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Contents

Foreword

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

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1 Scope

The present document establishes the minimum RF requirements for NR User Equipment (UE) operating on frequency Range 1.

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

[3] 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".

[4] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".

[5] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[6] 3GPP TS 38.211: "NR; Physical channels and modulation".

[7] 3GPP TS 38.331: "Radio Resource Control (RRC) protocol specification".

[8] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[9] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain".

[10] 3GPP TS 38.214: "NR; Physical layer procedures for data".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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: A 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:

ΔF_{Global}	Granularity of the global frequency raster
ΔF_{Raster}	Band dependent channel raster granularity
Δf_{OOB}	Δ Frequency of Out Of Band emission
ΔF_{TX-RX}	Δ Frequency of default TX-RX separation of the FDD *operating band*
$\Delta P_{PowerClass}$	Adjustment to maximum output power for a given power class
Δ_{RB}	The starting frequency offset between the allocated RB and the measured non-allocated RB
$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*
$\Delta R_{IB,4R}$	Reference sensitivity adjustment due to support for 4 antenna ports
Δ_{Shift}	Channel raster offset
ΔT_C	Allowed operating band edge transmission power relaxation
$\Delta T_{C,c}$	Allowed operating band edge transmission power relaxation for serving cell *c*
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for inter-band CA operation and due to support for SUL operations, for serving cell *c*
$BW_{Channel}$	Channel bandwidth
$BW_{Channel,block}$	Sub-block bandwidth, expressed in MHz. $BW_{Channel,block} = F_{edge,block,high} - F_{edge,block,low}$
$BW_{Channel\_CA}$	Aggregated channel bandwidth, expressed in MHz
$BW_{Channel,max}$	Maximum channel bandwidth supported among all bands in a release
BW_{GB}	max($BW_{GB,Channel(k)}$)
$BW_{GB,Channel(k)}$	Minimum guard band defined in clause 5.3A.1 of carrier *k*
BW_{DL}	Channel bandwidth for DL

BW_{UL}	Channel bandwidth for UL
$BW_{interferer}$	Bandwidth of the interferer
Ceil(x)	Rounding upwards; ceil(x) is the smallest integer such that ceil(x) ≥ x
Floor(x)	Rounding downwards; floor(x) is the greatest integer such that floor(x) ≤ x
F_C	Center frequency of a carrier for a numerology defined by the *RF reference frequency* on the channel raster mapped to the carrier according to sub-clause 5.4.2.2
$F_{C,block, high}$	Fc of the highest transmitted/received carrier in a *sub-block*
$F_{C,block, low}$	Fc of the lowest transmitted/received carrier in a *sub-block*
$F_{C,low}$	The Fc of the lowest carrier, expressed in MHz
$F_{C,high}$	The Fc 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*
$F_{edge,block,low}$	The lower *sub-block* edge, where $F_{edge,block,low} = F_{C,block,low} - F_{offset, low}$.
$F_{edge,block,high}$	The upper *sub-block* edge, where $F_{edge,block,high} = F_{C,block,high} + F_{offset, high}$.
$F_{edge , low}$	The *lower edge* of *aggregated channel bandwidth*, expressed in MHz. $F_{edge,low} = F_{C,low} - F_{offset,low}$.
$F_{edge, high}$	The *higher edge* of *aggregated channel bandwidth*, expressed in MHz. $F_{edge,high} = F_{C,high} + F_{offset,high}$.
$F_{Interferer}$ (offset)	Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured). For intra-band contiguous CA, the $F_{Interferer}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer
$F_{Interferer}$	Frequency of the interferer
$F_{Ioffset}$	Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)
F_{offset}	Frequency offset from F_{C_high} to the *higher edge* or F_{C_low} to the *lower edge*.
$F_{offset,high}$	Frequency offset from $F_{C,high}$ to the upper *UE RF Bandwidth edge*, or from $F_{C,block, high}$ to the upper sub-block edge
$F_{offset,low}$	Frequency offset from $F_{C,low}$ to the lower *UE RF Bandwidth edge*, or from $F_{C,block, low}$ to the lower sub-block edge
F_{OOB}	The boundary between the NR out of band emission and spurious emission domains
F_{REF}	RF reference frequency
$F_{REF-Offs}$	Offset used for calculating F_{REF}
$F_{REF, shift}$	RF reference frequency for Supplementary Uplink (SUL) bands, the uplink of all FDD bands, and TDD bands
F_{uw} (offset)	The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer
$GB_{Channel}$	Minimum guard band defined in clause 5.3.3, expressed in kHz
L_{CRB}	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks
Max()	The largest of given numbers
Min()	The smallest of given numbers
n_{PRB}	Physical resource block number
NR_{ACLR}	NR ACLR
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{RB_agg}	The number of the aggregated RBs within the fully allocated aggregated channel bandwidth $N_{RB\_agg} = \sum_{i=1}^{j} N_{RB_i} * 2^{\mu_i}$ for carrier 1 to j, where μ is defined in TS 38.211 [6]
$N_{RB,c}$	The transmission bandwidth configuration of component carrier c, expressed in units of resource blocks $N_{RB,cj} = N_{RB_j} * 2^{\mu_j}$ for carrier j, where μ is defined in TS 38.211 [6]
$N_{RB,low}$	The transmission bandwidth configurations according to Table 5.3.2-1 for the lowest assigned component carrier in section 5.3A.1
$N_{RB,high}$	The transmission bandwidth configurations according to Table 5.3.2-1 for the highest assigned component carrier in section 5.3A.1
N_{REF}	NR Absolute Radio Frequency Channel Number (NR-ARFCN)
$N_{REF-Offs}$	Offset used for calculating N_{REF}
P_{CMAX}	The configured maximum UE output power
$P_{CMAX, c}$	The configured maximum UE output power for serving cell *c*
$P_{CMAX, f, c}$	The configured maximum UE output power for carrier *f* of serving cell *c* in each slot
P_{EMAX}	Maximum allowed UE output power signalled by higher layers
$P_{EMAX, c}$	Maximum allowed UE output power signalled by higher layers for serving cell *c*