$ at anten	na port	dBm/ 15kH z		-	98		
Bandwidth		MHz	10	10	10	10	
Number of co	ts		2 (N	lote 1)	2 (No	ote1)	
EPDCCH-PR (setConfigld)			0	1	0	1	
PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized	
Number of PRB pair per EPDCCH-PRB-set		PRB	8	8	8	8	
	amforming model		Annex B.4.5	Annex B.4.5	Annex B.4.5	Annex B.4.5	
PDSCH transmission mode			TM10	TM10	TM10 Probability of	TM10 Probability of	
PDSCH trans	PDSCH transmission scheduling		Blanked in all the subframes	Transmit in all the subframes	occurrence of PDSCH transmission is 30% (Note 3)	occurrence of PDSCH transmission is 70% (Note 3)	
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0	
reference signal (NZPId=1)	CSI reference signal subframe configuration I <sub>CSI-RS</sub>		N/A	2	N/A	2	
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A	
reference signal (NZPId=2)	CSI reference signal subframe configuration $I_{\text{CSI-RS}}$		N/A	N/A	2	N/A	
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI-RS bitmap)	Bitma p	N/A	0000010000000 000	N/A	1000010000000 000	
signal (ZPId=1)	CSI-RS subframe configuration $I_{\text{CSI-RS}}$		N/A	2	N/A	2	
Zero power CSI	CSI-RS Configuration list (ZeroPowerCSI-RS bitmap)	Bitma p	N/A	N/A	1000010000000 000	N/A	
reference signal (ZPId=2)	CSI-RS subframe configuration $I_{\text{CSI-RS}}$		N/A	N/A	2	N/A	
PQI set 0 (Note 4)	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1	

	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1	
PQI set 1	Non-Zero power CSI RS Identity (NZPId)		N/A	N/A	2	N/A	
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	N/A	2	N/A	
Number of P	DCCH symbols	Symb ols	1 (Note 2)				
EPDCCH sta	arting position		pdsch-Start- pdsch-Start- pdsch-Start- pdsch-Start- r11=2 (Note 2) r11=2 (Note 2) r11=2 (Note 2) r11=2 (Note 3)				
Subframe co	nfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time offset between TPs		μs	N/A	2	N/A	2	
Frequency shift between TPs		Hz	N/A	200	N/A	200	
Cell ID			0	126	0	126	

- Note 1: Resource blocks n<sub>PRB</sub> =0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.
- Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11.

  And CFI is set to 1.
- Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.
- Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.

Table 8.8.3.1-2: Minimum Performance

Test	Aggregation	Reference OCNG		Propagation	Antenna	Reference value	
number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4
2	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4

#### 8.8.3.2 TDD

For the parameters specified in Table 8.8.3.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.2-2. In Table 8.8.3.2-1, transmission point 1 (TP1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.2-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

Parameter		1111	Te	Test 1		Test 2		
		Unit	TP 1	TP 2	TP 1	TP 2		
PHICH durati					rmal			
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0			
power	$ ho_{\scriptscriptstyle B}$	dB			0			
allocation	σ	dB			-3			
	δ	dB	0.15		0	Г		
$\hat{E}_s/N_{oc}$	$\hat{E}_s/N_{oc}$		0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.2-2	Reference value in Table 8.8.3.2-2	Reference value in Table 8.8.3.2-2		
$N_{\it oc}$ at antenna port		dBm/ 15kH z		-	98			
Bandwidth		MHz	10	10	10	10		
Number of El			2 (N	ote 1)	2 (No	ote1)		
EPDCCH-PR (setConfigld)			0	1	0	1		
PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized		
Number of PRB pair per EPDCCH-PRB-set		PRB	8	8	8	8		
EPDCCH beamforming model PDSCH transmission mode			Annex B.4.5 TM10	Annex B.4.5 TM10	Annex B.4.5 TM10	Annex B.4.5 TM10		
PDSCH transmission mode  PDSCH transmission scheduling			Blanked in all the subframes	Transmit in all the subframes	Probability of occurrence of PDSCH transmission is 30% (Note 3)	Probability of occurrence of PDSCH transmission is 70% (Note 3)		
	CSI reference signal configurations		Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16		
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0		
reference signal (NZPId=1)	CSI reference signal subframe configuration $I_{\text{CSI-RS}}$		N/A	0	N/A	0		
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A		
reference signal (NZPId=2)	CSI reference signal subframe configuration $I_{\text{CSI-RS}}$		N/A	N/A	0	N/A		
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	0000010000000 000	N/A	1000010000000		
signal (ZPId=1)	CSI-RS subframe configuration $I_{\text{CSI-RS}}$		N/A	0	N/A	0		
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	N/A	1000010000000	N/A		
signal (ZPId=2)	CSI-RS subframe configuration I <sub>CSI-RS</sub>		N/A	N/A	0	N/A		

PQI set 0	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1	
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1	
PQI set 1	Non-Zero power CSI RS Identity (NZPId)		N/A	N/A	2	N/A	
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	N/A	2	N/A	
Number of F	PDCCH symbols	Symb ols	1 (Note 2)				
EPDCCH sta	arting position		pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	
Subframe co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time offset b	Time offset between TPs		N/A	2	N/A	2	
Frequency shift between TPs		Hz	N/A	200	N/A	200	
Cell ID			0	126	0	126	
TDD UL/DL	configuration		0				
TDD special	subframe		1				
Note 1: Resource blocks none = 0.7.14.21.28.35.42.49 are allocated for both the first set and the second set							

- Note 1: Resource blocks  $n_{PRB} = 0, 7, 14, 21, 28, 35, 42, 49$  are allocated for both the first set and the second set.
- Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11.

  And CFI is set to 1.
- Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.
- Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.

Table 8.8.3.2-2: Minimum Performance

Test	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6
2	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6

# 8.8.4 Enhanced Downlink Control Channel Performance Requirements Type A - Localized Transmission with CRS Interference Model

#### 8.8.4.1 FDD

For the parameters specified in Table 8.8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.4.1-2. The purpose of this test is to verify the localized EPDCCH performance, when the EPDCCH transmission in the serving cell is interfered by the CRS of the interfering cells, applying the CRS interference model defined in clause B.6.5. In Table 8.8.4.1-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical setup is in accordance with Annex C.3.2.for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.4.1-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols		symbols	1 (Note 1)	2	2
EPDCCH starting symbol		symbols	2 (Note 1)	N/A	N/A
PHICH duration			Normal	Normal	Normal
Unused RE-s and PRB-s			OCNG	N/A	N/A
Cell ID			0	1	6
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3
·	σ	dB	-3	0	0
	δ	dB	0	0	0
Cell-specific reference signals	3		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN
		PRB	1	N/A	N/A
EPDCCH Precoder Update G	ranularity	ms	1	N/A	N/A
EPDCCH Beamforming Pre-0		Annex B. 4.5	N/A	N/A	
CSI-RS Reference Signal			Port 15 and 16	N/A	N/A
CSI-RS reference signal reso configuration	urce		0	N/A	N/A
CSI reference signal subfram configuration I <sub>CSI-RS</sub>	е		2	N/A	N/A
ZP-CSI-RS configuration bitm	ар		000001000000 0000	N/A	N/A
ZP-CSI-RS subframe configu	ration I <sub>ZP-CSI-</sub>		2	N/A	N/A
Number of EPDCCH Sets			1	N/A	N/A
EPDCCH Set type			Localized	N/A	N/A
Number of PRB per EPDCCH	l Set		8	N/A	N/A
EPDCCH Set PRBs			0, 7, 14, 21, 28, 35, 42, 49	N/A	N/A
EPDCCH Subframe Monitoring (Note 2)			N/A	N/A	N/A
PDSCH TM	,		TM9	N/A	N/A
DCI Format			2C	N/A	N/A
Interference model			N/A	As specified in clause B.6.5	As specified in clause B.6.5
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1	Hz	N/A	200	300	
Note 1: The starting symbol	I for EDDCCL				

Note 1: The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. CFI is set to 1.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Table 8.8.4.1-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EPA5	2 x 2 Low	1	[13.7]

#### 8.8.4.2 TDD

For the parameters specified in Table 8.8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.4.2-2. The purpose of this test is to verify the localized EPDCCH performance, when the EPDCCH transmission in the serving cell is interfered by the CRS of the interfering cells, applying the CRS interference model defined in clause B.6.5. In Table 8.8.4.2-1, Cell 1 is the serving cell, and Cell 2, 3

are interfering cells. The downlink physical setup is in accordance with Annex C.3.2.for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.4.2-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
Number of PDCCH symbols		symbols	1 (Note 1)	2	2		
EPDCCH starting symbol		symbols	2 (Note 1)	N/A	N/A		
PHICH duration		_	Normal	Normal	Normal		
Unused RE-s and PRB-s			OCNG	N/A	N/A		
Cell ID			0	1	6		
	$\rho_{\scriptscriptstyle A}$	dB	0	-3	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3		
, , , , , , , , , , , , , , , , , , , ,	σ	dB	-3	0	0		
	δ	dB	0	0	0		
Cell-specific reference signals	5		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
N <sub>oc</sub> at antenna port		dBm/15kHz		-98	- ,		
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34		
BW <sub>Channel</sub>		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
EDDOOLI Day on don Hardete C		PRB	1	N/A	N/A		
EPDCCH Precoder Update G	EPDCCH Precoder Update Granularity		1	N/A	N/A		
EPDCCH Beamforming Pre-0		Annex B. 4.5	N/A	N/A			
CSI-RS Reference Signal		Port 15 and 16	N/A	N/A			
CSI-RS reference signal resource configuration			0	N/A	N/A		
CSI reference signal subfram configuration I <sub>CSI-RS</sub>	е		2	N/A	N/A		
ZP-CSI-RS configuration bitm			000001000000 0000	N/A	N/A		
ZP-CSI-RS subframe configu	ration I <sub>ZP-CSI-</sub>		2	N/A	N/A		
Number of EPDCCH Sets			1	N/A	N/A		
EPDCCH Set type			Localized	N/A	N/A		
Number of PRB per EPDCCH	l Set		8	N/A	N/A		
EPDCCH Set PRBs			0, 7, 14, 21, 28, 35, 42, 49	N/A	N/A		
EPDCCH Subframe Monitoring	ng (Note 2)		N/A	N/A	N/A		
PDSCH TM			TM9	N/A	N/A		
DCI Format			2C	N/A	N/A		
Interference model			N/A	As specified in clause B.6.5	As specified in clause B.6.5		
Time offset to cell 1	us	N/A	2	3			
Frequency offset to cell 1	Hz	N/A	200	300			
TDD UL/DL Configuration		1 12	0	0	0		
TDD Special Subframe			1 (Note 4)	1	1		
Note 1: The starting symbol for EPDCCH is signalled with endcch-StartSymbol-r11 CFL is set to 1							

Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. CFI is set to 1.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Note 3: Demodulation performance is averaged over normal and special subframes.

Table 8.8.4.2-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 TDD	OP.7 FDD	EPA5	2 x 2 Low	1	[14.8]

# 8.8.5 Enhanced Downlink Control Channel Performance Requirements Type A - Distributed Transmission with TM9 Interference Model

#### 8.8.5.1 TDD

For the parameters specified in Table 8.8.5.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.5.2-2. The purpose of this test is to verify the distributed EPDCCH performance when the EPDCCH transmission in the serving cell is interfered by two interfering cells and applying TM9 interference model. In Table 8.8.5.2-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical setup is in accordance with Annex C.3.2.for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.4.1-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols		symbols	2 (Note 1)	2	2
PHICH duration			Normal	Normal	Normal
Cell ID			0	6	1
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
Downlink power allocation	σ	dB	0	0	0
	δ	dB	3	3	3
Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz		-98	
$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix	Cyclic Prefix			Normal	Normal
Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
EDDCCH propoder Undete Cr	on dority	PRB	1	N/A	N/A
EPDCCH precoder Update Gr	anulanty	ms	1	N/A	N/A
Beamforming Pre-Coder			Annex B. 4.4	N/A	N/A
Number of EPDCCH Sets Cor	nfigured		1	N/A	N/A
EPDCCH Set type			Distributed	N/A	N/A
Number of PRB per EPDCCH	Set		4	N/A	N/A
EPDCCH Set PRBs			3, 17, 31, 45	N/A	N/A
EPDCCH Subframe Monitoring	g (Note 2)		NA	N/A	N/A
PDSCH TM			TM9	N/A	N/A
DCI Format			2C	N/A	N/A
Interference model			N/A	As specified in clause B.5.4	As specified in clause B.5.4
Probability of occurrence of PDSCH transmission rank in	Rank 1	%	N/A	70	70
interfering cells  Rank 2		%	N/A	30	30
PDSCH precoder update granularity		PRB	N/A	50	50
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1	Hz	N/A	200	300	
TDD UL/DL Configuration		0	0	0	
TDD Special Subframe				1	1
TDD Special Subframe 1 (Note 3) 1 1					

Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Note 3: Demodulation performance is averaged over normal and special subframes.

Table 8.8.4.2-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55-1 TDD	OP.7 TDD	EPA5	2 x 2 Low	1	[14.3]

# 8.8.6 Enhanced Downlink Control Channel Performance Requirements Type A - Distributed Transmission with TM3 Interference Model

#### 8.8.6.1 FDD

For the parameters specified in Table 8.8.6.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.6.1-2. The purpose of this test is to verify the distributed EPDCCH performance when the serving cell EPDCCH transmission is interfered by two interfering cells applying asynchronous TM3 interference model. In Table 8.8.6.1-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical setup is in accordance with Annex C.3.2.for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.8.6.1-1: Test Parameters for EPDCCH

$ \begin{array}{ c c c c c } \hline Number of PDCCH symbols & symbols & 2 (Note 1) & 2 & 2 \\ \hline PHICH duration & Normal & Normal & Normal & O & 1 & 6 \\ \hline Cell ID & & & & & & & & & & & & & & & & & & $	Parameter		Unit	Cell 1	Cell 2	Cell 3
$ \begin{array}{ c c c c } \hline \text{PHICH duration} & \text{Normal} & \text{Normal} & \text{Normal} \\ \hline \text{Cell ID} & & & & & & & & & & & & & & & & & & &$	Number of PDCCH symbols		symbols	2 (Note 1)	2	2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				Normal	Normal	Normal
$\begin{array}{ c c c c c c } \hline Downlink power allocation & dB & -3 & -3 & -3 \\ \hline \sigma & dB & 0 & 0 & 0 \\ \hline \delta & dB & 3 & 0 & 0 \\ \hline \hline \delta & dB & 3 & 0 & 0 \\ \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline \hline \hline \hline $\delta$ & dB & 3 & 0 & 0 \\ \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline$	Cell ID			0	1	6
$ \begin{array}{ c c c c c c } \hline Downlink power allocation & \sigma & dB & 0 & 0 & 0 \\ \hline & \sigma & dB & 3 & 0 & 0 & 0 \\ \hline & \delta & dB & 3 & 0 & 0 & 0 \\ \hline & \delta & dB & 3 & 0 & 0 & 0 \\ \hline \hline & Antenna ports & Antenna ports & O,1 & O,1 & O,1 \\ \hline & N_{oc} \text{ at antenna port} & dBm/15kHz & -98 \\ \hline & E_s/N_{oc} & dB & N/A & 13.91 & 3.34 \\ \hline & BW_{Channel} & MHz & 10 & 10 & 10 \\ \hline & Cyclic Prefix & Normal & Normal & Normal & Normal \\ \hline Subframe Configuration & Non-MBSFN & Non-MBSFN & Non-MBSFN & Non-MBSFN \\ \hline & PRB & 1 & N/A & N/A \\ \hline & PPB & 1 & N/A & N/A \\ \hline & Number of EPDCCH Sets Configured & 1 & N/A & N/A \\ \hline & PPDCCH Set type & Distributed & N/A & N/A \\ \hline & Rumber of PRB per EPDCCH Set & 4 & N/A & N/A \\ \hline & EPDCCH Set PRBs & 3, 17, 31, 45 & N/A & N/A \\ \hline & PDCCH Subframe Monitoring (Note 2) & NA & N/A & N/A \\ \hline & PDSCH TM & TM9 & N/A & N/A \\ \hline & PDSCH TM & TM9 & N/A & N/A \\ \hline & PDSCH Transmission rank in interfering cells & Rank 1 & N/A & N/A & 30 & 30 \\ \hline & Time offset to cell 1 & us & N/A & 330 & 667 \\ \hline \end{array}$		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
$ \begin{array}{ c c c c c c c } \hline \sigma & dB & 0 & 0 & 0 \\ \hline \hline \delta & dB & 3 & 0 & 0 \\ \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline \hline$	Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Downlink power anocation	σ	dB	0	0	0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		δ	dB	_	-	-
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cell-specific reference signals	3		•	•	
MHz	$N_{oc}$ at antenna port		dBm/15kHz		-98	
MHz	$\hat{E}_s/N_{oc}$		dB	N/A	13.91	3.34
Cyclic Prefix         Normal         Normal         Normal           Subframe Configuration         Non-MBSFN         Non-MBSFN         Non-MBSFN           EPDCCH Precoder Update Granularity         PRB         1         N/A         N/A           EPDCCH Beamforming Pre-Coder         Annex B.4.4         N/A         N/A           Number of EPDCCH Sets Configured         1         N/A         N/A           EPDCCH Set type         Distributed         N/A         N/A           Number of PRB per EPDCCH Set         4         N/A         N/A           EPDCH Set PRBs         3, 17, 31, 45         N/A         N/A           EPDCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         N/A         N/A         As specified in clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         30         30           Time offset to cell 1         us         N/A         330         667	BW <sub>Channel</sub>	MHz	10	10	10	
EPDCCH Precoder Update Granularity         PRB         1         N/A         N/A           EPDCCH Beamforming Pre-Coder         Annex B.4.4         N/A         N/A           Number of EPDCCH Sets Configured         1         N/A         N/A           EPDCCH Set type         Distributed         N/A         N/A           Number of PRB per EPDCCH Set         4         N/A         N/A           EPDCCH Set PRBs         3, 17, 31, 45         N/A         N/A           EPDCCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         Rank 1         %         N/A         70         70           PDSCH transmission rank in interfering cells         Rank 2         %         N/A         30         30           Time offset to cell 1         us         N/A         330         667				Normal	Normal	Normal
PDCCH Precoder Update Granularity   ms	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
N/A   N/A	EDDCCH Brooder Undete C	ropularity	PRB	1		N/A
Number of EPDCCH Sets Configured         1         N/A         N/A           EPDCCH Set type         Distributed         N/A         N/A           Number of PRB per EPDCCH Set         4         N/A         N/A           EPDCCH Set PRBs         3, 17, 31, 45         N/A         N/A           EPDCCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         N/A         N/A         As specified in clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         70         70           Time offset to cell 1         us         N/A         330         667	EPDCCH Piecodei Opdate G	iranulanty	ms	1	N/A	N/A
Distributed   N/A   N/A	EPDCCH Beamforming Pre-0	Coder		Annex B.4.4		
Number of PRB per EPDCCH Set         4         N/A         N/A           EPDCCH Set PRBs         3, 17, 31, 45         N/A         N/A           EPDCCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         N/A         As specified in clause B.5.2 clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         70         70           Time offset to cell 1         us         N/A         330         667	Number of EPDCCH Sets Co	nfigured		1	N/A	N/A
EPDCCH Set PRBs         3, 17, 31, 45         N/A         N/A           EPDCCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         N/A         As specified in clause B.5.2         As specified in clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         70         70           Time offset to cell 1         us         N/A         330         667	EPDCCH Set type			Distributed	N/A	N/A
EPDCCH Subframe Monitoring (Note 2)         NA         N/A         N/A           PDSCH TM         TM9         N/A         N/A           DCI Format         2C         N/A         N/A           Interference model         N/A         As specified in clause B.5.2         As specified in clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         70         70           Time offset to cell 1         us         N/A         30         30	Number of PRB per EPDCCH	l Set		4	N/A	N/A
PDSCH TM	EPDCCH Set PRBs			3, 17, 31, 45	N/A	N/A
DCI Format         2C         N/A         N/A           Interference model         N/A         As specified in clause B.5.2         As specified in clause B.5.2           Probability of occurrence of PDSCH transmission rank in interfering cells         Rank 1         %         N/A         70         70           Time offset to cell 1         us         N/A         30         30           667	<b>EPDCCH Subframe Monitoring</b>	ng (Note 2)		NA	N/A	N/A
N/A	PDSCH TM			TM9	N/A	N/A
Probability of occurrence of PDSCH transmission rank in interfering cells   Rank 2   W   N/A   30   30	DCI Format			2C		
PDSCH transmission rank in interfering cells         Rank 2         %         N/A         30         30           Time offset to cell 1         us         N/A         330         667	Interference model			N/A		
interfering cells         Rank 2         %         N/A         30         30           Time offset to cell 1         us         N/A         330         667		Rank 1	%	N/A	70	70
Time offset to cell 1 us N/A 330 667	D = 1 - 0		%	N/A	30	30
Frequency offset to cell 1 Hz N/A 0 0		us	N/A	330	667	
	Frequency offset to cell 1	Hz	N/A	0	0	

Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Table 8.8.4.1-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55-1 FDD	OP.7 FDD	EVA70	2 x 2 Low	1	[15.9]

### 8.9 Demodulation (single receiver antenna)

The SNR deifintion is given in Clause 8.1.1 where the number of receiver antennas  $N_{RX}$  assumed for the minimum performance requirement in this clause is 1.

#### 8.9.1 PDSCH

#### 8.9.1.1 FDD and half-duplex FDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

Table 8.9.1.1-1: Common Test Parameters (FDD and half-duplex FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ		
processes per	Processes	8
component carrier		
Maximum number of		4
HARQ transmission		7
Redundancy version		{0,1,2,3} for QPSK and 16QAM
coding sequence		{0,0,1,2} for 64QAM
Number of OFDM		4 for 1.4 MHz bandwidth, 3 for 3 MHz and
symbols for PDCCH per	OFDM symbols	5 MHz bandwidths,
component carrier	OFDIVI SYMBOIS	2 for 10 MHz, 15 MHz and 20 MHz
component carrier		bandwidths
Cyclic Prefix		Normal
Precoder update		Frequency domain: 1 PRG
granularity		Time domain: 1 ms for Transmission
granulanty		mode 9

#### 8.9.1.1.1 Transmit diversity performance (Cell-Specific Reference Symbols)

#### 8.9.1.1.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.1.1-2, with the addition of the parameters in Table 8.9.1.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.9.1.1.1.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		2
Note 1: $P_B = 1$ .			

Table 8.9.1.1.1.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference	value	UE DL
number	width and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	category
1	10 MHz 16QAM 1/2	R. 62 FDD	OP.1 FDD	EPA5	2x1 Low	70	9.0	0

#### 8.9.1.1.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

#### 8.9.1.1.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.2.1-2, with the addition of the parameters in Table 8.9.1.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.9.1.1.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note	2)	ms	8
Reporting inter	val	ms	8
Reporting mod	de		PUSCH 1-2
CodeBookSubsetR	estricti		001111
on bitmap			
PDSCH transmis	sion		4
mode			

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.9.1.1.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE DL
number	width and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	categor y
1	10 MHz 64QAM 1/2	R. 63 FDD	OP.1 FDD	EPA5	2x1Low	70	13.2	0

#### 8.9.1.1.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

#### 8.9.1.1.3.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.9.1.1.3.1-2 with the addition of the parameters in Table 8.9.1.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.1.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming mod	del		Annex B.4.1
Cell-specific refere signals	nce		Antenna ports 0,1
CSI reference sign	nals		Antenna ports 15,,18
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5/2
CSI reference sig configuration	nal		0
Zero-power CSI-f configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-F bitmap		Subframes / bitmap	3 / 0001000000000000
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 4)
Number of allocated resource blocks (Note 2)		PRB	6
PDSCH transmiss mode	ion		9

Note 1:  $P_{R} = 1$ .

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.9.1.1.3.1-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE DL
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	category
1	10 MHz QPSK 1/3	R. 64 FDD	OP.1 FDD	EPA5	2x1 Low	70	4.7	0

#### 8.9.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.9.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value					
Uplink downlink configuration (Note 1)		1					
Special subframe configuration (Note 2)		4					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Number of HARQ processes per component carrier	Processes	7					
Maximum number of HARQ transmission		4					
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM					
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths					
Precoder update granularity		Frequency domain: 1 PRG Time domain: 1 ms for Transmission mode 9					
ACK/NACK feedback mode		Multiplexing					
Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4].							

#### 8.9.1.2.1 Transmit diversity performance (Cell-Specific Reference Symbols)

#### 8.9.1.2.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.1.1-2, with the addition of the parameters in Table 8.9.1.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.9.1.2.1.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Multiplexing
PDSCH transmission	on mode		2
Note 1: $P_B = 1$			

Table 8.9.1.2.1.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference	value	UE DL
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	category
1	10 MHz 16QAM 1/2	R. 62 TDD	OP.1 TDD	EPA5	2x1 Low	70	8.8	0

#### 8.9.1.2.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

#### 8.9.1.2.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.2.1-2, with the addition of the parameters in Table 8.9.1.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.9.1.2.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98
Precoding granular	ity	PRB	6
PMI delay (Note 2	2)	ms	10 or 11
Reporting interva	l	ms	1 or 4 (Note 3)
Reporting mode			PUSCH 1-2
CodeBookSubsetRest bitmap	riction		001111
ACK/NACK feedback	mode		Multiplexing
PDSCH transmission	mode		4

Note 1:  $P_R = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will

alternate between 1ms and 4ms.

Table 8.9.1.2.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Tes	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE DL
numb	er	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	category
1	10 MHz 64QAM 1/2	R. 63 TDD	OP.1 TDD	EPA5	2x1 Low	70	13.1	0

#### 8.9.1.2.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

#### 8.9.1.2.3.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.9.1.2.3.1-2 with the addition of the parameters in Table 8.9.1.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.2.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter	Parameter		Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Cell-specific refere	nce		Antenna ports 0,1
CSI reference sign	nals		Antenna ports 15,,18
Beamforming mo	del		Annex B.4.1
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5/4
CSI reference sig configuration	nal		1
Zero-power CSI-l configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-F bitmap		Subframes / bitmap	4 / 0010000100000000
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98
Symbols for unus PRBs	ed		OCNG (Note 4)
Number of allocated resource blocks (Note 2)		PRB	6
Simultaneous transmission			No
PDSCH transmiss mode	sion		9

Note 1:  $P_B = 1$ .

Note 2: The modulation symbols of the signal under test are

mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.9.1.2.3.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test Bandwidth		ridth Reference	ference OCNG	Propagation	Correlation	Reference value		UE DL
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	category
1	10 MHz QPSK 1/3	R. 64 TDD	OP.1 TDD	EPA5	2x1 Low	70	4.5	0

#### 8.9.2 PHICH

#### 8.9.2.1 FDD and half-duplex FDD

#### 8.9.2.1.1 Transmit diversity performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.9.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.1.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 FDD	EPA5	2 x 1 Low	0.1	8.6

#### 8.9.2.2 TDD

#### 8.9.2.2.1 Transmit diversity performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.9.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 TDD	EPA5	2 x 1 Low	0.1	8.6

#### 8.9.3 PBCH

### 8.9.3.1 FDD and half-duplex FDD

#### 8.9.3.1.1 Transmit diversity performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.9.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.1.1-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
	number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
	1	1.4 MHz	R.22	EPA5	2 x 1 Low	1	-1.3

#### 8.9.3.2 TDD

#### 8.9.3.2.1 Transmit diversity performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.9.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	1.4 MHz	R.22	EPA5	2 x 1 Low	1	-1.7

### 8.10 Demodulation (4 receiver antenna ports)

The performance requirements specified in this clause are valid for 4Rx capable UEs.

#### 8.10.1 PDSCH

#### 8.10.1.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.10.1.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.10.1.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

### 8.10.1.1.1 Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.1-2, with the addition of the parameters in Table 8.10.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.10.1.1.1-1: Test Parameters for Transmit diversity Performance (FRC) with 4 RX Antenna Ports

Paramete	ſ	Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmission	mode		2
NOTE 1: $P_B = 1$ .			

Table 8.10.1.1.1-2: Minimum performance Transmit Diversity (FRC) with 4 RX Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	value	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.11 FDD	OP.1 FDD	EVA5	2x4 Medium correlation A, ULA	70	3.9	≥2

## 8.10.1.1.2 Open-loop spatial multiplexing performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.2-2, with the addition of the parameters in Table 8.10.1.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.2-1: Test Parameters for Large Delay CDD (FRC) with 4 RX Antenna Ports

Paramete	er	Unit	Test 1
Davinlink navian	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna por	t	dBm/15kHz	-98
PDSCH transmission	n mode		3
NOTE 1: $P_B = 1$ .			

Table 8.10.1.1.2-2: Minimum performance Large Delay CDD (FRC) with 4 RX Antenna Ports

	Bandwidt B			Brono	Correlation	Reference value		UE
Test num	h and MCS	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	cate
1	10 MHz 16QAM 1/2	R.11 FDD	OP.1 FDD	EVA70	2x4 Low	70	8.0	≥2

8.10.1.1.3 Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.3-2, with the addition of the parameters in Table 8.10.1.1.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.10.1.1.3-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.1.3-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4 RX Antenna Ports

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	0
Cell-specific reference sign	gnals		Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BW <sub>Channel</sub>		MHz	10	10
Cell Id			0	1
PDSCH transmission mo	de		6	4
Interference model			N/A	As specified in clause B.5.3
Probability of	Rank 1	%	N/A	80
occurrence of transmission rank in interfering cells	Rank 2	%	N/A	20
Precoding granularity		PRB	50	6
PMI delay (Note 4)		ms	8	N/A
Reporting interval		ms	5	N/A
Reporting mode			PUCCH 1-1	N/A
CodeBookSubsetRestric	tion bitmap		1111	N/A

Note 1:  $P_R = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{\alpha c}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Table 8.10.1.1.3-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4 RX Antenna Ports

Test Number	Reference Channel		NG tern		gation itions	Correlation Reference Valu  Matrix and		/alue	UE Cate
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configuration (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 FDD 16QAM	OP.1 FDD	N/A	EVA5	EVA5	2x4 Low	70	-2.3	≥1
Note 1:						e statistically inde			
Note 2:	Note 2: SINR corresponds to $\widehat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.								
Note 3:	Correlation ma	trix and a	antenna d	configurat	tion parai	meters apply for e	ach of Cell 1 and Ce	ell 2.	

### 8.10.1.1.4 Closed-loop spatial multiplexing performance, Dual-Layer Spatial Multiplexing 4 Tx Antenna Port (Cell-Specific Reference Symbols)

For single carrier, the requirements are specified in Table 8.10.1.1.4-2, with the addition of the parameters in Table 8.10.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.4-1: Test Parameters for Dual-Layer Spatial Multiplexing (FRC) with 4 RX Antenna Ports

Parameter		Unit	Test 1-2
Davinlink navian	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna port	$N_{oc}$ at antenna port		-98
Precoding granularity	Precoding granularity		6
PMI delay (Note 2)		ms	8
Reporting interval		ms	1
Reporting mode			PUSCH 1-2
CodeBookSubsetRe	striction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
			0000000
PDSCH transmission	mode		4
			·

Note 1:  $P_R = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.10.1.1.4-2: Minimum performance Dual-Layer Spatial Multiplexing (FRC) with 4 RX Antenna Ports

Test num.	Bandwidt h and MCS	Reference channel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Reference Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory	DL UE categ ory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x4 Low	70	10.1	≥2	≥6
2	10 MHz	R.72 FDD	OP.1 FDD	EPA5	4x4 Low	70	18.0	11-12	≥11
	256 QAM								

## 8.10.1.1.5 Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.5-2, with the addition of the parameters in Table 8.10.1.1.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the

serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.10.1.1.5-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.1.5-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model and 4 RX Antenna Ports

parameter		Unit	Cell 1	Cell 2	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	
Cell-specific referen	ce signals		Antenna ports 0,1	Antenna ports 0,1	
CSI reference signa	ls		Antenna ports 15,16	N/A	
CSI-RS periodicity a subframe offset $T_{CS}$	<sub>I-RS</sub> / $\Delta_{\text{CSI-RS}}$	Subframes	5/2	N/A	
CSI reference signa configuration	l		0	N/A	
$N_{oc}$ at antenna por	İ	dBm/15kH z	-98	N/A	
DIP (Note 2)		dB	N/A	-1.73	
BW <sub>Channel</sub>		MHz	10	10	
Cell Id			0	126	
PDSCH transmission	n mode		9	9	
Beamforming mode	I		As specified in clause B.4.3 (Note 4, 5)	N/A	
Interference model			N/A	As specified in clause B.5.4	
Probability of occurrence of	Rank 1		N/A	70	
transmission rank in interfering cells	Rank 2		N/A	30	
Precoder update gra	anularity	PRB	50	6	
PMI delay (Note 5)		Ms	8	N/A	
Reporting interval		Ms	5	N/A	
Reporting mode			PUCCH 1-1	N/A	
CodeBookSubsetRebitmap	estriction		001111	N/A	
Symbols for unused	PRBs		OCNG (Note 6)	N/A	
Simultaneous transi	mission		No simultaneous transmission on the other antenna port in (7 or 8) used for the input signal under test	N/A	
Physical channe reporting			PUSCH(Note 8)	N/A	
cqi-pmi-Configura			5	N/A	

Note 1:  $P_{B} = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4: The precoder in clause B.4.3 follows UE recommended PMI.

Note 5: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 6: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 7: All cells are time-synchronous.

Note 8: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report

both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on

PUSCH in uplink subframe SF#8 and #3.

Table 8.10.1.1.5-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model and 4 RX Antenna Ports

Test Number	Reference Channel		NG tern	Propagation Conditions		Correlation Matrix and	Referenc	UE Categor	
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SINR (dB) (Note 2)	у
1	R. 76 FDD QPSK	OP.1 FDD	N/A	EVA5	EVA5	2x4 Low	70	-3.0	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

### 8.10.1.1.6 Dual-Layer Spatial Multiplexing (User-Specific Reference Symbols)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.10.1.1.6-2, with the addition of the parameters in Table 8.10.1.1.6-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.10.1.1.6-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations with 4 RX Antenna Ports

Parameter		Unit	Tes	
Parameter		Onit	Cell 1	Cell 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	4	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0
	σ	dB	-3	-3
Cell-specific refere signals	Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1
Cell ID			0	126
CSI reference sign	als		Antenna ports 15,16	NA
Beamforming mod	el		Annex B.4.2	NA
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$		Subframes	5/2	NA
CSI reference sign configuration	CSI reference signal configuration		8	NA
Zero-power CSI-R: configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	o-power CSI-RS ofiguration of roPowerCSI-RS		3 / 0010000000000000	NA
$N_{\it oc}$ at antenna po	rt	dBm/15kHz	-98	NA
$\hat{E}_s/N_{oc}$			Reference Value in Table 8.10.1.1.6-2	7.25dB
Symbols for unuse PRBs			OCNG (Note 2)	NA
	Number of allocated resource blocks (Note 2)		50	NA
Simultaneous transmission			No	NA
PDSCH transmissi mode	on		9	Blanked

Note 1:  $P_B = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK

modulated.

Table 8.10.1.1.6-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations and 4 RX Antenna Ports

Test number	Bandwidth and MCS	Reference Channel		NG tern	1		Correlation Matrix and	Reference value		UE Categ
			Cell1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	ory
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	N/A	ETU5	ETU5	2x4 Low	70	9.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1.

## 8.10.1.1.7 Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.7-2, with the addition of the parameters in Table 8.10.1.1.7-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.7-1: Test parameters for Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
Cell-specific reference			Antenna
signals			ports
signais			1,2,3,4
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
PDSCH transmission m	ode		3
PDSCH rank			3
CodeBookSubsetRestric	ction		0100
bitmap			
Note 1: $P_B = 1$ .			

Table 8.10.1.1.7-2: Minimum performance Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y	
1	10 MHz 64QAM	R.73 FDD	OP.1 FDD	EVA70	4x4 Low	70	15.1	≥5	

## 8.10.1.1.8 Closed-loop spatial multiplexing performance, 4 Layers spatial multiplexing 4 Tx antennas (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.8-2, with the addition of the parameters in Table 8.10.1.1.8-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.8-1: Test parameters for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
Cell-specific reference sign	gnals		Antenna Ports 0,1,2,3
PDSCH transmission m	ode		4
PDSCH rank			4
Precoding granularity	/	PRB	50
PMI delay		ms	8
Reporting interval		ms	1
Reporting mode			PUSCH 3-1
CodeBookSubsetRestric	tion		0xFFFF000000000000
Note 1: $P_B = 1$ .			

Table 8.10.1.1.8-2: Minimum performance for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Ī	Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference value		UE
	number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna	Fraction of Maximum	SNR (dB)	Categor
		IVICO				Configuration	Throughput (%)	(ub)	У
Ī	1	10 MHz	R.74 FDD	OP.1	EPA5	4x4 Low	70	14.9	≥5
		16QAM 1/2		FDD					

### 8.10.1.1.9 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.9-2, with the addition of the parameters in Table 8.10.1.1.9-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.9-1: Minimum performance for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Parameter		Unit	Test 1	
	$ ho_{\scriptscriptstyle A}$	dB	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	
	σ	dB	-3	
Beamforming model			4 layer precoding based on WB PMI feedback	
Cell-specific reference signals			Antenna ports 0,1	
CSI reference signals			Antenna ports 15,,18	
Beamforming model			Annex B.4.3	
CSI-RS periodicity and subframe of $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ffset	Subframes	5/2	
CSI reference signal configuration	on		3	
Zero-power CSI-RS configuration  I <sub>CSI-RS</sub> /  ZeroPowerCSI-RS bitmap	n	Subframes / bitmap	3 / 0001000000000000	
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	
Symbols for unused PRBs			OCNG (Note 3)	
Number of allocated resource blo (Note 2)	cks	PRB	50	
Simultaneous transmission			No	
PDSCH transmission mode			9	
Precoding granularity			50	
PMI delay			8	
Reporting interval			1	
Reporting mode			PUSCH 3-1	
alternativeCodeBookEnabledFor4T	X-r12		False	
CodeBookSubsetRestriction bitm	ap		0xFFFF000000000000	

Note 1:

Note 2: 50 resource blocks are allocated in sub-frames 1,2,3,4,6,7,8,9 and 41 resource

blocks (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0.

These physical resource blocks are assigned to an arbitrary number of virtual Note 3:

UEs with one PDSCH per virtual UE; the data transmitted over the OCNG

PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.10.1.1.9-2: Minimum performance for for 4 Layer Spatial Multiplexing (User-Specific **Reference Symbols)** 

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference va	lue	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y
1	10 MHz 16QAM	R.75 FDD	OP.1 FDD	EPA5	4x4 Low	70	18.4	≥5

#### 8.10.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.10.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.10.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value					
Uplink downlink configuration (Note 1)		1					
Special subframe configuration (Note 2)		4					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Number of HARQ processes per component carrier	Processes	7					
Maximum number of HARQ transmission		4					
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM					
Number of OFDM symbols for PDCCH	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated					
Cross carrier scheduling		Not configured					
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms					
ACK/NACK feedback mode		Multiplexing					
Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4].							

# 8.10.1.2.1 Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8. 10.1.2.1-2, with the addition of the parameters in Table 8. 10.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.10.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC) with 4Rx Antenna Ports

Parameter	-	Unit	Test 1
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3
	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmission	mode		2
Note 1: $P_B = 1$			

Table 8.10.1.2.1-2: Minimum performance Transmit Diversity (FRC) with 4Rx Antenna Ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna	Fraction of Maximum	SNR (dB)	Category
					Configuration	Throughput (%)		
1	10 MHz 16QAM 1/2	R.11 TDD	OP.1 TDD	EVA5	2x4 Medium correlation A, ULA	70	3.9	≥2

### 8.10.1.2.2 Open-loop spatial multiplexing performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.2-2, with the addition of the parameters in Table 8.10.1.2.2-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.2-1: Test Parameters for Large Delay CDD (FRC) with 4Rx Antenna Ports

Paramete	er	Unit	Test 1
Deventink news	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{oc}$ at antenna por	t	dBm/15kHz	-98
ACK/NACK feedbac	k mode		Bundling
PDSCH transmission	n mode		3
Note 1: $P_B = 1$			

Table 8.10.1.2.2-2: Minimum performance Large Delay CDD (FRC) with 4Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagatio	Correlation	Reference value		UE Cate gory
num ber	and MCS	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum (dB) Throughput (%)		
1	10 MHz 16QAM 1/2	R.11-1 TDD	OP.1 TDD	EVA70	2x4 Low	70	7.7	≥2

8.10.1.2.3 Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.3-2, with the addition of the parameters in Table 8.10.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.10.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.2.3-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4Rx Antenna Ports

Parameter	Unit	Cell 1	Cell 2	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	0
Cell-specific reference signal	s		Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna port		dBm/15kHz	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BW <sub>Channel</sub>	BW <sub>Channel</sub>			10
Cell Id			0	1
PDSCH transmission mode			6	N/A
Interference model			N/A	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80
transmission rank in interfering cells	Rank 2	%	N/A	20
Precoding granularity		PRB	50	6
PMI delay (Note 4)	ms	10 or 11	N/A	
Reporting interval	ms	5	N/A	
Reporting mode			PUCCH 1-1	N/A
CodeBookSubsetRestriction	bitmap		1111	N/A

Note 1:  $P_{B} = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Table 8.10.1.2.3-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4Rx Antenna Ports

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions		Correlation Matrix and	Reference Value		UE Cate
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 TDD 16QAM	OP.1 TDD	N/A	EVA5	EVA5	2x4 Low	70	-1.9	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

### 8.10.1.2.4 Closed-loop spatial multiplexing performance, Dual-Layer Spatial Multiplexing 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.4-2, with the addition of the parameters in Table 8.10.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.4-1: Test Parameters for Dual-Layer Spatial Multiplexing (FRC) with 4Rx Antenna Ports

Parameter		Unit	Test 1-2		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
$N_{\it oc}$ at antenna port		dBm/15kHz	-98		
Precoding granularity	/	PRB	6		
PMI delay (Note 2)		ms	10 or 11		
Reporting interval	orting interval		1 or 4 (Note 3)		
Reporting mode			PUSCH 1-2		
ACK/NACK feedback	ACK/NACK feedback mode		Bundling		
CodeBookSubsetRestriction			000000000000000000000000000000000000000		
bitmap			000011111111111111111100000000		
			0000000		
PDSCH transmission	mode	_	4		

Note 1:  $P_{R} = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Table 8.10.1.2.4-2: Minimum performance Dual-Layer Spatial Multiplexing (FRC) with 4Rx Antenna Ports

	Bandwidt	Reference	OCNG	Propagation		Reference v	value	UE	DL UE	
	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y	category	
1	10 MHz 64 QAM	R.36 TDD	OP.1 TDD	EPA5	4x4 Low	70	10.4	≥2	≥6	
2	10 MHz 256QAM	R.72 TDD	OP.1 TDD	EPA5	4x4 Low	70	17.5	11-12	≥11	

## 8.10.1.2.5 Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.5-2, with the addition of the parameters in Table 8.10.1.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.10.1.2.5-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.2.5-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model and 4Rx Antenna Ports

parameter		Unit	Cell 1	Cell 2
Daniel I. a. a. a. a. a.	$\rho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referen	ice signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference signals			Antenna ports 15,16	N/A
CSI-RS periodicity a subframe offset $T_{\rm CS}$		Subframes	5/4	N/A
CSI reference signal configuration			0	N/A
$N_{oc}$ at antenna por	t	dBm/15kH z	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BW <sub>Channel</sub>		MHz	10	10
Cell Id			0	126
PDSCH transmission	n mode		9	9
Beamforming model			As specified in clause B.4.3 (Note 4, 5)	N/A
Interference model			N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update gra	anularity	PRB	50	6
PMI delay (Note 5)		ms	10 or 11	N/A
Reporting interval		ms	5	N/A
Reporting mode			PUCCH 1-1	N/A
CodeBookSubsetRebitmap	estriction		001111	N/A
Symbols for unused	I PRBs		OCNG (Note 6)	N/A
Simultaneous transl	mission		No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channe reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			4	N/A

Note 1:  $P_{B} = 1$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4: The precoder in clause B.4.3 follows UE recommended PMI.

Note 5: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 6: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 7: All cells are time-synchronous.

Note 8: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report

both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on

PUSCH in uplink subframe SF#8 and #3.

Table 8.10.1.2.5-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model and 4Rx Antenna Ports

Test Number	Reference Channel		NG tern		gation itions	Correlation Matrix and	Reference	Reference Value	
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	ory
1	R.76 TDD QPSK	OP.1 TDD	N/A	EVA5	EVA5	2x4 Low	70	-3.3	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

# 8.10.1.2.6 Dual-Layer Spatial Multiplexing (User-Specific Reference Symbols)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.10.1.2.6-2, with the addition of the parameters in Table 8.10.1.2.6-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.10.1.2.6-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations and 4Rx Antenna Ports

Parameter		Unit	Test 1			
Parameter		Onit	Cell 1	Cell 2		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	4	0		
allocation	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0		
	σ	dB	-3	-3		
Cell-specific refere signals	nce		Antenna ports 0 and 1	Antenna ports 0 and 1		
Cell ID			0	126		
CSI reference sign	als		Antenna ports 15,16	NA		
Beamforming mod	el		Annex B.4.2	NA		
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$		Subframes	5 / 4	NA		
CSI reference sign configuration	al		8	NA		
Zero-power CSI-R: configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	4 / 00100000000000000	NA		
$N_{\scriptscriptstyle oc}$ at antenna po	rt	dBm/15kHz	-98	NA		
$\hat{E}_s/N_{oc}$			Reference Value in Table 8.10.1.2.6-2	7.25dB		
Symbols for unuse PRBs			OCNG (Note 2)	NA		
	Number of allocated resource blocks (Note 2)		50	NA		
Simultaneous transmission			No	NA		
PDSCH transmissi mode	on		9	Blanked		

Note 1:  $P_R = 1$ 

Note 2: These physical resource blocks are assigned to an arbitrary number of

virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK

modulated.

Table 8.10.1.2.6-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	Correlation Matrix and	Reference va	lue	UE Cate
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	gory
1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	N/A	ETU5	ETU5	2x4 Low	70	9.5	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1.

# 8.10.1.2.7 Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.7-2, with the addition of the parameters in Table 8.10.1.2.7-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.7-1: Test parameters for Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Paramete	r	Unit	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
Cell-specific reference	signals		Antenna Ports 0,1,2,3
PDSCH transmission	mode		3
PDSCH rank			3
CodeBookSubsetResi bitmap	triction		0100
Note 1: $P_B = 1$ .			

Table 8.10.1.2.7-2: Minimum performance Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 64QAM	R.73 TDD	OP.1 TDD	EVA70	4x4 Low	70	14.9	≥5

# 8.10.1.2.8 Closed-loop spatial multiplexing performance, 4 Layers spatial multiplexing 4 Tx antennas

The requirements are specified in Table 8.10.1.2.8-2, with the addition of the parameters in Table 8.10.1.2.8-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.8-1: Test parameters for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
Cell-specific reference sign	gnals		Antenna ports 0,1,2,3
PDSCH transmission m	ode		4
PDSCH rank			4
Precoding granularity	/	PRB	50
PMI delay		ms	10 or 11
Reporting interval		ms	1 or 4
Reporting mode			PUSCH 3-1
CodeBookSubsetRestric	ction		0xFFFF000000000000
Uplink-Downlink Configur	ation		1
Special subframe configu	ration		4
Note 1: $P_B = 1$ .			

Table 8.10.1.2.8-2: Minimum performance for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference v	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.74 TDD	OP.1 TDD	EPA5	4x4 Low	70	14.4	≥5

# 8.10.1.2.9 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.9-2, with the addition of the parameters in Table 8.10.1.2.9-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.9-1: Minimum performance for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming model			4 layer precoding based on WB PMI feedback
Cell-specific reference signals			Antenna ports 0,1
CSI reference signals			Antenna ports 15,,18
Beamforming model			Annex B.4.3
CSI-RS periodicity and subframe of $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ffset	Subframes	5/4
CSI reference signal configuration	on		3
Zero-power CSI-RS configuration  I <sub>CSI-RS</sub> /  ZeroPowerCSI-RS bitmap	n	Subframes / bitmap	4 / 0010000000000000
$N_{\scriptscriptstyle oc}$ at antenna port		dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 3)
Number of allocated resource blo (Note 2)	cks	PRB	50
Simultaneous transmission			No
PDSCH transmission mode			9
Precoding granularity			50
PMI delay			10 or 11
Reporting interval			1 or 4
Reporting mode			PUSCH 3-1
alternativeCodeBookEnabledFor4T	X-r12		False
CodeBookSubsetRestriction bitm	ap		0xFFFF000000000000

Note 1:  $P_B = 1$ 

Note 2: 50 resource blocks are allocated in sub-frames 4, 9 and 41 resource blocks

(RB0-RB20 and RB30-RB49) are allocated in sub-frame 0,1 and 6.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual

UEs with one PDSCH per virtual UE; the data transmitted over the OCNG

PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.10.1.2.9-2: Minimum performance for for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	h amd MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM	R.75 TDD	OP.1 TDD	EPA5	4x4 Low	70	19.0	≥5

# 8.10.2 PDCCH/PCFICH

### 8.10.2.1 FDD

The parameters specified in Table 8.10.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.10.2.1-1: Test Parameters for PDCCH/PCFICH with 4 Rx Antenna Ports

Param	eter	Unit	Single antenna port	Transmit diversity		
Number of PDCCH	l symbols	symbols	2	2		
PHICH Ng (Note 1	)		1	1		
PHICH duration			Normal	Normal		
Unused RE-s and	PRB-s (Note 2)		OCNG	OCNG		
Cell ID			0	0		
Develiel recore	$ ho_{\scriptscriptstyle A}$	dB	0	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3		
	σ	dB	0	0		
$N_{oc}$ at antenna po	rt	dBm/15kHz	-98	-98		
Cyclic prefix			Normal	Normal		
Note 1: according to Clause 6.9 in TS 36.211 [4].  Note 2: PDSCH is mapped as OCNG.						

Single-antenna port performance

8.10.2.1.1

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.1-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and	Refer val	
						correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x4 Low	1	-5.4

# 8.10.2.1.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8. 10.2.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.2-1: Minimum performance PDCCH/PCFICH with 4 Rx Antenna Ports

Test numbe	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Refere valu	
r						and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 4 Low	1	-3.5

# 8.10.2.1.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.1.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.3-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 4 Medium A Xpol	1	-0.4

## 8.10.2.2 TDD

Table 8.10.2.2-1: Test Parameters for PDCCH/PCFICH

Paran	neter	Unit	Single antenna port	Transmit diversity
Uplink downlink co (Note 1)	onfiguration		0	0
Special subframe (Note 2)	configuration		4	4
Number of PDCCI	H symbols	symbols	2	2
PHICH Ng (Note 3	3)		1	1
PHICH duration			Normal	Normal
Unused RE-s and	PRB-s (Note 4)		OCNG	OCNG
Cell ID			0	0
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3
σ		dB	0	0
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98
Cyclic prefix			Normal	Normal
ACK/NACK feedb	ack mode		Multiplexing	Multiplexing

Note 1: as specified in Table 4.2-2 in TS 36.211 [4].

Note 2: as specified in Table 4.2-1 in TS 36.211 [4].

Note 3: according to Clause 6.9 in TS 36.211 [4].

Note 4: PDSCH is mapped as OCNG.

# 8.10.2.2.1 Single-antenna port performance

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidt	Aggregation	Referenc	OCNG	Propagati	Antenna	Referen	ce value
numbe r	h	level	e Channel	Pattern	on Condition	configuratio n and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x4 Low	1	-4.7

## 8.10.2.2.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.2-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidt	Aggregation	Reference OCNG Propagation Antenna		Antenna	Referen	ce value	
number	h	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 4 Low	1	-3.2

## 8.10.2.2.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.3-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 4 Medium A Xpol	1	0.0

# 8.10.3 PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

## 8.10.3.1 FDD

The parameters specified in Table 8.10.3.1-1 are valid for all FDD tests with 4Rx unless otherwise stated.

Table 8.10.3.1-1: Test Parameters for PHICH with 4 Rx Antenna Ports

Para	meter	Unit	Single antenna port	Transmit diversity	
Develials access	$ ho_{\scriptscriptstyle A}$	dB	0	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	
	σ		0	0	
PHICH duration			Normal	Normal	
PHICH Ng (Note	1)		Ng = 1	Ng = 1	
PDCCH Content			UL Grant should be included with the proper information aligned with A.3.6.		
Unused RE-s and	PRB-s (Note 2)		OCNG	OCNG	
Cell ID			0	0	
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	
Cyclic prefix			Normal	Normal	
	ing to Clause 6.9 in H is mapped as OC				

## 8.10.3.1.1 Single Tx Antenna Port performance

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.1-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 4 Low	0.1	1.6

## 8.10.3.1.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.2-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 4 Low	0.1	0.6

# 8.10.3.1.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8 .10.3.1.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.3-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 4 Medium correlation A, Cross polarized	0.1	0.1

## 8.10.3.2 TDD

The parameters specified in Table 8.10.3.2-1 are valid for all TDD tests with 4 Rx unless otherwise stated.

Table 8.10.3.2-1: Test Parameters for PHICH with 4 Rx Antenna Ports

Para	meter	Unit	Single antenna port	Transmit diversity	
Uplink downlink c	onfiguration (Note		1	1	
Special subframe (Note 2)	configuration		4	4	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	
	σ	dB	0	0	
PHICH duration			Normal	Normal	
PHICH Ng (Note	1)		Ng = 1	Ng = 1	
PDCCH Content			UL Grant should be included with the proper information aligned with A.3.6.		
Unused RE-s and	PRB-s (Note 4)		OCNG	OCNG	
Cell ID			0	0	
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	
Cyclic prefix			Normal	Normal	
ACK/NACK feedb	ack mode		Multiplexing	Multiplexing	
Note 2: as special Note 3: accord	cified in Table 4.2-2 cified in Table 4.2-1 ing to Clause 6.9 in	in TS 36.211 [4 TS 36.211 [4].			

Note 4: PDSCH is mapped as OCNG.

## 8.10.3.2.1 Single Tx Antenna Port performance

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.1-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 4 Low	0.1	1.7

## 8.10.3.2.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.2-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 4 Low	0.1	0.9

## 8.10.3.2.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.3-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 4 Medium cotrrelation A, Cross polarized	0.1	0.3

# 8.10.4 ePDCCH

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.10.4.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

## 8.10.4.1 Distributed Transmission with 4Rx

## 8.10.4.1.1 FDD

The parameters specified in Table 8.10.4.1.1-1 are valid for all FDD distributed EPDCCH test with 4Rx unless otherwise stated.

Table 8.10.4.1.1-1: Test Parameters for Distributed EPDCCH with 4Rx

Parame	Unit	Value		
Number of PDCCH syl	symbols	2 (Note 1)		
PHICH duration	- Cyllisolo	Normal		
Unused RE-s and PRE	3-s		OCNG	
Cell ID			0	
	$ ho_{\scriptscriptstyle A}$	dB	-3	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3	
allocation	σ	dB	0	
	δ	dB	3	
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98	
Cyclic prefix			Normal	
Subframe Configuration	n		Non-MBSFN	
Precoder I Indate Gran	Precoder Update Granularity			
Trecoder Opdate Grai	luianty	ms	1	
Beamforming Pre-Cod	er		Annex B.4.4	
Cell Specific Reference			Port 0 and 1	
Number of EPDCCH S	Sets Configured		2 (Note 2)	
Number of PRB per El	PDCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)	
EPDCCH Subframe M	onitoring		NA	
PDSCH TM			TM3	
DCI Format			2A	
Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is not configured.  Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set.				
EPDCCH is	st set for Te	st 1 and second ways configured.		

For the parameters specified in Table 8.10.4.1.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.1.1-2: Minimum performance Distributed EPDCCH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	-0.7
2	10 MHZ	16 ECCE	R.56 FDD	OP.7 FDD	EVA70	2 x 4 Low	1	-5.8

## 8.10.4.1.2 TDD

The parameters specified in Table 8.10.4.1.2-1 are valid for all TDD distributed EPDCCH tests with 4Rx unless otherwise stated.

Table 8.10.4.1.2-1: Test Parameters for Distributed EPDCCH with 4Rx

Parame	Unit	Value	
Number of PDCCH syr	symbols	2 (Note 1)	
PHICH duration		Normal	
Unused RE-s and PRE		OCNG	
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
	δ	dB	3
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuratio	n		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
	•	ms	1
Beamforming Pre-Cod			Annex B.4.4
Cell Specific Reference			Port 0 and 1
Number of EPDCCH S	ets Configured		2 (Note 2)
Number of PRB per EF	PDCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)
EPDCCH Subframe M	onitoring		NA
PDSCH TM			TM3
DCI Format			2A
TDD UL/DL Configurat	ion		0
TDD Special Subframe	)		1 (Note 3)
Note 1: The starting PCFICH. RF configured.		from the pol-r11 is not	
Note 2: The two sets overlapping PRB = {0, 7 EPDCCH is set for Test	31, 45} for th 49} for the s st set for Te n sets are al	ne first set and	
special subf	J		

For the parameters specified in Table 8.10.4.1.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.1.2-2: Minimum performance Distributed EPDCCH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	-0.7
2	10 MHZ	TBD ECCE	R.56 TDD	OP.7 TDD	EVA70	2 x 4 Low	1	-5.8

## 8.10.4.2 Localized Transmission with TM9 and 4Rx

### 8.10.4.2.1 FDD

The parameters specified in Table 8.10.4.2.1-1 are valid for all FDD TM9 localized ePDCCH tests with 4Rx unless otherwise stated.

Table 8.10.4.2.1-1: Test Parameters for Localized EPDCCH with TM9 and 4Rx

Parame	eter	Unit	Value
Number of PDCCH syr	mbols	symbols	1 (Note 1)
EPDCCH starting syml	bol	symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRE	3-s		OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	$\sigma$	dB	-3
	δ	dB	0
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuratio	n		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
Trecoder opdate Gran	ulanty	ms	1
Beamforming Pre-Code			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sig			Port 15 and 16
CSI-RS reference sign configuration	al resource		0
CSI reference signal su configuration I <sub>CSI-RS</sub>	ubframe		2
ZP-CSI-RS configuration	on bitmap		000001000000000
ZP-CSI-RS subframe configuration $I_{ZP-}$			2
CSI-RS Number of EPDCCH Sets		+	2 (Noto 2)
EPDCCH Subframe Monitoring pattern			2 (Note 2) 1111111110 1111111101 1111111011
subframePatternConfig			
PDSCH TM	y-1 1 1	+	1111110111 (Note 3) TM9
LDOCU IIN			I IVIÐ

Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.

Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.

Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.

For the parameters specified in Table 8.10.4.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.2.1-2: Minimum performance Localized EPDCCH with TM9 and 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	6.5
2	10 MHZ	8 ECCE	R.58 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	-1.5

### 8.10.4.2.2 TDD

The parameters specified in Table 8.10.4.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.10.4.2.2-1: Test Parameters for Localized EPDCCH with TM9 and 4Rx

Parame	eter	Unit	Value
Number of PDCCH symbols		symbols	1 (Note 1)
EPDCCH starting symbol		symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRE	3-s		OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	σ	dB	-3
	δ	dB	0
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuration	n		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
		ms	1
Beamforming Pre-Cod			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sig			Port 15 and 16
CSI-RS reference sign configuration			0
CSI reference signal s configuration I <sub>CSI-RS</sub>	ubframe		0
ZP-CSI-RS configurati	on bitmap		000001000000000
ZP-CSI-RS subframe (			0
Number of EPDCCH Sets			2 (Note 2)
EPDCCH Subframe Monitoring pattern subframePatternConfig-r11			1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)
PDSCH TM			TM9
TDD UL/DL Configuration			0
TDD Special Subframe			1 (Note 4)
Note 1. The stanting	balton EDDCC	N I : a a : a : a a I a al	with and ach Start Symbol r11 Hawayar CELia

Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.

Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.

Note 4: Demodulation performance is averaged over normal and special subframe.

For the parameters specified in Table 8.10.4.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.

Table 8.10.4.2.2-2: Minimum performance Localized EPDCCH with TM9 and 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	6.0
2	10 MHz	8 ECCE	R.58 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	-2.1

# 8.11 Demodulation (UE supporting coverage enhancement)

The requirements in this sub-clause are defined based on the simulation results with UE DL Category M1 unless otherwise stated.

## 8.11.1 PDSCH

## 8.11.1.1 FDD and half-duplex FDD (Fixed Reference Channel)

The parameters specified in Table 8.11.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

Table 8.11.1.1-1: Common Test Parameters (FDD and half-duplex FDD)

Parameter	Unit	CE Mode A	CE Mode B
Inter-TTI Distance		1	1
Number of HARQ			
processes per	Processes	8	2
component carrier			
Maximum number of HARQ transmission		4	4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM	{0,0,0,0,1,1,1,1,2,2,2,2,3,3,3,3, } for QPSK and 16QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
Cyclic Prefix		Normal	Normal
Beamforming Precoder for MPDCCH		Annex B.4.4	Annex B.4.4
Precoder update granularity for MPDCCH		Frequency domain: 1 PRB Time domain: identical during the repetition period	Frequency domain: 1 PRB Time domain: identical during the repetition period

# 8.11.1.1.1 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

## 8.11.1.1.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.1.1.1-2, with the addition of the parameters in Table 8.11.1.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.11.1.1.1.1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
allocation	σ	dB	0
	δ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note	2)	ms	[8]
Reporting inter	val	ms	[8]
Reporting mod	de		PUCCH 1-1
CodeBookSubsetR	estricti		001111
on bitmap			
PDSCH transmis	sion		6
mode			
Coverage enhance	ement		CE Mode A
mode			CL Wode A
OFDM starting sy			2
(startSymbolL0	_		
Maximum number	er of		1
repetitions			'
Frequency hopp			
(mpdcch-pdsc			Disabled
HoppingConfig			
MPDCCH transmi	ssion		4
duration	- 4:4: \	ms	1
(mpdcch-NumRepe			
Starting subfrar			
configuration for MPDCCH			1
(mpdcch_startSF_UESS)			
Narrowband for			
MPDCCH			1
(mpdcch_Narrowband)			'
fdd-			[11100000 11100000
DownlinkOrTddSuk	oframe		11100000 11100000
BitmapLC	manic		11100000
Note 1: D = 1			11100000]

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), This reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For each test, DC subcarrier puncturing shall be considered.

Table 8.11.1.1.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwid	Reference	OCNG	Propagation	Correlation	Reference	value
number	th and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1	10MHz 16QAM 1/2	R.zz FDD	OP.2 FDD	EPA5	2x1 Low	70%	TBD

# 8.11.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.11.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.11.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	CE Mode A	CE Mode B
Uplink downlink configuration (Note 1)		1	1
Special subframe configuration (Note 2)		4	4
Cyclic prefix		Normal	Normal
Cell ID		0	0
Inter-TTI Distance		1	1
Number of HARQ processes per component carrier	Processes	7	2
Maximum number of HARQ transmission		4	4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM	{0,0,0,0,1,1,1,1,2,2,2,2,3, 3,3,3} for QPSK and 16QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
ACK/NACK feedback mode		Multiplexing	Multiplexing
Beamforming Precoder for MPDCCH		Annex B.4.4	Annex B.4.4
Precoder update granularity for MPDCCH		Frequency domain: 1 PRB Time domain: identical during the repetition period	Frequency domain: 1 PRB Time domain: identical during the repetition period

8.11.1.2.1 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

# 8.11.1.2.1.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.2.1.1-2, with the addition of the parameters in Table 8.11.1.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.11.1.2.1.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
allocation	σ	dB	0
	δ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note		ms	10 or 11
Reporting interv	/al	ms	5
Reporting mod	le		PUCCH 1-1
CodeBookSubsetR on bitmap	estricti		001111
ACK/NACK feedl mode	oack		Multiplexing
Physical channel for reporting	or CQI		PUSCH (Note 3)
PDSCH transmis	sion		
mode			6
Coverage enhance mode	ement		CE Mode A
OFDM starting sy (startSymbolL0			2
Maximum number repetitions			1
Frequency hopp (mpdcch-pdscl HoppingConfig	h-		Disabled
MPDCCH transmission duration (mpdcch-NumRepetition) Starting subframe configuration for MPDCCH (mpdcch_startSF_UESS)		ms	1
			1
Narrowband for MPDCCH (mpdcch_Narrowb	or		1

Note 1:  $P_B = 1$ .

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.

PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Note 4: For each test, DC subcarrier puncturing shall be considered.

Table 8.11.1.2.1.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test number	Bandwid th and MCS	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference v Fraction of Maximum Throughput	alue SNR (dB)
	40141-					(%)	
1	10MHz 16QAM 1/2	R.zz TDD	OP.2 FDD	EPA5	2x1 Low	70%	TBD

#### **MPDCCH** 8.11.2

The receiver characteristics of the MPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

#### 8.11.2.1 FDD and half-duplex FDD

Table 8.11.2.1-1: Test Parameters for MPDCCH

Parame	Unit	CE Mode A	
OFDM starting symbol	OFDM starting symbol (startSymbolLC)		
Unused RE-s and PRE		OCNG	
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
	δ	dB	3
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuratio	n		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
Frecoder Opdate Gran	ulanty	ms	[TBD](Note 2)
Beamforming Pre-Cod			Annex B.4.4
Cell Specific Reference	e Signal		Port 0 and 1
Number of PRB per M	PDCCH Set		4
Transmission type			Distributed
Frequency hopping			Disabled
Number of frequency harrowbands	nopping		N/A
Frequency hopping off	set		N/A
Frequency hopping inv	erval	ms	N/A
MPDCCH start subfrar startSF-UESS)	ne ( <i>mpdcch-</i>		1
Maximum number of re	epetitions		[TBD]
MPDCCH narrowband Narrowband)		1	
PDSCH TM	+	TM2	
DCI Format	1	6-1A	
	noturing shal	I be considered.	
		cross subframes	
where MPD	וטו מו ועם מי	oross submames	

where MPDCCH is repeated.

#### 8.11.2.1.1 CE Mode A

For the parameters specified in Table 8.11.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.11.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.2.1.1-1: Minimum performance CE Mode A MPDCCH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and correlation Matrix	Reference Pm-dsg (%)	se value SNR (dB)
1	10 MHz	16 ECCE	R.xx FDD	OP.2 FDD	EPA5	2 x 1 Low	1	TBD

#### 8.11.2.2 **TDD**

Table 8.11.2.2-1: Test Parameters for MPDCCH

Param	Unit	CE Mode A			
OFDM starting symbo	OFDM starting symbol (startSymbolLC)				
Unused RE-s and PRI	3-s		OCNG		
Cell ID			0		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3		
allocation	σ	dB	0		
	δ	dB	3		
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98		
Cyclic prefix			Normal		
Subframe Configuration	on		Non-MBSFN		
Proceder Undate Gran	vularity	PRB	1		
Precoder Update Grar	lularity	ms	[TBD] (Note 2)		
Beamforming Pre-Coo			Annex B.4.4		
Cell Specific Reference			Port 0 and 1		
Number of PRB per M	PDCCH Set		4		
Transmission type			Distributed		
Frequency hopping			Diabled		
Number of frequency l narrowbands	nopping		N/A		
Frequency hopping of			N/A		
Frequency hopping in	verval	ms	N/A		
MPDCCH start subfra	me ( <i>mpdcch-</i>		1		
Maximum number of r	epetitions		[TBD]		
MPDCCH narrowband (mpdcch- Narrowband) PDSCH TM			1		
			TM2		
DCI Format		6-1A			
TDD UL/DL Configura		0			
TDD Special Subframe		1			
	st,DC subcarrier pu	ncturing shal	l be considered.		
Note 2: Same precoding matrix is used for a PRB across subframe					

where MPDCCH is repeated.

#### CE Mode A 8.11.2.2.1

For the parameters specified in Table 8.11.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.11.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.2.2.1-1: Minimum performance CE Mode A MPDCCH

Ī	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	10 MHz	16 ECCE	R.xx TDD	OP.2 TDD	EPA5	2 x 1 Low	1	TBD

# 8.11.3 PBCH

# 8.11.3.1 FDD and half-duplex FDD

Table 8.11.3.1-1: Test Parameters for PBCH

Param	eter	Unit	Transmit diversity
Downlink power	PBCH_RA	dB	-3
allocation	PBCH_RB	dB	-3
$N_{oc}$ at ante	nna port	dBm/15kHz	-98
Cyclic p	refix		Normal
Cell	D		0
Repetition of the photographic channel (for the channel of the cha			Enabled
Cyclic p	refix		Normal
Note 1: as specifi	ed in Table 6.6.4-1	in TS 36.211 [4].	

# 8.11.3.1.1 Transmit diversity performance

For the parameters specified in Table 8.11.3.1-1 and Table 8.11.3.1.1-1, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.11.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.3.1.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	10 MHz	R.22	EPA1	2 x 1 Low	1	TBD

## 8.11.3.2 TDD

Table 8.11.3.2-1: Test Parameters for PBCH

	Par	ameter	Unit	Transmit diversity
Uplink dow	nlink o	configuration (Note 1)		1
Special sub	frame	configuration (Note 2)		4
Downlink po	ower	PBCH_RA	dB	-3
allocatio	n	PBCH_RB	dB	-3
Λ	$V_{oc}$ at a	antenna port	dBm/15kHz	-98
	Сус	ic prefix		Normal
	С	ell ID		0
		physical broadcast el (Note 3)		Enabled
	Сус	ic prefix		Normal
Note 1: a	s spec	ified in Table 4.2-2 in T	S 36.211 [4].	
		ified in Table 4.2-1 in T		
Note 3: a	s spec	ified in Table 6.6.4-2 in	TS 36.211 [4].	

# 8.11.3.2.1 Transmit diversity performance

For the parameters specified in Table 8.11.3.2-1 and Table 8.11.3.2.1-1, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.11.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.3.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	10 MHz	R.22	EPA1	2 x 1 Low	1	TBD

# 9 Reporting of Channel State Information

# 9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section, the definition of SNR and SINR are in accordance with the one given in clause 8.1.1.

For the performance requirements specified in this clause, it is assumed that  $N_{RX}$ =2 unless otherwise stated.

Unless otherwise stated, 4-bit CQI Table in Table 7.2.3-1 in TS 36.213 [6], and Modulation and TBS index table in Table 7.1.7.1-1 for PDSCH in TS 36.213 [6] are applied in all the CSI requirements.

# 9.1.1 Applicability of requirements

## 9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

# 9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1 and 3 or more DL CCs in Table 9.1.1.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 9.1.1.2-1: Applicability and test rules for CA UE CQI tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, 15MHz+5MHz
CA tests with 2CCs in Clause 9.6.1.2	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

Note 1: The applicability and test rules are specified in this table, unless otherwise stated.

Note 2: Number of the supported bandwidth combinations to be tested from each selected

CA configuration is 1.

Note 3: A single Uplink CC is configured for all tests

Table 9.1.1.2-2: Applicability and test rules for CA UE CQI tests with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order						
CA tests with 3 ore more CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination						
CA tests with 3 or more CCs in Clause 9.6.1.2	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination						
Note 1: The applicability and test rules are specified in this table, unless otherwise stated.									
	Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1.								
	e Uplink CC is confi	gured for all tests							

# 9.1.1.2A Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL TDD-FDD CA in Table 9.1.1.2A-1 and for 3 or more DL TDD-FDD CA in Table 9.1.1.2A-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 9.1.1.2A-1: Applicability and test rules for CA UE CQI tests for TDD-FDD CA with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order					
CA tests with 2CCs in Clause 9.6.1.3	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination					
CA tests with 2CCs in Clause 9.6.1.4	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination					
Note 1: The applicability and test rules are specified in this table, unless otherwise stated.  Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1								

A single Uplink CC is configured for all tests Note 3:

Table 9.1.1.2A-2: Applicability and test rules for CA UE CQI tests for TDD-FDD CA with 3 or more DL **CCs** 

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 3CCs in Clause 9.6.1.3	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 9.6.1.4	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

The applicability and test rules are specified in this table, unless otherwise stated. Note 1:

Number of the supported bandwidth combinations to be tested from each selected CA Note 2:

configuration is 1.

Note 3: A single Uplink CC is configured for all tests

#### 9.1.1.3 Test coverage for different number of componenet carriers

For FDD CA tests specified in 9.6.1.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 9.6.1.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 9.6.1.3 and 9.6.1.4, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

#### 9.1.1.4 Applicability of performance requirements for 4Rx capable UEs

#### 9.1.1.4.1 Applicability rule and antenna connection for single carrier tests with 2Rx

For 4Rx capable UEs all single carrier tests specified in 9.2 to 9.6 with 2Rx are tested on any of the 2 Rx supported bands by connecting 2 out of the 4Rx with data source from system simulator, and the other 2 Rx are connected with zero input, depending on UE's declaration and AP configuration. Same requirements specified with 2Rx should be applied.

## 9.1.1.4.2 Applicability rule and antenna connection for CA and DC tests with 2Rx

## 9.1.1.4.3 Applicability rule and antenna connection for single carrier tests with 4Rx

For 4Rx capable UEs all single carrier tests specified in 9.X with 4Rx are tested on any of the 4 Rx supported bands by connecting all 4Rx with data source from system simulator.

# 9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

### 9.2.1.1 FDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.1-1 and Table 9.2.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD / RC.14 FDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.2.1.1-2 is defined in 9.1.1.1.

Parameter Test 2 Unit Test 1 Bandwidth MHz 10 PDSCH transmission mode 1 dB 0 Downlink power dB 0  $\rho_{\scriptscriptstyle B}$ allocation dB 0 σ Propagation condition and AWGN (1 x 2) antenna configuration SNR (Note 2) dB 0 7 1 dB[mW/15kHz] -98 -97 -91 -92  $N^{\overline{(j)}}$ dB[mW/15kHz] -98 -98 Max number of HARQ transmissions Physical channel for CQI **PUCCH Format 2** reporting PUCCH Report Type Reporting periodicity ms  $N_{pd} = 5$ cqi-pmi-ConfigurationIndex 6

Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

Note 1: Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.2.1.1-2: PUCCH 1-0 static test (FDD 5MHz)

Parameter		Unit	Test 1		Te	Test 2	
Bandwidth		MHz	5				
PDSCH transmission	n mode		1				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0		0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB			0		
Propagation conditio antenna configuratio			AWGN (1 x 2)				
SNR (Note :	SNR (Note 2)		[0]	[1]	[6]	[7]	
$\hat{I}_{or}^{(j)}$	)		[-98]	[-97]	[-92]	[-91]	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-:	98	
Max number of HAR transmissions	Q				1		
Physical channel for reporting	CQI			PUCCH	l Format 2		
PUCCH Report Type	)		4				
Reporting periodicity		ms	$N_{\rm pd} = 5$				
cqi-pmi-Configuration	nIndex		6				

Note 1: Reference measurement channel RC.14 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

## 9.2.1.2 TDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Test 1 Test 2			st 2
Bandwidth		MHz	10			
PDSCH transmission	PDSCH transmission mode		1			
Uplink downlink conf	figuration				2	
Special subfra configuration			4			
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0			
	$ ho_{\scriptscriptstyle B}$	dB	0			
	σ	dB			0	
. •	Propagation condition and antenna configuration		AWGN (1 x 2)			
SNR (Note 2	2)	dB	0	1	6	7
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	18	-9	98
Max number of H transmission					1	
Physical channel f reporting	or CQI			PUSCH	I (Note 3)	
PUCCH Report	Туре				4	
Reporting period	dicity	ms	$N_{\rm pd} = 5$			
cqi-pmi-Configurati			3			
ACK/NACK feedback	ck mode			Multi	plexing	

- Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

# 9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.3-1: PUCCH 1-0 static test (FDD)

Parameter		1124	Test 1			Test 2		
Parameter		Unit	Ce	II 1	Cell 2	Ce	ell 1	Cell 2
Bandwidth		MHz		10		10		
PDSCH transmission	on mode		2	2	Note 10		2	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3	3		-	3
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3			-3	
	σ	dB		0				0
Propagation condit antenna configu				Clause B	3.1 (2x2)		Clause I	3.1 (2x2)
$\widehat{E}_s/N_{oc2}$ (Not	te 1)	dB	4	5	6	4	5	-12
(;)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (I	Note 7)	N/A	-98(N	lote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	,	lote 8)	N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (	Note 9)	N/A	-98(N	lote 9)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110
Subframe Configu	uration		Non-M	IBSFN	Non-MBSFN	Non-N	/BSFN	Non-MBSFN
Cell Id				)	1		0	1
Time Offset between	en Cells	μs	2.5	(synchro	nous cells)	2.5	(synchr	onous cells)
ABS pattern (No	ABS pattern (Note 2)		01010101 01010101 N/A 01010101 01010101 01010101		01010101 N/A 01010101 01010101		01010101 01010101 01010101 01010101 01010101	
RLM/RRM Measu Subframe Pattern			00000100 00000100 00000100 00000100 00000100		0000 0000 0000	00100 00100 00100 00100 00100	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		0101 0101 0101 0101	0101 0101 0101 0101 0101	N/A	0101 0101 0101 0101	10101 10101 10101 10101 10101	N/A
(Note 3)	C <sub>CSI,1</sub>		1010 1010 1010 1010	1010 1010 1010 1010 1010	N/A	1010 1010 1010 1010	01010 01010 01010 01010 01010	N/A
Number of control symbols	OFDM			3	}			3
Max number of F				1				1
Physical channel for reporting			ı	PUCCH F	Format 2		PUCCH	Format 2
Physical channel for reporting	C <sub>CSI,1</sub> CQI		F	PUSCH (	Note 12)		PUSCH	(Note 12)
PUCCH Report	PUCCH Report Type			4	ļ			4
Reporting perior	dicity	Ms		$N_{pd}$	= 5		$N_{pd}$	= 5
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1			6	6	N/A		6	N/A
cqi-pmi-Configuration	onIndex2		Ę	5	N/A		5	N/A

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cgi-pmi-ConfigurationIndex is applied for C<sub>CSL0</sub>.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C<sub>CSI,1</sub>.

# 9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

Parameter		Unit		Tes	st 1	Test 2		st 2
Parameter		Unit	Ce	II 1	Cell 2	Ce	II 1	Cell 2
Bandwidth		MHz		1	0		1	0
PDSCH transmission			2		Note 10	2	2	Note 10
Uplink downlink con					1			1
Special subfra configuration				4	4			4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-:	3		-	3
allocation	$ ho_{\scriptscriptstyle B}$	dB			3			3
	σ	dB		(	)		(	0
Propagation condit antenna configur				Clause E	3.1 (2x2)		Clause I	B.1 (2x2)
$\widehat{E}_s/N_{oc2}$ (Not	e 1)	dB	4	5	6	4	5	-12
(1)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (1	Note 7)	N/A	-98 (N	lote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	-98 (N	lote 8)	N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (I	Note 9)	N/A	-98 (N	lote 9)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110
Subframe Configu	uration		Non-M	IBSFN	Non-MBSFN	Non-M	IBSFN	Non-MBSFN
Cell Id			(		1	0		1
Time Offset between	en Cells	μs	2.5 (synchronous cells)		onous cells)	2.5 (synchronous cells)		onous cells)
ABS pattern (No	ote 2)		N/A		0100010001 0100010001	N.	/A	0100010001 0100010001
RLM/RRM Measu	rement		000000001		N/A	000000001		N/A
Subframe Pattern	(Note 4)		00000		IN/A	00000		IN/A
CSI Subframe Sets	$C_{\text{CSI,0}}$		01000 01000		N/A	01000 01000		N.A
(Note 3)	C <sub>CSI,1</sub>		10001	01000 01000	N/A		01000 01000	N/A
Number of control	OFDM		10001		<u> </u>	10001		
symbols				3	3		;	3
Max number of H	IARQ				1			 1
transmission					ı			ı
Physical channel for	C <sub>CSI,0</sub> CQI			PUCCH	Format 2		PUCCH	Format 2
reporting	0 001							
Physical channel for reporting	C <sub>CSI,1</sub> CQI		I	PUSCH (	(Note 12)		PUS	SCH
PUCCH Report	Tyne				4			4
Reporting period		ms			= 5			= 5
cqi-pmi-Configurati		-	,			,		
C <sub>CSI,0</sub> (Note 1	3)		3	<u> </u>	N/A		3	N/A
cqi-pmi-Configuration			4	1	N/A		1	N/A
ACK/NACK feedba				Multip	lexing		Multip	lexing

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category ≥2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1 and Annex A.5.2.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for C<sub>CSI,0</sub>.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C<sub>CSI.1</sub>.

# 9.2.1.5 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.5-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.5-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Te	st 1	Te	Test 2		
			Cell 1	Cell 2 and 3	Cell 1 Cell 2 and 3			
Bandwidth		MHz		10 10		_		
PDSCH transmission		-ID	2	Note 10	2	Note 10		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		3		3		
allocation	$ ho_{\scriptscriptstyle B}$	dB		3		3		
	σ	dB		0		0		
Propagation condi- antenna configu			Clause	B.1 (2x2)	Clause I	B.1 (2x2)		
$\widehat{E}_s/N_{oc2}$ (No	te 1)	dB	4 5	Cell 2: 12 Cell 3: 10	13 14	Cell 2: 12 Cell 3: 10		
<b>7.</b> (i)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (Note 7)	N/A	-98 (Note 7)	N/A		
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)	N/A	-98 (Note 8)	N/A		
·	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9)	N/A	-93 (Note 9)	N/A		
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN		
Cell Id			0	Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1		
			Cell 2	3 usec	Cell 2:	3 usec		
Time Offset between	en Cells	μs		-1usec		-1usec		
Frequency Shift betw	veen Cells	Hz		300Hz		300Hz		
		· ·-	Cell 3:	-100Hz	Cell 3:	-100Hz		
ABS pattern (Note 2)			N/A	01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101		
RLM/RRM Measu Subframe Pattern			00000100 00000100 00000100 00000100 00000100	N/A	00000100 00000100 00000100 00000100 00000100	N/A		
CSI Subframe Sets	C <sub>CSI,0</sub>		01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101	N/A		
(Note 3)	C <sub>CSI,1</sub>		10101010 10101010 10101010 10101010 10101010	N/A	10101010 10101010 10101010 10101010 10101010	N/A		
Number of control symbols	OFDM			3	;	3		
Max number of h				1		1		
Physical channel for reporting			PUCCH	Format 2	PUCCH	Format 2		
Physical channel for reporting	C <sub>CSI,1</sub> CQI		PUSCH	(Note 12)	PUSCH	(Note 12)		
PUCCH Report	Туре			4		4		
Reporting perio	dicity	Ms	N <sub>pc</sub>	_ = 5	$N_{pd}$	= 5		
cqi-pmi-Configurat C <sub>CSI,0</sub> (Note 1	3)		6	N/A	6	N/A		
cqi-pmi-Configuration	onIndex2		5	N/A	5	N/A		

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for C<sub>CSI,0</sub>.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C<sub>CSI,1</sub>.

# 9.2.1.6 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.6-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.6-1: PUCCH 1-0 static test (TDD)

Parameter		1124		Tes	st 1		Test 2		
Parameter		Unit	Ce	II 1	Cell 2 and 3	Ce	II 1	Cell 2 and 3	
Bandwidth		MHz			0		10		
PDSCH transmission			2	2	Note 10	:	2 Note 10		
Uplink downlink con					1			1	
Special subfra configuratio				4	4		4	4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-:	3		-	3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-:	3		-	3	
	σ	dB		(	)		(	0	
Propagation condi- antenna configu				Clause E	3.1 (2x2)		Clause I	B.1 (2x2)	
$\widehat{E}_s/N_{oc2}$ (No	te 1)	dB	4	5	Cell 2: 12 Cell 3: 10	13	14	Cell 2: 12 Cell 3: 10	
(:)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (N	lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	,	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (N	lote 9)	N/A	-93 (N	lote 9)	N/A	
Subframe Config	uration		Non-N	IBSFN	Non-MBSFN	Non-M	MBSFN	Non-MBSFN	
Cell Id			(	)	Cell 2: 6 Cell 3: 1	1 ()		Cell 2: 6 Cell 3: 1	
Time Offset between	Time Offset between Cells			Cell 2: 3 usec Cell 3: -1usec		Cell 2: 3 usec Cell 3: -1usec			
Frequency shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz		Cell 2: 300Hz Cell 3: -100Hz				
ABS pattern (No	ote 2)		N/	/A	0100010001 0100010001	N	/A	0100010001 0100010001	
RLM/RRM Measu Subframe Pattern			00000		N/A		00001 00001	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000		N/A		)10001 )10001	N.A	
(Note 3)	C <sub>CSI,1</sub>			01000 01000	N/A		01000 01000	N/A	
Number of control symbols	OFDM			3	3		;	3	
Max number of h transmission	-			,	1			1	
Physical channel for reporting			ı	PUCCH	Format 2		PUCCH	Format 2	
Physical channel for reporting			ı	PUSCH (	(Note 12)		PUSCH	(Note 12)	
PUCCH Report Type				4	4			4	
Reporting perior	dicity	ms		$N_{pd}$	= 5		$N_{\rm pd}$	= 5	
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1			3	3	N/A	;	3	N/A	
cqi-pmi-Configuration	onIndex2		4	1	N/A	4	4	N/A	
ACK/NACK feedba				Multip	lexing		Multip	plexing	

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for C<sub>CSI,0</sub>.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C<sub>CSI,1</sub>.

## 9.2.1.7 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and DL Category  $\geq$ 11. For the parameters specified in Table 9.2.1.7-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1A FDD in Table A.4-1 shall be in the range of  $\pm$ 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.2.1.7-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Test 1		Te	Test 2	
Bandwidth		MHz	10				
PDSCH transmission	n mode			1			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0		0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
	σ	dB	0				
Propagation condit antenna configur				VGN (1 x 2)			
SNR (Note 2	2)	dB	-1	0	20	21	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-99	-98	-78	-77	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-(	98	
Max number of H transmission					1		
Physical channel f reporting	or CQI		PUCCH Format 2				
PUCCH Report	Туре		4				
Reporting periodicity ms $N_{pd} = 5$							
cqi-pmi-Configurati	onIndex				6		

Note 1: Reference measurement channel RC.1A FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

# 9.2.1.8 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and UE DL Category  $\geq$ 11. For the parameters specified in Table 9.2.1.8-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1A TDD in Table A.4-1 shall be in the range of  $\pm$ 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Parameter		Unit	Tes	st 1	Te	st 2
Bandwidth		MHz		2	20	
PDSCH transmission	n mode				1	
Uplink downlink configuration					2	
Special subfra configuration			4			
December a second	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			0	
	σ	dB			0	
Propagation condition and antenna configuration			AWGN (1 x 2)			
SNR (Note 2	<u>'</u> )	dB	-1	0	20	21
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-99	-98	-78	-77
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of H transmission					1	
Physical channel f reporting	or CQI			PUSCH	I (Note 3)	
PUCCH Report				4		
Reporting period		ms	$N_{\rm pd} = 5$			
cqi-pmi-Configurati					3	
ACK/NACK feedbac	ck mode			Multi	olexing	
Note 1: Reference	measurem	ent channel RC.1A	TDD accordii	ng to Table A.	4-1 with one s	sided

Table 9.2.1.8-1: PUCCH 1-0 static test (TDD)

- Note 1: Reference measurement channel RC.1A TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

# 9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

### 9.2.2.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial

differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Parameter		Unit	Te	st 1	Tes	st 2
Bandwidth		MHz			10	
PDSCH transmission	n mode				4	
Downlink power $ ho_{\scriptscriptstyle A}$		dB	-3			
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3			
	σ	dB			0	
Propagation condit antenna configur				Clause	B.1 (2 x 2)	
CodeBookSubsetRe bitmap	estriction			01	0000	
SNR (Note 2	2)	dB	10	11	16	17
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-87	-82	-81
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			98
Max number of F transmission					1	
Physical channel for reporting				PUCCH	Format 2	
PUCCH Report Ty CQI/PMI	PUCCH Report Type for		2			
PUCCH Report Typ			3			
Reporting period		ms	$N_{pd} = 5$			
cqi-pmi-Configurati					6	
ri-ConfigInde		ant channel DC 2 FF			lote 3)	

Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

- Note 1: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test.

# 9.2.2.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

ACK/NACK feedback mode

	Unit	Tes	st 1	Tes	st 2	
	MHz			10		
n mode		4				
iguration				2		
me 1		4				
$ ho_{\scriptscriptstyle A}$	dB			-3		
$ ho_{\scriptscriptstyle B}$	dB			-3		
σ	dB			0		
ion and ation		Clause B.1 (2 x 2)				
estriction		010000				
)	dB	10	11	16	17	
	dB[mW/15kHz]	-88	-87	-82	-81	
	dB[mW/15kHz]	-9	98	-9	98	
IARQ s				1		
Physical channel for CQI/PMI reporting		PUSCH (Note 3)				
Гуре		2				
licity	ms	$N_{\rm pd} = 5$				
onIndex				3		
X			805 (	Note 4)		
	iguration me $\rho_A$ $\rho_B$ $\sigma$ on and ation estriction )  ARQ S CQI/PMI  Type licity conlndex	$\begin{array}{c c} & \text{MHz} \\ \text{In mode} \\ \text{iguration} \\ \text{me} \\ \text{In mode} \\ \\ \hline & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ &$	MHz  n mode iguration me  n  ρ <sub>A</sub> dB  ρ <sub>B</sub> dB  σ dB  on and ation estriction  ) dB 10  dB[mW/15kHz] -88  dB[mW/15kHz] -88  CQI/PMI  Type licity ms  onlandex	MHz           n mode iguration           me         dB           ρ <sub>B</sub> dB           σ         dB           on and ation estriction         Clause lateral           0)         dB         10         11           dB[mW/15kHz]         -88         -87           dB[mW/15kHz]         -98           ARQ is CQI/PMI         PUSCH           Type licity         ms         Np           ponIndex         Np	MHz         10           n mode         4           iguration         2           me         4           ρ <sub>A</sub> dB         -3           ρ <sub>B</sub> dB         0           on and ation         Clause B.1 (2 x 2)           estriction         010000           )         dB         10         11         16           dB[mW/15kHz]         -88         -87         -82           dRQ         1         -98         -5           ARQ         1         PUSCH (Note 3)           Type         2         1           conlindex         3         3	

Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

Note 1: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Multiplexing

- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

# 9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

## 9.2.3.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Table 9.2.3.1-1: PUCCH 1-	1 static test (FDD)
---------------------------	---------------------

Parameter		Unit	Test 1 Test 2				
Bandwidth		MHz			10		
PDSCH transmissi	on mode				9		
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	$P_c$	dB			-3		
	σ	dB			-3		
Cell-specific reference	ce signals			Antenna	a ports 0, 1		
CSI reference si	gnals			Antenna p	orts 15,,18		
CSI-RS periodicity an	d subframe						
offset					5/1		
$T_{ ext{CSI-RS}}$ / $\Delta_{ ext{CSI-}}$	RS						
CSI reference signal c	onfiguration				0		
Propagation condition				Clause	B 1 (/ v 2)		
configuratio			Clause B.1 (4 x 2)				
Beamforming M				As specified in Section B.4.3			
	CodeBookSubsetRestriction bitmap			0x0000 00	00 0100 0000		
SNR (Note 2	2)	dB	7	8	13	14	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-91	-90	-85	-84	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	8	
Max number of HARQ t	ransmissions				1		
Physical channel for	CQI/PMI			DUSCI	H (Note3)		
reporting				PUSCI	n (Notes)		
PUCCH Report Type 1	or CQI/PMI				2		
Physical channel for F	RI reporting		PUCCH Format 2				
PUCCH Report Ty	oe for RI		3				
Reporting perio	dicity	ms	$N_{\rm pd} = 5$				
CQI delay		ms		<u>.</u>	8		
cqi-pmi-Configurat					2		
ri-ConfigInde					1		
		annel RC 7 FDD acc	ording to Ta	hle A 4-1 with	n one sided dyr	amic OCNG	

Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

### 9.2.3.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI<sub>1</sub> = wideband CQI<sub>0</sub> - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.2.3.2-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter	•	Unit	Te	st 1	Tes	st 2
Bandwidth		MHz			10	
PDSCH transmissi	on mode				9	
Uplink downlink con	figuration				2	
Special subframe co	nfiguration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB			-6	
	σ	dB			-3	
CRS reference s	ignals			Antenna	ports 0, 1	
CSI reference si	gnals				orts 15,,22	
CSI-RS periodicity an	d subframe			•	· ·	
offset				5	5/ 3	
$T_{ ext{CSI-RS}}$ / $\Delta_{ ext{CSI-RS}}$	RS					
CSI reference signal c	onfiguration		0			
	Propagation condition and antenna			Clause	B.1 (8 x 2)	
configuratio					. ,	
Beamforming M			As specified in Section B.4.3			
CodeBookSubsetRestr			0x0000 0000 0020 0000 0000 0001 0000			
SNR (Note 2	2)	dB	4	5	10	11
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-88	-87
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(	98	-9	98
Max number of HARQ t	ransmissions				1	
Physical channel for	· CQI/PMI			DUCCL	L (Note 2)	
reporting				PUSCE	H (Note 3)	
PUCCH Report Type fo PMI	r CQI/second				2b	
Physical channel for RI reporting				PU	JSCH	
PUCCH Report Type for RI/ first PMI					5	
Reporting perio						
CQI delay		ms	·			
cqi-pmi-Configurat					3	
ri-ConfigInde				805 (	Note 4)	
ACK/NACK feedba					plexing	

- Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

# 9.2.4 Minimum requirement PUCCH 1-1 (With Single CSI Process)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

### 9.2.4.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.1-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial

differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.2.4.1-1: PUCCH 1-1 static test (FDD)

		11.74	Tes	t 1		Test 2		
Paramet	er	Unit	TP1	TP	2	TP1		2
Bandwidth		MHz			1	0		
PDSCH transmission	n mode				1	0		
	$ ho_{\scriptscriptstyle A}$	dB	0	0		0	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	0		0		
allocation (Note 1)	P <sub>c</sub>	dB	-3	-3		-3		3
	σ	dB	-3	N/	A	-3	-3 N/A	
Cell ID			C	)			)	
Cell-specific referer	nce signals		Antenna ports 0, 1	(Note	e 2)	Antenna ports 0, 1	(Not	te 2)
CSI reference signa	als		Antenna ports 15,,18	N/	A	Antenna ports 15,,18	N,	/A
CSI-RS periodicity a subframe offset $T_{\rm C}$			5/1	N/	A	5/1	N,	/A
CSI-RS configuration			0	N/	A	0	N,	/A
Zero-Power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPower bitmap			1 / 001000000000 0000	1 100000 000	00000	1 / 001000000000 0000	100000	/ 000000 000
CSI-IM configuratio  I <sub>CSI-RS</sub> / ZeroPower0  bitmap	CSI-RS		1 / 001000000000 0000	N/A		1 / 001000000000 0000	) N/A	
CSI process configu Signal/Interference/ mode			CSI-RS/CSI-IN	//PUCCH	I 1-1	CSI-RS/CSI-II	M/PUCCI	┨1-1
Propagation conditi antenna configurati			Clause B.1 (4 x 2)	Clause (2 x		Clause B.1 (4 x 2)	Claus (2)	
CodeBookSubsetRobitmap			0x0000 0000 0100 0000	1000	000	0x0000 0000 0100 0000	100	000
SNR (Note 3)		dB	20	6	7	20	14	15
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-78	-92	-91	-78	-84	-83
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	8		-9	)8	
Modulation / Inform payload	ation bit		(Note4)	QPSK /	4392	(Note4)	QPSK	/ 4392
Max number of HAI transmissions	RQ		1	N/	A	1	N,	/A
Physical channel fo reporting			PUSCH (Note5)	N/.	A	PUSCH (Note5)	N,	/A
PUCCH Report Typ	e for		2	N/	N/A 2		N,	/A
PUCCH Report Typ	e for RI		3	N/.	A	3 N/A		/A
Reporting periodicit	у	ms	$N_{pd} = 5$	N/		$N_{pd} = 5$		/A
CQI Delay	•	ms	8	N/	A	8		/A
cqi-pmi-Configuration	onIndex		2	N/.	A	2	N.	/A
ri-ConfigIndex			1	N/	A	1	N,	/A
PDSCH scheduled	sub-frames		1,2,3,4,			1,2,3,4		
Timing offset betwe		us	, , <u>, , , , , , , , , , , , , , , , , </u>				)	
Frequency offset be		Hz	C	)		(	)	
Notal: Deference		nt shannal BC 10	CDD according to	Table A 4	1 with	one sided dynamic	OCNO I	Jottorn

Note1: Reference measurement channel RC.10 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: REs for antenna ports 0 and 1 CRS have zero transmission power.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: N/A.

Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

# 9.2.4.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.2-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.2.4.2-1: PUCCH 1-1 static test (TDD)

Parameter		Unit	Tes	st 1		Tes	st 2	
	.ei		TP1	TP		TP1	TI	2
Bandwidth		MHz				10		
PDSCH transmissio						10		
Uplink downlink cor Special subframe co						<u>2</u> 4		
Special Subfraffie G		dB	0	0		0		)
Downlink nower	$\rho_{\scriptscriptstyle A}$			_				
Downlink power allocation (Note 1)	$\rho_{\scriptscriptstyle B}$	dB	0	0		0		)
anocation (Note 1)	Pc	dB	-6	-6		-6		6
	σ	dB	-3	N/	Α	-3	- I	
Cell ID			C	)		(	0	
Cell-specific referer	nce signals		Antenna ports 0, 1	(Not	e 2)	Antenna ports 0, 1	(No	te 2)
CSI reference signa	als		Antenna ports 15,,22	N/	Α	Antenna ports 15,,22	N.	/A
CSI-RS periodicity a subframe offset $T_{CS}$			5/3	N/	Α	5/3	N.	/A
CSI-RS configuration			0	N/	A	0	N.	/A
Zero-Power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPower(bitmap)			3 / 001000000000 0000	3 100001 000	00000	3 / 001000000000 0000	10000	/ 100000 000
CSI-IM configuratio  I <sub>CSI-RS</sub> / ZeroPowerC  bitmap	CSI-RS		3 / 001000000000 0000	N/	A	3 / 001000000000 0000	N.	/A
CSI process configu Signal/Interference/ mode			CSI-RS/CSI-IN	M/PUCCH	1 1-1	CSI-RS/CSI-II	M/PUCCI	<del>-</del> 1 1-1
Propagation condition antenna configuration			Clause B.1 (8 x 2)	Claus (2 x		Clause B.1 (8 x 2)	Claus (2:	
CodeBookSubsetRobitmap	estriction		0x0000 0000 0020 0000 0000 0001 0000	1000	000	0x0000 0000 0020 0000 0000 0001 0000	100	000
SNR (Note 3)		dB	17	6	7	17	14	15
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-81	-92	-91	-81	-84	-83
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	8		-6	8	
Modulation / Information / Information			(Note4)	QPSK.	/ 4392	(Note4)	QPSK	/ 4392
Max number of HAF transmissions	₹Q		1	N/	Α	1	N.	/A
Physical channel fo reporting	r CQI/PMI		PUSCH (Note5)	N/	A	PUSCH (Note5)	N.	/A
PUCCH Report Typ CQI/second PMI	e for		2b	N/	A	2b	N.	/A
Physical channel fo			PUSCH	H N/A		PUSCH	N.	/A
PUCCH Report Typ PMI			5	N/		5		/A
Reporting periodicit	У	ms	$N_{\rm pd} = 5$	N/		$N_{\rm pd} = 5$		/A
CQI Delay	anladay	ms	10 or 11 3	N/		10 or 11 3		/A /^
cqi-pmi-Configuration ri-ConfigIndex	oninaex		805 (Note 6)	N/		805 (Note 6)		<u>/A</u> /A
ACK/NACK feedba	ck mode		Multiplexing	N/		Multiplexing		/A /A
PDSCH scheduled			3,4,		, \	3,4		,,,
Timing offset betwe		us	3,4,			3,4,		
Frequency offset be		Hz	C			(		

- Note1: Reference measurement channel RC.10 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: REs for antenna ports 0 and 1 CRS have zero transmission power.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: N/A.
- Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 6: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

# 9.2.5 Minimum requirement PUCCH 1-1 (when *csi-SubframeSet –r12* and *EIMTA-MainConfigServCell-r12* are configured)

The following requirements apply to UE Category  $\geq 2$  which supports eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI and Rel-12 CSI subframe sets. For the parameters specified in table 9.2.5-1, and using the downlink physical channels specified in Tables C.3.2-1 and C.3.2-2, for each CSI subframe set, the reported CQI value shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. For each CSI subframe set, if the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The difference of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  and the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  shall be larger than or equal to 3.

Table 9.2.5 -1: PUCCH 1-1 static test (TDD)

Parameter	r	Unit	Test		
Bandwidth		MHz		10	
PDSCH transmission m				9	
Uplink downlink configu				0	
Downlink HARQ referen	nce				
configuration (eimta-	40) (1) (1)			2	
HarqReferenceConfig-r	12) (Note 4)				
Set of dynamic TDD UL			{C	), 2}	
configurations (Notes 4, Periodicity of monitoring			<u> </u>		
reconfiguration DCI (ein		ms		10	
CommandPeriodicity-r1		1113		10	
Set of subframes to mor					
reconfiguration DCI (ein			S	F#5	
CommandSubframeSet				-	
CSI-MeasSubframeSet-			0001	100011	
Special subframe config	guration			4	
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$\rho_{\scriptscriptstyle B}$	dB		0	
allocation		-			
	$P_c$	dB		0	
000	σ	dB		-3	
CRS reference signals				ports 0, 1	
CSI reference signals	l. f		Antenna	ports 15,16	
CSI-RS periodicity and offset	subtrame		E	= / 4	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$			•	5/4	
CSI reference signal co	nfiguration			4	
Zero-Power CSI-RS cor				0/	
I <sub>CSI-RS</sub> / ZeroPowerCSI-I				00000000	
Zero-Power CSI-RS cor				4 /	
I <sub>CSI-RS</sub> / ZeroPowerCSI-I			010000000000000		
Propagation condition a	nd antenna		Clause B.1 (2 x 2)		
configuration			· · ·		
Beamforming Model				n Section B.4.3	
CodeBookSubsetRestri				0001'	
SNR in CSI subframe se		dB	0	1	
SNR in CSI subframe se	et 1	dB	10	11	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	
$N_{oc1}^{(j)}$ for CSI subframe se	et 0	dB[mW/15kHz]	-98	-98	
$N_{oc2}^{(j)}$ for CSI subframe se	et 1	dB[mW/15kHz]	-108	-108	
PDSCH scheduled subf			(	0,5	
CSI subframe set 0				-,-	
PDSCH scheduled subf	rames for		3.4	1,8,9	
CSI subframe set 1	ronomicaia				
Max number of HARQ to				1	
Physical channel for CC reporting	⟨1/ Γ IVII		PUSCH	I (Note 6)	
	r COI/second				
PUCCH Report Type for CQI/second PMI			:	2b	
Physical channel for RI reporting			PU	SCH	
PUCCH Report Type for RI/ first PMI			<del>-</del>	5	
Reporting periodicity		ms		el-12 CSI subframe set	
CQI delay		ms	12 for CSI s	ubframe set 0 ubframe set 1	
cqi-pmi-ConfigurationIn	dex		8 for	r set 0 or set 1	
ri-ConfigIndex				and set 1 (Note 7)	
ACK/NACK feedback m	ode			plexing	
ACK/NACK feedback mode		i	ividiti	-·-···································	

- Note 1: Reference measurement channel RC.19 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 for CSI subframe set 0.
- Note 2: Reference measurement channel RC.20 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 for CSI subframe set 1.
- Note 3: In the test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level for each CSI subframe set separately.
- Note 4: As specified in Table 4.2-2 in TS 36.211.
- Note 5: UL/DL configuration in PDCCH with eIMTA-RNTI is cyclically selected from the given set on a per-DCI basis.
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2. CQI/PMI reports for CSI subframe set 0 is transmitted in SF#2 and CQI/PMI reports for CSI subframe set 1 is transmitted in SF#7.
- Note 7: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

# 9.3 CQI reporting under fading conditions

# 9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

#### 9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

Parai	Parameter		Tes	st 2			
Band	Bandwidth		10 MHz				
Transmiss	Transmission mode		1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0		
power	$ ho_{\scriptscriptstyle B}$	dB		-	0		
allocation	σ	dB			0		
SNR (	Note 3)	dB	9	10	14	15	
	(j) or	dB[mW/15kHz]	-89	-88	-84	-83	
N	(j) oc	dB[mW/15kHz]	-98 -98		98		
_			Clause B.2.4 with $\tau_d = 0.4$ . $a = 1, f_D = 5  \mathrm{Hz}$		).45 <i>μ</i> s,		
Propagation	on channel				$C_D = 5 \mathrm{Hz}$		
Antenna co	onfiguration			1:	x 2		
Reportin	g interval	ms			5		
CQI	delay	ms			8		
Reporting mode				PUSC	CH 3-0		
Sub-ba	Sub-band size			6 (ful	l size)		
	er of HARQ issions				1		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

### 9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

Parar	neter	Unit	Test 1 Test 2			t 2
Band	width	MHz		10	MHz	
Transmiss	sion mode			1 (p	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		(	0	
allocation	σ	dB		(	0	
Uplink d configu				:	2	
Special s configu				•	4	
SNR (I	Note 3)	dB	9	10	14	15
$\hat{I}_o^0$	j) r	dB[mW/15kHz]	-89	-88	-84	-83
$N_{c}$	(j) oc	dB[mW/15kHz]	-98 -98			8
Propagation	on channel		7	$\tau_d = 0.45$	3.2.4 with 5 <i>μ</i> s, <i>a</i> = = 5 Hz	
Antenna co	nfiguration			1:	x 2	
Reporting		ms		,	5	
CQI	delay	ms		10 c	or 11	
Reportin	ig mode			PUSC	CH 3-0	
Sub-ba	nd size	RB		6 (ful	l size)	
Max number transm					1	
				Multin	olexina	
ACK/NACK feedback mode Multiplexing  Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied					than	

- at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
$\beta$ [%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

#### 9.3.1.1.3 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band:
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.3-1 Sub-band test for single antenna transmission (FDD)

Doromotor		Unit		Tes	t 1	Te	est 2
Parameter			Се	II 1	Cell 2 and 3	Cell 1	Cell 2 and 3
Bandwidth		MHz		10			10
PDSCH transmission			1		Note 10	1	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0			0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0			0
	σ	dB		0			0
Propagation con	dition		with To	e B.2.4 I = 0.45 1, fd = Hz	EVA5 Low antenna correlation	Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz	EVA5 Low antenna correlation
Antenna configu	ration			1x			x2
$\widehat{E}_s/N_{oc2}$ (Not	e 1)	dB	4	5	Cell 2: 12 Cell 3: 10	14 15	Cell 2: 12 Cell 3: 10
- x(i)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (Note 7)	N/A
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	-98 (Note 8)	N/A
·	$N_{oc3}^{(j)}$	dBm/15kHz	,	lote 9)	N/A	-93 (Note 9)	N/A
Subframe Configu	uration		Non-M	1BSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			(	)	Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1
Time Offset between	en Cells	μs	Cell 2: 3 usec Cell 3: -1usec		Cell 2: 3 usec Cell 3: -1usec		
Frequency Shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz		Cell 2: 300Hz Cell 3: -100Hz		
ABS pattern (No	ote 2)		N	/A	01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101
	RLM/RRM Measurement Subframe Pattern (Note 4)		0000 0000 0000	0100 0100 0100 0100 0100	N/A	0000100 0000100 0000100 0000100 0000100	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0101 0101 0101 0101 0101	0101 0101	N/A	01010101 01010101 01010101 01010101 01010101	N/A
(Note 3)	C <sub>CSI,1</sub>		1010 1010 1010 1010	1010 1010 1010 1010 1010	N/A	10101010 10101010 10101010 10101010 10101010	N/A
Number of control symbols	OFDM			3		3	
Max number of F				1			1
CQI delay	-	ms	8				
Reporting interval (		ms	10				-
Reporting mo						CH 3-0	
Sub-band siz	ze	RB	6 (full size)				

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 12: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 13: The CSI reporting is such that reference subframes belong to Ccsi.0.

Table 9.3.1.1.3-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
3	0.01	0.01
UE Category	≥1	≥1

# 9.3.1.1.4 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.4-1: Sub-band test for single antenna transmission (TDD)

Parameter		Unit		Test 1		Test 2		
Parameter		Offic	Cel	ll 1	Cell 2 and 3	Ce	II 1	Cell 2 and 3
Bandwidth		MHz		1	0			0
PDSCH transmission			1		Note 10		1	Note 10
Uplink downlink con				1	1			1
Special subfra configuration				4	4		4	4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0			(	0
allocation	$ ho_{\scriptscriptstyle B}$	dB			)			)
	σ	dB			)			)
Propagation con	dition		Clause with Td us, a =	= 0.45 1, fd =	EVA5 Low antenna correlation	with Td us, a =	e B.2.4  = 0.45   1, fd =  Hz	EVA5 Low antenna correlation
Antenna configu	ration			1)	x2		1:	x2
$\widehat{E}_s/N_{oc2}$ (Not	e 1)	dB	4	5	Cell 2: 12 Cell 3: 10	14	15	Cell 2: 12 Cell 3: 10
( )	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	ote 7)	N/A	-98 (N	lote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8) N/A -93 (Note 9) N/A		N/A	-98 (Note 8)		N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz			-93 (Note 9)		N/A	
Subframe Configu	uration		Non-M	BSFN	Non-MBSFN	Non-MBSFN		Non-MBSFN
Cell Id			C	)	Cell 2: 6 Cell 3: 1	(	)	Cell 2: 6 Cell 3: 1
Time Offset between	en Cells	μs		Cell 2: Cell 3:	3 usec -1usec			3 usec -1usec
Frequency shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz			Cell 2:	300Hz -100Hz	
ABS pattern (No	•		N/	'A	0100010001 0100010001	N.	/A	0100010001 0100010001
RLM/RRM Measu Subframe Pattern (			00000		N/A	00000		N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000		N/A	01000 01000		N.A
(Note 3)	C <sub>CSI,1</sub>		10001 10001	01000	N/A		01000 01000	N/A
Number of control symbols	OFDM		3 3		3			
Max number of F transmission			1 1		1			
CQI delay		ms	10					
Reporting interval (		ms	10					
Reporting mo						CH 3-0		
Sub-band siz		RB			6 (full	size)		
ACK/NACK feedba	ck mode			Multip	lexing		Multip	lexing

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 12: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 13: The CSI reporting is such that reference subframes belong to Ccsi,0.

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
3	0.01	0.01
UE Category	≥1	≥1

Table 9.3.1.1.4-2 Minimum requirement (TDD)

### 9.3.1.1.5 TDD (when *csi-SubframeSet –r12* is configured)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets. For the parameters specified in Table 9.3.1.1.5-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.5-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for each CSI subframe set;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be ≥ γ for each CSI subframe set;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05 and less than 0.60 for each CSI subframe set.
- d) the difference of the wide-band median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},0}$  and the wide-band median CQI obtained by reports in CSI subframe sets  $C_{\text{CSI},1}$  shall be larger than or equal to 3.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.1.5-1: Sub-band test for TDD

	Parameter	Unit	Te	est	
Bandwidth		MHz		0	
Transmission m				2	
Uplink downlink				2	
Special subfram			4		
CSI-MeasSubtra		ID.	0001100000		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-	3	
allocation	$ ho_{\scriptscriptstyle B}$	dB	-	3	
	σ	dB		0	
SNR in CSI sub		dB	0	1	
SNR in CSI sub	frame set 1	dB	10	11	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	
$N_{oc1}^{(j)}$ for CSI sub		dB[mW/15kHz]	-98	-98	
$N_{oc2}^{(j)}$ for CSI sub	oframe set 1	dB[mW/15kHz]	-108	-108	
Propagation cha	annel			th $ au_d = 0.45  \mu \text{s}$ , $ au_D = 5  \text{Hz}$	
Antenna configu	ıration		2:	$\frac{C_D}{D} = 5 \text{ Hz}$ x2	
CRS reference	signals			ort 0 and 1	
	I-RS configuration 0 verCSI-RS bitmap		-	3 / 000000000	
Zero-Power CS	I-RS configuration 1		4	<b>!</b> /	
PDSCH schedu	verCSI-RS bitmap led subframes for CSI			00000000	
subframe set 0			8	,9	
PDSCH schedu subframe set 1	led subframes for CSI		3,4		
Reporting interv	al (Note 4)	ms	10 per subframe set		
CQI delay		ms	15 for CSI subframe set 0 15 for CSI subframe set 1		
Reporting mode	!		PUSC	CH 3-0	
Sub-band size		RB	6 (ful	l size)	
	HARQ transmissions			1	
ACK/NACK feed				olexing	
	CCH Sets Configured			te 5,6)	
	per EPDCCH Set			4	
EPDCCH Subfree				IA CCE	
EPDCCH Aggre				K B.4.4	
	UE reports in an available	Lunlink reporting insta			
	estimation at a downlink su				
	deband CQI cannot be app				
	rence measurement chann		`	,	
	dynamic OCNG Pattern C				
Note 3: In the	e test, the minimum require (s) and the respective wan	ements shall be fulfille	d for at least one	of the two	
Note 4: For C	SI subframe set 0, PDCC	H DCI format 0 with a	trigger for aperiod	dic CQI shall be	
SF#	transmitted in downlink SF#3 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF #7. For CSI subframe set 1, PDCCH DCI format 0 with a trigger for aperiodic CQI				
	shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2.				
Note 5: In car	se UE supports EPDCCH, CCH, otherwise PDCCH is		ng grants are tran	smitted via	
			verlapping with F	PRB = {0, 3, 6, 9}	
	Note 6: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {0, 3, 6, 9} for the first set and PRB = {40, 43, 46, 49} for the second set. EPDCCH set is selected				
	scheduling decision for PD				
	s, respectively. EPDCCH is				
	CCH is derived from the Po	CFICH. RRC signalling	g epdcch-StartSy	mbol-r11is not	
confi	gured				

Table 9.3.1.1.5-2: Minimum requirement (TDD)

	Test
α[%]	2
β[%]	55
γ	1.1
UE Category	≥1

# 9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

# 9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.1-1 Sub-band test for FDD

Parai	meter	Unit	Te	st 1	Tes	st 2
Band	width	MHz	10 MHz			
Transmission mode				!	9	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB	0			
	σ	dB			0	
SNR (	Note 3)	dB	4	5	11	12
	(j) or	dB[mW/15kHz]	-94	-93	-87	86
N	(j) oc	dB[mW/15kHz]	-98 -98		98	
Dropogatio	on channal		Clause B.2.4 with $ au_d=0$ .		).45 <i>μ</i> s,	
Propagatio	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Antenna co	onfiguration			2	x2	
Beamform	ning Model		As sp	pecified in	n Section	B.4.3
CRS refere	nce signals			Antenna	a ports 0	
	nce signals		Α	ntenna p	orts 15, 1	16
	and subframe offset $/$ $\Delta_{ extsf{CSI-RS}}$			5,	/ 1	
CSI-RS reference s	signal configuration				4	
	Restriction bitmap				0001	
Reporting into		ms			5	
	delay	ms	8			
Reportir	ng mode		PUSCH 3-1			
Sub-ba	nd size	RB	6 (full size)			
Max number of HA	ARQ transmissions		1			
Note 1: If the UE	reports in an available	uplink reporting insta	ince at si	ubframe \$	SF#n bas	ed on
CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband						

or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.8 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.1.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	≥1	≥1

#### 9.3.1.2.2 **TDD**

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.2-1 Sub-band test for TDD

Parai	meter	Unit	Test 1 Test 2			st 2
Band	lwidth	MHz		10	MHz	
Transmiss	sion mode			!	9	
Uplink downlin	k configuration				2	
Special subfran	ne configuration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB			0	
	σ	dB			0	
SNR (I	Note 3)	dB	4	5	11	12
$\hat{I}_{c}$	(j) or	dB[mW/15kHz]	-94	-93	-87	-86
N	(j) oc	dB[mW/15kHz]	-(	98	-9	98
			Clause	B.2.4 wi	th $\tau_d = 0$	).45 <i>μ</i> s,
Propagation	on channel			$a = 1, f_D = 5 \text{ Hz}$		
Antenna co	onfiguration				x2	
	ning Model		As sp	ecified in	n Section	B.4.3
CRS refere	ence signals		Antenna port 0			
CSI refere	nce signals		,	Antenna	port 15,1	6
	and subframe offset			5	/ 3	
	$/\Delta_{\text{CSI-RS}}$			J,	, ,	
	signal configuration				4	
	Restriction bitmap			000	0001	
Reporting into	erval (Note 4)	ms		;	5	
CQI	delay	ms		1	0	
Reportir	ng mode			PUSC	CH 3-1	
Sub-ba	and size	RB	6 (full size)			
Max number of HA	ARQ transmissions				1	
ACK/NACK fe	edback mode			Multip	lexing	
Note 1: If the UE	reports in an available	uplink reporting insta	nce at su	ubframe S	SF#n bas	ed on
CQI estim	nation at a downlink su	bframe not later than	SF#(n-4	), this rep	orted sul	bband
or wideba	and CQI cannot be app	lied at the eNB down	link befor	re SF#(n-	+4)	
Note 2: Reference					'two	
sided dyn	sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.					
Note 3: For each	test, the minimum req	uirements shall be fulf	filled for a	at least o	ne of the	two
	nd the respective want					
SF#3 and	#8 to allow aperiodic	CQI/PMI/RI to be tran	smitted	on uplink	SF#2 an	ıd #7.

Table 9.3.1.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	≥1	≥1

Test 1

### 9.3.1.2.3 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.3-1 Sub-band test for FDD

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Parameter Unit

raiai	raiailletei Oilit lest		วเ เ	
Band	width	MHz	10 I	MHz
Transmiss	sion mode		9	
	$ ho_{\scriptscriptstyle A}$	dB	(	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0
allocation	$P_{c}$	dB	(	0
	σ	dB	(	0
SNR (	Note 3)	dB	16	17
$\hat{I}_{c}$	(j) or	dB[mW/15kHz]	-82	-81
N	$N_{oc}^{(j)}$		-98	-98
Propagation channel			Clause B.2.4 with $\tau_{_d} = 0.45\mu$	
Propagatio	on channel		$a = 1, f_D = 5 \text{ Hz}$	
	onfiguration		_	x2
Beamform	ning Model		As specified in	Section B.4.3
CRS refere	nce signals		Antenna	a ports 0
	nce signals		Antenna p	orts 15, 16
CSI-RS periodicity	and subframe offset		5.	/ <b>1</b>
	$/\Delta_{ extsf{CSI-RS}}$		-	
	signal configuration			4
	Restriction bitmap		000001	
	erval (Note 4)	ms	5	
	delay	ms	8	
	ng mode		PUSCH 3-1	
	nd size	RB	6 (full size)	
	ARQ transmissions			1
Note 4. If the LIC reports in an evallable uplied reporting instance at subfrace CC#s based on				

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.8A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.1.2.3-2 Minimum requirement (FDD)

	Test 1
α[%]	2
β[%]	40
γ	1.1
UE Category	11-12
UE DL Category	≥11

# 9.3.1.2.4 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ,
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.3.1.2.4-1 Sub-band test for TDD

Parai	meter	Unit	Test 1
Bandwidth		MHz	20 MHz
Transmiss	sion mode		9
Uplink downlin	k configuration		2
Special subframe configuration			4
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0
	$P_{c}$	dB	0
	σ	dB	0

SNR (Note 3)	dB	16	17
$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-82	-81
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
Decreasion showed		Clause B.2.4 wi	th $\tau_d = 0.45 \mu\text{s}$ ,
Propagation channel		a=1, f	$T_D = 5 \text{ Hz}$
Antenna configuration			x2
Beamforming Model		As specified in Section B.4.3	
CRS reference signals		Antenna port 0	
CSI reference signals		Antenna port 15,16	
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$		5/ 3	
CSI-RS reference signal configuration		4	
CodeBookSubsetRestriction bitmap		000001	
Reporting interval (Note 4)	ms	5	
CQI delay ms 10		0	
Reporting mode	PUSCH 3-1		
Sub-band size	RB	8 (ful	l size)
Max number of HARQ transmissions		1	
ACK/NACK feedback mode		Multip	lexing

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.8A TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7.

Table 9.3.1.2.4-2 Minimum requirement (TDD)

	Test 1
<i>α</i> [%]	2
$\beta$ [%]	40
γ	1.1
UE Category	11-12
UE DL Category	≥11

9.3.1.2.5 Void

Table 9.3.1.2.5-1: Void

Table 9.3.1.2.5-2: Void

### 9.3.1.2.6 TDD (when *csi-SubframeSet –r12* is configured with one CSI process)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets and TM10. For the parameters specified in Table 9.3.1.2.6-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.6-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for each CSI subframe set;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the

TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$  for each CSI subframe set;

- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.01 for each CSI subframe set.
- d) The difference of the wide-band median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  and the wide-band median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  shall be larger than or equal to 3.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.6-1: Sub-band test for TDD

Down		l lmit	T .	
Parameter Bandwidth		Unit MHz	<b>Test</b> 10	
Transmission mode		IVII IZ		0
Uplink downlink configuration				2
Special subframe configuration				<u>-</u> 4
	oframeSet-r12		00011	00000
	$ ho_{\scriptscriptstyle A}$	dB		0
Danueliak manas		dB		0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$			
allocation	$P_{c}$	dB	-	3
	σ	dB	-	3
	ubframe set 0	dB	0	1
SNR in CSI s		dB	10	11
	(j) or	dB[mW/15kHz]	-98	-97
$N_{oc1}^{(j)}$ for CSI	subframe set 0	dB[mW/15kHz]	-98	-98
$N_{oc2}^{(j)}$ for CSI	subframe set 1	dB[mW/15kHz]	-108	-108
Propagation	on channel			th $\tau_d = 0.45 \mu\text{s}$ , $\tau_D = 5 \text{Hz}$
	onfiguration			
	ning Model			Section B.4.3
	nce signals			ort 0 and 1
	nce signals		Antenna	port 15,16
	and subframe offset		5/	0
	$\frac{\Delta_{\text{CSI-RS}}}{\Delta_{\text{CSI-RS}}}$			<u> </u>
	RS configuration 0		<u> </u>	
	erCSI-RS bitmap		0000010000000000	
Zero-Power CSI-F	RS configuration 1			1/
I <sub>CSI-RS</sub> / ZeroPow	erCSI-RS bitmap		01000000	00000000
	figuration 0 erCSI-RS bitmap			
CSI-IM con	figuration 1			00000000
CSI process configu	erCSI-RS bitmap		01000000	00000000
	Reporting mode for		CSI-RS/CSI-IN	/I 0/PUSCH 3-1
CSI subfr				
CSI process configuration Signal/Interference/	ration Reporting mode for		CSI-RS/CSI-IN	/I 1/PUSCH 3-1
	ame set 1 Restriction bitmap		000	0001
Reporting into		ms		bframe set
				ubframe set 0
CQI	delay	ms		ubframe set 1
	nd size	RB	6 (ful	l size)
	subframes for CSI ne set 0		8	,9
	subframes for CSI		3	,4
Max number of HARQ transmissions				1
	edback mode			lexing
	reports in an available			
	ation at a downlink su			
or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.18 TDD according to Table A.4-1 with one/tw				
sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.				
Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level for each subframe set separately				
Note 4: For CSI subframe set 0, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be				
transmitte	d in downlink SF#3 to	allow aperiodic CQI/I	PMI/RI to be trans	mitted on uplink
	r CSI subframe set 1,			
shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted				

on uplink SF#2.

Table 9.3.1.2.6-2: Minimum requirement (TDD)

	Test
α[%]	2
β[%]	55
γ	1.02
UE Category	≥1

# 9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

### 9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1 and Table 9.3.2.1.1-3, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and Table 9.3.2.1.1-4 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.3.2.1.1-3 and Table 9.3.2.1.1-4 is defined in 9.1.1.1.

Table 9.3.2.1.1-1 Fading test for single antenna (FDD)

Parameter		Unit	Test 1 Test 2		st 2	
Bandwidth		MHz	10 MHz			
Transmiss	sion mode			1 (port 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
SNR (N	Note 3)	dB	6	7	12	13
- 0		dB[mW/15kHz]	-92	-91	-86	-85
$N_{c}$	(j) oc	dB[mW/15kHz]	-98 -98		8	
Propagation	n channel		EPA5			
Correlat			High (1 x 2)			
antenna co	nfiguration		• ,			
Reportir			PUCCH 1-0			
Reporting	periodicity	ms	$N_{\rm pd} = 2$			
CQI	delay	ms	8			
Physical of	hannel for		PUSCH (Note 4)			
CQI reporting			PUSCH (Note 4)			
PUCCH Report Type			4			
cqi-pmi- ConfigurationIndex				,	1	
	er of HARQ		1			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.

Table 9.3.2.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

Table 9.3.2.1.1-3 Fading test for single antenna (FDD)

Parameter		Unit	Test 1 Test 2		st 2	
Bandwidth		MHz	5 MHz			
Transmiss	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
SNR (Note	e 3)	dB	6	7	12	13
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-92	-91	-86	-85
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(	98	-9	98
	on channel			EP	PA5	
Correlatio				High (	(1 x 2)	
	onfiguration		High (1 x 2)			
Reporting			PUCCH 1-0			
Reporting periodicity		ms	$N_{\rm pd} = 2$			
CQI delay		ms	8			
Physical channel for CQI reporting				PUSCH	(Note 4)	
	eport Type				4	
cqi-pmi-	сроп турс					
Configura	tionIndex			•	1	
Max numb	er of HARQ			,	1	
transmiss			L			
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.14 FDD according to Table A.4-1 for Category ≥ 2 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.15 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3: For						

each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 #3 #7 and #9

DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.

Table 9.3.2.1.1-4 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

# 9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

	neter	Unit	Test 1 Test 2		st 2	
Band	width	MHz	10 MHz		ИНz	
Transmiss	ion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
Uplink de configu				2	2	
Special s configu				4	4	
SNR (N	lote 3)	dB	6	7	12	13
$\hat{I}_{on}^{(\cdot)}$	r	dB[mW/15kHz]	-92	-91	-86	-85
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Propagatio	n channel		EPA5			
Correlati antenna co			High (1 x 2)			
Reportin				PUCC	CH 1-0	
Reporting p		ms			= 5	
CQI d		ms			or 11	
Physical channel for CQI reporting			PUSCH (Note 4)			
PUCCH Re	eport Type		4			
cqi-p Configura			3			
Max numbe transmi			1			
ACK/NACK mod			Multiplexing			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

Table 9.3.2.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

# 9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

#### 9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.1-1 Fading test for FDD

Parameter		Unit	Test 1 Test		st 2	
Bandwidth		MHz	10 MHz			
Transmission mode			9			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	$P_c$	dB	-3			
	σ	dB	-3			
SNR (I	Note 3)	dB	2	3	7	8
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-96	-95	-91	-90
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			)8
Propagation channel			EPA5			
	tenna configuration		ULA High (4 x 2)			
Beamforming Model			As specified in Section B.4.3			B.4.3
	ference signals		Antenna ports 0,1			
CSI reference signals			Antenna ports 15,,18			18
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$			5/1			
CSI-RS reference signal configuration			2			
CodeBookSubsetRestriction bitmap			0x0000 0000 0000 0001			001
Reportir			PUCCH 1-1			
Reporting periodicity		ms	$N_{\rm pd} = 5$			
CQI delay		ms	8			
Physical channel for CQI/ PMI reporting			PUSCH (Note 4)			
PUCCH Report Type for CQI/PMI			2			
PUCCH channel for RI reporting			PUCCH Format 2			
PUCCH report type for RI			3			
cqi-pmi-ConfigurationIndex			2			
ri-ConfigIndex					1	
Max number of HARQ transmissions					1	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Table 9.3.2.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

### 9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.2-1 Fading test for TDD

Parameter		Unit	Test 1 Test 2		st 2	
Bandwidth		MHz	10 MHz			
Transmission mode			9			
Uplink downlink configuration			2			
Special subframe configuration			4			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	$P_{c}$	dB	-6			
	σ	dB	-3			
SNR (I	Note 3)	dB	1	2	7	8
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-97	-96	-91	-90
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			98
Propagation channel			EPA5			
Correlation and and	tenna configuration		XP High (8 x 2)			
Beamforming Model			As specified in Section B.4.3			
CRS refere			Antenna ports 0, 1			
CSI reference signals			Antenna ports 15,,22			,22
	and subframe offset		5/ 3			
$T_{\text{CSI-RS}}$	$^{\prime}\Delta_{ extsf{CSI-RS}}$		3/ 3			
CSI-RS reference signal configuration			2			
CodeBookSubsetRestriction bitmap			0x0000 0000 0000 0020 0000 0000 0001		0000	
Reporting mode			PUCCH 1-1 (Sub-mode: 2)		le: 2)	
Reporting periodicity		ms	$N_{pd} = 5$			
CQI delay		ms	10			
Physical channel for CQI/ PMI			PUSCH (Note 4)			
reporting			2c			
PUCCH Report Type for CQI/ PMI Physical channel for RI reporting			PUCCH Format 2			
PUCCH report type for RI			3			
cqi-pmi-ConfigurationIndex			3			
ri-ConfigIndex			805 (Note 5)			
Max number of HARQ transmissions				000 (1	1	
	ACK/NACK feedback mode			Multin	lexing	
7.01717.01116	Caback Houc		l	ividitip	ioxing	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.2.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
<i>α</i> [%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

# 9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

# 9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

# 9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha\%$  for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

Parameter		Unit	Test 1	Test 2	
Bandwidth		MHz	10 MHz	10 MHz	
Transmission mode			1 (port 0)	1 (port 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0	
power	$ ho_{\scriptscriptstyle B}$	dB	0	0	
allocation	σ	dB	0	0	
$I_{ot}^{(j)}$ for RB 05		dB[mW/15kHz]	-102	-93	
$I_{ot}^{(j)}$ for RB 641		dB[mW/15kHz]	-93	-93	
$I_{ot}^{(j)}$ for RB 4249		dB[mW/15kHz]	-93	-102	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-94	
Max number of HARQ transmissions			1		
Propagation channel			Clause B.2.4 with $\tau_d = 0.45 \mu\text{s}$		
			$a = 1, f_D = 5 \text{ Hz}$		
Reporting interval		ms	5		
Antenna configuration			1 x 2		
CQI delay		ms	8		
Reporting mode			PUSCH 3-0		
Sub-band size		RB	6 (full size)		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Table 9.3.3.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

#### 9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha\%$  for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

Parar	neter	Unit	Test 1	Test 2
Band	width	MHz	10 MHz 10 MHz	
Transmiss	sion mode		1 (port 0)	1 (port 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	0	0
allocation	σ	dB	0	0
Uplink d configu			2	
Special s configu			4	
$I_{ot}^{(j)}$ for $I$	RB 05	dB[mW/15kHz]	-102	-93
$I_{ot}^{(j)}$ for F	RB 641	dB[mW/15kHz]	-93 -93	
$I_{ot}^{(j)}$ for R	B 4249	dB[mW/15kHz]	-93 -102	
$\hat{I}_o^0$	j) r	dB[mW/15kHz]	-94 -94	
Max numbe transm			1	
			Clause B.2.4 wit	h $ au_d=0.45\mu\mathrm{s},$
Propagation	on channel		$a = 1, f_I$	
Antenna co	nfiguration		1 x	2
Reporting	g interval	ms	5	<u> </u>
CQI		ms	10 or 11	
Reportin			PUSCH 3-0	
Sub-ba		RB	6 (full	size)
ACK/NACk mo	de	orts in an available i	Multip	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

Table 9.3.3.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

9.3.3.2 Void

9.3.3.2.1 Void

9.3.3.2.2 Void

### 9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

## 9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

#### 9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{\rm PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

Para	meter	Unit	Tes	st 1	Tes	st 2
Band	lwidth	MHz	10 MHz			
Transmis	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
SNR (	Note 3)	dB	9	10	14	15
	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
N	oc (j)	dB[mW/15kHz]	-6	98	-9	98
			Clause	B.2.4 wit	th $\tau_d = 0$	).45 <i>μ</i> s,
Propagation	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Reportin	g interval	ms	5			
CQI	delay	ms	8			
Reportii	ng mode			PUSC	H 2-0	
	er of HARQ				1	
	issions	DDa		2 /6	-:\	
	d size (k)	RBs		3 (full	size)	
	f preferred nds ( <i>M</i> )			Ę	5	
Note 1: I					CQI	
Note 2:	Reference me A.4-1 with one	e measurement channel RC.5 FDD according to Table one/two sided dynamic OCNG Pattern OP.1/2 FDD as in Annex A.5.1.1/2.				
I		the minimum requine two SNR(s) and t				

Table 9.3.4.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

#### 9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRR}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

Para	meter	Unit	Tes	st 1	Tes	st 2
Band	dwidth	MHz	10 MHz			
Transmis	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
config	downlink uration			2	2	
	subframe uration			4	4	
SNR (	Note 3)	dB	9	10	14	15
$\hat{I}$	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
N	(j) oc	dB[mW/15kHz]	-98 -98		)8	
Propagati	on channel		Clause B.2.4 with $\tau_d = 0.45$		$0.45  \mu s$ ,	
Tiopagati	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Reportin	g interval	ms		į	5	
CQI	delay	ms		10 c	or 11	
	ng mode			PUSC	CH 2-0	
	er of HARQ				1	
	nissions					
	d size (k)	RBs		3 (full	l size)	
	of preferred nds ( <i>M</i> )			į	5	
	K feedback			Multip	lexing	
	ode	rta in an available i	inlink ron	ortina ino	tonoo ot	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.5 TDD according to Table			CQI			
	A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.			D as		
1		the minimum requine two SNR(s) and t				

Table 9.3.4.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

# 9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

#### 9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting

from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

Para	ameter	Unit	Te	st 1	Tes	st 2
Ban	dwidth	MHz	10 MHz			
Transmi	ssion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$\rho_{\scriptscriptstyle R}$	dB		(	)	
allocation	σ	dB		(	)	
SNR	(Note 3)	dB	8	9	13	14
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-90	-89	-85	-84
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-(	98	-9	8
			Clause	B.2.4 wit	$\tau_d = 0$	.45 μs
Propaga	tion channel		u u			
Reportin	g periodicity	ms	$a = 1, f_D = 5 \text{ Hz}$ $N_P = 2$			
	l delay	ms	8			
	channel for eporting		PUSCH (Note 4)			
PUCCH Report Type for wideband CQI			4			
PUCCH	Report Type band CQI			,	Ī	
Max num	ber of HARQ missions			•	ĺ	
Subband size (k)		RBs		6 (full	size)	
Number of	of bandwidth rts ( <i>J</i> )			•	3	
ρα	K				1	
cgi-pmi-	ConfigIndex					
Note 1:	If the UE repositions subframe SF# not later than cannot be appreciated the subframe	E reports in an available uplink reporting instance at ne SF#n based on CQI estimation at a downlink subframe or than SF#(n-4), this reported subband or wideband CQI be applied at the eNB downlink before SF#(n+4) nece measurement channel RC.3 FDD according to Table				
Note 3:	described in A For each test,	Annex A.5.1.1/2. , the minimum requi	rements	/two sided dynamic OCNG Pattern OP.1/2 FDD as		

- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.
- Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with i=1.
- Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI report.

Table 9.3.4.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

#### 9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

Para	meter	Unit	Tes	st 1	Tes	st 2
	dwidth	MHz			ИНz	
	sion mode			1 (pc		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
	downlink			2	2	
	uration subframe					
	uration			2	1	
SNR (	(Note 3)	dB	8	9	13	14
$\hat{I}_{c}$	or	dB[mW/15kHz]	-90	-89	-85	-84
N	oc	dB[mW/15kHz]	-6	98	-9	18
Propagati	on channel		Clause	B.2.4 wit	th $\tau_d = 0$	$.45  \mu$ s,
Tropagati	on channel			a = 1, f	$_D = 5 \mathrm{Hz}$	
	periodicity	ms		$N_{P}$		
	delay	ms		10 c	or 11	
CQI re	channel for eporting			PUSCH	(Note 4)	
	teport Type band CQI		4			
PUCCH R	eport Type		1			
	oand CQI er of HARQ		'			
	nissions		1			
Subban	d size ( <i>k</i> )	RBs		6 (full	size)	
	f bandwidth ts ( <i>J</i> )		3			
	K			•	1	
cqi-pmi-C	ConfigIndex			3	3	
	K feedback ode			Multip	lexing	
Note 1:	If the UE reposubframe SF# not later than	orts in an available units in an available units in based on CQI es SF#(n-4), this report	timation a rted subb	at a down and or wi	link subfr deband (	
		olied at the eNB dove easurement channe				able
	A.4-1 with one	e/two sided dynamic				
		Annex A.5.2.1/2. the minimum requi	romonto	shall ba f	ulfillad far	r ot
		ne two SNR(s) and t				
Note 4:	level. To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink					
Note 5:	bandwidth pa according to t with j=1.				dth part	
		cording to the most				I

Table 9.3.4.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

# 9.3.5 Additional requirements for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

## 9.3.5.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

#### 9.3.5.1.1 FDD

For the parameters specified in Table 9.3.5.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.1.1-1 Fading test for single antenna (FDD)

Par	rameter	Unit	Cell 1	Cell 2	
Bai	ndwidth	MHz		MHz	
	ission mode			ort 0)	
	lic Prefix		Normal	Normal	
	Cell ID		0	1	
	R (Note 8)	dB	-2 N/A		
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A	
Propaga	ation channel		EPA5	Static (Note 7)	
	lation and configuration		Low (1 x 2)	(1 x 2)	
	(Note 4)	dB	N/A	-0.41	
Re	ference ment channel		Note 2	R.2 FDD	
	rting mode		PUCCH 1-0	N/A	
Reportir	ng periodicity	ms	$N_{\rm pd} = 2$	N/A	
CC	QI delay	ms	8	N/A	
Physica	al channel for reporting		PUSCH (Note 3)	N/A	
	Report Type		4	N/A	
CO	qi-pmi- urationIndex		1 N/A		
Max num	ber of HARQ		1	N/A	
Note 1:	missions	rta in an available	unlink roporting in	ostanaa at	
Note 2:  Note 3:	subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  e 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.				
NOIG 4.	cell relative to	respective received power spectral density of each interfering relative to $N_{oc}$ ' is defined by its associated DIP value as			
Note 5:	specified in clause B.5.1.  e 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.				
Note 6: Note 7:					

Table 9.3.5.1.1-2 Minimum requirement (FDD)

SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause

Gaussian noise model Cell 2 is not present.

γ	1.8
UE Category	≥1

# 9.3.5.1.2 TDD

Note 8:

For the parameters specified in Table 9.3.5.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%

Table 9.3.5.1.2-1 Fading test for single antenna (TDD)

Parameter	Unit	Cell 1	Cell 2	
Bandwidth	MHz	10 MHz		
Transmission mode		1 (port 0)		
Uplink downlink			2	
configuration		<u> </u>		
Special subframe			4	
configuration			·	
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-2	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
Propagation channel		EPA5	Static (Note 7)	
Correlation and antenna configuration		Low (1 x 2)	(1 x 2)	
DIP (Note 4)	dB	N/A	-0.41	
Reference		Note 2	R.2A TDD	
measurement channel				
Reporting mode		PUCCH 1-0	N/A	
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	
CQI delay	ms	10 or 11	N/A	
Physical channel for CQI reporting		PUSCH (Note 3)	N/A	
PUCCH Report Type		4	N/A	
cqi-pmi- ConfigurationIndex		3	N/A	
Max number of HARQ transmissions		1 N/A		
ACK/NACK feedback mode		Multiplexing N/A		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
- Note 8: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1

Table 9.3.5.1.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥1

# 9.3.5.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

## 9.3.5.2.1 FDD

For the parameters specified in Table 9.3.5.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.1-1 Fading test for single antenna (FDD)

Parameter	Unit	Cell 1	Cell 2	
Bandwidth	MHz		MHz	
Transmission mode	IVII IZ	9		
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-2	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A	
Propagation channel		EPA5	Static (Note 7)	
Correlation and antenna configuration		Low (2 x 2)	(1 x 2)	
DIP (Note 4)	dB	N/A	-0.41	
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0	
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and subframe offset		5/1	N/A	
CSI-RS reference signal configuration		2	N/A	
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	1 / 001000000000 000	
CodeBookSubsetRestr iction bitmap		001111	N/A	
Reference measurement channel		Note 2	R.2 FDD	
Reporting mode		PUCCH 1-1	N/A	
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	
CQI delay	ms	8	N/A	
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A	
PUCCH Report Type for CQI/PMI		2	N/A	
PUCCH channel for RI reporting		PUCCH Format 2	N/A	
PUCCH Report Type for RI		3	N/A	
cqi-pmi- ConfigurationIndex		2	N/A	
ri-ConfigIndex		1	N/A	
Max number of HARQ transmissions		1	N/A	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Note 4: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.

Note 6: Both cells are time-synchronous.

Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.

Note 8: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

### Table 9.3.5.2.1-2 Minimum requirement (FDD)

γ	1.8
UE Category	≥2

#### 9.3.5.2.2 TDD

For the parameters specified in Table 9.3.5.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.2-1 Fading test for single antenna (TDD)

Parameter	Unit	Cell 1 Cell 2			
Bandwidth	MHz	10 MHz			
Transmission mode		9			
Uplink downlink		2			
configuration		2			
Special subframe			4		
configuration		·	4		
Cyclic Prefix		Normal	Normal		
Cell ID		0	1		
SINR (Note 8)	dB	-2	N/A		
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98		
Propagation channel		EPA5	Static (Note 7)		
Correlation and		L avv. (0 v. 0)			
antenna configuration		Low (2 x 2)	(1 x 2)		
DIP (Note 4)	dB	N/A	-0.41		
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0		
CSI reference signals		Antenna ports 15,16	N/A		
CSI-RS periodicity and subframe offset		5/3	N/A		
CSI-RS reference		2	NI/A		
signal configuration		2	N/A		
Zero-power CSI-RS					
configuration	Subframes /		3/		
I <sub>CSI-RS</sub> /	bitmap	N/A	001000000000		
ZeroPowerCSI-RS	ышар		0000		
bitmap					
CodeBookSubsetRestr		001111	N/A		
iction bitmap		001111	14/71		
Reference		Note 2	R.2A TDD		
measurement channel					
Reporting mode		PUCCH 1-1	N/A		
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A		
CQI delay	ms	10	N/A		
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A		
PUCCH Report Type for CQI/PMI		2	N/A		
Physical channel for RI		PUCCH	N1/A		
reporting		Format 2	N/A		
PUCCH Report Type			N1/A		
for RI		3	N/A		
cqi-pmi-		3	N/A		
ConfigurationIndex					
ri-ConfigIndex		805 (Note 9)	N/A		
Max number of HARQ transmissions		1	N/A		
ACK/NACK feedback					
mode		Multiplexing	N/A		
N 4 1/4 1/5		1			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 4: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as

	specified in clause B.5.1.
Note 5:	Two cells are considered in which Cell 1 is the serving cell and Cell
	2 is the interfering cell. Intefering cell is fully loaded.
Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white
	Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to $\hat{E}_{s}/N_{oc}$ of Cell 1 as defined in clause
	8.1.1.
Note 9:	RI reporting interval is set to the maximum allowable length of
	160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK
	reports. In the case when all three reports collide, it is expected that
	CQI/PMI reports will be dropped, while RI and HARQ-ACK will be
	multiplexed. At eNB, CQI report collection shall be skipped every
	160ms during performance verification and the reported CQI in
	subframe SF#7 of the previous frame is applied in downlink
	subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.5.2.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥2

# 9.3.6 Minimum requirement (With multiple CSI processes)

The purpose of the test is to verify the reporting accuracy of the CQI and the UE processing capability for multiple CSI processes. Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.3.6-1. For UE supports one CSI process, CSI process 2 is configured and the corresponding requirements shall be fulfilled. For UE supports three CSI processes, CSI processes 0, 1 and 2 are configured and the corresponding requirements shall be fulfilled. For UE supports four CSI processes, CSI processes 0, 1, 2 and 3 are configured and the corresponding requirements shall be fulfilled.

Table 9.3.6-1: Configuration of CSI processes

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 0	CSI-IM resource 1	CSI-IM resource 2

#### 9.3.6.1 FDD

For the parameters specified in Table 9.3.6.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.1-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.6.1-1: Fading test for FDD

				Tes	et 1			To	st 2		
Para	meter	Unit	TP			2	TP1 TP2				
Band	dwidth	MHz		10 MHz		10 MHz					
Transmis	sion mode		10		1	0	1	0	1	0	
	$ ho_{\scriptscriptstyle A}$	dB	0			0					
Downlink power $ ho_{\scriptscriptstyle B}$		dB	0			0					
allocation	$P_c$	dB	-3	-3		0		-3		0	
	σ	dB		-	3			-	3		
SNR (	Note 7)	dB	10	11	7	8	14	15	9	10	
$\hat{I}_c$	(j) or	dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88	
N	r(j) oc	dB[mW/15kHz]		-6	98			-9	98		
Propagation	on channel		EPA 5	Low	a =	ith ).45 <i>μ</i> s, = 1,	EPA 5 Low $ au_d = 0$		Clause wi $\tau_d = 0$	th .45 <i>μ</i> s,	
Antonno o	onfiguration		4x2	)		= 5 Hz	4,	x2	J <sub>D</sub> -		
	onfiguration ning Model				Section	K2 B.4.3			Section		
	between TPs	us	710 000		0	D. 1.0	710 0		)	D. 1.0	
	et between TPs	Hz		(	0			(	)		
Cell-specific re	eference signals				ports 0,1				ports 0,1		
	signal 0		Antenna 15,		N.	/A		na ports ,18	N/	/A	
$T_{\text{CSI-RS}}$	$\prime$ and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		5/1		N.	/A	5	/1	N/	/A	
CSI-RS 0 c	configuration		0 N/A					N/			
	signal 1		N/A		Antenna ports 15,16		N/A Antenn				
	$\prime$ and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		N/A	N/A		/1	N/A		5/	<b>′</b> 1	
	configuration		N/A	4		5			5		
	RS 0 configuration verCSI-RS bitmap		N/A			/ 000000 00	Ν	/A	1 111000 00	000000	
	RS 1 configuration verCSI-RS bitmap		1 / 00100110000 N/A 00000		1 / 00100110000 00000 N/A		/A				
	and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		5/1 5/1		5.	/1	5/	<b>′</b> 1			
CSI-IM 0 c	onfiguration		2		2	2	2	2	2	2	
	and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		5/1		N.	/A	5	/1	N/	/A	
	onfiguration		6		N.	/A	(	6	N/	/A	
	and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		N/A	4	5.	/1	N	/A	5/	<b>′</b> 1	
CSI-IM 2 c	onfiguration		N/A			1	N	/A	1	<u> </u>	
	CSI-RS		CSI-RS 0 CS			RS 0					
	CSI-IM			CSI-IM 0 CSI-IN							
	Reporting mode CodeBookSubsetR			PUCCH 1-1 PUCC		CH 1-1					
	estriction bitmap		0x00	0x0000 0000 0000 0001		0 0000 0	001				
	Reporting periodicity	ms		$N_{pd}$	= 5			$N_{pd}$	= 5		
CSI process 0	CQI delay	ms		1	1			1	1		
	Physical channel for CQI/ PMI reporting		ı			11 H (Note 6)					
	PUCCH Report Type for CQI/PMI			2		2					
	PUCCH channel		F	UCCH	Format 2	!	PUCCH Format 2				

	for RI reporting					
	PUCCH report					
	type for RI			3	3	3
	cqi-pmi-			4	4	
	ConfigurationIndex		4	4	4	
	ri-ConfigIndex			2	2	)
	CSI-RS		CSI-RS 1		CSI-	RS 1
	CSI-IM	CSI-IM 0		-IM 0	CSI-	IM 0
	Reporting mode		PUSC	CH 3-1	PUSC	H 3-1
	CodeBookSubsetR		000	1001	000	001
CSI process 1	estriction bitmap		000	1001	000	001
•	Reporting interval (Note 10)	ms	;	5	Ę	5
	CQI delay	ms		1	1	
	Sub-band size	RB	6 (ful	l size)	6 (full	size)
	CSI-RS			RS 0	CSI-	RS 0
	CSI-IM		CSI-	-IM 1	CSI-	
	Reporting mode		PUSC	CH 3-1	PUSC	H 3-1
CSI process 2	CodeBookSubsetR		0x0000 0000 0000 0001		0x0000 0000 0000 0001	
(For UE configured	estriction bitmap					
single process)	Reporting interval	mo	5		5	
	(Note 8)	ms				
	CQI delay	ms	8		8	
	Sub-band size	RB	6 (full size) (Note 9)		6 (full size) (Note 9)	
	CSI-RS		CSI-RS 1		CSI-	
	CSI-IM		CSI-IM 2		CSI-IM 2	
	Reporting mode		PUSCH 3-1		PUSCH 3-1	
	CodeBookSubsetR		000	1001	000001	
CSI process 3	estriction bitmap		000	1001	000001	
	Reporting interval (Note 10)	ms		5	5	
	CQI delay	ms	1	1	1	1
	Sub-band size	RB	6 (ful		6 (full	
CSI process for P				ocess 2	CSI pro	
Cel	LID		0	6	0	6
	ated CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
			Same Cell ID	Same Cell ID	Same Cell ID	Same Cell ID
Quasi-co-lo	cated CRS		as Cell 1 as Cell 2 as Cell 1		as Cell 2	
PMI for subframe	2, 3, 4, 7, 8 and 9		0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000
PMI for subfi	ame 1 and 6		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000
Max number of HA	RQ transmissions		1	N/A	1	N/A
	conceto in an available	Under a manufacture de la contra				

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.12 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.
- Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.
- Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#2 and #7.
- Note 7: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.
- Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.
- Note 10: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#2 and #7 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#1 and #6.

Table 9.3.6.1-2: Minimum requirement (FDD)

	CSI process 0	CSI process 1	CSI process 2	CSI process 3		
<i>α</i> [%]	N/A	2	2	2		
β[%]	N/A	40	40	40		
δ[%]	10	N/A	N/A	N/A		
γ	N/A	N/A	1.02	N/A		
UE Category	≥1					

Table 9.3.6.1-3: Minimum median CQI difference between configured CSI processes (FDD)

	CSI process 1	CSI process 2	CSI process 3
CSI process 0	N/A	1	3
UE Category		≥1	

#### 9.3.6.2 TDD

For the parameters specified in Table 9.3.6.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.2-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.6.2-1: Fading test for TDD

Parameter		Unit	Test 1			Test 2				
	meter		TF		TP2		TP1 TP2		P2	
Bandwidth		MHz			MHz	0	10 MHz			
Transmission mode Uplink downlink configuration			10		10		10		10	
Special subframe co			2			<u>²                                    </u>	2			<u>~                                    </u>
Opecial Subframe co		dB	_		0	•			)	<del>T</del>
5 " 1	$\rho_A$				0				)	
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB			_				-	
anocanori	$P_c$	dB	-;		(	)	-	3		0
SNR (Note 7)	σ	dB dB	10	11	3	8	14	15	3 9	10
$\hat{I}_{or}^{(j)}$					İ	-90	-84		-89	
		dB[mW/15kHz]	-88	-87	-91	-90	-04	-85	-09	-88
$N_{oc}^{(j)}$		dB[mW/15kHz]		-6	98			-6	98	
Propagation channe	1		EPA (	5 Low	$ \begin{array}{c c} B.2.4. \\ \tau_d = 0 \\ a = 0 \end{array} $	.45 $\mu$ s,	EPA	5 Low	$B.2.4.$ $\tau_d = 0$ $a = 0$	ause .1 with ).45 \(\mu \text{s}\), = 1, = 5 Hz
Antenna configuration			4>		2)			x2	2:	x2
Beamforming Model			As sp		Section	B.4.3	As sp	ecified in		B.4.3
Timing offset between		US			0				)	
Frequency offset be Cell-specific referen		Hz	0 Antenna po				O Antonna r		a ports 0,1	
CSI-RS signal 0	oo digiralo		Antenna ports 15,, 18		N/A		Antenna ports 15,, 18			/A
CSI-RS 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/3		N/A		5/3		N	/A
CSI-RS 0 configurat	ion		0		N/A		(	0	N	/A
CSI-RS signal 1			N/A		Antenna ports 15, 16		N/A			na ports , 16
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N/A		5/3		N/A		5	/3
CSI-RS 1 configurat	ion		N/A		5		N/A			5
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPowerC			N/A		3 / 11100000000 00000			/A	111000	3 / 000000 000
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPowerC	SI-RS bitmap		3 / 00100110000 00000		N/A		00100	3 / 110000 000	N	/A
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/	/3	5/	'3	5	/3	5.	/3
CSI-IM 0 configurati			2	2	2	<u> </u>	:	2	2	2
CSI-IM 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/	/3	N.	'A	5	/3	N	/A
CSI-IM 1 configurati	on		6	3	N,	Ά	(	6	N	/A
CSI-IM 2 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N	/A	5/	/3	N	/A	5.	/3
CSI-IM 2 configuration			N/		,		N	/A		1
	CSI-RS				RS 0				RS 0	
	CSI-IM				-IM 0				·IM 0	
	Reporting mode CodeBookSubsetR estriction bitmap				UCCH 1-1 0000 0000 0001		0x0000 000			001
CSI process 0	Reporting periodicity	ms		$N_{pd}$	= 5		N <sub>pd</sub> = 5		= 5	
	CQI delay	ms		1	2			1	2	
	Physical channel for CQI/ PMI			PUSCH	(Note 6)			PUSCH	(Note 6)	
	reporting PUCCH Report			:	2		2			

			ı			
	Type for CQI/PMI					
PUCCH channel			PUCCH	PUCCH Format 2		Format 2
	for RI reporting					
	PUCCH report		;	3	3	3
	type for RI					
	cqi-pmi-		;	3	3	3
	ConfigurationIndex ri-ConfigIndex		00F (N	lata 40\	005 /N	ata 40\
				lote 10)	805 (N	
	CSI-RS CSI-IM			RS 1 -IM 0	CSI- CSI-	
	Reporting mode		PUSC	CH 3-1	PUSC	H 3-1
001	CodeBookSubsetR		000	0001	000	001
CSI process 1	estriction bitmap					
	Reporting interval	ms		5	5	5
,	(Note 9)					•
	CQI delay	ms		2	1	
	Sub-band size	RB	6 (ful		6 (full	
	CSI-RS			RS 0	CSI-	
	CSI-IM			-IM 1	CSI-	
	Reporting mode		PUSC	PUSCH 3-1		H 3-1
	CodeBookSubsetR		0x0000 000	0 0000 0001	0x0000 0000 0000 0001	
CSI process 2	estriction bitmap		0,0000 000			
	Reporting interval (Note 9)	ms		5		5
	CQI delay	ms	1	12		2
	Sub-band size	RB	6 (full size	e) (Note 8)	6 (full size) (Note 8)	
	CSI-RS		CSI-	RS 1	CSI-RS 1	
	CSI-IM		CSI-	-IM 2	CSI-IM 2	
	Reporting mode			CH 3-1	PUSCH 3-1	
	CodeBookSubsetR					
CSI process 3	estriction bitmap		000	0001	000001	
·	Reporting interval (Note 9)	ms		5	5	
	CQI delay	ms	1	2	1	2
	Sub-band size	RB			6 (full	
CSI process for PE		ND		6 (full size) CSI process 2		ocess 2
Cell ID	Joon I scrieduling		0	6	0	6
Quasi-co-located C	SI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
			Same Cell ID	Same Cell ID	Same Cell ID	Same Cell ID
Quasi-co-located C	CRS		as Cell 1	as Cell 2	as Cell 1	as Cell 2
PMI for subframe 4 and 9			0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000
PMI for subframe 3	3 and 8		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000
Max number of HA	RQ transmissions		1	N/A	1	N/A
ACK/NACK feedba			Multiplexing	N/A	Multiplexing	N/A
	= reports in an available	unlink reporting inc				

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.12 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.
- Note 4: TM10 OCNG is transmitted as specified in A.5.2.8 on subframe 3 and 8 from TP1.
- Note 5: TM10 OCNG is transmitted as specified in A.5.2.8 on subframe 3, 4, 8 and 9 from TP2
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 7: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2.
- Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.
- Note 10: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.6.2-2: Minimum requirement (TDD)

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
α[%]	N/A	2	2	2
β[%]	N/A	40	40	40
δ[%]	10	N/A	N/A	N/A
γ	N/A	N/A	1.02	N/A
UE Category			<u></u> ≥1	

Table 9.3.6.2-3: Minimum median CQI difference between configured CSI processes (TDD)

	CSI process 1	CSI process 2	CSI process 3
CSI process 0	N/A	1	3
UE Category		≥1	

# 9.3.7 Minimum requirement PUSCH 3-2

## 9.3.7.1 FDD

For the parameters specified in Table 9.3.7.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.1-2 and by the following.

- a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be  $\geq \alpha$ ;
- b) The ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be  $\geq \beta$ ;

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 FDD for test 1 and according to RC.18 FDD for test 2.

Table 9.3.7.1-1 Sub-band test for FDD

Paran	neter	Unit	Te	est 1	Test 2	
Bandy	Bandwidth			101	ИНz	
PDSCH resou	PDSCH resource allocation		50PRB		a subband, 6PRB	
Transmiss	ion mode		Т	M6	TI	M9
	$ ho_{\scriptscriptstyle A}$	dB		-6		0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	,	-6		0
allocation	$P_c$	dB		-	-	3
	σ	dB		3	-	3
SNR (N	lote 3)	dB	0	1	5	6
$\hat{I}_{oi}^{()}$	<i>i</i> )	dB[mW/15kHz]	-98	-97	-93	-92
$N_o^{()}$	j) c	dB[mW/15kHz]	-98	-98	-98	-98
Propagatio	n channel		EVA5		EVA5	
Antenna co	nfiguration		4x2 ULA low		4x2 XP high (Note 4)	
	Beamforming Model		-		B.4.3	
CRS referer			Antenna ports 0, 1, 2, 3		Antenna ports 0, 1	
Time offset between 5)	TX antenna (Note	ns	65		-	
CSI referen	ce signals				Antenna ports	15, 16, 17, 18
CSI-RS periodicity a $T_{\text{CSI-RS}}$ /			-		5/ 1	
CSI-RS reference s			-			4
alternativeCodeboo	kEnabledFor4TX		No		Y	es
CodeBookSubsetRestriction bitmap			0x0000 000	00 0000 FFFF		0 0000 FFFF FFFF
Reporting inte	rval (Note 6)	ms	5			5
CQI d		ms		8		8
Reporting	g mode		PUSCH 3-2	2, PUSCH 3-1	PUSCH 3-2	, PUSCH 1-2
Sub-bar	nd size	RB	6 (fu	ll size)	6 (full size)	
Max number of HA			·	1		1

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.17 FDD / RC.18 FDD for Test 1 / 2 according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.
- Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.
- Note 6: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.7.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α	1.05	-
β	-	1.15
UE Category	≥2	≥2

# 9.3.7.2 TDD

For the parameters specified in Table 9.3.7.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.2-2 and by the following.

a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be >\alpha:

b) The ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be  $\geq \beta$ ;

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 TDD for test 1 and RC.18 TDD for test 2.

Table 9.3.7.2-1 Sub-band test for TDD

Parar	neter	Unit	Te	st 1	Test 2	
Band	width	MHz		10ľ	ИHz	
PDSCH resource allocation		RB	50PRB		a subband, 6PRB	
Transmiss	sion mode		TI	M6	TN	И9
Uplink downlin	k configuration			1		1
Special subfran	ne configuration			4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-	-6	(	)
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-	-6		)
allocation	$P_{c}$	dB		-	-	3
	σ	dB		3	-	3
SNR (I	Note 3)	dB	0	1	5	6
$\hat{I}_{c}^{i}$	(j) or	dB[mW/15kHz]	-98	-97	-93	-92
N	(j) oc	dB[mW/15kHz]	-98	-98	-98	-98
Propagation	on channel		EVA5		EVA5	
Antenna co	onfiguration		4x2 ULA low		4x2 XP high (Note 4)	
Beamform	ning Model			-	B.4.3	
CRS refere	nce signals		Antenna ports 0, 1, 2, 3		Antenna ports 0, 1	
Time offset between	n TX antenna (Note	ns	65		-	
CSI referei	nce signals				Antenna ports 15, 16, 17, 18	
	and subframe offset $^{\prime}$ $\Delta_{ extsf{CSI-RS}}$		-		5/ 4	
	signal configuration		-		4	4
alternativeCodebo	okEnabledFor4TX		١	No	Y	es
CodeBookSubsetRestriction bitmap			0x0000 0000 0000 FFFF			0 0000 FFFF FFFF
Reporting into	Reporting interval (Note 6)		5		į	5
	delay	ms		8		3
Reportir			PUSCH 3-2	, PUSCH 3-1	PUSCH 3-2,	PUSCH 1-2
Sub-ba		RB	6 (ful	ll size)	6 (full	size)
Max number of HA	ARQ transmissions			1	,	1

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.17 TDD / RC.18 TDD for Test 1 / 2 according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.
- Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.
- Note 6: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#3 and #8.

Table 9.3.7.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α	1.05	-
β	-	1.15
UE Category	≥2	≥2

# 9.3.8 Additional requirements for enhanced receiver Type B

The purpose of the test is to verify that the reporting of the channel quality based on the receiver of the enhanced Type B meets a minimum performance. Performance requirements are specified in terms of the relative throughput obtained when the transport format is that indicated by the reported CQI with NeighCellsInfo-r12 configured compared to the case without NeighCellsInfo-r12 configured. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the interference cells.

## 9.3.8.1 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

#### 9.3.8.1.1 FDD

For the parameters specified in Table 9.3.8.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.1.1-2 and by the following

Table 9.3.8.1.1-1 Fading test for FDD

Parameter		Unit	Cell 1	Cell 2	Cell 3	
Bandwidth		MHz		10		
Transmission mod	е		4			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		
	σ	dB		0		
Cyclic Prefix			Normal	Normal	Normal	
Cell ID			0	1	6	
SNR		dB	8.34	N/A	N/A	
$\hat{E}_s/N_{oc}$			N/A	3.28	0.74	
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26	
$N_{oc}$		dB [mW/15kHz]				
Propagation chann			EPA5	EPA5 EPA5		
Correlation and an	tenna configuration		Low 2 x 2	Low 2 x 2	Low 2 x 2	
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
Interference mode	I		N/A	As specified in clause B.6.3	As specified in clause B.6.3	
Reporting periodic	ity	ms	$N_{pd} = 5$	N/A	N/A	
Physical channel	for CQI/PMI reporting		PUCCH Format 2	PUCCH N/A		
PUCCH Report Ty	pe for CQI/PMI		2			
PUCCH Report Ty			3	N/A	N/A	
cgi-pmi-ConfigurationIndex			6	6 N/A		
ri-ConfigurationInd	lex		1	N/A	N/A	
CodeBookSubsetRestriction bitmap			000001	000001 N/A		
Max number of HARQ transmissions			1 N/A		N/A	
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}	
r12 (Note 4)	transmissionModeList -r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}	
Nists 4. If the Lill		1: 1 ::		05"	001	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: All cells are time-synchronous.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.1.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

#### 9.3.8.1.2 TDD

For the parameters specified in Table 9.3.8.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.1.2-2 and by the following

Table 9.3.8.1.2-1 Fading test for TDD

Pa	rameter	Unit	Cell 1	Cell 2	Cell 3		
Bandwidth		MHz		10			
Transmission mod			4				
Uplink downlink co	onfiguration			2			
Special subframe	configuration			4			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3			
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3			
	σ	dB		0			
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
SNR		dB	8.34	N/A	N/A		
$\hat{E}_s/N_{oc}$			N/A	3.28	0.74		
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26		
$N_{oc}$	$N_{oc}$		-98				
Propagation chan	nel		EPA5 EPA5		EPA5		
Correlation and ar	ntenna configuration		Low 2 x 2 Low 2 x 2		Low 2 x 2		
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
Interference mode	el		N/A As specified in clause B.6.3		As specified in clause B.6.3		
Reporting periodic	city	ms	$N_{pd} = 5$ N/A		N/A		
Physical channel f	for CQI/PMI reporting		PUSCH (Note 3)	N/A	N/A		
PUCCH Report Ty	/pe		2	N/A	N/A		
cqi-pmi-Configura	tionIndex		3	N/A	N/A		
ri-ConfigIndex	ri-ConfigIndex		805 (Note 5)	N/A	N/A		
CodeBookSubsetRestriction bitmap			000001 N/A		N/A		
Max number of HARQ transmissions			1 N/A		N/A		
ACK/NACK feedback mode			Multiplexing N/A		N/A		
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}		
r12 (Note 6)	transmissionModeList -r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: All cells are time-synchronous.
- Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.
- Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.1.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

# 9.3.8.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

### 9.3.8.2.1 FDD

For the parameters specified in Table 9.3.8.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.2.1-2 and by the following

Table 9.3.8.2.1-1 Fading test for FDD

Parameter		Unit	Cell 1	Cell 2	Cell 3	
Bandwidth		MHz	10			
Transmission	mode		9			
	$ ho_{\scriptscriptstyle A}$	dB	0			
-	Downlink $ ho_{\scriptscriptstyle B}$		0			
power allocation	Pc	dB		0		
	σ	dB		0		
Cyclic Prefix			Normal	Normal	Normal	
Cell ID			0	1	6	
SNR		dB	8.34	N/A	N/A	
$\hat{E}_s/N_{oc}$			N/A	3.28	0.74	
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26	
$N_{oc}$		dB [mW/15kHz]		-98		
Propagation			EPA5	EPA5	EPA5	
Correlation a configuration			Low 2 x 2	Low 2 x 2	Low 2 x 2	
	eference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
Beamforming	Model			specified in Section B	.4.3	
CSI reference signals			Antenna ports 15,16	N/A	N/A	
CSI-RS periodicity and subframe offset			5/1	N/A	N/A	
CSI-RS reference signal configuration			2	N/A	N/A	
Zero-power CSI-RS configuration  I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	1 / 00010000000000 00	1 / 00010000000000 00	
CodeBookSu bitmap	CodeBookSubsetRestriction		000001	N/A	N/A	
	Interference model		N/A	As specified in clause B.6.4	As specified in clause B.6.4	
Reporting pe	riodicity	ms	$N_{\rm pd} = 5$	N/A	N/A	
Physical channel for CQI/PMI reporting			PUSCH (Note 3)	N/A	N/A	
PUCCH Report Type for CQI/PMI			2	N/A	N/A	
PUCCH channel for RI reporting			PUCCH Format 2	N/A	N/A	
PUCCH Report Type for RI			3	N/A	N/A	
cqi-pmi-ConfigurationIndex			2	N/A	N/A	
ri-ConfigIndex			1	N/A	N/A	
Max number	Max number of HARQ		1	N/A	N/A	
transmissions						
NeighCellsInf	p-aList-r12 transmission		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}	
-r12 (Note 5)	ModeList-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5
- Note 4: All cells are time-synchronous.
- Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.2.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.2.2 TDD

For the parameters specified in Table 9.3.8.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.2.2-2 and by the following

Table 9.3.8.2.2-1 Fading test for TDD

Parameter		Unit	Cell 1	Cell 2	Cell 3		
Bandwidth		MHz	10				
Transmission	mode		9				
$ ho_{\scriptscriptstyle A}$		dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	Pc	dB	0				
	σ	dB		0			
Uplink downlin	nk configuration			2			
	ame configuration			4			
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
SNR		dB	8.34	N/A	N/A		
$\hat{E}_s/N_{oc}$			N/A	3.28	0.74		
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26		
$N_{oc}$		dB [mW/15kHz]		-98			
Propagation of			EPA5	EPA5	EPA5		
Correlation ar configuration			Low 2 x 2	Low 2 x 2	Low 2 x 2		
Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
Beamforming	Model		As spe	As specified in Section B.4.3			
CSI reference signals			Antenna ports 15,16	N/A	N/A		
CSI-RS periodicity and subframe offset			5/3	N/A	N/A		
CSI-RS reference signal configuration			2	N/A	N/A		
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	3 / 0001000000000 000	3 / 0001000000000 000		
CodeBookSul bitmap	osetRestriction		000001	N/A	N/A		
Interference n	nodel		N/A	As specified in clause B.6.4	As specified in clause B.6.4		
Reporting per		ms	$N_{\rm pd} = 5$	N/A	N/A		
reporting	nnel for CQI/PMI		PUSCH (Note 3)	N/A	N/A		
PUCCH Report Type for CQI/PMI			2	N/A	N/A		
Physical channel for RI reporting			PUCCH Format 2	N/A	N/A		
PUCCH Report Type for RI			3	N/A	N/A		
cqi-pmi-ConfigurationIndex			3	N/A	N/A		
ri-ConfigIndex			805 (Note 5)	N/A	N/A		
Max number of transmissions	Max number of HARQ transmissions		1	N/A	N/A		
ACK/NACK fe			Multiplexing	N/A	N/A		
NeighCellsInfo	n al ict r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}		
-r12 (Note 6)	transmission ModeList-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}		
Note 1: If the		and the last and the last	reporting inctance at cu	L. f OF #	001		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 4: All cells are time-synchronous.

Note 5:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between
	RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that
	CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report
	collection shall be skipped every 160ms during performance verification and the reported CQI in
	subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after
	CQI/PMI dropping) is available.
Note 6:	NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.2.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

## 9.3.8.3 Minimum requirement with CSI process

#### 9.3.8.3.1 FDD

For the parameters specified in Table 9.3.8.3.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.1-2 and by the following

a) the ratio of the throughput obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified  $\hat{E}_s/N_{oc}$  and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified  $\hat{E}_s/N_{oc}$  shall be  $\geq \gamma$ ;

Table 9.3.8.3.1-1 Fading test for single antenna (FDD)

	ameter	Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz		10	
Transmission mode			10	9	9
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Cyclic Prefix			Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
$\widehat{E}_s/N_{oc}$		dB	N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
$N_{oc}$		dB[mW/15kHz]		-98	
Propagation channe	el		EPA5	EPA5	EPA5
Correlation and ant			Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific referen	nce signals		Antenna ports	Antenna port 0,	Antenna port
			0,1	1	0, 1
Beamforming Mode	el			pecified in Section	B.4.3
CSI reference signa	als		Antenna ports	N/A	N/A
	and subframe offset		15,16 5/1	N/A	N/A
CSI-RS reference s			2	N/A N/A	N/A
	<u> </u>			1/	1/
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPo	S configuration werCSI-RS bitmap	Subframes / bitmap	N/A	000100000000	00010000000 00000
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
	CSI-RS		CSI-RS	N/A	N/A
	CSI-IM		CSI-IM	N/A	N/A
	Reporting mode		PUCCH 1-1	N/A	N/A
	CodeBookSubsetRe striction bitmap		000001	N/A	N/A
	Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A N/A	N/A
l	CQI delay Physical channel for	ms	8 PUSCH	IN/A	N/A
	CQI/ PMI reporting		(Note 3)	N/A	N/A
CSI process	PUCCH Report Type for CQI/PMI		2	N/A	N/A
	PUCCH channel for RI reporting		PUCCH Format 2	N/A	N/A
	PUCCH report type for RI		3	N/A	N/A
	cqi-pmi- ConfigurationIndex		2	N/A	N/A
	ri-ConfigIndex		1	N/A	N/A
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/1	N/A	N/A
CSI-IM configuration			6	N/A	N/A
CSI process for PDSCH scheduling			CSI process	N/A	N/A
Quasi-co-located C			CSI-RS Same Cell ID as Cell 1	N/A N/A	N/A N/A
Reference measurement channel			Note 2	N/A	N/A
Max number of HA			1	N/A	N/A
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
r12 (Note 5)	transmissionModeLis t-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: If the LIE	reports in an available u	inlink reporting inst	ance at subframe	SE#n based on CC	) Actimation at

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG

	Pattern OP.1 FDD as described in Annex A.5.1.1.
Note 3:	To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic

CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Note 4: All cells are time-synchronous.

Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.3.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

### 9.3.8.3.2 TDD

For the parameters specified in Table 9.3.8.3.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.2-2 and by the following

a) the ratio of the throughput obtained obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified  $\hat{E}_s/N_{oc}$  and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified  $\hat{E}_s/N_{oc}$  shall be  $\geq \gamma$ ;

Table 9.3.8.3.2-1 Fading test for single antenna (TDD)

	Parameter	Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz		10	
Transmission mode			10	9	9
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Uplink downlink co	onfiguration			2	
Special subframe	configuration			4	
Cyclic Prefix			Normal	Normal	Normal
Cell ID		ID.	0	1	6
SNR		dB	8.34	N/A	N/A
$\hat{E}_s/N_{oc}$		dB	N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
$N_{oc}$		dB[mW/15k Hz]		-98	
Propagation chan			EPA5	EPA5	EPA5
	ntenna configuration		Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific refere	ence signals		Antenna ports	Antenna port	Antenna port
			0,1	0,1	0,1
Beamforming Mod	del			ecified in Section	B.4.3
CSI reference sign			Antenna ports 15,16	N/A	N/A
CSI-RS periodicity	and subframe offset		5/3	N/A	N/A
CSI-RS reference	signal configuration		2	N/A	N/A
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	3 / 000100000000 0000	3 / 00010000000 00000
Interference mode	el		N/A	As specified in clause B.6.4	As specified in clause B.6.4
	CSI-RS		CSI-RS	N/A	N/A
	CSI-IM		CSI-IM	N/A	N/A
	Reporting mode		PUCCH 1-1	N/A	N/A
	CodeBookSubsetRestricti on bitmap		000001	N/A	N/A
	Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	N/A
	CQI delay	ms	8	N/A	N/A
CSI process	Physical channel for CQI/ PMI reporting		PUSCH (Note 3)	N/A	N/A
OOI process	PUCCH Report Type for		1 /		
	CQI/PMI		2	N/A	N/A
	PUCCH channel for RI		PUCCH	N/A	N/A
	reporting		Format 2		
	PUCCH report type for RI		3	N/A	N/A
	cqi-pmi- ConfigurationIndex		3	N/A	N/A
	ri-ConfigIndex		805 (Note 5)	N/A	N/A
CSI-IM periodicity $\Delta_{\text{CSI-RS}}$	and subframe offset $T_{\text{CSI-RS}}$ /		5/1	N/A	N/A
CSI-IM configuration			6	N/A	N/A
CSI process for PDSCH scheduling			CSI process	N/A	N/A
Quasi-co-located CSI-RS			CSI-RS	N/A	N/A
Quasi-co-located CRS			Same Cell ID as Cell 1	N/A	N/A
Reference measu	rement channel		Note 2	N/A	N/A
	ARQ transmissions		1	N/A	N/A
ACK/NACK feedback mode			Multiplexing	N/A	N/A
ACK/NACK feedb					(10.0 10.0
NeighCellsInfo- r12 (Note 6)	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink

	before SF#(n+4)
Note 2:	Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG
	Pattern OP.1 TDD as described in Annex A.5.1.1.
Note 3:	To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic
	CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.
Note 4:	All cells are time-synchronous.
Note 5:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI,
	CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI
	reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall
	be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the
	previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.
Note 6:	NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.3.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

# 9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6 with 1 TX, transmission mode 9 with 4 TX and transmission mode 9 with 8 TX *alternativeCodebookEnabledCLASSB\_K1=TRUE* configured are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}}.$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement,  $t_{md}$  is 60% of the maximum throughput obtained at  $SNR_{md}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{md}$  with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

For PUCCH 1-1 single PMI requirement under transmission mode 9 with 8 TX  $alternativeCodebookEnabledCLASSB\_K1=TRUE$  configured,  $t_{ue}$  is 70% of the maximum throughput obtained at  $SNR_{follow}$  using the precoders configured according to the UE reports, and  $t_{rnd}$  is the throughput measured at  $SNR_{follow}$  with random precoding.

The requirements for transmission mode 9 with 8 TX and transmission mode 9 with 4TX enhanced codebook are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI, PUCCH 1-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{follow1,follow2}$  is 70% of the maximum throughput obtained at  $SNR_{follow1,follow2}$  using the precoders configured according to the UE reports, and  $t_{md1,md2}$  is the throughput measured at  $SNR_{follow1,follow2}$  with random precoding.

The requirements for transmission mode 9 with 12 TX and 16 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue,follow1,1,follow1,2,follow2}}{t_{rnd1,1,rnd1,2,rnd2}}$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{ue,follow1,1,follow1,2,follow2}$  is 90% of the maximum throughput obtained at  $SNR_{follow1,1,follow1,2,follow2}$  using the precoders configured according to the UE reports, and  $t_{rnd1,1,rnd1,2,rnd2}$  is the throughput measured at  $SNR_{follow1,1,follow1,2,follow2}$  with random precoding.

# 9.4.1 Single PMI

## 9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

#### 9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

Table 9.4.1.1.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Propagation	on channel		EVA5
Precoding	granularity	PRB	50
Correlat antenna co			Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting	g interval	ms	1
PMI delay	y (Note 2)	ms	8
Measurement channel			R. 10 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.4.1.1.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.1
UE Category	≥1

## 9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

Table 9.4.1.1.2-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
	downlink		1
	uration		ı
Special	subframe		4
	uration		•
	on channel		EVA5
	granularity	PRB	50
	tion and		Low 2 x 2
antenna co	onfiguration		LOW Z X Z
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporti	ng mode		PUSCH 3-1
Reporting interval		ms	1
PMI delay (Note 2)		ms	10 or 11
Measurem	ent channel		R.10 TDD
OCNG	Pattern		OP.1 TDD
Max numb	er of HARQ		4
transm	nissions		4
	ncy version		{0,1,2,3}
coding sequence			[0,1,2,0]
ACK/NACK feedback			Multiplexing
mode			
	Note 1: For random precoder selection, the precoder		
	shall be updated in each available downlink		
	transmission instance.		
	Note 2: If the UE reports in an available uplink reporting		
instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-			· · · · · · · · · · · · · · · · · · ·
4), this reported PMI cannot be applied at the			
			opiieu at tile
eNB downlink before SF#(n+4).			

Table 9.4.1.1.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	1.1
UE Category	≥1

# 9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

## 9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

Table 9.4.1.2.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1		
Bandwidth		MHz	10		
Transmission mode			6		
Propagation channel			EVA5		
	tion and onfiguration		Low 4 x 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6		
power	$ ho_{\scriptscriptstyle B}$	dB	-6		
allocation	σ	dB	3		
N	c(j) oc	dB[mW/15kHz]	-98		
PMI	delay	ms	8 or 9		
	ng mode		PUCCH 2-1 (Note 6)		
	periodicity	ms	$N_{\rm pd} = 2$		
	channel for porting		PUSCH (Note 3)		
for wideba	eport Type nd CQI/PMI		2		
	eport Type and CQI		1		
Measurem	ent channel		R.14-1 FDD		
OCNG	Pattern		OP.1/2 FDD		
	granularity	PRB	6 (full size)		
	bandwidth s ( <i>J</i> )		3		
K			1		
cqi-pmi-ConfigIndex			1		
Max numb	er of HARQ		4		
transm	issions		4		
	ncy version		{0,1,2,3}		
	equence				
	Note 1: For random precoder selection, the precoder shall be updated every two TTI (2 ms granularity).				
t	Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).				
Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI or subband CQI, it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.					
Note 4: F	Note 4: Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.				
		nere wideband PMI n the most recently (	is reported, data is to be used subband.		
Note 6:					

report on PUCCH.

Table 9.4.1.2.1-2: Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	≥1

## 9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

Table 9.4.1.2.2-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1	
Bandwidth		MHz	10	
Transmission mode			6	
	lownlink uration		1	
	subframe uration		4	
	on channel		EVA5	
	tion and			
antenna co	onfiguration		Low 4 x 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6	
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6	
allocation	σ	dB	3	
N	(j) oc	dB[mW/15kHz]	-98	
PMI	delay	ms	10	
	ng mode		PUCCH 2-1 (Note 6)	
	periodicity	ms	N <sub>P</sub> = 5	
Physical c	hannel for porting		PUSCH (Note 3)	
	eport Type nd CQI/PMI		2	
	eport Type		,	
for subband CQI			1	
Measurement channel			R.14-1 TDD	
OCNG Pattern			OP.1/2 TDD	
Precoding granularity		PRB	6 (full size)	
Number of bandwidth			3	
parts (J)				
	onfialadov		1 4	
	onfigIndex er of HARQ		4	
transmissions			4	
Redundancy version			(0.4.0.0)	
	equence		{0,1,2,3}	
	K fedback		Multiplexing	
mode				
			ne precoder shall be updated in	
	each available downlink transmission instance.			
			plink reporting instance at	
	subrame SF#n based on PMI estimation at a downlink SF not later			
than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).			oarmot be applied at the end	
			Q-ACK and wideband CQI/PMI or	
s	subband CQI	it is necessary to re	port both on PUSCH instead of	
PUCCH. PDC			nall be transmitted in downlink	
SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-A on PUSCH in uplink subframe SF#8 and #3.				
p	part) are to be disregarded and instead data is to be transmitted on			
the most recently used subband for the				
Note 5: In the case where wideband				
transmitted on the most recently used subband.  Note 6: The bit field for PMI confirmation in DCI format 1B shall be mappe				
			indicate the codebook index used	
			[4] according to the latest PMI	
	eport on PUC			
Topon on the contract of the c				

Table 9.4.1.2.2-2: Minimum requirement (TDD)

	Test 1
γ	1.2
UE Category	≥1

## 9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

### 9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

Table 9.4.1.3.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Propagation	on channel		EPA5
Precoding	granularity	PRB	50
Correlat	tion and		Low
antenna co			ULA 4 x 2
Cell-specific			Antenna ports
sigr	nals		0,1
CSI referer	nce signals		Antenna ports 15,,18
Beamform			Annex B.4.3
CSI-RS per subfram T <sub>CSI-RS</sub> /			5/ 1
CSI-RS r signal cor	eference		6
CodeBookS iction b	SubsetRestr		0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{c}$	(j) oc	dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 3-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	8
Measurement channel			R.44 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ocurry 3		<u> </u>	

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDSCH\_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.1.3.1-2: Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

## 9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

Table 9.4.1.3.2-1: PMI test for single-layer (TDD)

Darar	notor	Unit	Test 1
Parameter Bandwidth		MHz	10
Transmission mode		1711 12	9
	lownlink		-
configu			1
Special s configu			4
Propagation			EVA5
Precoding		PRB	50
Antenna co			8 x 2
Correlation	n modeling		High, Cross polarized
Cell-specific			Antenna ports 0,1
CSI referer			Antenna ports
Beamform			15,,22 Annex B.4.3
CSI-RS per			Annex b.4.3
subfram			5/ 4
CSI-RS r	eference		0
signal cor	itiguration		-
CodeBookS iction b			0x0000 0000 001F FFE0 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-6
	σ	dB	-3
N	(j) oc	dB[mW/15kHz]	-98
Reportin	ng mode		PUSCH 3-1
Reporting	g interval	ms	5
PMI dela	y (Note 2)	ms	10
Measurement channel			R.45-1 TDD for UE Category 1, R.45 TDD for UE Category ≥2
OCNG	Pattern		OP.1 TDD
Max number	er of HARQ		4
transmissions  Redundancy version			
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback			Multiplexing
mode			-
Note 2:	shall be updated in each TTI (1 ms granularity).  te 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-		
Note 3: F	4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.		
Note 4: F	lote 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4		

Table 9.4.1.3.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	3
UE Category	≥1

# 9.4.1.3.3 FDD (with Class A 12Tx codebook)

For the parameters specified in Table 9.4.1.3.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.3-2.

Table 9.4.1.3.3-1: PMI test for single-layer (FDD)

Parameter  Bandwidth  Transmission mode  Propagation channe  Precoding granularit  Correlation and anter configuration  Cell-specific reference s  CSI reference signa  Beamforming mode CDM Type  CSI-RS periodicity at subframe offset TCSI-RS / ACSI-RS  NZP-CSI-RS-Configuration  eMIMO-Type codebookConfig-Ni codebook-Over-Sampi RateConfig-O1  codebook-Over-Sampi RateConfig-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2  Codebook-Configi-O2	el tty nna signals signals nd on-List 1 2 ling-	PRB	Test 1  10  9  EPA5  50  High 2D XP  12(2,3,2) x 2  Antenna ports 0,1  Antenna ports  15,,26  Annex B.4.3  CDM2  5/ 1  {0,1,2}  Class A  2
Transmission mode Propagation channe Precoding granularii Correlation and anter configuration Cell-specific reference s CSI reference signa Beamforming mode CDM Type CSI-RS periodicity at subframe offset TCSI-RS / \( \Delta \text{CSI-RS} \) NZP-CSI-RS-Configuratio eMIMO-Type codebookConfig-Ni codebook-Over-Sampl RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config	el tty nna signals signals nd on-List 1 2 ling-		9 EPA5 50 High 2D XP 12(2,3,2) x 2 Antenna ports 0,1 Antenna ports 15,,26 Annex B.4.3 CDM2  5/ 1  {0,1,2} Class A
Propagation channed Precoding granularity Correlation and anter configuration Cell-specific reference signal Beamforming mode CDM Type CSI-RS periodicity at subframe offset TCSI-RS / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{CSI-RS} \) / \( \Delta \text{COIFIGURATION} \) / \( \text{CODEDOOK CONFIGURATION} \) / \( CODEDOOK CONFIGURAT	el tty nna signals signals nd on-List 1 2 ling-	PRB	50 High 2D XP 12(2,3,2) x 2 Antenna ports 0,1 Antenna ports 15,,26 Annex B.4.3 CDM2  5/ 1  {0,1,2} Class A
Correlation and anter configuration  Cell-specific reference s  CSI reference signa  Beamforming mode CDM Type  CSI-RS periodicity at subframe offset TCSI-RS / ACSI-RS  NZP-CSI-RS-Configuration  eMIMO-Type codebookConfig-N2 codebookConfig-N2 codebookConfig-N2 codebook-Over-Sample RateConfig-O1 codebook-Over-Sample RateConfig-O2 Codebook-Config	nna ignals ils el nd on-List 1 2 ling-	PRB	High 2D XP 12(2,3,2) x 2  Antenna ports 0,1  Antenna ports 15,,26  Annex B.4.3  CDM2  5/ 1  {0,1,2}  Class A
configuration Cell-specific reference s CSI reference signa Beamforming mode CDM Type CSI-RS periodicity ar subframe offset T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub> NZP-CSI-RS-Configuration eMIMO-Type codebookConfig-N2 codebook-Over-Sampl RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config	ignals als als and annd ann-List 1 2 ling-		12(2,3,2) x 2  Antenna ports 0,1  Antenna ports 15,,26  Annex B.4.3  CDM2  5/ 1  {0,1,2}  Class A
Cell-specific reference signa  Beamforming mode  CDM Type  CSI-RS periodicity at subframe offset  TCSI-RS / \( \Delta \text{CSI-RS} \)  NZP-CSI-RS-Configuration  eMIMO-Type  codebookConfig-N2  codebook-Over-Sample  RateConfig-O1  codebook-Over-Sample  RateConfig-O2  Codebook-Config	on-List  1 2 ling-		Antenna ports 0,1  Antenna ports 15,,26  Annex B.4.3  CDM2  5/ 1  {0,1,2}  Class A
CSI reference signa  Beamforming mode  CDM Type  CSI-RS periodicity are subframe offset  T <sub>CSI-RS</sub> / ∆ <sub>CSI-RS</sub> NZP-CSI-RS-Configuration  eMIMO-Type  codebookConfig-NodebookConfig-Nodebook-Over-Sample RateConfig-O1  codebook-Over-Sample RateConfig-O2  Codebook-Config	on-List  1 2 ling-		Antenna ports 15,,26 Annex B.4.3 CDM2 5/ 1 {0,1,2} Class A
Beamforming mode  CDM Type  CSI-RS periodicity at subframe offset  TCSI-RS / \( \Delta \text{CSI-RS} \)  NZP-CSI-RS-Configuration  eMIMO-Type  codebookConfig-N:  codebook-Over-Sample  RateConfig-O1  codebook-Over-Sample  RateConfig-O2  Codebook-Config	on-List  1 2 ling-		15,,26 Annex B.4.3 CDM2 5/ 1 {0,1,2} Class A
CDM Type CSI-RS periodicity ar subframe offset T <sub>CSI-RS</sub> / ∆ <sub>CSI-RS</sub> NZP-CSI-RS-Configurative eMIMO-Type codebookConfig-Nicodebook-Over-Sample RateConfig-O1 codebook-Over-Sample RateConfig-O2 Codebook-Config	on-List  1 2 ling-		5/ 1 {0,1,2} Class A
CSI-RS periodicity an subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$ NZP-CSI-RS-Configuration eMIMO-Type codebookConfig-N2 codebook-Over-Sample RateConfig-O1 codebook-Over-Sample RateConfig-O2 Codebook-Config	on-List  1 2 ling-		5/ 1 {0,1,2} Class A
subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$ NZP-CSI-RS-Configuration eMIMO-Type codebookConfig-Nicodebook-Over-Sample RateConfig-O1 codebook-Over-Sample RateConfig-O2 Codebook-Config	on-List  1 2 ling-		{0,1,2} Class A
T <sub>CSI-RS</sub> / ∆ <sub>CSI-RS</sub> NZP-CSI-RS-Configuration  eMIMO-Type  codebookConfig-N:  codebook-Over-Sample  RateConfig-O1  codebook-Over-Sample  RateConfig-O2  Codebook-Config	1 2 ling-		{0,1,2} Class A
NZP-CSI-RS-Configuration  eMIMO-Type  codebookConfig-Nicodebook-Over-Sample RateConfig-O1  codebook-Over-Sample RateConfig-O2  Codebook-Config	1 2 ling-		Class A
eMIMO-Type codebookConfig-N: codebookConfig-N: codebook-Over-Sampl RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config	1 2 ling-		Class A
codebookConfig-N: codebookConfig-N: codebook-Over-Sampl RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config	2 ling-		
codebookConfig-N2 codebook-Over-Sampl RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config	2 ling-		
RateConfig-O1 codebook-Over-Sampl RateConfig-O2 Codebook-Config			3
codebook-Over-Samp RateConfig-O2 Codebook-Config	ling-	l l	8
RateConfig-O2 Codebook-Config	ling-		3
			4
codebookSubsetRestric			Note 5
codebookSubsetRestriction-1			0x01  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF
codebookSubsetRestriction-2			FFFF FFFF FFFF FFFF  Codebook-Config 1: 0000 0000 1111  Codebook-Config 2,3,4: 0x 00 000000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-8
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting interval		ms	5
PMI delay (Note 2)	,	ms	8
Measurement chann			R.77 FDD
Rank Number of PDS	ОП		OP.1 FDD
OCNG Pattern  Max number of HAR	20		OF.1 FDD
transmissions	· · ·		4
Redundancy version co	oding		{0,1,2,3}
sequence  Note 1: For random precoder s		 selection, the precor	
(1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#r based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).			orting instance at subrame SF#n not later than SF#(n-4), this downlink before SF#(n+4).
and OCNG po	Note 3: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.  Note 4: Randomization of the principle beam direction shall be used as specified in		
B.2.3B.4.  Note 5: Value of parameter codebookConfig shall be random selected one value from UE supported codebook configurations.			

Table 9.4.1.3.3-2: Minimum requirement (FDD)

Parameter	Test 1
γ	[2.5]
UE Category	≥2

# 9.4.1.3.4 TDD (with Class A 12Tx codebook)

For the parameters specified in Table 9.4.1.3.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.4-2.

Table 9.4.1.3.4-1: PMI test for single-layer (TDD)

Bandwidth   MHz	Paramete	ar .	Unit	Test 1
Transmission mode				
Uplink downlink configuration   Special subframe configuration   4			IVII IZ	-
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				
Propagation channel				-
Precoding granularity				
Correlation and antenna configuration			DDD	
Cell-specific reference signals         Antenna ports 0,1           CSI reference signals         Antenna ports 0,1           CSI reference signals         Antenna ports 15,,26           Beamforming model         Annex B.4.3           CDM Type         CDM2           CSI-RS periodicity and subframe offset TCSHRS / ACSHRS         5/4           NZP-CSI-RS-Configuration-List         6(0,1,2)           eMIMO-Type         Class A           codebookConfig-N1         2           codebook-Over-Sampling-RateConfig-O1         8           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           0x01         FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF			FKD	
Cell-specific reference signals         Antenna ports 0,1           CSI reference signals         Antenna ports 15,,26           Beamforming model         Annex B.4.3           CDM Type         CDM2           CSI-RS periodicity and subframe offset Tosh-RS-Configuration-List         5/ 4           MZP-CSI-RS-Configuration-List         {0,1,2}           eMIMO-Type         Class A codebookConfig-N1           codebookConfig-N2         3           codebook-Over-Sampling-RateConfig-O1         8           Codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           0x01         FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				
Antenna ports   15,,26				
Streteletic signals   15,26	Cell-specific referen	nce signais		
CDM Type         CDM2           CSI-RS periodicity and subframe offset TCSI-RS / ACSI-RS         5/4           TCSI-RS / ACSI-RS         5/4           NZP-CSI-RS-Configuration-List         {0,1,2}           eMIMO-Type         Class A           codebookConfig-N1         2           codebookConfig-N2         3           codebook-Over-Sampling-RateConfig-O1         8           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           codebookSubsetRestriction-1         FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF	CSI reference :	signals		
CSI-RS periodicity and subframe offset TCSI-RS / ΔCSI-RS         5/ 4           NZP-CSI-RS / CΔSI-RS         (0,1,2)           NZP-CSI-RS-Configuration-List         Class A           eMIMO-Type         Class A           codebookConfig-N1         2           codebookConfig-N2         3           codebook-Over-Sampling-RateConfig-O1         4           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           0x01         0x01           codebookSubsetRestriction-1         FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF	Beamforming model			Annex B.4.3
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				CDM2
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				5/ 4
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$T_{\text{CSI-RS}}$ / $\Delta_{\text{CS}}$	SI-RS		
Class A   CodebookConfig-N1   CodebookConfig-N2   CodebookConfig-N2   Codebook-Over-Sampling-RateConfig-O1   RateConfig-O2   A   Codebook-Over-Sampling-RateConfig-O2   A   Codebook-Config   Note 5	NZP-CSI-RS-Con			{0.1.2}
codebookConfig-N1         2           codebookConfig-N2         3           codebook-Over-Sampling-RateConfig-O1         8           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           codebookSubsetRestriction-1         0x01           FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				
codebookConfig-N2         3           codebook-Over-Sampling-RateConfig-O1         8           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           0x01         0x01           FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				
codebook-Over-Sampling-RateConfig-O1         8           codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           codebookSubsetRestriction-1         0x01           FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				
RateConfig-O1				3
codebook-Over-Sampling-RateConfig-O2         4           Codebook-Config         Note 5           codebookSubsetRestriction-1         0x01           FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				8
RateConfig-O2	RateConfig	-01		-
Codebook-Config         Note 5           codebookSubsetRestriction-1         0x01           FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF				4
$\begin{array}{c} \text{codebookSubsetRestriction-1} \\ \text{codebookSubsetRestriction-2} \\ \\ \text{codebookSubsetRestriction-2} \\ \\ \text{codebookSubsetRestriction-2} \\ \\ \\ \text{codebookSubsetRestriction-2} \\ \\ \\ \\ \text{codebook-Config 1:} \\ \\ \\ \text{codebook-Config 2:} \\ \\ codebook-C$				
$ \begin{array}{c} {\rm codebookSubsetRestriction-1} \\ {\rm codebookSubsetRestriction-2} \\ {\rm codebookSubsetRestriction-2} \\ \\ {\rm codebookSubsetRestriction-2} \\ \\ {\rm codebook-Config\ 1:} \\ {\rm codebook-Config\ 2:} \\ $	Codebook-C	onfig		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	codebookSubsetRestriction-1			FFFF FFFF FFFF FFFF
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	codebookSubsetRestriction-2			0000 0000 1111 Codebook-Config 2,3,4:
Pc   dB   -8     -8		$ ho_{\scriptscriptstyle A}$	dB	0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	allocation	Pc	dB	-8
Reporting mode PUSCH 3-1 Reporting interval ms 5 PMI delay (Note 2) ms 10 Measurement channel R.77 TDD Rank Number of PDSCH 1 OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode PUSCH 3-1  Reporting mode PUSCH 3-1  Ms 5  4  R.77 TDD  ACK/NACK feedback mode PUSCH 3-1  R.77 TDD  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PU		σ	dB	-3
Reporting mode PUSCH 3-1 Reporting interval ms 5 PMI delay (Note 2) ms 10 Measurement channel R.77 TDD Rank Number of PDSCH 1 OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode PUSCH 3-1  Reporting mode PUSCH 3-1  Ms 5  4  R.77 TDD  ACK/NACK feedback mode PUSCH 3-1  R.77 TDD  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  Ms 5  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  Ms 6  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PUSCH 3-1  ACK/NACK feedback mode PU	$N_{\alpha\alpha}^{(j)}$		dB[mW/15kHz]	-98
Reporting interval ms 5 PMI delay (Note 2) ms 10 Measurement channel R.77 TDD Rank Number of PDSCH 1 OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Ms.		inde		PUSCH 3-1
PMI delay (Note 2) ms 10  Measurement channel R.77 TDD  Rank Number of PDSCH 1  OCNG Pattern OP.1 TDD  Max number of HARQ transmissions  Redundancy version coding sequence ACK/NACK feedback mode Multiplexing			me	
Measurement channel R.77 TDD  Rank Number of PDSCH 1  OCNG Pattern OP.1 TDD  Max number of HARQ 4  transmissions 4  Redundancy version coding sequence ACK/NACK feedback mode Multiplexing				
Rank Number of PDSCH  OCNG Pattern  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  1 OP.1 TDD  4  (0,1,2,3)  Multiplexing			1113	_
OCNG Pattern OP.1 TDD  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  OP.1 TDD  4  (0,1,2,3)  Multiplexing				
Max number of HARQ transmissions 4  Redundancy version coding sequence {0,1,2,3}  ACK/NACK feedback mode Multiplexing				·
transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  4  {0,1,2,3}  Multiplexing				
Redundancy version coding sequence {0,1,2,3}  ACK/NACK feedback mode Multiplexing				4
ACK/NACK feedback mode Multiplexing	Redundancy versi	on coding		{0.1.2.3}
				· · · · · · · · · · · · · · · · · · ·

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3B.4.

Note 5: Value of parameter codebookConfig shall be random selected one value from UE supported codebook configurations.

Table 9.4.1.3.4-2: Minimum requirement (TDD)

Parameter	Test 1
γ	TBD
UE Category	≥2

# 9.4.1.4 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

## 9.4.1.4.1 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.1-2.

Table 9.4.1.4.1-1 PMI test for single-layer (FDD)

Parame	ter	Unit	Test 1
Bandwidth		MHz	10
Transmission	n mode		9
Propagation channel			EPA5
Precoding gra		PRB	50
Correlation and configura			High XP 4 x 2
Beamforming			Annex B.4.3
Cell-specific re			
signals			Antenna ports 0,1
CSI reference signals			Antenna ports 15,,18
CSI-RS period	licity and		, ,
subframe offset	T <sub>CSI-RS</sub>		5/ 1
/ I <sub>CSI-R</sub>	6		
CSI-RS referer	ice signal		6
configura			_
CodeBookSubse bitmap			0x0000 0000 0000 FFFF 0000 00FF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUCCH 1-1 submode1
Reporting in		ms	5
PMI delay (I		ms	10
Physical cha	nnel for		PUSCH (Note 3)
CQI/PMI rep			, ,
PUCCH Repor CQI/second			2b
	Physical channel for RI reporting		PUSCH
PUCCH Report Type for RI/ first PMI			5
cqi-pmi-ConfigurationIndex			4
ri-ConfigIndex			1
Measurement channel			R.60 FDD
OCNG Pattern			OP.1 FDD
Max number of	of HARQ		4
transmiss			'
Redundancy vers	_		{0,1,2,3}
alternativeCodeE	BookEnable		True
dFor4TX-r12		ı	i l

- Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)
- Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.
- Note 4: PDSCH\_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.
- Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4

Table 9.4.1.4.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.8
UE Category	≥1

# 9.4.1.4.2 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.2-2.

Table 9.4.1.4.2-1 PMI test for single-layer (TDD)

Paramet	or	Unit	Test 1
		MHz	10
Bandwidth Transmission mode		IVII IZ	9
Uplink dow			9
configura			1
Special sub			
configura			4
Propagation (			EPA5
Precoding gra		PRB	50
Correlation and			
configura			High XP 4 x 2
Beamforming			Annex B.4.3
Cell-specific re			A
signals			Antenna ports 0,1
CCI reference	aignala		Antenna ports
CSI reference	signais		15,,18
CSI-RS period			
subframe offset	$T_{CSI-RS}$		5/ 4
/ I <sub>CSI-RS</sub>			
CSI-RS referen			6
configura			
CodeBookSubse			0x0000 0000 0000
bitmap	)		FFFF 0000 00FF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode		a=[, .o=]	PUCCH 1-1 submode1
Reporting in		ms	5
PMI delay (N		ms	15
Physical char		1110	
CQI/PMI rep			PUSCH (Note 3)
PUCCH Report Type for			
CQI/second			2b
Physical chann	nel for RI		DUIGGU
reportin	g		PUSCH
PUCCH Report 7			5
first PMI			3
cqi-pmi-ConfigurationIndex			4
ri-ConfigIndex			1
Measurement channel			R.60 TDD
OCNG Pattern			OP.1 TDD
Max number of HARQ			4
transmissions			,
Redundancy version coding			{0,1,2,3}
sequence			
ACK/NACK feed			Multiplexing
alternativeCodeB			True
Mote 1: For random precoder selection, the precoder shall be updated			
	n TTI (1 ms g		ecoder strait be updated
			reporting instance at
Note 2: If the UE reports in an available uplink reporting instance at			

- Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.
- Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.
- Note 5: Randomization of the principle beam direction shall be used as

specified in B.2.3A.4.

Table 9.4.1.4.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.8
UE Category	≥1

# 9.4.1.4.3 FDD (with Class B alternative codebook for one CSI-RS resource configured)

For the parameters specified in Table 9.4.1.4.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.3-2.

Table 9.4.1.4.3-1 PMI test for single-layer (FDD)

Doromo	for	Unit	Test 1
Parameter Pandwidth		MHz	10
Bandwidth Transmission mode		IVIITZ	9
Propagation (			EPA5
Precoding gra		PRB	50
Correlation and		TIND	
configura			ULA Low 4 x 2
Beamforming			Annex B.4.3
Cell-specific re			
signals			Antenna ports 0,1
CSI reference signals			Antenna ports 15,,22
CSI-RS period	licity and		
subframe offset	T <sub>CSI-RS</sub> /		5/ 1
I <sub>CSI-RS</sub>			
CSI-RS referen	nce signal		6
configura			-
eMIMO-T			Class B
alternativeCodebo			
CLASSB_			TRUE
codebookSubsetF	Restriction-3		0x 000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-6
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting r	mode		PUCCH 1-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	10
Physical channel for CQI/PMI reporting			PUSCH (Note 3)
	PUCCH Report Type for		2
	Physical channel for RI		
reportin			PUSCH
PUCCH Report			3
cqi-pmi-ConfigurationIndex			2
	ri-ConfigIndex		
	ndex		1
ri-ConfigIr			
	channel		1
ri-ConfigIr Measurement	channel of PDSCH		1
ri-ConfigIr  Measurement  Rank number o	channel f PDSCH ttern		1 R.45 FDD 1 OP.1 FDD
ri-Configlr Measurement Rank number o OCNG Pa	channel of PDSCH ttern of HARQ		1 R.45 FDD 1
ri-Configlir  Measurement Rank number of OCNG Pa  Max number of transmiss  Redundancy vers	channel of PDSCH ttern of HARQ ions sion coding		1 R.45 FDD 1 OP.1 FDD
ri-Configlir  Measurement Rank number of OCNG Pa Max number of transmiss Redundancy vers sequence	channel of PDSCH ttern of HARQ ions sion coding ce	er selection, the pre	1 R.45 FDD 1 OP.1 FDD 4 {0,1,2,3}
ri-Configlir  Measurement Rank number of OCNG Par  Max number of transmiss Redundancy versisequence Note 1: For randeach To Note 2: If the Usubram than Sl	channel of PDSCH ttern of HARQ ions sion coding ce idom precode TI (1 ms gran E reports in a ne SF#n base	ularity). an available uplink d on PMI estimatic eported PMI canno	1 R.45 FDD 1 OP.1 FDD

necessary to report both on PUSCH instead of PUCCH.

PDSCH\_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same

Note 4: PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.1.4.3-2 Minimum requirement (FDD)

Parameter	Test 1
γ	TBD
UE Category	≥2

# 9.4.1.4.4 TDD (with Class B alternative codebook for one CSI-RS resource configured)

For the parameters specified in Table 9.4.1.4.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.4-2.

Table 9.4.1.4.4-1 PMI test for single-layer (TDD)

Paramet	or	Unit	Test 1
Parameter Bandwidth		MHz	10
Transmission mode		IVII IZ	9
Uplink downlink co			1
Special subt			
configurat			4
Propagation of	hannel		EPA5
Precoding gra	nularity	PRB	50
Correlation and			ULA Low 8 x 2
configurat			
Beamforming			Annex B.4.3
Cell-specific refere	ence signals		Antenna ports 0,1
CSI reference signals			Antenna ports 15,,22
CSI-RS period	icity and		
subframe o			5/ 4
T <sub>CSI-RS</sub> / I <sub>C</sub>	SI-RS		
CSI-RS referen			6
configurat			<u> </u>
eMIMO-Ty			Class B
alternativeCodebo			TRUE
codebookSubsetRestriction-3			0x 000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUCCH 1-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	10
Physical channel f	or CQI/PMI		PUSCH (Note 3)
reportin	g ( 001/		. 555 (1.1515.5)
PUCCH Report Ty	pe for CQI/		2
Physical chann			PUSCH
reportin			2
PUCCH Report 7			<u>3</u> 4
ri-Confiain	cqi-pmi-ConfigurationIndex ri-ConfigIndex		805
Measurement channel			R.45 TDD
Rank number of PDSCH			1
OCNG Pattern			OP.1 TDD
Max number of HARQ			
transmissions			4
Redundancy version coding			{0,1,2,3}
sequence			
ACK/NACK feedl			Multiplexing
Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later			
downlin	than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).		
Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.			

PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI Note 4: to be transmitted on uplink SF#3 and #8.

Table 9.4.1.4.4-2 Minimum requirement (TDD)

Parameter	Test 1
γ	TBD
UE Category	≥2

9.4.1a Void

9.4.1a.1 Void

9.4.1a.1.1 Void

9.4.1a.1.2 Void

9.4.2 Multiple PMI

9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

Table 9.4.2.1.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Propagation	on channel		EPA5
Precoding granularity (only for reporting and following PMI)		PRB	6
	tion and onfiguration		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 1-2
Reporting interval		ms	1
PMI delay		ms	8
Measurement channel			R.11-3 FDD for UE Category 1, R.11 FDD for UE Category ≥2
OCNG Pattern			OP.1/2 FDD
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).			

Table 9.4.2.1.1-2: Minimum requirement (FDD)

One/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2 shall be

Parameter	Test 1
γ	1.2
UE Category	≥1

### 9.4.2.1.2 TDD

Note 3:

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

Table 9.4.2.1.2-1: PMI test for single-layer (TDD)

Parameter         Office           Bandwidth         MHz         10           Transmission mode         6         6           Uplink downlink configuration         1         1           Special subframe configuration         4         4           Propagation channel         EPA5         EPA5           Precoding granularity (only for reporting and following PMI)         PRB         6           Correlation and antenna configuration         Low 2 x 2           Downlink power allocation         PA         dB         -3           Downlink power allocation         PB         dB         -3           Downlink power allocation         PB         dB         -3           Downlink power allocation         PB         dB         -3           Begorting mode         PUSCH 1-2         -98           Reporting interval         ms         1           Reporting interval         ms         1           PMI delay         ms         1 or 11           Measurement channel         R.11-3 TDD for UE Category           Measurement channel         Category 1           Measurement channel         QP.1/2 TDD for UE Category           2         COCNG Pattern         OP.1/2 TDD	Dara	motor	Unit	Test 1
Transmission mode  Uplink downlink configuration  Special subframe configuration  Propagation channel  Precoding granularity (only for reporting and following PMI)  Correlation and antenna configuration  Downlink power allocation  The power allocation  Reporting mode  Reporting mode  Reporting interval  PMI delay  Measurement channel  Measurement channel  Measurement channel  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported Mnamics Configuration Configuration  Note 3: One/two sided dynamic OCNG Pattern OP.1/2  Note 3: One/two sided dynamic OCNG Pattern OP.1/2  TDD as described in Annex A.5.2.1/2 shall be	Parameter  Randwidth			
Uplink downlink configuration  Special subframe configuration  Propagation channel  Precoding granularity (only for reporting and following PMI)  Correlation and antenna configuration  Downlink power allocation			IVII IZ	
configuration       1         Special subframe configuration       4         Propagation channel       EPA5         Precoding granularity (only for reporting and following PMI)       PRB       6         Correlation and antenna configuration       Low 2 x 2         Downlink power allocation       PA       dB       -3         Downlink power allocation       PB       dB       -3         Beporting mode power allocation       PUSCH 1-2       -98         Reporting mode Reporting interval power powe				-
Special subframe configuration       4         Propagation channel       EPA5         Precoding granularity (only for reporting and following PMI)       PRB       6         Correlation and antenna configuration       Low 2 x 2         Downlink power allocation       PA       dB       -3         Downlink power allocation       PB       dB       -3         Downlink power allocation       PB       dB       -3         Bepower allocation       G       dB       0         N(j)       dB       -3       -3         Begower allocation       G       dB       0         N(j)       dB       -3       -98         Reporting mode       PUSCH 1-2       -98         Reporting interval       ms       1         PMI delay       ms       1         Reporting interval       ms       1         Return ment channel       R.11-3 TDD for UE Category         Locategory       ≥2         OCNG Pattern       OP.1/2 TDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         ACK/NACK feedback mode       Multiplexing         Note 1:       For random precoder sele	- 1			1
Propagation channel         EPA5           Precoding granularity (only for reporting and following PMI)         PRB         6           Correlation and antenna configuration         Low 2 x 2           Downlink power allocation         PA         dB         -3           Downlink power allocation         PB         dB         -3           Reporting mode         PUSCH 1-2         -98           Reporting mode         PUSCH 1-2         Reporting interval         ms         1           PMI delay         ms         10 or 11         R.11-3 TDD for UE Category 1 R.11 TDD for UE Category 1 R.11 TDD for UE Category 2 ≥2           OCNG Pattern         OP.1/2 TDD         OP.1/2 TDD           Max number of HARQ transmissions         4         ACK/NACK feedback mode           Note 1:         For random precoder selection, the precoders shall be updated in each available downlink transmission instance.         Multiplexing           Note 2:         If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).           Note 3:         One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	Special	subframe		1
Precoding granularity (only for reporting and following PMI)  Correlation and antenna configuration  Downlink power allocation    Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the power allocation   Part of the part of the power allocation   Part of the part of the power allocation   Part of the power allocation				·
(only for reporting and following PMI)       PRB       6         Correlation and antenna configuration       Low 2 x 2         Downlink power allocation       PA       dB       -3         Downlink power allocation       PB       dB       -3         Measurement channel       G       dB[mW/15kHz]       -98         Reporting mode Reporting interval       PUSCH 1-2       Reporting interval       ms       1         PMI delay       ms       10 or 11       R.11-3 TDD for UE Category 1 R.11 TDD for UE Category 1 R.11 TDD for UE Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 2 Category 3 Categ				EPA5
following PMI)       Correlation and antenna configuration       Low 2 x 2         Downlink power allocation       ρ <sub>A</sub> dB       -3         Downlink power allocation       ρ <sub>B</sub> dB       -3         Reporting mode PMI cannot be applied at the eNB downlink transmissions       PUSCH 1-2       -98         Reporting mode PMI cannot be applied at the eNB downlink before SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).       10 or 11         Reporting mode PMI cannot be applied at the eNB downlink before SF#(n+4).       QUECH 1-2         Reporting mode PMS (BIMW/15kHz]       -98         Reporting mode PMS (BIMW/15kHz]       -98         PUSCH 1-2       -98         Reporting mode PMS (BIMW/15kHz)       -			222	
$ \begin{array}{c c} \text{Correlation and} \\ \text{antenna configuration} \\ \hline \\ \text{Downlink} \\ \text{power} \\ \text{allocation} \\ \hline \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $			PRB	6
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				Low 2 x 2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	antenna co	T _	dD.	2
allocation σ dB 0  Noc dB[mW/15kHz] -98  Reporting mode PUSCH 1-2  Reporting interval ms 1  PMI delay ms 10 or 11  R.11-3 TDD for UE Category 1  R.11 TDD for UE Category ≥2  OCNG Pattern OP.1/2 TDD  Max number of HARQ transmissions  Redundancy version coding sequence ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	Downlink	$\rho_A$	-	
Noc       dB[mW/15kHz]       -98         Reporting mode       PUSCH 1-2         Reporting interval       ms       1         PMI delay       ms       10 or 11         R.11-3 TDD for UE Category 1 R.11 TDD for UE Category ≥2       Category 1 R.11 TDD for UE Category ≥2         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         ACK/NACK feedback mode       Multiplexing         Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.       Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).         Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be		$ ho_{\scriptscriptstyle B}$	dB	-3
Reporting mode Reporting interval  PMI delay  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Refure to the Category 1 Refure to the Category 2 Performed to the Category 2 Performed to the Category 2 Performed to the Category 4 Refure to the Category 1 Refure to the	anocation	σ	dB	0
Reporting interval ms 1  PMI delay ms 10 or 11  R.11-3 TDD for UE Category 1 R.11 TDD for UE Category ≥2  OCNG Pattern OP.1/2 TDD  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be			dB[mW/15kHz]	
PMI delay ms 10 or 11  R.11-3 TDD for UE Category 1 R.11 TDD for UE Category 2 PMI delay Delay 22  OCNG Pattern OP.1/2 TDD  Max number of HARQ transmissions  Redundancy version coding sequence ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				PUSCH 1-2
Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  Measurement channel  R.11-3 TDD Category 1 R.11 TDD for UE Category ≥2  OP.1/2 TDD  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n- 4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be			ms	•
Measurement channel	PMI delay		ms	10 or 11
Measurement channel       Category 1 R.11 TDD for UE Category ≥2         OCNG Pattern       OP.1/2 TDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         ACK/NACK feedback mode       Multiplexing         Note 1:       For random precoder selection, the precoders shall be updated in each available downlink transmission instance.         Note 2:       If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n- 4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).         Note 3:       One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
Measurement channel  R.11 TDD for UE Category ≥2  OCNG Pattern  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
OCNG Pattern  OP.1/2 TDD  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	Measurem	ent channel		
Described in Annex A.5.2.1/2 shall be				
OCNG Pattern  Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				• •
Max number of HARQ transmissions  Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	OCNG Pattern			
Redundancy version coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				4
coding sequence  ACK/NACK feedback mode  Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	transm	issions		4
Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				{0 1 2 3}
Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be	coding s	equence		(0,1,2,0)
Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				Multiplexing
shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be		•		
estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				
eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2  TDD as described in Annex A.5.2.1/2 shall be				
Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be				opiieu at trie
TDD as described in Annex A.5.2.1/2 shall be				
used.				
		used.		

Table 9.4.2.1.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

# 9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

### 9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

Table 9.4.2.2.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Propagation	on channel		EVA5
	tion and onfiguration		Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
PMI delay		ms	8
Reporting mode			PUSCH 2-2
Reporting interval		ms	1
Measurement channel			R.14-2 FDD
OCNG Pattern			OP.1/2 FDD
Subband size (k)		RBs	3 (full size)
Number of preferred subbands ( <i>M</i> )			5
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
NI-t- 4. F			a muana dan abali ba umalata diin

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Table 9.4.2.2.1-2: Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	≥1

### 9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

Table 9.4.2.2.2-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Uplink d			1
configu			'
Special s			4
configu			·
Propagation			EVA5
Correlat antenna co			Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
PMI delay		ms	10
Reporting mode			PUSCH 2-2
Reporting	g interval	ms	1
Measureme	ent channel		R.14-2 TDD
OCNG	Pattern		OP.1/2 TDD
Subband		RBs	3 (full size)
Number of preferred			5
subbands (M)			
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing

Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.4.2.2.2-2 Minimum requirement (TDD)

	Test 1
γ	1.15
UE Category	≥1

# 9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

### 9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

Table 9.4.2.3.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
	on channel		EVA5
	granularity porting and	PRB	6
Correlat	tion and		Low
	nfiguration		ULA 4 x 2
	c reference nals		Antenna ports 0,1
CSI referen	nce signals		Antenna ports 15,,18
Beamform			Annex B.4.3
subfram T <sub>CSI-RS</sub>	riodicity and ne offset $^{\prime}$ $\Delta_{\text{CSI-RS}}$		5/ 1
signal cor			8
CodeBookSubsetRestr iction bitmap			0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
	(j) oc	dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
	g interval	ms	5
PMI (	delay	ms	8
Measurement channel			R.45-1 FDD for UE Category 1, R.45 FDD for UE Category ≥2
OCNG Pattern			OP.7 FDD for UE Category 1 OP.1 FDD for UE Category 2-8
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}

Note 1: For random precoder selection, the precoders

shall be updated in each TTI (1 ms granularity). If the UE reports in an available uplink reporting Note 2: instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDSCH \_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per

subcarrier at the receiver.

Table 9.4.2.3.1-2: Minimum requirement (FDD)

Parameter	Test 1
γ	1.3
UE Category	≥1

## 9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

Table 9.4.2.3.2-1: PMI test for single-layer (TDD)

Parar	neter	Unit	Test 1
Band	width	MHz	10
Transmission mode			9
Uplink downlink configuration			1
Special s			4
Propagation			EVA5
Precoding (only for reposition following)	granularity porting and	PRB	6
Antenna co			8 x 2
Correlation			High, Cross polarized
Cell-specifi			Antenna ports 0,1
CSI referer			Antenna ports 15,,22
Beamform	ing model		Annex B.4.3
CSI-RS per subfram T <sub>CSI-RS</sub> /	iodicity and ie offset $\Delta_{\text{CSI-RS}}$		5/ 4
CSI-RS r signal cor			4
CodeBookSubsetRestr iction bitmap			0x0000 0000 001F FFE0 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	db	-6
	σ	dB	-3
N	(j) oc	dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
Reporting		ms	5 (Note 4)
PMI delay		ms	10 R.45-1 TDD
Measurement channel			for UE Category 1, R.45 TDD for UE Category ≥2
OCNG Pattern			OP.7 TDD for UE Category 1 OP.1 TDD for UE Category 2-8
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
Note 1: F	or random p	recoder selection, the	
shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting			

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic

CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted

on uplink SF#3 and #8.

Note 5: Randomization of the principle beam direction

shall be used as specified in B.2.3A.4.

Table 9.4.2.3.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	3.5
UE Category	≥1

## 9.4.2.3.3 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.3-2.

Table 9.4.2.3.3-1 PMI test for dual-layer (FDD)

Parameter		Unit	Test 1
Bandwid		MHz	10
Transmission mode			9
Propagation of			EVA5
Precoding gra			
(only for repor	ting and	PRB	6
following I			
Correlation and			High XP 4 x 2
configura			-
Beamforming			Annex B.4.3
Cell-specific re			Antenna ports 0,1
signals	<u> </u>		Antenna ports
CSI reference	signals		15,,18
CSI-RS period			
subframe offset	T <sub>CSI-RS</sub>		5/ 1
/ I <sub>CSI-RS</sub>			
CSI-RS referen			8
configura	tion		-
CodeBookSubse			0x0000 0000 FFFF
bitmap	)		0000 FFFF 0000
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting r	node		PUSCH1-2
Reporting in	nterval	ms	5
PMI delay (f	Note 2)	ms	8
			R.45-1 FDD for UE
Measurement	channel		Category 1, R.45 FDD
			for UE Category 2-8
Rank Number of PDSCH			2
OCNG Pattern			OP.7 FDD for UE
			Category 1 OP.1 FDD for UE
			Category 2-8
Max number of HARQ			
transmissions			4
Redundancy version coding			{0,1,2,3}
sequence			
alternativeCodeBookEnable			True
dFor4TX-		or coloction the pr	acadar aball ba undatad

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDSCH\_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4

Table 9.4.2.3.3-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

# 9.4.2.3.4 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.4-2.

Table 9.4.2.3.4-1 PMI test for dual-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission	mode		9
Uplink downlink			1
configuration			
Special sub configurate			4
Propagation of			EVA5
Precoding gra			277.0
(only for repor		PRB	6
following F	PMĬ)		
Correlation and			XP High 4 x 2
configurat			
Beamforming			Annex B.4.3
Cell-specific re signals			Antenna ports 0,1
CSI reference	signals		Antenna ports 15,,18
CSI-RS period	icity and		, , -
subframe offset / Icsi-Rs	T <sub>CSI-RS</sub>		5/ 4
CSI-RS referen			
configuration			4
CodeBookSubset bitmap			0x0000 0000 FFFF 0000 FFFF 0000
	$\rho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
	mada		DUCCH4 2
Reporting r Reporting in		mc	PUSCH1-2 5
PMI delay (N		ms ms	10
1 Wil delay (I	<b>1</b> 010 2)	1113	R.61-1 TDD for UE
Measurement	channel		Category 1, R.61 TDD
			for UE Category 2-8
Rank Number of	f PDSCH		2
OCNG Pat			OP.1 TDD
Max number of HARQ			4
transmissions			
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
alternativeCodeBookEnable			True
dFor4TX-r12			
Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)			ecoder shall be updated
Note 2: If the UE reports in an available uplink reporting instance at			reporting instance at
subrame SF#n based on PMI estimation at a downlink SF not			
later th	an SF#(n-4),	this reported PMI	cannot be applied at the
eNB downlink before SF#(n+4).			

eNB downlink before SF#(n+4). One/two sided dynamic OCNG Pattern OP.1/2 TDD as Note3: described in Annex A.5.1.1/2 shall be used.

PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic Note 4: CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Randomization of the principle beam direction shall be used as specified in B.2.3A.4. Note 5:

Table 9.4.2.3.4-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

# 9.4.2.3.5 FDD (with Class A 16Tx codebook)

For the parameters specified in Table 9.4.2.3.5-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.3.5-2.

Table 9.4.2.3.5-1: PMI test for dual-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission	mode		9
Propagation channel			EVA5
Precoding gran	ularity		
(only for reporting ar PMI)		PRB	6
Correlation and a	antenna		High 2D XP
configuration	on		16(2,4,2) x 2
Cell-specific referer	nce signals		Antenna ports 0,1
CSI reference s	signals		Antenna ports
Beamforming r			15,,30 Annex B.4.3
CDM Type			CDM4
CSI-RS periodic			CENT
subframe of			5/ 1
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CS}}$			3/ 1
NZP-CSI-RS-Config	บาลtion-l ist		{0,1}
eMIMO-Typ			Class A
codebookConf			2
codebookConf			4
codebook-Over-S			4
RateConfig-			8
codebook-Over-S RateConfig-	ampling-		8
			Note 5
Codebook-Co	oniig		Note 5 0x01
codebookSubsetRestriction-1			FFFF FFFF
codebookSubsetRestriction-2			Codebook-Config 1: 0000 1111 0000 Codebook-Config 2,3,4: 0x 00 000000 FFFF 0000
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0
	$ ho_{\scriptscriptstyle B}$	dB	0
	Pc	dB	-6
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 1-2
	Reporting interval		5
PMI delay (Note 2)		ms ms	8
Measurement channel			R.78 FDD
Rank Number of PDSCH			2
OCNG Pattern			OP.1 FDD
Max number of HARQ			
transmissions			4
Redundancy version coding			{0,1,2,3}
sequence			
Note 1: For random precoder selection, the precoder shall be updated in each TTI			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDSCH\_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Note 4:	Randomization of the principle beam direction shall be used as specified in B.2.3B.4.
Note 5:	Value of parameter codebookConfig shall be random selected one value
	from LIE supported codebook configurations

Table 9.4.2.3.5-2: Minimum requirement (FDD)

Parameter	Test 1
γ	[2.5]
UE Category	≥2

# 9.4.2.3.6 TDD (with Class A 16Tx codebook)

For the parameters specified in Table 9.4.2.3.6-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.3.6-2.

Table 9.4.2.3.6-1: PMI test for dual-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission	mode		9
Uplink downlink configuration			1
Special subframe c	onfiguration		4
Propagation c			EVA5
Precoding granularity (only for reporting and following PMI)		PRB	6
Correlation and configurati			High 2D XP 16(2,4,2) x 2
Cell-specific refere			Antenna ports 0,1
Cell-specific refere	rice signais		Antenna ports Antenna ports
CSI reference			15,,26
Beamforming			Annex B.4.3
CDM Typ			CDM4
CSI-RS periodi subframe of $T_{\text{CSI-RS}}$ / $\Delta_{\text{CS}}$	ffset		5/ 4
NZP-CSI-RS-Con			{0,1}
List	'no		
eMIMO-Ty codebookCon			Class A 2
codebookCon			4
codebook-Over-S			4
			8
RateConfig-O1 codebook-Over-Sampling-			
RateConfig			8
Codebook-Config			Note 5
codebookSubsetRestriction-1			FFFF FFFF
codebookSubsetRestriction-2			Codebook-Config 1: 0000 1111 0000 Codebook-Config 2,3,4: 0x 00 000000 FFFF 0000
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-6
	σ	dB	-3
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98
Reporting mode			PUSCH 1-2
Reporting interval		ms	5
PMI delay (Note 2)		ms	10
Measurement channel			R.78 TDD
Rank Number of PDSCH			2
OCNG Pattern			OP.1 TDD
Max number of HARQ			4
transmissions			т
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
Note 1: For random precoder selection, the precoder shall be updated in each			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-

<ol> <li>this reported PMI cannot be applied at the eNB downlink bet</li> </ol>	fore
SE#/ 4\	

SF#(n+4).

Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be

transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to

be transmitted on uplink SF#3 and #8.

Note 4: Randomization of the principle beam direction shall be used as

specified in B.2.3B.4

Note 5: Value of parameter codebookConfig shall be random selected one

value from UE supported codebook configurations.

Table 9.4.2.3.6-2: Minimum requirement (TDD)

Parameter	Test 1
γ	TBD
UE Category	≥2

### 9.4.3 Void

9.4.3.1 Void

9.4.3.1.1 Void

9.4.3.1.2 Void

# 9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3, and transmission mode 10 is used with the specified CodebookSubSetRestriction in section 9.5.5.

For fixed rank 1 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

# 9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

### 9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

Table 9.5.1.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3		
Bandwidth		MHz		10			
PDSCH transmission	on mode		4				
Downlink nower $\rho_{A}$		dB	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3				
	σ	dB		0			
Propagation condit antenna configur				2 x 2 EPA5			
CodeBookSubsetRe bitmap	estriction		01000	000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI			
Antenna correla	ation		Low	Low	High		
RI configuration			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI		
SNR		dB	0	20	20		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78		
Maximum number of transmission			1				
Reporting mo	de		PUC	PUCCH 1-1 (Note 4)			
Physical channel for reporting	CQI/PMI		PL	JCCH Format 2			
PUCCH Report Ty CQI/PMI	PUCCH Report Type for			2			
Physical channel for RI reporting			PUSCH (Note 3)				
PUCCH Report Type for RI				3			
Reporting periodicity		ms		$N_{pd}=5$			
PMI and CQI delay		ms		8			
cqi-pmi-Configurati	onIndex			6			
ri-Configuration	nInd			1 (Note 5)			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:
  - For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1
  - For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2
  - For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0
- Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.1.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
29	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

### 9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

Table 9.5.1.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3	
Bandwidth		MHz	10			
PDSCH transmission	on mode		4			
Downlink names $ ho_{\scriptscriptstyle A}$		dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3			
	σ	dB		0		
Uplink downlink conf				2		
Special subfra configuration	า			4		
	pagation condition and ntenna configuration		2 x 2 EPA5			
CodeBookSubsetRestriction			000011 for fixed $RI = 1$			
bitmap			010000 for fixed RI = $2$			
•			010011 for UE reported RI			
Antenna correla	ation		Low	Low	High	
RI configuration	on		Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	
Maximum number of HARQ transmissions			1			
Reporting mode			PUSCH 3-1 (Note 3)			
Reporting interval		ms	5			
PMI and CQI delay		ms	10 or 11			
ACK/NACK feedback	ck mode			Bundling		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

Table 9.5.1.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
24	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

### 9.5.2 Minimum requirement (CSI Reference Symbols)

### 9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

Table 9.5.2.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3	
Bandwidth		MHz	10			
PDSCH transmission	n mode			9		
	$ ho_{\scriptscriptstyle A}$	dB		0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0		
allocation	Pc	dB	0			
	σ	dB		0		
Propagation condit	ion and			2 x 2 EPA5		
antenna configur				ZXZEFAS		
Cell-specific reference	e signals		Ar	ntenna ports 0		
Beamforming M	odel		As speci	fied in Section B.	4.3	
CSI reference sign	gnals		Ante	nna ports 15, 16		
CSI-RS periodicit	y and					
subframe offs	et			5/1		
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-II}}$						
CSI reference s				6		
configuration						
CodeBookSubsetRestriction			000011 for fixed $RI = 1$			
bitmap			010000 for fixed $RI = 2$			
·			010011 for UE reported RI			
Antenna correlation			Low	Low	High	
RI configuration	on		Fixed RI=2 and	Fixed RI=1	Fixed RI=1	
_			follow RI	and follow RI	and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	
Maximum number of	f HARQ			1		
transmission						
Reporting mo				PUCCH 1-1		
Physical channel for	CQI/PMI		DI	JSCH (Note 3)		
reporting				70011 (14010-0)		
PUCCH Report Type for CQI/PMI				2		
Physical channel for RI			DI	ICCH Format 2		
reporting			PU	CON FUMAL 2		
PUCCH Report Type for RI				3		
Reporting periodicity		ms	$N_{\rm pd} = 5$			
PMI and CQI de		ms		8		
cqi-pmi-Configurati	onIndex		2			
ri-Configuration	nInd			1 (Note 4)		
Note 1: If the LIE reports in an available uplink reporting instance at subframe SE#n based on PMI and						

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5
- Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.2.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

### 9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

Table 9.5.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz	10		
PDSCH transmission	on mode			9	
	$ ho_{_{A}}$	dB	0		
Downlink power	$\rho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Uplink downlink con		uБ		1	
Special subfra					
configuration				4	
Propagation condit					
antenna configui				2 x 2 EPA5	
Cell-specific reference			A	ntenna ports 0	
CSI reference si				enna ports 15, 16	
Beamforming M				ified in Section B.	4.3
CSI reference s			•		
configuration				4	
CSI-RS periodicit	ty and				
subframe offset			5/4		
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$					
CodeBookSubsetRestriction			000011  for fixed RI = 1		
bitmap			010000 for fixed $RI = 2$		
'			010011 for UE reported RI		
Antenna correla	ation		Low Fixed RI=2 and	Low Fixed RI=1	High Fixed RI=1
RI configuration	on		follow RI	and follow RI	and follow RI
SNR		dB	0	20	20
			<del>_</del>		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78
Maximum number of	of HARQ			1	
transmission				*	
Reporting mo				PUCCH 1-1	
Physical channel for	CQI/ PMI		Pl	JSCH (Note 3)	
reporting	f== 001/				
PUCCH report type for CQI/ PMI				2	
Physical channel for RI			PL	ICCH Format 2	
reporting		ma		$N_{pd} = 5$	
Reporting periodicity PMI and CQI delay		ms ms		$N_{pd} = 5$	
ACK/NACK feedba		ms		Bundling	
cqi-pmi-Configurati			Bundling 4		
ri-Configuration				<del>4</del> 1	
Note 1: If the LIE r		available uplink rer	porting instance at cul	· · · · · · · · · · · · · · · · · · ·	od on BMI and

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.9 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8.

Table 9.5.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
74	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

# 9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

### 9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ 

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

Table 9.5.3.1-1: RI Test (FDD)

Donomotor		Unit	To	est 1	Tes	st 2
Parameter			Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth		MHz		10	1	
PDSCH transmission		40	3	Note 10	3	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3	-3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3	-3	
Dropogotion conditi	σ	dB		0	(	)
Propagation conditi antenna configur			2 x 2	2 EPA5	2 x 2	EPA5
CodeBookSubsetRestriction bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A
Antenna correla	tion			_OW	Lo	)W
RI configuration	on		Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
$\widehat{E}_s/N_{oc2}$		dB	0	-12	20	6
	$N_{oc1}^{(j)}$		-98 (Note 3)	N/A	-102 (Note 3)	N/A
$N_{oc}^{(j)}$	$N_{oc2}^{(j)}$	dBmW/15kH z	-98 (Note 4)	N/A	-98 (Note 4)	N/A
	$N_{oc3}^{(j)}$		-98 (Note 5)	N/A	-94.8 (Note 5)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	-98	-110	-78	-92
Subframe Configu	ration		Non- MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset between		μѕ	2.5 (synch	1000000 1000000 1000000 1000000 1000000 1000000	2.5 (synchro	1000000 1000000 1000000 1000000 1000000
RLM/RRM Measur Subframe Pattern (			10000000 1000000 1000000 1000000 1000000	N/A	10000000 10000000 10000000 10000000 1000000	N/A
CSI Subframe Sets (Note 8)	Ccsi,0		10000000 10000000 10000000 10000000 0111111	N/A	1000000 1000000 1000000 1000000 1000000 0111111	N/A
Number of control Symbols	OFDM		3	3	3	3
Maximum number o transmission	S		DI C	1	1	
Reporting mod Physical channel for reporting				CH 1-0 I Format 2	PUCCH 1-0 PUCCH Format 2	
PUCCH Report Type for CQI			4		4	

Physical	channel for RI reporting		PUCCH	Format 2	PUCCH	Format 2
PUCC	CH Report Type for RI		3	3	3	3
Re	porting periodicity	ms	N <sub>pd</sub> =	= 10	N <sub>pd</sub> =	= 10
cqi-pr	ni-ConfigurationIndex		1	1	1	1
ri	-ConfigurationInd		5	5	5	5
cqi-pn	ni-ConfigurationIndex2		1	0	1	0
ri-	ConfigurationInd2		2	)	2	2
	Cyclic prefix		Normal	Normal	Normal	Normal
Note 1:  Note 2:  Note 3:  Note 4:	If the UE reports in an avan a downlink subframe not downlink before SF#(n+4 Reference measurement OCNG Pattern OP.1 FD This noise is applied in Coverlapping with the agg This noise is applied in CABS.	later than SF#( 4). t channel in Cell D as described DFDM symbols a ressor ABS.	n-4), this report I 1 RC.2 FDD a in Annex A.5.1. #1, #2, #3, #5,	ced wideband (ccording to Ta 1. #6, #8, #9, #10	CQI cannot be app ble A.4-1 with one 0,#12, #13 of a sub	lied at the eNB sided dynamic
Note 5: Note 6:	Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS					n-ABS
Note 7:	Time-domain measurem	ent resource res	striction pattern	for PCell mea	surements as defii	ned in [7].
Note 8:	Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].					
110.00.	Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell is the same.					7.1 . a.i.a 0011 Z

Table 9.5.3.1-2: Minimum requirement (FDD)

Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as

	Test 1	Test 2
29	0.9	1.05
UE Category	≥2	≥2

### 9.5.3.2 TDD

The minimum performance requirement in Table 9.5.3.2-2 is defined as

defined in Annex A.5.1.5.

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ .

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

Table 9.5.3.2-1: RI Test (TDD)

		Unit	Tes	st1	Tes	st2
Parameter			Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth		MHz	1	•	1(	
PDSCH transmission			3	Note 11	3	Note 11
Uplink downlink conf Special subfra			1		1	
configuration			4		4	
	$ ho_{\scriptscriptstyle A}$	dB	-(	3	-3	3
Downlink power	$\rho_{\scriptscriptstyle B}$	dB	-(	3	-3	3
allocation	σ	dB	C		0	
Propagation condit			2 x 2 l	EDA6	2 x 2 E	EDA <i>E</i>
antenna configur	ation			EFAS	2 X 2 E	EPAS
CodeBookSubsetRe bitmap	estriction		01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A
			RI			
Antenna correla	ition		Lo	W	Lo	w
RI configuration	on		Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
$\widehat{E}_s/N_{oc2}$		dB	0	-12	20	6
	$N_{oc1}^{(j)}$		-98 (Note 4)	N/A	-102 (Note 4)	N/A
$N_{oc}^{(j)}$	$N_{\text{oc}2}^{(j)}$	dB[mW/15k Hz]	-98 (Note 5)	N/A	-98 (Note 5)	N/A
	$N_{\text{oc}3}^{(j)}$		-98 (Note 6)	N/A	-94.8 (Note 6)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	-98	-110	-78	-92
Subframe Configu	ıration		Non- MBSFN	Non- MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset between	en Cells	μs	2.5 (synchronous cells)		2.5 (synchronous cells)	
ABS Pattern (No	te 7)		N/A	0000000 001 0000000 001	N/A	0000000001 0000000001
RLM/RRM Measu Subframe Pattern (			00000000 01 00000000 01	N/A	0000000001 0000000001	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		00000000 01 00000000 01	N/A	0000000001 0000000001	N/A
(Note 9)	C <sub>CSI,1</sub>		11001110 00 11001110 00		1100111000 1100111000	14/1
Number of control Symbols	OFDM		3	3	3	3
	Maximum number of HARQ			ī.	4	<u> </u>
transmissions			1		1	
Reporting mo			PUCC	H 1-0	PUCC	H 1-0
Physical channel for and RI reporti	C <sub>CSI,0</sub> CQI		PUCCH I	Format 2	PUCCH I	Format 2
PUCCH Report Type			4	ļ.	4	
FOCCIT Report Type for CQI		!	· · · · · · · · · · · · · · · · · · ·		·	

Physical channel for C <sub>CSI,1</sub> CQI and RI reporting		PUSCH (Note 3)		PUSCH (Note 3)	
PUCCH Report Type for RI		;	3		3
Reporting periodicity	ms	N <sub>pd</sub> =	= 10	N <sub>pd</sub> = 10	
ACK/NACK feedback mode		Multiplexing		Multiplexing	
cqi-pmi-ConfigurationIndex		8	8		3
ri-ConfigurationInd		Į.	5	5	
cqi-pmi-ConfigurationIndex2		9		9	
ri-ConfigurationInd2		0		(	)
Cyclic prefix	_	Normal	Normal	Normal	Normal

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 5: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 6: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 7: ABS pattern as defined in [9].
- Note 8: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 9: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 10: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.
- Note 11: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5.

Table 9.5.3.2-2: Minimum requirement (TDD)

	Test 1	Test 2
2/1	0.9	1.05
UE Category	≥2	≥2

# 9.5.4 Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)

### 9.5.4.1 FDD

For the parameters specified in Table 9.5.4.1-1, the minimum performance requirement in Table 9.5.4.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{1}$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.1-1: RI Test (FDD)

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmissio	n mode		3	As defined in Note 1	As defined in Note 1
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
	σ	dB	0	N/A	N/A
Propagation conditi antenna configura			2x2 EPA5 (Note 2)	2x2 EPA5 (Note 2)	2x2 EPA5 (Note 2)
CodeBookSubsetRe bitmap	striction		01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	As defined in Note 1	As defined in Note 1
	$N_{oc1}$	dB[mW/15k Hz]	-98 (Note 3)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	$N_{oc3}$	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 9.5.4.1-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	Reference Value in Table 9.5.4.1-2 for each test	-86	-88
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	te 6)		N/A	10000000 10000000 10000000 10000000 1000000	1000000 1000000 1000000 1000000 1000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		10000000 10000000 10000000 10000000 1000000	N/A	N/A
(Note 8)	C <sub>CSI,1</sub>		01111111 01111111 01111111 01111111 0111111	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number or transmissions			1	N/A	N/A
Reporting mode			PUCCH 1-0	N/A	N/A
Physical channel for reporting			PUCCH format 2	N/A	N/A
PUCCH Report Type	for COI		4	N/A	N/A
Physical channel for R			PUCCH Format 2	N/A	N/A
PUCCH Report Typ			3	N/A	N/A
Reporting period		ms	<i>N<sub>pd</sub></i> = 10	N/A	N/A

	ni-ConfigurationIndex		11	N/A	N/A	
ri-	ConfigurationInd		5	N/A	N/A	
cqi-pm	i-ConfigurationIndex2		10	N/A	N/A	
ri-0	ConfigurationInd2		2	N/A	N/A	
	Cyclic prefix Normal				Normal	
Note 1:	Downlink physical chan	nel setup in Cell	2 in accordance with	Annex C.3.3 app	lying OCNG	
	pattern OP.5 FDD as de	efined in Annex A	A.5.1.5.			
Note 2:	The propagation conditi	ons for Cell 1, C	ell 2 and Cell 3 are s	tatistically indeper	ndent.	
Note 3:	This noise is applied in	OFDM symbols	#1, #2, #3, #5, #6, #8	3, #9, #10,#12, #1	3 of a subframe	
	overlapping with the age					
Note 4:	This noise is applied in	OFDM symbols	#0, #4, #7, #11 of a s	subframe overlapp	oing with the	
	aggressor ABS.					
Note 5:	This noise is applied in					
Note 6:	ABS pattern as defined					
	PDCCH/PCFICH are tra					
	overlapped with the ABS		ggressor cell and the	subframe is avail	able in the	
	definition of the reference					
Note 7:	Time-domain measuren	nent resource re	striction pattern for P	Cell measuremen	its as defined in	
	[7]					
Note 8:	As configured according		nain measurement re	source restriction	pattern for CSI	
1	measurements defined					
Note 9:	The number of control C	•	s not available for AB	BS and is 3 for the	subframe	
	indicated by "0" of ABS					
Note 10:	If the UE reports in an a					
	estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot					
	be applied at the eNB downlink before SF#(n+4).					
Note 11:	Reference measuremer			•	with one sided	
N ( 40	dynamic OCNG Pattern					
	The number of the CRS			e same.		
Note 13:	SIB-1 will not be transm	iπed in Celi2 an	a Ceil 3 in this test.			

Table 9.5.4.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
$\hat{E}_s/N_{oc2}$ for Cell 1 (dB)	4	20	20
$\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])	-94	-78	-78
Antenna correlation	High for Cell 1, low for Cell 2 and Cell 3	Low for Cell 1, Cell 2 and Cell 3	High for Cell 1, low for Cell 2 and Cell 3
74	N/A	1.05	0.9
72	1.05	N/A	N/A
UE Category	≥2	≥2	≥2

### 9.5.4.2 TDD

For the parameters specified in Table 9.5.4.2-1, the minimum performance requirement in Table 9.5.4.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{l;}$
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.2-1: RI Test (TDD)

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmissio	n mode		3	As defined in Note 1	As defined in Note 1
Uplink downlink conf	iguration		1	1	1
Special subframe con			4	4	4
	$\rho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
anodaton	σ	dB	0	N/A	N/A
Propagation conditi			2×2 EPA5 (Note	2×2 EPA5	2×2 EPA5
antenna configur CodeBookSubsetRe bitmap			2) 01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	(Note 2) As defined in Note 1	(Note 2) As defined in Note 1
	$N_{oc1}$	dB[mW/15k Hz]	-98 (Note 3)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	$N_{oc3}$	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 9.5.4.2-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	Reference Value in Table 9.5.4.2-2 for each test	-86	-88
Subframe Configu	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 6)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			0000000001 0000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
(Note 8)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number o transmissions			1	N/A	N/A
Reporting mod	de		PUCCH 1-0	N/A	N/A
Physical channel for 0 and RI reporting			PUCCH format 2	N/A	N/A
Physical channel for 0 and RI reportir	C <sub>CSI,1</sub> CQI		PUSCH (Note 14)	N/A	N/A
PUCCH Report Type	for CQI		4	N/A	N/A
PUCCH Report Typ			3	N/A	N/A
Reporting periodicity		ms	<i>N<sub>pd</sub></i> = 10	N/A	N/A
ACK/NACK feedback mode			Multiplexing	N/A	N/A
cqi-pmi-Configuration			8	N/A	N/A
ri-Configuration			5	N/A	N/A
cqi-pmi-Configuratio			9	N/A N/A	N/A N/A
Cyclic prefix			Normal	Normal	Normal
Cyclic prefix		<u> </u>	rvoimai	ivoimai	Homai

- Note 1: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.
- Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 9: The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by "0" of ABS pattern.
- Note 10: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 12: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.
- Note 13: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.
- Note 14: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 9.5.4.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
$\hat{E}_s/N_{oc2}$ for Cell 1 (dB)	4	20	20
$\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])	-94	-78	-78
Antenna correlation	High for Cell 1, low for Cell 2 and Cell 3	Low for Cell 1, Cell 2 and Cell 3	High for Cell 1, low for Cell 2 and Cell 3
74	N/A	1.05	0.9
72	1.05	N/A	N/A
UE Category	≥2	≥2	≥2

# 9.5.5 Minimum requirement (with CSI process)

Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.5.5-1.

For UE supports one CSI process, CSI process 0 is configured for Test 1 and Test 2, but CSI process 1 is not configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled. The requirement on reported RI for CSI process 1 in Test 2 is not applicable.

For UE supports multiple CSI processes, CSI process 0 is configured for Test 1 and CSI processes 0 and 1 are configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled, and also the requirement on reported RI for CSI process 1 in Test 2.

Table 9.5.5-1: Configuration of CSI processes

	CSI process 0	CSI process 1
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 1

### 9.5.5.1 FDD

The minimum performance requirement in Table 9.5.5.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.1-2.

Table 9.5.5.1-1: RI Test (FDD)

			Tes	ct 1	To	st 2	
Para	meter	Unit	TP1	TP2	TP1	TP2	
Bandwidth		MHz		MHz		10 MHz	
Transmission mode			10	10	10	10	
	$ ho_{\scriptscriptstyle A}$	dB	(	0	(	)	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	(	0	(	)	
allocation	$P_c$	dB	0	0	0	0	
	σ	dB	(	0	(	)	
SNR		dB	0	0	20	20	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	98	
Propagation channe	el		EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High	
Antenna configuration	on		2x2	2x2	2x2	2x2	
Beamforming Mode			· · · · · · · · · · · · · · · · · · ·	Section B.4.3	•	Section B.4.3	
Timing offset between		us		0		)	
Frequency offset be Cell-specific referen		Hz		o ports 0		o ports 0	
	ice signais		Antenna ports		Antenna ports		
CSI-RS signal 0			15,16	N/A	15,16	N/A	
CSI-RS 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/1	N/A	5/1	N/A	
CSI-RS 0 configurat	tion		0	N/A	0	N/A	
CSI-RS signal 1			N/A	Antenna ports 15,16	N/A	Antenna ports 15,16	
CSI-RS 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N/A	5/1	N/A	5/1	
CSI-RS 1 configurat	tion		N/A	3	N/A	3	
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPowerC			N/A	1 / 10000010000 00000	N/A	1] / 10000010000 00000	
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPowerC	CSI-RS bitmap		1 / 00110000000 00000	N/A	1 / 00110000000 00000	N/A	
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/1	N/A	5/1	N/A	
CSI-IM 0 configurati	on		2	N/A	2	N/A	
CSI-IM 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N/A	5/1	N/A	5/1	
CSI-IM 1 configurati	on		N/A	6	N/A	6	
RI configuration			Fixed RI=2	N/A	Fixed RI=1	N/A	
- Til Gormigaradori			and follow RI	1471	and follow RI		
Physical channel for	r CQI/PMI reporting		PUSCH (Note 6)	N/A	PUSCH (Note 6)	PUSCH (Note 6)	
PUCCH Report Typ	e for CQI/PMI		2	N/A	2	2	
Physical channel for	r RI reporting		PUCCH	N/A	PUCCH	PUCCH	
PUCCH Report Typ	•		Format 2 3	N/A	Format 2	Format 2 3	
. осотткерой тур	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A	
	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A	
	Reporting mode		PUCCH 1-1	N/A	PUCCH 1-1	N/A	
CSI process 0	Reporting periodicity	ms	$N_{pd} = 5$	N/A	$N_{\rm pd} = 5$	N/A	
(Note 7)	CQI delay	ms	8	N/A	10	N/A	
	cqi-pmi- ConfigurationIndex		6	N/A	6	N/A	
	ri-ConfigIndex		1	N/A	1	N/A	
	CSI-RS		N/A	N/A	N/A	CSI-RS 1	
CSI process 1	CSI-IM		N/A	N/A	N/A	CSI-IM 1	
(Note 7, Note 9)	Reporting mode		N/A	N/A	N/A	PUCCH 1-1	
,	Reporting periodicity	ms	N/A	N/A	N/A	$N_{\rm pd} = 5$	

CQI delay	ms	N/A	N/A	N/A	10
cqi-pmi- ConfigurationIndex		N/A	N/A	N/A	4
ri-ConfigIndex		N/A	N/A	N/A	1
CSI process for PDSCH scheduling		CSI pro	ocess 0	CSI pro	ocess 0
Cell ID		0	6	0	6
Quasi-co-located CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co-located CRS		Same Cell ID	Same Cell ID	Same Cell ID	Same Cell ID
Quasi-co-located CN3		as Cell 1	as Cell 2	as Cell 1	as Cell 2
PMI for subframe 2, 3, 4, 7, 8 and 9		010000 for fixed RI = 2 010011 for UE reported RI	100000	000011 for fixed RI = 1 010011 for UE reported RI	N/A
PMI for subframe 1 and 6		100000	100000	100000	N/A
Max number of HARQ transmissions		1	N/A	1	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.13 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.
- Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.
- Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.
- Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.
- Note 9: If UE supports one CSI process, CSI process 1 is not configured in Test 2.

Table 9.5.5.1-2: Minimum requirement (FDD)

	Test 1	Test 2
71	N/A	1.0
72	1.0	N/A
UE Category	≥2	≥2

### 9.5.5.2 TDD

The minimum performance requirement in Table 9.5.5.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.2-2.

Table 9.5.5.2-1: RI Test (TDD)

<b>.</b>			Tes	st 1	Tes	st 2
Parameter		Unit MHz	TP1	TP2	TP1 TP2	
Bandwidth				MHz	10 MHz	
Transmission mode			10	10	10	10
	$ ho_{\scriptscriptstyle A}$	dB	(	0	(	)
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	(	)
allocation	$P_c$	dB	0	0	0	0
	σ	dB		<u>                                       </u>	(	)
Uplink downlink con	-	QD_	2	2	2	2
Special subframe co			4	4	4	4
SNR	J	dB	0	0	20	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(	98	-6	98
Propagation channe			EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High
Antenna configuration			2x2	2x2	2x2	2x2
Beamforming Mode				Section B.4.3	•	Section B.4.3
Timing offset between Frequency offset be		us Hz		<u>0</u> 0	(	
Cell-specific referen		П∠		a ports 0	Antenna	
	ice signais		Antenna ports		Antenna ports	
CSI-RS 0 periodicity	y and subframe offset		15,16	N/A	15,16	N/A
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$			5/3	N/A	5/3	N/A
CSI-RS 0 configurat	tion		0	N/A	0	N/A
CSI-RS signal 1	CSI-RS signal 1		N/A	Antenna ports 15,16	N/A	Antenna ports 15,16
CSI-RS 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	y and subframe offset		N/A	5/3	N/A	5/3
CSI-RS 1 configurat	tion		N/A	3	N/A	3
	Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		N/A	3 / 10000010000 00000	N/A	3 / 10000010000 00000
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPowerC			3 / 00110000000 00000	N/A	3 / 00110000000 00000	N/A
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/3	N/A	5/3	N/A
CSI-IM 0 configurati			2	N/A	2	N/A
	and subframe offset		N/A	5/3	N/A	5/3
T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>	ion					
CSI-IM 1 configurati	ION		N/A Fixed RI=2	6	N/A Fixed RI=1	6
RI configuration			and follow RI	N/A	and follow RI	N/A
	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A
CSI process 0	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A
(Note 6, 7)	Reporting mode		PUSCH 3-1	N/A	PUSCH 3-1	N/A
(	Reporting Interval	ms	5	N/A	5	N/A
	CQI delay CSI-RS	ms	11 N/A	N/A N/A	11 N/A	N/A
	CSI-RS CSI-IM		N/A N/A	N/A N/A	N/A N/A	CSI-RS 1 CSI-IM 1
CSI process 1	Reporting mode		N/A	N/A N/A	N/A	PUSCH 3-1
(Note 6, 7, 8)	Reporting Interval	ms	N/A	N/A	N/A	5
	CQI delay	ms	N/A	N/A	N/A	11
CSI process for PDSCH scheduling				ocess 0	CSI pro	
Cell ID			0	6	0	6
Quasi-co-located CS	SI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co-located Cl	RS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2
PMI for subframe 4	and 9		010000 for	100000	000011 for	N/A

	fixed RI = 2		fixed RI = 1	
	010011 for UE		010011 for UE	
	reported RI		reported RI	
PMI for subframe 3 and 8	100000	100000	100000	N/A
Max number of HARQ transmissions	1	N/A	1	N/A
ACK/NACK feedback mode	Multiplexing	N/A	Multiplexing	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.13 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.
- Note 4: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3 and 8 from TP1.
- Note 5: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3, 4, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test
- Note 6: Reported wideband CQI and PMI are used and sub-band CQI is discarded.
- Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.
- Note 8: If UE supports one CSI process, CSI process 1 is not configured in Test 2.
- Note 9: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2.

Table 9.5.5.2-2: Minimum requirement (TDD)

	Test 1	Test 2			
71	N/A	1.0			
72	1.0	N/A			
UE Category	≥2	≥2			

# 9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

# 9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

### 9.6.1.1 FDD

The following requirements apply to UE Category ≥3. For CA with 2 DL CC, for the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}$  – wideband  $CQI_{Scell} \ge 2$ 

Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 2 DL CA)

Parameter		Unit	Pcell	Scell		
PDSCH transmission mode				1		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0		
allocation	$ ho_{\scriptscriptstyle B}$	dB		0		
Propagation condit antenna configur			AWGN (1 x 2)			
SNR		dB	10	4		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98		
Physical channel f reporting	or CQI		PUCCH Format 2			
PUCCH Report Type			4			
Reporting periodicity		ms	$N_{pd} = 10$			
cqi-pmi-ConfigurationIndex			11	16 (shift of 5 ms relative to Pcell)		
No. 4. Co. 1. I. H. A. L. PROCILIN PROCILIC AND A LITTLE WILLIAM AND A L						

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Table 9.6.1.1-2: PUCCH 1-0 static test (FDD, 2 DL CA)

Test nu	ımber	Bandwidth combination	
1		10MHz for both cells	
2		20MHz for both cells	
3		5MHz for both cells	
4		5MHz for PCell and 10MHz for SCell	
5		5MHz for PCell and 15MHz for SCell	
Note 1:		olicability of requirements for different CA configurations and	
	bandwidth combination sets is defined in 9.1.1.2. The test coverage for		
	different number of component carriers is defined in 9.1.1.3.		
Note 2:			
	bandwid	dth, randomly choose one as PCell.	

The following requirements for 3DL CA apply to UE Category ≥5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.1-3 and Table 9.6.1.1-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

wideband 
$$CQI_{PCell}$$
 – wideband  $CQI_{SCell1} \ge 2$ 

wideband 
$$CQI_{SCell1}$$
 – wideband  $CQI_{SCell2} \ge 2$ 

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Category ≥8. For CA with 4 DL CC, for the parameters specified in Table 9.6.1.1-3 and Table 9.6.1.1-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2, and SCell 3 reported shall be such that

wideband 
$$CQI_{PCell}$$
 – wideband  $CQI_{SCell1} \ge 2$ 

wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell2} \ge 2$ 

wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell3} \ge 2$ 

Table 9.6.1.1-3: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 3 and 4 DL CA)

Parameter		Unit	Pcell Scell1		Scell2, 3	
PDSCH transmission mode			1			
Downlink power $ ho_{\scriptscriptstyle A}$		dB		0		
allocation	$ ho_{\scriptscriptstyle B}$	dB			0	
Propagation condit antenna configur				AWO	GN (1 x 2)	
SNR		dB	12	6	0	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
Physical channel f reporting	or CQI		PUCCH Format 2			
PUCCH Report	Туре				4	
Reporting period	dicity	ms	$N_{\rm pd} = 20$			
cqi-pmi-ConfigurationIndex			21	26 (shift of 5 ms relative to Pcell)	31 for Scell2 (shift of 10 ms relative to Pcell), 36 for Scell3 (shift of 15ms relative to Pcell)	

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Table 9.6.1.1-4: PUCCH 1-0 static test (FDD, 3 DL CA)

Test number	Bandwidth combination (MHz)	
1	3x20	
2	20+20+15	
3	20+20+10	
4	20+15+15	
5	20+15+10	
6	20+10+10	
7	15+15+10	
8	20+10+5	
9	20+15+5	
configura defined i	cability of requirements for different CA tions and bandwidth combination sets is a 9.1.1.2. The test coverage for different of component carriers is defined in 9.1.1.3.	
choose of all the ce the same	nan one cell can be configured as PCell, ne with the smallest bandwidth as PCell. If lls which can be configured as PCell have bandwidth, randomly choose one as andomly associate the other cells to SCell 1 l 2.	

Table 9.6.1.1-5: PUCCH 1-0 static test (FDD, 4 DL CA)

Test r	number	Bandwidth combination (MHz)	
	1	4x20	
	2	20+20+20+10	
	3	20+20+10+10	
Note 1:		cability of requirements for different CA	
	configurat	ions and bandwidth combination sets is	
		9.1.1.2. The test coverage for different	
	number of	component carriers is defined in 9.1.1.3.	
Note 2:	If more that	an one cell can be configured as PCell,	
	choose or	ne with the smallest bandwidth as PCell. If	
all the cells which can be configured as PCell have			
the same bandwidth, randomly choose one as			
	PCell. Rai	ndomly associate the other cells to SCell	
	1, SCell 2	and SCell3.	

The following requirements for 5DL CA apply to UE Category 8 and ≥11. For CA with 5 DL CC, for the parameters specified in Table 9.6.1.1-6 and Table 9.6.1.1-7, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell 3, and SCell 1 and SCell 4 reported shall be such that

 $\label{eq:continuous_continuous$ 

for more than 90% of the time.

Table 9.6.1.1-6: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 5 DL CA)

Parameter		Unit	Pcell	Scell1	Scell2, 3, 4		
PDSCH transmission mode				1			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0			
allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
Propagation condition antenna configuration				AW	GN (1 x 2)		
SNR		dB	12	6	0		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98		
Physical channel for reporting	CQI			PUCC	CH Format 2		
PUCCH Report Type	١				4		
Reporting periodicity		ms		^	$V_{pd} = 40$		
cqi-pmi-ConfigurationIndex			41	46 (shift of 5 ms relative to Pcell)	51 for Scell 2 (shift of 10 ms relative to Pcell), 56 for Scell 3 (shift of 15ms relative to Pcell), 61 for Scell4 (shift of 20ms relative to Pcell)		
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.							

Table 9.6.1.1-7: PUCCH 1-0 static test (FDD, 5 DL CA)

Test number		Bandwidth combination (MHz)
	1	5x20
Note 1:	configurat defined in	cability of requirements for different CA ions and bandwidth combination sets is 9.1.1.2. The test coverage for different component carriers is defined in 9.1.1.3.
Note 2:	choose or all the cell the same PCell. Rai	an one cell can be configured as PCell, ne with the smallest bandwidth as PCell. If s which can be configured as PCell have bandwidth, randomly choose one as andomly associate the other cells to SCell1, Cell3 and SCell4.

### 9.6.1.2 TDD

The following requirements apply to UE Category  $\geq$ 3. For CA with 2 DL CC, for the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}$  – wideband  $CQI_{Scell} \ge 2$ 

for more than 90% of the time.

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD, 2 DL CA)

Parameter		Unit	Pcell	Scell
PDSCH transmission	PDSCH transmission mode		1	
Uplink downlink conf	figuration			2
Special subfra configuration			4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0
allocation	$ ho_{\scriptscriptstyle B}$	dB		0
Propagation condition and antenna configuration			AWGN (1 x 2)	
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel for CQI reporting			PUCCH Format 2	
PUCCH Report Type			4	
Reporting periodicity		ms	$N_{pd} = 10$	
cqi-pmi-ConfigurationIndex			8	13 (shift of 5 ms relative to Pcell)

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Table 9.6.1.2-2: PUCCH 1-0 static test (TDD, 2 DL CA)

Test number		Bandwidth combination
1		20MHz for both cells
2		15MHz for PCell and 20MHz for SCell
Note 1:	and bar	olicability of requirements for different CA configurations adwidth combination sets is defined in 9.1.1.2. The test performed for different number of component carriers is defined 3.
		ecells which can be configured as PCell have the same dth, randomly choose one as PCell.

The following requirements for 3DL CA apply to UE Category  $\geq$ 5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.2-3 and Table 9.6.1.2-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

 $wideband \ CQI_{PCell} - wideband \ CQI_{SCell1} \geq 2$ 

wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell2} \ge 2$ 

Table 9.6.1.2-3: PUCCH 1-0 static test on multiple cells (TDD, 3 DL CA)

Parameter		Unit	Pcell	Scell1	Scell2	
PDSCH transmission	PDSCH transmission mode					
Uplink downlink configuration			2			
Special subfra configuration			4			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0		
allocation	$ ho_{\scriptscriptstyle B}$	dB		0		
Propagation condit antenna configur				AWGN (1 x 2)		
SNR		dB	12	6	0	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98	
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98	-98	-98	
Physical channel f reporting	or CQI		PUCCH Format 2			
PUCCH Report	Туре		4			
Reporting periodicity		ms		$N_{\rm pd} = 20$		
cqi-pmi-ConfigurationIndex			18	23 (shift of 5 ms relative to Pcell)	28 (shift of 10 ms relative to Pcell)	
Note 1: 3 symbols are allocate UE with one sided dyn A.5.2.1.						

Table 9.6.1.2-4: PUCCH 1-0 static test (TDD, 3 DL CA)

Test	number	Bandwidth combination (MHz)				
	1	3x20				
	2	20+20+15				
Note 1:		ability of requirements for different CA				
	defined in 9	configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.				
Note 2: If more that choose one all the cells the same b		n one cell can be configured as PCell, e with the smallest bandwidth as PCell. If which can be configured as PCell have andwidth, randomly choose one as domly associate the other cells to SCell 1 2.				

### 9.6.1.3 TDD-FDD CA with FDD PCell

The following requirements apply to UE Category  $\geq$ 5. For TDD-FDD CA with FDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.3-1 and Table 9.6.1.3-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband  $CQI_{PCell}$  – wideband  $CQI_{SCell} \ge 2$ 

Table 9.6.1.3-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 2 DL CA)

Parameter		Unit	PCell	SCell	
PDSCH transmission mode				1	
Uplink downlink con	figuration		N/A	2	
Special subfra configuration			N/A	4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condition and antenna configuration			AWG	N (1 x 2)	
SNR		dB	10	4	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	
Physical channel reporting	for CQI		PUCC	H Format 2	
PUCCH Report	Туре		4		
Reporting perior	dicity	ms	$N_{\rm pd} = 10$		
cqi-pmi-ConfigurationIndex			9	14 (shift of 5 ms relative to Pcell)	
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the LIE with one					

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.

Table 9.6.1.3-2: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 2 DL CA)

Test number		Bandwidth combination		
1		20MHz for FDD cell and 20MHz for TDD cell		
2		10MHz for FDD cell and 20MHz for TDD cell		
3		15MHz for FDD cell and 20MHz for TDD cell		
Note 1:	Note 1: The applicability of requirements for different CA configurations and			
	dth combination sets is defined in 9.1.1.2A. The test coverage			
	for different number of component carriers is defined in 9.1.1.3.			

The following requirements for 3DL CA apply to UE Category  $\geq$ 5. For TDD-FDD CA with FDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

$$\label{eq:continuous} wideband \ CQI_{PCell} - wideband \ CQI_{SCell1} \geq 2$$
 
$$\label{eq:cql} wideband \ CQI_{SCell2} - wideband \ CQI_{SCell2} \geq 2$$

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Cateogry  $\geq$ 8. For TDD-FDD CA with FDD PCell with 4 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell1 and SCell3 reported shall be such that

$$\label{eq:continuous} \begin{split} \text{wideband } CQI_{PCell} - \text{wideband } CQI_{SCell1} \geq 2 \\ \\ \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell2} \geq 2 \\ \\ \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell3} \geq 2 \end{split}$$

Table 9.6.1.3-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 3 and 4 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3	
PDSCH transmission	n mode			1		
Uplink downlink configuration			N/A	2 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	2	
Special subframe configuration			N/A	4 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0		
allocation	$ ho_{\scriptscriptstyle B}$	dB	0			
Propagation condition antenna configur			AWGN (1 x 2)			
SNR		dB	12	6	0	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
Physical channel for reporting	or CQI		PUCCH Format 2			
PUCCH Report				4		
Reporting periodicity		ms		$N_{pd} = 2$	20	
cqi-pmi-ConfigurationIndex			19	24 (shift of 5 ms relative to Pcell)	29 for SCell 2 (shift of 10 ms relative to Pcell), 34 for SCell 3 (shift of 15ms relative to PCell)	

Table 9.6.1.3-4: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 3 DL CA)

dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.

	Test number	Bandwidth combination (MHz)		
	1	20MHz for FDD cell and 2x20MHz for TDD cell		
	2	15MHz for FDD cell and 2x20MHz for TDD cell		
	3	10MHz for FDD cell and 2x20MHz for TDD cell		
	4	2x20MHz for FDD cell and 20MHz for TDD cell		
	5	20+15MHz for FDD cell and 20MHz for TDD cell		
	6	20+10MHz for FDD cell and 20MHz for TDD cell		
Note 1:	combination sets is defi	uirements for different CA configurations and bandwidth ned in 9.1.1.2A. The test coverage for different number		
bandwidth as PCell. If a		n be configured as PCell, choose one with the smallest all the cells which can be configured as PCell have the mly choose one as PCell. Randomly associate the		

Table 9.6.1.3-5: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 4 DL CA)

	Test number	Bandwidth combination (MHz)	
	1	20MHz for FDD cell and 3x20MHz for TDD cell	
	2	2x20MHz for FDD cell and 2x20MHz for TDD cell	
	3	20+15MHz for FDD cell and 2x20MHz for TDD cell	
	4	2x15MHz for FDD cell and 2x20MHz for TDD cell	
	5	2x20+15MHz for FDD cell and 20MHz for TDD cell	
	6	2x15+20MHz for FDD cell and 20MHz for TDD cell	
Note 1:	The applicability of requ	uirements for different CA configurations and bandwidth	
		ned in 9.1.1.2A. The test coverage for different number	
	of component carriers is	s defined in 9.1.1.3.	
Note 2:		n be configured as PCell, choose one with the smallest	
	bandwidth as PCell. If a	all the cells which can be configured as PCell have the	
	same bandwidth, rando	mly choose one as PCell. Randomly associate the	
	other cells to SCell 1, S	Cell 2 and SCell3.	

The following requirements for 5DL CA apply to UE Category 8 and ≥11. For TDD-FDD CA with FDD PCell with 5 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-6, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, SCell1 and SCell3, and SCell 1 and SCell 4 reported shall be such that

$$\begin{split} & \text{wideband } CQI_{PCell} - \text{wideband } CQI_{SCell1} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell2} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell3} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell4} \geq [2] \end{split}$$

Table 9.6.1.3-6: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 5 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3, SCell4
PDSCH transmission			1		
Uplink downlink configuration			N/A	2 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	2
Special subframe configuration			N/A	4 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condition and antenna configuration			AWGN (1 x 2)		
SNR		dB	12	6	0
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
Physical channel for reporting	CQI		PUCCH Format 2		
PUCCH Report Type			4		
Reporting periodicity		ms		$N_{pd} =$	40
cqi-pmi-Configuration		39	54 (shift of 5 ms relative to Pcell)	59 for SCell 2 (shift of 10 ms relative to Pcell), 64 for SCell 3 (shift of 15 ms relative to Pcell), 69 for SCell 4 (shift of 20 ms relative to Pcell)	
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided					

Table 9.6.1.3-7: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 5 DL CA)

Test number		Bandwidth combination (MHz)
1		15MHz+2×20MHz for FDD cell and 2x20MHz for TDD cell
	2	2×15MHz+20MHz for FDD cell and 2x20MHz for TDD cell
		irements for different CA configurations and bandwidth ned in 9.1.1.2A. The test coverage for different number of efined in 9.1.1.3.

### 9.6.1.4 TDD-FDD CA with TDD PCell

The following requirements apply to UE Category ≥5. For TDD-FDD CA with TDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.4-1 and Table 9.6.1.4-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband  $CQI_{PCell}$  – wideband  $CQI_{SCell} \ge 2$ 

for more than 90% of the time.

Table 9.6.1.4-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 2 DL CA)

Parameter		Unit	PCell	SCell
PDSCH transmission mode				1
Uplink downlink conf			2	N/A
Special subfra configuration			4	N/A
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	(	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	(	0
Propagation condit antenna configur			AWGN (1 x 2)	
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel f reporting	or CQI		PUCCH Format 2	
PUCCH Report	Туре		4	
Reporting period	dicity	ms	$N_{\rm pd} = 10$	
cqi-pmi-Configurati	cqi-pmi-ConfigurationIndex		8	13 (shift of 5 ms relative to Pcell)

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.

Table 9.6.1.4-2: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 2 DL CA)

Test number		Bandwidth combination
1		20MHz for TDD cell and 20MHz for FDD cell
2		20MHz for TDD cell and 10MHz for FDD cell
3		20MHz for TDD cell and 15MHz for FDD cell
Note 1:	Note 1: The applicability of requirements for different CA config	
bandwidth combination sets is defined in 9.1.1.2A. The test coverage		
	for diffe	rent number of component carriers is defined in 9.1.1.3.

The following requirements for 3DL CA apply to UE Category  $\geq$ 5. For TDD-FDD CA with TDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

wideband  $CQI_{PCell}$  – wideband  $CQI_{SCell1} \ge 2$ wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell2} \ge 2$ 

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Cateogry ≥8. For TDD-FDD CA with TDD PCell with 4 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, and SCell3 reported shall be such that

> wideband  $CQI_{PCell}$  – wideband  $CQI_{SCell1} \ge 2$ wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell2} \ge 2$ wideband  $CQI_{SCell1}$  – wideband  $CQI_{SCell3} \ge 2$

for more than 90% of the time.

Table 9.6.1.4-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 3 and 4 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3		
PDSCH transmission	n mode		1				
Uplink downlink configuration			2	2 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	N/A		
Special subfra configuration			4	4 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	N/A		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0			
allocation	$ ho_{\scriptscriptstyle B}$	dB		0			
Propagation condition and antenna configuration				AWGN (1 x 2)			
SNR		dB	12	6	0		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	Hz] -86 -92 -		-98		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98 -98 -98			
Physical channel f reporting	or CQI			PUCCH Forn	nat 2		
PUCCH Report	Туре			4			
Reporting periodicity ms		ms	$N_{\rm pd} = 20$				
cqi-pmi-ConfigurationIndex			18	23 (shift of 5 ms relative to Pcell)	28 for SCell 2 (shift of 10 ms relative to Pcell), 33 for SCell 3 (shift of 15ms relative to PCell)		
_				r user data is scheduled fo			

dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.

Table 9.6.1.4-4: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 3 DL CA)

	Test number	Bandwidth combination (MHz)		
	1	2x20MHz for TDD cell and 20MHz for FDD cell		
	2	2x20MHz for TDD cell and 15MHz for FDD cell		
	3	2x20MHz for TDD cell and 10MHz for FDD cell		
	4	2x20MHz for FDD cell and 20MHz for TDD cell		
	5	20+15MHz for FDD cell and 20MHz for TDD cell		
	6	20+10MHz for FDD cell and 20MHz for TDD cell		
Note 1:	ote 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	Note 2: If more than one cell can be configured as PCell, choose one with the smallest bandwidth as PCell. If all the cells which can be configured as PCell have the same bandwidth, randomly choose one as PCell. Randomly associate the other cells to SCell 1 and SCell 2.			

Table 9.6.1.4-5: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 4 DL CA)

Test number		Bandwidth combination (MHz)		
1		3x20MHz for TDD cell and 20MHz for FDD cell		
	2	2x20MHz for FDD cell and 2x20MHz for TDD cell		
	3	20+15MHz for FDD cell and 2x20MHz for TDD cell		
	4	2x15MHz for FDD cell and 2x20MHz for TDD cell		
5		2x20+15MHz for FDD cell and 20MHz for TDD cell		
6		2x15+20MHz for FDD cell and 20MHz for TDD cell		
Note 1:	The applicability of requ	irements for different CA configurations and bandwidth		
	combination sets is defi	ned in 9.1.1.2A. The test coverage for different number		
	of component carriers is	s defined in 9.1.1.3.		
Note 2: If more than one cell can be configured as PCell, choose one with the small		n be configured as PCell, choose one with the smallest		
bandwidth as PCell. If all the cells which can be configured as PCell have the				
	same bandwidth, randomly choose one as PCell. Randomly associate the			
	other cells to SCell 1, SCell 2 and SCell3.			

The following requirements for 5DL CA apply to UE Category 8 and  $\geq$ 11. For TDD-FDD CA with TDD PCell with 5 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-6, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, SCell1 and SCell3 and SCell 1 and SCell 4 reported shall be such that

$$\begin{split} & \text{wideband } CQI_{PCell} - \text{wideband } CQI_{SCell1} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell2} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell3} \geq [2] \\ & \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell4} \geq [2] \end{split}$$

Table 9.6.1.4-6: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 5 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3, SCell4		
PDSCH transmission	n mode		1				
Uplink downlink configuration			N/A	2 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	2		
Special subframe configuration			N/A	4 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell	4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0			
allocation	$ ho_{\scriptscriptstyle B}$	dB		0			
Propagation condition antenna configuration		AWGN (1 x 2)					
SNR		dB	12	6	0		
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-86	-92	-98		
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$ dB[mW/15kH		-98	-98	-98		
Physical channel for reporting	CQI		PUCCH Format 2				
PUCCH Report Type			4				
Reporting periodicity ms			$N_{\rm pd} = 40$				
cqi-pmi-ConfigurationIndex			39	54 (shift of 5 ms relative to Pcell)	59 for SCell 2 (shift of 10 ms relative to Pcell), 64 for SCell 3 (shift of 15 ms relative to Pcell), 69 for SCell 4 (shift of 20 ms relative to Pcell)		
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided							

Table 9.6.1.4-7: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 5 DL CA)

dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.

Test number		Bandwidth combination (MHz)		
	1	15MHz+2×20MHz for FDD cell and 2x20MHz for TDD cell		
	2	2x15MHz+20MHz for FDD cell and 2x20MHz for TDD cell		
Note 1:	Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	·			

# 9.7 CSI reporting (Single receiver antenna)

The number of receiver antennas  $N_{RX}$  assumed for the minimum performance requirement in this clause is 1.

## 9.7.1 CQI reporting definition under AWGN conditions

### 9.7.1.1 FDD and half-duplex FDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.16 FDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.7.1.1-1: PUCCH 1-0 static test (FDD and half-duplex FDD)

Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz	10			
PDSCH transmission	n mode		1			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			0	
	σ	dB			0	
Propagation condit antenna configur			AWGN (1 x 1)			
SNR (Note 2	2)	dB	0	1	6	7
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of H transmission			1			
Physical channel for CQI reporting			PUCCH Format 2			
PUCCH Report	Туре		4			
Reporting periodicity		ms	$N_{pd} = 40$			
cqi-pmi-Configurati	onIndex		41			

Note 1: Reference measurement channel RC.16 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

### 9.7.1.2 TDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.16 TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

**Parameter** Unit Test 1 Test 2 Bandwidth MHz 10 PDSCH transmission mode 1 Uplink downlink configuration 2 Special subframe configuration 4 dB 0  $\rho_{\scriptscriptstyle A}$ Downlink power dB 0  $\rho_{\scriptscriptstyle B}$ allocation dB 0 σ Propagation condition and AWGN (1 x 1) antenna configuration SNR (Note 2) dB 0 -98 -97 -92 -91  $\hat{\boldsymbol{I}}^{(j)}$ dB[mW/15kHz]  $N^{(j)}$ dB[mW/15kHz] -98 -98 Max number of HARQ 1 transmissions Physical channel for CQI PUSCH (Note 3) reporting

Table 9.7.1.2-1: PUCCH 1-0 static test (TDD)

Note 1: Reference measurement channel RC.16 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

 $N_{pd} = 5$ 

Multiplexing

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

ms

Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

## 9.7.2 CQI reporting under fading conditions

### 9.7.2.1 FDD and half-duplex FDD

PUCCH Report Type Reporting periodicity

cqi-pmi-ConfigurationIndex
ACK/NACK feedback mode

For the parameters specified in Table 9.7.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD and in each available downlink transmission instance for half-duplex FDD.

Table 9.7.2.1-1 Sub-band test for single antenna transmission (FDD and half-duplex FDD)

Para	meter	Unit	Test 1 Test 2		st 2		
Band	lwidth	MHz	10 MHz				
Transmiss	sion mode		1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0				
power	$ ho_{\scriptscriptstyle B}$	dB		(	0		
allocation	σ	dB	0		0	)	
SNR (	Note 3)	dB	8	9	13	14	
	(j) or	dB[mW/15kHz]	-90 -89 -85 -8		-84		
N	·(j) oc	dB[mW/15kHz]	-98 -98		98		
			Clause B.2.4 with $\tau_d=0.45\mu$		).45 <i>μ</i> s,		
Propagation	on channel		$a = 1, f_D = 5 \text{ Hz}$				
Antenna co	onfiguration		1 x 1				
Reportin	g interval	ms	8				
CQI	delay	ms	8				
Reporting mode			PUSCH 3-0				
Sub-band size		RB	6 (full size)				
Max number of HARQ transmissions			1				

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.16 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.7.2.1-2 Minimum requirement (FDD and half-duplex FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE DL Category	0	0

### 9.7.2.2 TDD

For the parameters specified in Table 9.7.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band:
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Table 9.7.2.2-1 Sub-band test for single antenna transmission (TDD)

Parar	Parameter		Те	Test 1 Test 2		t 2
Band	Bandwidth		10 MHz			
Transmiss	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	0	
power	$ ho_{\scriptscriptstyle B}$	dB		(	0	
allocation	σ	dB		(	0	
Uplink o configu	lownlink uration			:	2	
Special s configu	subframe uration				4	
SNR (	Note 3)	dB	8	9	13	14
$\hat{I}_{a}^{0}$	(j) or	dB[mW/15kHz]	-90	-89	-85	-84
$N_{c}$	( j ) oc	dB[mW/15kHz]	z] -98 -98		8	
				Clause E	3.2.4 with	1
Propagation channel			$ au_d = 0.45  \mu$ s, $a = 1$ ,		1,	
					= 5 Hz	
Antenna co	onfiguration		1 x 1			
Reporting	g interval	ms			5	
	delay	ms			or 11	
Reportir	ng mode		PUSCH 3-0			
Sub-band size		RB	6 (full size)			
Max number	er of HARQ				1	
transmissions						
ACK/NACK fe					olexing	
		an available uplink				
SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at						

the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.16 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.7.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE DL Category	0	0

### CSI reporting (UE supporting coverage enhancement) 9.8

The requirements in this sub-clause are defined based on the simulation results with UE DL Category M1 unless otherwise stated.

#### 9.8.1 CQI reporting definition under AWGN conditions

#### 9.8.1.1 FDD and half-duplex FDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.8.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to [RC.21] FDD in Table A.4-1 shall be in the range of ±1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using

the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

Table 9.8.1.1-1: PUCCH 1-0 static test (FDD and half-duplex FDD)

Parameter		Unit	Test 1	
Bandwidth	Bandwidth		10	
PDSCH transmission	n mode			1
	$ ho_{\scriptscriptstyle A}$	dB		0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0
allocation	σ	dB		0
	δ	dB		0
Propagation condit antenna configur	ion and ation		AWG	N (1 x 1)
SNR (Note 2		dB	TBD	TBD
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	TBD	TBD
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
	Max number of HARQ transmissions 1		1	
Physical channel f reporting	or CQI		PUCCH Format 2	
PUCCH Report	Туре			4
Reporting period	dicity	ms	N <sub>pd</sub>	= [40]
cqi-pmi-Configurati				[41]
Frequency hopp			Dis	sabled
Starting OFDM sy (startSymbolL				3
PDSCH repetition	n level			1
M-PDCCH repetition	M-PDCCH repetition level			1
Beamforming Prece			Annex B.4.4	
Precoder update gra for MPDCCH	anularity H		Frequency domain: 1 PRB Time domain: 1 ms	
fdd- DownlinkOrTddSubfr apLC	ameBitm		[11100000 11100000 111	00000 11100000 11100000]

Note 1: Reference measurement channel [RC.21] FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: For each test, DC subcarrier puncturing shall be considered.

#### 9.8.1.2 TDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.7.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to [RC.21] TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

Table 9.8.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Te	est 1
Bandwidt	Bandwidth			10
PDSCH transmiss	ion mode			1
	$ ho_{\scriptscriptstyle A}$	dB		0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0
allocation	σ	dB		0
	δ	dB		0
Propagation cond antenna config			AWG	N (1 x 1)
SNR (Note		dB	[4]	[5]
$\hat{I}_{or}^{(j)}$	,	dB[mW/15kHz]	[-94]	[-93]
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
	Max number of HARQ transmissions			1
Physical channe reporting	Physical channel for CQI		PUSCH (Note 3)	
	PUCCH Report Type		4	
	Reporting periodicity		$N_{pd} = 5$	
cqi-pmi-Configura	tionIndex		3	
Frequency ho			Disabled	
Starting OFDM (startSymbo			3	
PDSCH repetition				1
ACK/NACK feedb	ack mode		Multi	plexing
M-PDCCH repeti				1
Beamforming Pre MPDCCH			Anne	x B.4.4
Precoder update of for MPDCO				lomain: 1 PRB main: 1ms
Note 1: Reference	e measurem		TDD according to Table A scribed in Annex A.5.2.1.	
Note 2: For each	test, the mir	nimum requirements	shall be fulfilled for at leas	t one of the two SNR(s)
and the respective wanted signal input level.  Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7				

## 9.9 CSI reporting for 4Rx UE

## 9.9.1 CQI reporting definition under AWGN conditions

For each test,DC subcarrier puncturing shall be considered

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.9.1.1 Minimum requirement PUCCH 1-0 with Rank 1 (Cell-Specific Reference Symbols)

#### 9.9.1.1.1 FDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.9.1.1.1-1, using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD / RC.4 FDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH

BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI -1) shall be less than or equal to 0.1.

Table 9.9.1.1.1-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Test 1		Te	Test 2	
Bandwidth		MHz	10				
PDSCH transmission	n mode				1		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB			0		
Propagation condition and antenna configuration			AWGN (1 x 4)				
SNR (Note 2)		dB	[-2]	[-1]	[4]	[5]	
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		[-100]	[-99]	[-94]	[-93]	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
	Max number of HARQ transmissions		1				
Physical channel for CQI reporting			PUCCH Format 2				
PUCCH Report Type			4				
	Reporting periodicity		$N_{\rm pd} = 5$				
cqi-pmi-ConfigurationIndex			6				

Note 1: Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

#### 9.9.1.1.2 TDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.9.1.1.2-1, using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1/RC.4 TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.9.1.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Test 1 Test 2			st 2	
Bandwidth		MHz	10				
PDSCH transmission	n mode				1		
Uplink downlink conf	iguration				2		
Special subfra configuration			4				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB			0		
Propagation condition and antenna configuration			AWGN (1 x 4)				
SNR (Note 2	2)	dB	[-2]	[-1]	[4]	[5]	
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$ dE		[-100]	[-99]	[-94]	[-93]	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-(	98	
Max number of H transmission					1		
Physical channel for CQI reporting			PUSCH (Note 3)				
PUCCH Report Type					4		
Reporting periodicity		ms	·	N <sub>pe</sub>	<sub>d</sub> = 5		
cqi-pmi-ConfigurationIndex					3		
ACK/NACK feedback	ck mode			Multi	olexing		

- Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

#### 9.9.1.2 Minimum requirement PUCCH 1-1 with Rank 2 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.9.1.2.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.9.1.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.9.1.2.1-1: PUCCH 1-1 static test (FDD)

Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz			10	
PDSCH transmission	on mode				9	
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB			-3	
	σ	dB			-3	
Cell-specific reference	ce signals			Antenna	ports 0, 1	
CSI reference si					orts 15,,18	
CSI-RS periodicity and	d subframe			•		
offset				Ę	5/1	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-}}$						
CSI reference signal configuration			0			
Propagation condition and antenna			Clause B.1 (4 x 4)			
configuration			· · ·			
Beamforming Model			As specified in Section B.4.3			3
CodeBookSubsetRestr			0x0000 0000 0100 0000			
SNR (Note 2	2)	dB	[5]	[6]	[11]	[12]
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-93]	[-92]	[-87]	[-86]
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		8	
Max number of HARQ to	ransmissions				1	
Physical channel for	CQI/PMI			PUSCE	H (Note3)	
reporting				1 0001	, ,	
PUCCH Report Type for CQI/PMI					2	
Physical channel for RI reporting				PUCCH	Format 2	
PUCCH Report Typ					3	
Reporting perior		ms			<sub>d</sub> = 5	
CQI delay		ms			8	
cqi-pmi-Configurati					2	
ri-ConfigIndex					1	

- Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

#### 9.9.1.2.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.9.1.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.9.1.2.2-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz			10	
PDSCH transmissi	on mode				9	
Uplink downlink con	figuration				2	
Special subframe co	nfiguration				4	
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB			-6	
	σ	dB			-3	
CRS reference s	ignals			Antenna	ports 0, 1	
CSI reference si	ignals			Antenna p	orts 15,,22	
CSI-RS periodicity an	d subframe					
offset				5	5/ 3	
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$						
CSI reference signal configuration			0			
Propagation condition and antenna			Clause B.1 (8 x 4)			
configuration			, ,			
Beamforming Model			As specified in Section B.4.3			
CodeBookSubsetRestr			0x0000 0000 0020 0000 0000 0001 0000			
SNR (Note 2	2)	dB	[2]	[3]	[8]	[9]
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-96]	[-95]	[-90]	[-89]
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of HARQ t	ransmissions				1	
Physical channel for	· CQI/PMI			DUISCL	J (Note 2)	
reporting			PUSCH (Note 3)			
PUCCH Report Type for CQI/second PMI			2b			
Physical channel for RI reporting				PU	ISCH	
PUCCH Report Type for RI/ first PMI					5	
Reporting perio		ms		N <sub>p</sub>	<sub>d</sub> = 5	
CQI delay		ms			or 11	
cqi-pmi-Configurat					3	
ri-ConfigInde				805 (	Note 4)	
ACK/NACK feedba					plexing	
N		100 T TDD		1.1. 0.4.4.14.141	· · · · · ·	

- Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

# 9.9.1.3 Minimum requirement PUCCH 1-1 with Rank 4 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.9.1.3.1 FDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

**Parameter** Unit Test 1 Test 2 Bandwidth MHz 10 PDSCH transmission mode 4 dB -6  $\rho_{\scriptscriptstyle A}$ Downlink power  $\rho_{\scriptscriptstyle B}$ dB -6 allocation dB 0 σ Propagation condition and Clause B.1 (4 x 4) antenna configuration CodeBookSubsetRestriction 0x0002 0000 0000 0000 bitmap SNR (Note 2) dΒ [5] [6] [11] [12] [-87] [-93][-92] [-86]  $\hat{I}^{(j)}$ dB[mW/15kHz]  $N^{\overline{(j)}}$ dB[mW/15kHz] -98 -98 Max number of HARQ transmissions Physical channel for CQI/PMI **PUCCH Format 2** reporting **PUCCH Report Type for** 2 CQI/PMI PUCCH Report Type for RI 3 Reporting periodicity ms  $N_{pd} = 5$ cqi-pmi-ConfigurationIndex 6 ri-ConfigIndex 1 (Note 3) Note 1: Reference measurement channel RC.21 FDD according to Table A.4-1 with one sided

Table 9.9.1.3.1-1: PUCCH 1-1 static test (FDD)

**TDD** 

Note 2:

Note 3:

9.9.1.3.2

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s)

It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

and the respective wanted signal input level.

shall not be used by the eNB in this test.

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Table 9.9.1.3.2-1: PUCCI	1 1-1 static test (TDD)
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Parameter	Parameter		Tes	st 1	Tes	st 2	
Bandwidth		MHz	10				
PDSCH transmissi	on mode		4				
Uplink downlink con	figuration				2		
Special subfra					4		
configuratio	n				4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB			-6		
allocation	$ ho_{\scriptscriptstyle B}$	dB			-6		
	σ	dB			0		
Propagation condi	tion and			Clause	B.1 (4x4)		
antenna configu	ration			Clause	D. I (4X4)		
CodeBookSubsetR bitmap	CodeBookSubsetRestriction			0x0002 0000 0000 0000			
SNR (Note 2	2)	dB	[5]	[6]	[11]	[12]	
$\hat{I}_{or}^{(j)}$	,	dB[mW/15kHz]	[-93]	[-92]	[-87]	[-86]	
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98 -98		8		
Max number of I			1				
transmission	_						
Physical channel for reporting	· CQI/PMI		PUSCH (Note 3)				
PUCCH Report	Туре		2				
Reporting perio	dicity	ms		N <sub>p</sub>	<sub>d</sub> = 5		
cqi-pmi-Configurat	ionIndex				3		
ri-ConfigInde				805 (	Note 4)		
ACK/NACK feedba					plexing		
		ent channel RC.21			4-1 with one si	ded	
dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.							
	Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s)						
		anted signal input le		0 4014:4:			
		tween CQI/PMI rep					
		JCCH. PDCCH DCI					
#8 to allow SF#7 and		QI/PMI to multiplex	with the HAR	Q-ACK on Pl	JOCH IN UPIINK	subtrame	

## 9.9.1.4 Minimum requirement PUCCH 1-1 with Rank 3 (CSI Reference Symbols)

RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.9.1.4.1 FDD

Note 4:

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.4.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI<sub>1</sub> = wideband CQI<sub>0</sub> - Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1+1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0-1$  and median  $CQI_1-1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0+1$  and median  $CQI_1+1$  shall be greater than or equal to 0.1.

Table 9.9.1.4.1-1: PUCCH 1-1 static test (FDD)

Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz	10			
PDSCH transmissi	on mode				9	
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_{c}$	dB			-3	
	σ	dB			-3	
Cell-specific referen	ce signals			Antenna	ports 0, 1	
CSI reference si	gnals			Antenna p	orts 15,,18	
CSI-RS periodicity and subframe offset  TCSI-RS / \( \Delta \text{CCSI-RS} \)				Ę	5/1	
CSI reference signal configuration			0			
Propagation condition and antenna configuration			Clause B.1 (4 x 4)			
Beamforming Model			As specified in Section B.4.3			3
CodeBookSubsetRestr	CodeBookSubsetRestriction bitmap		0x0000 0020 0000 0000			
SNR (Note 2	2)	dB	[5]	[6]	[11]	[12]
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-93]	[-92]	[-87]	[-86]
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		18	
Max number of HARQ t	ransmissions				1	
Physical channel for CQI/PMI reporting			PUSCH (Note3)			
PUCCH Report Type for CQI/PMI					2	
Physical channel for F				PUCCH	Format 2	
	PUCCH Report Type for RI				3	
Reporting perio		ms		N <sub>p</sub>	<sub>d</sub> = 5	
CQI delay		ms			8	
cqi-pmi-Configurat					2	
ri-ConfigInde	ex				1	

Note 1: Reference measurement channel RC.22 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

#### 9.9.1.4.2 TDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.4.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Table 9.9.1.4.2-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter		Unit	Test 1 Test 2			st 2
Bandwidth		MHz			10	
PDSCH transmissi	on mode				9	
Uplink downlink con					2	
Special subframe co	nfiguration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	$P_c$	dB			-3	
	σ	dB			-3	
CRS reference s	ignals			Antenna	ports 0, 1	
CSI reference si	gnals				orts 15,,18	
CSI-RS periodicity an	d subframe			•		
offset				5	5/ 3	
$T_{ exttt{CSI-RS}}$ / $\Delta_{ exttt{CSI-RS}}$	RS					
CSI reference signal c	onfiguration				0	
Propagation condition	Propagation condition and antenna			Clause	2 1 (1 v 1)	
configuration			Clause B.1 (4 x 4)			
	Beamforming Model		As specified in Section B.4.3			3
CodeBookSubsetRestr			TBD			
SNR (Note 2	2)	dB	[5]	[6]	[11]	[12]
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-93]	[-92]	[-87]	[-86]
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		8	
Max number of HARQ t					1	
Physical channel for reporting	· CQI/PMI		PUSCH (Note 3)			
PUCCH Report Type fo	r CQI/second		2b			
Physical channel for F	RI reporting			PU	SCH	
PUCCH Report Type fo					5	
Reporting perio		ms		N <sub>p</sub>	<sub>d</sub> = 5	
CQI delay		ms			or 11	
cqi-pmi-Configurat					3	
	ri-ConfigIndex 805 (Note 4)					
ACK/NACK feedba	ck mode				plexing	
Note 1: Reference mo	easurement ch	annel RC.22 TDD as described in Anne	x A.5.2.1.	able A.4-1 wi	th one sided dy	
		requirements shall l	be fulfilled for	at least one of	or the two SNR	(s) and the
respective wanted signal input level.  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.						

## 9.9.2 CQI reporting definition under fading conditions

Note 4:

# 9.9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol) for enhanced receiver Type A

collection shall be skipped every 160ms during performance verification.

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a

RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report

white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

#### 9.9.2.1.1 FDD

For the parameters specified in Table 9.9.2.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.9.2.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%

Table 9.9.2.1.1-1 Fading test for single antenna (FDD)

Pa	rameter	Unit	Cell 1	Cell 2
	ndwidth	MHz		MHz
	nission mode			ort 0)
	lic Prefix		Normal	Normal
	Cell ID		0	1
SIN	R (Note 8)	dB	[-4]	N/A
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
Propaga	ation channel		EPA5	Static (Note 7)
	elation and configuration		Low (1 x 4)	(1 x 4)
	(Note 4)	dB	N/A	-0.41
	eference ement channel		Note 2	R.2 FDD
Repo	rting mode		PUCCH 1-0	N/A
Reportii	ng periodicity	ms	$N_{pd} = 2$	N/A
CC	QI delay	ms	8	N/A
•	al channel for reporting		PUSCH (Note 3)	N/A
PUCCH	Report Type		4	N/A
	qi-pmi- urationIndex		1	N/A
	nber of HARQ smissions		1	N/A
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to				

- Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.
- Note 4: The respective received power spectral density of each interfering cell relative to  $N_{\alpha c}$  is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Static channel is used for the interference model. In case for white Note 7: Gaussian noise model Cell 2 is not present.
- SINR corresponds to  $\hat{E}_s/N_{ac}$  of Cell 1 as defined in clause Note 8:

Table 9.9.2.1.1-2 Minimum requirement (FDD)

γ	TBD
UE Category	≥1

#### 9.9.2.1.2 **TDD**

For the parameters specified in Table 9.9.2.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.9.2.1.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.1.2-1 Fading test for single antenna (TDD)

	· ·	•	` '		
Parameter	Unit	Cell 1	Cell 2		
Bandwidth	MHz	10 [	ИНz		
Transmission mode		1 (port 0)			
Uplink downlink			2		
configuration		4			
Special subframe			4		
configuration			-		
Cyclic Prefix		Normal	Normal		
Cell ID		0	1		
SINR (Note 8)	dB	[-4]	N/A		
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98		
Propagation channel		EPA5	Static (Note 7)		
Correlation and antenna configuration		Low (1 x 4)	(1 x 4)		
DIP (Note 4)	dB	N/A	-0.41		
Reference		Note 0	D OA TOD		
measurement channel		Note 2	R.2A TDD		
Reporting mode		PUCCH 1-0	N/A		
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A		
CQI delay	ms	10 or 11	N/A		
Physical channel for		PUSCH (Note	N/A		
CQI reporting		3)	21/2		
PUCCH Report Type		4	N/A		
cqi-pmi- ConfigurationIndex		3	N/A		
Max number of HARQ		1	N/A		
transmissions ACK/NACK feedback					
mode		Multiplexing	N/A		
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.1 TDD according to Table					
110.0 2. Italian incasarante in anno 110.1 1 1 2 2 according to labe					

- A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
- Note 8: SINR corresponds to  $\hat{E}_s/N_{oc}$  of Cell 1 as defined in clause 8.1.1.

Table 9.3.5.1.2-2 Minimum requirement (TDD)

γ	TBD
UE Category	≥1

## 9.9.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol) for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

#### 9.9.2.2.1 FDD

For the parameters specified in Table 9.9.2.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.9.2.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.2.1-1 Fading test for single antenna (FDD)

Parameter	Unit	Cell 1	Cell 2
Bandwidth	MHz	10	MHz
Transmission mode			9
Cyclic Prefix		Normal	Normal
Cell ID		0	1
SINR (Note 8)	dB	[-4]	N/A
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
Propagation channel		EPA5	Static (Note 7)
Correlation and antenna configuration		Low (2 x 4)	(1 x 4)
DIP (Note 4)	dB	N/A	-0.41
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0
CSI reference signals		Antenna ports 15,16	N/A
CSI-RS periodicity and subframe offset		5/1	N/A
CSI-RS reference signal configuration		2	N/A
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	1 / 0010000000000 000
CodeBookSubsetRestr iction bitmap		001111	N/A
Reference measurement channel		Note 2	R.2 FDD
Reporting mode		PUCCH 1-1	N/A
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A
CQI delay	ms	8	N/A
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A
PUCCH Report Type for CQI/PMI		2	N/A
PUCCH channel for RI reporting		PUCCH Format 2	N/A
PUCCH Report Type for RI		3	N/A
cqi-pmi- ConfigurationIndex		2	N/A
ri-ConfigIndex	_	1	N/A
Max number of HARQ transmissions		1	N/A

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Note 4: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  ' is defined by its associated DIP value as specified in clause B.5.1.

Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.

Note 6: Both cells are time-synchronous.

Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.

Note 8:	SINR corresponds to	$\widehat{E}_s/N_{oc}$	of Cell 1 as defined in clause
	8.1.1.		

Table 9.9.2.2.1-2 Minimum requirement (FDD)

γ	TBD	
UE Category	≥2	

#### 9.9.2.2.2 TDD

For the parameters specified in Table 9.9.2.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.9.2.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.2.2-1				
Fading test for single				
antenna	Unit	Cell 1	Cell 2	
(TDD)Parameter				
Bandwidth	MHz	10 I	MHz	
Transmission mode		(	9	
Uplink downlink			,	
configuration		-	2	
Special subframe			4	
configuration		•	4	
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	[-4]	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
	ub[iiivv/15kHz]			
Propagation channel		EPA5	Static (Note 7)	
Correlation and		Low (2 x 4)	(1 x 4)	
antenna configuration DIP (Note 4)	dB	N/A	0.41	
	UD		-0.41	
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0	
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and subframe offset		5/3	N/A	
CSI-RS reference		_		
signal configuration		2	N/A	
Zero-power CSI-RS				
configuration	Subframes /		3 /	
I <sub>CSI-RS</sub> /	bitmap	N/A	001000000000	
ZeroPowerCSI-RS	Jap		0000	
bitmap				
CodeBookSubsetRestr		001111	N/A	
iction bitmap				
Reference		Note 2	R.2A TDD	
measurement channel		PUCCH 1-1	NI/A	
Reporting mode	mo	$N_{\rm pd} = 5$	N/A N/A	
Reporting periodicity CQI delay	ms	10	N/A N/A	
Physical channel for	ms	PUSCH (Note	IN/A	
CQI/PMI reporting		3)	N/A	
PUCCH Report Type		3)		
for CQI/PMI		2	N/A	
Physical channel for RI		PUCCH	A1/2	
reporting		Format 2	N/A	
PUCCH Report Type			NI/A	
for RI		3	N/A	
cqi-pmi-		3	N/A	
ConfigurationIndex ri-ConfigIndex		805 (Note 9)	N/A	
Max number of HARQ				
transmissions		1	N/A	
ACK/NACK feedback		Multiplexing	N/A	
mode	i	INIGITIPIENTING	'*/^	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.

Note 4: The respective received power spectral density of each interfering

	cell relative to $N_{oc}$ is defined by its associated DIP value as
	specified in clause B.5.1.
Note 5:	Two cells are considered in which Cell 1 is the serving cell and Cell
	2 is the interfering cell. Intefering cell is fully loaded.
Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white
	Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to $\widehat{E}_{s}/N_{oc}$ of Cell 1 as defined in clause
	8.1.1.
Note 9:	RI reporting interval is set to the maximum allowable length of
	160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK
	reports. In the case when all three reports collide, it is expected that
	CQI/PMI reports will be dropped, while RI and HARQ-ACK will be
	multiplexed. At eNB, CQI report collection shall be skipped every
	160ms during performance verification and the reported CQI in
	subframe SF#7 of the previous frame is applied in downlink
	subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.9.2.2.2-2 Minimum requirement (TDD)

γ	TBD
UE Category	≥2

## 9.9.3 Reporting of Precoding Matrix Indicator (PMI) for 4Rx UE

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI  $t_{follow1,follow2}$  is 70% of the maximum throughput obtained at  $SNR_{follow1,follow2}$  using the precoders configured according to the UE reports, and  $t_{md1,md2}$  is the throughput measured at  $SNR_{follow1,follow2}$  with random precoding .

### 9.9.3.1 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

#### 9.9.3.1.1 TDD

For the parameters specified in Table 9.9.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.3.1.1-2.

Table 9.9.3.1.1-1: PMI test for single-layer (TDD)

Para	meter	Unit	Test 1		
	lwidth	MHz	10		
Transmission mode			9		
Uplink downlink configuration			1		
	subframe		4		
	uration on channel		EVA5		
	granularity	PRB	50		
	onfiguration		8 x 4		
	n modeling		High, Cross polarized		
	ic reference nals		Antenna ports 0,1		
	nce signals		Antenna ports 15,,22		
Beamform	ning model		Annex B.4.3		
CSI-RS per subfran	riodicity and ne offset $/$ $\Delta_{\text{CSI-RS}}$		5/ 4		
CSI-RS	reference		0		
signal col	nfiguration		0x0000 0000		
	SubsetRestr bitmap		001F FFE0 0000 0000 FFFF		
	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0		
power allocation	Pc	dB	-6		
	σ	dB	-3		
N	oc (j)	dB[mW/15kHz]	-98		
	ng mode		PUSCH 3-1		
	g interval	ms	5		
	y (Note 2)	ms	10		
	ent channel		R.45-2		
	Pattern er of HARQ		OP.1 TDD		
	er of HARQ issions		4		
	ncy version		{0,0,1,2}		
	equence K feedback		(-,-,-,-)		
	ode		Multiplexing		
Note 2:	shall be updated in each TTI (1 ms granularity).				
estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.  Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4					

Table 9.9.3.1.1-2: Minimum requirement (TDD)

Parameter	Test 1
γ	[2.5]
UE Category	≥2

## 9.9.4 Reporting of Rank Indicator (RI)

The purpose of this test for 4Rx UEs is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.9.4.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.9.4.2.

For the fixed rank 1 transmission with 2 Tx ports the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission with 2 Tx ports the RI and PMI reporting is restricted to one two-layer precoder. For the follow RI transmission for rank 1 and 2 and 2 Tx ports the RI and PMI reporting is restricted to select the union of these precoders.

For the fixed rank 2 transmission with 4 Tx ports the RI and PMI reporting is restricted to any 2 Layer precoder, for the follow RI transmission the RI and PMI reporting is not restricted at all.

Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

#### 9.9.4.1 Minimum requirement (Cell-Specific Reference Symbols)

#### 9.9.4.1.1 FDD

The minimum performance requirement in Table 9.9.4.1.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.9.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.1.1-2.

Table 9.9.4.1.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	
Bandwidth N		MHz	10				
PDSCH transmission	on mode		4				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3				
	σ	dB		0			
Propagation condit antenna configur				2 x 4 EPA5		4 x 4 EPA5	
Cell-specific reference	e signals		Ant	enna ports 0, 1		Antenna ports 0-3	
CodeBookSubsetRe bitmap	estriction		01000	11 for fixed RI = 1 00 for fixed RI = 2 for UE reported	2	Note 6	
Antenna correla	ation		Low	Low	High	Low	
RI configuration	on		Fixed RI=2 and Fixed RI=1 Fixed RI=1 follow RI and follow RI and follow RI		Fixed RI=2 and follow RI		
SNR		dB	-4	16	16	25	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98 -98		-98		
$\hat{I}_{or}^{(j)}$			-102	-82	-82	-73	
Maximum number o				1			
Reporting mo	de			PUCCH 1-1 (	Note 4)		
Physical channel for reporting	CQI/PMI			PUCCH Fo	rmat 2		
PUCCH Report Ty CQI/PMI	ype for		2				
Physical channel reporting	for RI		PUSCH (Note 3)				
PUCCH Report Type for RI		3					
Reporting periodicity ms		N <sub>pd</sub> = 5					
PMI and CQI d		ms	8				
cqi-pmi-Configurati				6			
ri-Configuration	nInd		1 (Note 5)				

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:
  - For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1
  - For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2
  - For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0
- Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.
- Note 6: The following precoders are allowed in Test 4:

" $0x0000\ 0000\ FFFF\ 0000$ " for RI=2

"0xFFFF FFFF FFFF FFFF" for UE reported RI

Table 9.9.4.1.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
<b>7</b> 1	N/A	[1.05]	[0.9]	N/A
72	[1]	N/A	N/A	[1.1]
UE Category	≥2	≥2	≥2	≥5

#### 9.9.3.1.1 TDD

The minimum performance requirement in Table 9.9.4.1.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.9.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.1.2-2.

Table 9.9.4.1.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz		10		
PDSCH transmission	n mode			4		
Develials nesses	$ ho_{\scriptscriptstyle A}$	dB		-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		
	σ	dB		0		
Uplink downlink conf	iguration			2		
Special subfra configuration				4		
Propagation condit antenna configur				2 x 4 EPA5		4 x 4 EPA5
Cell-specific reference	fic reference signals Antenna ports 0, 1		Antenna ports 0-3			
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 Note 010000 for fixed RI = 2 010011 for UE reported RI			Note 4
Antenna correla	ation		Low	Low	High	Low
RI configuration	on		Fixed RI=2 and follow RI	Fixed RI= 1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI
SNR		dB	-4	16	16	25
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$ dB[m]		dB[mW/15kHz]	-102	-82	-82	-73
Maximum number of HARQ transmissions			1			
Reporting mode			PUSCH 3-1 (Note 3)			
Reporting interval ms		5				
PMI and CQI do	elay	ms	10 or 11			<u> </u>
ACK/NACK feedback mode				Bundlir	ng	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

Note 4: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.1.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	[1.05]	[0.9]	N/A
72	[1]	N/A	N/A	[1.1]
UE Category	≥2	≥2	≥2	≥5

### 9.9.4.2 Minimum requirement (CSI Reference Symbols)

#### 9.9.4.2.1 FDD

The minimum performance requirement in Table 9.9.4.2.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.9.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.2.1-2.

Table 9.9.4.2.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	
Bandwidth		MHz		10			
PDSCH transmission	n mode			9			
	$ ho_{\scriptscriptstyle A}$	dB		0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0			
allocation	Pc	dB	0				
	σ	dB		0			
Propagation condit			2 x 4 EPA5 4 x 4 EPA			4 x 4 EPA5	
antenna configur						_	
Cell-specific reference				Antenna ports 0			
Beamforming M	odel		•	As specified in Se	ection B.4.3	Δ.,	
CSI reference sign	gnals		Ante	nna ports 15, 16		Antenna ports 15-18	
CSI-RS periodicit subframe offs $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-II}}$	et RS			5/1			
CSI reference si configuration			6				
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 Note 5 010000 for fixed RI = 2 010011 for UE reported RI			Note 5	
Antenna correla	ation		Low	Low	High	Low	
RI configuration			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI	
SNR		dB	-4	16	16	25	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102 -82 -82 -		-73		
Maximum number o			1				
	Reporting mode			PUCCH	1-1		
Physical channel for CQI/PMI reporting			PUSCH (Note 3)				
PUCCH Report Type for CQI/PMI		2					
Physical channel for RI reporting			PUCCH Format 2				
PUCCH Report Type for RI				3			
Reporting periodicity		ms		$N_{\rm pd} = 3$	5		
PMI and CQI delay		ms		8			
cqi-pmi-Configurati			2				
ri-ConfigurationInd			1 (Note 4)				

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.
- Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.
- Note 5: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.2.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	[1.05]	[0.9]	N/A
72	[1]	N/A	N/A	[1.1]
UE Category	≥2	≥2	≥2	≥5

### 9.9.4.2.1 TDD

The minimum performance requirement in Table 9.9.4.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.9.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.2.2-2.

Table 9.9.4.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz		10		
PDSCH transmission	on mode			9		
	$ ho_{\scriptscriptstyle A}$	dB		0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0		
allocation	Pc	dB		0		
	σ	dB		0		
Uplink downlink con	figuration			1		
Special subfra configuration	า			4		
Propagation condit antenna configur			2 x 4 EPA5 4 x 4 EF		4 x 4 EPA5	
Cell-specific reference				Antenna po	orts 0	
CSI reference si	gnals		Ante	enna ports 15, 16		Antenna ports 15-18
Beamforming M	odel			As specified in Se	ection B.4.3	•
CSI reference s configuration	า			4		
CSI-RS periodicity subframe offs $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et		5/4			
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 Note 4 010000 for fixed RI = 2 010011 for UE reported RI			Note 4
Antenna correla	ation		Low	Low	High	Low
RI configurati			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI
SNR		dB	-4	16	16	25
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102	-82	-82	-73
Maximum number of transmission			1			
Reporting mode			PUCCH 1-1			
Physical channel for CQI/ PMI reporting			PUSCH (Note 3)			
PUCCH report type for CQI/ PMI			2			
Physical channel for RI reporting				PUCCH For	rmat 2	
Reporting periodicity		ms		$N_{\rm pd} = 3$	5	
PMI and CQI delay		ms		10		
ACK/NACK feedba				Bundlir	ng	
cqi-pmi-Configurati				4		
ri-Configuration	nInd	21.1.1.12.12		11		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8.
- Note 4: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	[1.05]	[0.9]	N/A
72	[1]	N/A	N/A	[1.1]
UE Category	≥2	≥2	≥2	≥5

## 10 Performance requirement (MBMS)

## 10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value		
Number of HARQ processes	Processes	None		
Subcarrier spacing	kHz	15 kHz		
Allocated subframes per Radio Frame (Note 1)		6 subframes		
Number of OFDM symbols for PDCCH		2		
Cyclic Prefix Extended				
Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.				

## 10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

Table 10.1.1-1: Test Parameters for Testing

Parameter		Unit	Test 1-4	
	$ ho_{\scriptscriptstyle A}$	dB	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	
	σ	dB	0	
$N_{oc}$ at antenna port		dBm/15kHz	-98	
Note 1: $P_B = 0$ .				

20.1

20.5

6.6

≥2

1

≥1

Bandwidth

10 MHz

10 MHz

10 MHz

5.0MHz

1.4 MHz

Test

number

2

3

Reference value OCNG MBMS Reference **Propagation** Correlation Channel **Pattern** condition Matrix and UE **BLER** SNR(dB) Category antenna (%) R.37 FDD OP.4 4.1 FDD R.38 FDD OP.4 11.0 ≥1 FDD **MBSFN** 

1x2 low

Table 10.1.1-2: Minimum performance

channel

model (Table B.2.6-1)

## 10.2 TDD (Fixed Reference Channel)

R.39 FDD

R.39-1 FDD

R.40 FDD

OP.4

FDD

OP.4

FDD

OP.4

FDD

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value	
Number of HARQ processes	Processes	None	
Subcarrier spacing	g kHz	15 kHz	
Allocated subframes Radio Frame (Note	· ·	5 subframes	
Number of OFDM symbols for PDCC		2	
Cyclic Prefix Extended			
Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.			

## 10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

Table 10.2.1-1: Test Parameters for Testing

Parameter		Unit	Test 1-4	
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	
	σ	dB	0	
$N_{oc}$ at antenna port		dBm/15kHz	-98	
Note 1: $P_{R} = 0$ .				

Bandwidth MBMS Test Reference **OCNG Propagation** Correlation Reference value condition number Channel Pattern Matrix and UE **BLER** SNR(dB) antenna Category (%) 10 MHz R.37 TDD OP.4 ≥1 **TDD** OP.4 2 R.38 TDD 10 MHz 11.1 ≥1 **TDD MBSFN** 3a 10 MHz R.39 TDD OP.4 20.1 ≥2 channel 1x2 low 1 **TDD** model (Table 5MHz R.39-1 TDD OP.4 B.2.6-1) 3b 20.5 1 **TDD** 4 1.4 MHz R.40 TDD OP.4 5.8 ≥1 TDD

Table 10.2.1-2: Minimum performance

## 11 Performance requirement (ProSe Direct Discovery)

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Discovery.

### 11.1 General

## 11.1.1 Applicability of requirements

The requirements in this clause are applicable to UEs that support ProSe Direct Discovery. Some of the tests defined in this clause are applicable only to UEs that additionally support transmission and reception of Sidelink synchronization signal (indicated using *disc-SLSS*). The test case applicability is in according to table 11.1.1-1 depending on UE capability.

Table 11.1.1-1: ProSe Direct Discovery test applicability

	ProSe Direct Discovery without support of SLSS	ProSe Direct Discovery with support of SLSS
FDD	11.2.1, 11.3.1, 11.5.1	11.3.1, 11.4.1, 11.5.1
TDD	11.2.2, 11.3.2, 11.5.2	11.2.2, 11.3.2, 11.5.2

For maximum Sidelink Processes test specified in clause 11.5, the UE is required to only meet the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE.

## 11.1.2 Reference DRX configuration

Table 11.1.2-1: Reference DRX configuration

Parameter	Value	Comments
onDurationTimer	psf1	
drx-InactivityTimer	psf1	
drx-RetransmissionTimer	psf1	
longDRX-CycleStartOffset	sf2560, 0	
shortDRX	disabled	
NOTE 1: For further information see c	lause 6.3.2 in TS 36.331.	

## 11.2 Demodulation of PSDCH (single link performance)

The purpose of the requirements in this subclause is to verify the PSDCH demodulation performance with a single active PSDCH link under different operating scenarios and channel conditions.

The active cell(s), when present, are specified in the test parameters specific to the test.

### 11.2.1 FDD

The minimum requirements are specified in Table 11.2.1-2 with the test parameters specified in Table 11.2.1-1. The receiver UE under test is associated with Cell 1.

Table 11.2.1-1: Test Parameters

Parameter			Unit	Test 1
Discovery resource pool configuration				As specified in Table A.7.1.1-1 (Configuration #1-FDD)
DRX configuration				As specified in Table 11.1.2-1
$N_{oc}$ at antenna port (NOTE 3)			dBm/15kHz	-98
Active cell(s)	Active cell(s)			Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Cell ID			0
	Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0
0 11 4		$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1		σ	dB	0
	OCNG Patterr	OCNG Pattern (NOTE 2)		OP.1 FDD
	Propagation channel			AWGN
	Antenna confi	Antenna configuration		1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s	s)			Sidelink UE 1
	Sidelink Trans	missions		PSDCH
	PSDCH RB al	PSDCH RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Cidalials LIE 4	Time offset (N	OTE 4)	μs	+1
Sidelink UE 1	Frequency offs 5)	Frequency offset (NOTE		+200
	Propagation C	hannel		EPA5
	Antenna confi			1x2 Low

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.2.1-2: Minimum performance

Test num.	Sidelink UE	Band-width	Reference channel	Reference val	lue
				BLER of PSDCH (%)	SNR (dB)
1	1	5 MHz	D.1 FDD	30	4.6

### 11.2.2 TDD

The minimum requirements are specified in Table 11.2.2-2 with the test parameters specified in Table 11.2.2-1. The receiver UE under test is associated with Cell 1.

Table 11.2.2-1: Test Parameters

Parameter			Unit	Test 1
Discovery resource pool configuration				As specified in Table A.7.1.2-1 (Configuration #1-TDD)
DRX configuration				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna po	ort (NOTE 5)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Uplink downlink configuration (NC	OTE 3)		0
		Special subframe configuration (NOTE 4)		4
	Cell ID			0
Cell 1	Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	allocation	σ	dB	0
	OCNG Pattern No	OCNG Pattern NOTE 2		OP.1 TDD
	Propagation char	Propagation channel		AWGN
	Antenna configur	Antenna configuration		1x2
	RSRP	RSRP		-92
Active Sidelink UE	(s)			Sidelink UE 1
	Sidelink Transmi	ssions		PSDCH
	RB allocation			PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Cidaliak LIF 1	Time offset (NOT	E 6)	μs	+1
Sidelink UE 1	Frequency offset 7)		Hz	+200
	Propagation Cha	nnel		EPA5
	Antenna configui			1x2 Low

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].

NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].

NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery.

NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.2.2-2: Minimum performance

Test num.	Sidelink UE	Band-width	Reference channel	Reference value		
				BLER of PSDCH (%)	SNR (dB)	
1	1	5 MHz	D.1 TDD	30	4.6	

## 11.3 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSDCH transmissions from two Sidelink UEs with power imbalance in one subframe.

#### 11.3.1 FDD

The minimum requirements are specified in Table 11.3.1-2 with the test parameters specified in Table 11.3.1-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.1-1: Test Parameters

Parameter			Unit	Test 1
Discovery resource pool configuration				As specified in Table A.7.1.1-1 (Configuration #1-FDD)
DRX configuration				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna port	(NOTE 3)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Cell ID			0
	Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
	allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1		σ	dB	0
	OCNG Pattern (NOTE 2)			OP.1 FDD
	Propagation channel			AWGN
	Antenna configuration			1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s	Active Sidelink UE(s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions			PSDCH
	PSDCH RB allocation			PRB pairs {45}
Sidelink UE 1	Time offset (NOTE 3)		μs	0
Sidellik OE 1	Frequency offset	(NOTE 4)	Hz	0
		Propagation Channel		AWGN
	Antenna configuration			1x2 Low
	Sidelink Transmis	sions		PSDCH
	PSDCH RB alloca	ation		PRB pairs {67}
	Time offset (w.r.t.	Cell 1 DL)	μs	0
Sidelink UE 2	Frequency offset 1 UL)	(w.r.t. Cell	Hz	0
	Propagation Char	nnel		AWGN
	Antenna configura			1x2 Low
NOTE 1. D. O			•	

NOTE 1:  $P_{\scriptscriptstyle B}=0$  .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs. NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.3.1-2: Minimum performance

Test	Test Band- S		Reference	Reference value				
num.	width	width UE	channel	BLER of PSDCH (%)	SNR (dB)			
4	5	1	D.1 FDD	(NOTE 1)	24.3			
1	MHz	2	D.1 FDD	30	6.9			
NOTE	NOTE 1: There is no BLER requirement for Sidelink UE 1.							

#### 11.3.2 **TDD**

The minimum requirements are specified in Table 11.3.2-2 with the test parameters specified in Table 11.3.2-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.2-1: Test Parameters

Parameter		Unit	Test 1	
Discovery resource po	ool configuration			As specified in Table A.7.1.2-1
• • •				(Configuration #1-TDD)
DRX configuration				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna port (	NOTE 5)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Uplink downlinl configuration ()	NOTE 3)		0
	Special subfrar configuration ()			4
	Cell ID			0
Cell 1	Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	allocation	σ	dB	0
	OCNG Pattern NOTE 2			OP.1 TDD
	Propagation channel			AWGN
	Antenna configuration			1x2
RSRP		dBm/15kHz	-92	
Active Sidelink UE(s)				Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions			PSDCH
	PSDCH RB allocation			PRB pairs {45}
	Time offset (NOTE 6)		μs	0
Sidelink UE 1	Frequency offset (NOTE 7)		Hz	0
	Propagation Cl			AWGN
	Antenna config			1x2 Low
	Sidelink Transr	missions		PSDCH
	RB allocation			PRB pairs {67}
	Time offset (NO		μs	0
Sidelink UE 2	Frequency offs 7)		Hz	0
	Propagation Cl			AWGN
	Antenna config	uration		1x2 Low
NOTE 1: D O			-	

NOTE 1:  $P_{\scriptscriptstyle B}=0$  .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4]. NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].

NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery. NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.3.2-2: Minimum performance

Test	Test Band- S		Reference	Reference value				
num.	width	UE	channel	BLER of PSDCH (%)	SNR (dB)			
4	5	1	D.1 TDD	(NOTE 1)	24.3			
1	MHz	2	D.1 TDD	30	6.9			
NOTE	NOTE 1: There is no BLER requirement for Sidelink UE 1.							

#### Multiple timing reference test 11.4

The purpose of this test is to check the demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overlapping in time).

### 11.4.1 FDD

The test parameters are specified in Table 11.4.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and 3 are associated with another cell and use a different timing, and UE 1 acts as a synchronization reference. The minimum requirements are specified in Table 11.4.1-2.

Table 11.4.1-1: Test Parameters

Pa	arameter	Unit	Test 1
Discovery resource po	ool configuration		As specified in Table A.7.1.1-2 (Configuration #2-FDD)
DRX configuration			As specified in Table 11.1.2-1
	$N_{oc}$ at antenna port (NOTE 3)		-98
Active cell(s)			Cell 1 (Serving cell)
	Cyclic prefix		Normal
	Cell ID		0
j	Downlink $ ho_{\scriptscriptstyle A}$	dB	0
Call 1	power $\rho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1	σ	dB	0
	OCNG Pattern NOTE 2		OP.1 FDD
	Propagation channel		AWGN
	Antenna configuration		1x2
	RSRP	dBm/15kHz	-92
Active Sidelink UE(s)	T		Sidelink UEs 1, 2, 3
	Sidelink Transmissions		SLSS
	networkControlledSyncTx	<u> </u>	ON
	slssid	<u> </u>	30
	Time offset (NOTE 4)	μs	3511
Sidelink UE 1	Frequency offset (NOTE 5)	Hz	-100
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ of SLSS at antenna	dBm/15kHz	-82
	port		
	Sidelink Transmissions		PSDCH
	Resource pool used for transmissions		discRxPool(0)
	RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Sidelink UE 2	Time offset (NOTE 4)	μs	+1
	Frequency offset (NOTE	μs Hz	+200
	5)	+	EPA5
	Propagation Channel	+	
	Antenna configuration Sidelink Transmissions	+	1x2 Low PSDCH
		+	FODUT
	Resource pool used for transmissions		discRxPool(1)
<u></u> _	RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Sidelink UE 3	Time offset (NOTE 4)	μs	3511
	Frequency offset (NOTE 5)	Hz	+300
	Propagation Channel	†	EPA5
	Antenna configuration	1	1x2 Low
NOTE 1: P = 0	/ Intornia cornigaration	<u> </u>	IAL LOW

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.4.1-2: Minimum performance

Test num.	Band-width	Sidelink UE	Reference channel	Reference value	
				BLER of PSDCH (%)NOTE 1	SNR (dB)
1	5 MHz	2	D.1 FDD	30	4.6
I	3 IVITZ	3	D.1 FDD	30	4.6

NOTE 1: The BLER is measured after 5 D2D Discovery periods (1600 frames) of lead time during which the test UE detects and synchronizes to Sidelink UE 1 SLSS.

## 11.5 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes supported by the UE as reported using UE capability signalling (*discSupportedProc*).

The UE is required to meet only the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE.

### 11.5.1 FDD

The test parameters are specified in Table 11.5.1-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.1-2.

Table 11.5.1-1: Test Parameters

Parameter			Unit	Test 1-7	
Discovery resource pool configuration			As specified in Table A.7.1.1-3 (Configuration #3-FDD) with parameters BW <sub>Channel</sub> , NPools = Number of configured resource pools (as specified in Table 11.5.1-2), and N = discSupportedProc		
DRX configura	tion			As specified in Table 11.1.2-1	
Active cell(s)				Cell 1 (Serving cell)	
	Cyclic prefix			Normal	
	Cell ID			0	
	Downlink	$\rho_{\scriptscriptstyle A}$	dB	0	
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)	
Cell 1	allocation	σ	dB	0	
	OCNG Patter	n <sup>NOTE 2</sup>		OP.1 FDD	
	Propagation of	Propagation channel		Static propagation condition  No external noise sources are applied	
	Antenna configuration			1x2	
	RSRP		dBm/15kHz	-85	
Active Sidelink				Sidelink UE i, i = 0,, discSupportedProc-1	
	Sidelink Transmission:	S		PSDCH (D.1 FDD)	
	Resource pool index (NOTE 3)			$\left\lfloor rac{i}{N_{{\scriptsize MAX}\_{\scriptsize SF}}}  ight floor$	
Sidelink UE i	PSDCH RB a (NOTE 3)	PSDCH RB allocation (NOTE 3)		PRB pairs {2*(i % $N_{MAX\_SF}$ ), 2*(i % $N_{MAX\_SF}$ )+1}	
	Time offset (N	IOTE 4)	μs	0	
	Frequency off (NOTE 4)	set	Hz	0	
	Propagation (			Static propagation condition  No external noise sources are applied	
	Antenna confi	guration		1x2 Low	

NOTE 1:  $P_{\scriptscriptstyle B}=0$  .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs..

NOTE 3:  $N_{MAX\_SF}$  represents the maximum number of Sidelink UEs transmitting in one subframe.  $N_{MAX\_SF}$  = 12 (5)

MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.5.1-2: Minimum performance

Test num.	Bandwidth	discSupportedProc	Number of configured resource pools	$\hat{E}_{s}$ at antenna port (dBm/15kHz)	Reference value for Sidelink UE i=0discSupportedProc- 1 Fraction of maximum throughput (%)
1	5 MHz	50	5	-85	95
2	10 MHz	50	2	-85	95
3	15 MHz	50	2	-85	95
4	20 MHz	50	1	-85	95
5	10 MHz	400	16	-85	95
6	15 MHz	400	11	-85	95
7	20 MHz	400	8	-85	95

#### 11.5.2 TDD

The test parameters are specified in Table 11.5.2-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.2-2.

Table 11.5.2-1: Test Parameters

	Parameter		Unit	Test 1-7
Discovery resource pool configuration			As specified in Table A.7.1.2-2 (Configuration #2-TDD) with parameters BW <sub>Channel</sub> , NPools = Number of configured resource pools (as specified in Table 11.5.2-2), and N = discSupportedProc	
DRX configuration				As specified in Table 11.1.2-1
Active cell(s)				Cell 1 (Serving cell)
	clic prefix			Normal
	ink downlin figuration (			0
	ecial subfra ofiguration (			4
Cel	IID			0
Cell 1 Dov	wnlink	$ ho_{\scriptscriptstyle A}$	dB	0
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
allo	allocation	σ	dB	0
OC	OCNG Pattern NOTE 2			OP.1 TDD
Pro	pagation cl	nannel		Static propagation condition No external noise sources are applied
	enna config	guration		1x2
RSI			dBm/15kHz	-85
Active Sidelink UE(s				Sidelink UE i, i = 0,, discSupportedProc-1
	elink nsmissions	i		PSDCH (D.1 TDD)
	PSDCH Resource pool (NOTE 5)			$\left\lfloor rac{i}{N_{\mathit{MAX\_SF}}}  ight floor$
0:-1-1:-1-11	DCH RB all DTE 5)	ocation		PRB pairs {2*(i % N <sub>MAX_SF</sub> ),2*(i % N <sub>MAX_SF</sub> )+1}
	ne offset (N	OTE 6)	μs	0
	quency offs OTE 7)	set	Hz	0
Pro	pagation C	hannel		Static propagation condition  No external noise sources are applied
Ant	enna config	guration		1x2 Low

NOTE 1:  $P_{\scriptscriptstyle B}=0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs. NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].

NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].

NOTE 5: N<sub>MAX\_SF</sub> represents the maximum number of Sidelink UEs transmitting in one subframe. N<sub>MAX\_SF</sub> = 12 (5 MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).

NOTE 6: Transport of Sidelink UEs visib propert to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.5.2-2: Minimum performance

	Number of		$\hat{E}_{arepsilon}$ at	Reference value	
Test num.	Bandwidth	discSupportedProc	configured resource pools	antenna port (dBm/15kHz	Fraction of maximum throughput (%) for Sidelink UE i=0discSupportedProc-1
1	5 MHz	50	5	-85	95
2	10 MHz	50	2	-85	95
3	15 MHz	50	2	-85	95
4	20 MHz	50	1	-85	95
5	10 MHz	400	16	-85	95
6	15 MHz	400	11	-85	95
7	20 MHz	400	8	-85	95

# 12 Performance requirement (ProSe Direct Communication)

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Communication in TS 36.211 [4].

#### 12.1 General

#### 12.1.1 Applicability of requirements

The requirements in this clause are applicable to UEs that support ProSe Direct Communication. Test cases defined for 5MHz channel bandwidth are applicable to UEs that support ProSe Direct Communication on only Band 31.

### 12.1.2 Reference DRX configuration

Table 12.1.2-1: Reference DRX configuration

Parameter	Value	Comments			
onDurationTimer	psf1				
drx-InactivityTimer	psf1				
drx-RetransmissionTimer	psf1				
longDRX-CycleStartOffset	sf2560, 0				
shortDRX disabled					
NOTE 1: For further information see clause 6.3.2 in TS 36.331.					

#### 12.2 Demodulation of PSSCH

The purpose of the requirements in this subclause is to verify the PSSCH demodulation performance with a single active PSSCH link.

#### 12.2.1 FDD

The minimum requirements are specified in Table 12.2.1-2 with the test parameters specified in Table 12.2.1-1. This test specifies an out-of-coverge scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.2.1-1: Test Parameters

F	Parameter		Test 1
	Communication resource pool		As specified in Table A.7.2.1-1
configuration			(Configuration #1-FDD)
DRX configuration		dBm/15	As specified in Table 12.1.2-1
$N_{\it oc}$ at antenna	$N_{oc}$ at antenna port (NOTE 1)		-98
Active cell(s)			None
	Sidelink Transmissions		SLSS + PSBCH
	networkControlledSyn cTx		ON
	slssid		30
Sidelink UE 1	inCoverage (in MIB- SL)		TRUE
	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15 kHz	-85
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		5MHz: CC.3 FDD 10 MHz: CC.4 FDD
	PSCCH subframe allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen randomly
	PSCCH RB allocation		(uniformly) in $[0, \lfloor M_{\it RB}^{\it PSCCH} \_{\it RP} / 2 \rfloor L_{\it PSCCH} - 1]$ every sc-period
	$\widehat{E}_s$ of PSCCH at	dBm/15 kHz	-85
	antenna port PSSCH RMC		As specificied in Table 12.2.1-2
Sidelink UE 2	PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
	PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213 HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
	Time offset (NOTE 2)	μs	+1
	Frequency offset (NOTE 3)	Hz	+200
	Propagation Channel		EVA70
	Antenna configuration		1x2 Low

NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.

NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency.

Table 12.2.1-2: Minimum performance

Test	Sidelink	Band- PSSCH		Reference value		
	width	Reference channel	Fraction of maximum throughput (%) (NOTE 1)	SNR (dB) of PSSCH		
4	2	10 MHz	CD.1 FDD	70	-3.4	
'   2	5 MHz CD.1 FDD		70	-3.3		

NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

### 12.3 Demodulation of PSCCH

The purpose of the requirements in this subclause is to verify the PSCCH demodulation performance with a single active PSSCH link.

#### 12.3.1 FDD

The minimum requirements are specified in Table 12.3.1-2 with the test parameters specified in Table 12.3.1-1. This test specifies an out-of-coverage scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.3.1-1: Test Parameters

Parameter		Unit	Test 1
Communication resource pool			As specified in Table A.7.2.1-1
configuration			(Configuration #1-FDD)
DRX configuration			As specified in Table 12.1.2-1
$N_{oc}$ at antenna port (NOTE 1)		dBm/15 kHz	-98
Active cell(s)			None
	Sidelink Transmissions		SLSS + PSBCH
	networkControlledSyn cTx		ON
	slssid		30
Sidelink UE 1	inCoverage (in MIB- SL)		TRUE
	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15 kHz	-85
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		As specified in Table 12.3.1-2
	PSCCH subframe allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen randomly
	PSCCH RB allocation		(uniformly) in $[0, \lfloor M_{RB}^{PSCCH} \_{RP} / 2 \rfloor L_{PSCCH} - 1]$ every sc-period
	PSSCH RMC		CD.1 FDD
Sidelink UE 2	PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
Sidelifik de 2	PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213  HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
	Time offset (NOTE 2)	μs	+1
	Frequency offset (NOTE 3)	Hz	+200
	Propagation Channel		EVA70
	Antenna configuration		1x2 Low

NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.

NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency.

Table 12.3.1-2: Minimum performance

Test	Sidelink	Band- PSCCH Reference		Reference value		
num.	UE	width	channel	Probability of missed PSCCH (%) (NOTE 1)	SNR (dB) of PSCCH	
1	2	10 MHz	CC.4 FDD	1	4.7	
5 MHz CC		CC.3 FDD	1	4.8		

NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

#### 12.4 Demodulation of PSBCH

The purpose of the requirements in this subclause is to verify the PSBCH demodulation performance with a single active link.

#### 12.4.1 FDD

The minimum requirements are specified in Table 12.4.1-2 with the test parameters specified in Table 12.4.1-1.

Table 12.4.1-1: Test Parameters

	Parameter	Unit	Test 1
Communication res	ource pool configuration		As specified in Table A.7.2.1-1 (Configuration #1-FDD)
DRX configuration			As specified in Table 12.1.2-1
$N_{\it oc}$ at antenna por	t	dBm/15kHz	-98
Active cell(s)			None
	Sidelink Transmissions		SLSS + PSBCH (CP.1 FDD)
	networkControlledSyncTx		ON
	slssid		30
Sidelink UE 1	inCoverage (in MIB-SL)		TRUE
Sidelifik de 1	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low

Table 12.4.1-2: Minimum performance

Test	Sidelink	Band-	Reference	Reference value		
num.	UE	width	channel	Probability of missed PSBCH (%) (NOTE 1)	SNR (dB)	
1	1	10 MHz	PSBCH	1	4.4	
'	•	5 MHz	(CP.1 FDD)	l	4.4	

NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

## 12.5 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one subframe.

#### 12.5.1 FDD

The test parameters in Table 12.5.1-1 specifies an in-coverage scenario where Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSSCH on adjacent RBs. The minimum requirements are specified in Table 12.5.1-2.

Table 12.5.1-1: Test Parameters

Parameter			Unit	Test 1
Communication resource pool configuration				As specified in Table A.7.2.1-2
	ource poor cornigural	.1011		(Configuration #2-FDD)
DRX configuration	DRX configuration			As specified in Table 12.1.2-1
$N_{oc}$ at antenna port (Note 3)			dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
Cyclic prefix			Normal	
	Cell ID			0
	Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
	allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1		σ	dB	0
	OCNG Pattern (N	ote 2)		OP.1 FDD
	Propagation chan			AWGN
	Antenna configura	ation		1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(	s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmis	sions		PSCCH + PSSCH
	PSCCH RMC			5 MHz: CC.1 FDD
		PSCCH RIVIC		10 MHz: CC.2 FDD
	PSCCH subframe			$n_{PSCCH}=0$ (as defined in TS 36.213)
	PSCCH RB alloca	ation		PSCCH o (do dominod in 10 do.210)
Cidalial: UE 4	$\widehat{E}_s$ of PSCCH at antenna		dBm/15kHz	-85
Sidelink UE 1	PSSCH RMC			As specified in Table 12.5.1-2
	PSSCH subframe	allocation		As per time repetition pattern specified in PSCCH
	PSSCH RB alloca			PRB pairs {4, 5}
	Time offset (NOT		μs	0
	Frequency offset		Ηz	0
	Propagation Char		112	AWGN
	Antenna configuration			1x2 Low
	Sidelink Transmis			PSCCH + PSSCH
				5 MHz: CC.1 FDD
	PSCCH RMC			10 MHz: CC.2 FDD
	PSCCH subframe	allocation		
	PSCCH RB alloca	ation		$n_{\it PSCCH}=2$ (as defined in TS 36.213)
	$\widehat{E}_s$ of PSCCH at	antenna	dBm/15kHz	-85
Sidelink UE 2	port			
	PSSCH RMC			As specified in Table 12.5.1-2
	PSSCH subframe			As per time repetition pattern specified in PSCCH
	PSSCH RB alloca			PRB pairs {6, 7}
	Time offset (NOT		μs	0
	Frequency offset		Hz	0
	Propagation Channel			AWGN
	Antenna configura	ation		1x2 Low

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 4: The power of PSCCH is set high to ensure reliable reception of PSCCH.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.5.1-2: Minimum performance

Test	Band-	Sidelink	PSSCH Reference	Reference value					
num.	width	UE	channel	Fraction of maximum throughput (%)	SNR (dB) of PSSCH				
1	5 / 10	1	CD.5 FDD	(NOTE 1)	24.35				
'	MHz	2	CD.5 FDD	70 2.4					
NOTE	1: There	is no throughp	out requirement for Sidelink L	JE 1.					

## 12.6 Multiple timing reference test

The puporse of this test is to check the PSSCH demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overalapping in time).

#### 12.6.1 FDD

The test parameters are specified in Table 12.6.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and Sidelink UE 3 are associated with another cell and use a different timing, and Sidelink UE 1 acts as a synchronization reference only. The minimum requirements are specified in Table 12.6.1-2.

**Table 12.6.1-1: Test Parameters** 

F	Parameter		Unit	Test 1		
			0.111	As specified in Table A.7.2.1-3		
Communication resou	urce pool configurat	ion		(Configuration #3-FDD)		
DRX configuration				As specified in Table 12.1.2-1		
$N_{ac}$ at antenna port (	(Note 3)		dBm/15kHz	-98		
Active cell(s)				Cell 1 (Serving cell)		
7.00.70 00.1(0)	Cyclic prefix			Normal		
	Cell ID			0		
		$ ho_{\scriptscriptstyle A}$	dB	0		
	Downlink power		dB	0 (NOTE 1)		
Cell 1	allocation	$\rho_{\scriptscriptstyle B}$	-	· · · · · ·		
	OCNG Pattern NO	σ IE 2	dB	0		
	Propagation chan	nel		OP.1 FDD AWGN		
	Antenna configura			1x2		
	RSRP	duom	dBm/15kHz	-92		
Active Sidelink UE(s)				Sidelink UE 1, Sidelink UE 2, Sidelink UE 3		
,	Sidelink Transmis	sions		SLSS + PSBCH		
	networkControlled	lSyncTx		ON		
	slssid			30		
	inCoverage (in MI	B-SL)		TRUE		
	syncOffsetIndicate	or		Set same as syncOffsetIndicator in Configuration		
Sidelink UE 1				#3-FDD		
	Time offset (NOT		ms	+12.51 ms		
	Frequency offset		Hz	-100 Hz EPA5		
	Propagation chan Antenna configura			1x2 Low		
	_					
	$ec{E}_{s}$ at antenna po	ort	dBm/15kHz	-85		
	Sidelink Transmis	sions		PSCCH + PSSCH		
	Resource pool			commRxPool(0)		
	DOCOLL DMO			5MHz: CC.1 FDD		
	PSCCH RMC			10 MHz: CC.2 FDD (NOTE 5)		
				·		
	PSCCH subframe	allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen		
				randomly (uniformly) in		
	PSCCH RB alloca	ition		$[0, M_{RB}^{PSCCH-RP}/2]L_{PSCCH}-1]$ every sc-period		
	$\widehat{E}_{\scriptscriptstyle s}$ of PSCCH at	antenna				
Sidelink UE 2		antenna	dBm/15kHz	-85 As specified in Table 12.6.1-2		
	PSSCH RMC					
	PSSCH subframe	allocation		As specified in Table 12.0.1-2  As per time repetition pattern specified in PSCCH		
	1 00011 Subilaine	anocation		First transmission: Chosen randomly (uniformly)		
	DOCCLI DD -II	4:		among the allowed RBs as per TS36.213		
	PSSCH RB alloca	ition		HARQ retransmission: As per frequency hopping		
				indicated in PSCCH and specified in TS36.213		
	Time offset (NOT			PSCCH: +1μsPSSCH: +1μs – 288T <sub>s</sub>		
	Frequency offset		Hz	+200		
	Propagation Char			EVA70		
	Antenna configura Sidelink Transmis			1x2 Low PSCCH + PSSCH		
	Resource pool	010110		commRxPool(1)		
	,			5MHz: CC.5 FDD		
	PSCCH RMC		<u> </u>	10 MHz: CC.6 FDD		
	PSCCH subframe	allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen		
Sidelink UE 3						
	PSCCH RB alloca	ation		randomly (uniformly) in		
				$[0, \left\lfloor M_{\scriptscriptstyle RB}^{\scriptscriptstyle PSCCH} - ^{\scriptscriptstyle RP} / 2  ight floor L_{\scriptscriptstyle PSCCH} - 1]$ every sc-period		
	$\widehat{E}_{\scriptscriptstyle  m c}$ of PSCCH at	antenna	dDm/451d1=	or.		
	port	-	dBm/15kHz	-85		
	PSSCH RMC			As specified in Table 12.6.1-2		
	. OCCITICINO		l .	7.0 opcomod ii7 Table 12.0.1 Z		

PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213 HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
Time offset (NOTE 5)	ms	+12.509
Frequency offset (NOTE 6)	Hz	+300
Propagation Channel		EVA70
Antenna configuration		1x2 Low

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 4: Timing advance indication in PSSCH is set as 18 (= $288T_s$ ) in this test. PSSCH timing is advanced with respect

to PSCCH timing by the quantity (i.e., PSSCH timing shall be  $+1\mu s - 288T_s$  in this test).

NOTE 5: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 6: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

#### Table 12.6.1-2: Minimum performance

	Band-	Sidelink	PSSCH	Reference value				
Test num.	width	UE	Reference channel	Fraction of maximum throughput (%) (NOTE 1)	SNR (dB)			
	10 MHz	2	CD.4 FDD	70	3.0			
4	10 MHZ	3	CD.2 FDD	70	2.8			
	E MILI-	2	CD.3 FDD	70	2.9			
	5 MHz	3	CD.2 FDD	70	2.8			

NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

### 12.7 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes and the maximum number of bits per TTI supported by the UE.

#### 12.7.1 FDD

The test parameters are specified in Table 12.7.1-1. Multiple communication resource pools are interleaved. Each active Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 12.7.1-2.

Table 12.7.1-1: Test Parameters

	Parameter		Unit	Test 1		
Communication ro	acurae peel configure	tion		As specified in Table A.7.2.1-4		
	source pool configura	uon		(Configuration #4-FDD)		
DRX configuration				As specified in Table 12.1.2-1		
Active cell(s)				Cell 1 (Serving cell)		
	Cyclic prefix			Normal		
	Cell ID			0		
	Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0		
	allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)		
Cell 1		σ	dB	0		
	OCNG Pattern (N	ote 2)		OP.1 FDD		
	Propagation chan	nel		Static propagation condition		
	. •	Propagation channel		No external noise sources are applied		
	Antenna configura	ation		1x2		
	RSRP		dBm/15kHz	-85		
Active Sidelink UE	`			Sidelink UE i, 0 ≤ i ≤ 15		
	Sidelink Transmis	sions		PSCCH + PSSCH		
	Resource pool	Resource pool		$commRxPool(\left\lfloor rac{i}{8}  ight floor)$		
	PSCCH RMC			5MHz: CC.1 FDD with I <sub>TRP</sub> =i%8 (NOTE 3) 10 MHz: CC.2 FDD with I <sub>TRP</sub> = i%8 (NOTE 3)		
Sidelink UE i,		PSCCH subframe allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ = i		
0 ≤ i ≤ 15	PSCCH RB alloca	ation				
	PSSCH RMC			As specified in Table 12.7.1-2		
	PSSCH subframe			As per time repetition pattern specified in PSCCH		
	PSSCH RB alloca	ation		Fully allocated		
	Time offset (NOT	E 4)	μs	0		
	Frequency offset	(NOTE 5)	Hz	0		
	Propagation Char	nnel		Static propagation condition  No external noise sources are applied		
	Antenna configura	ation		1x2 Low		
NOTE 1. D. O.	· · ·					

NOTE 1:  $P_B = 0$ .

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

 $I_{TRP} = 1$  corresponds to a time repetition pattern of (0,1,0,0,0,0,0,0), etc.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.7.1-2: Minimum performance

Test	Bandwidth	PSCCH $\hat{E}_s$ at $\hat{E}_s$		Reference value for Sidelink UE i=015			
num.	Danawiani	channel	antenna port (dBm/15kHz)	Fraction of maximum throughput (%)			
4	10 MHz	CD.7 FDD	-85	95			
'	5 MHz	CD.6 FDD	-85	95			

#### 12.8 Sustained downlink data rate with active Sidelink

The purpose of this test is to verify the downlink data rate is not impacted when Sidelink resource are also configured. The test parameters are in Table 12.8.1-1. Cell 1 is the serving cell and UE 1 and UE 2 are transmitters of Prose Direct Communication. The test UE is expected to receive all PDSCH transmissions, and prioritize the transmission of ACK/NACK over the reception of UE 2's PSSCH.

The test cases apply to UE categories and bandwidth combinations with maximum aggregated bandwidth as specified in Table 12.8.1-2. The minimum requirements are specified in Table 12.8.1-3. The TB success rate in the cellular link shall be sustained during at least 300 frames.

Table 12.8.1-1: Test parameters for sustained downlink data rate (FDD 64QAM) with active Sidelink

F	Parameter	Unit	Test 1, 2, 3A
Communication roca	urce pool configuration		As specified in Table A.7.2.1-5
Communication reso	urce pool configuration		(Configuration #5-FDD)
Active cell(s)			Cell 1 (Serving cell)
Cell 1	Test parameters		As specified in clause 8.7.1: Table 8.7.1-1 and Test
	i i		1, 2, 3A in Table 8.7.1-2
Active Sidelink UE(s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		10 MHz: CC.2 FDD with I <sub>TRP</sub> =0 (NOTE 1)
	PSCCH subframe allocation		As defined by TS 36.213 with $n_{PSCCH} = 0$
	PSCCH RB allocation		
	PSSCH RMC		10 MHz: CD.7 FDD
	PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
Sidelink UE 1	PSSCH RB allocation		Fully allocated
	Time offset (NOTE 3)	μs	0
	Frequency offset (NOTE 4)	Hz	0
	Propagation Channel		Static propagation condition
			No external noise sources are applied
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15kHz	-85
	Sidelink Transmissions		PSCCH (NOTE 2)
	PSCCH RMC		10 MHz: CC.2 FDD with ITRP=1 (NOTE 1)
	PSCCH subframe allocation		As defined by TS 36.213 with $n_{PSCCH} = 1$
	PSCCH RB allocation		As defined by 13 30.213 with $n_{PSCCH} = 1$
	Time offset (NOTE 3)	μs	0
Sidelink UE 2	Frequency offset (NOTE 4)	Hz	0
	Propagation Channel		Static propagation condition  No external noise sources are applied
	Antenna configuration		1x2 Low
	$\widehat{E}_s$ at antenna port	dBm/15kHz	-85

NOTE 1: For  $N_{TRP} = 8$  (FDD) and trpt-Subset = 001,  $I_{TRP} = 0$  corresponds to a time repetition pattern of (1,0,0,0,0,0,0,0),  $I_{TRP} = 1$  corresponds to a time repetition pattern of (0,1,0,0,0,0,0,0).

NOTE 2: Sidelink UE 2 transmits PSCCH but not PSSCH.

NOTE 3: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 4: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.8.1-2: Test cases for sustained data rate

CA config	Maximum supported Bandwidth/ Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,7	Cat. 9,10	Cat 11, 12
Single carrier	10	1	2	3A	3A	3A	3A	3A

Table 12.8.1-3: Minimum requirements (FDD 64QAM) with active Sidelink

Test	Bandwidth (MHz)	Number of bits of a	Measurement	Reference value
		DL-SCH transport	channel	PDSCH TB success rate (%)
		block received within		
		a TTI		
1	10	10296	R.31-1 FDD (NOTE 2)	95
2	10	25456	R.31-2 FDD (NOTE 2)	95
3A	10	36696 (NOTE 1)	R.31-3A FDD (NOTE	85
			2)	
NOTE 1	: 35160 bits for sub-fram	ie 5.		
NOTE 2	<ol><li>PDSCH scheduling pat</li></ol>	tern is changed as per the	following bitmap that repea	ats every 40ms.
	PDSCH scheduling sul	oframe bitmap = {01110111	11110111 11110111 111	10111 11111110}.

# Annex A (normative): Measurement channels

#### A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

#### A.2 UL reference measurement channels

#### A.2.1 General

#### A.2.1.1 Applicability and common parameters

The following sections define the UL signal applicable to the Transmitter Characteristics (clause 6) and for the Receiver Characteristics (clause 7) where the UL signal is relevant.

The Reference channels in this section assume transmission of PUSCH and Demodulation Reference signal only. The following conditions apply:

- 1 HARQ transmission
- Cyclic Prefix normal
- PUSCH hopping off
- Link adaptation off
- Demodulation Reference signal as per TS 36.211 [4] subclause 5.5.2.1.2.

Where ACK/NACK is transmitted, it is assumed to be multiplexed on PUSCH as per TS 36.212 [5] subclause 5.2.2.6.

- ACK/NACK 1 bit
- ACK/NACK mapping adjacent to Demodulation Reference symbol
- ACK/NACK resources punctured into data
- Max number of resources for ACK/NACK: 4 SC-FDMA symbols per subframe
- No CQI transmitted, no RI transmitted

#### A.2.1.2 Determination of payload size

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{RB}$ 

- 1. Calculate the number of channel bits  $N_{\rm ch}$  that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1\\ C, & \text{if } C > 1 \end{cases}$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{RB}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- c) For RMC-s, which at the nominal target coding rate do not cover all the possible UE categories for the given modulation, reduce the target coding rate gradually (within the same modulation), until the maximal possible number of UE categories is covered.
- 3. If there is more than one A that minimises the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

#### A.2.1.3 Overview of UL reference measurement channels

In Table A.2.1.3-1 are listed the UL reference measurement channels specified in annexes A.2.2 and A.2.3 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.2.2 and A.2.3 as appropriate.

Table A.2.1.3-1: Overview of UL reference measurement channels

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Ful	I RB allocation, QP	SK							
FDD	Table A.2.2.1.1-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.1.1-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.1.1-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.1.1-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.1.1-1		15	QPSK	1/5	75		≥ 1	
FDD /	Table A.2.2.1.1-1		20	QPSK	1/6	100		≥ 1	
FDD / HD-FDD	Table A.2.2.1.1-1a		1.4	QPSK	1/3	6		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		3	QPSK	1/5	15		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		5	QPSK	1/8	25		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		10	QPSK	1/10	36		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		15	QPSK	1/10	36		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		20	QPSK	1/10	36		-	UE UL category 0
FDD, Ful	I RB allocation, 16-	QAM							
FDD	Table A.2.2.1.2-1		1.4	16QAM	3/4	6		≥ 1	
FDD	Table A.2.2.1.2-1		3	16QAM	1/2	15		≥ 1	
FDD	Table A.2.2.1.2-1		5	16QAM	1/3	25		≥ 1	
FDD	Table A.2.2.1.2-1		10	16QAM	3/4	50		≥ 2	
FDD	Table A.2.2.1.2-1		15	16QAM	1/2	75		≥ 2	
FDD /	Table A.2.2.1.2-1		20	16QAM	1/3	100		≥ 2	
HD-FDD	Table A.2.2.1.2-1a		1.4	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		3	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		5	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		10	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		15	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		20	16QAM	1/3	5		-	UE UL category 0
FDD, Ful	I RB allocation, 64-	QAM			ı				
FDD	Table A.2.2.1.3-1		1.4	64QAM	3/4	6		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		3	64QAM	3/4	15		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		5	64QAM	3/4	25		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		10	64QAM	3/4	50		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		15	64QAM	3/4	75		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		20	64QAM	3/4	100		5,8	UL category 5, 8, 13, 14
FDD, Par	tial RB allocation,	QPSK							
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	1		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	

500	T.I. A.O.O.A.A		0 00	0.0014	4 (0	•		
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	6	≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	8	≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	9	≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	10	≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	12	≥ 1	
FDD FDD	Table A.2.2.2.1-1 Table A.2.2.2.1-1		5 - 20	QPSK QPSK	1/3	15	≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20 5 - 20	QPSK	1/3	16 18	≥1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	20	≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	24	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	25	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	27	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	30	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	32	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	36	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	40	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	45	≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	48	≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	50	≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	54	≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	60	≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	64	≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	72	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	75	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	80	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	81	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	90	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	96	≥ 1	
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	1	ı	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	2	ı	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	3	ı	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	4	ı	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	5	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	6	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	8	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	9	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	10	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/4	12	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/5	15	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/5	16	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/6	18	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/6	20	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/8	24	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		10-20	QPSK	1/8	25	-	UE UL category 0

FDD / HD-FDD	Table A.2.2.2.1-1a		10-20	QPSK	1/8	27	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		10-20	QPSK	1/10	30	-	UE UL category 0
	tial RB allocation,	16-QAM						
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	1	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	2	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	3	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	4	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	5	≥ 1	
FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	6	≥ 1	
FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	8	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	9	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	10	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	12	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	15	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	16	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	18	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	20	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	24	≥ 1	
FDD	Table A.2.2.2.1		10 - 20	16QAM	1/3	25	≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	1/3	27	≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	30	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	32	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	36	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	40	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	45	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	48	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	3/4	50	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	3/4	54	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	2/3	60	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	2/3	64	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	1/2	72	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	1/2	75	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	1/2	80	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	1/2	81	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	2/5	90	≥ 2	
FDD /	Table A.2.2.2.1		20	16QAM	2/5	96	≥ 2	
HD-FDD	Table A.2.2.2.1a		1.4 - 20	16QAM	3/4	1	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1a		1.4 - 20	16QAM	3/4	2	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2-1a		1.4 - 20	16QAM	2/5	4	-	UE UL category 0
FDD, Par	tial RB allocation,	64-QAM						
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	1	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	2	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	3	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	4	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	5	5,8	UL category 5, 8, 13, 14

FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	6	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	8	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	9	5,8	14 UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	10	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	12	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	15	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	16	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	18	5,8	14 UL category 5, 8, 13,
	Table A.2.2.2.3-1			64QAM			5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	20	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		5 - 20		3/4	24		14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	25	5,8	14
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	27	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	30	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	32	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	36	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1	,	10 - 20	64QAM	3/4	40	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	45	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	48	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1	,	15 - 20	64QAM	3/4	50	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	54	5,8	14 UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	60	5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1	,	15 - 20	64QAM	3/4	64	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	72	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	75	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	80	5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	81	5,8	14 UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	90	5,8	14 UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	96	5,8	UL category 5, 8, 13,
TDD. Ful	II RB allocation, QP	SK			l .			17
TDD	Table A.2.3.1.1-1		1.4	QPSK	1/3	6	≥ 1	
TDD	Table A.2.3.1.1-1		3	QPSK	1/3	15	≥ 1	
TDD	Table A.2.3.1.1-1		5	QPSK	1/3	25	≥ 1	
TDD	Table A.2.3.1.1-1		10	QPSK	1/3	50	≥ 1	
TDD	Table A.2.3.1.1-1		15	QPSK	1/5	75	 ≥ 1	
TDD	Table A.2.3.1.1-1		20	QPSK	1/6	100	≥ 1	
TDD	Table A.2.3.1.1-1a		1.4	QPSK	1/3	6	-	UE UL category 0
TDD	Table A.2.3.1.1-1a		3	QPSK	1/5	15	-	UE UL category 0
TDD	Table A.2.3.1.1-1a		5	QPSK	1/8	25	-	UE UL category 0
TDD	Table A.2.3.1.1-1a		10	QPSK	1/10	36	-	UE UL category 0
-	Table A.2.3.1.1-1a		15	QPSK	1/10	36	-	UE UL category 0

TDD	Table A.2.3.1.1-1a		20	QPSK	1/10	36	-	UE UL category 0
TDD, Ful	I RB allocation, 16-	QAM						
TDD	Table A.2.3.1.2-1		1.4	16QAM	3/4	6	≥ 1	
TDD	Table A.2.3.1.2-1		3	16QAM	1/2	15	≥ 1	
TDD	Table A.2.3.1.2-1		5	16QAM	1/3	25	≥ 1	
TDD	Table A.2.3.1.2-1		10	16QAM	3/4	50	≥ 2	
TDD	Table A.2.3.1.2-1		15	16QAM	1/2	75	≥ 2	
TDD	Table A.2.3.1.2-1		20	16QAM	1/3	100	≥ 2	
TDD	Table A.2.3.1.2-1a		1.4	16QAM	1/3	5	-	UE UL category 0
TDD	Table A.2.3.1.2-1a		3	16QAM	1/3	5	-	UE UL category 0
TDD	Table A.2.3.1.2-1a		5	16QAM	1/3	5	-	UE UL category 0
TDD	Table A.2.3.1.2-1a		10	16QAM	1/3	5	-	UE UL category 0
TDD	Table A.2.3.1.2-1a		15	16QAM	1/3	5	-	UE UL category 0
TDD	Table A.2.3.1.2-1a		20	16QAM	1/3	5	-	UE UL category 0
TDD, Ful	I RB allocation, 64-	QAM						
TDD	Table A.2.3.1.3-1		1.4	64QAM	3/4	6	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		3	64QAM	3/4	15	5,8	UL category 5, 8, 13,
TDD	Table A.2.3.1.3-1		5	64QAM	3/4	25	5,8	UL category 5, 8, 13,
TDD	Table A.2.3.1.3-1		10	64QAM	3/4	50	5,8	UL category 5, 8, 13,
TDD	Table A.2.3.1.3-1		15	64QAM	3/4	75	5,8	UL category 5, 8, 13,
TDD	Table A.2.3.1.3-1		20	64QAM	3/4	100	5,8	UL category 5, 8, 13,
TDD, Pai	rtial RB allocation,	QPSK						
TDD	Table A.2.3.2.1-1	1	.4 - 20	QPSK	1/3	1	≥ 1	
TDD	Table A.2.3.2.1-1	1	.4 - 20	QPSK	1/3	2	≥ 1	
TDD	Table A.2.3.2.1-1	1	.4 - 20	QPSK	1/3	3	≥ 1	
TDD	Table A.2.3.2.1-1	1	.4 - 20	QPSK	1/3	4	≥ 1	
TDD	Table A.2.3.2.1-1	1	.4 - 20	QPSK	1/3	5	≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	6	≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	8	≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	9	≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	10	≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	12	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	15	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	16	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	18	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	20	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	24	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	25	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	27	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	30	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	32	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	36	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	40	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	45	≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	48	≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	50	≥ 1	

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TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	75		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	80		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	81		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	90		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	96		≥ 1	
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	1		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	2		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	3		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	4		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	5		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	6		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	8		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	9		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	10		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/4	12		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/5	15		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/5	16		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/6	18		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/6	20		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/8	24		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		10-20	QPSK	1/8	25		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		10-20	QPSK	1/8	27		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		10-20	QPSK	1/10	30		-	UE UL category 0
TDD, Pa	rtial RB allocation,	16-QAM							
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	1		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	2		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	3		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	4		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	5		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	6		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	8		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	9		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	10		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	12		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	15		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	16		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	18		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/3	20		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/3	24		≥ 1	
TDD	Table A.2.3.2.2-1	1	10 - 20	16QAM	1/3	25		≥ 1	
TDD	Table A.2.3.2.2-1	1	10 - 20	16QAM	1/3	27		≥ 1	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	30		≥ 2	
TDD	Table A.2.3.2.2-1	1	10 - 20	16QAM	3/4	32		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	36		≥ 2	
	i l		i		i	1	1	1	

TDD	Table A.2.3.2.2-1	10 -	20	16QAM	3/4	40	≥ 2	
TDD	Table A.2.3.2.2-1	10 -	20	16QAM	3/4	45	≥ 2	
TDD	Table A.2.3.2.2-1	10 -	20	16QAM	3/4	48	≥ 2	
TDD	Table A.2.3.2.2-1	15 -	20	16QAM	3/4	50	≥ 2	
TDD	Table A.2.3.2.2-1	15 -	20	16QAM	3/4	54	≥ 2	
TDD	Table A.2.3.2.2-1	15 -	20	16QAM	2/3	60	≥ 2	
TDD	Table A.2.3.2.2-1	15 -	20	16QAM	2/3	64	≥ 2	
TDD	Table A.2.3.2.2-1	15 -	20	16QAM	1/2	72	≥ 2	
TDD	Table A.2.3.2.2-1	2	)	16QAM	1/2	75	≥ 2	
TDD	Table A.2.3.2.2-1	2	)	16QAM	1/2	80	≥ 2	
TDD	Table A.2.3.2.2-1	2	)	16QAM	1/2	81	≥ 2	
TDD	Table A.2.3.2.2-1	2	)	16QAM	2/5	90	≥ 2	
TDD	Table A.2.3.2.2-1	2	)	16QAM	2/5	96	≥ 2	
TDD	Table A.2.3.2.2-1a	1.4		16QAM	3/4	1	-	UE UL category 0
TDD	Table A.2.3.2.2-1a	1.4	- 20	16QAM	3/4	2	-	UE UL category 0
TDD	Table A.2.3.2.2-1a	1.4	20	16QAM	2/5	4	-	UE UL category 0
TDD, Pa	rtial RB allocation, 6	4-QAM						
TDD	Table A.2.3.2.3-1	1.4	20	64QAM	3/4	1	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	1.4	- 20	64QAM	3/4	2	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	1.4	- 20	64QAM	3/4	3	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	1.4	- 20	64QAM	3/4	4	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	1.4	- 20	64QAM	3/4	5	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	3 -	20	64QAM	3/4	6	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	3 -	20	64QAM	3/4	8	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	3 -	20	64QAM	3/4	9	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	3 -	20	64QAM	3/4	10	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	3 -	20	64QAM	3/4	12	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	5 -	20	64QAM	3/4	15	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	5 -	20	64QAM	3/4	16	5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1	5 -	20	64QAM	3/4	18	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	5 -	20	64QAM	3/4	20	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	5 -	20	64QAM	3/4	24	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	25	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	27	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	30	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	32	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	36	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	40	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	45	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	10 -	20	64QAM	3/4	48	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	15 -	20	64QAM	3/4	50	 5,8	UL category 5, 8, 13, 14

TDD	Table A.2.3.2.3-1	15 - 20	64QAM	3/4	54	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	15 - 20	64QAM	3/4	60	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	15 - 20	64QAM	3/4	64	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	15 - 20	64QAM	3/4	72	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	20	64QAM	3/4	75	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	20	64QAM	3/4	80	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	20	64QAM	3/4	81	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	20	64QAM	3/4	90	5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1	20	64QAM	3/4	96	5,8	UL category 5, 8, 13, 14

#### A.2.2 Reference measurement channels for FDD

#### A.2.2.1 Full RB allocation

#### A.2.2.1.1 QPSK

Table A.2.2.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6
Payload size	Bits	600	1544	2216	5160	4392	4584
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
(Note 1)							
Total number of bits per Sub-Frame	Bits	1728	4320	7200	14400	21600	28800
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥1
(Note 1) Total number of bits per Sub-Frame Total symbols per Sub-Frame		864 ≥ 1	2160 ≥ 1	3600 ≥ 1	7200 ≥ 1	10800	14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.1.1-1a Reference Channels for QPSK with full/maximum RB allocation for UE UL category
0

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	36	36	36
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/5	1/8	1/10	1/10	1/10
Payload size	Bits	600	872	904	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	1728	4320	7200	10368	10368	10368
Total symbols per Sub-Frame		864	2160	3600	5184	5184	5184
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.1.1-1b Reference Channels for QPSK with full/maximum RB allocation for UE UL category M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	6	6	6	6	6
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	600	600	600	600	600	600
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	1728	1728	1728	1728	1728	1728
Total symbols per Sub-Frame		864	864	864	864	864	864
UE UL Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

#### A.2.2.1.2 16-QAM

Table A.2.2.1.2-1: Reference Channels for 16-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3
Payload size	Bits	2600	4264	4968	21384	21384	19848
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	4	4	4
(Note 1)							
Total number of bits per Sub-Frame	Bits	3456	8640	14400	28800	43200	57600
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400
UE Category		≥ 1	≥1	≥1	≥ 2	≥2	≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.1.2-1a: Reference Channels for 16-QAM with maximum RB allocation for UE UL category 0

816

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame		720	720	720	720	720	720
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.1.2-1b: Reference Channels for 16-QAM with maximum RB allocation for UE UL category M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame		720	720	720	720	720	720
UE Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

#### A.2.2.1.3 64-QAM

Table A.2.2.1.3-1: Reference Channels for 64-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding rate		3/4	3/4	3/4	3/4	3/4	3/4
Payload size	Bits	3752	9528	15840	31704	46888	63776
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)		1	2	3	6	8	11
Total number of bits per Sub-Frame	Bits	5184	12960	21600	43200	64800	86400
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400
UE Category (Note 2)		5,8	5,8	5,8	5,8	5,8	5,8
UE UL Cateogry (Note 2)		5, 8,	5, 8,	5, 8,	5, 8,	5, 8,	5, 8,
		13, 14	13, 14	13, 14	13, 14	13, 14	13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note2: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If UE reports UE UL category, then the applicability of reference channel is determined by UE UL category.

#### A.2.2.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

#### A.2.2.2.1 QPSK

Table A.2.2.2.1-1: Reference Channels for QPSK with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	≥ 1
	3-20	12	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20	24	12	QPSK	1/3	2472	24	1	6912	3456	≥ 1
	10-20	25	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	12	QPSK	1/3	2792	24	1	7776	3888	≥ 1
	10-20	30	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
	20	96	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.2.1-1a: Reference Channels for QPSK with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE UL Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	0
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	0
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	0
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	0
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	0
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	0
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	0
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	0
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	0
	3-20	12	12	QPSK	1/4	840	24	1	3456	1728	0
	5-20	15	12	QPSK	1/5	872	24	1	4320	2160	0
	5-20	16	12	QPSK	1/5	904	24	1	4608	2304	0
	5-20	18	12	QPSK	1/6	776	24	1	5184	2592	0
	5-20	20	12	QPSK	1/6	872	24	1	5760	2880	0
	5-20	24	12	QPSK	1/8	872	24	1	6912	3456	0
	10-20	25	12	QPSK	1/8	904	24	1	7200	3600	0
	10-20	27	12	QPSK	1/8	968	24	1	7776	3888	0
	10-20	30	12	QPSK	1/10	808	24	1	8640	4320	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.2.1-1b: Reference Channels for QPSK with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	M1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	M1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	M1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	M1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	M1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

#### A.2.2.2.2 16-QAM

Table A.2.2.2-1 Reference Channels for 16-QAM with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits	` ′	Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	12	16QAM	2/3	23688	24	4	34560	8640	≥ 2
	15 - 20	64	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	12	16QAM	1/2	21384	24	4	43200	10800	≥ 2
	20	80	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	12	16QAM	1/2	22920	24	4	46656	11664	≥ 2
	20	90	12	16QAM	2/5	20616	24	4	51840	12960	≥ 2
	20	96	12	16QAM	2/5	22152	24	4	55296	13824	≥ 2

= 0 Bit

Table A.2.2.2-1a Reference Channels for 16-QAM with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbol s per Sub- Frame	UE UL Catego ry
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	0
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	0
	1.4 - 20	4	12	16QAM	2/5	904	24	1	2304	576	0

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block Note 1: (otherwise L = 0 Bit)

For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled. Note 2:

Table A.2.2.2-1b Reference Channels for 16-QAM with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Catego ry
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	M1
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	M1
	1.4 - 20	4	12	16QAM	2/5	904	24	1	2304	576	M1

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block Note 1:

(otherwise L = 0 Bit)

For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled. Note 2:

#### A.2.2.2.3 64-QAM

Table A.2.2.2.3-1: Reference Channels for 64-QAM with partial RB allocation

Param eter	Ch BW	Alloca ted RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Codin g rate	Payloa d size	Trans- port block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total numbe r of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Categor y (Note 2)	UE UL Cateogr y (Note 2)
Unit	MHz					Bits	Bits		Bits			
	1.4 - 20	1	12	64QAM	3/4	616	24	1	864	144	5,8	5, 8, 13, 14
	1.4 - 20	2	12	64QAM	3/4	1256	24	1	1728	288	5,8	5, 8, 13, 14
	1.4 - 20	3	12	64QAM	3/4	1864	24	1	2592	432	5,8	5, 8, 13, 14
	1.4 - 20	4	12	64QAM	3/4	2536	24	1	3456	576	5,8	5, 8, 13, 14
	1.4 - 20	5	12	64QAM	3/4	3112	24	1	4320	720	5,8	5, 8, 13, 14
	3-20	6	12	64QAM	3/4	3752	24	1	5184	864	5,8	5, 8, 13, 14
	3-20	8	12	64QAM	3/4	5160	24	1	6912	1152	5,8	5, 8, 13, 14
	3-20	9	12	64QAM	3/4	5736	24	1	7776	1296	5,8	5, 8, 13, 14
	3-20	10	12	64QAM	3/4	6200	24	2	8640	1440	5,8	5, 8, 13, 14
	3-20	12	12	64QAM	3/4	7480	24	2	10368	1728	5,8	5, 8, 13, 14
	5-20	15	12	64QAM	3/4	9528	24	2	12960	2160	5,8	5, 8, 13, 14
	5-20	16	12	64QAM	3/4	10296	24	2	13824	2304	5,8	5, 8, 13, 14
	5-20	18	12	64QAM	3/4	11448	24	2	15552	2592	5,8	5, 8, 13, 14
	5-20	20	12	64QAM	3/4	12576	24	3	17280	2880	5,8	5, 8, 13, 14
	5-20	24	12	64QAM	3/4	15264	24	3	20736	3456	5,8	5, 8, 13, 14
	10-20	25	12	64QAM	3/4	15840	24	3	21600	3600	5,8	5, 8, 13, 14
	10-20	27	12	64QAM	3/4	16992	24	3	23328	3888	5,8	5, 8, 13, 14
	10-20	30	12	64QAM	3/4	19080	24	4	25920	4320	5,8	5, 8, 13, 14
	10-20	32	12	64QAM	3/4	20616	24	4	27648	4608	5,8	5, 8, 13, 14
	10-20	36	12	64QAM	3/4	22920	24	4	31104	5184	5,8	5, 8, 13, 14
	10-20	40	12	64QAM	3/4	25456	24	5	34560	5760	5,8	5, 8, 13, 14
	10-20	45	12	64QAM	3/4	28336	24	5	38880	6480	5,8	5, 8, 13, 14
	10-20	48	12	64QAM	3/4	30576	24	5	41472	6912	5,8	5, 8, 13, 14
	15 - 20	50	12	64QAM	3/4	31704	24	6	43200	7200	5,8	5, 8, 13,
	15 - 20	54	12	64QAM	3/4	34008	24	6	46656	7776	5,8	5, 8, 13, 14
	15 - 20	60	12	64QAM	3/4	37888	24	7	51840	8640	5,8	5, 8, 13, 14
	15 - 20	64	12	64QAM	3/4	40576	24	7	55296	9216	5,8	5, 8, 13, 14
	15 - 20	72	12	64QAM	3/4	45352	24	8	62208	10368	5,8	5, 8, 13, 14
	20	75	12	64QAM	3/4	46888	24	8	64800	10800	5,8	5, 8, 13,
	20	80	12	64QAM	3/4	51024	24	9	69120	11520	5,8	5, 8, 13, 14

20	81	12	64QAM	3/4	51024	24	9	69984	11664	5,8	5, 8, 13, 14
20	90	12	64QAM	2/3	51024	24	9	77760	12960	5,8	5, 8, 13, 14
20	96	12	64QAM	3/4	61664	24	11	82944	13824	5,8	5, 8, 13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code

Block (otherwise L = 0 Bit)

Note2: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If

UE reports UE UL category, then the applicability of reference channel is determined by UE UL category

#### A.2.2.3 Void

Table A.2.2.3-1: Void

#### A.2.3 Reference measurement channels for TDD

For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL:2UL.

#### A.2.3.1 Full RB allocation

#### A.2.3.1.1 QPSK

Table A.2.3.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	1544	2216	5160	4392	4584
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	14400	21600	28800
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.1.1-1a Reference Channels for QPSK with full/maximum RB allocation for UE UL category 0

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	36	36	36
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/5	1/8	1/10	1/10	1/10
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	872	904	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	10368	10368	10368
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8	·	864	2160	3600	5184	5184	5184
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211

Table A.2.3.1.1-1b Reference Channels for QPSK with full/maximum RB allocation for UE UL category M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	6	6	6	6	6
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	600	600	600	600	600
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	1728	1728	1728	1728	1728
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	864	864	864	864	864
UE UL Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211

#### A.2.3.1.2 16-QAM

Table A.2.3.1.2-1: Reference Channels for 16-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	2600	4264	4968	21384	21384	19848
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	4	4	4
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	3456	8640	14400	28800	43200	57600
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8	· · · · · · · · · · · · · · · · · · ·	864	2160	3600	7200	10800	14400
UE Category		≥1	≥ 1	≥ 1	≥ 2	≥ 2	≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.1.2-1a: Reference Channels for 16-QAM with maximum RB allocation for UE UL category

Parameter	Unit	Value						
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		5	5	5	5	5	5	
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1	
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12	
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM	
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3	
Payload size								
For Sub-Frame 2,3,7,8	Bits	872	872	872	872	872	872	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of code blocks per Sub-Frame								
(Note 1)								
For Sub-Frame 2,3,7,8		1	1	1	1	1	1	
Total number of bits per Sub-Frame								
For Sub-Frame 2,3,7,8	Bits	2880	2880	2880	2880	2880	2880	
Total symbols per Sub-Frame	•							
For Sub-Frame 2,3,7,8		720	720	720	720	720	720	
UE UL Category		0	0	0	0	0	0	

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211[4]

Table A.2.3.1.2-1b: Reference Channels for 16-QAM with maximum RB allocation for UE UL category M1

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		5	5	5	5	5	5		
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1		
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12		
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM		
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3		
Payload size									
For Sub-Frame 2,3,7,8	Bits	872	872	872	872	872	872		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of code blocks per Sub-Frame (Note 1)									
For Sub-Frame 2,3,7,8		1	1	1	1	1	1		
Total number of bits per Sub-Frame									
For Sub-Frame 2,3,7,8	Bits	2880	2880	2880	2880	2880	2880		
Total symbols per Sub-Frame									
For Sub-Frame 2,3,7,8		720	720	720	720	720	720		
UE Category		M1	M1	M1	M1	M1	M1		

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211[4]

#### A.2.3.1.3 64-QAM

Table A.2.3.1.3-1: Reference Channels for 64-QAM with full RB allocation

Parameter	Unit	Value						
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1	
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding rate		3/4	3/4	3/4	3/4	3/4	3/4	
Payload size								
For Sub-Frame 2,3,7,8	Bits	3752	9528	15840	31704	46888	63776	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of code blocks per Sub-Frame (Note 1)								
For Sub-Frame 2,3,7,8		1	2	3	6	8	11	
Total number of bits per Sub-Frame								
For Sub-Frame 2,3,7,8	Bits	5184	12960	21600	43200	64800	86400	
Total symbols per Sub-Frame								
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400	
UE Category (Note 3)		5, 8	5, 8	5, 8	5, 8	5, 8	5, 8	
UE UL Cateogry (Note 3)		5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Note 3: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If UE reports UE UL category, then the applicability of reference channel is determined by UE UL category.

#### A.2.3.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

#### A.2.3.2.1 **QPSK**

Table A.2.3.2.1-1: Reference Channels for QPSK with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	1	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	1	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	1	12	QPSK	1/3	872	24	1	2880	1440	≥ 1
	3-20	12	1	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	1	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	1	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	1	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	1	12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20	24	1	12	QPSK	1/3	2472	24	1	6912	3456	≥ 1
	10-20	25	1	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	1	12	QPSK	1/3	2792	24	1	7776	3888	≥1
<b>—</b>	10-20	30	1	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20 10-20	32 36	1	12 12	QPSK QPSK	1/3 1/3	2792 3752	24 24	1	9216 10368	4608 5184	≥ 1 ≥ 1
	10-20	40	1	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	1	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	1	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	1	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	1	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	1	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	1	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	1	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	1	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	1	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	1	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	1	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
Note 4	20	96	1	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block Note 1:

(otherwise L = 0 Bit)

Note 2: Às per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.1-1a: Reference Channels for QPSK with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7,	UE UL Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	0
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	0
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	0
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	0
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	0
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	0
	3-20	8	1	12	QPSK	1/3	808	24	1	2304	1152	0
	3-20	9	1	12	QPSK	1/3	776	24	1	2592	1296	0
	3-20	10	1	12	QPSK	1/3	872	24	1	2880	1440	0
	3-20	12	1	12	QPSK	1/4	840	24	1	3456	1728	0
	5-20	15	1	12	QPSK	1/5	872	24	1	4320	2160	0
	5-20	16	1	12	QPSK	1/5	904	24	1	4608	2304	0
	5-20	18	1	12	QPSK	1/6	776	24	1	5184	2592	0
	5-20	20	1	12	QPSK	1/6	872	24	1	5760	2880	0
	5-20	24	1	12	QPSK	1/8	872	24	1	6912	3456	0
	10-20	25	1	12	QPSK	1/8	904	24	1	7200	3600	0
	10-20	27	1	12	QPSK	1/8	968	24	1	7776	3888	0
	10-20	30	1	12	QPSK	1/10	808	24	1	8640	4320	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.1-1b: Reference Channels for QPSK with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	M1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	M1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	M1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	M1
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	M1
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: As per Table 4.2-2 in TS 36.211 [4].

#### A.2.3.2.2 16-QAM

Table A.2.3.2.2-1: Reference Channels for 16QAM with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	1	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	1	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	1	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	1	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	1	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	1	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	1	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	1	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	1	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	1	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	1	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	1	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	1	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	1	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	1	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	1	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	1	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	1	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	1	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	1	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	1	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	1	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	1	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	1	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	1	12	16QAM	2/3	23688	24	4	34560	8640	≥ 2
	15 - 20	64	1	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	1	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	1	12	16QAM	1/2	21384	24	4	43200	10800	≥ 2
	20	80	1	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	1	12	16QAM	1/2	22920	24	4	46656	11664	≥ 2
	20	90	1	12	16QAM	2/5	20616	24	4	51840	12960	≥ 2
Note 1:	20	96	1 de Block is p	12	16QAM	2/5	22152	24	4	55296	13824	≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.2-1a: Reference Channels for 16QAM with partial RB allocation UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE UL Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	0
	1.4 - 20	2		12	16QAM	3/4	840	24	1	1152	288	0
	1.4 - 20	4		12	16QAM	2/5	904	24	1	2304	576	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.2-1b: Reference Channels for 16QAM with partial RB allocation UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	M1
	1.4 - 20	2		12	16QAM	3/4	840	24	1	1152	288	M1
	1.4 - 20	4		12	16QAM	2/5	904	24	1	2304	576	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: As per Table 4.2-2 in TS 36.211 [4].

#### A.2.3.2.3 64-QAM

Table A.2.3.2.3-1: Reference Channels for 64-QAM with partial RB allocation

Param eter	Ch BW	Alloca ted RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Codin g rate	Payloa d size	Trans- port block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total numbe r of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Categor y (Note 3)	UE UL Cateogr y (Note 3)
Unit	MHz					Bits	Bits		Bits			
	1.4 - 20	1	12	64QAM	3/4	616	24	1	864	144	5,8	5, 8, 13, 14
	1.4 - 20	2	12	64QAM	3/4	1256	24	1	1728	288	5,8	5, 8, 13, 14
	1.4 - 20	3	12	64QAM	3/4	1864	24	1	2592	432	5,8	5, 8, 13, 14
	1.4 - 20	4	12	64QAM	3/4	2536	24	1	3456	576	5,8	5, 8, 13, 14
	1.4 - 20	5	12	64QAM	3/4	3112	24	1	4320	720	5,8	5, 8, 13, 14
	3-20	6	12	64QAM	3/4	3752	24	1	5184	864	5,8	5, 8, 13, 14
	3-20	8	12	64QAM	3/4	5160	24	1	6912	1152	5,8	5, 8, 13, 14
	3-20	9	12	64QAM	3/4	5736	24	1	7776	1296	5,8	5, 8, 13, 14
	3-20	10	12	64QAM	3/4	6200	24	2	8640	1440	5,8	5, 8, 13, 14
	3-20	12	12	64QAM	3/4	7480	24	2	10368	1728	5,8	5, 8, 13, 14
	5-20	15	12	64QAM	3/4	9528	24	2	12960	2160	5,8	5, 8, 13, 14
	5-20	16	12	64QAM	3/4	10296	24	2	13824	2304	5,8	5, 8, 13, 14
	5-20	18	12	64QAM	3/4	11448	24	2	15552	2592	5,8	5, 8, 13, 14
	5-20	20	12	64QAM	3/4	12576	24	3	17280	2880	5,8	5, 8, 13, 14
	5-20	24	12	64QAM	3/4	15264	24	3	20736	3456	5,8	5, 8, 13, 14
	10-20	25	12	64QAM	3/4	15840	24	3	21600	3600	5,8	5, 8, 13, 14
	10-20	27	12	64QAM	3/4	16992	24	3	23328	3888	5,8	5, 8, 13, 14
	10-20	30	12	64QAM	3/4	19080	24	4	25920	4320	5,8	5, 8, 13, 14
	10-20	32	12	64QAM	3/4	20616	24	4	27648	4608	5,8	5, 8, 13, 14
	10-20	36	12	64QAM	3/4	22920	24	4	31104	5184	5,8	5, 8, 13, 14
	10-20	40	12	64QAM	3/4	25456	24	5	34560	5760	5,8	5, 8, 13, 14
	10-20	45	12	64QAM	3/4	28336	24	5	38880	6480	5,8	5, 8, 13, 14
	10-20	48	12	64QAM	3/4	30576	24	5	41472	6912	5,8	5, 8, 13, 14
	15 - 20	50	12	64QAM	3/4	31704	24	6	43200	7200	5,8	5, 8, 13, 14
	15 - 20	54	12	64QAM	3/4	34008	24	6	46656	7776	5,8	5, 8, 13, 14
	15 - 20	60	12	64QAM	3/4	37888	24	7	51840	8640	5,8	5, 8, 13, 14
	15 - 20	64	12	64QAM	3/4	40576	24	7	55296	9216	5,8	5, 8, 13, 14
	15 - 20	72	12	64QAM	3/4	45352	24	8	62208	10368	5,8	5, 8, 13, 14
	20	75	12	64QAM	3/4	46888	24	8	64800	10800	5,8	5, 8, 13, 14
	20	80	12	64QAM	3/4	51024	24	9	69120	11520	5,8	5, 8, 13, 14

	20	81	12	64QAM	3/4	51024	24	9	69984	11664	5,8	5, 8, 13, 14
	20	90	12	64QAM	3/4	51024	24	9	77760	12960	5,8	5, 8, 13, 14
	20	96	12	64QAM	3/4	61664	24	11	82944	13824	5,8	5, 8, 13, 14
Note 1:	If more t	han one C	ode Block	s present,	an additio	nal CRC s	equence c	of L = 24 Bit	s is attach	ed to each	Code	
	Block (o	therwise L	= 0 Bit)									
Note 2:	As per T	able 4.2-2	in TS 36.2	11 [4].								

If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If

UE reports UE UL category, then the applicability of reference channel is determined by UE UL category

A.2.3.3 Void

Note 3:

Table A.2.3.3-1: Void

## A.3 DL reference measurement channels

#### A.3.1 General

The number of available channel bits varies across the sub-frames due to PBCH and PSS/SSS overhead. The payload size per sub-frame is varied in order to keep the code rate constant throughout a frame.

Unless otherwise stated, no user data is scheduled on subframes #5 in order to facilitate the transmission of system information blocks (SIB).

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{RB}$ 

- 1. Calculate the number of channel bits  $N_{ch}$  that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min \left| R - (A + 24 * (N_{CB} + 1)) / N_{ch} \right|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1 \\ C, & \text{if } C > 1 \end{cases},$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{RB}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- 3. If there is more than one A that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.
- 4. For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL+DwPTS (12 OFDM symbol): 2UL

#### A.3.1.1 Overview of DL reference measurement channels

In Table A.3.1.1-1 are listed the DL reference measurement channels specified in annexes A.3.2 to A.3.10 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.3.2 to A.3.10 as appropriate.

Table A.3.1.1-1: Overview of DL reference measurement channels

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Rece	eiver requirements								
FDD	Table A.3.2-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.2-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.2-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.2-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.2-1		15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.2-1		20	QPSK	1/3	100		≥ 1	
FDD / HD-FDD	Table A.3.2-1a		1.4	QPSK	1/3	6		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		3	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		5	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		10	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		15	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		20	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1b		1.4	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		3	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		5	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		10	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		15	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		20	QPSK	1/3	4		M1	
TDD, Rece	eiver requirements								
TDD	Table A.3.2-2		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.2-2		3	QPSK	1/3	15		≥ 1	
TDD	Table A.3.2-2		5	QPSK	1/3	25		≥ 1	
TDD	Table A.3.2-2		10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.2-2		15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.2-2		20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.2-2a		1.4	QPSK	1/3	6		-	UE DL Category 0
TDD	Table A.3.2-2a		3	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		5	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		10	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		15	QPSK	1/3	14		-	UE DL Category 0
-	Table A.3.2-2a		20	QPSK	1/3	14		-	UE DL Category 0
TDD Band 46	Table A.3.2-2c		20	QPSK	1/3	100		≥ 3	
TDD	Table A.3.2-2b		1.4	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		3	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		5	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		10	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		15	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		20	QPSK	1/3	4		M1	
FDD, Rece	eiver requirements,	Maximum inp	ut level	for UE Cat	egories	≥ 3			
FDD	Table A.3.2-3		1.4	64QAM	3/4	6		-	

FDD	Table A.3.2-3		3	64QAM	3/4	15	-	
FDD	Table A.3.2-3		5	64QAM	3/4	25	ı	
FDD	Table A.3.2-3		10	64QAM	3/4	50	ı	
FDD	Table A.3.2-3		15	64QAM	3/4	75	-	
FDD	Table A.3.2-3		20	64QAM	3/4	100	ı	
FDD, Rec	eiver requirements,	Maximum inpu	ut level f	or UE Cat	egories	1		
FDD	Table A.3.2-3a		1.4	64QAM	3/4	6	-	
FDD	Table A.3.2-3a		3	64QAM	3/4	15	-	
FDD	Table A.3.2-3a		5	64QAM	3/4	18	-	
FDD	Table A.3.2-3a		10	64QAM	3/4	17	-	
FDD	Table A.3.2-3a		15	64QAM	3/4	17	-	
FDD	Table A.3.2-3a		20	64QAM	3/4	17	-	
FDD, Rec	eiver requirements,	Maximum inpu	ut level f	or UE Cat	egories	2		
FDD	Table A.3.2-3b		1.4	64QAM	3/4	6	-	
FDD	Table A.3.2-3b		3	64QAM	3/4	15	-	
FDD	Table A.3.2-3b		5	64QAM	3/4	25	-	
FDD	Table A.3.2-3b		10	64QAM	3/4	50	-	
FDD	Table A.3.2-3b		15	64QAM	3/4	75	-	
FDD	Table A.3.2-3b		20	64QAM	3/4	83	-	
FDD, Rece	eiver requirements,	Maximum inpu	ut level f	or UE DL	Categor	ies 0		
FDD	Table A.3.2-3c		1.4	64QAM	3/4	2	-	
FDD	Table A.3.2-3c		3	64QAM	3/4	2	-	
FDD	Table A.3.2-3c		5	64QAM	3/4	2	-	
FDD	Table A.3.2-3c		10	64QAM	3/4	2	-	
FDD	Table A.3.2-3c		15	64QAM	3/4	2	-	
FDD	Table A.3.2-3c		20	64QAM	3/4	2	-	
TDD, Rec	eiver requirements,	Maximum inpu	ut level f	or UE Cat	egories	≥ 3		
TDD	Table A.3.2-4		1.4	64QAM	3/4	6	-	
TDD	Table A.3.2-4		3	64QAM	3/4	15	-	
TDD	Table A.3.2-4		5	64QAM	3/4	25	-	
TDD	Table A.3.2-4		10	64QAM	3/4	50	-	
TDD	Table A.3.2-4		15	64QAM	3/4	75	-	
TDD	Table A.3.2-4		20	64QAM	3/4	100	-	
TDD Band 46	Table A.3.2-4d		20	64QAM	3/4	100	-	
	l eiver requirements,	Maximum inpu	ıt level f	or UF Cat	egories	1		
TDD	Table A.3.2-4a	пахинан пр	1.4	64QAM	3/4	6	-	
TDD	Table A.3.2-4a		3	64QAM	3/4	15	-	
TDD	Table A.3.2-4a		5	64QAM	3/4	18	-	
TDD	Table A.3.2-4a		10	64QAM	3/4	17	-	
TDD	Table A.3.2-4a		15	64QAM	3/4	17	-	
TDD	Table A.3.2-4a		20	64QAM	3/4	17	-	
	eiver requirements,	Maximum inni						
TDD	Table A.3.2-4b		1.4	64QAM	3/4	6	-	
TDD	Table A.3.2-4b		3	64QAM	3/4	15	_	
TDD	Table A.3.2-4b		5	64QAM	3/4	25	-	
TDD	Table A.3.2-4b		10	64QAM	3/4	50	_	
TDD	Table A.3.2-4b		15	64QAM	3/4	75	-	
TDD	Table A.3.2-4b		20	64QAM	3/4	83	-	
1 .55	1 , ¬10	l l		J / GC/ 11V1	] , ,	55		l l

TDD, Rece	eiver requirements,	Maximum inpu	ut level f	or UE DL	Categor	ies 0			
TDD	Table A.3.2-4c		1.4	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		3	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		5	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		10	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		15	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		20	64QAM	3/4	2		-	
FDD, Rece	eiver requirements,	Maximum inpu	ut level f	or UE Cat	egories	11/12	and UE	DL ca	ategories ≥ 11
FDD	Table A.3.2-5		1.4	256QAM	4/5	6		-	
FDD	Table A.3.2-5		3	256QAM	4/5	15		-	
FDD	Table A.3.2-5		5	256QAM	4/5	25		-	
FDD	Table A.3.2-5		10	256QAM	4/5	50		-	
FDD	Table A.3.2-5		15	256QAM	4/5	75		-	
FDD	Table A.3.2-5		20	256QAM	4/5	100		-	
TDD, Rece	eiver requirements,	Maximum inpu	ut level f	or UE Cat	egories	11/12 :	and UE	DL ca	ategories ≥ 11
TDD	Table A.3.2-6		1.4	256QAM	4/5	6		-	
TDD	Table A.3.2-6		3	256QAM	4/5	15		-	
TDD	Table A.3.2-6		5	256QAM	4/5	25		_	
TDD	Table A.3.2-6		10	256QAM	4/5	50		_	
TDD	Table A.3.2-6		15	256QAM	4/5	75		-	
TDD	Table A.3.2-6		20	256QAM	4/5	100		-	
TDD	Table A.3.2-7		20	256QAM	4/5	100		_	
Band 46						100		-	
	CH Performance, S			1	1	_			T
FDD	Table A.3.3.1-1	R.4 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.1-1	R.42 FDD	20	QPSK	1/3	100		≥ 1	
FDD	Table A.3.3.1-1	R.42-1 FDD	3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.3.1-1	R.42-2 FDD	5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.3.1-1	R.42-3 FDD	15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.3.1-1	R.2 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.1-2	R.3-1 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.1-2	R.3 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.1-3	R.5 FDD	3	64QAM	3/4	15		≥ 1	
FDD	Table A.3.3.1-3	R.6 FDD	5	64QAM	3/4	25		≥ 2	
FDD	Table A.3.3.1-3	R.7 FDD	10	64QAM	3/4	50		≥ 2	
FDD	Table A.3.3.1-3	R.8 FDD	15	64QAM	3/4	75		≥ 2	
FDD	Table A.3.3.1-3	R.9 FDD	20	64QAM	3/4	100		≥ 3	
FDD	Table A.3.3.1-3a	R.6-1 FDD	5	64QAM	3/4	18		≥ 1	
FDD	Table A.3.3.1-3a	R.7-1 FDD	10	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.8-1 FDD	15	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-1 FDD	20	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-2 FDD	20	64QAM	3/4	83		≥ 2	
FDD	Table A.3.3.1-6	R.41 FDD	10	QPSK	1/10	50		≥ 1	
FDD, PDS	CH Performance, S	ingle-antenna	transmis	ssion (CR	S), Singl	e PRB	(Chan	nel ed	lge)
FDD	Table A.3.3.1-4	R.0 FDD	3	16QAM	1/2	1		≥ 1	
FDD	Table A.3.3.1-4	R.1 FDD	10 / 20	16QAM	1/2	1		≥ 1	
FDD, PDS	CH Performance, S	ingle-antenna		ssion (CR	S), Singl	e PRB	(MBSI	FN Co	nfiguration)
FDD	Table A.3.3.1-5	R.29 FDD	10	16QAM	1/2	1		≥ 1	
FDD, PDS	CH Performance: C	arrier aggrega	tion with	n power in	nbalance	•			

FDD	Table A.3.3.1-7	R.49 FDD	20	64QAM	0.84- 0.87	100		≥ 5	
FDD	Table A.3.3.1-7	R.49-1 FDD	10	64QAM	0.84- 0.87	50		≥2	
FDD	Table A.3.3.1-7	R.49-2 FDD	5	64QAM	0.84- 0.86	25		≥2	
FDD, PDS	CH Performance, M	lulti-antenna tr	ansmiss	sion (CRS)	, Two aı	ntenna	ports		
FDD	Table A.3.3.2.1-1	R.10 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.11 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-1 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-2 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-3 FDD	10	16QAM	1/2	40		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-4 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.30 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.1-1	R.30-1 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.1-1	R.35 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-1 FDD	20	64QAM	0.39	100		4	
FDD	Table A.3.3.2.1-1	R.35-2 FDD	15	64QAM	0.39	75		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-3 FDD	10	64QAM	0.39	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.35-4 FDD	10	64QAM	0.47	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.46 FDD	10	QPSK		50		≥ 1	
FDD	Table A.3.3.2.1-2	R.47 FDD	10	16QAM		50		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-5 FDD	1.4	16QAM	1/2	6		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-6 FDD	3	16QAM	1/2	15		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-7 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.1-2	R.11-8 FDD	10	QPSK	3/5	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.11-9 FDD	10	QPSK	0.58	50		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-10 FDD	10	QPSK	0.67	50		≥ 1	
FDD	Table A.3.3.2.1-2	R.10-2 FDD	5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.3.2.1-2	R.10-3 FDD	10	16QAM	0.58	50		≥ 2	

FDD	Table A.3.3.2.1-2	R.65 FDD	10	256QAM	0.55	50		11- 15	
FDD	Table A.3.3.2.1-3	R. 62 FDD	10	16QAM	1/2	3		0	
FDD	Table A.3.3.2.1-3	R.63 FDD	10	64QAM	1/2	1		0	
FDD	Table A.3.3.2.1-4	R.zz FDD	10	16QAM	1/2	3		M1, ≥ 0	
FDD, PDS	CH Performance, N	lulti-antenna tr	ansmiss	sion (CRS)	, Four a	ntenna	ports		
FDD	Table A.3.3.2.2-1	R.12 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.13 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.2.2-1	R.14 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.2-1	R.14-1 FDD	10	16QAM	1/2	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-2 FDD	10	16QAM	1/2	3		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-3 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.2-1	R.36 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.2-1	R.14-4 FDD	1.4	16QAM	1/2	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-5 FDD	3	16QAM	1/2	15		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-6 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-7 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.2-1	R.72 FDD	10	256QAM	0.62	50		≥ 11	
FDD	Table A.3.3.2.2-1	R.73 FDD	10	64QAM	0.43	50		≥ 5	
FDD	Table A.3.3.2.2-1	R.74 FDD	10	16QAM	1/2	50		≥ 5	
FDD, PDS	CH Performance (U	E specific RS)	without	CSI-RS					
FDD	Table A.3.3.3.0-1	R.70 FDD	10	QPSK	0.65	50		≥ 1	
FDD	Table A.3.3.3.0-1	R.71 FDD	10	16QAM	0.6	50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS)	Two an	tenna port	s (CSI-F	RS)			
FDD	Table A.3.3.3.1-1	R.51 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-1	R.51-1 FDD	10	16QAM	0.54	50		≥ 2	

FDD	Table A.3.3.3.1-1	R.76 FDD	10	QPSK		50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS)	Two an	tenna port	s (CSI-F	RS, nor	n Quasi	Co-lo	ocated)
FDD	Table A.3.3.3.1-2	R.52 FDD	10	64QAM	1/2	50		≥ 2	, 
FDD	Table A.3.3.3.1-2	R.52-1 FDD	10	16QAM	0.54	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.53 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.54 FDD	10	16QAM	1/2	50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS)	Four an	tenna por	ts (CSI-	RS)			
FDD	Table A.3.3.3.2-1	R.43 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.50 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.44 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-2	R.45 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.45-1 FDD	10	16QAM	1/2	39		≥ 1	
FDD	Table A.3.3.3.2-1	R.48 FDD	10	QPSK		50		≥ 1	
FDD	Table A.3.3.3.2-2	R.60 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.3.2-3	R.64 FDD	10	QPSK	1/3	6		0 11-	
FDD	Table A.3.3.3.2-1	R.66 FDD	10	256QAM	0.77	50		15	
FDD	Table A.3.3.3.2-4	R.69 FDD	10	QPSK	0.74- 0.8	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.75 FDD	10	16QAM	0.57	50		≥ 5	
FDD, PDS	CH Performance (U	E specific RS)	Twelve	antenna p	orts (CS	SI-RS)			
FDD	Table A.3.3.3.3-1	R.77 FDD	10	64QAM	1/2	50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS)	Sixteen	antenna p	oorts (C	SI-RS)			
FDD	Table A.3.3.3.4-1	R.78 FDD	10	16QAM	1/2	50		≥ 2	
	CH Performance, S				1	ı			T
TDD	Table A.3.4.1-1	R.4 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.1-1	R.42 TDD	20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.4.1-1	R.2 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.1-1 Table A.3.4.1-1	R.2A TDD	10	QPSK	1/3	50		≥1	
TDD TDD	Table A.3.4.1-1	R.42-1 TDD R.42-2 TDD	3 5	QPSK QPSK	1/3	15 25		≥ 1 ≥ 1	
TDD	Table A.3.4.1-1	R.42-2 TDD R.42-3 TDD	15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.4.1-2	R.3-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.1-2	R.3 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.1-3	R.5 TDD	3	64QAM	3/4	15		<u></u> ≥ 1	
TDD	Table A.3.4.1-3	R.6 TDD	5	64QAM	3/4	25		≥ 2	
TDD	Table A.3.4.1-3	R.7 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.1-3	R.8 TDD	15	64QAM	3/4	75		≥ 2	
TDD	Table A.3.4.1-3	R.9 TDD	20	64QAM	3/4	100		≥ 3	
TDD	Table A.3.4.1-3a	R.6-1 TDD	5	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.1-3a	R.7-1 TDD	10	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.8-1 TDD	15	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-1 TDD	20	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-2 TDD	20	64QAM	3/4	83		≥ 2	
TDD	Table A.3.4.1-6	R.41 TDD	10	QPSK	1/10	50		≥ 1	
	CH Performance, S			1	S), Sing	le PRB	(Chan	nel ed	ge)
TDD	Table A.3.4.1-4	R.0 TDD	3	16QAM	1/2	1		≥ 1	
TDD	Table A.3.4.1-4	R.1 TDD	10 / 20	16QAM	1/2	1		≥ 1	
TDD, PDS	CH Performance, S	ingle-antenna	transmis	ssion (CRS	S), Sing	le PRB	(MBSF	N Co	nfiguration)

TDD	Table A.3.4.1-5	R.29 TDD	10	16QAM	1/2	1		≥ 1	
TDD, PDS	CH Performance: C	Carrier aggrega	tion witl	n power in	nbalance	е			
TDD	Table A.3.4.1-7	R.49 TDD	20	64QAM	0.81- 087	100		≥ 5	
TDD	Table A.3.4.1-7	R.49-1 TDD	15	64QAM	0.80- 0.86	75		≥ 3	
TDD, PDS	CH Performance, N	lulti-antenna tr	ansmiss	sion (CRS)	, Two a	ntenna	ports		
TDD	Table A.3.4.2.1-1	R.10 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.2.1-1	R.11 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.11-1 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.11-2 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.2.1-1	R.11-3 TDD	10	16QAM	1/2	40		≥ 1	
TDD	Table A.3.4.2.1-1	R.11-4 TDD	10	QPSK	1/2	50		≥ 1	
TDD	Table A.3.4.2.1-1	R.30 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-1 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-2 TDD	20	16QAM	1/2	100		3	
TDD	Table A.3.4.2.1-1	R.35 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.35-1 TDD	20	64QAM	0.39	100		4	
TDD	Table A.3.4.2.1-2	R.35-2 TDD	10	64QAM	0.47	50		≥ 2	
TDD	Table A.3.4.2.1-2	R.46 TDD	10	QPSK		50		≥ 1	
TDD	Table A.3.4.2.1-2	R.47 TDD	10	16QAM		50		≥ 1	
TDD	Table A.3.4.2.1-2	R.11-5 TDD	1.4	16QAM	1/2	6		≥ 1	
TDD	Table A.3.4.2.1-2	R.11-6 TDD	3	16QAM	1/2	15		≥ 1	
TDD	Table A.3.4.2.1-2	R.11-7 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.2.1-2	R.11-8 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-2	R.11-9 TDD	15	16QAM	1/2	75		≥ 2	
TDD	Table A.3.4.2.1-2	R.11-10 TDD	10	QPSK	3/5	50		≥ 2	
TDD	Table A.3.4.2.1-2	R.11-11 TDD	10	QPSK	0.48- 0.58	50		≥ 1	
TDD	Table A.3.4.2.1-2	R.11-12 TDD	10	QPSK	0.54- 0.66	50		≥ 1	
TDD	Table A.3.4.2.1-2	R.10-3 TDD	10	16QAM	0.57- 0.58	50		≥ 1	

TDD	Table A.3.4.2.1-3	R.62 TDD	10	16QAM	1/2	3		0	
TDD	Table A.3.4.2.1-3	R.63 TDD	10	64QAM	1/2	1		0	
TDD	Table A.3.4.2.1-4	R.65 TDD	20	256QAM	0.6	100		11-	
TDD	Table A.3.4.2.1-5	R.67 TDD	10	16QAM	0.4	50		15 ≥ 1	
								M1,	
TDD	Table A.3.4.2.1-6	R.zz TDD	10	16QAM	1/2	3		≥ 0	
	CH Performance, M						ports		
TDD	Table A.3.4.2.2-1	R.12 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.13 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.2.2-1	R.14 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.2-1	R.14-1 TDD	10	16QAM	1/2	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.14-2 TDD	10	16QAM	1/2	3		≥ 1	
TDD	Table A.3.4.2.2-1	R.43 TDD	20	16QAM	1/2	100		≥2	
TDD	Table A.3.4.2.2-1	R.36 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.2-1	R.43-1 TDD	1.4	16QAM	1/2	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.43-2 TDD	3	16QAM	1/2	15		≥ 1	
TDD	Table A.3.4.2.2-1	R.43-3 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.2.2-1	R.43-4 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.2-1	R.43-5 TDD	15	16QAM	1/2	75		≥ 2	
TDD	Table A.3.4.2.2-1	R.72 TDD	10	256QAM	0.62	50		≥ 11	
TDD	Table A.3.4.2.2-1	R.73 TDD	10	64QAM	0.44	50		≥ 5	
TDD	Table A.3.4.2.2-1	R.74 TDD	10	16QAM	1/2	50		≥ 5	
TDD, PDS	CH Performance, S	ingle antenna	port (DR	S)					
TDD	Table A.3.4.3.1-1	R.25 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.1-1	R.26 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.26-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.3.1-1	R.27 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.27-1 TDD	10	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.3.1-1	R.28 TDD	10	16QAM	1/2	1		≥ 1	
TDD, PDS	CH Performance, T	wo antenna po	rts (DRS	5)					
TDD	Table A.3.4.3.2-1	R.31 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.2-1	R.32 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.32-1 TDD	5	16QAM	1/2	[25]		≥ 1	
TDD	Table A.3.4.3.2-1	R.33 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.33-1 TDD	10	64QAM	3/4	[18]		≥ 1	
TDD	Table A.3.4.3.2-1	R.34 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.2	R.70 TDD	10	QPSK	0.54- 0.65	50		≥ 1	
TDD	Table A.3.4.3.2	R.71 TDD	10	16QAM	0.5- 0.6	50		≥ 2	
TDD, PDS	CH Performance (U	IE specific RS)	Two an	tenna port		RS)			
TDD	Table A.3.4.3.3-1	R.51 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.3-1	R.51-1 TDD	10	16QAM	0.57	50		≥ 2	

TDD	Table A.3.4.3.1-1	R.76 FDD	10	QPSK		50	≥	2
TDD, PDS	SCH Performance (U	JE specific RS)	Two an	tenna port	s (CSI-F	RS, nor	Quasi C	o-located)
TDD	Table A.3.4.3.3-2	R.52 TDD	10	64QAM	1/2	50	≥	2
TDD	Table A.3.4.3.3-2	R.52-1 TDD	10	16QAM	0.57	50	≥	2
TDD	Table A.3.4.3.3-2	R.53 TDD	10	64QAM	1/2	50	≥	2
TDD	Table A.3.4.3.3-2	R.54 TDD	10	16QAM	1/2	50	≥	2
TDD, PDS	CH Performance (U	JE specific RS)	Four an	tenna por	ts (CSI-	RS)		<u> </u>
TDD	Table A.3.4.3.4-1	R.44 TDD	10	64QAM	1/2	50	≥	2
TDD	Table A.3.4.3.4-1	R.48 TDD	10	QPSK		50	≥	1
TDD	Table A.3.4.3.4-2	R.60 TDD	10	QPSK	1/2	50	≥	1
TDD	Table A.3.4.3.4-2	R.61 TDD	10	16QAM	1/2	50	≥	2
TDD	Table A.3.4.3.4-2	R.61-1 TDD	10	16QAM	1/2	39	≥	1
TDD	Table A.3.4.3.4-3	R.64 TDD	10	QPSK	1/3	6		0
TDD	Table A.3.4.3.4-1	R.66 TDD	20	256QAM		100		1- 5
TDD	Table A.3.4.3.4-4	R.69 TDD	10	QPSK	0.61- 0.8	50	≥	1
TDD	Table A.3.4.3.4-1	R.75 TDD	10	16QAM	0.57	50	≥	5
TDD, PDS	CH Performance (U	IE specific RS)	Eight a	ntenna po	rts (CSI-	RS)		
TDD	Table A.3.4.3.5-1	R.50 TDD	10	QPSK	1/3	50	≥	1
TDD	Table A.3.4.3.5-2	R.45 TDD	10	16QAM	1/2	50	≥	2
TDD	Table A.3.4.3.5-2	R.45-1 TDD	10	16QAM	1/2	39	≥	1
TDD	Table A.3.4.3.5-2	R.45-2 TDD	10	64QAM		50	≥	2
•	CH Performance (U	1						
TDD	Table A.3.4.3.6-1	R.77 TDD	10	64QAM	1/2	50	≥	2
TDD, PDS	Table A.3.4.3.7-1	R.78 TDD		-	1/2	1	T	2
	CCH / PCFICH Perfor		10	16QAM	1/2	50		2
FDD	Table A.3.5.1-1	R.15 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.15-1 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.15-2 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.16 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.16-1 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.16-2 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.16-3 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.16-4 FDD	10	PDCCH				
FDD	Table A.3.5.1-1	R.17 FDD	5	PDCCH				
TDD, PDC	CH / PCFICH Perfor	rmance						
		5 15	10	PDCCH				
TDD	Table A.3.5.2-1	R.15 TDD	10	FDCCII				
TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1	R.15 IDD R.15-1 TDD	10	PDCCH				
TDD	Table A.3.5.2-1	R.15-1 TDD	10	PDCCH				
TDD TDD	Table A.3.5.2-1  Table A.3.5.2-1	R.15-1 TDD R.15-2 TDD	10 10	PDCCH PDCCH				
TDD TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1	R.15-1 TDD R.15-2 TDD R.16 TDD	10 10 10	PDCCH PDCCH				
TDD TDD TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1	R.15-1 TDD R.15-2 TDD R.16 TDD R.16-1 TDD	10 10 10 10	PDCCH PDCCH PDCCH				
TDD TDD TDD TDD TDD TDD TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1	R.15-1 TDD R.15-2 TDD R.16 TDD R.16-1 TDD R.16-2 TDD	10 10 10 10 10	PDCCH PDCCH PDCCH PDCCH PDCCH PDCCH				
TDD TDD TDD TDD TDD TDD TDD TDD TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1	R.15-1 TDD  R.15-2 TDD  R.16 TDD  R.16-1 TDD  R.16-2 TDD  R.16-3 TDD  R.16-4 TDD  R.17 TDD	10 10 10 10 10 10	PDCCH PDCCH PDCCH PDCCH PDCCH PDCCH				
TDD TDD TDD TDD TDD TDD TDD TDD TDD TDD	Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1 Table A.3.5.2-1	R.15-1 TDD  R.15-2 TDD  R.16 TDD  R.16-1 TDD  R.16-2 TDD  R.16-3 TDD  R.16-4 TDD  R.17 TDD	10 10 10 10 10 10 10	PDCCH PDCCH PDCCH PDCCH PDCCH PDCCH				

	1	1		1		1		1	
FDD / TDD	Table A.3.6-1	R.19	10	PHICH					
FDD	Table A.3.6.1	R.19-1	5	PHICH					
FDD / TDD	Table A.3.6-1	R.20	5	PHICH					
FDD / TDD	Table A.3.6-1	R.24	10	PHICH					
	D, PBCH Performan	ce							
FDD / TDD	Table A.3.7-1	R.21	1.4	QPSK	40/ 1920				
FDD/	Table A.3.7-1	R.22	1.4	QPSK	40/				
TDD FDD /	Table A.3.7-1	R.23	1.4	QPSK	1920 40/				
TDD PMC	CH Performance	11.20		Q. O.	1920				
FDD, FWIC	Table A.3.8.1-1	R.40 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.8.1-1	R.37 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.8.1-2	R.38 FDD	10	16QAM	1/2	50		≥1	
FDD	Table A.3.8.1-3	R.39-1 FDD	5	64QAM	2/3	25		≥ 1	
FDD PMG	Table A.3.8.1-3	R.39 FDD	10	64QAM	2/3	50		≥ 2	
•	CH Performance	D 40 TDD		0.001/			l		
TDD	Table A.3.8.2-1	R.40 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.8.2-1	R.37 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.8.2-2	R.38 TDD	10	16QAM	1/2	50		≥ 1	
TDD	Table A.3.8.2-3	R.39-1 TDD	5	64QAM	2/3	25		≥ 1	
TDD	Table A.3.8.2-3	R.39 TDD	10	64QAM	2/3	50		≥ 2	
FDD, Sus	tained data rate (CF	RS)		T					
FDD	Table A.3.9.1-1	R.31-1 FDD	10	64QAM	0.40			≥ 1	
FDD	Table A.3.9.1-1	R.31-2 FDD	10	64QAM	0.59- 0.64			≥ 2	
FDD	Table A.3.9.1-1	R.31-3 FDD	20	64QAM	0.59- 0.62			≥ 2	
FDD	Table A.3.9.1-1	R.31-3A FDD	10	64QAM	0.85- 0.90			≥ 2	
FDD	Table A.3.9.1-1	R.31-3C FDD	15	64QAM	0.87- 0.91			≥ 3	
FDD	Table A.3.9.1-1	R.31-4 FDD	20	64QAM	0.87- 0.90			≥ 3	
FDD	Table A.3.9.1-1	R.31-4B FDD	15	64QAM	0.85- 0.88			≥ 4	
FDD	Table A.3.9.1-1	R.31-5 FDD	15	64QAM	0.85- 0.91			≥ 3	
FDD	Table A.3.9.1-2	R.31-6 FDD	5	64QAM	0.83- 0.85			≥ 2	
FDD	Table A.3.9.1-3	R.68 FDD	20	256QAM	0.74- 0.85			11- 12	
FDD	Table A.3.9.1-3	R.68-1 FDD	15	256QAM	0.74- 0.88			11- 12	
FDD	Table A.3.9.1-3	R.68-2 FDD	10	256QAM	0.74- 0.85			11- 12	
FDD	Table A.3.9.1-3	R.68-3 FDD	5	256QAM	0.77- 0.85			11- 12	
TDD, Sus	tained data rate (CF	RS)							
TDD	Table A.3.9.2-1	R.31-1 TDD	10	64QAM	0.40			≥ 1	
TDD	Table A.3.9.2-1	R.31-2 TDD	10	64QAM	0.59- 0.64			≥ 2	
TDD	Table A.3.9.2-1	R.31-3 TDD	20	64QAM	0.59- 0.62			≥ 2	
TDD	Table A.3.9.2-1	R.31-3A TDD	15	64QAM	0.87- 0.90			≥ 2	
TDD	Table A.3.9.2-1	R.31-4 TDD	20	64QAM	0.87- 0.90			≥ 3	
TDD	Table A.3.9.2-1	R.31-4A TDD	20	64QAM	0.87- 0.90			≥ 3	
TDD	Table A.3.9.2-1	R.31-5 TDD	15	64QAM	0.85-			≥ 3	

					0.88		
TDD	Table A.3.9.2-1	R.31-5A TDD	15	64QAM	0.85-	≥ 3	
TDD	Table A.3.9.2-1	R.31-6 TDD	10	64QAM	0.88 0.85-	≥ 2	
TDD	Table A.3.9.2-2	R.68 TDD	20	256QAM	0.88	11-	
						12 11-	
TDD	Table A.3.9.2-2	R.68-1 TDD	15	256QAM		12 11-	
TDD	Table A.3.9.2-2	R.68-2 TDD	10	256QAM		12 11-	
TDD	Table A.3.9.2-2	R.68-3 TDD	20	256QAM		12	
TDD	Table A.3.9.2-2	R.68-4 TDD	15	256QAM		12	
FDD, Sust	tained data rate tes	t with EPDCCH	schedu			1	
FDD	Table A.3.9.3-1	R.31E-1 FDD	10	64QAM	0.40-	≥ 1	
FDD	Table A.3.9.3-1	R.31E-2 FDD	10	64QAM	0.59- 0.66	≥ 2	
FDD	Table A.3.9.3-1	R.31E-3 FDD	20	64QAM	0.59- 0.63	≥ 2	
FDD	Table A.3.9.1-1	R.31E-3C FDD	15	64QAM	0.87- 0.92	≥ 3	
FDD	Table A.3.9.3-1	R.31E-3A FDD	10	64QAM	0.85- 0.92	≥ 2	
FDD	Table A.3.9.3-1	R.31E-4 FDD	20	64QAM	0.87- 0.91	≥ 3	
FDD	Table A.3.9.1-1	R.31E-4B FDD	15	64QAM	0.87- 0.90	≥ 4	
TDD, Sust	tained data rate tes		schedu	ling (CRS			
TDD	Table A.3.9.4-1	R.31E-1 TDD	10	64QAM	0.40- 0.41	≥ 1	
TDD	Table A.3.9.4-1	R.31E-2 TDD	10	64QAM	0.59- 0.65	≥ 2	
TDD	Table A.3.9.4-1	R.31E-3 TDD	20	64QAM	0.59- 0.63	≥ 2	
TDD	Table A.3.9.4-1	R.31E-3A TDD	15	64QAM	0.87- 0.92	≥ 2	
TDD	Table A.3.9.4-1	R.31E-4 TDD	20	64QAM	0.87- 0.90	≥ 3	
FDD, ePD	CCH performance						
FDD	Table A.3.10.1-1	R.55 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.55-1 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.56 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.57 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.58 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.59 FDD	10	EPDCC H			
TDD, ePD	CCH performance						
TDD	Table A.3.10.2-1	R.55 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.55-1 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.56 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.57 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.58 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.59 TDD	10	EPDCC H			
FDD, MPD	OCCH performance						
FDD	Table A.3.11.1-1	R.xx FDD	10	MPDCC H			
TDD, MPD	OCCH performance						

TDD	Table A.3.11.2-1	R.xx TDD	10	MPDCC H					
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# A.3.2 Reference measurement channel for receiver characteristics

Unless otherwise stated, Tables A.3.2-1 and A.3.2-2 are applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4 (Maximum input level).

Unless otherwise stated, Tables A.3.2-3, A.3.2-3a, A.3.2-3b, A.3.2-4, A.3.2-4a and A.3.2-4b are applicable for subclause 7.4 (Maximum input level).

Unless otherwise stated, Tables A.3.2-1 and A.3.2-2 also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

For transmissions in TDD Band 46, Table A.3.2-2c is applicable for measurements of Receiver Characteristics (clause 7) except for the Maximum Input Level (clause 7.4A) for which Table A.3.2-4d and Table A.3.2-7 apply. For these measurements, the discovery signals measurement timing configuration (DMTC) periodicity shall be set at *dmtc-Periodicity* = 40 ms with an offset *dmtc-Offset* = 0 for the channel and the DRS shall be transmitted in the first subframe of each DMTC occasion. Furthermore, no PBCH is transmitted and the PDSCH is also scheduled in subframe #5.

Table A.3.2-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		9	9	9	9	9	9
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1320	2216	4392	6712	8760
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	152	872	1800	4392	6712	8760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	2	2
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	1	1	1	1	2	2
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3780	6300	13800	20700	27600
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	528	2940	5460	12960	19860	26760
Max. Throughput averaged over 1 frame	kbps	341.6	1143.	1952.	3952.	6040.	7884
			2	8	8	8	
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to

each Code Block (otherwise L = 0 Bit)

Table A.3.2-1a Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	14	14	14	14	14
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		9	9	9	9	9	9
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1000	1000	1000	1000	1000
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	152	840	840	904	904	904
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	1	1
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3528	3528	3864	3864	3864
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	528	2688	2688	3024	3024	3024
Max. Throughput averaged over 1 frame	kbps	341.6	884	884	890.4	890.4	890.4
UE DL Category		0	0	0	0	0	0

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz
- Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.
- Note 3: For Sub-Frame 0, it is assumed the 6PRBs are allocated in the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 4: For HD-FDD UE, the downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.

Table A.3.2-1b Fixed Reference Channel for Receiver Requirements (FDD) - for CAT-M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		4	4	4	4	4	4
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		9	9	9	9	9	9
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	[8]	[8]	[8]	[8]	[8]	[8]
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	256	256	256	328	328	328
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	256	256	256	328	328	328
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	1	1
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	912	1008	1008	1104	1104	1104
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	912	1008	1008	1104	1104	1104
Max. Throughput averaged over 1 frame	kbps	230.4	230.4	230.4	295.2	295.2	295.2
UE DL Category		M1	M1	M1	M1	M1	M1

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz
- Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.
- Note 3: For Sub-Frame 0, the scheduled narrowband avoids the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 4: For HD-FDD UE, PDSCH are scheduled at the [2th, 10th, 18th, 26th, and 34th] subframes every [40]ms. Information bit payload is available if downlink subframe is scheduled. The corresponding M-PDCCH is scheduled at the [0th, 8th, 16th, 24th, and 32th] subframes every [40]ms.

Note 5: 2 resource blocks allocated to M-PDCCH

Table A.3.2-1c Fixed Reference Channel for Receiver Requirements (HD-FDD) without repetition – for CAT-NB1

Parameter	Unit	Value
Channel bandwidth	MHz	0.2
Number of subcarriers		12
Modulation		QPSK
Target Coding Rate		1/3
Number of HARQ Processes	Processes	1
Maximum number of HARQ transmissions		1
Transport block size	Bits	88
Number of Sub-Frames per transport block		1
Transport block CRC	Bits	24
Binary Channel Bits Per Sub-Frame	Bits	320
LTE CRS port		N/A
Number of NRS ports		1
Number of NPDSCH repetitions		0
UE DL Category		NB1

Note 1: NB-IoT in stand-alone mode has been considered here.

Note 2: Reference signal, Synchronization signals and NPBCH allocated as per TS 36.211.

Table A.3.2-1d: Fixed Reference Channel for Receiver Requirements (HD-FDD) with repetition – for CAT-NB1

	Value
MHz	0.2
	12
	QPSK
	1/3
Processes	1
	1
Bits	88
	1
Bits	24
Bits	320
	N/A
	1
•	TBD
	NB1
	Processes  Bits  Bits

Note 1: NB-IoT in stand-alone mode has been considered here.

Note 2: Reference signal, Synchronization signals and NPBCH allocated as per TS 36.211.

Table A.3.2-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		408	1320	2216	4392	6712	8760
For Sub-Frame 1, 6		N/A	968	1544	3240	4968	6712
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		208	1064	1800	4392	6712	8760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	2	2
For Sub-Frame 1, 6		N/A	1	1	1	1	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	2	2
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		1368	3780	6300	13800	20700	27600
For Sub-Frame 1, 6		N/A	3276	5556	11256	16956	22656
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		672	3084	5604	13104	20004	26904
Max. Throughput averaged over 1 frame	kbps	102.4	564	932	1965.	3007.	3970.
-					6	2	4
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.

Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance

Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: As per Table 4.2-2 in TS 36.211 [4]

Table A.3.2-2a Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	14	14	14	14	14
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		408	1000	1000	1000	1000	1000
For Sub-Frame 1, 6		N/A	872	872	872	872	872
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		208	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	1	1
For Sub-Frame 1, 6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		1368	3528	3528	3864	3864	3864
For Sub-Frame 1, 6		N/A	3048	3048	3048	3048	3048
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		672	2832	2832	3168	3168	3168
Max. Throughput averaged over 1 frame	kbps	102.4	474.4	474.4	474.4	474.4	474.4
UE DL Category		0	0	0	0	0	0

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]

Table A.3.2-2b Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		4	4	4	4	4	4
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D)		3	3	3	3	3	3
Number of HARQ Processes	Processes	[7]	[7]	[7]	[7]	[7]	[7]
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		256	256	256	328	328	328
For Sub-Frame 1, 6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		256	256	256	328	328	328
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	1	1
For Sub-Frame 1, 6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		912	1008	1008	1104	1104	1104
For Sub-Frame 1, 6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		912	1008	1008	1104	1104	1104
Max. Throughput averaged over 1 frame	kbps	76.8	76.8	76.8	98.4	98.4	98.4
UE DL Category		M1	M1	M1	M1	M1	M1

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: No data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]
- Note 6: For Sub-Frame 0, the scheduled narrowband avoids the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 7: 2 resource blocks allocated to M-PDCCH

Table A.3.2-2c Fixed Reference Channel for Receiver Requirements (TDD Band 46)

Parameter	Unit	Value
Channel bandwidth	MHz	20
Allocated resource blocks		100
Uplink-Downlink Configuration		N/A
Subcarriers per resource block		12
Allocated subframes per Radio Frame (D)		8
Modulation		QPSK
Target Coding Rate		1/3
Number of HARQ Processes	Processes	N/A
Maximum number of HARQ transmissions		N/A
Information Bit Payload per Sub-Frame		
For Sub-Frames 3,4,6,7,8,9	Bits	8760
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	8760
Transport block CRC	Bits	24
Number of Code Blocks per Sub-Frame		
(Note 3)		
For Sub-Frames 3,4,6,7,8,9	Bits	2
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	2
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 3,4,6,7,8,9	Bits	27600
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	27312
Max. Throughput averaged over 1 frame	kbps	7008
UE Category		≥ 1

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal and Synchronization signals allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.2-3 Fixed Reference Channel for Maximum input level for UE Categories ≥ 3(FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	61664
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	61664
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	11
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	82800
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	55498

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3a Fixed Reference Channel for Maximum input level for UE Category 1 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	18	17	17	17
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	10296	10296	10296	10296
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	8248	10296	10296	10296
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	2	2	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2	2	2	2
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	13608	14076	14076	14076
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	11088	14076	14076	14076
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	9079.6	9266.4	9266.4	9266.4

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3b Fixed Reference Channel for Maximum input level for UE Category 2 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	83
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	51024
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	51024
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	9
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	9
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	68724
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	66204
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	45922

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3c Fixed Reference Channel for Maximum input level for UE DL Category 0 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1000	1000	1000	1000	1000	1000
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	N/A	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9		1	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	1	1	1	1	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	1512	1512	1656	1656	1656
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	N/A	1512	1512	1656	1656	1656
Max. Throughput averaged over 1 frame	kbps	800	900	900	900	900	900

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.

Note 3: For Sub-Frame 0, it is assumed that the allocated 2PRBs are scheduled on the RBs other than the center 6PRBs as most of the symbols are occupied by PBCH and synchronization signals.

Table A.3.2-4 Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	61664
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	46888
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	61664
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	3	5	8	11
For Sub-Frames 1,6		N/A	2	2	4	6	8
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	11
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	82800
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	67968
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	16812	39312	60012	80712
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	27877

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4a Fixed Reference Channel for Maximum input level for UE Category 1 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	18	17	17	17
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	10296	10296	10296	10296
For Sub-Frames 1,6	Bits	N/A	6968	8248	7480	7480	7480
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	8248	10296	10296	10296
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	2	2	2	2
For Sub-Frames 1,6		N/A	2	2	2	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2	2	2	2
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	13608	14076	14076	14076
For Sub-Frames 1,6		N/A	9828	11880	11628	11628	11628
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	11520	14076	14076	14076
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	4533.6	4584.8	4584.8	4584.8

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4b Fixed Reference Channel for Maximum input level for UE Category 2 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	83
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	51024
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	39232
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	51024
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	3	5	8	9
For Sub-Frames 1,6		N/A	2	3	5	7	7
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	9
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	68724
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	56340
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	16380	39312	60012	66636
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	23154

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4c Fixed Reference Channel for Maximum input level for UE DL Category 0 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	1000	1000	1000	1000	1000	1000
For Sub-Frames 1,6	Bits	N/A	712	712	712	712	712
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	1	1	1	1	1
For Sub-Frames 1,6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	1	1	1	1	1
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	1368	1512	1512	1656	1656	1656
For Sub-Frames 1,6		N/A	1224	1224	1368	1368	1368
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	1512	1512	1656	1656	1656
Max. Throughput averaged over 1 frame	kbps	200	442.4	442.4	442.4	442.4	442.4

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4d Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (TDD Band 46)

Parameter	Unit	Value						
Channel bandwidth	MHz	20						
Allocated resource blocks		100						
Uplink-Downlink Configuration		N/A						
Subcarriers per resource block		12						
Allocated subframes per Radio Frame (D)		8						
Modulation		64QAM						
Target Coding Rate		3/4						
Number of HARQ Processes	Processes	N/A						
Maximum number of HARQ transmissions		N/A						
Information Bit Payload per Sub-Frame								
For Sub-Frames 3,4,6,7,8,9	Bits	61664						
For Sub-Frame 1,2	Bits	N/A						
For Sub-Frame 0,5	Bits	61664						
Transport block CRC	Bits	24						
Number of Code Blocks per Sub-Frame								
(Note 3)								
For Sub-Frames 3,4,6,7,8,9		11						
For Sub-Frame 1,2		N/A						
For Sub-Frame 0,5		11						
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 3,4,6,7,8,9	Bits	82800						
For Sub-Frame 1,2	Bits	N/A						
For Sub-Frame 0,5	Bits	81936						
Max. Throughput averaged over 1 frame	kbps	49331.2						
Note 1: 2 symbols allocated to PDCCH fo								
Note 2: Reference signal, Synchronization	n signals alloca	ted as per TS						
36.211 [4].								
Note 3: If more than one Code Block is present, an additional CRC								

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 3:

Table A.3.2-5 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (FDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Subcarriers per resource block		12	12	12	12	12	12		
Allocated subframes per Radio Frame		8	9	9	9	9	9		
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM	256QAM		
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5		
Number of HARQ Processes	Processes	8	8	8	8	8	8		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392	12216	19848	42368	63776	84760		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	N/A	9912	17568	40576	63776	84760		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	4	7	11	14		
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0		N/A	2	3	7	11	14		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	5472	15120	25200	55200	82800	110400		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	N/A	12210	22290	51840	79440	107040		
Max. Throughput averaged over 1 frame	kbps	3513.6	10764	17635.2	37952	57398.4	76284		

<sup>2</sup> symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz. Note 1:

Note 2:

Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Note 3: Block (otherwise L = 0 Bit).

Table A.3.2-6 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (TDD)

Parameter	Unit	Value								
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks		6	15	25	50	75	100			
Subcarriers per resource block		12	12	12	12	12	12			
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1			
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2			
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM	256QAM			
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5			
Number of HARQ Processes	Processes	7	7	7	7	7	7			
Maximum number of HARQ transmissions		1	1	1	1	1	1			
Information Bit Payload per Sub-Frame										
For Sub-Frames 4,9	Bits	4392	12216	19848	42368	63776	84760			
For Sub-Frames 1,6	Bits	N/A	10680	17568	36696	55056	75376			
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	N/A	9912	17568	42368	63776	84760			
Transport block CRC	Bits	24	24	24	24	24	24			
Number of Code Blocks per Sub-Frame										
(Note 4)										
For Sub-Frames 4,9		1	2	4	7	11	14			
For Sub-Frames 1,6		N/A	2	3	6	9	13			
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0		N/A	2	3	7	11	14			
Binary Channel Bits per Sub-Frame										
For Sub-Frames 4,9	Bits	5472	15120	25200	55200	82800	110400			
For Sub-Frames 1,6		N/A	13104	22224	45024	67824	90624			
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	N/A	12336	22416	52416	80016	107616			
Max. Throughput averaged over 1 frame	kbps	878.4	5570.4	9240	20049.6	30144	40503.2			

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-7 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (TDD Band 46)

Parameter	Unit	Value					
Channel bandwidth	MHz	20					
Allocated resource blocks		100					
Uplink-Downlink Configuration		N/A					
Subcarriers per resource block		12					
Allocated subframes per Radio Frame (D)		8					
Modulation		256QAM					
Target Coding Rate		4/5					
Number of HARQ Processes	Processes	N/A					
Maximum number of HARQ transmissions		N/A					
Information Bit Payload per Sub-Frame							
For Sub-Frames 3,4,6,7,8,9	Bits	84760					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	84760					
Transport block CRC	Bits	24					
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 3,4,6,7,8,9		14					
For Sub-Frame 1,2		N/A					
For Sub-Frame 0,5		14					
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 3,4,6,7,8,9	Bits	110400					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	109248					
Max. Throughput averaged over 1 frame	kbps	67808					
Note 1: 2 symbols allocated to PDCCH for							
Note 2: Reference signal, Synchronization signals allocated as per TS 36.211 [4].							
Note 3: If more than one Code Block is pre	esent, an addi	tional CRC					
sequence of L = 24 Bits is attache (otherwise L = $0$ Bit).	d to each Cod	e Block					

# A.3.3 Reference measurement channels for PDSCH performance requirements (FDD)

### A.3.3.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.3.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit	Value							
Reference channel		R.4	R.42	R.42-1	R.42-2	R.42-3	R.2		
		FDD	FDD	FDD	FDD	FDD	FDD		
Channel bandwidth	MHz	1.4	20	3	5	15	10		
Allocated resource blocks (Note 4)		6	100	15	25	75	50		
Allocated subframes per Radio Frame		9	9	9	9	9	9		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3		
Information Bit Payload (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	8760	1320	2216	6712	4392		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	152	8760	1064	1800	6712	4392		
Number of Code Blocks									
(Notes 3 and 4)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	1	1	2	1		
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0		1	2	1	1	2	1		
Binary Channel Bits (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	27600	3780	6300	20700	13800		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	528	26760	2940	5460	19860	12960		
Max. Throughput averaged over 1 frame	Mbps	0.342	7.884	1.162	1.953	6.041	3.953		
(Note 4)									
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Table A.3.3.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter Unit							
Reference channel				R.3-1 FDD	R.3 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Allocated subframes per Radio Frame				9	9		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			6456	14112		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9				2	3		
For Sub-Frame 5				N/A	N/A		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			12600	27600		
For Sub-Frame 5	Bits			N/A	N/A		•
For Sub-Frame 0	Bits			10920	25920		
Max. Throughput averaged over 1 frame	Mbps			5.738	12.586		
UE Category				≥ 1	≥2		•

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Va	lue		
Reference channel			R.5	R.6	R.7	R.8	R.9 FDD
			FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Allocated subframes per Radio Frame			9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		8504	14112	30576	46888	61664
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		6456	12576	28336	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			2	3	5	8	11
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		11340	18900	41400	62100	82800
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	Mbps		7.449	12.547	27.294	42.046	55.498
UE Category			≥ 1	≥2	≥ 2	≥ 2	≥ 3

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3a: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit	Value								
Reference channel		R.	6-1	R.7-1	R.8-1	R.9-1	R.9-2			
		F	DD	FDD	FDD	FDD	FDD			
Channel bandwidth	MHz		5	10	15	20	20			
Allocated resource blocks (Note 3)		1	18	17	17	17	83			
Allocated subframes per Radio Frame			9	9	9	9	9			
Modulation		640	QAM	64QAM	64QAM	64QAM	64QAM			
Target Coding Rate		3	3/4	3/4	3/4	3/4	3/4			
Information Bit Payload										
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10	296	10296	10296	10296	51024			
For Sub-Frame 5	Bits	N	l/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	82	248	10296	10296	10296	51024			
Number of Code Blocks per Sub-Frame										
(Note 4)										
For Sub-Frames 1,2,3,4,6,7,8,9			2	2	2	2	9			
For Sub-Frame 5		N	l/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0			2	2	2	2	9			
Binary Channel Bits Per Sub-Frame										
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13	608	14076	14076	14076	68724			
For Sub-Frame 5	Bits	N	l/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	11	880	14076	14076	14076	66204			
Max. Throughput averaged over 1 frame	Mbps	9.0	062	9.266	9.266	9.266	45.922			
UE Category		≥	: 1	≥ 1	≥ 1	≥ 1	≥ 2			

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: Localized allocation started from RB #0 is applied.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-4: Fixed Reference Channel Single PRB (Channel Edge)

Parameter	Unit						
Reference channel			R.0 FDD		R.1 FDD		
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Allocated subframes per Radio Frame			9		9		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		224		256		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		504		552		
For Sub-Frame 5	Bits		N/A		N/A	_	
For Sub-Frame 0	Bits		504		552	_	
Max. Throughput averaged over 1 frame	Mbps		0.202		0.230		
UE Category			≥ 1	•	≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value
Reference channel	Oilit	R.29 FDD
Telefolioc chariller		(MBSFN)
Channel bandwidth	MHz	10
Allocated resource blocks		1
MBSFN Configuration (Note 4)		111111
Allocated subframes per Radio Frame		3
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 4,9	Bits	256
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	256
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)
Number of Code Blocks per Sub-Frame		
(Note 3)		
For Sub-Frames 4,9		1
For Sub-Frame 5		N/A
For Sub-Frame 0		1
For Sub-Frame 1,2,3,6,7,8		0 (MBSFN)
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9	Bits	552
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	552
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)
Max. Throughput averaged over 1 frame	kbps	76.8
UE Category		≥ 1
Note 1: 2 symbols allocated to PDCCH.		
Note 2: Reference signal, synchronization	n signals a	and PBCH
allocated as per TS 36.211 [4].		
Note 3: If more than one Code Block is p		

CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation Note 4:

Table A.3.3.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit						
Reference channel					R.41 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame					9		
Modulation					QPSK		
Target Coding Rate					1/10		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				1384		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				1384		
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9					1		
For Sub-Frame 5					N/A		
For Sub-Frame 0					1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				13800		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				12960		
Max. Throughput averaged over 1 frame	Mbps				1.246		
UE Category				_	≥1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to

each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-7: Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit		Value	
Reference channel		R.49 FDD	R.49-1 FDD	R.49-2 FDD
Channel bandwidth	MHz	20	10	5
Allocated resource blocks		100	50	25
Allocated subframes per Radio Frame		9	9	9
Modulation		64QAM	64QAM	64QAM
Coding Rate				
For Sub-Frame 1,2,3,4,6,7,8,9,		0.84	0.84	0.84
For Sub-Frame 5		N/A	N/A	N/A
For Sub-Frame 0		0.87	0.87	0.86
Information Bit Payload				
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	63776	31704	15840
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0		63776	30576	14112
Number of Code Blocks per Sub-Frame (Note 3)				
For Sub-Frames 0,1,2,3,4,6,7,8,9	Code	11	6	3
1 01 000 1 1011100 0, 1,2,0, 1,0,1 ,0,0	Blocks			Ü
For Sub-Frame 5	Code Blocks	N/A	N/A	N/A
Binary Channel Bits Per Sub-Frame			5	3
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	75600		
For Sub-Frame 5	Bits	N/A	37800	18900
For Sub-Frame 0	Bits	73080	N/A	N/A
Max. Throughput averaged over 1 frame	Mbps	57.398	35280	16380
UE Category		≥5	≥2	≥2

Note 1: 3 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

# A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

#### A.3.3.2.1 Two antenna ports

Table A.3.3.2.1-1: Fixed Reference Channel two antenna ports

Parameter	Unit						Va	lue					
Reference channel		R.10 FDD	R.11 FDD	R.11- 1 FDD	R.11- 2 FDD	R.11- 3 FDD Note 5	R.11- 4 FDD	R.30 FDD	R.30- 1 FDD	R.35- 1 FDD	R.35 FDD	R.35- 2 FDD	R.35- 3 FDD
Channel bandwidth	MHz	10	10	10	5	10	10	20	15	20	10	15	10
Allocated resource blocks (Note 4)		50	50	50	25	40	50	100	75	100	50	75	50
Allocated subframes per Radio Frame		9	9	8	9	9	9	9	8	8	9	8	8
Modulation		QPSK	16QA M	16QA M	16QA M	16QA M	QPSK	16QA M	16QA M	64QA M	64QA M	64QA M	64QA M
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39	1/2	0.39	0.39
Information Bit Payload (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392	12960	12960	5736	10296	6968	25456	19080	30576	19848	22920	15264
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	4392	12960	N/A	4968	10296	6968	25456	N/A	N/A	18336	N/A	N/A
Number of Code Blocks (Notes 3 and 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	3	3	1	2	2	5	4	5	4	4	3
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame	Bits	1	3	N/A	1	2	2	5	N/A	N/A	3	N/A	N/A
Binary Channel Bits (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	26400	12000	21120	13200	52800	39600	79200	39600	59400	39600
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12384	24768	N/A	10368	19488	12384	51168	N/A	N/A	37152	N/A	N/A
Max. Throughput averaged over 1 frame (Note 4)	Mbps	3.953	11.66 4	10.36 8	5.086	9.266	6.271	22.91 0	15.26 4	24.46 1	17.71 2	18.33 6	12.21 1
UE Category Note 1: 2 symbo		≥ 1	≥2	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	4	≥ 2	≥ 2	≥ 2

<sup>2</sup> symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and Note 1: 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2:

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block Note 3: (otherwise L = 0 Bit).

Note 4:

Given per component carrier per codeword. For R.11-3 resource blocks of RB6–RB45 are allocated. Note 5:

Table A.3.3.2.1-2: Fixed Reference Channel two antenna ports

Parameter	Unit						Val	ue					
Reference channel		R.46	R.47	R.35-4	R.11-5	R.11-6	R.11-7	R.11-8	R.11-	R.11-	R.65	R.10-	R.10-
		FDD	FDD	FDD	FDD	FDD	FDD	FDD	9 FDD	10	FDD	2 FDD	3 FDD
										FDD			
Channel bandwidth	MHz	10	10	10	1.4	3	15	10	10	10	10	5	10
Allocated resource blocks (Note 4)		50	50	50	6	15	75	50	50	50	50	25	50
Allocated number of PDCCH symbols		2	2	2	4	3	2	2	3	3	2	3	2
Allocated subframes per Radio Frame		9	9	9	8	9	9	9	8	8	9	9	9
Modulation		QPSK	16QA	64QA	16QA	16QA	16QA	QPSK	QPSK	QPSK	256QA	QPSK	16QA
			М	M	М	M	M				M		M
Target Coding Rate				0.47	1/2	1/2	1/2	3/5	0.58	0.67	0. 55	1/3	0.58
Information Bit Payload (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	5160	8760	18336	1352	3368	19080	7992	6968	7992	31704	1800	15264
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	5160	8760	16416	N/A	2664	19080	6968	N/A	N/A	N/A	1800	14112
Number of Code Blocks													
(Notes 3 and 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	2	3	1	1	4	2	2	2	6	1	3
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	1	2	3	1	1	4	2	N/A	N/A	N/A	1	3
Binary Channel Bits (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	39600	2592	7200	39600	13200	12000	12000	57600	6000	26400
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	12384	24768	37152	N/A	5568	37968	12384	N/A	N/A	N/A	5184	24768
Max. Throughput averaged over 1	Mbps	4.644	7.884	16.310	1.082	2.961	17.172	7.0904	5.5744	6.3936	25.363	1.620	13.62
frame (Note 4)													24
UE Category		≥ 1	≥1	≥ 2	≥ 1	≥1	≥ 2	≥2	≥ 1	≥ 1	11-12	≥ 1	≥ 2
UE DL Category		≥ 6	≥ 6	≥ 6	≥ 6	≥ 6	≥ 6	≥ 6			≥ 13	≥ 6	

Note 1: Void

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 4: Given per component carrier per codeword.

Table A.3.3.2.1-3: Fixed Reference Channel two antenna ports

Parameter	Unit	Va	lue
Reference channel		R.62	R.63
		FDD	FDD
Channel bandwidth	MHz	10	10
Allocated resource blocks (Note 4)		3	1
Allocated DL subframes per 4 Radio Frames		15	15
(Note 3)			
Modulation		16QAM	64QAM
Target Coding Rate		1/2	1/2
Information Bit Payload			
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	744	408
Number of Code Blocks			
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code	1	1
	blocks		
Binary Channel Bits			
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1584	792
Max. Throughput averaged over 4 frames	Mbps	0.279	0.153
UE DL Category		0	0
Note 1: 2 symbols allocated to PDCCH			
Note 2: Reference signal, synchronization s	ignals and	PBCH allo	cated as

lote 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: The downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.

Note 4: Allocated PRB positions start from {9, 10, ..., 9+N-1}, where N is the number of allocated resource blocks.

Table A.3.3.2.1-4: Fixed Reference Channel two antenna ports

Parameter	Unit	Values
Reference channel		R.zz FDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		3
Allocated DL subframes per 4 Radio Frames (Note 3)		15
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	744
Number of Code Blocks		
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code blocks	1
Binary Channel Bits	DIOCKS	
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1584
Max. Throughput averaged over 4 frames	Mbps	0.279
UE DL Category		M1, ≥ 0

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: The downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled (starting from 0th subframe). The 3rd-7th, 11th-15th, 19th-23rd, 27th-31st, 35th-36th subframes every 40ms are set as invalid subframe.

Note 4: Allocated PRB positions for PDSCH are {3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.

# A.3.3.2.2 Four antenna ports

Table A.3.3.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit								Value						
Reference channel		R.12	R.13	R.14	R.14-	R.14-	R.14-	R.36	R.14-	R.14-	R.14-	R.14-	R.72	R.73	R.74
		FDD	FDD	FDD	1	2	3	FDD	4	5	6	7	FDD	FDD	FDD
					FDD	FDD	FDD		FDD	FDD	FDD	FDD			
Channel bandwidth	MHz	1.4	10	10	10	10	20	10	1.4	3	5	15	10	10	10
Allocated resource		6	50	50	6	3	100	50	6	15	25	75	50	50	50
blocks (Note 4)															
Allocated subframes		9	9	9	8	8	9	9	8	9	9	9	9	9	9
per Radio Frame															
Modulation		QPS	QPS	16Q	16QA	16QA	16QA	64Q	16QA	16QA	16QA	16QA	256Q	64QAM	16QA
		K	K	AM	М	M	M	AM	М	M	М	M	AM		M
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.62	0.43	1/2
Information Bit Payload															
(Note 4)															
For Sub-Frames	Bits	408	4392	1296	1544	744	25456	1833	1192	3368	5736	19080	31704	16416	25456
1,2,3,4,6,7,8,9				0				6						(CW0)	
														32856	
														(CW1)	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	152	3624	1144	N/A	N/A	22920	1833	N/A	2664	4968	19080	31704	15264	22920
				8				6						(CW0)	
														30576	
														(CW1)	
Number of Code															
Blocks															
(Notes 3 and 4)		<u> </u>												2 (0)1(2)	_
For Sub-Frames		1	1	3	1	1	5	3	1	1	1	4	3	3 (CW0)	5
1,2,3,4,6,7,8,9		11/4	N1/A	11/1	N1/A	11/A	,	N1/A	N 1 / A	11/4	N1/A	A1/A	B 1 / A	6 (CW1)	11/1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	2	N/A	N/A	4	3	N/A	1	1	4	3	3 (CW0)	5
														5 (CW1)	
Binary Channel Bits															
(Note 4)															
For Sub-Frames	Bits	1248	1280	2560	3072	1536	51200	3840	2496	6960	11600	38400	51200	38400	51200
1,2,3,4,6,7,8,9			0	0				0						(CW0)	
														76800	
	D:	N1/A	N1/A	N1/A	N1/A	N1/A	<b>_</b>	N1/A	N1/A	N1/A	N1/A	N1/A	N1/A	(CW1)	NI/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	480	1203	2406	N/A	N/A	49664	3609	N/A	5424	10064	36864	48128	36096	48128
			2	4		I	I	6		I		Ì	l	(CW0)	

														72192 (CW1)	
Max. Throughput averaged over 1 frame (Note 4)	Mbp s	0.34 2	3.87 6	11.5 13	1.235	0.595	22.65 6	16.5 02	0.954	2.961	5.086	17.17 2	28.53 4	14.659 (CW0) 29.342 (CW1)	22.65 7
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥2	≥ 11	≥ 5	≥ 5

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

# A.3.3.3 Reference Measurement Channel for UE-Specific Reference Symbols

### A.3.3.3.0 Two antenna ports (no CSI-RS)

The reference measurement channels in Table A.3.3.3.0-1 apply with two CRS antenna ports and without CSI-RS.

Table A.3.3.3.0-1: Fixed Reference Channel without CSI-RS

Parameter	Unit		Value
Reference channel		R.70 FDD	R.71 FDD
Channel bandwidth	MHz	10	10
Allocated resource blocks		50	50
Allocated subframes per Radio		10	10
Frame			
Modulation		QPSK	16QAM
Target Coding Rate		0.65	0.6
Information Bit Payload			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	6968	12960
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Number of Code Blocks per Sub-			
Frame			
(Note 4)			
For Sub-Frames 1,2,3,4,6,7,8,9		2	3
For Sub-Frame 5		N/A	N/A
For Sub-Frame 0		N/A	N/A
Binary Channel Bits Per Sub-			
Frame			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10800	21600
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Max. Throughput averaged over 1	Mbps	5.5744	10.368
frame			
UE Category		≥1	≥ 2

Note 1: 3 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

### A.3.3.3.1 Two antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.3.3.1-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

Parameter	Unit		Value	
Reference channel		R.51 FDD	R.51-1 FDD	R.76 FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)
Allocated subframes per Radio Frame		9	9	9
Modulation		16QAM	16QAM	QPSK
Target Coding Rate		1/2	0.54	
Information Bit Payload				
For Sub-Frames 1,4,6,9	Bits	11448	12960	6200
For Sub-Frames 2,3,7,8	Bits	11448	12960	6200
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	9528	10680	4968
Number of Code Blocks (Note 4)				
For Sub-Frames 1,4,6,9	Code	2	3	2
	blocks			
For Sub-Frames 2,3,7,8	Code	2	3	2
	blocks			
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	2	2	1
Binary Channel Bits				
For Sub-Frames 1,4,6,9	Bits	24000	24000	12000
For Sub-Frames 2,7		23600	23600	11800
For Sub-Frames 3,8		23200	23200	12000
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	19680	19680	9840
Max. Throughput averaged over 1	Mbps	10.1112	11.436	5.4568
frame				
UE Category		≥ 2	≥ 2	≥2

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks

(RB0-RB20 and RB30-RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A3.3.3.1-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Table A.3.3.3.1-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

Parameter	Unit		Val	ue	
Reference channel		R.52 FDD	R.52-1 FDD	R.53 FDD	R.54 FDD
Channel bandwidth	MHz	10	10	10	10
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)	50 (Note 3)
Allocated subframes per Radio Frame		9	9	9	9
Modulation		64QAM	16QAM	64QAM	16QAM
Target Coding Rate		1/2	0.54	1/2	1/2
Information Bit Payload					
For Sub-Frames 1,3,4,6,8,9	Bits	18336	12960	18336	11448
For Sub-Frames 2,7	Bits	16416	12960	16416	11448
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	14688	10680	14688	9528
Number of Code Blocks (Note 4)					
For Sub-Frames 1,3,4,6,8,9	Code	3	3	3	2
For Sub-Frames 2, 7	blocks Code	3	3	3	2
FOI Sub-Flames 2, 7	blocks	3	3	3	2
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	3	2	3	2
Binary Channel Bits					
For Sub-Frames 1,3,4,6,8,9	Bits	36000	24000	36000	24000
For Sub-Frames 2,7		34200	22800	33600	22800
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	29520	19680	29520	19680
Max. Throughput averaged over 1 frame	Mbps	15.7536	11.436	15.7536	10.1112

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

## A.3.3.3.2 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value							
Reference channel		R.43 FDD	R.43-1	R.50 FDD	R.48 FDD	R.66 FDD	R.75 FDD		
			FDD						
Channel bandwidth	MHz	10	10	10	10	10	10		
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)	50 (Note	50 (Note	50 (Note		
All ( )   ( )					3)	3)	3)		
Allocated subframes per Radio Frame		9	9	9	9	9	9		
Modulation		QPSK	QPSK	64QAM	QPSK	256QAM	16QAM		
Target Coding Rate		1/3	1/3	1/2		0.77	0.57		
Information Bit Payload									
For Sub-Frames 1,4,6,9	Bits	3624	3624	18336	6200	36696	25456		
For Sub-Frames 2,3,7,8	Bits	3624	3624	16416	6200	35160	25456		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	2984	2984	14688	4968	30576	21384		
Number of Code Blocks (Note 4)									
For Sub-Frames 1,4,6,9	Code	1	1	3	2	6	5		
	blocks								
For Sub-Frames 2,3,7,8	Code	1	1	3	2	6	5		
	blocks								
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	1	1	3	1	5	4		
Binary Channel Bits									
For Sub-Frames 1,6	Bits	12000	13200	36000	12000	48000	43200		
For Sub-Frames 4,9	Bits	12000	12000	36000	12000	48000	43200		
For Sub-Frames 2,7	Bits	11600	12800	34800	11600	46400	41600		
For Sub-Frames 3,8	Bits	11600	12800	34800	12000	46400	41600		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	9840	9840	29520	9840	39360	35424		
Max. Throughput averaged over 1	Mbps	3.1976	3.1976	15.3696	5.4568	31.800	22.503		
frame									
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	11-12	≥ 5		
UE DL Category		≥ 6	≥ 6	≥ 6	≥ 6	≥ 13	≥ 6		

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A.3.3.3.2-2 apply for verifying FDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-2: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit	Value					
Reference channel		R.44	R.45	R.45-1	R.60		
		FDD	FDD	FDD	FDD		
Channel bandwidth	MHz	10	10	10	10		
Allocated resource blocks		50 <sup>3</sup>	50 <sup>3</sup>	39	50 <sup>3</sup>		
Allocated subframes per Radio Frame		10	10	10	10		
Modulation		QPSK	16QAM	16QAM	QPSK		
Target Coding Rate		1/3	1/2	1/2	1/2		
Information Bit Payload							
For Sub-Frames (Non CSI-RS subframe)	Bits	3624	11448	8760	6200		
For Sub-Frames (CSI-RS subframe)	Bits	3624	11448	8760	6200		
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A		
subframe)							
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	2984	9528	8760	N/A		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames (Non CSI-RS subframe)		1	2	2	2		
For Sub-Frames (CSI-RS subframe)		1	2	2	2		
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A		
subframe)							
For Sub-Frame 5		N/A	N/A	N/A	N/A		
For Sub-Frame 0		1	2	2	N/A		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames (Non CSI-RS subframe)	Bits	12000	24000	18720	12000		
For Sub-Frames (CSI-RS subframe)	Bits	11600	23200	18096	11600		
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A		
subframe)							
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	9840	19680	18720	N/A		
Max. Throughput averaged over 1 frame	Mbps	3.1976	10.1112	7.884	4.96		
UE Category		≥ 1	≥ 2	≥ 1	≥1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: For R.44, R.45 and R.60, 50 resource blocks are allocated in sub-frames 1,2,3,4,6,7,8,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.45-1, 39 resource blocks are allocated in all subframes (RB0–RB20 and RB30–RB47).

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

The reference measurement channels in Table A.3.3.3.2-3 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-3: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

	Parameter	Unit	Value
Reference	e channel		R.64
			FDD
Channel	bandwidth	MHz	10
Allocated	resource blocks (Note 4)		6
Allocated	subframes per 4 Radio Frames		15
Modulation	on		QPSK
Target C	oding Rate		1/3
Informati	on Bit Payload		
For Sub	-Frames 0,1,4,5,6,9 (Note 3)	Bits	504
For Sub	-Frames 2,3,7,8 (Note 3)	Bits	504
Number	of Code Blocks		
For Sub	-Frames 0,1,4,5,6,9	Code	1
		blocks	
For Sub	-Frames 2,3,7,8	Code	1
		blocks	
	nannel Bits		
	-Frames 0,1,4,5,6,9	Bits	1440
For Sub	-Frames 2,3,7,8	Bits	1392
Max. Thr	oughput averaged over 4 frames	Mbps	0.189
UE DL C			0
Note 1:	2 symbols allocated to PDCCH.		
Note 2:	Reference signal, synchronization si	gnals and F	PBCH
	allocated as per TS 36.211 [4].		
Note 3:	The downlink subframes are schedu		, ,
	2nd, 8th, 9th, 10th, 16th, 17th, 18th,		
	32nd, 33rd, 34th subframes every 40		
	payload is avaialbe if downlink subfr		
Note 4:	Allocated PRB positions start from {		
	where N is the number of allocated r	esource blo	CKS.

The reference measurement channels in Table A.3.3.3.2-4 apply with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-4: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit	Value
Reference channel		R.69 FDD
Channel bandwidth	MHz	10
Allocated resource blocks		50
Allocated subframes per Radio Frame		8
Modulation		QPSK
Target Coding Rate		
For Sub-Frames 2,3,4,6,7,8,9		0.74
For Sub-Frame 1		0.8
nformation Bit Payload		
For Sub-Frames 2,3,4,6,7,8,9	Bits	7992
For Sub-Frame 1	Bits	7992
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 2,3,4,6,7,8,9		2
For Sub-Frame 1		2
For Sub-Frame 5		N/A
For Sub-Frame 0		N/A
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 2,3,4,6,7,8,9	Bits	10800
For Sub-Frame 1	Bits	10000
2 For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Max. Throughput averaged over 1 frame	Mbps	6.3936
JE Category		≥1
		_

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4] Note 2:

If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit) Note 3:

#### A.3.3.3.3 Twelve antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.3-1 apply for verifying PMI accuracy performance for UEspecific reference symbols with two cell-specific antenna ports and twelve CSI-RS antenna ports.

Table A.3.3.3.1: Fixed Reference Channel for CDM-multiplexed DM RS with twelve CSI-RS antenna ports

Parameter	Unit	Value
Reference channel		R.77 FDD
Channel bandwidth	MHz	10
Allocated resource blocks		50 (Note 3)
Allocated subframes per Radio Frame		9
Modulation		64QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames (Non CSI-RS	Bits	18336
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	16416
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0		14688
Number of Code Blocks per Sub-Frame	Code	
·	blocks	
For Sub-Frames (Non CSI-RS	Code	3
subframe)	blocks	
For Sub-Frames (CSI-RS subframe)	Bits	3
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5		N/A
For Sub-Frame 0	Bits	3
Binary Channel Bits Per Sub-Frame		
For Sub-Frames (Non CSI-RS		36000
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	32400
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	29520
Max. Throughput averaged over 1	Mbps	15.7536
frame		
UE Category		≥ 2
Note 1: 2 symbols allocated to PDCCF		
Note 2: Reference signal, synchroniza	ition signal	s and PBCH
allocated as per TS 36.211 [4]		
Note 3: 50 resource blocks are allocat		
6, 7, 8, 9 and 41 resource bloc		
RB30–RB49) are allocated in		
Note 4: If more than one Code Block is	s present,	an additional

### A.3.3.3.4 Sixteen antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.4-1 apply for verifying PMI accuracy performance for UE-specific reference symbols with two cell-specific antenna ports and sixteen CSI-RS antenna ports.

Block (otherwise L = 0 Bit).

Table A.3.3.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with sixteen CSI-RS antenna ports

CRC sequence of L = 24 Bits is attached to each Code

Paramter	Unit	Value

Reference channel		R.78 FDD
Channel bandwidth	MHz	10
Allocated resource blocks		50 (Note 3)
Allocated subframes per Radio Frame		9
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames (Non CSI-RS	Bits	11448
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	9912
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0		9528
Number of Code Blocks per Sub-Frame	Code	
	blocks	
For Sub-Frames (Non CSI-RS	Code	2
subframe)	blocks	
For Sub-Frames (CSI-RS subframe)	Bits	2
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5		N/A
For Sub-Frame 0	Bits	2
Binary Channel Bits Per Sub-Frame		
For Sub-Frames (Non CSI-RS		24000
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	20800
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	19680
Max. Throughput averaged over 1	Mbps	9.804
frame		
UE Category		≥ 2

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code

# A.3.4 Reference measurement channels for PDSCH performance requirements (TDD)

# A.3.4.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.4.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit				Value			
Reference channel		R.4	R.42	R.2A	R.2	R.42-1	R.42-2	R.42-3
		TDD	TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	20	10	10	3	5	15
Allocated resource blocks (Note 6)		6	100	50	50	15	25	75
Uplink-Downlink Configuration (Note 4)		1	1	2	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	5+2	3+2	3+2	3+2	3+2
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload (Note 6)								
For Sub-Frames 4,9	Bits	408	8760	4392	4392	1320	2216	6712
For Sub-Frames 1,6	Bits	N/A	7736	3240	3240	1128	1864	5992
For Sub-Frames 3,8	Bits	N/A	N/A	4392	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	208	8760	4392	4392	1064	1800	6712
Number of Code Blocks								
(Notes 5 and 6)								
For Sub-Frames 4,9		1	2	1	1	1	1	2
For Sub-Frames 1,6		N/A	2	1	1	1	1	1
For Sub-Frames 3,8		N/A	N/A	1	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	1	1	1	1	2
Binary Channel Bits (Note 6)								
For Sub-Frames 4,9	Bits	1368	27600	13800	13800	3780	6300	20700
For Sub-Frames 1,6	Bits	N/A	22656	11256	11256	3276	5556	16956
For Sub-Frames 3,8		N/A	N/A	13800	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	672	26904	13104	13104	3084	5604	20004
Max. Throughput averaged over 1 frame	Mbps	0.102	4.175	2.844	1.966	0.596	0.996	3.212
(Note 6)								
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.

Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 4: As per Table 4.2-2 in TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Given per component carrier per codeword.

Table A.3.4.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter	Unit	Value					
Reference channel				R.3-1	R.3		
				TDD	TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Uplink-Downlink Configuration (Note 3)				1	1		
Allocated subframes per Radio Frame (D+S)				3+2	3+2		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits			6456	14112		
For Sub-Frames 1,6	Bits			5160	11448		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9				2	3		
For Sub-Frames 1,6				1	2		
For Sub-Frame 5				N/A	N/A		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits			12600	27600		
For Sub-Frames 1,6	Bits			11112	22512		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			11208	26208		
Max. Throughput averaged over 1 frame	Mbps			2.897	6.408		
UE Category				≥ 1	≥ 2		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

882

Parameter	Unit	Value						
Reference channel			R.5	R.6 TDD	R.7	R.8	R.9	
			TDD		TDD	TDD	TDD	
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks			15	25	50	75	100	
Uplink-Downlink Configuration (Note 3)			1	1	1	1	1	
Allocated subframes per Radio Frame (D+S)			3+2	3+2	3+2	3+2	3+2	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate			3/4	3/4	3/4	3/4	3/4	
Information Bit Payload								
For Sub-Frames 4,9	Bits		8504	14112	30576	46888	61664	
For Sub-Frames 1,6	Bits		6968	11448	23688	35160	46888	
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits		6968	12576	30576	45352	61664	
Number of Code Blocks per Sub-Frame								
(Note 4)								
For Sub-Frames 4,9			2	3	5	8	11	
For Sub-Frames 1,6			2	2	4	6	8	
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0			2	3	5	8	11	
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 4,9	Bits		11340	18900	41400	62100	82800	
For Sub-Frames 1,6	Bits		9828	16668	33768	50868	67968	
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits		9252	16812	39312	60012	80712	
Max. Throughput averaged over 1 frame	Mbps		3.791	6.370	13.910	20.945	27.877	
UE Category			≥ 1	≥ 2	≥ 2	≥ 2	≥ 3	

<sup>2</sup> symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH Note 1: for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

As per Table 4.2-2 TS 36.211 [4]. Note 3:

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Note 4: Block (otherwise L = 0 Bit).

Table A.3.4.1-3a: Fixed Reference Channel 64QAM R=3/4

883

Parameter	Unit	Value					
Reference channel		R.6-1	R.7-1	R.8-1	R.9-1	R.9-2	
		TDD	TDD	TDD	TDD	TDD	
Channel bandwidth	MHz	5	10	15	20	20	
Allocated resource blocks (Note 3)		18	17	17	17	83	
Uplink-Downlink Configuration (Note 4)		1	1	1	1	1	
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	
Information Bit Payload							
For Sub-Frames 4,9	Bits	10296	10296	10296	10296	51024	
For Sub-Frames 1,6	Bits	8248	7480	7480	7480	39232	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	8248	10296	10296	10296	51024	
Number of Code Blocks per Sub-Frame							
(Note 5)							
For Sub-Frames 4,9		2	2	2	2	9	
For Sub-Frames 1,6		2	2	2	2	7	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0		2	2	2	2	9	
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits	13608	14076	14076	14076	68724	
For Sub-Frames 1,6	Bits	11880	11628	11628	11628	56340	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	11520	14076	14076	14076	66636	
Max. Throughput averaged over 1 frame	Mbps	4.534	4.585	4.585	4.585	23.154	
UE Category		 ≥ 1	≥ 1	≥ 1	≥ 1	≥ 2	

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: Localized allocation started from RB #0 is applied.

Note 4: As per Table 4.2-2 TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-4: Fixed Reference Channel Single PRB

Parameter	Unit	Value					
Reference channel			R.0 TDD		R.1 TDD		
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Uplink-Downlink Configuration (Note 3)			1		1		
Allocated subframes per Radio Frame (D+S)			3+2		3+2		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits		224		256		
For Sub-Frames 1,6	Bits		208		208		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame (Note 4)							
For Sub-Frames 4,9			1		1		
For Sub-Frames 1,6			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits		504		552		
For Sub-Frames 1,6	Bits		456		456		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		504		552		
Max. Throughput averaged over 1 frame	Mbps		0.109		0.118		
UE Category			≥ 1		≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value
Reference channel		R.29 TDD
		(MBSFN)
Channel bandwidth	MHz	10
Allocated resource blocks		1
MBSFN Configuration (Note 5)		010010
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		1+2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	208
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	256
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	1
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	1
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	456
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	552
Max. Throughput averaged over 1 frame	kbps	67.2
UE Category		≥ 1

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

as per Table 4.2-2 in TS 36.211 [4]. Note 3:

Note 4: If more than one Code Block is present, an additional CRC

sequence of L = 24 Bits is attached to each Code Block (otherwise

L = 0 Bit).

MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation Note 5:

Table A.3.4.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit			Va	lue		
Reference channel					R.41 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Uplink-Downlink Configuration (Note 4)					1		
Allocated subframes per Radio Frame (D+S)					3+2		
Modulation					QPSK		
Target Coding Rate					1/10		
Information Bit Payload							
For Sub-Frames 4,9	Bits				1384		
For Sub-Frames 1,6	Bits				1032		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				1384		
Number of Code Blocks per Sub-Frame							
(Note 5)							
For Sub-Frames 4,9					1		
For Sub-Frames 1,6					1		
For Sub-Frame 5					N/A		
For Sub-Frame 0					1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits				13800		
For Sub-Frames 1,6	Bits				11256		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				13104		
Max. Throughput averaged over 1 frame	Mbps				0.622		
UE Category					≥ 1		

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-7: Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit	Val	ue
Reference channel		R.49 TDD	R.49-1 TDD
Channel bandwidth	MHz	20	15
Allocated resource blocks		100	75
Uplink-Downlink Configuration (Note 1)		1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2
Modulation		64QAM	64QAM
Number of OFDM symbols for PDCCH per component carrier			
For Sub-Frames 0,4,5,9	OFDM symbols	3	3
For Sub-Frames 1,6	OFDM symbols	2	2
Target Coding Rate			
For Sub-Frames 4,9		0.84	0.83
For Sub-Frames 1,6		0.81	0.80
For Sub-Frames 5		N/A	N/A
For Sub-Frames 0		0.87	0.86
Information Bit Payload			
For Sub-Frames 0, 4, 9	Bits	63776	46888
For Sub-Frame 1,6	Bits	55056	40576
For Sub-Frame 5	Bits	N/A	N/A
Number of Code Blocks per Sub-Frame (Note 2)			
For Sub-Frames 0, 4, 9	Code Blocks	11	8
For Sub-Frame 1,6	Code Blocks	9	7
For Sub-Frame 5	Code Blocks	N/A	N/A
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 4,9	Bits	75600	56700
For Sub-Frame 1,6	Bits	67968	50868
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	73512	54612
Max. Throughput averaged over 1 frame	Mbps	30.144	22.182
UE Category		≥5	≥ 3

Note 1: Reference signal, synchronization signals and PBC allocated as per TS 36.211 [4].

Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

# A.3.4.2 Multi-antenna transmission (Common Reference Signals)

## A.3.4.2.1 Two antenna ports

Table A.3.4.2.1-1: Fixed Reference Channel two antenna ports

Parameter			Uı	nit					Va	lue		
Reference channel		R.10 TDD	R.11 TDD	R.11-1 TDD	R.11-2 TDD	R.11-3 TDD Note 6	R.11-4 TDD	R.30 TDD	R.30-1 TDD	R.30-2 TDD	R.35 TDD	R.35-1 TDD
Channel bandwidth	MHz	10	10	10	5	10	10	20	20	20	10	20
Allocated resource blocks (Note 5)		50	50	50	25	40	50	100	100	100	50	100
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	2+2	3+2	3+2	2	3+2	2+2	2	2+2	2
Modulation		QPSK	16QAM	16QAM	16QAM	16QAM	QPSK	16QAM	16QAM	16QAM	64QAM	64QAM
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39
Information Bit Payload (Note 5)												
For Sub-Frames 4,9	Bits	4392	12960	12960	5736	10296	6968	25456	25456	25456	19848	30576
For Sub-Frames 1,6		3240	9528	9528	5160	9144	N/A	22920	21384	N/A	15840	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	4392	12960	N/A	4968	10296	N/A	25456	N/A	N/A	N/A	N/A
Number of Code Blocks (Notes 4 and 5)												
For Sub-Frames 4,9		1	3	3	1	2	2	5	5	5	4	5
For Sub-Frames 1,6		1	2	2	1	2	N/A	4	4	N/A	3	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	3	N/A	1	2	N/A	5	N/A	N/A	N/A	N/A
Binary Channel Bits (Note 5)												
For Sub-Frames 4,9	Bits	13200	26400	26400	12000	21120	13200	52800	52800	52800	39600	79200
For Sub-Frames 1,6		10656	21312	21312	10512	16992	10656	42912	42912	N/A	31968	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12528	25056	N/A	10656	19776	12528	51456	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1	Mbps	1.966	5.794	4.498	2.676	4.918	1.39	12.221	9.368	5.091	7.138	6.115

frame (Note 5)											
UE Category	≥ 1	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	3	≥ 2	4

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Given per component carrier per codeword.
- Note 6: For R.11-3 resource blocks of RB6–RB45 are allocated.

#### Table A.3.4.2.1-2: Fixed Reference Channel two antenna ports

Parameter	Unit		Value										
Reference channel		R.46 TDD	R.47 TDD	R.35-2	R.11-5	R.11-6	R.11-7	R.11-8	R.11-9	R.11-10	R.11-11	R.11-12	R.10-3
				TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	10	10	10	1.4	3	5	10	15	10	10	10	10
Allocated resource blocks (Note		50	50	50	6	15	25	50	75	50	50	50	50
5)													
Uplink-Downlink Configuration		1	1	1	1	1	1	1	1	1	1	1	1
(Note 3)													
Allocated number of PDCCH		2	2	2	4	3	3	2	2	2	3	3	2
symbols in normal subframes					7	<u> </u>	0			_	<u> </u>	J	
Allocated number of PDCCH		2	2	2	2	2	2	2	2	2	2	2	2
symbols in special subframes													
Allocated subframes per Radio		3+2	3+2	2+2	2+2	2+2	2+2	2+2	2+2	3+2	2+2	2+2	3+2
Frame (D+S)													
Modulation		QPSK	16QAM	64QAM	16QAM	16QAM	16QAM	16QAM	16QAM	QPSK	QPSK	QPSK	16QAM
Target Coding Rate				0.47	1/2	1/2	1/2	1/2	1/2	3/5			
For Sub-Frames 4,9											0.58	0.66	0.58
For Sub-Frames 1,6											0.48	0.54	0.57
Information Bit Payload (Note 5)													
For Sub-Frames 4,9	Bits	5160	8760	18336	1352	3368	5736	12960	19080	7992	6968	7992	15264
For Sub-Frames 1,6		3880	7480	14688	1128	3112	5160	10680	15840	5736	5160	5736	12216
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	5160	8760	N/A	N/A	N/A	N/A	N/A	N/A	7992	N/A	N/A	14112
Number of Code Blocks													
(Notes 4 and 5)													
For Sub-Frames 4,9		1	2	3	1	1	1	3	4	2	2	2	3
For Sub-Frames 1,6		1	2	3	1	1	1	2	3	1	1	1	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	3
Binary Channel Bits (Note 5)													
For Sub-Frames 4,9	Bits	13200	26400	39600	2592	7200	12000	26400	39600	13200	12000	12000	26400
For Sub-Frames 1,6		10656	21312	31968	2304	6192	10512	21312	32112	10656	10656	10656	21312
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12528	25056	N/A	N/A	N/A	N/A	N/A	N/A	12528	N/A	N/A	25056
Max. Throughput averaged over	Mbps	2.324	4.124	6.604	0.496	1.296	2.179	4.498	6.984	3.5448	2.4256	2.7456	6.9072
1 frame (Note 5)													
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1

Note 1: Void

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword

Table A.3.4.2.1-3: Fixed Reference Channel two antenna ports

Parameter	Unit	Va	lue
Reference channel		R.62 TDD	R.63 TDD
Channel bandwidth	MHz	10	10
Allocated resource blocks (Note 4)		3	1
Uplink-Downlink Configuration (Note 3)		1	1
Allocated subframes per Radio Frame		4+2	4+2
(D+S)			
Modulation		16QAM	64QAM
Target Coding Rate		1/2	1/2
Information Bit Payload			
For Sub-Frames 0,4,5,9	Bits	744	408
For Sub-Frames 1,6	Bits	440	280
Number of Code Blocks			
For Sub-Frames 0,4,5,9	Code	1	1
	blocks		
For Sub-Frames 1,6	Clode	1	1
	blocls		
Binary Channel Bits			
For Sub-Frames 0,4,5,9	Bits	1584	792
For Sub-Frames 1,6		1296	648
Max. Throughput averaged over 1 frame	Mbps	0.3856	0.2192
UE DL Category		0	0

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3:

As per Table 4.2-2 in TS 36.211 [4]. Allocated PRB positions start from {9, 10, ..., 9+N-1}, where N is the Note 4: number of allocated resource blocks.

Table A.3.4.2.1-4: Fixed Reference Channel two antenna ports

	Parameter	Unit	Va	lue				
Reference	e channel		R.65 TDD					
Channel	bandwidth	MHz	20					
Allocated	resource blocks (Note 5)		100					
Uplink-D	ownlink Configuration (Note 3)		1					
Allocated	subframes per Radio Frame		2+2					
(D+S)	·							
Modulation	on		256QAM					
Target C	oding Rate							
Informati	on Bit Payload (Note 5)							
	-Frames 4,9	Bits	63776					
For Sub	-Frames 1,6		46888					
For Sub	-Frame 5	Bits	N/A					
For Sub	-Frame 0	Bits	N/A					
Number	of Code Blocks							
(Notes 4	and 5)							
For Sub	o-Frames 4,9		11					
For Sub	p-Frames 1,6		9					
For Sub	o-Frame 5		N/A					
	o-Frame 0		N/A					
Binary C	hannel Bits (Note 5)							
For Sub	o-Frames 4,9	Bits	115200					
For Sub	o-Frames 1,6		95424					
	-Frame 5	Bits	N/A					
	o-Frame 0	Bits	N/A					
Max. Thr	oughput averaged over 1 frame	Mbps	22.133					
(Note 5)								
UE Cate			11-12					
UE DL C			≥ 13					
Note 1:	2 symbols allocated to PDCCH for							
	channel BW; 3 symbols allocated t							
	symbols allocated to PDCCH for 1							
OFDM symbols are allocated to PDCCH. For 256QAM reference channel 1 symbol is allocated								
channel 1 symbol is allocated.  Note 2: Reference signal synchronization signals and PRCH allocated as per								
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].								
Note 3:		1						
Note 3:	As per Table 4.2-2 in TS 36.211 [4	1.						

Note 4: If more than one Code Block is present, an additional CRC sequence of

L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword

Table A.3.4.2.1-5: Fixed Reference Channel two antenna ports when *EIMTA-MainConfigServCell-r12* is configured

Parameter	Unit	Value						
Reference channel					R.67 TDD	)		
Channel bandwidth	MHz				10			
Allocated resource blocks (Note 5)					50			
Modulation					16QAM			
Target Coding Rate		0.4						
Dynamic Uplink-Downlink Configuration (Note 3)		0 1 2 3 4 5						
Allocated subframes per Radio Frame (D+S)		1+2	3+2	5+2	5+1	6+1	7+1	2+2
Information Bit Payload (Note 5)								
For Sub-Frame 0	Bits	9912	9912	9912	9912	9912	9912	9912
For Sub-Frame 1	Bits	7480	7480	7480	7480	7480	7480	7480
For Sub-Frame 2	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 3	Bits	NA	NA	9912	NA	NA	9912	NA
For Sub-Frame 4	Bits	NA	9912	9912	NA	9912	9912	NA
For Sub-Frame 5	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 6	Bits	7480	7480	7480	9912	9912	9912	7480
For Sub-Frame 7	Bits	NA	NA	NA	9912	9912	9912	NA
For Sub-Frame 8	Bits	NA	NA	9912	9912	9912	9912	NA
For Sub-Frame 9	Bits	NA	9912	9912	9912	9912	9912	9912

Normalism of Osala Disaba (Nista a 4 and 5)								
Number of Code Blocks (Notes 4 and 5)		_	_	_	_	_	_	_
For Sub-Frame 0		2	2	2	2	2	2	2
For Sub-Frame 1		2	2	2	2	2	2	2
For Sub-Frame 2		NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 3		NA	NA	2	NA	NA	2	NA
For Sub-Frame 4		NA	2	2	NA	2	2	NA
For Sub-Frame 5		NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 6		2	2	2	2	2	2	2
For Sub-Frame 7		NA	NA	NA	2	2	2	NA
For Sub-Frame 8		NA	NA	2	2	2	2	NA
For Sub-Frame 9		NA	2	2	2	2	2	2
Binary Channel Bits (Note 5)								
For Sub-Frame 0	Bits	25056	25056	25056	25056	25056	25056	25056
For Sub-Frame 1	Bits	21312	21312	21312	21312	21312	21312	21312
For Sub-Frame 2	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 3	Bits	NA	NA	26400	NA	NA	26400	NA
For Sub-Frame 4	Bits	NA	26400	26400	NA	26400	26400	NA
For Sub-Frame 5	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 6	Bits	21312	21312	21312	26112	26112	26112	21312
For Sub-Frame 7	Bits	NA	NA	NA	26400	26400	26400	NA
For Sub-Frame 8	Bits	NA	NA	26400	26400	26400	26400	NA
For Sub-Frame 9	Bits	NA	26400	26400	26400	26400	26400	26400
Max. Throughput averaged over 1 frame (Note 5)	Mbps	2.49	4.47	6.45	5.70	6.70	7.69	3.48
Max. Throughput averaged over 1 frame and	Mbps				F 20			
over all dynamic UL-DL configurations (Note 5)					5.28			
UE Category					≥ 1			

- Note 1: 2 OFDM symbols are allocated to PDCCH in all subframes
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Given per component carrier per codeword.

Table A.3.4.2.1-6: Fixed Reference Channel two antenna ports

Parameter	Unit	Values
Reference channel		R.zz TDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		3
Allocated subframes per Radio Frame (D+S)		4+2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 0,4,5,9	Bits	744
For Sub-Frames 1,6	Bits	440
Number of Code Blocks		
For Sub-Frames 0,4,5,9	Code	1
	blocks	
For Sub-Frames 0,4,5,9	Code	1
	blocks	
Binary Channel Bits		
For Sub-Frames 0,4,5,9	Bits	1584
For Sub-Frames 1,6	Bits	1296
Max. Throughput averaged over 4 frames	Mbps	0.3856
UE DL Category		M1, ≥ 0
Note 1: 2 symbols allocated to PDCCH		

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: Allocated PRB positions for PDSCH are {3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.

# A.3.4.2.2 Four antenna ports

Table A.3.4.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit								Va	lue						
Reference channel		R.12	R.13	R.14	R.14-	R.14-	R.43	R.36	R.43-	R.43-	R.43-	R.43-	R.43-	R.72	R.73	R.74
		TDD	TDD	TDD	1 TDD	2 TDD	TDD	TDD	1 TDD	2 TDD	3 TDD	4 TDD	5 TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10	1.4	3	5	10	15	10	10	10
Allocated resource		6	50	50	6	3	100	50	6	15	25	50	75	50	50	50
blocks (Note 6)																
Uplink-Downlink		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Configuration (Note																
4) Allocated subframes		3	3+2	2+2	2	2	2+2	2+2	2	2+2	2+2	2+2	2+2	2+2	2+2	2+2
per Radio Frame		3	3+2	2+2	2		2+2	2+2		2+2	2+2	2+2	2+2	2+2	2+2	2+2
(D+S)																
Modulation		QPS	QPS	16Q	16QA	16QA	16Q	64Q	16QA	16QA	16QA	16QA	16QA	256Q	64QAM	16QA
		K	K	AM	М	M	AM	AM	М	M	M	M	M	AM		M
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.62	0.44	1/2
Information Bit																
Payload (Note 6)																
For Sub-Frames 4,9	Bits	408	4392	1296	1544	744	2545	1833	1192	3368	5736	12960	19080	31704	16416	25456
				0			6	6							(CW0)	
															32856	
F O F 4 O	D:4-	NI/A	0040	0500	NI/A	NI/A	0400	4504	NI/A	0050	5400	40000	45040	00000	(CW1)	40000
For Sub-Frames 1,6	Bits	N/A	3240	9528	N/A	N/A	2138 4	1584 0	N/A	2856	5160	10680	15840	23688	12216 (CW0)	19080
							4	U							24496	
															(CW1)	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	208	4392	N/A	N/A											
Number of Code					-			-	-			-	-	-	-	
Blocks																
(Notes 5 and 6)																
For Sub-Frames 4,9		1	1	3	1	1	5	3	1	1	1	3	4	3	3 (CW0)	5
															6 (CW1)	
For Sub-Frames 1,6		N/A	1	2	N/A	N/A	4	3	N/A	1	1	2	3	3	2 (CW0)	4
F O F F		NI/A	NI/A	NI/A	N1/A	NI/A	N1/A	NI/A	4 (CW1)	N1/A						
For Sub-Frame 5 For Sub-Frame 0		N/A 1	N/A 1	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A
Binary Channel Bits		'		IN/A	N/A											
(Note 6)																
For Sub-Frames 4,9	Bits	1248	1280	2560	3072	1536	5120	3840	2496	6960	11600	25600	38400	51200	38400	51200
1 2. 202 1 10.1103 1,0		5	0	0	00.2		0	0					30.00	3.200	(CW0)	3.200

															76800 (CW1)	
For Sub-Frames 1,6		N/A	1025 6	2051 2	N/A	N/A	4131 2	3076 8	N/A	5952	10112	20512	30912	41024	30768 (CW0) 61536 (CW1)	41024
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	624	1217 6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1 frame (Note 6)	Mbp s	0.10 2	1.96 6	4.49 8	0.309	0.149	9.36 8	6.83 5	0.238	1.245	2.179	4.728	6.984	18.44 5	5.726 (CW0) 11.470 (CW1)	8.907
UE Category		≥ 1	≥ 1	≥2	≥ 1	≥ 1	≥ 2	≥2	≥ 1	≥ 1	≥ 1	≥2	≥ 2	≥ 11	≥ 5	≥ 5

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Given per component carrier per codeword.

# A.3.4.3 Reference Measurement Channels for UE-Specific Reference Symbols

#### A.3.4.3.1 Single antenna port (Cell Specific)

The reference measurement channels in Table A.3.4.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

Table A.3.4.3.1-1: Fixed Reference Channel for DRS

Parameter	Unit			Val	ue		
Reference channel		R.25 TDD	R.26 TDD	R.26-1 TDD	R.27 TDD	R.27-1 TDD	R.28 TDD
Channel bandwidth	MHz	10	10	5	10	10	10
Allocated resource blocks		50 <sup>4</sup>	50 <sup>4</sup>	25 <sup>4</sup>	50 <sup>4</sup>	18 <sup>6</sup>	1
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2	3+2
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	16QAM
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2
Information Bit Payload							
For Sub-Frames 4,9	Bits	4392	12960	5736	28336	10296	224
For Sub-Frames 1,6	Bits	3240	9528	4584	22920	8248	176
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	2984	9528	3880	22152	10296	224
Number of Code Blocks per Sub-Frame (Note 5)							
For Sub-Frames 4,9		1	3	1	5	2	1
For Sub-Frames 1,6		1	2	1	4	2	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	1	4	2	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits	12600	25200	11400	37800	13608	504
For Sub-Frames 1,6	Bits	10356	20712	10212	31068	11340	420
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	10332	20664	7752	30996	13608	504
Max. Throughput averaged over 1 frame	Mbps	1.825	5.450	2.452	12.466	4.738	0.102
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

#### A.3.4.3.2 Two antenna ports (Cell Specific)

The reference measurement channels in Table A.3.4.3.2-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Localized allocation started from RB #0 is applied.

Table A.3.4.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS

Reference channel		R.31 TDD	R.32 TDD	R.32-1 TDD	R.33 TDD	R.33-1 TDD	R.34 TDD		
Channel bandwidth	MHz	10	10	5	10	10	10		
Allocated resource		50 4	50 4	25 4	50 4	18 <sup>6</sup>	50 <sup>4</sup>		
blocks									
Uplink-Downlink		1	1	1	1	1	1		
Configuration (Note 3)									
Allocated subframes		3+2	3+2	3+2	3+2	3+2	3+2		
per Radio Frame (D+S)									
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	64QAM		
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2		
Information Bit Payload									
For Sub-Frames 4,9	Bits	3624	11448	5736	27376	9528	18336		
For Sub-Frames 1,6		2664	7736	3112	16992	7480	11832		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	2984	9528	3496	22152	9528	14688		
Number of Code Blocks									
per Sub-Frame									
(Note 5)									
For Sub-Frames 4,9		1	2	1	5	2	3		
For Sub-Frames 1,6		1	2	1	3	2	2		
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0		1	2	1	4	2	3		
Binary Channel Bits Per									
Sub-Frame									
For Sub-Frames 4,9	Bits	12000	24000	10800	36000	12960	36000		
For Sub-Frames 1,6		7872	15744	6528	23616	10368	23616		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	9840	19680	7344	29520	12960	29520		
Max. Throughput	Mbps	1.556	4.79	2.119	11.089	4.354	7.502		
averaged over 1 frame									
UE Category		≥ 1	≥2	≥ 1	≥ 2	≥ 1	≥ 2		
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols									
allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.  For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.									
Note 2: Reference sign			ignals and	PBCH allo	cated as pe	er TS 36.211	l [4].		
Note 3: as per Table 4.			, .						
Note 4: For R.31, R.32	. R.33and	R.34, 50 re	esource blo	cks are allo	ocated in si	ub-trames 4	9 and 41		

Note 4: For R.31, R.32, R.33and R.34, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.32-1, 25 resouce blocks are allocated in sub-frames 4,9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1, 6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Localized allocation started from RB #0 is applied.

The reference measurement channels in Table A.3.4.3.2-2 apply with two CRS antenna ports.

Table A.3.4.3.2-2: Fixed Reference Channel for CDM-multiplexed DM RS

Parameter	Unit	V	alue
Reference channel		R.70 TDD	R.71 TDD
Channel bandwidth	MHz	10	10
Allocated resource blocks		50 (Note 4)	50 (Note 4)
Uplink-Downlink Configuration (Note 3)		1	1
Allocated subframes per Radio Frame (D+S)		2+2	2+2
Modulation		QPSK	16QAM
Target Coding Rate			
For Sub-Frames 4,9		0.65	0.6
For Sub-Frames 1,6		0.54	0.5
Information Bit Payload			
For Sub-Frames 4,9	Bits	6968	12960
For Sub-Frames 1,6	Bits	4264	7736
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Number of Code Blocks per Sub-Frame			
(Note 5)			
For Sub-Frames 4,9		2	3
For Sub-Frames 1,6		1	2
For Sub-Frame 5		N/A	N/A
For Sub-Frame 0		N/A	N/A
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 4,9	Bits	10800	21600
For Sub-Frames 1,6	Bits	7872	15744
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Max. Throughput averaged over 1 frame	Mbps	2.2464	4.1392
UE Category		≥ 1	≥ 2

- Note 1: 3 symbols allocated to PDCCH in normal subframes and 2 symbols allocated to PDCCH in special subframes
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.63, and R.64, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in the DwPTS portion of sub-frames 1,6.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

### A.3.4.3.3 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.3-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.4.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

Parameter	Unit		Value	
Reference channel		R.51 TDD	R.51-1 TDD	R.76 TDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 (Note 5)	50 (Note 5)	50 (Note 5)
Uplink-Downlink Configuration (Note 3)		1	1	1
Allocated subframes per Radio Frame		3+2	3+2	3+2
(D+S)				
Modulation		16QAM	16QAM	QPSK
Target Coding Rate		1/2	0.57	
Information Bit Payload				
For Sub-Frames 4,9 (non CSI-RS	Bits	11448	N/A	6200
subframe)				
For Sub-Frame 4,9	Bits	11448	12960	6200
For Sub-Frames 1,6	Bits	7736	9144	4264
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	9528	10680	4968
Number of Code Blocks				
(Note 4)				
For Sub-Frames 4, 9 (non CSI-RS	Code	2	N/A	2
subframe)	blocks			
For Sub-Frames 4,9	Code	2	3	2
	blocks			
For Sub-Frames 1,6	Code	2	2	1
	blocks			
For Sub-Frame 5		N/A	N/A	N/A
For Sub-Frame 0	Code	2	2	1
Bi Ol IBi	blocks			
Binary Channel Bits	5	0.4000	N1/A	44000
For Sub-Frames 4, 9 (non CSI-RS	Bits	24000	N/A	11800
subframe)		00000	00000	44000
For Sub-Frames 4,9		22800	22800	11800
For Sub-Frames 1,6	D.:	15744	15744	7872
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	19680	19680	9840
Max. Throughput averaged over 1	Mbps	4.7896	5.4888	2.5896
frame				
UE Category		≥ 2	≥ 2	≥ 2

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1.6

The reference measurement channels in Table A3.4.3.3-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Table A.3.4.3.3-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

Parameter		Value					
Reference channel		R.52 TDD	R.52-1 TDD	R.53 TDD	R.54 TDD		
Channel bandwidth	MHz	10	10	10	10		
Allocated resource blocks		50 (Note 5)	50 (Note 5)	50 (Note 5)	50 (Note 5)		
Uplink-Downlink Configuration (Note 3)		1	1	1	1		
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2		
Modulation		64QAM	16QAM	64QAM	16QAM		
Target Coding Rate		1/2	0.57	1/2	1/2		
Information Bit Payload							
For Sub-Frame 4,9	Bits	16416	12960	16416	11448		
For Sub-Frames 1,6	Bits	11832	9144	11832	7736		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	14688	10680	14688	9528		
Number of Code Blocks							
(Note 4)							
For Sub-Frames 4,9	Code blocks	3	3	3	2		
For Sub-Frames 1,6	Code blocks	2	2	2	2		
For Sub-Frame 5		n/a	n/a	n/a	n/a		
For Sub-Frame 0	Code blocks	3	2	3	2		
Binary Channel Bits							
For Sub-Frames 4,9		34200	22800	33600	22800		
For Sub-Frames 1,6		23616	15744	23616	15744		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	29520	19680	29520	19680		
Max. Throughput averaged over 1 frame	Mbps	7.1184	5.4888	7.1184	4.7896		
UE Category		≥ 2	≥2	≥ 2	≥ 2		

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: 50 resource blocks are allocated in sub-frames 4, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1, 6.

### A.3.4.3.4 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.4-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter Unit Value						
Reference channel		R.44 TDD	R.48 TDD	R.48 TDD   R.66 TDD   R.7		
Channel bandwidth	MHz	10	10	20	10	
Allocated resource blocks		50 (Note 4)	50 (Note 4)	100	50 (Note 4)	
Uplink-Downlink Configuration (Note 3)		1	1	1		
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	
Modulation		64QAM	QPSK	256QAM	16QAM	
Target Coding Rate		1/2			0.57	
Information Bit Payload						
For Sub-Frames 4,9 (non CSI-RS subframe)	Bits	18336	N/A	N/A	N/A	
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	16416	6200	71112	25456	
For Sub-Frames 1,6		11832	4264	48936	16992	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	14688	4968	66592	21384	
Number of Code Blocks per Sub- Frame (Note 5)						
For Sub-Frames 4,9 (non CSI-RS subframe)		3	2	N/A	N/A	
For Sub-Frames 4,9 (CSI-RS subframe)		3	2	12	5	
For Sub-Frames 1,6		2	1	8	3	
For Sub-Frame 5		N/A	N/A	N/A	N/A	
For Sub-Frame 0		3	1	11	4	
Binary Channel Bits Per Sub- Frame						
For Sub-Frames 4,9 (non CSI-RS subframe)	Bits	36000	12000	N/A	N/A	
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	33600	11600	89600	40000	
For Sub-Frames 1,6		23616	7872	67584	27552	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	29520	9840	84480	35424	
Max. Throughput averaged over 1 frame	Mbps	7.1184	2.5896	30.669	10.628	
UE Category		≥ 2	≥ 1	11-12	≥ 5	
UE DL Category		≥ 6	≥ 6	≥ 13	≥ 6	

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: For R.44,R.48 and R.75, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.66, 100 resource blocks are allocated in sub-frames 4, 9 and 88 resources blockes (RB0–RB43 and RB56–RB99) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A.3.4.3.4-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-2: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit		Value	
Reference channel		R.60	R.61	R.61-1
		TDD	TDD	TDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 <sup>⁴</sup>	50⁴	39 <sup>5</sup>
Uplink-Downlink Configuration (Note 3)		1	1	1
Allocated subframes per Radio Frame		4+2	4+2	4+2
(D+S)				
Allocated subframes per Radio Frame		10	10	10
Modulation		QPSK	16QAM	16QAM
Target Coding Rate		1/2	1/2	1/2
Information Bit Payload				
For Sub-Frames 4 and 9	Bits	N/A	N/A	N/A
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	6200	11448	8760
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	N/A	7736	7480
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9528	8760
Number of Code Blocks per Sub-Frame				
(Note 6)				
For Sub-Frames 4 and 9		N/A	N/A	N/A
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9		2	2	2
(CSI-RS subframe)				
For Sub-Frames 1,6		N/A	2	2
For Sub-Frame 5		N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2
Binary Channel Bits Per Sub-Frame				
For Sub-Frames 4 and 9	Bits	N/A	N/A	N/A
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	11600	23200	18096
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	N/A	15744	14976
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	19680	18720
Max. Throughput averaged over 1 frame	Mbps	1.24	4.7896	4.1240
UE Category		≥ 1	≥ 2	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R. 60 and R.61, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.
- Note 5: For R. 61-1, 39 resource blocks (RB0–RB20 and RB30–RB47) are allocated in subframe 0. 1, 4, 6 and 9.
- Note 6: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 7: Localized allocation started from RB #0 is applied.

The reference measurement channels in Table A.3.4.3.4-3 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-3: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value
Reference channel		R.64 TDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		6
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		4+2
Modulation		QPSK
Target Coding Rate		1/3
Information Bit Payload		
For Sub-Frames 4,9 (non CSI-RS subframe)	Bits	504
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	504
For Sub-Frames 1,6		256
For Sub-Frames 0,5	Bits	504
Number of Code Blocks per Sub-Frame		
For Sub-Frames 4,9 (non CSI-RS subframe)	Code	1
	blocks	
For Sub-Frames 4,9 (CSI-RS subframe)	Code	1
	blocks	
For Sub-Frames 1,6	Code	1
	blocks	
For Sub-Frames 0,5	Code	1
	blocks	
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9 (non CSI-RS subframe)	Bits	1440
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	1352
For Sub-Frames 1,6		1152
For Sub-Frames 0,5	Bits	1440
Max. Throughput averaged over 1 frame	Mbps	0.2528
UE DL Category		0

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH

allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: Allocated PRB positions start from {9, 10, ..., 9+N-1}, where

N is the number of allocated resource blocks.

The reference measurement channels in Table A.3.4.3.4-4 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-4: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value
Reference channel		R.69 TDD
Channel bandwidth	MHz	10
Allocated resource blocks		50 (Note 4)
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		2+2
Modulation		QPSK
Target Coding Rate		
For Sub-Frame 4(CSI-RS subframe)		0.8
For Sub-Frame 9 (non CSI-RS subframe)		0.74
For Sub-Frames 1,6		0.61
Information Bit Payload		
For Sub-Frame 4(CSI-RS subframe)	Bits	7992
For Sub-Frame 9 (non CSI-RS subframe)	Bits	7992
For Sub-Frames 1,6	Bits	4776
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 5)		
For Sub-Frame 4(CSI-RS subframe)		2
For Sub-Frame 9 (non CSI-RS subframe)		2
For Sub-Frames 1,6		1
For Sub-Frame 5		N/A
For Sub-Frame 0		N/A
Binary Channel Bits Per Sub-Frame		
For Sub-Frame 4(CSI-RS subframe)	Bits	10000
For Sub-Frame 9 (non CSI-RS subframe)	Bits	10800
For Sub-Frames 1,6	Bits	7872
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Max. Throughput averaged over 1 frame	Mbps	2.5536
UE Category		≥ 1
Note 1: 3 symbols allocated to PDCCH.		

Note 1: 3 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in the DwPTS portion of sub-frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

## A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

Parameter	Unit	Value		
Reference channel		R.50 TDD	R.50-1 TDD	
Channel bandwidth	MHz	10	10	
Allocated resource blocks		50 (Note 4)	50 (Note 4)	
Uplink-Downlink Configuration (Note		1	1	
3)				
Allocated subframes per Radio		3+2	3+2	
Frame (D+S)				
Modulation		QPSK	QPSK	
Target Coding Rate		1/3	1/3	
Information Bit Payload				
For Sub-Frames 4,9 (non CSI-RS	Bits	3624	3624	
subframe)				
For Sub-Frames 4,9 (CSI-RS	Bits	3624	3624	
subframe)				
For Sub-Frames 1,6		2664	2664	
For Sub-Frame 5	Bits	N/A	N/A	
For Sub-Frame 0	Bits	2984	2984	
Number of Code Blocks per Sub-				
Frame				
(Note 5)				
For Sub-Frames 4,9 (non CSI-RS		1	1	
subframe)				
For Sub-Frames 4,9 (CSI-RS		1	1	
subframe)				
For Sub-Frames 1,6		1	1	
For Sub-Frame 5		N/A	N/A	
For Sub-Frame 0		1	1	
Binary Channel Bits Per Sub-Frame				
For Sub-Frames 4,9 (non CSI-RS	Bits	12000	13200	
subframe)				
For Sub-Frames 4,9 (CSI-RS	Bits	10400	11600	
subframe)				
For Sub-Frames 1,6		7872	7872	
For Sub-Frame 5	Bits	N/A	N/A	
For Sub-Frame 0	Bits	9840	9840	
Max. Throughput averaged over 1	Mbps	1.556	1.556	
frame				
UE Category		≥ 1	≥1	

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-2: Fixed Reference Channel for eight antenna ports (CSI-RS)

Parameter	Unit		Value	
Reference channel		R.45	R.45-1	R.45-2
		TDD	TDD	TDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 <sup>4</sup>	39	50⁴
Uplink-Downlink Configuration (Note 3)		1	1	1
Allocated subframes per Radio Frame		4+2	4+2	4+2
(D+S)				
Allocated subframes per Radio Frame		5	5	10
Modulation		16QAM	16QAM	64QAM
Target Coding Rate		1/2	1/2	
Information Bit Payload				
For Sub-Frames 4 and 9	Bits	N/A	N/A	N/A
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	11448	8760	[18336]
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	7736	7480	[11832]
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	9528	8760	[14688]
Number of Code Blocks per Sub-Frame				
(Note 5)				
For Sub-Frames 4 and 9		N/A	N/A	N/A
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9		2	2	
(CSI-RS subframe)				
For Sub-Frames 1,6		2	2	
For Sub-Frame 5		N/A	N/A	
For Sub-Frame 0		2	2	
Binary Channel Bits Per Sub-Frame				
For Sub-Frames 4 and 9	Bits	N/A	N/A	
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	22400	17472	[33600]
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	15744	14976	[23616]
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	19680	18720	[29520]
Max. Throughput averaged over 1 frame	Mbps	4.7896	4.1240	7.3296
UE Category		≥ 2	≥ 1	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.45 and R.45-2, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.45-1, 39 resource blocks are allocated in sub-frames 0,4,9 and the DwPTS portion of sub-frames 1,6 (RB0–RB20 and RB30–RB47)
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Localized allocation started from RB #0 is applied.

## A.3.4.3.6 Twelve antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.6-1 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and twelve CSI-RS antenna ports.

Table A.3.4.3.6-1: Fixed Reference Channel for twelve antenna ports (CSI-RS)

	Parameter	Unit	Value
Referenc	e channel		R.77 TDD
	bandwidth	MHz	10
Allocated	resource blocks		50 <sup>4</sup>
	ownlink Configuration (Note 3)		1
	subframes per Radio Frame		3+2
(D+S)	rodonamos por radio i ramo		0.2
	subframes per Radio Frame		10
Modulation			64QAM
	oding Rate		1/2
	on Bit Payload		.,_
	-Frames 4 and 9	Bits	N/A
	SI-RS subframe)	2.13	,,,
	Frames 4 and 9	Bits	16416
	S subframe)	Ditto	10110
	Frames 1,6	Bits	11832
	-Frame 5	Bits	N/A
	Frame 0	Bits	14688
	of Code Blocks per Sub-Frame	2.13	1.1000
(Note 5)	5. 3040 2.00.0 por 345		
	-Frames 4 and 9		N/A
	SI-RS subframe)		
	Frames 4 and 9		3
(CSI-R	S subframe)		
	Frames 1,6		2
	-Frame 5		N/A
	-Frame 0		3
	nannel Bits Per Sub-Frame		
	-Frames 4 and 9	Bits	N/A
(Non CS	SI-RS subframe)		
	-Frames 4 and 9	Bits	32400
(CSI-RS	S subframe)		
For Sub-I	Frames 1,6	Bits	23616
For Sub	-Frame 5	Bits	N/A
For Sub	-Frame 0	Bits	29520
Max. Thro	oughput averaged over 1 frame	Mbps	7.1184
UE Cate			≥ 2
Note 1:	2 symbols allocated to PDCCH fo		
	MHz channel BW; 3 symbols allo		
	and 3 MHz; 4 symbols allocated t		
	subframe 1&6, only 2 OFDM sym	bols are allocat	ted to
	PDCCH.		
Note 2:	Reference signal, synchronization	n signals and P	BCH
	allocated as per TS 36.211 [4].		
Note 3:	As per Table 4.2-2 in TS 36.211 [		
Note 4:	50 resource blocks are allocated		
	resource blocks (RB0-RB20 and		
Note 5:	in sub-frame 0 and the DwPTS po		
Note 5:	If more than one Code Block is pr		
	sequence of $L = 24$ Bits is attached (otherwise $L = 0$ Bit).	eu to each Cod	e block
Note 6:	Localized allocation started from	DR #0 is applia	d
Note 6:	Localized allocation Started from	vp #0 is abblie	u.

# A.3.4.3.7 Sixteen antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.7-1 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and sixteen CSI-RS antenna ports.

Table A.3.4.3.7-1: Fixed Reference Channel for sixteen antenna ports (CSI-RS)

	Parameter	Unit	Value
Reference	channel		R.78 TDD
Channel b		MHz	10
Allocated i	resource blocks		50 <sup>4</sup>
	wnlink Configuration (Note 3)		1
	subframes per Radio Frame		3+2
(D+S)			
Allocated	subframes per Radio Frame		10
Modulation			16QAM
Target Cod			1/2
	n Bit Payload		
	Frames 4 and 9	Bits	N/A
	-RS subframe)		
	Frames 4 and 9	Bits	9912
(CSI-RS	subframe)		
For Sub-F		Bits	7736
For Sub-		Bits	N/A
For Sub-		Bits	9528
	Code Blocks per Sub-Frame		
(Note 5)	·		
For Sub-	Frames 4 and 9		N/A
(Non CS	I-RS subframe)		
	rames 4 and 9		2
(CSI-RS	subframe)		
For Sub-F	rames 1,6		2
For Sub-	Frame 5		N/A
For Sub-	Frame 0		2
Binary Cha	annel Bits Per Sub-Frame		
For Sub-	Frames 4 and 9	Bits	N/A
(Non CSI	-RS subframe)		
For Sub-	Frames 4 and 9	Bits	20800
(CSI-RS	subframe)		
For Sub-F	rames 1,6	Bits	15744
For Sub-	Frame 5	Bits	N/A
For Sub-	Frame 0	Bits	19680
Max. Thro	ughput averaged over 1 frame	Mbps	4.4824
UE Catego	ory		≥ 2
Note 1:	2 symbols allocated to PDCCH fo	r 20 MHz, 15 N	/IHz and 10
	MHz channel BW; 3 symbols allow		
	and 3 MHz; 4 symbols allocated to		
	subframe 1&6, only 2 OFDM sym	bols are alloca	ted to
	PDCCH.		
Note 2:	Reference signal, synchronization	n signals and P	BCH
	allocated as per TS 36.211 [4].		
Note 3:	As per Table 4.2-2 in TS 36.211 [		
Note 4:	50 resource blocks are allocated in	in sub-frames 4	1,9 and 41
	resource blocks (RB0-RB20 and		

Note 5:

Note 6:

in sub-frame 0 and the DwPTS portion of sub-frames 1,6. If more than one Code Block is present, an additional CRC

sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Localized allocation started from RB #0 is applied.

# A.3.5 Reference measurement channels for PDCCH/PCFICH performance requirements

## A.3.5.1 FDD

Table A.3.5.1-1: Reference Channel FDD

Parameter	Unit					Value				
Reference channel		R.15	R.15-1	R.15-2	R.16	R.16-1	R.16-2	R.16-3	R.16-4	R.17
		FDD	FDD	FDD	FDD	FDD	FDD	FDD	FDD	FDD
Number of		1	2	2	2	2	2	2	2	4
transmitter										
antennas										
Channel bandwidth	MHz	10	10	10	10	10	10	10	10	5
Number of OFDM	symb	2	3	2	2	3	3	1	1	2
symbols for	ols									
PDCCH										
Aggregation level	CCE	8	8	8	4	2	4	2	4	2
DCI Format		1	1	1	2	2	2	2	2	2
Cell ID		0	0	0	0	0	0	0	0	0
Payload (without	Bits	31	31	31	43	43	43	43	43	42
CRC)										

### A.3.5.2 TDD

Table A.3.5.2-1: Reference Channel TDD

Parameter	Unit			•		Value				•
Reference channel		R.15	R.15-1	R.15-2	R.16	R.16-1	R.16-2	R.16-3	R.16-4	R.17
		TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD	TDD
Number of		1	2	2	2	2	2	2	2	4
transmitter										
antennas										
Channel bandwidth	MHz	10	10	10	10	10	10	10	10	5
Number of OFDM	symb	2	3	2	2	3	3	1	1	2
symbols for	ols									
PDCCH										
Aggregation level	CCE	8	8	8	4	2	4	2	4	2
DCI Format		1	1	1	2	2	2	2	2	2
Cell ID		0	0	0	0	0	0	0	0	0
Payload (without	Bits	34	34	34	46	46	46	46	46	45
CRC)										

# A.3.6 Reference measurement channels for PHICH performance requirements

Table A.3.6-1: Reference Channel FDD/TDD

Parameter	Unit	Value						
Reference channel		R.18	R.19	R.19-1	R.20	R.24		
Number of transmitter antennas		1	2	2	4	1		
Channel bandwidth	MHz	10	10	5	5	10		
User roles (Note 1)		W I1 I2	W I1 I2	W I1 I2	W I1 I2	W I1		
Resource allocation (Note 2)		(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1)		
Power offsets (Note 3)	dB	-4 0 -3	-4 0 -3	-4 0 -3	-4 0 -3	+3 0		
Payload (Note 4)		ARR	ARR	ARR	ARR	AR		

W=wanted user, I1=interfering user 1, I2=interfering user 2. Note 1:

Note 2:

The resource allocation per user is given as (N\_group\_PHICH, N\_seq\_PHICH).

The power offsets (per user) represent the difference of the power of BPSK modulated symbol per PHICH Note 3:

relative to the first interfering user.

Note 4: A=fixed ACK, R=random ACK/NACK

### Reference measurement channels for PBCH performance A.3.7 requirements

Table A.3.7-1: Reference Channel FDD/TDD

Parameter	Unit	Value							
Reference channel		R.21	R.22	R.23					
Number of transmitter antennas		1	2	4					
Channel bandwidth	MHz	1.4	1.4	1.4					
Modulation		QPSK	QPSK	QPSK					
Target coding rate		40/1920	40/1920	40/1920					
Payload (without CRC)	Rite	2/	2/	2/					

# A.3.8 Reference measurement channels for MBMS performance requirements

### A.3.8.1 FDD

Table A.3.8.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	PMCH								
	Unit			Val	ue				
Reference channel		R.40 FDD			R.37 FDD				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6			50				
Allocated subframes per Radio		6			6				
Frame (Note 1)									
Modulation		QPSK			QPSK				
Target Coding Rate		1/3			1/3				
Information Bit Payload (Note 2)									
For Sub-Frames 1,2,3,6,7,8	Bits	408			3624				
For Sub-Frames 0,4,5,9	Bits	N/A			N/A				
Number of Code Blocks per		1			1				
Subframe (Note 3)									
Binary Channel Bits Per Subframe									
For Sub-Frames 1,2,3,6,7,8	Bits	1224			10200				
For Sub-Frames 0,4,5,9	Bits	N/A			N/A				
MBMS UE Category		≥ 1			≥ 1				

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter				PMC	CH		
	Unit				Value		
Reference channel					R.38 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame (Note 1)					6		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits				9912		
For Sub-Frames 0,4,5,9	Bits				N/A		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 1,2,3,6,7,8	Bits				20400		
For Sub-Frames 0,4,5,9	Bits				N/A		
MBMS UE Category					≥ 1		

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.1-3: Fixed Reference Channel 64QAM R=2/3

Parameter	PMCH									
	Unit	Value								
Reference channel				R.39-1 FDD	R.39 FDD					
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks				25	50					
Allocated subframes per Radio Frame(Note1)				6	6					
Modulation				64QAM	64QAM					
Target Coding Rate				2/3	2/3					
Information Bit Payload (Note 2)										
For Sub-Frames 1,2,3,6,7,8	Bits			9912	19848					
For Sub-Frames 0,4,5,9	Bits			N/A	N/A					
Number of Code Blocks per Sub-Frame (Note 3)				2	4					
Binary Channel Bits Per Subframe				•						
For Sub-Frames 1,2,3,6,7,8	Bits			15300	30600					
For Sub-Frames 0,4,5,9	Bits			N/A	N/A					
MBMS UE Category				≥ 1	≥ 2					

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each

Code Block (otherwise L = 0 Bit).

### A.3.8.2 TDD

Table A.3.8.2-1: Fixed Reference Channel QPSK R=1/3

Parameter	PMCH						
	Unit			Va	lue		
Reference channel		R.40 TDD			R.37 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Uplink-Downlink Configuration(Note 1)		5			5		
Allocated subframes per Radio Frame		5			5		
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits	408			3624		
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A		
Number of Code Blocks per Subframe		1			1		
(Note 3)							
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits	1224			10200		
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A		
MBMS UE Category		≥ 1			≥ 1		

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.2-2: Fixed Reference Channel 16QAM R=1/2

Parameter	PMCH								
	Unit				Value				
Reference channel					R.38 TDD				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks					50				
Uplink-Downlink Configuration(Note 1)					5				
Allocated subframes per Radio Frame					5				
Modulation					16QAM				
Target Coding Rate					1/2				
Information Bit Payload (Note 2)									
For Sub-Frames 3,4,7,8,9	Bits				9912				
For Sub-Frames 0,1,2,5,6	Bits				N/A				
Number of Code Blocks per Subframe (Note 3)					2				
Binary Channel Bits Per Subframe									
For Sub-Frames 3,4,7,8,9	Bits				20400				
For Sub-Frames 0,1,2,5,6	Bits				N/A				
MBMS UE Category					≥ 1				

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211. Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.2-3: Fixed Reference Channel 64QAM R=2/3

Parameter	PMCH							
	Unit			Val	ue			
Reference channel				R.39-1TDD	R.39 TDD			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks				25	50			
Uplink-Downlink Configuration(Note 1)				5	5			
Allocated subframes per Radio Frame				5	5			
Modulation				64QAM	64QAM			
Target Coding Rate				2/3	2/3			
Information Bit Payload (Note 2)								
For Sub-Frames 3,4,7,8,9	Bits			9912	19848			
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A			
Number of Code Blocks per Sub-Frame (Note 3)				2	4			
Binary Channel Bits Per Subframe								
For Sub-Frames 3,4,7,8,9	Bits			15300	30600			
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A			
MBMS UE Category				≥ 1	≥ 2			

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

# A.3.9 Reference measurement channels for sustained downlink data rate provided by lower layers

#### A.3.9.1 FDD

Table A.3.9.1-1: Fixed Reference Channel for sustained data-rate test (FDD 64QAM)

Parameter	Unit				Va	alue			
Reference channel		R.31-1	R.31-2	R.31-3	R.31-	R.31-3C	R.31-4	R.31-4B	R.31-5
		FDD	FDD	FDD	3A FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 10	Note 7	Note 11	Note 9
Allocated subframes per Radio Frame		10	10	10	10	10	10	10	10
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate									
For Sub-Frame 1,2,3,4,6,7,8,9,		0.40	0.59	0.59	0.85	0.87	0.88	0.85	0.85
For Sub-Frame 5		0.40	0.64	0.62	0.89	0.88	0.87	0.87	0.91
For Sub-Frame 0		0.40	0.63	0.61	0.90	0.91	0.90	0.88	0.88
Information Bit Payload (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056	55056
Number of Code Blocks									
(Notes 3 and 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9	9
Binary Channel Bits (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352	62352
Number of layers		1	2	2	2	2	2	2	2
Max. Throughput averaged over 1	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826	54.826
frame (Note 8)									
UE Categories		≥ 1	≥ 2	≥2	≥ 2	≥ 3	≥ 3	≥ 4	≥ 3

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Resource blocks  $n_{PRB} = 0..2$  are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 5: Resource blocks n<sub>PRB</sub> = 6..14,30..49 are allocated for the user data in all sub-frames.
- Note 6: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Given per component carrier per codeword.
- Note 9: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 10: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.
- Note 11: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in sub-frames 0.1,2,3,4,6,7,8,9.

Table A.3.9.1-2: Fixed Reference Channel for sustained data-rate test (FDD 64QAM)

Parameter	Unit		Value
Reference channel		R.31-6	
		FDD	
Channel bandwidth	MHz	5	
Allocated resource blocks (Note 5)		Note 4	
Allocated subframes per Radio Frame		9	
Modulation		64QAM	
Coding Rate			
For Sub-Frame 1,2,3,4,6,7,8,9,		0.85	
For Sub-Frame 5		N/A	
For Sub-Frame 0		0.83	
Information Bit Payload (Note 5)			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	18336	
For Sub-Frame 5	Bits	N/A	
For Sub-Frame 0	Bits	15840	
Number of Code Blocks			
(Notes 3 and 5)			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	3	
For Sub-Frame 5	Bits	N/A	
For Sub-Frame 0	Bits	3	
Binary Channel Bits (Note 5)			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	21600	
For Sub-Frame 5	Bits	N/A	
For Sub-Frame 0	Bits	19152	
Number of layers		2	
Max. Throughput averaged over 1 frame (Note 5)	Mbps	17.837	
UE Categories		≥ 2	

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Resource blocks  $n_{PRB} = 0..24$  in sub-frames 0,1,2,3,4,6,7,8,9.

Note 5: Given per component carrier per codeword.

Note 6: Ng=1/6.

Table A.3.9.1-3: Fixed Reference Channel for sustained data-rate test (FDD 256QAM)

Parameter	Unit				Value	
Reference channel		R.68	R.68-1	R.68-2	R.68-3	
		FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	20	15	10	5	
Allocated resource blocks (Note 4)		Note 5	Note 6	Note 7	Note 8	
Allocated subframes per Radio Frame		10	10	10	10	
Modulation		256QAM	256QAM	256QAM	256QAM	
Coding Rate						
For Sub-Frames 3,4,8,9		0.85	0.88	0.85	0.85	
For Sub-Frames 1,2,6,7		0.74	0.74	0.74	0.77	
For Sub-Frame 5		0.75	0.77	0.77	0.79	
For Sub-Frame 0		0.76	0.77	0.78	0.84	
Information Bit Payload (Note 4)						
For Sub-Frames 3,4,8,9	Bits	97896	75376	48936	24496	
For Sub-Frames 1,2,6,7		84760	63776	42368	21384	
For Sub-Frame 5	Bits	81176	61664	40576	19848	
For Sub-Frame 0	Bits	84760	63776	42368	21384	
Number of Code Blocks (Notes 3 and 4)						
For Sub-Frames 3,4,8,9	Bits	16	13	8	4	
For Sub-Frames 1,2,6,7		14	11	7	4	
For Sub-Frame 5	Bits	14	11	7	4	
For Sub-Frame 0	Bits	14	11	7	4	
Binary Channel Bits (Note 4)						
For Sub-Frames 3,4,8,9	Bits	115200	86400	57600	28800	
For Sub-Frames 1,2,6,7		115200	86400	57600	28800	
For Sub-Frame 5	Bits	109440	80640	52992	25344	
For Sub-Frame 0	Bits	111936	83136	54336	25536	
Number of layers		2	2	2	2	
Max. Throughput averaged over 1 frame (Note 4)	Mbp	89.656	68.205	44.816	22.475	
	S	11-12	11-12	11-12	11-12	
UE Categories		13-14	13-14		13-14	
UE DL Categories		13-14	13-14	13-14	13-14	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Given per component carrier per codeword.
- Note 5: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 6: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0.1,2,3,4,6,7,8,9. Note 7: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0.1,2,3,4,6,7,8,9.
- Note 8: Resource blocks  $n_{PRB} = 2..24$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..24$  in sub-frames 0,1,2,3,4,6,7,8,9.

### A.3.9.2 TDD

Table A.3.9.2-1: Fixed Reference Channel for sustained data-rate test (TDD 64QAM)

Parameter	Unit					Value				
Reference channel		R.31-1	R.31-2	R.31-3	R.31-	R.31-4	R.31-	R.31-5	R.31-	R.31-6
		TDD	TDD	TDD	3A	TDD	4A	TDD	5A	TDD
					TDD		TDD		TDD	
Channel bandwidth	MHz	10	10	20	15	20	20	15	15	10
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	Note 8	Note 8	Note	Note	Note 7
								11	11	
Uplink-Downlink		5	5	5	1	1	2	1	2	1
Configuration (Note 3)							_		_	-
Number of HARQ Processes	Proce	15	15	15	7	7	10	7	10	7
per component carrier	sses									
Allocated subframes per		8+1	8+1	8+1	4	4	6+2	4	6+2	4
Radio Frame (D+S)										
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate				·			·			
For Sub-Frames 4,9		0.40	0.59	0.59	0.87	0.88	0.88	0.85	0.85	0.85
For Sub-Frames 3,8		0.40	0.59	0.59	N/A	N/A	0.88	N/A	0.85	N/A
For Sub-Frame 7		0.40	0.59	0.59	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frames 0		0.40	0.62	0.61	0.90	0.90	0.90	0.88	0.88	0.90
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.40	0.64	0.62	0.88	0.87	0.87	0.87	0.87	0.88
For Sub-Frames 6		0.40	0.60	0.60	N/A	N/A	N/A	N/A	N/A	N/A
Information Bit Payload		0.40	0.00	0.00	1 1// 1	1 1// 1	1 1// 1	14// (	1 1// 1	14// \
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376	75376	55056	55056	36696
For Sub-Frames 3,8	Bits	10296	25456	51024	0	0	75376	0	55056	0
For Sub-Frame 7	Bits	10296	25456	51024	0	0	N/A	0	N/A	0
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376	75376	55056	55056	36696
For Sub-Frame 1	Bits	0	0	0	0	0	0	0	0	0
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112	71112	52752	52752	35160
For Sub-Frame 6	Bits	10296	25456	51024	0	0	0	0	0	0
Number of Code Blocks per	DIIS	10290	23430	31024	0	0	U	U	0	U
Sub-Frame										
(Note 4)										
For Sub-Frames 4,9	<del>                                     </del>	2	5	9	9	13	13	9	9	6
For Sub-Frames 3,8	<del>                                     </del>	2	5	9	N/A	N/A	13	N/A	9	N/A
For Sub-Frame 7	<del>                                     </del>	2	5	9	N/A	N/A	N/A	N/A N/A	N/A	N/A
For Sub-Frame 0	<del>                                     </del>	2	5	9	9	13	13	9	9	6
For Sub-Frame 1	<del>                                     </del>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5	<u> </u>		5 5			10/A 12	12		9	6
For Sub-Frame 6	Bits	2	5	9	9 n/a	N/A	N/A	9 N/A	N/A	N/A
Binary Channel Bits Per Sub-	DIIS		3	9	II/a	IN/A	IN/A	IN/A	IN/A	IN/A
Frame	D:to	26100	43200	86400	58752	96400	96400	64900	64800	43200
For Sub-Frames 4,9	Bits					86400	86400	64800		
For Sub-Frames 3,8	Bits	26100	43200	86400	0	0	86400	0	64800	0
For Sub-Frame 7	Bits	26100	43200	86400	0	0	86400	0	64800	0
For Sub-Frame 0	Bits	26100	41184	84384	56736	84384	84384	62784	62784	41184
For Sub-Frame 1	Bits	0	0	0	0	0	0	0	0	0
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512	82512	60912	60912	40176
For Sub-Frame 6	Bits	26100	42768	85968	N/A	N/A	0	N/A	0	N/A
Number of layers	N 4L	1	2	2	2	2	2	2	2	2
Max. Throughput averaged over 1 frame (Note 10)	Mbps	8.237	20.365	40.819	20.409	29.724	52.337	25.330	38.309	14.525
UE Category		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3	≥ 3	≥ 3	≥ 3	≥ 2
Note 1: 1 symbol allocated to	2 PDCCH	for all test		•	•	•	•		•	•

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Resource blocks  $n_{PRB} = 0..2$  are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Resource blocks  $n_{PRB} = 6..14,30..49$  are allocated for the user data in all subframes. Note 6:

Note 7: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in the available downlink sub-frames according to uplink downlink configurations used .

Note 8:	Resource blocks n <sub>PRB</sub> = 499 are allocated for the user data in sub-frame 5, and resource blocks n <sub>PRB</sub> = 099 in sub-
	frames 0 3 4 6 7 8 9

Note 9: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in all sub-frames

Note10: Given per component carrier per codeword.

Note11: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in other downlink sub-frames.

Table A.3.9.2-2: Fixed Reference Channel for sustained data-rate test (TDD 256QAM)

Parameter	Unit											
Reference channel		R.68	R.68-1	R.68-2	R.68-3	R.68-4						
		TDD	TDD	TDD	TDD	TDD						
Channel bandwidth	MHz	20	15	10	20	15						
Allocated resource blocks	PRB	Note 6	Note 7	Note 8	Note 6	Note 7						
Uplink-Downlink Configuration (Note 3)		1	1	1	[2]	[2]						
Number of HARQ Processes per	Proces	7	7	7	[10]	[10]						
component carrier	ses				' '							
Allocated subframes per Radio Frame		4+2	4+2	4+2	[6+2]	[6+2]						
(D+S)												
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM						
Target Coding Rate												
For Sub-Frame 0		0.76	0.77	0.78	0.76	0.77						
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A						
For Sub-Frames 3		N/A	N/A	N/A	0.74	0.79						
For Sub-Frames 4		0.74	0.79	0.74	0.74	0.79						
For Sub-Frame 5		0.74	0.76	0.76	0.74	0.76						
For Sub-Frame 6		N/A	N/A	N/A	[N/A]	[N/A]						
For Sub-Frame 7		N/A	N/A	N/A	[N/A]	[N/A]						
For Sub-Frames 8		N/A	N/A	N/A	0.85	0.88						
For Sub-Frames 9		0.85	0.88	0.85	0.85	0.88						
Information Bit Payload												
For Sub-Frame 0	Bits	84760	63776	42368	84760	63776						
For Sub-Frame 1	Bits	0	0	0	0	0						
For Sub-Frames 3	Bits	N/A	N/A	N/A	84760	63776						
For Sub-Frames 4	Bits	84760	63776	42368	84760	63776						
For Sub-Frame 5	Bits	81176	61664	40576	81176	61664						
For Sub-Frame 6	Bits	0	0	0	[0]	[0]						
For Sub-Frame 7	2.10	N/A	N/A	N/A	[N/A]	[N/A]						
For Sub-Frames 8	Bits	N/A	N/A	N/A	97896	75376						
For Sub-Frames 9	Bits	97896	75376	48936	97896	75376						
Number of Code Blocks per Sub-Frame					0.000							
(Note 4)												
For Sub-Frame 0		14	11	7	14	11						
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A						
For Sub-Frames 3		N/A	N/A	N/A	14	11						
For Sub-Frames 4		14	11	7	14	11						
For Sub-Frame 5		14	11	7	14	11						
For Sub-Frame 6		N/A	N/A	N/A	[N/A]	[11]						
For Sub-Frame 7		N/A	N/A	N/A	[N/A]	[11]						
For Sub-Frames 8		N/A	N/A	N/A	16	13						
For Sub-Frames 9		16	13	8	16	13						
Binary Channel Bits Per Sub-Frame				_								
For Sub-Frame 0	Bits	112512	83712	54912	112512	83712						
For Sub-Frame 1	Bits	0	0	0	0	0						
For Sub-Frames 3	Bits	N/A	N/A	N/A	115200	86400						
For Sub-Frames 4	Bits	115200	86400	57600	115200	86400						
For Sub-Frame 5		110016	81216	53568	110016	81216						
For Sub-Frame 6	Bits	0	0	0	[0]	[0]						
For Sub-Frame 7		N/A	N/A	N/A	[N/A]	[N/A]						
For Sub-Frames 8	Bits	N/A	N/A	N/A	115200	86400						
For Sub-Frames 9	Bits	115200	86400	57600	115200	86400						
Number of layers		2	2	2	2	2						
Max. Throughput averaged over 1 frame	Mbps	34.859	26.459	17.425	[53.125]	[40.374]						
(Note 5)		2			[221.20]	[						
UE Categories		11-12	11-12	11-12	11-12	11-12						
UE DL Categories		13-14	13-14	13-14	13-14	13-14						
Note 1: 1 symbol allocated to PDCCH for	r all tacte											

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword.

Note 6: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in other

downlink sub-frames.

Note 7: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in other

downlink sub-frames.

Note 8: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in the

available downlink sub-frames according to uplink downlink configurations used.

# A.3.9.3 FDD (EPDCCH scheduling)

Table A.3.9.3-1: Fixed Reference Channel for sustained data-rate test with EPDCCH scheduling (FDD)

Parameter	Unit				Value			
Reference channel		R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-
		1 FDD	2 FDD	3 FDD	3A FDD	3C FDD	4 FDD	4B FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 9	Note 7	Note 10
Allocated subframes per Radio		10	10	10	10	10	10	10
Frame								
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate								
(subframes with PDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.3972	0.5926	0.5933	0.8533	0.8725	0.8763	0.8533
For Sub-Frame 5		0.3972	0.6441	0.6246	0.8889	0.8855	0.8702	0.8762
For Sub-Frame 0		0.3972	0.6282	0.6106	0.9046	0.9105	0.9018	0.8868
Coding Rate								
(subframes with EPDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.4114	0.6047	0.5993	0.8707	0.8855	0.8851	0.8649
For Sub-Frame 5		0.4114	0.6584	0.6312	0.9086	0.8990	0.8794	0.8889
For Sub-Frame 0		0.4114	0.6418	0.6170	0.9242	0.9246	0.9112	0.8993
Information Bit Payload (Note 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056
Number of Code Blocks								
(Notes 3 and 8)						_		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9
Binary Channel Bits (Note 8)								
(subframes with PDCCH USS								
monitoring)	D.,	00400	40000	00400	10000		00400	0.4000
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352
Binary Channel Bits (Note 8)								
(subframes with EPDCCH USS								
monitoring)	Dito	25200	40000	05506	40006	F7000	05500	62026
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	25200	42336	85536	42336	57888	85536	63936
For Sub-Frame 5	Bits	25200	38880	81216	38880	57024	81216	59616
For Sub-Frame 0 Number of layers	Bits	25200	39888 2	83088 2	39888 2	55440 2	83088 2	61488 2
	Mess	10.206						
Max. Throughput averaged over 1 frame (Note 8)	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826
UE Categories	00111	≥ 1	≥ 2	≥2	≥ 2	≥ 3	≥ 3	≥ 4

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Resource blocks n<sub>PRB</sub> = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 5: Resource blocks  $n_{PRB} = 6..14,30..49$  are allocated for the user data in all sub-frames.

Note 6: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,1,2,3,4,6,7,8,9.

Note 7: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,1,2,3,4,6,7,8,9.

Note 8: Given per component carrier per codeword.

Note 9: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 10: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in sub-frames 0,1,2,3,4,6,7,8,9.

# A.3.9.4 TDD (EPDCCH scheduling)

Table A.3.9.4-1: Fixed Reference Channel for sustained data-rate with EPDCCH scheduling (TDD)

Reference channel         R.31E-1 TDD         R.31E-2 TDD         R.31E-3 TDD         R.31E-3 TDD	R.31E-4 TDD
TDD   TDD   TDD   TDD	
Allocated resource blocks  Uplink-Downlink Configuration (Note 3)  Number of HARQ Processes per component carrier  Allocated subframes per Radio Frame (D+S)  Coding Rate (subframes with PDCCH USS	
Uplink-Downlink Configuration (Note 3)  Number of HARQ Processes per component carrier  Allocated subframes per Radio Frame (D+S)  Coding Rate (subframes with PDCCH USS	20
Uplink-Downlink Configuration (Note 3)  Number of HARQ Processes per component carrier  Allocated subframes per Radio Frame (D+S)  Coding Rate (subframes with PDCCH USS	Note 8
Number of HARQ Processes per component carrier  Allocated subframes per Radio Frame (D+S)  Coding Rate (subframes with PDCCH USS	1
Number of HARQ Processes per component carrier  Allocated subframes per Radio 8+1 8+1 4  Frame (D+S)  Coding Rate (subframes with PDCCH USS	
component carrier  Allocated subframes per Radio 8+1 8+1 4  Frame (D+S)  Coding Rate (subframes with PDCCH USS	7
Frame (D+S) Coding Rate (subframes with PDCCH USS	
Frame (D+S) Coding Rate (subframes with PDCCH USS	4
(subframes with PDCCH USS	
monitoring)	
For Sub-Frames 4,9 0.3972 0.5926 0.5933 0.8725	0.8763
For Sub-Frames 3,7,8 0.3972 0.5926 0.5933 N/A	N/A
For Sub-Frames 1 N/A N/A N/A N/A	N/A
For Sub-Frames 5 0.3972 0.6372 0.6213 0.8790	0.8656
For Sub-Frames 6 0.3972 0.5986 0.5963 N/A	N/A
For Sub-Frames 0 0.3972 0.6216 0.6075 0.9036	0.8972
Coding Rate	
(subframes with EPDCCH USS	
monitoring)	
For Sub-Frames 4,9 0.4114 0.6047 0.5993 0.8856	0.8851
For Sub-Frames 3,7,8 0.4114 0.6047 0.5993 N/A	N/A
For Sub-Frames 1 N/A N/A N/A N/A	N/A
For Sub-Frames 5 0.4114 0.6512 0.6279 0.8922	0.8748
For Sub-Frames 6 0.4114 0.6109 0.6024 N/A	N/A
For Sub-Frames 0 0.4114 0.6349 0.6138 0.9175	0.9065
Information Bit Payload	
For Sub-Frames 4,9 Bits 10296 25456 51024 51024	75376
For Sub-Frames 3,7,8 Bits 10296 25456 51024 N/A	N/A
For Sub-Frame 1         Bits         0         0         N/A	N/A
For Sub-Frame 5 Bits 10296 25456 51024 51024	71112
For Sub-Frame 6 Bits 10296 25456 51024 N/A	N/A
For Sub-Frame 0 Bits 10296 25456 51024 51024	75376
Number of Code Blocks per Sub-	
Frame (Note 4)	
For Sub-Frames 4,9 2 5 9 9	13
For Sub-Frames 3,7,8 2 5 9 N/A	N/A
For Sub-Frame 1 N/A N/A N/A N/A	N/A
For Sub-Frame 5 2 5 9 9	12
For Sub-Frame 6         Bits         2         5         9         N/A	N/A
For Sub-Frame 0 2 5 9 9	13
Binary Channel Bits per Sub-Frame	
(subframes with PDCCH USS	
monitoring)	
For Sub-Frames 4,9 Bits 26100 43200 86400 58752	86400
For Sub-Frames 3,7,8         Bits         26100         43200         86400         N/A	N/A
For Sub-Frame 1         Bits         0         0         0         N/A	N/A
For Sub-Frame 5 Bits 26100 40176 82512 58320	82512
For Sub-Frame 6 Bits 26100 42768 85968 N/A	N/A
For Sub-Frame 0 Bits 26100 41184 84384 56736	84384
Binary Channel Bits per Sub-Frame	
(subframes with EPDCCH USS	

monitoring)						
For Sub-Frames 4,9	Bits	25200	42336	85536	57888	85536
For Sub-Frames 3,7,8	Bits	25200	42336	85536	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	25200	39312	81648	57456	81648
For Sub-Frame 6	Bits	25200	41904	85104	N/A	N/A
For Sub-Frame 0	Bits	25200	40320	83520	55872	83520
Number of layers		1	2	2	2	2
Max. Throughput averaged over 1	Mbps	8.237	20.365	40.819	20.409	29.724
frame (Note 10)						
UE Category		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n<sub>PRB</sub> = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks  $n_{PRB} = 6..14,30..49$  are allocated for the user data in all subframes.
- Note 7: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,3,4,6,7,8,9.
- Note 8: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,3,4,6,7,8,9.
- Note 9: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in all sub-frames
- Note10: Given per component carrier per codeword.

# A.3.10 Reference Measurement Channels for EPDCCH performance requirements

## A.3.10.1 FDD

Table A.3.10.1-1: Reference Channel FDD

Parameter	Unit	Value												
Reference channel		R.55 FDD	R.56 FDD	R.57 FDD	R.58 FDD	R.59 FDD	R.55-1 FDD							
Number of transmitter antennas		2	2	2	2	2	2							
Channel bandwidth	MHz	10	10	10	10	10	10							
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	2							
Aggregation level	ECCE	4	16	2	8	2	4							
DCI Format		2A	2A	2C	2C	2D	2C							

#### A.3.10.2 TDD

Table A.3.10.2-1: Reference Channel TDD

Parameter	Unit			Va	lue		
Reference channel		R.55 TDD	R.56 TDD	R.57 TDD	R.58 TDD	R.59 TDD	R.55 TDD
Number of transmitter antennas		2	2	2	2	2	2
Channel bandwidth	MHz	10	10	10	10	10	10
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	2
Aggregation level	CCE	4	16	2	8	2	4
DCI Format		2A	2A	2C	2C	2D	2C

# A.3.11 Reference Measurement Channels for MPDCCH performance requirements

# A.3.11.1 FDD and half-duplex FDD

Table A.3.11.1-1: Reference Channel FDD and half-duplex FDD

Parameter	Unit	Value
Reference channel		R.xx FDD
Number of transmitter antennas		2
Channel bandwidth	MHz	10
OFDM starting symbol (startSymbolLC)	symbols	2
Aggregation level	ECCE	16
DCI Format		6-1A

### A.3.11.2 TDD

Table A.3.11.2-1: Reference Channel TDD

Parameter	Unit	Value
Reference channel		R.xx TDD
Number of transmitter antennas		2
Channel bandwidth	MHz	10
OFDM starting symbol (startSymbolLC)	symbols	2
Aggregation level	ECCE	16
DCI Format		6-1A

# A.4 CSI reference measurement channels

This section defines the DL signal applicable to the reporting of channel status information (Clause 9.2, 9.3 and 9.5).

In Table A.4-1 are specified the reference channels. Table A.4-13 specifies the mapping of CQI index to modulation coding scheme, which complies with the CQI definition specified in Section 7.2.3 of [6].

Table A.4-0: Void

Table A.4-1: CSI reference measurement channels

RMC Name	Duplex	CH- BW	Alloc. RB-s	UL/DL Config	Alloc. SF-s	MCS Scheme	Nr. HARQ Proc.	Max. nr HARQ Trans.	Notes
1 CRS Port									
RC.1 FDD	FDD	10	50	-		MCS.1	8	1	
RC.1A FDD	FDD	10	50			MCS.1A	8	1	
RC.1 TDD	TDD	10	50	Note 3		MCS.1	10	1	
RC.1A TDD	TDD	20	100	Note 3		MCS.1B	10	1	
RC.3 FDD	FDD	10	6	-		MCS.10	8	1	
RC.3 TDD	TDD	10	6	Note 3		MCS.10	10 or 7 (Note 9)	1	
RC.4 FDD	FDD	10	15	-		MCS.15	8	1	Note 6
RC.4 TDD	TDD	10	15	Note 3		MCS.15	10	1	Note 6
RC.5 FDD	FDD	10	3	-		MCS.17	8	1	
RC.5 TDD	TDD	10	3	Note 3		MCS.17	10	1	
RC.14 FDD	FDD	5	25	-		MCS.14	8	1	
RC.15 FDD	FDD	5	15	-		MCS.15	8	1	Note 6
RC.16 FDD	FDD/HD- FDD	10	2			MCS.20	8	1	Note 8,10
RC.16 TDD	TDD	10	2	Note 3		MCS.20	10	1	Note 8
[RC.21] FDD	FDD/HD- FDD	10	3			MCS.26	8	1	Note 12, 13
[RC.21] TDD	TDD	10	3			MCS.26	10	1	Note 12
2 CRS Port	ts								
RC.2 FDD	FDD	10	50	-		MCS.2	8	1	
RC.2 TDD	TDD	10	50	Note 3		MCS.2	10 or 7 (Note 9)	1	
RC.6 FDD	FDD	10	15	-		MCS.16	8	1	Note 6
RC.6 TDD	TDD	10	15	Note 3		MCS.16	7	1	Note 6
4 CRS Port	s								
RC.17 FDD	FDD	10	50	-		MCS.18	8	1	
RC.17 TDD	TDD	10	50	Note 3		MCS.18	7	1	
RC.21 FDD	FDD	10	50	-		MCS.26	8	1	
RC.21 TDD	TDD	10	50	Note 3		MCS.26	7	1	
1 CRS Port	+ CSI-RS								
RC.8 FDD	FDD	10	6	-	Non CSI-RS	MCS.11	. 8	1	
					2 CSI-RS	MCS.12			
RC.8A FDD	FDD	10	6	-	Non CSI-RS	MCS.11A	8	1	
					2 CSI-RS Non	MCS.12A			
RC.8 TDD	TDD	10	6	Note 3	CSI-RS	MCS.11	10	1	
			-		2 CSI-RS Non	MCS.12			
RC.8A TDD	TDD	20	8	Note 3	CSI-RS	MCS.11B	10	1	
			-		2 CSI-RS Non	MCS.12B			
RC.9 FDD	FDD	10	50	-	CSI-RS	MCS.3	. 8	1	
RC.9 TDD	TDD	10	50	Note 3	2 CSI-RS Non	MCS.4 MCS.3	7	1	
טטו פּ.סאו	טטו	10	50	INDIG 3	CSI-RS	IVICO.S	,	'	

					2 CSI-RS	MCS.4			
2 CRS Port	, CSLDS				2 CSI-RS	IVICS.4			
2 CR3 POIL	+ CSI-KS				Non	MOCE			
RC.7 FDD	FDD	10	50	-	CSI-RS	MCS.5	8	1	
					4 CSI-RS Non	MCS.7			
RC.7 TDD	TDD	10	50	Note 3	CSI-RS	MCS.5	10	1	
					8 CSI-RS	MCS.8			
RC.11 FDD	FDD	10	50	_	Non CSI-RS	MCS.5	8	1	
NO.TT DD	100	10	00		2 CSI-RS	MCS.6	O	'	
DO 44 TDD	7	40	50	Nata 0	Non CSI-RS	MCS.5	40	4	
RC.11 TDD	TDD	10	50	Note 3	2 CSI-RS	MCS.6	10	1	
20 10 522					Non CSI-RS	MCS.13			
RC.18 FDD	FDD	10	6	-	4 CSI-RS	MCS.19	8	1	
					Non	MCS.13			
RC.18 TDD	TDD	10	6	Note 3	CSI-RS 4 CSI-RS	MCS.19	7	1	
RC.17 TDD	TDD	10	6	Note 3	4 ZP-CSI-	MCS.21	10	1	
					RS 4 ZP-CSI-				
RC.18 TDD	TDD	10	6	Note 3	RS	MCS.22	10	1	
RC.19 TDD	TDD	10	41	Note3	4 ZP-CSI- RS	MCS.23	10	1	Note 11
					Non CSI-RS	MCS.24			
RC.20 TDD	TDD	10	50	Note3	2 CSI-RS,	M00.05	10	1	
					4 ZP-CSI- RS	MCS.25			
RC.22 FDD	FDD	10	50	_	Non CSI-RS	MCS.5	8	1	
110.22 1 00					4 CSI-RS	MCS.27		'	
RC.22 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.5	10	1	
					4 CSI-RS	MCS.27			
1 CRS Port	+ CSI-RS	+ CSI-IM		T	Non CCI			T	
RC.13 FDD	FDD	10	50	_	Non CSI- RS/IM	MCS.3	8	1	
10.101 00	100	10	30		CSI- RS/IM	N/A	O	'	
					Non CSI-	MCS.3			
RC.13 TDD	TDD	10	50	Note 3	RS/IM CSI-	N/A	10	1	
2 CDC Dowt	. CEL DE	. CCL IM			RS/IM	IN/A			
2 CRS Port	+ 031-83	+ 691-114			Non	1400 -		l l	
DC 10 EDD	EDD	10	50		CSI-RS	MCS.5	0	_	
RC.10 FDD	FDD	10	50	-	4 CSI-RS, 1 CSI	MCS.8	8	1	
					process Non				
DO 46 TD5	TD5	40	F0	Net 0	CSI-RS	MCS.5	40		
RC.10 TDD	TDD	10	50	Note 3	8 CSI-RS, 1 CSI	MCS.9	10	1	
					process Non CSI-				
RC.12 FDD	FDD	10	6	_	RS/IM	MCS.13	8	1	
	. 23				CSI- RS/IM	N/A	Ŭ		
					Non CSI- RS/IM	MCS.13			
RC.12 TDD	TDD	10	6	Note 3	CSI-	N/A	10	1	
Note 1: 3	symbols a	llocated to	PDCCH		RS/IM	14/7			

3 symbols allocated to PDCCH. Note 1:

For FDD only subframes 1, 2, 3, 4, 6, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead. Note 2:

TDD UL-DL configuration as specified in the individual tests. Note 3:

- Note 4: For TDD when UL-DL configuration 1 is used only subframes 4 and 9 are allocated to avoide PBCH and synchronizaiton signal overhead.
- Note 5: For TDD when UL-DL configuration 2 is used only subframes 3, 4, 8, and 9 are allocated to avoid PBCH and synchronization signal overhead.
- Note 6: Centered within the Transmission Bandwidth Configuration (Figure 5.6-1).
- Note 7: Only subframes 2, 3, 4, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.
- Note 8: Allocate PDSCH on 5th and 6th PRBs within a subband.
- Note 9: The number of HARQ processes is 10 for TDD UL/DL configuration 2 and 7 for TDD UL/DL configuration 1.
- Note 10: The downlink subframes are scheduled at the 1st, 2nd, 8th, 9th, 16th, 17th, 18th, 24th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.(starting from 0th subframe)
- Note 11: 41 resource blocks (RB0-RB20 and RB30-RB49) are allocated in subframe 0 and 5 in RC.19 TDD.
- Note 12: Allocate PDSCH on 3th, 4th and 6th PRBs within a narrowband. Allocate MPDCCH on the 0th and 1st PRBs within a narrowband.
- Note 13: The downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled (starting from 0th subframe). The 3rd-7th, 11th-15th, 19th-23rd, 27th-31st, 35th-36th subframes every 40ms are set as invalid subframe.

Table A.4-1a: Void

Table A.4-1b: Void

Table A.4-1c: Void

Table A.4-1d: Void

Table A.4-1e: Void

Table A.4-2: Void

Table A.4-2a: Void

Table A.4-2b: Void

Table A.4-2c: Void

Table A.4-2d: Void

Table A.4-2e: Void

Table A.4-3: Void

Table A.4-3a: Void

Table A.4-3b: Void

Table A.4-3c: Void

Table A.4-3d: Void

Table A.4-3e: Void

Table A.4-3f: Void

Table A.4-3g: Void

Table A.4-3h: Void

Table A.4-3i: Void

Table A.4-3j: Void

Table A.4-3k: Void

Table A.4-3I: Void

Table A.4-3m: Void

Table A.4-4: Void

Table A.4-4a: Void

Table A.4-4b: Void

Table A.4-5: Void

Table A.4-5a: Void

Table A.4-5b: Void

Table A.4-6: Void

Table A.4-6a: Void

Table A.4-6b: Void

Table A.4-6c: Void

Table A.4-6d: Void

Table A.4-6e: Void

Table A.4-6f: Void

Table A.4-7: Void

Table A.4-8: Void

Table A.4-9: Void

Table A.4-10: Void

Table A.4-11: Void

Table A.4-12: Void

Table A.4-13: Mapping of CQI Index to Modulation coding scheme (MCS)

CQI	Index		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Co	oding R	Rate	00R	0.0762	0.1172	0.1885	0.3008	0.4385	0.5879	0.3691	0.4785	0.6016	0.4551 0.6537 0.6504 0.7539 0.8525					Notes	
Mode	ulation		OOR	QPSK						16QAM			64QAM						
MCS Scheme	PRB	Available RE-s								Imcs									
MCS.1	50	6300	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.2	50	6000	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.3	50	5700	DTX	0	0	2	4	6	8	10	13	15	17	19	21	23	25	26	
MCS.4	50	5600	DTX	0	0	2	4	6	7	10	12	14	17	19	21	23	25	26	
MCS.5	50	5400	DTX	0	0	2	3	5	7	10	12	14	17	19	21	23	24	25	
MCS.6	50	5300	DTX	0	0	1	3	5	7	10	12	14	17	19	21	22	24	25	
MCS.7	50	5200	DTX	0	0	1	3	5	7	10	12	14	17	18	20	22	24	25	
MCS.8	50	5000	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.9	50	4800	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.10	6	756	DTX	0	0	2	4	6	8	11	13	16	19	21	23	25	27	27	
MCS.11	6	684	DTX	0	0	2	4	6	8	11	13	14	17	20	21	23	25	27	
MCS.12	6	672	DTX	0	0	1	4	6	8	10	12	14	17	19	21	23	25	26	
MCS.13	6	648	DTX	0	0	1	3	5	7	10	12	14	17	19	21	22	24	25	
MCS.14	25	3150	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.15	15	1890	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.16	15	1800	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.17	3	378	DTX	0	1	2	5	7	9	12	13	16	19	21	23	25	27	27	
MCS.18	50	5800	DTX	0	0	2	4	6	8	11	13	15	17	20	22	23	26	27	
MCS.19	6	624	DTX	0	0	1	3	5	7	10	12	14	17	18	20	22	24	25	
MCS.20	2	252	DTX	0	0	2	4	6	8	11	13	16	19	21	23	23	23	23	
MCS.21	6	696	DTX	0	0	2	4	6	8	11	13	15	18	20	21	24	25	27	

MCS	.22	6	624	DTX	0	0	1	3	5	7	10	12	14	15	19	20	22	24	24	
MCS	.23	41	4264	DTX	0	0	1	3	5	7	10	12	14	15	18	20	22	24	24	
MCS	.24	50	5400	DTX	0	0	2	3	5	7	10	12	14	15	19	21	23	24	25	
MCS	.25	50	5100	DTX	0	0	1	3	5	7	8	12	13	15	18	20	22	23	24	
MCS	26	50	5800	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS 27	CW0	50	4600	DTX	0	0	1	3	5	6	10	11	13	17	18	19	21	23	23	
MCS.27	CW1	50	4600	DTX	0	0	1	3	5	6	10	11	13	17	18	19	21	22	23	

Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6].

Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement except for [MCS.23]. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-14: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS indx Table 2 and 4-bit CQI Table 2 are used)

CQI Index			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Coding Rate		OOR	0.0762	0.1885	0.4385	0.3691	0.4785	0.6016	0.4551	0.5537	0.6504	0.7539	0.6394	0.6943	0.7783	0.8643	0.9258	Notes	
Me	odulatio	on	OOR		QPSK		1	16QAM			64C	MAQ		256QAM					
MCS Scheme	PRB	Available RE-s								Imcs									
MCS.1A	50	6300	DTX	0	1	3	5	7	10	11	14	16	18	20	22	24	26	26	
MCS.1B	100	12600	DTX	0	1	3	5	7	10	11	14	15	18	20	22	24	26	26	

Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6].

Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-15: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS indx Table 2 and 4-bit CQI Table 2 are used)

С	QI Inde	х	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Coding Rate		OOR	0.0762	0.1885	0.4385	0.3691	0.4785	0.6016	0.6826	0.5537	0.6504	0.7539	0.8525	0.6943	0.7783	0.8643	0.9258	Notes	
Me	Modulation				QPSK 16QAM					64QAM 256QAM									
MCS Scheme	PRB	Available RE-s								Imcs	3								
MCS.11A	6	684	DTX	0	1	3	5	7	8	10	13	14	16	18	20	22	24	25	
MCS.12A	6	672	DTX	0	1	3	5	6	8	10	12	14	16	18	20	22	24	25	
MCS.11B	8	912	DTX	0	1	3	5	7	9	10	13	14	16	18	19	22	24	26	
MCS.12B	8	896	DTX	0	1	3	5	6	8	10	12	14	16	18	19	22	24	25	

Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6].

Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-16: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS indx Table 3)

CQI Index			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Coding Rate			OOR	0.0391	0.0762	0.1172	0.1885	0.3008	0.4385	0.5879	0.3691	0.4785	0.6015	Reserved	Reserved	Reserved	Reserved	Reserved	Notes
Modulation																			
MCS Scheme																			
MCS.26	3	378	DTX	0	0	0	2	4	6	8	11	13	16	N/A	N/A	N/A	N/A	N/A	
Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6].  Note 2: startSymbolLC = 3																			

# A.5 OFDMA Channel Noise Generator (OCNG)

## A.5.1 OCNG Patterns for FDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i RA / OCNG RA = PDSCH_i RB / OCNG RB$$

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for each CC.

# A.5.1.1 OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.1.1-1: OP.1 FDD: One sided dynamic OCNG FDD Pattern

Relative power level $\gamma_{\it PRB}$ [dB]											
0	0 5 1-4,6-9										
	Allocation										
First unallocated PRB	First unallocated PRB	First unallocated PRB	]								
Last unallocated PRB	Last unallocated PRB	Last unallocated PRB									
Last difallocated FND	Last difailocated FIND	Last unanocateu i ND									
0	0	0	Note 1								

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

## A.5.1.2 OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{\rm \tiny RR}$  -1.

Table A.5.1.2-1: OP.2 FDD: Two sided dynamic OCNG FDD Pattern

F								
0	0 5 1-4,6-9							
	PDSCH Data							
0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	i booii bata					
and	and	and						
(Last allocated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –						
$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$						
0	0	0	Note 1					

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

# A.5.1.3 OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.1.3-1: OP.3 FDD: OCNG FDD Pattern 3

All	Re						
Allocation		PDSCH Data	PMCH Data				
$n_{\it PRB}$	0	5	4, 9	1 – 3, 6 – 8	Dutu	2414	
1 – 49	0	0 (Allocation: all empty PRB-s)	0	N/A	Note 1	N/A	
0 – 49	N/A	N/A	N/A	0	N/A	Note 2	

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.

Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The parameter  $\gamma_{PRB}$  is used to scale the power of PMCH.

Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

N/A: Not Applicable

# A.5.1.4 OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.1.4-1: OP.4 FDD: One sided dynamic OCNG FDD Pattern for MBMS transmission

		Re								
Alloca			PDSCH Data	PMCH Data						
$n_{{\scriptscriptstyle PRB}}$		0, 4, 9	5	1 – 3, 6 – 8	Data	Data				
First unallocated PRB - Last unallocated PRB		0	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A				
First unall PRI – Last unall PRI	B located	N/A	N/A	N/A	N/A	Note 2				
Note 1:	Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be									
	uncorrelated pseudo random data, which is QPSK modulated. The parameter $\gamma_{\it PRB}$ is									
Note 2:	used to scale the power of PDSCH.									

Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The parameter  $\gamma_{PRB}$  is used to scale the power of PMCH.

Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

N/A: Not Applicable

# A.5.1.5 OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of DL sub-frames, when the unallocated area is continuous in the frequency domain (one sided).

Table A.5.1.5-1: OP.5 FDD: One sided dynamic 16QAM modulated OCNG FDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]						
Subframe						
	0 5 1-4,6-9					
Allocation						
First	unallocated PRB First unallocated PRB First unallocated		First unallocated PRB	-		
Last unallocated PRB Las		Last unallocated PRB	Last unallocated PRB			
	0 0 0		Note 1			
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random						
	data, which is 16QAM modulated. The parameter $\gamma_{\it PRB}$ is used to scale the power of PDSCH.					
Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large						

### A.5.1.6 OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks

Delay CDD). The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission

modes are specified in section 7.1 in 3GPP TS 36.213.

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{RB}-1$ .

Table A.5.1.6-1: OP.6 FDD: OCNG FDD Pattern when user data is in 2 non-contiguous blocks

F				
	Subframe			
0	5	1 – 4, 6 – 9		
	Allocation			
0 - (First allocated PRB of	0 - (First allocated PRB of	0 - (First allocated PRB of	PDSCH Data	
first block -1)	first block -1)	first block -1)		
and	and	and		
(Last allocated PRB of first	(Last allocated PRB of first	(Last allocated PRB of first		
block +1) - (First allocated	block +1) - (First allocated	block +1) - (First allocated		
PRB of second block -1)	PRB of second block -1)	PRB of second block -1)		
0	0	0	Note 1	
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual				
UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK				

UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual

users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

## A.5.1.7 OCNG FDD pattern 7: dynamic OCNG FDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in

multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m}-1$ , where  $m=1,\ldots,M$ . The system bandwidth starts with RPB 0 and ends with  $N_{RR}-1$ .

Table A.5.1.7-1: OP.7 FDD: OCNG FDD Pattern when user data is in multiple non-contiguous blocks

F	Relative power level $\gamma_{\it PRB}$ [dE	3]	
	Subframe		
0	5	1 – 4, 6 – 9	
	Allocation		
$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	
			PDSCH Data
$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	
$N_{Start,m}-1)$	$N_{Start,m}-1$ )	$N_{Start,m}-1$ )	
 (PRB N <sub>End,M</sub> ) – (PRB	 (PRB N <sub>End,M</sub> ) – (PRB	 (PRB N <sub>End,M</sub> ) – (PRB	
$N_{RB}-1$ )	$N_{RB}-1$ )	$N_{RB}-1$ )	
0	0	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

### A.5.1.8 OCNG FDD pattern 8: One sided dynamic OCNG FDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.1.1-1: OP.8 FDD: One sided dynamic OCNG FDD Pattern

Relative power level $\gamma_{\it PRB}$ [dB]				
Subframe				
0 5 1-4,6-9				
Allocation				
First unallocated PRB	First unallocated PRB First unallocated PRB First unallocated PRB			
Last unallocated PRB Last unallocated PRB Last unallocated PRB				
0	0	0	Note 1,2,3	

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is 16QAM modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.

Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

Note 3: The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.

#### A.5.2 OCNG Patterns for TDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i RA/OCNG RA = PDSCH_i RB/OCNG RB,$$

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

#### A.5.2.1 OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.1-1: OP.1 TDD: One sided dynamic OCNG TDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					
Subframe (only if available for DL)					
5	3, 4, 7, 8, 9 and 6 (as normal subframe) Note 2	1 and 6 (as special subframe) <sup>Note 2</sup>	PDSCH Data		
Allo	cation				
First unallocated PRB	First unallocated PRB	First unallocated PRB			
– Last unallocated PRB	– Last unallocated PRB	– Last unallocated PRB			
0	0	0	Note 1		
	Subframe (only i  5  Alloc First unallocated PRB  Last unallocated PRB	Subframe (only if available for DL)  3, 4, 7, 8, 9 and 6 (as normal subframe) Note 2  Allocation  First unallocated PRB  Last unallocated PRB  Last unallocated PRB	Subframe (only if available for DL)  3, 4, 7, 8, 9 and 6 (as normal subframe) Note 2  Allocation  First unallocated PRB First unallocated PRB First unallocated PRB Last unallocated PRB Last unallocated PRB Last unallocated PRB		

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

#### A.5.2.2 OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is

discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{\rm RB}$  –1.

Table A.5.2.2-1: OP.2 TDD: Two sided dynamic OCNG TDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRR}$ [dB]					
	Subframe (only in	f available for DL)		Data	
0	5	3, 4, 6, 7, 8, 9	1,6		
		(6 as normal subframe)	(6 as special subframe)		
Allocation					
0 –	0 –	0 –	0 –		
(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)		
and	and	and	and		
(Last allocated PRB+1) -	(Last allocated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –		
$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$		
0	0	0	0	Note 1	

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36 211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

### A.5.2.3 OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.2.3-1: OP.3 TDD: OCNG TDD Pattern 3 for 5ms downlink-to-uplink switch-point periodicity

Allocation		Relative power	level $\gamma_{PRB}$ [dB]			
		Subf	PDSCH Data	PMCH Data		
$n_{\it PRB}$	0	5	4, 9 <sup>Note 2</sup>	1, 6		
1 – 49	0	0 (Allocation: all empty PRB-s)	N/A	0	Note 1	N/A
0 – 49	N/A	N/A	0	N/A	N/A	Note 3

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211.
- Note 3: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- Note 4: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

#### A.5.2.4 OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.2.4-1: OP.4 TDD: One sided dynamic OCNG TDD Pattern for MBMS transmission

		Relative power	level $\gamma_{\it PRB}$ [dB]				
Allocation		Subframe (	only for DL)		PDSCH Data PMCH Data		
$n_{\it PRB}$	0 and 6 (as normal subframe)	1 (as special subframe)	5	3, 4, 7 – 9	r DOCH Data	r WiCii Data	
First unallocate d PRB  - Last unallocate d PRB	0	0 (Allocation: all empty PRB-s of DwPTS)	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A	
First unallocate d PRB  - Last unallocate d PRB	N/A	N/A	N/A	N/A	N/A	Note2	
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data,							

- which is QPSK modulated. The parameter  $\gamma_{\it PRB}$  is used to scale the power of PDSCH.
- Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

#### A.5.2.5 OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.5-1: OP.5 TDD: One sided dynamic 16QAM modulated OCNG TDD Pattern

	Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					
Subframe (only if available for DL)						
0		5	3, 4, 7, 8, 9 and 6 (as normal subframe) <sup>Note 2</sup>	1 and 6 (as special subframe) <sup>Note 2</sup>	PDSCH Data	
		Allo	cation			
First unallocated PRB		First unallocated PRB -	First unallocated PRB  -	First unallocated PRB -		
Last unal	llocated PRB	Last unallocated PRB	Last unallocated PRB	Last unallocated PRB		
0		0	0	0	Note 1	
Note 1:			ssigned to an arbitrary num ne OCNG PDSCHs shall b			
	which is 16Q	AM modulated. The para	meter $\gamma_{\it PRB}$ is used to scale	e the power of PDSCH.		
Note 2:	ote 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211					
Note 3:	Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay					
	CDD). The parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is equal					
	between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					

### A.5.2.6 OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{\rm RB}-1$ .

Table A.5.2.6-1: OP.6 TDD: OCNG TDD Pattern when user data is in 2 non-contiguous blocks

Relative power level $\gamma_{{\scriptscriptstyle PRB}}$ [dB]					
	Subframe (only it	f available for DL)			
0	5	3, 4, 6, 7, 8, 9	1,6		
		(6 as normal subframe)	(6 as special subframe)		
	Alloc	ation			
0 – (First allocated PRB	0 – (First allocated PRB	0 – (First allocated PRB	0 – (First allocated PRB		
of first block -1)	of first block -1)	of first block -1)	of first block -1)		
and	and	and	and		
(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of		
first block +1) - (First	first block +1) – (First	first block +1) – (First	first block +1) - (First		
allocated PRB of second	allocated PRB of second	allocated PRB of second	allocated PRB of second		
block -1)	block -1)	block -1)	block -1)		
0	0	0	0	Note 1	

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

### A.5.2.7 OCNG TDD pattern 7: dynamic OCNG TDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m}-1$ , where m=1,...,M. The system bandwidth starts with RPB 0 and ends with  $N_{RB}-1$ .

Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

Data
Data
Note 1

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter  $\gamma_{PRB}$  applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

### A.5.2.8 OCNG TDD pattern 8: One sided dynamic OCNG TDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.1.1-1: OP.8 TDD: One side	ed dynamic OCNG TDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]						
Subframe						
0 5 1-4,6-9						
	Allocation		- Data			
First unallocated PRB	First unallocated PRB	First unallocated PRB				
– Last unallocated PRB	<ul> <li>Last unallocated PRB</li> </ul>	– Last unallocated PRB				
0	0	0	Note 1,2,3			

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is 16QAM modulated. The parameter  $\gamma_{PRB}$  is used to scale the power of PDSCH.
- Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- Note 3: The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.

#### A.6 Sidelink reference measurement channels

#### A.6.1 General

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{RR}$ 

- 1. Calculate the number of channel bits  $N_{\rm ch}$  that can be transmitted during the first transmission of a given subframe.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min \left| R - (A + 24*(N_{CB} + 1)) / N_{ch} \right|, where \ N_{CB} = \begin{cases} 0, if \ C = 1 \\ C, if \ C > 1 \end{cases},$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{RB}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- 3. If there is more than one *A* that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

## A.6.2 Reference measurement channel for receiver characteristics

For ProSe Direct Discovery, Table A.6.2-1 is applicable for measurements on the Receiver Characteristics (clause 7) including the requirements of subclause 7.4D (Maximum input level).

For ProSe Direct Communication, Table A.6.2-2 is applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4D (Maximum input level). Tables A.6.2-3, A.6.2-4, are applicable for subclause 7.4D (Maximum input level).

Table A.6.2-1: Fixed Reference measurement channel for ProSe Direct Discovery receiver requirements and maximum input level

Parameter	Unit	Value					
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				2	2	2	2
Subcarriers per resource block				12	12	12	12
Allocated subframes per Discovery period				1	1	1	1
DFT-OFDM Symbols per subframe (see				11	11	11	11
note)							
Modulation				QPSK	QPSK	QPSK	QPSK
Transport Block Size				232	232	232	232
Transport block CRC	Bits			24	24	24	24
Maximum number of HARQ transmissions				1	1	1	1
Binary Channel Bits (see note)	Bits			528	528	528	528
Max. Throughput averaged over 1 Discovery	kbps			0.725	0.725	0.725	0.725
period of 320ms							
UE Category			, in the second	≥ 1	≥ 1	≥ 1	≥ 1

NOTE1: PSDCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE2: Throughput is 232 bits per Discovey period. The discovery period is configured as 320ms in the test.

Table A.6.2-2: Fixed Reference measurement channel for ProSe Direct Communication receiver requirements

Parameter	Unit	Value					
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Subcarriers per resource block				12	12		
Packets per SA period				1	1		
Modulation				QPSK	QPSK		
Transport Block Size				2216	4392		
Transport block CRC	Bits			24	24		
Maximum number of HARQ transmissions				4	4		
Binary Channel Bits	Bits			7200	14400		
Max. Throughput averaged over 1 SA period	kbps			55.4	109.8		
of 40ms							
UE Category				≥ 1	≥ 1		
UE Category				≥1			

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: Throughput (in kbps) will depend on SA period configuration

Table A.6.2-3: Fixed Reference measurement channel for ProSe Direct Communication for maximum input power for UE categories 2-8

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Subcarriers per resource block				12	12		
Packets per SA period				1	1		
Modulation				16QAM	16QAM		
Transport Block Size				9912	18336		
Transport block CRC	Bits			24	24		
Maximum number of HARQ				4	4		
transmissions							
Binary Channel Bits	Bits			14400	28800		
Max. Throughput averaged over 1 SA period of 40ms	kbps			247.8	458.4		

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 3: Throughput (in kbps) will depend on SA period configuration

Table A.6.2-4: Fixed Reference measurement channel for ProSe Direct Communication for maximum input power for UE category 1

Parameter	Parameter Unit Value						
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	24		
Subcarriers per resource block				12	12		
Packets per SA period				1	1		
Modulation				16QAM	16QAM		
Transport Block Size				9912	10296		
Transport block CRC	Bits			24	24		
Maximum number of HARQ transmissions				4	4		
Binary Channel Bits	Bits			14400	13824		
Max. Throughput averaged over 1 SA period of 40ms	kbps			247.8	257.4		

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 3: Throughput (in kbps) will depend on SA period configuration

## A.6.3 Reference measurement channels for PSDCH performance requirements

Table A.6.3-1: Fixed Reference measurement channel for PSDCH performance requirement

Parameter	Unit		Value				
Reference channel				D.1 FDD /	/ D.1 TDE	)	
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				2	2	2	2
Subcarriers per resource block				12	12	12	12
DFT-OFDM Symbols per subframe (NOTE 1)				11	11	11	11
Modulation				QPSK	QPSK	QPSK	QPSK
Transport Block Size				232	232	232	232
Transport block CRC	Bits			24	24	24	24
Binary Channel Bits (NOTE 1)	Bits			528	528	528	528
Max. Throughput averaged over 1 Discovery	kbps			0.725	0.725	0.725	0.725
period of 320ms							
UE Category				≥ 1	≥ 1	≥ 1	≥ 1

NOTE1: PSDCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

## A.6.4 Reference measurement channels for PSCCH performance requirements

Table A.6.4-1: Fixed reference measurement channel for PSCCH performance requirement

	Parameter	Unit			Val	ue			
Reference ch	annel		CC.1 FDD CC.2 FDD CC.3 FDD CC.4 FDD CC.5 FDD CC.6 F						
Channel band	dwidth	MHz	5 10 5 10 5 10						
Allocated res	ource blocks		1	1	1	1	1	1	
Subcarriers p	er resource block		12	12	12	12	12	12	
DFT-OFDM S	Symbols per subframe		11	11	11	11	11	11	
(see Note 1)			11	11	11	11	11	11	
Modulation			QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	
Transport Blo	ock Size	Bits	41	43	41	43	41	43	
	Frequency hopping flag		0	0	1	1	1	1	
	RB assignment		S	Set as per PS	SSCH RB allo	ocation spec	ific in the tes	t	
					1	(1,1)	0	(1,0)	
	Hopping bits		N/A	N/A	Type 2	Type 2	Type 1	Type 1	
Information					Hopping	Hopping	Hopping	Hopping	
bits	Time resource pattern (I <sub>TRP</sub> )			8 (unles	ss specified o Not)		the test)		
	Modulation and coding scheme			Set as the	PSSCH MC	S specified	in the test		
	Timing advance indication			0 (unles	s specified c	therwise in t	he test)		
	Group destination ID				As set by hi	gher layers			
Transport blo	ck CRC	Bits	16	16	16	16	16	16	
Maximum nu	mber of HARQ transmissions		2 2 2 2 2 2						
Binary Chann	nel Bits (see Note 1,2)	Bits	264	264	264	264	264	264	
Max. Through period (bits/s	nput averaged over one sc- c-period)		41	43	41	43	41	43	

NOTE 1: PSCCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: For  $N_{TRP} = 8$  (FDD) and trpt-Subset = 010,  $I_{TRP} = 8$  corresponds to a time repetition pattern of (1,1,0,0,0,0,0,0) as per TS 36.213.

## A.6.5 Reference measurement channels for PSSCH performance requirements

Table A.6.5-1: Fixed reference measurement channel for PSSCH performance requirement

Parameter	Unit			Value		
Reference channel		CD.1 FDD	CD.2 FDD	CD.3 FDD	CD.4 FDD	CD.5 FDD
Channel bandwidth	MHz	5/10	5 / 10	5	10	5 / 10
Allocated resource blocks		10	10	25	50	2
Subcarriers per resource block		12	12	12	12	12
DFT-OFDM Symbols per subframe (see Note 1)		11	11	11	11	11
Modulation		QPSK	16QAM	16QAM	16QAM	QPSK
Transport Block Size		872	2536	6546	12960	328
Transport block CRC	Bits	24	24	24	24	24
Maximum number of HARQ transmissions		4	4	4	4	4
Binary Channel Bits (see Note 1,2)	Bits	2640	5280	13200	26400	528
Max. Throughput averaged over one sc-period (bits/sc-period)		872	2536	6546	12960	328

NOTE 1: PSSCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.6.5-2: Fixed reference measurement channel for PSSCH for maximum Sidelink processes test

Parameter	Unit	Value		
Reference channel		CD.6 FDD	CD.7 FDD	
Channel bandwidth	MHz	5	10	
Allocated resource blocks		25	50	
Subcarriers per resource block		12	12	
DFT-OFDM Symbols per subframe (see Note 1)		11	11	
Modulation		16QAM	16QAM	
Transport Block Size		15840	25456	
Transport block CRC	Bits	24	24	
Maximum number of HARQ transmissions		4	4	
Binary Channel Bits (see Note 1,2)	Bits	13200	26400	
Max. Throughput averaged over one sc-period (bits/sc-period)		15840	25456	

NOTE 1: PSSCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

## A.6.6 Reference measurement channels for PSBCH performance requirements

Table A.6.6-1: Fixed reference measurement channel for PSBCH performance requirement

Parameter	Unit	Value				
Reference channel		CP.1 FDD				
Channel bandwidth	MHz	5 / 10				
Allocated resource blocks		6				
Subcarriers per resource block		12				
DFT-OFDM Symbols per subframe		7				
(see Note 1)		7				
Modulation		QPSK				
Transport Block Size		40				
Transport block CRC	Bits	16				
Maximum number of HARQ transmissions		1				
Binary Channel Bits (see Note 1,2)	Bits	1008				
Max. Throughput averaged over 40ms kbps 1						
NOTE 1: PSBCH transmissions are rate-matched for 8 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.						

### A.7 Sidelink reference resource pool configurations

## A.7.1 Reference resource pool configurations for ProSe Direct Discovery demodulation tests

#### A.7.1.1 FDD

Table A.7.1.1-1: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #1-FDD)

I	nformation Element		Value
discRxPool	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	160
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

Table A.7.1.1-2: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #2-FDD)

ı	nformation Element		Value
discRxPool(0)	cp-Len		Normal
` ,	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	150
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters		not present
discRxPool(1)	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
	ti rtoccurco comig	prb-Start	0
		prb-End	23
		offsetIndicator	170
		subframeBitmap	10000000
		очьнатовинар	0000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters	tdd-Config	not present
	in didiniotoro	syncConfigIndex	0
discTxPoolCommon		-joco.mgmaox	not present
discTxPowerInfo			not present
SL-SyncConfig(0)	syncCP-Len		Normal
SE Symboling(s)	syncOffsetIndicator		0 (160 mod
	Syriconscindicator		40)
	slssid		30
	txParameters		not present
	rxParamsNCell	physCellId	1
	TAT GIGITION CON	discSyncWindow	w1
discInterFreqList		aloogriovillaov	not present
alsolliteri requist			not present

Table A.7.1.1-3: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #3-FDD)

I	nformation Element		Value
discRxPool(iPool), iPool = 0NPool-1	cp-Len		Normal
	discPeriod		rf32
	numRetx		3
	numRepetition		=2 if NPool > 10,
	·		=1 otherwise
	tf-ResourceConfig	prb-Num	5MHz: min{24, 2N-24*iPool} / 2
			10MHz: 25
			15MHz: min{74, 2N-74*iPool} / 2
			20MHz: 50
		prb-Start	0
		prb-End	5 MHz: min{24, 2N-24*iPool} - 1
			10 MHz: 49
			15 MHz: min{74, 2N-74*iPool} - 1
			20 MHz: 99
		offsetIndicator	160
		subframeBitmap	a(0), a(1),, a(39), s.t.
			a(i * NPool + iPool) = 1, i = 0,,K;
			a(k) = 0 otherwise
			where
			K = 1 is NPool > 10, $K = 3$ otherwise
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

NOTE 1: The resource pool configuration description is parameterized using channel BW, number of configured resource pools (NPool), and maximum number of configured Sidelink UEs to be supported (N).

#### A.7.1.2 TDD

Table A.7.1.2-1: ProSe Direct Discovery configuration for E-UTRA TDD Config 0 (Configuration #1-TDD)

I	nformation Element		Value
discRxPool	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	163
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
			00
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

Table A.7.1.2-2: ProSe Direct Discovery configuration for E-UTRA TDD (Configuration #2-TDD)

l.	nformation Element		Value
discRxPool(iPool), iPool = 0NPool-1	cp-Len		Normal
	discPeriod		rf32
	numRetx		3
	numRepetition		=2 if NPool > 10, =1 otherwise
	tf-ResourceConfig	prb-Num	5MHz: min{24, 2N-24*iPool} / 2 10MHz: 25 15MHz: min{74, 2N-74*iPool} / 2 20MHz: 50
		prb-Start	0
		prb-End	5 MHz: min{24, 2N-24*iPool} - 1 10 MHz: 49 15 MHz: min{74, 2N-74*iPool} - 1 20 MHz: 99
		offsetIndicator	163
		subframeBitmap	a(0), a(1),, a(39), s.t. a(i * NPool + iPool) = 1, i = 0,,K; a(k) = 0 otherwise
			where K = 1 is NPool > 10, K = 3 otherwise
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

NOTE 1: The resource pool configuration description is parameterized using channel BWs, number of configured resource pools (NPool), and maximum number of configured Sidelink UE to be supported (N).

## A.7.2 Reference resource pool configurations for ProSe Direct Communication demodulation tests

#### A.7.2.1 FDD

Table A.7.2.1-1: ProSe Direct Communication pre-configuration for E-UTRAN FDD for out-of-network coverage operation (Configuration #1-FDD)

Info	ormation Element / (BW config	juration)		Value (5MHz)	Value (10MHz)
preconfigSync	syncCP-Len-r12			No	rmal
	syncOffsetIndicator1				1
	syncOffsetIndicator2				2
	syncTxParameters			2	23
					0
	syncTxThreshOoC			(-110	dBm /
				15	κHz)
	filterCoefficient			f	00
	syncRefMinHyst			d	B0
	syncRefDiffHyst			d	B0
preconfigComm	sc-CP-Len				rmal
	sc-Period			st	40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
				0001	1000
					00000
		subframeBitmap			00000
					00000
					00000
	data-CP-Len				rmal
	dataHoppingConfig	hoppingParameter			04
		numSubbands			s2
		rb-Offset			0
	ue-	data-TF-	prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	'		
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
					00000
					1111
			subframeBitmap		11111
					00000
		1			00000
		trpt-Subset-r12		0	10

Table A.7.2.1-2: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #2-FDD)

Information Element / (BW configuration)			Value (5MHz)	Value (10MHz)	
commRxPool	sc-CP-Len			No	rmal
	sc-Period			Si	f40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
		subframeBitmap		0000 0000 0000	11100 00000 00000 00000 00000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
		_	prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
			subframeBitmap	1117 1117 0000	00000 11111 11111 00000 00000
		trpt-Subset-r12		0	10
	rxParametersNCell			not p	resent
	txParameters				resent
commTxPoolNormalCommon					resent
SL-SyncConfig					resent

Table A.7.2.1-3: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #3-FDD)

	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool(0)	sc-CP-Len			Nor	mal
	sc-Period			sf	40
	sc-TF-ResourceConfig	prb-Num		13	25
	-	prb-Start		0	0
		prb-End		24	49
		offsetIndicator		(	)
				0011	0000
					0000
		subframeBitmap			0000
					0000
					0000
	data-CP-Len				mal
	dataHoppingConfig	hoppingParameter			)4
	datar toppingConing				52
		numSubbands			
		rb-Offset		(	)
	ue-	data-TF-	prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	·	_	
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator	(	)
				0000	1111
					0000
			subframeBitmap		0000
					1111
					0000
		trpt-Subset-r12			10
	rxParametersNCell	tipt Odb3Ct 112			esent
	txParameters				
a a marco Di v D a a 1/4 )					resent
commRxPool(1)	sc-CP-Len				mal
	sc-Period				40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			)
				0011	0000
				0000	0000
		subframeBitmap		0000	0000
				0000	0000
				0000	0000
	data-CP-Len			Nor	mal
	dataHoppingConfig	hoppingParameter			)4
	gg	numSubbands			s2
		rb-Offset			)
	ue-	data-TF-		'	ĺ
	SelectedResourceConfig	ResourceConfig	prb-Num	13	25
	- Jereotean resource Cornig	resourceCornig	prb-Start	^	0
				0	0
			prb-End	24	49
			offsetIndicator		)
					1111
					0000
			subframeBitmap		1111
					0000
		_			0000
		trpt-Subset-r12			10
	rxParametersNCell	tdd-Config		not pi	resent
		syncConfigIndex			)
	txParameters	•		not pi	resent
commTxPoolNormalCommon					resent
SL-SyncConfig(0)	syncCP-Len				mal
== cynoconng(o)	syncOffsetIndicator			1401	<u></u> 1
	slssid			2	0
	txParameters				resent

rxParamsNCell	physCellId	1
	discSyncWindow	w1

Table A.7.2.1-4: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #4-FDD)

In	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool(0)	sc-CP-Len				rmal
	sc-Period			sf	80
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
					0000
					00000
		subframeBitmap			00000
					00000
					00000
	data-CP-Len				rmal
	dataHoppingConfig	hoppingParameter			04
		numSubbands			s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
		_	prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
				0000	00000
					1111
			subframeBitmap		0000
			· ·	1111	1111
				0000	0000
		trpt-Subset-r12		0	01
	rxParametersNCell	•		not p	resent
	txParameters				resent
commRxPool(1)	sc-CP-Len				rmal
• •	sc-Period			sf	80
	sc-TF-ResourceConfig	prb-Num		13	25
	-	prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
				0000	)1111
				0000	0000
		subframeBitmap		0000	0000
		·		0000	0000
				0000	0000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue-	data-TF-	prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	•		
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
					00000
					00000
			subframeBitmap		1111
					00000
		tout Order of 40			1111
	ryDarametersMCsII	trpt-Subset-r12	1		01 recept
	rxParametersNCell				resent
a a mana Tur Da a INI - mara - IO - ma	txParameters				resent
commTxPoolNormalCommon			1		resent
SL-SyncConfig				not p	resent

Table A.7.2.1-5: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #5-FDD)

Information Element / (BW configuration)			Value (5MHz)	Value (10MHz)	
commRxPool	sc-CP-Len			No	rmal
	sc-Period			Si	f40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
		subframeBitmap		0000 0000 0000	11000 00000 00000 00000 00000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
			subframeBitmap	111 <i>°</i> 111 <i>°</i> 111 <i>°</i>	00000 11111 11111 11111 11111
		trpt-Subset-r12			01
	rxParametersNCell			not p	resent
	txParameters				resent
commTxPoolNormalCommon					resent
SL-SyncConfig					resent

## Annex B (normative): Propagation conditions

#### B.1 Static propagation condition

#### B.1.1 UE Receiver with 2Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}.$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j & -j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j \\ 1 & 1 & 1 & 1 - j - j - j - j \end{bmatrix}$$

#### B.1.2 UE Receiver with 4Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}.$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & j \\ 1 & -j \\ 1 & j \\ 1 & -j \end{bmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 & -j & -j \\ 1 & -1 & j & -j \\ 1 & -1 & -j & j \end{bmatrix}.$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j & j \\ 1 & 1 & 1 & 1 & -j & -j & -j & -j \\ 1 & 1 & -1 & -1 & j & j & -j & -j \\ 1 & 1 & -1 & -1 & -j & -j & j & j \end{bmatrix}$$

#### B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.
- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency
- A set of correlation matrices defining the correlation between the UE and eNodeB antennas in case of multi-antenna systems.
- Additional multi-path models used for CQI (Channel Quality Indication) tests

#### B.2.1 Delay profiles

The delay profiles are selected to be representative of low, medium and high delay spread environments. The resulting model parameters are defined in Table B.2.1-1 and the tapped delay line models are defined in Tables B.2.1-2, B.2.1-3 and B.2.1-4.

Table B.2.1-1 Delay profiles for E-UTRA channel models

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)
Extended Pedestrian A (EPA)	7	45 ns	410 ns
Extended Vehicular A model (EVA)	9	357 ns	2510 ns
Extended Typical Urban model (ETU)	9	991 ns	5000 ns

Table B.2.1-2 Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

Table B.2.1-3 Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table B.2.1-4 Extended Typical Urban model (ETU)

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

#### B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as EVA[number], EPA[number] or ETU[number] where 'number' indicates the maximum Doppler frequency (Hz).

Table B.2.2-1 Void

#### B.2.3 MIMO Channel Correlation Matrices

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both eNodeB and UE.

#### B.2.3.1 Definition of MIMO Correlation Matrices

Table B.2.3.1-1 defines the correlation matrix for the eNodeB

Table B.2.3.1-1 eNodeB correlation matrix

	One antenna	Two antennas	Four antennas
eNode B Correlation	$R_{eNB} = 1$	$R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$	$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$

Table B.2.3.1-2 defines the correlation matrix for the UE:

Table B.2.3.1-2 UE correlation matrix

	One antenna	Two antennas	Four antennas
UE Correlation	$R_{UE} = 1$	$R_{UE} = \begin{pmatrix} 1 & \boldsymbol{\beta} \\ \boldsymbol{\beta}^* & 1 \end{pmatrix}$	$R_{UE} = \begin{pmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{pmatrix}$

Table B.2.3.1-3 defines the channel spatial correlation matrix  $R_{spat}$ . The parameters,  $\alpha$  and  $\beta$  in Table B.2.3.1-3 defines the spatial correlation between the antennas at the eNodeB and UE.

Table B.2.3.1-3:  $R_{\it spat}$  correlation matrices

1x2 case	$R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
1x4 case	$R_{spat} = R_{UE} = \begin{pmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} \\ \beta^* & \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 \end{pmatrix}$
2x1 case	$R_{spat} = R_{eNB} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix}$
2x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$
2x4 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha \beta \\ \beta^* & 1 & \alpha \beta^* & \alpha \\ \alpha^* & \alpha^* \beta & 1 & \beta \\ \alpha^* \beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$ $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{bmatrix}$ $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^* & \alpha^{4/9} & \alpha^{1/9} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
4x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^* & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
4x4 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{*} & \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 \end{bmatrix}$

For cases with more antennas at either eNodeB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of  $R_{eNB}$  and  $R_{UE}$  according to  $R_{spat} = R_{eNB} \otimes R_{UE}$ .

#### B.2.3.2 MIMO Correlation Matrices at High, Medium and Low Level

The  $\alpha$  and  $\beta$  for different correlation types are given in Table B.2.3.2-1.

Table B.2.3.2-1: The  $\alpha$  and  $\beta$  parameters for ULA MIMO correlation matrices

Correlation Model	α	β
Low correlation	0	0
Medium	0.3	0.9
Correlation		
Medium	0.3	0.3874
Correlation A		
High Correlation	0.9	0.9

The correlation matrices for high, medium, low and medium A correlation are defined in Table B.2.3.1-2, B.2.3.2-3, B.2.3.2-4 and B.2.3.2-5 as below.

The values in Table B.2.3.2-2 have been adjusted for the 4x2 and 4x4 high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spatial} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 4x2 high correlation case, a=0.00010. For the 4x4 high correlation case, a=0.00012.

The same method is used to adjust the 4x4 medium correlation matrix in Table B.2.3.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00012.

Table B.2.3.2-2: MIMO correlation matrices for high correlation

1x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$											
2x1 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$											
2x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$											
4x2 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$											
4x4 case	$R_{high} = \begin{cases} 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 & 0.8894 & 0.9541 & 0.9430 & 0.9105 & 0.8587 & 0.8999 & 0.8894 & 0.8587 & 0.8099 \\ 0.9882 & 1.0000 & 0.9882 & 0.9541 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.9430 & 0.9541 & 0.9430 & 0.8587 & 0.8894 & 0.8587 \\ 0.9541 & 0.9882 & 1.0000 & 0.9882 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9105 & 0.9430 & 0.9541 & 0.8099 & 0.8587 & 0.8894 & 0.8999 \\ 0.9882 & 0.9767 & 0.9430 & 0.8894 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.8099 & 0.8587 & 0.8894 & 0.8999 \\ 0.9882 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.8587 \\ 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9882 & 1.0000 & 0.9882 & 0.9541 & 0.9767 & 0.9430 & 0.9430 & 0.9541 & 0.9430 & 0.9105 \\ 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 1.0000 & 0.9882 & 0.9767 & 0.9482 & 0.9767 & 0.9430 & 0.9541 \\ 0.9541 & 0.9430 & 0.9767 & 0.9882 & 0.8999 & 0.9541 & 0.9882 & 1.0000 & 0.8894 & 0.9430 & 0.9767 & 0.9430 & 0.9541 \\ 0.9541 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 \\ 0.9105 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9430 & 0.9882 & 1.0000 & 0.9882 & 0.9541 & 0.9767 & 0.9882 & 0.9767 \\ 0.8587 & 0.9105 & 0.9430 & 0.9541 & 0.8894 & 0.9430 & 0.9767 & 0.9882 & 0.8999 & 0.9541 & 0.9882 & 0.9767 & 0.9430 \\ 0.8587 & 0.8999 & 0.8894 & 0.8587 & 0.8099 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 \\ 0.8587 & 0.8894 & 0.8999 & 0.8894 & 0.8587 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9882 & 1.0000 & 0.9882 & 0.9541 \\ 0.8587 & 0.8894 & 0.8999 & 0.8894 & 0.9105 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 1.0000 & 0.9882 \\ 0.8099 & 0.8587 & 0.8894 & 0.8999 & 0.8587 & 0.9105 & 0.9430 & 0.9541 & 0.8894 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 0.9767$											

Table B.2.3.2-3: MIMO correlation matrices for medium correlation

1x2		N/A														
case								IN/A								
2x1								N/A								
case		(1,00,02,027)														
2x2 case		$R_{medium} = \begin{pmatrix} 1 & 0.9 & 0.3 & 0.27 \\ 0.9 & 1 & 0.27 & 0.3 \\ 0.3 & 0.27 & 1 & 0.9 \\ 0.27 & 0.3 & 0.9 & 1 \end{pmatrix}$														
				1.0000	0.900	00 0.	8748			5856	0.527	1 0.3	000	0.2700		
				0.9000	1.000	00 0.	7873	0.874	8 0	5271	0.5850	5 0.2	700	0.3000	)	
				0.8748	0.787	73 1.	0000	0.900	0 0.3	8748	0.787	3 0.5	856	0.5271		
				0.7873	0.874		9000	1.000		7873	0.874			0.5856		
4x2 case		$R_{medium}$	=													
case				0.5856	0.52		8748	0.787			0.9000			0.7873		
				0.5271	0.585	56 O.	7873	0.874	8 0.9	9000	1.0000	0.7	873	0.8748	1	
				0.3000	0.270	0.00	.5856	0.527	1 0.	8748	0.787	3 1.0	000	0.9000	)	
				0.2700	0.300	00 0.	.5271	0.585	6 0.	7873	0.874	8 0.9	0000	1.0000		
		1.0000 0.988	2 0.954	1 0.8999	0.8747	0.8645	0.8347	0.7872	0.5855	0.5787	0.5588	0.5270	0.3000	0.2965	0.2862	0.2700
		0.9882 1.000	0.988	2 0.9541	0.8645	0.8747	0.8645	0.8347	0.5787	0.5855	0.5787	0.5588	0.2965	0.3000	0.2965	0.2862
		0.9541 0.988	2 1.000	0.9882	0.8347	0.8645	0.8747	0.8645	0.5588	0.5787	0.5855	0.5787	0.2862	0.2965	0.3000	0.2965
		0.8999 0.954	0.988	2 1.0000	0.7872	0.8347	0.8645	0.8747	0.5270	0.5588	0.5787	0.5855	0.2700	0.2862	0.2965	0.3000
		0.8747 0.864	5 0.834	7 0.7872	1.0000	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872	0.5855	0.5787	0.5588	0.5270
		0.8645 0.874	7 0.864	5 0.8347	0.9882	1.0000	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347	0.5787	0.5855	0.5787	0.5588
		0.8347 0.864	5 0.874	7 0.8645	0.9541	0.9882	1.0000	0.9882	0.8347	0.8645	0.8747	0.8645	0.5588	0.5787	0.5855	0.5787
4x4	R =	0.7872 0.834	7 0.864	5 0.8747	0.8999	0.9541	0.9882	1.0000	0.7872	0.8347	0.8645	0.8747	0.5270	0.5588	0.5787	0.5855
case	$R_{medium}$ =	0.5855 0.578	7 0.558	8 0.5270	0.8747	0.8645	0.8347	0.7872	1.0000	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872
		0.5787 0.585	5 0.578	7 0.5588	0.8645	0.8747	0.8645	0.8347	0.9882	1.0000	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347
		0.5588 0.578	7 0.585	5 0.5787	0.8347	0.8645	0.8747	0.8645	0.9541	0.9882	1.0000	0.9882	0.8347	0.8645	0.8747	0.8645
		0.5270 0.558	8 0.578	7 0.5855	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1.0000	0.7872	0.8347	0.8645	0.8747
		0.3000 0.296	5 0.286	2 0.2700	0.5855	0.5787	0.5588	0.5270	0.8747	0.8645	0.8347	0.7872	1.0000	0.9882	0.9541	0.8999
		0.2965 0.300	0.296	5 0.2862	0.5787	0.5855	0.5787	0.5588	0.8645	0.8747	0.8645	0.8347	0.9882	1.0000	0.9882	0.9541
		0.2862 0.296														
		0.2700 0.286	2 0.296	5 0.3000	0.5270	0.5588	0.5787	0.5855	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1.0000

Table B.2.3.2-4: MIMO correlation matrices for low correlation

1x2 case	$R_{low} = \mathbf{I}_2$
1x4 case	$R_{low} = \mathbf{I}_4$
2x1 case	$R_{low} = \mathbf{I}_2$
2x2 case	$R_{low} = \mathbf{I}_4$
2x4 case	$R_{low} = \mathbf{I}_8$
4x2 case	$R_{low} = \mathbf{I}_8$
4x4 case	$R_{low} = \mathbf{I}_{16}$

In Table B.2.3.2-4,  $\mathbf{I}_d$  is the  $d \times d$  identity matrix.

Table B.2.3.2-5: MIMO correlation matrices for medium correlation A

		1.0000	0.9000	0.6561	0.3874	0.3000	0.2700	0.1968	0.1162
		0.9000	1.0000	0.9000	0.6561	0.2700	0.3000	0.2700	0.1968
		0.6561	0.9000	1.0000	0.9000	0.1968	0.2700	0.3000	0.2700
2x4	D _	0.3874	0.6561	0.9000	1.0000	0.1162	0.1968	0.2700	0.3000
case	$\mathbf{K}_{Medium \ A} = \mathbf{I}_{Medium \ A}$	0.3000	0.2700	0.1968	0.1162	1.0000	0.9000	0.6561	0.3874
		0.2700	0.3000	0.2700	0.1968	0.9000	1.0000	0.9000	0.6561
		0.1968	0.2700	0.3000	0.2700	0.6561	0.9000	1.0000	0.9000
		0.1162	0.1968	0.2700	0.3000	0.3874	0.6561	0.9000	1.0000)

## B.2.3A MIMO Channel Correlation Matrices using cross polarized antennas

The MIMO channel correlation matrices defined in B.2.3A apply for the antenna configuration using cross polarized (XP/X-pol) antennas at both eNodeB and UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

For the cross-polarized antennas, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of transmit or receive antennas.

### B.2.3A.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- $R_{UE}$  is the spatial correlation matrix at the UE with same polarization,
- $R_{eNB}$  is the spatial correlation matrix at the eNB with same polarization,
- $\Gamma$  is a polarization correlation matrix, and
- $(\bullet)^T$  denotes transpose.

The matrix  $\Gamma$  is defined as

$$\Gamma = \begin{bmatrix}
1 & 0 & -\gamma & 0 \\
0 & 1 & 0 & \gamma \\
-\gamma & 0 & 1 & 0 \\
0 & \gamma & 0 & 1
\end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt \\ 0 & \text{otherwise} \end{cases}$$

where  $N_t$  and  $N_r$  is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3A.

### B.2.3A.2 Spatial Correlation Matrices using cross polarized antennas at eNB and UE sides

#### B.2.3A.2.1 Spatial Correlation Matrices at eNB side

For 2-antenna transmitter using one pair of cross-polarized antenna elements,  $R_{\scriptscriptstyle eNR}=1$ .

For 4-antenna transmitter using two pairs of cross-polarized antenna elements,  $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$ .

For 8-antenna transmitter using four pairs of cross-polarized antenna elements,  $R_{eNB} = \begin{pmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} \\ \alpha^* & \alpha^{4/9} & \alpha^{1/9} & 1 \end{pmatrix}.$ 

#### B.2.3A.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements,  $R_{UE}=1$ .

For 4-antenna receiver using two pairs of cross-polarized antenna elements,  $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ .

#### B.2.3A.3 MIMO Correlation Matrices using cross polarized antennas

The values for parameters  $\alpha$ ,  $\beta$  and  $\gamma$  for the cross polarized antenna models are given in Table B.2.3A.3-1.

Table B.2.3A.3-1: The  $\alpha$  and  $\beta$  parameters for cross-polarized MIMO correlation matrices

Correlati	ion Model	α	β	γ					
Med	dium	0.3	0.6	0.2					
Correl	ation A								
High Co	rrelation	0.9	0.9	0.3					
Note 1:	Value of $\alpha$ applies when more than one								
	pair of cros	ss-polarized	d antenna	elements					
	at eNB sid	e.							
Note 2:	Value of β applies when more than one								
	pair of cross-polarized antenna elements								
	at UE side								

The correlation matrices for high spatial correlation and medium correlation A are defined in Table B.2.3A.3-2 and Table B.2.3A.3-3 as below.

The values in Table B.2.3A.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8x2 high spatial correlation case, a=0.00010.

Table B.2.3A.3-2: MIMO correlation matrices for high spatial correlation

				1.0	000	0.0000	0.90	00 0	0.0000	-0.30	000 (	0.0000	-0.27	700	0.0000			
				0.0	000 1	.0000	0.00	00 0	.9000	0.00	000 (	0.3000	0.00	000	0.2700			
					000 (	0.0000	1.00	00 0	0.0000	-0.27	00 (	0.0000	-0.30	000	0.0000			
				0.0	000 (	0.9000	0.00	000 1	.0000	0.00	000 (	0.2700	0.00	00	0.3000			
4x2 case	4x2 case		$R_{high} =$	-03	000 (	0.0000			0.0000	1.000		0.0000	0.90	00	0.0000			
						0.3000			0.2700	0.00		.0000	0.00		0.9000			
				-0.2	/00 (	0.0000	- 0.30	J00 C	0.0000	0.90	00 0	0.0000	1.00	00 (	0.0000			
				0.0	000 (	0.2700	0.0	000 (	0.3000	0.00	00 0	).9000	0.00	00 1	.0000			
		1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000	
			0.0000		0.0000					0.8999			0.0000				0.0000	0
		0.9883	0.0000		0.0000							-0.3000						
		0.0000	0.9883	0.0000								0.0000						
		0.9542			0.0000							-0.2965						
			0.9542	0.0000								0.0000						
		0.8999	0.8999	0.9542								0.0000		0.0000		0.0000		
8x2 case	$R_{high} =$	-0.3000	0.0000									0.9883		0.9542		0.8999		
		0.0000		0.0000								0.0000		0.0000		0.0000		
		-0.2965		-0.3000								1.0000		0.9883		0.9542		
		0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	
		-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	
		0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	
		-0.2700	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	
		0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	

Table B.2.3A.3-3: MIMO correlation matrices for medium correlation A

	( 1.0000 0.60	0.0000	0.0000 0.300	0.1800	0.0000	0.0000 - 0.200	0 - 0.1200	0.0000	0.0000 - 0.00	00 - 0.036	0.0000	0.0000
	0.6000 1.00	0.0000	0.0000 0.180	0.3000	0.0000	0.0000 - 0.120	0 - 0.2000	0.0000	0.0000 - 0.00	60 - 0.060	0.0000	0.0000
	0.0000 0.00	00 1.0000	0.6000 0.000	0.0000	0.3000	0.1800 0.000	0.0000	0.2000	0.1200 0.00	0.0000	0.0600	0.0360
	0.0000 0.00	0.6000	1.0000 0.000	0.0000	0.1800	0.3000 0.000	0.0000	0.1200	0.2000 0.00	0.0000	0.0360	0.0600
	0.3000 0.18	0.0000	0.0000 1.000	0.6000	0.0000	0.0000 - 0.060	0 - 0.0360	0.0000	0.0000 - 0.20	00 - 0.120	0.0000	0.0000
	0.1800 0.30	0.0000	0.0000 0.600	0 1.0000	0.0000	0.0000 - 0.036	0 - 0.0600	0.0000	0.0000 - 0.12	00 - 0.200	0.0000	0.0000
	0.0000 0.00	00 0.3000	0.1800 0.000	0.0000	1.0000	0.6000 0.000	0.0000	0.0600	0.0360 0.00	0.0000	0.2000	0.1200
44	0.0000 0.00	00 0.1800	0.3000 0.000	0.0000	0.6000	1.0000 0.000	0.0000	0.0360	0.0600 0.00	0.0000	0.1200	0.2000
4x4	$R_{Medium\ A} = -0.2000 - 0.12$	0.0000	0.0000 - 0.06	00 - 0.0360	0.0000	0.0000 1.000	0.6000	0.0000	0.0000 0.3	000 0.180	0.0000	0.0000
	- 0.1200 - 0.20	0.0000	0.0000 - 0.03	60 - 0.0600	0.0000	0.0000 0.600	00 1.0000	0.0000	0.0000 0.1	300 0.300	0.0000	0.0000
	0.0000 0.00	00 0.2000	0.1200 0.000	0.0000	0.0600	0.0360 0.000	0.0000	1.0000	0.6000 0.00	0.0000	0.3000	0.1800
	0.0000 0.00	00 0.1200	0.2000 0.000	0.0000	0.0360	0.0600 0.000	0.0000	0.6000	1.0000 0.00	0.0000	0.1800	0.3000
	-0.0600 -0.03	360 0.0000	0.0000 - 0.20	00 - 0.1200	0.0000	0.0000 0.300	00 0.1800	0.0000	0.0000 1.0	0.600	0.0000	0.0000
	- 0.0360 - 0.06	500 0.0000	0.0000 - 0.120	00 - 0.2000	0.0000	0.0000 0.180	0.3000	0.0000	0.0000 0.6	000 1.000	0.0000	0.0000
	0.0000 0.00	00 0.0600	0.0360 0.000	0.0000	0.2000	0.1200 0.000	0.0000	0.3000	0.1800 0.00	00 0.0000	1.0000	0.6000
	0.0000 0.00	00 0.0360	0.0600 0.000	0.0000	0.1200	0.2000 0.000	0.0000	0.1800	0.3000 0.00	0.0000	0.6000	1.0000

#### B.2.3A.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3A.1, the corresponding random channel matrix  $\mathbf{H}$  can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_h}Wx + n$$

Where

- H is the Nr xNt channel matrix per subcarrier.
- $D_{\theta_{k}}$  is the steering matrix,

For 8 transmission antennas, 
$$D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_k} & 0 & 0 \\ 0 & 0 & e^{j2\theta_k} & 0 \\ 0 & 0 & 0 & e^{j3\theta_k} \end{bmatrix};$$

For 4 transmission antennas, 
$$D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_k} \end{bmatrix}$$
.

- $\theta_k$  controls the phase variation, and the phase for k-th subframe is denoted by  $\theta_k = \theta_0 + \Delta\theta \cdot k$ , where  $\theta_0$  is the random start value with the uniform distribution, i.e.,  $\theta_0 \in [0,2\pi]$ ,  $\Delta\theta$  is the step of phase variation, which is defined in Table B.2.3A.4-1, and k is the linear increment of 1 for every subframe throughout the simulation,
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3A.4-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta  heta$	1.2566×10 <sup>-3</sup>

# B.2.3B MIMO Channel Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

The MIMO channel correlation matrices defined in B.2.3B apply for the antenna configuration using two-dimension (2D) cross polarized antennas at eNodeB and the antenna configuration using cross polarized antennas at UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

For 2D cross-polarized antenna array at eNodeB, the N antennas are indexed by  $(N_1, N_2, P)$ , and total number of antennas is  $N = P \cdot N_1 \cdot N_2$ , where

- $N_1$  is the number of antenna elements in first dimension (i.e. vertical direction) with same polarization,
- $N_2$  is the number of antenna elements in second dimension (i.e. horizontal direction) with same polarization, and
- *P* is the number of polarization groups.

For the 2D cross-polarized antennas at eNB, the N antennas are labelled such that antennas shall be in increasing order of the second dimension firstly, then the first dimension, and finally the polarization group. For a specific antenna

element at p-th polarization,  $n_1$ -th row, and  $n_2$ -th column within the 2D antenna array, the following index number is used for antenna labelling:

$$Index(p, n_1, n_2) = p \cdot N_1 \cdot N_2 + n_1 \cdot N_2 + n_2 + 1,$$
  $p = 0, 1, n_1 = 0, \dots, N_1 - 1, n_2 = 0, \dots, N_2 - 1.$ 

where N is the number of transmit antennas, p is the polarization group index,  $n_1$  is the row index, and  $n_2$  is the column index of the antenna element.

For the cross-polarized antennas at UE, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of receive antennas.

### B.2.3B.1 Definition of MIMO Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- $R_{UE}$  is the spatial correlation matrix at the UE with same polarization,
- $R_{eNR}$  is the spatial correlation matrix at the eNB with same polarization,
- $\Gamma$  is a polarization correlation matrix, and
- $(\bullet)^T$  denotes transpose.

The spatial correlation matrix at the eNB is further expressed as following:

$$R_{eNB} = R_{eNB Dim.1} \otimes R_{eNB Dim.2}$$

where

- $R_{eNB\_Dim,1}$  is the correlation matrix of antenna elements in first dimension with same polarization, and
- $R_{PNR-Dim,2}$  is the correlation matrix of antenna elements in second dimension with same polarization.

The matrix  $\Gamma$  is defined as

$$\Gamma = \begin{bmatrix}
1 & 0 & -\gamma & 0 \\
0 & 1 & 0 & \gamma \\
-\gamma & 0 & 1 & 0 \\
0 & \gamma & 0 & 1
\end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt + 1, \dots, Nt/2 \\ 0 & \text{otherwise} \end{cases}$$

where  $N_t$  and  $N_r$  is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3B.

## B.2.3B.2 Spatial Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

### B.2.3B.2.1 Spatial Correlation Matrices at eNB side

For one direction of the 2D antenna array at the eNB side, the followings are used to construct the spatial correlation matrix:

For 1 antenna element of the same polarization in one direction,  $R_{eNB\ Dim,i}=1$ .

For 2 antenna elements of the same polarization in one direction,  $R_{eNB\_Dim,i} = \begin{pmatrix} 1 & \alpha_i \\ \alpha_i^* & 1 \end{pmatrix}$ .

For 3 antenna elements of the same polarization in one direction,  $R_{eNB\_Dim,i} = \begin{pmatrix} 1 & \alpha_i^{1/4} & \alpha_i \\ \alpha_i^{1/4} & 1 & \alpha_i^{1/4} \\ \alpha_i^* & \alpha_i^{1/4} & 1 \end{pmatrix}$ .

For 4 antenna elements of the same polarization in one direction,  $R_{eNB\_Dim,i} = \begin{pmatrix} 1 & \alpha_i^{1/9} & \alpha_i^{4/9} & \alpha_i \\ \alpha_i^{1/9} & 1 & \alpha_i^{1/9} & \alpha_i^{4/9} \\ \alpha_i^{4/9} & \alpha_i^{1/9} & 1 & \alpha_i^{1/9} \\ \alpha_i^{*} & \alpha_i^{4/9} & \alpha_i^{1/9} & 1 \end{pmatrix}.$ 

where the index i = 1,2 stands for first dimension and second dimension respectively.

#### B.2.3B.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements,  $R_{\rm UE}=1$ .

For 4-antenna receiver using two pairs of cross-polarized antenna elements,  $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ .

## B.2.3B.3 MIMO Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

The values for parameters  $\alpha_l$ ,  $\alpha_2$ ,  $\beta$  and  $\gamma$  for high spatial correlation are given in Table B.2.3B.3-1.

Table B.2.3B.3-1

High spatial correlation							
	$\alpha_1$ $\alpha_2$ $\beta$ $\gamma$						
	0.9 0.9 0.9 0.3						
Note 1:	<ol> <li>Value of α₁ applies when more than one pair of cross-polarized antenna elements in first dimension at eNB side.</li> </ol>						
Note 2:	Value of $\alpha_2$ applies when more than one pair of cross-polarized antenna elements in second dimension at eNB side.						
Note 3:	Value of $\beta$ applies when more than one pair of cross-polarized antenna elements at UE side.						

The correlation matrices for high spatial correlation are defined in Table B.2.3B.3-2 as below.

The values in Table B.2.3B.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 16(2,4,2)x2 high spatial correlation case, a=0.00012.

Table B.2.3B.3-2: MIMO correlation matrices for high spatial correlation

	Table B.2.3B.3-2: MIMO correlation matrices for high spatial correlation
	$R_{high} = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ , where
	1.0000     0.0000     0.9740     0.0000     0.9000     0.0000     0.9000     0.0000     0.8766     0.0000     0.8100     0.0000       0.0000     1.0000     0.0000     0.9740     0.0000     0.9000     0.0000     0.9000     0.0000     0.8766     0.0000     0.8100
	0.9740 0.0000 1.0000 0.0000 0.9740 0.0000 0.8766 0.0000 0.9000 0.0000 0.8766 0.0000 0.0000 0.9740 0.0000 1.0000 0.0000 0.9740 0.0000 0.8766 0.0000 0.9000 0.0000 0.8766
	0.9000 0.0000 0.9740 0.0000 1.0000 0.0000 0.8700 0.0000 0.9000 0.0000 0.8700
	$A = D = \begin{bmatrix} 0.0000 & 0.9000 & 0.0000 & 0.9740 & 0.0000 & 1.0000 & 0.8100 & 0.0000 & 0.8766 & 0.0000 & 0.9000 \end{bmatrix}$
	0.9000 0.0000 0.8766 0.0000 0.8100 0.0000 1.0000 0.0000 0.9740 0.0000 0.9000 0.0000 0.0000 0.0000 0.9000 0.0000 0.8766 0.0000 0.8100 0.0000 1.0000 0.0000 0.9740 0.0000 0.9000
	0.8766 0.0000 0.9000 0.0000 0.8766 0.0000 0.9740 0.0000 0.9740 0.0000 0.9000
	0.0000 0.8766 0.0000 0.9000 0.0000 0.8766 0.0000 0.9740 0.0000 1.0000 0.0000 0.9740
12(2,3,2)x2	0.8100 0.0000 0.8766 0.0000 0.9000 0.0000 0.9000 0.9740 0.0000 1.0000 0.0000
case	[ 0.0000 0.8100 0.0000 0.8766 0.0000 0.9000 0.0000 0.9000 0.0000 0.9740 0.0000 1.0000] [ -0.3000 0.0000-0.2922 0.0000-0.2700 0.0000-0.2700 0.0000-0.2630 0.0000-0.2430 0.0000]
	0.0000 0.3000 0.0000 0.2922 0.0000 0.2700 0.0000 0.2700 0.0000 0.2630 0.0000 0.2430
	-0.2922 0.0000-0.3000 0.0000-0.2922 0.0000-0.2630 0.0000-0.2700 0.0000-0.2630 0.0000
	0.0000 0.2922 0.0000 0.3000 0.0000 0.2922 0.0000 0.2630 0.0000 0.2700 0.0000 0.2630
	-0.2700 0.0000-0.2922 0.0000-0.3000 0.0000-0.2430 0.0000-0.2630 0.0000-0.2700 0.0000 0.0000 0.2700 0.0000 0.2922 0.0000 0.3000 0.0000 0.2430 0.0000 0.2630 0.0000 0.2700
	$B = C = \begin{vmatrix} 0.0000 & 0.2700 & 0.0000 & 0.2322 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2300 & 0.0000 & 0.2700 \\ -0.2700 & 0.0000 - 0.2630 & 0.0000 - 0.2430 & 0.0000 - 0.3000 & 0.0000 - 0.2922 & 0.0000 - 0.2700 & 0.0000 &$
	0.0000 0.2700 0.0000 0.2630 0.0000 0.2430 0.0000 0.3000 0.0000 0.2922 0.0000 0.2700
	-0.2630 0.0000-0.2700 0.0000-0.2630 0.0000-0.2922 0.0000-0.3000 0.0000-0.2922 0.0000
	0.0000 0.2630 0.0000 0.2700 0.0000 0.2630 0.0000 0.2922 0.0000 0.3000 0.0000 0.2922 -0.2430 0.0000-0.2630 0.0000-0.2700 0.0000-0.2700 0.0000-0.2922 0.0000-0.3000 0.0000
	0.0000 0.2430 0.0000 0.2630 0.0000 0.2700 0.0000 0.2700 0.0000 0.2922 0.0000 0.3000
	$R_{high} = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ , where
	[C D]  1.0000 0.0000 0.9882 0.0000 0.9541 0.0000 0.8999 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000 0.8099 0.0000  0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.0000 0.8999 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000 0.8099  0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000  0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000  0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000  0.9541 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.8587 0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000  0.0000 0.9541 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.8587 0.0000 0.8584 0.0000 0.8999 0.0000 0.8894  0.8999 0.0000 0.9541 0.0000 0.9882 0.0000 1.0000 0.0000 0.8099 0.0000 0.8587 0.0000 0.8894 0.0000 0.8999 0.0000
	$A = D = \begin{bmatrix} 0.0000 & 0.8999 & 0.0000 & 0.9541 & 0.0000 & 0.9882 & 0.0000 & 1.0000 & 0.8099 & 0.0000 & 0.8587 & 0.0000 & 0.8894 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9882 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8099 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8099 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8099 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8899 \\ 0.8999 & 0.0000 & 0.8894 & 0.0000 \\ 0.8999 & 0.0000 & $
	0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000 0.8099 0.0000 1.0000 0.9882 0.0000 0.9541 0.0000 0.8999 0.0000
	0.8894 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.0000
	0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000 0.8587 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000 0.9541 0.8587 0.0000 0.8894 0.0000 0.8899 0.0000 0.8894 0.0000 0.9541 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882 0.0000
	0.0000 0.8587 0.0000 0.8894 0.0000 0.8999 0.0000 0.8894 0.0000 0.9541 0.0000 0.9882 0.0000 1.0000 0.0000 0.9882
16(2,4,2)x2 case	0.8099 0.0000 0.8587 0.0000 0.8894 0.0000 0.8999 0.0000 0.8999 0.0000 0.9541 0.0000 0.9882 0.0000 1.0000 0.0000
Case	$ \begin{bmatrix} 0.0000 & 0.8099 & 0.0000 & 0.8587 & 0.0000 & 0.8894 & 0.0000 & 0.8999 & 0.0000 & 0.8999 & 0.0000 & 0.9541 & 0.0000 & 0.9882 & 0.0000 & 1.0000 \end{bmatrix} $ $ \begin{bmatrix} -0.3000 & 0.0000 - 0.2965 & 0.0000 - 0.2862 & 0.0000 - 0.2700 & 0.0000 - 0.2700 & 0.0000 - 0.2668 & 0.0000 - 0.2576 & 0.0000 - 0.2430 & 0.0000 \end{bmatrix} $
	0.0000 0.3000 0.0000 0.2965 0.0000 0.2862 0.0000 0.2700 0.0000 0.2700 0.0000 0.2668 0.0000 0.2576 0.0000 0.2430
	-0.2965 0.0000-0.3000 0.0000-0.2965 0.0000-0.2862 0.0000-0.2668 0.0000-0.2700 0.0000-0.2668 0.0000-0.2576 0.0000
	0.0000 0.2965 0.0000 0.3000 0.0000 0.2965 0.0000 0.2862 0.0000 0.2668 0.0000 0.2700 0.0000 0.2668 0.0000 0.2576 -0.2862 0.0000-0.2965 0.0000-0.3000 0.0000-0.2965 0.0000-0.2576 0.0000-0.2668 0.0000-0.2700 0.0000-0.2668 0.0000
	0.0000 0.2862 0.0000 0.2965 0.0000 0.3000 0.0000 0.2965 0.0000 0.2576 0.0000 0.2668 0.0000 0.2700 0.0000 0.2668
	-0.2700 0.0000-0.2862 0.0000-0.2965 0.0000-0.3000 0.0000-0.2430 0.0000-0.2576 0.0000-0.2668 0.0000-0.2700 0.0000
	$B = C = \begin{bmatrix} 0.0000 & 0.2700 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2700 \\ -0.2700 & 0.0000 - 0.2668 & 0.0000 - 0.2576 & 0.0000 - 0.2430 & 0.0000 - 0.3000 & 0.0000 - 0.2965 & 0.0000 - 0.2862 & 0.0000 - 0.2700 & 0.0000 \end{bmatrix}$
	0.0000 0.2700 0.0000 0.2668 0.0000 0.2576 0.0000 0.2430 0.0000 0.3000 0.0000 0.2965 0.0000 0.2862 0.0000 0.2700
	-0.2668 0.0000-0.2700 0.0000-0.2668 0.0000-0.2576 0.0000-0.2965 0.0000-0.3000 0.0000-0.2965 0.0000-0.2862 0.0000
	0.0000 0.2668 0.0000 0.2700 0.0000 0.2668 0.0000 0.2576 0.0000 0.2965 0.0000 0.3000 0.0000 0.2965 0.0000 0.2862 -0.2576 0.0000-0.2668 0.0000-0.2700 0.0000-0.2668 0.0000-0.2862 0.0000-0.2965 0.0000-0.3000 0.0000-0.2965 0.0000
	0.0000 0.2576 0.0000 0.2668 0.0000 0.2700 0.0000 0.2668 0.0000 0.2862 0.0000 0.2965 0.0000 0.3000 0.0000 0.2965
	-0.2430 0.0000-0.2576 0.0000-0.2668 0.0000-0.2700 0.0000-0.2700 0.0000-0.2862 0.0000-0.2965 0.0000-0.3000 0.0000
	0.0000 0.2430 0.0000 0.2576 0.0000 0.2668 0.0000 0.2700 0.0000 0.2700 0.0000 0.2862 0.0000 0.2965 0.0000 0.3000

### B.2.3B.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3B.1, the corresponding random channel matrix  $\mathbf{H}$  can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_{k-1},\theta_{k-2}}Wx + n$$

And the steering matrix is further expressed as following:

$$D_{\theta_{k,1},\theta_{k,2}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \left( D_{\theta_{k,1}}(N_1) \otimes D_{\theta_{k,2}}(N_2) \right)$$

where

- H is the Nr xNt channel matrix per subcarrier.
- $D_{\theta_{k,1},\theta_{k,2}}$  is the steering matrix,
- $D_{\theta_{-}}(N_1)$  is the steering matrix in first dimension with same polarization,
- $D_{\theta_{k,2}}(N_2)$  is the steering matrix in second dimension with same polarization,
- $N_1$  is the number of antenna elements infirst dimension with same polarization,
- $N_2$  is the number of antenna elements in second dimension with same polarization,

For 1 antenna element of the same polarization in one direction,  $D_{\theta_{-}}(1) = 1$ .

For 2 antenna elements of the same polarization in one direction,  $D_{\theta_{k,i}}(2) = \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_{k,i}} \end{bmatrix}$ .

For 3 antenna elements of the same polarization in one direction,  $D_{\theta_{k,i}}(3) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & e^{j1.5\theta_{k,i}} & 0 \\ 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$ 

For 4 antenna elements of the same polarization in one direction,  $D_{\theta_{k,i}}(4) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_{k,i}} & 0 & 0 \\ 0 & 0 & e^{j2\theta_{k,i}} & 0 \\ 0 & 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$ 

where the index i = 1,2 stands for first dimension and second dimension respectively.

- $\theta_{k,i}$  controls the phase variation in first dimension and second dimension respectively, and the phase for k-th subframe is denoted by  $\theta_{k,i} = \theta_{0,i} + \Delta\theta \cdot k$ , where  $\theta_{0,i}$  is the random start value with the uniform distribution, i.e.,  $\theta_{0,i} \in [0,2\pi]$ ,  $\Delta\theta$  is the step of phase variation, which is defined in Table B.2.3B.4-1, and k is the linear increment of 1 for every subframe throughout the simulation, the index i=1,2 stands for first dimension and second dimension respectively.
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3B.4-1: The step of phase variation

Variation Step	Value (rad/subframe)	
$\Delta \theta$	1.2566×10 <sup>-3</sup>	

## B.2.4 Propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(-i2\pi f_D t)\delta(\tau - \tau_d)$$
,

in continuous time  $(t, \tau)$  representation, with  $\tau_d$  the delay, a a constant and  $f_D$  the Doppler frequency. The same  $h(t, \tau)$  is used to describe the fading channel between every pair of Tx and Rx.

### B.2.4.1 Propagation conditions for CQI tests with multiple CSI processes

For CQI tests with multiple CSI processes, the following additional multi-path profile is used for 2 port transmission:

$$H = \begin{bmatrix} 1 & j \\ 1 & -j \end{bmatrix} \circ H_{MP}$$

Where  $\circ$  represents Hadamard product,  $H_{MP}$  indicates the 2x2 propagation channel generated in the manner defined in Clause B.2.4.

#### B.2.5 Void

## B.2.6 MBSFN Propagation Channel Profile

Table B.2.6-1 shows propagation conditions that are used for the MBSFN performance requirements in multi-path fading environment in an extended delay spread environment.

Table B.2.6-1: Propagation Conditions for Multi-Path Fading Environments for MBSFN Performance Requirements in an extended delay spread environment

Extended Delay Spread  Maximum Doppler frequency [5Hz]				
0	0			
30	-1.5			
150	-1.4			
310	-3.6			
370	-0.6			
1090	-7.0			
12490	-10			
12520	-11.5			
12640	-11.4			
12800	-13.6			
12860	-10.6			
13580	-17.0			
27490	-20			
27520	-21.5			
27640	-21.4			
27800	-23.6			
27860	-20.6			
28580	-27.0			

## B.3 High speed train scenario

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1}$$

where  $f_s(t)$  is the Doppler shift and  $f_d$  is the maximum Doppler frequency. The cosine of angle  $\theta(t)$  is given by

$$\cos\theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.2)

$$\cos \theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.3)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), t > 2D_s/v$$
(B.3.4)

where  $D_s/2$  is the initial distance of the train from eNodeB, and  $D_{\min}$  is eNodeB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

Doppler shift and cosine angle are given by equation B.3.1 and B.3.2-B.3.4 respectively, where the required input parameters listed in table B.3-1 and the resulting Doppler shift shown in Figure B.3-1 are applied for all frequency bands.

Parameter	Value
$D_s$	300 m
$D_{\min}$	2 m
ν	300 km/h
$f_{A}$	750 Hz

Table B.3-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3-1 including  $f_d$  and Doppler shift trajectories presented on figure B.3-1 were derived from Band 7 and are applied for performance verification in all frequency bands.

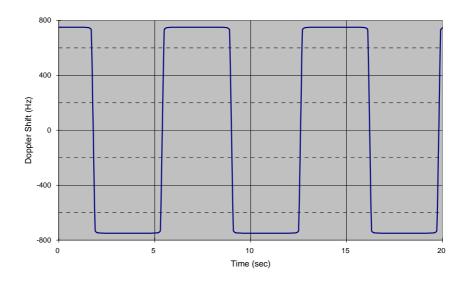


Figure B.3-1: Doppler shift trajectory

For 1x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx.

For 2x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx with phase shift according to  $\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}$ .

## B.4 Beamforming Model

## B.4.1 Single-layer random beamforming (Antenna port 5, 7, or 8)

Single-layer transmission on antenna port 5 or on antenna port 7 or 8 without a simultaneous transmission on the other antenna port, is defined by using a precoder vector W(i) of size  $2\times 1$  randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1$ , for antenna port  $p\in\{5,7,8\}$ , with  $M_{\mathrm{symb}}^{\mathrm{ap}}$  the number of modulation symbols including the

user-specific reference symbols (DRS), and generates a block of signals  $y_{bf}(i) = [y_{bf}(i) \ \tilde{y}_{bf}(i)]^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i)$$

Single-layer transmission on antenna port 7 or 8 with a simultaneous transmission on the other antenna port, is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size  $2\times1$ , which are not identical and randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} (W_1(i)y^{(7)}(i) + W_2(i)y^{(8)}(i))$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15,16,...,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15,16,...,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\widetilde{y}_{bf}(i)$ .

### B.4.2 Dual-layer random beamforming (antenna ports 7 and 8)

Dual-layer transmission on antenna ports 7 and 8 is defined by using a precoder matrix W(i) of size  $2 \times 2$  randomly selected with the number of layers v=2 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input a block of signals for antenna ports 7 and 8,  $y(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) \end{bmatrix}^T$ ,  $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$ , with  $M_{\text{symb}}^{\text{ap}}$  being the number of modulation symbols per antenna port including the user-specific reference symbols, and generates a block of signals  $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \widetilde{y}_{bf}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix},$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15,16,...,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15,16,...,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\widetilde{y}_{bf}(i)$ .

## B.4.3 Generic beamforming model (antenna ports 7-14)

The transmission on antenna port(s) p=7,8,...,v+6 is defined by using a precoder matrix W(i) of size  $N_{CSI} \times v$ , where  $N_{CSI}$  is the number of CSI reference signals configured per test and v is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) p=7,8,...,v+6,  $y^{(p)}(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) & \cdots & y^{(6+v)}(i) \end{bmatrix}$ ,  $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$ , with  $M_{\text{symb}}^{\text{ap}}$  being the number of modulation symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals  $y_{bf}^{(q)}(i) = \begin{bmatrix} y_{bf}^{(0)}(i) & y_{bf}^{(1)}(i) & \cdots & y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same time-frequency index pair (k,l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

The precoder matrix W(i) is specific to a test case.

The physical antenna elements are identified by indices  $j = 0,1,...,N_{ANT}-1$ , where  $N_{ANT}=N_{CSI}$  is the number of physical antenna elements configured per test.

Modulation symbols  $y_{bf}^{(q)}(i)$  with  $q \in \{0,1,...,N_{CSI}-1\}$  (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j=q.

Modulation symbols  $y^{(p)}(i)$  with  $p \in \{0,1,...,P-1\}$  (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{0,1,...,P-1\}$  (i.e. CRS) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{15,16,...,14+N_{CSI}\}$  (i.e. CSI-RS) are mapped to the physical antenna index j=p-15, where  $N_{CSI}$  is the number of CSI reference signals configured per test.

## B.4.4 Random beamforming for EPDCCH distributed transmission (Antenna port 107 and 109)

EPDCCH distributed transmission on antenna port 107 and antenna port 109 is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size  $2\times 1$ , which are not identical and randomly selected per EPDCCH PRB pair with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$ , for antenna port  $p\in\{107,109\}$ , with  $M_{\text{symb}}^{\text{ap}}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a block of signals  $y_{bf}(i)=\begin{bmatrix} y_{bf}(i) & \widetilde{y}_{bf}(i) \end{bmatrix}^T$ . When EPDCCH is associated with port 107, the transmitted block of signals is deonted as

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W_1(i) y^{(107)}(i).$$

When EPDCCH is associated with port 109, the transmitted block of signals is denoted as

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W_2(i)y^{(109)}(i).$$

## B.4.5 Random beamforming for EPDCCH localized transmission (Antenna port 107, 108, 109 or 110)

EPDCCH localized transmission on antenna port 107, 108, 109 or 110 is defined by using a precoder vector W(i) of size  $2\times1$  randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1$ , for antenna port  $p\in\{107,108,109,110\}$ , with

 $M_{\text{symb}}^{\text{ap}}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a

block of signals  $y_{bf}(i) = [y_{bf}(i) \ \tilde{y}_{bf}(i)]^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i).$$

# B.5 Interference models for enhanced performance requirements Type-A

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-A including: definition of dominant interferer proportion, transmission mode 3, 4 and 9 type of interference modelling.

### B.5.1 Dominant interferer proportion

Each interfering cell involved in enhanced performance requirements Type-A is characterized by its associated dominant interferer proportion (DIP) value:

$$DIP_i = \frac{\hat{I}_{or(i+1)}}{N_{oc}}$$

where is  $\hat{I}_{or(i+1)}$  is the average received power spectral density from the i-th strongest interfering cell involved in the requirement scenario ( $\hat{I}_{or(1)}$  is assumed to be the power spectral density associated with the serving cell) and

 $N_{oc}' = \sum_{j=2}^{N} \hat{I}_{or(j)} + N_{oc}$  where  $N_{oc}$  is the average power spectral density of a white noise source consistent with the

definition provided in subclause 3.2 and N is the total number of cells involved in a given requirement scenario.

### B.5.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For rank-1 transmission over a subband, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission over a subband, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.5.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth according to the probabilities of occurrence. Transmitted physical channels shall include PSS, SSS and PBCH. Probabilities of occurrence in each subframe are as specified in the requirement scenario. If the probabilities of occurrence in each subframe are not specified in the requirement scenario, as default, they are equal to 1.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices for each subframe and each CQI subband.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.5.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth according to the probabilities of occurrence. Transmitted physical channels shall include PSS, SSS and PBCH. Probabilities of occurrence in each subframe are as specified in the requirement scenario. If the probabilities of occurrence in each subframe are not specified in the requirement scenario, as default, they are equal to 1.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and each CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-2 of [4].

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe and each CQI subband shall be applied to 16QAM randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

# B.6 Interference models for enhanced performance requirements Type-B

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-B including: transmission mode 2, 3, 4 and 9 type of interference modelling and a definition of the random interference model.

### B.6.1 Transmission mode 2 interference model

This subclause provides transmission mode 2 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

Precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.6.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined for each user defined in section B.6.6 with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For rank-1 transmission, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

#### B.6.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For each TTI, for each user defined in B.6.6, a single precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices as specified in subclause B.6.6.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.6.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For each TTI, for each user defined in B.6.6, a single precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe shall be applied to randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For each TTI, for each user defined in B.6.6, the scrambling ID value nSCID is randomly assigned from the set of  $\{0,1\}$ .

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.6.5 CRS interference model

This subclause provides for the CRS interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe there is no PDSCH transmitted. Transmitted physical channels shall include PSS, SSS and PBCH.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

### B.6.6 Random interference model

This subclause presents the interference model which defines the resource allocation, MCS and rank for the two interference cells. The model includes approximately 10% DTX on these interference cells. Table B.6.6-1 shows the resource allocation for four users in two different configurations for each of the two interferers. Table B.6.6-2 shows the resource allocation to be used for special subframes with TM9 interference. Table B.6.6-3 shows the probabilities for the MSC and rank for these users.

Table B.6.6-1: Resource allocation for the random interference model

Resource		Resource allocation for random interference model				
allocation	User	Resource	Bitmap for resource allocation (Note 1)			Probability
configurations Indexes	Index	allocation type	1st field bitmap	2nd field bitmap	3rd field bitmap	Trobability
Configuration 1	User 0	1	00 0 10101000101010			
	User 1	1	00	0	01010101010101	50%
	User 2	0	01001001001001		30 /6	
	User 3	0		00100100100	100100	
Configuration 2	User 0	1	00 0 101010101010			
	User 1	1	00	1	01010100010101	50%
	User 2	0		010010010010	001001	30%
	User 3	0		00100100100	100100	

Note 1: The 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> field bitmaps are only valid for resource allocation type 1 which was defined in [6]. Note 2: The resource allocation model is used for both 1<sup>st</sup> and 2<sup>nd</sup> interfering cells and the resource allocation is independent for each interfering cell.

Table B.6.6-2: Resource allocation for the random interference model for TM9 special subframes

Resource		Resour				
allocation	User	Resource	Resource Bitmap for resource allocation (Note 1)			Probability
configurations Indexes	Index	allocation type	1st field bitmap	2nd field bitmap	3rd field bitmap	Probability
Configuration 1	User 0	1	00	0	10101000101010	
	User 1	1	00	0	01010101000001	50%
	User 2	0	01001000001001001		30%	
	User 3	0	00100100000100100			
Configuration 2	User 0	1	00 0 10101000101010		10101000101010	
	User 1	1	00	1	01010000010101	50%
	User 2	0	01001000001001001		50%	
	User 3	0		00100100000	100100	

Note 1: The 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> field bitmaps are only valid for resource allocation type 1 which was defined in [6]. Note 2: The resource allocation model is used for both 1<sup>st</sup> and 2<sup>nd</sup> interfering cells and the resource allocation is independent for each interfering cell.

Table B.6.6-3 MCS and rank configuration for the random interference model

MCS probability				Rank probability		
MCS5 MCS14 MCS25			Rank 1	Rank 2		
50% 25% 25%				80%	20%	
Note 1:	The MCS and rank should follow the probability indicated in the table randomly per UE per TTI.					
Note 2:	The probabilities for MCS and rank configuration are used for both 1 <sup>st</sup> and 2 <sup>nd</sup> interfering cells.					
	The MCS and r	The MCS and rank configurations are independent for each interfering cell.				

# B.7 Interference models for enhanced downlink control channel performance requirements Type A and B

This clause provides a description for the modelling of interfering cell transmissions for the enhanced downlink control channel performance requirements Type A and B.

### B.7.1 PDCCH, PCFICH and PHICH interference model

This subclause provides a description of the interfering cell transmissions model for the enhanced PDCCH/PCFICH and PHICH downlink control channel performance requirements Type A and B under synchronous network scenarios.

The transmitted physical signals and channels shall include CRS, PSS, SSS, PBCH and PCFICH. The PDCCH and PHICH transmit signals are emulated as virtual PDCCH signals described further in the clause.

The PDCCH signals are modelled with a per control channel element (CCE) level granularity and have guaranteed 50% CCE resource loading in each subframe. For each subframe the set of active and inactive CCEs is derived in accordance to the following procedure:

- 1) All available CCEs for the PDCCH and PHICH are marked as  $CCE_0$ ,  $CCE_1$ , ...,  $CCE_{N-1}$ .
- 2) For the given partial loading ratio X = 50% the numbers of active CCEs  $M_{Active}$  and inactive CCEs  $M_{Inactive}$  are derived

$$M_{Inactive} = \lfloor N * (100 - X \%) \rfloor$$
$$M_{Active} = N - M_{Inactive}$$

- 3) The indexes of  $M_{Inactive}$  inactive CCEs are randomly selected out of the full set of CCEs.
- 4) The remaining  $M_{Active}$  CCEs are assigned to be active.

No signals are transmitted in the REs corresponding to the inactive CCEs. The PDCCH signals are transmitted in the REs corresponding to the active CCEs. For PDCCH REs, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio of the PDCCH REs in the active CCEs shall be derived in accordance to the following procedure:

- 1) For each generated active i-th CCE the PDCCH power boosting level P(i) shall be randomly generated using the uniform distribution in the [Pmin, Pmax] range. The Pmin is equal to -6 dB, the Pmax is equal to 6 dB. The random values should be derived in the dB scale.
- 2) Additional power normalization is applied for each generated i-th PDCCH power boosting level:

$$P_{norm}(i) = P(i) - \alpha$$

where P(i) and  $P_{norm}(i)$  are the PDCCH power boosting coefficients before and after normalization in the dB scale; the power normalization factor  $\alpha$  is equal to 1.3 dB.

3) The normalized PDCCH power boosting coefficients  $P_{norm}(i)$  are further applied to the PDCCH\_RA and PDCCH\_RB values to derive the EPRE ratio of the PDCCH signals transmitted in the REs corresponding the i-th CCE in each subframe.

## Annex C (normative): Downlink Physical Channels

### C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

## C.2 Set-up

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Table C.2-1: Downlink Physical Channels required for connection set-up

Physical Channel
PBCH
SSS
PSS
PCFICH
PDCCH
EPDCCH
PHICH
PDSCH

## C.3 Connection

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

### C.3.1 Measurement of Receiver Characteristics

Unless otherwise stated, Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7).

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio
PBCH	PBCH_RA = 0 dB
	PBCH_RB = 0 dB
PSS	$PSS_RA = 0 dB$
SSS	$SSS_RA = 0 dB$
PCFICH	PCFICH_RB = 0 dB
PDCCH	PDCCH_RA = 0 dB
	PDCCH_RB = 0 dB
PDSCH	PDSCH_RA = 0 dB
	PDSCH_RB = 0 dB
OCNG	OCNG_RA = 0 dB
	OCNG_RB = 0 dB

NOTE 1: No boosting is applied.

For measurements on cells in TDD Band 46, Table C.3.1-1a is applicable for measurements of Receiver Characteristics (clause 7).

Table C.3.1-1a: Downlink Physical Channels transmitted during a connection (TDD Band 46)

Physical Channel	EPRE Ratio	
DRS	NOTE 1	
PSS	PSS_RA = 0 dB	
SSS	$SSS_RA = 0 dB$	
PCFICH	PCFICH_RB = 0 dB	
PDCCH	PDCCH_RA = 0 dB	
	PDCCH_RB = 0 dB	
PDSCH	PDSCH_RA = 0 dB	
	PDSCH_RB = 0 dB	
OCNG	OCNG_RA = 0 dB	
	OCNG_RB = 0 dB	
NOTE 1: No boosting is applied.		

Table C.3.1-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Transmitted power spectral density $I_{\it or}$	dBm/15 kHz	Test specific	1. $I_{or}$ shall be kept constant throughout all OFDM symbols
Cell-specific reference signal power ratio $E_{\it RS}$ / $I_{\it or}$		0 dB	

## C.3.2 Measurement of Performance requirements

Table C.3.2-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels.

Table C.3.2-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio		
PBCH	PBCH_RA = $\rho_A$ + $\sigma$		
	PBCH_RB = $\rho_B$ + $\sigma$		
PSS	$PSS_RA = 0 \text{ (Note 3)}$		
SSS	$SSS_RA = 0$ (Note 3)		
PCFICH	PCFICH_RB = $\rho_B$ + $\sigma$		
PDCCH	PDCCH_RA = $\rho_A$ + $\sigma$		
	PDCCH_RB = $\rho_B$ + $\sigma$		
EPDCCH	EPDCCH_RA = $\rho_A$ + $\delta$		
	EPDCCH_RB = $\rho_B + \delta$		
MPDCCH	MPDCCH_RA = $\rho_A$ + $\delta$		
	MPDCCH_RB = $\rho_B$ + $\delta$		
PDSCH	PDSCH_RA = $\rho_A$		
	PDSCH_RB = $\rho_B$		
PMCH	$PMCH_RA = \rho_A$		
	$PMCH_RB = \rho_B$		
MBSFN RS	MBSFN RS_RA = $\rho_A$		
	MBSFN RS_RB = ρ <sub>B</sub>		
OCNG	OCNG_RA = $\rho_A$ + $\sigma$		
	OCNG_RB = $\rho_B$ + $\sigma$		

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: MBSFN RS and OCNG are not defined downlink physical channels in [4].

NOTE 3: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 4:  $\rho_A$ ,  $\rho_B$ ,  $\sigma$ , and  $\delta$  are test specific.

NOTE 5: For TM 8, TM 9 and TM10  $\rho_A$ ,  $\rho_B$  are used for the purpose of the test set up only.

Table C.3.2-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Total transmitted power	dBm/15 kHz	Test specific	1. $I_{or}$ shall be kept
spectral density $I_{\it or}$			constant throughout all OFDM symbols
Cell-specific reference		Test specific	Applies for antenna
signal power ratio $E_{\it RS}$ / $I_{\it or}$			port p
Energy per resource element EPRE		Test specific	1. The complex-valued symbols $y^{(p)}(i)$ and
			$a_{k,l}^{(p)}$ defined in [4] shall
			conform to the given EPRE value. 2. For TM8, TM9 and TM10 the reference point for EPRE is before the precoder in Annex B.4.

## C.3.3 Aggressor cell power allocation for Measurement of Performance Requirements when ABS is Configured

For the performance requirements and channel state information reporting when ABS is configured, the power allocation for the physical channels of the aggressor cell in non-ABS and ABS is listed in Table C.3.3-1.

Table C.3.3-1: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell

Physical Channel	Parameters	Unit	EP	RE Ratio			
Physical Channel			Non-ABS	ABS			
PBCH	PBCH_RA	dB	ρΑ	Note 1			
PBCH	PBCH_RB	dB	ρв	Note 1			
PSS	PSS_RA	dB	ρΑ	Note 1			
SSS	SSS_RA	dB	ρΑ	Note 1			
PCFICH	PCFICH_RB	dB	ρв	Note 1			
PHICH	PHICH_RA dB		ρΑ	Note 1			
PHICH	PHICH_RB	dB	ρв	Note 1			
PDCCH	PDCCH_RA	dB	ρΑ	Note 1			
PDCCH	PDCCH_RB	dB	ρв	Note 1			
PDSCH	PDSCH_RA	dB	N/A	Note 1			
PDSCH	PDSCH_RB	dB	N/A	Note 1			
OCNG	OCNG_RA	dB	ρΑ	Note 1			
CONG	OCNG_RB	dB	ρв	Note 1			
Note 1: -∞ dB is allocated f							

Table C.3.3-2: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell when the CRS assistance information is provided

Dhysical Channel	Parameters	Unit	EP	RE Ratio	
Physical Channel			Non-ABS	ABS	
PBCH	PBCH_RA	dB	ρΑ	ρΑ	
PBCH	PBCH_RB	dB	ρв	ρ <sub>Β</sub>	
PSS	PSS_RA	dB	ρΑ	$\rho_{A}$	
SSS	SSS_RA	dB	ρΑ	ρΑ	
PCFICH	PCFICH_RB	dB	ρв	Note 1	
PHICH	PHICH_RA	dB	ρΑ	Note 1	
PHICH	PHICH_RB	dB	ρв	Note 1	
PDCCH	PDCCH_RA	dB	ρΑ	Note 1	
PDCCH	PDCCH_RB	dB	ρв	Note 1	
PDSCH	PDSCH_RA	dB	N/A	Note 1	
PDSCH	PDSCH_RB	dB	N/A	Note 1	
OCNG	OCNG_RA	dB	ρΑ	Note 1	
CONG	OCNG_RB	dB	ρв	Note 1	
Note 1: -∞ dB is allocated for this channel in this test.					

## C.3.4 Power Allocation for Measurement of Performance Requirements when Quasi Co-location Type B: same Cell ID

For the performance requirements related to quasi-colocation type B behaviour when transmission points share the same Cell ID, the power allocation for the physical channels of the serving cell is listed in Table C.3.4-1 and the power allocation for the physical channels of the cell transmitting PDSCH is listed in Table C.3.4-2

Table C.3.4-1: Downlink physical channels transmitted in the serving cell (TP1)

Physical Channel	EPRE Ratio	
PBCH	PBCH_RA = $\rho_A$ + $\sigma$	
	PBCH_RB = $\rho_B$ + $\sigma$	
PSS	$PSS_RA = 0 (Note 2)$	
SSS	$SSS_RA = 0 $ (Note 2)	
PDSCH	PDSCH_RA = $\rho_A$	
	PDSCH_RB = $\rho_B$	
PCFICH	PCFICH_RB = $\rho_B$ + $\sigma$	
PDCCH	PDCCH_RA = $\rho_A$ + $\sigma$	
	PDCCH_RB = $\rho_B$ + $\sigma$	

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 3:  $\rho_A$ ,  $\rho_B$  and  $\sigma$  are test specific.

Table C.3.4-2: Downlink physical channels for the transmission point transmitting PDSCH (TP2)

Physical Channel	Value
PDSCH	Test Specific

### C.3.5 Simplified CA testing method

For CA tests which require more than 16 independent faders, if a test system cannot support a throughput measurement with fading on all carriers simultaneously, the simplified CA testing method shall be used.

In the simplified CA testing method, the resulting propagation channel(s) shall be generated by considering a number of independent faders needed for one carrier and connecting them to the signal of randomly chosen carrier(s). The maximum number of channel faders on the test will be less than or equal to 16. The remaining carrier(s) shall be connected without a channel fader but with AWGN. The throughput is then collected only for the carrier(s) connected to channel faders.

In the simplified CA testing method, the test shall be repeated by choosing carrier(s) excluding already chosen carrier(s) until all the carrier(s) are tested under fading conditions. All the collected throughtputs from each carrier shall be compared against the reference value of the requirements.

All supported carriers shall be configured and activated during the test.

## Annex D (normative): Characteristics of the interfering signal

### D.1 General

Unless otherwise stated, when the channel bandwidth is wider or equal to 5MHz, a modulated 5MHz full bandwidth E-UTRA downlink signal and CW signal are used as interfering signals when RF performance requirements for E-UTRA UE receiver are defined. For channel bandwidths below 5MHz, the bandwidth of modulated interferer should be equal to bandwidth of the received signal.

For Band 46, the bandwidth of interfering signal is 20MHz when RF performance requirements for E-UTRA UE receiver are defined.

## D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel bandwidth options.

Table D.2-1: Description of modulated E-UTRA interferer

	Channel bandwidth						
	1.4 MHz	1.4 MHz   3 MHz   5 MHz   10 MHz   15 MHz   20 MHz					
BW <sub>Interferer</sub>	1.4 MHz	3 MHz	5 MHz	5 MHz	5 MHz	5 MHz	
RB	6	15	25	25	25	25	

Table D.2-2 describes the modulated interferer setting 2 for different channel bandwidth options for Band 46.

Table D.2-2: Description of modulated E-UTRA interferer for Band 46

	Channel bandwidth					
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
BW <sub>Interferer</sub>						20 MHz
RB						100

# Annex E (normative): Environmental conditions

## E.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

### E.2 Environmental

The requirements in this clause apply to all types of UE(s).

### E.2.1 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

**Table E.2.1-1** 

+15°C to +35°C	for normal conditions (with relative humidity of 25 % to 75 %)
-10°C to +55°C	for extreme conditions (see IEC publications 68-2-1 and 68-2-2)

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation.

### E.2.2 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The manufacturer shall declare the lower and higher extreme voltages and the approximate shutdown voltage. For the equipment that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified below.

**Table E.2.2-1** 

Power source	Lower extreme	Lower extreme voltage Higher extreme voltage		
			voltage	
AC mains	0,9 * nominal	1,1 * nominal	nominal	
Regulated lead acid battery	0,9 * nominal	1,3 * nominal	1,1 * nominal	
Non regulated batteries:				
Leclanché	0,85 * nominal	Nominal	Nominal	
Lithium	0,95 * nominal	1,1 * Nominal	1,1 * Nominal	
Mercury/nickel & cadmium	0,90 * nominal		Nominal	

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

### E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

**Table E.2.3-1** 

Frequency	ASD (Acceleration Spectral Density) random vibration		
5 Hz to 20 Hz	$0.96 \text{ m}^2/\text{s}^3$		
20 Hz to 500 Hz	0,96 m <sup>2</sup> /s <sup>3</sup> at 20 Hz, thereafter –3 dB/Octave		

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 36.101 for extreme operation.

# Annex F (normative): Transmit modulation

### F.1 Measurement Point

Figure F.1-1 shows the measurement point for the unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).

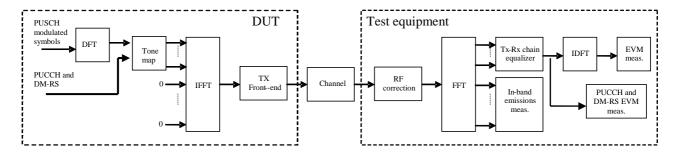


Figure F.1-1: EVM measurement points

## F.2 Basic Error Vector Magnitude measurement

The EVM is the difference between the ideal waveform and the measured waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{v \in T_m} |z'(v) - i(v)|^2}{|T_m| \cdot P_0}},$$

where

 $T_m$  is a set of  $|T_m|$  modulation symbols with the considered modulation scheme being active within the measurement period,

z'(v) are the samples of the signal evaluated for the EVM,

i(v) is the ideal signal reconstructed by the measurement equipment, and

 $P_0$  is the average power of the ideal signal. For normalized modulation symbols  $P_0$  is equal to 1.

The basic EVM measurement interval is defined over one slot in the time domain for PUCCH and PUSCH and over one preamble sequence for the PRACH.

### F.3 Basic in-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks. The in-band emission requirement is evaluated for PUCCH and PUSCH transmissions. The in-band emission requirement is not evaluated for PRACH transmissions.

The in-band emissions are measured as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{\max(f_{\min}, f_{l} + 12 \cdot \Delta_{RB} * \Delta f) \\ \min(f_{\max}, f_{h} + 12 \cdot \Delta_{RB} * \Delta f)}} |Y(t, f)|^{2}, \Delta_{RB} < 0 \\ \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{f_{h} + (12 \cdot \Delta_{RB} - 11) * \Delta f \\ f_{h} + (12 \cdot \Delta_{RB} - 11) * \Delta f}} |Y(t, f)|^{2}, \Delta_{RB} > 0 \end{cases}$$

where

 $T_s$  is a set of  $|T_s|$  SC-FDMA symbols with the considered modulation scheme being active within the measurement period,

 $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.  $\Delta_{RB}=1$  or  $\Delta_{RB}=-1$  for the first adjacent RB),

 $f_{\min}$  (resp.  $f_{\max}$ ) is the lower (resp. upper) edge of the UL system BW,

 $f_l$  and  $f_h$  are the lower and upper edge of the allocated BW, and

Y(t, f) is the frequency domain signal evaluated for in-band emissions as defined in the subsection (ii)

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_s| \cdot N_{RB}} \sum_{t \in T} \sum_{f_s}^{f_t + (12 \cdot N_{RB} - 1)\Delta f} |Y(t, f)|^2}$$

where

 $N_{RR}$  is the number of allocated RBs

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

In the evaluation of in-band emissions, the timing is set according to  $\Delta \tilde{t} = \Delta \tilde{c}$ , where sample time offsets  $\Delta \tilde{t}$  and  $\Delta \tilde{c}$  are defined in subclause F.4.

## F.4 Modified signal under test

Implicit in the definition of EVM is an assumption that the receiver is able to compensate a number of transmitter impairments.

The PUSCH data or PRACH or Physical Sidelink Channel signal under test is modified and, in the case of PUSCH or Physical Sidelink Channel data signal, decoded according to:

$$Z'(t,f) = IDFT \left\{ \frac{FFT \left\{ z(v - \Delta \widetilde{t}) \cdot e^{-j2\pi \Delta \widetilde{f}v} \right\} e^{j2\pi f\Delta \widetilde{t}}}{\widetilde{a}(t,f) \cdot e^{j\widetilde{\varphi}(t,f)}} \right\}$$

997

where

z(v) is the time domain samples of the signal under test.

The PUCCH or PUSCH or Physical Sidelink Channel demodulation reference signal or PUCCH data signal under test is equalised and, in the case of PUCCH data signal decoded according to:

$$Z'(t,f) = \frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi \Delta \tilde{f}v}\right\} e^{j2\pi \tilde{f}\Delta \tilde{t}}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}}$$

where

z(v) is the time domain samples of the signal under test.

To minimize the error, the signal under test should be modified with respect to a set of parameters following the procedure explained below.

Notation:

 $\Delta \tilde{t}$  is the sample timing difference between the FFT processing window in relation to nominal timing of the ideal signal.

 $\Delta \tilde{f}$  is the RF frequency offset.

 $\widetilde{\varphi}(t,f)$  is the phase response of the TX chain.

 $\tilde{a}(t, f)$  is the amplitude response of the TX chain.

In the following  $\Delta \tilde{c}$  represents the middle sample of the EVM window of length W (defined in the next subsections) or the last sample of the first window half if W is even.

The EVM analyser shall

- ightharpoonup detect the start of each slot and estimate  $\Delta \widetilde{t}$  and  $\Delta \widetilde{f}$  ,
- $\blacktriangleright$  determine  $\Delta \tilde{c}$  so that the EVM window of length W is centred
  - on the time interval determined by the measured cyclic prefix minus 16 samples of the considered OFDM symbol for symbol 0 for normal CP, i.e. the first 16 samples of the CP should not be taken into account for this step. In the determination of the number of excluded samples, a sampling rate of 30.72MHz was assumed. If a different sampling rate is used, the number of excluded samples is scaled linearly.
  - on the measured cyclic prefix of the considered OFDM symbol symbol for symbol 1 to 6 for normal CP and for symbol 0 to 5 for extended CP.
  - on the measured preamble cyclic prefix for the PRACH

To determine the other parameters a sample timing offset equal to  $\Delta \tilde{c}$  is corrected from the signal under test. The EVM analyser shall then

- ightharpoonup correct the RF frequency offset  $\Delta \widetilde{f}$  for each time slot, and
- > apply an FFT of appropriate size. The chosen FFT size shall ensure that in the case of an ideal signal under test, there is no measured inter-subcarrier interference.

The carrier leakage shall be removed from the evaluated signal before calculating the EVM and the in-band emissions; however, the removed relative carrier leakage power also has to satisfy the applicable requirement.

At this stage the allocated RBs shall be separated from the non-allocated RBs. In the case of PUCCH and PUSCH EVM, the signal on the non-allocated RB(s), Y(t, f), is used to evaluate the in-band emissions.

Moreover, the following procedure applies only to the signal on the allocated RB(s).

- In the case of PUCCH and PUSCH and Physical Sidelink Channel, the UL EVM analyzer shall estimate the TX chain equalizer coefficients  $\tilde{a}(t,f)$  and  $\tilde{\varphi}(t,f)$  used by the ZF equalizer for all subcarriers by time averaging at each signal subcarrier of the amplitude and phase of the reference and data symbols. The time-averaging length is 1 slot. This process creates an average amplitude and phase for each signal subcarrier used by the ZF equalizer. The knowledge of data modulation symbols may be required in this step because the determination of symbols by demodulation is not reliable before signal equalization.
- In the case of PRACH, the UL EVM analyzer shall estimate the TX chain coefficients  $\widetilde{a}(t)$  and  $\widetilde{\varphi}(t)$  used for phase and amplitude correction and are seleted so as to minimize the resulting EVM. The TX chain coefficients are not dependent on frequency, i.e.  $\widetilde{a}(t,f)=\widetilde{a}(t)$  and  $\widetilde{\varphi}(t,f)=\widetilde{\varphi}(t)$ . The TX chain coefficient are chosen independently for each preamble transmission and for each  $\Delta \widetilde{t}$ .

At this stage estimates of  $\Delta \widetilde{f}$ ,  $\widetilde{\alpha}(t,f)$ ,  $\widetilde{\varphi}(t,f)$  and  $\Delta \widetilde{c}$  are available.  $\Delta \widetilde{t}$  is one of the extremities of the window W, i.e.  $\Delta \widetilde{t}$  can be  $\Delta \widetilde{c} + \alpha - \left\lfloor \frac{W}{2} \right\rfloor$  or  $\Delta \widetilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$ , where  $\alpha = 0$  if W is odd and  $\alpha = 1$  if W is even. The EVM analyser shall then

- ightharpoonup calculate EVM<sub>1</sub> with  $\Delta \tilde{t}$  set to  $\Delta \tilde{c} + \alpha \left| \frac{W}{2} \right|$ ,
- ightharpoonup calculate EVM<sub>h</sub> with  $\Delta \tilde{t}$  set to  $\Delta \tilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$ .

## F.5 Window length

## F.5.1 Timing offset

As a result of using a cyclic prefix, there is a range of  $\Delta \tilde{t}$ , which, at least in the case of perfect Tx signal quality, would give close to minimum error vector magnitude. As a first order approximation, that range should be equal to the length of the cyclic prefix. Any time domain windowing or FIR pulse shaping applied by the transmitter reduces the  $\Delta \tilde{t}$  range within which the error vector is close to its minimum.

### F.5.2 Window length

The window length W affects the measured EVM, and is expressed as a function of the configured cyclic prefix length. In the case where equalization is present, as with frequency domain EVM computation, the effect of FIR is reduced. This is because the equalization can correct most of the linear distortion introduced by the FIR. However, the time domain windowing effect can't be removed.

### F.5.3 Window length for normal CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for normal CP. The nominal window length for 3 MHz is rounded down one sample to allow the window to be centered on the symbol.

Table F.5.3-1 EVM window length for normal CP

Channel Bandwidth MHz	Cyclic prefix length $N_{cp}$ for symbol 0	$\begin{array}{c} \textbf{Cyclic prefix}\\ \textbf{length}^1\\ N_{cp} \textbf{ for}\\ \textbf{symbols 1 to 6} \end{array}$	Nominal FFT size	Cyclic prefix for symbols 1 to 6 in FFT samples	EVM window length W in FFT samples	Ratio of W to CP for symbols 1 to 6 2	
1.4				128	9	5	55.6
3			256	18	12	66.7	
5	160	144	512	36	32	88.9	
10	100	144	1024	72	66	91.7	
15			1536	108	102	94.4	
20			2048	144	136	94.4	

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative and apply to symbols 1 through 6. Symbol 0 has a longer CP and therefore a lower percentage.

### F.5.4 Window length for Extended CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for extended CP. The nominal window lengths for 3 MHz and 15 MHz are rounded down one sample to allow the window to be centered on the symbol.

Table F.5.4-1 EVM window length for extended CP

Channel Bandwidth MHz	$\begin{array}{c} \text{Cyclic} \\ \text{prefix} \\ \text{length}^1 N_{cp} \end{array}$	Nominal FFT size	Cyclic prefix in FFT samples	EVM window length W in FFT samples	Ratio of W to CP <sup>2</sup>
1.4	512	128	32	28	87.5
3		256	64	58	90.6
5		512	128	124	96.9
10		1024	256	250	97.4
15		1536	384	374	97.4
20		2048	512	504	98.4

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative

## F.5.5 Window length for PRACH

The table below specifies the EVM window length for PRACH preamble formats 0-4.

Table F.5.5-1 EVM window length for PRACH

Preamble format	$\begin{array}{c} \textbf{Cyclic} \\ \textbf{prefix} \\ \textbf{length}^1 \ N_{cp} \end{array}$	Nominal FFT size <sup>2</sup>	EVM window length <i>W</i> in FFT samples	Ratio of W to CP*
0	3168	24576	3072	96.7%
1	21024	24576	20928	99.5%
2	6240	49152	6144	98.5%
3	21024	49152	20928	99.5%
4	448	4096	432	96.4%

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed

Note 2: The use of other FFT sizes is possible as long as appropriate

scaling of the window length is applied Note 3: These percentages are informative

### F.5.F Window length for category NB1

The EVM window length, W, for NPUSCH is set to 1 (in FFT samples where the nominal FFT size is 128) for both 15 kHz and 3.75 kHz sub-carrier spacings.

The EVM window length, W, for NPRACH is set to 110 (in FFT samples where the nominal FFT size is 128) for preamble format 0 and to 494 for preamble format 1.

## F.6 Averaged EVM

The general EVM is averaged over basic EVM measurements for n slots in the time domain.

$$\overline{EVM} = \sqrt{\frac{1}{n} \sum_{i=1}^{n} EVM_{i}^{2}},$$

where n is

n = 20 for PUCCH, PUSCH, PSDCH, PSCCH, and PSSCH,

n = 48 for PBSCH.

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_1$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_1$  in the expressions above and  $\overline{\text{EVM}}_h$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_h$ .

Thus we get:

$$EVM = \max(\overline{EVM}_1, \overline{EVM}_h)$$

The calculation of the EVM for the demodulation reference signal,  $EVM_{DMRS}$ , follows the same procedure as calculating the general EVM, with the exception that the modulation symbol set  $T_m$  defined in clause F.2 is restricted to symbols containing uplink demodulation reference signals.

The basic  $EVM_{DMRS}$  measurements are first averaged over 20 slots in the time domain to obtain an intermediate average  $EVM_{DMRS}$ .

$$\overline{EVM}_{DMRS} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_{DMRS,i}^2}$$

In the determination of each  $EVM_{DMRS,i}$ , the timing is set to  $\Delta \tilde{t} = \Delta \tilde{t}_l$  if  $\overline{EVM}_l > \overline{EVM}_h$ , and it is set to  $\Delta \tilde{t} = \Delta \tilde{t}_l$  otherwise, where  $\overline{EVM}_l$  and  $\overline{EVM}_h$  are the general average EVM values calculated in the same 20 slots over which the intermediate average  $\overline{EVM}_{DMRS}$  is calculated. Note that in some cases, the general average EVM may be calculated only for the purpose of timing selection for the demodulation reference signal EVM.

Then the results are further averaged to get the EVM for the demodulation reference signal,  $EVM_{DMRS}$ ,

$$EVM_{DMRS} = \sqrt{\frac{1}{6} \sum_{j=1}^{6} \overline{EVM}_{DMRS,j}^{2}}$$

The PRACH EVM,  $EVM_{PRACH}$ , is averaged over two preamble sequence measurements for preamble formats 0, 1, 2, 3, and it is averaged over 10 preamble sequence measurements for preamble format 4.

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_{\text{PRACH,1}}$  is calculated using  $\Delta \widetilde{t} = \Delta \widetilde{t}_1$  and  $\overline{\text{EVM}}_{\text{PRACH,h}}$  is calculated using  $\Delta \widetilde{t} = \Delta \widetilde{t}_h$ .

Thus we get:

$$EVM_{PRACH} = \max(\overline{EVM}_{PRACH,1}, \overline{EVM}_{PRACH,h})$$

### F.6.F Averaged EVM for category NB1

The general EVM for NB-IoT is calculated using the procedure defined in Annex F.6 with the exception that the general EVM is averaged over basic EVM measurements for  $240/N_{\text{tones}}$  slots in the time domain, where  $N_{\text{tones}} = \{1, 3, 6, 12\}$  is the number of subcarriers for the transmission.

The calculation of the EVM for the demodulation reference symbols for NB-IoT follows the procedure defined for DMRS in Annex F.6 with the exception that the basic EVM DMRS measurements are first averaged over  $240/N_{tones}$  slots to obtain the intermediate average EVM.

The calculation of the NPRACH EVM for both formats follows the procedure defined for PRACH in Annex F.6 with the exception that *EVM* <sub>PRACH</sub> is averaged over 240 slots, using the slot duration corresponding to 3.75 kHz sub-carrier spacing.

## F.7 Spectrum Flatness

The data shall be taken from FFT coded data symbols and the demodulation reference symbols of the allocated resource block.

## Annex G (informative): Reference sensitivity level in lower SNR

This annex contains information on typical receiver sensitivity when HARQ transmission is enabled allowing operation in lower SNR regions (HARQ is disabled in conformance testing), thus representing the configuration normally used in live network operation under noise-limited conditions.

### G.1 General

The reference sensitivity power level  $P_{SENS}$  with HARQ retransmission enabled (operation in lower SNR) is the minimum mean power applied to both the UE antenna ports at which the residual BLER after HARQ shall meet the requirements for the specified reference measurement channel. The residual BLER after HARQ transmission is defined as follows:

$$BLER_{residual} = 1 - \frac{A}{B}$$

A: Number of correctly decoded MAC PDUs

B: Number of transmitted MAC PDUs (Retransmitted MAC PDUs are not counted)

## G.2 Typical receiver sensitivity performance (QPSK)

The residual BLER after HARQ shall be lower than 1% for the reference measurement channels as specified in Annexes G.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table G.2-1 and Table G.2-2

Table G.2-1: Reference sensitivity QPSK PSENS

Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1				[-102]			FDD
2				TBD			FDD
3				TBD			FDD
4				TBD			FDD
5				TBD			FDD
6				TBD			FDD
7				TBD			FDD
8				TBD			FDD
9				TBD			FDD
10				TBD			FDD
11				TBD			FDD
12				TBD			FDD
13				TBD			FDD
14				TBD			FDD
17				TBD			FDD
18				TBD			FDD
19				TBD			FDD
20				TBD			FDD
21				TBD			FDD
22				TBD			FDD
23				TBD			FDD
26				TBD			FDD
27				TBD			FDD
28				TBD			FDD
30				TBD			FDD
31			TBD				FDD
33				[-102]			TDD
34				[-102]			TDD
35				[-102]			TDD
36				[-102]			TDD
37				[-102]			TDD
38				[-102]			TDD
39				[-102]			TDD
40				[-102]			TDD
42				[-102]			TDD
43				[-102]			TDD
44				[-102]			TDD
45				[-102]			TDD
65				TBD			FDD
		<del> </del>		·	<u> </u>	<del> </del>	

Note 1: The transmitter shall be set to P<sub>UMAX</sub> as defined in clause 6.2.5

Note 2: Reference measurement channel is G.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

Note 3: The signal power is specified per port

Note 4: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

Note 5: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

Table G.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement in lower SNR must be met.

Table G.2-2: Minimum uplink configuration for reference sensitivity

E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1				[6] <sup>1</sup>			FDD
2				[6] <sup>1</sup>			FDD
3				[6] <sup>1</sup>			FDD
4				[6] <sup>1</sup>			FDD
5				[6] <sup>1</sup>			FDD
6				[6] <sup>1</sup>			FDD
7				[6] <sup>1</sup>			FDD
8				[6] <sup>1</sup>			FDD
9				[6] <sup>1</sup>			FDD
10				[6] <sup>1</sup>			FDD
11				[6] <sup>1</sup>			FDD
12				[6] <sup>1</sup>			FDD
13				[6] <sup>1</sup>			FDD
14				[6] <sup>1</sup>			FDD
17				[6] <sup>1</sup>			FDD
18				[6] <sup>1</sup>			FDD
19				[6] <sup>1</sup>			FDD
20				[6] <sup>1</sup>			FDD
22				[6] <sup>1</sup>			FDD
21				[6] <sup>1</sup>			FDD
23				[6] <sup>1</sup>			FDD
26				[6] <sup>1</sup>			FDD
27				[6] <sup>1</sup>			FDD
28				[6] <sup>1</sup>			FDD
30				[6] <sup>1</sup>			FDD
31			[5] <sup>4</sup>				FDD
				50			TDD
33				50			TDD
34				50			TDD
35	1			50			TDD
36	1			50			TDD
37				50			TDD
38	1			50			TDD
39 40				50			TDD
				50			TDD
42	1			50			TDD
43				50			TDD
44				50			TDD
45	1			50			TDD
				ro1 <sup>1</sup>			FD.0
65 Note 1:	<u> </u>	L	<u> </u>	[6] <sup>1</sup>	<u> </u>	possible to	FDD

Note 2: For the UE which supports both Band 11 and Band 21 the minimum uplink configuration for reference sensitivity is FFS.

Note 3: For Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RBstart \_11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RBstart \_16

Note 4: For Band 31; in the case of 5MHz channel bandwidth, the UL resource

blocks shall be located at RBstart \_10

Unless given by Table G.2-3, the minimum requirements specified in Tables G.2-1 and G.2-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

Table G.2-3: Network Signalling Value for reference sensitivity

E-UTRA Band	Network Signalling value				
2	NS_03				
4	NS_03				
10	NS_03				
12	NS_06				
13	NS_06				
14	NS_06				
17	NS_06				
19	NS_08				
21	NS_09				
23	NS_03				
30	NS_21				
35	NS_03				
36	NS_03				

# G.3 Reference measurement channel for REFSENSE in lower SNR

Tables G.3-1 and G.3-2 are applicable for Annex G.2 (Reference sensitivity level in lower SNR).

Table G.3-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit Value						
Channel bandwidth	MHz			5	10		
Allocated resource blocks				25	50		
Subcarriers per resource block				12	12		
Allocated subframes per Radio Frame				9	9		
Modulation				QPSK	QPSK		
Target Coding Rate				1/3	1/3		
Number of HARQ Processes	Processes			8	8		
Maximum number of HARQ transmissions				[4]	[4]		
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			2216	4392		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			1800	4392		
Transport block CRC	Bits			24	24		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			1	1		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			1	1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			6300	13800		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5460	12960		
Max. Throughput averaged over 1 frame	kbps		_	1952.	3952.	_	
				8	8		
UE Category				1-8	1-8		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 4: Redundancy version coding sequence is {0, 1, 2, 3} for QPSK.

Table G.3-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit	Value
Channel Bandwidth	MHz	10
Allocated resource blocks		50
Uplink-Downlink Configuration (Note 5)		1 1
Allocated subframes per Radio Frame		4+2
(D+S)		
Number of HARQ Processes	Processes	7
Maximum number of HARQ transmission		[4]
Modulation		QPSK
Target coding rate		1/3
Information Bit Payload per Sub-Frame	Bits	
For Sub-Frame 4, 9		4392
For Sub-Frame 1, 6		3240
For Sub-Frame 5		N/A
For Sub-Frame 0		4392
Transport block CRC	Bits	24
Number of Code Blocks per Sub-Frame		
(Note 5)		
For Sub-Frame 4, 9		1
For Sub-Frame 1, 6		1
For Sub-Frame 5		N/A
For Sub-Frame 0		1
Binary Channel Bits Per Sub-Frame	Bits	
For Sub-Frame 4, 9		13800
For Sub-Frame 1, 6		11256
For Sub-Frame 5		N/A
For Sub-Frame 0		13104
Max. Throughput averaged over 1 frame	kbps	1965.
-		6
UE Category		1-5

- For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz Note 1: channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with Note 2: insufficient PDCCH performance
- Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3:
- If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to Note 4: each Code Block (otherwise L = 0 Bit). As per Table 4.2-2 in TS 36.211 [4]
- Note 5:
- Redundancy version coding sequence is {0, 1, 2, 3} for QPSK. Note 6:

## Annex H (normative): Modified MPR behavior

## H.1 Indication of modified MPR behavior

This annex contains the definitions of the bits in the field *modifiedMPRbehavior* indicated in the IE UE Radio Access Capability [7] by a UE supporting an MPR or A-MPR modified in a later release of this specification.

Table H.1-1: Definitions of the bits in the field modifiedMPRbehavior

Index of field	Definition	Notes
(bit number)	(description of the supported functionality if indicator	
	set to one)	
0 (leftmost bit)	- The MPR for intra-band contiguous carrier	- This bit shall be set to 1 by
	aggregation bandwidth class C with non-contiguous	a UE supporting intra-band
	resource allocation specified in Clause 6.2.3A in	contiguous CA bandwidth
	version 12.5.0 of this specification	class C
1	- The A-MPR associated with NS_05 for Band 1 in	- This bit shall be set to 1 by
	Clause 6.2.4 in version 12.10.0 of this specification.	a UE supporting A-MPR
		associated to NS_05 for
		Band 1.

## Annex I (informative): Change history

**Table I.1: Change History** 

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
11-2007	R4#45	R4-72206				TS36.101V0.1.0 approved by RAN4	
12-2007	RP#38	RP-070979				Approved version at TSG RAN #38	8.0.0
03-2008	RP#39	RP-080123	3			TS36.101 - Combined updates of E-UTRA UE requirements	8.1.0
05-2008	RP#40	RP-080325	4			TS36.101 - Combined updates of E-UTRA UE requirements	8.2.0
09-2008	RP#41	RP-080638	5r1			Addition of Ref Sens figures for 1.4MHz and 3MHz Channel bandwiidths	8.3.0
09-2008	RP#41	RP-080638	7r1			Transmitter intermodulation requirements	8.3.0
09-2008	RP#41	RP-080638	10			CR for clarification of additional spurious emission requirement	8.3.0
09-2008	RP#41	RP-080638	15			Correction of In-band Blocking Requirement	8.3.0
09-2008	RP#41	RP-080638	18r1			TS36.101: CR for section 6: NS_06	8.3.0
09-2008	RP#41	RP-080638	19r1			TS36.101: CR for section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080638	20r1			TS36.101: CR for UE minimum power	8.3.0
09-2008	RP#41	RP-080638	21r1			TS36.101: CR for UE OFF power	8.3.0
09-2008	RP#41	RP-080638	24r1			TS36.101: CR for section 7: Band 13 Rx sensitivity	8.3.0
09-2008	RP#41	RP-080638	26			UE EVM Windowing	8.3.0
09-2008	RP#41	RP-080638	29			Absolute ACLR limit	8.3.0
09-2008	RP#41	RP-080731	23r2			TS36.101: CR for section 6: UE to UE co-existence	8.3.0
09-2008	RP#41	RP-080731	30			Removal of [] for UE Ref Sens figures	8.3.0
09-2008	RP#41	RP-080731	31			Correction of PA, PB definition to align with RAN1 specification	8.3.0
09-2008	RP#41	RP-080731	37r2			UE Spurious emission band UE co-existence	8.3.0
09-2008	RP#41	RP-080731	44			Definition of specified bandwidths	8.3.0
09-2008	RP#41	RP-080731	48r3			Addition of Band 17	8.3.0
09-2008	RP#41	RP-080731	50			Alignment of the UE ACS requirement	8.3.0
09-2008	RP#41	RP-080731	52r1			Frequency range for Band 12	8.3.0
09-2008	RP#41	RP-080731	54r1			Absolute power tolerance for LTE UE power control	8.3.0
09-2008	RP#41	RP-080731	55			TS36.101 section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080732	6r2			DL FRC definition for UE Receiver tests	8.3.0
09-2008	RP#41	RP-080732	46			Additional UE demodulation test cases	8.3.0
09-2008	RP#41	RP-080732	47			Updated descriptions of FRC	8.3.0
09-2008	RP#41	RP-080732	49			Definition of UE transmission gap	8.3.0
09-2008	RP#41	RP-080732	51			Clarification on High Speed train model in 36.101	8.3.0
09-2008	RP#41	RP-080732	53			Update of symbol and definitions	8.3.0
09-2008	RP#41	RP-080743	56			Addition of MIMO (4x2) and (4x4) Correlation Matrices	8.3.0
12-2008	RP#42	RP-080908	94r2			CR TX RX channel frequency separation	8.4.0
12-2008	RP#42	RP-080909	105r1			UE Maximum output power for Band 13	8.4.0
12-2008	RP#42	RP-080909	60			UL EVM equalizer definition	8.4.0
12-2008	RP#42	RP-080909	63			Correction of UE spurious emissions	8.4.0
12-2008	RP#42	RP-080909	66			Clarification for UE additional spurious emissions	8.4.0
12-2008	RP#42	RP-080909	72			Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803	8.4.0
12-2008	RP#42	RP-080909	75			Removal of [] from Section 6 transmitter characteristcs	8.4.0
12-2008	RP#42	RP-080909	81			Clarification for PHS band protection	8.4.0
12-2008	RP#42	RP-080909	101			Alignement for the measurement interval for transmit signal quality	8.4.0
12-2008	RP#42	RP-080909	98r1			Maximum power	8.4.0
12-2008	RP#42	RP-080909	57r1			CR UE spectrum flatness	8.4.0
12-2008	RP#42	RP-080909	71r1			UE in-band emission	8.4.0
12-2008	RP#42	RP-080909	58r1			CR Number of TX exceptions	8.4.0
12-2008	RP#42	RP-080951	99r2			CR UE output power dynamic	8.4.0
12-2008	RP#42	RP-080951	79r1			LTE UE transmitter intermodulation	8.4.0
12-2008	RP#42	RP-080910	91			Update of Clause 8	8.4.0
12-2008	RP#42	RP-080950	106r1			Structure of Clause 9 including CSI requirements for PUCCH mode 1-0	8.4.0
12-2008	RP#42	RP-080911	59			CR UE ACS test frequency offset	8.4.0
					•	•	

12-2008	RP#42	RP-080911	65	Correction of spurious response parameters	8.4.0
12-2008	RP#42	RP-080911	80	Removal of LTE UE narrowband intermodulation	8.4.0
12-2008	RP#42	RP-080911	90r1	Introduction of Maximum Sensitivity Degradation	8.4.0
12-2008	RP#42	RP-080911	103	Removal of [] from Section 7 Receiver characteristic	8.4.0
12-2008	RP#42	RP-080912	62	Alignement of TB size n Ref Meas channel for RX characteristics	8.4.0
12-2008	RP#42	RP-080912	78	TDD Reference Measurement channel for RX characterisctics	8.4.0
12-2008	RP#42	RP-080912	73r1	Addition of 64QAM DL referenbce measurement channel	8.4.0
12-2008	RP#42	RP-080912	74r1	Addition of UL Reference Measurement Channels	8.4.0
12-2008	RP#42	RP-080912	104	Reference measurement channels for PDSCH performance requirements (TDD)	8.4.0
12-2008	RP#42	RP-080913	68	MIMO Correlation Matrix Corrections	8.4.0
12-2008	RP#42	RP-080915	67	Correction to the figure with the Transmission Bandwidth configuration	8.4.0
12-2008	RP#42	RP-080916	77	Modification to EARFCN	8.4.0
12-2008	RP#42	RP-080917	85r1	New Clause 5 outline	8.4.0
12-2008	RP#42	RP-080919	102	Introduction of Bands 12 and 17 in 36.101	8.4.0
12-2008	RP#42	RP-080927	84r1	Clarification of HST propagation conditions	8.4.0
03-2009	RP#43	RP-090170	156r2	A-MPR table for NS_07	8.5.0
03-2009	RP#43	RP-090170	170	Corrections of references (References to tables and figures)	8.5.0
03-2009	RP#43	RP-090170	108	Removal of [] from Transmitter Intermodulation	8.5.0
03-2009	RP#43	RP-090170	155	E-UTRA ACLR for below 5 MHz bandwidths	8.5.0
03-2009	RP#43	RP-090170	116	Clarification of PHS band including the future plan	8.5.0
03-2009	RP#43	RP-090170	119	Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts	8.5.0
03-2009	RP#43	RP-090170	120	Removal of "Out-of-synchronization handling of output power" heading	8.5.0
03-2009	RP#43	RP-090170	126	UE uplink power control	8.5.0
03-2009	RP#43	RP-090170	128	Transmission BW Configuration	8.5.0
03-2009	RP#43	RP-090170	130	Spectrum flatness	8.5.0
03-2009	RP#43	RP-090170	132r2	PUCCH EVM	8.5.0
03-2009	RP#43	RP-090170	134	UL DM-RS EVM	8.5.0
03-2009	RP#43	RP-090170	140	Removal of ACLR2bis requirements	8.5.0
03-2009	RP#43	RP-090171	113	In-band blocking	8.5.0
03-2009	RP#43	RP-090171	127	In-band blocking  In-band blocking and sensitivity requirement for band 17	8.5.0
03-2009	RP#43	RP-090171	137r1	Wide band intermodulation	8.5.0
03-2009	RP#43	RP-090171	141	Correction of reference sensitivity power level of Band 9	8.5.0
03-2009	RP#43	RP-090172	109	AWGN level for UE DL demodulation performance tests	8.5.0
03-2009	RP#43	RP-090172	124	Update of Clause 8: additional test cases	8.5.0
03-2009	RP#43	RP-090172	139r1	Performance requirement structure for TDD PDSCH	8.5.0
03-2009	RP#43	RP-090172	142r1	Performance requirements and reference measurement channels for TDD PDSCH demodulation with UE-specific reference symbols	8.5.0
03-2009	RP#43	RP-090172	145	Number of information bits in DwPTS	8.5.0
03-2009	RP#43	RP-090172	160r1	MBSFN-Unicast demodulation test case	8.5.0
03-2009	RP#43	RP-090172	163r1	MBSFN-Unicast demodulation test case for TDD	8.5.0
03-2009	RP#43	RP-090173	162	Clarification of EARFCN for 36.101	8.5.0
03-2009	RP#43	RP-090369	110	Correction to UL Reference Measurement Channel	8.5.0
03-2009	RP#43	RP-090369	114	Addition of MIMO (4x4, medium) Correlation Matrix	8.5.0
03-2009	RP#43	RP-090369	121	Correction of 36.101 DL RMC table notes	8.5.0
03-2009	RP#43	RP-090369	125	Update of Clause 9	8.5.0
			138r1		1
03-2009	RP#43	RP-090369	161	Clarification on OCNG	8.5.0
03-2009	RP#43	RP-090369	164	CQI reference measurement channels	8.5.0
03-2009	RP#43	RP-090369		PUCCH 1-1 Static Test Case	8.5.0
03-2009	RP#43	RP-090369	111	Reference Measurement Channel for TDD	8.5.0
03-2009	RP#44			Editorial correction in Table 6.2.4-1	8.5.1
05-2009	RP#44	RP-090540	167	Boundary between E-UTRA fOOB and spurious emission	8.6.0

					domain for 1.4 MHz and 3 MHz bandwiths. (Technically	
					Endorsed CR in R4-50bis - R4-091205)	
05-2009	RP#44	RP-090540	168		EARFCN correction for TDD DL bands. (Technically Endorsed CR in R4-50bis - R4-091206)	8.6.0
05.0000	DD#44	DD 000540	400		Editorial correction to in-band blocking table. (Technically	8.6.0
05-2009	RP#44	RP-090540	169		Endorsed CR in R4-50bis - R4-091238)	0.0.0
05-2009	RP#44	RP-090540	171		CR PRACH EVM. (Technically Endorsed CR in R4-50bis - R4-091308)	8.6.0
					CR EVM correction. (Technically Endorsed CR in R4-50bis -	
05-2009	RP#44	RP-090540	172		R4-091309)	8.6.0
05-2009	RP#44	RP-090540	177		CR power control accuracy. (Technically Endorsed CR in	8.6.0
00 2000	101 #	111 030340	177		R4-50bis - R4-091418)	0.0.0
05-2009	RP#44	RP-090540	179		Correction of SRS requirements. (Technically Endorsed CR in R4-50bis - R4-091426)	8.6.0
	55				Clarification for EVM. (Technically Endorsed CR in R4-50bis	0.00
05-2009	RP#44	RP-090540	186		- R4-091512)	8.6.0
05-2009	RP#44	RP-090540	187		Removal of [] from band 17 Refsens values and ACS offset	8.6.0
05-2009	RP#44	DD 000540	191	<del>                                     </del>	frequencies  Completion of hand17 requirements	8.6.0
		RP-090540			Completion of band17 requirements  Removal of 1.4 MHz and 3 MHz bandwidths from bands 13,	
05-2009	RP#44	RP-090540	192		14 and 17.	8.6.0
05-2009	RP#44	RP-090540	223		CR: 64 QAM EVM	8.6.0
05-2009	RP#44	RP-090540	201		CR In-band emissions	8.6.0
05-2009	RP#44	RP-090540	203		CR EVM exclusion period	8.6.0
05-2009	RP#44	RP-090540	204		CR In-band emissions timing	8.6.0
05-2009	RP#44	RP-090540	206		CR Minimum Rx exceptions	8.6.0
05-2009	RP#44	RP-090540	207		CR UL DM-RS EVM	8.6.0
05-2009	RP#44	RP-090540	218r1		A-MPR table for NS_07	8.6.0
05-2009	RP#44	RP-090540	205r1		CR In-band emissions in shortened subframes	8.6.0
05-2009	RP#44	RP-090540	200r1		CR PUCCH EVM	8.6.0
05-2009	RP#44	RP-090540	178r2		No additional emission mask indication. (Technically	8.6.0
05-2009	RP#44	RP-090540	220r1	<del>                                     </del>	Endorsed CR in R4-50bis - R4-091421)	8.6.0
05-2009	RP#44	RP-090540 RP-090540	197r2		Spectrum emission requirements for band 13  CR on aggregate power tolerance	8.6.0
05-2009	RP#44	RP-090540	19712 196r2		CR: Rx IP2 performance	8.6.0
05-2009	RP#44	RP-090541	198r1		Maximum output power relaxation	8.6.0
03-2009	NF#44	KF-090341	19011		Update of performance requirement for TDD PDSCH with	0.0.0
05-2009	RP#44	RP-090542	166		MBSFN configuration. (Technically Endorsed CR in R4-	8.6.0
					50bis - R4-091180)	
05.0000	DD#44	DD 000540	475		Adding AWGN levels for some TDD DL performance	8.6.0
05-2009	RP#44	RP-090542	175		requirements. (Technically Endorsed CR in R4-50bis - R4-091406)	0.0.0
					OCNG Patterns for Single Resource Block FRC	
05-2009	RP#44	RP-090542	182		Requirements. (Technically Endorsed CR in R4-50bis - R4-	8.6.0
					091504)	
05-2009	RP#44	RP-090542	170r1		Update of Clause 8: PHICH and PMI delay. (Technically Endorsed CR in R4-50bis - R4-091275)	8.6.0
					Requirements for frequency-selective fading test.	
05-2009	RP#44	RP-090543	183		(Technically Endorsed CR in R4-50bis - R4-091505)	8.6.0
05-2009	RP#44	RP-090543	199		CQI requirements under AWGN conditions	8.6.0
05-2009	RP#44	RP-090543	188r1		Adaptation of UL-RMC-s for supporting more UE categories	8.6.0
05-2009	RP#44	RP-090543	193r1		Correction of the LTE UE downlink reference measurement	8.6.0
		1 0000.0			channels	
05-2009	RP#44	RP-090543	184r1		Requirements for frequency non-selective fading tests. (Technically Endorsed CR in R4-50bis - R4-091506)	8.6.0
05.0000	DD#44	DD 000540	405.4		Requirements for PMI reporting. (Technically Endorsed CR	0.00
05-2009	RP#44	RP-090543	185r1		in R4-50bis - R4-091510)	8.6.0
05-2009	RP#44	RP-090543	221r1		Correction to DL RMC-s for Maximum input level for	8.6.0
					supporting more UE-Categories	8.6.0
05-2009	RP#44	RP-090543	216		Addition of 15 MHz and 20 MHz bandwidths into band 38 Introduction of Extended LTE800 requirements. (Technically	
05-2009	RP#44	RP-090559	180		Endorsed CR in R4-50bis - R4-091432)	9.0.0
09-2009	RP#45	RP-090826	239		A-MPR for Band 19	9.1.0
09-2009	RP#45	RP-090822	225		LTE UTRA ACLR1 centre frequency definition for 1.4 and 3	9.1.0
					MHz BW	
09-2009	RP#45	RP-090822	227		Harmonization of text for LTE Carrier leakage	9.1.0
09-2009	RP#45	RP-090822	229		Sensitivity requirements for Band 38 15 MHz and 20 MHz bandwidths	9.1.0
	1				Operating band edge relaxation of maximum output power	
09-2009	RP#45	RP-090822	236		for Band 18 and 19	9.1.0
09-2009	RP#45	RP-090822	238		Addition of 5MHz channel bandwidth for Band 40	9.1.0
09-2009	RP#45	RP-090822	245		Removal of unnecessary requirements for 1.4 and 3 MHz	9.1.0

		T		bandwidths on bands 13 and 17	
09-2009	RP#45	RP-090877	261	Correction of LTE UE ACS test parameter	9.1.0
09-2009	RP#45	RP-090877	263R1	Correction of LTE UE ACLR test parameter	9.1.0
09-2009	RP#45	RP-090877	286	Uplink power and RB allocation for receiver tests	9.1.0
09-2009	RP#45	RP-090877	320	CR Sensitivity relaxation for small BW	9.1.0
09-2009	RP#45	RP-090877	324	Correction of Band 3 spurious emission band UE co-	9.1.0
09-2009	RP#45	RP-090877	249R1	CR Pcmax definition (working assumption)	9.1.0
09-2009	RP#45	RP-090877	330	Spectrum flatness clarification	9.1.0
09-2009	RP#45	RP-090877	332	Transmit power: removal of TC and modification of REFSENS note	9.1.0
09-2009	RP#45	RP-090877	282R1	Additional SRS relative power requirement and update of measurement definition	9.1.0
09-2009	RP#45	RP-090877	284R1	Power range applicable for relative tolerance	9.1.0
09-2009	RP#45	RP-090878	233	TDD UL/DL configurations for CQI reporting	9.1.0
09-2009	RP#45	RP-090878	235	Further clarification on CQI test configurations	9.1.0
09-2009	RP#45	RP-090878	243	Corrections to UL- and DL-RMC-s	9.1.0
09-2009	RP#45	RP-090878	247	Reference measurement channel for multiple PMI requirements	9.1.0
09-2009	RP#45	RP-090878	290	CQI reporting test for a scenario with frequency-selective interference	9.1.0
09-2009	RP#45	RP-090878	265R2	CQI reference measurement channels	9.1.0
09-2009	RP#45	RP-090878	321R1	CR RI Test	9.1.0
09-2009	RP#45	RP-090875	231	Correction of parameters for demodulation performance requirement	9.1.0
09-2009	RP#45	RP-090875	241R1	UE categories for performance tests and correction to RMC references	9.1.0
09-2009	RP#45	RP-090875	333	Clarification of Ês definition in the demodulation requirement	9.1.0
09-2009	RP#45	RP-090875	326	Editorial corrections and updates to PHICH PBCH test cases.	9.1.0
09-2009	RP#45	RP-090875	259R3	Test case numbering in section 8 Performance tests	9.1.0
	RP-46		335	Test case numbering in TDD PDSCH performance test	9.2.0
12-2009	RP-46	RP-091264	337	(Technically endorsed at RAN 4 52bis in R4-093523)  Adding beamforming model for user-specfic reference signal	9.2.0
12-2009	RP-40	RP-091261	337	(Technically endorsed at RAN 4 52bis in R4-093525)	9.2.0
12-2009	RP-46	RP-091263	339R1	Adding redundancy sequences to PMI test (Technically endorsed at RAN 4 52bis in R4-093581)	9.2.0
12-2009	RP-46	RP-091264	341	Throughput value correction at FRC for Maximum input level (Technically endorsed at RAN 4 52bis in R4-093660)	9.2.0
12-2009	RP-46	RP-091261	343	Correction to the modulated E-UTRA interferer (Technically endorsed at RAN 4 52bis in R4-093662)	9.2.0
12-2009	RP-46	RP-091264	345R1	OCNG: Patterns and present use in tests (Technically endorsed at RAN 4 52bis in R4-093664)	9.2.0
12-2009	RP-46	RP-091264	347	OCNG: Use in receiver and performance tests (Technically endorsed at RAN 4 52bis in R4-093666)	9.2.0
12-2009	RP-46	RP-091263	349	Miscellaneous corrections on CSI requirements (Technically endorsed at RAN 4 52bis in R4-093676)	9.2.0
12-2009	RP-46	RP-091261	351	Removal of RLC modes (Technically endorsed at RAN 4 52bis in R4-093677)	9.2.0
12-2009	RP-46	RP-091261	353	CR Rx diversity requirement (Technically endorsed at RAN 4 52bis in R4-093703)	9.2.0
12-2009	RP-46	RP-091261	355	A-MPR notation in NS_07 (Technically endorsed at RAN 4 52bis in R4-093706)	9.2.0
12-2009	RP-46	RP-091263	359	Single- and multi-PMI requirements (Technically endorsed at RAN 4 52bis in R4-093846)	9.2.0
12-2009	RP-46	RP-091263	363	CQI reference measurement channel (Technically endorsed at RAN 4 52bis in R4-093970)	9.2.0
12-2009	RP-46	RP-091292	364	LTE MBSFN Channel Model (Technically endorsed at RAN 4 52bis in R4-094020)	9.2.0
12-2009	RP-46	RP-091264	367	Numbering of PDSCH (User-Specific Reference Symbols) Demodulation Tests	9.2.0
12-2009	RP-46	RP-091264	369	Numbering of PDCCH/PCFICH, PHICH, PBCH Demod Tests	9.2.0
12-2009	RP-46	RP-091261	371	Remove [] from Reference Measurement Channels in Annex A	9.2.0
12-2009	RP-46	RP-091264	373R1	Corrections to RMC-s for Maximum input level test for low UE categories	9.2.0
12-2009	RP-46	RP-091261	377	Correction of UE-category for R.30	9.2.0
12-2009	RP-46	RP-091286	378	Introduction of Extended LTE1500 requirements for TS36.101	9.2.0
12-2009	RP-46	RP-091262	384	CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from additional spurious emissions requirements for Band 1 PHS protection	9.2.0

12-2009	RP-46 RP-46	RP-091262	386R3	requirements at the edge of spurious domain	9.2.0
	DD-16			Spurious emission table correction for TDD bands 33 and	
40.0000	INF -40	RP-091262	390	38.	9.2.0
12-2009	RP-46	RP-091262	392R2	36.101 Symbols and abreviations for Pcmax	9.2.0
12-2009	RP-46	RP-091262	394	UTRAACLR1 requirement definition for 1.4 and 3 MHz BW completed	9.2.0
12-2009	RP-46	RP-091263	396	Introduction of the ACK/NACK feedback modes for TDD requirements	9.2.0
12-2009	RP-46	RP-091262	404R3	CR Power control exception R8	9.2.0
12-2009	RP-46	RP-091262	416R1	Relative power tolerance: special case for receiver tests	9.2.0
12-2009	RP-46	RP-091263	420R1	CSI reporting: test configuration for CQI fading requirements	9.2.0
12-2009	RP-46	RP-091284	421R1	Inclusion of Band 20 UE RF parameters	9.2.0
	RP-46	RP-091264	425	Editorial corrections and updates to Clause 8.2.1 FDD demodulation test cases	9.2.0
12-2009	RP-46	RP-091262	427	CR: time mask	9.2.0
12-2009	RP-46	RP-091264	430	Correction of the payload size for PDCCH/PCFICH performance requirements	9.2.0
12-2009	RP-46	RP-091263	432	Transport format and test point updates to RI reporting test cases	9.2.0
12-2009	RP-46	RP-091263	434	Transport format and test setup updates to frequency- selective interference CQI tests	9.2.0
12-2009	RP-46	RP-091263	436	CR RI reporting configuration in PUCCH 1-1 test	9.2.0
12-2009	RP-46	RP-091261	438	Addition of R.11-1 TDD references	9.2.0
	RP-46	RP-091292	439	Performance requirements for LTE MBMS	9.2.0
	RP-46	RP-091262	442R1	In Band Emissions Requirements Correction CR	9.2.0
	RP-46	RP-091262	444R1	PCMAX definition	9.2.0
	RP-47	RP-100246	453r1	Corrections of various errors in the UE RF requirements	9.3.0
	RP-47	RP-100246	462r1	UTRA ACLR measurement bandwidths for 1.4 and 3 MHz	9.3.0
	RP-47	RP-100246	493	Band 8 Coexistence Requirement Table Correction	9.3.0
	RP-47	RP-100246	489r1	Rel 9 CR for Band 14	9.3.0
	RP-47	RP-100246	485r1	CR Band 1- PHS coexistence	9.3.0
	RP-47	RP-100247	501	Fading CQI requirements for FDD mode	9.3.0
03-2010	RP-47	RP-100247	499	CR correction to RI test	9.3.0
03-2010	RP-47	RP-100249	451	Reporting mode, Reporting Interval and Editorial corrections for demodulation	9.3.0
	RP-47	RP-100249	464r1	Corrections to 1PRB PDSCH performance test in presence of MBSFN.	9.3.0
	RP-47	RP-100249	458r1	OCNG corrections	9.3.0
	RP-47	RP-100249	467	Addition of ONCG configuration in DRS performance test	9.3.0
	RP-47	RP-100249	465r1	PDSCH performance tests for low UE categories	9.3.0
	RP-47	RP-100250	460r1	Use of OCNG in CSI tests	9.3.0
	RP-47	RP-100250	491r1	Corrections to CQI test configurations	9.3.0
	RP-47 RP-47	RP-100250 RP-100251	469r1 456r1	Corrections of some CSI test parameters  TBS correction for RMC UL TDD 16QAM full allocation BW	9.3.0
				1.4 MHz	
	RP-47	RP-100262	449	Editorial corrections on Band 19 REFSENS	9.3.0
	RP-47	RP-100263	470r1	Band 20 UE RF requirements	9.3.0
	RP-47	RP-100264	446r1	A-MPR for Band 21	9.3.0
03-2010	RP-47	RP-100264	448	RF requirements for UE in later releases	9.3.0
03-2010	RP-47	RP-100268	445	36.101 CR: Editorial corrections on LTE MBMS reference measurement channels	9.3.0
03-2010	RP-47	RP-100268	454	The definition of the Doppler shift for LTE MBSFN Channel Model	9.3.0
03-2010	RP-47	RP-100239	478r3	Modification of the spectral flatness requirement and some editorial corrections	9.3.0
06-2010	RP-48	RP-100619	559	Corrections of tables for Additional Spectrum Emission Mask	9.4.0
	RP-48	RP-100619	538	Correction of transient time definition for EVM requirements	9.4.0
	RP-48	RP-100619	557r2	CR on UE coexistence requirement	9.4.0
06-2010	RP-48	RP-100619	547r1	Correction of antenna configuration and beam-forming model for DRS	9.4.0
06-2010	RP-48	RP-100619	536r1	CR: Corrections on MIMO demodulation performance requirements	9.4.0
	RP-48	RP-100619	528r1	Corrections on the definition of PCMAX	9.4.0
06-2010	RP-48	RP-100619	568	Relaxation of the PDSCH demodulation requirements due to control channel errors	9.4.0
	RP-48	RP-100619	566	Correction of the UE output power definition for RX tests	9.4.0
	RP-48	RP-100620	505r1	Fading CQI requirements for TDD mode	9.4.0
	RP-48	RP-100620	521	Correction to FRC for CQI index 0	9.4.0
	RP-48	RP-100620	516r1	Correction to CQI test configuration	9.4.0
06-2010	RP-48	RP-100620	532	Correction of CQI and PMI delay configuration description for TDD	9.4.0
			F74	Correction to FDD and TDD CSI test configurations	9.4.0
	RP-48	RP-100620	574	Minimum requirements for Rank indicator reporting	0.7.0

06-2010	RP-48	RP-100628	563	LTE MBMS performance requirements (FDD)	9.4.0
06-2010	RP-48	RP-100628	564	LTE MBMS performance requirements (TDD)	9.4.0
06-2010	RP-48	RP-100629	553r2	Performance requirements for dual-layer beamforming	9.4.0
06-2010	RP-48	RP-100630	524r2	CR: low Category CSI requirement	9.4.0
06-2010	RP-48	RP-100630	519	Correction of FRC reference and test case numbering	9.4.0
06-2010				Correction of carrier frequency and EARFCN of Band 21 for	0.4.0
	RP-48	RP-100630	526	TS36.101	9.4.0
06-2010		111 100000	929	Addition of PDSCH TDD DRS demodulation tests for Low	
00 2010	RP-48	RP-100630	508r1	UE categories	9.4.0
06-2010	1(1 -40	1(1-100030	30011	Specification of minimum performance requirements for low	
06-2010	DD 40	DD 400000	500		9.4.0
	RP-48	RP-100630	539	UE category	
06-2010				Addition of minimum performance requirements for low UE	9.4.0
	RP-48	RP-100630	569	category TDD CRS single-antenna port tests	0.4.0
06-2010				Introduction of sustained downlink data-rate performance	9.4.0
	RP-48	RP-100631	549r3	requirements	9.4.0
06-2010	RP-48	RP-100683	530r1	Band 20 Rx requirements	9.4.0
09-2010	RP-49	RP-100920	614r2	Add OCNG to MBMS requirements	9.5.0
09-2010	RP-49	RP-100916	599	Correction of PDCCH content for PHICH test	9.5.0
09-2010	RP-49	RP-100920	597r1	Beamforming model for transmission on antenna port 7/8	9.5.0
09-2010	RP-49	RP-100920	600r1	Correction of full correlation in frequency-selective CQI test	9.5.0
09-2010				Correction on single-antenna transmission fixed reference	
20.00	RP-49	RP-100920	601	channel	9.5.0
09-2010	<u> </u>			Reference sensitivity requirements for the 1.4 and 3 MHz	
	RP-49	RP-100914	605	bandwidths	9.5.0
09-2010	RP-49	RP-100920	608r1	CR for DL sustained data rate test	9.5.0
09-2010				Correction of references in section 10 (MBMS performance	
	RP-49	RP-100919	611	requirements)	9.5.0
09-2010	RP-49	RP-100914	613	Band 13 and Band 14 spurious emission corrections	9.5.0
09-2010	RP-49	RP-100914	617r1		
				Rx Requirements	9.5.0
09-2010	RP-49	RP-100926	576r1	Clarification on DL-BF simulation assumptions	9.5.0
09-2010	RP-49	RP-100920	582r1	Introduction of additional Rel-9 scenarios	9.5.0
09-2010	RP-49	RP-100925	575r1	Correction to band 20 ue to ue Co-existence table	9.5.0
09-2010	RP-49	RP-100916	581r1	Test configuration corrections to CQI reporting in AWGN	9.5.0
09-2010	RP-49	RP-100916	595	Corrections to RF OCNG Pattern OP.1 and 2	9.5.0
09-2010	RP-49	RP-100919	583	Editorial corrections of 36.101	9.5.0
09-2010	111 40	100010	666	Addition of minimum performance requirements for low UE	0.0.0
09-2010	RP-49	RP-100920	586	category TDD tests	9.5.0
00.0040			1		
09-2010	RP-49	RP-100914	590r1	Downlink power for receiver tests	9.5.0
09-2010	RP-49	RP-100920	591	OCNG use and power in beamforming tests	9.5.0
09-2010	RP-49	RP-100916	593	Throughput for multi-datastreams transmissions	9.5.0
09-2010	RP-49	RP-100914	588	Missing note in Additional spurious emission test with NS_07	9.5.0
09-2010	RP-49	RP-100927	596r2	CR LTE_TDD_2600_US spectrum band definition additions	10.0.0
				to TS 36.101	
12-2010	RP-50	RP-101309	680	Demodulation performance requirements for dual-layer	10.1.0
12 2010	1 00	111 101000		beamforming	10.1.0
12-2010	RP-50	RP-101325	672	Correction on the statement of TB size and subband	10.1.0
12-2010	KF-50	KF-101323	672		10.1.0
10.0010	DD 50	DD 404007	252	selection in CSI tests	40.4.0
12-2010	RP-50	RP-101327	652	Correction to Band 12 frequency range	10.1.0
12-2010	RP-50	RP-101329	630	Removal of [] from TDD Rank Indicator requirements	10.1.0
12-2010	RP-50	RP-101329	635r1	Test configuration corrections to CQI TDD reporting in	10.1.0
	<u> </u>	1		AWGN (Rel-10)	
12-2010	RP-50	RP-101330	645	EVM window length for PRACH	10.1.0
12-2010	RP-50	RP-101330	649	Removal of NS signalling from TDD REFSENS tests	10.1.0
12-2010	RP-50	RP-101330	642r1	Correction of Note 4 In Table 7.3.1-1: Reference sensitivity	10.1.0
1.2.2010	1 50	1 101000		QPSK PREFSENS	
12-2010	RP-50	RP-101341	627	Add 20 RB UL Ref Meas channel	10.1.0
					10.1.0
12-2010	RP-50	RP-101341	654r1	Additional in-band blocking requirement for Band 12	10.1.0
12-2010	RP-50	RP-101341	678	Further clarifications for the Sustained Downlink Data Rate	10.1.0
	<u> </u>	<u> </u>		Test	
12-2010	RP-50	RP-101341	673r1	Correction on MBMS performance requirements	10.1.0
12-2010	RP-50	RP-101349	667r3	CR Removing brackets of Band 41 reference sensitivity to	10.1.0
]	İ			TS 36.101	
12-2010	RP-50	RP-101356	666r2	Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for	10.1.0
				TS 36.101	
12-2010	RP-50	RP-101359	646r1	CR for CA, UL-MIMO, eDL-MIMO, CPE	10.1.0
	RP-50	RP-101361	620r1	Introduction of L-band in TS 36.101	10.1.0
	RP-50				
12-2010	- DD PU	RP-101379	670r1	Correction on the PMI reporting in Multi-Laye Spatial	10.1.0
12-2010	KF-30		1 1	Multiplexing performance test	
12-2010			<del>                                  </del>		
12-2010 12-2010	RP-50	RP-101380	679r1	Adding antenna configuration in CQI fading test case	10.1.0
12-2010		RP-101380	679r1	Adding antenna configuration in CQI fading test case  Clause numbering correction	10.1.0 10.1.1
12-2010 12-2010 01-2011			679r1 695	Adding antenna configuration in CQI fading test case Clause numbering correction	10.1.1
12-2010 12-2010 01-2011 03-2011	RP-50 RP-51	RP-110359	695	Adding antenna configuration in CQI fading test case  Clause numbering correction  Removal of E-UTRA ACLR for CA	10.1.1 10.2.0
12-2010 12-2010 01-2011	RP-50			Adding antenna configuration in CQI fading test case Clause numbering correction Removal of E-UTRA ACLR for CA PDCCH and PHICH performance: OCNG and power	10.1.1
12-2010 12-2010 01-2011 03-2011	RP-50 RP-51	RP-110359	695	Adding antenna configuration in CQI fading test case  Clause numbering correction  Removal of E-UTRA ACLR for CA	10.1.1 10.2.0

03-2011	RP-51	RP-110352	707r1	REFSENSE in lower SNR	10.2.0
03-2011	RP-51	RP-110338	710	PMI performance: Power settings and precoding granularity	10.2.0
03-2011	RP-51	RP-110359	715r2	Definition of configured transmitted power for Rel-10	10.2.0
03-2011	RP-51	RP-110359	717	Introduction of requirement for adjacent intraband CA image rejection	10.2.0
03-2011	RP-51	RP-110343	719	Minimum requirements for the additional Rel-9 scenarios	10.2.0
03-2011	RP-51	RP-110343	723	Corrections to power settings for Single layer beamforming with simultaneous transmission	10.2.0
03-2011	RP-51	RP-110343	726r1	Correction to the PUSCH3-0 subband tests for Rel-10	10.2.0
03-2011	RP-51	RP-110338	730	Removing the square bracket for TS36.101	10.2.0
03-2011	RP-51	RP-110349	739	Removal of square brackets for dual-layer beamforming demodulation performance requirements	10.2.0
03-2011	RP-51	RP-110359	751	CR: Maximum input level for intra band CA	10.2.0
03-2011	RP-51	RP-110349	754r2	UE category coverage for dual-layer beamforming	10.2.0
03-2011	RP-51	RP-110343	756r1	Further clarifications for the Sustained Downlink Data Rate Test	10.2.0
03-2011	RP-51	RP-110343	759	Removal of square brackets in sustained data rate tests	10.2.0
03-2011	RP-51	RP-110337	762r1	Clarification to LTE relative power tolerance table	10.2.0
03-2011	RP-51	RP-110343	764	Introducing UE-selected subband CQI tests	10.2.0
03-2011	RP-51	RP-110343	765	Verification framework for PUSCH 2-2 and PUCCH 2-1 reporting	10.2.0
04-2011		55 //000/	l	Editorial: Spec Title correction, removal of "Draft"	10.2.1
06-2011 06-2011	RP-52 RP-52	RP-110804 RP-110795	766 768	Add Expanded 1900MHz Band (Band 25) in 36.101	10.3.0
06-2011	RP-52	RP-110795	768	Fixing Band 24 inclusion in TS 36.101  CR: Corrections for UE to UE co-existence requirements of	10.3.0
				Band 3	
06-2011	RP-52	RP-110812 RP-110789	774 782	Add 2GHz S-Band (Band 23) in 36.101	10.3.0
06-2011 06-2011	RP-52 RP-52	RP-110789 RP-110796	782	CR: Band 19 A-MPR refinement REFSENS in lower SNR	10.3.0
06-2011	RP-52	RP-110799	805	Clarification for MBMS reference signal levels	10.3.0
06-2011	RP-52	RP-110792	810	FDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110787	814	Correction on CQI mapping index of RI test	10.3.0
06-2011	RP-52	RP-110789	824	Corrections to in-band blocking table	10.3.0
06-2011	RP-52	RP-110794	826	Correction of TDD Category 1 DRS and DMRS RMCs	10.3.0
06-2011	RP-52	RP-110794	828	TDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110796	829	Correction of TDD RMC for Low SNR Demodulation test	10.3.0
06-2011	RP-52	RP-110796	830	Informative reference sensitivity requirements for Low SNR	10.3.0
06-2011	RP-52	RP-110787	778r1	for TDD  Minor corrections to DL-RMC-s for Maximum input level	10.3.0
06-2011	RP-52	RP-110789	832	PDCCH and PHICH performance: OCNG and power	10.3.0
00 20	02	1	302	settings	. 0.0.0
06-2011	RP-52	RP-110789	818r1	Correction on 2-X PMI test for R10	10.3.0
06-2011	RP-52	RP-110791	816r1	Addition of performance requirements for dual-layer	10.3.0
06-2011	RP-52	RP-110789	834	beamforming category 1 UE test  Performance requirements for PUCCH 2-0, PUCCH 2-1 and	10.3.0
				PUSCH 2-2 tests	
06-2011 09-2011	RP-52 RP-53	RP-110807 RP-111248	835r1 862r1	CR for UL MIMO and CA Removal of unnecessary channel bandwidths from	10.3.0 10.4.0
09-2011	RP-53	RP-111248	869r1	REFSENS tables  Clarification on BS precoding information field for RI FDD	10.4.0
				and PUCCH 2-1 PMI tests	
09-2011	RP-53	RP-111248	872r1	CR for B14Rx requirement Rrel 10	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111248 RP-111248	890r1 893	CR to TS36.101: Correction on the accuracy test of CQI. CR to TS36.101: Correction on CQI mapping index of TDD	10.4.0
				RI test	
09-2011	RP-53	RP-111248	904	Correction of code block numbers for some RMCs	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111248 RP-111248	907 914r1	Correction to UL RMC for FDD and TDD  Adding codebook subset restriction for single layer closed-	10.4.0 10.4.0
09-2011	RP-53	RP-111251	883	loop spatial multiplexing test Sustained data rate: Correction of the ACK/NACK feedback	10.4.0
00 2044	DD F2	RP-111251	929	mode 36.101 CR on MBSFN FDD requirements(R10)	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111251 RP-111251	929	TDD MBMS performance requirements for 64QAM mode	10.4.0
09-2011	RP-53	RP-111251	895	Further clarification for the dual-layer beamforming	10.4.0
09-2011	RP-53	RP-111255	908r1	demodulation requirements Introduction of Band 22	10.4.0
09-2011	RP-53	RP-111255	939	Modifications of Band 42 and 43	10.4.0
09-2011	RP-53	RP-111260	944	CR for TS 36.101 Annex B: Static channels for CQI tests	10.4.0
09-2011	RP-53	RP-111262	878r1	Correction of CSI reference channel subframe description	10.4.0
09-2011	RP-53	RP-111262	887	Correction to UL MIMO	10.4.0
09-2011	RP-53	RP-111262	926r1	Power control accuracy for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	927r1	In-band emissions requirements for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	930r1	Adding the operating band for UL-MIMO	10.4.0

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09-2011	RP-53	RP-111265	848	Corrections to intra-band contiguous CA RX requirements	10.4.0
09-2011	RP-53	RP-111265	863	Intra-band contiguos CA MPR requirement refinement	10.4.0
09-2011	RP-53	RP-111265	866r1	Intra-band contiguous CA EVM	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111266 RP-111266	935 936r1	Introduction of the downlink CA demodulation requirements Introduction of CA UE demodulation requirements for TDD	10.4.0 10.4.0
12-2011	RP-54	KF-111200	93011	Corrections of UE categories of Rel-10 reference channels	10.4.0
		RP-111684	947	for RF requirements	
12-2011	RP-54	RP-111684	948	Alternative way to define channel bandwidths per operating band for	10.5.0
12-2011	RP-54	RP-111686	949	CR for TS36.101: Adding note to the function of MPR	10.5.0
12-2011	RP-54	1 111000	0.0	Clarification on applying CSI reports during rank switching in	10.5.0
		RP-111680	950	RI FDD test - Rel-10	
12-2011	RP-54	RP-111734	953r1	Corrections for Band 42 and 43 introduction	10.5.0
12-2011	RP-54	RP-111680	956	UE spurious emissions	10.5.0
12-2011	RP-54	RP-111682	959	Add scrambling identity n_SCID for MU-MIMO test	10.5.0
12-2011	RP-54	RP-111690	960r1	P-MPR definition	10.5.0
12-2011	RP-54	RP-111693	962	Pcmax,c Computation Assumptions	10.5.0
12-2011	RP-54	RP-111733	963r1	Correction of frequency range for spurious emission requirements	10.5.0
12-2011	RP-54	RP-111680	966	General review of the reference measurement channels	10.5.0
12-2011	RP-54	RP-111691	945	Corrections of Rel-10 demodulation performance	10.5.0
12 2011	IXI O4	1111031		requirements This CR is only partially implemented due to confliction with CR 966	10.0.0
12-2011	RP-54	RP-111684	946	Corrections of UE categories for Rel-10 CSI requirements This CR is only partially implemented due to confliction with CR 966	10.5.0
12-2011	RP-54	RP-111691	982r2	Introduction of SDR TDD test scenario for CA UE demodulation This CR is only partially implemented due to confliction with	10.5.0
40.0044	DD 54	DD 444000	074.4	CR 966	40.5.0
12-2011 12-2011	RP-54 RP-54	RP-111693	971r1	CR on Colliding CRS for non-MBSFN ABS Introduction of elCIC demodulation performance	10.5.0 10.5.0
		RP-111693	972r1	requirements for FDD and TDD	
12-2011	RP-54	RP-111686	985	Adding missing UL configuration specification in some UE receiver requirements for case of 1 CC UL capable UE	10.5.0
12-2011	RP-54	RP-111684	998	Correction and maintenance on CQI and PMI requirements (ReI-10)	10.5.0
12-2011	RP-54	RP-111735	1004	MPR for CA Multi-cluster	10.5.0
12-2011	RP-54	RP-111691	1005	CA demodulation performance requirements for LTE FDD	10.5.0
12-2011	RP-54	RP-111692	1006	CQI reporting accuracy test on frequency non-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1007	CQI reporting accuracy test on frequency-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1008	PMI reporting accuracy test for TDD on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1009r1	CR for TS 36.101: RI performance requirements	10.5.0
12-2011	RP-54	RP-111692	1010r1	CR for TS 36.101: Introduction of static CQI tests (Rel-10)	10.5.0
03-2012	RP-55	RP-120291	1014	RF: Updates and corrections to the RMC-s related annexes (Rel-10)	10.6.0
03-2012	RP-55	RP-120300	1015r1	On elCIC ABS pattern	10.6.0
03-2012	RP-55	RP-120300	1016r1	On eICIC interference models	10.6.0
03-2012	RP-55	RP-120299	1017r1	TS36.101 CR: on eDL-MIMO channel model using cross- polarized antennas	10.6.0
03-2012	RP-55	RP-120304	1020r1	TS36.101 CR: Correction to MBMS Performance Test Parameters	10.6.0
03-2012	RP-55	RP-120303	1021	Harmonic exceptions in LTE UE to UE co-ex tests	10.6.0
03-2012	RP-55	RP-120304	1023	Unified titles for Rel-10 CSI tests	10.6.0
03-2012	RP-55	RP-120300	1033r1	Introduction of reference channel for eICIC demodulation	10.6.0
03-2012	RP-55	RP-120304	1040r1	Correction of Actual code rate for CSI RMCs	10.6.0
03-2012	RP-55	RP-120304	1041r1	Definition of synchronized operation	10.6.0
03-2012	RP-55	RP-120296	1048r1	Intra band contiguos CA Ue to Ue Co-ex	10.6.0
03-2012 03-2012	RP-55 RP-55	RP-120296 RP-120299	1049r1 1053	REL-10 CA specification editorial consistency  Beamforming model for TM9	10.6.0 10.6.0
03-2012	RP-55	RP-120299	1053	Requirement for CA demodulation with power imbalance	10.6.0
03-2012	RP-55	RP-120298	1057	Updating Band 23 duplex specifications	10.6.0
03-2012	RP-55	RP-120298	1058r1	Correcting UE Coexistence Requirements for Band 23	10.6.0
03-2012	RP-55	RP-120304	1059r1	CA demodulation performance requirements for LTE TDD	10.6.0
03-2012	RP-55	RP-120304	1061	Requirement for CA SDR FDD test scenario	10.6.0
03-2012	RP-55	RP-120293	1064r1	TS36.101 RF editorial corrections Rel 10	10.6.0
03-2012	RP-55	RP-120299	1067r1	Introduction of TM9 demodulation performance requirements	10.6.0
03-2012	RP-55	RP-120304	1071r1	Introduction of a CA demodulation test for UE soft buffer management testing	10.6.0
03-2012	RP-55	RP-120296	1072	MPR formula correction For intra-band contiguous CA Bandwidth Class C	10.6.0

03-2012	RP-55	RP-120303	1077r1	CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture	10.6.0
03-2012	RP-55	RP-120300	1082	TM3 tests for eICIC	10.6.0
03-2012	RP-55	RP-120300	1083r1	Introduction of requirements of CQI reporting definition for ecICIC	10.6.0
03-2012	RP-55	RP-120304	1084	eDL MIMO CSI requirements	10.6.0
03-2012	RP-55	RP-120306	1070r1	Introduction of Band 26/XXVI to TS 36.101	11.0.0
03-2012	RP-55	RP-120310	1074	Band 41 CA CR for TS36.101, section 5	11.0.0
03-2012	RP-55	RP-120310	1075r1	Band 41 CA CR for TS36.101, section 6	11.0.0
03-2012	RP-55	RP-120310	1076	Band 41 CA CR for TS36.101, section 7	11.0.0
06-2012	RP-56	RP-120795	1076 1085r2	Modulator specification tightening	11.1.0
00-2012	KF-30	KF-120793	100312		11.1.0
06-2012	RP-56	RP-120777	1087r1	Carrier aggregation Relative power tolerance, removal of TBD.	11 1 0
					11.1.0 11.1.0
06-2012	RP-56	RP-120783	1089	UE spurious emissions for Band 7 and Band 38 coexistence	11.1.0
06-2012	RP-56	RP-120780	1092	Deleting square brackets in Reference Measurement Channels	11.1.0
06-2012	RP-56	RP-120779	1097	CR to TS36.101: Correction on parameters for the eDL- MIMO CQI and PMI tests	11.1.0
00-2012	KF-50	KF-120779	1097	CR to TS36.101: Fixed reference channel for PDSCH	11.1.0
				demodulation performance requirements on eDL-MIMO –	
				NOT implemented as it is based on a wrong version of the	
06-2012	RP-56	RP-120780	1098r1		11.1.0
				Spec	
06-2012	RP-56	RP-120774	1107	RMC correction on eDL-MIMO RI test	11.1.0
06-2012	RP-56	RP-120774	1108r1	FRC correction on frequency selective CQI and PMI test (Rel-11)	11.1.0
06-2012	RP-56	RP-120774	1111	Correction on test point for PMI test (Rel-11)	11.1.0
06-2012	RP-56	RP-120784	1114r1	Corrections and clarifications on eICIC demodulation test	11.1.0
06-2012	RP-56	RP-120784	1117r1	Corrections and clarifications on eICIC demodulation test	11.1.0
		RP-120783			
06-2012	RP-56		1119r1	Corrections on UE performance requirements	11.1.0
06-2012	RP-56	RP-120773	1120	Introduction of CA band combination Band1 + Band19 to TS 36.101	11.1.0
06-2012	RP-56	RP-120769	1127	Addition of ETU30 channel model	11.1.0
06-2012	RP-56	RP-120773	1140	Addition of Maximum Throughput for R.30-1 TDD RMC	11.1.0
06-2012	RP-56	RP-120779	1141	CR for 36.101: The clarification of MPR and A-MPR for CA	11.1.0
06-2012	RP-56	RP-120784	1142	Corrections for elCIC demod test case with MBSN ABS	11.1.0
06-2012	RP-56	RP-120785	1144	Removing brackets of contiguous allocation A-MPR for CA_NS_04	11.1.0
06-2012	RP-56	RP-120784	1149r1	Introduction of PDCCH test with colliding RS on MBSFN-ABS	11.1.0
06-2012	RP-56	RP-120784	1153r1	Some clarifications and OCNG pattern for elClC demodulation requirements	11.1.0
06-2012	RP-56	RP-120773	1155	Introduction of TDD CA Soft Buffer Limitation	11.1.0
06-2012	RP-56	RP-120795	1156	B26 and other editorial corrections	11.1.0
06-2012	RP-56	RP-120779	1161	Corrections on CQI and PMI test	11.1.0
06-2012	RP-56	RP-120780	1163	FRC for TDD PMI test	11.1.0
06-2012	RP-56	RP-120778	1165r1	Clean-up of UL-MIMO for TS36.101	11.1.0
06-2012	RP-56	RP-120782	1171	Removal of unnecessary references to single carrier	11.1.0
				requirements from Interband CA subclauses	
06-2012	RP-56	RP-120781	1174	PDCCH wrong detection in receiver spurious emissions test	11.1.0
06-2012	RP-56	RP-120776	1184	Corrections to 3500 MHz	11.1.0
06-2012	RP-56	RP-120793	1189r2	Introduction of Band 44	11.1.0
06-2012	RP-56	RP-120784	1193r1	Target SNR setting for eICIC demodulation requirement	11.1.0
06-2012	RP-56	RP-120780	1196	Editorial simplification to CA REFSENS UL allocation table	11.1.0
06-2012	RP-56	RP-120778	1199	Correction of wrong table refernces in CA receiver tests	11.1.0
	-		1200r1	Introduction of e850_LB (Band 27) to TS 36.101	1 11 1 0
06-2012	RP-56	RP-120791			11.1.0
06-2012	RP-56	RP-120791 RP-120764	1212	Correction of PHS protection requirements for TS 36.101	11.1.0
06-2012 06-2012	RP-56 RP-56	RP-120791 RP-120764 RP-120793	1212 1213r1	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101	11.1.0 11.1.0
06-2012 06-2012 06-2012	RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781	1212 1213r1 1215r1	Correction of PHS protection requirements for TS 36.101	11.1.0 11.1.0 11.1.0
06-2012 06-2012	RP-56 RP-56	RP-120791 RP-120764 RP-120793	1212 1213r1	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101	11.1.0 11.1.0
06-2012 06-2012 06-2012	RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781	1212 1213r1 1215r1	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101	11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120781	1212 1213r1 1215r1 1217r1	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101	11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120781 RP-120795	1212 1213r1 1215r1 1217r1 1219r1	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120781 RP-120795 RP-120782 RP-120778	1212 1213r1 1215r1 1217r1 1219r1 1221 1223	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuraiton for CA TM4 tests R11	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120781 RP-120795 RP-120778 RP-120778 RP-120773	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuraiton for CA TM4 tests R11 CR on CA UE receiver timing window R11	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120795 RP-120795 RP-120778 RP-120778 RP-120773 RP-120784	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120781 RP-120795 RP-120778 RP-120778 RP-120773	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 09-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-57	RP-120791 RP-120764 RP-120793 RP-120781 RP-120795 RP-120795 RP-120778 RP-120778 RP-120773 RP-120784 RP-121294	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226 1230	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56	RP-120791 RP-120764 RP-120793 RP-120781 RP-120795 RP-120795 RP-120778 RP-120778 RP-120773 RP-120784	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel RF: Corrections to power allocation parameters for	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 09-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-57	RP-120791 RP-120764 RP-120764 RP-120781 RP-120781 RP-120795  RP-120778 RP-120778 RP-120778 RP-120778 RP-120774 RP-121294  RP-121313	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226 1230	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel RF: Corrections to power allocation parameters for transmission mode 8 (Rel-11)	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.2.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 09-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-57	RP-120791 RP-120764 RP-120793 RP-120781 RP-120795 RP-120795 RP-120778 RP-120778 RP-120773 RP-120784 RP-121294	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226 1230	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel RF: Corrections to power allocation parameters for transmission mode 8 (Rel-11) RF-CA: non-CA notation and applicability of test points in	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 09-2012 09-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-57 RP-57	RP-120791 RP-120764 RP-120764 RP-120781 RP-120781 RP-120795  RP-120778 RP-120778 RP-120778 RP-120778 RP-121294  RP-121313  RP-121304	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226 1230 1233r1 1235	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel RF: Corrections to power allocation parameters for transmission mode 8 (Rel-11) RF-CA: non-CA notation and applicability of test points in scenarios without and with CA operation (Rel-11)	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.2.0 11.2.0
06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 06-2012 09-2012	RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-56 RP-57	RP-120791 RP-120764 RP-120764 RP-120781 RP-120781 RP-120795  RP-120778 RP-120778 RP-120778 RP-120778 RP-120774 RP-121294  RP-121313	1212 1213r1 1215r1 1217r1 1219r1 1221 1223 1225 1226 1230	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101 Proposed revision of subclause 4.3A for TS36.101 Proposed revision on subclause 6.3.4A for TS36.101 Aligning requirements between Band 18 and Band 26 in TS36.101 SNR definition Correction of CSI configuration for CA TM4 tests R11 CR on CA UE receiver timing window R11 Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference Measurement Channel RF: Corrections to power allocation parameters for transmission mode 8 (Rel-11) RF-CA: non-CA notation and applicability of test points in	11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.1.0 11.2.0

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09-2012	RP-57	RP-121302	1241	requirements (resubmission of R4-63AH-0194 for Rel-11)  ABS pattern setup for MBSFN ABS test (resubmission of	11.2.0
09-2012	KF-37	KF-121302	1241	R4-63AH-0204 for Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1243	CR on elCIC CQI definition test (resubmission of R4-63AH-	11.2.0
00 20 .2		12.002		0205 for Rel-11)	
09-2012	RP-57	RP-121302	1245	Transmission of CQI feedback and other corrections (Rel-	11.2.0
				11)	
09-2012	RP-57	RP-121302	1247	Target SNR setting for eICIC MBSFN-ABS demodulation	11.2.0
				requirements (Rel-11)	
09-2012	RP-57	RP-121335	1248	Introduction of CA_1_21 RF requirements into TS36.101	11.2.0
09-2012	RP-57	RP-121300	1251	Corrections of spurious emission band UE co-existence	11.2.0
09-2012	RP-57	RP-121306	1253	applicable in Japan  Correction on RMC for frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1255	Requirements for the eDL-MIMO CQI test	11.2.0
09-2012	RP-57	RP-121302	1257	Clarification on PDSCH test setup under MBSFN ABS	11.2.0
09-2012	RP-57	RP-121316	1258	Update of Band 28 requirements	11.2.0
09-2012	RP-57	RP-121313	1262	Applicability of statement allowing RBW < Meas BW for	11.2.0
				spurious	
09-2012	RP-57	RP-121298	1265	Clarification of RB allocation for DRS demodulation tests	11.2.0
09-2012	RP-57	RP-121304	1267	Removal of brackets for CA Tx	11.2.0
09-2012	RP-57	RP-121337	1268r1	TS 36.101 CR for CA_38	11.2.0
09-2012	RP-57	RP-121327	1269	Introduction of CA_B7_B20 in 36.101	11.2.0
09-2012	RP-57	RP-121313	1271	Corrections of FRC subframe allocations and other minor	11.2.0
00.0045	DD	DD 101007	4074	problems	44.0.0
09-2012	RP-57	RP-121305	1274	Introduction of requirements for TDD CA Soft Buffer	11.2.0
09-2012	RP-57	RP-121307	1276	Limitation  Correction of eDL-MIMIO CSI RMC tables and references	11.2.0
09-2012	RP-57	RP-121307	1278		11.2.0
09-2012	RP-57	RP-121307	1278	Correction of MIMO channel model for polarized antennas  Addition of 15 and 20MHz Bandwidths for Band 23 to TS	11.2.0
09-2012	101-51	101-121303	1200	36.101 (Rel-11)	11.2.0
09-2012	RP-57	RP-121334	1283r1	Add requirements for inter-band CA of B_1-18 and B_11-18	11.2.0
				in TS36.101	
09-2012	RP-57	RP-121304	1285r1	CR for MPR mask for multi-clustered simultaneous	11.2.0
				transmission in single CC in Rel-11	
09-2012	RP-57	RP-121447	1288r2	Introduction of Japanese Regulatory Requirements to LTE	11.2.0
				Band 8(R11)	
09-2012	RP-57	RP-121315	1289	CR for Band 27 MOP	11.2.0
09-2012	RP-57	RP-121315	1290	CR for Band 27 A-MPR	11.2.0
09-2012	RP-57	RP-121316	1291	CR to replace protected frequency range with new band number 27	11.2.0
09-2012	RP-57	RP-121215	1292r1	Introduction of CA band combination Band3 + Band5 to TS	11.2.0
09-2012	101-51	101-121213	129211	36.101	11.2.0
09-2012	RP-57	RP-121306	1300r1	Requirements for eDL-MIMO RI test	11.2.0
09-2012	RP-57	RP-121306	1304	Corrections to TM9 demodulation tests	11.2.0
09-2012	RP-57	RP-121313	1306	Correction to PCFICH power parameter setting	11.2.0
09-2012	RP-57	RP-121306	1310r1	Correction on frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1313r1	eDL-MIMO CQI/PMI test	11.2.0
09-2012	RP-57	RP-121313	1316	Correction of the definition of unsynchronized operation	11.2.0
09-2012	RP-57	RP-121304	1320r1	Correction to Transmit Modulation Quality Tests for Intra-	11.2.0
00.0040	DD 57	DD 404000	10010	Band CA	44.0.0
09-2012	RP-57	RP-121338	1324r2	36.101 CR for LTE_CA_B7	11.2.0
09-2012 09-2012	RP-57 RP-57	RP-121331 RP-121316	1325 1326	Introduction of CA_3_20 RF requirements into TS36.101  A-MPR table correction for NS 18	11.2.0 11.2.0
09-2012	RP-57	RP-121310	1332r1	Bandwidth combination sets for intra-band and inter-band	11.2.0
09-2012	KF-31	KF-121304	133211	carrier aggregation	11.2.0
09-2012	RP-57	RP-121325	1339	Introduction of LTE Advanced Carrier Aggregation of Band 4	11.2.0
00 20 .2		12.020		and Band 13	
09-2012	RP-57	RP-121326	1340r1	Introduction of CA configurations CA-12A-4A and CA-17A-	11.2.0
				4A	
09-2012	RP-57	RP-121324	1341	Introduction of CA_B3_B7 in 36.101	11.2.0
09-2012	RP-57	RP-121328	1343	Introduction of Band 2 + Band 17 inter-band CA	11.2.0
00.00:-	D5	DD 101	1054	configuration into 36.101	44.5 -
09-2012	RP-57	RP-121306	1351	FRC for TM9 FDD	11.2.0
09-2012	RP-57	RP-121295	1352	Random precoding granularity in PMI tests Introduction of RI test for eICIC	11.2.0
09-2012 09-2012	RP-57 RP-57	RP-121302 RP-121304	1358 1360	Notes for deltaTib and deltaRib tables	11.2.0 11.2.0
1 05-2012	RP-57	RP-121304 RP-121304	1361	CR for A-MPR masks for NS_CA_1C	11.2.0
		RP-121884	1362	Introduction of CA_3_8 RF requirements to TS 36.101	11.2.0
09-2012	RP-58	11 12 1004		Removal of square brackets for Band 27 in Table 5.6.1-1	11.3.0
09-2012 12-2012	RP-58	RP-121870	1 1363		
09-2012 12-2012 12-2012	RP-58	RP-121870 RP-121861	1363 1366		
09-2012 12-2012		RP-121870 RP-121861	1366	Some changes related to CA tests and overview table of DL measurement channels	11.3.0
09-2012 12-2012 12-2012	RP-58			Some changes related to CA tests and overview table of DL	
09-2012 12-2012 12-2012 12-2012	RP-58 RP-58	RP-121861	1366	Some changes related to CA tests and overview table of DL measurement channels	11.3.0

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12-2012	RP-58	RP-121862	1376	Correction on FRC table in CSI test	11.3.0
12-2012	RP-58	RP-121862	1382	Correction of reference channel table for TDD eDL-MIMIO RI	11.3.0
				test	
12-2012	RP-58	RP-121850	1386	OCNG patterns for Sustained Data rate testing	11.3.0
12-2012	RP-58	RP-121867	1388r1	Introduction of one periodic CQI test for CA deployments	11.3.0
12-2012	RP-58	RP-121894	1396	Introduction of CA_B5_B12 in 36.101	11.3.0
12-2012	RP-58	RP-121850	1401	Introducing the additional frequency bands of 5 MHz x 2 in	11.3.0
				1.7 GHz in Japan to Band 3	
12-2012	RP-58	RP-121887	1406r1	Reference sensitivity for the small bandwidth of CA_4-12	11.3.0
12-2012	RP-58	RP-121860	1407	CR on elClC RI test	11.3.0
12-2012	RP-58	RP-121862	1409	Cleaning of 36.101 Performance sections Rel-11	11.3.0
12-2012	RP-58	RP-121861	1416	Out-of-band blocking requirements for inter-band carrier	11.3.0
.2 20.2	00			aggregation	
12-2012	RP-58	RP-121861	1418	Adding missed SNR reference values for CA soft buffer tests	11.3.0
12-2012	RP-58	RP-121890	1422	Introduction of CA_4A-5A into 36.101	11.3.0
12-2012	RP-58	RP-121867	1431	Clean up of specification R11	11.3.0
12-2012	RP-58	RP-121867	1436	Band 1 to Band 33 and Band 39 UE coexistence	11.3.0
12-2012	KP-56	KP-121007	1436		11.3.0
40.0040	DD 50	DD 404074	4.407-4	requirements	44.0.0
12-2012	RP-58	RP-121871	1437r1	Editorial corrections for Band 26	11.3.0
12-2012	RP-58	RP-121896	1438	Introduction of Band 5 + Band 17 inter-band CA	11.3.0
				configuration into 36.101	
12-2012	RP-58	RP-121862	1442	Correction of eDL-MIMO RI test and RMC table for the CSI	11.3.0
		<u> </u>	<b>+ +</b>	test	
12-2012	RP-58	RP-121861	1444	Minor correction to ceiling function example - rel11	11.3.0
12-2012	RP-58	RP-121862	1449	Correction of SNR definition	11.3.0
12-2012	RP-58	RP-121860	1450	Brackets clean up for eICIC CSI/demodulation	11.3.0
12-2012	RP-58	RP-121860	1455	CR on elCIC RI testing (Rel-11)	11.3.0
12-2012	RP-58	RP-121862	1459	Correction on FRC table	11.3.0
12-2012	RP-58	RP-121879	1461r1	CR for LTE B14 HPUE (Power Class 1)	11.3.0
12-2012	RP-58	RP-121862	1464	Adding references to the appropriate beamforming model	11.3.0
.2 20.2	00			(Rel-11)	
12-2012	RP-58	RP-121898	1465r1	Introduction of CA_8_20 RF requirements into TS36.101	11.3.0
12-2012	RP-58	RP-121882	1468r1	Introduction of inter-band CA_11-18 into TS36.101	11.3.0
12-2012	RP-58	RP-121903	1472r1	Introduction of inter-band CA_11-16 into 1336.101	11.3.0
12-2012	KP-56	KP-121903	147211		11.3.0
10.0010	DD 50	DD 404000	1,170,1	performance (FDD)	44.0.0
12-2012	RP-58	RP-121903	1473r1	Introduction of performance requirements for verifying the	11.3.0
				receiver type for advanced receivers (FDD/TDD)	
12-2012	RP-58	RP-121886	1474	CR to remove the square bracket of A-MPR in TS36.101	11.3.0
12-2012	RP-58	RP-121861	1476	Correction of some errors in reference sensitivity for CA in	11.3.0
				TS 36.101 (R11)	
12-2012	RP-58	RP-121903	1480r1	Introduction of Advanced Receivers Test Cases for TDD	11.3.0
12-2012	RP-58	RP-121901	1490r1	Introduction of Band 29	11.3.0
12-2012	RP-58	RP-121849	1494	Low-channel Band 1 coexistence with PHS	11.3.0
12-2012	RP-58	RP-121861	1498r1	Completion of the tables of bandwidth combinations	11.3.0
				specified for CA	
12-2012	RP-58	RP-121861	1499r1	Exceptions to REFSENS requrirements for class A2 CA	11.3.0
	1			combinations	
12-2012	RP-58	RP-121892	1500	Introduction of carrier aggregation configuration CA_4-7	11.3.0
12-2012	RP-58	RP-121870	1504	Editorial corrections to Band 27 specifications	11.3.0
12-2012	RP-58	RP-121878	1505	Band 28 AMPR for DTV protection	11.3.0
12-2012	RP-58	RP-121852	1509r1	UE-UE coexistence between bands with small frequency	11.3.0
12-2012	IVE-20	NE-121002	130311	separation	11.3.0
12-2012	RP-58	RP-121911	1510	Adding UE-UE Coexistence Requirement for Band 3 and	11.3.0
12-2012	מכ-את	KF-121911	1310	Band 26	11.3.0
12 2042	DD 50	DD 404000	1512		11 2 0
12-2012	RP-58	RP-121866	1513	Maintenance of Band 23 UE Coexistence	11.3.0
12-2012	RP-58	RP-121851	1515	Corrections to TM4 rank indicator Test 3	11.3.0
12-2012	RP-58	RP-121861	1517	Correction of test configurations and FRC for CA	11.3.0
		1		demodulation with power imbalance	
12-2012	RP-58	RP-121860	1518	Applicable OFDM symbols of Noc_2 for PDCCH/PCFICH	11.3.0
				ABS-MBSFN test cases	
03-2013	RP-59	RP-130279	1519	OCNG patterns for Enhanced Performance Requirements	11.4.0
	<u> </u>	<u></u>		Type A	
03-2013	RP-59	RP-130277	1520	Corrections on in-band blocking for Band 29 for carrier	11.4.0
	1			aggregation	
03-2013	RP-59	RP-130268	1523	Brackets removal in Rel-11 TM4 rank indicator Test 3	11.4.0
03-2013	RP-59	RP-130279	1524r1	Cleanup of Advanced Receivers requirement scenarios for	11.4.0
30 20 10	1 00	1 150275		demodulation and CSI (FDD/TDD)	1
03-2013	RP-59	RP-130258	1528	Corrections to CQI reporting	11.4.0
03-2013	RP-59	RP-130256	1536		
03-2013	RP-59 RP-59			Corrections for eICIC performance requirements (rel-11)	11.4.0
00 0040	- RP-50	RP-130264	1539	Correction of CA power imbalance performance	11.4.0
03-2013	111 33				1
		DD 100	1510	requirements	44
03-2013	RP-59	RP-130287	1543	Correction of a symbol for MPR in single carrier for TS	11.4.0
		RP-130287	1543 1544r1		11.4.0

				36.101 (R11)	
03-2013	RP-59	RP-130276	1546	Correction of contigous allocation A-MPR for CA_NS_05	11.4.0
03-2013	RP-59	RP-130263	1547r1	Clarification of spurious emission domain for CA in TS 36.101 (R11)	11.4.0
03-2013	RP-59	RP-130264	1548	CR for CA performance requirements	11.4.0
03-2013	RP-59	RP-130284	1553r1	Introduction of downlink non-contiguous CA into REL -11 TS 36.101	11.4.0
03-2013	RP-59	RP-130263	1557	CA_1C: CA_NS_02 and CA_NS_03 A-MPR REL-11	11.4.0
03-2013	RP-59	RP-130287	1560	Editorial corrections to subclause 5	11.4.0
03-2013	RP-59	RP-130267	1562	Addition of UE Regional Requirements to Band 23 Based on New Regulatory Order in the US	11.4.0
03-2013	RP-59	RP-130272	1567	Band 26: modification of A-MPR for 'NS_15'	11.4.0
03-2013	RP-59	RP-130287	1571r1	Band 41 requirements for operation in China and Japan	11.4.0
03-2013	RP-59	RP-130260	1574	Remove [] from CSI test case parameters	11.4.0
03-2013	RP-59	RP-130287	1575	Corrections to UE co-existence	11.4.0
03-2013	RP-59	RP-130287	1579	UE-UE co-existence between Band 1 and Band 33/39	11.4.0
03-2013	RP-59	RP-130287	1580	Correction on reference to note for Band 7 and 38 co- existence	11.4.0
03-2013	RP-59	RP-130263	1584r1	Cleanup for CA UE RF requirements	11.4.0
03-2013	RP-59	RP-130263	1586	Corrections on UL configuration for CA UE receiver requirements	11.4.0
03-2013	RP-59	RP-130263	1588	Correction of Transmit modulation quality requirements for CA	11.4.0
03-2013	RP-59	RP-130268	1590	Revision of Common Test Parameters for User-specific Demodulation Tests	11.4.0
03-2013	RP-59	RP-130278	1595	Correction for a Band 27 A-MPR table	11.4.0
03-2013	RP-59	RP-130264	1597	Correction of CA CQI test setup	11.4.0
03-2013	RP-59	RP-130287	1600r1	Correction of B12 DL Specification in Table 5.5A-2	11.4.0
03-2013	RP-59	RP-130263	1602	Correction of table reference	11.4.0
06-2013	RP-60	RP-130765	1604r1	Complementary description for definition of MIMO Correlation Matrices using cross polarized antennas	11.5.0
06-2013	RP-60	RP-130763	1607	Correction of transport format parameters for CQI index 10 (15 RBs) - Rel 11	11.5.0
06-2013	RP-60	RP-130765	1610	Maintenance of Band 23 A-MPR (NS_11) in TS 36.101 (Rel-	11.5.0
06-2013	RP-60	RP-130770	1613	CR for 36.101 : Adding the definition of CA_NS_05 and CA_NS_06 for additional spurious emissions for CA	11.5.0
06-2013	RP-60	RP-130770	1619	CR for introducing UE TM3 demodulation performance requirements under high speed	11.5.0
06-2013	RP-60	RP-130765	1623	Correction of test parameters for elCIC performance requirements	11.5.0
06-2013	RP-60	RP-130765	1625	Correction of test parameters for elCIC CSI requirements	11.5.0
06-2013	RP-60	RP-130765	1627	Correction of resource allocation for the multiple PMI Cat 1 UE test	11.5.0
06-2013	RP-60	RP-130766	1629	Removal of note 2 from band 28	11.5.0
06-2013	RP-60	RP-130770	1641	Correction of the CSI-RS parameter configuration	11.5.0
06-2013	RP-60	RP-130770	1650r1	Addition of Band 41 for intra-band non-contiguous CA for 36.101	11.5.0
06-2013	RP-60	RP-130770	1654r1	MPR for intra-band non-contiguous CA	11.5.0
06-2013	RP-60	RP-130765	1656	Modification of configured output power to account for larger tolerance	11.5.0
06-2013	RP-60	RP-130769	1658r1	Missing symbols in the NS_15 table	11.5.0
06-2013	RP-60	RP-130766	1673	Corrections to Rx requirements for inter-band CA configurations with REFSENS exceptions	11.5.0
06-2013	RP-60	RP-130770	1681r1	Correction for TS 36.101	11.5.0
06-2013	RP-60	RP-130763	1684	RF: Corrections to RMC-s for sustained data rate test	11.5.0
06-2013	RP-60	RP-130770	1685	Non-contiguous intraband CA channel spacing	11.5.0
06-2013	RP-60	RP-130766	1689	Carrier aggregation in multi RAT and multiple band combination terminals	11.5.0
06-2013	RP-60	RP-130766	1691	Completion of out-of-band blocking requirements for inter- band CA with one UL	11.5.0
06-2013	RP-60	RP-130767	1695r1	CR on the bandwidth coverage issue of CA demodulation performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130765	1697	Correction on UE maximum output power for intra-band CA (R11)	11.5.0
06-2013	RP-60	RP-130770	1698r1	CR for introduction of FeICIC demodulation performance requirements	11.5.0
06-2013	RP-60	RP-130770	1701	Removing bracket from CA_11A-18A requirments	11.5.0
06-2013	RP-60	RP-130767	1703	CR on the bandwidth coverage issue of CA CQI performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130766	1705	Corrections to ACLR for Rel-11 CA	11.5.0
06-2013	RP-60	RP-130765	1716	Corrections to NS_11 A-MPR Table	11.5.0
06-2013	RP-60	RP-130769	1717	Corrections to NS_12 A-MPR Table	11.5.0
06-2013	RP-60	RP-130771	1532r1	Introduction of CA 1+8 into TS36.101(Rel-12)	12.0.0
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06-2013	RP-60	RP-130781	1545r1	Introduction of LTE Advanced inter-band Carrier Aggregation of Band 3 and Band 28 to TS 36.101	12.0.0
06-2013	RP-60	RP-130785	1608r1	Introduction of LTE Advanced inter-band Carrier Aggregation of Band 23 and Band 29 to TS 36.101	12.0.0
06-2013	RP-60	RP-130777	1642r1	Introduction of CA B3+19 into TS36.101(Rel-12)	12.0.0
06-2013	RP-60	RP-130787	1687	Introduction of CA_4A-4A into 36.101	12.0.0
06-2013	RP-60	RP-130795	1712	Adding 5MHz CBW for B3 of Inter band CA of B3+26	12.0.0
06-2013	RP-60	RP-130795	1712 1713r1	Introduction of LTE Advanced Inter-Band Carrier	12.0.0
				Aggregation of Band 2 and Band 13	
06-2013	RP-60	RP-130790	1723r1	Introduction of the LTE 450 band to TS 36.101	12.0.0
06-2013	RP-60	RP-130791	1724r1	Introduction of the WCS band to TS 36.101	12.0.0
06-2013	RP-60	RP-130784	1707r1	Introduction of CA 19+21 into TS36.101(Rel-12)	12.0.0
09-2013	RP-61	RP-131300	1730r1	36.101 CR for LTE_CA_C_B3	12.1.0
09-2013	RP-61	RP-131285	1732	CR on performance requirements of CA soft buffer managemen (Rel-12)	12.1.0
09-2013	RP-61	RP-131303	1733r1	CR to introdue TM3 and TM4 test for 5MHz channel bandwidth	12.1.0
09-2013	RP-61	RP-131281	1736	CR on applicability of CA sustained data rate tests (Rel-12)	12.1.0
09-2013	RP-61	RP-131293	1739	Performance requirement for UE under EVA200	12.1.0
09-2013	RP-61	RP-131290	1743	CR for introduction of FelCIC PBCH performance requirement	12.1.0
09-2013	RP-61	RP-131290	1745	CR for introduction of FelCIC RI reporting requirements	12.1.0
09-2013	RP-61	RP-131292	1747	Beamforming model for EPDCCH test	12.1.0
09-2013	RP-61	RP-131303	1748	CR to introduce CSI tests for LTE450	12.1.0
09-2013	RP-61	RP-131303	1749	CR to extend UE category of the existing 5MHz performance	12.1.0
09-2013	RP-61	RP-131281	1767	requirements  UE REFSENS when supporting intra-band CA and inter-	12.1.0
				band CA	
09-2013	RP-61	RP-131279	1772	Correlation matrix for high speed train demodulation scenarios (Rel-12)	12.1.0
09-2013	RP-61	RP-131280	1776	Corrections to sustained data rate test (Rel-12)	12.1.0
09-2013	RP-61	RP-131303	1781	CR to introduce a new PHICH test based on 5MHz	12.1.0
09-2013	RP-61	RP-131303	1782	CR placeholder for applicability of new 5MHz tests	12.1.0
09-2013	RP-61	RP-131303	1783r1	CR : Proposal of applicability of new 5MHz tests	12.1.0
09-2013	RP-61	RP-131303	1784	CR: PHICH tests for 5MHz	12.1.0
09-2013	RP-61	RP-131290	1786	CR for introduction of FelCIC CQI requirements	12.1.0
09-2013	RP-61	RP-131281	1794	Clarification of multi-cluster transmission	12.1.0
09-2013	RP-61	RP-131294	1800r1	CA UE Coexistence Table update (Release 12)	12.1.0
09-2013	RP-61	RP-131302	1802	Coexistence between Band 27 and Band 38 (Release 12)	12.1.0
09-2013	RP-61	RP-131285	1803	Addional requirement for CA_1A-18A into TS36.101	12.1.0
09-2013	RP-61	RP-131296	1804	Add requirements for CA_1A-26A into TS36.101	12.1.0
09-2013	RP-61	RP-131281	1807	Incorrect REFSENS UL allocation for CA_1C	12.1.0
09-2013	RP-61	RP-131297	1808r1	Introduction of CA_2A-4A into 36.101	12.1.0
09-2013	RP-61	RP-131281	1811	Contiguous intraband CA REFSENS with one UL	12.1.0
09-2013	RP-61	RP-131281	1822	The Pcmax clauses restructured: This CR was NOT implemented as it was based on the wrong version of the spec	12.1.0
09-2013	RP-61	RP-131298	1824	Introduction of inter-band CA Band 2+5	12.1.0
09-2013	RP-61	RP-131285	1831	MPR for intra-band non-contiguous CA	12.1.0
09-2013	RP-61	RP-131281	1832	Correction to Rel-10 A-MPR for CA_NS_04	12.1.0
09-2013	RP-61	RP-131285	1834	CR for 36.101 : Add the definition of 5+20MHz for spectrum	12.1.0
09-2013	RP-61	RP-131303	1839	emission mask for CA CR to introduce CSI tests for LTE450	12.1.0
09-2013	RP-61	RP-131293	1840	Remianed Transmitter requirements for intra-band non- contiguous CA	12.1.0
09-2013	RP-61	RP-131303	1841	CR to introdue TM3 and TM4 test for 5MHz channel bandwidth	12.1.0
12-2013	RP-62	RP-131928	1847r1	Corrections to the notes in the band UE co-existence requirements table (Rel-12)	12.2.0
12-2013	RP-62	RP-131924	1852	Clean-up of uplink reference measurement channels (Rel- 12)	12.2.0
12-2013	RP-62	RP-131946	1857	Introduction of CA band combination Band2 + Band12 to TS	12.2.0
12-2013	RP-62	RP-131954	1858	36.101 Introduction of CA band combination Band12 + Band25 to	12.2.0
12-2013	RP-62	RP-131931	1867	TS 36.101 CA_NS_05 Emissions	12.2.0
12-2013	RP-62	RP-131939	1869	NS signaling for CA refsens	12.2.0
	RP-62	RP-131965	1870	Introduction of CA_23A-23A RF requirements into 36.101	12.2.0
12-2013		RP-131928	1877r2	Intraband CA channel bandwidth combination table	12.2.0
	RP-62			restructuring	
12-2013	RP-62 RP-62	RP-131940	1878	restructuring  Addition of CA_3C missing UE to UE co-existence requirement and corection to SEM	12.2.0
12-2013 12-2013			1878		12.2.0

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40.0040	DD 00	DD 404000	4000		oughput for CA	40.00
12-2013	RP-62	RP-131939	1889		on correction of test configurations of CA soft buffer tests	12.2.0
12-2013 12-2013	RP-62 RP-62	RP-131936 RP-131936	1893 1895r1		for FelCIC demodulation performance requirements	12.2.0 12.2.0
12-2013	RP-62	RP-131936	1897r1		on FeICIC PBCH performance requirement on RI reporting requirement	12.2.0
12-2013	RP-62	RP-131938	1899	Rea	mforming model for EPDCCH localized test	12.2.0
12-2013	RP-62	RP-131938	1901		/nlink physical setup for EPDCCH test	12.2.0
12-2013	RP-62	RP-131926	1904		rection on the UE category for eICIC CQI test	12.2.0
12-2013	RP-62	RP-131931	1906		for receiver type verification test of CSI-RS based	12.2.0
					anced receivers (Rel-12)	
12-2013	RP-62	RP-131956	1910r1	Spu	rious emission band UE co-existence requirements for	12.2.0
				cros	s-region issue	
12-2013	RP-62	RP-131928	1916r2		wed power reductions for multiple transmissions in a	12.2.0
10.0010	DD 00	DD 404007	1017.1		rame	40.00
12-2013	RP-62 RP-62	RP-131967	1917r1		coexistence requirements between Band 39 and Band 3	12.2.0
12-2013	KP-02	RP-131967	1918r1		Pcmax clauses restructured and removal of addition of to P-MPR	12.2.0
12-2013	RP-62	RP-131956	1919		figured maximum output power for multiple TAG	12.2.0
12 2010	101 02	101000	1010		smission	12.2.0
12-2013	RP-62	RP-131936	1927r1		figured maximum output power for multiple TAG	12.2.0
					smission	
12-2013	RP-62	RP-131927	1934	CR	on correction of FRC of power imbalance test	12.2.0
12-2013	RP-62	RP-131927	1937		UE coexistence for Band 40	12.2.0
12-2013	RP-62	RP-131957	1955r1		oduction of LTE Advanced intra-band contiguous Carrier	12.2.0
					regation in Band 23 to TS 36.101	
12-2013	RP-62	RP-131961	1956r1		oduction of CA_3A-3A into TS 36.101	12.2.0
12-2013	RP-62	RP-131937	1957		Minimum requirement with Different Cell ID and Colliding (with single NZP CSI-RS resource)	12.2.0
12-2013	RP-62	RP-131937	1958		Minimum requirement with Same Cell ID (with multiple	12.2.0
12-2013	KF-02	KF-131931	1936		CSI-RS resources)	12.2.0
12-2013	RP-62	RP-131936	1962		oduction of reference SNR-s for FeICIC demodulation	12.2.0
	02		.002		ormance requirements	12.2.0
12-2013	RP-62	RP-131938	1964	OCI	NG pattern for EPDCCH test	12.2.0
12-2013	RP-62	RP-131931	1965	CA	performance requirements for TDD intra-band NC CA	12.2.0
12-2013	RP-62	RP-131958	1966r1		performance requirements for TDD intra-band NC CA	12.2.0
12-2013	RP-62	RP-131939	1968		oduction of UE TM3 demodulation performance	12.2.0
10.0010	DD 00	DD 404007	4070		uirements under ETU300	40.00
12-2013 12-2013	RP-62 RP-62	RP-131937	1970 1972		oduction of test 1-A for CoMP	12.2.0 12.2.0
12-2013	RP-62	RP-131939 RP-131928	1972		lification of TM9 test to verify correct SNR estimation rection to blocking requirements and use of Delta_RIB	12.2.0
12-2013	RP-62	RP-131950	1985		ection to blocking requirements and use of Berta_RB eduction of CA band combination Band5 + Band25 to TS	12.2.0
12 2013	102	101330	1303	36.1		12.2.0
12-2013	RP-62	RP-131939	1988r1		on test point clarification for CA demodulation test	12.2.0
12-2013	RP-62	RP-131937	1994		to Introduce fading CQI test for CoMP (TDD)	12.2.0
12-2013	RP-62	RP-131937	1996	CR	to Introduce channel model for CoMP fading CQI tests	12.2.0
12-2013	RP-62	RP-131937	1998		to Introduce RI test for CoMP (FDD)	12.2.0
12-2013	RP-62	RP-131938	2001r1		ributed EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131938	2003r1		alized EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131938	2005r1		alized EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131937	2007		oduction of DL CoMP FDD static CQI test oduction of DL CoMP TDD static CQI test	12.2.0 12.2.0
12-2013 12-2013	RP-62 RP-62	RP-131937 RP-131924	2009		ax for Band 38 to Band 7 coexistence	12.2.0
12-2013	RP-62	RP-131948	2015	Intro	oduction of CA band combination B5 + B7 to TS 36.101	12.2.0
12-2013	RP-62	RP-131952	2017		oduction of CA band combination B7 + B28 to TS 36.101	12.2.0
12-2013	RP-62	RP-131937	2024		mum requirement with Same Cell ID (with multiple NZP	12.2.0
					-RS resources) TDD	
12-2013	RP-62	RP-131937	2026	CR	Minimum requirement with Different Cell ID and Colliding	12.2.0
					S (with single NZP CSI-RS resource) TDD	
12-2013	RP-62	RP-131936	2028		oral change on FeICIC PBCH Noc setup	12.2.0
12-2013	RP-62	RP-131937	2032		oduction of test 1-A for CoMP	12.2.0
12-2013	RP-62	RP-131931	2035r1		rection of nominal guard bands for bandwidth classes A,	12.2.0
12-2013	RP-62	RP-131937	2042	Bar	to Introduce RI test for CoMP (TDD)	12.2.0
12-2013	RP-62	RP-131937 RP-131937	2042		to Introduce Ri test for CoMP (TDD) to Introduce fading CQI test for CoMP (FDD)	12.2.0
12-2013	RP-62	RP-131937	2045		rection of TDD PCFICH/PDCCH test parameter table	12.2.0
12-2013	RP-62	RP-131939	2047		EVA200 to table of channel model parameters	12.2.0
12-2013	RP-62	RP-131963	2050r1		oduction of CA_7A-7A into TS 36.101	12.2.0
12-2013	RP-62	RP-131967	2057		d 41 deployment in Japan	12.2.0
12-2013	RP-62	RP-131926	2059	CA_	1C: Correction on CA_NS_02 A-MPR table	12.2.0
12-2013	RP-62	RP-131924	2060		plification of Band 12/17 in-band blocking test cases	12.2.0
12-2013	RP-62	RP-131967	2064		rection of duplicated notes on table 7.3.1A-3	12.2.0
12-2013	RP-62	RP-131938	2066	Intro	oduction of EPDCCH TM10 localized test R-12	12.2.0
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12-2013	RP-62	RP-131938	2068		oduction of SDR test for PDSCH with EPDCCH eduling	12.2.0

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03-2014	RP-63	RP-140377	2115	Editorial Correction for TS36.101 Rel-12	12.3.0
03-2014	RP-63	RP-140371	2108	UL-DL configuration and other parameters for FelCIC TDD	12.3.0
02 2014	DD 62	DD 440274	2007	CQI fading test (Rel-12) CR on TM9 localized ePDCCH test	10.00
03-2014	RP-63	RP-140374	2097		12.3.0
03-2014	RP-63	RP-140374	2101	CR on reference measurement channel for ePDCCH test	12.3.0
03-2014	RP-63	RP-140371	2110	CR for TS36.101 COMP demodulation requirements	12.3.0
03-2014	RP-63	RP-140371	2113	CR for Combinations of channel model parameters	12.3.0
03-2014	RP-63	RP-140374	2114	CR for EPDCCH power allocation (Rel-12)	12.3.0
03-2014	RP-63	RP-140371	2106	Cleanup of the specification for FelCIC (Rel-12)	12.3.0
03-2014	RP-63	RP-140375	2089	CR for introduction of 15MHz based single carrier and CA	12.3.0
	55.00	DD / /00==	2000 /	SDR tests in Rel-12	10.00
03-2014	RP-63	RP-140375	2080r1	CR on TM3 demodulation and soft buffer management test	12.3.0
03-2014	RP-63	RP-140371	2086	CR on reference measurement channel for TM10 PDSCH	12.3.0
<del></del>				demodulation test	
03-2014	RP-63	RP-140241	2174	Introduction of 3MHz in Band 8 for CA_8_20 RF	12.3.0
<del></del>		<b></b>		requirements into TS36.101	
03-2014	RP-63	RP-140417	2173r1	Addition of bandwidth combination set for CA_2A-29A and	12.3.0
<b></b>	L			CA_4A-29A	
03-2014	RP-63	RP-140387	2071r1	Introduction of TDD inter-band CA_B39_B41 into 36.101	12.3.0
03-2014	RP-63	RP-140378	2069	CA_3C is adding 100RB+75RB uplink configuration for	12.3.0
				reference sensitivity	
03-2014	RP-63	RP-140388	2070	CR for TS36.101 on CA_C_B39	12.3.0
03-2014	RP-63	RP-140386	2072	Introduction of CA band B3+B27 to TS36.101	12.3.0
03-2014	RP-63	RP-140374	2074	CR of EPDCCH localzied test with TM10 QCL Type-B	12.3.0
<u> </u>				configuration (Rel-12)	
03-2014	RP-63	RP-140371	2142	Clarification of contiguous and non-contiguous intra-band UE	12.3.0
<u> </u>				capabilities in the same band	
03-2014	RP-63	RP-140385	2161	Inrtroduction of additional bandwidth combination set for	12.3.0
I				CA_2A-4A	
03-2014	RP-63	RP-140371	2131r1	CR to finalize RI test for CoMP	12.3.0
03-2014	RP-63	RP-140368	2147	Correction of coding rate for 18RBs in UL RMC table	12.3.0
03-2014	RP-63	RP-140371	2144	Channel spacing for non-contiguous intra-band carrier	12.3.0
I				aggregation	
03-2014	RP-63	RP-140374	2163	Distributed EPDCCH Demodulation Test	12.3.0
03-2014	RP-63	RP-140368	2137	Configured transmitted power for CA	12.3.0
03-2014	RP-63	RP-140368	2122	CR for 36.101. Editorial correction on OCNG pattern	12.3.0
03-2014	RP-63	RP-140370	2160	Correction of table notes for NS_12-NS_15 spurious	12.3.0
1				emissions requirements	
03-2014	RP-63	RP-140371	2129r1	CR to finalize fading CQI test for CoMP	12.3.0
03-2014	RP-63	RP-140375	2119	Introduction of requirements for SNR test for TM9	12.3.0
03-2014	RP-63	RP-140374	2125	CR on correction of downlink SDR tests with EPDCCH	12.3.0
1	1 00	111 110071	2.20	scheduling	12.0.0
03-2014	RP-63	RP-140371	2127	Correction on DL CoMP static CQI tests (Rel 12)	12.3.0
06-2014	RP-64	RP-140909	2177r3	RF: Corrections to spurious emission requirements with NS	12.4.0
1				different than NS 01 (Rel-12)	
06-2014	RP-64	RP-140932	2187r1	Additional bandwidth combination set for LTE Advanced	12.4.0
1	1 0.1	111 110002	210711	inter-band Carrier Aggregation of Band 3 and Band 20	120
06-2014	RP-64	RP-140934	2188	Additional bandwidth combination set for LTE Advanced	12.4.0
1	1 0.1	111 110001	2100	inter-band Carrier Aggregation of Band 7 and Band 20	12.1.0
06-2014	RP-64			inter band carrier riggregation of band 7 and band 20	
		RP-140943	2195r1	CR for TS 36 101 on introduction CA 41D	12 4 0
06-2014		RP-140943	2195r1 2196r3	CR for TS 36.101 on introduction CA_41D CR to TS 36.101 on introduction of CA BW class D	12.4.0
06-2014	RP-64	RP-140943 RP-140943	2195r1 2196r3	CR to TS 36.101 on introduction of CA BW class D	12.4.0
	RP-64	RP-140943	2196r3	CR to TS 36.101 on introduction of CA BW class D requirements	12.4.0
06-2014	RP-64 RP-64	RP-140943 RP-140918	2196r3 2198	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test	12.4.0 12.4.0
	RP-64	RP-140943	2196r3	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test CR of EPDCCH localzied test with TM10 QCL Type-B	12.4.0
06-2014 06-2014	RP-64 RP-64 RP-64	RP-140943 RP-140918 RP-140917	2196r3 2198 2207	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations	12.4.0 12.4.0 12.4.0
06-2014 06-2014	RP-64 RP-64 RP-64	RP-140943 RP-140918 RP-140917 RP-140918	2196r3 2198 2207 2209	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations Clean up of TM9 SNR tests	12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933	2196r3 2198 2207 2209 2210r1	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations Clean up of TM9 SNR tests Introduction of band B4+B27 CA to TS36.101	12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942	2196r3 2198 2207 2209 2210r1 2213	CR to TS 36.101 on introduction of CA BW class D requirements CR on correction on TDD IRC CQI test CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations Clean up of TM9 SNR tests Introduction of band B4+B27 CA to TS36.101 Introduction of CA band combination B1+B20 to TS 36.101	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917	2196r3 2198 2207 2209 2210r1 2213 2216	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914	2196r3 2198 2207 2209 2210r1 2213 2216 2218	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140914	2196r3 2198 2207 2209 2210r1 2213 2216 2218 2220	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140914	2196r3 2198 2207 2209 2210r1 2213 2216 2218 2220	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918	2196r3 2198 2207 2209 2210r1 2213 2216 2218 2220 2222 2226	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FelCIC rank testing (Rel-12)  CR on FelCIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140918	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918	2196r3 2198 2207 2209 2210r1 2213 2216 2218 2220 2222 2226	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FelCIC rank testing (Rel-12)  CR on FelCIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140914  RP-140914  RP-140918  RP-140918  RP-140918  RP-140911  RP-140945	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226  2228 2229	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140918	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance  Clarification of Intra-band contiguous CA class C Narrow	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140911  RP-140945  RP-140911	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226  2228 2229  2233	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance  Clarification of Intra-band contiguous CA class C Narrow band blocking requirements	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140911  RP-140911  RP-140911	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226  2228 2229  2233  2239	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance  Clarification of Intra-band contiguous CA class C Narrow band blocking requirements  Correction for CA soft buffer test (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140911  RP-140945  RP-140911	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226  2228 2229  2233	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance  Clarification of Intra-band contiguous CA class C Narrow band blocking requirements  Correction for CA soft buffer test (Rel-12)  CR on OCNG and propagation conditions for dual layer TM9	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64 RP-64	RP-140943  RP-140918  RP-140917  RP-140918  RP-140933  RP-140942  RP-140917  RP-140914  RP-140918  RP-140918  RP-140911  RP-140911  RP-140911	2196r3  2198 2207  2209 2210r1 2213 2216 2218 2220 2222 2226  2228 2229  2233  2239	CR to TS 36.101 on introduction of CA BW class D requirements  CR on correction on TDD IRC CQI test  CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12): correction of CSI-RS configurations  Clean up of TM9 SNR tests  Introduction of band B4+B27 CA to TS36.101  Introduction of CA band combination B1+B20 to TS 36.101  CR for EPDCCH test (Rel-12)  CR of modification on FeICIC rank testing (Rel-12)  CR on FeICIC PBCH performance requirement (Rel-12)  Correction on out-of-band blocking for CA  Update demodualtion performance requirements with new UE categories  Correction for CA sustained data rate test (Rel-12)  Correction on wrong annotation for close- loop spatial multiplexing performance  Clarification of Intra-band contiguous CA class C Narrow band blocking requirements  Correction for CA soft buffer test (Rel-12)	12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0 12.4.0

		1		Locarios aggregation	
06-2014	RP-64	RP-140914	2258	carrier aggregation  Applicability of exceptions to reference sensitivity	12.4.0
				requirements for CA	
06-2014	RP-64	RP-140909	2269	In-band blocking case numbering re-establisment	12.4.0
06-2014	RP-64	RP-140918	2273	CR for TS36.101 FRC tables for COMP demodulation requirements	12.4.0
06-2014	RP-64	RP-140945	2277	Editorial correction of note in clause 4.4	12.4.0
06-2014	RP-64	RP-140926	2282r1	Editorial correction of note in clause 4.4	12.4.0
06-2014	RP-64	RP-140911	2283	Introduction of new bandwidth combination set for CA_1A-5A UE	12.4.0
06-2014	RP-64	RP-140914	2286	CR for finalizing DL COMP CSI reporting requirements	12.4.0
06-2014	RP-64	RP-140914	2288	CR for adding DL CoMP CSI RMC tables (Rel-12)	12.4.0
06-2014	RP-64	RP-140921	2291	Simplification of 36.101 Table 5.6A.1-1 for LTE_CA_C_B27	12.4.0
06-2014	RP-64	RP-140914	2293	Finalization of CoMP demodulation test cases	12.4.0
06-2014	RP-64	RP-140918	2294	Editorial corrections for UE performance requirements for R12	12.4.0
06-2014	RP-64	RP-140937	2295	Introduction of CA performance requirements for Band 27 CA	12.4.0
06-2014	RP-64	RP-140931	2296	Introduction of CA 1+11 to 36.101 (Rel-12)	12.4.0
06-2014	RP-64	RP-140994	2309	Inclusion of the out of band emission limit concluded in CEPT into band 28	12.4.0
06-2014	RP-64	RP-140911	2314	UE to UE co-existence between B42/B43	12.4.0
06-2014	RP-64	RP-140911	2318	Perf: Corrections to CA (Class C) performance with power imbalance (Rel-12)	12.4.0
06-2014	RP-64	RP-140920	2319	Introduction of CA performance requirements for Band 23 CA	12.4.0
06-2014	RP-64	RP-140914	2321	CR of modification on FelCIC rank testing (Rel-12)	12.4.0
06-2014	RP-64	RP-140914	2323	CR of introducing FelCIC TM9 testing (Rel-12)	12.4.0
06-2014	RP-64	RP-140917	2325	CR for EPDCCH SDR test (Rel-12)	12.4.0
06-2014	RP-64	RP-140911	2328	Clean-up CR for demodulation requirements (Rel-12)	12.4.0
06-2014	RP-64	RP-140945	2330r1	Additional updates of UE categories for demodualtion performance requirements (Rel-12)	12.4.0
06-2014	RP-64	RP-140911	2333	Throughput calculation for elCIC demodulation requirements	12.4.0
06-2014	RP-64	RP-140914	2335r1	Introduction of Band 28 requirements for flexible operation in Japan	12.4.0
06-2014	RP-64	RP-140911	2337r1	Add missing Uplink downlink configuration to elCIC TDD RI requirement	12.4.0
06-2014	RP-64	RP-140945	2338	Add static propagation condition matrix for 1 x 2	12.4.0
06-2014	RP-64	RP-140911	2341	Cleanup of terminology for Rx requirements	12.4.0
06-2014	RP-64	RP-140945	2344	CR on separating CA UE demodulation tests from single carrier tests in Rel-12	12.4.0
06-2014	RP-64	RP-140911	2351	Test configuration for intra-band contiguous carrier aggregation power control	12.4.0
06-2014	RP-64	RP-140935	2358	Addition of bandwidth combination sets for CA_2A-29A, CA_3A-5A, CA_4A-5A, CA_4A-12A, and CA_4A-29A into 36.101	12.4.0
06-2014	RP-64	RP-140914	2362	Correction of test configurations for intra-band non- contiguous aggregation	12.4.0
06-2014	RP-64	RP-140911	2365	Clarification on CA bandwidth classes	12.4.0
06-2014	RP-64	RP-140917	2374	CR on correction of downlink SDR tests with EPDCCH scheduling	12.4.0
06-2014	RP-64	RP-140922	2377	Correction on LTE_CA_C_B39	12.4.0
06-2014	RP-64	RP-140911	2378	Corrections on CA CQI tests	12.4.0
06-2014	RP-64	RP-140930	2381r1	Introduction of LTE-Advanced CA of Band 8 and Band 40 to TS36.101	12.4.0
06-2014	RP-64	RP-140927	2382r1	FRC for DL MIMO enahncement PMI requirements	12.4.0
06-2014	RP-64	RP-140603	2384r2	CR for TS 36.101 on introduction CA_40D	12.4.0
06-2014	RP-64	RP-140944	2385r1	CR to TS 36.101 on introduction of 3DL intra-band non- contiguous CA requirements	12.4.0
06-2014	RP-64	RP-140938	2387	Introduction of CA_2A-2A into TS 36.101	12.4.0
06-2014	RP-64	RP-140927	2392	Introduction of 4Tx beam steering model	12.4.0
06-2014	RP-64	RP-140914	2394	CA_7C A-MPR Corrections	12.4.0
06-2014	RP-64	RP-140936	2395r2	Introduction of a new CA_7C bandwidth combination set into 36.101	12.4.0
06-2014	RP-64	RP-140918	2398	CR for TS36.101 CSI RMC table	12.4.0
06-2014	RP-64	RP-140940	2413	Introduction of LTE_CA_NC_B42 into 36.101	12.4.0
06-2014	RP-64	RP-140942	2420	Introduction of CA band combination B1+B20 to TS 36.101	12.4.0
06-2014	RP-64	RP-140919	2422	CA_3C is deleting 75RB+75RB uplink configuration for reference sensitivity	12.4.0
06-2014	RP-64	RP-140914	2425	CR on correction for TM10 CSI reporting requirements	12.4.0
09-2014	RP-65	RP-141197	2458r1	Introduction of CA_B1_B3_B19 into TS 36.101	12.5.0
	RP-65	RP-141428	2568	Updated REFSENS requirements for band combinations	12.5.0
09-2014	KF-05	141420		with Band 4 and Band 12	

09-2014	RP-65	RP-141469	2571	Correction to CA in Band 1+20	12.5.0
09-2014	RP-65	RP-141525	2504r1	Perf: Cleanup and better description of DL-RMC-s with	12.5.0
03 2014	100	1(1-141323	230411	dynamic coding rate for CSI requirements (Rel-12)	12.5.0
09-2014	RP-65	RP-141525	2565	Corrections to UE coex table	12.5.0
09-2014	RP-65	RP-141527	2434	Correction on support of a bandwidth combination set	12.5.0
09-2014	RP-65	RP-141527	2452r1	Remove the redundant table for FDD 4Tx multi-layer tests and correct the test case number (Rel-12)	12.5.0
09-2014	DD 65	RP-141527	2466		12.5.0
09-2014	RP-65 RP-65	RP-141527	2469	Unequal DL CC RB allocations in Maximum input level	12.5.0
09-2014	RP-65	RP-141527	2484	Intra-band contiguous CA ACS case 2 test clarification  Corrections on delta Tc for UE MOP for intra-band	12.5.0
09-2014	KF-05	KF-141527	2404	contiguous CA	12.5.0
09-2014	RP-65	RP-141527	2487	Removal of Class B in UE TX requirement	12.5.0
09-2014	RP-65	RP-141527	2516r1	CR for CA applicability rule in 36.101 in Rel-12	12.5.0
09-2014	RP-65	RP-141527	2519r1	Editorial CR for CA performance tests in 36.101 in Rel-12	12.5.0
09-2014	RP-65	RP-141527	2548	Correction to NS_20 A-MPR for Band 23	12.5.0
09-2014	RP-65	RP-141530	2447	CR of introducing FeICIC TM9 testing (Rel-12)	12.5.0
09-2014	RP-65	RP-141530	2454	Maintenance of CoMP demodulation performance requirements (Rel-12)	12.5.0
09-2014	RP-65	RP-141530	2456	Clean-up CR for EPDCCH and FelCIC PBCH (Rel-12)	12.5.0
09-2014	RP-65	RP-141530	2471	Throughput calculation for felCIC demodulation	12.5.0
00.0011	DD 25	DD 411505	0.400	requirements	10.5.3
09-2014	RP-65	RP-141532	2439	CR on correction on CQI reporting TDD CSI meas in case two CSI subframe sets with CRS test (Rel-12)	12.5.0
09-2014	RP-65	RP-141532	2441	CR on correction on RI reporting CSI meas in case two CSI	12.5.0
				subframe sets with CRS tests (Rel-12)	
09-2014	RP-65	RP-141532	2444	Clarification of high speed train scenario in 36.101 (Rel-12)	12.5.0
09-2014	RP-65	RP-141532	2478	CQI reporting under fading: CQI indices in set	12.5.0
09-2014	RP-65	RP-141532	2490	Correction on A-MPR table	12.5.0
09-2014	RP-65	RP-141532	2499	RF: Corrections to spurious emission band co-existence requirement for Band 44	12.5.0
09-2014	RP-65	RP-141535	2559	Addition of E-UTRA CA configurations and bandwidth	12.5.0
				combination sets defined for inter-band CA for Band 4 and 27	
09-2014	RP-65	RP-141537	2541	Band 42 contiguous CA channel bandwidth correction	12.5.0
09-2014	RP-65	RP-141546	2463r1	Introduction of PMI reporting requirements for DL MIMO	12.5.0
				enhancement	
09-2014	RP-65	RP-141548	2457r2	Introduction of CA_B1_B3 into TS 36.101	12.5.0
09-2014	RP-65	RP-141549	2556	Addition of bandwidth combination set for CA_2A-4A	12.5.0
09-2014	RP-65	RP-141550	2566	Addition of 3MHz bandwidth for Band 12 , in the B2+B12 CA combination	12.5.0
09-2014	RP-65	RP-141551	2445	Introduction of CA 8+11 to 36.101 (Rel-12)	12.5.0
09-2014	RP-65	RP-141553	2491r1	Introduction of a new bandwidth combination set for	12.5.0
09-2014	RP-65	RP-141554	2533r1	CA_25A-25A into 36.101  Introduction of requirements for 3DL inter-band carrier	12.5.0
				aggregation (FDD)	
09-2014	RP-65	RP-141554	2534	Introduction of requirements for 3DL combinations with Band 30 (FDD)	12.5.0
09-2014	RP-65	RP-141557	2461r1	Introduction of CA_B19_B42_B42 into TS 36.101	12.5.0
09-2014	RP-65	RP-141559	2460r1	Introduction of CA_B1_B42_B42 into TS 36.101	12.5.0
09-2014	RP-65	RP-141560	2427	Adding 15MHz channel BW to B40 3DL and new bandwidth	12.5.0
				combination set for the 2DL	
09-2014	RP-65	RP-141561	2488r1	Corrections on Maximum input level for intra-band non- contiguous 3DL	12.5.0
09-2014	RP-65	RP-141562	2436	Corrections on Maximum input level and ACS for intra-band	12.5.0
00.2044	DD 65	DD 444500	2494=4	CA Introduction of CA hand combination P44 + P42 to TS 26 101	10 5 0
09-2014 09-2014	RP-65	RP-141562 RP-141562	2481r1	Introduction of CA band combination B41+ B42 to TS 36.101 CR on CA power imbalance tests in Rel-12	12.5.0 12.5.0
09-2014	RP-65 RP-65	RP-141562 RP-141562	2522 2560	CR on CA power imbalance tests in Rei-12  CR Reducing MPR for Contiguous CA with Non-Contiguous	12.5.0
				Resource Allocations	
09-2014	RP-65	RP-141563	2555r1	UL configuration for CA_4A-12A reference sensitivity	12.5.0
09-2014	RP-65	RP-141563	2557	Addition of bandwidth combination set for CA_4A-12A	12.5.0
09-2014	RP-65	RP-141612	2494r2	Introduction of inter-band CA_18-28 into TS36.101	12.5.0
09-2014	RP-65	RP-141635	2552r2	Introduction of CA_1A-7A into 36.101(Rel-12)	12.5.0
09-2014	RP-65	RP-141636	2480r2	Introduction of 3DLs CA band combination of Band1 +5 + 7 to TS 36.101 Rel-12	12.5.0
09-2014	RP-65	RP-141653	2435r3	Introduction of 3 Band Carrier Aggregation (3DL/1UL) of	12.5.0
09-2014	RP-65	RP-141682	2570r1	Band 1, Band 3 and Band 8 to TS 36.101 Introduction of CA band combination B1+B7+B20 to TS	12.5.0
	1			36.101	
09-2014	RP-65	RP-141708	2492r3	Introduction of 3 Band Carrier Aggregation of Band 1,Band 3 and Band 5 to TS 36.101	12.5.0
12-2014	RP-66	RP-142147	2671	Correction of CoMP TDD CSI tests (Rel-12)	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142147 RP-142144	2671 2574	Correction of CoMP TDD CSI tests (Rel-12) CR for REFSENSE in lower SNR and change history	12.6.0 12.6.0

		T = =	T		
12-2014	RP-66	RP-142142	2587	CR for 1 PRB allocation performance in presence of MBSFN (rel-12)	12.6.0
12-2014	RP-66	RP-142144	2590	Maintenance of CA demodulation performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142147	2592	Clean up for FelCIC demodulation performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142166	2600	Correction of placement of CA_40D in Table	12.6.0
12-2014	RP-66	RP-142162	2601	CQI test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142162	2602	Sustained downlink data rate test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142165	2611	Removal of square brackets for CA_B1_B3 and CA_B1_B3_B19	12.6.0
12-2014	RP-66	RP-142147	2620	CQI reporting in AWGN: CQI indices in set	12.6.0
12-2014	RP-66	RP-142147	2629	CR to fix error of CA capability for CA performance tests in 36.101 in Rel-12	12.6.0
12-2014	RP-66	RP-142144	2637	Definition of the bits in the bitmap for indication of modified MPR behavior	12.6.0
12-2014	RP-66	RP-142147	2641	Applicability of in-gap and out-of-gap measurements for intra-band NC CA	12.6.0
12-2014	RP-66	RP-142183	2642	Introduction of additional bandwidth combination set for CA_2A-5A	12.6.0
12-2014	RP-66	RP-142164	2643	Corrections for 3DL inter-band CA band combinations	12.6.0
12-2014	RP-66	RP-142147	2661	Maintenance of TM10 demodulation test configurations on PQI set and ZP-CSIRS ( Rel-12 test 8.3.1.3.2, 8.3.2.4.2 )	12.6.0
12-2014	RP-66	RP-142173	2582r1	Introduction of PUSCH 3-2 requirements into TS36.101	12.6.0
12-2014	RP-66	RP-142162	2603r1	Normal demodulation test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142164	2576r1	Corrections on Out-of-band blocking requirements for CA Class B and D	12.6.0
12-2014	RP-66	RP-142149	2678	CR to specify applicability of CoMP RI test (Rel-12)	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142144 RP-142164	2688 2689	Removal of bracket for UL MIMO Corection of B29 REFSENS for CA_2A-29A-30A and	12.6.0 12.6.0
12-2014	RP-66	RP-142104	2700	CA_4A-29A-30A  Delete the incorrect notes for FDD DMRS demodulation	12.6.0
12-2014	RP-66	RP-142144	2594r3	tests (Rel-12)  Correcting requirements for inter-band CA_18-28 in	12.6.0
	RP-66	RP-142160		TS36.101  CR of modification on PMI reporting requirements for DL	
12-2014			2705	MIMO enhancement	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142144 RP-142147	2720 2722	Band 22 correction in UE to UE co-existance table.  Correction to non-contiguous downlink intraband CA receiver	12.6.0 12.6.0
				requirements	
12-2014	RP-66	RP-142159	2752	Removal of dRib from CA_1A-7A	12.6.0
12-2014	RP-66	RP-142147	2723	Correction to table format of allowed channel bandwidths of non-contiguous intraband CA	12.6.0
12-2014	RP-66	RP-142164	2643r1	Corrections for 3DL inter-band CA band combinations	12.6.0
12-2014	RP-66	RP-142146	2731	Modifications for NS_12 and NS_13	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142189 RP-142173	2739 2706r1	Introduction of CA_5-13 into 36.101  CR of reference measurement channel for PUSCH3-2 test	12.6.0 12.6.0
12-2014	RP-66	RP-142144	2727r1	CR for CA applicability rule in 36.101 in Rel-12	12.6.0
12-2014	RP-66	RP-142188	2676r1	CR to remove CA capability column in CA performance test tables (Rel-12)	12.6.0
12-2014	RP-66	RP-142173	r3	Introduction of PUSCH 3-2 requirements into TS36.101	12.6.0
12-2014	RP-66	RP-142187	2690r1	CR on sustained data rate test for 3DL CA	12.6.0
12-2014	RP-66	RP-142187	2681r2	CR on normal demodulation test for 3DL CA	12.6.0
12-2014	RP-66	RP-142147	2747r1	TS36.101 removal of brackets (RF)	12.6.0
12-2014	RP-66	RP-142144	2755 2710r1	Correction to Transmit Modulation Quality for CA Clarification on UL and DL CA	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142144 RP-142144	2710r1 2717r1	Clarification of notes relating to interferer offsets in intraband	12.6.0 12.6.0
10 0044	DD 60	DD 440447	2725-4	CA receiver requirement tables.	10.6.0
12-2014 12-2014	RP-66 RP-66	RP-142147 RP-142179	2735r1 2684r1	Band 28 and NS_24 CR for UE requirements for 256QAM	12.6.0 12.6.0
12-2014	RP-66	RP-142179 RP-142180	2729r1	Introduction of Dual Connectivity to TS 36.101 Rel-12, RF	12.6.0
12-2014	RP-66	RP-142184	2680r1	Introduction of dual uplink inter-band CA in TS 36.101 rel-12	12.6.0
12-2014	RP-66	RP-142182	2701r1	Introduction of inter-band CA_1-28 into TS36.101	12.6.0
12-2014	RP-66	RP-142144	2758	Correction to Note 2 of Harmonic Signal Exceptions in Spurious Emissions	12.6.0
12-2014	RP-66	RP-142144	2751r2	Removal of brackets and TBD from CA feature	12.6.0
12-2014	RP-66	RP-142144	2697r1	Maintenance of CA performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142187	2679r2	CR to introduce CQI test for 3 DL CA	12.6.0
12-2014	RP-66	RP-142185	2721r1	Addition of 2UL non-contiguous intraband CA feature	12.6.0
12-2014 12-2014	RP-66 RP-66	RP-142144 RP-142176	2704r2 2685r2	UE to UE co-existence between B42/B43 Introduction of LC MTC into TS 36.101	12.6.0 12.6.0
12-2014	1/1-00	NF-1421/0	200312	I ITHEOGRACION OF LC INTO ITHU 13 30. IUT	12.0.0

12-2014	RP-66	RP-142190	2759r1	Introduction of additional band combinations for 3DL interband CA	12.6.0
03-2015	RP-67	RP-150387	2760r2	Introduce additional bands of LC MTC	12.7.0
03-2015	RP-67	RP-150387	276012	CR on corrections to Dual-Layer Spatial Multiplexing with	12.7.0
03-2015	RP-67	RP-150392	2765r1	multiple CSI-RS config Rel-12  CR for applicability and test rules for TDD-FDD CA	12.7.0
03-2015	RP-67	RP-150392	2766	performance requirements Introduction of CQI tests for TDD-FDD CA	12.7.0
03-2015	RP-67	RP-150395	2767r1	CR to introduce the SU-MIMO whitening verification test	12.7.0
03-2015	RP-67	RP-150393	2768r1		12.7.0
				CR on power imbalance test for 3DL CA	
03-2015 03-2015	RP-67 RP-67	RP-150392 RP-150394	2769 2770r1	CR on sustained data rate test for TDD FDD CA	12.7.0 12.7.0
				CR for introduction of 256QAM demodulation performance requirements	
03-2015	RP-67	RP-150393	2772r1	CR: DC UE performance requirements	12.7.0
03-2015	RP-67	RP-150390	2773r1	CR: MTC demodulation performance requirements	12.7.0
03-2015	RP-67	RP-150390	2774r1	CR: MTC CSI requirements	12.7.0
03-2015	RP-67	RP-150396	2775r1	Introduction of the eIMTA functional PDSCH demodulation test	12.7.0
03-2015	RP-67	RP-150387	2776r3	CR on RF core requirements for D2D	12.7.0
03-2015	RP-67	RP-150387	2777	Modification of CSI reference measurement channel Rel-12	12.7.0
03-2015	RP-67	RP-150388	2779	Editorial correction for CA_18A-28A	12.7.0
03-2015	RP-67	RP-150388	2781	Removing brackets for CA_1A-28A MSD requirements	12.7.0
03-2015	RP-67	RP-150384	2783	Editorial correction on symbols for enhanced performance requirements type A	12.7.0
03-2015	RP-67	RP-150387	2784		12.7.0
03-2015		RP-150387 RP-150388	2784	Corrections on reference measurement channel Correction of TS 36.101 for the Pcell support of 25+41	
	RP-67				12.7.0
03-2015 03-2015	RP-67 RP-67	RP-150395 RP-150391	2793r1 2794	CR for single cell demodulation test for SU-MIMO	12.7.0 12.7.0
03-2015	RP-67	RP-150391	2797	Introduction of CA_3A-42A and CA_3A-42C into 36.101  UL HARQ in PDSCH and PDCCH/PCFICH demod test	12.7.0
00.0045	DD 07	DD 450000	0000	cases for elCIC/felCIC with MBSFN ABS	40.70
03-2015	RP-67	RP-150382	2800	Correction to elCIC aggressor cell configurations	12.7.0
03-2015	RP-67	RP-150387	2801	R4-73AH-0040: Correction for uplik CA configuration in TS 36.101 Rel-12	12.7.0
03-2015	RP-67	RP-150387	2802r1	Correction of MSD levels for CA_1A-8A in TS 36.101 rel-12	12.7.0
03-2015	RP-67	RP-150387	2805	Removal of eDL-MIMO term from specification	12.7.0
03-2015	RP-67	RP-150388	2809	Clarification of 2UL/3DL contiguous intraband CA REFSENS test	12.7.0
03-2015	RP-67	RP-150392	2811r1	CR on TM4 normal demodulation test for 3DL CA	12.7.0
03-2015	RP-67	RP-150392	2812	CR on introducing new DL referece measurement channels	12.7.0
03-2015	RP-67	RP-150392	2813r1	CR on normal demodulation test for TDD-FDD CA	12.7.0
03-2015	RP-67	RP-150388	2815	Additions of bandwidth combination set reference	12.7.0
03-2015	RP-67	RP-150388	2816	Correction of band number in Table 5.6A.1-2a for LTE_CA_B4_B12_B30	12.7.0
03-2015	RP-67	RP-150382	2819	UE to UE co-existence between B42/B43	12.7.0
03-2015	RP-67	RP-150382	2822	Corrections to CA in-band emissions requirement	12.7.0
03-2015	RP-67	RP-150381	2830	Uplink RMCs for sustained data rate test	12.7.0
03-2015	RP-67	RP-150382	2833	Corrections to the CA power imbalance test	12.7.0
03-2015	RP-67	RP-150392	2839r1	CR for soft buffer tests for TDD-FDD CA in 36.101 in Rel-12	12.7.0
03-2015	RP-67	RP-150392	2842	Editorial CR for CA UE performance tests in 36.101 in Rel-	12.7.0
03 2045	DD 67	DD 150207	2947	12	12.7.0
03-2015 03-2015	RP-67 RP-67	RP-150387 RP-150387	2847 2850	UE spurious emissions structure correction for CA  Correction of PCMAX for uplink inter-band and intra-band carrier aggregation	12.7.0 12.7.0
03-2015	RP-67	RP-150387	2851	Exceptions for spurious response for UL CA	12.7.0
03-2015	RP-67	RP-150387 RP-150388	2852r1	Correction of REFSENS, OOBB and uplink configuration for	12.7.0
			1	3DL/1UL CA	
03-2015	RP-67	RP-150390	2853	SNR definition for category 0 UE	12.7.0
03-2015	RP-67	RP-150390	2854r1	FRC for category 0 UE PDSCH performance requirements	12.7.0
03-2015	RP-67	RP-150390	2855r1	Introduction of new PHICH and PBCH performance requirements for category 0 UE	12.7.0
03-2015	RP-67	RP-150387	2861	Correction to FOOB reference in definition of MPR for contiguous CA with non-contiguous resource allocation	12.7.0
03-2015	RP-67	RP-150387	2862	Band 31 update	12.7.0
03-2015	RP-67	RP-150384	2867	Implementation of CA configurations specified in later releases	12.7.0
06-2015	RP-68	RP-150958	2870r2	Intra-band contiguous CA reference sensitivity definition for Class D	12.8.0
06-2015	RP-68	RP-150961	2881r2	CR on MTC CQI tests	12.8.0
06-2015	RP-68	RP-150961 RP-150962	2882r2	CR on MTC CQI tests  CR on 256QAM demodulation performance requirements	12.8.0
06-2015	RP-68	RP-150962	2883r3	CR on 256QAM sustained data rate tests for single carrier	12.8.0
				and TDD or FDD CA	
06-2015	RP-68	RP-150962	2885r4	CR on 256QAM CQI test	12.8.0
		1 00 150062	2886r3	CR on DC SDR tests	12.8.0
06-2015 06-2015	RP-68 RP-68	RP-150963 RP-150963	2887r2	Maintenance CR for DC demodualtion performance	12.8.0

				requirements	
06-2015	RP-68	RP-150958	2888	CR to restore R.10-2 FDD	12.8.0
06-2015	RP-68	RP-150961	2889r3	Introduction of UE category 0 PDSCH/PHICH/PBCH performance requirements	12.8.0
06-2015	RP-68	RP-150954	2901	UE to UE co-existence between B42/B43	12.8.0
06-2015	RP-68	RP-150958	2902	Correction of maximum aggregated bandwidth for CA_26A-41A	12.8.0
06-2015	RP-68	RP-150957	2903r2	Introduction of TDD SU-MIMO whitening verification test	12.8.0
06-2015	RP-68	RP-150958	2904	Correction of FRC table for CA demodualtion with power	12.8.0
				imbalance	
06-2015	RP-68	RP-150958	2905r1	Add SCell power levels for 2DL CA power imbalance test	12.8.0
06-2015	RP-68	RP-150955	2907	Corrections on UL transmit power for CA receiver	12.8.0
00 0045	DD CO	DD 450050	2000	requirements	40.0.0
06-2015 06-2015	RP-68 RP-68	RP-150958 RP-150957	2909 2910r1	Corrections to the CA power imbalance test Clarification on RMC for D2D UE	12.8.0 12.8.0
06-2015	RP-68	RP-150957	291011	Correction on TDD eIMTA PDSCH functionality test	12.8.0
06-2015	RP-68	RP-150954	2931	3.5 GHz out-of-band blocking	12.8.0
06-2015	RP-68	RP-150965	2933	Correction of FRC names	12.8.0
06-2015	RP-68	RP-150954	2936	Correction of the 3DL CA REFSENS	12.8.0
06-2015	RP-68	RP-150962	2939r1	CR on 256QAM sustained data rate tests for TDD FDD CA	12.8.0
06-2015	RP-68	RP-150958	2940r1	Maintenance CR for 3DL CA performance requirements	12.8.0
06-2015	RP-68	RP-150958	2941r1	Maintenance CR for TDD FDD CA demodulation performance requirements	12.8.0
06-2015	RP-68	RP-150965	2944	Corrections on 2UL intra-band non-contiguous CA requirements	12.8.0
06-2015	RP-68	RP-150958	2947	Updates to the definitions of CA capability (Rel-12)	12.8.0
06-2015	RP-68	RP-150955	2950	Clarification of PDSCH allocation in CSI PUSCH 3-0 felCIC	12.8.0
06-2015	RP-68	RP-150954	2956	tests (Rel-12)  NS value for intra-band contiguous CA configurations not	12.8.0
06-2015	RP-68	RP-150957	2958	allowed A-MPR  Receiver spurious emissions requirements for downlink-only	12.8.0
06-2015	RP-68	RP-150958	2959	bands Amendments to MPR for uplink inter-band and intra-band	12.8.0
06-2015	RP-68	RP-150958	2960r1	non-contiguous CA  NS values for secondary cells of non-contigous CA	12.8.0
06-2015	RP-68	RP-150955	2961r1	configurations Corrections to test configurations for intra-band non-	12.8.0
			1	contiguous CA	
06-2015	RP-68	RP-150954	2962	Corrections to test configurations for 3DL inter-band CA	12.8.0
06-2015	RP-68	RP-150958	2967	Adding REFSENS exception requirements for 1+3+26	12.8.0
06-2015 06-2015	RP-68 RP-68	RP-150954 RP-150958	2971 2972	Corrections to NS_22 and NS_23 Corrections to 41D fallback	12.8.0 12.8.0
06-2015	RP-68	RP-150957	2972	Corrections to EVM requirements for ProSe and Annex F of	12.8.0
06-2015	RP-68	RP-150958	2976	36.101  Removal of B27 from 2UL CA_7A_20A co-existence protected band list	12.8.0
06-2015	RP-68	RP-150957	2977r1	CR on corrections to D2D RF core requirements	12.8.0
06-2015	RP-68	RP-150963	2978r1	CR on corrections to D2D RF core requirements	12.8.0
06-2015	RP-68	RP-150957	2979	CR clarification of RMC for DL category 0 UE HD-FDD	12.8.0
06-2015	RP-68	RP-150960	2980r1	Introducation of TDD eIMTA CQI requirement	12.8.0
06-2015	RP-68	RP-150958	2985	Change of 1.4MHz single carrier SNR values for multiple CA configurations	12.8.0
06-2015	RP-68	RP-150954	2992	Clarification to spurious emission requirement for the edge of spurious domain	12.8.0
06-2015	RP-68	RP-150955	2996	Correction to CA_7C A-MPR in CA-NS_06	12.8.0
06-2015	RP-68	RP-150965	2998r1	CR to update UE performance tests for UE DL category in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150965	2999	CR to update Annex for new DL category in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150958	3002	CR for updating CA applicability rule in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150957	3005r1	CR for Rel-12 NAICS - Definitions	12.8.0
06-2015	RP-68	RP-150965	3012r1	Clarification on uplink configuration for reference sensitivity of inter-band CA	12.8.0
06-2015	RP-68	RP-150954	3018	EVM for Intra-band contiguous UL CA for non-equal Channel BWs	12.8.0
06-2015	RP-68	RP-150958	3019	A-MPR correction for CA_39C CA_NS_07	12.8.0
06-2015	RP-68	RP-150958	2780r3	Introduction of dual uplink CA into 36.101	13.0.0
06-2015	RP-68	RP-150646	2785r2	Introduction of intra-band CA_42D to TS 36.101	13.0.0
06-2015	RP-68	RP-150968	2951r2	Introduction of additional 2DL inter-band CA	13.0.0
06-2015	RP-68	RP-150972	2952r1	Introduction of additional 3DL inter-band CA	13.0.0
06-2015	RP-68	RP-150974	2953r2	Introduction of 4DL inter-band CA	13.0.0
06-2015	RP-68	RP-150975	2994r1	Introduction of non-contiguous Carrier Aggregation (CA) in Band 42 for 3DL	13.0.0
06-2015	RP-68	RP-150967	3011r1	CR to 36.101: New CA bandwidth classes for FeCA	13.0.0
06-2015	RP-68	RP-150668	3021	Introduction of CA_3A-40A to TS 36.101	13.0.0

06-2015	RP-68	RP-150673	3022	Introduction of CA_3A-40C to TS 36.101	13.0.0
09-2015	RP-69	RP-151479	3028	Table 7.3.1A-0f (2UL CA MSD) notes numbering correction	13.1.0
09-2015	RP-69	RP-151505	3029	Additional bandwidth combination set for LTE Advanced intra-band non-contiguous Carrier Aggregation in Band 4	13.1.0
09-2015	RP-69	RP-151479	3031	Correction to TDD FDD CA	13.1.0
09-2015	RP-69	RP-151483	3033	Alignment of CA Receiver requirements parameters	13.1.0
09-2015	RP-69	RP-151476	3036	Correction to CoMP demodulation requirements	13.1.0
09-2015	RP-69	RP-151475	3040	Correction to RI test parameters in TS 36.101 (Rel-13)	13.1.0
09-2015	RP-69	RP-151475	3050	UE co-existence requirements between Band 42 and Japanese bands	13.1.0
09-2015	RP-69	RP-151483	3052	Introduction of relaxation rule for multiple 3DL inter-band CA configurations	13.1.0
09-2015	RP-69	RP-151491	3056r1	Adding CA_42D to the out of band blocking requirement exception	13.1.0
09-2015	RP-69	RP-151501	3057r1	Introduction of finished 4DL inter-band CAs to TS 36.101	13.1.0
09-2015	RP-69	RP-151487	3060r1	Corrections on CA reference sensitivity requirements	13.1.0
09-2015	RP-69	RP-151476	3064	Correction to RC.2 TDD Nr. HARQ Proc. into TS36.101	13.1.0
09-2015	RP-69	RP-151483	3065	Corrections to CSI PUCCH 1-0 static test 4 and PUSCH 3-2 tests	13.1.0
09-2015	RP-69	RP-151488	3066	Corrections in Table 5.6A.1-2, 7.3.1-1A and 7.3.1-1B.	13.1.0
09-2015	RP-69	RP-151479	3068	Corrections of Spurious emission band UE co-existence for	13.1.0
09-2015	RP-69	RP-151483	3070	interband 2UL CA in Table 6.6.3.2A-0  Revisions of Spurious emission band UE co-existence in	13.1.0
				Table 6.6.3.2-1	
09-2015	RP-69	RP-151475	3076	Correction to PDCCH/PCFICH test parameters in TS 36.101 (Rel-13)	13.1.0
09-2015	RP-69	RP-151475	3080	Correction to PMI delay in PMI test for TDD	13.1.0
09-2015	RP-69	RP-151503	3081r1	Introduction of dual uplink CA into 36.101	13.1.0
09-2015	RP-69	RP-151479	3083	Maintanence CR for MTC CSI performance requirements	13.1.0
09-2015	RP-69	RP-151479	3085	Maintanence CR for SCE demodulation and CSI requriements	13.1.0
09-2015	RP-69	RP-151479	3087	Maintenance CR for DC demodulation performance requirements and SDR tests	13.1.0
09-2015	RP-69	RP-151479	3089	Cleanup of TDD-FDD CA demodulation performance requirments	13.1.0
09-2015	RP-69	RP-151479	3091	Cleanup of R12 SU-MIMO Enhanced Performance Type C requirments	13.1.0
09-2015	RP-69	RP-151475	3102	Correction on UE maximum output power class of Band 22 for UL MIMO	13.1.0
09-2015	RP-69	RP-151479	3104	Removal of square brackets for Cat-0 UE demodulation requirements	13.1.0
09-2015	RP-69	RP-151479	3106	Removal of square brackets for LTE-CA_B41_B42	13.1.0
09-2015	RP-69	RP-151490	3107	Removal of square brackets for LTE-CA_B41_B42_B42	13.1.0
09-2015	RP-69	RP-151479	3112	Corrections on 3DL CA performance requirements	13.1.0
09-2015	RP-69	RP-151489	3113	CR 36.101 BW combination for CA_8A_41A	13.1.0
09-2015	RP-69	RP-151479	3114	UL DL pairing for CA of B39+B41+B41 and B39+B39+B41	13.1.0
09-2015	RP-69	RP-151498	3116	Introduction of additional band combinations for 2DL interband CA	13.1.0
09-2015	RP-69	RP-151499	3117	Introduction of additional band combinations for 3DL interband CA	13.1.0
09-2015	RP-69	RP-151475	3118	Minor corrections in 36.101	13.1.0
09-2015	RP-69	RP-151479	3121	CR adding clarification for Band 28 restrictions in 36.101	13.1.0
09-2015	RP-69	RP-151494	3123r1	Introduction of propagation conditions to handle 4 receivers in the UE	13.1.0
09-2015	RP-69	RP-151504	3125r1	Addition on interband CA 2UL/3DL pairs without MSD	13.1.0
09-2015	RP-69	RP-151483	3127	CR for UE performance tests for intra-band contiguous CA	13.1.0
				with minimum channel spacing on Band 41	
09-2015	RP-69	RP-151496	3130r2	TM9 performance with CRS assistance information	13.1.0
09-2015	RP-69	RP-151495	3133r1	Introduction of UL 64QAM to TS 36.101	13.1.0
09-2015	RP-69	RP-151483	3135r1	Modification of test parameters for TM9 demodulation with 256QAM (Rel-13)	13.1.0
09-2015	RP-69	RP-151485	3137	CR to add demodulation tests for new release 13 2CC combinations in 36.101	13.1.0
09-2015	RP-69	RP-151501	3139r1	Introduction of 4CC demodulation requirements for FDD and FDD-TDD CA	13.1.0
09-2015	RP-69	RP-151479	3141	Correction to FDD-TDD closed loop spatial multiplexing 3CC requirement table	13.1.0
09-2015	RP-69	RP-151473	3143r1	Correction to DC supported testable bandwidth list	13.1.0
09-2015	RP-69	RP-151479	3145	Clarification of UL configuration for CA demodulation	13.1.0
09-2015	RP-69	RP-151479	3146r1	requirements Spreading of harmonic for 2UL interband and 2 ULnon-	13.1.0
				contiguous intraband CA	
09-2015	RP-69	RP-151502	3147	Correction to dRib and REFSENS	13.1.0
09-2015	RP-69	RP-151479	3153	Corrections to CSI RMCs used for PUSCH 3-2 testing (Rel-	13.1.0

09-2015   RP-89   RP-151483   3155   Corrections to applicability of CSI requirements for low UE   13.1.0			T		1 (2)	ı
September   Sept	00 2015	DD 60	DD 151/02	2155	Corrections to applicability of CSI requirements for low LIE	12 1 0
09-2016   RP-89   RP-161482   3164   CR for Rel-12 NAICS - Demodulation Test   13.1.0   09-2016   RP-89   RP-161482   3166   CR for Rel-12 NAICS - Fixed Reference Channels   13.1.0   09-2016   RP-89   RP-161482   3166   CR for Rel-12 NAICS - Interference Channels   13.1.0   09-2016   RP-89   RP-161482   3167   CR for Rel-12 NAICS - Coll Tests   13.1.0   09-2016   RP-89   RP-161482   3167   CR for Rel-12 NAICS - Coll Tests   13.1.0   09-2016   RP-89   RP-161482   3167   CR for Rel-12 NAICS - Coll Tests   13.1.0   09-2016   RP-89   RP-161538   3170   Introduction of CAL Rel-12 NAICS - Interference Models   13.1.0   09-2016   RP-90   RP-152139   3170   Introduction of CAL Rel-12 NAICS - Coll Tests   13.1.0   12-2015   RP-70   RP-152139   3173   Correction of CAL Rel-12 NAICS - CAL Rel   13.2.0   12-2016   RP-70   RP-152139   3173   Correction of U. B40AM measurement channels   13.2.0   12-2016   RP-70   RP-152139   3178   Release 13 CAT A CR to salph NS, 04 values to meet FCC   33.2.0   12-2016   RP-70   RP-152133   3178   Correction for MR-7 PDSCH demodulation test   13.2.0   12-2016   RP-70   RP-152133   31991   Correction for MR-7 PDR-162133   31991   Correction of MR-7 PDR-162133   31991   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   31904   Correction of MR-7 PDR-162133   3205   Correction of MR-7 PDR-162133   3205   Correction of MR-7 PDR-162133   3205   Correction of MR-7 PDR-162133   3205   Correction of MR-7 PDR-162133   3206   Correction of MR-7 PDR-162133   3206   Correction of MR-7 PDR-162133   3206   Correction of MR-7 PDR-162133   3206   Correction of MR-7 PDR-162133   3206   Correction of MR-7 PDR-162133   3206   C	09-2013	KF-09	KF-131463	3133		13.1.0
09-2015   RP-69   RP-151482   3165   CR for Rel-12 NAICS - Fixed Reference Channels   13.1.0   09-2015   RP-69   RP-151482   3166   CR for Rel-12 NAICS - Interference Models   13.1.0   09-2015   RP-69   RP-151495   3166   CR for Rel-12 NAICS - COI Tests   13.1.0   09-2015   RP-69   RP-151205   3168   Introduction of CA / AvA.0 and CA 7A-40C for TS 36 101   13.1.0   09-2015   RP-69   RP-151205   3168   Introduction of CA / AvA.0 and CA 7A-40C for TS 36 101   13.1.0   09-2015   RP-79   RP-15137   3173   Correction on U. Ed.00M measument of Avantament   13.2.0   12-2015   RP-70   RP-152131   3175   Cremetion on U. Ed.00M measument of Avantament   13.2.0   12-2015   RP-70   RP-152131   3178   Maintenance of eMTA PDSCH demondulation test   13.2.0   12-2015   RP-70   RP-152133   3180   Correction for MITA COI tests   13.2.0   12-2015   RP-70   RP-152133   3193   Correction of U. Ed.00M measument of SAMAH UE   13.2.0   12-2015   RP-70   RP-152133   3193   Correction of U. Ed.00M measument of SAMAH UE   13.2.0   12-2015   RP-70   RP-152133   3193   Correction of TOI TOI TOI tests   13.2.0   12-2015   RP-70   RP-152133   3193   Correction of TOI TOI TOI tests   Correction of MITA COI tests   Correction of U. Ed.00M   Correction of MITA COI tests   Correction of U. Ed.00M   Corre	09-2015	RP-69	RP-151482	3164		13.1.0
09-2015   RP-69   RP-15125   3167						
09-2015   RP-69   RP-151265   3198   Introduction of CA 7A-40Q to 15 3 8:101   13.10	09-2015	RP-69	RP-151482	3166	CR for Rel-12 NAICS - Interference Models	13.1.0
19-2015   RP-09   RP-151939   3170   CR for Rel-13 NAICS - TM10 Demodulation and CSI Test   13,2.0	09-2015	RP-69	RP-151482	3167	CR for Rel-12 NAICS - CQI Tests	13.1.0
12-2015   RP-70   RP-152133   31721   Introduction of UE RF requirements for CA. 42E   13.2.0	09-2015				Introduction of CA_7A-40A and CA_7A-40C to TS 36.101	13.1.0
12-2015   RP-70   RP-152133   3173   Correction on UL 64QAM measurment channels   13.2.0	09-2015		RP-151593	3170	CR for Rel-13 NAICS – TM10 Demodulation and CSI Test	13.1.0
12-2015   RP-70   RP-152136   3175   Release 13 CAT A CR to align NS, Q4 values to meet FCC   13.2.0		RP-70	RP-152158	3172r1		
2.2015 RP-70 RP-152136 3178   Maintenance of eliMTA PDSCH demodulation test   13.2.0   12.2015 RP-70 RP-152133 3186   Simplified CA fading Test method becomes optional   13.2.0   12.2015 RP-70 RP-152133 3191   Correction for eliMTA CDSCH demodulation   13.2.0   12.2015 RP-70 RP-152133 3191   Correction of the applicable UE categories for 2560AM UE   13.2.0   12.2015 RP-70 RP-152133 31931   Correction of the applicable UE categories for 2560AM UE   13.2.0   12.2015 RP-70 RP-152133 31931   Correction of The DC Ap and Top Maintenants (Rel-13)   12.2015 RP-70 RP-152133 31951   Correction of TDD CA performance requirements (Rel-13)   12.2015 RP-70 RP-152133 31951   Correction of TDD CA performance requirements (Rel-13)   12.2015 RP-70 RP-152163 3196   CR on introduction of SCC EDD/TDD CA demodulation   13.2.0   12.2015 RP-70 RP-152163 3197   CR on introduction of SCC EDD/TDD CA demodulation   13.2.0   12.2015 RP-70 RP-152132 3205   Correction of the AMPR table for NS_14 in TS_36.101 R13   13.2.0   12.2015 RP-70 RP-152134 3206   Correction of the AMPR table for NS_14 in TS_36.101 R13   13.2.0   12.2015 RP-70 RP-152133 32105   Correction of the AMPR table for NS_14 in TS_36.101 R13   13.2.0   12.2015 RP-70 RP-152133 32101   Introduction of SCC TD FDD CA demodulation   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Introduction of SULPUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existence table for CA_18A-   13.2.0   12.2015 RP-70 RP-152133 3214   Correction of the SUL CA co-existen						
12-2015   RP-70   RP-152136   3187   Maintenance of elMTA PDSCH demodulation test   13.2.0	12-2015	RP-70	RP-152131	3175		13.2.0
12-2015   RP-70   RP-152133   3180   Simplified CA rading Test method becomes optional   13.2.0						
12-2015   RP-70   RP-152133   3198   Simplified CA fading Test method becomes optional   13-2-0   13-2-0   RP-70   RP-152133   3191   Correction of the applicable UE categories for 2560AM UE   13-2-0   demodulation performance requirements (Rel-13)   12-2015   RP-70   RP-152133   3193/1   Correction of TDD-FDD CA performance requirements (Rel-13)   13-2-0   1						
12-2015   RP-70   RP-152133   3191   Correction of the applicable UE categories for 256CAM UE   13.2.0   12-2015   RP-70   RP-152133   3193/1   Correction of TDD-FDD CA performance requirements (Rel-13)   13.0						
December   Content   Con						
12-2015   RP-70   RP-152133   3196r1   Correction of TDD-FDD CA performance requirements (Rel-13)   13-20   13-2015   RP-70   RP-152133   3196r1   Correction on FDD CA and TDD CA performance requirements (Rel-13)   12-2015   RP-70   RP-152163   3196   CR on introduction of 5CC FDD/TDD CA demodulation   13-2.0   12-2015   RP-70   RP-152132   3197   CR on introduction of 5CC FDD/TDD CA demodulation   13-2.0   12-2015   RP-70   RP-152133   3206   CR on introduction of 5CC FDD/TDD CA demodulation   13-2.0   12-2015   RP-70   RP-152134   3206   Correction of the AMPR table for NS_14 in TS_36.101 R13   13-2.0   12-2015   RP-70   RP-152134   3206   Correction of the AMPR table for NS_14 in TS_36.101 R13   13-2.0   12-2015   RP-70   RP-152153   3210   Introduction of 3DL/ZUL DC   13-2.0   13-2.0   12-2015   RP-70   RP-152133   3212   Introduction of dual tuplink Configuration for CA_42D   13-2.0   12-2015   RP-70   RP-152133   3214   Correction to the CSI minimum requirement for PUSCH 3-2   13-2.0   (Rel-13)   RP-70   RP-152133   3216   Correction to the CSI minimum requirement for PUSCH 3-2   13-2.0   (Rel-13)   RP-70   RP-152133   3216   Corrections to the CSI minimum requirement for PUSCH 3-2   13-2.0   (Rel-13)   RP-70   RP-152133   3216   Correction to MIMO Correlation Matrices using cross   13-2.0   (Rel-13)   RP-70   RP-152136   3225   CR for Up a performance tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152136   3225   CR for Up a performance tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152136   3225   CR for Up a performance tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152136   3225   CR for Up a performance tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152136   3224   Correction in Matrices cash of Up a performance tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152136   3224   Correction in Matrices tests for intra-band contiguous CA   13-2.0   (Rel-13)   RP-70   RP-152133   3224   Correction in Ma	12-2015	RP-70	RP-152133	3191		13.2.0
12:2015   RP-70   RP-152133   3196   Correction on FDD CA and TDD CA performance   13:2.0	12 2015	DD 70	DD 152122	2102r1		12 2 0
12-2015   RP-70   RP-152133   31961   Correction on FDD CA and TDD CA performance requirements (Rel-13)   RP-70   RP-152163   3196   CR on introduction of SCC FDD/TDD CA demodulation   13.2.0   RP-70   RP-152163   3197   CR on introduction of SCC FDD/TDD CA demodulation   13.2.0   RP-70   RP-152163   3197   CR on introduction of SCC TDD FDD CA demodulation   13.2.0   RP-70   RP-152134   3205   Correction of the AMPR table for NS_14 in TS_36.101 R13   13.2.0   RP-70   RP-152134   3206   Correction of the PAUR CA co-existence table for CA_18A-   132.0   12-2015   RP-70   RP-152152   3209   Introduction of BDL/2UL DC   13.2.0   12-2015   RP-70   RP-152133   3210   Correction of the PAUR CA co-existence table for CA_18A-   132.0   12-2015   RP-70   RP-152133   3212   Introduction of datu plink Configuration for CA_42D   13.2.0   12-2015   RP-70   RP-152133   3214   Correction of datu plink Configuration for PUSCH 3-2   13.2.0   (Rel-13)   RP-70   RP-152133   3214   Correction to datu plink Correlation Matrices using cross   13.2.0   (Rel-13)   RP-70   RP-152133   3216   Correction in SMIMO Correlation Matrices using cross   13.2.0   RP-70   RP-152136   3225   CR for UE performance tests for intra-band contiguous CA   13.2.0   RP-70   RP-152136   3225   CR for UE performance tests for intra-band contiguous CA   13.2.0   RP-70   RP-152136   32321   Correction in SRN definition for CSI test   13.2.0   RP-70   RP-152136   32331   CORRECTION CORRECTION RP-70   RP-152136   32321   Correction in SRN definition for CSI test   13.2.0   RP-70   RP-152136   32321   Correction in SRN definition for CSI test   13.2.0   RP-70   RP-152136   32331   CORRECTION RP-70   RP-152136   32342   Correction to reference channel for CCI requirements   13.2.0   RP-70   RP-152136   3242   Introduction or CSI test   13.2.0   RP-70   RP-152136   3242   Correction to reference channel for CCI requirements   13.2.0   RP-70   RP-152136   3249   Correction to reference channel for CCI requirements   13.2.0   RP-70   RP-152133   3246   CR on FRC f	12-2013	KF-70	KF-132133	319311		13.2.0
12-2015   RP-70   RP-152163   3196   CR on introduction of SCC FDD/TDD CA demodulation   13.2.0	12-2015	RP-70	RP-152133	3195r1		13.2.0
12-2015   RP-70   RP-152163   3199   CR on introduction of SCC FDD/TDD CA demodulation   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   RP-70   RP-152132   3205   Correction of the AMPR table for NS_14 in TS_08.010 R13_3_0.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   22.2015   RP-70   RP-152133   3212   Introduction of JDL/ZUL DC   13.2.0   1	12 2010	10 70	141 102100	010011		10.2.0
Performance requirements	12-2015	RP-70	RP-152163	3196		13.2.0
12-2015   RP-70   RP-152163   3197   CR on introduction of SCC TDD FDD CA demodulation   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   performance requirements   13.2.0   RP-70   RP-152134   3205   Correction of the AMPR table for NS_14 in TS 36.101 R13   13.2.0   12-2015   RP-70   RP-152152   3209   Introduction of 13DL/ZUL DC   13.2.0   12-2015   RP-70   RP-152133   3212   Introduction of JDL/ZUL DC   13.2.0   13.2.0   12-2015   RP-70   RP-152133   3212   Introduction of JDL/ZUL DC   13.2.0   13.2.0   12-2015   RP-70   RP-152133   3212   Introduction of JDL/ZUL DC   13.2.0   (Rel-13)   (Rel-1						
Performance requirements	12-2015	RP-70	RP-152163	3197	CR on introduction of 5CC TDD FDD CA demodulation	13.2.0
12-2015   RP-70   RP-152134   3206   Correction of the AMPR table for NS. 14 in TS 36.101 R13   13.2.0   28A   13.2.0   28A   13.2.0   28A   13.2.0   13.2						
12-2015   RP-70   RP-152132   3209   Introduction of 3DL/2UL DC   13.2.0   13.2.0   12-2015   RP-70   RP-152133   3210   Correction of uplink configuration for CA 42D   13.2.0   13.2.0   12-2015   RP-70   RP-152133   3214   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0   12-2015   RP-70   RP-152133   3214   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0   12-2015   RP-70   RP-152133   3216   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0   12-2015   RP-70   RP-152157   3221r1   Introduction B201-B67 CA into TS 36.101   13.2.0   12-2015   RP-70   RP-152157   3221r1   Introduction B201-B67 CA into TS 36.101   13.2.0   12-2015   RP-70   RP-152136   3225   CR for UE performance tests for intra-band contiguous CA with minimum channel spacing on Band 41   13.2.0   12-2015   RP-70   RP-152136   3227r1   Correction in SNR definition for CSI test   13.2.0   12-2015   RP-70   RP-152136   323371   Correction in SNR definition for CSI test   13.2.0   12-2015   RP-70   RP-152130   3232   Correction to reference channel for CGI requirements   13.2.0   12-2015   RP-70   RP-152168   323371   CR 36.101 BW combination for CA 8B   13.2.0   12-2015   RP-70   RP-152164   3242   Correction to interface channel for CGI requirements   13.2.0   12-2015   RP-70   RP-152132   3246   CR on FRC for CDM-multiplexed DM RS   13.2.0   12-2015   RP-70   RP-152132   3249   Correction to physical channel for CGI reporting in type A   13.2.0   12-2015   RP-70   RP-152133   3255   CR for Rel-12 NAICS - Demodulation Test   13.2.0   12-2015   RP-70   RP-152133   3263   Correction to physical channel for CGI reporting in type A   13.2.0   12-2015   RP-70   RP-152133   3263   Correction to physical channel for CGI reporting in type A   13.2.0   12-2015   RP-70   RP-152133   3263   Correction for CA, 4A-4-5a table reference   13.2.0   12-2015   RP-70   RP-152133   3263   Crection of upinimum and the combination of the combination of the combination of the combination of the combination of the c	12-2015	RP-70	RP-152132	3205		13.2.0
12-2015   RP-70   RP-152132   3209   Introduction of 3DL/ZUL DC   13.2.0   13.2.0   12-2015   RP-70   RP-152133   3212   Introduction of dual uplink CA into 36.101   13.2.0   12-2015   RP-70   RP-152133   3214   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0   12-2015   RP-70   RP-152133   3214   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0   (Rel-13)	12-2015	RP-70	RP-152134	3206	Correction of the 2UL CA co-existence table for CA_18A-	13.2.0
12-2015 RP-70 RP-152139 32101   Correction of uplink configuration for CA 42D 13.2.0						
12-2015   RP-70   RP-152133   3212   Introduction of dual uplink CA into 36.101   13.2.0						
12-2015   RP-70   RP-152133   3214   Corrections to the CSI minimum requirement for PUSCH 3-2   13.2.0 (Rel-13)						
RP-70				<del>                                     </del>		
12-2015   RP-70   RP-152133   3216   Corrections to MIMO Correlation Matrices using cross polarized antennas (Rel-12)	12-2015	RP-70	RP-152133	3214		13.2.0
12-2015   RP-70   RP-152136   3225   CR for UE performance tests for intra-band contiguous CA   13.2.0	12-2015	RP-70	RP-152133	3216	Corrections to MIMO Correlation Matrices using cross	13.2.0
12-2015   RP-70   RP-152136   3225   CR for UE performance tests for intra-band contiguous CA   13.2.0	12-2015	RP-70	RP-152157	3221r1		13.2.0
12-2015   RP-70   RP-152136   32271   Correction in SNR definition for CSI test   13.2.0	12-2015	RP-70	RP-152136	3225	CR for UE performance tests for intra-band contiguous CA	13.2.0
12-2015   RP-70   RP-152168   32332   Correction to reference channel for CQI requirements   13.2.0						
12-2015   RP-70   RP-152168   323311   CR 36.101 BW combination for CA_8B   13.2.0						
12-2015   RP-70   RP-152164   3241   Correction to mandatory 2UL support for 3DL interband CA   13.2.0						
12-2015 RP-70 RP-152132 3246   Introduction of 2 UL and 3 DL interband cases with MSD   13.2.0				<del>                                     </del>		
12-2015 RP-70 RP-152132 3246						
12-2015 RP-70 RP-152133 3249   Correction to physical channel for CQI reporting in type A test case   12-2015 RP-70 RP-152133 3255   CR for Rel-12 NAICS - Demodulation Test   13.2.0   12-2015 RP-70 RP-152133 3263   Correction on CA_4A-4A-5A table reference   13.2.0   12-2015 RP-70 RP-152134 3269r1   Clarification of Pcell support in 36.101 in CA scenarios   13.2.0   12-2015 RP-70 RP-152132 3273   A-MPR correction for CA_NS_06 CA-7C non-contiguous RB allocation   12-2015 RP-70 RP-152133 3278   Clarification on relative power tolereance for CA   13.2.0   12-2015 RP-70 RP-152133 3278   Correction of uplink configuration for CA_18-28   13.2.0   12-2015 RP-70 RP-152133 3278   CR on corrections for ProSe Direct Discovery demodulation   13.2.0   12-2015 RP-70 RP-152135   3281   CR to finalize demodulation performance requirements for D2D Communication   12-2015 RP-70 RP-152131   3285   Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests   13.2.0   12-2015 RP-70 RP-152167   3286r1   Introduction of CA_5B to TS 36.101   13.2.0   12-2015 RP-70 RP-152163   3288   Introduction of dual uplink Ca Into 36.101   13.2.0   12-2015 RP-70 RP-152133   3288   Introduction of dual uplink Ca Into 36.101   13.2.0   12-2015 RP-70 RP-152131   3298   Introduction of B65 in Region 1   13.2.0   12-2015 RP-70 RP-152131   3298   Introduction of B65 in Region 1   13.2.0   12-2015 RP-70 RP-152131   3294   Correction of supported sub-block frequency arrangement for CA_4.1-41   12-2015 RP-70 RP-152131   3296   Correction of test configuration for combinations of interband and intra-band CA   RP-70 RP-152148   3300r2   Introduction of RP requirements for UE(s) supporting four antenna ports   Introduction of RP requirements for LAA operation   13.2.0   13.						
test case						
12-2015         RP-70         RP-152133         3263         Correction on CA_4A-4A-5A table reference         13.2.0           12-2015         RP-70         RP-152134         3269r1         Clarification of Pcell support in 36.101 in CA scenarios         13.2.0           12-2015         RP-70         RP-152132         3273         A-MPR correction for CA_NS_06 CA-7C non-contiguous RB allocation           12-2015         RP-70         RP-152136         3276         Clarification on relative power tolereance for CA         13.2.0           12-2015         RP-70         RP-152133         3278         Correction of uplink configuration for CA_18-28         13.2.0           12-2015         RP-70         RP-152135         3280         CR on corrections for ProSe Direct Discovery demodulation requirements         13.2.0           12-2015         RP-70         RP-152135         3281         CR to finalize demodulation performance requirements for D2D Communication         13.2.0           12-2015         RP-70         RP-152131         3285         Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests         13.2.0           12-2015         RP-70         RP-152167         3286r1         Introduction of CA_5B to TS 36.101         13.2.0           12-2015         RP-70         RP-152133         3288	12-2015	RP-70	RP-152132	3249		13.2.0
12-2015         RP-70         RP-152134         3269r1         Clarification of Pcell support in 36.101 in CA scenarios         13.2.0           12-2015         RP-70         RP-152132         3273         A-MPR correction for CA_NS_06 CA-7C non-contiguous RB allocation         13.2.0           12-2015         RP-70         RP-152136         3276         Clarification on relative power tolereance for CA         13.2.0           12-2015         RP-70         RP-152133         3278         Correction of uplink configuration for CA_18-28         13.2.0           12-2015         RP-70         RP-152135         3280         CR on corrections for ProSe Direct Discovery demodulation requirements         13.2.0           12-2015         RP-70         RP-152135         3281         CR to finalize demodulation performance requirements for D2D Communication         13.2.0           12-2015         RP-70         RP-152131         3285         Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests         13.2.0           12-2015         RP-70         RP-152167         3286r1         Introduction of CA_5B to TS 36.101         13.2.0           12-2015         RP-70         RP-152169         3287         Introduction of dual uplink CA into 36.101         13.2.0           12-2015         RP-70         RP-152133	12-2015	RP-70	RP-152133	3255	CR for Rel-12 NAICS - Demodulation Test	13.2.0
12-2015   RP-70   RP-152132   3273   A-MPR correction for CA_NS_06 CA-7C non-contiguous RB allocation   12-2015   RP-70   RP-152136   3276   Clarification on relative power tolereance for CA   13.2.0   12-2015   RP-70   RP-152133   3278   Correction of uplink configuration for CA_18-28   13.2.0   12-2015   RP-70   RP-152135   3280   CR on corrections for ProSe Direct Discovery demodulation requirements   12-2015   RP-70   RP-152135   3281   CR to finalize demodulation performance requirements for D2D Communication   13.2.0   Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests   13.2.0   Multiple PMI CSI Reference Symbol tests   13.2.0   12-2015   RP-70   RP-152167   3286r1   Introduction of CA_5B to TS 36.101   13.2.0   12-2015   RP-70   RP-152169   3287   Introduction of CA_5B to TS 36.101   13.2.0   12-2015   RP-70   RP-152150   3291r1   CR on eD2D RF core requirements   13.2.0   12-2015   RP-70   RP-152150   3291r1   CR on eD2D RF core requirements   13.2.0   12-2015   RP-70   RP-152131   3294   Correction of supported sub-block frequency arrangement for CA_41-41   13-2015   RP-70   RP-152131   3296   Correction of test configuration for combinations of interband and intra-band CA   RF receiver requirements for UE(s) supporting four antenna ports   12-2015   RP-70   RP-152148   3300r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152148   3300r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152171   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0   11-2015   RP-70   RP-152172   3309r2   Introduction of Band 66	12-2015	RP-70	RP-152133	3263	Correction on CA_4A-4A-5A table reference	13.2.0
12-2015   RP-70   RP-152136   3276   Clarification on relative power tolereance for CA   13.2.0	12-2015	RP-70	RP-152134	3269r1	Clarification of Pcell support in 36.101 in CA scenarios	13.2.0
12-2015   RP-70   RP-152136   3276   Clarification on relative power tolereance for CA   13.2.0     12-2015   RP-70   RP-152133   3278   Correction of uplink configuration for CA_18-28   13.2.0     12-2015   RP-70   RP-152135   3280   CR on corrections for ProSe Direct Discovery demodulation requirements     12-2015   RP-70   RP-152135   3281   CR to finalize demodulation performance requirements for D2D Communication     12-2015   RP-70   RP-152131   3285   Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests     12-2015   RP-70   RP-152167   3286r1   Introduction of CA_5B to TS 36.101   13.2.0     12-2015   RP-70   RP-152169   3287   Introduction of CA_5A-5A to TS 36.101   13.2.0     12-2015   RP-70   RP-152133   3288   Introduction of dual uplink CA into 36.101   13.2.0     12-2015   RP-70   RP-152150   3291r1   CR on eD2D RF core requirements   13.2.0     12-2015   RP-70   RP-152171   3292r3   Introduction of Band Sub-block frequency arrangement for CA_41-41   12-2015   RP-70   RP-152131   3294   Correction of test configuration for combinations of interband and intra-band CA   RF receiver requirements for UE(s) supporting four antenna ports   Introduction of RF requirements for LAA operation   13.2.0   Introduction of BR RP-70   RP-152148   3300r2   Introduction of Band 66   13.2.0   Introduction of Band 66   13.2.0   Introduction of Band 66   Interduction of Band 66   Interd	12-2015	RP-70	RP-152132	3273	A-MPR correction for CA_NS_06 CA-7C non-contiguous RB	13.2.0
12-2015   RP-70   RP-152133   3278   Correction of uplink configuration for CA_18-28   13.2.0						
12-2015   RP-70   RP-152135   3280   CR on corrections for ProSe Direct Discovery demodulation requirements   13.2.0						
requirements   12-2015   RP-70   RP-152135   3281   CR to finalize demodulation performance requirements for D2D Communication   13.2.0     12-2015   RP-70   RP-152131   3285   Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests   13.2.0     12-2015   RP-70   RP-152167   3286r1   Introduction of CA_5B to TS 36.101   13.2.0     12-2015   RP-70   RP-152169   3287   Introduction of CA_5B to TS 36.101   13.2.0     12-2015   RP-70   RP-152133   3288   Introduction of dual uplink CA into 36.101   13.2.0     12-2015   RP-70   RP-152150   3291r1   CR on eD2D RF core requirements   13.2.0     12-2015   RP-70   RP-152171   3292r3   Introduction of B65 in Region 1   13.2.0     12-2015   RP-70   RP-152131   3294   Correction of supported sub-block frequency arrangement for CA_41-41     12-2015   RP-70   RP-152147   3299r2   Correction of test configuration for combinations of interband CA   RF receiver requirements for UE(s) supporting four antenna ports   13.2.0     12-2015   RP-70   RP-152148   3300r2   Introduction of RF requirements for LAA operation   13.2.0     12-2015   RP-70   RP-152172   3309r2   Introduction of Band 66   13.2.0						
D2D Communication   12-2015   RP-70   RP-152131   3285   Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests   13.2.0	12-2015	RP-70	RP-152135	3280	requirements	
Multiple PMI CSI Reference Symbol tests	12-2015			3281	CR to finalize demodulation performance requirements for D2D Communication	
12-2015         RP-70         RP-152167         3286r1         Introduction of CA_5B to TS_36.101         13.2.0           12-2015         RP-70         RP-152169         3287         Introduction of CA_5A-5A to TS_36.101         13.2.0           12-2015         RP-70         RP-152133         3288         Introduction of dual uplink CA into 36.101         13.2.0           12-2015         RP-70         RP-152150         3291r1         CR on eD2D RF core requirements         13.2.0           12-2015         RP-70         RP-152171         3292r3         Introduction of B65 in Region 1         13.2.0           12-2015         RP-70         RP-152131         3294         Correction of supported sub-block frequency arrangement for CA_41-41         13.2.0           12-2015         RP-70         RP-152131         3296         Correction of test configuration for combinations of interband CA         13.2.0           12-2015         RP-70         RP-152147         3299r2         RF receiver requirements for UE(s) supporting four antenna ports         13.2.0           12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0	12-2015	RP-70	RP-152131	3285	Missing RB allocation and OCNG Pattern for Cat 1 UEs in	13.2.0
12-2015	12-2015		RP-152167	3286r1	Introduction of CA_5B to TS 36.101	13.2.0
12-2015         RP-70         RP-152133         3288         Introduction of dual uplink CA into 36.101         13.2.0           12-2015         RP-70         RP-152150         3291r1         CR on eD2D RF core requirements         13.2.0           12-2015         RP-70         RP-152171         3292r3         Introduction of B65 in Region 1         13.2.0           12-2015         RP-70         RP-152131         3294         Correction of supported sub-block frequency arrangement for CA_41-41         13.2.0           12-2015         RP-70         RP-152131         3296         Correction of test configuration for combinations of interband CA         13.2.0           12-2015         RP-70         RP-152147         3299r2         RF receiver requirements for UE(s) supporting four antenna ports         13.2.0           12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0		RP-70				
12-2015         RP-70         RP-152171         3292r3         Introduction of B65 in Region 1         13.2.0           12-2015         RP-70         RP-152131         3294         Correction of supported sub-block frequency arrangement for CA_41-41         13.2.0           12-2015         RP-70         RP-152131         3296         Correction of test configuration for combinations of interband CA         13.2.0           12-2015         RP-70         RP-152147         3299r2         RF receiver requirements for UE(s) supporting four antenna ports         13.2.0           12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0						
12-2015         RP-70         RP-152131         3294         Correction of supported sub-block frequency arrangement for CA_41-41         13.2.0           12-2015         RP-70         RP-152131         3296         Correction of test configuration for combinations of interband CA         13.2.0           12-2015         RP-70         RP-152147         3299r2         RF receiver requirements for UE(s) supporting four antenna ports         13.2.0           12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0				3291r1		
12-2015   RP-70   RP-152131   3296   Correction of test configuration for combinations of interband and intra-band CA						
band and intra-band CĀ				3294	for CA_41-41	
12-2015         RP-70         RP-152147         3299r2         RF receiver requirements for UE(s) supporting four antenna ports         13.2.0           12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0	12-2015	RP-70	RP-152131	3296	Correction of test configuration for combinations of inter-	13.2.0
12-2015         RP-70         RP-152148         3300r2         Introduction of RF requirements for LAA operation         13.2.0           12-2015         RP-70         RP-152172         3309r2         Introduction of Band 66         13.2.0	12-2015	RP-70	RP-152147	3299r2	RF receiver requirements for UE(s) supporting four antenna	13.2.0
12-2015 RP-70 RP-152172 3309r2 Introduction of Band 66 13.2.0	12-2015	RP-70	RP-152148	3300r2		13.2.0
12-2015 RP-70 RP-152136 3311 Correction on CQI test 1A for TDD eIMTA 13.2.0			RP-152172		·	

12-2015	RP-70	RP-152166	3312r1			Introduction of 3DL/3UL Inter-band CA of CA_39A-41C and	13.2.0
12-2015	RP-70	RP-152133	3314			CA_39C-41A  Correction of the resource allocation in FRC for CAT0 UE	13.2.0
12-2015	RP-70	RP-152151	3318			demodulation tests Introduce TM4 performance requirements when CRS	13.2.0
12-2013	KF-70	KF-152151	3310			assistance information is provided	13.2.0
12-2015	RP-70	RP-152151	3319r1			Introduce TM10 performance requirements when CRS assistance information is provided for multiple-CSI-process capable UE	13.2.0
12-2015	RP-70	RP-152151	3320r1			Introduce TM10 performance requirements when CRS assistance information is provided for one-CSI-process capable UE	13.2.0
12-2015	RP-70	RP-152163	3325			Introduction of 5DL/1UL CA combinations into TS 36.101	13.2.0
12-2015	RP-70	RP-152175	3326r1			Introduction of Region 3 requirement in Band 65	13.2.0
12-2015 12-2015	RP-70 RP-70	RP-152138 RP-152133	3327 3329			Correction of CA_8A-41C bandwidth combination set  Removal of DC channel bandwidth combination set table	13.2.0 13.2.0
12-2015	RP-70	RP-152136	3331			CR on demodulation requirements of Dual Connectivity	13.2.0
12-2015	RP-70	RP-152131	3332r1			Modification and correction of CA_3A-3A BCS1 in Rel.13 36.101	13.2.0
12-2015	RP-70	RP-152133	3334			Correction of MSD levels for 2UL inter-band CA in TS 36.101 Rel-13	13.2.0
12-2015	RP-70	RP-152162	3338	ļ		Introduction of finished 4DL inter-band CAs to TS 36.101	13.2.0
12-2015 12-2015	RP-70 RP-70	RP-152170 RP-152164	3339 3340r1	1	<b> </b>	Introduction of CA_7A-7A BCS1 to TS 36.101 Introduction of additional 2 UL and 3 DL interband cases	13.2.0 13.2.0
12-2015	KP-/U	KF-102104	334011			with MSD	13.2.0
12-2015	RP-70	RP-152158	3341r1			Addition of Class E into CA BW Class table.	13.2.0
12-2015	RP-70	RP-152131	3343			Table 6.2.4A-1 note 1 correction	13.2.0
12-2015 12-2015	RP-70 RP-70	RP-152164 RP-152160	3345 3347	1	-	Removal of (NOTE 4) from Table 5.6A.1-2a Introduction of 4DL NC CA in band42 in 36.101	13.2.0 13.2.0
12-2015	RP-70	RP-152173	3348			Introduction of 44DL NC CA in band42 in 36.101  Introduction of 1447-1467MHz Band into 36.101	13.2.0
12-2015	RP-70	RP-152136	3352			CR: PDSCH ETU600 performance requirements	13.2.0
12-2015	RP-70	RP-152156	3357			Introduction of additional band combinations for 2DL interband CA	13.2.0
12-2015	RP-70	RP-151972	3358r2			Revision of the RAN4 approved R4-158446 (big CR 3DL 36.101)	13.2.0
12-2015	RP-70	RP-152147	3359r1			Introduction of the Medium Correlation A model	13.2.0
12-2015 12-2015	RP-70 RP-70	RP-152147 RP-152147	3360r1 3361r1			Requirements for ePDCCH with 4Rx	13.2.0
12-2015	RP-70	RP-152147	3362r1			Requirements for PDCCH with 4Rx Requirements for PDSCH with 4Rx	13.2.0 13.2.0
12-2015	RP-70	RP-152147	3363r1			Requirements for PHICH with 4Rx	13.2.0
12-2015	RP-70	RP-152159	3367r1			Introduction of intra-band non-contiguous CA in Band 41 for 4DL	13.2.0
12-2015	RP-70	RP-152165	3368			Addition of 2 UL and 3 DL mixed intra/inter band carrier aggregation combinations without MSD.	13.2.0
12-2015	RP-70	RP-152133	3372r1			Revision to CR 3256	13.2.0
12-2015 12-2015	RP-70 RP-70	RP-152133 RP-152162	3375 3376			Correction to Pcmax for CA to include delta_T_ProSe  Delta TIB,c and Delta RIB,c for 1UL/4DL	13.2.0 13.2.0
12-2015	RP-70	RP-152136	3378			NS_05 modification for PHS protection in Japan	13.2.0
01-2016	RP-70					Edotorial correction: Correction of reference to section 6.6.3.3.19 for NS_04 in Table 6.2.4-1	13.2.1
03/2016	RP-71	RP-160472	3467	1	В	UE receiver requirements for Rel-13 MTC	13.3.0
03/2016	RP-71	RP-160472	3443	1	В	CR on TX requirements for Rel-13 eMTC	13.3.0
03/2016	RP-71	RP-160474	3419		В	Introduce Robustness test for CRS-IM capable UE	13.3.0
03/2016	RP-71	RP-160474	3422	1	В	FRC for non-TM10 with CRS assistance information	13.3.0
03/2016	RP-71	RP-160474	3420	1	В	Introduce non-TM10 performance with CRS assistance information	13.3.0
03/2016	RP-71	RP-160474	3421	1	В	Introduce TM10 performance with CRS assistance information	13.3.0
03/2016	RP-71	RP-160474	3423	1	В	FRC for TM10 with CRS assistance information	13.3.0
03/2016	RP-71	RP-160475	3460	1	В	CR: Correction of FRC for SDR test (Rel-13)	13.3.0
03/2016	RP-71	RP-160479	3459		F	Correction of 4Rx demodulation performance requirements	13.3.0
03/2016	RP-71	RP-160479	3462		В	Correction of Correlation Model for Medium Correlation A	13.3.0
03/2016	RP-71	RP-160479	3466		В	UE Demodulation Requirements for DL Control channels for 4Rx	13.3.0
03/2016	RP-71	RP-160479	3463	1	В	UE Demodulation Requirements for DL PDSCH rank 1 and 2 performance	13.3.0
03/2016	RP-71	RP-160479	3464	1	В	UE Demodulation Requirements for DL PDSCH rank 3 and 4 requirements	13.3.0
03/2016	RP-71	RP-160479	3412	2	F	Corrections to UE RF receiver requirements for 4RX	13.3.0

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02/2016	DD 74	DD 160490	2424		D	AP and support of CA	12.2.0
03/2016	RP-71	RP-160480	3431		В	Introduction of additional band combinations for 3DL inter-band CA	13.3.0
03/2016	RP-71	RP-160481	3396		В	Introduction of completed R13 4DL inter-band CA's to TS 36.101	13.3.0
03/2016	RP-71	RP-160482	3424		В	Introduction of 5DL/1UL CA combinations	13.3.0
03/2016	RP-71	RP-160483	3415	2	В	Introduction of Band 68 for Arab region into 36.101	13.3.0
03/2016	RP-71	RP-160487	3429		Α	[Rel-13] Correction on Intra-band non-contiguous CA	13.3.0
03/2016	RP-71	RP-160488	3381		Α	Correction to Type A CQI test parameters in TS 36.101	13.3.0
03/2016	RP-71	RP-160488	3405		Α	CQI reports in CoMP fading test	13.3.0
03/2016	RP-71	RP-160488	3453		F	Maintenance CR for CA (Rel-13)	13.3.0
03/2016	RP-71	RP-160488	3461		Α	Correction to TDD CQI Reporting for felCIC	13.3.0
03/2016	RP-71	RP-160488	3481		Α	Beamforming model correction on TM10 DPS UE tests	13.3.0
03/2016	RP-71	RP-160489	3384		А	Correction in beam steering rate for 4 Tx antenna in Rel-13	13.3.0
03/2016	RP-71	RP-160489	3386		Α	CR for correction to syncOffsetIndicator parameter in D2D resource pool configuration	13.3.0
03/2016	RP-71	RP-160489	3390	1	Α	Correction of eIMTA CSI test	13.3.0
03/2016	RP-71	RP-160489	3402		A	[Rel-13] NS_05 modification for PHS protection in Japan	13.3.0
03/2016	RP-71	RP-160489	3411	1	Α	Correction of Pcmax for Dual Connectivity	13.3.0
03/2016	RP-71	RP-160489	3436		Α	Correction on UE category in Annex of TS 36.101	13.3.0
03/2016	RP-71	RP-160489	3438		A	Removal of brackets for Maximum input level for 256QAM in TS 36.101	13.3.0
03/2016	RP-71	RP-160489	3440		Α	Removal of brackets for Measurment channels for MTC in TS 36.101	13.3.0
03/2016	RP-71	RP-160489	3456		Α	Maintenance CR for D2D (Rel-13)	13.3.0
03/2016	RP-71	RP-160489	3458		Α	CR: Correction of FRC for SDR test (Rel-13)	13.3.0
03/2016	RP-71	RP-160489	3482		Α	Maintenance CR for DC (Rel-13)	13.3.0
03/2016	RP-71	RP-160490	3382		F	Correction in UL CA support table	13.3.0
03/2016	RP-71	RP-160490	3397		F	Removing the brackets for 3+40 REFSENS	13.3.0
03/2016	RP-71	RP-160490	3416		F	Corrections on BCS and EARFCN tables	13.3.0
03/2016	RP-71	RP-160490	3425		F	Removal of channel bandwidth sets for three bands DC	13.3.0
03/2016	RP-71	RP-160490	3427		F	Corrections to Notes in 2UL spurious emission table	13.3.0
03/2016	RP-71	RP-160490	3442		F	Revision of channel bandwidths for CA_B3_B41_B42 in 36.101	13.3.0
03/2016	RP-71	RP-160490	3447		F	Removing DC_5-17 from 36.101 Rel 13	13.3.0
03/2016	RP-71	RP-160490	3473		D	CR of editorial change on PHICH group and Ng in Rel-13	13.3.0
03/2016	RP-71	RP-160490	3477		F	Supported bandwidths for Band 66	13.3.0
03/2016	RP-71	RP-160490	3478		F	Corrections to CA_66C	13.3.0
03/2016	RP-71	RP-160490	3441	1	F	Correction on Annex D for LAA in TS 36.101	13.3.0
03/2016	RP-71	RP-160490	3406	3	F	Correction to UL 64 QAM measurement channels in TS 36.101	13.3.0
03/2016	RP-71	RP-160490	3430	3	F	Corrections and bracket removals to B46 specifications	13.3.0
06/2016	RP-72	RP-161141	3489		Α	Correction on B39 coexistence spurious emission requirements	13.4.0
06/2016	RP-72	RP-161141	3491		Α	Square brackets on B39 single carrier spurious emission requirements for protecting B3	13.4.0
06/2016	RP-72	RP-161135	3492		F	Introduction of EB/FD-MIMO channel model using 2D XP antennas at eNB	13.4.0
06/2016	RP-72	RP-161142	3493	1	F	CR to Correct Notes for CA REFSENS Tables	13.4.0
06/2016	RP-72	RP-161142	3494	1	D	Editorial modification on uplink inter-band CA	13.4.0
06/2016	RP-72	RP-161141	3496		A	CSI requirements for 2DL FDD-TDD for UE Cat 3 (Rel 13)	13.4.0
06/2016	RP-72	RP-161141	3498	1	Α	Wrong RMC description in overview table (Rel-13)	13.4.0
06/2016	RP-72	RP-161142	3499	1	F	Correction of Pcmax for Prose	13.4.0
06/2016	RP-72	RP-161128	3504	3	В	Introduction of PDSCH demodulation requirement for Cat-M1 UE	13.4.0
06/2016	RP-72	RP-161128	3505	3	В	Introduction of CQI test for Cat-M1 UE	13.4.0
06/2016	RP-72	RP-161142	3507	1	C	Correcting fallback inconsistencies in CA of B41 and	13.4.0
						B42 in REL-13	

06/2016	RP-72	RP-161141	3510	1	F	CR: Addition of performance requirement for TDD-FDD DC(Rel-13)	13.4.0
06/2016	RP-72	RP-161133	3514		F	Correction on 4Rx demodulation tests	13.4.0
06/2016	RP-72	RP-161142	3517		F	Introduction of 4Rx requirement for Band 1	13.4.0
06/2016	RP-72	RP-161142	3522		F	CR on reference measurement channel for Rel-13 eMTC	13.4.0
06/2016	RP-72	RP-161142	3526		F	Introduction of 4Rx REFSENS for Band 41	13.4.0
06/2016	RP-72	RP-161142	3528		F	Rx requirement for the non-contiguous CA with more than two component carriers	13.4.0
06/2016	RP-72	RP-161141	3530		F	Correction on UE category for MTC and eMTC in TS 36.101	13.4.0
06/2016	RP-72	RP-161142	3531	1	F	Correction on eMTC in TS 36.101	13.4.0
06/2016	RP-72	RP-161140	3535		Α	ACS for CA Bandwidth Class D: Case 2 wanted signal power	13.4.0
06/2016	RP-72	RP-161140	3538		Α	Maintenance CR for demodulation performance requirements (Rel-13)	13.4.0
06/2016	RP-72	RP-161142	3545	1	F	Maintenance CR for CRS-IM	13.4.0
06/2016	RP-72	RP-161142	3548		F	Correction to UE Categories for 64 QAM Reference channels	13.4.0
06/2016	RP-72	RP-161142	3549		F	Clean up for CRS-IM related requirements	13.4.0
06/2016	RP-72	RP-161142	3551	2	F	Correction on eMTC In-band emissions in TS 36.101	13.4.0
06/2016	RP-72	RP-161136	3554	1	В	CR on the introduction of the LTE DL Control Channels Interference Mitigation: PDCCH/PCFICH demodulation performance requirements	13.4.0
06/2016	RP-72	RP-161136	3555	1	В	CR on the introduction of the LTE DL Control Channels Interference Mitigation: Interference models	13.4.0
06/2016	RP-72	RP-161141	3559		F	Corrections to 9.6.1.3 and 9.6.1.4 TDD FDD CQI Reporting test	13.4.0
06/2016	RP-72	RP-161142	3560		F	Corrections for CA_28A-42A and CA_28A-42C requirements	13.4.0
06/2016	RP-72	RP-161128	3568	1	В	CR for eMTC PBCH demodulation requirement for enhanced coverage	13.4.0
06/2016	RP-72	RP-161128	3569	1	В	CR for eMTC M-PDCCH demodulation requirement for CE Mode A and CE Mode B	13.4.0
06/2016	RP-72	RP-161135	3573		В	Introduction of EB/FD-MIMO Class A PMI test	13.4.0
06/2016	RP-72	RP-161135	3574		В	Introduction of EB/FD-MIMO Class B K=1 PMI test	13.4.0
06/2016	RP-72	RP-161142	3576		F	RMC for verification of RF receiver requirements for LAA	13.4.0
06/2016	RP-72	RP-161142	3578		F	Corrections of CA 8A-42A/C in REL-13	13.4.0
06/2016	RP-72	RP-161142	3579	1	F	CR on control channel requirements of 4 Rx UE	13.4.0
06/2016	RP-72	RP-161142	3585		F	CR on Frequency bands for UE category 0 and UE category M1	13.4.0
06/2016	RP-72	RP-161142	3587		F	CR for dTib,c and dRib,c for CA combinations including Band 21 and 42	13.4.0
06/2016	RP-72	RP-161126	3589		В	Category NB1 CR for 36.101	13.4.0
06/2016	RP-72	RP-161142	3590	1	F	CR for delta F_HD for B46 combinations	13.4.0
06/2016	RP-72	RP-161136	3592	2	В	CR on Definitions for DL control channel IM	13.4.0
06/2016	RP-72	RP-161136	3593	1	В	CR on PHICH performance requirements for DL control channel IM	13.4.0
06/2016	RP-72	RP-161136	3594r1		В	CR on ePDCCH performance requirements for DL control channel IM	13.4.0
06/2016	RP-72	RP-161136	3595		В	CR on FRC for enhanced EPDCCH performance requirements	13.4.0
06/2016	RP-72	RP-161133	3597	1	В	Finalization of 4Rx UE Demodulation Requirements	13.4.0
06/2016	RP-72	RP-161142	3602	1	F	Clarification on eMTC RX requirements in TS 36.101	13.4.0
06/2016	RP-72	RP-161142	3610	1	F	Uplink configuration for reference sensitivity for B45	13.4.0
06/2016	RP-72	RP-161142	3614		F	CR: Maintenance CR for demodulation performance requirements (Rel-13)	13.4.0
06/2016	RP-72	RP-161142	3619	1	F	CR 36.101 on 7+38 blocking requirement	13.4.0
06/2016	RP-72	RP-161141	3623		Α	Editorial correction for TM4 MMSE-IRC PDSCH demodulation test	13.4.0
06/2016	RP-72	RP-161142	3632	1	F	CR for TM9 tests with MBSFN subframes configured for PDSCH in Rel-13	13.4.0
06/2016	RP-72	RP-161133	3633	2	В	CR for applicability rule, antenna connection and test method for 4Rx UEs in Rel-13	13.4.0
06/2016	RP-72	RP-161136	3634	1	В	CR of introducing enhanced control channels	13.4.0

						requirements under asynchronous network in Rel-13	
06/2016	RP-72	RP-161139	3635	1	F	Reference sensitivity for combinations of inter-band and NC intra-band CA	13.4.0
06/2016	RP-72	RP-161142	3636	1	F	Correction to A-MPR for NS_26	13.4.0
06/2016	RP-72	RP-161136	3640	1	В	CR for applicability rule for control channel enhancement requirements in Rel-13	13.4.0

## History

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