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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).

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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

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

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies requirements for Rel-16 UEs supporting release independent features like:

- additional NR operating bands and power classes on top of Rel-16 of TS 38.101 [2-5] and TS 38.133 [6];

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[4] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[5] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: UE performance requirements".

[6] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[7] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

release independent: applicable to some frozen releases, starting from a certain release Rel-M

NOTE 1: Normally, a feature is introduced only in the latest open release Rel-N and future releases are based on the previous one so that future releases inherit the requirements of this feature. Introducing a feature "in a release independent way from Rel-M onwards" (M<N) means it was decided by TSG RAN that this feature would be also beneficial in previous, already frozen releases starting with Rel-M until Rel-(N-1). In order to avoid touching TS 38.101 [2-5] or TS 38.133 [6] of these frozen releases, the corresponding requirements are captured in TS 38.307 via pointers to [2-5] or [6] of the release in which the feature was introduced.

NOTE 2: Release independent does not mean applicable to all releases.

3.2 Symbols

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

N Release in which a feature is introduced into TS 38.101 [2-5] or TS 38.133 [6]
M Release from which onwards (including release M) a feature is release independent

3.3 Abbreviations

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

BW Bandwidth
CA Carrier Aggregation
CC Component carrier
DL Downlink
EN-DC Dual connectivity between E-UTRA and NR
FDD Frequency Division Duplex
FR1 Frequency range 1
FR2 Frequency range 2
NR New radio
PMI Precoding Matrix Indicator
REL Release
SDL Supplementary downlink
SUL Supplementary uplink
TDD Time Division Duplex
UE User Equipment
UL Uplink

4 General

TSG-RAN has agreed for certain features (see the following clauses) to introduce them in a "release independent way".

This means for each feature:

- it is "introduced" in a release N, i.e. TS 38.101 [2-5] and TS 38.133 [6] of release N define certain UE requirements for this feature; the feature is indicated in the tables of the following clauses;
- it is "release independent" starting from a release M (M<N); M for the given feature is provided in the tables of the following clauses;
- UEs supporting this feature have to fulfil additional requirements in release M or higher which are specified in one or more Annexes of TS 38.307 of release N; the applicable Annexes for a given feature are provided in the tables of the following clauses.

The applicable UE Categories are specified in TS 38.306 [7] according to the release to which the UE conforms.

In the table of release independent features in subsequent clauses, "FDD, TDD" refers to CA or EN-DC configuration composed by only FDD bands or only TDD bands, respectively. "FDD and TDD" refers to CA or EN-DC configuration including both FDD and TDD bands. "SDL and FDD, SDL and TDD" refers to CA configuration including both SDL and FDD bands or both SDL and TDD bands, respectively. "TDD and SUL" refers to SUL configuration including both TDD and SUL bands. "FDD and TDD and SUL" refers to EN-DC configuration including both FDD, TDD and SUL bands. Unless stated otherwise, the release independent for the band combinations are from Rel-15.

When a new feature is introduced only the latest release of release independent spec needs to be updated. The latest release of release independent spec refers to the release which the new feature is introduced in. If an RF feature introduced in the same release as the release which the feature is independent from, (i.e. M=N), the common UE RF requirements table in annex B.4 is specified from release N+1, otherwise the common UE RF requirements table is specified from release N.

5 Release independent features for NR frequency range 1

5.1 Additional NR operating bands and UE power classes for NR frequency range 1

Requirements for a Rel-16 UE for additional NR operating bands and power classes compared to TS 38.101-1 of Rel-16 [2] are introduced via this clause.

Table 5.1-1: NR operating bands

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Operating bands	FDD, TDD, SDL, SUL	Rel-15	Table B.4.1-1, Table B.4.3-1
Shared spectrum access operating bands	TDD	Rel-16	

Table 5.1-2: NR UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the power class was introduced)
Power Class 1	FDD	Rel-15	Table B.4.1-1
Power Class 1.5	TDD	Rel-15	Table B.4.1-1, Table B.4.3-1
Power Class 2	TDD	Rel-15	Table B.4.1-1, Table B.4.3-1
Power Class 3	FDD, TDD, SUL	Rel-15	Table B.4.1-1, Table B.4.3-1

5.2 Additional NR CA configurations for NR frequency range 1

5.2.1 Intra-band CA

Requirements for a Rel-16 UE for additional NR intraband CA configurations within FR1 compared to TS 38.101-1 of Rel-16 [2] are introduced via this clause.

Table 5.2.1-1: NR intra-band CA within FR1

Feature	DL/UL	CA BW Class	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous CA configurations within FR1	DL	B, C, D, E, G, H, I, J, K, L, M, N, O	FDD,TDD	Rel-15	Table B.3.1-1, Table B.4.2-1
	UL	A,B,C	FDD,TDD	Rel-15	

Table 5.2.1-2: NR intra-band non-contiguous CA within FR1

Feature	DL/UL	number of sub-blocks	maximum number of CCs within a sub-block	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band non-contiguous CA configurations within FR1	DL	2	1	FDD, TDD	Rel-15	Table B.3.1-1, Table B.4.2-1
		3	1	TDD	Rel-15	
		4	1	TDD	Rel-15	

5.2.2 Inter-band CA

Requirements for a Rel-16 UE for additional NR inter-band CA configurations within FR1 compared to TS 38.101-1 of Rel-16 [2] are introduced via this clause.

Table 5.2.2-1: NR inter-band CA within FR1

Feature	DL/UL	Maximum number of bands	number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band CA configurations within NR FR1	DL	4	5	A, B, C	TDD, FDD, SDL and FDD, SDL and TDD, FDD and TDD	Rel-15	Table B.3.1-1, Table B.4.2-1
	UL	2	2	A	TDD, FDD, FDD and TDD	Rel-15	

5.3 Additional NR SUL configurations for NR frequency range 1

Requirements for a Rel-16 UE for additional NR SUL configurations within FR1 compared to TS 38.101-1 of Rel-16 [2] are introduced via this clause.

Table 5.3-1: NR SUL within FR1

Feature	DL/UL	number of bands	number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the SUL configuration was introduced)
Inter-band SUL configurations within NR FR1	DL	1	2	A	TDD	Rel-15	Table B.4.3-1
	UL	2	2	A	TDD and SUL	Rel-15	

5.4 Other release independent features for NR frequency range 1

This clause covers requirements for a Rel-15 UE coming from all other release independent features that are not covered under clause 5.1, 5.2 and 5.3, e.g. generic baseband requirements or requirements that are not band/CA/SUL configuration specific.

Table 5.4-1: Additional requirements of other release independent features

Feature	Release independent from	Requirements to be fulfilled (see 38.307 of the REL when the feature was introduced)	Further information
RRM requirements for high speed train scenario	Rel-15 (NOTE 1)	Table C.1-1	Rel-16 WI NR_HST introduced band independent RRM requirements: see Table C.1-1
UE demodulation requirements for high speed train scenario	Rel-15 (NOTE 1)	Table C.2-1	Rel-16 WI NR_HST introduced band independent UE demodulation requirements: see Table C.2-1
RF requirements for 4Rx UEs	Rel-15	Table B.4.7-1, Table B.4.7-2	
HST-SFN CA demodulation enhancement for FR1 high speed train scenario enhancement	Rel-16 (NOTE 2)	Table C.4-1	Rel-17 WI NR_HST_FR1_enh introduced band independent HST-SFN CA demodulation enhancement: see Table C.4-1
HST-DPS CA demodulation enhancement for FR1 high speed train scenario enhancement	Rel-15 (NOTE 3)	Table C.4-1	Rel-17 WI NR_HST_FR1_enh introduced band independent HST-DPS CA demodulation enhancement: see Table C.4-1
RRM enhancement for FR1 high speed train scenario enhancement	Rel-16 (NOTE 2)	Table C.3-1	Rel-17 WI NR_HST_FR1_enh introduced band independent RRM enhancement: see Table C.3-1
NOTE 1: Rel-15 UEs supporting the high speed train are assumed to read the Rel-16 high speed train scenario information, which is broadcast to all UEs. NOTE 2: Rel-16 UEs supporting the high speed train are assumed to read the Rel-17 high speed train scenario information, which is broadcast to all UEs. NOTE 3: Rel-15 UEs supporting the high speed train are assumed to read the Rel-17 high speed train scenario information, which is broadcast to all UEs.			

5.5 Additional Inter-band NR-DC configurations for NR frequency range 1

Requirements for a Rel-16 UE for additional NR-DC configurations within FR1 compared to TS 38.101-1 of Rel-16 [2] are introduced via this clause.

Table 5.5.1-1: NR-DC within FR1

Feature	DL/UL	Maximum number of bands	number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the DC configuration was introduced)
NR-DC configurations within NR FR1	DL	2	2	A	FDD	Rel-16	

5.6 Other release independent requirements for NR frequency range 1

This clause covers requirements for a Rel-16 UE coming from all other release independent requirements with the corresponding features introduced in Rel-15.

Table 5.6-1: Release independent requirements with the corresponding features introduced in Rel-15

Feature	Release independent from	Requirements to be fulfilled (see 38.307 of the REL when the feature was introduced)	Further information
Precoding matrix indicator (PMI) reporting requirements for TypeI-SinglePanel and TypeII Codebooks with more than 8TX and up to 32TX	Rel-15	Table D.1-1, Table D.2-1	Rel-16 NR_perf_enh-Perf WI introduced band independent PMI reporting requirements for 16TX and 32TX TypeI-SinglePanel Codebook, and 16TX TypeII Codebook: see Table D.1-1 and Table D.2-1 respectively.
PDSCH demoulation requirements with LTE CRS rate matching for TDD band	Rel-15	Table E.1-1	Rel-16 NR_perf_enh-Perf WI introduced band independent PDSCH demodulation requirements with LTE CRS rate matching for TDD band: see Table E.1-1.

5.7 Additional Inter-band EN-DC or NR CA configurations involving shared spectrum access

Requirements for a Rel-16 UE for additional NR CA, EN-DC, and NR DC configurations involving shared spectrum access compared to TS 38.101-1 of Rel-16 [2] or TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 5.7-1: NR-DC within FR1

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see 38.307 of the REL in which the EN-DC or NR CA configuration was introduced)
Intra-band and Inter-band NR CA configurations involving shared spectrum access	FDD and TDD, TDD	Rel-16	
Inter-band EN-DC configurations involving shared spectrum access	FDD and TDD, TDD	Rel-16	

6 Release independent features for NR frequency range 2

6.1 Additional NR operating bands and UE power classes for NR frequency range 2

Requirements for a Rel-16 UE for additional NR operating bands and power classes compared to TS 38.101-2 of Rel-16 [3] are introduced via this clause.

Table 6.1-1: NR operating bands

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Operating bands	TDD	Rel-15	Table B.4.1-1

Table 6.1-2: NR UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Power Class 1, 2, 3, 4	TDD	Rel-15	Table B.4.1-1

6.2 Additional NR CA configurations for NR frequency range 2

6.2.1 Intra-band CA

Requirements for a Rel-16 UE for additional NR intra-band CA configurations within FR2 compared to TS 38.101-2 of Rel-16 [3] are introduced via this clause.

Table 6.2.1-1: NR intra-band contiguous CA within FR2

Feature	DL/UL	CA BW Class	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous CA configurations within FR2	DL	B, C, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-15	Table B.3.1-1, Table B.4.2-1
	UL	B, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-15	

Table 6.2.1-2: NR non-contiguous intra-band CA within FR2

Feature	DL/UL	number of sub-blocks	maximum number of CCs within a sub-block	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band non-contiguous CA configurations within FR2	DL	2	4	TDD	Rel-15	Table B.3.1-1, Table B.4.2-1
		3	1	TDD	Rel-15	
		4	1	TDD	Rel-15	
		5	2	TDD	Rel-15	
		6	2	TDD	Rel-15	
		7	2	TDD	Rel-15	
		8	1	TDD	Rel-15	
		9	1	TDD	Rel-15	
		10	1	TDD	Rel-15	

Table 6.2.1-3: NR inter-band CA within FR2

Feature	DL/UL	Maximum number of bands	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band CA configurations within NR FR2	DL	2	B, C, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-16	Table B.4.2-1
	UL	1	B, C, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-16	

7 Release independent features for NR interworking between NR frequency range 1 and NR frequency range 2

7.1 Additional NR inter-band CA configurations between frequency range 1 and frequency range 2

Requirements for a Rel-16 UE for additional NR inter-band CA configurations between FR1 and FR2 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 7.1-1: NR inter-band CA between FR1 and FR2

Feature	DL/UL	number of bands	maximum number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band CA configurations for NR interworking between FR1 and FR2	DL FR1	3	4	A, C	FDD, TDD, FDD and TDD	Rel-15	Table B.4.4-1
	DL FR2	1	4	A, D, E, F, G, H, I, J, K, L, M	TDD	Rel-15	
	UL FR1	1	1	A	FDD, TDD	Rel-15	
	UL FR2	1	1	A, D, G, H, I, J, K, L,M	TDD	Rel-15	

7.2 Additional Inter-band NR-DC configurations between frequency range 1 and frequency range 2

Requirements for a Rel-16 UE for additional Inter-band NR-DC configurations between FR1 and FR2 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 7.2-1: Inter-band NR-DC between FR1 and FR2

Feature	DL/UL	number of bands	maximum number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band DC configurations for NR interworking between FR1 and FR2	DL FR1	3	4	A, C	FDD, TDD, FDD and TDD	Rel-15	Table B.4.5-1
	DL FR2	1	8	A, D, E, F, G, H, I, J, K, L, M	TDD	Rel-15	
	UL FR1	1	1	A	FDD,	Rel-15	
	UL FR2	1	1	A, D, G, H, I, J, K, L,M	TDD	Rel-15	

8 Release independent features for NR interworking between NR and E-UTRA

8.1 Additional EN-DC configurations

8.1.1 Intra-band EN-DC

Requirements for a Rel-16 UE for additional EN-DC intra-band configurations within FR1 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 8.1.1-0: EN-DC intra-band UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Intra-band contiguous EN-DC power class 1.5	TDD	Rel-15	Table B.4.6-1
Intra-band contiguous EN-DC power class 2	TDD	Rel-15	
Intra-band contiguous EN-DC power class 3	FDD, TDD	Rel-15	
Intra-band non-contiguous EN-DC power class 1.5	TDD	Rel-15	
Intra-band non-contiguous EN-DC power class 2	TDD	Rel-15	
Intra-band non-contiguous EN-DC power class 3	FDD, TDD	Rel-15	

Table 8.1.1-1: EN-DC contiguous intra-band configurations within FR1

Feature	DL/UL	maximum number of E-UTRA CCs	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous EN-DC	DL	3	2	FDD, TDD	Rel-15	Table B.3.2-1, Table B.4.6-1
	UL	1	1	FDD, TDD	Rel-15	

Table 8.1.1-2: EN-DC non-contiguous intra-band configurations within FR1

Feature	DL/UL	maximum number of sub-blocks	maximum number of E-UTRA CCs	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band non-contiguous EN-DC	DL	3	3	1	FDD, TDD	Rel-15	Table B.3.2-2, Table B.4.6-1
	UL	2	1	1	FDD, TDD	Rel-15	

8.1.2 Inter-band EN-DC

8.1.2.1 Inter-band EN-DC within frequency range 1

Requirements for a Rel-16 UE for additional EN-DC inter-band configurations within FR1 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 8.1.2.1-0: EN-DC inter-band UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Inter-band EN-DC Power Class 2	TDD, FDD and TDD	Rel-15	Table B.4.6-1
Inter-band EN-DC Power Class 3	FDD, TDD, FDD and TDD	Rel-15	

Table 8.1.2.1-1: EN-DC inter-band configurations without SUL within FR1

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	6	6	2	3	FDD, TDD, FDD and TDD	Rel-15	Table B.4.6-1
	UL	1	2	1	2	FDD, TDD, FDD and TDD	Rel-15	

Table 8.1.2.1-2: EN-DC inter-band configurations with SUL within FR1

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	2	3	1	1	FDD, TDD, FDD and TDD	Rel-15	Table B.4.6-1
	UL	1	1	2	2	FDD, TDD, FDD and TDD and SUL	Rel-15	

8.1.2.2 Inter-band EN-DC including frequency range 2

Requirements for a Rel-16 UE for additional EN-DC inter-band configurations including FR2 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 8.1.2.2-1: EN-DC inter-band configurations including FR2

Feature	DL/UL	number of E-UTRA bands	maximum number of E-UTRA CCs	number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	4	6	1	10	TDD, FDD and TDD	Rel-15	Table B.4.6-1
	UL	1	4	1	8	TDD, FDD and TDD	Rel-15	

8.1.2.3 Inter-band EN-DC including frequency range 1 and frequency range 2

Requirements for a Rel-16 UE for additional EN-DC inter-band configurations including FR1 and FR2 compared to TS 38.101-3 of Rel-16 [4] are introduced via this clause.

Table 8.1.2.3-1: EN-DC inter-band configurations including FR1 and FR2

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL FR1	4	6	1	2	TDD, FDD, FDD and TDD	Rel-15	Table B.4.6-1
	DL FR2			1	8	TDD	Rel-15	
	UL FR1	1	2	1	1	FDD, TDD, FDD and TDD	Rel-15	
	UL FR2			1	3	TDD,	Rel-15	

Annex A :
Frequency arrangement for overlapping operating bands

The following information is provided in order to assist a UE derive the DL NR-ARFCN and UL NR-ARFCN in a multi-band environment, in which multiple overlapping operating bands may be indicated in the fields *freqBandIndicatorNR* and *MultiFrequencyBandListNR-SIB*.

The overlapping bands, independent of release, which may be indicated in a cell are shown in Table A-1 for applicable NR operating bands. The DL NR-ARFCN and UL NR-ARFCN are derived according to TS 38.101-1.

Table A-1: Overlapping bands (multi-band environments) for each NR band

NR Operating Band	Overlapping NR operating bands	Duplex Mode
n2	n25	FDD
n5	n18, n26	FDD
n18	n5, n26	FDD
n25	n2	FDD
n26	n5, n18	FDD
n38	n41, n90	TDD
n41	n38, n90	TDD
n48	n78,n77	TDD
n78	n48,n77	TDD
n77	n48,n78	TDD
n80	n86	SUL
n86	n80	SUL
n257	n258	TDD
n257	n261	TDD
n259	n260	TDD

Annex B (normative): Common Requirements for bands, CA, SUL or DC

B.1 Purpose of annex

The purpose of Annex B is to group the requirements that are common for several bands or CA configurations in this specification and use the common tables as references.

B.2 Common RRM requirements

B.3 Common UE performance requirements

B.3.1 Common UE performance requirements for different CA configurations and combination sets

The requirements and test cases listed in Table B.3.1-1 are specified in Rel-16 version of TS 38.101-4 [5].

Table B.3.1-1: Common UE performance requirements for different CA configurations and combination sets

Section / Clause	Description
5.2A.2.1	PDSCH 2RX demodulation requirements for NR FR1 CA configurations (Note 1)
5.2A.3.1	PDSCH 4RX demodulation requirements for NR FR1 CA configurations (Note 1)
7.2A.2	PDSCH 2RX demodulation requirements for NR FR2 CA configurations (Note 1)
5.2A.2.2	PDSCH 2RX demodulation requirements for NR FR1 intra-band contiguous CA with power imbalance (Note 2)
5.2A.3.2	PDSCH 4RX demodulation requirements for NR FR1 intra-band contiguous CA with power imbalance (Note 2)
6.2A	Channel Quality Indicator (CQI) reporting requirements for NR FR1 CA (Note 3)
8.2A	Channel Quality Indicator (CQI) reporting requirements for NR FR2 CA (Note 3)
NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is specified in Section 5.1.1.5 and 7.1.1.5. NOTE 2: The applicability of PDSCH performance requirements with power imbalance for intra-band contiguous CA is specified in Section 5.1.1.6. NOTE 3: The applicability of Channel Quality Indicator (CQI) reporting requirements for CA specified in Section 6.1.1.5 and 8.1.1.5.	

B.3.2 Common UE performance requirements for interworking between NR and E-UTRA

The requirements and test cases listed in Table B.3.2-1 and Table B.3.2-2 are specified in Rel-16 version of TS 38.101-4 [5].

Table B.3.2-1: Common UE performance requirements for intra-band contiguous EN-DC within FR1

Section / Clause	Description
9.5B.1.1	PDSCH demodulation for FR1 intra-band contiguous EN-DC with power imbalance (Note 1)
NOTE 1: The requirements applicability for UE supporting FR1 intra-band and inter-band EN-DC is specified in Section 9.1.1.	

Table B.3.2-2: Common UE performance requirements for intra-band non-contiguous EN-DC within FR1

Section / Clause	Description
9.5B.1.2	PDSCH demodulation for FR1 intra-band non-contiguous EN-DC with power imbalance (Note 1)
NOTE 1: The requirements applicability for UE supporting FR1 intra-band and inter-band EN-DC is specified in Section 9.1.1.	

B.4 Common UE RF requirements

B.4.1 Common UE RF requirements for a release independent band

The requirements and test cases listed in Table B.4.1-1 are specified in REL-16 version of TS 38.101-1 [2] or TS 38.101-2 [3].

Table B.4.1-1: Common UE RF requirements for a release independent band

Clause / Clause	Description
5.2	Operating bands
5.3	UE Channel bandwidth
5.4	Channel arrangement
6.2	Transmitter power
6.3	Output power dynamics
6.4	Transmit signal quality
6.5	Output RF spectrum emissions
6.6 of [3]	Beam correspondence
7.3	Reference sensitivity
7.4	Maximum input level
7.5	Adjacent Channel Selectivity
7.6	Blocking characteristics
7.7 of [2]	Spurious response
7.8 of [2]	Intermodulation characteristics
7.9	Spurious emissions
NOTE: A UE which supports any FR2 band introduced in release N, where N > 15, shall meet the requirements according to the FR2 UE multi-band relaxation factors defined in Table 6.2.1.3-4 of the release N version of [3] for all FR2 bands which it supports.	

B.4.2 Common UE RF requirements for CA configurations within NR frequency range 1 or NR frequency range 2

The requirements and test cases listed in Table B.4.2-1 are specified in in REL-16 version of TS 38.101-1 [2] or TS 38.101-2 [3].

Table B.4.2-1: Common UE RF requirements for a release independent CA configurations within NR frequency range 1 or NR frequency range 2

Clause	Description
5.2A	Operating bands for CA
5.3A	UE channel bandwidth for CA
5.4A	Channel arrangement for CA
6.2A	Transmitter power for CA
6.3A	Output power dynamics for CA
6.4A	Transmit signal quality for CA
6.5A	Output RF spectrum emissions for CA
6.6A of [3]	Beam correspondence for CA
7.3A	Reference sensitivity for CA
7.4A	Maximum input level for CA
7.5A	Adjacent Channel Selectivity for CA
7.6A	Blocking characteristics for CA
7.7A of [2]	Spurious response for CA
7.8A of [2]	Intermodulation characteristics for CA
7.9A of [2]	Spurious emissions for CA

B.4.3 Common UE RF requirements for SUL

The requirements and test cases listed in Table B.4.3-1 are specified in REL-16 version of TS 38.101-1 [2].

Table B.4.3-1: Common UE RF requirements for a release independent SUL

Clause	Description
5.2	Operating bands
5.2C	Operating band combination for SUL
5.4.2.1	NR-ARFCN and channel raster (7.5kHz frequency shift for SUL)
5.5C	Configurations for SUL
6.2C	Transmitter power for SUL
6.4.2.2	Carrier leakage (7.5 kHz shift with the carrier frequency.)
7.3.3	ΔRIB,c
7.3C	Reference sensitivity for SUL
7.6C	Blocking characteristics for SUL

B.4.4 Common UE RF requirements for interband CA configurations between NR frequency range 1 and NR frequency range 2

The requirements and test cases listed in Table B.4.4-1 are specified in in REL-16 version of TS 38.101-3 [4].

Table B.4.4-1: Common UE RF requirements for a release independent interband CA configurations between NR frequency range 1 and NR frequency range 2

Clause	Description
5.2A	Operating bands for CA
5.3A	UE channel bandwidth for CA
5.4A	Channel arrangement for CA
6.2A	Transmitter power for CA
6.3A	Output power dynamics for CA
6.4A	Transmit signal quality for CA
6.5A	Output RF spectrum emissions for CA
7.3A	Reference sensitivity for CA
7.4A	Maximum input level for CA
7.5A	Adjacent Channel Selectivity for CA
7.6A	Blocking characteristics for CA
7.7A	Spurious response for CA
7.8A	Intermodulation characteristics for CA
7.9A	Spurious emissions for CA

B.4.5 Common UE RF requirements for Inter-band NR-DC configurations between frequency range 1 and frequency range 2

The requirements and test cases listed in Table B.4.5-1 are specified in in REL-16 version of TS 38.101-3 [4].

Table B.4.5-1: Common UE RF requirements for a release independent Inter-band NR-DC configurations between frequency range 1 and frequency range 2

Clause	Description
4.2	Applicability of minimum requirements
5.2B	Operating bands for DC
6.2B.5	Configured output power for NR-DC

B.4.6 Common UE RF requirements for NR interworking between NR and E-UTRA

The requirements and test cases listed in Table B.4.6-1 are specified in in REL-16 version of TS 38.101-3 [4].

Table B.4.6-1: Common UE RF requirements for a release independent NR interworking between NR and E-UTRA

Clause	Description
4.2	Applicability of minimum requirements
5.2B	Operating bands for DC
5.3B	UE channel bandwidth for DC
5.4B	Channel arrangement for DC
6.2B	Transmitter power for DC
6.3B	Output power dynamics for DC
6.4B	Transmit signal quality for DC
6.5B	Output RF spectrum emissions for DC
6.6B	Beam correspondence for DC
7.3B	Reference sensitivity level for DC
7.4B	Maximum input level for DC in FR1
7.5B	Adjacent Channel Selectivity for DC in FR1
7.6B	Blocking characteristics for DC in FR1
7.7B	Spurious response for DC in FR1
7.8B	Intermodulation characteristics for DC in FR1
7.9A	Spurious emissions for CA in FR1

B.4.7 Common UE RF requirements for 4Rx

The requirements and test cases listed in Table B.4.7-1 are specified in REL-16 version of TS 38.101-1 [2].

Table B.4.7-1: Common UE RF requirements for 4Rx for single band in FR1

Clause	Description
7.3	Reference sensitivity
7.4	Maximum input level
7.5	Adjacent Channel Selectivity
7.6	Blocking characteristics
7.7	Spurious response
7.8	Intermodulation characteristics
7.9	Spurious emissions

The requirements and test cases listed in Table B.4.7-2 are specified in REL-16 version of TS 38.101-1 [2].

Table B.4.7-2: Common UE RF requirements for 4Rx for CA in FR1

Clause	Description
7.3A	Reference sensitivity for CA
7.4A	Maximum input level for CA
7.5A	Adjacent Channel Selectivity for CA
7.6A	Blocking characteristics for CA
7.7A	Spurious response for CA
7.8A	Intermodulation characteristics for CA
7.9A	Spurious emissions for CA

Annex C (normative): Common Requirements for high speed train scenario

C.1 Common RRM requirements for high speed train scenario

The requirements and test cases listed in Table C.1-1 are specified in TS 38.133 Rel-16 and TS 36.133 Rel-16.

Table C.1-1: RRM requirements for high speed train scenario

Clause	Description
4.2.2.2 in TS 38.133	Cell Re-selection requirements for intra-frequency NR cells for high speed train scenario
9.2.5 in TS 38.133	NR intra-frequency measurements without measurement gaps for high speed train scenario
9.2.6 in TS 38.133	NR intra-frequency measurements with measurement gaps for high speed train scenario
4.2.2.5 in TS 38.133	Cell Re-selection measurements of inter-RAT E-UTRAN cells for high speed train scenario
9.4.2 in TS 38.133	NR − E-UTRAN FDD measurements for high speed train scenario
9.4.3 in TS 38.133	NR − E-UTRAN TDD measurements for high speed train scenario
9.5.4 in TS 38.133	L1-RSRP measurement requirements for high speed train scenario
4.2.2.5.6 in TS 36.133	Cell Re-selection measurements of inter-RAT NR cells for high speed train scenario
8.1.2.4.21 in TS 36.133	E-UTRAN FDD – NR measurements for high speed train scenario
8.1.2.4.22 in TS 36.133	E-UTRAN TDD – NR measurements for high speed train scenario

C.2 Common UE demodulation requirements for high speed train scenario

The requirements and test cases listed in Table C.2-1 are specified in TS 38.101-4 Rel-16.

Table C.2-1: UE demodulation requirements for high speed train scenario

Clause	Description
5.2.2.2.9 test 1-1	TDD PDSCH requirements for HST-SFN for high speed train scenario with 2RX
5.2.3.2.9 test 1-1	TDD PDSCH requirements for HST-SFN for high speed train scenario with 4RX
5.2.2.1.9 test 1-1	FDD PDSCH requirements for HST-SFN for high speed train scenario with 2RX
5.2.3.1.9 test 1-1	FDD PDSCH requirements for HST-SFN for high speed train scenario with 4RX
5.2.2.2.1 test 1-10, 1-11	TDD PDSCH requirements for HST single tap and multi-path for high speed train scenario with 2RX
5.2.3.2.1 test 1-10, 1-11	TDD PDSCH requirements for HST single tap and multi-path for high speed train scenario with 4RX
5.2.2.1.1 test 1-6, 1-7	FDD PDSCH requirements for HST single tap and multi-path for high speed train scenario with 2RX
5.2.3.1.1 test 1-6, 1-7	FDD PDSCH requirements for HST single tap and multi-path for high speed train scenario with 4RX
5.2.2.1.10 test 1-1, test 1-2	FDD PDSCH requirements for HST DPS for high speed train scenario with 2RX
5.2.2.2.10 test 1-1, test 1-2	TDD PDSCH requirements for HST DPS for high speed train scenario with 2RX
5.2.3.1.10 test 1-1, test 1-2	FDD PDSCH requirements for HST DPS for high speed train scenario with 4RX
5.2.3.2.10 test 1-1, test 1-2	TDD PDSCH requirements for HST DPS for high speed train scenario with 4RX

C.3 Common RRM requirements for FR1 high speed train scenario enhancement

The requirements and test cases listed in Table C.3-1 are specified in TS 38.133 Rel-17.

Table C.3-1: RRM requirements for FR1 high speed train scenario enhancement

Clause	Description
4.2.2.4 in TS 38.133	Cell Re-selection requirements for inter-frequency NR cells for FR1 high speed train scenario
9.2.5 in TS 38.133	NR intra-frequency measurements without measurement gaps for activated SCell and deactivated SCell for FR1 high speed train scenario
9.2.6 in TS 38.133	NR intra-frequency measurements with measurement gaps for active SCell for FR1 high speed train scenario
9.3.4 in TS 38.133	Inter-frequency measurement with measurement gaps for FR1 high speed train scenario
9.3.5 in TS 38.133	Inter-frequency measurement with measurement gaps for FR1 high speed train scenario
9.3.9 in TS 38.133	Inter frequency measurements without measurement gaps for FR1 high speed train scenario
9.5.4 in TS 38.133	L1-RSRP measurement requirements for FR1 high speed train scenario

C.4 Common UE demodulation requirements for FR1 high speed train scenario enhancement

The requirements and test cases listed in Table C.4-1 are specified in TS 38.101-4 Rel-17.

Table C.4-1: CA demodulation requirements for FR1 high speed train scenario enhancement

Clause	Description
5.2A.2.4	PDSCH requirements for HST-SFN CA for FR1 high speed train scenario with 2RX
5.2A.3.4	PDSCH requirements for HST-SFN CA for FR1 high speed train scenario with 4RX
5.2A.2.5	PDSCH requirements for HST-DPS CA for FR1 high speed train scenario with 2RX
5.2A.3.5	PDSCH requirements for HST-DPS CA for FR1 high speed train scenario with 4RX

Annex D (normative): Common PMI reporting requirements for 16TX and 32TX

D.1 Common UE PMI reporting requirements for 16TX and 32TX TypeI-SinglePanel Codebook

The requirements and test cases listed in Table D.1-1 are specified in Rel-16 version of TS 38.101-4 [5].

Table D.1-1: UE PMI reporting requirements for 16TX and 32TX TypeI-SinglePanel Codebook

Section / Clause	Description
6.3.2.1.3	Multiple PMI with 16TX TypeI-SinglePanel Codebook for 2Rx FDD
6.3.2.1.4	Single PMI with 32TX TypeI-SinglePanel Codebook for 2Rx FDD
6.3.2.2.3	Multiple PMI with 16TX TypeI-SinglePanel Codebook for 2Rx TDD
6.3.2.2.4	Single PMI with 32TX TypeI-SinglePanel Codebook for 2Rx TDD
6.3.3.1.3	Multiple PMI with 16TX TypeI-SinglePanel Codebook for 4Rx FDD
6.3.3.1.4	Single PMI with 32TX TypeI-SinglePanel Codebook for 4Rx FDD
6.3.3.2.3	Multiple PMI with 16TX TypeI-SinglePanel Codebook for 4Rx TDD
6.3.3.2.4	Single PMI with 32TX TypeI-SinglePanel Codebook for 4Rx TDD

D.2 Common UE PMI reporting requirements for 16TX TypeII Codebook

The requirements and test cases listed in Table D.2-1 are specified in Rel-16 version of TS 38.101-4 [5].

Table D.2-1: UE PMI reporting requirements for 16TX TypeII Codebook

Section / Clause	Description
6.3.2.1.5	Multiple PMI with 16TX TypeII Codebook for 2Rx FDD
6.3.2.2.5	Multiple PMI with 16TX TypeII Codebook for 2Rx TDD
6.3.3.1.5	Multiple PMI with 16TX TypeII Codebook for 4Rx FDD
6.3.3.2.5	Multiple PMI with 16TX TypeII Codebook for 4Rx TDD

Annex E (normative): Common PDSCH demoulation requirements with LTE CRS rate matching

E.1 Common PDSCH demoulation requirements with LTE CRS rate matching

The requirements and test cases listed in Table E.1-1 are specified in Rel-16 version of TS 38.101-4 [5].

Table E.1-1: UE PDSCH demoulation requirements with LTE CRS rate matching for TDD band

Section / Clause	Description
5.2.2.2.4	PDSCH demoulation requirements with LTE CRS rate matching for 2Rx TDD
5.2.3.2.4	PDSCH demoulation requirements with LTE CRS rate matching for 4Rx TDD

Annex F (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-09	RAN4#85	R4-1712166				Skeleton TS	0.0.1
2018-03	RAN4#86	R4-1802107				TS 38.307 v0.1.0	0.1.0
2018-06	RAN#80	RP-180988				v1.0.0 submitted for plenary approval	1.0.0
2018-06	RAN#80					Approved by plenary – Rel-15 spec under change control	15.0.0
2018-09	RAN#81	RP-181896	0001		F	CR for FR2 Power Classes in TS38.307	15.1.0
2018-12	RAN#82	RP-182362	0002	2	B	CR for TS 38.307	15.2.0
2019-06	RAN#84	RP-191237	0005		B	Addition of missing features for TS 38.307	15.3.0
2019-09	RAN#85	RP-192046	0007	1	B	REL-16 TS 38.307 addition of Annexes for UE RF requirements	16.0.0
2019-12	RAN#86	RP-193019	0009		B	CR for REL-16 TS 38.307 for PC2 EN-DC TDD+TDD	16.1.0
2019-12	RAN#86	RP-193018	0012		B	CR for TS 38.307: additional UE channel bandwidth	16.1.0
2019-12	RAN#86	RP-193036	0014		A	Adding SDL to 38.307	16.1.0
2020-03	RAN#87	RP-200404	0016		A	38.307 CR power class	16.2.0
2020-06	RAN#88	RP-201046	0018		F	CR to 38.307 on clarification of the FR2 multi-band requirement framework	16.3.0
2020-06	RAN#88	RP-200986	0022		A	Maintenance CR to 38307 on a reference spec number R16	16.3.0
2020-06	RAN#88	RP-200959	0023		F	Endorsed CR to 38307 on applicable SUL requirements	16.3.0
2020-06	RAN#88	RP-200965	0019	1	B	CR for 38.307: Introduction of Power Class 1.5	16.3.0
2020-09	RAN#89	RP-201503	0028		B	CR for 38.307: Introduction of Power Class 1.5	16.4.0
2020-12	RAN#90	RP-202485	0032	1	F	CR on adding NR ovelapping bands list in TS38.307 in Rel-16	16.5.0
2020-12	RAN#90	RP-202428	0040	1	B	CR to TS 38.307 on release independent update for the Rel.16 EN-DC and NR CA/DC	16.5.0
2020-12	RAN#90	RP-202429	0041		B	CR to TS 38.307 on Release independence of FDD-TDD EN-DC High Power UE	16.5.0
2020-12	RAN#90	RP-202422	0035	1	B	CR on release independent for Rel.16 NR HST RRM requirements	16.5.0
2020-12	RAN#90	RP-202422	0036	1	B	CR on release independent for Rel.16 NR HST UE demodulation requirements	16.5.0
2021-03	RAN#91	RP-210065	0044	1	B	Draft CR for TS 38.307 on UE demodulation performance requirements (Rel-16)	16.6.0
2021-03	RAN#91	RP-210078	0047	1	F	CR on release independent for Rel-16 NR HST UE demodulation requirements	16.6.0
2021-06	RAN#92	RP-211120	0061		F	CR to 38.307 to add interband CA R16 CATF	16.7.0
2021-09	RAN#93	RP-211921	0070		A	CR to TS 38.307 on the definition of the duplex-mode for the band configurations	16.8.0
2021-09	RAN#93	RP-211922	0076		F	CR Correction of common UE RF requirement 38.307 Annex tables R16	16.8.0
2021-12	RAN#94	RP-212848	0084		F	Big CR for TS 38.307 Maintenance (Rel-16)	16.9.0
2022-03	RAN#95	RP-220337	0092		F	Big CR for TS 38.307 Maintenance (Rel-16)	16.10.0
2022-03	RAN#95	RP-220352	0095		F	CR for release independent for 4Rx support for NR band	16.10.0
2022-06	RAN#96	RP-221663	0103		F	Big CR for TS 38.307 Maintenance (Rel-16)	16.11.0
2022-06	RAN#96	RP-221680	0105		B	CR to 38.307: release independent for FR1 HST demodulation (Rel-16)	16.11.0
2022-12	RAN#98-e	RP-223310	0110	1	F	CR on release independent for Rel-17 FR1 HST RRM Note: This is for Rel-16 to align with Rel-17	16.12.0
2023-03	RAN#99	RP-230501	0114		F	CR 38.307 Addition of FR2 overlapping bands into Annex-A R16	16.13.0
2023-06	RAN#100	RP-231341	0118	1	F	Correction to Frequency arrangement for overlapping operating bands information R16	16.14.0

History

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