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IMT cellular networks;
Harmonised Standard for access to radio spectrum;
Part 25: New Radio (NR) User Equipment (UE) Release 15

Reference
DEN/MSG-TFES-15-25

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Mobile Standards Group (MSG), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure.

For non-EU countries, the present document may be used for regulatory (Type Approval) purposes.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU [i.2] on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Tables A-1 to A-3 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is part 25 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.12].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the Radio Equipment Directive [i.2]. The present document is produced following the guidance in ETSI EG 203 336 [i.3] as applicable.

1 Scope

1.0 General

The present document applies to the following radio equipment type:

- User Equipment for New Radio (NR).

Requirements throughout the present document are in many cases defined separately for different Frequency Ranges (FR). The frequency ranges in which NR can operate according to this version of the present document are identified as described in Table 1-1.

Table 1-1: Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	450 MHz - 7 125 MHz
FR2	24 250 MHz - 52 600 MHz

1.1 Operating bands in FR1

This radio equipment type is capable of operating in all or any part of the frequency bands of FR1 given in tables from 1.1-1 through 1.1-5.

Table 1.1-1: NR operating bands in FR1

NR operating band	Uplink (UL) *operating band* UE transmit F_{UL_low} - F_{UL_high}	Downlink (DL) *operating band* UE receive F_{DL_low} - F_{DL_high}	Duplex Mode	Related EC/ECC Decision
n1	1 920 MHz - 1 980 MHz	2 110 MHz - 2 170 MHz	FDD	[i.19] and [i.20]
n3	1 710 MHz - 1 785 MHz	1 805 MHz - 1 880 MHz	FDD	[i.17] and [i.18]
n7	2 500 MHz - 2 570 MHz	2 620 MHz - 2 690 MHz	FDD	[i.23]
n8	880 MHz - 915 MHz	925 MHz - 960 MHz	FDD	[i.17] and [i.18]
n20	832 MHz - 862 MHz	791 MHz - 821 MHz	FDD	[i.6] and [i.7]
n28 (note 1)	703 MHz - 748 MHz	758 MHz - 803 MHz	FDD	[i.8] and [i.11]
n38	2 570 MHz - 2 620 MHz	2 570 MHz - 2 620 MHz	TDD	[i.22] and [i.23]
n40	2 300 MHz - 2 400 MHz	2 300 MHz - 2 400 MHz	TDD	[i.21]
n41 (note 2)	2 496 MHz - 2 690 MHz	2 496 MHz - 2 690 MHz	TDD	[i.22] and [i.23]
n50 (note 3)	1 432 MHz - 1 517 MHz	1 432 MHz - 1 517 MHz	TDD	[i.14], [i.15] and [i.16]
n51 (note 3)	1 427 MHz - 1 432 MHz	1 427 MHz - 1 432 MHz	TDD	[i.14] and [i.15]
n65 (note 6)	1 920 MHz - 2 010 MHz	2 110 MHz - 2 200 MHz	FDD	[i.19], [i.20] and [i.27]
n75	N/A	1 432 MHz - 1 517 MHz	SDL	[i.14], [i.15] and [i.16]
n76	N/A	1 427 MHz - 1 432 MHz	SDL	[i.14] and [i.15]
n77 (note 4)	3 300 MHz - 4 200 MHz	3 300 MHz - 4 200 MHz	TDD	[i.29] and [i.24]
n78 (note 5)	3 300 MHz - 3 800 MHz	3 300 MHz - 3 800 MHz	TDD	[i.29] and [i.24]
n80	1 710 MHz - 1 785 MHz	N/A	SUL	[i.17] and [i.18]
n81	880 MHz - 915 MHz	N/A	SUL	[i.17] and [i.18]
n82	832 MHz - 862 MHz	N/A	SUL	[i.6] and [i.7]
n83	703 MHz - 748 MHz	N/A	SUL	
n84	1 920 MHz - 1 980 MHz	N/A	SUL	[i.19] and [i.20]

NR operating band	Uplink (UL) *operating band* UE transmit F_{UL_low} - F_{UL_high}	Downlink (DL) *operating band* UE receive F_{DL_low} - F_{DL_high}	Duplex Mode	Related EC/ECC Decision
NOTE 1: In Europe, according to [i.8] and [i.11], NR UE in Band n28 operates between 703 MHz and 736 MHz (F_{UL_low} = 703 MHz and F_{UL_high} = 736 MHz) for the transmitter and between 758 MHz and 791 MHz (F_{DL_low} = 758 MHz and F_{DL_high} = 791 MHz) for the receiver. NOTE 2: In Europe, according to [i.22] and [i.23], NR UE in Band n41 operates between 2 500 MHz and 2 690 MHz (F_{UL_low} = 2 500 MHz and F_{UL_high} = 2 690 MHz). NOTE 3: NR UE operation in Band 50 and Band n51 is restricted to downlink only. NOTE 4: In Europe, according to [i.29] and [i.24], NR UE in Band 77 operates between 3 400 MHz and 4 200 MHz (F_{UL_low} = 3 400 MHz and F_{UL_high} = 3 800 MHz). NOTE 5: In Europe, according to [i.29] and [i.24], NR UE in Band 78 operates between 3 400 MHz and 3 800 MHz (F_{UL_low} = 3 400 MHz and F_{UL_high} = 3 800 MHz). NOTE 6: This band includes two frequency ranges that are harmonised in Europe: (a) According to [i.19] and [i.20], radio equipment in band n65 operates between 2 110 MHz and 2 170 MHz for the transmitter (F_{DL_low} = 2 110 MHz and F_{DL_high} = 2 170 MHz), and between 1 920 MHz and 1 980 MHz for the receiver (F_{UL_low} = 1 920 MHz and F_{UL_high} = 1 980 MHz). (b) Based on [i.27], radio equipment in band n65 operates between 2 170 MHz and 2 200 MHz for the transmitter (F_{DL_low} = 2 170 MHz and F_{DL_high} = 2 200 MHz) and between 1 980 MHz and 2 010 MHz for the receiver (F_{UL_low} = 1 980 MHz and F_{UL_high} = 2 010 MHz) as the Complementary Ground Component (CGC) of a Mobile-satellite service by reference to the present document.				

Table 1.1-2: Void

Table 1.1-3: Void

Table 1.1-4: Void

NR supplementary uplink is designed to operate in the operating band combination defined in Table 1.1-5, where all operating bands are within FR1.

Table 1.1-5: Operating band combination for SUL in FR1

NR Band combination for SUL	NR Band (Table 1.1-1)
SUL_n78-n80 (note 2)	n78, n80
SUL_n78-n81 (note 2)	n78, n81
SUL_n78-n82 (note 2)	n78, n82
SUL_n78-n83 (note 2)	n78, n83
SUL_n78-n84 (note 2)	n78, n84
NOTE 1: If a UE is configured with both NR UL and NR SUL carriers in a cell, the switching time between NR UL carrier and NR SUL carrier is 0us. NOTE 2: For UE supporting SUL band combination simultaneous Rx/Tx capability is mandatory.	

The requirements for FR1 in the present document apply to the combination of channel bandwidths, SCS and operating bands shown in Table 1.1-6. The channel bandwidths are specified for both the TX and RX paths.

Table 1.1-6: Channel Bandwidths for Each NR band in FR1

	NR band / SCS / UE Channel bandwidth												
NR Band	SCS kHz	5 MHz	10[1,2] MHz	15[2] MHz	20[2] MHz	25[2] MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90[4] MHz	100 MHz
n1	15	Yes	Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]	Yes[4]				
	30		Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]	Yes[4]				
	60		Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]	Yes[4]				
n3	15	Yes	Yes	Yes	Yes	Yes	Yes						
	30		Yes	Yes	Yes	Yes	Yes						
	60		Yes	Yes	Yes	Yes	Yes						

	NR band / SCS / UE Channel bandwidth												
NR Band	**SCS kHz**	**5 MHz**	**10[1,2] MHz**	**15[2] MHz**	**20[2] MHz**	**25[2] MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90[4] MHz**	**100 MHz**
n7	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								
n8	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												
n20	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												
n28	15	Yes	Yes	Yes	Yes[5]								
	30		Yes	Yes	Yes[5]								
	60												
n38	15	Yes	Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]					
	30		Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]					
	60		Yes	Yes	Yes	Yes[4]	Yes[4]	Yes[4]					
n40	15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
	30		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
	60		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
n41	15		Yes	Yes	Yes		Yes[4]	Yes	Yes				
	30		Yes	Yes	Yes		Yes[4]	Yes	Yes	Yes	Yes	Yes	Yes
	60		Yes	Yes	Yes		Yes[4]	Yes	Yes	Yes	Yes	Yes	Yes
n50	15	Yes	Yes	Yes	Yes			Yes	Yes				
	30		Yes	Yes	Yes			Yes	Yes	Yes	Yes[3]		
	60		Yes	Yes	Yes			Yes	Yes	Yes	Yes[3]		
n51	15	Yes											
	30												
	60												
n65	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								
n75	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								
n76	15	Yes											
	30												
	60												
n77	15		Yes	Yes	Yes			Yes	Yes				
	30		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
	60		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
n78	15		Yes	Yes	Yes			Yes	Yes				
	30		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
	60		Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes
n80	15	Yes	Yes	Yes	Yes	Yes	Yes						
	30		Yes	Yes	Yes	Yes	Yes						
	60		Yes	Yes	Yes	Yes	Yes						
n81	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												
n82	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												
n83	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												
n84	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								

NOTE 1: 90 % spectrum utilization may not be achieved for 30 kHz SCS.
NOTE 2: 90 % spectrum utilization may not be achieved for 60 kHz SCS.
NOTE 3: This UE channel bandwidth applies only to downlink.
NOTE 4: This UE channel bandwidth is optional in this version of the present document.
NOTE 5: For the 20 MHz bandwidth, the minimum requirements are specified for NR UL carrier frequencies confined to either 713 MHz - 723 MHz or 728 MHz - 738 MHz.

1.2 Operating bands in FR2

This radio equipment type is capable of operating in all or any part of the frequency bands of FR2 given in tables from 1.2-1 through 1.2-4.

NR is designed to operate in the FR2 operating bands defined in Table 1.2-1.

Table 1.2-1: NR operating bands in FR2

Operating Band	Uplink (UL) operating band UE transmit	Downlink (DL) operating band UE receive	Duplex Mode	Relevant EC/ECC Decision
	F_{UL_low} - F_{UL_high}	F_{DL_low} - F_{DL_high}		
n257 (note)	26 500 MHz - 29 500 MHz	26 500 MHz - 29 500 MHz	TDD	[i.25] and [i.26]
n258	24 250 MHz - 27 500 MHz	24 250 MHz - 27 500 MHz	TDD	[i.25] and [i.26]
NOTE: In Europe, according to [i.25] and [i.26], NR UE radio equipment in band n257 operates between 26 500 MHz and 27 500 MHz (F_{UL_low} = 26 500 MHz and F_{UL_high} = 27 500 MHz).				

Table 1.2-2: Void

Table 1.2-3: Void

NR UL-MIMO is designed to operate in the operating bands defined in Table 1.2-4.

Table 1.2-4: NR UL-MIMO operating bands in FR2

UL-MIMO operating band (Table 1.2-1)
n257
n258

The present document covers requirements for 5G NR User Equipment from 3GPP™ Release 15 defined in ETSI TS 138 101-1 [6], ETSI TS 138 101-2 [7], ETSI TS 138 101-3 [8]. This includes the requirements for 5G NR UE operating bands and 5G NR UE CA operating bands from 3GPP™ Release 15 defined in ETSI TS 138 101-1 [6], ETSI TS 138 101-2 [7], ETSI TS 138 101-3 [8]. Additionally, it includes requirements for selected NR operating bands from 3GPP Release 16.

Table 1.2-5: Void

The FR2 requirements in the present document apply to the combination of channel bandwidths, SCS and operating bands shown in Table 1.2-6. The channel bandwidths are specified for both the Tx and Rx paths.

Table 1.2-6: Channel bandwidths for each NR band

Operating band / SCS / UE channel bandwidth					
Operating band	**SCS kHz**	**50 MHz**	**100 MHz**	**200 MHz**	**400[2] MHz**
n257	60	Yes	Yes	Yes	N/A
	120	Yes	Yes	Yes	Yes
n258	60	Yes	Yes	Yes	N/A
	120	Yes	Yes	Yes	Yes
NOTE 1: For test configuration tables from the transmitter and receiver tests in clause 5.2 and clause 5.3 that refer to this table and indicate test SCS to use, if referenced SCS value is not supported by the UE in UL and/or DL, select the closest SCS supported by the UE in both UL and DL. NOTE 2: This UE channel bandwidth is optional in this version of the present document.					

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.2] is given in annex A.

1.3 Operating bands for Range 1 and Range 2 interworking operation with other radios

1.3.1 Inter-band EN-DC within FR1

Table 1.3.1-1: Inter-band EN-DC configurations within FR1 (two bands)

EN-DC configuration	Uplink EN-DC configuration (NOTE 1)	Single UL allowed
DC_1A_n28A	DC_1A_n28A	No
DC_1A_n77A[2]	DC_1A_n77A	DC_1_n77
DC_1A_n78A[2]	DC_1A_n78A	No
DC_3A_n7A	DC_3A_n7A	No
DC_3A_n28A	DC_3A_n28A	No
DC_3A_n77A[2]	DC_3A_n77A	DC_3_n77
DC_3A_n78A[2] DC_3C_n78A[2]	DC_3A_n78A	DC_3_n78
DC_7A_n28A	DC_7A_n28A	No
DC_7A_n78A[2]	DC_7A_n78A	No
DC_7A-7A_n78A[2]	DC_7A_n78A	No
DC_7C_n78A[2]	DC_7A_n78A	No
DC_8A_n77A[2]	DC_8A_n77A	No
DC_8A_n78A[2]	DC_8A_n78A	No
DC_20A_n8A	DC_20A_n8A	DC_20_n8
DC_20A_n28A[3,4,5]	DC_20A_n28A	No
DC_20A_n78A[2]	DC_20A_n78A	No
DC_28A_n77A[2]	DC_28A_n77A	No
DC_28A_n78A[2]	DC_28A_n78A	No
DC_38A_n78A[2]	DC_38A_n78A	No
DC_41A_n77A DC_41C_n77A	DC_41A_n77A	No
DC_41A_n78A DC_41C_n78A	DC_41A_n78A	No

NOTE 1: Uplink EN-DC configurations are the configurations supported by this version of the present document.
NOTE 2: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability.
NOTE 3: The frequency range in band n28 is restricted for this band combination to 703 MHz - 733 MHz for the UL and 758 - 788 MHz for the DL.
NOTE 4: The maximum power spectral density imbalance between downlink carriers is within 6 dB. The power spectral density imbalance condition also applies for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration.
NOTE 5: The minimum requirements apply for synchronized DL carriers with a maximum receive time difference ≤ 3 μsec. The requirements also apply for these carriers when applicable EN-DC configuration is a subset of a higher order EN-DC configuration.

1.3.1a Void

1.3.2 Inter-band EN-DC including FR2

Table 1.3.2-1: Inter-band EN-DC configurations including FR2 (two bands)

EN-DC configuration	Uplink EN-DC configuration (NOTE 1)
DC_1A_n257A	DC_1A_n257A
DC_3A_n257A	DC_3A_n257A
DC_3A_n258A	DC_3A_n258A

EN-DC configuration	Uplink EN-DC configuration (NOTE 1)
DC_7A_n257A	DC_7A_n257A
DC_7A-7A_n257A	DC_7A_n257A
DC_7A_n258A	DC_7A_n258A
DC_8A_n257A	DC_8A_n257A
DC_8A_n258A	DC_8A_n258A
DC_20A_n258A	DC_20A_n258A
DC_28A_n257A	DC_28A_n257A
DC_28A_n258A	DC_28A_n258A
DC_42A_n257A DC_42C_n257A DC_42D_n257A DC_42E_n257A	DC_42A_n257A DC_42C_n257A
NOTE 1: Uplink EN-DC configurations are the configurations supported by this version of the present document. NOTE 2: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability for all of the above combinations.	

1.3.3 Inter-band EN-DC including FR1 and FR2

1.3.3-1: Inter-band EN-DC configurations including FR1 and FR2 (three bands)

EN-DC configuration	Uplink EN-DC configuration (note 1)
DC_1A_n77A-n257A	DC_1A_n77A DC_1A_n257A DC_1A_n77A-n257A
DC_1A_n78A-n257A	DC_1A_n78A DC_1A_n257A DC_1A_n78A-n257A
DC_3A_n77A-n257A	DC_3A_n77A DC_3A_n257A DC_3A_n77A-n257A
DC_3A_n78A-n257A	DC_3A_n78A DC_3A_n257A DC_3A_n78A-n257A
DC_5A_n78A-n257A[2]	DC_5A_n78A DC_5A_n257A
DC_7A_n78A-n257A	DC_7A_n78A DC_7A_n257A
DC_7A-7A_n78A-n257A	DC_7A_n78A DC_7A_n257A DC_7A_n78A-n257A
NOTE 1: Uplink EN-DC configurations are the configurations supported by this version of the present document. NOTE 2: Applicable for UE supporting inter-band EN-DC with mandatory simultaneous Rx/Tx capability.	

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 138 521-1 (V17.10.0) (10-2023): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone (3GPP TS 38.521-1 version 17.0.0 Release 17)".

[2] ETSI TS 138 521-2 (V17.4.0) (10-2023): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone (3GPP TS 38.521-2 version 17.0.0 Release 17)".

[3] ETSI TS 138 521-3 (V17.10.0) (10-2023): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios (3GPP TS 38.521-3 version 17.0.0 Release 17)".

[4] ETSI TS 138 508-1 (V17.10.0) (10-2023): "5G; 5GS; User Equipment (UE) conformance specification; Part 1: Common test environment (3GPP TS 38.508-1 version 17.0.0 Release 17)".

[5] ETSI TS 138 508-2 (V16.5.0) (09-2020): "5G; 5GS; User Equipment (UE) conformance specification; Part 2: Common Implementation Conformance Statement (ICS) proforma (3GPP TS 38.508-2 version 16.5.0 Release 16)".

[6] ETSI TS 138 101-1 (V15.24.0) (02-2024): "5G; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (3GPP TS 38.101-1 version 15.24.0 Release 15)".

[7] ETSI TS 138 101-2 (V15.25.0) (05-2024): "5G; NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone (3GPP TS 38.101-2 version 15.25.0 Release 15)".

[8] ETSI TS 138 101-3 (V15.24.0) (02-2024): "5G; NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios (3GPP TS 38.101-3 version 15.24.0 Release 15)".

[9] IEC 60068-2-1 (2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".

[10] IEC 60068-2-2 (2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".

[11] ETSI TS 136 521-1 (V16.5.0) (09-2020): "LTE Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing (3GPP TS 36.521-1 version 16.5.0 Release 16)".

[12] ETSI EN 301 908-13 (V13.2.1) (02-2022): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)".

[13] ETSI TS 136 508 (V14.5.0) (04-2018): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing (3GPP TS 36.508 version 14.5.0 Release 14)".

[14] ETSI TS 136 101 (V13.11.0) (04-2018): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 13.11.0 Release 13)".

[15] ETSI TS 136 214 (V15.5.0) (01-2020): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Layer; Measurements (3GPP TS 36.214 version 15.5.0 Release 15)".

[16] ETSI TS 136 133 (V15.20.0) (07-2023): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management (3GPP TS 36.133 version 15.20.0 Release 15)".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.3] ETSI EG 203 336 (V1.2.1) (05-2020): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

[i.4] Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".

[i.5] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.6] Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.

[i.7] ECC Decision (09)03 of 30 October 2009 on harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz.

[i.8] Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

[i.9] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.10] Void.

[i.11] ECC Decision (15)01: "Harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink)", Approved 06 March 2015.

[i.12] ETSI EN 301 908-1 (V15.2.1) (01-2023): "IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements".

[i.13] Recommendation ERC 74-01 (05-2019): "Unwanted emissions in the spurious domain".

[i.14] Commission Implementing Decision (EU) 2018/661 of 26 April 2018 amending Implementing Decision (EU) 2015/750 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union as regards its extension in the harmonised 1427-1452 MHz and 1492-1517 MHz frequency bands.

[i.15] ECC Decision (13)03: "The harmonised use of the frequency band 1 452-1 492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)".

[i.16] ECC Decision 17(06): "The harmonised use of the frequency bands 1 427-1 452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)", Approved 17 November 2017, corrected 2 March 2018.

[i.17] Commission Implementing Decision (EU) 2022/173 of 7 February 2022 on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing electronic communications services in the Union and repealing Decision 2009/766/EC.

[i.18] ECC Decision (06)13 "Designation of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz for terrestrial UMTS, LTE, WiMAX and IoT cellular systems", Approved 01 December 2006, Amended 8 March 2019.

[i.19] Commission Implementing Decision (EU) 2020/667 of 6 May 2020 amending Decision 2012/688/EU as regards an update of relevant technical conditions applicable to the frequency bands 1 920-1 980 MHz and 2 110-2 170 MHz.

[i.20] ECC Decision (06)01: The harmonised utilisation of the bands1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems, Approved 24 March 2006.

[i.21] ECC Decision 14(02): "Harmonised technical and regulatory conditions for the use of the band 2 300-2 400 MHz for Mobile/Fixed Communications Networks (MFCN)", Approved 27 June 2014.

[i.22] Commission Implementing Decision (EU) 2020/636 of 8 May 2020 amending Decision 2008/477/EC as regards an update of relevant technical conditions applicable to the 2 500-2 690 MHz frequency band.

[i.23] ECC Decision 05(05): "Harmonised utilization of spectrum for Mobile/Fixed Communications Networks (MFCN) operating within the band 2 500-2 690 MHz", Approved 18 March 2005, Amended 05 July 2019.

[i.24] ECC Decision 11(06): "Harmonised frequency arrangements and least restrictive technical conditions (LRTC) for mobile/fixed communications networks (MFCN) operating in the band 3400-3800 MHz" Approved 09 December 2011, Amended 26 October 2018.

[i.25] Commission Implementing Decision (EU) 2020/590 of 24 April 2020 amending Decision (EU) 2019/784 as regards an update of relevant technical conditions applicable to the 24,25-27,5 GHz frequency band.

[i.26] ECC Decision 18(06): "Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24,25 - 27,5 GHz", Approved 06 July 2018, Last amended 20 November 2020.

[i.27] ECC Decision 06(09): "Designation of the bands 1980-2010 MHz and 2170-2200 MHz for use by systems in the Mobile-Satellite Service including those supplemented by a Complementary Ground Component (CGC)", Approved 01 December 2006, Amended 05 September 2007.

[i.28] FCC 47 CFR Part 30: "Upper microwave flexible use service, §30.202 Power limits".

[i.29] Commission Implementing Decision (EU) 2019/235 of 24 January 2019 on amending Decision 2008/411/EC as regards an update of relevant technical conditions applicable to the 3 400-3 800 MHz frequency band".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

channel bandwidth: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell

NOTE 1: The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE 2: Channel bandwidth and the maximum transmission bandwidth configuration for one NR channel are described in Figure 3.1-1.

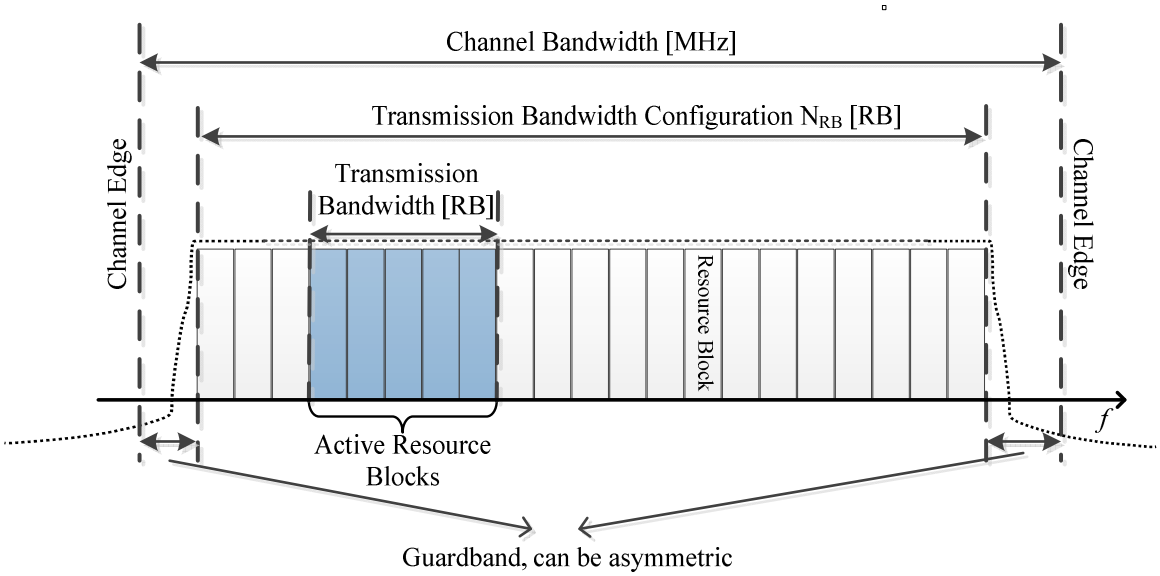

Figure 3.1-1: Definition of the channel bandwidth and the maximum transmission bandwidth configuration for one NR channel

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

EIRP (Link=Link angle, Meas=Link angle): measurement of the UE such that the link angle is aligned with the measurement angle

NOTE: EIRP (indicator to be measured) can be replaced by EIS, Frequency, EVM, carrier Leakage, In-band emission and OBW.

EIRP (Link=TX beam peak direction, Meas=Link angle): measurement of the EIRP of the UE such that the measurement angle is aligned with the beam peak direction within an acceptable measurement error uncertainty

NOTE: EIRP (indicator to be measured) can be replaced by Frequency, EVM, carrier Leakage, In-band emission and OBW.

EIS (equivalent isotropic sensitivity): sensitivity for an isotropic directivity device equivalent to the sensitivity of the discussed device exposed to an incoming wave from a defined AoA

EIS (Link=RX beam peak direction, Meas=Link angle): measurement of the EIS of the UE such that the measurement angle is aligned with the RX beam peak direction within an acceptable measurement error uncertainty

NOTE 1: The sensitivity is the minimum received power level at which specific requirement is met.

NOTE 2: Isotropic directivity is equal in all directions (i.e. 0 dBi).

link angle: DL-signal AoA from the view point of the UE, as described in annex J in ETSI TS 138 101-2 [7]

NOTE: If the beam lock function is used to lock the UE beam(s), the link angle can become any arbitrary AoA once the beam lock has been activated.

Maximum Output Power (MOP): mean power level per carrier of UE measured at the antenna connector in a specified reference condition

mean power: when applied to NR transmission this is the power measured in the operating system bandwidth of the carrier

NOTE: The period of measurement is assumed to be at least one subframe (1 ms) unless otherwise stated.

measurement angle: angle of measurement of the desired metric from the view point of the UE, as described in annex J in ETSI TS 138 101-2 [7]

network signalled value: signalling value sent from the BS to the UE to indicate additional unwanted emission requirements to the UE

occupied bandwidth: width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission

operating band: frequency range (paired or unpaired) in which NR operates that is defined with a specific set of technical requirements

output power: mean power of one carrier of the UE, delivered to a load with resistance equal to the nominal load impedance of the transmitter

radiated interface boundary: operating band-specific radiated requirements reference point where the radiated requirements apply

radiated requirements reference point: for the RF measurement setup, the radiated requirements reference point is located at the centre of the quiet zone

NOTE: From the UE perspective, the reference point is the input of the UE antenna array.

reference bandwidth: bandwidth in which an emission level is specified

resource block: physical resource consisting of a number of symbols in the time domain and a number of consecutive subcarriers spanning 180 kHz in the frequency domain

RX beam peak direction: direction where the maximum total component of RSRP and thus best total component of EIS is found

sub-block: one contiguous allocated block of spectrum for transmission and reception by the same UE

NOTE: There may be multiple instances of sub-blocks within an RF bandwidth.

sub-block bandwidth: bandwidth of one sub-block

sub-block gap: 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

transmission bandwidth: bandwidth of an instantaneous transmission from a UE or BS, measured in Resource Block units

NOTE: See Figure 3.1-1.

TRP (Link=TX beam peak direction, Meas=TRP grid): measurement of the TRP of the UE such that the measurement angles are aligned with the directions of the TRP grid points within an acceptable measurement uncertainty while the link angle is aligned with the TX beam peak direction

NOTE: For requirements based on EIRP/EIS, the radiated interface boundary is associated to the far-field region.

TX beam peak direction: direction where the maximum total component of EIRP is found

UE transmission bandwidth configuration: set of resource blocks located within the UE channel bandwidth which may be used for transmitting or receiving by the UE

vehicular UE: UE embedded in a vehicle, permanently connected to an embedded antenna system that radiates externally for NR operating bands

NOTE: Vehicular UE does not refer to other UE form factors placed inside the vehicle.

3.2 Symbols

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

ΔFHD	Range of harmonic distortion frequencies
Δf_{OOB}	Δ Frequency of out-of-band emission
Δ_{MBP} & Δ_{MBs}	UE multi-band adjustment parameter
ΔR_{IBNC}	Allowed reference sensitivity relaxation due to support for intra-band non-contiguous CA operation
$BW_{Channel}$	Channel bandwidth
$BW_{Channel\_CA}$	Aggregated channel bandwidth, expressed in MHz
BW_{GB}	Virtual guard band to facilitate transmitter (receiver) filtering above/below edge CCs
$BW_{Interferer}$	Channel Bandwidth of the interferer
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 received energy per RE during the useful part of the symbol, i.e. excluding the cyclic prefix, averaged across the allocated RB(s) (average power within the allocated RB(s)), divided by the number of RE within this allocation and normalized to the subcarrier spacing) at the UE antenna connector
BW_{UTRA}	Channel Bandwidth UTRA
F	Frequency
$F_{Interferer}$ (offset)	Frequency offset of the interferer
$F_{Interferer}$	Frequency of the interferer
$F_{Ioffset}$	Frequency offset of the interferer
F_C	Frequency of the carrier centre frequency
F_{CA_low}	The centre frequency of the *lowest carrier*, expressed in MHz
F_{CA_high}	The centre frequency of the *highest carrier*, expressed in MHz
F_{DL_low}	The lowest frequency of the downlink operating band
F_{DL_high}	The highest frequency of the downlink operating band
F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
F_{edge_low}	The *lower edge* of aggregated channel bandwidth, expressed in MHz
F_{edge_high}	The *higher edge* of aggregated channel bandwidth, expressed in MHz
$F_{offset\_NS\_23}$	Frequency offset in MHz needed if NS_23 is used
F_{OOB}	The boundary between the NR 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 normalized to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal or the power spectral density of the total input signal at the UE antenna connector (power averaged over the useful part of the symbols within a given bandwidth and normalized to the said bandwidth), 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 normalized 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 the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalized 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 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 expressed in units of resources blocks

N_{oc} The power spectral density of a white noise source (average power per RE normalized to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector

N_{od} 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 normalized to the 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

$N_{Offs-DL}$ Offset used for calculating downlink EARFCN

$N_{Offs-UL}$ Offset used for calculating uplink EARFCN

N_{RB} Transmission bandwidth configuration, expressed in units of resource blocks

N_{RB_agg} Aggregated Transmission Bandwidth Configuration The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth

N_{tone} Transmission bandwidth configuration for category NB1, expressed in units of tones

$N_{tone\ 3,75\ kHz}$ Transmission bandwidth configuration for category NB1 with 3,75 kHz sub-carrier spacing, expressed in units of tones

$N_{tone\ 15\ kHz}$ Transmission bandwidth configuration for category NB1 with 15 kHz sub-carrier spacing, expressed in units of tones

N_{UL} Uplink EARFCN

N_{DL} Downlink EARFCN

$N_{UL/DL}$ Uplink and Downlink EARFCN

NS_x Network signalled value "x"

P Number of cell-specific antenna ports

p Antenna port number

P_{CMAX} Configured maximum UE output power

P_{CMAX_L} Lower bound for configured maximum UE output power

$P_{CMAX\_L,c}$ Lower bound for configured maximum UE output power for serving cell *c*

$P_{CMAX\_L\_E-UTRA,c}$ Lower bound for configured maximum UE output power for serving cell c for E-UTRA

$P_{CMAX\_L,f,c,NR}$ Lower bound for configured maximum UE output power for serving cell c for NR

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

P_{UMAX} Maximum UE Power with possible power reduction due to modulation type, network signalling values and location near the edge of the band

R_{av} Minimum average throughput per RB

3.3 Abbreviations

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

AC Alternating current
ACLR Adjacent Channel Leakage Ratio
ACS Adjacent Channel Selectivity
AoA Angle of Arrival
ARFCN Absolute Radio-Frequency Channel Number

BPSK	Binary Phase-Shift Keying
BS	Base Station
BW	BandWidth
C_RNTI	Cell Radio Network Temporary Identifier
CA	Carrier Aggregation
CBW	Channel Bandwidth
CC	Component Carrier
CDM	Code Division Multiplexing
CG	Cell Group
CGC	Complementary Ground Component
CH	Channel
CP	Cyclic Prefix
CQI	Channel Quality Indicator
CW	Continuous Wave
DC	Dual Connectivity
DCI	Downlink Control Information
DFT-S	Discrete Fourier Transform-Spread
DL	DownLink
DMRS	DeModulation Reference Signal
DUT	Device under Test
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
ECC	Electronic Communications Committee
EFTA	European Free Trade Association
EIRP	Effective Isotropic Radiated Power
EIS	Equivalent Isotropic Sensitivity
EN-DC	E-UTRAN New Radio - Dual Connectivity
EPRE	Energy Per Resource Element
ERP	Effective radiated power
EU	European Union
E-UTRA	Evolved UMTS Terrestrial Radio Access
EVM	Error vector magnitude
FDD	Frequency Division Duplex
FR	Frequency Range
FWA	Fixed Wireless Access
GSM	Global System for Mobile
HARQ	Hybrid Acknowledge Request
IBB	In-Band Blocking
IE	Information element
IMD	Intermodulation
IMT	International Mobile Telecommunications
LB	Lower Band
LO	Local oscillator
LTE	Long Term Evolution
MAC	Medium Access Control
MBW	Measurement BandWidth
MCG	Master Cell Group
MIMO	Multiple Antenna transmission
MOD	Modulation
MOP	Maximum Output Power
MPR	Maximum Power Reduction
MSD	Maximum Sensitivity Degradation
MSG	Mobile Standards Group
NC	Normal Conditions
NE-DC	NR-E-UTRA Dual Connectivity
NR ACLR	New Radio Adjacent Channel Leakage Ratio
NR	New Radio
NS	Network Signalling
NS_X	Network Signalling lable for specific bands
NSA	Non-Stand-Alone
OBW	Occupied Bandwidth
OCNG	OFDMA Channel Noise Generator
OFDM	Orthogonal Frequency Division Multiplexing

OOB	Out Of Band
OP	OFDMA Channel Noise Generator Pattern
OTA	Over The Air
PC	Power Class
PC3	Power Class 3
PCC	Primary Component Carrier
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PHS	Personal Handy-phone System
PUSCH	Physical Uplink Shared Channel
QAM	Quadrature amplitude modulation
QPSK	Quadrature Phase Shift Keying
QZ	Quiet Zone
RB	Resource Block
RBC	Radio Bearer Control
RE	Resource Element
REFSENS	REFerence SENSitivity power level
RF	Radio Frequency
RIB	Radiated Interface Boundary
RMC	Reference Measurement Channel
RMS	Root Mean Square (value)
RoT	Rise over Thermal
RRC	Root Raised Cosine
RS	Reference Signal
RSRP	Reference Signal Received Power
RX	Receiver
SA	Stand Alone
SCC	Secondary Component Carrier
SCG	Secondary Cell Group
SCS	Subcarrier spacing
SDL	Supplementary Downlink
SNR	Signal to Noise Ratio
SRS	Sounding Reference Signal
SS	System Simulator
SUL	Supplementary Uplink
TA	Time Alignment
TDD	Time Division Duplex
TE	Test Equipment
TH	Temperature High
TH/VH	High extreme Temperature/High extreme Voltage
TH/VL	High extreme Temperature/Low extreme Voltage
TL	Temperature Low
TL/VH	Low extreme Temperature/High extreme Voltage
TL/VL	Low extreme Temperature/Low extreme Voltage
TPC	Transmitter Power Control
TR	Technical Report
TRP	Total Radiated Power
TS	Technical Specification
TX	Transmitter
UBF	Beamlock test Function
UE	User Equipment
UL	UpLink
UL-MIMO	Uplink Multiple Antenna transmission
UTRA	Universal Terrestrial Radio Access
VH	Higher extreme Voltage
VL	Lower extreme Voltage

4 Technical requirements specifications

4.1 Technical requirements specification for Frequency Range 1

4.1.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.1.2 Conformance requirements

4.1.2.0 General

The requirements in the present document are based on the assumption that the operating band (see tables 1.1-1 through 1.1-5) is shared between systems of the IMT family (for band n3 and n8 also GSM) or systems having compatible characteristics.

The transmission bandwidth configuration in Table 5.3.2-1 of ETSI TS 138 101-1 [6] shall be supported for each of the specified channel bandwidths in Table 1.1-6.

NR UE that complies with the NR Band n50 minimum requirements in the present document shall also comply with the NR Band n51 minimum requirements.

NR UE that complies with the NR Band n65 minimum requirements in the present document shall also comply with the NR Band n1 minimum requirements.

NR UE that complies with the NR Band n75 minimum requirements in the present document shall also comply with the NR Band n76 minimum requirements.

4.1.2.1 Introduction

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.2] for IMT User Equipment (UE), a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.12] have been identified. Table 4.1.2.1-1 provides a cross-reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 4.1.2.1-1: Cross references

Essential parameter	Corresponding technical requirements	Corresponding test suite
Transmitter spectrum mask	4.1.2.4 Transmitter spectrum emissions mask	5.1.3.3
Transmitter unwanted emissions in the out-of-band domain	4.1.2.5 Transmitter adjacent channel leakage power ratio	5.1.3.4
Transmitter unwanted emissions in the spurious domain	4.1.2.6 Transmitter spurious emissions	5.1.3.5
Transmitter power limits	4.1.2.2 Transmitter maximum output power	5.1.3.1
Transmitter Power Control (TPC)	4.1.2.3 Transmitter minimum output power	5.1.3.2
Transmitter power accuracy	4.1.2.2 Transmitter maximum output power	5.1.3.1
Receiver unwanted emissions in the spurious domain	4.1.2.12 Receiver spurious emissions	5.1.3.11
Receiver blocking	4.1.2.9 Receiver blocking characteristics	5.1.3.8
Receiver desensitization		
Receiver spurious response rejection	4.1.2.10 Receiver spurious response	5.1.3.9
Receiver radio-frequency intermodulation	4.1.2.11 Receiver intermodulation characteristics	5.1.3.10
Receiver adjacent signal selectivity	4.1.2.8 Receiver adjacent channel selectivity (ACS)	5.1.3.7
Receiver sensitivity	4.1.2.7 Receiver reference sensitivity level	5.1.3.6
Equipment operating under the control of a network	ETSI EN 301 908-1 [i.12], clause 4.2.4 Control and Monitoring functions	-
	4.1.2.13 Transmit OFF power	5.1.3.12

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.

Transmitter requirements for UL MIMO operation apply when the UE transmits on 2 ports on the same CDM group. The UE may use higher MPR values outside this limitation.

4.1.2.2 Transmitter Maximum Output Power

4.1.2.2.1 Transmitter Maximum Output Power for Single Carrier

4.1.2.2.1.1 Definition

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth of NR carrier unless otherwise stated. The period of measurement shall be at least one subframe (1 ms).

4.1.2.2.1.2 Limits

The maximum output power for UE with power class 3 shall be within the range in Table 4.1.2.2.1.2-1.

The maximum output power for UE with power class 2 shall be within the range in Table 4.1.2.2.1.2-2.

Table 4.1.2.2.1.2-1: Maximum Output Power requirement for Power Class 3

NR band	Power Class 3			
	BW ≤ 40 MHz		40 MHz < BW ≤ 100 MHz	
	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)
n1	20,3	25,7	20,0	26,0
n3	20,3 (note 2)	25,7		
n7	20,3 (note 2)	25,7		
n8	20,3 (note 2)	25,7		
n20	20,3 (note 2)	25,0		
n28	20,3	25,0		
n38	20,3	25,7		
n40	20,3	25,0	20,0	25,0
n41	20,3 (note 2)	25,7	20,0 (note 2)	26,0
n50	20,3	25,7	20,0	26,0
n51	20,3	25,7		
n65	20,3	25,7		
n77	19,0	26,0	19,0	26,0
n78	19,0	26,0	19,0	26,0
n80	20,3	25,7		
n81	20,3	25,7		
n82	20,3	25,7		
n83	19,8	25,7		
n84	20,3	25,7		
NOTE 1: Power class 3 is the default power class unless otherwise stated. NOTE 2: Refers to the transmission bandwidths confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.				

Table 4.1.2.2.1.2-2: Maximum Output Power requirement for Power Class 2

NR band	Power Class 2 (dBm)			
	BW ≤ 40 MHz		40 MHz < BW ≤ 100 MHz	
	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)
n41	22,3 (note 2)	28,7	22,0 (note 2)	29,0
n77	22,0	29,0	22,0	29,0
n78	22,0	29,0	22,0	29,0
NOTE 1: Power class 3 is the default power class unless otherwise stated. NOTE 2: Refers to the transmission bandwidths confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.				

NOTE: These requirements do not take into account the maximum power reductions allowed to the UE subject to certain transmission conditions specified in ETSI TS 138 101-1 [6], clauses 6.2.2 and 6.2.3.

4.1.2.2.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.1.1 of the present document.

4.1.2.2.2 Void

4.1.2.2.3 Void

4.1.2.2.4 Void

4.1.2.2.5 Transmitter Maximum Output Power for UL-MIMO

4.1.2.2.5.1 Definition

For power class 2 UE with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 4.1.2.2.5.2-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1.3-2 of ETSI TS 138 521-1 [1]. For UE supporting UL MIMO, the maximum output power is defined as the sum of the maximum output power from both UE antenna connectors. The period of measurement shall be at least one subframe (1 ms).

The requirements shall be met with the UL MIMO configurations of using 2-layer UL MIMO transmission with a codebook of $\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$. DCI Format for UE configured in PUSCH transmission mode for uplink single-user MIMO shall be used.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 4.1.2.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.

4.1.2.2.5.2 Limits

The maximum output power shall be within the range in Table 4.1.2.2.5.2-1.

Table 4.1.2.2.5.2-1: UE Power Class for UL MIMO in closed loop spatial multiplexing scheme

NR band	Power Class 2 (dBm)				Power Class 3 (dBm)			
	BW ≤ 40 MHz		40 MHz < BW ≤ 100 MHz		BW ≤ 40 MHz		40 MHz < BW ≤ 100 MHz	
	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)
n41	22,3 (note 1)	28,7	22,0 (note 1)	29,0	19,3 (note 1)	25,7	19,0 (note 1)	26,0
n77	22,0	29,0	22,0	29,0	19,0	26,0	19,0	26,0
n78	22,0	29,0	22,0	29,0	19,0	26,0	19,0	26,0
NOTE 1: Refers to the transmission bandwidths confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB. NOTE 2: Power class 3 is the default power class unless otherwise stated.								

NOTE: These requirements do not take into account the maximum power reductions allowed to the UE subject to certain transmission conditions specified in ETSI TS 138 101-1 [6], clauses 6.2D-2 and 6.2D-3.

4.1.2.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.1.5 of the present document.

4.1.2.3 Transmitter Minimum Output Power

4.1.2.3.1 Transmitter Minimum Output Power for Single Carrier

4.1.2.3.1.1 Definition

The minimum output power of the UE is defined as the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) when the power is set to a minimum value. The minimum output power is defined as the mean power in at least one sub-frame (1 ms).

4.1.2.3.1.2 Limits

The minimum output power shall not exceed the values specified in Table 4.1.2.3.1.2-1.

Table 4.1.2.3.1.2-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)		Measurement bandwidth (MHz)
	f ≤ 3,0 GHz	3,0 GHz < f ≤ 6,0 GHz	
5	-39	-38,7	4,515
10	-39	-38,7	9,375
15	-39	-38,7	14,235
20	-39	-38,7	19,095
25	-38	-37,7	23,955
30	-37,2	-36,9	28,815
40	-36	-35,7	38,895
50	-34,7	-34,7	48,615
60	-33,9	-33,9	58,35
80	-32,7	-32,7	78,15
90	-32,2	-32,2	88,23
100	-31,7	-31,7	98,31

4.1.2.3.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.2.1 of the present document.

4.1.2.3.2 Void

4.1.2.3.3 Void

4.1.2.3.4 Void

4.1.2.3.5 Transmitter Minimum Output Power for UL-MIMO

4.1.2.3.5.1 Definition

For UE with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each UE antenna connector in one sub-frame (1 ms).

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 4.1.2.3.1 apply.

4.1.2.3.5.2 Limits

The minimum output power shall not exceed the values specified in Table 4.1.2.3.1.2-1.

4.1.2.3.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.2.5 of the present document.

4.1.2.4 Transmitter Spectrum Emission Mask

4.1.2.4.1 Transmitter Spectrum Emission Mask for Single Carrier

4.1.2.4.1.1 Definition

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.

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.

4.1.2.4.1.2 Limits

4.1.2.4.1.2.1 General spectrum emission mask

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. The power of any UE emission shall fulfil requirements in tables 4.1.2.4.1.2.1-1 and 4.1.2.4.1.2.1-2.

Table 4.1.2.4.1.2.1-1: General NR spectrum emission mask, for BW ≤ 100 MHz and f ≤ 3,0 GHz

Spectrum emission limit (dBm) / Channel bandwidth													
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Measurement bandwidth
± 0 - 1	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5						1 % channel bandwidth
± 0 - 1								-22,5	-22,5	-22,5	-22,5	-22,5	30 kHz
± 1 - 5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
± 5 - 6	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	11,5	1 MHz
± 6 - 10	-23,5												1 MHz
± 10 - 15		-23,5											1 MHz
± 15 - 20			-23,5										1 MHz
± 20 - 25				-23,5									1 MHz
± 25 - 30					-23,5								1 MHz
± 30 - 35						-23,5							1 MHz
± 35 - 40													1 MHz
± 40 - 45							-23,5						1 MHz
± 45 - 50													1 MHz
± 50 - 55								-23,5					1 MHz
± 55 - 60													1 MHz
± 60 - 65									-23,5				1 MHz
± 65 - 80													1 MHz
± 80 - 85										-23,5			1 MHz
± 85 - 90													1 MHz
± 90 - 95											-23,5		1 MHz
± 95 - 100													1 MHz
± 100 - 105												-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.
NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.
NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.

Table 4.1.2.4.1.2.1-2: General NR spectrum emission mask, for BW ≤ 100 MHz and 3,0 GHz < f ≤ 4,2 GHz and 4,2 GHz < f ≤ 6,0 GHz

Spectrum emission limit (dBm) / Channel bandwidth													
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Measurement bandwidth
± 0 - 1	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2						1 % channel bandwidth
± 0 - 1								-22,2	-22,2	-22,2	-22,2	-22,2	30 kHz
± 1 - 5	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	1 MHz

Spectrum emission limit (dBm) / Channel bandwidth													
Δf_{OOB} (MHz)	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**	**Measurement bandwidth**
± 5 - 6	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	
± 6 - 10	-23,2												
± 10 - 15		-23,2											
± 15 - 20			-23,2										
± 20 - 25				-23,2									
± 25 - 30					-23,2								
± 30 - 35						-23,2							
± 35 - 40													
± 40 - 45							-23,2						
± 45 - 50													
± 50 - 55								-23,2					
± 55 - 60													
± 60 - 65									-23,2				
± 65 - 80													
± 80 - 85										-23,2			
± 85 - 90													
± 90 - 95											-23,2		
± 95 - 100													
± 100 - 105												-23,2	

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.
NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.
NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.

4.1.2.4.1.2.2 Additional spectrum emission mask

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.

This clause specifies the requirements for the specified NR band for an additional spectrum emission requirement for different NS_values.

When "NS_04" is indicated in the cell (applicable to band n41):

- the power of any UE emission shall fulfil requirements in tables 4.1.2.4.1.2.2-1.

Table 4.1.2.4.1.2.2-1: Additional requirements for "NS_04", for BW ≤ 100 MHz and f ≤ 3,0 GHz

	Spectrum emission limit (dBm) / measurement bandwidth for each channel bandwidth									
Δf_{OOB} MHz	**10 MHz**	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**	**Measurement bandwidth**
± 0 - 1	-8,5	-8,5	-8,5	-8,5						2 % channel bandwidth
					-8,5					1 MHz
± 1 - 5	-8,5									1 MHz
± 5 - X	11,5									
± X - ($BW_{Channel}$ + 5 MHz)	-23,5									
NOTE: X is defined in Table 6.5.2.3.2-1 of ETSI TS 138 101-1 [6] for CP-OFDM and Table 6.5.2.3.2-2 of ETSI TS 138 101-1 [6] for DFT-S-OFDM.										

4.1.2.4.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.3.1 of the present document.

4.1.2.4.2 Void

4.1.2.4.3 Void

4.1.2.4.4 Void

4.1.2.4.5 Transmitter Spectrum Emission Mask for UL-MIMO

4.1.2.4.5.1 Definition

For UE supporting UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters is defined as the sum of the emissions from both UE transmit antenna connectors.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 4.1.2.4.1 apply.

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.

4.1.2.4.5.2 Limits

4.1.2.4.5.2.1 General spectrum emission mask

For UEs with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the requirements in clause 4.1.2.4.1.2.1 apply. The requirements shall be met with UL MIMO configurations described in clause 4.1.2.2.5.

4.1.2.4.5.2.2 Additional spectrum emission mask

For UEs with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the requirements in clause 4.1.2.4.1.2.2 apply. The requirements shall be met with UL MIMO configurations described in clause 4.1.2.2.5.

4.1.2.4.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.3.5 of the present document.

4.1.2.5 Transmitter Adjacent Channel Leakage Power Ratio

4.1.2.5.1 Transmitter Adjacent Channel Leakage Power Ratio for Single Carrier

4.1.2.5.1.1 Definition

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.

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.

NR adjacent channel leakage power ratio (NR_{ACLR}) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent NR channel frequency at nominal channel spacing.

UTRA adjacent channel leakage power ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

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.

4.1.2.5.1.2 Limits

4.1.2.5.1.2.1 NR ACLR

The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 4.1.2.5.1.2.1-0.

Table 4.1.2.5.1.2.1-0: NR ACLR measurement bandwidth

NR channel bandwidth / NR ACLR measurement bandwidth												
	5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
NR ACLR measurement bandwidth (MHz)	4,515	9,375	14,235	19,095	23,955	28,815	38,895	48,615	58,35	78,15	88,23	98,31

If the measured adjacent channel power is greater than -50 dBm then the NR_{ACLR} shall be higher than the value specified in Table 4.1.2.5.1.2.1-1.

Table 4.1.2.5.1.2.1-1: NR ACLR requirement

	Power class 1	**Power class 2**			**Power class 3**		
		BW ≤ 100 MHz			**BW ≤ 100 MHz**		
		f ≤ 3,0 GHz	**3,0 GHz < f ≤ 4,2 GHz**	**4,2 GHz < f ≤ 6,0 GHz**	**f ≤ 3,0 GHz**	**3,0 GHz < f ≤ 4,2 GHz**	**4,2 GHz < f ≤ 6,0 GHz**
NR_{ACLR}		30,2 dB	30,2 dB	30,2 dB	29,2 dB	29,2 dB	29,2 dB

4.1.2.5.1.2.2 UTRA ACLR

UTRA ACLR requirement is applicable when signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission*.

$UTRA_{ACLR}$ is specified for the first adjacent UTRA channel ($UTRA_{ACLR1}$) which centre frequency is ± 2,5 MHz from the NR channel edge and for the 2nd adjacent UTRA channel ($UTRA_{ACLR2}$) which centre frequency is ± 7,5 MHz from the NR channel edge.

The UTRA channel power is measured with an RRC filter with roll-off factor α =0,22 and bandwidth of 3,84 MHz. The assigned NR channel power is measured with a rectangular filter with measurement bandwidth specified in Table 4.1.2.5.1.2.1-0.

If the measured adjacent channel power is greater than -50 dBm then the $UTRA_{ACLR1}$ and $UTRA_{ACLR2}$ shall be higher than the value specified in Table 4.1.2.5.1.2.2-1.

Table 4.1.2.5.1.2.2-1: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	32,2 dB
$UTRA_{ACLR2}$	35,2 dB

4.1.2.5.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.4.1 of the present document.

4.1.2.5.2 Void

4.1.2.5.3 Void

4.1.2.5.4 Void

4.1.2.5.5 Transmitter Adjacent Channel Leakage Power Ratio for UL-MIMO

4.1.2.5.5.1 Definition

For UE supporting UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters is defined as the sum of the emissions from both UE transmit antenna connectors.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0_0 or by DCI format 0_1 for single antenna port codebook based transmission, the requirements in clause 4.1.2.5.1 apply.

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.

4.1.2.5.5.2 Limits

For UEs with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the requirements in clause 4.1.2.5.1 apply. The requirements shall be met with UL MIMO configurations described in clause 4.1.2.2.5.

4.1.2.5.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.4.5 of the present document.

4.1.2.6 Transmitter Spurious Emissions

4.1.2.6.1 Transmitter Spurious Emissions for Single Carrier

4.1.2.6.1.1 Definition

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.

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.

4.1.2.6.1.2 Limits

4.1.2.6.1.2.1 General spurious emissions

This clause specifies the requirements for the specified NR band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 4.1.2.6.1.2.1-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth. The spurious emission limits in Table 4.1.2.6.1.2.1-1 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

The measured average power of spurious emission shall not exceed the described value in Table 4.1.2.6.1.2.1-1.

Table 4.1.2.6.1.2.1-0: Boundary between NR out of band and general spurious emission domain

Channel bandwidth	OOB boundary F_{OOB} (MHz)
$BW_{Channel}$	$BW_{Channel}$ + 5

Table 4.1.2.6.1.2.1-1: General spurious emissions requirements

Frequency Range	Maximum Level	Measurement bandwidth	Note
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12,75 GHz	-30 dBm	1 MHz	4
	-25 dBm	1 MHz	3
12,75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
12,75 GHz < f < 26 GHz	-30 dBm	1 MHz	2
NOTE 1: Applies for Band for which the upper frequency edge of the UL Band is greater than 2,55 GHz and less than or equal to 5,2 GHz. NOTE 2: Applies for Band that the upper frequency edge of the UL Band more than 5,2 GHz. NOTE 3: Applies for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in clause 5.2B of ETSI TS 138 101-3 [8] when NS_04 is signalled. NOTE 4: Does not apply for Band n41, CA configurations including Band n41, and EN-DC configurations that include n41 specified in clause 5.2B of ETSI TS 138 101-3 [8] when NS_04 is signalled.			

4.1.2.6.1.2.2 Spurious emission for UE co-existence

This clause specifies the requirements for the specified NR band for coexistence with protected bands as indicated in Table 4.1.2.6.1.2.2-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth. The spurious emission limits in Table 4.1.2.6.1.2.2-1 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

The measured average power of spurious emission shall not exceed the described value in Table 4.1.2.6.1.2.2-1.

Table 4.1.2.6.1.2.2-1: Requirements for spurious emissions for UE co-existence

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
n1, n84	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 38, 40, 41, 42, 43, 50, 51, 65, 67, 68, 69, 75, 76, NR Band n78	FDL_low	-	FDL_high	-50	1	
	NR Band n77	FDL_low	-	FDL_high	-50	1	2
	E-UTRA Band 3, 34	FDL_low	-	FDL_high	-50	1	15
	Frequency range	1 880	-	1 895	-40	1	15, 27
	Frequency range	1 895	-	1 915	-15,5	5	15, 26, 27
	Frequency range	1 915	-	1 920	+1,6	5	15, 26, 27
n3, n80	E-UTRA Band 1, 7, 8, 20, 28, 31, 32, 33, 34, 38, 40, 41, 43, 50, 51, 65, 67, 68, 69, 75, 76.	FDL_low	-	FDL_high	-50	1	
	E-UTRA Band 3	FDL_low	-	FDL_high	-50	1	15
	E-UTRA Band 22, 42, NR Band n77, n78	FDL_low	-	FDL_high	-50	1	2
	Frequency range	1 884,5	-	1 915,7	-41	0,3	8
n7	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 34, 40, 42, 43, 50, 51, 65, 67, 68, 75, 76 NR Band n77, n78	FDL_low	-	FDL_high	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	15, 21, 26
	Frequency range	2 575	-	2 595	-15,5	5	15, 21, 26
	Frequency range	2 595	-	2 620	-40	1	15, 21
n8, n81	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 40, 50, 51, 65, 67, 68, 69, 75, 76	FDL_low	-	FDL_high	-50	1	
	E-UTRA band 3, 7, 22, 41, 42, 43, NR Band n77, n78	FDL_low	-	FDL_high	-50	1	2
	E-UTRA 8	FDL_low	-	FDL_high	-50	1	15
	Frequency range	1 884,5	-	1 915,7	-41	0,3	8
n20, n82	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 50, 51, 65, 67, 68, 75, 76	FDL_low	-	FDL_high	-50	1	
	E-UTRA Band 20	FDL_low	-	FDL_high	-50	1	15
	E-UTRA Band 38, 42, 69, NR Band n77, n78	FDL_low	-	FDL_high	-50	1	2
	Frequency range	758	-	788	-50	1	
n28, n83	E-UTRA Band 1, 22, 32, 42, 43, 50, 51, 65, 75, 76, NR Band n77, n78	FDL_low	-	FDL_high	-50	1	2
	E-UTRA Band 1	FDL_low	-	FDL_high	-50	1	19, 25
	E-UTRA Band 3, 7, 8, 20, 31, 34, 38, 40, 41	FDL_low	-	FDL_high	-50	1	
	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	1 884,5	-	1 915,7	-41	0,3	8, 19
n38	E-UTRA Band 1, 3, 8, 20, 22, 28, 31, 32, 33, 34, 40, 42, 43, 50, 51, 65, 67, 68, 75, 76	FDL_low	-	FDL_high	-50	1	
	Frequency range	2 620	-	2 645	-15,5	5	15, 22, 26
	Frequency range	2 645	-	2 690	-40	1	15, 22

NR Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
n40	E-UTRA Band 1, 3, 5, 7, 8, 20, 22, 28, 31, 32, 33, 34, 38, 41, 42, 43, 50, 51, 65, 67, 68, 69, 75, 76 NR Band n77, n78	FDL_low	-	FDL_high	-50	1	
n41	E-UTRA Band 1, 3, 8, 25, 28, 34, 42, 50, 51, 65, NR Band n77, n78	FDL_low	-	FDL_high	-50	1	
	Frequency range	1 884,5		1 915,7	-41	0,3	8
n50	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 34, 38, 40, 41, 42, 43, 65, 67, 68	FDL_low	-	FDL_high	-50	1	
n51	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 34, 38, 40, 41, 42, 43, 65, 67, 68	FDL_low	-	FDL_high	-50	1	
n65	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 38, 40, 41, 42, 43, 50, 51, 65, 68, 69, 75, 76, NR Band n78, n79	FDL_low	-	FDL_high	-50	1	
	NR Band n77	FDL_low	-	FDL_high	-50	1	2
	E-UTRA Band 34	FDL_low	-	FDL_high	-50	1	43
	Frequency range	1 900	-	1 915	-15,5	5	15, 26, 27a
	Frequency range	1 915	-	1 920	+1,6	5	15, 26, 27a
n77	E-UTRA Band 1, 3, 7, 8, 20, 28, 34, 39, 40, 41, 65	FDL_low	-	FDL_high	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	8
n78	E-UTRA Band 1, 3, 7, 8, 20, 28, 32, 34, 40, 41, 65, 75, 76	FDL_low	-	FDL_high	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	8

NOTE 1: FDL_low and FDL_high refer to each frequency band specified in Table 1.1-1 for NR band, Table 5.5-1 in ETSI TS 136 521-1 [11] for E-UTRA band.

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 4.1.2.6.1.2.1-1 are permitted for each assigned NR carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to the 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 (2 MHz + N x LCRB x RBsize kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the Measurement Bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: 15 kHz SCS is assumed when RB is mentioned in the note when channel bandwidth is less than or equal to 50 MHz, lowest SCS is assumed when channel bandwidth is larger than 50 MHz. The transmission bandwidth in terms of RB position and range is not limited to 15 kHz SCS and shall scale with SCS accordingly.

NOTES 4 to 7: N/A.

NOTE 8: Applicable when co-existence with PHS system operating in 1 884,5 - 1 915,7 MHz.

NOTES 9 to 14: N/A.

NOTE 15: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

NOTES 16 to 18: N/A.

NOTE 19: Applicable when the assigned NR 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 2 500 MHz - 2 570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 560,5 MHz - 2 562,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 552 MHz - 2 560 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 power class 3 UE for any channel bandwidths within the range 2 570 MHz - 2 615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 605,5 MHz - 2 607,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 597 MHz - 2 605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For power class 2 UE for any channel bandwidths within the range 2 570 MHz - 2 615 MHz, NS_44 shall apply. For power class 2 or 3 UE for carriers with channel bandwidth overlapping the frequency range 2 615 MHz - 2 620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE P-Max.

NOTE 23: N/A.

NR Band	Spurious emission for UE co-existence				
	Protected band	Frequency range (MHz)	Maximum Level (dBm)	MBW (MHz)	Note
NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned NR carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1 of ETSI TS 138 101-1 [6]) for which the 2nd 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 NR carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1 of ETSI TS 138 101-1 [6])) for which the 3rd 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 1 920 MHz - 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 MHz - 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 MHz - 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.					
NOTE 27a: This requirement is applicable for channel bandwidths up to 20 MHz within the range 1 920 MHz - 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when the carrier centre frequency is within the range 1 927,5 MHz - 1 929,5 MHz and for carriers of 20 MHz bandwidth when the carrier centre frequency is within the range 1 930 MHz - 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.					
NOTES 28 to 33: N/A.					
NOTE 34: This requirement is applicable for 5 and 10 MHz NR channel bandwidth allocated within 718 MHz - 728 MHz. 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 NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.					
NOTES 36 to 42: N/A.					
NOTE 43: This requirement is applicable for NR channel bandwidth allocated within 1 920 MHz - 1 980 MHz.					

NOTE: To simplify Table 4.1.2.6.1.2.2-1, E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation or both E-UTRA and NR operation in ETSI TS 138 101-1 [6] or ETSI TS 136 101 [14]. NR band numbers are listed for bands which are specified only for NR operation.

4.1.2.6.1.2.3 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.

This clause specifies the requirements for the specified NR band for an additional spectrum emission requirement with protected bands for different NS_values.

When "NS_04" is indicated in the cell (applicable to band n41):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-2 of ETSI TS 138 521-1 [1] for power class 2 UE, and Table 6.2.3.5-3 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-1. This requirement also applies to the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-1: Additional requirements for "NS_04"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	10, 15, 20, 40, 50, 60, 80, 90, 100	
2 495 ≤ f < 2 496	-13	1 % of Channel BW
2 490,5 ≤ f < 2 495	-13	1 MHz
0,009 < f < 2 490,5	-25	1 MHz

When "NS_17" is indicated in the cell (applicable to bands n28, n83):

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-2. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-2: Additional requirements for "NS_17"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10 MHz	
470 ≤ f ≤ 710	-26,2	6 MHz
NOTE: 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.		

When "NS_18" is indicated in the cell (applicable to bands n28, n83):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-8 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-3. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-3: Additional requirements for "NS_18"

Frequency range (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 30 MHz	
692 - 698	-26,2	6 MHz

When "NS_05" or "NS_05U" is indicated in the cell (applicable to bands n1, n65, n84):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-6 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-4. This requirement also applies to the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-4: Additional requirements for "NS_05" and "NS_05U"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20	
1 884,5 ≤ f ≤ 1 915,7	-41	300 kHz

When "NS_43" or "NS_43U" is indicated in the cell (applicable to bands n8, n81):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-10 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-5. This requirement also applies to the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-5: Additional requirement for "NS_43" and "NS_43U"

Frequency range (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15	
860 ≤ f ≤ 890	-40	1 MHz
NOTE: Applicable for 5 MHz and 15 MHz channel BW confined between 900 MHz and 915 MHz and for 10 MHz channel BW confined between 905 MHz and 915 MHz.		

When "NS_41" is indicated in the cell (applicable to band n50):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-20 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-6. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-6: Additional requirements for NR channels assigned within 1 432 MHz - 1 517 MHz for "NS_41"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 40, 50, 60	
1 400 ≤ f ≤ 1 427	-32	27 MHz
NOTE: This requirement shall be verified with UE transmission power of 15 dBm.		

When "NS_42" is indicated in the cell (applicable to band n50):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-21 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-7. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-7: Additional requirements for NR channels assigned within 1 432-1 517 MHz for "NS_42"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20, 40, 50, 60	
1 518 ≤ f ≤ 1 520	-0,8	1 MHz
1 520 < f ≤ 1 559	-30	1 MHz

When "NS_24" is indicated in the cell (applicable to band n65):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-17 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-8. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth.

Table 4.1.2.6.1.2.3-8: Additional requirements for "NS_24"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz, 15 MHz, 20 MHz	
2 010 ≤ f ≤ 2 025	-50	1 MHz
NOTE: 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.		

When "NS_47" is indicated in the cell (applicable to band n41):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-22 of ETSI TS 138 521-1 [1] for power class 3 UE.

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-23 of ETSI TS 138 521-1 [1] for power class 2 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-9. This requirement applies when the NR carrier is within 2 545 MHz - 2 575 MHz. In the current release the requirement in Table 4.1.2.6.1.2.3-9 applies for 30 MHz channel bandwidth.

Table 4.1.2.6.1.2.3-9: Additional requirement for "NS_47"

Frequency band (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)	Measurement bandwidth
	30	
2 530 ≤ f ≤ 2 535	-25	1 MHz
2 505 ≤ f ≤ 2 530	-30	1 MHz

When "NS_48" is indicated in the cell (applicable to bands n1, n84):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-24 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-10. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth. In the present release the requirement in Table 4.1.2.6.1.2.3-10 is applicable for 25, 30, 40 and 50 MHz channel bandwidths.

Table 4.1.2.6.1.2.3-10: Additional requirements for "NS_48"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)
E-UTRA band 34 NR band n34	FDL_low	-	FDL_high	-50	1
Frequency range (note)	1 900	-	1 915	-15,5	5
Frequency range (note)	1 915	-	1 920	+1,6	5
NOTE: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.					

When "NS_49" is indicated in the cell (applicable to bands n1, n84):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-33 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-11. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth. In the present release the requirement in Table 4.1.2.6.1.2.3-11 is applicable for 25, 30, 40 and 50 MHz channel bandwidths.

Table 4.1.2.6.1.2.3-11: Additional requirements for "NS_49"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)
E-UTRA band 34 NR band n34	FDL_low	-	FDL_high	-50	1
Frequency range	1 880	-	1 895	-40	1
Frequency range (note)	1 895		1 915	-15,5	5
Frequency range (note)	1 915	-	1 920	1,6	5
NOTE: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.					

When "NS_44" is indicated in the cell (applicable to band n38):

The measured UE mean power in the channel bandwidth shall fulfil requirements in Table 6.2.3.5-31 of ETSI TS 138 521-1 [1] for power class 3 UE.

The power of any UE emission shall not exceed the levels specified in Table 4.1.2.6.1.2.3-12. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 from the edge of the channel bandwidth. In the present release the requirement in Table 4.1.2.6.1.2.3-12 is applicable for 25, 30 and 40 MHz channel bandwidths.

Table 4.1.2.6.1.2.3-12: Additional requirements for "NS_44"

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2 620	-	2 645	-15,5	5	1, 2
Frequency range	2 645	-	2 690	-40	1	1
NOTE 1: This requirement is applicable for carriers confined in 2 570 MHz - 2 615 MHz. NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.						

4.1.2.6.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.5.1 of the present document.

4.1.2.6.2 Void

4.1.2.6.3 Void

4.1.2.6.4 Void

4.1.2.6.5 Transmitter Spurious Emissions for UL-MIMO

4.1.2.6.5.1 Definition

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.

If UE is configured for transmission on a single-antenna port, the requirements in clause 4.1.2.6.1 apply.

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.

4.1.2.6.5.2 Limits

For UEs with two transmit antenna connectors in a closed-loop spatial multiplexing scheme, the requirements specified in clause 4.1.2.6.1 apply. The requirements shall be met with the UL MIMO configurations described in clause 4.1.2.2.5.

4.1.2.6.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.5.5 of the present document.

4.1.2.7 Receiver Reference Sensitivity Level

4.1.2.7.1 Receiver Reference Sensitivity Level for single carrier

4.1.2.7.1.1 Definition

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

In later subclauses of clause 4 where the value of REFSENS is used as a reference to set the corresponding requirement:

- in all bands, the UE shall be verified against those requirements by applying the REFSENS value in Table 4.1.2.7.1.2-1with 2 Rx antenna ports tested;
- for bands where the UE is required to be equipped with 4 Rx antenna ports, the UE shall additionally be verified against those requirements by applying the resulting REFSENS value derived from the requirement in Table 4.1.2.7.1.2-2 with 4 Rx antenna ports tested.

4.1.2.7.1.2 Limits

The throughput shall be $\geq$ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2.2, A.2.3.2, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2.

Table 4.1.2.7.1.2-1: Two antenna port reference sensitivity

Operating band / SCS / Channel bandwidth / Duplex-mode														
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**	**Duplex Mode**
n1	15	-99,3	-96,1	-94,3	-93,1	-92,0	-91,2	-89,9	-88,9					FDD
	30		-96,4	-94,4	-93,3	-92,1	-91,3	-90,0	-89,0					
	60		-96,8	-94,7	-93,5	-92,3	-91,4	-90,2	-89,0					
n3	15	-96,3	-93,1	-91,3	-90,1	-89	-88,2							FDD
	30		-93,4	-91,4	-90,3	-89,1	-88,3							
	60		-93,8	-91,7	-90,5	-89,3	-88,4							
n7 (note 1)	15	-97,3	-94,1	-92,3	-91,1									FDD
	30		-94,4	-92,4	-91,3									
	60		-94,8	-92,7	-91,5									
n8	15	-96,3	-93,1	-90,7	-85,1									FDD
	30		-93,4	-91	-86,5									
	60													
n20	15	-96,3	-93,1	-90,3	-89,1									FDD
	30		-93,4	-90,4	-89,3									
	60													
n28	15	-97,8	-94,8	-92,8	-90,1									FDD
	30		-94,9	-92,9	-90,3									
	60													
n38 (note 1)	15	-99,3	-96,1	-94,3	-93,0	-92,0	-90,5	-89,4						TDD
	30		-96,4	-94,4	-93,1	-92,1	-90,6	-89,4						
	60		-96,8	-94,7	-93,4	-92,3	-90,8	-89,6						
n40	15	-99,3	-96,1	-94,3	-93,0	-92,0	-91,2	-89,9	-89,0					TDD
	30		-96,4	-94,4	-93,1	-92,1	-91,3	-89,9	-89,0	-88,1	-86,8			
	60		-96,8	-94,7	-93,4	-92,3	-91,4	-90,1	-89,1	-88,2	-86,9			
n41 (note 1)	15		-93,9	-92,1	-90,8		-88,3	-87,7	-86,8					TDD
	30		-94,4	-92,4	-91,1		-89,6	-87,9	-87,0	-86,1	-84,8	-84,3	-83,8	
	60		-94,8	-92,7	-91,4		-88,8	-88,1	-87,1	-86,2	-84,9	-84,4	-83,9	
n50	15	-99,3	-96,1	-94,3	-93,0			-89,9	-89,0					TDD
	30		-96,4	-94,4	-93,1			-89,9	-89,0	-88,1	-86,8			
	60		-96,8	-94,7	-93,4			-90,1	-89,1	-88,2	-86,9			
n51	15	-99,3												TDD
	30													
	60													
n65	15	-98,8	-95,6	-93,8	-92,6									FDD
	30		-95,9	-93,9	-92,8									
	60		-96,3	-94,2	-93									

Operating band / SCS / Channel bandwidth / Duplex-mode														
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**	**Duplex Mode**
n77 (notes 1&4)	15		-94,1	-92,3	-91,0			-87,9	-87,0					TDD
	30		-94,6	-92,6	-91,3			-88,1	-87,2	-86,3	-85,0	-84,5	-84,0	
	60	-	-95,0	-92,9	-91,6			-88,3	-87,3	-86,4	-85,1	-84,6	-84,1	
n78 (note 1)	15		-94,6	-92,8	-91,5			-88,4	-87,5					TDD
	30		-95,1	-93,1	-91,8			-88,6	-87,7	-86,8	-85,5	-85,0	-84,5	
	60		-95,5	-93,4	-92,1			-88,8	-87,8	-86,9	-85,6	-85,1	-84,6	
NOTE 1: Four Rx antenna ports shall be the baseline for this operating band except for two Rx vehicular UE.														
NOTE 2: The transmitter shall be set to P_{UMAX} as defined in clause 6.2.4 of ETSI TS 138 101-1 [6].														
NOTE 3: The requirement is modified by -0,5 dB when the assigned NR channel bandwidth is confined within 1 475,9 MHz - 1 510,9 MHz.														
NOTE 4: The requirement is modified by -0,5 dB when the assigned UE channel bandwidth is confined within 3 300 MHz - 3 800 MHz.														

For UE(s) equipped with 4 Rx antenna ports, reference sensitivity for 2Rx antenna ports in Table 4.1.2.7.1.2-1 shall be modified by the amount given in $\Delta R_{IB,4R}$ in Table 4.1.2.7.1.2-2 for the applicable operating bands.

Table 4.1.2.7.1.2-2: Four antenna port reference sensitivity allowance $\Delta R_{IB,4R}$

Operating band	$\Delta R_{IB,4R}$ (dB)
n1, n3, n40, n7, n38, n41	-2,7
n77, n78	-2,2

The reference sensitivity (REFSENS) requirement specified in Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 4.1.2.7.1.2-3.

Table 4.1.2.7.1.2-3: Uplink configuration for reference sensitivity

Operating band / SCS / Channel bandwidth / Duplex mode														
Operating Band	**SCS kHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**	**Duplex Mode**
n1	15	25	50[1]	75[1]	100[1]	128[1]	128[1]	128[1]	128[1]					FDD
	30		24	36[1]	50[1]	64[1]	64[1]	64[1]	64[1]					
	60		10[1]	18	24	30[1]	30[1]	30[1]	30[1]					
n3	15	25	50[1]	50[1]	50[1]	50[1]	50[1]							FDD
	30		24	24[1]	24[1]	24[1]	24[1]							
	60		10[1]	10[1]	10[1]	10[1]	10[1]							
n7	15	25	50[1]	75[1]	75[1]									FDD
	30		24	36[1]	36[1]									
	60		10[1]	18	18[1]									
n8	15	25	25[1]	20[1]	20[1]									FDD
	30		12[1]	10[1]	10[1]									
	60													
n20	15	25	20[1]	20[2]	20[2]									FDD
	30		10[1]	10[2]	10[2]									
	60													
n28	15	25	25[1]	25[1]	25[1]									FDD
	30		10[1]	10[1]	10[1]									
	60													
n38	15	25	50	75	100	128	160	216						TDD
	30		24	36	50	64	75	100						
	60		10	18	24	30	36	50						
n40	15	25	50	75	100	128	160	216	270					TDD
	30		24	36	50	64	75	100	128	162	216			
	60		10	18	24	30	36	50	64	75	100			
n41	15		50	75	100		160	216	270					TDD
	30		24	36	50		75	100	128	162	216	243	270	
	60		10	18	24		36	50	64	75	100	120	135	
n50	15	25	50	75	100			216	270					TDD
	30		24	36	50			100	128	162	note 3			
	60		10	18	24			50	64	75	note 3			
n51	15	25												TDD
	30													
	60													
n65	15	25	50[1]	75[1]	100[1]									FDD
	30		24	36[1]	50[1]									
	60		10[1]	18	24									
n77	15		50	75	100			216	270					TDD
	30		24	36	50			100	128	162	216	243	270	
	60		10	18	24			50	64	75	100	120	135	
n78	15		50	75	100			216	270					TDD
	30		24	36	50			100	128	162	216	243	270	
	60		10	18	24			50	64	75	100	120	135	

Operating band / SCS / Channel bandwidth / Duplex mode														
Operating Band	**SCS kHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**	**Duplex Mode**
NOTE 1: 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 5.3.2-1 of ETSI TS 138 101-1 [6]).														
NOTE 2: For Band 20; for 15 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16; for 30 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 6 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 8; for 60 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 3 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RBstart 4;													
NOTE 3: For DL channel bandwidths that do not have symmetric UL channel bandwidth, the highest valid UL configuration with the lowest duplex distance shall be used.														

4.1.2.7.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.6 of the present document.

4.1.2.7.2 Void

4.1.2.7.3 Void

4.1.2.7.4 Void

4.1.2.7.5 Receiver Reference Sensitivity Level for UL-MIMO

For UE with two transmitter antenna connectors in a closed-loop spatial multiplexing scheme, the minimum requirements specified in clause 4.1.2.7.1 shall be met with the UL MIMO configurations described in clause 4.1.2.2.5 and the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2 and A.2.3 for CP-OFDM waveforms shall apply. For UL MIMO, the parameter P_{UMAX} is the total transmitter power over the two transmits power over the two transmit antenna connectors.

4.1.2.8 Receiver Adjacent Channel Selectivity (ACS)

4.1.2.8.1 Receiver Adjacent Channel Selectivity (ACS) for single carrier

4.1.2.8.1.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an NR 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).

4.1.2.8.1.2 Limits

The UE shall fulfil the minimum requirements specified in Table 4.1.2.8.1.2-1 for NR bands with $F_{DL\_high} < 2\,700$ MHz and $F_{UL\_high} < 2\,700$ MHz and the minimum requirements specified in Table 4.1.2.8.1.2-2. for NR bands with $F_{DL\_low} \geq 3\,300$ MHz and $F_{UL\_low} \geq 3\,300$ MHz. These requirements apply for all values of an adjacent channel interferer up to -25 dBm and for any SCS specified for the channel bandwidth of the wanted signal. However, it is not possible to directly measure the ACS; instead, the lower and upper range of test parameters are chosen as in Table 4.1.2.8.1.2-3 and Table 4.1.2.8.1.2-4 for verification of the requirements specified in Table 4.1.2.8.1.2-1, and as in Table 4.1.2.8.1.2-5 and Table 4.1.2.8.1.2-6 for verification of the requirements specified in Table 4.1.2.8.1.2-2. For these test parameters, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1). For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.8.1.2-1: ACS for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
ACS	dB	33	33	30	27	26
RX parameter	Units	Channel bandwidth				
		30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
ACS	dB	25,5	24	23	22,5	21
RX parameter	Units	Channel bandwidth				
		90 MHz	100 MHz			
ACS	dB	20,5	20			

Table 4.1.2.8.1.2-2: ACS for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
ACS	dB	33	33	33	33	33
RX parameter	Units	Channel bandwidth				
		60 MHz	80 MHz	90 MHz	100 MHz	
ACS	dB	33	33	33	33	

Table 4.1.2.8.1.2-3: Test parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz, case 1

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45,5 dB	REFSENS + 45,5 dB	REFSENS + 42,5 dB	REFSENS + 39,5 dB	REFSENS + 38,5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7,5 / -7,5	10 / -10	12,5 / -12,5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 38 dB	REFSENS + 36,5 dB	REFSENS + 35,5 dB	REFSENS + 35 dB	REFSENS + 33,5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17,5 / -17,5	22,5 / -22,5	27,5 / -27,5	32,5 / -32,5	42,5 / -42,5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 33 dB	REFSENS + 32,5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47,5 / -47,5	52,5 / -52,5			

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].						
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS.						
NOTE 3: The interferer consists of the NR interferer RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.						

Table 4.1.2.8.1.2-4: Test parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz, case 2

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	-56,5	-56,5	-53,5	-50,5	-49,5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7,5 / -7,5	10 / -10	12,5 / -12,5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	-49	-47	-46,5	-46	-44,5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17,5 / -17,5	22,5 / -22,5	27,5 / -27,5	32,5 / -32,5	42,5 / -42,5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	-44	-43,5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47,5 / -47,5	52,5 / -52,5			
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].						
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS.						
NOTE 3: The interferer consists of the RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.						

Table 4.1.2.8.1.2-5: Test parameters for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz, case 1

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45,5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45,5 dB	REFSENS + 45,5 dB	REFSENS + 45,5 dB	REFSENS + 45,5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil |F_{\text{interferer}}| / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.

Table 4.1.2.8.1.2-6: Test parameters for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz, case 2

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	-56,5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	-56,5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil |F_{\text{interferer}}| / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.
NOTE 3: The interferer consists of the RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.

4.1.2.8.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.7 of the present document.

4.1.2.8.2 Void

4.1.2.8.3 Void

4.1.2.8.4 Void

4.1.2.8.5 Receiver Adjacent Channel Selectivity (ACS) for UL-MIMO

For UE(s) with two transmitter antenna connectors in a closed-loop spatial multiplexing scheme, the minimum requirements specified in clause 4.1.2.8.1 shall be met with the UL-MIMO configurations described in clause 4.1.2.2.5. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

4.1.2.9 Receiver Blocking Characteristics

4.1.2.9.1 Receiver Blocking characteristics for single carrier

4.1.2.9.1.1 Definition

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 occurs.

4.1.2.9.1.2 Limits

4.1.2.9.1.2.1 In-band blocking

For NR bands with $F_{DL\_high} < 2\,700$ MHz and $F_{UL\_high} < 2\,700$ In-Band Blocking (IBB)is defined for an unwanted interfering signal within the range of 15 MHz below and 15 MHz above the UE receive band.

The throughput of the wanted signal shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.9.1.2.1-1 and Table 4.1.2.9.1.2.1-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.9.1.2.1-1: In-band blocking parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
$BW_{interferer}$	MHz	5				
$F_{loffset,\ case\ 1}$	MHz	7,5				
$F_{loffset,\ case\ 2}$	MHz	12,5				
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	11	12	13	14	15
$BW_{interferer}$	MHz	5				
$F_{loffset,\ case\ 1}$	MHz	7,5				
$F_{loffset,\ case\ 2}$	MHz	12,5				
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	15,5	16			
$BW_{interferer}$	MHz	5				
$F_{loffset,\ case\ 1}$	MHz	7,5				
$F_{loffset,\ case\ 2}$	MHz	12,5				

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].
NOTE 2: The interferer consists of the RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1 and 15 kHz SCS.

Table 4.1.2.9.1.2.1-2: In-band blocking for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3
	$P_{interferer}$	dBm	-56	-44	-15
	$F_{interferer}$ (offset)	MHz	$-BW_{Channel}/2 - F_{loffset,\ case\ 1}$ and $BW_{Channel}/2 + F_{loffset,\ case\ 1}$	$\leq -BW_{Channel}/2 - F_{loffset,\ case\ 2}$ and $\geq BW_{Channel}/2 + F_{loffset,\ case\ 2}$	
n1, n3, n7, n8, n20, n28, n38, n40, n41, n50, n51, n65, n75, n76	$F_{interferer}$	MHz	note 2	F_{DL_low} - 15 to F_{DL_high} + 15	
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0{,}5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{Channel}/2 - F_{loffset,\ case\ 1}$; b: $BW_{Channel}/2 + F_{loffset,\ case\ 1}$.					

For NR bands with $F_{DL\_low} \geq 3\ 300$ MHz and $F_{UL\_low} \geq 3\ 300$ MHz In-Band Blocking (IBB) is defined for an unwanted interfering signal falling into the UE receive band or into an immediately adjacent frequency range up to $3 \times BW_{Channel}$ below or above the UE receive band with $BW_{Channel}$ is the bandwidth of the wanted signal. The throughput of the wanted signal shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.9.1.2.1-3 and Table 4.1.2.9.1.2.1-4. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 4.1.2.9.1.2.1-3: In-band blocking parameters for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{loffset,\ case\ 1}$	MHz	15	22,5	30	60	75
$F_{loffset,\ case\ 2}$	MHz	25	37,5	50	100	125
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6				
$BW_{interferer}$	MHz	60	80	90	100	
$F_{loffset,\ case\ 1}$	MHz	90	120	135	150	
$F_{loffset,\ case\ 2}$	MHz	150	200	225	250	
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6]. NOTE 2: The interferer consists of the RMC specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.						

Table 4.1.2.9.1.2.1-4: In-band blocking for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78	$F_{interferer}$ (offset)	MHz	-$BW_{Channel}$/2 - $F_{loffset, case\ 1}$ and $BW_{Channel}$/2 + $F_{loffset, case\ 1}$	≤ -$BW_{Channel}$/2 - $F_{loffset, case\ 2}$ and ≥ $BW_{Channel}$/2 + $F_{loffset, case\ 2}$
	$F_{interferer}$		Note 2	F_{DL_low} - 3 × $BW_{Channel}$ to F_{DL_high} + 3 × $BW_{Channel}$
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0{,}5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: - $BW_{Channel}$/2 - $F_{loffset, case\ 1}$; b: $BW_{Channel}$/2 + $F_{loffset, case\ 1}$. NOTE 3: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal.				

4.1.2.9.1.2.2 Out-of-band blocking

For NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band. The throughput of the wanted signal shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.9.1.2.2-1 and Table 4.1.2.9.1.2.2-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.9.1.2.2-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	15,5	16			
NOTE: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].						

Table 4.1.2.9.1.2.2-2: Out-of-band blocking for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n3, n7, n8, n20, n28, n38, n40, n41, n50, n51, n65, n75, n76	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f - F_{DL_low} < -15 or 15 < f - F_{DL_high} < 60	-85 < f - F_{DL_low} ≤ -60 or 60 ≤ f - F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} - 85 or F_{DL_high} + 85 ≤ f ≤ 12 750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6 000 MHz.					
NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50.					
NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75.					
NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38.					
NOTE 5: Void.					
NOTE 6: Void.					
NOTE 7: Void.					

For interferer frequencies across ranges 1, 2 and 3 in Table 4.1.2.9.1.2.2-2, a maximum of:

$$\lfloor max\{24{,}6 \cdot \lceil n \cdot N_{RB}/6 \rceil\}/min\{\lfloor n \cdot N_{RB}/10 \rfloor, 5\} \rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min(BW_{channel}/2, 5)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ is the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 4.1.2.10 apply.

For NR bands with $F_{DL\_low} \geq$ 3 300 MHz and $F_{UL\_low} \geq$ 3 300 MHz out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range up to 3 × $BW_{Channel}$ below or from 3 × $BW_{Channel}$ above the UE receive band, where $BW_{Channel}$ is the channel bandwidth. The throughput of the wanted signal shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.9.1.2.2-3 and Table 4.1.2.9.1.2.2-4. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 4.1.2.9.1.2.2-3: Out-of-band blocking parameters for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].						

Table 4.1.2.9.1.2.2-4: Out of-band blocking for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (note 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_low} \leq -3 \times BW_{Channel}$ or $3 \times BW_{Channel} \leq f - F_{DL\_high} < 60$	$-200 < f - F_{DL\_low} \leq -MAX(60, 3 \times BW_{Channel})$ or $MAX(60, 3 \times BW_{Channel}) \leq f - F_{DL\_high} < 200$	$1 \leq f \leq F_{DL\_low} - MAX(200, 3 \times BW_{Channel})$ or $F_{DL\_high} + MAX(200, 3 \times BW_{Channel}) \leq f \leq 12\,750$
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6 000 MHz.					
NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal.					
NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2 700 MHz and $F_{Interferer}$ < 4 800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3 × $BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3 × $BW_{Channel}$ from the band edge.					
NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3 650 MHz and $F_{Interferer}$ < 5 750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3 × $BW_{Channel}$ from the band edge.					

For interferer frequencies across ranges 1, 2 and 3 in Table 4.1.2.9.1.2.2-4, a maximum of:

$$\lfloor max\{24{,}6 \cdot \lceil n \cdot N_{RB}/6 \rceil\}/min\{\lfloor n \cdot N_{RB}/10 \rfloor, 5\}\rfloor$$

Exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min(BW_{channel}/2, 5)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 4.1.2.10 apply.

4.1.2.9.1.2.3 Narrow band blocking

This requirement is the measure of a receiver's ability to receive a NR 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.

The relative throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.9.1.2.3-1. For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.9.1.2.3-1: Narrow Band Blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
n1, n3, n7, n8, n20, n28, n38, n40, n41, n50, n51, n65, n75, n76	P_w	dBm		$P_{REFSENS}$ + channel-bandwidth specific value below										
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55
	F_{uw} (offset SCS= 15 kHz)	MHz	2,7075	5,2125	7,7025	10,2075	13,0275	15,6075	20,5575	25,7025	NA	NA	NA	NA
	F_{uw} (offset SCS= 30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	NA	30,855	40,935	45,915	50,865
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].														
NOTE 2: Reference measurement channel is specified in ETSI TS 138 101-1 [6], clauses A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1.														
NOTE 3: The $P_{REFSENS}$ power level is specified in Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2 for two and four antenna ports, respectively.														

4.1.2.9.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.7 of the present document.

4.1.2.9.2 Void

4.1.2.9.3 Void

4.1.2.9.4 Void

4.1.2.9.5 Receiver Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in a closed-loop spatial multiplexing scheme, the minimum requirements specified in clause 4.1.2.9.1 shall be met with the UL-MIMO configurations described in clause 4.1.2.2.5. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

4.1.2.10 Receiver Spurious Response

4.1.2.10.1 Receiver Spurious Response for single carrier

4.1.2.10.1.1 Definition

Spurious response is a measure of the ability of the receiver 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 for which a response is obtained, i.e. for which the out-of-band blocking limit as specified in clause 4.1.2.9.1 is not met.

4.1.2.10.1.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses 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 ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters for the wanted signal as specified in Table 4.1.2.10.1.2-1 for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz and in Table 4.1.2.10.1.2-2 for NR bands with F_{DL_high} ≥ 3 300 MHz and F_{UL_high} ≥ 3 300 MHz and for the interferer as specified in Table 4.1.2.10.1.2-3. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.10.1.2-1: Spurious response parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15,5	16			
NOTE: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 in ETSI TS 138 101-1 [6].						

Table 4.1.2.10.1.2-2: Spurious response parameters for NR bands with $F_{DL\_low} \geq 3\,300$ MHz and $F_{UL\_low} \geq 3\,300$ MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2.3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 in ETSI TS 138 101-1 [6]						

Table 4.1.2.10.1.2-3: Spurious response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

4.1.2.10.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.9.1 of the present document.

4.1.2.10.2 Void

4.1.2.10.3 Void

4.1.2.10.4 Void

4.1.2.10.5 Receiver spurious response for UL-MIMO

4.1.2.10.5.1 Definition

Spurious response verifies the ability of the UE that supports UL MIMO 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 for UL MIMO limit as specified in clause 4.1.2.9.5 is not met.

4.1.2.10.5.2 Limits

The throughput measurement derived in the test procedure shall be $\geq$ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 521-1 [1], clause A.3 with parameters specified in Tables 4.1.2.10.5-1 and 4.1.2.10.5-2.

Table 4.1.2.10.5-1: Spurious response parameters

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	30 MHz	40 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		50 MHz	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	9	9	9	9	9
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} with P_{CMAX_L} as defined in clause 6.2.4 of ETSI TS 138 101-1 [6].						
NOTE 2: The reference measurement channel is specified in clause A.3 of ETSI TS 138 101-1 [6] with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in clauses A.5.1.1/A.5.2.1 in ETSI TS 138 101-1 [6].						

Table 4.1.2.10.5-2: Spurious Response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

4.1.2.10.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.9 of the present document.

4.1.2.11 Receiver Intermodulation Characteristic

4.1.2.11.1 Receiver Intermodulation Characteristic for single carrier

4.1.2.11.1.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

4.1.2.11.1.2 Limits

The wideband intermodulation requirement is defined using a CW carrier and modulated NR signal as interferer 1 and interferer 2 respectively.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1) with parameters specified in Table 4.1.2.11.1.2-1 for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz and Table 4.1.2.11.1.2-2 for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 1.1-1), the requirements only apply for carriers assigned in the paired part.

Table 4.1.2.11.1.2-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2 700 MHz and F_{UL_high} < 2 700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16
$P_{Interferer\ 1}$ (CW)	dBm	-46											
$P_{Interferer\ 2}$ (Modulated)	dBm	-46											
$BW_{Interferer\ 2}$	MHz	5											
$F_{Interferer\ 1}$ (Offset)	MHz	- $BW_{Channel}$ /2 - 7,5 / + $BW_{Channel}$ /2 + 7,5											
$F_{Interferer\ 2}$ (Offset)	MHz	2 × $F_{Interferer\ 1}$											

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].
NOTE 2: Reference measurement channel is specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6] clauses A.5.1.1/A.5.2.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1 and 15 kHz SCS.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

Table 4.1.2.11.1.2-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3 300 MHz and F_{UL_low} ≥ 3 300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	$BW_{Channel}$							
$F_{Interferer\ 1}$ (Offset)	MHz	$-2 \times BW_{Channel}$ / $+2 \times BW_{Channel}$							
$F_{Interferer\ 2}$ (Offset)	MHz	$2 \times F_{Interferer\ 1}$							

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 4.1.2.7.1.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 of ETSI TS 138 101-1 [6].

NOTE 2: Reference measurement channel is specified in ETSI TS 138 101-1 [6], clauses A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1).

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in ETSI TS 138 101-1 [6], clauses A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 138 101-1 [6], clauses A.5.1.1/A.5.2.1 and the same SCS as the wanted signal.

NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

4.1.2.11.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.10 of the present document.

4.1.2.11.2 Void

4.1.2.11.3 Void

4.1.2.11.4 Void

4.1.2.11.5 Receiver Intermodulation Characteristic for UL-MIMO

For UE(s) with two transmitter antenna connectors in a closed-loop spatial multiplexing scheme, the minimum requirements in clause 4.1.2.11.1 shall be met with the UL-MIMO configurations described in clause 4.1.2.2.5. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

4.1.2.12 Receiver Spurious Emissions

4.1.2.12.1 Receiver Spurious Emissions for single carrier

4.1.2.12.1.1 Definition

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

4.1.2.12.1.2 Limits

The power of any spurious emission shall not exceed the maximum level specified in Table 4.1.2.12.1.2-1.

Table 4.1.2.12.1.2-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	Note
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12,75 GHz	1 MHz	-47 dBm	
12,75 GHz ≤ f ≤ 5th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	2
12,75 GHz - 26 GHz	1 MHz	-47 dBm	3
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in ETSI TS 138 101-1 [6] clause C.3.1. NOTE 2: Applies for Band that the upper frequency edge of the DL Band more than 2,69 GHz. NOTE 3: Applies for Band that the upper frequency edge of the DL Band more than 5,2 GHz.			

4.1.2.12.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.11 of the present document.

4.1.2.12.2 Void

4.1.2.12.3 Void

4.1.2.12.4 Void

4.1.2.13 Transmit OFF Power

4.1.2.13.1 Transmit OFF Power for Single Carrier

4.1.2.13.1.1 Definition

Transmit OFF power is defined as the mean power in the channel bandwidth when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of its ports. An excess transmit OFF power potentially increases the Rise Over Thermal (ROT) and therefore reduces the cell coverage area for other UEs.

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1 ms) excluding any transient periods.

4.1.2.13.1.2 Limits

The transmit OFF power shall not exceed the values specified in Table 4.1.2.13.1.2-1.

Table 4.1.2.13.1.2-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)		Measurement bandwidth (MHz)
	f ≤ 3,0 GHz	3,0 GHz < f ≤ 6,0 GHz	
5	-48,5	-48,2	4,515
10	-48,5	-48,2	9,375
15	-48,5	-48,2	14,235
20	-48,5	-48,2	19,095
25	-48,5	-48,2	23,955
30	-48,5	-48,2	28,815
40	-48,5	-48,2	38,895
50	-48,3	-48,2	48,615
60	-48,3	-48,2	58,35
80	-48,3	-48,2	78,15
90	-48,3	-48,2	88,23
100	-48,3	-48,2	98,31

4.1.2.13.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.12.1 of the present document.

4.1.2.13.2 Void

4.1.2.13.3 Void

4.1.2.13.4 Void

4.1.2.13.5 Transmit OFF Power for UL-MIMO

4.1.2.13.5.1 Definition

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1 ms) excluding any transient periods.

4.1.2.13.5.2 Limits

The transmit OFF power at each transmit antenna connector shall not exceed the values specified in clause 4.1.2.13.1.

4.1.2.13.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.1.3.12.5 of the present document.

4.2 Technical requirements specification for Frequency Range 2

4.2.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2.2 Conformance requirements

4.2.2.0 General

The requirements in the present document are based on the assumption that the operating band (see tables 1.2-1 through 1.2-5) is shared between systems of the IMT family (for band 3 and 8 also GSM) or systems having compatible characteristics.

4.2.2.1 Introduction

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.2] for IMT User Equipment (UE), a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.12] have been identified. Table 4.2.2.1-1 provides a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 4.2.2.1-1: Cross references

Essential parameter	Corresponding technical requirements	Corresponding test suite
Transmitter spectrum mask	4.2.2.4 Transmitter spectrum emissions mask	5.2.3.3
Transmitter unwanted emissions in the out-of-band domain	4.2.2.5 Transmitter adjacent channel leakage power ratio	5.2.3.4
Transmitter unwanted emissions in the spurious domain	4.2.2.6 Transmitter spurious emissions	5.2.3.5
Transmitter power limits	4.2.2.2 Transmitter maximum output power	5.2.3.1
Transmitter Power Control (TPC)	4.2.2.3 Transmitter minimum output power	5.2.3.2
Transmitter power accuracy	4.2.2.2 Transmitter maximum output power	5.2.3.1
Receiver unwanted emissions in the spurious domain	4.2.2.10 Receiver spurious emissions	5.2.3.9
Receiver blocking	4.2.2.9 Receiver Blocking characteristics	5.2.3.8
Receiver desensitization		
Receiver adjacent signal selectivity	4.2.2.8 Receiver Adjacent Channel Selectivity (ACS)	5.2.3.7
Receiver sensitivity	4.2.2.7 Receiver Reference Sensitivity Level	5.2.3.6
Equipment operating under the control of a network	ETSI EN 301 908-1 [i.12], clause 4.2.4 Control and Monitoring functions	

Unless otherwise stated, the transmitter characteristics are specified Over The Air (OTA) with a single or multiple transmit chains and the receiver characteristics are specified OTA as well.

4.2.2.2 Transmitter Maximum Output Power

4.2.2.2.1 Transmitter maximum output power for Single Carrier

4.2.2.2.1.0 General

Power class 1, 2, 3 and 4 are specified based on the assumption of certain UE types with specific device architectures. The UE types can be found in Table 4.2.2.2.1.0-1.

Table 4.2.2.2.1.0-1: Assumption of UE Types

UE Power class	UE type
1	Fixed wireless access (FWA) UE
2	Vehicular UE
3	Handheld UE
4	High power non-handheld UE

Power class 3 is the default power class.

4.2.2.2.1.1 Definition

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

The maximum allowed EIRP is derived from regulatory requirements [i.28]. The requirements are verified with the test metrics of the total component of EIRP (Link=TX beam peak direction, Meas=Link angle).

4.2.2.2.1.2 Limits

The UE maximum output power limits for power class 3 are listed in Table 4.2.2.2.1.2-3.

Table 4.2.2.2.1.2-1: Void

Table 4.2.2.2.1.2-2: Void

Table 4.2.2.2.1.2-3: UE maximum output power limits for power class 3

Operating band	Max EIRP (dBm)
n257	43
n258	43

Table 4.2.2.2.1.2-4: Void

4.2.2.2.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.1 of the present document.

4.2.2.3 Transmitter Minimum Output Power

4.2.2.3.1 Transmitter Minimum Output Power for Single Carrier

4.2.2.3.1.1 Definition

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

The minimum output power is defined as the mean power in at least one sub frame (1 ms).

4.2.2.3.1.2 Limits

Table 4.2.2.3.1.2-1: Void

For power class 3 UEs, the minimum output power shall not exceed the values specified in Table 4.2.2.3.1.2-2 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 4.2.2.3.1.2-2: Minimum output power for power class 3

Operating band	Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
n257, n258	50	-8,79	47,58
	100	-8,08	95,16
	200	-6,94	190,20
	400	-4,6	380,28

4.2.2.3.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.2 of the present document.

4.2.2.4 Transmitter Spectrum Emission Mask

4.2.2.4.1 Transmitter Spectrum Emission Mask for Single Carrier

4.2.2.4.1.1 Definition

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth.

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.

4.2.2.4.1.2 Limits

The power of any UE emission shall not exceed the levels specified in Table 4.2.2.4.1.2-1 for the specified channel bandwidth. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid). The requirements in clause 4.2.2.4.1.2 only apply when both UL and DL of a UE are configured for single CC operation, and they are of the same bandwidth. All out of band emissions for range 2 are TRP.

Table 4.2.2.4.1.2-1: General NR spectrum emission mask for frequency range 2: 23,45 GHz ≤ f ≤ 32,125 GHz

Spectrum emission limit (dBm)/ Channel bandwidth					
Δf_{OOB} (MHz)	50 MHz	100 MHz	200 MHz	400 MHz	Measurement bandwidth
± 0 - 5	-1,79	-1,79	-1,79	-1,79	1 MHz
± 5 - 10	-9,79	-1,79	-1,79	-1,79	1 MHz
± 10 - 20	-9,79	-9,79	-1,79	-1,79	1 MHz
± 20 - 40	-9,79	-9,79	-9,79	-1,79	1 MHz
± 40 - 100	-9,79	-9,79	-9,79	-9,79	1 MHz
± 100 - 200		-9,79	-9,79	-9,79	1 MHz
± 200 - 400			-9,79	-9,79	1 MHz
± 400 - 800				-9,79	1 MHz
NOTE 1: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.					
NOTE 2: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.					

4.2.2.4.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.3.1 of the present document.

4.2.2.5 Transmitter Adjacent Channel Leakage Power Ratio

4.2.2.5.1 Transmitter Adjacent Channel Leakage Power Ratio for Single Carrier

4.2.2.5.1.1 Definition

NR Adjacent Channel Leakage power Ratio (NR_{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.

4.2.2.5.1.2 Limits

The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 4.2.2.5.1.2-1.

If the measured adjacent channel power is greater than -35 dBm then the NR_{ACLR} shall be higher than the value specified in Table 4.2.2.5.1.2-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 4.2.2.5.1.2-1: General requirements for NR_{ACLR} for 23,45 GHz ≤ f ≤ 30,3 GHz

		Channel bandwidth / NR_{ACLR} / Measurement bandwidth			
	Test ID	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**
NR_{ACLR} for band n257, n258	1-2 and 4-5	12,9 dB	12,51 dB	12,34 dB	11,94
	3 and 6	12,92	12,55	12,41	11,94
	7-9	12,85	12,41	12,15	11,16
	10-12	12,64	12,02	11,44	10,04
	13-15	12,83	12,38	12,04	11,01
NR channel Measurement bandwidth		47,58 MHz	95,16 MHz	190,20 MHz	380,28 MHz
Adjacent channel centre frequency offset [MHz]		+50 / -50	+100,0 / -100,0	+200 / -200	+400 / -400
NOTE: Test ID are in Table 5.2.3.4.1.1.1-1.					

4.2.2.5.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.4.1 of the present document.

4.2.2.6 Transmitter Spurious Emissions

4.2.2.6.1 Transmitter Spurious Emissions for Single Carrier

4.2.2.6.1.1 Definition

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 in line with Recommendation ITU-R SM.329 [i.4] and NR operating band requirement to address UE co-existence. Spurious emissions are measured as TRP.

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.

4.2.2.6.1.2 Limits

4.2.2.6.1.2.1 Spurious emission limits

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 4.2.2.6.1.2-1 starting from the edge of the assigned NR channel bandwidth. The spurious emission limits in Table 4.2.2.6.1.2-2 apply for all transmitter band configurations (NRB) and channel bandwidths. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

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 4.2.2.6.1.2-1: Boundary between NR out of band and spurious emission domain

Channel bandwidth	50 MHz	100 MHz	200 MHz	400 MHz
OOB boundary F_{OOB} (MHz)	100	200	400	800

Table 4.2.2.6.1.2-2: Spurious emissions limits (ERC/REC 74-01 [i.13])

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz	1
1 GHz ≤ f ≤ 7,25 GHz	-30 dBm	1 MHz	1
7,25 GHz ≤ f < 2nd harmonic of the upper frequency edge of the UL operating band in GHz	-13 dBm	1 MHz	1 2
	-10 dBm	100 MHz	1 2 3
NOTE 1: The metric for unwanted emissions is TRP. However, the maximum EIRP (ERP) metric is valid as long as the max EIRP (ERP) does not hit the TRP limit. NOTE 2: Both limits are simultaneously applicable. NOTE 3: This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.2.2.6.1.2-1 from the edge of the channel bandwidth.			

Table 4.2.2.6.1.2-3: Additional requirements (EC Decision (2020/590 EU) [i.25])

Frequency band (GHz)	Channel bandwidth / Spectrum emission limit (dBm)				Measurement bandwidth	NOTE
	50 MHz	100 MHz	200 MHz	400 MHz		
23,6 ≤ f ≤ 24	1	1	1	1	200 MHz	1, 2, 4
	-5	-5	-5	-5	200 MHz	1, 3, 4
NOTE 1: The protection of frequency range 23 600 - 24 000 MHz is meant for protection of satellite passive services. NOTE 2: Entry into force of EC Decision (2020/590 EU) [i.25]. NOTE 3: Entry into force on 1 January 2024. This limit applies to terminal stations brought into use after 1 January 2024. This limit does not apply to terminal stations that have been brought into use prior to that date. For those terminal stations, the limit of 1 dBm/200 MHz continues to apply after 1 January 2024. NOTE 4: This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.2.2.6.1.2-1 from the edge of the channel bandwidth.						

NOTE: The limit sets in Table 4.2.2.6.1.2-3 is less stringent than the requirement sets in Table 4.2.2.6.1.2-2. Therefore, it is sufficient that the UE only fulfils the requirement in Table 4.2.2.6.1.2-2.

4.2.2.6.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.5.1 of the present document.

4.2.2.7 Receiver Reference Sensitivity Level

4.2.2.7.1 Reference sensitivity power level Single Carrier

4.2.2.7.1.0 General

Unless otherwise stated, the receiver characteristics are specified Over The Air (OTA).

The minimum requirements on Effective Isotropic Sensitivity (EIS) are defined with two orthogonal polarizations.

4.2.2.7.1.1 Definition

The reference sensitivity power level REFSENS is the EIS level (total component) at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

4.2.2.7.1.2 Limits

4.2.2.7.1.2.1 Void

4.2.2.7.1.2.2 Void

4.2.2.7.1.2.3 Reference sensitivity power level for power class 3

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses A.2.3.2 and A.3.3.2 of ETSI TS 138 521-2 [2] (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in clause A.5.2.1 of ETSI TS 138 521-2 [2]) with peak reference sensitivity specified in Table 4.2.2.7.1.2.3-1. The requirement is verified with the test metric of EIS (Link=Beam peak search grids, Meas=Link Angle).

For the UEs that support multiple FR2 bands, the minimum requirement for Reference sensitivity in Table 4.2.2.7.1.2.3-1 shall be increased per band, respectively, by the reference sensitivity adjustment parameter ΔMB_P and ΔMB_S as specified in Table 4.2.2.7.1.2.3-1a. The requirement for the UE which supports a single FR2 band is specified in Table 4.2.2.7.1.2.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both tables 4.2.2.7.1.2.3-1 and 4.2.2.7.1.2.3-1a.

Table 4.2.2.7.1.2.3-1: Reference sensitivity for power class 3

Operating band	REFSENS (dBm) / Channel bandwidth			
	50 MHz	100 MHz	200 MHz	400 MHz
n257	-85,96	-82,96	-79,96	-76,96
n258	-85,96	-82,96	-79,96	-76,96
NOTE: The transmitter shall be set to P_{UMAX} as defined in clause 6.2.4 in the ETSI TS 138 101-2 [7].				

Table 4.2.2.7.1.2.3-1a: UE multi-band adjustment parameter for power class 3 (Rel-15)

Supported bands	$\sum MB_P$ (dB)	$\sum MB_S$ (dB)
n257, n258	≤ 1,3	≤ 1,25

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 4.2.2.7.1.2.3-2.

Table 4.2.2.7.1.2.3-2: Uplink configuration for reference sensitivity

Operating band	NR Band / Channel bandwidth / NRB / SCS / Duplex mode					
	50 MHz	100 MHz	200 MHz	400 MHz	SCS	Duplex Mode
n257	32	64	128	256	120 kHz	TDD
n258	32	64	128	256	120 kHz	TDD

Unless given by Table 4.2.2.7.1.2.3-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS_200 (Table 6.2.3.3.1-1 of ETSI TS 138 521-2 [2]) configured.

Table 4.2.2.7.1.2.3-3: Network signalling value for reference sensitivity

Operating band	Network Signalling value
n258	NS_201

4.2.2.7.1.2.4 Void

4.2.2.7.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.6.1 of the present document.

4.2.2.8 Receiver Adjacent Channel Selectivity (ACS)

4.2.2.8.1 Receiver Adjacent Channel Selectivity Level Single Carrier

4.2.2.8.1.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a NR 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).

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

4.2.2.8.1.2 Limits

The UE shall fulfil the minimum requirement specified in Table 4.2.2.8.1.2-1 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 4.2.2.8.1.2-2 and Table 4.2.2.8.1.2-3 where the throughput shall be $\geq$ 95 % of the maximum throughput of the reference measurement channels as specified in clauses A.2.3.2 and A.3.3.2 of ETSI TS 138 521-2 [2], with QPSK, R=1/3 and one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in clause A.5.2.1 of ETSI TS 138 521-2 [2]. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 4.2.2.8.1.2-1: Adjacent channel selectivity

		Adjacent channel selectivity / Channel bandwidth			
Operating band	Units	50 MHz	100 MHz	200 MHz	400 MHz
n257, n258	dB	23	23	23	23

Table 4.2.2.8.1.2-2: Test parameters for adjacent channel selectivity, Case 1

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB			
$P_{Interferer}$ for band n257, n258	dBm	REFSENS +35,5 dB	REFSENS +35,5 dB	REFSENS +35,5 dB	REFSENS +35,5 dB
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 note 3	100 / -100 note 3	200 / -200 note 3	400 / -400 note 3
NOTE 1: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 138 521-2 [2] with one sided dynamic OCNG Pattern as described in clause A.3.2 of ETSI TS 138 521-2 [2] and set-up according to annex C of ETSI TS 138 521-2 [2]. NOTE 2: The REFSENS power level is specified in clause 4.2.2.7.1.2, which are applicable to different UE power classes. NOTE 3: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{Interferer} \rvert / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have the same SCS. NOTE 4: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4 in ETSI TS 138 101-2 [7], with the uplink configuration specified in Table 4.2.2.7.1.2.3-2.					

Table 4.2.2.8.1.2-3: Test parameters for adjacent channel selectivity, Case 2

Rx Parameter	Units	Channel bandwidth			
		50 MHz	100 MHz	200 MHz	400 MHz
Power in Transmission Bandwidth Configuration for band n257, n258	dBm	-46,5	-46,5	-46,5	-46,5
$P_{Interferer}$	dBm	-25			
$BW_{Interferer}$	MHz	50	100	200	400
$F_{Interferer}$ (offset)	MHz	50 / -50 note 2	100 / -100 note 2	200 / -200 note 2	400 / -400 note 2
NOTE 1: The interferer consists of the Reference measurement channel specified in clause 3.2 of ETSI TS 138 521-2 [2] with one sided dynamic OCNG Pattern TDD as described in clause A5.2.1 of ETSI TS 138 521-2 [2] and set-up according to annex C of ETSI TS 138 521-2 [2]. NOTE 2: The absolute value of the interferer offset $F_{Interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{Interferer} \rvert / SCS \rceil + 0{,}5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have the same SCS. NOTE 3: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4 in ETSI TS 138 101-2 [7], with the uplink configuration specified in Table 4.2.2.7.1.2.3-2.					

4.2.2.8.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.7 of the present document.

4.2.2.9 Receiver Blocking Characteristics

4.2.2.9.1 Inband blocking Single Carrier

4.2.2.9.1.0 General

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 occurs.

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

4.2.2.9.1.1 Definition

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the spectrum equivalent to twice the channel bandwidth below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

4.2.2.9.1.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in annex A of ETSI TS 138 521-2 [2] with one sided dynamic OCNG Pattern for the DL-signal as described in annex A of ETSI TS 138 521-2 [2]. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

Table 4.2.2.9.1.2-1: In band blocking requirements

Rx parameter	Units	Channel bandwidth			
		50 MHz	**100 MHz**	**200 MHz**	**400 MHz**
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB			
$BW_{Interferer}$	MHz	50	100	200	400
$P_{Interferer}$ for bands n257, n258	dBm	REFSENS + 35,5 dB	REFSENS + 35,5 dB	REFSENS + 35,5 dB	REFSENS + 35,5 dB
$F_{loffset}$	MHz	≤ 100 & ≥ -100 note 5	≤ 200 & ≥ -200 note 5	≤ 400 & ≥ -400 note 5	≤ 800 & ≥ -800 note 5
$F_{Interferer}$	MHz	F_{DL_low} + 25 to F_{DL_high} - 25	F_{DL_low} + 50 to F_{DL_high} - 50	F_{DL_low} + 100 to F_{DL_high} - 100	F_{DL_low} + 200 to F_{DL_high} - 200

NOTE 1: The interferer consists of the Reference measurement channel specified in annex A of ETSI TS 138 521-2 [2] with one sided dynamic OCNG Pattern OP1.TDD as described in annex A of ETSI TS 138 521-2 [2] and set-up according to annex C of ETSI TS 138 521-2 [2].
NOTE 2: The REFSENS power level is specified in clause 4.2.2.7.1.2, which are applicable according to different UE power classes.
NOTE 3: The wanted signal consists of the reference measurement channel specified in annex A of ETSI TS 138 521-2 [2] QPSK, R=1/3 with one sided dynamic OCNG pattern OP1.TDD as described in annex A of ETSI TS 138 521-2 [2] and set-up according to annex C of ETSI TS 138 521-2 [2].
NOTE 4: $F_{loffset}$ is the frequency separation between the centre of the aggregated CA bandwidth and the centre frequency of the Interferer signal.
NOTE 5: The absolute value of the interferer offset $F_{loffset}$ shall be further adjusted to $(\lceil |F_{Interferer}|/SCS \rceil + 0{,}5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. Wanted and interferer signal have the same SCS.
NOTE 6: $F_{Interferer}$ range values for unwanted modulated interfering signals are interferer centre frequencies.
NOTE 7: The transmitter shall be set to 4 dB below the $P_{UMAX,f,c}$ as defined in clause 6.2.4 in ETSI TS 138 101-2 [7], with the uplink configuration specified in Table 4.2.2.7.1.2.3-2.

4.2.2.9.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.8 of the present document.

4.2.2.10 Receiver Spurious Emissions

4.2.2.10.1 Receiver Spurious Emissions Single Carrier

4.2.2.10.1.1 Definition

The spurious emissions power is the power of emissions generated or amplified in a receiver. The spurious emissions power level is measured as TRP.

4.2.2.10.1.2 Limits

The power of any spurious emission shall not exceed the maximum level specified in Table 4.2.2.10.1.2-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction).

Table 4.2.2.10.1.2-1: Receiver spurious emissions limits (ERC/REC 74-01)

Frequency Range	Maximum Level	Measurement bandwidth	Note
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz	1
1 GHz ≤ f ≤ 7,25 GHz	-30 dBm	1 MHz	1
7,25 GHz ≤ f < 2nd harmonic of the upper frequency edge of the UL operating band in GHz	-13 dBm	1 MHz	1 2
	-10 dBm	100 MHz	1 2
NOTE 1: The metric for unwanted emissions is TRP. However, the maximum EIRP (ERP) metric is valid as long as the max EIRP (ERP) does not hit the TRP limit. NOTE 2: Both limits are simultaneously applicable.			

4.2.2.10.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.2.3.9 of the present document.

4.3 Technical requirements specification for Frequency Range 1 and Frequency Range 2 interworking operation with other radios

4.3.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.3.2 Conformance requirements

4.3.2.0 General

Unless otherwise stated, the transmitter and receiver characteristics are specified at the antenna connector(s) of the UE for the bands operating on frequency range 1 and over the air for the bands operating on frequency range 2. The requirements for frequency range 1 and frequency range 2 can be verified separately. For the carrier in frequency range 1, requirements can be verified with NR FR2 link disabled. For the carrier in frequency range 2, requirements can be verified in OTA mode ensuring the E-UTRA link is functional.

For the transmitter characteristics, unless otherwise stated, the requirements for NR transmitter written in ETSI TS 138 101-1 [6] and ETSI TS 138 101-2 [7] apply and are assumed anchor agnostic.

Unless otherwise stated, if UE indicates IE maxNumberSRS-Ports-PerResource = n2 in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE maxNumberSRS-Ports-PerResource = n1 for EN-DC on this NR band.

For the receiver characteristics, the requirements defined in this clause are the extra requirements compared with the single carrier requirements defined in ETSI TS 138 101-1 [6] and ETSI TS 138 101-2 [7].

Unless otherwise stated, the UL and DL reference measurement channels are the same with the configurations specified in ETSI TS 138 101-1 [6] and ETSI TS 138 101-2 [7].

Unless otherwise stated, requirements for NR written in ETSI TS 138 101-1 [6] and ETSI TS 138 101-2 [7] apply and are assumed anchor agnostic. Requirements are verified under conditions where anchor resources do not interfere NR operation.

For the requirements of FR1 in this clause, the UE shall be verified with four Rx antenna ports and skip two Rx antenna ports requirements in operating bands where the UE is equipped with four Rx antenna ports, otherwise, the UE shall be verified with two Rx antenna ports.

4.3.2.1 Introduction

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.2] for IMT User Equipment (UE), a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.12] have been identified. Table 4.3.2.1-1 provides a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 4.3.2.1-1: Cross references

Essential parameter	Corresponding technical requirements	Corresponding test suite
Transmitter spectrum mask	4.3.2.4 Transmitter Spectrum emissions mask 4.3.2.5 Transmitter adjacent channel leakage power ratio	5.3.3.3 5.3.3.4
Transmitter unwanted emissions in the out-of-band domain		
Transmitter unwanted emissions in the spurious domain	4.3.2.6 Transmitter spurious emissions	5.3.3.5
Transmitter power limits	4.3.2.2 Transmitter maximum output power 4.3.2.3 Transmitter minimum output power	5.3.3.1 5.3.3.2
Transmitter Power Control (TPC)		
Transmitter power accuracy	4.3.2.2 Transmitter maximum output power	5.3.3.1
Receiver unwanted emissions in the spurious domain	4.3.2.12 Receiver spurious emissions	5.3.11
Receiver blocking	4.3.2.9 Receiver Blocking characteristics	5.3.3.8
Receiver desensitization		
Receiver spurious response rejection	4.3.2.10 Receiver spurious response	5.3.3.9
Receiver radio-frequency intermodulation	4.3.2.11 Receiver Intermodulation characteristics	5.3.3.10
Receiver adjacent signal selectivity	4.3.2.8 Receiver Adjacent Channel Selectivity (ACS)	5.3.3.7
Receiver sensitivity	4.3.2.7 Receiver Reference Sensitivity Level	5.3.3.6
Equipment operating under the control of a network	ETSI EN 301 908-1 [i.12], clause 4.2.4 Control and Monitoring functions	_

4.3.2.2 Transmitter Maximum Output Power

4.3.2.2.1 Void

4.3.2.2.2 Transmitter Maximum Output Power for EN-DC

4.3.2.2.2.1 Void

4.3.2.2.2.2 Void

4.3.2.2.2.3 Transmitter Maximum Output Power for Inter-Band EN-DC within FR1

####### 4.3.2.2.2.3.1 Definition

For inter-band EN-DC of E-UTRA and NR in FR1, 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 (1 ms). 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.

####### 4.3.2.2.2.3.2 Limits

LTE anchor agnostic approach is not applied. E-UTRA test point analysis is included and E-UTRA measurements are performed.

For overlapping UL transmission, the maximum output power for the DC configuration shall be within the range in Table 4.3.2.2.2.3.2-1.

For non-overlapping UL transmission, the maximum output power for the DC configuration shall be within the range in Table 4.2.2.1.2-1 in ETSI EN 301 908-13 [12] and Table 4.1.2.2.1.2-1 for E-UTRA carrier and NR carrier respectively.

Table 4.3.2.2.2.3.2-1: Maximum output power for inter-band EN-DC (two bands) (Overlapping UL transmission)

EN-DC configuration	Power class 3 (dBm)					
	LTE BW ≤ 20 MHz					
	NR BW ≤ 20 MHz		20 MHz < NR BW ≤ 40 MHz		40 MHz < NR BW ≤ 100 MHz	
	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)
DC_1A_n28A	19,3	25,7	19,3	25,7	19	26
DC_1A_n77A	19	26	19	26	19	26
DC_1A_n78A	19	26	19	26	19	26
DC_3A_n7A	19,3 (note 1)	25,7	19,3 (note 1)	25,7	19 (note 1)	26
DC_3A_n28A	19,3 (note 1)	25,7	19,3 (note 1)	25,7	19 (note 1)	26
DC_3A_n77A	19 (note 1)	26	19 (note 1)	26	19 (note 1)	26
DC_3A_n78A	19 (note 1)	26	19 (note 1)	26	19 (note 1)	26
DC_3A_n82A	19,3 (note 1)	25,7	19.3 (note 1)	25.7	19 (note 1)	26
DC_7A_n28A	19,3 (note 1)	25,7	19,3 (note 1)	25,7	19 (note 1)	26
DC_7A_n78A DC_7C_n78A	19	26	19	26	19	26
DC_8A_n77A	19	26	19	26	19	26
DC_8A_n78A	19 (note 1)	26	19 (note 1)	26	19 (note 1)	26
DC_20A_n8A	19,3	25,7	19,3	25,7	19	26

EN-DC configuration	Power class 3 (dBm)					
	LTE BW ≤ 20 MHz					
	NR BW ≤ 20 MHz		20 MHz < NR BW ≤ 40 MHz		40 MHz < NR BW ≤ 100 MHz	
	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)	Lower limit (dBm)	Upper limit (dBm)
DC_20A_n28A DC_20A_n83A	19,3	25,7	19,3	25,7	19	26
DC_20A_n78A	19 (note 1)	26	19 (note 1)	26	19	26
DC_28A_n77A	19	26	19	26	19	26
DC_28A_n78A	19 (note 1)	26	19 (note 1)	26	19	26
DC_41A_n77A DC_41C_n77A	19 (note 1)	26	19 (note 1)	26	19(note 1)	26
DC_41A_n78A DC_41C_n78A	19 (note 1)	26	19 (note 1)	26	19(note 1)	26

NOTE 1: For the transmission bandwidths confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.
NOTE 2: For inter-band EN-DC the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).
NOTE 3: Power Class 3 is the default power class unless otherwise stated.

4.3.2.2.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.1.2.3 of the present document.

4.3.2.2.4 Transmitter Maximum Output Power for Inter-Band EN-DC including FR2

4.3.2.2.4.1 Definition

The maximum output power values for EIRP are found in Table 4.2.2.2.1.2-3. The maximum allowed EIRP is derived from regulatory requirements [i.28]. The requirements are verified with the test metric of total component of EIRP (Link=TX beam peak direction, Meas=Link angle).

4.3.2.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.2.1.2 for the NR carrier apply.

4.3.2.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.1.2.4 of the present document.

4.3.2.2.5 Transmitter Maximum Output Power for Inter-Band EN-DC including both FR1 and FR2

4.3.2.2.5.1 Definition

Same as in clause 4.3.2.2.2.3.1 and clause 4.3.2.2.4.1.

4.3.2.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.2.2.3.2 and clause 4.3.2.2.4.2 respectively.

4.3.2.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.1.2.5 of the present document.

4.3.2.3 Transmitter Minimum Output Power

4.3.2.3.1 Void

4.3.2.3.2 Transmitter Minimum Output Power for EN-DC

4.3.2.3.2.1 Void

4.3.2.3.2.2 Void

4.3.2.3.2.3 Transmitter Minimum Output Power for Inter-Band EN-DC within FR1

4.3.2.3.2.3.1 Definition

The minimum output power of the UE is defined as the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) when the power is set to a minimum value. The minimum output power is defined as the mean power in one sub-frame (1 ms).

4.3.2.3.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limit as in clause 4.1.2.3.1.2 for the NR carrier.

4.3.2.3.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.2.2.3 of the present document

4.3.2.3.2.4 Void

4.3.2.3.2.4 Transmitter Minimum Output Power for Inter-Band EN-DC including FR2

4.3.2.3.2.4.1 Definition

The minimum output power of the UE is defined as the EIRP in the channel bandwidth for all transmit bandwidth configurations (resource blocks) when the power is set to a minimum value. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

4.3.2.3.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.3.1.2 for the NR carrier.

4.3.2.3.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.2.2.4 of the present document.

4.3.2.3.2.5 Transmitter Minimum Output Power for Inter-Band EN-DC including both FR1 and FR2

4.3.2.3.2.5.1 Definition

Same as in clause 4.3.2.3.2.3.1 and clause 4.3.2.3.2.4.1.

4.3.2.3.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.3.2.3.2 and clause 4.3.2.3.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.3.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.2.2.5 of the present document.

4.3.2.4 Transmitter Spectrum Emission Mask

4.3.2.4.1 Void

4.3.2.4.2 Transmitter Spectrum Emission Mask for EN-DC

4.3.2.4.2.1 Void

4.3.2.4.2.2 Void

4.3.2.4.2.3 Transmitter Spectrum Emission for Inter-Band EN-DC within FR1

4.3.2.4.2.3.1 Definition

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.

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth.

4.3.2.4.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

4.3.2.4.2.3.2.1 General spectrum emission mask

Power of any UE emission shall fulfil requirements in tables 4.1.2.4.1.2.1-1 and 4.1.2.4.1.2.1-2 for the NR carrier.

4.3.2.4.2.3.2.2 Additional spectrum emission mask

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 (applicable to band n41), Power of any UE emission shall fulfil the requirements in Table 4.1.2.4.1.2.2-1 for the NR carrier.

4.3.2.4.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.3.2.3 of the present document.

4.3.2.4.2.4 Transmitter Spectrum Emission for Inter-Band EN-DC including FR2

4.3.2.4.2.4.1 Definition

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. For frequencies offset greater than F_{OOB} as specified the transmit spurious requirements are applicable. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

4.3.2.4.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.4.1.2 for the NR carrier.

4.3.2.4.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.3.2.4 of the present document.

4.3.2.4.2.5 Transmitter Spectrum Emission for Inter-Band EN-DC including both FR1 and FR2

4.3.2.4.2.5.1 Definition

Same as in clause 4.3.2.4.2.3.1 and clause 4.3.2.4.2.4.1.

4.3.2.4.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.4.2.3.2 and clause 4.3.2.4.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.4.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.3.2.5 of the present document.

4.3.2.5 Transmitter Adjacent Channel Leakage Power Ratio

4.3.2.5.1 Void

4.3.2.5.2 Transmitter Adjacent Channel Leakage Power Ratio for EN-DC

4.3.2.5.2.1 Void

4.3.2.5.2.2 Void

4.3.2.5.2.3 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC within FR1

4.3.2.5.2.3.1 Definition

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.

NR adjacent channel leakage power ratio (NR_{ACLR}) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent channel frequency.

4.3.2.5.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

If the measured adjacent channel power is greater than -50 dBm then the measured NR_{ACLR} shall be higher than the limits in Table 4.1.2.5.1.2.1-2 for the NR carrier.

4.3.2.5.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.4.2.3 of the present document.

4.3.2.5.2.4 Void

4.3.2.5.2.4 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC including FR2

4.3.2.5.2.4.1 Definition

NR Adjacent Channel Leakage power Ratio (NR_{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 requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

4.3.2.5.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.5.1.2 for the NR carrier.

4.3.2.5.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.4.2.4 of the present document.

4.3.2.5.2.5 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC including both FR1 and FR2

4.3.2.5.2.5.1 Definition

Same as in clause 4.3.2.5.2.3.1 and clause 4.3.2.5.2.4.1.

4.3.2.5.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.5.2.3.2 and clause 4.3.2.5.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.5.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.4.2.5 of the present document.

4.3.2.6 Transmitter Spurious Emissions

4.3.2.6.1 Void

4.3.2.6.2 Transmitter Spurious Emissions for EN-DC

4.3.2.6.2.1 Void

4.3.2.6.2.2 Void

4.3.2.6.2.3 Transmitter Spurious Emissions for Inter-Band EN-DC within FR1

4.3.2.6.2.3.1 Definition

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 in line with Recommendation ITU-R SM.329 [i.4] and NR operating band requirement to address UE co-existence.

4.3.2.6.2.3.2 Limits

4.3.2.6.2.3.2.1 General spurious emissions

Exception requirements are applicable for both NR and LTE, therefore the LTE anchor agnostic approach is not applied.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) from the edge of the channel bandwidth shown in Table 4.1.2.6.1.2.1-0 for NR carrier, and Table 4.2.4.1.2-1 of ETSI EN 301 908-13 [12] for E-UTRA carrier.

Same limits as in Table 4.1.2.6.1.2.1-1 for each component carrier.

NOTE: The general spurious emission requirements with both uplink carriers active are allowed to be verified for only a single inter-band EN-DC configuration per NR band. Furthermore, the requirements are allowed to 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.

4.3.2.6.2.3.2.2 Spurious emission band UE co-existence

Exception requirements for both NR and E-UTRA are defined for this test and therefore LTE anchor agnostic approach is not applied. E-UTRA test point analysis is included and E-UTRA measurements are performed.

The requirements are in Table 4.3.2.6.2.3.2.2-1 for each component carrier with all component carriers are active.

NOTE 1: For inter-band EN-DC with uplink assigned to one LTE band and one NR band the requirements in Table 4.3.2.6.2.3.2.2-1 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.

Table 4.3.2.6.2.3.2.2-1: Requirements for Spurious Emissions UE Co-existence

EN-DC Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
DC_1_n28	E-UTRA Band, 7, 8, 20, 31, 38, 40, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 32, 43, 65 NR band n77,n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	8, 9
	Frequency range	470	-	694	-42	8	4, 14
	Frequency range	470	-	710	-26,2	6	12
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26,2	6	4
	Frequency range	1 880	-	1 895	-40	1	4, 13
	Frequency range	1 895	-	1 915	-15,5	5	4, 6, 13
	Frequency range	1 915	-	1 920	+1,6	5	4, 6, 13
DC_1_n77	E-UTRA Band 1, 3, 7, 8, 20, 28, 34, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 880	-	1 895	-40	1	4, 7
	Frequency range	1 895	-	1 915	-15,5	5	4, 6, 7
	Frequency range	1 915	-	1 920	+1,6	5	4, 6, 7
DC_1_n78	E-UTRA Band 1, 3, 7, 8, 20, 28, 34, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 880	-	1 895	-40	1	4, 7
	Frequency range	1 895	-	1 915	-15,5	5	4, 6, 7
	Frequency range	1 915	-	1 920	+1,6	5	4, 6, 7
DC_3_n7	E-UTRA Band 1, 7, 8, 20, 28, 31, 32, 33, 34, 40, 43, 50, 51, 65, 67, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4

EN-DC Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
	E-UTRA band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	2 570	-	2 575	+1,6	5	4, 5, 6
	Frequency range	2 575	-	2 595	-15,5	5	4, 5, 6
	Frequency range	2 595	-	2 620	-40	1	4, 5
DC_3_n28	E-UTRA Band 1, 42, 43, 50, 51, 65, 75, 76 NR band n77, n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA band 1	F_{DL_low}	-	F_{DL_high}	-50	1	8, 10
	E-UTRA band 3	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 7, 8, 20, 31, 34, 38, 40,41	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	
	Frequency range	470	-	710	-26,2	6	12
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3, 8
DC_3_n77	E-UTRA Band 1, 3, 7, 8, 20, 28, 34, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3
DC_3_n78	E-UTRA Band 1, 3, 7, 8, 20, 28, 34, 40, 41, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0.3	3
DC_7_n28	E-UTRA Band 3, 7, 8, 20, 31, 34, 40	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 42, 43, 50, 65, 75, 76 NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA band 1	F_{DL_low}	-	F_{DL_high}	-50	1	8, 9
	Frequency range	758	-	773	-32	1	4
	Frequency range	773	-	803	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	4, 5, 6
	Frequency range	2 575	-	2 595	-15,5	5	4, 5, 6
	Frequency range	2 595	-	2 620	-40	1	4, 5
DC_7_n78	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 32, 33, 34, 40, 50, 51, 65, 67, 68, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	4, 6, 6
	Frequency range	2 575	-	2 595	-15,5	5	4, 6, 6
	Frequency range	2 595	-	2 620	-40	1	4, 5
DC_8_n77	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 40, 50, 51, 65, 67, 68, 69	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA band 3, 7, 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
	Frequency range	860	-	890	-40	1	4, 11
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3, 11
DC_8_n78	E-UTRA Band 1, 20, 28, 34, 40, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 7, 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	4
	Frequency range	860	-	890	-40	1	4, 11
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3, 11
DC_20_n8	E-UTRA Band 1, 28, 31, 32, 34, 65, 75, 76	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 7, 22, 38, 42, 43 NR band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2
DC_20_n28	E-UTRA Band 3, 7, 8, 31, 34,	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 32, 38, 42, 43, 65, 75, 76 NR Band n78	F_{DL_low}	-	F_{DL_high}	-50	1	2

EN-DC Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
DC_20_n78	E-UTRA Band 1, 3, 7, 8, 31, 32, 33, 34, 40, 65, 67, 68	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	4
	E-UTRA Band 38, 69	F_{DL_low}	-	F_{DL_high}	-50	1	2
DC_28_n77	E-UTRA Band 3, 7, 8, 20, 34, 40, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	8, 10
	Frequency range	758	-	773	-32	1	
	Frequency range	773	-	803	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3,8
DC_28_n78	E-UTRA Band 3, 7, 8, 20, 34, 40, 41	F_{DL_low}	-	$F_{D\ L\_high}$	-50	1	
	E-UTRA Band 1, 65	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	8, 10
	Frequency range	758	-	773	-32	1	
	Frequency range	773	-	803	-50	1	
	Frequency range	1 884,5	-	1 915,7	-41	0,3	3,8
DC_38_n78	N/A						
DC_41_n77	E-UTRA Band 1, 3, 8, 28, 33, 34, 40	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5		1 915,7	-41	0.3	3
DC_41_n78	E-UTRA Band 1, 3, 8, 28, 34, 40	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5	-	1,915,7	-41	0.3	3

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.5-1 of ETSI TS 136 101 [14] or in Table 5.2-1 in ETSI TS 138 101-1[6].

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 in ETSI TS 136 101 [14] and Table 4.1.2.6.1.2.1-1 are permitted for each assigned carrier used in the measurement due to 2nd, 3rd, 4th or 5th harmonic spurious emissions. Due to the 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 (2 MHz + N × L_{CRB} × 180 kHz), where N is 2, 3, 4, 5 for the 2nd, 3rd, 4th or 5th harmonic respectively. The exception is allowed if the Measurement Bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: Applicable when co-existence with PHS system operating in 1 884,5 MHz - 1 915,7 MHz.

NOTE 4: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 4.1.2.6.1.2.1-0 and Table 4.2.4.1.2-1 of ETSI EN 301 908-13 [12] from the edge of the channel bandwidth.

NOTE 5: This requirement is applicable for any channel bandwidths within the range 2 500 MHz - 2 570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 560,5 MHz - 2 562,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 552 MHz - 2 560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 6: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

NOTE 7: This requirement is applicable for any channel bandwidths within the range 1 920 MHz - 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 MHz - 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 - 1 938 MHz the requirement is applicable only for an uplink.

NOTE 8: 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 9: 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 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1 of ETSI TS 138 521-1 [1]) for which the 2nd harmonic totally or partially overlaps the Measurement Bandwidth (MBW).

NOTE 10: 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 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.3.1-1 of ETSI TS 138 521-1 [1]) for which the 3rd harmonic totally or partially overlaps the Measurement Bandwidth (MBW).

EN-DC Configuration	Spurious emission				
	Protected band	Frequency range (MHz)	Maximum Level (dBm)	MBW (MHz)	Note
NOTE 11: This requirement is applicable only for the following cases: A: for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 902,5 MHz ≤ Fc < 907,5 MHz with an uplink transmission bandwidth less than or equal to 20 RB;B: for carriers of 5 MHz channel bandwidth when carrier centre frequency (Fc) is within the range 907,5 MHz ≤ Fc ≤ 912,5 MHz without any restriction on uplink transmission bandwidth; C: for carriers of 10 MHz channel bandwidth when carrier centre frequency (Fc) is Fc = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RBstart > 3. NOTE 12: This requirement is applicable for 5 and 10 MHz E-UTRA or NR channel bandwidth allocated within 718 MHz - 728 MHz. 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 13: This requirement is applicable for any channel bandwidths within the range 1 920 MHz - 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 MHz - 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 MHz - 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 14: This requirement is applicable in the case of a 10 MHz E-UTRA or NR carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.					

NOTE 2: To simplify the above table, E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation or both E-UTRA and NR operation in ETSI TS 138 101-1 [6] or ETSI TS 136 101 [14]. NR band numbers are listed for bands which are specified only for NR operation.

4.3.2.6.2.3.2.3 Additional Spurious Emissions

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.6.1.2.3 for the NR carrier.

4.3.2.6.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.5.2.3 of the present document.

4.3.2.6.2.4 Transmitter Spurious Emissions for Inter-Band EN-DC including FR2

4.3.2.6.2.4.1 Definition

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 in line with Recommendation ITU-R SM.329 [i.4] and NR operating band requirement to address UE co-existence. Spurious emissions are measured as TRP. 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. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

4.3.2.6.2.4.2 Limits

4.3.2.6.2.4.2.1 General spurious emissions

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.6.1.2.1 for the NR carrier.

4.3.2.6.2.4.2.2 Spurious emission band UE co-existence

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

Same limits as in clause 4.2.2.6.1.2.2.

4.3.2.6.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.5.2.4 of the present document.

4.3.2.6.2.5 Transmitter Spurious Emissions for Inter-Band EN-DC including both FR1 and FR2

4.3.2.6.2.5.1 Definition

Same as in clause 4.3.2.6.2.3.1 and clause 4.3.2.6.2.4.1.

4.3.2.6.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.6.2.3.2 and clause 4.3.2.6.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.6.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.5.2.5 of the present document.

4.3.2.7 Receiver Reference Sensitivity Level

4.3.2.7.1 Void

4.3.2.7.2 Receiver Reference Sensitivity for EN-DC

4.3.2.7.2.0 General

For EN-DC, E-UTRA and NR single carrier REFSENS requirements defined in ETSI TS 138 101-1 [6], ETSI TS 138 101-2 [7], ETSI TS 138 101-3 [8] and ETSI TS 136 101 [14] apply to all downlink bands of EN-DC configurations listed in clause 5.5B in ETSI TS 138 521-3 [3], unless sensitivity degradation exception is allowed in clause 4.3.2.7.2, clause 7.3 in ETSI TS 138 101-1 [6] or clause 7.3 in ETSI TS 136 101 [14]. Allowed exceptions specified in this clause also apply to any higher-order EN-DC configuration combination containing one of the band combinations that exception is allowed for. Reference sensitivity exceptions are specified by applying Maximum Sensitivity Degradation (MSD) into applicable REFSENS requirement. EN-DC REFSENS requirements shall be met for NR uplink transmissions using QPSK DFT-s-OFDM waveforms as defined in clause 7.3.2 in ETSI TS 138 101-1 [6]. Unless otherwise specified UL allocation uses the lowest SCS allowable for a given channel BW. Limits on configured maximum output power for the uplink according to clause 6.2B.4 in ETSI TS 138 101-3 [8] shall apply.

In the case of interband EN-DC, the receiver REFSENS requirements in this clause do not apply for 1,4 and 3 MHz E-UTRA carriers. For the case of inter-band EN-DC with a single carrier per cell group and multi-carrier per cell group, in addition to the E-UTRA and NR single carrier, CA, and MIMO operation of REFSENS requirements defined in ETSI TS 138 101-1 [6], ETSI TS 138 101-2 [7] and ETSI TS 138 101-3 [8], and ETSI TS 136 101 [14], the REFSENS requirements specified therein also apply with both downlink carriers and both uplink carriers active unless sensitivity exceptions are allowed in this clause of the present document, clause 7.3 in ETSI TS 138 101-1 [6] or clause 7.3 in ETSI TS 136 101 [14].

NOTE: For inter-band EN-DC, the reference sensitivity requirement with both uplink carriers active is allowed to be verified for only a single inter-band EN-DC configuration per NR band.

4.3.2.7.2.1 Void

4.3.2.7.2.2 Void

4.3.2.7.2.3 Receiver Reference Sensitivity for Inter-Band EN-DC within FR1

4.3.2.7.2.3.1 Definition

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

4.3.2.7.2.3.2 Limits

4.3.2.7.2.3.2.1 Limits for inter-band without exceptions

For EN-DC with non-exception requirements applicable to NR, the LTE anchor agnostic approach is applied.

For inter-band EN-DC configurations, the throughput of each CG shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clause A.3.2 of ETSI TS 138 521-1 [1] with reference receive power level specified in Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2.

For the UE which supports inter-band EN-DC, the minimum requirement for reference sensitivity in Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2 for NR band and Table 4.2.12.1.2-1 of ETSI EN 301 908-13 [12] - for E-UTRA band, shall be increased by the amount given in $\Delta R_{IB,c}$ defined in clause 4.3.2.7.3.4.

4.3.2.7.2.3.2.2 Limits for inter-band with exceptions

For EN-DC combination with exception requirements, LTE anchor agnostic approach is not applied.

For inter-band EN-DC configurations affected by reference sensitivity exceptions, when test points without notes 6, 7 and 9 in Table 5.3.3.6.2.3.1.2.1-1 are tested, the throughput of each CG shall be ≥ 95 % of the maximum throughput for the reference receive power level specified in Table 4.3.2.7.2.3.2.2-1, Table 4.3.2.7.2.3.2.2-2, Table 4.3.2.7.2.3.2.2-3, and Table 4.3.2.7.2.3.2.2-4 for MSDs due to uplink harmonic, harmonic mixing, cross-band isolation and dual uplinks, respectively. For a given EN-DC combo, if more than one category of MSD applies, UE shall pass all requirement.

For test points with notes 6 or 7 in Table 5.3.3.6.2.3.1.2.1-1, reference sensitivity requirements are specified in Table 4.1.2.7.1.2-1 for the NR CC, and Table 4.2.12.1.2-1 of ETSI EN 301 908-13 [12] for E-UTRA CC.

Reference sensitivity exceptions due to UL harmonic interference for EN-DC in NR FR1 are specified in Table 4.3.2.7.2.3.2.2-1 with the uplink configuration specified in Table 5.3.3.6.2.3.1.2.1-1.

Table 4.3.2.7.2.3.2.2-1: Reference sensitivity due to UL harmonic for EN-DC in NR FR1

UL band	DL band	SCS (kHz)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	25 MHz (dBm)	30 MHz (dBm)	40 MHz (dBm)	50 MHz (dBm)	60 MHz (dBm)	80 MHz (dBm)	90 MHz (dBm)	100 MHz (dBm)
1, 3	n77 (notes 1 and 7)	15	--	-70,4	-70,4	-70,3	--	--	-70,2	-70,3	--	--	--	--
		30	--	-70,7	-70,5	-70,5	--	--	-70,3	-70,4	-70,4	-70,3	-70,3	-70,3
		60	--	-71,1	-70,8	-70,7	--	--	-70,5	-70,5	-70,5	-70,4	-70,4	-70,4
	n77 (note 2)	15	--	-93,2	-91,7	-90,9	--	--	--	--	--	--	--	--
		30	--	-93,5	-91,8	-91,1	--	--	--	--	--	--	--	--
		60	--	-93,9	-92,1	-91,3	--	--	--	--	--	--	--	--
3	n78 (notes 1 and 7)	15	--	-70,9	-70,9	-70,8	--	--	-70,7	-70,8	--	--	--	--
			--	-73,1 (note 9)	-73,1 (note 9)	-73,0 (note 9)			-72,9 (note 9)	-73,0 (note 9)	--	--	--	--
		30	--	-71,2	-71,0	-71,0	--	--	-70,8	-70,9	-70,9	-70,8	-70,8	-70,8
			--	-73,4 (note 9)	-73,2 (note 9)	-73,2 (note 9)	--	--	-73,0 (note 9)	-73,1 (note 9)	-73,1 (note 9)	-73,0 (note 9)	-73,0 (note 9)	-73,0 (note 9)
		60	--	-71,6	-71,3	-71,2	--	--	-71,0	-71,0	-71,0	-70,9	-70,9	-70,9
			--	-73,8 (note 9)	-73,5 (note 9)	-73,4 (note 9)	--	--	-73,2 (note 9)	-73,2 (note 9)	-73,2 (note 9)	-73,1 (note 9)	-73,1 (note 9)	-73,1 (note 9)
	n78 (note 2)	15	--	-93,7	-92,2	-91,4	--	--	--	--	--	--	--	--
			--	-95,9 (note 9)	-93,4 (note 9)	-93,6 (note 9)	--	--	--	--	--	--	--	--
		30	--	-94,0	-92,3	-91,6	--	--	--	--	--	--	--	--
			--	-96,2 (note 9)	-94,5 (note 9)	-93,8 (note 9)	--	--	--	--	--	--	--	--
		60	--	-94,4	-92,6	-91,8	--	--	--	--	--	--	--	--
			--	-96,6 (note 9)	-94,8 (note 9)	-94,0 (note 9)	--	--	--	--	--	--	--	--
8	n77 (notes 5 and 6) n78 (notes 5 and6)	15	--	-83,5	-83,4	-83,2	--	--	-83,0	-82,9	--	--	--	--
		30	--	-83,8	-83,5	-83,4	--	--	-83,1	-83,0	-82,9	-82,8	-82,5	-82,7
		60	--	-84,2	-83,8	-83,6	--	--	-83,3	-83,1	-83,0	-82,9	-82,6	-82,8
28	n77 (notes 3 and 4) n78 (notes 3 and 4)	15	--	-83,9	-83,6	-83,4	--	--	-83,4	-83,4	--	--	--	--
		30	--	-84,2	-83,7	-83,6	--	--	-83,5	-83,5	-83,4	-83,4	-83,4	-83,4
		60	--	-84,6	-84,0	-83,8	--	--	-83,7	-83,6	-83,5	-83,5	-83,5	-83,5
n28	1 (notes 7, 8 and 9)	15	-89,1	-88,7	-88,3	-88,0	--	--	--	--	--	--	--	--

UL band	DL band	SCS (kHz)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	25 MHz (dBm)	30 MHz (dBm)	40 MHz (dBm)	50 MHz (dBm)	60 MHz (dBm)	80 MHz (dBm)	90 MHz (dBm)	100 MHz (dBm)
NOTE 1: The requirements should be verified for UL EARFCN or NR ARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.2 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2$ with a carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band.														
NOTE 2: The requirements are only applicable to channel bandwidths no larger than 20 MHz and with a carrier frequency at $\pm (20 + BW_{Channel}^{HB} / 2)$ MHz offset from $2 f_{UL}^{LB}$ in the victim (higher band) with $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2$, 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 3: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.														
NOTE 4: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.5 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2$ with a carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band.														
NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 4th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.														
NOTE 6: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.4 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2$ with a carrier frequency in the victim (higher) band in MHz and the channel bandwidth configured in the lower band.														
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 ΔFHD above and below the edge of this downlink transmission bandwidth. The value ΔFHD depends on the EN-DC band combination: ΔFHD = 10 MHz for DC_1_n77, DC_3_n77, DC_28_n51 and DC_3_n78.														
NOTE 8: MSD test point can be chosen according to supported BW and lowest SCS supported by the UE.														
NOTE 9: Applicable only if operation with 4 antenna ports is supported in the band with EN-DC configured.														

Reference sensitivity exceptions due to receiver harmonic mixing for EN-DC in NR FR1, are specified in Table 4.3.2.7.2.3.2.2-2 with the uplink configuration specified in Table 5.3.3.6.2.3.1.2.1-1.

Table 4.3.2.7.2.3.2.2-2: Reference sensitivity due to receiver harmonic mixing for EN-DC in NR FR1

UL band	DL band	SCS (kHz)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	25 MHz (dBm)	40 MHz (dBm)	50 MHz (dBm)	60 MHz (dBm)	80 MHz (dBm)	90 MHz (dBm	100 MHz (dBm)
n77	28 (note 2)	N/A	-69,8	-69,8	-69,8	-68,3	--	--	--	--	--	--	--
n77	3	N/A	-90,6	-89,3	-88,5	-87,6	--	--	--	--	--	--	--
			-93,3 (note 5)	-92,0 (note 5)	-91,2 (note 5)	-90,3 (note 5)							
n78	3	N/A	-90,6	-89,3	-88,5	-87,6	--	--	--	--	--	--	--
			-93,3 (note 5)	-92,0 (note 5)	-91,2 (note 5)	-90,3 (note 5)	--	--	--	--	--	--	--
n77	41 (note 3)	N/A	-86,9	-83,9	-82,1	-80,9	--	--	--	--	--	--	--
n78	41 (note 3)	N/A	-86,9	-83,9	-82,1	-80,9	--	--	--	--	--	--	--

NOTE 1: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (higher) band for which the mixing product due to harmonic of victim (lower) band LO with leakage of aggressor (higher) band is within the downlink transmission bandwidth of a victim (lower) band.

NOTE 2: The requirements should be verified for DL EARFCN of the victim (lower) band (superscript LB) such that $f_{DL}^{LB} = \lfloor f_{UL}^{HB} / 0.5 \rfloor 0.1$ in MHz and $F_{DL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{DL}^{LB} \leq F_{DL\_high}^{LB} - BW_{Channel}^{LB} / 2$ with f_{DL}^{LB} carrier frequency in the victim (lower) band in MHz and the channel bandwidth configured in the lower band.

NOTE 3: The requirements should be verified for DL EARFCN of the victim (lower) band (superscript LB) such that $f_{DL}^{LB} = \lfloor f_{UL}^{HB} / 0.15 \rfloor 0.1$ with f_{DL}^{LB} the DL carrier frequency in the lower band and f_{UL}^{HB} the UL carrier frequency in the higher band, both in MHz.

NOTE 4: MSD test point can be chosen according to supported BW and lowest SCS supported by the UE.

NOTE 5: Applicable only if operation with 4 antenna ports is supported in the band with EN-DC configured.

Reference sensitivity exceptions due to cross band isolation for EN-DC in NR FR1, are specified in Table 4.3.2.7.2.3.2.2-3 with the uplink configuration specified in Table 5.3.3.6.2.3.12.1-1.

Table 4.3.2.7.2.3.2.2-3: Reference sensitivity exceptions due to cross band isolation for EN-DC in NR FR1

E-UTRA or NR Band / Channel bandwidth of the affected DL band														
UL band	**DL band**	**SCS (kHz)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**
n77	41	N/A	-92,8	-89,8	-88,0	-86,8	--	--	--	--	--	--	--	--
41	n77 (note 4)	30	--	-86,3	-84,3	-83,1	--	--	-81,9	-81,9	-81,9	--	-81,1	-80,7
n78	7 (note 1)	N/A	-93,5	-90,5	-88,7	-87,5	--	--	--	--	--	--	--	--
n78	38	N/A	-96,7	-93,7	-91,9	-90,7	--	--	--	--	--	--	--	--
n78	41	N/A	-92,8	-89,8	-88,0	-86,8	--	--	--	--	--	--	--	--
41	n78	30	--	-86,8	-84,8	-83,6	--	--	-82,4	-82,4	-82,4	--	-81,6	-81,2
NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied. NOTE 2: The DL victim band should be configured using the lowest SCS that is compatible with the highest CBW for which an MSD is specified. NOTE 3: MSD test point can be chosen according to supported BW and lowest SCS supported by the UE. NOTE 4: The requirement is modified by -0,5 dB when the assigned UE channel bandwidth is confined within 3 300 MHz - 3 800 MHz.														

Reference sensitivity exceptions due to dual uplink operation for EN-DC in NR FR1, are specified in Table 4.3.2.7.2.3.2.2-4 with the uplink configuration specified in Table 5.3.3.6.2.3.1.2.1-1.

Table 4.3.2.7.2.3.2.2-4: Reference sensitivity exceptions due to dual uplink operation for EN-DC in NR FR1 (two bands)

			NR or E-UTRA Band / Channel bandwidth						
EN-DC Configuration	**E-UTRA or NR band**	**SCS (kHz)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm))**	**20 MHz (dBm)**	**40 MHz (dBm)**	**IMD order)**	**Duplex mode**
DC_1A_n77A	1	N/A	-69,5 --	--	--	--	--	IMD2 (note 3)	FDD
	n77	15	--	REFSENS	--	--	--	N/A	TDD
DC_1A_n77A DC_1A_n78A,	1	N/A	-91,3 -	--	--	--	--	IMD4	FDD
	n77,n78	15	-	REFSENS	--	--	--	N/A	TDD

			NR or E-UTRA Band / Channel bandwidth						
EN-DC Configuration	**E-UTRA or NR band**	**SCS (kHz)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm))**	**20 MHz (dBm)**	**40 MHz (dBm)**	**IMD order)**	**Duplex mode**
DC_3A_n7A	3	N/A	REFSENS	--	--	--	--	N/A	FDD
	n7	15	-	-83,9 (note 5)	--	--	--	IMD4	FDD
DC_3A_n77A, DC_3A_n78A, DC_3C_n78A	3	N/A	-70,3	--	--	--	--	IMD2 (note 3)	FDD
	n77, n78	15	-	REFSENS	--	--	--	N/A	TDD
DC_3A_n77A, DC_3A_n78A, DC_3C_n78A	3	N/A	-88,3	--	--	--	--	IMD4 (note 3)	FDD
	n77, n78	15	--	REFSENS	--	--	--	N/A	TDD
DC_8A_n77A	8	N/A	-88,0	--	--	--	--	IMD4	FDD
DC_8A_n78A	n77, n78	15	--	REFSENS	--	--	--	N/A	TDD
DC_20A_n8A	20	N/A	-71,3	--	--	--	--	IMD3	FDD
	n8	15	-71,3	--	--	--	--	IMD3	FDD
DC_20A_n78A,	20	N/A	-85,3	--	--	--	--	IMD4	FDD
	n78	15	--	REFSENS	--	--	--	N/A	TDD
DC_28A_n77A,	28	N/A	-92,3	--	--	--	--	IMD5	FDD
DC_28A_n78A,	n77, n78	15	--	REFSENS	--	--	--	N/A	TDD

NOTE 1: E-UTRA carrier shall be set to min(+20 dBm, $P_{CMAX\_L\_E\text{-}UTRA,c}$) and NR carrier shall be set to min(+20 dBm, $P_{CMAX\_L,f,c,NR}$) as defined in clause 6.2B.4.1.3 of ETSI TS 138 521-3 [3].
NOTE 2: RB_{START} = 0.
NOTE 3: This band is subject to IMD5 also which MSD is not specified.
NOTE 4: Applicable only if operation with 4 antenna ports is supported in the band with EN-DC configured.
NOTE 5: The symbol "REFSENS" in this table refers to the reference sensitivity values for single carrier specified in Table 4.2.12.1.2-1 of ETSI EN 301 908-13 [12] for 2 antenna port E-UTRA band, Table 7.3.1.5-1 of ETSI TS 136 521-1 [11] for 4 antenna port E-UTRA band, Table 4.1.2.7.1.2-1 for 2 antenna port NR band and Table 4.1.2.7.1.2-2 for 4 antenna port NR band.
NOTE 6: For NR band, UL/DL BW and UL L_{CRB} can be adjusted according to the supported BW and lowest SCS supported by the UE.

4.3.2.7.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.6.2.3 of the present document.

4.3.2.7.2.4 Void

4.3.2.7.2.4 Receiver Reference Sensitivity for Inter-Band EN-DC including FR2

4.3.2.7.2.4.1 Definition

Unless otherwise stated, the receiver characteristics are specified Over The Air (OTA).

The minimum requirements on Effective Isotropic Sensitivity (EIS) are defined with two orthogonal polarizations.

The reference sensitivity power level REFSENS is the EIS level (total component) at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

4.3.2.7.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.7.1.2 for the NR carrier.

4.3.2.7.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.6.2.4 of the present document.

4.3.2.7.2.5 Receiver Reference Sensitivity for Inter-Band EN-DC including both FR1 and FR2

4.3.2.7.2.5.1 Definition

Same as in clause 4.3.2.7.2.3.1 and clause 4.3.2.7.2.4.1.

4.3.2.7.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.7.2.3.2 and clause 4.3.2.7.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.7.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.6.2.5 of the present document.

4.3.2.7.3 $\Delta R_{IB,c}$, ΔR_{IBNC} for EN-DC

4.3.2.7.3.1 General

For the UE which supports inter-band EN-DC configuration, the minimum requirement for reference sensitivity in Table 7.3.1-1 and Table 7.3.1-1a in ETSI TS 136 101 [14], clauses 7.3.2, 7.3A.2, 7.3C.2 in ETSI TS 138 101-1 [6] and clause 7.3.2, 7.3A.2 in ETSI TS 138 101-2 [7] shall be increased by the amount given in $\Delta R_{IB,c}$, ΔR_{IBNC} in Table 4.3.2.7.3.4.1-1 where unless otherwise stated, the same $\Delta R_{IB,c}$, ΔR_{IBNC} are applicable to NR band(s) part for DC configurations which have the same NR operating band combination. Unless otherwise stated, $\Delta R_{IB,c}$ or ΔR_{IBNC} is set to zero.

In case the UE supports more than one of the band combinations for CA, SUL or DC, and an operating band belongs to more than one band combinations, then:

- When the operating band frequency range is ≤ 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the average value for all band combinations defined in clause 7.3A, 7.3B, 7.3C in ETSI TS 138 521-3 [3] and 7.3A, 7.3B in ETSI TS 138 101-3 [8], truncated to one decimal place that applies for that operating band among the supported band combinations. In case there is a harmonic relation between low band UL and high band DL, then the maximum $\Delta R_{IB,c}$ among the different supported band combinations involving such band shall be applied.

- When the operating band frequency range is > 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the maximum value for all band combinations defined in clauses 7.3A, 7.3B, 7.3C in ETSI TS 138 521-3 [3] and clauses 7.3A, 7.3B in ETSI TS 138 101-3 [8] for the applicable operating bands.

Unless $\Delta R_{IB,c}$ is specified for the NE-DC configuration, the specified $\Delta R_{IB,c}$ for the EN-DC configuration including the same bands as the corresponding NE-DC configuration is applicable for the NE-DC configuration.

4.3.2.7.3.2 Void

4.3.2.7.3.3 Void

4.3.2.7.3.4 $\Delta R_{IB,c}$ for Inter-band EN-DC within FR1

4.3.2.7.3.4.1 $\Delta R_{IB,c}$ for Inter-band EN-DC in two bands within FR1

Table 4.3.2.7.3.4.1-1: $\Delta R_{IB,c}$ due to EN-DC(two bands)

Inter-band EN-DC configuration	E-UTRA or NR Band	$\Delta R_{IB,c}$ (dB)
DC_1_n28	n28	0,2
DC_1_n77	1	0,2
	n77	0,5
DC_1_n78	n78	0,5
DC_3_n77	3	0,2
	n77	0,5
DC_3_n78	3	0,2
	n78	0,5
DC_7_n77	n77	0,5
DC_7_n78 DC_7-7_n78	n78	0,5
DC_8_n77	8	0,2
	n77	0,5
DC_8_n78	3	0,2
	n78	0,5
DC_20_n78	n78	0,5
DC_28_n77	28	0,2
	n77	0,5
DC_28_n78	28	0,2
	n78	0,5
DC_38_n78	38	0,4
	n78	0,5
DC_41_n77	n77	0,5
DC_41_n78	n78	0,5

4.3.2.8 Receiver Adjacent Channel Selectivity (ACS)

4.3.2.8.1 Void

4.3.2.8.2 Receiver Adjacent Channel Selectivity for EN-DC

4.3.2.8.2.1 Void

4.3.2.8.2.2 Void

4.3.2.8.2.3 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC within FR1

4.3.2.8.2.3.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an NR and 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).

4.3.2.8.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.8.1.2 for the NR carrier.

4.3.2.8.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.7.2.3 of the present document.

4.3.2.8.2.4 Void

4.3.2.8.2.4 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC including FR2

4.3.2.8.2.4.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a NR 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).

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

4.3.2.8.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.8.1.2 for the NR carrier.

4.3.2.8.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.7.2.4 of the present document.

4.3.2.8.2.5 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC including both FR1 and FR2

4.3.2.8.2.5.1 Definition

Same as in clause 4.3.2.8.2.3.1 and clause 4.3.2.8.2.4.1.

4.3.2.8.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.8.2.3.2 and clause 4.3.2.8.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.8.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.7.2.5 of the present document.

4.3.2.9 Receiver Blocking Characteristics

4.3.2.9.1 Void

4.3.2.9.2 Receiver Blocking Characteristics for EN-DC

4.3.2.9.2.1 Void

4.3.2.9.2.2 Void

4.3.2.9.2.3 Blocking for Inter-Band EN-DC within FR1

4.3.2.9.2.3.1 Definition

The blocking characteristic for EN-DC in FR1 is a measure of the receiver's ability of an UE that supports EN-DC in FR1 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 occurs.

4.3.2.9.2.3.2 Limits

4.3.2.9.2.3.2.1 In-band blocking

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.9.1.2.1 for the NR carrier.

4.3.2.9.2.3.2.2 Out-of-band blocking

Exception requirements for both NR and E-UTRA are defined for this test and therefore LTE anchor agnostic approach is not applied. E-UTRA test point analysis is included and E-UTRA measurements are performed.

Out-of-band blocking requirements for E-UTRA single carrier and CA operation specified in clauses 4.2.7.1 and 4.2.7.2 of ETSI EN 301 908−13 [12] and for NR single carrier operation specified in clause 4.1.2.9.1 apply for lowest level EN-DC fallbacks (two bands) with the following conditions:

- one E-UTRA uplink carrier with the output power set to 4 dB below $P_{CMAX\_L,c}$ and the NR band whose downlink is being tested has its uplink carrier output power set to 29 dB below $P_{CMAX\_L,f,c}$.
- one NR uplink carrier with the output power set to 4 dB below $P_{CMAX\_L,f,c}$ on the NR band with both E-UTRA and NR downlinks being tested with E-UTRA output power set to 29 dB below $P_{CMAX\_L,c}$.

If CW interferer falls in a gap between F_{DL_high} of the E-UTRA or NR band and F_{DL_low} of the NR or E-UTRA band, where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

If F_{DL_high} of the lower E-UTRA or NR band is greater than or equal to the F_{DL_low} of the upper NR or E-UTRA band as in overlapping RX frequency ranges, then the OOB range shall start from the F_{DL_low} of the lower E-UTRA or NR band, and from the F_{DL_high} of the upper NR or E-UTRA band.

For EN-DC combination listed in Table 4.3.2.9.2.3.2.2-1 under the first test condition above, exceptions to the requirement specified in Table 4.3.2.9.2.3.2.2-2 are allowed when the second-order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

Table 4.3.2.9.2.3.2.2-1: EN-DC combination with exceptions allowed

EN-DC combination
DC_8_n77
DC_8_n78
DC_20_n78
DC_28_n77
DC_28_n78

Table 4.3.2.9.2.3.2.2-2: Exceptions allowed

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE: The requirement applies when $\lvert f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB} \rvert \leq (BW_{UL}^{LB} + BW_{DL}^{HB})/2$, where f_{UL}^{LB} and f_{DL}^{HB} are the carrier frequencies for lower frequency band UL and higher frequency band DL, respectively. BW_{UL}^{LB} and BW_{DL}^{HB} are the channel bandwidths configured for lower frequency band UL carrier and higher frequency band DL carrier in MHz, respectively.		

For each of the two test cases in clauses 4.2.7.1 and 4.2.7.2 of ETSI EN 301 908−13 [12] and for NR single carrier specified in clause 4.1.2.9.1 for all interferer frequency ranges a maximum of:

$$\lfloor max\{24{,}6 \cdot \lceil n \cdot N_{RB}/6 \rceil\}/min\{\lfloor n \cdot N_{RB}/10 \rfloor, 5\} \rfloor$$

Exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min(\lfloor CBW/2 \rfloor, 5)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, *CBW* the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 4.3.2.10.2.3 apply.

4.3.2.9.2.3.2.3 Narrow band blocking

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.9.1.2.3 for the NR carrier.

4.3.2.9.2.1.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.8.2.3 of the present document.

4.3.2.9.2.4 Void

4.3.2.9.2.4 Receiver Blocking for Inter-Band EN-DC including FR2

4.3.2.9.2.4.1 Definition

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 occurs. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link angle).

The requirement applies at the RIB when the AoA of the incident wave of the wanted signal and the interfering signal are both from the direction where peak gain is achieved.

The wanted and interfering signals apply to all supported polarizations, under the assumption of polarization match.

4.3.2.9.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.9.1.2 for the NR carrier.

4.3.2.9.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.8.2.4 of the present document.

4.3.2.9.2.5 Receiver Blocking for Inter-Band EN-DC including both FR1 and FR2

4.3.2.9.2.5.1 Definition

Same as in clause 4.3.2.9.2.3.1 and clause 4.3.2.9.2.4.1.

4.3.2.9.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.9.2.3.2 and clause 4.3.2.9.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.9.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.8.2.5 of the present document.

4.3.2.10 Receiver Spurious Response

4.3.2.10.1 Void

4.3.2.10.2 Receiver Spurious Response for EN-DC

4.3.2.10.2.1 Void

4.3.2.10.2.2 Void

4.3.2.10.2.3 Receiver Spurious Response for Inter-Band EN-DC within FR1

4.3.2.10.2.3.1 Definition

Spurious response is a measure of the ability of the receiver 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 for which a response is obtained, i.e. for which the out-of-band blocking limit as specified in clause 4.3.2.9.2.3.2.2 is not met.

The lack of the spurious response ability decreases the coverage area when another unwanted interfering signal exists at any other frequency.

4.3.2.10.2.3.2 Limits

Exception requirements for both NR and E-UTRA are defined for this test and therefore LTE anchor agnostic approach is not applied. E-UTRA test point analysis is included and E-UTRA measurements are performed.

Spurious response requirement for E-UTRA single carrier and CA operation specified in clauses 4.2.8.1 and 4.2.8.2 of ETSI EN 301 908−13 [12] and for NR single carrier specified in clauses 4.1.2.10 apply for lowest level EN-DC fallbacks (two bands) with the following conditions:

- one E-UTRA uplink carrier with the output power set to 4 dB below $P_{CMAX\_L,c}$ and the NR band whose downlink is being tested has its uplink carrier output power set to 29 dB below $P_{CMAX\_L,f,c}$;
- one NR uplink carrier with the output power set to 4 dB below $P_{CMAX\_L,f,c}$ on the NR band with both E-UTRA and NR downlinks being tested with E-UTRA output power set to 29 dB below $P_{CMAX\_L,c}$.

4.3.2.10.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.9.2.3 of the present document.

4.3.2.10.2.4 Void

4.3.2.10.2.5 Receiver Spurious Response for Inter-Band EN-DC including both FR1 and FR2

4.3.2.10.2.5.1 Definition

Same as in clause 4.3.2.10.2.3.1.

4.3.2.10.2.5.2 Limits

The FR1 conducted requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 in clause 4.3.2.10.2.3.2. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.10.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.9.2.5 of the present document.

4.3.2.11 Receiver Intermodulation Characteristic

4.3.2.11.1 Void

4.3.2.11.2 Wideband Intermodulation for EN-DC

4.3.2.11.2.1 Void

4.3.2.11.2.2 Void

4.3.2.11.2.3 Wideband Intermodulation for Inter-Band EN-DC within FR1

4.3.2.11.2.3.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal

4.3.2.11.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.11.1.2 for the NR carrier.

4.3.2.11.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.10.2.3 of the present document.

4.3.2.11.2.4 Void

4.3.2.11.2.5 Receiver Intermodulation for Inter-Band EN-DC including both FR1 and FR2

4.3.2.11.2.5.1 Definition

Same as in clause 4.3.2.11.2.3.1.

4.3.2.11.2.5.2 Limits

The FR1 conducted requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 test cases in clause 4.3.2.11.2.3.2. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

4.3.2.11.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.10.2.5 of the present document.

4.3.2.12 Receiver Spurious Emissions

4.3.2.12.1 Void

4.3.2.12.2 Receiver Spurious Emissions for EN-DC

4.3.2.12.2.1 Void

4.3.2.12.2.2 Void

4.3.2.12.2.3 Receiver Spurious Emissions for Inter-Band EN-DC within FR1

####### 4.3.2.12.2.3.1 Definition

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

####### 4.3.2.12.2.3.2 Limits

No exception requirements are applicable to NR or LTE. LTE anchor agnostic approach is applied.

Same limits as in clause 4.1.2.12.1.2.

####### 4.3.2.12.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.11.2.3 of the present document.

4.3.2.12.2.4 Receiver Spurious Emissions for Inter-Band EN-DC including FR2

####### 4.3.2.12.2.4.1 Definition

The spurious emissions power is the power of emissions generated or amplified in a receiver. The spurious emissions power level is measured as TRP. The requirement is verified in beam locked mode with the test metric of TRP (Link= TX beam peak direction, Meas=TRP grid).

####### 4.3.2.12.2.4.2 Limits

LTE anchor agnostic approach is applied as defined in clause 4.3.2.1. Same limits as in clause 4.2.2.10.1.2 for the NR carrier.

####### 4.3.2.12.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.11.2.4 of the present document.

4.3.2.12.2.5 Receiver Spurious Emissions for Inter-Band EN-DC including both FR1 and FR2

####### 4.3.2.12.2.5.1 Definition

Same as in clause 4.3.2.12.2.3.1 and clause 4.3.2.12.2.4.1.

####### 4.3.2.12.2.5.2 Limits

The FR1 conducted and FR2 radiated requirements are tested separately. The NSA limits/requirements apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 4.3.2.12.2.3.2 and clause 4.3.2.12.2.4.2 respectively. LTE anchor agnostic approach is applied as defined in clause 4.3.2.1.

####### 4.3.2.12.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3.11.2.5 of the present document.

5 Testing for compliance with technical requirements

5.1 Testing for compliance with technical requirements for Frequency Range 1

5.1.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.

All tests shall be conducted using normal test conditions except where otherwise stated. For guidance on the use of other conditions to be used in order to show compliance reference can be made to ETSI TS 138 521-1 [1], clause F.1.1.

5.1.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) k = 1,96 (which provide a confidence level of respectively 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.5], in particular in annex C of the ETSI TR 100 028-2 [i.5]. For guidance on other measurement conditions reference can be made to annexes A to H of ETSI TS 138 521-1 [1].

Recommended values for the maximum measurement uncertainty based on this expansion factor can be found in annex D.

5.1.3 Essential radio test suites

5.1.3.0 General

This clause describes the test suites that shall be used for 5G-NR frequency range 1.

5.1.3.1 Transmitter Maximum Output Power

5.1.3.1.1 Transmitter Maximum Output Power for Single Carrier

5.1.3.1.1.1 Method of test

5.1.3.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.1.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.1.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Mid, Highest (note 3)	
Test SCS as specified in Table 1.1-6		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for maximum output power test case	**Modulation (note 2)**	**RB allocation (note 1)**
1		DFT-s-OFDM PI/2 BPSK	Inner Full
2		DFT-s-OFDM PI/2 BPSK	Inner 1RB Left
3		DFT-s-OFDM PI/2 BPSK	Inner 1RB Right
4		DFT-s-OFDM QPSK	Inner Full
5		DFT-s-OFDM QPSK	Inner 1RB Left
6		DFT-s-OFDM QPSK	Inner 1RB Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1]. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 3: For band n28, the Highest test channel bandwidth is replaced by 20 MHz due to MPR is always larger than 0 dB for 30 MHz bandwidth.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.1.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.2.1.4.3 of ETSI TS 138 521-1 [1].

5.1.3.1.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.1.1.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

4) For UEs supporting Power Class 2, repeat steps 1~3 on the applicable bands with message exception of P-Max defined in Table 6.2.1.4.3-2 in ETSI TS 138 521-1 [1].

5.1.3.1.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.2.1.2 in order to show compliance.

5.1.3.1.2 Void

5.1.3.1.3 Void

5.1.3.1.4 Void

5.1.3.1.5 Transmitter Maximum Output Power for UL-MIMO

5.1.3.1.5.1 Method of test

5.1.3.1.5.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.1.5.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.1.5.1.1-1: Test Configuration Table for 2-layer UL MIMO

Initial Conditions
N/A
Test Parameters for Channel Bandwidths
N/A

NOTE: No test points are defined since there is no configuration satisfying MPR=0 dB. .

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.1.5.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.2D.1.4.3 of ETSI TS 138 521-1 [1].

5.1.3.1.5.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.1.5.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3) Measure the sum of the mean power of the UE at each transmit antenna connector in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of 1 ms over all active uplink slots and in the uplink symbols. For TDD slots only slots consisting of only UL symbols are under.

5.1.3.1.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.2.5.2 in order to show compliance.

NOTE: No test points are defined in this release.

5.1.3.2 Transmitter Minimum Output Power

5.1.3.2.1 Transmitter Minimum Output Power for Single Carrier

5.1.3.2.1.1 Method of test

5.1.3.2.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.2.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clauses A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.2.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4] clause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4] clause 4.3.1		Low range, Mid range, High range (note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4] clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**Modulation**	**RB allocation (note 1)**
1		DFT-s-OFDM QPSK	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1]. NOTE 2: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.2.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.3.1.4.3. of ETSI TS 138 521-1 [1].

5.1.3.2.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.2.1.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.

3) Measure the mean power of the UE in the associated measurement channel bandwidth specified in Table 4.1.2.3.1.2-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD slots with transient periods are not under test.

5.1.3.2.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.3.1.2 in order to show compliance.

5.1.3.2.2 Void

5.1.3.2.3 Void

5.1.3.2.4 Void

5.1.3.2.5 Transmitter Minimum Output Power for UL-MIMO

5.1.3.2.5.1 Method of test

5.1.3.2.5.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.2.5.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.2.5.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4] clause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4] clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4] clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**Modulation**	**RB allocation (note)**
1		CP-OFDM QPSK	Outer Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4] annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.2.5.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.3D.1.4.3 of ETSI TS 138 521-1 [1].

5.1.3.2.5.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.2.5.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.

3) Measure the sum of the mean power of the UE at each UE antenna connector in the associated measurement channel bandwidth specified in Table 4.1.2.3.1.2-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of 1 ms over all active uplink slots and in the uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

5.1.3.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.3.5.2 in order to show compliance.

5.1.3.3 Transmitter Spectrum Emission Mask

5.1.3.3.1 Transmitter Spectrum Emission Mask for Single Carrier

5.1.3.3.1.1 Method of test

5.1.3.3.1.1.1 General spectrum emission mask

5.1.3.3.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, which are shown in Tables 5.1.3.3.1.1.1.1-1, 5.1.3.3.1.1.1.1-2, and 5.1.3.3.1.1.1.1-3. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.3.1.1.1.1-1: Test Configuration Table for power class 3 (contiguous allocation)

Default Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1					Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Low range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 1.1-6					Lowest, Highest	
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Spectrum Emission Mask test case	**Modulation (note 2)**	**RB allocation (note 1)**
1 note 3	Low				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left
2 note 3	High				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right
3 note 3	Default				DFT-s-OFDM PI/2 BPSK	Outer_Full
4 note 4	Low				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Left
5 note 4	High				DFT-s-OFDM PI/2 BPSK	Edge_1RB_Right
6 note 4	Default				DFT-s-OFDM PI/2 BPSK	Outer_Full
7	Low				DFT-s-OFDM QPSK	Edger_1RB_Left
8	High				DFT-s-OFDM QPSK	Edge_1RB_Right
9	Default				DFT-s-OFDM QPSK	Outer_Full
10	Low				DFT-s-OFDM 16 QAM	Edge_1RB_Left
11	High				DFT-s-OFDM 16 QAM	Edge_1RB_Right
12	Default				DFT-s-OFDM 16 QAM	Outer_Full
13	Low				DFT-s-OFDM 64 QAM	Edge_1RB_Left
14	High				DFT-s-OFDM 64 QAM	Edge_1RB_Right
15	Default				DFT-s-OFDM 64 QAM	Outer_Full
16	Low				DFT-s-OFDM 256 QAM	Edge_1RB_Left
17	High				DFT-s-OFDM 256 QAM	Edge_1RB_Right
18	Default				DFT-s-OFDM 256 QAM	Outer_Full
19	Low				CP-OFDM QPSK	Edge_1RB_Left
20	High				CP-OFDM QPSK	Edge_1RB_Right
21	Default				CP-OFDM QPSK	Outer_Full
22	Low				CP-OFDM 16 QAM	Edge_1RB_Left
23	High				CP-OFDM 16 QAM	Edge_1RB_Right
24	Default				CP-OFDM 16 QAM	Outer_Full
25	Low				CP-OFDM 64 QAM	Edge_1RB_Left
26	High				CP-OFDM 64 QAM	Edge_1RB_Right
27	Default				CP-OFDM 64 QAM	Outer_Full

28	Low				CP-OFDM 256 QAM	Edge_1RB_Left
29	High				CP-OFDM 256 QAM	Edge_1RB_Right
30	Default				CP-OFDM 256 QAM	Outer_Full
31 notes 5&6	Low				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
32 notes 5&6	High				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
33 notes 5&6	Default				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full

NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and the IE *powerBoostPi2BPSK* is set to 1 for bands n40, n41, n77 andn78.
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77 and n78, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n41, n77 and n78.
NOTE 5: For Power Class 3 testing, UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77 and n78, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n77 and n78.
NOTE 6: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

Table 5.1.3.3.1.1.1.1-2: Test Configuration Table for power class 2 (contiguous allocation)

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 1.1-6			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A	**Modulation (note 2)**	**RB allocation (note 1)**
1	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
2	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
3	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
4	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
5	High		DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default		DFT-s-OFDM QPSK	Outer Full
7	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default		DFT-s-OFDM 16 QAM	Outer Full
10	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 64 QAM	Outer Full
13	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 256 QAM	Outer Full
16	Low		CP-OFDM QPSK	Edge_1RB_Left
17	High		CP-OFDM QPSK	Edge_1RB_Right
18	Default		CP-OFDM QPSK	Outer Full
19	Low		CP-OFDM 16 QAM	Edge_1RB_Left
20	High		CP-OFDM 16 QAM	Edge_1RB_Right
21	Default		CP-OFDM 16 QAM	Outer Full
22	Low		CP-OFDM 64 QAM	Edge_1RB_Left
23	High		CP-OFDM 64 QAM	Edge_1RB_Right
24	Default		CP-OFDM 64 QAM	Outer Full
25	Low		CP-OFDM 256 QAM	Edge_1RB_Left
26	High		CP-OFDM 256 QAM	Edge_1RB_Right
27	Default		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].				
NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.				
NOTE 3: It is essential that all test points in this table also exist in Table 6.2.2.4.1-2 of ETSI TS 138 521-1 [1].				

Table 5.1.3.3.1.1.1.1-3: Test Configuration Table for power class 2&3 (almost contiguous allocation)

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Highest	
Test SCS as specified in Table 1.1-6			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
		N/A	**Modulation**	**RB allocation (note 1)**
1	Default		CP-OFDM QPSK	Inner Full
2	Default		CP-OFDM QPSK	Outer Full
3	Default		CP-OFDM 16 QAM	Inner Full
4	Default		CP-OFDM 16 QAM	Outer Full
5	Default		CP-OFDM 64 QAM	Outer Full
6	Default		CP-OFDM 256 QAM	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.5.2.2.4.1-4 of ETSI TS 138 521-1 [1]. NOTE 2: It is essential that all test points in this Table also exist in Table 6.2.2.4.1-3 of ETSI TS 138 521-1 [1]. NOTE 3: Test applies only for UEs which support almost contiguous UL CP-OFDM transmissions. For PC2 UE which support almost contiguous UL CP-OFDM transmissions, test is only applicable for Release 16 and forward.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.3.1.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.2.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.3.1.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.3.1.1.1.1-1, Table 5.1.3.3.1.1.1.1-2 and Table 5.1.3.3.1.1.1.1-3. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 6.2.2.5-1 to 6.2.2.5-9 of ETSI TS 138 521-1 [1]. The period of the measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots. For TDD, only slots consisting of only UL symbols are under test.

4) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.1.2.4.1.2.1-1 and 4.1.2.4.1.2.1-2. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 5.1.3.3.1.1.1.1-1 and Table 5.1.3.3.1.1.1.1-2, send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: 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.

5.1.3.3.1.1.2 Additional spectrum emission mask

5.1.3.3.1.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in clause 6.2.3.4.1 of ETSI TS 138 521-1 [1]. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4] annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1] and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to the applicable test configuration table in clause 6.2.3.4.1 of ETSI TS 138 521-1 [1].

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.2.3.4.3 of ETSI TS 138 521-1 [1].

5.1.3.3.1.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the applicable test configuration table in clause 6.2.3.4.1 of ETSI TS 138 521-1 [1]. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach the P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in the applicable table in clause 4.1.2.4.1.2.2. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Measure the power of the transmitted signal with a measurement filter of bandwidths according to the applicable test configuration table. The centre frequency of the filter shall be stepped in continuous steps according to the applicable test requirement table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.2.3.4.1-1 through 6.2.3.4.1-2 of ETSI TS 138 521-1 [1], send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3, Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: 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.

5.1.3.3.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.4.1.2 in order to show compliance.

5.1.3.3.2 Void

5.1.3.3.3 Void

5.1.3.3.4 Void

5.1.3.3.5 Transmitter Spectrum Emission Mask for UL-MIMO

5.1.3.3.5.1 Method of test

5.1.3.3.5.1.1 General spectrum emission mask

5.1.3.3.5.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.3.5.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.3.5.1.1.1-1: Test Configuration Table

Default Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1					Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Low range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 1.1-6					Lowest and Highest	
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Spectrum Emission Mask test case	**Modulation**	**RB allocation (note)**
1	Low				CP-OFDM QPSK	Edge_1RB_Left
2	High				CP-OFDM QPSK	Edge_1RB_Right
3	Default				CP-OFDM QPSK	Outer_Full
4	Low				CP-OFDM 16 QAM	Edge_1RB_Left
5	High				CP-OFDM 16 QAM	Edge_1RB_Right
6	Default				CP-OFDM 16 QAM	Outer_Full
7	Low				CP-OFDM 64 QAM	Edge_1RB_Left
8	High				CP-OFDM 64 QAM	Edge_1RB_Right
9	Default				CP-OFDM 64 QAM	Outer_Full
10	Low				CP-OFDM 256 QAM	Edge_1RB_Left
11	High				CP-OFDM 256 QAM	Edge_1RB_Right
12	Default				CP-OFDM 256 QAM	Outer_Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].						

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.3.5.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5D.2.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.3.5.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.3.5.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the sum of the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration according to the requirements described in tables 6.2D.2.5-1 or 6.2D.2.5-2 of ETSI TS 138 521-1 [1]. The period of the measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD, slots consisting of UL symbols only are under test.

4) Measure the power of the transmitted signal at each antenna connector with a measurement filter of bandwidths according to limit tables in clause 4.1.2.4.5.2.1. The centre frequency of the filter shall be stepped in continuous steps according to the same Table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

5.1.3.3.5.1.2 Additional spectrum emission mask

5.1.3.3.5.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.3.5.1.2.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.3.5.1.2.1-1: Test Configuration Table for NS_04 for band n41

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			(See Freq column)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 1.1-6			Lowest, Highest	
Test parameters for NS_04				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
			Modulation	**RB allocation (NOTE)**
1	Low	N/A	CP-OFDM QPSK	Edge_1RB_Left
2	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz		CP-OFDM QPSK	Edge_1RB_Left
3	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)		CP-OFDM QPSK	Inner Full
4			CP-OFDM QPSK	Outer Full
5	High		CP-OFDM QPSK	Edge_1RB_Right
6	High		CP-OFDM QPSK	Inner Full
7	High		CP-OFDM QPSK	Outer Full
8	Low		CP-OFDM 16 QAM	Edge_1RB_Left
9	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz		CP-OFDM 16 QAM	Edge_1RB_Left
10	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)		CP-OFDM 16 QAM	Inner Full
11			CP-OFDM 16 QAM	Outer Full
12	High		CP-OFDM 16 QAM	Edge_1RB_Right
13	High		CP-OFDM 16 QAM	Inner Full
14	High		CP-OFDM 16 QAM	Outer Full
15	Low		CP-OFDM 64 QAM	Edge_1RB_Left
16	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz		CP-OFDM 64 QAM	Edge_1RB_Left
17	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)		CP-OFDM 64 QAM	Outer Full
18	High		CP-OFDM 64 QAM	Edge_1RB_Right
19	High		CP-OFDM 64 QAM	Outer Full
20	Low		CP-OFDM 256 QAM	Edge_1RB_Left
21	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz		CP-OFDM 256 QAM	Edge_1RB_Left
22	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)		CP-OFDM 256 QAM	Outer Full
23	High		CP-OFDM 256 QAM	Edge_1RB_Right
24	High		CP-OFDM 256 QAM	Outer Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to tables 5.1.3.3.5.1.2.1-1.

5) Propagation conditions are set according to Annex B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5D.2.3.4.3 of ETSI TS 138 521-1 [1].

5.1.3.3.5.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.3.5.1.2.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200 ms for the UE to reach P_{UMAX} level.

3) Measure the sum of the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2D.3.5-1 or 6.2D.3.5-2 of ETSI TS 138 521-1 [1]. The period of the measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

4) Measure the power of the transmitted signal at each antenna connector with a measurement filter of bandwidths according to limit tables in clause 4.1.2.4.5.2.2. The centre frequency of the filter shall be stepped in continuous steps according to the same Table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

5.1.3.3.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.4.5.2 in order to show compliance.

5.1.3.4 Transmitter Adjacent Channel Leakage Power Ratio

5.1.3.4.1 Transmitter Adjacent Channel Leakage Power Ratio for Single Carrier

5.1.3.4.1.1 Method of test

5.1.3.4.1.1.1 NR ACLR

5.1.3.4.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in the test configuration tables in clause 6.2.2.4.1 of ETSI TS 138 521-1 [1]. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4] annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2.2.4.1 of ETSI TS 138 521-1 [1].

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.2.4.1.4.3 of ETSI TS 138 521-1 [1].

5.1.3.4.1.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the test configuration tables in clause 6.2.2.4.1 of ETSI TS 138 521-1 [1]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2.2.4.2 of ETSI TS 138 521-1 [1], which shall meet the requirements described in clause 6.2.2.5 of ETSI TS 138 521-1 [1] as appropriate.

4) Measure the rectangular filtered mean power for the assigned NR channel.

5) Measure the rectangular filtered mean power of the first NR adjacent channel on both the lower and upper side of the assigned NR channel, respectively.

6) Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR, respectively.

7) For UEs supporting Power Class 2, repeat steps 1~6 for Test ID 22 and 36 in Table 6.2.2.4.1-1 of ETSI TS 138 521-1 [1] on the applicable bands with message exception of P-Max defined in Table 6.5.2.4.1.4.3-1 of ETSI TS 138 521-1 [1].

8) Void.

NOTE: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2.2.4.1 of ETSI TS 138 521-1 [1], send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

5.1.3.4.1.1.2 UTRA ACLR

5.1.3.4.1.1.2.1 Initial conditions

Same as in clause 6.2.3.4.1 of ETSI TS 138 521-1 [1] with the following exceptions:

- Only network signalling values NS_5U, NS_43U, and NS_100 with the corresponding band defined in Table 6.2.3.3.1-1 of ETSI TS 138 521-1 [1] need to perform the UTRA ACLR test.

- Message contents in step 6 are defined in clause 6.5.2.4.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.4.1.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the applicable test configuration table in clause 6.2.3.4.1 of ETSI TS 138 521-1 [1]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in clause 6.2.3.5 of ETSI TS 138 521-1 [1] as appropriate. The period of the measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD slots with transient periods are not under test.

4) Measure the rectangular filtered mean power for the assigned NR channel.

5) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel on both the lower and upper side of the NR channel, respectively.

6) Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper UTRA ACLR, respectively.

NOTE: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.2.3.4.1-1 of ETSI TS 138 521-1 [1], send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

5.1.3.4.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.5.1.2 in order to show compliance.

5.1.3.4.2 Void

5.1.3.4.3 Void

5.1.3.4.4 Void

5.1.3.4.5 Transmitter Adjacent Channel Leakage Power Ratio for UL-MIMO

5.1.3.4.5.1 Method of test

5.1.3.4.5.1.1 NR ACLR

5.1.3.4.5.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in the test configuration tables in clause 6.2D.2.4.1 of ETSI TS 138 521-1 [1]. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to the test configuration tables in clause 6.2D.2.4.1 of ETSI TS 138 521-1 [1].

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4] clause 4.5. Message contents are defined in clause 6.5D.2.4.1.4.3 of ETSI TS 138 521-1 [1]. (If UE supports ULFPTx. The PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode1, ULFPTx_Mode2 or ULFPTx_ModeFull in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2 depending on UE reported capability.)

5.1.3.4.5.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to the test configuration tables in clause 6.2D.2. 4 of ETSI TS 138 521-1 [1]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the sum of the mean power of the UE at from both antenna connectors in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of clause 6.2D.2.4.2 of ETSI TS 138 521-1 [1], which shall meet the requirements described in clauses 6.2D.2.5 of ETSI TS 138 521-1 [1] as appropriate.

4) Measure the rectangular filtered mean power for the assigned NR channel at each antenna connector of UE.

5) Measure the rectangular filtered mean power of the first NR adjacent channel at each antenna connector of UE on both the lower and upper side of the assigned NR channel, respectively.

6) Calculate the ratios of the power between the values measured in step 4) over step 5) for lower and upper NR ACLR at each antenna connector of UE, respectively.

5.1.3.4.5.1.2 UTRA ACLR

5.1.3.4.5.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, which are shown in Table 5.1.3.4.5.1.2.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.4.5.1.2.1-1: Test Configuration Table for NS_03U

Default Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4] clause 4.1					Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4] clause 4.3.1					Low range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4] clause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 1.1-6					Lowest, Highest	
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Adjacent Channel Leakage Ratio test case	**Modulation**	**RB allocation (note)**
1	Low				CP-OFDM QPSK	Edge_1RB_Left
2	High				CP-OFDM QPSK	Edge_1RB_Right
3	Default				CP-OFDM QPSK	Outer_Full
4	Low				CP-OFDM 16 QAM	Edge_1RB_Left
5	High				CP-OFDM 16 QAM	Edge_1RB_Right
6	Default				CP-OFDM 16 QAM	Outer_Full
7	Low				CP-OFDM 64 QAM	Edge_1RB_Left
8	High				CP-OFDM 64 QAM	Edge_1RB_Right
9	Default				CP-OFDM 64 QAM	Outer_Full
10	Low				CP-OFDM 256 QAM	Edge_1RB_Left
11	High				CP-OFDM 256 QAM	Edge_1RB_Right
12	Default				CP-OFDM 256 QAM	Outer_Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].						

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.4.5.1.2.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4] clause 4.5. Message contents are defined in clause 6.5D.2.4.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.4.5.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.4.5.1.2.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4] clause 4.3.6.1.1.2.

2) Send continuously power control "up" commands to the UE until the UE transmits at the P_{UMAX} level. Allow at least 200 ms for the UE to reach the P_{UMAX} level.

3) Measure the sum of the mean power of the UE at each antenna connector in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in clause 6.2D.3.5 of ETSI TS 138 521-1 [1] as appropriate. The period of the measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

4) Measure the rectangular filtered mean power for the assigned NR channel at each antenna connector of UE.

5) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel at each antenna connector of UE on both the lower and upper side of the assigned NR channel, respectively.

6) Calculate the ratio of the power between the values measured in step 4 over step 5 for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$ for both lower an upper side of the assigned NR channel, respectively.

5.1.3.4.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.5.5.2 in order to show compliance.

5.1.3.5 Transmitter Spurious Emissions

5.1.3.5.1 Transmitter Spurious Emissions for Single Carrier

5.1.3.5.1.1 Method of test

5.1.3.5.1.1.1 General spurious emissions

5.1.3.5.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, which are shown in Table 5.1.3.5.1.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.5.1.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1.		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Low range, Mid range, High range (note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spurious Emissions testing	**Modulation**	**RB allocation (note 1)**
1		CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] Common UL configuration. NOTE 2: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.5.1.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4] clause 4.5. Message contents are defined in clause 6.5.3.1.4.3 of ETSI TS 138 521-1 [1] with no exceptions.

5.1.3.5.1.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.5.1.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 4.1.2.6.1.2.1-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 4.1.2.6.1.2.1-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4) For UE operating on Band n41, redo the test for the frequency range 1 GHz ≤ f < 12,75 GHz with the message content in step 6 of initial conditions with exceptions defined in clause 6.5.3.1.4.3 of ETSI TS 138 521-1 [1].

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.

5.1.3.5.1.1.2 Spurious emission for UE co-existence

5.1.3.5.1.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.5.1.1.2.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.5.1.1.2.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1.		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Low range, Mid range, High range (see note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (note 1)**
1		CP-OFDM QPSK	Outer_Full
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in ETSI TS 138 521-1 [1], Table 6.1-1 Common UL configuration. NOTE 2: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.5.1.1.2.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4] clause 4.5. Message contents are defined in clause 6.5.3.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.5.1.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.5.1.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 4.1.2.6.1.2.2-1. The centre frequency of the filter shall be stepped in contiguous steps according to table 4.1.2.6.1.2.2-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

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.

5.1.3.5.1.1.3 Additional spurious emissions

5.1.3.5.1.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All these configurations shall be tested with applicable test parameters for each channel bandwidth and sub-carrier spacing, are shown in this clause for different NS values. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

For network signalled value NS_04 the same test configuration as listed in Table 6.2.3.4.1-2 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 10, 15, 20, 40, 50, 60, 80, 90 and 100 MHz.
- Test SCS shall be: Lowest.

Table 5.1.3.5.1.1.3.1-1: Test Configuration Table (network signalled value "NS_17")

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		5 MHz, 10 MHz	
Test SCS as specified in Table 1.1-6		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (note)**
1		CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] Common UL configuration.			

For network signalled value NS_18 the same test configuration as listed in Table 6.2.3.4.1-11 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 5, 10, 20 and 30 MHz.
- Test SCS shall be: Lowest.

For network signalled value NS_05 and NS_05U the same test configuration as listed in Table 6.2.3.4.1-4 of ETSI TS 138 521-1 [1] shall be used with the following exceptions: Test SCS shall be: Lowest.

For network signalled value NS_43 and NS_43U the same test configuration as listed in Table 6.2.3.4.1-6 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 5, 10 and 15 MHz.
- Test SCS shall be: Lowest.

For network signalled value NS_41 the same test configuration as listed in Table 6.2.3.4.1-15 of ETSI TS 138 521-1 [1] shall be used.

For network signalled value NS_42 the same test configuration as listed in Table 6.2.3.4.1-16 of ETSI TS 138 521-1 [1] shall be used.

For network signalled value NS_24 the same test configuration as listed in Table 6.2.3.4.1-12 of ETSI TS 138 521-1 [1] shall be used.

For network signalled value NS_47 the same test configuration as listed in Table 6.2.3.4.1-17, Table 6.2.3.4.1-17a and Table 6.2.3.4.1-18 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 30 MHz.
- Test SCS shall be: Lowest.

For network signalled value NS_48 the same test configuration as listed in Table 6.2.3.4.1-19 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, 45 and 50 MHz
- Test SCS shall be: Lowest.

For network signalled value NS_49 the same test configuration as listed in Table 6.2.3.4.1-29 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, 45 and 50 MHz
- Test SCS shall be: Lowest.

For network signalled value NS_44 the same test configuration as listed in Table 6.2.3.4.1-26 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test SCS shall be: Lowest.

1) Connect the SS to the UE to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to clause 5.1.3.5.1.1.3.1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.3.3.4.3 of ETSI TS 138 521-1 [1].

5.1.3.5.1.1.3.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0-1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.5.1.1.3.1-1-1 through Table 5.1.3.5.1.1.3.1-14. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration in tables 5.1.3.5.1.1.3.1-1-1 through 5.1.3.5.1.1.3.1-14 as appropriate, which shall meet the requirements in clause 6.5.3.3.5 of ETSI TS 138 521-1 [1] with allowed A-MPR values specified in tables 6.2.3.5-1 through 6.2.3.5-27 of ETSI TS 138 521-1 [1] as appropriate per test condition specified in tables 6.2.3.4.1-1 through 6.2.3.4.1-30 of ETSI TS 138 521-1 [1] as appropriate. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.3.3.1-1 to Table 6.5.3.3.3.1-27 of ETSI TS 138 521-1 [1] as appropriate. The centre frequency of the filter shall be stepped in contiguous steps according to the same table. For NS_41 the additional spurious emissions requirement shall be verified with UE transmission power obtained by sending uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level 15 dBm for at least the duration of the additional spurious emissions measurement.

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 5.1.3.5.1.1.3.2-1: Uplink power control window for FR1 standalone

Carrier centre frequency, F_C	$BW_{Channel}$	Uplink power control window (dB)
$F_C \leq 3{,}0$ GHz	$BW_{Channel} \leq 40$ MHz	-0,7 dB to 3,1 dB
	40 MHz < $BW_{Channel} \leq 100$ MHz	-1,4 dB to 4,1 dB
3,0 GHz < $F_C \leq 4{,}2$ GHz	$BW_{Channel} \leq 40$ MHz	-1,0 dB to 3,4 dB
	40 MHz < $BW_{Channel} \leq 100$ MHz	-1,6 dB to 4,3 dB
4,2 GHz < $F_C \leq 6{,}0$ GHz	$BW_{Channel} \leq 20$ MHz	-1,3 dB to 3,7 dB
	20 MHz < $BW_{Channel} \leq 40$ MHz	-1,5 dB to 3,9 dB
	40 MHz < $BW_{Channel} \leq 100$ MHz	-1,6 dB to 4,3 dB

5.1.3.5.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.6.1.2 in order to show compliance.

5.1.3.5.2 Void

5.1.3.5.3 Void

5.1.3.5.4 Void

5.1.3.5.5 Transmitter Spurious Emissions for UL-MIMO

5.1.3.5.5.1 Method of test

5.1.3.5.5.1.1 General spurious emissions

5.1.3.5.5.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.5.5.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.5.5.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1.		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spurious Emissions testing	Modulation	RB allocation (note)
1		CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] Common UL configuration.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.2.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to Table 5.1.3.5.5.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5D.3.1.4.3 of ETSI TS 138 521-1 [1].

5.1.3.5.5.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.5.5.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the power of the transmitted signal at each antenna connector with a measurement filter of bandwidths according to Table 4.1.2.6.1.2.1-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 4.1.2.6.1.2.1-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

5.1.3.5.5.1.2 Spurious emission for UE co-existence

5.1.3.5.5.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.5.5.1.2.1-1 The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.5.5.1.2.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1.		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spurious Emissions testing	Modulation	RB allocation (note)
1		CP-OFDM QPSK	Outer_Full
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] Common UL configuration.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.2.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channels are set according to Table 5.1.3.5.5.1.2.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5D.3.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.5.5.1.2.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.5.5.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the power of the transmitted signal at each UE antenna connector with a measurement filter of bandwidths according to Table 4.1.2.6.1.2.2-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 4.1.2.6.1.2.2-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

5.1.3.5.5.1.3 Additional spurious emissions

5.1.3.5.5.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All these configurations shall be tested with applicable test parameters for each channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.5.5.1.3.1-1 through Table 5.1.3.5.5.1.3.1-12 for different NS values. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.5.5.1.3.1-1: Test Configuration Table (network signalled value "NS_04") (applicable to band n41)

Initial Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1					Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1					(See Freq column)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 1.1-6					Lowest	
Additional spurious emissions test parameters for NS_04						
				Downlink Configuration	**Uplink Configuration**	
Test ID	**Freq**			**N/A for A-MPR testing**	**Modulation**	**RB allocation (see note)**
1	Low				CP-OFDM QPSK	Edge_1RB_Left
2	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz				CP-OFDM QPSK	Edge_1RB_Left
4	2 496 + $BW_{Channel}$ /2 +				CP-OFDM QPSK	Inner Full
4	MAX(10 MHz, 0,25 × $BW_{Channel}$)				CP-OFDM QPSK	Outer Full
5	High				CP-OFDM QPSK	Edge_1RB_Right
6	High				CP-OFDM QPSK	Inner Full
7	High				CP-OFDM QPSK	Outer Full
8	Low				CP-OFDM 16 QAM	Edge_1RB_Left
9	2 496 + 3/2 × $BW_{Channel}$ - 6 MHz				CP-OFDM 16 QAM	Edge_1RB_Left
10	2 496 + $BW_{Channel}$ /2 +				CP-OFDM 16 QAM	Inner Full
11	MAX(10 MHz, 0,25 × $BW_{Channel}$)				CP-OFDM 16 QAM	Outer Full
12	High				CP-OFDM 16 QAM	Edge_1RB_Right
13	High				CP-OFDM 16 QAM	Inner Full
14	High				CP-OFDM 16 QAM	Outer Full
15	Low				CP-OFDM 64 QAM	Edge_1RB_Left
16	2 496 + 3/2 × $BW_{Channel}$ – 6 MHz				CP-OFDM 64 QAM	Edge_1RB_Left
17	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)				CP-OFDM 64 QAM	Outer Full
18	High				CP-OFDM 64 QAM	Edge_1RB_Right
19	High				CP-OFDM 64 QAM	Outer Full
20	Low				CP-OFDM 256 QAM	Edge_1RB_Left
21	2 496 + 3/2 × $BW_{Channel}$ – 6 MHz				CP-OFDM 256 QAM	Edge_1RB_Left
22	2 496 + $BW_{Channel}$ /2 + MAX(10 MHz, 0,25 × $BW_{Channel}$)				CP-OFDM 256 QAM	Outer Full
23	High				CP-OFDM 256 QAM	Edge_1RB_Right
24	High				CP-OFDM 256 QAM	Outer Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].						

Table 5.1.3.5.5.1.3.1-2: Test Configuration table for NS_47 power class 3 (contiguous allocation) (applicable to band n41)

Initial Conditions	
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	Normal
Test Frequencies	As specified in Tables 6.2.3.4.1-19 and 6.2.3.4.1-20 of ETSI TS 138 521-1 [1]
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1	30 MHz
Test SCS as specified in Table 1.1-6	Lowest

A-MPR test parameters for NS_47									
Test ID	Fc (MHz)	Ch BW (MHz)	SCS (kHz)	Downlink Configuration	Uplink Configuration				
						Modulation (Note 2)	RB allocation (note 1)		
							SCS 15 kHz	SCS 30 kHz	SCS 60 kHz
43	Default	30	Default		CP-OFDM	QPSK	Edge_1RB_Left (A1)		
44	Default	30	Default			QPSK	1@29 (A2)	1@15 (A2)	1@8 (A2)
45	Default	30	Default			QPSK	Edge_1RB_Right (A3)		
46	Default	30	Default			QPSK	Outer_Full (A2)		
47	Default	30	Default			QPSK	108@0 (A4)	54@0 (A4)	27@0 (A4)
48	Default	30	Default			QPSK	80@0 (A4)	40@0 (A4)	20@0 (A4)
49	Default	30	Default			QPSK	54@0 (A2)	27@0 (A2)	12@0 (A2)
50	Default	30	Default			16 QAM	Edge_1RB_Left (A1)		
51	Default	30	Default			16 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
52	Default	30	Default			16 QAM	Edge_1RB_Right (A3)		
53	Default	30	Default			16 QAM	Outer_Full (A2)		
54	Default	30	Default			16 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
55	Default	30	Default			16 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
56	Default	30	Default			16 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
57	Default	30	Default			64 QAM	Edge_1RB_Left (A1)		
58	Default	30	Default			64 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
59	Default	30	Default			64 QAM	Edge_1RB_Right (A3)		
60	Default	30	Default			64 QAM	Outer_Full (A2)		
61	Default	30	Default			64 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
62	Default	30	Default			64 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
63	Default	30	Default			64 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
64	Default	30	Default			256 QAM	Edge_1RB_Left (A1)		
65	Default	30	Default			256 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
66	Default	30	Default			256 QAM	Edge_1RB_Right (A3)		
67	Default	30	Default			256 QAM	Outer_Full (A2)		
68	Default	30	Default			256 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
69	Default	30	Default			256 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
70	Default	30	Default			256 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] unless otherwise stated in this table.
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 3: UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability powerBoosting-pi2BPSK and the IE powerBoostPi2BPSK is set to 1 for bands n41.
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n41, or in TDD mode the IE powerBoostPi2BPSK is set to 0 for bands n41.

Table 5.1.3.5.5.1.3.1-3: Test Configuration table for NS_47 power class 3 (almost contiguous allocation) (applicable to band n41)

Initial Conditions							
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1							Normal
Test Frequencies							As specified in Tables 6.2.3.4.1-19 and 6.2.3.4.1-20 of ETSI TS 138 521-1 [1]
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1							30 MHz
Test SCS as specified in Table 1.1-6							Lowest
A-MPR test parameters for NS_47							
Test ID	**Fc (MHz)**	**Ch BW (MHz)**	**SCS (kHz)**	**Downlink Configuration**	**Uplink Configuration**		
					Modulation		**RB allocation (note 1)**
1	Default	30	Default		CP-OFDM	QPSK	Outer_Full (A2)
2	Default	30	Default			16 QAM	Outer_Full (A2)
3	Default	30	Default			64 QAM	Outer_Full (A2)
4	Default	30	Default			256 QAM	Outer_Full (A2)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.2.2.4.1-4 of ETSI TS 138 521-1 [1]. NOTE 2: Void.							

Table 5.1.3.5.5.1.3.1-4: Test Configuration table for NS_47 power class 2 (contiguous allocation) (applicable to band n41)

Initial Conditions	
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	Normal
Test Frequencies	As specified in Tables 6.2.3.4.1-19 and 6.2.3.4.1-20 of ETSI TS 138 521-1 [1]
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1	30 MHz
Test SCS as specified in Table 1.1-6	Lowest

A-MPR test parameters for NS_47									
Test ID	Fc (MHz)	Ch BW (MHz)	SCS (kHz)	Downlink Configuration	Uplink Configuration				
						Modulation (note 2)	RB allocation (note 1)		
							SCS 15 kHz	SCS 30 kHz	SCS 60 kHz
36	Default	30	Default		CP-OFDM	QPSK	Edge_1RB_Left (A1)		
37	Default	30	Default			QPSK	1@29 (A2)	1@15 (A2)	1@8 (A2)
38	Default	30	Default			QPSK	Edge_1RB_Right (A3)		
39	Default	30	Default			QPSK	Outer_Full (A2)		
40	Default	30	Default			QPSK	108@0 (A4)	54@0 (A4)	27@0 (A4)
41	Default	30	Default			QPSK	80@0 (A4)	40@0 (A4)	20@0 (A4)
42	Default	30	Default			QPSK	54@0 (A2)	27@0 (A2)	12@0 (A2)
43	Default	30	Default			16 QAM	Edge_1RB_Left (A1)		
44	Default	30	Default			16 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
45	Default	30	Default			16 QAM	Edge_1RB_Right (A3)		
46	Default	30	Default			16 QAM	Outer_Full (A2)		
47	Default	30	Default			16 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
48	Default	30	Default			16 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
49	Default	30	Default			16 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
50	Default	30	Default			64 QAM	Edge_1RB_Left (A1)		
51	Default	30	Default			64 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
52	Default	30	Default			64 QAM	Edge_1RB_Right (A3)		
53	Default	30	Default			64 QAM	Outer_Full (A2)		
54	Default	30	Default			64 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
55	Default	30	Default			64 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
56	Default	30	Default			64 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)
57	Default	30	Default			256 QAM	Edge_1RB_Left (A1)		
58	Default	30	Default			256 QAM	1@29 (A2)	1@15 (A2)	1@8 (A2)
59	Default	30	Default			256 QAM	Edge_1RB_Right (A3)		
60	Default	30	Default			256 QAM	Outer_Full (A2)		
61	Default	30	Default			256 QAM	108@0 (A4)	54@0 (A4)	27@0 (A4)
62	Default	30	Default			256 QAM	80@0 (A4)	40@0 (A4)	20@0 (A4)
63	Default	30	Default			256 QAM	54@0 (A2)	27@0 (A2)	12@0 (A2)

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1] unless otherwise stated in this table.
NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.

For network signalled value NS_05 which is applicable to bands n1, n65 and n84, the same test configuration as listed in Table 6.2.3.4.1-4 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 66 to 115 shall be tested.

For network signalled value NS_48 which is applicable to bands n1 and n84, the same test configuration as listed in Table 6.2.3.4.1-19 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40 and 50 MHz
- Test SCS shall be: Lowest.
- Only Test IDs 31 to 60 shall be tested.

For network signalled value NS_49 which is applicable to bands n1 and n84, the same test configuration as listed in Table 6.2.3.4.1-29 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test Channel Bandwidths shall be: 25, 30, 40, 45 and 50 MHz
- Test SCS shall be: Lowest.
- Only Test IDs 53 to 104 shall be tested.

For network signalled value NS_44 which is applicable to band n38, the same test configuration as listed in Table 6.2.3.4.1-26 of ETSI TS 138 521-1 [1] shall be used with the following exceptions:

- Test SCS shall be: Lowest.
- Only Test IDs 23 to 44 shall be tested.

1) Connect the SS to the UE to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement channels are set according to clause 5.1.3.5.5.1.3.1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.3.3.4.3 of ETSI TS 138 521-1 [1].

5.1.3.5.1.1.3.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to tables in clause 5.1.3.5.5.1.3.1 as appropriate. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at the P_{UMAX} level.

3) Measure the sum of the mean power at each UE antenna connector in the channel bandwidth of the radio access mode according to the test configurations in clause 5.1.3.5.5.1.3.1, which shall meet the requirements described in clauses 6.2D.3.5 of ETSI TS 138 521-1 [1] as appropriate for each network signalling. The period of measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots and uplink symbols. For TDD, only slots consisting of only UL symbols are under test.

4) Measure the power of the transmitted signal at each UE antenna connector with a measurement filter of bandwidths according to tables in clause 4.1.2.6.1.2.3 as appropriate. The centre frequency of the filter shall be stepped in contiguous steps according to the same table the measured power shall be verified for each step. The measurement period shall capture the active time slots.

5) If UE supports ULFPTx Mode-2 or Mode-full power, repeat test steps 1~4 with the exception that the PDCCH DCI format 0_1 is specified with the condition ULFPTx_Mode2 or ULFPTx_ModeFull in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2 depending on UE reported capability.

5.1.3.5.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.6.5.2 in order to show compliance.

5.1.3.6 Receiver Reference Sensitivity Level

5.1.3.6.1 Receiver Reference Sensitivity Level for Single Carrier

5.1.3.6.1.1 Method of test

5.1.3.6.1.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 5.1.3.6.1.1.1-1, Table 5.1.3.6.1.1.1-2 and Table 5.1.3.6.1.1.1-3. The details of the uplink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clause A.2.2. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.6.1.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4] clause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4] clause 4.3.1			Low range, Mid range, High range (note 4)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4] clause 4.3.1			Lowest, Mid, Highest (note 4) Lowest UL / Lowest DL, Lowest UL / Highest DL (note 3)	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (note 1)	DFT-s-OFDM QPSK	REFSENS (note 2)

NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 5.1.3.6.1.1.1-2.
NOTE 2: REFSENS refers to Table 5.1.3.6.1.1.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.
NOTE 3: Additional test points selected according to asymmetric channel bandwidths specified in clause 5.3.6 of ETSI TS 138 521-1 [1]. DL channel bandwidth shall be selected first.
NOTE 4: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.
NOTE 5: In a band where UE supports 4Rx, the test needs to be repeated with only 2Rx antennas connected and the other antennas terminated.

Table 5.1.3.6.1.1.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	SCS(kHz)	LCRBmax	Outer RB allocation / Normal RB allocation
5 MHz	15	25	25@0
	30	11	11@0
	60	N/A	N/A
10 MHz	15	52	52@0
	30	24	24@0
	60	11	11@0
15 MHz	15	79	79@0
	30	38	38@0
	60	18	18@0
20 MHz	15	106	106@0
	30	51	51@0
	60	24	24@0
25 MHz	15	133	133@0
	30	65	65@0
	60	31	31@0
30 MHz	15	160	160@0
	30	78	78@0
	60	38	38@0
40 MHz	15	216	216@0
	30	106	106@0
	60	51	51@0
50 MHz	15	270	270@0
	30	133	133@0
	60	65	65@0
60 MHz	15	N/A	N/A
	30	162	162@0
	60	79	79@0
80 MHz	15	N/A	N/A
	30	217	217@0
	60	107	107@0
90 MHz	15	N/A	N/A
	30	245	245@0
	60	121	121@0
100 MHz	15	N/A	N/A
	30	273	273@0
	60	135	135@0
NOTE: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 1.1-6.			

Table 5.1.3.6.1.1.1-3: Uplink configuration for reference sensitivity, LCRB @ Restart format

Operating Band	SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Duplex Mode
n1	15	25@0	50@2[1]	75@4[1]	100@6[1]		128@32[1]	128@88[1]						FDD
	30		24@0	36@2[1]	50@1[1]		64@14[1]	64@42[1]						
	60		10@1[1]	18@0	24@0		30@8[1]	30@21[1]						
n3	15	25@0	50@2[1]	50@29[1]	50@56[1]	50@83[1]	50@110[1]							FDD
	30		24@0	24@14[1]	24@27[1]	24@41[1]	24@54[1]							
	60		10@1[1]	10@8[1]	10@14[1]	10@21[1]	10@28[1]							
n7	15	25@0	50@2[1]	75@4[1]	75@31[1]									FDD
	30		24@0	36@2[1]	36@15[1]									
	60		10@1[1]	18@0	18@6[1]									
n8	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		10@14[1]	10@28[1]	10@41[1]									
	60													
n20	15	25@0	20@0[1]	20@11[2]	20@16[2]									FDD
	30		10@0[1]	10@6[2]	10@8[2]									
	60													
n28	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		10@14[1]	10@28[1]	10@41[1]									
	60													
n38	15	25@0	50@0	75@0	100@0									TDD
	30		24@0	36@0	50@0									
	60		10@0	18@0	24@0									
n40	15	25@0	50@0	75@0	100@0	128@0	160@0	216@0	270@0					TDD
	30		24@0	36@0	50@0	64@0	75@0	100@0	128@0	162@0	216@0			
	60		10@0	18@0	24@0	30@0	36@0	50@0	64@0	75@0	100@0			
n41	15		50@0	75@0	100@0		160@0	216@0	270@0					TDD
	30		24@0	36@0	50@0		75@0	100@0	128@0	162@0	216@0	243@0	270@0	
	60		10@0	18@0	24@0		36@0	50@0	64@0	75@0	100@0	120@0	135@0	
n50	15	25@0	50@0	75@0	100@0[1]			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	note 3			
	60		10@0	18@0	24@0			50@0	64@0	75@0	note 3			
n51	15	25@0												TDD
	30													
	60													
n65	15	25@0	50@2[1]	75@4[1]	100@6[1]									FDD
	30		24@0	36@2[1]	50@1[1]									
	60		10@1[1]	18@0	24@0									
n77	15		50@0	75@0	100@0			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	216@0	243@0	270@0	
	60		10@0	18@0	24@0			50@0	64@0	75@0	100@0	120@0	135@0	

Operating Band	SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Duplex Mode
n78	15		50@0	75@0	100@0[1]			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	216@0	243@0	270@0	
	60		10@0	18@0	24@0			50@0	64@0	75@0	100@0	120@0	135@0	

NOTE 1: 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 5.3.2-1 of ETSI TS 138 101-1 [6]).
NOTE 2: For Band 20; for 15 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16; for 30 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 6 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 8; for 60 kHz SCS, in the case of 15 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 3 and in the case of 20 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 4.
NOTE 3: For DL channel bandwidths that do not have symmetric UL channel bandwidth, the highest valid UL configuration with the lowest duplex distance shall be used.

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, and C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2, and G.3.1.

4) The UL and Reference Measurement Channel is set according to Table 5.1.3.6.1.1.1-1, Table 5.1.3.6.1.1.1-2, and Table 5.1.3.6.1.1.1-3.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.3.2.4.3.

5.1.3.6.1.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.1.3.6.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.6.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the appropriate REFSENS value defined in Table 4.1.2.7.1.2-1 or Table 4.1.2.7.1.2-2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement.

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], clause H.2.

5.1.3.6.1.2 Test requirements

The results obtained in step 4 shall be compared to the limits in Table 4.1.2.7.1.2-1 for two antenna port and Table 4.1.2.7.1.2-2 for four antenna port in order to show compliance.

5.1.3.6.2 Void

5.1.3.6.3 Void

5.1.3.6.4 Void

5.1.3.6.5 Receiver Reference Sensitivity Level for UL-MIMO

5.1.3.6.5.1 Method of test

5.1.3.6.5.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.1-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 5.1.3.6.5.1.1-1, Table 5.1.3.6.1.1.1-2, and Table 5.1.3.6.1.1.1-3. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.6.5.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (note 1)	CP-OFDM QPSK	REFSENS (note 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 5.1.3.6.1.1.1-2. NOTE 2: REFSENS refers to Table 5.1.3.6.1.1.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2 and C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The UL and DL Reference Measurement Channel is set according to Table 5.1.3.6.5.1.1-1, Table 5.1.3.6.1.1.1-2 and Table 5.1.3.6.1.1.1-3.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.3D.2.4.3.

5.1.3.6.5.1.2 Test Procedure

Same test procedure as specified in clause 5.1.3.6.1.1.2 with the following exceptions:

- Instead of Table 5.1.3.6.1.1.1-1, use Table 5.1.3.6.5.1.1-1 in step 1.
- Step 2: SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.6.5.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

5.1.3.6.5.2 Test requirements

The results obtained in step 4 shall be compared to the limits in clause 4.1.2.7.5 in order to show compliance.

5.1.3.7 Receiver Adjacent Channel Selectivity (ACS)

5.1.3.7.1 Receiver Adjacent Channel Selectivity for Single Carrier

5.1.3.7.1.1 Method of test

5.1.3.7.1.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.7.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.7.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range (note 3)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	DFT-s-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 3: For NR band n28, 30 MHz test channel bandwidth is tested with Low range test frequencies.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2, G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.7.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message content is defined in ETSI TS 138 521-1 [1], clause 7.5.4.3.

5.1.3.7.1.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to 5.1.3.7.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.1.3.7.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in Table 4.1.2.8.1.2-3 or Table 4.1.2.8.1.2-5 as appropriate (Case 1). Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.8.1.2-3 or Table 4.1.2.8.1.2-5 for at least the duration of the Throughput measurement.

4) Set the Interferer signal level to the value as defined in Table 4.1.2.8.1.2-3 or Table 4.1.2.8.1.2-5 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in ETSI TS 138 521-1 [1], annex D.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], annex H.

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 4).

7) Set the Downlink signal level to the value as defined in Table 4.1.2.8.1.2-4 or Table 4.1.2.8.1.2-6 as appropriate (Case 2). Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.8.1.2-4 or Table 4.1.2.8.1.2-6 for at least the duration of the Throughput measurement.

8) Set the Interferer signal level to the value as defined in Table 4.1.2.8.1.2-4 or Table 4.1.2.8.1.2-6 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in ETSI TS 138 521-1 [1], annex D.

9) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], annex H.

10) Repeat steps from 7 to 9, using an interfering signal above the wanted signal in Case 2 at step 8).

11) Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.7.1.2 Test requirements

The results obtained shall be compared to the limits in tables 4.1.2.8.1.2-1, 4.1.2.8.1.2-2, 4.1.2.8.1.2-3, 4.1.2.8.1.2-4, 4.1.2.8.1.2-5 and 4.1.2.8.1.2-6 in order to show compliance.

5.1.3.7.2 Void

5.1.3.7.3 Void

5.1.3.7.4 Void

5.1.3.7.5 Receiver Adjacent Channel Selectivity for UL MIMO

5.1.3.7.5.1 Method of test

5.1.3.7.5.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.1-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 5.1.3.7.5.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clause A.2 and clause A.3 respectively. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.7.5.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid and Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	CP-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in tables 5.1.3.6.1.1.1-2 and 5.1.3.6.1.1.1-3 for Downlink and Uplink respectively. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.4 for TE diagram and clause A.3.2.3 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.7.5.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4] clause 4.5. Message content is defined in ETSI TS 138 521-1 [1], clause 7.5D.4.3.

5.1.3.7.5.1.2 Test procedure

Same test procedure as specified in clause 5.1.3.7.1.1.2 with the following exceptions:

- Instead of Table 5.1.3.7.1.1.1-1, use Table 5.1.3.7.5.1.1-1 in step 1.
- Step 2: SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.7.5.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

5.1.3.7.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.8.5 in order to show compliance.

5.1.3.8 Receiver Blocking Characteristics

5.1.3.8.1 Receiver Blocking Characteristics for Single Carrier

5.1.3.8.1.1 Method of test

5.1.3.8.1.1.1 In-band Blocking

5.1.3.8.1.1.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.8.1.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMC) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.8.1.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range (note 3)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	**CP-OFDM QPSK**	note 1	DFT-s-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 3: For NR band n28, 30 MHz test channel bandwidth is tested with Low range test frequencies.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.8.1.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6.2.4.3.

5.1.3.8.1.1.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.1.3.8.1.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.8.1.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3) Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to tables 4.1.2.9.1.2.1-1 and 4.1.2.9.1.2.1-2 or tables 4.1.2.9.1.2.1-3 and 4.1.2.9.1.2.1-4 as appropriate depending on NR band.

4) Set the downlink signal level according to Table 4.1.2.9.1.2.1-1 or 4.1.2.9.1.2.1-3 as appropriate. Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.9.1.2.1-1 or Table 4.1.2.9.1.2.1-3 for at least the duration of the Throughput measurement.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], annex H.

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3.

7) Repeat steps from 3 to 6, using interfering signals in Case 2 at step 3 and 6. The ranges of case 2 are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the centre frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to $F_{Interferer}$ range limit defined at the corresponding band edge.

8) If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 3 at step 3.

9) If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 4 at step 3

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.8.1.1.2 Out-of-band blocking

5.1.3.8.1.1.2.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.8.1.1.2.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3 respectively. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.3.

Table 5.1.3.8.1.1.2.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			One frequency chosen arbitrarily from low or high range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	DFT-s-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4. 2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The UL and DL Reference Measurement Channels are set according to Table 5.1.3.8.1.1.2.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6.3.4.3.

5.1.3.8.1.1.2.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.1.3.8.1.1.2.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.8.1.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 4.1.2.9.1.2.2-2 or Table 4.1.2.9.1.2.2-4. The frequency step size is $\min(\lfloor BW_{channel}/2 \rfloor, 5)$ MHz.

4) Set the downlink signal level according to Table 4.1.2.9.1.2.2-1 or Table 4.1.2.9.1.2.2-3. Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.9.1.2.2-1 or Table 4.1.2.9.1.2.2-3 for at least the duration of the Throughput measurement.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], annex H.

6) Record the frequencies for which the throughput does not meet the requirements.

7) Repeat steps from 3 to 6, using an interfering signal above the wanted signal at step 3.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.8.1.1.3 Narrow band blocking

5.1.3.8.1.1.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.8.1.1.3.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3 respectively. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.8.1.1.3.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range (note 4)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid and Highest (note 2)	
Test SCS as specified in ETSI TS 138 508-1 [4], clause 4.3.1			According to CH BW SCS in Table 4.1.2.9.1.2.3-1	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	DFT-s-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: Void. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 4: For NR band n28, 30 MHz test channel bandwidth is tested with Low range test frequencies.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2 and C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The UL and DL Reference Measurement Channels are set according to Table 5.1.3.8.1.1.3.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6.4.4.3.

5.1.3.8.1.1.3.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.1.3.8.1.1.3.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.8.1.1.3.1-1. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 4.1.2.9.1.2.3-1.

4) Set the downlink signal level according to Table 4.1.2.9.1.2.3-1. Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.9.1.2.3-1 for at least the duration of the Throughput measurement.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], clause H.2.

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.8.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.9.1.2 in order to show compliance.

5.1.3.8.2 Void

5.1.3.8.3 Void

5.1.3.8.4 Void

5.1.3.8.5 Receiver Blocking Characteristics for UL-MIMO

5.1.3.8.5.1 Method of test

5.1.3.8.5.1.1 In-band Blocking

5.1.3.8.5.1.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.8.5.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMC) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.8.5.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	CP-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.5.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS and interfering source to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.4 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2, G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.8.5.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6D.2.4.3.

5.1.3.8.5.1.1.2 Test Procedure

Same test procedure as specified in clause 5.1.3.8.1.1.1.2 with the following exceptions:

- Instead of Table 5.1.3.8.1.1.1.1-1, use Table 5.1.3.8.5.1.1.1-1 in step 1 and step 2.

5.1.3.8.5.1.2 Out-of-band blocking

5.1.3.8.5.1.2.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.8.5.1.2.1-1. The details of the uplink and downlink Reference Measurement Channels (RMC) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.8.5.1.2.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			One frequency chosen arbitrarily from low or high range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	CP-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.5.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS and interfering source to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.5 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2, G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.8.5.1.2.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6D.3.4.3.

5.1.3.8.5.1.2.2 Test Procedure

Same test procedure as specified in 5.1.3.8.1.1.2.2, with the following exceptions:

- Instead of Table 5.1.3.8.1.1.2.1-1, use Table 5.1.3.8.5.1.2.1-1 in step 1 and step 2.

5.1.3.8.5.1.3 Narrow band blocking

5.1.3.8.5.1.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.8.5.1.3.1-1. The details of the uplink and downlink Reference Measurement Channels (RMC) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.8.5.1.3.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	CP-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.5.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS and interfering source to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.5 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2, G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.8.5.1.3.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [1], clause 7.6D.4.4.3.

5.1.3.8.5.1.3.2 Test Procedure

Same test procedure as specified in clause 5.1.3.8.1.1.3.2, with the following exceptions:

- Instead of Table 5.1.3.8.1.1.3.1-1, use Table 5.1.3.8.5.1.3.1-1 in step 1 and step 2.

5.1.3.8.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.9.5 in order to show compliance.

5.1.3.9 Receiver Spurious Response

5.1.3.9.1 Receiver Spurious Response for Single Carrier

5.1.3.9.1.1 Method of test

5.1.3.9.1.1.1 Initial Conditions

The initial conditions shall be the same as in clause 5.1.3.8.1.1.2.1 in order to test spurious responses obtained in clause 5.1.3.8.1.2 under the same conditions.

5.1.3.9.1.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 5.1.3.8.1.1.2.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.1.3.8.1.1.2.1-1. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal according to Table 5.1.3.8.1.2.1.1-1-3. The spurious frequencies are taken from records in the final step of test procedures in Table 5.1.3.8.1.1.2.1-1.

4) Set the downlink signal level according to Table 4.1.2.10.1.2-1 or 4.1.2.10.1.2-2. Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 of the target power level in Table 4.1.2.10.1.2-1 or 4.1.2.10.1.2-2 for at least the duration of the Throughput measurement.

5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], clause H.2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.9.1.1.3 Test requirements

The results obtained in step 5 shall be compared to the limits in Table 4.1.2.10.1.2-1, 4.1.2.10.1.2-2, 4.1.2.10.1.2-3 in order to show compliance.

5.1.3.9.2 Void

5.1.3.9.3 Void

5.1.3.9.4 Void

5.1.3.9.5 Receiver Spurious Response for UL-MIMO

5.1.3.9.5.1 Method of test

5.1.3.9.5.1.1 Initial Conditions

The initial conditions shall be the same as in clause 5.1.3.8.5.1.2.1 in order to test spurious responses obtained in clause 5.1.3.8.5.2 under the same conditions.

5.1.3.9.5.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Test Configuration Table 5.1.3.8.5.1.2.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the Test Configuration Table 5.1.3.8.5.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

3) Set the parameters of the CW signal generator for an interfering signal according to Table 4.1.2.10.5-2. The spurious frequencies are taken from records in the final step of test procedures in clause 5.1.3.8.5.1.2.2.

4) Set the downlink signal level according to Table 4.1.2.10.5-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level Table 4.1.2.10.5-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement.

5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], clause H.2.

5.1.3.9.5.3 Test requirements

The results obtained in step 5 shall be compared to the limits in tables 4.1.2.10.5-1 and 4.1.2.10.5-2 in order to show compliance.

5.1.3.10 Receiver Intermodulation Characteristics

5.1.3.10.1 Receiver Intermodulation Characteristics for Single Carrier

5.1.3.10.1.1 Method of test

5.1.3.10.1.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.10.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.10.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range (note 3)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Highest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	DFT-s-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 3: For NR band n28, 30 MHz test channel bandwidth is tested with Low range test frequencies.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.3 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1] clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.10.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message content is defined in ETSI TS 138 521-1 [1], clause 7.5.4.3.

5.1.3.10.1.1.2 Test Procedure

1) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.1.3.10.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.10.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in Table 4.1.2.11.1.2-1 or Table 4.1.2.11.1.2-2. Send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.1.3.5.1.1.3.2-1 dB of the target power level in Table 4.1.2.11.1.2-1 for at least the duration of the Throughput measurement.

4) Set the Interfering signal levels to the values as defined in Table 4.1.2.11.1.2-1 or Table 4.1.2.11.1.2-2 and frequency below the wanted signal.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 138 521-1 [1], clause G.2.

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 4.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-1 [1], clause F.4.3.

5.1.3.10.1.2 Test requirements

The results obtained in step 5 shall be compared to the limits in tables 4.1.2.11.1.2-1 and 4.1.2.11.1.2-2 in order to show compliance.

5.1.3.10.2 Void

5.1.3.10.3 Void

5.1.3.10.4 Void

5.1.3.10.5 Receiver Intermodulation Characteristics for UL-MIMO

5.1.3.10.5.1 Method of test

5.1.3.10.5.1.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.10.5.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. The details of the OCNG patterns used are specified in ETSI TS 138 521-1 [1], clause A.5. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.10.5.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6			Highest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	note 1	CP-OFDM QPSK	note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.5.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements.				

1) Connect the SS and interfering sources to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.6 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1, and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.10.5.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message content is defined in ETSI TS 138 521-1 [1], clause 7.8D.2.4.3.

5.1.3.10.5.1.2 Test Procedure

Same test procedure as specified in clause 5.1.3.10.1.1.2 with the following exceptions:

- Instead of Table 5.1.3.10.1.1.1-1, use Table 5.1.3.10.5.1.1-1 in step 1 and step 2.

5.1.3.10.5.2 Test requirements

The results obtained in step 5 shall be compared to the limits in clause 4.1.2.11.5 in order to show compliance.

5.1.3.11 Receiver Spurious Emissions

5.1.3.11.1 Receiver Spurious Emissions for Single Carrier

5.1.3.11.1.1 Method of test

5.1.3.11.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.1.3.11.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clauses A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.11.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, Mid range, High range (note 3)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Highest	
Test SCS as specified in Table 1.1-6			Highest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	N/A	0	N/A	0
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.1.3.6.1.1.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 3: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.				

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.5.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 138 521-1 [1], clauses C.0, C.1, C.2, C.3.1 and uplink signals according to ETSI TS 138 521-1 [1], clauses G.0, G.1, G.2 and G.3.1.

4) The DL and UL Reference Measurement Channels are set according to Table 5.1.3.11.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message content is defined in ETSI TS 138 521-1 [1], clause 7.5.4.3.

5.1.3.11.1.1.2 Test Procedure

1) Sweep the spectrum analyser (or equivalent equipment) over a frequency range and measure the average power of spurious emission.

2) Repeat step 1 for all NR Rx antennas of the UE.

5.1.3.11.1.2 Test requirements

The results obtained in step 1 shall be compared to the limits in Table 4.1.2.12.1.2-1 in order to show compliance.

5.1.3.11.2 Void

5.1.3.11.3 Void

5.1.3.11.4 Void

5.1.3.12 Transmit OFF power

5.1.3.12.1 Transmit OFF power for Single Carrier

5.1.3.12.1.1 Method of Test

5.1.3.12.1.1.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.12.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in ETSI TS 138 521-1 [1], clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 138 521-1 [1], clause C.2.

Table 5.1.3.12.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, Mid range, High range (note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**Modulation**	**RB allocation (note 1)**
1		DFT-s-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1]. NOTE 2: For NR band n28, 30 MHz test channel bandwidth is tested with Low range and High range test frequencies.			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4] annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.12.1.1.1-1.

5) Propagation conditions are set according to ETSI TS 138 521-1 [1], clause B.0.

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.3.3.2.4.3 of ETSI TS 138 521-1 [1].

5.1.3.12.1.1.2 Test procedure

1) SS sends uplink scheduling information via PDCCH DCI format 0_1 with TPC command 0 dB for C_RNTI to schedule the UL RMC according to Table 5.1.3.12.1.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for15 kHz SCS, on slots 8 and 18 for 30 kHz SCS and on slots 17 and 37 for 60 kHz SCS.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3) Measure the UE transmission OFF power during the slot prior to the PUSCH transmission, excluding a transient period of 10 µs at the end of the slot.

4) Measure the output power of the UE PUSCH transmission during one slot.

5) Measure the UE transmission OFF power during the slot following the PUSCH transmission, excluding a transient period of 10 µs at the beginning of the slot.

5.1.3.12.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.13.1.2 in order to show compliance.

5.1.3.12.2 Void

5.1.3.12.3 Void

5.1.3.12.4 Void

5.1.3.12.5 Transmit OFF power for UL-MIMO

5.1.3.12.5.1 Method of Test

5.1.3.12.5.1.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.1-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in Table 5.1.3.12.5.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-1 [1]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-1 [1].

Table 5.1.3.12.5.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.1-6		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**Modulation**	**RB allocation (note)**
1		CP-OFDM QPSK	Inner Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 of ETSI TS 138 521-1 [1].			

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], Annex A, Figure A.3.1.1.2 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2 of ETSI TS 138 521-1 [1], and uplink signals according to clauses G.0, G.1, G.2 and G.3.0 of ETSI TS 138 521-1 [1].

4) The UL Reference Measurement Channel is set according to Table 5.1.3.12.5.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1].

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.3D.3.4.3 of ETSI TS 138 521-1 [1].

5.1.3.12.5.1.2 Test procedure

1) SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.1.3.12.5.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for15 kHz SCS, on slots 8 and 18 for 30 kHz SCS and on slots 17 and 37 for 60 kHz SCS. The PDCCH DCI format 0_1 is specified with the condition 2TX_UL_MIMO in ETSI TS 138 508-1 [4], clause 4.3.6.1.1.2.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3) Measure the UE transmission OFF power at each antenna connectors during the slot prior to the PUSCH transmission, excluding a transient period of 10 µs in the end of the slot.

4) Measure the sum output power at two transmit antenna connectors of the UE PUSCH transmission during one slot.

5) Measure the UE transmission OFF power at each antenna connectors during the slot following the PUSCH transmission, excluding a transient period of 10 µs at the beginning of the slot.

5.1.3.12.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.1.2.13.5.2 in order to show compliance.

5.2 Testing for compliance with technical requirements for Frequency Range 2

5.2.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.

All tests shall be conducted using normal test conditions except where otherwise stated. For guidance on the use of other conditions to be used in order to show compliance reference can be made to ETSI TS 138 521-2 [2], clause F.1.1.

5.2.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) k = 1,96 (which provide a confidence level of respectively 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.5], in particular in annex C of the ETSI TR 100 028-2 [i.5]. For guidance on other measurement conditions reference can be made to annexes A to M of ETSI TS 138 521-2 [2].

Recommended values for the maximum measurement uncertainty based on this expansion factor can be found in annex D.

5.2.3 Essential radio test suites

5.2.3.0 General

This clause describes the test suites that shall be used for NR FDD and TDD.

5.2.3.1 Transmitter Maximum Output Power

5.2.3.1.1 Transmitter maximum output power for Single Carrier

5.2.3.1.1.1 Method of test

5.2.3.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.2.3.1.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.2.3.1.1.1.1-1: Test Configuration Table

Default Conditions					
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1				Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Low range, Mid Range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Lowest, 100 MHz, Highest	
Test SCS as specified in Table 1.2-6				120 kHz	
Test Parameters					
Test ID	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default		**Modulation**	**RB allocation (note)**
1	50			DFT-s-OFDM QPSK	Inner_Full for PC3
2	100				
3	200				
4	400				
NOTE: The specific configuration of each RF allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC3.					

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clause C, and uplink signals according to clauses G. in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement Channels are set according to Table 5.2.3.1.1.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.2.1.1.4.3 in ETSI TS 138 521-2 [2].

5.2.3.1.1.1.2 Test procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.2.3.1.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in clause 6.2.1.1.4.3 in ETSI TS 138 521-2 [2].

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (NOTE 1) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 4.2.2.2.1.2-3. The EIRP test procedure is defined in clause K.1.3 in ETSI TS138 521-2 [2]. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.2.3.1.1.2 Test requirements

The results obtained in step 5 shall be compared to the limits in Table 4.2.2.2.1.2-3 in order to show compliance.

5.2.3.2 Transmitter Minimum Output Power

5.2.3.2.1 Transmitter minimum output power for Single Carrier

5.2.3.2.1.1 Method of test

5.2.3.2.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.2.3.2.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.2.3.2.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.2-6.		Highest	
Test Parameters			
	Downlink Configuration	**Uplink Configuration**	
Test ID		**Modulation**	**RB allocation (note)**
1		DFT-s-OFDM QPSK	Outer_Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC 3.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C in ETSI TS 138 521-2 [2] and uplink signals according to annex G in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement Channel is set according to Table 5.2.3.2.1.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.3.1.4.3 in ETSI TS 138 521-2 [2].

5.2.3.2.1.1.2 Test procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.2.3.2.1.1.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure UE EIRP in the Tx beam peak direction in the measurement bandwidth specified Table 4.2.2.3.1.2-2 for the specific channel bandwidth under test. The EIRP test procedure is defined in clause K 1.3 in ETSI TS 138 521-2 [2]. The measuring duration is one active subframe (1 ms). EIRP is calculated considering both polarizations, theta and phi. For TDD, only slots consisting of only UL symbols are under test.

6) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.2.3.2.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.3.1.2 in Table 4.2.2.3.1.2-2 in order to show compliance.

5.2.3.3 Transmitter Spectrum Emission Mask

5.2.3.3.1 Transmitter spectrum emission mask for Single Carrier

5.2.3.3.1.1 Method of test

5.2.3.3.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.2.3.3.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.2.3.3.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 1.2-6		Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (note 1)**
1		DFT-s-OFDM PI/2 BPSK	Outer_Full
2		DFT-s-OFDM QPSK	Outer_Full
3		DFT-s-OFDM16QAM	Outer_Full
4		DFT-s-OFDM 64QAM	Outer_Full
5		CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC3. NOTE 2: All test points in this table should also exist in Table 6.2.2.4.1-7, Table 6.2.2.4.1-8, Table 6.2.2.4.1-9 in ETSI TS 138 521-2 [2] for PC3.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1. for TE diagram and clause A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C in ETSI TS 138 521-2 [2], and uplink signals according to annex G in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement Channels are set according to Table 5.2.3.3.1.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.2.1.4.3 in ETSI TS 138 521-2 [2].

5.2.3.3.1.1.2 Test procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.2.3.3.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note 2) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note 2) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure the TRP of the transmitted signal with a measurement filter of bandwidths according to Table 4.2.2.4.1.2-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. TRP shall be recorded for each step. The measurement period shall capture the active time slots. Total radiated power is measured according to TRP measurement procedure defined in annex K in ETSI TS 138 521-2 [2]. The measurement grid used for TRP measurement defined in annex M in ETSI TS 138 521-2 [2]. TRP is calculated considering both polarizations, theta and phi.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 5.2.3.3.1.1.1-1, send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3, Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.2.3.3.1.2 Test requirements

The results obtained in step 5) shall be compared to the limits in Table 4.2.2.4.1.2-1 in clause 4.2.2.4.1.2 in order to show compliance.

5.2.3.4 Transmitter Adjacent Channel Leakage Power Ratio

5.2.3.4.1 Transmitter adjacent channel leakage power ratio

5.2.3.4.1.1 Method of test

5.2.3.4.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.2.3.4.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.2.3.4.1.1.1-1: Test Configuration Table

Default Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1					Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1					Lowest Highest	
Test SCS as specified in Table 1.2-6					Lowest, Highest	
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default		**Modulation**	**RB allocation (note 1)**
1	Low				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
2	High				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
3	Mid				DFT-s-OFDM PI/2 BPSK	Outer_Full
4	Low				DFT-s-OFDM QPSK	Outer_1RB_Left
5	High				DFT-s-OFDM QPSK	Outer_1RB_Right
6	Mid				DFT-s-OFDM QPSK	Outer_Full
7	Low				DFT-s-OFDM 16 QAM	Outer_1RB_Left
8	High				DFT-s-OFDM 16 QAM	Outer_1RB_Right
9	Mid				DFT-s-OFDM 16 QAM	Outer_Full
10	Low				DFT-s-OFDM 64 QAM	Outer_1RB_Left
11	High				DFT-s-OFDM 64 QAM	Outer_1RB_Right
12	Mid				DFT-s-OFDM 64 QAM	Outer_Full
13	Low				CP-OFDM QPSK	Outer_1RB_Left
14	High				CP-OFDM QPSK	Outer_1RB_Right
15	Mid				CP-OFDM QPSK	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC3 in ETSI TS 138 521-2 [2]. NOTE 2: Following Test IDs shall be skipped for PC3: Test ID 10-12 for 100 MHz Channel Bandwidth. NOTE 3: All test points in this table should also exist in Table 6.2.2.4.1-8 in in ETSI TS 138 521-2 [2].						

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and clause A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C in ETSI TS 138 521-2 [2], and uplink signals according to annex G in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement Channels are set according to Table 5.2.3.4.1.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.2.3.4.3 in ETSI TS 138 521-2 [2].

5.2.3.4.1.1.2 Test procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table.5.2.3.4.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note 2) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note 2) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure EIRP of the transmitted signal in the Tx beam peak direction for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 4.2.2.5.1.2-1. EIRP measurement procedure defined in annex K in ETSI TS 138 521-2 [2]. EIRP is calculated considering both polarizations, theta and phi.

6) Measure EIRP of the first NR adjacent channel on both the lower and upper side of the assigned NR channel, respectively using a rectangular measurement filter with bandwidths according to Table 4.2.2.5.1.2-1. EIRP measurement procedure defined in annex K in ETSI TS 138 521-2 [2]. EIRP is calculated considering both polarizations, theta and phi.

7) Calculate the ratios of the power between the values measured in step 5 over step 6 for lower and upper NR ACLR, respectively.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 5.2.3.4.1.1.1-1, send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.2.3.4.1.2 Test Requirement

The measured NR ACLR, derived in step 7, shall be higher than the limits in Table 4.2.2.5.1.2-1 in clause 4.2.2.5.1.2 in order to show compliance.

5.2.3.5 Transmitter Spurious Emissions

5.2.3.5.1 Transmitter spurious emissions for single carrier

5.2.3.5.1.1 Method of test

5.2.3.5.1.1.1 General spurious emission

5.1.3.5.1.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the Subscriber Station (SS) to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.2.3.5.1.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.2.3.5.1.1.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, High range (note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Highest	
Test SCS as specified in Table 1.2-6		120 kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
		Modulation	**RB allocation (note 1)**
1		DFT-s - OFDM QPSK	Inner_Full
2		DFT-s - OFDM QPSK	Inner_1RB (note 3)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2]. Common UL configuration for PC3.			
NOTE 2: When testing Low range test only in Frequency Range lower than (F_{UL_low} - Δf_{OOB}) and when testing High range test only in Frequency Range higher than (F_{UL_high} + Δf_{OOB}).			
NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left and when testing High range configure uplink RB to Inner_1RB_Right.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C in ETSI TS 138 521-2 [2], and uplink signals according to annex G in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement channels are set according to Table 5.1.3.5.1.1.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5.3.1.4.3 in ETSI TS 138 521-2 [2].

5.2.3.5.1.1.1.2 Test procedure

1) Select any of the three Alignment Options (1, 2 or 3) from Tables N.2-1 through N.2-3 in ETSI TS 138 521-2 [2] to mount the DUT inside the QZ.

2) If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.2.3.5.1.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4) Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note 3) for the UE Tx beam selection to complete.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (see note 3) for the UE Tx beam selection to complete.

6) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

7) Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K ETSI TS 138 521-2 [2] if the re-positioning concept is applied (see note 4). Step a) is optional and applicable only if SNR (test requirement level in Table 4.2.2.6.1.2-2 minus offset value minus noise floor of the test system) ≥ 0 dB is guaranteed. During measurement the spectrum analyser shall be set to 'Detector' = RMS.

   a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in annex K in ETSI TS 138 521-2 [2], using coarse TRP measurement grid selection criteria as per tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2]. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 4.2.2.6.1.2-2. Optionally, a larger and non-constant measurement bandwidth than that of Table 4.2.2.6.1.2-2 may be applied. The measurement period shall capture the active time slots.

      For each spurious emission frequency with coarse TRP identified to be less than the offsets listed in tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2] from the TRP limit according to Table 4.2.2.6.1.2-2, either continue with another coarse TRP procedure and corresponding offset according to step a) or continue with fine TRP procedures according to step b).

      Different coarse TRP grids and corresponding offset values may be used for different frequencies. Multiple coarse TRP grids measurements with the corresponding offset values can be performed before the fine TRP measurement grid is applied. The coarse TRP grids and offset values used shall be recorded in the test report.

   b) Measure fine TRP measurements according to procedures in annex K in ETSI TS 138 521-2 [2], using fine TRP measurement grid selection criteria as per Table M.4.5-3 in annex M in ETSI TS 138 521-2 [2], for each of the spurious emission frequency identified in step a). Apply a measurement bandwidth according to Table 4.2.2.6.1.2-2.

8) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE 1: The frequency range defined in Table 4.2.2.6.1.2-2 may be split into ranges. For each range, a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges should pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

NOTE 5: Void.

5.2.3.5.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.6.1.2 in order to show compliance.

5.2.3.6 Receiver Reference Sensitivity Level

5.2.3.6.1 Receiver Sensitivity Level Single Carrier

5.2.3.6.1.1 Method of test

5.2.3.6.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 5.2.3.6.1.1.1-1, Table 5.2.3.6.1.1.1-2 and Table 5.2.3.6.1.1.1-3. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 of ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-2 [2].

Table 5.2.3.6.1.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, 100 MHz and Highest	
Test SCS as specified in Table 1.2-6			120 kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (note 1)	DFT-s-OFDM QPSK	REFSENS (note 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 5.2.3.6.1.1.1-2.				
NOTE 2: REFSENS refers to Table 5.2.3.6.1.1.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.				

Table 5.2.3.6.1.1.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	**SCS kHz**	**LCRBmax**	**RB allocation (LCRB@RBstart)**
50 MHz	120	32	32@0
100 MHz	120	64	64@0
200 MHz	120	128	128@0
400 MHz	120	256	256@0
NOTE: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 1.2-6.			

Table 5.2.3.6.1.1.1-3: Uplink configuration for reference sensitivity, LCRB@RBstart format

Operating Band	**SCS kHz**	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**	**Duplex Mode**
n257	120	32@0	64@0	128@0	256@0	TDD
n258	120	32@0	64@0	128@0	256@0	TDD

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4] annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 of ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 of ETSI TS 138 521-2 [2].

4) The DL and UL Reference Measurement channels are set according to Table 5.2.3.6.1.1.1-1, Table 5.2.3.6.1.1.1-2 and Table 5.2.3.6.1.1.1-3.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-2 [2].

6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 508-1 [4], clause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

5.2.3.6.1.1.2 Test procedure

1) SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 5.2.3.6.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.2.3.6.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX}.

4) Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in clause K.1.2 of ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Rx beam selection to complete.

5) Perform EIS procedure as stated in clause K.1.4 of ETSI TS 138 521-2 [2] to calculate "averaged EIS". At each power level, by changing the power level of the wanted signal with a step size of 0,2 dB (coarse and fine searches are not precluded as long as the fine search is using the 0,2 dB step size near the sensitivity level). For each power step measure the average throughput for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-2 [2]. The downlink power step size shall be no more than 0,2 dB when the RF power level is near the sensitivity level.

6) Compare the dB value of the "averaged EIS" value corresponding to the Rx beam peak direction identified in step 5 to the test requirement in clause 4.2.2.7.1.2. If the EIS value is lower or equal to the value in clause 4.2.2.7.1, pass the UE. Otherwise fail the UE.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 of ETSI TS 138 521-2 [2].

5.2.3.6.1.2 Test requirements

The results obtained in step 6) shall be compared to the limits in clause 4.2.2.7.1.2 in order to show compliance.

5.2.3.7 Receiver Adjacent Channel Selectivity (ACS)

5.2.3.7.1 Receiver Adjacent Channel Selectivity Single Carrier

5.2.3.7.1.1 Method of test

5.2.3.7.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.2.3.6.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clauses A.2 and A.3 of ETSI TS 138 521-2 [2]. The details of the OCNG patterns used are specified in annex A of ETSI TS 138 521-2 [2]. The details of the OCNG patterns used are specified in clause A.5 of ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-2 [2].

Table 5.2.3.7.1.1.1-1: Test Configuration

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	Normal			
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1	Mid range			
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1	50 MHz, 100 MHz			
Test SCS as specified in Table 1.2-6	120 kHz			
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	note	DFT-s-OFDM QPSK	note
NOTE: The specific configuration of each RB allocation is defined in Table 5.2.3.6.1.1.1-1.				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.4.1 for TE diagram and clause A.3.4 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C of ETSI TS 138 521-2 [2], and uplink signals according to annex G of ETSI TS 138 521-2 [2].

4) The DL and UL Reference Measurement channels are set according to Table 5.2.3.7.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are according to ETSI TS 138 508-1 [4], clause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

5.2.3.7.1.1.2 Test procedure

1) Set the UE in the Rx beam peak direction found with a 3D EIRP scan as performed in clause K.1.2 of ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Rx beam selection to complete.

2) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.7.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.2.3.7.1.1.1-1. Since the UL has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

4) Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.2.3.7.1.1.2-1 of the target power level in Table 4.2.2.8.1.2-2 (Case 1) or Table 4.2.2.8.1.2-3 (Case 2) for at least the duration of the throughput measurement.

Table 5.2.3.7.1.1.2-1: Uplink power control window for FR2 standalone

Carrier centre frequency, F_C	Power Class	Uplink power control window (dB)
23,45 GHz < F_C ≤ 32,125 GHz	PC3	-4,89 dB to 8,59 dB

5) Perform Blocking measurement procedure as stated in clause K.1.8 of ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 4.2.2.8.1-2 (Case 1). Modulated interferer signal characteristics as defined in annex D of ETSI TS 138 521-2 [2]. with frequency below the wanted signal. Measure throughput for a duration sufficient to achieve statistical significance according to clause H.2 ETSI TS 138 521-2 [2].

6) Repeat step 5 using an interfering signal frequency above the wanted signal in Case 1.

7) Perform Blocking measurement procedure as stated in clause K.1.8 of ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 4.2.2.8.1-3 (Case 2). Modulated interferer signal characteristics as defined in annex D of ETSI TS 138 521-2 [2] with frequency below the wanted signal. Measure throughput for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-2 [2].

8) Repeat step 7 using an interfering signal frequency above the wanted signal in Case 2.

9) Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 of ETSI TS 138 521-2 [2].

5.2.3.7.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.8.1 in Table 4.2.2.8.1.2-1 in order to show compliance.

5.2.3.8 Receiver Blocking Characteristics

5.2.3.8.1 Receiver In-Band Blocking Single Carrier

5.2.3.8.1.1 Method of test

5.2.3.8.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.2.3.8.1.1.1-1. The details of the uplink Reference Measurement Channels (RMC) are specified in clauses A.2 and A.3 of ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-2 [2]. The details of the OCNG patterns used are specified in clause A.5 of ETSI TS 138 521-2 [2].

Table 5.2.3.8.1.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			50 MHz, 100 MHz	
Test SCS as specified in Table 1.2-6			120 kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	note	DFT-s-OFDM QPSK	note
NOTE: The specific configuration of each RB allocation is defined in Table 5.2.3.6.1.1.1-1.				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.1 for TE diagram and clause A.3.4 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C of ETSI TS 138 521-2 [2], and uplink signals according to clauses G of TS 138 521-2 [2].

4) The DL and UL Reference Measurement channels are set according to Table 5.2.3.8.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are according to ETSI TS 138 508-1 [4], clause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

5.2.3.8.1.1.2 Test procedure

1) Set the UE in the Rx beam peak direction found with a with a 3D EIRP scan as performed in clause K1.2 of ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Rx beam selection to complete.

2) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.2.3.8.1.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.2.3.8.1.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4) Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.2.3.7.1.1.2-1 of the target power level in Table 4.2.2.9.1.2-1 for at least the duration of the throughput measurement.

5) Perform the Blocking measurement procedure as stated in clause K.1.8 of ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 4.2.2.9.1.2-1. Modulated interferer signal characteristics as defined in annex D of ETSI TS 138 521-2 [2]. Measure throughput for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-2 [2].

6) Repeat steps using interfering signals specified in Table 4.2.2.9.1.2-1. The ranges are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the centre frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to $F_{Interferer}$ range limit defined at the corresponding band edge.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.2.3.8.1.2 Test requirements

The results obtained in step 5) shall be compared to the limits in Table 4.2.2.9.1.2-1 in order to show compliance.

5.2.3.9 Receiver Spurious Emissions

5.2.3.9.1 Receiver Spurious Emissions Single Carrier

5.2.3.9.1.1 Method of test

5.2.3.9.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.2.3.9.1.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in clauses A.2 and A.3 of ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 of ETSI TS 138 521-2 [2].

Table 5.2.3.9.1.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Highest	
Test SCS as specified in Table 1.2-6			Highest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	-	-	-	-
NOTE: The specific configuration of uplink and downlink are defined in Table 5.2.3.6.1.1.1-1.				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], Annex A, in Figure A.3.1.5.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to annex C of ETSI TS 138 521-2 [2], and uplink signals according to annex G of ETSI TS 138 521-2 [2].

4) The DL and UL Reference Measurement channels are set according to Table 5.2.3.9.1.1.1-1.

5) Propagation conditions are set according to clause B.0 of ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 7.5.4.3. in ETSI TS 138 521-2 [2].

5.2.3.9.1.1.2 Test procedure

1) Select any of the three Alignment Options (1, 2, or 3) from Tables N.2-1 through N.2-3 in ETSI TS 138 521-2 [2] to mount the DUT inside the QZ.

2) If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1°; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1). If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3) Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2] using the uplink configuration in clause 5.2.3.1.1. Allow at least BEAM_SELECT_WAIT_TIME (note 3) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K in ETSI TS 138 521-2 [2] if the re-positioning concept is applied (see note 4). Step a) is optional and applicable only if SNR (test requirement level in Table 4.2.2.10.1.2-1 minus offset value minus noise floor of the test system) $\geq$ 0 dB is guaranteed.

a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K of ETSI TS 138 521-2 [2], using coarse TRP measurement grid selection criteria as per tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2]. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 4.2.2.10.1.2-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 4.2.2.10.1.2-1 may be applied. The measurement period shall capture the active time slots.

   For each spurious emission frequency with coarse TRP identified to be less than the offsets listed in Tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2] from the TRP limit according to Table 4.2.2.10.1.2-1, either continue with another coarse TRP procedure and corresponding offset according to step a) or continue with fine TRP procedures according to step b).

   Different coarse TRP grids and corresponding offset values may be used for different frequencies. Multiple coarse TRP grids measurements with the corresponding offset values can be performed before the fine TRP measurement grid is applied. The coarse TRP grids and offset values used shall be recorded in the test report.

b) Measure fine TRP measurements according to procedures in annex K of ETSI TS 138 521-2 [2], using fine TRP measurement grid selection criteria as per Table M.4.5-3 in annex M of ETSI TS 138 521-2 [2], for each of the spurious emission frequency identified in step a). Apply a measurement bandwidth according to Table 4.2.2.10.1.2-1.

6) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE 1: The frequency range defined in Table 4.2.2.10.1.2-1 may be split into ranges. For each range, a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges should pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 of ETSI TS 138 521-2 [2].

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

Message contents are according to ETSI TS 138 508-1 [4], clause 4.6.

5.2.3.9.1.2 Test requirements

The results obtained shall be compared to the limits in Table 4.2.2.10.1.2-1, clause 4.2.2.10.1.2 in order to show compliance.

5.3 Testing for compliance with technical requirements for Frequency Range 1 and Frequency Range 2 interworking operation with other radios

5.3.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.

All tests shall be conducted using normal test conditions except where otherwise stated. For guidance on the use of other conditions to be used in order to show compliance reference can be made to ETSI TS 138 521-3 [3], clause F.1.1.

5.3.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor) k = 1,96 (which provide a confidence level of respectively 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.5], in particular in annex C of the ETSI TR 100 028-2 [i.5]. For guidance on other measurement conditions reference can be made to annex A to of ETSI TS 138 521-1 [1].

5.3.3 Essential radio test suites

5.3.3.0 Introduction

5.3.3.0.0 General

For Tx test cases the identified beam peak direction can be stored and reused for a device under test in various configurations/environments for the full duration of device testing as long as beam peak direction is the same.

Unless otherwise stated the transmitter, characteristics are specified at the antenna connector(s) of the UE for the bands operating on frequency range 1 and over the air of the UE for the bands operating on frequency range 2. The requirements for frequency range 1 and frequency range 2 can be verified separately. For the carrier in frequency range 1, requirements can be verified with the NR FR2 link disabled. For the carrier in frequency range 2, requirements can be verified in OTA mode with LTE connecting to the network by OTA without calibration.

Unless otherwise stated, requirements for NR transmitter written in ETSI TS 138 101-1 [6] and ETSI TS 138 101-2 [7] apply and are assumed anchor agnostic. Unless otherwise stated, if UE indicates IE maxNumberSRS-Ports-PerResource = n2 in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE maxNumberSRS-Ports-PerResource = n1 for EN-DC on this NR band. Requirements are verified under conditions where anchor resources do not interfere with NR operation.

Unless otherwise stated, Channel Bandwidth shall be prioritized in the selecting of test points. Subcarrier spacing shall be selected after Test Channel Bandwidth is selected.

For conformance testing involving FR2 test cases in the present document, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

Uplink RB allocations for E-UTRA carrier given in Table 5.3.3.0.0-1 are used throughout this clause unless otherwise stated by the test case.

Table 5.3.3.0.0-1: Common uplink configuration for E-UTRA carrier

Channel Bandwidth	RB allocation			
	Full_Allocation	Partial_Allocation	1RB_Left	1RB_Right
1,4 MHz	6@0	5@0	1@0	1@5
3 MHz	15@0	4@0	1@0	1@14
5 MHz	25@0	8@0	1@0	1@24
10 MHz	50@0	12@0	1@0	1@49
15 MHz	75@0	16@0	1@0	1@74
20 MHz	100@0	18@0	1@0	1@99
NOTE: Partial_Allocation corresponds to the test points with 0 dB $MPR_{single,E-UTRA}$ for QPSK modulation type included in ETSI TS 136 521-1 [11], Table 6.2.2.4.1-1.				

5.3.3.0.1 Applicability and test coverage rules

1) The applicability and test coverage rules for Non-Standalone (NSA) only capable devices shall include the following:

   a) For each NR band in a device, test all the EN-DC exception test requirements as per test procedures in ETSI TS 138 521-3 [3].

   b) Test all the EN-DC FR2 non-exception test requirements in ETSI TS 138 521-3 [3] with test procedures which refer appropriately back to ETSI TS 138 521-2 [2] for each NR band. Test only one EN-DC combination per FR2 band for each EN-DC configuration as defined in clause 5.5B of ETSI TS 138 101-3 [8] using LTE anchor agnostic approach.

   c) Test all the EN-DC FR1 non-exception test requirements in ETSI TS 138 521-3 [3] with test procedures which refer appropriately back to ETSI TS 138 521-1 [1] for each NR band. Test only one EN-DC combination per FR1 band for each EN-DC configuration as defined in clause 5.5B of ETSI TS 138 101-3 [8] using LTE anchor agnostic approach.

2) The applicability and test coverage rules for Standalone (SA) and NSA capable devices shall include the following:

   a) For each NR band in a device, test all the EN-DC exception test requirements as per test procedures in ETSI TS 138 521-3 [3].

   b) Test all the Standalone FR2 test requirements as per test procedures in ETSI TS 138 521-2 [2] for each NR band. This also fulfils coverage for all non-exception EN-DC FR2 test requirements for that NR band and need not be retested. If Standalone FR2 cannot be tested (due to test case not being complete), then test in EN-DC mode following 1) b) above.

   c) Test all the Standalone FR1 test requirements as per test procedures in ETSI TS 138 521-1 [1] for each NR band. This also fulfils coverage for all non-exception EN-DC FR1 test requirements for that NR band and need not be retested. If Standalone FR1 cannot be tested (due to test case not being complete), then test in EN-DC mode following 1) c) above.

5.3.3.0.2 E-UTRA configuration for EN-DC FR1 tests applying the E-UTRA anchor-agnostic approach

This clause applies to EN-DC test cases where E-UTRA anchor needs to be configured as per the anchor-agnostic approach outlined in clauses 6.1 and 7.1 of ETSI TS 138 101-3 [8]. The LTE anchor-agnostic approach is defined as measurements on the NR carrier under conditions where the LTE anchor resources do not interfere with NR operation. The configuration defined in this clause ensures the establishment of such conditions.

For baseline configuration, the E-UTRA carrier will be configured for each test case in clauses 5.3.3 as defined in the equivalent standalone E-UTRA test in ETSI TS 136 521-1 [11]. However, the below exceptions defined in tables 5.3.3.0.2-1, 5.3.3.0.2-2, 5.3.3.0.2-3, 5.3.3.0.2-4 and 5.3.3.0.2-5 are applied to ensure that the E-UTRA anchor resources do not interfere with NR operation.

For EN-DC within FR1 band combinations with multiple E-UTRA component carriers, it is sufficient to configure any one E-UTRA carrier from the carrier group whenever it is determined that anchor agnostic approach can be applied.

Table 5.3.3.0.2-1: E-UTRA configuration for EN-DC FR1 tests applying anchor agnostic approach

Parameter	Value	Comments
Test Frequency during and after connection setup	Mid (see Table 5.3.3.0.2-2)	As defined in ETSI TS 136 508 [13] for the LTE band under test.
Bandwidth during and after connection setup	5 MHz (see Table 5.3.3.0.2-2)	Supported by all LTE bands.
DL signal levels during connection setup	RS EPRE -85,0 dBm/15 kHz	DL physical channels as defined in clauses C.0, C.1, C.2 and C.3 of ETSI TS 136 521-1 [11] ETSI TS 136 521-1 [11], clause C.0 defines the default DL power level of RS EPRE to be -85 dBm/15 kHz.
UL Signal levels during connection setup	PUSCH Power	Attained by enabling open loop power control and setting up UL signal levels according to clauses H.0, H.2 and H.3 of ETSI TS 136 521-1 [11].
DL/UL RMC after connection setup	0 RB allocation on both DL and UL (see Table 5.3.3.0.2-2)	Once the LTE link is established, then LTE Tx can be restricted by configuring 0 RB allocation on DL and UL. *TimeAlignmentTimerDedicated* IE to be set to infinity to ensure UE does not look for TA adjustments (see Table 5.3.3.0.2-5).
CQI Reports and SRS after connection setup	Disabled (see tables 5.3.3.0.2-3 and 5.3.3.0.2-4)	Disable periodic and aperiodic CQI reports to ensure none of these transmissions occurs on the LTE uplink. Since LTE transmissions could easily exceed spurious emissions limits, tests that are intended to measure RF parametrics on the NR should simply avoid LTE transmit altogether.

Table 5.3.3.0.2-2: E-UTRA Test Configuration Table

E-UTRA Test Parameters					
E-UTRA Channel Bandwidth	**E-UTRA Test Frequency**	**Downlink**		**Uplink**	
		Modulation	**RB allocation**	**Modulation**	**RB allocation**
5 MHz (note 2)	Mid Range (note 1)	N/A	0	N/A	0
NOTE 1: E-UTRA Test Frequency as specified in ETSI TS 136 508 [13], clause 4.3.1. NOTE 2: For EN-DC Intra-band tests that need to apply E-UTRA anchor agnostic approach, refer to and pick applicable E-UTRA channel bandwidth from clause 5.3B.1 of ETSI TS 138 521-3 [3] and indicate within test case if it is different than 5 MHz.					

Table 5.3.3.0.2-3: *CQI-ReportConfig-DEFAULT:* Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.6.3, Table 4.6.3-2 CQI-ReportConfig-DEFAULT			
Information Element	**Value/remark**	**Comment**	**Condition**
CQI-ReportConfig-DEFAULT ::= SEQUENCE {			
cqi-ReportModeAperiodic	NOT PRESENT		
cqi-ReportPeriodic	NOT PRESENT		
}			

Table 5.3.3.0.2-4: *PhysicalConfigDedicated-DEFAULT:* Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.8.2, Table 4.8.2.1.6-1 PhysicalConfigDedicated-DEFAULT			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
soundingRS-UL-ConfigDedicated	Not present		RBC
}			

Table 5.3.3.0.2-5: *MAC-MainConfig-RBC*: Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.8.2.1.5, Table 4.8.2.1.5-1 MAC-MainConfig-RBC			
Information Element	**Value/remark**	**Comment**	**Condition**
timeAlignmentTimerDedicated	Infinity		

5.3.3.0.3 E-UTRA configuration for EN-DC FR2 tests applying the E-UTRA anchor-agnostic approach

This clause applies to EN-DC test cases where E-UTRA anchor needs to be configured as per the anchor-agnostic approach outlined in clauses 6.1 and 7.1 of ETSI TS 138 101-3 [8]. The LTE anchor-agnostic approach is defined as measurements on the NR carrier under conditions where the LTE anchor resources do not interfere with NR operation. The configuration defined in this clause ensures the establishment of such conditions.

For baseline configuration, the E-UTRA carrier will be configured for each test case in clauses 5.3.3 as defined in the equivalent standalone E-UTRA test in ETSI TS 136 521-1 [11]. However, the below exceptions defined in tables 5.3.3.0.3-1 to 5.3.3.0.3-7 are applied to ensure that the E-UTRA anchor resources do not interfere with NR operation.

Since the E-UTRA link is always a functional link when testing EN-DC including FR2 band combinations, it is sufficient to configure any one E-UTRA carrier from the carrier group, irrespective of the number of E-UTRA carriers in the EN-DC combination under test.

Table 5.3.3.0.3-1: E-UTRA configuration for EN-DC FR2 tests applying anchor agnostic approach

Parameter	Value	Comments
Test Frequency during and after connection setup	Mid (see Table 5.3.3.0.3-2)	As defined in ETSI TS 136 508 [13] for the LTE band under test.
Bandwidth during and after connection setup	5 MHz (see Table 5.3.3.0.3-2)	Supported by all LTE bands.
DL signal levels	See Table 5.3.3.0.3-3	DL physical channels as defined in clauses C.0, C.1, C.2 and clause C.3 of ETSI TS 136 521-1 [11].
UL Signal levels for connection setup and UBF transmission	PUSCH Power	Attained by enabling open loop power control and setting up UL signal levels according to clauses H.0, H.2 and H.3 of ETSI TS 136 521-1 [11] with the exception for power control message exception defined in Table 5.3.3.0.3-5.
DL/UL RMC after connection setup except for UBF transmission	0 RB allocation on both DL and UL (see Table 5.3.3.0.3-2)	Once the LTE link is established, then LTE Tx can be restricted by configuring 0 RB allocation on DL and UL. *TimeAlignmentTimerDedicated* IE to be set to infinity to ensure UE does not look for TA adjustments (see Table 5.3.3.0.3-7).
CQI Reports and SRS after connection setup	Disabled (see tables 5.3.3.0.3-4 and 5.3.3.0.3-6)	Disable periodic and aperiodic CQI reports to ensure none of these transmissions occurs on the LTE uplink. Since LTE transmissions could easily exceed spurious emissions limits, tests that are intended to measure RF parametrics on the NR should simply avoid LTE transmit altogether.

Table 5.3.3.0.3-2: E-UTRA Test Configuration Table

E-UTRA Test Parameters					
E-UTRA Channel Bandwidth	**E-UTRA Test Frequency**	**Downlink**		**Uplink**	
		Modulation	**RB allocation**	**Modulation**	**RB allocation**
5 MHz (note 2)	Mid Range (note 1)	N/A	0	N/A	0
NOTE 1: E-UTRA Test Frequency as specified in ETSI TS 136 508 [13], clause 4.3.1. NOTE 2: For EN-DC Intra-band tests that need to apply E-UTRA anchor agnostic approach, refer to and pick applicable E-UTRA channel bandwidth from clause 5.3B.1 of ETSI TS 138 521-3 [3] and indicate within test case if it is different than 5 MHz.					

Table 5.3.3.0.3-3: Default Downlink power levels for E-UTRA anchor

	Unit	Band Group	Channel Bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
RS EPRE	dBm/15 kHz	FDD_A, TDD_A	N/A	N/A	≥ -120,0	N/A	N/A	N/A
		FDD_B1, TDD_B1	N/A	N/A	≥ -119,5	N/A	N/A	N/A
		FDD_C, TDD_C	N/A	N/A	≥ -119,0	N/A	N/A	N/A
		FDD_D, TDD_D	N/A	N/A	≥ -118,5	N/A	N/A	N/A
		FDD_E, TDD_E	N/A	N/A	≥ -118,0	N/A	N/A	N/A
		FDD_G, TDD_G	N/A	N/A	≥ -117,0	N/A	N/A	N/A
		FDD_H, TDD_H	N/A	N/A	≥ -116,5	N/A	N/A	N/A
		FDD_N, TDD_N	N/A	N/A	≥ -113,5	N/A	N/A	N/A
NOTE 1: The power level is specified at the RSRP reference point as defined in ETSI TS 136 214 [15]. NOTE 2: E-UTRA Band groups are defined in ETSI TS 136 133 [16], clause 3.5.1.								

Table 5.3.3.0.3-4: *CQI-ReportConfig-DEFAULT:* Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.6.3, Table 4.6.3-2 CQI-ReportConfig-DEFAULT			
Information Element	**Value/remark**	**Comment**	**Condition**
CQI-ReportConfig-DEFAULT ::= SEQUENCE {			
cqi-ReportModeAperiodic	NOT PRESENT		
cqi-ReportPeriodic	NOT PRESENT		
}			

Table 5.3.3.0.3-5: UplinkPowerControlCommon-DEFAULT: Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.6.3, UplinkPowerControlCommon-DEFAULT			
Information Element	**Value/remark**	**Comment**	**Condition**
UplinkPowerControlCommon-DEFAULT ::= SEQUENCE {			
p0-NominalPUSCH	-60 (-60 dBm)	To attain maximum power from the DUT	
}			

Table 5.3.3.0.3-6: *PhysicalConfigDedicated-DEFAULT:* Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.8.2, Table 4.8.2.1.6-1 PhysicalConfigDedicated-DEFAULT			
Information Element	**Value/remark**	**Comment**	**Condition**
PhysicalConfigDedicated-DEFAULT ::= SEQUENCE {			
soundingRS-UL-ConfigDedicated	Not present		RBC
}			

Table 5.3.3.0.3-7: *MAC-MainConfig-RBC*: Additional E-UTRA Anchor Configuration

Derivation Path: ETSI TS 136 508 [13], clause 4.8.2.1.5, Table 4.8.2.1.5-1 MAC-MainConfig-RBC			
Information Element	**Value/remark**	**Comment**	**Condition**
timeAlignmentTimerDedicated	Infinity		

5.3.3.1 Transmitter Maximum Output Power

5.3.3.1.1 Void

5.3.3.1.2 Transmitter Maximum Output Power for EN-DC

5.3.3.1.2.1 Void

5.3.3.1.2.2 Void

5.3.3.1.2.3 Transmitter Maximum Output Power for Inter-Band EN-DC within FR1

5.3.3.1.2.3.1 Method of test

5.3.3.1.2.3.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, DC configuration specified in ETSI TS 138 521-3 [3], clause 5.5B.4 and test channel bandwidths specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1, and sub-carrier spacing based on NR operating bands specified in ETSI TS 138 521-1 [1], clause 5.3. All of these configurations shall be tested with applicable test parameters for each EN-DC configuration, and are shown in Table 5.3.3.1.2.3.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in ETSI TS 136 521-1 [11], annex A, clause A.2.3 for E-UTRA RMC for TDD, ETSI TS 136 521-1 [11], annex A, clause A.2.2 for E-UTRA RMC for FDD, and ETSI TS 138 521-1 [1], annex A, clause A.2 for NR RMC. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 136 521-1 [11], annex C, clause C.2 and in ETSI TS 138 521-1 [1], annex C, clause C.2 for E-UTRA CG and NR CG respectively.

Table 5.3.3.1.2.3.1.1-1: Test configuration table

Default Conditions	
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	NC, TL/VL, TL/VH, TH/VL, TH/VH
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1 and ETSI TS 136 508 [13]	Low for E-UTRA CC1 and NR CC1, Mid for E-UTRA CC1 and NR CC1, High for E-UTRA CC1 and NR CC1 (note 4)
Test EN-DC channel bandwidth as specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4] clause 4.3.1	5 MHz for E-UTRA CC1 and Lowest for NR CC1, Highest for E-UTRA CC1 and Highest for NR CC1
Test SCS for the NR cell as specified in Table 1.1-6	Lowest, Highest

Test Parameters								
Test ID	Test Freq	E-UTRA BW	NR BW	Downlink Configuration	EN-DC Uplink Configuration			
					E-UTRA Cell		NR Cell	
					Modulation	RB allocation (note 1)	Modulation (note 3)	RB allocation (note 2)
1	High	Default	Default	N/A	QPSK	1RB_Right	DFT-s-OFDM PI/2 BPSK	Inner_1RB_Right
2	Low	Default	Default		QPSK	1RB_Left	DFT-s-OFDM PI/2 BPSK	Inner_1RB_Left
3	Default	Default	Default		QPSK	Partial_Allocation	DFT-s-OFDM PI/2 BPSK	Inner_Full
4	High	Default	Default		QPSK	1RB_Right	DFT-s-OFDM QPSK	Inner_1RB_Right
5	Low	Default	Default		QPSK	1RB_Left	DFT-s-OFDM QPSK	Inner_1RB_Left
6	Default	Default	Default		QPSK	Partial_Allocation	DFT-s-OFDM QPSK	Inner_Full
7	High	Default	Lowest		QPSK	1RB_Right	N/A	N/A
8	Low	Default	Lowest		QPSK	1RB_Left	N/A	N/A
9	Default	Default	Lowest		QPSK	Partial_Allocation	N/A	N/A
10	High	5 MHz	Default		N/A	N/A	DFT-s-OFDM PI/2 BPSK	Inner_1RB_Right
11	Low	5 MHz	Default		N/A	N/A	DFT-s-OFDM PI/2 BPSK	Inner_1RB_Left
12	Default	5 MHz	Default		N/A	N/A	DFT-s-OFDM PI/2 BPSK	Inner_Full
13	High	5 MHz	Default		N/A	N/A	DFT-s-OFDM QPSK	Inner_1RB_Right
14	Low	5 MHz	Default		N/A	N/A	DFT-s-OFDM QPSK	Inner_1RB_Left
15	Default	5 MHz	Default		N/A	N/A	DFT-s-OFDM QPSK	Inner_Full

NOTE 1: The specific configuration of each RB allocation is defined in Table 5.3.3.0.0-1.
NOTE 2: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-1 [1].
NOTE 3: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in NR FR1.
NOTE 4: For NR band n28, the Highest test channel bandwidth is replaced by 20 MHz due to MPR is always larger than 0 dB for 30 MHz bandwidth.

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], clause A.3.1.1 for SS and clause A.3.2.1 for UE.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [11], clause C.0 and ETSI TS 138 521-1 [1], clause C.0 for E-UTRA CG and NR CG respectively, and uplink signals according to ETSI TS 136 521-1 [11], annex H and ETSI TS 138 521-1 [1] annex G for E-UTRA CG and NR CG respectively.

4) The UL Reference Measurement channels are ETSI TS 136 521-1 [11], clause A.2 and ETSI TS 138 521-1 [1], clause A.2 for E-UTRA CG and NR CG respectively.

5) Propagation conditions are set according to ETSI TS 136 521-1 [11] and ETSI TS 138 521-1 [1], clause B.0 for E-UTRA CG and NR CG respectively.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-3 [3], clause 6.2B.1.3.4.3.

7) For the case of testing overlapping E-UTRA and NR UL transmission scenario when both bands are TDD, ensure E-UTRA UL transmission overlaps with NR UL transmission in time by giving SCG a delay of 3 E-UTRA subframes, or by giving MCG a delay of 2 subframes.

5.3.3.1.2.3.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 and DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.3.3.1.2.3.1.1-1 on E-UTRA CC and NR CC respectively. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands to the UE for NR and E-UTRA carrier according to Table 5.3.3.1.2.3.1.1-1 until the UE transmits at its P_{UMAX} level; allow at least 200 ms from the first TPC command for the UE to reach P_{UMAX} level.

3) For test ID 1~6 measure the sum of mean transmitted power over all EN-DC component carriers in the EN-DC, which shall meet the requirements described in Table 4.3.2.2.2.3.2-1 and the period of the measurement shall be at least the continuous duration of one active sub-frame.

   For test ID 7~15 measure the mean transmitted power over E-UTRA carrier or NR carrier, which shall meet the requirements described in Table 4.2.2.1.2-1 in ETSI EN 301 908-13 [12] or Table 4.1.2.2.1.2-1 respectively. The period of the measurement shall be at least the continuous duration of one active sub-frame.

5.3.3.1.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.2.2.3.2 in order to show compliance.

5.3.3.1.2.4 Void

5.3.3.1.2.4 Transmitter Maximum Output Power for Inter-Band EN-DC including FR2

5.3.3.1.2.4.1 Method of test

5.3.3.1.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, as shown in Table 5.3.3.1.2.4.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.1.2.4.1.1-1: Test Configuration Table

Default Conditions					
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1				Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Low range, Mid Range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Lowest, 100 MHz, Highest	
Test SCS as specified in Table 1.2-6				120 kHz	
Test Parameters					
Test ID	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	N/A	**Modulation**	**RB allocation (note 1)**
1	50			DFT-s-OFDM QPSK	Inner_Full for PC2, PC3 and PC4 Inner_Full_Region1 for PC1
2	100				
3	200				
4	400				
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC3. NOTE 2: Void.					

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clause C.2 in ETSI TS 138 521-2 [2] and ETSI TS 138 508-1 [4], clause 5.2.1.1.1, and uplink signals according to clauses G.0, G.1 and G.3.0 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement channels are set according to Table 5.3.3.1.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.1.2.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.1.2.4.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in clause 6.2.1.1.4.3 in ETSI TS 138 521-2 [2].

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 6.2.1.1.5-1 to 6.2.1.1.5-4 in ETSI TS 138 521-2 [2]. EIRP test procedure is defined in clause K.1.3 in ETSI TS 138 521-2 [2]. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6) Measure TRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1 in ETSI TS 138 521-2 [2]. Total radiated power is measured according to TRP measurement procedure defined in clause K.1.7 in ETSI TS 138 521-2 [2] and measurement grid specified in clause M.4 in ETSI TS 138 521-2 [2]. TRP is calculated considering both polarizations, theta and phi.

7) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.3.3.1.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.2.2.4.2 in order to show compliance.

5.3.3.1.2.5 Transmitter Maximum Output Power for Inter-Band EN-DC including both FR1 and FR2

5.3.3.1.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.1.2.3.1 and clause 5.3.3.1.2.4.1 respectively. The EN-DC requirements for maximum output power apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.1.2.

5.3.3.1.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.2.2.5.2 in order to show compliance.

5.3.3.2 Transmitter Minimum Output Power

5.3.3.2.1 Void

5.3.3.2.2 Transmitter Minimum Output Power for EN-DC

5.3.3.2.2.1 Void

5.3.3.2.2.2 Void

5.3.3.2.2.3 Transmitter Minimum Output Power for Inter-Band EN-DC within FR1

5.3.3.2.2.3.1 Method of test

5.3.3.2.2.3.1.1 Initial conditions

Same test descriptions as in clause 5.1.3.2.1.1 for the NR carrier with the following exceptions.

The initial test configurations for E-UTRA band consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA bands specified in Table 5.3.3.0.2-1. For Initial conditions as in clause 5.1.3.2.1.1.1, the following steps will be added to configure E-UTRA component:

2.1) The parameter settings for the E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.2.1.1.1 is replaced by the following two steps:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set TimeAlignmentTimerDedicated IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.2.2.3.1.2 Procedure

Same test procedure as in clause 5.1.3.2.1.1.2 for the NR carrier.

5.3.3.2.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.3.2.3.2 in order to show compliance.

5.3.3.2.2.4 Transmitter Minimum Output Power for Inter-Band EN-DC including FR2

5.3.3.2.2.4.1 Method of test

5.3.3.2.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 5.3.3.2.2.4.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.2.2.4.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 1.2-6		Highest	
Test Parameters			
	Downlink Configuration	**Uplink Configuration**	
Test ID	N/A for minimum output power test case	**Modulation**	**RB allocation (note)**
1		DFT-s-OFDM QPSK	Outer_Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC3.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.0, and uplink signals according to clauses G.0, G.1 and G.3.0 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement Channel is set according to Table 5.3.3.2.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.2.2.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3.1.4.1-1 in ETSI TS 138 521-2 [2]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note 1) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure UE EIRP in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3.1.5-1 and Table 6.3.1.5-2 in ETSI TS 138 521-2 [2] for the specific channel bandwidth under test. EIRP test procedure is defined in clause K.1.3 in ETSI TS 138 521-2 [2]. The measuring duration is [one active uplink subframe]. EIRP is calculated considering both polarizations, theta and phi. For TDD, only slots consisting of only UL symbols are under test.

6) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.3.3.2.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.3.2.4.2 in order to show compliance.

5.3.3.2.2.5 Transmitter Minimum Output Power for Inter-Band EN-DC including both FR1 and FR2

5.3.3.2.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.2.2.3 and clause 5.3.3.2.2.4 respectively. The requirement is sufficiently verified in clauses5.3.3.2.2.3 and 5.3.3.2.2.4 and no additional test is required.

5.3.3.2.2.5.2 Test requirements

Clauses 5.3.3.2.2.3.2 and 5.3.3.2.2.4.2 apply.

5.3.3.3 Transmitter Spectrum Emission Mask

5.3.3.3.1 Void

5.3.3.3.2 Transmitter Spectrum Emission Mask for EN-DC

5.3.3.3.2.1 Void

5.3.3.3.2.2 Void

5.3.3.3.2.3 Transmitter Spectrum Emission for Inter-Band EN-DC within FR1

5.3.3.3.2.3.1 Method of test

####### 5.3.3.3.2.3.1.1 General spectrum emission mask

######## 5.3.3.3.2.3.1.1.1 Initial conditions

Same test descriptions as in clause 5.1.3.3.1.1.1 for the NR carrier with the following exception:

The initial test configurations for E-UTRA band consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA bands specified in Table 5.3.3.0.2-1. For Initial conditions as in clause 5.1.3.3.1.1.1.1, the following steps will be added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.3.1.1.1.1 is replaced by the following two steps:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

######## 5.3.3.3.2.3.1.1.2 Procedure

Same test procedure described in clause 5.1.3.3.1.1.1.2 shall apply for the NR carrier.

####### 5.3.3.3.2.3.1.2 Additional Spectrum emissions mask

######## 5.3.3.3.2.3.1.2.1 Initial conditions

Same test description as in clause 5.1.3.3.1.1.2 for the NR carrier with the following exception:

The initial test configurations for E-UTRA band consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA bands specified in Table 5.3.3.0.2-1. For Initial conditions as in clause 5.1.3.3.1.1.2.1, the following steps will be added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.3.1.1.2.1 is replaced by the following two steps:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.3.2.3.1.2.2 Procedure

Same procedure described in clause 5.1.3.3.1.1.2.2 shall apply for the NR carrier.

5.3.3.3.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.4.2.3.2 in order to show compliance.

5.3.3.3.2.4 Transmitter Spectrum Emission for Inter-Band EN-DC including FR2

5.3.3.3.2.4.1 Method of test

5.3.3.3.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.3.3.3.2.4.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.3.2.4.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Lowest, Highest	
Test SCS as specified in Table 1.2-6		Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spectrum Emission Mask test case	**Modulation**	**RB allocation (note)**
1		DFT-s-OFDM PI/2 BPSK	Outer_Full
2		DFT-s-OFDM QPSK	Outer_Full
3		DFT-s-OFDM 16 QAM	Outer_Full
4		DFT-s-OFDM 64 QAM	Outer_Full
5		CP-OFDM QPSK	Outer_Full
NOTE: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-2 [2] for PC3.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 in ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement channels are set according to Table 5.3.3.3.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.3.2.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.2.1.4.2-1 in ETSI TS 138 521-2 [2]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note 2) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (note 2) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4] clause 4.9.2 using condition Tx only.

5) Measure the TRP of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.2.1.1.5-1 in ETSI TS 138 521-2 [2]. The centre frequency of the filter shall be stepped in continuous steps according to the same table. TRP shall be recorded for each step. The measurement period shall capture the active time slots. Total radiated power is measured according to TRP measurement procedure defined in annex K in ETSI TS 138 521-2 [2]. The measurement grid used for TRP measurement defined in annex M in ETSI TS 138 521-2 [2]. TRP is calculated considering both polarizations, theta and phi.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 5.3.3.3.2.4.1.1-1, send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

NOTE 2: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.3.3.3.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.4.2.4.2 in order to show compliance.

5.3.3.4 Transmitter Adjacent Channel Leakage Power Ratio

5.3.3.4.1 Void

5.3.3.4.2 Transmitter Adjacent Channel Leakage Power Ratio for EN-DC

5.3.3.4.2.1 Void

5.3.3.4.2.2 Void

5.3.3.4.2.3 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC within FR1

5.3.3.4.2.3.1 Method of test

####### 5.3.3.4.2.3.1.1 Initial conditions

Same test description as in clause 5.1.3.4.1.1.1 for the NR carrier with the following exception:

The initial test configurations for E-UTRA band consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA bands specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.4.1.1.1.1, the following steps will be added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.4.1.1.1.1 is replaced by the following two steps:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.4.2.3.1.2 Procedure

The test procedure described in clause 5.1.3.4.1.1.1.2 shall apply for NR carrier.

5.3.3.4.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.5.2.3.2 in order to show compliance.

5.3.3.4.2.4 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC including FR2

5.3.3.4.2.4.1 Method of test

5.3.3.4.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.3.3.4.2.4.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.4.2.4.1.1-1: Test Configuration Table

Default Conditions						
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1				Normal, TL, TH		
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Low range, Mid range, High range		
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1				Lowest, Highest		
Test SCS as specified in Table 1.2-6				Lowest, Highest		
Test Parameters						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Adjacent Channel Leakage Ratio test case	**Modulation**	**RB allocation (note)**
1	Low				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Left
2	High				DFT-s-OFDM PI/2 BPSK	Outer_1RB_Right
3	Mid				DFT-s-OFDM PI/2 BPSK	Outer_Full
4	Low				DFT-s-OFDM QPSK	Outer_1RB_Left
5	High				DFT-s-OFDM QPSK	Outer_1RB_Right
6	Mid				DFT-s-OFDM QPSK	Outer_Full
7	Low				DFT-s-OFDM 16 QAM	Outer_1RB_Left
8	High				DFT-s-OFDM 16 QAM	Outer_1RB_Right
9	Mid				DFT-s-OFDM 16 QAM	Outer_Full

10	Low				DFT-s-OFDM 64 QAM	Outer_1RB_Left
11	High				DFT-s-OFDM 64 QAM	Outer_1RB_Right
12	Mid				DFT-s-OFDM 64 QAM	Outer_Full
13	Low				CP-OFDM QPSK	Outer_1RB_Left
14	High				CP-OFDM QPSK	Outer_1RB_Right
15	Mid				CP-OFDM QPSK	Outer_Full
NOTE: The specific configuration of each RF allocation is defined in Table 6.1-1 in ETSI TS 138 508-2 [5] for PC3.						

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 in ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement channels are set according to Table 5.3.3.4.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.4.2.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.2.3.1.4.1-1 in ETSI TS 138 521-2 [2]. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (note) for the UE Tx beam selection to complete.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Tx beam selection to complete.

3.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.6-1 under clause 4.6 in ETSI TS 138 521-3 [3].

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure EIRP of the transmitted signal in the Tx beam peak direction for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1 in ETSI TS 138 521-2 [2]. EIRP measurement procedure defined in annex K. EIRP is calculated considering both polarizations, theta and phi.

6) Measure EIRP of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively using a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1 in ETSI TS 138 521-2 [2]. EIRP measurement procedure defined in annex K. EIRP is calculated considering both polarizations, theta and phi.

7) Calculate the ratios of the power between the values measured in step 5 over step 6 for lower and upper NR ACLR, respectively.

NOTE: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 5.3.3.4.2.4.1.1-1, send an NR RRCReconfiguration message according to ETSI TS 138 508-1 [4], clause 4.6.3, Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

5.3.3.4.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.5.2.4.1 in order to show compliance.

5.3.3.4.2.5 Transmitter Adjacent Channel Leakage Power Ratio for Inter-Band EN-DC including both FR1 and FR2

5.3.3.4.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.4.2.3.1 and clause 5.3.3.4.2.4.1 respectively. The EN-DC requirements for maximum output power apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.4.2.

5.3.3.4.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.5.2.5.2 in order to show compliance.

5.3.3.5 Transmitter Spurious Emissions

5.3.3.5.1 Void

5.3.3.5.2 Transmitter Spurious Emissions for EN-DC

5.3.3.5.2.1 Void

5.3.3.5.2.2 Void

5.3.3.5.2.3 Transmitter Spurious Emissions for Inter-Band EN-DC within FR1

5.3.3.5.2.3.1 Method of test

5.3.3.5.2.3.1.1 General spurious emissions

5.3.3.5.2.3.1.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, DC configuration specified in Table 5.5B.4.1-1 in ETSI TS 138 521-3[3] and test channel bandwidths specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1 and sub-carrier spacings for the NR cell specified in ETSI TS 138 521-1 [1], clause 5.3. All of these configurations shall be tested with applicable test parameters for each EN-DC configuration, and are shown in Table 5.3.3.5.2.3.1.1.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in ETSI TS 136 521-1[11], clause A.2.3 for E-UTRA RMC for TDD, ETSI TS 136 521-1 [11], clause A.2.2 for E-UTRA RMC for FDD, and ETSI TS 138 521-1 [1], clause A.2 for NR RMC. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 136 521-1 [11], clause C.2 and in ETSI TS 138 521-1 [1], clause C.2 for E-UTRA CG and NR CG respectively.

Table 5.3.3.5.2.3.1.1.1-1: Test configuration table

Initial Conditions					
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	Normal				
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1	Low range for PCC and SCC High range for PCC and SCC				
Test EN-DC channel bandwidth as specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1	5 MHz for E-UTRA CC1 and Lowest for NR CC1, Highest for E-UTRA CC1 and Highest for NR CC1				
Test SCS for the NR cell as specified in Table 1.1-6	Lowest SCS per Channel Bandwidth				
Test Parameters					
Test ID	**Downlink Configuration**	**EN-DC Uplink Configuration**			
		E-UTRA Cell		**NR Cell**	
		Modulation	**RB allocation (note 2)**	**Modulation**	**RB allocation (note 1)**
1	N/A for Spurious emission.	QPSK	Outer_1RB_Left	CP-OFDM QPSK	Edge_1RB_Left
2		QPSK	Outer_1RB_Right	CP-OFDM QPSK	Edge_1RB_Right
3		QPSK	Outer_Full	CP-OFDM QPSK	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 521-1 [1]. NOTE 2: Outer_Full defined as the transmission bandwidth configuration NRB per channel bandwidth for the E-UTRA component as indicated in ETSI TS 136 521-1 [11], Table 5.4.2-1. Outer_1RB_Left defined as 1 RB allocated at the left edge of the E-UTRA component. Outer_1RB_Right defined as 1 RB allocated at the right edge of the E-UTRA component. NOTE 3: Only applicable to UEs not supporting UE capability *singleUL-Transmission*. NOTE 4: Only one EN-DC combination per FR1 band is tested for each EN-DC configuration as defined in ETSI TS 138 521-3 [3], clause 5.5B.4.					

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2.1 for UE diagram.

2) The parameter settings for the E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3, and the parameter settings for the NR cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) E-UTRA downlink signals are initially set up according to clauses C.0, C.1 and C.3.0, and uplink signals according to clauses H.1 and H.3.0 of ETSI TS 136 521-1 [11].

4) NR downlink signals are initially set up according to clauses C.0, C.1 and C.2, and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

5) The UL Reference Measurement channels are set up according to ETSI TS 136 521-1 [11], clause A.2 and ETSI TS 138 521-1 [1], clause A.2 for E-UTRA CG and NR CG respectively.

6) Propagation conditions are set according to ETSI TS 136 521-1 [11], clause B.0 and ETSI TS 138 521-1 [1] clause B.0 for E-UTRA CG and NR CG, respectively.

7) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in clause 6.5B.3.3.1.4.3 of ETSI TS 138 521-3 [3].

8) For both E-UTRA and NR UL uplink carriers active when both bands are TDD, ensure E-UTRA UL transmission overlaps with NR UL transmission in time by giving SCG a delay of 3 subframes, or by giving MCG a delay of 2 subframes.

5.3.3.5.2.3.1.1.2 Procedure

1) E-UTRA SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to Table 5.3.3.5.2.3.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) NR SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.5.2.3.1.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Both NR and E-UTRA SS send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

4) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 4.1.2.6.1.2.1-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 4.1.2.6.1.2.1-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

5.3.3.5.2.3.1.2 Spurious emission band UE co-existence

5.3.3.5.2.3.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies and channel bandwidths based on EN-DC operating bands specified in clause 5.5B.4 of ETSI TS 138 521-3 [3], channel bandwidths and sub-carrier spacings for the NR cell specified in clause 5.3 of ETSI TS 138 521-1 [1] and channel bandwidth for the E-UTRA cell are specified in clause 5.4.2 of ETSI TS 136 521-1 [11]. All of these configurations shall be tested with applicable test parameters for each EN-DC configuration specified in clause 5.5B.4.1 of ETSI TS 138 521-3 [3] and are shown in Table 5.3.3.5.2.3.1.2.1-1. The details of the uplink Reference Measurement Channels (RMCs) are specified in ETSI TS 136 521-1 [11], Annex A, clause A.2.3 for E-UTRA RMC for TDD, ETSI TS 136 521-1 [11], Annex A, clause A.2.2 for E-UTRA RMC for FDD, and ETSI TS 138 521-1 [1], Annex A, clause A.2 for NR RMC. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 136 521-1 [11], clause C.2 and in ETSI TS 138 521-1 [1], clause C.2 for E-UTRA CG and NR CG respectively.

Table 5.3.3.5.2.3.1.2.1-1: Test configuration table

Initial Conditions											
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1					NC						
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1					For test frequencies refer to "Range" columns.						
Test EN-DC channel bandwidth as specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1					Refer to "NR N_{RB}" and "E-UTRA N_{RB}" columns						
Test SCS for the NR cell as specified in Table 1.1-6					Lowest SCS per Channel Bandwidth						
Test Parameters for DC Configurations											
ID	**DC Configuration / N_{RB_agg}**						**DL Allocation**		**UL Allocation (notes 1 and 2)**		
	DC Configuration				**E-UTRA Ch BW/N_{RB}**	**NR Ch BW/N_{RB}**	**CC MOD E-UTRA/NR**	**E-UTRA & NR RB allocation**	**CC MOD E-UTRA/NR**	**E-UTRA & NR allocations (L_{CRB} @ RB_{start})**	
	E-UTRA		**NR**								
	Band	**Range**	**Band**	**Range**							
Default Test Settings for a DC_XA-YA Configuration											
1	X	Low	Y	Low	Highest N_{RB_agg} /Highest N_{RB}	Highest N_{RB_agg} /Highest N_{RB}	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	X	High	Y	High	Highest N_{RB_agg} /Highest N_{RB}	Highest N_{RB_agg} /Highest N_{RB}	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@RB_{max}	1@RB_{max}
Test Setting for DC_1A_n28A Configuration											
1	1	Low	28	Low	10/50	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	1	Low	28	High	10/50	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
3	1	High	28	High	10/50	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	10/50	20/106
Test Setting for DC_1A_n77A Configuration											
1	1	High	77	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@0
2	1	Low	77	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
3	1	Low	77	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
4	1	Low	77	note 5	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
5	1	Low	77	note 5	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
6	1	Low	77	note 5	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
7	1	Low	77	note 5	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
8	1	Low	77	note 5	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0

Test Setting for DC_1A_n78A Configuration											
1	1	High	78	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
2	1	Low	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
3	1	Low	78	Note 3	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
Test Setting for DC_3A_n7A Configuration											
1	3	Low	7	High	20/100	10/52	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@47	1@51
2	3	Mid	7	High	20/100	10/52	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@51
3	3	Low	7	Low	20/100	10/52	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@51
4	3	Mid	7	Low	20/100	10/52	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
5	3	Low	7	High	20/100	10/52	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@51
Test Settings for DC_3A_n28A Configuration											
1	3	Low	28	Low	20/100	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	3	Low	28	High	20/100	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@105
3	3	High	28	High	20/100	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@105
Test Setting for DC_3A_n77A Configuration											
1	3	Low	77	Note 6	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	3	Low	77	Note 6	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
3	3	Low	77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
4	3	Low	77	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@75
5	3	Low	77	Note 6	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
6	3	Low	77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
7	3	High	77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0

Test Setting for DC_3A_n78A Configuration											
1	3	High	78	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@272
2	3	High	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@272
3	3	Low	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
Test Setting for DC_7A_n28A Configuration											
1	7	High	28	High	20/100	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@105
Test Setting for DC_7A_n78A Configuration											
1	7	Low	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	7	Mid	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
3	7	Mid	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@27	1@272
4	7	Low	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@272
5	7	High	78	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@77	1@0
6	7	Mid	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@272
7	7	High	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
8	7	High	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
9	7	High	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
10	7	Low	78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@165

Test Settings for DC_8A_n77A Configuration											
1	8	Low	77	Note 4	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	8	High	77	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@37
3	8	High	77	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@97
4	8	Low	77	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@211
5	8	Low	77	Note 4	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
6	8	High	77	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@272
7	8	High	77	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@0
8	8	Low	77	Note 4	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
9	8	High	77	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@85
Test Settings for DC_8A_n78A Configuration											
1	8	High	78	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@272
2	8	High	78	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
3	8	Low	78	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@272
4	8	High	78	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
5	8	High	78	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@0
6	8	Mid	78	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@25	1@0
Test Setting for DC_20A_n28A Configuration											
1	20	Low	28	Low	20/100	20/106	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@105

Test Setting for DC_20A_n78A Configuration											
1	20	Low	78	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
2	20	Low	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
3	20	Low	78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@205
4	20	High	78	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@104
5	20	Low	78	Note 8	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
Test Setting for DC_28A_n77A Configuration											
1	28	High	77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
2	28	Low	77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@158
3	28	High	77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@130
4	28	Low	77	Note 7	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
5	28	Low	77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
6	28	Low	77	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
7	28	Low	77	Note 7	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
Test Setting for DC_28A_n78A Configuration											
1	28	Low	n78	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	28	High	n78	High	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@272
3	28	Mid	n78	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@272
4	28	High	n78	Low	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@49	1@190
5	28	High	n78	Mid	10/50	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0

Test Setting for DC_41A_n77A Configuration											
1	41	Mid	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
2	41	Low	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@185
3	41	Low	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@57
4	41	Low	n77	Note 9	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
5	41	Low	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
6	41	High	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@201
7	41	Mid	n77	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@46
8	41	Low	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@214
9	41	Low	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@29
10	41	High	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@272
11	41	Mid	n77	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
12	41	Low	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
13	41	Low	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
14	41	Mid	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
15	41	High	n77	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@161
16	41	High	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@122
17	41	Mid	n77	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@27
18	41	Low	n77	High	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@240
19	41	Mid	n77	Note 9	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@125

Test Settings for DC_41A_n78A Configuration											
1	41	High	n78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
2	41	Low	n78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@185
3	41	High	n78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@272
4	41	Low	n78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@0
5	41	Low	n78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@214
6	41	Low	n78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@69
7	41	Low	n78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
8	41	High	n78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@161
9	41	Mid	n78	Low	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@99	1@0
10	41	Low	n78	Mid	20/100	100/273	QPSK/CP-OFDM QPSK	NA	QPSK / CP-OFDM QPSK	1@0	1@98

NOTE 1: Use DC Configuration - specific test points if present in the table, otherwise use test points from matching Group Test Settings, if present in the table. Otherwise use the Default Test Settings test points.
NOTE 2: X, Y correspond to the different bands in the DC Configuration. E.g. for DC_1A-n3A, X=1, Y=3.
NOTE 3: Test Point ID 3 for DC_1A_n78A has the centre carrier frequency of 3 470 MHz in Band 78 (NR ARFCN=631332).
NOTE 4: Test Point ID 1 for DC_8A_n77A has the centre carrier frequency of 3 950,13 MHz in Band n77 (NR ARFCN=663342). Test Point ID 5 for has the centre carrier frequency of 3 524,55 MHz in Band n77 (NR ARFCN=634970). Test Point ID 8 for has the centre carrier frequency of 3 584,55 MHz in Band n77 (NR ARFCN=638970).
NOTE 5: Test Point ID 4 for DC_1A_n77Ahas the centre carrier frequency of 3 472,95 MHz in Band n77 (NR ARFCN=631530). Test Point ID 5 has the centre carrier frequency of 3 987,03 MHz in Band n77 (NR ARFCN=665802). Test Point ID 6 for has the centre carrier frequency of 3 857,04 MHz in Band n77 (NR ARFCN=657136). Test Point ID 7 has the centre carrier frequency of 3 874,53 MHz in Band n77 (NR ARFCN=658302). Test Point ID 8 has the centre carrier frequency of 3 887,04 MHz in Band n77 (NR ARFCN=659136).
NOTE 6: Test Point ID 1 for DC_3A_n77A has the centre carrier frequency of 3 900,03 MHz in Band n77 (NR ARFCN=660002). Test Point ID 2 has the centre carrier frequency of 3 602,55 MHz in Band n77 (NR ARFCN=640170). Test Point ID 5 has the centre carrier frequency of 3 660,15 MHz in Band n77 (NR ARFCN=644010).
NOTE 7: Test Point ID 4 for DC_28A_n77A has the centre carrier frequency of 3 474,63 MHz in Band n77 (NR ARFCN=631642). Test Point ID 7 has the centre carrier frequency of 3 597,12 MHz in Band n77 (NR ARFCN=639808).
NOTE 8: Test Point ID 5 for DC_20A_n78A has the centre carrier frequency of 3 477,03 MHz in Band n78 (NR ARFCN=631802).
NOTE 9: Test Point ID 4 for DC_41A_n77A has the centre carrier frequency of 3 488,55 MHz in Band n77 (NR ARFCN=632570). Test Point ID 19 has the centre carrier frequency of 3 500 MHz in Band n77 (NR ARFCN=633333).

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2.1 for UE diagram.

2) The parameter settings for the E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3, and the parameter settings for the NR cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) E-UTRA downlink signals are initially set up according to clauses C.0, C.1 and C.3.0, and uplink signals according to clauses H.1 and H.3.0 of ETSI TS 136 521-1 [11].

4) NR downlink signals are initially set up according to clauses C.0, C.1 and C.2, and uplink signals according to clauses G.0, G.1, G.2, G.3.0 of ETSI TS 138 521-1 [1].

5) The UL Reference Measurement channels are set up according to ETSI TS 136 521-1 [11] clause A.2 and ETSI TS 138 521-1 [1] clause A.2 for E-UTRA CG and NR CG respectively.

6) Propagation conditions are set according to ETSI TS 136 521-1 [11], clause B.0 and ETSI TS 138 521-1 [1], clause B.0 for E-UTRA CG and NR CG, respectively.

7) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-3 [3], clause 6.5B.3.1.2.4.3.

8) For both E-UTRA and NR UL uplink carriers active when both bands are TDD, ensure E-UTRA UL transmission overlaps with NR UL transmission in time by giving SCG a delay of 3 E-UTRA subframes, or by giving MCG a delay of 2 subframes.

5.3.3.5.2.3.1.2.2 Procedure

1) E-UTRA SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to Table 5.3.3.5.2.3.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) NR SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.5.2.3.1.2.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Both NR and E-UTRA SS send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level

4) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 4.3.2.6.2.3.2.2-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 4.3.2.6.2.3.2.2-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

5.3.3.5.2.3.1.3 Additional Spurious Emissions

5.3.3.5.2.3.1.3.1 Initial conditions

Same test description as in clause 5.1.3.5.1.1.3.1 for the NR carrier with the following exception:

The initial test configurations for E-UTRA band consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA bands specified in Table 5.3.3.0.2-1. For Initial conditions as in clause 5.1.3.5.1.1.3.1, the following steps will be added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508-1 [4], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.5.1.1.3.1 is replaced by the following two steps:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 136 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.5.2.3.1.3.2 Procedure

Same test procedure as in clause 5.1.3.5.1.1.3.2.

5.3.3.5.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.6.2.3.2 in order to show compliance.

5.3.3.5.2.4 Transmitter Spurious Emissions for Inter-Band EN-DC including FR2

5.3.3.5.2.4.1 Method of test

5.3.3.5.2.4.1.1 Initial conditions

Initial conditions for General spurious emissions and for Spurious emissions for UE co-existence are a set of test configurations the UE needs to be tested in and the steps for the Subscriber Station (SS) to take with the UE to reach the correct measurement state.

Table 5.3.3.5.2.4.1.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1		Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Low range, High range (note 2)	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1		Highest	
Test SCS as specified in Table 1.2-6		120 kHz	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spurious Emissions testing	**Modulation**	**RB allocation (note 1)**
1		DFT-s - OFDM QPSK	Inner_Full for PC3
2		DFT-s - OFDM QPSK	Inner_1RB for PC3 (note 3)
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 in ETSI TS 138 508-2 [5] for PC3.			
NOTE 2: When testing Low range test only in Frequency Range lower than (F_{UL_low} - Δf_{OOB}) and when testing High range test only in Frequency Range higher than (F_{UL_high} + Δf_{OOB}).			
NOTE 3: When testing Low range configure uplink RB to Inner_1RB_Left for PC3 and when testing High range configure uplink RB to Inner_1RB_Right for PC3.			

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.0 in ETSI TS 138 508-2 [5], and uplink signals according to clauses G.0, G.1 and G.3.0 in ETSI TS 138 508-2 [5].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement channels are set according to Table 5.3.3.5.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 508-2 [5].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.5.2.4.1.2 Procedure

For General spurious emissions and for Spurious emission for UE co-existence, test procedure described as below shall apply:

1) Select any of the three Alignment Options (1, 2 or 3) from tables N.2-1 through N.2-3 in ETSI TS 138 521-2 [2] to mount the DUT inside the QZ.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0^o \leq \theta \leq 90^o$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90^o < \theta \leq 180^o$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.3.3.5.2.4.1.1-1 Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note 3) for the UE Tx beam selection to complete.

5. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX}. Allow at least BEAM_SELECT_WAIT_TIME (see note 3) for the UE Tx beam selection to complete.

6) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

7) Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K in ETSI TS 138 521-2 [2] if the re-positioning concept is applied (see note 4). Step (a) is optional and applicable only if SNR (test requirement level in Table 4.2.2.6.1.2-1 for general spurious emissions and in Table 4.2.2.6.1.2-2 for Spurious emission for UE co-existence minus offset value minus noise floor of the test system) ≥ 0 dB is guaranteed. During measurement the spectrum analyser shall be set to 'Detector' = RMS.

   a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K in ETSI TS 138 521-2 [2], using coarse TRP measurement grid selection criteria as per tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2]. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 4.2.2.6.1.2-1 for general spurious emissions and Table 4.2.2.6.1.2-2 for Spurious emission for UE co-existence. Optionally, a larger and non-constant measurement bandwidth than that of Table 4.2.2.6.1.2-1 for general spurious emissions and Table 4.2.2.6.1.2-2 for Spurious emission for UE co-existence may be applied. The measurement period shall capture the active time slots.

      For each spurious emission frequency with coarse TRP identified to be less than the offsets listed in tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2] from the TRP limit according to Table 4.2.2.6.1.2-1 for general spurious emissions and Table 4.2.2.6.1.2-2 for Spurious emission for UE co-existence, either continue with another coarse TRP procedure and corresponding offset according to step a) or continue with fine TRP procedures according to step b).

      Different coarse TRP grids and corresponding offset values may be used for different frequencies. Multiple coarse TRP grids measurements with the corresponding offset values can be performed before the fine TRP measurement grid is applied. The coarse TRP grids and offset values used shall be recorded in the test report.

   b) Measure fine TRP measurements according to procedures in annex K in ETSI TS 138 521-2 [2], using fine TRP measurement grid selection criteria as per Table M.4.5-3 in annex M in ETSI TS 138 521-2 [2], for each of the spurious emission frequency identified in step a). Apply a measurement bandwidth according to Table 6.5.3.1.3-2 in ETSI TS 138 521-2 [2].

8) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE 1: The frequency range defined in Table 6.5.3.1.3-2 in ETSI TS 138 521-2 [2] may be split into ranges. For each range, a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges should pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

5.3.3.5.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.6.2.4.2 in order to show compliance.

5.3.3.5.2.5 Transmitter Spurious Emissions for Inter-Band EN-DC including both FR1 and FR2

5.3.3.5.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.5.2.3.1 and clause 5.3.3.5.2.4.1 respectively. The EN-DC requirements for spurious emissions apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.5.2.

5.3.3.5.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.6.2.5.2 in order to show compliance.

5.3.3.6 Receiver Reference Sensitivity Level

5.3.3.6.1 Void

5.3.3.6.2 Receiver Reference Sensitivity for EN-DC

5.3.3.6.2.1 Void

5.3.3.6.2.2 Void

5.3.3.6.2.3 Receiver Reference Sensitivity for Inter-Band EN-DC within FR1

5.3.3.6.2.3.1 Method of test

5.3.3.6.2.3.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths based on EN-DC operating bands specified in clause 5.5B of ETSI TS 138 521-3[3], channel bandwidths and sub-carrier spacings for the NR cell specified in ETSI TS 138 521-1 [1], clause 5.3 and channel bandwidth for the E-UTRA cell are specified in ETSI TS 136 521-1 [11], clause 5.4.2. All of these configurations shall be tested with applicable test parameters for each EN-DC configuration, and are shown in Table 5.3.3.6.2.3.1.1-1 and for non-exception requirements NR configurations in clause 5.1.3.6.1.1.1.

The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in ETSI TS 136 521-1 [11], clauses A.2 and A.3 for E-UTRA RMC, and in ETSI TS 138 521-1 [1], clauses A.2 and A.3 for NR RMC respectively. The details of the OCNG patterns used are specified in ETSI TS 136 521-1 [11], clause A.5 and in ETSI TS 138 521-1 [1], clause A.5 for E-UTRA CG and NR CG, respectively. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 136 521-1 [11], clause C.2 and in ETSI TS 138 521-1 [1], clause C.2 for E-UTRA CG and NR CG, respectively.

For configurations without any reference sensitivity exception, in a FR1 band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected. For configurations with reference sensitivity exception, in an E-UTRA band or FR1 band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected.

Table 5.3.3.6.2.3.1.2.1-1: Test Configuration Table for EN-DC configurations affected by Reference sensitivity exceptions (two bands)

Initial Conditions								
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1				Normal, TL/VL, TL/VH, TH/VL, TH/VH				
NR Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1, E-UTRA Test Frequencies as specified in ETSI TS 136 508 [13], clause 4.3.1				For test frequencies refer to "Range" columns.				
Test EN-DC channel bandwidth as specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1.				Refer to "NR N_{RB}"and "E-UTRA N_{RB} " columns				
NR Test SCS as specified in Table 1.1-6				Lowest supported SCS				
Network signalling value				NS_01 by default Unless given by Table 7.3.3-3 in ETSI TS 136 521-1 [11] for the E-UTRA band and Table 7.3.2.3-4 in ETSI TS 138 521-1 [1] for the NR band.				
Test Parameters for DC Configurations								
ID	**PCC - E-UTRA**				**SCG -NR**			
	Band	**Range**	**N_{RB}**		**Band**	**Range**	**N_{RB}**	
	UL MOD	**DL MOD**	**CH BW**	**DLalloc / UL alloc**	**UL MOD**	**DL MOD**	**UL/DL Ch BW**	**DLalloc / UL alloc**
Test Settings for a DC_1A_n28A Configuration								
1 (note 2)	1	UL 1 950 / DL 2 140			n28	UL 713,3 / DL 768,3		
	N/A	QPSK	20 MHz	All RBs / 0	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_1
2 (note 6)	1	UL 1 970 / DL 2 160			n28	UL 708 / DL 763		
	N/A	QPSK	20 MHz	All RBs / 0	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_1

Test Settings for a DC_1A_n77A Configuration								
1 (note 2)	1	UL 1 950/ DL 2 140			n77	UL/DL 3900		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
2 (note 2)	1	UL 1 950/ DL 2 140			n77	UL/DL 3 870		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	20 MHz	All RBs / 0
3 (note 3)	1	UL 1 950/ DL 2 140			n77	UL/DL 4 090,005		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	N/A	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
4 (note 3)	1	UL 1 950/ DL 2 140			n77	UL/DL 3 709,995		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	N/A	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
Test Settings for a DC_1A_n78A Configuration								
1 (note 3)	1	UL 1 950 / DL 2 140			n78	UL/DL 3 709,995		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
Test Settings for DC_3A_n77A and DC_3A_n78A Configurations								
1 (note 2)	3	Mid			n78	UL/DL 3 495		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
2 (note 2)	3	Mid			n78	UL/DL 3 525		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	20 MHz	All RBs / 0
3 (note 4)	3	Mid			n78	UL/DL 3 685,005		
	N/A	QPSK	20 MHz	All RBs / 0	DFT-s-OFDM QPSK	CP-OFDM QPSK	20 MHz	All RBs / REFSENS_ENDC_2
3 (note 7)	3	Low			n78	High		
	QPSK	QPSK	20 MHz	All RBs/0	DFT-s-OFDM QPSK	CP-OFDM QPSK	20 MHz	All RBs / REFSENS_ENDC_2
4 (note 3)	3	UL 1740 / DL 1835			n78	UL/DL 3 574,995		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
5 (note 3)	3	UL 1765 / DL 1860			n78	UL/DL 3 435		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4

Test Settings for DC_8A_n77A and DC_8A_n78A Configurations								
1 (note 2)	8	Mid			n77	UL/DL 3 590,01		
	QPSK	QPSK	10 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
2 (note 6)	8	Mid			n77	UL/DL 3 520,005		
	QPSK	QPSK	10 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
3 (note 3)	8	UL 897,5			n77	UL/DL 3 634,995		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
Test Settings for a DC_20A_n8A Configuration								
1 (note 3)	20	UL 849,5 / DL 808,5			n8	UL 892,5 / DL 937,5		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	5 MHz	All RBs / REFSENS_ENDC_4
Test Settings for a DC_20A_n78A Configuration								
1 (note 6)	20	Mid			n78	Mid		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
2 (note 2)	20	Mid			n78	UL/DL 3 387,99		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
3 (note 3)	20	UL 850 / DL 809			n78	UL/DL 3 358,995		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	DFT-s-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
Test Settings for a DC_28A_n77A/DC_28A_n78A Configuration (Test ID 4 only apply to DC_28A_n77A)								
1 (note 2)	28	Low			n77/n78	UL/DL 3 540		
	QPSK	QPSK	10 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
2 (note 6)	28	Low			n77/n78	Low		
	QPSK	QPSK	10 MHz	All RBs / REFSENS_ENDC_1	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0
3 (note 3)	28	UL 705,5 / DL 760,5			n77/n78	UL/DL 3 582,495		
	QPSK	QPSK	5 MHz	All RBs / REFSENS_ENDC_4	CP-OFDM QPSK	CP-OFDM QPSK	10 MHz	All RBs / REFSENS_ENDC_4
4 (note 4)	28	Low			n77	UL/DL 3 815,01		
	N/A	QPSK	10 MHz	All RBs / 0	CP-OFDM QPSK	CP-OFDM QPSK	100 MHz	All RBs / REFSENS_ENDC_2

Test Settings for a DC_41A_n77A/DC_41A_n78A Configuration								
1 (note 4)	41	Low			n77/n78	UL/DL 3 750		
	N/A	QPSK	20 MHz	All RBs / 0	DFT-s-OFDM QPSK	CP-OFDM QPSK	100 MHz	All RBs / REFSENS_ENDC_2
2 (note 5)	41	High			n77/n78	Low		
	N/A	QPSK	20 MHz	All RBs / 0	DFT-s-OFDM QPSK	CP-OFDM QPSK	100 MHz	All RBs / REFSENS_ENDC_3
3 (note 5)	41	High			n77/n78	Low		
	QPSK	QPSK	20 MHz	All RBs / REFSENS_ENDC_3	N/A	CP-OFDM QPSK	100 MHz	All RBs / 0

NOTE 1: REFSENS_LTE refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.3-2 of ETSI TS 136 521-1 [11].
REFSENS_NR refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3 of ETSI TS 138 521-1 [1].
REFSENS_ENDC_1 refers to the Uplink RB allocation for reference sensitivity exceptions due to UL harmonic interference according to Table 7.3B.2.0.3.1-2 in ETSI TS 138 521-3 [3].
REFSENS_ENDC_2 refers to the Uplink RB allocation for reference sensitivity exceptions due to receiver harmonic mixing according to Table 7.3B.2.0.3.2-2 in ETSI TS 138 521-3 [3].
REFSENS_ENDC_3 refers to the Uplink RB allocation for reference sensitivity exceptions due to cross band isolation according to Table 7.3B.2.0.3.4-2 in ETSI TS 138 521-3 [3].
REFSENS_ENDC_4 refers to the Uplink RB allocation for reference sensitivity exceptions due to dual uplink operation for ENDC according to Table 7.3B.2.0.3.5.1-1 in ETSI TS 138 521-3 [3].
NOTE 2: Test ID with UL harmonic exception.
NOTE 3: Test ID with 2UL intermodulation exception.
NOTE 4: Test ID with UL receiver harmonic mixing.
NOTE 5: Test ID with UL cross band isolation.
NOTE 6: Test ID with UL harmonic exception avoided.
NOTE 7: Test ID with UL receiving harmonic mixing exception avoided.
NOTE 8: In an E-UTRA band or FR1 band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected.
NOTE 9: If the NR frequency does not match to a valid NR-ARFCN, apply the closest NR frequency with a valid NR-ARFCN.

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2) The parameter settings for NR cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

4) NR downlink signals are initially set up according to clauses C.0, C.1, C.2, C.3.1, and uplink signals according to clauses G.0, G.1, G.2, and G.3.1 of ETSI TS 138 521-1 [1].

5) E-UTRA downlink signals are initially set up according to clauses C.0, C.1 and C.3.0, and uplink signals according to clauses H.1 and H.3.0 of ETSI TS 136 521-1 [11].

6) For test points in Table 5.3.3.6.2.3.1.2.1-1, the DL and UL Reference Measurement channels are set according to Table 5.3.3.6.2.3.1.2.1-1 for E-UTRA CG and NR CG.

   6.1) For non-exception requirements, The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1.

7) NR propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [1]. E-UTRA propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

8) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-3 [3], clause7.3B.2.3.4.2.3.

9) For non-exception requirements only, on the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.6.2.3.1.2.2 Procedure

For test points in Tables 5.3.3.6.2.3.1.2.1-1:

1) SS transmits PDSCH via PDCCH DCI format 1A and PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables 5.3.3.6.2.3.1.2.1-1 on the E-UTRA CC and NR CC. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 and DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 5.3.3.6.2.3.1.2.1-1on the E-UTRA CC and NR CC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level for the E-UTRA CC and NR CC to the appropriate REFSENS value defined in Tables 4.3.2.7.2.3.2.2-1 to 4.3.2.7.2.3.2.2-4. Send continuously uplink power control "up" commands in the uplink scheduling information to both carriers to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement.

4) Measure the average throughput of both NR and E-UTRA for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-1 [1] for NR band, and clause G.2 of ETSI TS 136 521-1 [11] for E-UTRA band.

For non-exception requirements test procedure in clause 5.1.3.6.1.1.2 applies.

5.3.3.6.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.7.2.3.2 in order to show compliance.

5.3.3.6.2.4 Void

5.3.3.6.2.4 Receiver Reference Sensitivity for Inter-Band EN-DC including FR2

5.3.3.6.2.4.1 Method of test

5.3.3.6.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 5.3.3.6.2.4.1.1-1, Table 5.3.3.6.2.4.1.1-2 and Table 5.3.3.6.2.4.1.1-3. The details of the uplink Reference Measurement Channels (RMCs) are specified in clause A.2 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.6.2.4.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal, TL, TH	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Lowest, 100 MHz, Highest	
Test SCS as specified in Table 1.2-6			120 kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (note 1)	DFT-s-OFDM QPSK	REFSENS (note 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 5.3.3.6.2.4.1.1-2. NOTE 2: REFSENS refers to Table 5.3.3.6.2.4.1.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.				

Table 5.3.3.6.2.4.1.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	**SCS kHz**	**LCRBmax**	**RB allocation (LCRB@RBstart)**
50 MHz	120	32	32@0
100 MHz	120	66	66@0
200 MHz	120	132	132@0
400 MHz	120	264	264@0
NOTE: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 1.2-6.			

Table 5.3.3.6.2.4.1.1-3: Uplink configuration for reference sensitivity, LCRB@RBstart format

Operating Band	**SCS kHz**	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**	**Duplex Mode**
n257	120	32@0	64@0	128@0	256@0	TDD
n258	120	32@0	64@0	128@0	256@0	TDD

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 in ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The UL Reference Measurement channels are set according to Table 5.3.3.6.2.4.1.1-1, Table 5.3.3.6.2.4.1.1-2 and Table 5.3.3.6.2.4.1.1-3.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.6.2.4.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 5.3.3.6.2.4.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.6.2.4.1.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX}.

4) Set the UE in the Rx beam peak direction found with a 3D EIS scan as performed in clause K.1.2 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Rx beam selection to complete.

5) Perform EIS procedure as stated in clause K.1.4 in ETSI TS 138 521-2 [2] to calculate "averaged EIS". At each power level, measure the average throughput for a duration sufficient to achieve statistical significance according to clause H.2 in ETSI TS 138 521-2 [2]. The downlink power step size shall be no more than 0,2 dB when the RF power level is near the sensitivity level.

6) Compare the dB value of the "averaged EIS" value corresponding to the Rx beam peak direction identified in step 5 to the test requirement in Table 7.3.2.5-1 in ETSI TS 138 521-2 [2]. If the EIS value is lower or equal to the value in Table 7.3.2.5-1 in ETSI TS 138 521-2 [2], pass the UE. Otherwise fail the UE.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.3.3.6.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.7.2.4.2 in order to show compliance.

5.3.3.6.2.5 Receiver Reference Sensitivity for Inter-Band EN-DC including both FR1 and FR2

5.3.3.6.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.6.2.3.1 and clause 5.3.3.6.2.4.1 respectively. The EN-DC requirements for reference sensitivity apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.6.2.

5.3.3.6.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.7.2.5.2 in order to show compliance.

5.3.3.7 Receiver Adjacent Channel Selectivity (ACS)

5.3.3.7.1 Void

5.3.3.7.2 Receiver Adjacent Channel Selectivity for EN-DC

5.3.3.7.2.1 Void

5.3.3.7.2.2 Void

5.3.3.7.2.3 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC within FR1

5.3.3.7.2.3.1 Method of test

5.3.3.7.2.3.1.1 Initial conditions

Same initial conditions as in clause 5.1.3.7.1.1 for the NR carrier with the following exceptions:

The initial test configurations for E-UTRA consist of test frequency based on E-UTRA operating band and test channel bandwidth as specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.7.1.1.1, add step 2.1 and step 3.1 as follows:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.7.1.1.1 is replaced by:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5.

Add step 7 to Initial conditions in clause 5.1.3.7.1.1.1 as follows:

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.7.2.3.1.2 Procedure

Same test procedure as in clause 5.1.3.7.1.1.2 for NR Carrier.

5.3.3.7.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.8.2.3.2 in order to show compliance.

5.3.3.7.2.4 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC including FR2

5.3.3.7.2.4.1 Method of test

5.3.3.7.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 5.3.3.7.2.4.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in annex A in ETSI TS 138 521-2 [2]. The details of the OCNG patterns used are specified in annex A in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.7.2.4.1.1-1: Test Configuration

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			50 MHz, 100 MHz	
Test SCS as specified in Table 1.2-6			120 kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	note	DFT-s-OFDM QPSK	note
NOTE: The specific configuration of each RB allocation is defined in Table 7.3.2.4.1-1 in ETSI TS 138 521-2 [2].				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.1.4.1 for TE diagram and clause A.3.4 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3. The E-UTRA downlink signal level, uplink signal level are set according to Table 4.6-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 in ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 in ETSI TS 138 521-2 [2].

4) The UL Reference Measurement channels are set according to Table 5.3.3.7.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.3-1 under clause 5.3.3.0.3.

5.3.3.7.2.4.1.2 Procedure

1) Set the UE in the Rx beam peak direction found with a 3D EIRP scan as performed in clause K.1.2 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Rx beam selection to complete.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set TimeAlignmentTimerDedicated IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.3-1 under clause 5.3.3.0.3.

2) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.3.3.7.2.4.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.7.2.4.1.1-1. Since the UL has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

4) Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.2.3.7.1.1.2-1 of the target power level in Table 7.5.5-2 (Case 1) in ETSI TS 138 521-2 [2] or Table 7.5.5-3 (Case 2) in ETSI TS 138 521-2 [2], for at least the duration of the throughput measurement.

5) Perform Blocking measurement procedure as stated in clause K.1.8 in ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 7.5.5-2 (Case 1) in ETSI TS 138 521-2 [2]. Modulated interferer signal characteristics as defined in annex D in ETSI TS 138 521-2 [2] with frequency below the wanted signal.

6) Repeat step 5 using an interfering signal frequency above the wanted signal in Case 1.

7) Perform Blocking measurement procedure as stated in clause K.1.8 in ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 7.5.5-3 (Case 2) in ETSI TS 138 521-2 [2]. Modulated interferer signal characteristics as defined in annex D in ETSI TS 138 521-2 [2] with frequency below the wanted signal. Measure throughput for a duration sufficient to achieve statistical significance according to clause H.2 in ETSI TS 138 521-2 [2].

8) Repeat step 7 using an interfering signal frequency above the wanted signal in Case 2.

9) Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 of ETSI TS 138 521-2 [2].

5.3.3.7.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.8.2.4.2 in order to show compliance.

5.3.3.7.2.5 Receiver Adjacent Channel Selectivity for Inter-Band EN-DC including both FR1 and FR2

5.3.3.7.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.7.2.3.1 and clause 5.3.3.7.2.4.1 respectively. The EN-DC requirements for spurious emissions apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.7.2.

5.3.3.7.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.8.2.5.2 in order to show compliance.

5.3.3.8 Receiver Blocking Characteristics

5.3.3.8.1 Void

5.3.3.8.2 Receiver Blocking Characteristics for EN-DC

5.3.3.8.2.1 Void

5.3.3.8.2.2 Void

5.3.3.8.2.3 Receiver blocking for Inter-Band EN-DC within FR1

5.3.3.8.2.3.1 Method of test

5.3.3.8.2.3.1.1 In-band blocking

####### 5.3.3.8.2.3.1.1.1 Initial conditions

Same initial conditions as in clause 5.1.3.8.1.1.1 for the NR carrier with the following exceptions:

The initial test configurations for E-UTRA consist of test frequency based on E-UTRA operating band and test channel bandwidth as specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.8.1.1.1.1, add step 2.1 and step 3.1 as follows:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.8.1.1.1.1 is replaced by:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5.

Add step 7 to Initial conditions in clause 5.1.3.8.1.1.1.1 as follows:

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

####### 5.3.3.8.2.3.1.1.2 Procedure

Same test procedure as in clause 5.1.3.8.1.1.1.2 for the NR Carrier.

5.3.3.8.2.3.1.2 Out-of-band blocking

####### 5.3.3.8.2.3.1.2.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, DC configuration specified in ETSI TS 138 521-3 [3], clause 5.5B.4 and test channel bandwidths specified in ETSI TS 136 508 [13], clause 4.3.1 and ETSI TS 138 508-1 [4], clause 4.3.1, and sub-carrier spacing based on NR operating bands specified in ETSI TS 138 521-1 [1], clause 5.3. All of these configurations shall be tested with applicable test parameters for each EN-DC configuration, and are shown in Table 5.3.3.8.2.3.1.2.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) and OCNG patterns are specified in ETSI TS 136 521-1 [11], annex A for E-UTRA, and ETSI TS 138 521-1 [1], annex A for NR. Configurations of PDSCH and PDCCH before measurement are specified in ETSI TS 136 521-1 [11], annex C and in ETSI TS 138 521-1 [1], annex C for E-UTRA CG and NR CG respectively.

Table 5.3.3.8.2.3.1.2.1-1: Test configuration table

Initial Conditions							
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1				Normal			
NR Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1 E-UTRA Test Frequencies as specified in ETSI TS 136 508 [13], clause 4.3.1				Mid range for E-UTRA and Mid range for NR (note 3)			
NR Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1 E-UTRA Test Channel Bandwidths as specified in ETSI TS 136 508 [13], clause 4.3.1				Highest for E-UTRA and Highest for NR			
NR Test SCS as specified in Table 1.1-6				Lowest			
Test Parameters							
Downlink Configuration				**Uplink Configuration**			
E-UTRA Cell		**NR Cell**		**E-UTRA Cell**		**NR Cell**	
Modulation	**RB allocation**	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
QPSK	Note 1	CP-OFDM QPSK	Note 1	QPSK	Note 1	DFT-s-OFDM QPSK	Note 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 5.3.3.6.2.3.1.2.1-1. NOTE 2: In an E-UTRA band or FR1 band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 4.1.2.7.1.2-1 and Table 4.1.2.7.1.2-2) is used in the test requirements. NOTE 3: For NR band n28, 30 MHz test channel bandwidth is tested with Low range test frequency.							

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.2 for SS diagram and clause A.3.2 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [11], annex C and ETSI TS 138 521-1 [1] annex C for E-UTRA CG and NR CG respectively, and uplink signals according to ETSI TS 136 521-1 [11] annex H and ETSI TS 138 521-1 [1], annex G for E-UTRA CG and NR CG respectively.

4) The UL and DL Reference Measurement channels are ETSI TS 136 521-1 [11], clauses A.2, A.3 and ETSI TS 138 521-1 [1], clauses A.2, A.3 for E-UTRA CG and NR CG respectively.

5) Propagation conditions are set according to ETSI TS 136 521-1 [11], clause B.0 and ETSI TS 138 521-1 [1] clause B.0 for E-UTRA CG and NR CG respectively.

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG* and *SCG*, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5. Message contents are defined in ETSI TS 138 521-3 [3], clause 7.6B.3.3.4.3.

5.3.3.8.2.3.1.2.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A and PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.3.3.8.2.3.1.2.1-1 on E-UTRA CC and NR CC respectively. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 and DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.3.3.8.2.3.1.2.1-1 on E-UTRA CC and NR CC respectively. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in Table 4.2.7.1.2-3 of ETSI EN 301 908-13 [12], Table 4.1.2.9.1.2.2-1, or Table 4.1.2.9.1.2.2-3 for E-UTRA CC and NR CC respectively. For NR CC and E-UTRA CC, send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.3.3.8.2.3.1.2.2-1 of ($P_{CMAX\_L,c}$ - 4 dB) for E-UTRA CC, and of 29 dB below $P_{CMAX\_L,f,c}$ for NR CC, for at least the duration of the Throughput measurement.

4) Set the parameters of the CW signal generator for an interfering signal below the aggregated component carriers according to Table 4.1.2.9.1.2.2-2 or Table 4.1.2.9.1.2.2-4. The frequency step size is $\min(\lfloor BW_{channel}/2 \rfloor, 5)$ MHz.

   If CW interferer falls in a gap between F_{DL_high} of the E-UTRA or NR band and F_{DL_low} of the NR or E-UTRA band, where the corresponding OOB ranges 1 and 2 in Table 4.2.7.1.2-4 of ETSI EN 301 908-13 [12] and Table 4.1.2.9.1.2.2-2 or Table 4.1.2.9.1.2.2-4 overlap, then the lower level interferer limit of the overlapping OOB ranges applies. CW interferer is eliminated from F_{DL_low} - 15 MHz to F_{DL_high} + 15 MHz of E-UTRA carrier.

   If F_{DL_high} of the lower E-UTRA or NR band is greater than or equal to the F_{DL_low} of the upper NR or E-UTRA band as in overlapping RX frequency ranges, then the OOB range shall start from the F_{DL_low} of the lower E-UTRA or NR band, and from the F_{DL_high} of the upper NR or E-UTRA band.

   For the EN-DC combination listed in Table 4.3.2.9.2.3.2.2-1, exceptions to the requirement specified in Table 4.3.2.9.2.3.2.2-2 are allowed when the second-order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

5) Measure the average throughput of NR CC for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-3 [3]. Record the frequencies for which the throughput does not meet the requirements.

6) Repeat steps from 4 to 5, using an interfering signal above the aggregated component carriers at step 4.

7) Set the Downlink signal level to the value as defined in Table 4.2.7.1.2-3 of ETSI EN 301 908-13 [12], Table 4.1.2.9.1.2.2-1, or Table 4.1.2.9.1.2.2-3 for E-UTRA CC and NR CC respectively. For NR CC and E-UTRA CC, send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.3.3.8.2.3.1.2.2-1 of ($P_{CMAX\_L,c}$ - 4 dB) for E-UTRA CC, and of 29 dB below $P_{CMAX\_L,f,c}$ for NR CC, for at least the duration of the Throughput measurement.

8) Set the parameters of the CW signal generator for an interfering signal below the aggregated component carriers according to Table 4.2.7.1.2-4 of ETSI EN 301 908-13 [12], Table 4.1.2.9.1.2.2-2 or Table 4.1.2.9.1.2.2-4 for E-UTRA CC and NR CC testing respectively. The frequency step size is $\min(\lfloor BW_{channel}/2 \rfloor, 5)$ MHz.

   If CW interferer falls in a gap between F_{DL_high} of the E-UTRA or NR band and F_{DL_low} of the NR or E-UTRA band, where the corresponding OOB ranges 1 and 2 in Table 4.2.7.1.2-4 of ETSI EN 301 908-13 [12], Table 4.1.2.9.1.2.2-2 or Table 4.1.2.9.1.2.2-4 overlap, then the lower level interferer limit of the overlapping OOB ranges applies. CW interferer is eliminated from F_{DL_low} - 15 MHz to F_{DL_high} + 15 MHz of E-UTRA and NR carriers.

   If F_{DL_high} of the lower E-UTRA or NR band is greater than or equal to the F_{DL_low} of the upper NR or E-UTRA band as in overlapping RX frequency ranges, then the OOB range shall start from the F_{DL_low} of the lower E-UTRA or NR band, and from the F_{DL_high} of the upper NR or E-UTRA band.

9) Measure the average throughput of E-UTRA CC and NR CC respectively for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-3 [3]. Record the frequencies for which the throughput does not meet the requirements.

10) Repeat steps from 8 to 9, using an interfering signal above the aggregated component carriers at step 8).

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-3 [3], annex F, clause F.4.

Table 5.3.3.8.2.3.1.2.2-1: Uplink power control window for EN-DC

Uplink power control window (dB) for each $BW_{Channel}$ and carrier centre frequency						
	E-UTRA $BW_{Channel}$ ≤ 20 MHz					
Fc (GHz)	NR $BW_{Channel}$ ≤ 20 MHz		20 MHz < NR $BW_{Channel}$ ≤ 40 MHz		40 MHz < NR $BW_{Channel}$ ≤ 100 MHz	
NR: Fc ≤ 3	NR CC	E-UTRA CC	NR CC	E-UTRA CC	NR CC	E-UTRA CC
E-UTRA: Fc ≤ 3	-0,7 to 3,1	-0,7 to 3,4	-0,7 to 3,1	-0,7 to 3,4	-1,4 to 4,1	-1,4 to 4,1
NR: Fc ≤ 3;	NR CC	E-UTRA CC	NR CC	E-UTRA CC	NR CC	E-UTRA CC
E-UTRA: 3,0 < Fc ≤ 4,2	-1 to 3,4	-1 to 3,7	-1 to 3,4	-1 to 3,7	-1,4 to 4,1	-1,4 to 4,1
NR: 3,0 < Fc ≤ 4,2	NR CC	E-UTRA CC	NR CC	E-UTRA CC	NR CC	E-UTRA CC
E-UTRA: Fc ≤ 4,2	-1 to 3,4	-1 to 3,7	-1 to 3,4	-1 to 3,7	-1,6 to 4,3	-1,6 to 4,3
NR: 4,2 < Fc ≤ 6,0	NR CC	E-UTRA CC	NR CC	E-UTRA CC	NR CC	E-UTRA CC
E-UTRA: Fc ≤ 4,2	-1,3 to 3,7	-1,3 to 4	-1,5 to 3,9	-1,5 to 4,2	-1,6 to 4,3	-1,6 to 4,3

5.3.3.8.2.3.1.3 Narrowband blocking

5.3.3.8.2.3.1.3.1 Initial conditions

Same initial conditions as in clause 5.1.3.8.1.1.3.1 for the NR carrier with the following exceptions:

The initial test configurations for E-UTRA consist of test frequency based on E-UTRA operating band and test channel bandwidth as specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.8.1.1.3.1, add step 2.1 and step 3.1 as follows:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508-1 [13], clause 4.4.3.

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

Step 6 of Initial conditions as in clause 5.1.3.8.1.3.1.1 is replaced by:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508 [4], clause 4.5.

Add step 7 to Initial conditions in clause 5.1.3.8.1.1.3.1 as follows:

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

5.3.3.8.2.3.1.3.2 Procedure

Same test procedure as in clause 5.1.3.8.1.1.3.2 for the NR Carrier.

5.3.3.8.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.9.2.3.2 in order to show compliance.

5.3.3.8.2.1.4 Void

5.3.3.8.2.4 Receiver blocking for Inter-Band EN-DC including FR2

5.3.3.8.2.4.1 Method of test

5.3.3.8.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.3.3.8.2.4.1.1-1. The details of the uplink Reference Measurement Channels (RMC) are specified in clauses A.2 and A.3 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2]. The details of the OCNG patterns used are specified in clause A.5 in ETSI TS 138 521-2 [2].

Table 5.3.3.8.2.4.1.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1			Normal	
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1			Mid range	
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1			50 MHz, 100 MHz	
Test SCS as specified in Table 1.2-6			120 kHz	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	note	DFT-s-OFDM QPSK	note
NOTE: The specific configuration of each RB allocation is defined in Table 7.3.2.4.1-1 in ETSI TS 138 521-2 [2].				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, in Figure A.3.1.4.1 for TE diagram and clause A.3.4 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1 and C.3.1 in ETSI TS 138 521-2 [2], and uplink signals according to clauses G.0, G.1 and G.3.1 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.6-1 in ETSI TS 138 521-3 [3] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The DL and UL Reference Measurement channels are set according to Table 5.3.3.8.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set TimeAlignmentTimerDedicated IE to infinity and disable downlink and uplink scheduling, all as per Table 4.6-1 in ETSI TS 138 521-3 [3], under clause 4.6.

5.3.3.8.2.4.1.2 Procedure

1) Set the UE in the Rx beam peak direction found with a 3D EIRP scan as performed in clause K.1.2 in ETSI TS 138 521-2 [2]. Allow at least BEAM_SELECT_WAIT_TIME (see note) for the UE Rx beam selection to complete.

2) SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.3.3.8.2.4.1.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 5.3.3.8.2.4.1.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

4) Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.2.3.7.1.1.2-1of the target power level in Table 4.2.2.9.1.2-1, for at least the duration of the throughput measurement.

5) Perform the Blocking measurement procedure as stated in clause K.1.8 in ETSI TS 138 521-2 [2] using Downlink signal level and Interferer signal level as defined in Table 7.6.2.5-1 in ETSI TS 138 521-2 [2]. Modulated interferer signal characteristics as defined in annex D in ETSI TS 138 521-2 [2]. Measure throughput for a duration sufficient to achieve statistical significance according to clause H.2 in ETSI TS 138 521-2 [2].

6) Repeat steps using interfering signals specified in Table 7.6.2.5-1 in ETSI TS 138 521-2 [2]. The ranges are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the centre frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to FInterferer range limit defined at the corresponding band edge.

NOTE: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

5.3.3.8.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.9.2.4.2 in order to show compliance.

5.3.3.8.2.5 Receiver blocking for Inter-Band EN-DC including both FR1 and FR2

5.3.3.8.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.8.2.3.1 and clause 5.3.3.8.2.4.1 respectively. The EN-DC requirements for spurious emissions apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.8.2.

5.3.3.8.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.9.2.5.2 in order to show compliance.

5.3.3.9 Receiver Spurious Response

5.3.3.9.1 Void

5.3.3.9.2 Receiver Spurious Response for EN-DC

5.3.3.9.2.1 Void

5.3.3.9.2.2 Void

5.3.3.9.2.3 Receiver Spurious Response for Inter-Band EN-DC within FR1

5.3.3.9.2.3.1 Method of test

5.3.3.9.2.3.1.1 Initial conditions

The initial conditions shall be the same as in clause 5.3.3.8.2.3.1.2.1 in order to test spurious responses obtained in clause 5.3.3.8.2.3.1.2 under the same conditions.

5.3.3.9.2.3.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A and PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 5.3.3.8.2.3.1.2.1-1 on E-UTRA CC and NR CC respectively. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 and DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 5.3.3.8.2.3.1.2.1-1 on E-UTRA CC and NR CC respectively. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in Table 4.2.8.1.2-1 of ETSI EN 301 908-13 [12], Table 4.1.2.10.1.2-1, or Table 4.1.2.10.1.2-2 for E-UTRA CC and NR CC respectively. For NR CC and E-UTRA CC, send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.3.3.8.2.3.1.2.2-1 of ($P_{CMAX\_L,c}$ - 4 dB) for E-UTRA CC, and of 29 dB below $P_{CMAX\_L,f,c}$ for NR CC, for at least the duration of the Throughput measurement.

4) Set the parameters of the CW signal generator for an interfering signal according to Table 4.1.2.10.1.2-3. The spurious frequencies are taken from records in test procedures in clause 5.3.3.8.2.3.1.2.2.

5) For the spurious frequency, measure the average throughput of NR CC for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-3 [3].

6) Set the Downlink signal level to the value as defined in Table 4.2.8.1.2-1 of ETSI EN 301 908-13 [12], Table 4.1.2.10.1.2-1, or Table 4.1.2.10.1.2-2 for E-UTRA CC and NR CC respectively. For NR CC and E-UTRA CC, send uplink power control commands to the UE using 1 dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window in Table 5.3.3.8.2.3.1.2.2-1 of ($P_{CMAX\_L,c}$ - 4 dB) for E-UTRA CC, and of 29 dB below $P_{CMAX\_L,f,c}$ for NR CC, for at least the duration of the Throughput measurement.

7) Set the parameters of the CW signal generator for an interfering signal according to Table 4.1.2.10.1.2-3. The spurious frequencies are taken from records in test procedures in clause 5.3.3.8.2.3.1.2.2 for E-UTRA CC and NR CC testing respectively.

8) For the spurious frequency, measure the average throughput of E-UTRA CC and NR CC respectively for a duration sufficient to achieve statistical significance according to clause H.2 of ETSI TS 138 521-3 [3].

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in ETSI TS 138 521-3 [3], annex F, clause F.4.

5.3.3.9.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.10.2.3.2 in order to show compliance.

5.3.3.9.2.4 Void

5.3.3.9.2.5 Receiver Spurious Response for Inter-Band EN-DC including both FR1 and FR2

5.3.3.9.2.5.1 Method of test

The conducted requirements are tested separately as in clause 5.3.3.9.2.3. The requirement is sufficiently verified in clause 5.3.3.9.2.3 and no additional test is required.

5.3.3.9.2.5.2 Test requirements

Clause 5.3.3.9.2.3.2 applies.

5.3.3.10 Receiver Intermodulation Characteristic

5.3.3.10.1 Void

5.3.3.10.2 Wideband Intermodulation for EN-DC

5.3.3.10.2.1 Void

5.3.3.10.2.2 Void

5.3.3.10.2.3 Wideband Intermodulation for Inter-Band EN-DC within FR1

5.3.3.10.2.3.1 Method of test

5.3.3.10.2.3.1.1 Initial conditions

Same initial conditions as in clause 5.1.3.10.1.1 for the NR carrier with the following exceptions:

The initial test configurations for E-UTRA consist of test frequency based on E-UTRA operating band and test channel bandwidth as specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.10.1.1.1, the following steps are added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3. The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

Step 6 of Initial conditions as in clause 5.1.3.10.1.1.1 is replaced by:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.10.2.3.1.2 Procedure

Same test procedure as in clause 5.1.3.10.1.1.2 for NR Carrier.

5.3.3.10.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.11.2.3.2 in order to show compliance.

5.3.3.10.2.4 Void

5.3.3.10.2.5 Receiver Intermodulation for Inter-Band EN-DC including both FR1 and FR2

5.3.3.10.2.5.1 Method of test

The conducted requirements are tested separately as in clause 5.3.3.10.2.3.1. The requirement is sufficiently verified in clause 5.3.3.10.2.3 and no additional test is required.

5.3.3.10.2.5.2 Test requirements

Clause 5.3.3.10.2.3.2 applies.

5.3.3.11 Receiver Spurious Emissions

5.3.3.11.1 Void

5.3.3.11.2 Receiver Spurious Emissions for EN-DC

5.3.3.11.2.1 Void

5.3.3.11.2.2 Void

5.3.3.11.2.3 Receiver Spurious Emissions for Inter-Band EN-DC within FR1

5.3.3.11.2.3.1 Method of test

5.3.3.11.2.3.1.1 Initial conditions

Same initial conditions as in clause 5.1.3.11.1.1 for the NR carrier with the following exceptions:

The initial test configurations for E-UTRA consist of test frequency based on E-UTRA operating band and test channel bandwidth as specified in Table 5.3.3.0.2-1.

For Initial conditions as in clause 5.1.3.11.1.1.1, the following steps are added to configure E-UTRA component:

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3. The E-UTRA downlink signal level, uplink signal level are set according to Table 5.3.3.0.2-1 and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

7) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set *TimeAlignmentTimerDedicated* IE to infinity and disable downlink and uplink scheduling, all as per Table 5.3.3.0.2-1 under clause 5.3.3.0.2.

Step 6 of Initial conditions as in clause 5.1.3.11.1.1.1 is replaced by:

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [4] clause 4.5.

5.3.3.11.2.3.1.2 Procedure

Same test procedure as in clause 5.1.3.11.1.1.2 for NR Carrier.

5.3.3.11.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.12.2.3.2 in order to show compliance.

5.3.3.11.2.4 Void

5.3.3.11.2.4 Receiver Spurious Emissions for Inter-Band EN-DC including FR2

5.3.3.11.2.4.1 Method of test

5.3.3.11.2.4.1.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 1.2-6. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 5.3.3.11.2.4.1.1-1. The details of the uplink and downlink Reference Measurement Channels (RMCs) are specified in clauses A.2 and A.3 in ETSI TS 138 521-2 [2]. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2 in ETSI TS 138 521-2 [2].

Table 5.3.3.11.2.4.1.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in ETSI TS 138 508-1 [4], clause 4.1	Normal			
Test Frequencies as specified in ETSI TS 138 508-1 [4], clause 4.3.1	Low range, Mid range, High range			
Test Channel Bandwidths as specified in ETSI TS 138 508-1 [4], clause 4.3.1	Highest			
Test SCS as specified in Table 1.2-6	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	N/A	0	N/A	0
NOTE: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1 in ETSI TS 138 521-2 [2].				

1) Connection between SS and UE is shown in ETSI TS 138 508-1 [4], annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [4], clause 4.4.3.

2.1) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [13], clause 4.4.3.

3) Downlink signals are initially set up according to clauses C.0, C.1, C.2, C.3.1, and uplink signals according to clauses G.0, G.1, G.2, G.3.1 in ETSI TS 138 521-2 [2].

3.1) The E-UTRA downlink signal level, uplink signal level are set according to Table 4.7-1 in ETSI TS 138 521-2 [2] and propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [11].

4) The DL and UL Reference Measurement channels are set according to Table 5.3.3.11.2.4.1.1-1.

5) Propagation conditions are set according to clause B.0 in ETSI TS 138 521-2 [2].

6) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer MCG and SCG, Connected without release On according to ETSI TS 138 508-1 [4], clause 4.5.

5.3.3.11.2.4.1.2 Procedure

1) Select any of the three Alignment Options (1, 2 or 3) from Tables N.2-1 through N.2-3 in ETSI TS 138 521-2 [2] to mount the DUT inside the QZ.

1.1) On the E-UTRA carrier, disable periodic and aperiodic CQI reports, disable SRS, set TimeAlignmentTimerDedicated IE to infinity and disable downlink and uplink scheduling, all as per Table 4.7-1 under clause 4.7 in ETSI TS 138 521-3 [3].

2) If the re-positioning concept is applied, position the device in DUT Orientation 1 if the maximum beam peak direction is within zenith angular range $0° \leq \theta \leq 90°$ for the alignment option selected in step 1; position the device in DUT Orientation 2 (either Options 1 or 2) if the maximum beam peak direction is within zenith angular range $90° < \theta \leq 180°$ for DUT Orientation 1 for the alignment option selected in step 1. If the re-positioning concept is not applied, position the device in DUT Orientation 1.

3) Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in clause K.1.1 of ETSI TS 138 521-2 [2] using the uplink configuration in clause 5.2.3.1.1. Allow at least BEAM_SELECT_WAIT_TIME (see note 3) for the UE Tx beam selection to complete.

4) SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.2 using condition Tx only.

5) Measure the spurious emissions as per steps outlined below with an exception to the procedure in Annex K ETSI TS 138 521-2 [2] if the re-positioning concept is applied (see note 4). Step (a) is optional and applicable only if SNR (test requirement level in Table 4.2.2.10.1.2-1 minus offset value minus noise floor of the test system) ≥ 0 dB is guaranteed.

   a) Perform coarse TRP measurements to identify spurious emission frequencies and corresponding power level according to the procedures in Annex K of ETSI TS 138 521-2 [2], using coarse TRP measurement grid selection criteria as per tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2]. The measurement is completed in both polarizations θ and ϕ over frequency range and measurement bandwidth according to Table 4.2.2.10.1.2-1. Optionally, a larger and non-constant measurement bandwidth than that of Table 4.2.2.10.1.2-1 may be applied. The measurement period shall capture the active time slots. For each spurious emission frequency with coarse TRP identified to be less than the offsets listed in Tables 6.5.3.1.4.2-1 through 6.5.3.1.4.2-3 in ETSI TS 138 521-2 [2] from the TRP limit according to Table 4.2.2.10.1.2-1, either continue with another coarse TRP procedure and corresponding offset according to step (a) or continue with fine TRP procedures according to step b).

      Different coarse TRP grids and corresponding offset values may be used for different frequencies. Multiple coarse TRP grids measurements with the corresponding offset values can be performed before the fine TRP measurement grid is applied. The coarse TRP grids and offset values used shall be recorded in the test report.

   b) Measure fine TRP measurements according to procedures in annex K in ETSI TS 138 521-2 [2], using fine TRP measurement grid selection criteria as per Table M.4.5-3 in annex M in ETSI TS 138 521-2 [2], for each of the spurious emission frequency identified in step a). Apply a measurement bandwidth according to Table 7.9.5-1 or Table 7.9.5-2 in ETSI TS 138 521-2 [2].

6) SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in ETSI TS 138 508-1 [4], clause 4.9.3.

NOTE 1: The frequency range defined in Table 7.9.5-1 or Table 7.9.5-2 in ETSI TS 138 521-2 [2] may be split into ranges. For each range, a different test system, e.g. antenna and/or chamber, may be used. To pass the test case all verdicts of the frequency ranges should pass.

NOTE 2: Void.

NOTE 3: The BEAM_SELECT_WAIT_TIME default value is defined in clause K.1.1 in ETSI TS 138 521-2 [2].

NOTE 4: If the (in-band) beam peak is within $0^o \leq \theta \leq 90^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 1 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 2. If the (in-band) beam peak is within $90^o < \theta \leq 180^o$: perform first hemispherical TRP scan ($0^o \leq \theta \leq 90^o$) in DUT Orientation 2 and second hemispherical TRP scan ($90^o > \theta \geq 0^o$) in DUT Orientation 1. The DUT with UBF activated needs to be re-positioned during the test.

5.3.3.11.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.12.2.4.2 in order to show compliance.

5.3.3.11.2.5 Receiver Spurious Emissions for Inter-Band EN-DC including both FR1 and FR2

5.3.3.11.2.5.1 Method of test

The conducted and radiated requirements are tested separately as in clause 5.3.3.11.2.3.1 and clause 5.3.3.11.2.4.1 respectively. The EN-DC requirements for spurious emissions apply and are tested as part of the EN-DC within FR1 and EN-DC including FR2 test cases in clause 5.3.3.11.2.

5.3.3.11.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.3.2.12.2.5.2 in order to show compliance.

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Tables A-1 to A-3 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table A-1: Relationship between the present document and the essential requirements of Directive 2014/53/EU [i.2] for devices operating in frequency range 1

Harmonised Standard ETSI EN 301 908-25					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Transmitter maximum output power	3.2	4.1.2.2	U	
2	Transmitter minimum output power	3.2	4.1.2.3	U	
3	Transmitter spectrum emission mask	3.2	4.1.2.4	U	
4	Transmitter Adjacent Channel Leakage Power Ratio	3.2	4.1.2.5	U	
5	Transmitter spurious emissions	3.2	4.1.2.6	U	
6	Receiver Reference Sensitivity Level	3.2	4.1.2.7	U	
7	Receiver adjacent channel selectivity (ACS)	3.2	4.1.2.8	U	
8	Receiver blocking characteristics	3.2	4.1.2.9	U	
9	Receiver spurious response	3.2	4.1.2.10	U	
10	Receiver intermodulation characteristics	3.2	4.1.2.11	U	
11	Receiver spurious emissions	3.2	4.1.2.12	U	
12	Transmit OFF power	3.2	4.1.2.13	U	

Table A-2: Relationship between the present document and the essential requirements of Directive 2014/53/EU [i.2] for devices operating in frequency range 2

Harmonised Standard ETSI EN 301 908-25					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Transmitter maximum output power	3.2	4.2.2.2	U	
2	Transmitter minimum output power	3.2	4.2.2.3	U	
3	Transmitter spectrum emission mask	3.2	4.2.2.4	U	
4	Transmitter Adjacent Channel Leakage Power Ratio	3.2	4.2.2.5	U	
5	Transmitter spurious emissions	3.2	4.2.2.6	U	
6	Receiver Reference Sensitivity Level	3.2	4.2.2.7	U	
7	Receiver adjacent channel selectivity (ACS)	3.2	4.2.2.8	U	
8	Receiver blocking characteristics	3.2	4.2.2.9	U	
9	Receiver spurious emissions	3.2	4.2.2.10	U	

Table A-3: Relationship between the present document and the essential requirements of Directive 2014/53/EU for devices operating in interworking with other radios

Harmonised Standard ETSI EN 301 908-25					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Transmitter maximum output power	3.2	4.3.2.2	U	
2	Transmitter minimum output power	3.2	4.3.2.3	U	
3	Transmitter spectrum emission mask	3.2	4.3.2.4	U	
4	Transmitter Adjacent Channel Leakage Power Ratio	3.2	4.3.2.5	U	
5	Transmitter spurious emissions	3.2	4.3.2.6	U	
6	Receiver Reference Sensitivity Level	3.2	4.3.2.7	U	
7	Receiver adjacent channel selectivity (ACS)	3.2	4.3.2.8	U	
8	Receiver blocking characteristics	3.2	4.3.2.9	U	
9	Receiver spurious response	3.2	4.3.2.10	U	
10	Receiver intermodulation characteristics	3.2	4.3.2.11	U	
11	Receiver spurious emissions	3.2	4.3.2.12	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (normative): Environmental profile

B.1 General

B.1.1 Introduction

This annex specifies the environmental profile of the UE.

B.1.2 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table B.1.2-1: Temperature Test Environment

+15 °C to +35 °C	For normal conditions (with relative humidity up to 75 %)
-10 °C to +55 °C	For extreme conditions (see IEC 60068-2-1 [9] and IEC 60068-2-2 [10])

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 ETSI TS 138 101-1 [6], for extreme operation.

The normative reference for this requirement is ETSI TS 138 101-1 [6], clause E.2.1.

Some tests are performed also in extreme temperature conditions. These test conditions are denoted as TL (Temperature Low, -10 °C) and TH (Temperature High, +55 °C).

B.1.3 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 B.1.3-1: Voltage Test Environment

Power source	Lower extreme Voltage	Higher extreme voltage	Normal conditions 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 Lithium Mercury/nickel and cadmium	 0,85 × nominal 0,95 × nominal 0,90 × nominal	 Nominal 1,1 × Nominal	 Nominal 1,1 × 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 ETSI TS 138 101-1 [6] for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

The normative reference for this requirement is ETSI TS 138 101-1 [6], clause E.2.2.

Some tests are performed also in extreme voltage conditions. These test conditions are denoted as VL (Lower extreme Voltage) and VH (Higher extreme Voltage).

B.1.4 Test environment

Where a normal environment is required then the normal conditions shown in clauses B.1.2 and B.1.3 shall be applied.

Where an extreme environment is required then the various combinations of extreme temperatures together with the extreme voltages shown in clauses B.1.2 and B.1.3 shall be applied. The combinations are:

- Low extreme Temperature/Low extreme Voltage (TL/VL);
- Low extreme Temperature/High extreme Voltage (TL/VH);
- High extreme Temperature/Low extreme Voltage (TH/VL);
- High extreme Temperature/High extreme Voltage (TH/VH).

Annex C (informative): Selection of receiver parameters

C.0 Introduction

Receiver parameters under article 3.2 of Directive 2014/53/EU [i.1] listed in ETSI EG 203 336 [i.3] v1.2.1 are analysed and the parameters which are applicable to the present document are specified in respective clauses. [In each clause in Annex C the definition of the requirement is taken from the ETSI EG 203 336 [i.3].

C.1 Receiver sensitivity

Receiver sensitivity is the ability to receive a wanted signal at low input signal levels while providing a pre-determined level of performance. Receiver sensitivity is specified in the present document in clauses 4.1.2.7, 4.2.2.7 and 4.3.2.7.

C.2 Receiver co-channel rejection

Receiver co-channel rejection is a measure of the capability of a receiver to receive a wanted signal, without exceeding a given degradation, due to the presence of an unwanted signal, both signals being at the nominal frequency of the receiver.

In frequency bands covered by the present document, any modulation, channel width, centre frequency and data rate may be used. A combination of many signals of widely different characteristics manifests itself primarily as an increase in the noise floor.

Thus, a specific test for co-channel rejection is not included because the co-channel rejection performance of the receiver combined with the receiver noise figure directly affects the sensitivity performance, which is tested. The required limits for sensitivity ensure that products have the required co-channel rejection.

C.3 Receiver adjacent channel selectivity

Adjacent channel selectivity is a measure of the receiver capability to receive a wanted modulated signal without exceeding the general performance criteria stated in the present document due to the presence of an unwanted input signal in the adjacent channels. Adjacent channel selectivity is specified in the present document in clauses 4.1.2.8, 4.2.2.8 and 4.3.2.8

C.4 Receiver spurious response rejection

The spurious response rejection is a measure of the capability of the receiver to receive a wanted signal without exceeding a given degradation due to the presence of an unwanted signal at any frequency at which a response is obtained. The frequencies of the adjacent signals (channels) are excluded.

Receiver spurious response rejection is specified in the present document in clauses 4.1.2.10 and 4.3.2.10.

C.5 Receiver blocking

Blocking is a measure of the receiver capability to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels or bands. Receiver Blocking is specified in the present document in clauses 4.1.2.9, 4.2.2.9 and 4.3.2.9.

C.6 Receiver radio-frequency intermodulation

Intermodulation rejection is a measure of the ability of a receiver to operate in the presence of two or more unwanted signals the frequencies of which have a specific frequency relationship to the wanted signal. Receiver Intermodulation is specified in the present document in clauses 4.1.2.11 and 4.3.2.11.

C.7 Receiver dynamic range

Receiver dynamic range is defined as the range of the wanted input signal level over which a receiver functions at a specified performance level. The lower end of this range is normally the sensitivity of the receiver. The upper end of a receiver's dynamic range determines how strong a received signal can be before producing degradation due to overloading.

The UEs are normally deployed far away from BS and for a few UEs which are close to BS, sufficient coupling loss is also guaranteed due to the antenna high difference between BS and UE. Such that UE will not receive a wanted signal that is high enough to provide overloading effect. Thus, receiver dynamic range is not included in the present document.

C.8 Receiver unwanted emissions in the spurious domain

As a default, the limit for unwanted emissions in the spurious domain referenced at the antenna port should respect those in ERC/REC 74-01 [i.9]. Receiver spurious emission is specified in the present document in clauses 4.1.2.12, 4.2.2.10 and 4.3.2.12.

Annex D (informative): Recommended maximum uncertainty values

The measurements described in the present document are based on the following assumptions:

- the measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter is included in the test report.

For the test methods, the recommended values of the maximum measurement uncertainty are calculated and correspond to an expansion factor (coverage factor) k = 1,96 (which provide a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.5], in particular in annex D of ETSI TR 100 028-2 [i.5].

The maximum measurement uncertainty values could be found in Annex F in ETSI 138 521-1 [1], Annex F in ETSI TS 138 521-2 [2], and Annex F in ETSI 138 521-3 [3].

Annex E (informative): Bibliography

- Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC (EMC Directive).
- Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).
- Commission Decision 2008/477/EC of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community.
- Commission Decision (EU) 2015/750 of 8 May 2015 on the harmonisation of the 1 452-1 492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union.
- Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.
- Commission Decision 2005/513/EC of 11 July 2005 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs).
- Commission Decision 2007/90/EC of 12 February 2007 amending Decision 2005/513/EC on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs).
- Commission Implementing Decision 2012/688/EU on the harmonisation of the frequency bands 1920-1980 MHz and 2110-2170 MHz for terrestrial systems capable of providing electronic communications services in the Union - Press Release.

History

Document history			
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