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Technical Specification

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (Release 11)



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Foreword

This Technical Specification (TS) 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:
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- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

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

2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain"
- [3] ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".
- [4] 3GPP TS 36.211: "Physical Channels and Modulation".
- [5] 3GPP TS 36.212: "Multiplexing and channel coding".
- [6] 3GPP TS 36.213: "Physical layer procedures".
- [7] 3GPP TS 36.331: " Requirements for support of radio resource management ".
- [8] 3GPP TS 36.307: " Requirements on User Equipments (UEs) supporting a release-independent frequency band".
- [9] 3GPP TS 36.423: "X2 application protocol (X2AP) ".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

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

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

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

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

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

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

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

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.

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.

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

Unsynchronized operation: Operation of TDD in two different systems, where the conditions for synchronized operation

3.2 Symbols

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

BW_{Channel}	Channel bandwidth
$BW_{\text{Channel_CA}}$	Aggregated channel bandwidth, expressed in MHz.
BW_{GB}	Virtual guard band to facilitate transmitter (receiver) filtering above / below edge CCs.
E_{RS}	Transmitted energy per RE for reference symbols during the useful part of the symbol, i.e. excluding the cyclic prefix, (average power normalized to the subcarrier spacing) at the eNode B transmit antenna connector
$\hat{E}_s$	The received energy per RE of the wanted signal 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
F	Frequency
$F_{\text{Interferer (offset)}}$	Frequency offset of the interferer
$F_{\text{Interferer}}$	Frequency of the interferer
F_{C}	Frequency of the carrier centre frequency
$F_{\text{CA_low}}$	The centre frequency of the <i>lowest carrier</i> , expressed in MHz.
$F_{\text{CA_high}}$	The centre frequency of the <i>highest carrier</i> , expressed in MHz.
$F_{\text{DL_low}}$	The lowest frequency of the downlink operating band
$F_{\text{DL_high}}$	The highest frequency of the downlink operating band
$F_{\text{UL_low}}$	The lowest frequency of the uplink operating band
$F_{\text{UL_high}}$	The highest frequency of the uplink operating band
$F_{\text{edge_low}}$	The <i>lower edge</i> of aggregated channel bandwidth, expressed in MHz.
$F_{\text{edge_high}}$	The <i>higher edge</i> of aggregated channel bandwidth, expressed in MHz.
F_{offset}	Frequency offset from $F_{\text{C_high}}$ to the <i>higher edge</i> or $F_{\text{C_low}}$ to the <i>lower edge</i> .

I_o	The power spectral density of the total input signal (power averaged over the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal
I_{or}	The total transmitted power spectral density of the own-cell downlink signal (power averaged over the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the eNode B transmit antenna connector
$\hat{I}_{or}$	The total received power spectral density of the own-cell downlink signal (power averaged over the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector
I_{ot}	The received power spectral density of the total noise and interference for a certain RE (average power obtained within the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector
LCRB	The length of a contiguous resource block allocation
N_{cp}	Cyclic prefix length
N_{DL}	Downlink EARFCN
N_{oc}	The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector
N_{oc1}	The power spectral density of a white noise source (average power per RE normalized to the subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that are not defined in a test procedure, as measured at the UE antenna connector.
N_{oc2}	The power spectral density of a white noise source (average power per RE normalized to the subcarrier spacing), simulating interference in CRS symbols in ABS subframe from all cells that are not defined in a test procedure, as measured at the UE antenna connector.
N_{oc3}	The power spectral density of a white noise source (average power per RE normalised to the 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_{otx}	The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing) simulating eNode B transmitter impairments as measured at the eNode B transmit antenna connector
N_{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_{RB_alloc}	Total number of simultaneously transmitted resource blocks in Aggregated Channel Bandwidth configuration.
N_{UL}	Uplink EARFCN
R_{av}	Minimum average throughput per RB
P_{CMAX}	The configured maximum UE output power.
$P_{CMAX,c}$	The configured maximum UE output power for serving cell c .
P_{EMAX}	Maximum allowed UE output power signalled by higher layers. Same as IE P_{Max} , defined in [7].
$P_{EMAX,c}$	Maximum allowed UE output power signalled by higher layers for serving cell c . Same as IE P_{Max} , defined in [7].
$P_{Interferer}$	Modulated mean power of the interferer
$P_{PowerClass}$	$P_{PowerClass}$ is the nominal UE power (i.e., no tolerance).
P_{UMAX}	The measured configured maximum UE output power.
RB_{start}	Indicates the lowest RB index of transmitted resource blocks.
ΔF_{OOB}	Δ Frequency of Out Of Band emission.
$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell c .
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell c .
ΔT_C	Allowed operating band edge transmission power relaxation.

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

3.3 Abbreviations

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

ABS	Almost Blank Subframe
ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
A-MPR	Additional Maximum Power Reduction
AWGN	Additive White Gaussian Noise
BS	Base Station
CA	Carrier Aggregation
CA_X	CA for band X where X is the applicable E-UTRA operating band
CA_X-Y	CA for band X and Band Y where X and Y are the applicable E-UTRA operating band
CC	Component Carriers
CPE	Customer Premise Equipment
CPE_X	Customer Premise Equipment for E-UTRA operating band X
CW	Continuous Wave
DL	Downlink
eDL-MIMO	Down Link Multiple Antenna transmission
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EPRE	Energy Per Resource Element
E-UTRA	Evolved UMTS Terrestrial Radio Access
EUTRAN	Evolved UMTS Terrestrial Radio Access Network
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
FRC	Fixed Reference Channel
HD-FDD	Half-Duplex FDD
MCS	Modulation and Coding Scheme
MOP	Maximum Output Power
MPR	Maximum Power Reduction
MSD	Maximum Sensitivity Degradation
OCNG	OFDMA Channel Noise Generator
OFDMA	Orthogonal Frequency Division Multiple Access
OOB	Out-of-band
PA	Power Amplifier
PCC	Primary Component Carrier
P-MPR	Power Management Maximum Power Reduction
PSS	Primary Synchronization Signal
PSS_RA	PSS-to-RS EPRE ratio for the channel PSS
RE	Resource Element
REFSENS	Reference Sensitivity power level
r.m.s	Root Mean Square
SCC	Secondary Component Carrier
SNR	Signal-to-Noise Ratio
SSS	Secondary Synchronization Signal
SSS_RA	SSS-to-RS EPRE ratio for the channel SSS
TDD	Time Division Duplex
UE	User Equipment
UL	Uplink
UL-MIMO	Up Link Multiple Antenna transmission
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
xCH_RA	xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS
xCH_RB	xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols containing RS