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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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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.
 - 3GPP TR 21.905: "Vocabulary for 3GPP Specifications". [1] [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain" [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". 3GPP TS 36.212: "Multiplexing and channel coding". [5] [6] 3GPP TS 36.213: "Physical layer procedures". 3GPP TS 36.331: "Requirements for support of radio resource management". [7] 3GPP TS 36.307: "Requirements on User Equipments (UEs) supporting a release-independent [8] frequency band". 3GPP TS 36.423: "X2 application protocol (X2AP)". [9]

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.

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.

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 are not met.

3.2 Symbols

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

BW_{Channel} Channel bandwidth

 $BW_{Channel_CA} \qquad \text{Aggregated channel bandwidth, expressed in MHz}.$

 ${
m BW}_{
m GB}$ 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 averaged received energy per RE of the wanted signal during the useful part of the symbol,

i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical channels (including user specific RSs when present), divided by the number of REs within the set, and normalized to the subcarrier spacing

F Frequency

 $F_{Interferer}$ (offset) Frequency offset of the interferer $F_{Interferer}$ Frequency of the interferer

F_C Frequency of the carrier centre frequency

 F_{C_low} The centre frequency of the *lowest carrier*, expressed in MHz. F_{C_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} Frequency offset from $F_{C\ high}$ to the higher edge or $F_{C\ low}$ to the lower edge.

F_{offset NS 23} Frequency offset in MHz needed if NS_23 is used

 F_{OOB} The boundary between the E-UTRA out of band emission and spurious emission domains.

 RB_{start}

 $RB_{end} \\$

 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 The total transmitted power spectral density of the own-cell downlink signal (power averaged over I_{or} 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 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 Transmission bandwidth which represents the length of a contiguous resource block allocation LCRB expressed in units of resource blocks N_{cp} Cyclic prefix length Downlink EARFCN N_{DL} The power spectral density of a white noise source (average power per RE normalised to the N_{oc} subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector The power spectral density of a white noise source (average power per RE normalized to the N_{oc1} 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. The power spectral density of a white noise source (average power per RE normalized to the N_{oc2} 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 $N_{Offs\text{-}DL}$ Offset used for calculating downlink EARFCN Offset used for calculating uplink EARFCN $N_{Offs-UL}$ 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 Transmission bandwidth configuration, expressed in units of resource blocks N_{RB} N_{RB_agg} The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth. Total number of simultaneously transmitted resource blocks in Aggregated Channel Bandwidth N_{RB_alloc} configuration. The transmission bandwidth configuration of component carrier c, expressed in units of resource $N_{RB,c}$ blocks $N_{RB,largest\;BW}$ The largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in units of resource blocks N_{UL} Uplink EARFCN Minimum average throughput per RB Rav $P_{CMAX} \\$ The configured maximum UE output power. The configured maximum UE output power for serving cell c. $P_{CMAX,c}$ Maximum allowed UE output power signalled by higher layers. Same as IE *P-Max*, defined in [7]. P_{EMAX} Maximum allowed UE output power signalled by higher layers for serving cell c. Same as IE $P_{EMAX,c}$ P-Max, defined in [7]. Modulated mean power of the interferer PInterferer P_{PowerClass} is the nominal UE power (i.e., no tolerance). PowerClass The measured configured maximum UE output power. P_{UMAX} Puw Power of an unwanted DL signal PwPower of a wanted DL signal

Indicates the lowest RB index of transmitted resource blocks.

Indicates highest 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.

ΔT_{IB,c} Allowed maximum configured output power relaxation due to support for inter-band CA

operation, for serving cell c.

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

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

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

Annex C.3.2.

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

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

4 General

4.1 Relationship between minimum requirements and test requirements

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

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

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

4.2 Applicability of minimum requirements

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

4.3 Void

4.3A Applicability of minimum requirements (CA, UL-MIMO)

The requirements in clauses 5, 6 and 7 which are specific to CA and UL-MIMO are specified as suffix A, B, C, D where;

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

d) Suffix D additional requirements need to support TBD

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

A terminal which supports more than one feature (CA and UL-MIMO) in clauses 5, 6 and 7 shall meet all of the separate corresponding requirements.

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

4.4 RF requirements in later releases

The standardisation of new frequency bands may be independent of a release. However, in order to implement a UE that conforms to a particular release but supports a band of operation that is specified in a later release, it is necessary to specify some extra requirements. TS 36.307 [8] specifies requirements on UEs supporting a frequency band that is independent of release.

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

5 Operating bands and channel arrangement

5.1 General

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

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

- 5.2 Void
- 5.3 Void
- 5.4 Void

5.5 Operating bands

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

Table 5.5-1 E-UTRA operating bands

Ful. low - Ful. ligh	E-UTRA Operating Band	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode
2				
3				
4 1710 MHz - 1755 MHz 2110 MHz - 2155 MHz FDD 5 824 MHz - 849 MHz 869 MHz - 894MHz FDD 61 830 MHz - 840 MHz 875 MHz - 885 MHz FDD 7 2500 MHz - 2570 MHz 2620 MHz - 2690 MHz FDD 8 880 MHz - 915 MHz 925 MHz - 960 MHz FDD 9 1749.9 MHz - 1784.9 MHz 1844.9 MHz - 1879.9 MHz FDD 10 1710 MHz - 1770 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 1495.9 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz - 756 MHz FDD 14 788 MHz - 798 MHz 758 MHz - 768 MHz FDD 15 Reserved Reserved Reserved FDD 16 Reserved Reser		1850 MHz - 1910 MHz		FDD
5 824 MHz 849 MHz 869 MHz - 894MHz FDD 6¹ 830 MHz - 840 MHz 875 MHz - 885 MHz FDD 7 2500 MHz - 2570 MHz 2620 MHz - 2690 MHz FDD 8 880 MHz - 915 MHz 925 MHz - 960 MHz FDD 9 1749.9 MHz - 1770 MHz 2110 MHz - 1879.9 MHz FDD 10 1710 MHz - 1770 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 1495.9 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz - 756 MHz FDD 14 788 MHz - 788 MHz - 756 MHz FDD 15 Reserved Reserved Reserved FDD 16 Reserved Reserved FDD 17 704 MHz - 716 MHz 734 MHz - 746 MHz FDD		1710 MHz – 1785 MHz	1805 MHz - 1880 MHz	FDD
61 830 MHz - 840 MHz 875 MHz - 885 MHz FDD 7 2500 MHz - 2570 MHz 2620 MHz - 2690 MHz FDD 8 880 MHz - 915 MHz 925 MHz - 960 MHz FDD 9 1749.9 MHz - 1770 MHz 1844.9 MHz - 1879.9 MHz FDD 10 1710 MHz - 1770 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 2170 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz - 756 MHz FDD 14 788 MHz - 787 MHz 746 MHz - 768 MHz FDD 15 Reserved Reserved FDD 16 Reserved Reserved FDD 17 704 MHz - 716 MHz 734 MHz - 746 MHz FDD 18 815 MHz - 830 MHz 860 MHz - 875 MHz FDD		1710 MHz – 1755 MHz	2110 MHz - 2155 MHz	FDD
7 2500 MHz - 2570 MHz 2620 MHz - 2690 MHz FDD 8 880 MHz - 915 MHz 925 MHz - 960 MHz FDD 9 1749.9 MHz - 1784.9 MHz 1844.9 MHz - 1879.9 MHz FDD 10 1710 MHz - 1770 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 1495.9 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz FDD 14 788 MHz - 798 MHz 758 MHz - 768 MHz FDD 15 Reserved Reserved Reserved FDD 16 Reserved Reserved FDD FDD 17 704 MHz - 716 MHz 734 MHz - 746 MHz FDD 18 815 MHz - 830 MHz 860 MHz - 875 MHz FDD 19 830 MHz - 845 MHz 875 MHz 890 MHz	5	824 MHz – 849 MHz	869 MHz – 894MHz	FDD
8 880 MHz - 915 MHz 925 MHz - 960 MHz FDD 9 1749.9 MHz - 1784.9 MHz 1844.9 MHz - 1879.9 MHz FDD 10 1710 MHz - 170 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 1495.9 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz - 756 MHz FDD 14 788 MHz - 798 MHz 758 MHz - 768 MHz FDD 15 Reserved Reserved Reserved FDD FDD FDD 16 Reserved Reserved FDD FDD FDD FDD FDD Base MHz FDD FDD FDD Base MHz FDD FDD FDD FDD FDD Base MHz FDD	6 ¹	830 MHz - 840 MHz	875 MHz – 885 MHz	FDD
9 1749.9 MHz - 1784.9 MHz 1844.9 MHz - 1879.9 MHz FDD 10 1710 MHz - 1770 MHz 2110 MHz - 2170 MHz FDD 11 1427.9 MHz - 1447.9 MHz 1475.9 MHz - 1495.9 MHz FDD 12 699 MHz - 716 MHz 729 MHz - 746 MHz FDD 13 777 MHz - 787 MHz 746 MHz - 756 MHz FDD 14 788 MHz - 798 MHz 758 MHz - 768 MHz FDD 15 Reserved Reserved FDD 16 Reserved Reserved FDD 17 704 MHz - 716 MHz 734 MHz - 746 MHz FDD 18 815 MHz - 830 MHz 860 MHz - 875 MHz FDD 19 830 MHz - 845 MHz 875 MHz - 821 MHz FDD 20 832 MHz - 862 MHz 791 MHz - 821 MHz FDD 21 1447.9 MHz - 1462.9 MHz 1495.9 MHz - 3590 MHz FDD 22 3410 MHz - 3490 MHz 3510 MHz - 3590 MHz FDD 23 2000 MHz - 2020 MHz 1525 MHz - 1559 MHz FDD 24 1626.5 MHz - 1660.5 MHz 1930 MHz - 1995 MHz FDD 25 1850 MHz - 1910 MHz 1930 MHz - 1990 MHz FDD 33 1900 MHz - 2025 MHz 1930 MHz - 1990 MHz FDD 34 2010 MHz - 1910 MHz 1850 MHz - 1910 MHz TDD 35 1850 MHz - 1910 MHz 1930 MHz - 1990 MHz TDD 36 1930 MHz - 1930 MHz 1930 MHz - 1990 MHz TDD 37 1910 MHz - 1930 MHz 1930 MHz - 1930 MHz TDD 38 2570 MHz - 1930 MHz 1930 MHz - 1930 MHz TDD 39 1880 MHz - 1920 MHz 1880 MHz - 1920 MHz TDD 39 1880 MHz - 1920 MHz 1880 MHz - 2620 MHz TDD 40 2300 MHz - 24400 MHz 2330 MHz - 24400 MHz TDD 41 2496 MHz 2690 MHz 2300 MHz - 24400 MHz TDD	7	2500 MHz - 2570 MHz	2620 MHz - 2690 MHz	FDD
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33	24	1626.5 MHz - 1660.5 MHz	1525 MHz - 1559 MHz	FDD
33 1900 MHz - 1920 MHz 1900 MHz - 1920 MHz TDD 34 2010 MHz - 2025 MHz 2010 MHz - 2025 MHz TDD 35 1850 MHz - 1910 MHz 1850 MHz - 1910 MHz TDD 36 1930 MHz - 1990 MHz 1930 MHz - 1990 MHz TDD 37 1910 MHz - 1930 MHz - 1930 MHz TDD 38 2570 MHz - 2620 MHz 2570 MHz - 2620 MHz TDD 39 1880 MHz - 1920 MHz 1880 MHz - 1920 MHz TDD 40 2300 MHz - 2400 MHz 2300 MHz - 2400 MHz TDD 41 2496 MHz 2690 MHz 2496 MHz 2690 MHz TDD	25	1850 MHz - 1915 MHz	1930 MHz - 1995 MHz	FDD
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39 1880 MHz - 1920 MHz 1880 MHz - 1920 MHz TDD 40 2300 MHz - 2400 MHz 2300 MHz - 2400 MHz TDD 41 2496 MHz 2690 MHz 2496 MHz 2690 MHz TDD				
40 2300 MHz - 2400 MHz 2300 MHz - 2400 MHz TDD 41 2496 MHz 2690 MHz 2496 MHz 2690 MHz TDD				
41 2496 MHz 2690 MHz 2496 MHz 2690 MHz TDD				
1 47 SADDIMEZ - SKODIMEZ SZZODIMEZ - SKODIMEZ 1911				
43 3600 MHz - 3800 MHz 3600 MHz - 3800 MHz TDD NOTE 1: Band 6 is not applicable			3600 MHZ - 3800 MHZ	טטו

5.5A Operating bands for CA

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

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

E-UTRA CA Band	E-UTRA Band	BS receive	Sink (UL) operating band Size receive / UE transmit Ful low - Ful high			Downlink (DL) operating band BS transmit / UE receive FDL_low - FDL_high 2110 MHz 2170 MHz		Duplex Mode
CA_1	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD

Table 5.5A-2: Inter-band CA operating bands

E-UTRA	E-UTRA	Uplink (UL)	rating band	Downlink (D	perating band	Duplex		
CA Band	Band	BS receive / UE transmit			BS transmit / UE receive			Mode
		Ful_low - Ful_high			F _{DL_lo}			
CA 1-5	1	1920 MHz	-	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-5	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	רטט

5.5B Operating bands for UL-MIMO

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

Table 5.5B-1: Void

5.6 Channel bandwidth

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

Table 5.6-1: Transmission bandwidth configuration N_{RB} in E-UTRA channel bandwidths

Channel bandwidth BWChannel [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N _{RB}	6	15	25	50	75	100

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

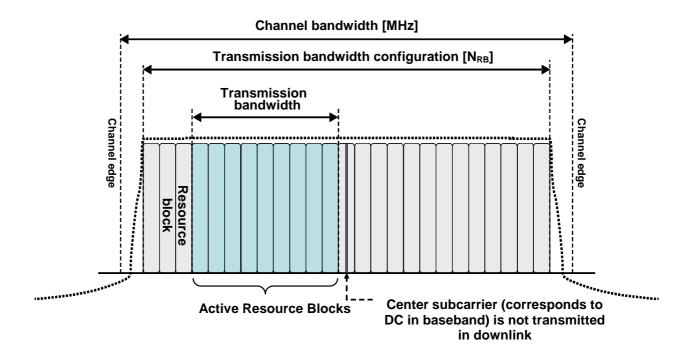


Figure 5.6-1: Definition of channel bandwidth and transmission bandwidth configuration for one E-UTRA carrier

5.6.1 Channel bandwidths per operating band

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

Table 5.6.1-1: E-UTRA channel bandwidth

E-UTRA band / Channel bandwidth											
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz					
1			Yes	Yes	Yes	Yes					
2	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹					
3	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹					
4	Yes	Yes	Yes	Yes	Yes	Yes					
5	Yes	Yes	Yes	Yes ¹							
6			Yes	Yes ¹							
7			Yes	Yes	Yes ²	Yes ^{1,2}					
8	Yes	Yes	Yes	Yes ¹							
9			Yes	Yes	Yes ¹	Yes ¹					
10			Yes	Yes	Yes	Yes					
11			Yes	Yes ¹							
12	Yes	Yes	Yes ¹	Yes ¹							
13			Yes ¹	Yes ¹							
14			Yes ¹	Yes ¹							
17			Yes ¹	Yes ¹							
18			Yes	Yes ¹	Yes ¹						
19			Yes	Yes ¹	Yes ¹						
20			Yes	Yes ¹	Yes ¹	Yes ¹					
21			Yes	Yes ¹	Yes ¹						
22			Yes	Yes	Yes ¹	Yes ¹					
23	Yes	Yes	Yes	Yes	Yes ¹	Yes1					
24			Yes	Yes							
25	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹					
33			Yes	Yes	Yes	Yes					
34			Yes	Yes	Yes						
35	Yes	Yes	Yes	Yes	Yes	Yes					
36	Yes	Yes	Yes	Yes	Yes	Yes					
37			Yes	Yes	Yes	Yes					
38			Yes	Yes	Yes ²	Yes ²					
39			Yes	Yes	Yes	Yes					
40			Yes	Yes	Yes	Yes					
41			Yes	Yes	Yes	Yes					
42			Yes	Yes	Yes	Yes					
43			Yes	Yes	Yes	Yes					

NOTE 1: ¹ refers to the bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (subclause 7.3) is allowed.

NOTE 2: refers to the bandwidth for which the uplink transmission bandwidth can be restricted by the network for some channel assignments in FDD/TDD coexistence scenarios in order to meet unwanted emissions requirements (Clause 6.6.3.2).

5.6A Channel bandwidth for CA

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

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

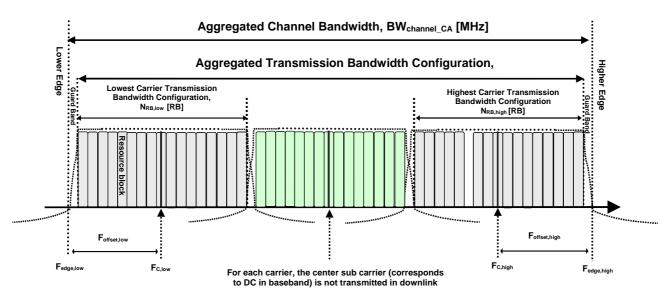


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

The aggregated channel bandwidth, BW_{Channel_CA}, is defined as

$$BW_{Channel_CA} = F_{edge,high} - F_{edge,low}$$
 [MHz].

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

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

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

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

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

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

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

NOTE: The values of BW_{Channel_CA} for UE and BS are the same if the lowest and the highest component carriers are identical.

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

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

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

NOTE 1: BW_{Channel(1)} and BW_{Channel(2)} are channel bandwidths of two E-UTRA component carriers according to Table 5.6-1 and $\Delta f_1 = \Delta f$ for the downlink with Δf the subcarrier spacing while $\Delta f_1 = 0$ for the uplink.

NOTE 2: Applicaple for later releases.

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

5.6A.1 Channel bandwidths per operating band for CA

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

For each carrier aggregation configuration, requirements are specified for all bandwidth combinations contained in a *bandwidth combination set*, which is indicated per supported band combination in the UE radio access capability. A UE can indicate support of several bandwidth combination sets per band combination. Requirements for intra-band contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-1. Requirements for inter-band carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-2.

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

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

E-UTRA CA configuration / Bandwidth combination set										
	Hallada OA	Component carriers in carrier free	_	Maximum	Dan deed dide					
E-UTRA CA configuration	Uplink CA configurations (NOTE 3)	Channel bandwidths for carrier [MHz] Channel bandwidths for carrier [MHz]		aggregated bandwidth [MHz]	Bandwidth combination set					
CA 1C	CA 1C	15		40	0					
CA_1C	CA_1C	20	20	40	0					
		10	20							
CA_40C	CA_40C	15	15	40	0					
		20	10, 20							

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

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

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

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

	E-UTRA CA configuration / Bandwidth combination set										
E-UTRA CA configuration	Uplink CA configurations (NOTE 4)	E- UTRA bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set	
CA 1A 5A		1				Yes			20	0	
CA_1A-5A	-	5				Yes			20	U	

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

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

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

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

5.6B Channel bandwidth for UL-MIMO

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

5.6B.1 Void

5.7 Channel arrangement

5.7.1 Channel spacing

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

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

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

5.7.1A Channel spacing for CA

For intra-band contiguous carrier aggregation bandwidth class C, the nominal channel spacing between two adjacent E-UTRA component carriers is defined as the following:

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

5.7.2 Channel raster

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

5.7.2A Channel raster for CA

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

5.7.3 Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs-DL}$ are given in Table 5.7.3-1 and N_{DL} is the downlink EARFCN.

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

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

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

Table 5.7.3-1: E-UTRA channel numbers

E-UTRA		Downlink			Uplink	
Operating Band	F _{DL_low} (MHz)	N _{Offs-DL}	Range of N _{DL}	Ful_low (MHz)	NOffs-UL	Range of N _{UL}
1	2110	0	0 – 599	1920	18000	18000 – 18599
2	1930	600	600 – 1199	1850	18600	18600 – 19199
3	1805	1200	1200 – 1949	1710	19200	19200 – 19949
4	2110	1950	1950 – 2399	1710	19950	19950 – 20399
5	869	2400	2400 - 2649	824	20400	20400 - 20649
6	875	2650	2650 - 2749	830	20650	20650 - 20749
7	2620	2750	2750 - 3449	2500	20750	20750 - 21449
8	925	3450	3450 - 3799	880	21450	21450 – 21799
9	1844.9	3800	3800 - 4149	1749.9	21800	21800 – 22149
10	2110	4150	4150 – 4749	1710	22150	22150 - 22749
11	1475.9	4750	4750 – 4949	1427.9	22750	22750 - 22949
12	729	5010	5010 - 5179	699	23010	23010 - 23179
13	746	5180	5180 – 5279	777	23180	23180 – 23279
14	758	5280	5280 – 5379	788	23280	23280 – 23379

	1	1				1
17	734	5730	5730 – 5849	704	23730	23730 - 23849
18	860	5850	5850 - 5999	815	23850	23850 - 23999
19	875	6000	6000 - 6149	830	24000	24000 – 24149
20	791	6150	6150 - 6449	832	24150	24150 – 24449
21	1495.9	6450	6450 – 6599	1447.9	24450	24450 – 24599
22	3510	6600	6600 – 7399	3410	24600	24600 - 25399
23	2180	7500	7500 – 7699	2000	25500	25500 - 25699
24	1525	7700	7700 - 8039	1626.5	25700	25700 – 26039
25	1930	8040	8040 - 8689	1850	26040	26040 - 26689
33	1900	36000	36000 - 36199	1900	36000	36000 - 36199
34	2010	36200	36200 - 36349	2010	36200	36200 - 36349
35	1850	36350	36350 - 36949	1850	36350	36350 - 36949
36	1930	36950	36950 - 37549	1930	36950	36950 - 37549
37	1910	37550	37550 – 37749	1910	37550	37550 – 37749
38	2570	37750	37750 – 38249	2570	37750	37750 – 38249
39	1880	38250	38250 - 38649	1880	38250	38250 - 38649
40	2300	38650	38650 - 39649	2300	38650	38650 - 39649
41	2496	39650	39650 -41589	2496	39650	39650 -41589
42	3400	41590	41590 – 43589	3400	41590	41590 – 43589
43	3600	43590	43590 – 45589	3600	43590	43590 – 45589

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

5.7.4 TX-RX frequency separation

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

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

E-UTRA Operating Band	TX - RX carrier centre frequency separation
1	190 MHz
2	80 MHz.
3	95 MHz.
4	400 MHz
5	45 MHz
6	45 MHz
7	120 MHz
8	45 MHz
9	95 MHz
10	400 MHz
11	48 MHz
12	30 MHz
13	-31 MHz
14	-30 MHz
17	30 MHz
18	45 MHz
19	45 MHz
20	-41 MHz
21	48 MHz
22	100 MHz
23	180 MHz
24	-101.5 MHz
25	80 MHz

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

5.7.4A TX-RX frequency separation for CA

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

6 Transmitter characteristics

6.1 General

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

6.2 Transmit power

6.2.1 Void

6.2.2 UE maximum output power

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

Table 6.2.2-1: UE Power Class

EUTRA	Class 1	Tolerance	Class 2	Tolerance	Class 3	Tolerance	Class 4	Tolerance
band	(dBm)	(dB)	(dBm)	(dB)	(dBm)	(dB)	(dBm)	(dB)
1					23	±2		
2					23	±2 ²		
3					23	±2 ²		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2 ²		
8					23	±2 ²		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2 ²		
13					23	±2		
14					23	±2		
					_			
17					23	±2		
18					23	±2		
19					23	±2		
20					23	±2 ²		
21					23	±2		
22					23	+2/-3.5 ²		
23					23 ⁵	±2 ⁵		
24					23	±2		
25					23	±2 ²		
					20	<u></u> 2		
33					23	±2		
34					23	±2		
35		+		 	23	±2	 	
36					23	±2		
37					23	±2 ±2		
38					23	±2 ±2	1	
39		+		-	23	±2 ±2	1	
					23			
40						±2 ±2 ²		
41					23			
42					23	+2/-3	1	
43	L				23	+2/-3		

NOTE 1: Void

NOTE 2: ² refers to the transmission bandwidths (Figure 5.6-1) 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 is relaxed by reducing the lower tolerance limit by 1.5 dB

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

NOTE 4: PPowerClass is the maximum UE power specified without taking into account the tolerance

NOTE 5: When NS_20 is signalled, the total output power within 2000-2005 MHz shall be limited to 7 dBm.

6.2.2A UE maximum output power for CA

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

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

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

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

Table 6.2.2A-1: CA UE Power Class

	E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
Γ	CA_1C					23	+2/-2		
Γ	CA_40C					23	+2/-2		

NOTE 1: Void

NOTE 2: If all transmitted resource blocks (Figure 5.6 A -1) over all component carriers are confined within F_{UL_low} and F_{UL_low} + 4 MHz or/and F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB

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

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

6.2.2B UE maximum output power for UL-MIMO

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

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

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1	(abiii)	(42)	(uBiii)	(GD)	23	+2/-3	(abiii)	(42)
2					23	+2/-32		
3					23	+2/-32		
4					23	+2/-3		
5					23	+2/-3		
6					23	+2/-3		
7					23	+2/-32		
8					23	+2/-32		
9					23	+2/-3		
10					23	+2/-3		
11					23	+2/-3		
12					23	+2/-32		
13					23	+2/-3		
14					23	+2/-3		
17					23	+2/-3		
18					23	+2/-3		
19					23	+2/-3		
20					23	+2/-32		
21					23	+2/-3		
22					23	+2/-4.5 ²		
23					23	+2/-3		
24					23	+2/-3		
25					23	+2/-32		
33					23	+2/-3		
34					23	+2/-3		
35					23	+2/-3		
36					23	+2/-3		
37					23	+2/-3		
38					23	+2/-3		
39					23	+2/-3		
40					23	+2/-3		
41					23	+2/-32		
42					23	+2/-4		
43					23	+2/-4		
NOTE 1:	\/a:d			1		· · · · · · · · · · · · · · · · · · ·	L.	1

NOTE 1: Void

NOTE 2: ² refers to the transmission bandwidths (Figure 5.6-1) 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 is relaxed by reducing the lower tolerance limit by 1.5 dB

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

NOTE 4: PPowerClass is the maximum UE power specified without taking into account the tolerance

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

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

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.2 apply.

6.2.3 UE maximum output power for modulation / channel bandwidth

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

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

ulation Channel bandwidth / Transmission bandwidth (N_{RB}) MPR (d

Modulation	Cha	MPR (dB)					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

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

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

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

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

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

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

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

Modulation	C/	MPR (dB)		
	50 RB + 100 RB	75 RB + 75 RB	100 RB + 100 RB	
QPSK	> 12 and ≤ 50	> 16 and ≤ 75	> 18 and ≤ 100	≤ 1
QPSK	> 50	> 75	> 100	≤ 2
16 QAM	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 12 and ≤ 50	> 16 and ≤ 75	> 18 and ≤ 100	≤ 2
16 QAM	> 50	> 75	> 100	≤ 3

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

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

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

Where MA is defined as follows

$$\begin{array}{lll} M_A = & 8.2 & ; 0 \leq A < 0.025 \\ & 9.2 - 40A & ; 0.025 \leq A < 0.05 \\ & 8 - 16A & ; 0.05 \leq A < 0.25 \\ & 4.83 - 3.33A & ; 0.25 \leq A \leq 0.4, \\ & 3.83 - 0.83A & ; 0.4 \leq A \leq 1, \end{array}$$

Where

 $A = N_{RB_alloc} \, / \, N_{RB_agg}$

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

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

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

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

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

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

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.3 apply.

6.2.4 UE maximum output power with additional requirements

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

For UE Power Class 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4.-1 to 6.2.4-6 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

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

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks ($N_{ m RB}$)	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
			3	>5	≤ 1
		2, 4,10, 23, 25, 35, 36	5	>6	≤ 1
NS_03	6.6.2.2.1		10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS 04	6.6.2.2.2	41	5	>6 ≤1	
110_04	0.0.2.2.2	71	10, 15, 20	Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤3
NS_09	6.6.3.3.4	21	10, 15	> 40 > 55	≤1 ≤2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1 6.6.3.3.13	23	1.4, 3, 5, 10, 15, 20	Table 6.2.4-5	Table 6.2.4-5
NS_20	6.2.2 6.6.2.2.1 6.6.3.3.14	23	5, 10, 15, 20	Table 6.2.4-6	Table 6.2.4-6
NS_22	6.6.3.3.15	42, 43	5, 10, 15, 20	Table	6.2.4-7
NS_23			5, 10, 15, 20	N/A	
NS_32	-	-	-	-	-

Table 6.2.4-2: A-MPR for "NS_07"

Parameters	Region A		Regio	Region C	
RB _{start}	0 - 12		13 – 18	19 – 42	43 – 49
LCRB [RBs]	6-8	1 to 5 and 9-50	≥8	≥18	≤2
A-MPR [dB]	≤ 8	≤ 12	≤ 12	≤ 6	≤ 3

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks

NOTE 2; L_{CRB} is the length of a contiguous resource block allocation NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.

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

Table 6.2.4-3: A-MPR for "NS_10"

Channel bandwidth [MHz]	Parameters	Region A
	RB _{start}	0 – 10
15	LCRB [RBs]	1 -20
	A-MPR [dB]	≤ 2
	RB _{start}	0 – 15
20	LCRB [RBs]	1 -20
	A-MPR [dB]	≤5

- NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks
- NOTE 2: L_{CRB} is the length of a contiguous resource block allocation
- NOTE 3: For intra-subframe frequency hopping which intersects Region A, notes 1 and 2 apply on a per slot basis
- NOTE 4: For intra-subframe frequency hopping which intersect Region A, the larger A-MPR value may be applied for both slots in the subframe

Table 6.2.4-4: A-MPR requirements for "NS_04" with bandwidth >5MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
10	RB _{start}	0 – 12	13 – 36	37 – 49
	RB _{start} + L _{CRB} [RBs]	N/A	>37	N/A ³
	A-MPR [dB]	≤3dB	≤2dB	≤3dB
15	RB _{start}	0 – 18	19 – 55	56 – 74
	RB _{start} + L _{CRB} [RBs]	N/A	>56	N/A ³
	A-MPR [dB]	≤3dB	≤2dB	≤3dB
20	RB _{start}	0 – 24	25 – 74	75 – 99
	RB _{start} + L _{CRB} [RBs]	N/A	>75	N/A ³
	A-MPR [dB]	≤3dB	≤2dB	≤3dB

- NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks
- NOTE 2: LCRB is the length of a contiguous resource block allocation
- NOTE 3: ³ refers to any RB allocation that starts in Region A or C is allowed the specified A-MPR
- NOTE 4: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis
- NOTE 5: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

Table 6.2.4-5: A-MPR for "NS_11"

Channel Bandwidth [MHz]	Parameters								
	Fc (MHz)	<20	04			≥2004			
3	L _{CRB} [RBs]		1-15			>5			
	A-MPR [dB]					≤ 1			
	Fc [MHz]	<20	04		200)4 ≤ Fc <	:2007	2	≥2007
5	L _{CRB} [RBs]	1-2	25			6 & -25	8-12		>6
	A-MPR [dB]	≤7	7		≤	4	0		≤ 1
	Fc [MHz]	200)5 ≤	Fc <2	2015	5	,	2015	
	RB _{start}		0	-49				0-49	
10	LCRB [RBs]	1-50				1-50			
	A-MPR [dB]	≤ 12				0			
	Fc [MHz]					<2012	2.5		
	RB _{start}	0-4		,	5-2′	1	22	-56	57-74
	LCRB [RBs]	≥1	7-	50	0-	6 & ≥50	≤25	>25	>0
	A-MPR [dB]	≤15	≤	7		≤10	0	≤6	≤15
15	Fc [MHz]					2012	.5		
	RB _{start}	0-12			13	-39	40-6	5	66-74
	LCRB [RBS]	≥1		≥3	0	<30	≥ (69 RB _{sta}		≥1
	A-MPR [dB]	≤10 ≤6 0		0	≤2		≤6.5		
	Fc [MHz]	2010							
	RB _{start}	0-12		1	3-29	9	30-	-68	69-99
20	LCRB [RBS]	≥1	10	-60		1-9 & >60	1-24	≥25	≥1
	A-MPR [dB]	≤15	-	≦7		≤10	0	≤7	≤15

Table 6.2.4-6: A-MPR for "NS_20"

Channel Bandwidth [MHz]	Parameters										
	Fc [MHz]	< 20	07.5		200	7.5	≤ Fc < 2	c < 2012.5 ≤ Fc ≤		c ≤ 2017.5	
	RB _{start}	≤:	≤24 0-3)-3			4-6	≤2	24	
5	L _{CRB} [RBs]	>	•0	1	5-19	2	≥20	:	≥18	1-:	25
	A-MPR [dB]	≤	17		≤1		≤4		≤2	≤	0
	Fc [MHz]			I			2005				
	RB _{start}		0-25				26-34	ļ		35-	49
	LCRB [RBs]		>0		,	8-15		>	15	>	0
40	A-MPR [dB]	≤16 ≤2			≤2		≤5		≤ 6		
10	Fc [MHz]						2015		I		
	RB _{start}		O	-5				6-10			
	LCRB [RBs]		≥	32				≥40			
	A-MPR [dB]		<u> </u>	≤4						≤2	
	Fc [MHz]						2012.5				
45	RB _{start}		0-14				15-	24		25-39	61-74
15	LCRB [RBs]	1-9 & 4	0-75	10-3	39	2	4-29		≥30	≥36	≤6
	A-MPR [dB]	≤11 ≤6				≤1 ≤7		≤7	≤5	≤6	
	Fc [MHz]	2010									
20	RB _{start}	0-21	22-31			32-3	8	39-49	50-68	69-99	
20	L _{CRB} [RBs]	>0	1-9 & 3	31-75	75 10-30		≥15		≥24	≥25	>0
	A-MPR [dB]	≤17	≤1	2	≤6	6	≤9		≤7	≤5	≤16

NOTE 1: When NS_20 is signaled the minimum requirements for the 10 MHz bandwidth are specified for E-UTRA

UL carrier center frequencies of 2005 MHz or 2015 MHz.

NOTE 2: When NS_20 is signaled the minimum requirements for the 15 MHz channel bandwidth are specified for E-UTRA UL carrier center frequency of 2012.5 MHz.

Table 6.2.4-7: A-MPR for "NS 22"

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

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks

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

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

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

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

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

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

6.2.4A UE maximum output power with additional requirements for CA

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

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

For intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0 dB, unless the value indicated is CA_NS_31.

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

CA Network Signalling value	Requirements (subclause)	Uplink CA Configuration	A-MPR [dB] (subclause)	
CA_NS_01	6.6.3.3A.1	CA_1C	6.2.4A.1	
CA_NS_02	6.6.3.3A.2	CA_1C	6.2.4A.2	
CA_NS_03	6.6.3.3A.3	CA_1C	6.2.4A.3	
CA_NS_31	NOTE 1	Table 5.6A.1-1 (NOTE 1)	N/A	
CA NS 32	Reserved			

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

NOTE 2: The index of the sequence CA_NS corresponds to the value of additionalSpectrumEmissionSCell-

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

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

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

6.2.4A.1 A-MPR for CA_NS_01 for CA_1C

If the UE is configured to CA_1C and it receives IE CA_NS_01 the allowed maximum output power reduction applied to transmissions on the PCC and the SCC for contiguously aggregated signals is specified in table 6.2.4A.1-1.

Table 6.2.4A.1-1: Contiguous allocation A-MPR for CA_NS_01

CA_1C: CA_NS_01	RB _{start}	LCRB [RBS]	RB _{start} + L _{CRB} [RBs]	A-MPR for QPSK and 16-QAM [dB]
	0 - 23 and 176 - 199	> 0	N/A	≤ 12.0
100 RB / 100 RB	24 – 105	> 64	N/A	≤ 6.0
	106 – 175	N/A	> 175	≤ 5.0
	0 Cond 142 140	0 < L _{CRB} ≤ 10	N/A	≤ 11.0
75 DD / 75 DD	0 – 6 and 143 – 149	> 10	N/A	≤ 6.0
75 RB / 75 RB	7 – 90	> 44	N/A	≤ 5.0
	91 – 142	N/A	> 142	≤ 2.0

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

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

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for

both slots in the subframe

If the UE is configured to CA_1C and it receives IE CA_NS_01 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

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

Where M_A is defined as follows

 $M_A = -22.5 A + 17$; $0 \le A < 0.20$

-11.0 A + 14.7 ; $0.20 \le \text{A} < 0.70$

-1.7 A + 8.2 ; $0.70 \le A \le 1$

Where $A = N_{RB_alloc} / N_{RB_agg}$.

6.2.4A.2 A-MPR for CA_NS_02 for CA_1C

If the UE is configured to CA_1C and it receives IE CA_NS_02 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.2-1.

Table 6.2.4A.2-1: Contiguous allocation A-MPR for CA_NS_02

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

If the UE is configured to CA_1C and it receives IE CA_NS_02 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

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

Where M_A is defined as follows

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

Where $A=N_{RB_alloc}\,/\,N_{RB_agg.}$

6.2.4A.3 A-MPR for CA_NS_03 for CA_1C

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

A-MPR for QPSK and CA 1C: CA NS 03 **RB**end L_{CRB} [RBs] 16-QAM [dB] 0 - 26 ≤ 10 dB > 0 27 - 63 ≤ 6 dB ≥ RB_{end} - 27 27 - 63 < RBend - 27 ≤ 1 dB 100 RB / 100 RB 64 - 100 $> RB_{end} - 20$ ≤ 4 dB ≤ 7 dB 101 - 171> 68 172 - 199≤ 10 dB > 0 0 - 20 ≤ 10 dB > 0 21 - 45 ≤ 4 dB > 0 46 - 75 $> RB_{end} - 13$ ≤ 2 dB 75 RB / 75 RB 76 - 95> 45 ≤ 5 dB 96 - 149> 43 ≤ 8 dB 120 - 1491-43 ≤ 6 dB

Table 6.2.4A.3-1: Contiguous allocation A-MPR for CA_NS_03

If the UE is configured to CA_1C and it receives IE CA_NS_03 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

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

Where MA is defined as follows

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

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

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

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in subclause 6.2.4 shall apply to the maximum output power specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

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

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.4 apply.

6.2.5 Configured transmitted power

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

$$P_{CMAX,L,c} < P_{CMAX,c} < P_{CMAX,H,c}$$

with

$$\begin{split} P_{CMAX_L,c} = MIN \; \{ P_{EMAX,c} - \Delta T_{C,c}, \; P_{PowerClass} - MAX(MPR_{,c} + A-MPR_{,c} + \Delta T_{IB,c} + \Delta T_{C,c}, P-MPR_{,c}) \} \\ P_{CMAX_H,c} = MIN \; \{ P_{EMAX,c}, \; P_{PowerClass} \} \end{split}$$

where

- $P_{EMAX,c}$ is the value given by IE *P-Max* for serving cell *c*, defined in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1.
- MPR_c and A-MPR_c for serving cell c are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{\text{IB,c}}$ is the additional tolerance for serving cell c as specified in Table 6.2.5-2; $\Delta T_{\text{IB,c}} = 0$ dB otherwise;
- $\Delta T_{C,c} = 1.5$ dB when Note 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c} = 0$ dB when Note 2 in Table 6.2.2-1 does not apply.

P-MPR_c is the allowed maximum output power reduction for

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

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

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

NOTE 2: P-MPR_c may impact the maximum uplink performance for the selected UL transmission path.

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

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

$$P_{CMAX_L,c} - \ MAX\{T_{L,c}, T(P_{CMAX_L,c})\} \ \leq \ P_{UMAX,c} \leq \ P_{CMAX_H,c} + \ T(P_{CMAX_L,c})$$

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

Table 6.2.5-1: P_{CMAX,c} tolerance

Р _{смах,с} (dВm)	Tolerance T(P _{CMAX,c}) (dB)
$21 \le P_{CMAX,c} \le 23$	2.0
20 ≤ P _{CMAX,c} < 21	2.5
19 ≤ P _{CMAX,c} < 20	3.5
18 ≤ P _{CMAX,c} < 19	4.0
13 ≤ P _{CMAX,c} < 18	5.0
8 ≤ P _{CMAX,c} < 13	6.0
-40 ≤ P _{CMAX,c} < 8	7.0

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

Table 6.2.5-2: ΔT_{IB,c}

Inter-bar	nd CA	E-UTRA Band	ΔT _{IB,c} [dB]				
Configu	ration						
CA 1A	ΕΛ.	1	0.3				
CA_IA	N-SA	5 0.3					
NOTE 1:	The ab	above additional tolerances are only applicable for the E-UTRA operating					
	bands	that belong to the supported inter-ban	d carrier aggregation				
	configu	ırations					
NOTE 2:	NOTE 2: The above additional tolerances also apply in non-aggregated operation for the						
	supported E-UTRA operating bands that belong to the supported inter-band						
		arrier aggregation configurations					
NOTE 3:		case the UE supports more than one of the above inter-band carrier					
		ation configurations and a E-UTRA of					
	one int	er-band carrier aggregation configura					
	-	When the E-UTRA operating band					
			all be the average of the tolerances				
			e decimal place for that operating				
		band among the supported CA co					
			nd UL and high band DL, then the				
	maximum tolerance among the different supported carrier						
	aggregation configurations involving such band shall be applied - When the E-UTRA operating band frequency range is >1GHz, the						
	applicable additional tolerance shall be the maximum tolerance in						
	Table 6.2.5A-3 that applies for that operating band among the						
		supported CA configurations	at operating band among the				

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

6.2.5A Configured transmitted power for CA

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

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

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

The total configured maximum output power P_{CMAX} shall be set within the following bounds:

$$P_{CMAX_L} \leq \, P_{CMAX} \, \leq \, P_{CMAX_H}$$

For uplink intra-band contiguous carrier aggregation,

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

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell *c* in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;

- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{\rm IB,c}$ is the additional tolerance for serving cell c as specified in Table 6.2.5-2;
- P-MPR is the power management term for the UE;
- ΔT_C is the highest value $\Delta T_{C,c}$ among all serving cells c in the subframe over both timeslots. $\Delta T_{C,c} = 1.5$ dB when Note 2 in Table 6.2.2A-1 applies to the serving cell c, otherwise $\Delta T_{C,c} = 0$ dB.

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

The measured maximum output power P_{UMAX} over all serving cells shall be within the following range:

$$\begin{split} P_{CMAX_L} - \ MAX\{T_L, T_{LOW}(P_{CMAX_L})\} \ \leq \ P_{UMAX} \leq \ P_{CMAX_H} + \ T_{HIGH}(P_{CMAX_H}) \\ \\ P_{UMAX} = 10 \ log_{10} \ \sum p_{UMAX_c} \end{split}$$

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

Table 6.2.5A-2: P_{CMAX} tolerance for dual uplink intra-band contiguous CA

P _{CMAX} (dBm)	Tolerance TLOW(PCMAX) (dB)	Tolerance Thigh(Pcmax) (dB)		
21 ≤ P _{CMAX} ≤ 23	2.0			
20 ≤ P _{CMAX} < 21	2.5			
19 ≤ P _{CMAX} < 20	3.5			
18 ≤ P _{CMAX} < 19	4.0			
13 ≤ P _{CMAX} < 18	5.0			
8 ≤ P _{CMAX} < 13	6.0			
-40 ≤ P _{CMAX} < 8	7.	.0		

6.2.5B Configured transmitted power for UL-MIMO

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

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

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

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

$$P_{CMAX_L,c} - \ MAX\{T_L, T_{LOW}(P_{CMAX_L,c})\} \ \leq \ P_{UMAX,c} \leq \ P_{CMAX_H,c} + \ T_{HIGH}(P_{CMAX_H,c})$$

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

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

Table 6.2.5B-1: P_{CMAX,c} tolerance in closed-loop spatial multiplexing scheme

P _{CMAX,c} (dBm)	Tolerance TLOW(PCMAX_L,c) (dB)	Tolerance Thigh(Pcmax_h,c) (dB)			
$P_{CMAX,c} = 23$	3.0	2.0			
22 ≤ P _{CMAX,c} < 23	5.0	2.0			
21 ≤ P _{CMAX,c} < 22	5.0	3.0			
20 ≤ P _{CMAX,c} < 21	6.0	4.0			
16 ≤ P _{CMAX,c} < 20	5.0				
11 ≤ P _{CMAX,c} < 16	6.0				
-40 ≤ P _{CMAX,c} < 11	7.	.0			

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.5 apply.

6.3 Output power dynamics

6.3.1 (Void)

6.3.2 Minimum output power

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

6.3.2.1 Minimum requirement

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

Table 6.3.2.1-1: Minimum output power

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

6.3.2A UE Minimum output power for CA

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

6.3.2A.1 Minimum requirement for CA

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

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

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

6.3.2B UE Minimum output power for UL-MIMO

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

6.3.2B.1 Minimum requirement

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

Table 6.3.2B.1-1: Minimum output power

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

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.2 apply.

6.3.3 Transmit OFF power

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

6.3.3.1. Minimum requirement

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

Table 6.3.3.1-1: Transmit OFF power

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

6.3.3A UE Transmit OFF power for CA

For intra-band contiguous carrier aggregation, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on both component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During measurements gaps, the UE is not considered to be OFF.

6.3.3A.1 Minimum requirement for CA

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

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

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

6.3.3B UE Transmit OFF power for UL-MIMO

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

6.3.3B.1 Minimum requirement

bandwidth

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

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

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

6.3.4 ON/OFF time mask

6.3.4.1 General ON/OFF time mask

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

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

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

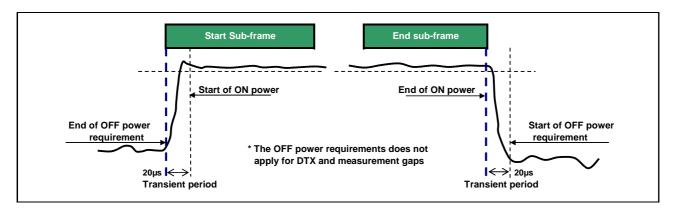


Figure 6.3.4.1-1: General ON/OFF time mask

6.3.4.2 PRACH and SRS time mask

6.3.4.2.1 PRACH time mask

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

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

 PRACH preamble format
 Measurement period (ms)

 0
 0.9031

 1
 1.4844

 2
 1.8031

 3
 2.2844

0.1479

Table 6.3.4.2-1: PRACH ON power measurement period

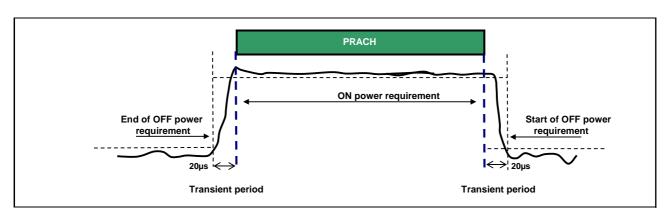


Figure 6.3.4.2-1: PRACH ON/OFF time mask

6.3.4.2.2 SRS time mask

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

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

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

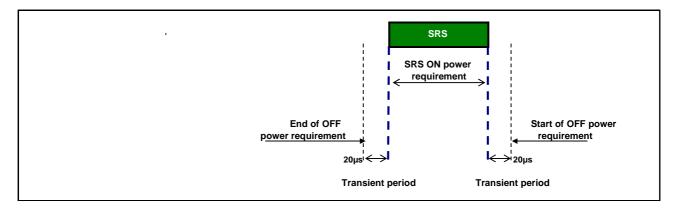


Figure 6.3.4.2.2-1: Single SRS time mask

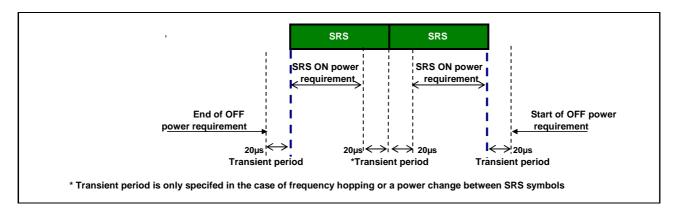


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

6.3.4.3 Slot / Sub frame boundary time mask

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

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

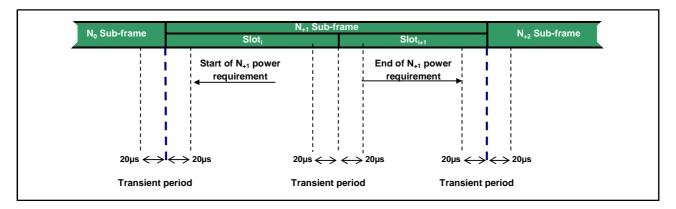


Figure 6.3.4.3-1: Transmission power template

6.3.4.4 PUCCH / PUSCH / SRS time mask

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

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

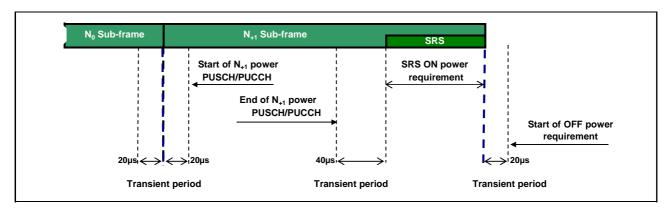


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

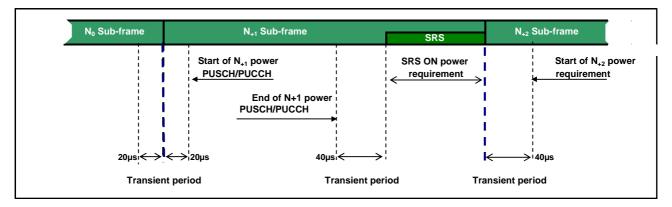


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

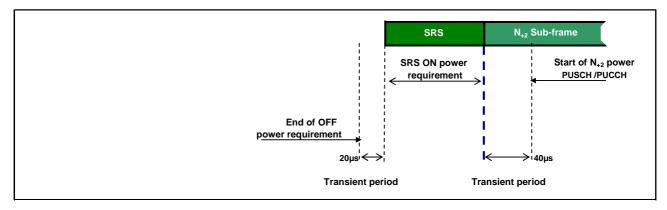


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before

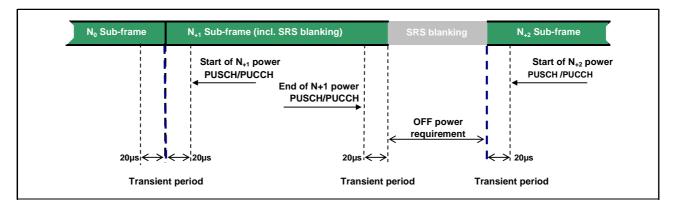


Figure 6.3.4.4-4: SRS time mask when there is FDD SRS blanking

6.3.4A ON/OFF time mask for CA

For intra-band contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.4.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.4.1 shall only be applicable for each component carrier when all the component carriers are OFF.

6.3.4B ON/OFF time mask for UL-MIMO

For UE supporting UL-MIMO, the ON/OFF time mask requirements in subclause 6.3.4 apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.4.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.4 apply.

6.3.5 Power Control

6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133)

In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under Note 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high} .

Table 6.3.5.1.1-1: Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

6.3.5.2 Relative Power tolerance

The relative power tolerance is the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is ≤ 20 ms.

For PRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4.2-1.

6.3.5.2.1 Minimum requirements

The requirements specified in Table 6.3.5.2.1-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2 and the measured P_{UMAX} as defined in subclause 6.2.5 (i.e, the actual power as would be measured assuming no measurement error). This power shall be within the power limits specified in subclause 6.2.5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.2 and 6.2.2. For these exceptions the power tolerance limit is a maximum of ± 6.0 dB in Table 6.3.5.2.1-1

Table 6.3.5.2.1-1 Relative power tolerance for transmission (normal conditions)

Power step ΔP (Up or down) [dB]	All combinations of PUSCH and PUCCH transitions [dB]	All combinations of PUSCH/PUCCH and SRS transitions between sub- frames [dB]	PRACH [dB]
ΔP < 2	±2.5 (Note 3)	±3.0	±2.5
2 ≤ ΔP < 3	±3.0	±4.0	±3.0
3 ≤ ΔP < 4	±3.5	±5.0	±3.5
4 ≤ ΔP ≤ 10	±4.0	±6.0	±4.0
10 ≤ ΔP < 15	±5.0	±8.0	±5.0
15 ≤ ΔP	±6.0	±9.0	±6.0

NOTE 1: For extreme conditions an additional ± 2.0 dB relaxation is allowed NOTE 2: For operating bands under Note 2 in Table 6.2.2-1, the relative power tolerance is relaxed by increasing the upper limit by 1.5 dB if the transmission bandwidth of the reference sub-frames is confined within Fullow and Fullow + 4 MHz or Fullhigh - 4 MHz and Fullhigh and the target sub-frame is not confined within any one of these frequency ranges; if the transmission bandwidth of the target sub-frame is confined within Fullow and Fullow + 4 MHz or Fullhigh - 4 MHz and Fullhigh and the reference sub-frame is not confined within any one of these frequency ranges, then the tolerance is relaxed by reducing the lower limit by 1.5 dB.

NOTE 3: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods for TDD: for a power step $\Delta P \le 1$ dB, the relative power tolerance for transmission is ± 1.0 dB.

The power step (ΔP) is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames with the power setting according to subclause 5.1 of [TS 36.213]. The error is the difference between ΔP and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5.2.1-1.

For sub-frames not containing an SRS symbol, the power change is defined as the relative power difference between the mean power of the original reference sub-frame and the mean power of the target subframe not including transient durations. The mean power of successive sub-frames shall be calculated according to Figure 6.3.4.3-1 and Figure 6.3.4.1-1 if there is a transmission gap between the reference and target sub-frames.

If at least one of the sub-frames contains an SRS symbol, the power change is defined as the relative power difference between the mean power of the last transmission within the reference sub-frame and the mean power of the first transmission within the target sub-frame not including transient durations. A transmission is defined as PUSCH, PUCCH or an SRS symbol. The mean power of the reference and target sub-frames shall be calculated according to Figures 6.3.4.1-1, 6.3.4.2-1, 6.3.4.4-1, 6.3.4.4-2 and 6.3.4.4-3 for these cases.

6.3.5.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant.

6.3.5.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2.

Table 6.3.5.3.1-1: Aggregate power control tolerance

TPC command UL channel		Aggregate power tolerance within 21 ms		
0 dB	PUCCH	±2.5 dB		
0 dB PUSCH		±3.5 dB		
NOTE: The UE transmission gap is 4 ms. TPC command is transmitted via PDCCH 4 subframes preceding each PUCCH/PUSCH transmission.				

6.3.5A Power control for CA

The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per component carrier with power setting in accordance with Clause 5.1 of [6].

6.3.5A.1 Absolute power tolerance

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

6.3.5A.1.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth class C the absolute power control tolerance per component carrier is given in Table 6.3.5.1.1-1.

6.3.5A.2 Relative power tolerance

6.3.5A.2.1 Minimum requirements

The requirements apply when the power of the target and reference sub-frames on each component carrier exceed-20 dBm and the total power is limited by P_{UMAX} as defined in subclause 6.2.5A. For the purpose of these requirements, the power in each component carrier is specified over only the transmitted resource blocks.

For intra-band contiguous carrier aggregation bandwidth class C, the UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

- a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.5.2.1-1;
- b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.5.2.1-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subrames:
- c) for RACH on the primary component carrier, the requirements given in Table 6.3.5.2.1-1 for PRACH.

For a) and b) above, the power step ΔP between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

For a), b) and c) above, two exceptions are allowed for each component carrier for a power per carrier ranging from -20 dBm to $P_{UMAX,c}$ as defined in subclause 6.2.5. For these exceptions the power tolerance limit is ± 6.0 dB in Table 6.3.5.2.1-1.

6.3.5A.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in [6] are constant on all active component carriers.

6.3.5A.3.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth class C, the aggregate power tolerance per component carrier is given in Table 6.3.5.3.1-1 with either simultaneous PUSCH or simultaneous PUCCH- PUSCH (if supported by the UE) configured. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

6.3.5B Power control for UL-MIMO

For UE supporting UL-MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.5 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2, wherein

- The Maximum output power requirements for UL-MIMO are specified in subclause 6.2.2B
- The Minimum output power requirements for UL-MIMO are specified in subclause 6.3.2B
- The requirements for configured transmitted power for UL-MIMO are specified in subclause 6.2.5B.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.5 apply.

6.4 Void

6.5 Transmit signal quality

6.5.1 Frequency error

The UE modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B

6.5.1A Frequency error for CA

For intra-band contiguous carrier aggregation the UE modulated carrier frequencies per band shall be accurate to within ± 0.1 PPM observed over a period of one timeslot compared to the carrier frequency of primary component carrier received from the E-UTRA in the corresponding band.

6.5.1B Frequency error for UL-MIMO

For UE(s) supporting UL-MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ± 0.1 PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

6.5.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.5.2 are defined using the measurement methodology specified in Annex F.

6.5.2.1 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and is one slot for the PUCCH and PUSCH in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the EVM measurement interval is reduced by one symbol, accordingly. The PUSCH or PUCCH EVM measurement interval is also reduced when the mean power, modulation or allocation between slots is expected to change. In the case of PUSCH transmission, the measurement interval is reduced by a time interval equal to the sum of 5 μ s and the applicable exclusion period defined in subclause 6.3.4, adjacent to the boundary where the power change is expected to occur. The PUSCH exclusion period is applied to the signal obtained after the front-end IDFT. In the case of PUCCH transmission with power change, the PUCCH EVM measurement interval is reduced by one symbol adjacent to the boundary where the power change is expected to occur.

6.5.2.1.1 Minimum requirement

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, [all PRACH preamble formats 0-4 and] all PUCCH formats 1, 1a, 1b, 2, 2a and 2b are considered to have the same EVM requirement as QPSK modulated.

Table 6.5.2.1.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5

Table 6.5.2.1.1-2: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ -40
Operating conditions		Normal conditions

6.5.2.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as amodulated waveform carrier frequency. The measurement interval is one slot in the time domain.

6.5.2.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

Table 6.5.2.2.1-1: Minimum requirements for relative carrier leakage power

Parameters	Relative limit (dBc)
Output power >0 dBm	-25
-30 dBm ≤ Output power ≤0 dBm	-20

$-40 \text{ dBm} \le \text{Output power} < -30 \text{ dBm}$	-10

6.5.2.3 In-band emissions

The in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non-allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

6.5.2.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2.3.1-1.

Table 6.5.2.3.1-1: Minimum requirements for in-band emissions

Parameter description	Unit	Limit (Note 1)	Applicable Frequencies
General	dB	$\max \left\{ -25 - 10 \cdot \log_{10} \left(N_{RB} / L_{CRB} \right), \\ 20 \cdot \log_{10} EVM - 3 - 5 \cdot \left(\left \Delta_{RB} \right - 1 \right) / L_{CRB}, \\ -57 \ dBm \ / 180 \ kHz - P_{RB} \right\}$	Any non-allocated (Note 2)
IQ Image	dB	-25	Image frequencies (Notes 2, 3)
Carrier leakage	dBc	-25 Output power > 0 dBm -20 -30 dBm ≤ Output power ≤ 0 dBm -10 -40 dBm ≤ Output power < -30 dBm	Carrier frequency (Notes 4, 5)

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in Note 10.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated RBs.
- NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency if N_{RB} is odd, or in the two RBs immediately adjacent to the DC frequency if N_{RB} is even, but excluding any allocated RB.
- NOTE 6: $L_{\it CRB}$ is the Transmission Bandwidth (see Figure 5.6-1).
- NOTE 7: $N_{\it RB}$ is the Transmission Bandwidth Configuration (see Figure 5.6-1).
- NOTE 8: EVM is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.
- NOTE 10: $P_{\it RB}$ is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

6.5.2.4 EVM equalizer spectrum flatness

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex F) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block. The basic measurement interval is the same as for EVM.

6.5.2.4.1 Minimum requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.5.2.4.1-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.5.2.4.1-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.5.2.4.1-1).

Table 6.5.2.4.1-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

	Frequency range	Maximum ripple [dB]				
F _{UL_Meas}	s – F _{UL_Low} ≥ 3 MHz and F _{UL_High} – F _{UL_Meas} ≥ 3 MHz	4 (p-p)				
	(Range 1)					
F _{UL_Mea}	$_{as}$ - F_{UL_Low} < 3 MHz or F_{UL_High} - F_{UL_Meas} < 3 MHz	8 (p-p)				
	(Range 2)					
NOTE 1:	$F_{\text{UL_Meas}}$ refers to the sub-carrier frequency for which	the equalizer coefficient is				
	evaluated					
NOTE 2:	NOTE 2: Ful_Low and Ful_High refer to each E-UTRA frequency band specified in Table					
	5.5-1					

Table 6.5.2.4.1-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple [dB]
F _{UL_Meas} – F _{UL_Low} ≥ 5 MHz and F _{UL_High} – F _{UL_Meas} ≥ 5 MHz	4 (p-p)
(Range 1)	
Ful_Meas - Ful_Low < 5 MHz or Ful_High - Ful_Meas < 5 MHz	12 (p-p)
(Range 2)	
NOTE 1: F _{UL_Meas} refers to the sub-carrier frequency for which evaluated	the equalizer coefficient is
NOTE 2: Ful_Low and Ful_High refer to each E-UTRA frequency 5.5-1	band specified in Table

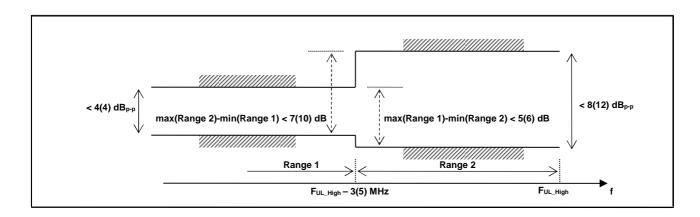


Figure 6.5.2.4.1-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement within brackets).

6.5.2A Transmit modulation quality for CA

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

6.5.2A.1 Error Vector Magnitude

For the intra-band contiguous carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers. Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.5.2.1.

When a single component carrier is configured Table 6.5.2.1.1-1 apply.

The EVM requirements are according to Table 6.5.2A.1-1 if CA is configured in uplink.

Table 6.5.2A.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level per CC	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5

6.5.2A.2 Carrier leakage for CA

Carrier leakage is an additive sinusoid waveform that is confined within the aggrecated transmission bandwidth configuration. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

6.5.2A.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2A.2.1-1.

Table 6.5.2A.2.1-1: Minimum requirements for Relative Carrier Leakage Power

Parameters	Relative Limit (dBc)
Output power >0 dBm	-25
-30 dBm ≤ Output power ≤0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

6.5.2A.3 In-band emissions

6.5.2A.3.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation bandwidth class C, the requirements in Table 6.5.2A.3.1-1 and 6.5.2A.3.1-2 apply within the aggregated transmission bandwidth configuration with both component carrier (s) active and one single contiguous PRB allocation of bandwidth $L_{\it CRB}$ at the edge of the aggregated transmission bandwidth configuration.

The inband emission is defined as the interference falling into the non allocated resource blocks for all component carriers. The measurement method for the inband emissions in the component carrier with PRB allocation is specified in annex F. For a non allocated component carrier a spectral measurement is specified.

Table 6.5.2A.3.1-1: Minimum requirements for in-band emissions (allocated component carrier)

Parameter	Unit		Limit	Applicable Frequencies		
General	dB	$\max \left\{ -2 \right.$ $20 \cdot \log_{10} A$	Any non-allocated (Note 2)			
		– 57 <i>dBm</i>	$/180 kHz - P_{RB}$			
IQ Image	dB		-25	Exception for IQ image (Note 3)		
		-25	Output power > 0 dBm			
Carrier	dBc	-20	-30 dBm ≤ Output power ≤ 0 dBm	Exception for Carrier frequency		
leakage	ubc	age dBC	-10	-40 dBm ≤ Output power < -30 dBm	(Note 4)	

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in Note 9. The limit is evaluated in each non-allocated RB.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
- NOTE 3: Exceptions to the general limit are allowed for up to $L_{\it CRB}$ +1 RBs within a contiguous width of $L_{\it CRBs}$ +1 non-allocated RBs. The measurement bandwidth is 1 RB.
- NOTE 4: Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs. The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in the non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5: L_{CRB} is the Transmission Bandwidth (see Figure 5.6-1) not exceeding $\left|N_{RB}/2-1\right|$
- NOTE 6: N_{RB} is the Transmission Bandwidth Configuration (see Figure 5.6-1) of the component carrier with RBs allocated.
- NOTE 7: *EVM* is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 8: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth).
- NOTE 9: $P_{\rm RB}$ is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

Table 6.5.2A.3.1-2: Minimum requirements for in-band emissions (non-allocated component carrier)

Para- meter	Unit	Meas BW Note 1		Limit	remark	Applicable Frequencies
General	dB	BW of 1 RB (180KHz rectangular)	20 · log 10	$25 - 10 \cdot \log_{10}(N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot (\Delta_{RB} - 1) / L_{CRB}$ $e / 180 kHz - P_{RB}$	The reference value is the average power per allocated RB in the allocated component carrier	Any RB in the non allocated component carrier. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
IQ Image	dB	BW of 1 RB (180KHz rectangular)		-25 Note 2	The reference value is the average power per allocated RB in the allocated component carrier	The frequencies of the $L_{\it CRB}$ contig uous nonallocated RBs are unknown. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
		BW of 1 RB (180KHz		Note 3	The reference value is the	The frequencies of
		rectangular)	-25	Output power > 0 dBm	total power of the allocated	the up to 2 non-allocated
Carrier leakage	dBc	dBc	-20	-30 dBm ≤ Output power ≤ 0 dBm	RBs in the allocated component carrier	RBs are unknown. The frequency raster of the RBs is derived when this
			-10	-40 dBm ≤ Output power < - 30 dBm		component carrier is allocated with RBs

NOTE1: Resolution BWs smaller than the measurement BW may be integrated to achieve the measurement bandwidth.

NOTE 2: Exceptions to the general limit are allowed for up to $L_{\it CRB}$ +1 RBs within a contiguous width of $L_{\it CRB}$ +1 non-allocated RBs.

NOTE 3: Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs NOTE 4: Notes 1, 5, 6, 7, 8, 9 from Table 6.5.2A.3.1-1 apply for Table 6.5.2A.3.1-2 as well.

NOTE 5: Δ_{RB} for measured non-allocated RB in the non allocated component carrier may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.

6.5.2B Transmit modulation quality for UL-MIMO

For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna connector.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.5.2 apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)

- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

6.5.2B.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.5.2.1.1-1 which is defined in subclause 6.5.2.1 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.5.2.2.1-1 which is defined in subclause 6.5.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.5.2.3.1-1 which is defined in subclause 6.5.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.4 EVM equalizer spectrum flatness for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.5.2.4.1-1 and Table 6.5.2.4.1-2 which are defined in subclause 6.5.2.4 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.6 Output RF spectrum emissions

The output UE transmitter spectrum consists of the three components; the emission within the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

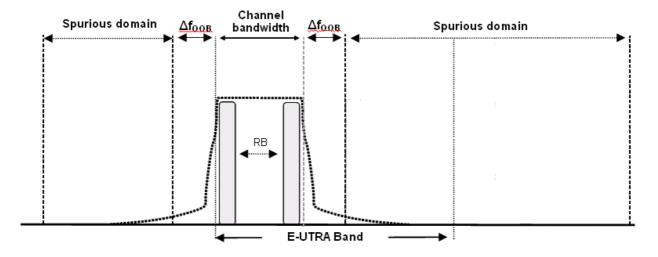


Figure 6.6-1: Transmitter RF spectrum

6.6.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.6.1-1

Occupied channel bandwidth / Channel bandwidth 1.4 3.0 MHz MHz MHz MHz MHz MHz Channel bandwidth 1.4 3 5 10 15 20 (MHz)

Table 6.6.1-1: Occupied channel bandwidth

6.6.1A Occupied bandwidth for CA

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.6A.

6.6.1B Occupied bandwidth for UL-MIMO

For UE supporting UL-MIMO, the requirements for occupied bandwidth is specified at each transmit antenna connector. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in Table 6.6.1B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

	Occupied channel bandwidth / Channel bandwidth						
	1.4 3.0 5 10 15						
	MHz	MHz	MHz	MHz	MHz	MHz	
Channel bandwidth (MHz)	1.4	3	5	10	15	20	

Table 6.6.1B-1: Occupied channel bandwidth

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.6.1 apply.

6.6.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio.

6.6.2.1 Spectrum emission mask

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the assigned E-UTRA channel bandwidth. For frequencies greater than (Δf_{OOB}) as specified in Table 6.6.2.1.1-1 the spurious requirements in subclause 6.6.3 are applicable.

6.6.2.1.1 Minimum requirement

The power of any UE emission shall not exceed the levels specified in Table 6.6.2.1.1-1 for the specified channel bandwidth.

Spectrum emission limit (dBm)/ Channel bandwidth								
Δf _{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth	
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz	
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz	
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz	
± 2.8-5		-10	-10	-10	-10	-10	1 MHz	
± 5-6		-25	-13	-13	-13	-13	1 MHz	
± 6-10			-25	-13	-13	-13	1 MHz	
± 10-15				-25	-13	-13	1 MHz	
± 15-20					-25	-13	1 MHz	
± 20-25						-25	1 MHz	

Table 6.6.2.1.1-1: General E-UTRA spectrum emission mask

NOTE:

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.1A Spectrum emission mask for CA

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the aggregated channel bandwidth (Table 5.6A-1) For intra-band contiguous carrier aggregation the bandwidth class C, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.1A-1 for the specified channel bandwidth.

Spectrum emission limit [dBm]/BW_{Channel_CA} Δfooв 50RB+100RB 75RB+75RB 100RB+100RB Measurement bandwidth (MHz) (29.9 MHz) (30 MHz) (39.8 MHz) 30 kHz -22.5 -22.5 $\pm 0-1$ -24 -10 ± 1-5 -10 -10 1 MHz -13 -13 $\pm 5 - 29.9$ -13 1 MHz $\pm 29.9 - 30$ -25 -13 -13 1 MHz -25 -25 -13 1 MHz $\pm 30 - 34.9$ -25 -13 1 MHz $\pm 34.9 - 35$ -13 1 MHz $\pm 35 - 39.8$ -25 1 MHz $\pm 39.8 - 44.8$

Table 6.6.2.1A-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C

6.6.2.2 Additional spectrum emission mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

6.6.2.2.1 Minimum requirement (network signalled value "NS_03", "NS_11", and "NS_20")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_03", "NS_11" or "NS_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.1-1.

Spectrum emission limit (dBm)/ Channel bandwidth 1.4 3.0 5 10 15 20 Measurement Δfоов (MHz) MHz MHz MHz MHz MHz MHz bandwidth -10 -13 -15 -18 -20 -21 30 kHz ± 0-1 -13 -13 -13 -13 -13 1 MHz -13 $\pm 1 - 2.5$ -13 -13 -13 1 MHz -25 -13 -13 $\pm 2.5 - 2.8$ 1 MHz $\pm 2.8-5$ -13 -13 -13 -13 -13 -25 -13 -13 -13 -13 1 MHz $\pm 5-6$ -25 -13 -13 -13 1 MHz ± 6-10 -13 -13 1 MHz ± 10-15 -25 -25 -13 ± 15-20 1 MHz $\pm 20-25$ -25 1 MHz

Table 6.6.2.2.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.2.2 Minimum requirement (network signalled value "NS_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.2-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δf _{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth		
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz		
± 1-2.5	-13	-13	-13	-13	-13	-13	1 MHz		
± 2.5-2.8	-25	-13	-13	-13	-13	-13	1 MHz		
± 2.8-5.5		-13	-13	-13	-13	-13	1 MHz		
± 5.5-6		-25	-25	-25	-25	-25	1 MHz		
± 6-10			-25	-25	-25	-25	1 MHz		
± 10-15				-25	-25	-25	1 MHz		
± 15-20					-25	-25	1 MHz		
± 20-25						-25	1 MHz		

Table 6.6.2.2.2-1: Additional requirements

Note:

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.2.3 Minimum requirement (network signalled value "NS 06" or "NS 07")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_06" or "NS_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.3-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δfoob	1.4	3.0	5	10	Measurement				
(MHz)	MHz	MHz	MHz	MHz	bandwidth				
± 0-0.1	-13	-13	-15	-18	30 kHz				
± 0.1-1	-13	-13	-13	-13	100 kHz				
± 1-2.5	-13	-13	-13	-13	1 MHz				
± 2.5-2.8	-25	-13	-13	-13	1 MHz				
± 2.8-5		-13	-13	-13	1 MHz				
± 5-6		-25	-13	-13	1 MHz				
± 6-10			-25	-13	1 MHz				
± 10-15				-25	1 MHz				

Table 6.6.2.2.3-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.3 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirements for one E-UTRA carrier are specified for two scenarios for an adjacent E-UTRA and /or UTRA channel as shown in Figure 6.6.2.3-1.

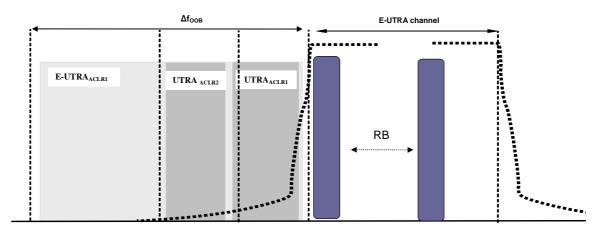


Figure 6.6.2.3-1: Adjacent Channel Leakage requirements for one E-UTRA carrier

6.6.2.3.1 Minimum requirement E-UTRA

E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.1-1. If the measured adjacent channel power is greater than -50dBm then the E-UTRA_{ACLR} shall be higher than the value specified in Table 6.6.2.3.1-1.

Table 6.6.2.3.1-1: General requirements for E-UTRA_{ACLR}

	Cha	Channel bandwidth / E-UTRA _{ACLR1} / Measurement bandwidth						
	1.4	3.0	5	10	15	20		
	MHz	MHz	MHz	MHz	MHz	MHz		
E-UTRA _{ACLR1}	30 dB	30 dB	30 dB	30 dB	30 dB	30 dB		
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz		
Adjacent channel	+1.4	+3.0	+5	+10	+15	+20		
centre frequency	/	/	/	/	/	/		
offset [MHz]	-1.4	-3.0	-5	-10	-15	-20		

6.6.2.3.1A Void

6.6.2.3.2 Minimum requirements UTRA

UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned E-UTRA channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA_{ACLR1}) and the 2^{nd} UTRA adjacent channel (UTRA_{ACLR2}). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor α =0.22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2-1. If the measured UTRA channel power is greater than –50dBm then the UTRA_{ACLR} shall be higher than the value specified in Table 6.6.2.3.2-1.

Table 6.6.2.3.2-1: Requirements for UTRA_{ACLR1/2}

		Channel bandwidth / UTRA _{ACLR1/2} / Measurement bandwidth								
	1.4	3.0	5	10	15	20				
	MHz	MHz	MHz	MHz	MHz	MHz				
UTRA _{ACLR1}	33 dB	33 dB	33 dB	33 dB	33 dB	33 dB				
Adjacent channel centre frequency offset [MHz]	0.7+BWutra/2 / -0.7- BWutra/2	1.5+BW _{UTRA} /2 / -1.5- BW _{UTRA} /2	+2.5+BWutra/2 / -2.5-BWutra/2	+5+BWutra/2 / -5-BWutra/2	+7.5+BWutra/2 / -7.5-BWutra/2	+10+BWutra/2 / -10-BWutra/2				
UTRA _{ACLR2}	-	-	36 dB	36 dB	36 dB	36 dB				
Adjacent channel centre frequency offset [MHz]	-	-	+2.5+3*BW _{UTRA} /2 / -2.5-3*BW _{UTRA} /2	+5+3*BWutra/2 / -5-3*BWutra/2	+7.5+3*BW _{UTRA} /2 / -7.5-3*BW _{UTRA} /2	+10+3*BW _{UTRA} /2 / -10-3*BW _{UTRA} /2				
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz				
UTRA 5MHz channel Measurement bandwidth (Note 1)	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz				
UTRA 1.6MHz channel measurement bandwidth (Note 2) NOTE 1: Ap	1.28 MHz	1.28 MHz	1.28 MHz tence with UTRA FD	1.28MHz	1.28MHz	1.28MHz				

NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.

NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.

6.6.2.3.2A Minimum requirement UTRA for CA

For intra-band contiguous carrier aggregation the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA_{ACLR1}) and the 2^{nd} UTRA adjacent channel (UTRA_{ACLR2}). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor α =0.22. The assigned aggregated channel bandwidth power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2A-1. If the measured UTRA channel power is greater than –50dBm then the UTRA_{ACLR} shall be higher than the value specified in Table 6.6.2.3.2A-1.

CA bandwidth class / UTRA_{ACLR1/2} / measurement bandwidth CA bandwidth class C UTRA_{ACLR1} 33 dB + BW_{Channel_CA} /2 + BW_{UTRA}/2 Adjacent channel centre frequency offset (in MHz) - BW_{Channel_CA} / 2 - BW_{UTRA}/2 UTRA_{ACLR2} 36 dB + BW_{Channel_CA} /2 + 3*BW_{UTRA}/2 Adjacent channel centre frequency offset (in MHz) - $BW_{Channel_CA}/2 - 3*BW_{UTRA}/2$ CA E-UTRA channel BWchannel_CA - 2* BWGB Measurement bandwidth UTRA 5MHz channel 3.84 MHz Measurement bandwidth (Note 1) UTRA 1.6MHz channel 1.28 MHz measurement bandwidth (Note 2) NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.

Table 6.6.2.3.2A-1: Requirements for UTRA_{ACLR1/2}

6.6.2.3.3A Minimum requirements for CA E-UTRA

For intra-band contiguous carrier aggregation the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-UTRA $_{ACLR}$) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-1. If the measured adjacent channel power is greater than - 50dBm then the E-UTRA $_{ACLR}$ shall be higher than the value specified in Table 6.6.2.3.3A-1.

	CA bandwidth class / CA E-UTRA _{ACLR} / Measurement bandwidth		
	CA bandwidth class C		
CA E-UTRA _{ACLR}	30 dB		
CA E-UTRA channel Measurement bandwidth	BWchannel_CA - 2* BWGB		
Adjacent channel centre frequency offset (in MHz)	+ BWChannel_CA / - BWChannel CA		

Table 6.6.2.3.3A-1: General requirements for CA E-UTRA_{ACLR}

6.6.2.4 Void

6.6.2.4.1 Void

6.6.2A Void

<reserved for future use>

6.6.2B Out of band emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.6.2 apply.

6.6.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements inline with SM.329 [2] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.3.1 Minimum requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.6.3.1-2 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.1-1: Boundary between E-UTRA out of band and spurious emission domain

Channel	1.4	3.0	5	10	15	20
bandwidth	MHz	MHz	MHz	MHz	MHz	MHz
OOB boundary Foob (MHz)	2.8	6	10	15	20	25

Frequency Range **Maximum Level** Measurement bandwidth Note -36 dBm 1 kHz $9 \text{ kHz} \le \text{f} < 150 \text{ kHz}$ $150 \text{ kHz} \le f < 30 \text{ MHz}$ -36 dBm 10 kHz $30 \text{ MHz} \le f < 1000 \text{ MHz}$ -36 dBm 100 kHz $1 \text{ GHz} \le f < 12.75 \text{ GHz}$ -30 dBm 1 MHz 12.75 GHz ≤ f < 5th harmonic of the upper frequency edge of the -30 dBm 1 MHz 1 UL operating band in GHz NOTE 1: Applies for Band 22, Band 42 and Band 43

Table 6.6.3.1-2: Spurious emissions limits

6.6.3.1A Minimum requirements for CA

This clause specifies the spurious emission requirements for carrier aggregation.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth (Table 5.6A-1). For frequencies Δf_{OOB} greater than F_{OOB} as specified in Table 6.6.3.1A-1 the spurious emission requirements in Table 6.6.3.1-2 are applicable.

Table 6.6.3.1A-1: Boundary between E-UTRA out of band and spurious emission domain for intraband contiguous carrier aggregation

CA Bandwidth Class	OOB boundary F _{OOB} (MHz)		
A	Table 6.6.3.1-1		
В	FFS		
С	BW _{Channel_CA} + 5		

6.6.3.2 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.2-1: Requirements

		Spurious emission Frequency range (MHz)				MBW (MHz)	Note
E-UTRA Band	Protected band				Maximu m Level (dBm)		
1	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 38, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 3, 34	F _{DL_low}	-	F _{DL_high}	-50	1	15
	Frequency range	1880	-	1895	-40	1	15,19
	Frequency range	1895	-	1915	-15.5	5	15,19,20
	Frequency range	1915	-	1920	+1.6	5	15,19,20
2	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 41, 42	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 2, 25	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
3	E-UTRA Band 1, 7, 8, 20, 33, 34, 38, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 11, 18, 19, 21	F _{DL_low}	-	F _{DL_high}	-50	1	13
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	13
4	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
5	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 41	F _{DL_low}	-	F _{DL_high}	-50	1	2
6	E-UTRA Band 1, 9, 11, 34	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	860	-	875	-37	1	
	Frequency range	875	-	895	-50	1	
	Frequency range	1884.5	-	1919.6	-41	0.3	7
		1884.5	-	1915.7	1		8
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2570	-	2575	+1.6	5	15, 16, 20
	Frequency range	2575	-	2595	-15.5	5	15, 16, 20
	Frequency range	2595	-	2620	-40	1	15, 16
8	E-UTRA Band 1, 20, 33, 34, 38, 39, 40	F_{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA band 3	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA band 7	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 8	F_{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F_{DL_low}	-	F _{DL_high}	-50	1	18
	Frequency range	860		890	-40	1	15, 18
	Frequency range	1884.5		1915.7	-41	0.3	8, 18
9	E-UTRA Band 1, 11, 18, 19, 21, 34	F_{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
11	E-UTRA Band 1, 11, 18, 19, 21, 34, 42	F _{DL_low}	_	F _{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
12	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 4, 10	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 4, 10	FDL_low	-	FDL_high	-50	1	15
13	E-UTRA Band 12 E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 41	FDL_low	-	FDL_high	-50	1	10
	Frequency range	769	-	775	-35	0.00625	15
	1	, , ,	<u> </u>			0.00020	

	1 e	700		005	0.5	0.00005	44.45
	Frequency range	799	-	805	-35	0.00625	11, 15
	E-UTRA Band 14	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 24	F _{DL_low}	-	F _{DL_high}	-50	1	2
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	F _{DL_low}	-	F _{DL_high}	-50	1	
	23, 24, 25, 41	. 52_1011		· DL_mgn			
	Frequency range	769		775	-35	0.00625	12, 15
			-				
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
17	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25,	F _{DL_low}	-	F_{DL_high}	-50	1	
	41						
	E-UTRA Band 4, 10	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 12	F _{DL_low}	_	F _{DL_high}	-50	1	15
18	E-UTRA Band 1, 11, 21, 34, 42				-50	1	10
10		F _{DL_low}	-	F _{DL_high}			
	Frequency range	860	-	890	-40	1	
		1884.5	-	1915.7	-41	0.3	8
	Frequency range						
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
19	E-UTRA Band 1, 11, 21, 34, 42	F _{DL_low}	-	F _{DL_high}	-50	1	
	2 3110 (Bana 1, 11, 21, 31, 12	1884.5		1915.7	-41	0.3	8
	Frequency range	1004.0	-	1910.7	-41	0.3	O
	Frequency range	945		960	-50	1	
			<u> </u>				
	Frequency range	1839.9	-	1879.9	-50	1	
20	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34,	F_{DL_low}	-	F_{DL_high}	-50	1	
	40, 43]		
	E-UTRA Band 20	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 38, 42	F _{DL_low}	_	F _{DL_high}	-50	1	2
21	E-UTRA Band 1, 18, 19, 34, 42				-50	1	
21		F _{DL_low}	-	F _{DL_high}			0
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
22	E-UTRA Band 1, 3, 7, 8, 20, 33, 34, 38,	F _{DL} low	-	F _{DL_high}	-50	1	
	39, 40, 43	52_1011		1 DLg			
	Frequency range	3510	-	3525	-40	1	15
							13
	Frequency range	3525	-	3590	-50	1	
23	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23,	F _{DL_low}	-	F_{DL_high}	-50	1	
	24, 41						
24	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	F _{DL_low}	-	F _{DL_high}	-50	1	
	23, 24, 25, 41			_ 3			
25	E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23,	F _{DL_low}	_	F _{DL_high}	-50	1	
23		I DL_IOW	_	I DL_nign	-30	· ·	
	24, 41, 42						4.5
	E-UTRA Band 2	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 25	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 43	F_{DL_low}	-	F _{DL_high}	-50	1	2
33	E-UTRA Band 1, 7, 8, 20, 22, 34, 38, 40,	F _{DL} low	<u> </u>	F _{DL_high}	-50	1	5
33		I DL_IOW	-	ı ∪∟_nigh	-30	ı	5
	42, 43	-		_	F.0		4.5
	E-UTRA Band 3	F _{DL_low}	-	F _{DL_high}	-50	1	15
34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20,	F _{DL_low}	-	F_{DL_high}	-50	1	5
	21, 22, 33, 38,39, 40, 42, 43						
	Frequency range	1884.5	-	1915.7	-41	0.3	8
35							
36					1		
					1		
37	ELITRA D. 140 0 00 00 00 00 00	_		_			
38	E-UTRA Band 1,3, 8, 20, 22, 33, 34, 40,	F _{DL_low}	-	F _{DL_high}	-50	1	
	42, 43						
	Frequency range	2620	-	2645	-15.5	5	15, 17, 20
	Frequency range	2645	-	2690	-40	1	15, 17
39	E-UTRA Band 22, 34, 40, 42	F _{DL_low}	_	F _{DL_high}	-50	1	-,
33							2
10	E-UTRA Band 43	F _{DL_low}	_	F _{DL_high}	-50	1	2
40	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34,	F _{DL_low}	-	F _{DL_high}	-50	1	
	38, 39, 42, 43						
41	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	F _{DL_low}	-	F _{DL_high}	-50	1	
	23, 24, 25						
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11,	F _{DL_low}	-	F _{DL_high}	-50	1	
	18, 19, 20, 21, 25, 33, 34, 38, 40	. DL_IOW		. DL_IIIGII		•	
L	10, 10, 20, 21, 20, 00, 07, 00, 40	J			L		

	Frequency range	1884.5	ı	1915.7	-41	0.3	8
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20,	F_{DL_low}	-	F _{DL_high}	-50	1	
	25, 33, 34, 38, 40						

- NOTE 1: F_{DL} low and F_{DL} high refer to each E-UTRA frequency band specified in Table 5.5-1
- NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x Lcrb x 180kHz), where N is 2, 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: N/A
- NOTE 4: N/A
- NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band
- NOTE 6: N/A.
- NOTE 7: Applicable when co-existence with PHS system operating in 1884.5-1919.6MHz.
- NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.
- NOTE 9: N/A.
- NOTE 10: N/A.
- NOTE 11: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD
- NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB
- NOTE 13: This requirement applies for 5, 10, 15 and 20 MHz E-UTRA channel bandwidth allocated within 1744.9MHz and 1784.9MHz.
- NOTE 14: N/A.
- NOTE 15: These requirements also apply for the frequency ranges that are less than Foob (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.
- NOTE 16: This requirement is applicable for any channel bandwidths within the range 2500 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 17: This requirement is applicable for any channel bandwidths within the range 2570 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers with channel bandwidth overlapping the frequency range 2615 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE *P-Max.*NOTE 18: This requirement is applicable only for the following cases:
 - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 902.5 MHz $\leq F_c$ < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB
 - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 907.5 MHz ≤ F_c ≤ 912.5 MHz without any restriction on uplink transmission bandwidth.
 - for carriers of 10 MHz channel bandwidth when carrier centre frequency (F_c) is F_c = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RB_{start} > 3.
- NOTE 19: This requirement is applicable for any channel bandwidths within the range 1920 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 20: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
- NOTE 21 N/A.
- NOTE 22 N/A.

NOTE: The restriction on the maximum uplink transmission to 54 RB in Notes 16, 17, and 19 of Table 6.6.3.2-1 is intended for conformance testing and may be applied to network operation to facilitate coexistence when the aggressor and victim bands are deployed in the same geographical area. The applicable spurious emission requirement of -15.5 dBm/5MHz is a least restrictive technical condition for FDD/TDD coexistence and may have to be revised in the future.

6.6.3.2A Spurious emission band UE co-existence for CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.2A-1: Requirements

E-		Spurious emission								
UTRA CA Config uration	Protected band	Frequency range (MHz)		Maximu m Level (dBm)	MBW (MHz)	Note				
CA_1C	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 38, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1				
	E-UTRA Band 3	F _{DL_low}	-	F _{DL_high}	-50	1	8			
CA 40	F LITPA Panel 4 2 7 9 20 22 23 24									
CA_40 C	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34, 38, 39, 42, 43	F _{DL} low	_	FDL high	-50	1				
NOTE 1:										
NOTE 2:	As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are									

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x Lcrb x 180kHz), where N is 2, 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: To meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 4: N/A NOTE 5: N/A NOTE 6: N/A NOTE 7: N/A

NOTE 8: The requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 9: N/A

6.6.3.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.6.3.3.1 Minimum requirement (network signalled value "NS_05")

When "NS_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.1-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.1-1: Additional requirements (PHS)

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)			Measurement bandwidth	Note	
, ,	5	10	15	20		
	MHz	MHz	MHz	MHz		
1884.5 ≤ f ≤1915.7	-41	-41	-41	-41	300 KHz	1

NOTE 1: Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is larger than or equal to the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as defined in subclause 5.6. Additional restrictions apply for operations below this point.

The requirements in Table 6.6.3.3.1-1 apply with the additional restrictions specified in Table 6.6.3.3.1-2 when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is less than the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned.

Table 6.6.3.3.1-2: RB restrictions for additional requirement (PHS).

15 MHz channel bandwidth with f _c = 1932.5 MHz						
RB _{start}	0-7	8-66	67-74			
L _{CRB}	N/A	≤ MIN(30, 67 – RB _{start})	N/A			
	20 MHz channel bandwidth with fc = 1930 MHz					
RB _{start}	0-23	24-75	76-99			
LCRB	N/A	≤ MIN(24, 76 – RB _{start})	N/A			

6.6.3.3.2 Minimum requirement (network signalled value "NS_07")

When "NS_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.2-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.2-1: Additional requirements

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth		
		10 MHz			
769 :	≤ f ≤ 775	-57	6.25 kHz		
NOTE:	NOTE: The emissions measurement shall be sufficiently power averaged to ensure standard deviation < 0.5 dB.				

6.6.3.3.3 Minimum requirement (network signalled value "NS_08")

When "NS 08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.3-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.3-1: Additional requirement

Frequency band	Channel band	Measurement bandwidth		
(MHz)	5MHz	10MHz	15MHz	
860 ≤ f ≤ 890	-40	-40	-40	1 MHz

6.6.3.3.4 Minimum requirement (network signalled value "NS_09")

When "NS 09" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.4-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.4-1: Additional requirement

Frequency band (MHz)	Channel bar	Measurement bandwidth		
	5MHz	10MHz	15MHz	
1475.9 ≤ f ≤ 1510.9	-35	-35	-35	1 MHz

NOTE 1: Void

NOTE 2: To improve measurement accuracy, A-MPR values for NS_09 specified in Table 6.2.4-1 in subclause 6.2.4 are derived based on 100 kHz RBW.

6.6.3.3.5	Void
6.6.3.3.6	Void
6.6.3.3.7	Void
6.6.3.3.8	Void
6.6.3.3.9	Void
6.6.3.3.10	Void
6.6.3.3.11	Void
6.6.3.3.12	Void

6.6.3.3.13 Minimum requirement (network signalled value " NS_11")

When " NS_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.13-1. These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.13-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10, 15, 20 MHz	Measurement bandwidth
E-UTRA Band 2	-50	1 MHz
1998 ≤ f ≤ 1999	-21	1 MHz
1997 ≤ f < 1998	-27	1 MHz
1996 ≤ f < 1997	-32	1 MHz
1995 ≤ f < 1996	-37	1 MHz
1990 ≤ f < 1995	-40	1 MHz

6.6.3.3.14 Minimum requirement (network signalled value " NS_20")

When "NS_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.14-1. These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.14-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth			
1990 ≤ f < 1999	-40	1 MHz			
1999 ≤ f ≤ 2000	-40	Note 1			
Note 1: The measurement bandwidth is 1% of the applicable E-UTRA channel bandwidth.					

6.6.3.3.15 Minimum requirement (network signalled value "NS_22")

When " NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.15-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.15-1: Additional requirement

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm)	MBW		
	5, 10, 15, 20 MHz				
3400	≤ f ≤ 3800	-23 (Note 1, Note 3)	5 MHz		
		-40 (Note 2)			
Note 1:	from the lowe	equirement applies within an offset between 5 MHz and 25 MHz ne lower and from the upper edge of the channel bandwidth, ever these frequencies overlap with the specified frequency band.			
Note 2:	, , , , , , , , , , , , , , , , , , , ,				
Note 3: This emission limit might imply risk of harmful interference to UE(s) oper in the protected operating band.			o UE(s) operating		

6.6.3.3.16 Minimum requirement (network signalled value "NS_23")

When "NS 23" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.16-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.16-1: Additional requirement

	ency band MHz)	MBW	
3400 ±	≤ f ≤ 3800	-23 (Note 1, Note 4)	5 MHz
		-40 (Note 2)	1 MHz
NOTE 1:	This requiren	nent applies within an offset between 5 MHz +	- F _{offset_NS_23}
	and 25 MHz	+ F _{offset_NS_23} from the lower and from the upper	er edges of
	the channel b	andwidth, whenever these frequencies overlap	with the
	specified freq	uency band.	
NOTE 2:	This requiren	thent applies from 3400 MHz to 25 MHz $+$ F _{ofi}	fset_NS_23
	below the lov	ver E-UTRA channel edge and from 25 MHz -	 +
	Foffset NS 23 ab	ove the upper E-UTRA channel edge to 3800	MHz.
NOTE 3:	F _{offset_NS_23} is:		
	0 MHz for 5	MHz channel BW,	
	5 MHz for 10	MHz channel BW,	
	9 MHz for 15	MHz channel BW and	
	12 MHz for 2	0 MHz channel BW.	
NOTE 4:	This emission	n limit might imply risk of harmful interference	e to UE(s)
	operating in t	he protected operating band.	. ,

6.6.3.3A Additional spurious emissions for CA

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell reconfiguration message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.6.3.3A.1 Minimum requirement for CA_1C (network signalled value "CA_NS_01")

When "CA_NS_01" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.1-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.1-1: Additional requirements (PHS)

Protected band	Frequenc	y rar	nge (MHz)	Maximum Level (dBm)	MBW (MHz)	Note
E-UTRA band 34	F_{DL_low}	-	F _{DL_high}	-50	1	
Frequency range	1884.5	-	1915.7	-41	0.3	1
NOTE 1: Applicable v	hen the aggre	gate	d channel band	dwidth is confined within frequency	cy range 1940 – 19	980 MHz

6.6.3.3A.2 Minimum requirement for CA_1C (network signalled value "CA_NS_02")

When "CA_NS_02" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.2-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.2-1: Additional requirements

Protected band	Frequenc	y ra	nge (MHz)	Maximum Level (dBm)	MBW (MHz)
E-UTRA band 34	F_{DL_low}	-	F _{DL_high}	-50	1
Frequency range	1900	-	1915	-15.5	5
Frequency range	1915	-	1920	+1.6	+1.6

6.6.3.3A.3 Minimum requirement for CA 1C (network signalled value "CA NS 03")

When "CA_NS_03" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.3-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.3-1: Additional requirements

Protected band	Frequency range (MHz)		nge (MHz)	Maximum Level (dBm)	MBW (MHz)	Note
E-UTRA band 34	F_{DL_low}	•	F _{DL_high}	-50	1	
Frequency range	1880	•	1895	-40	1	
Frequency range	1895	-	1915	-15.5	5	1, 2
Frequency range	1915	•	1920	+1.6	5	1, 2

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band

6.6.3A Void

<reserved for future use>

6.6.3B Spurious emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.3 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-1.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.6.3 apply.

6.6A Void

6.6B Void

6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.7.1 Minimum requirement

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through E-UTRA rectangular filter with measurement bandwidth shown in Table 6.7.1-1.

The requirement of transmitting intermodulation is prescribed in Table 6.7.1-1.

Table 6.7.1-1: Transmit Intermodulation

BW Channel (UL)	5M	5MHz		MHz	151	ИHz	20MHz	
Interference Signal Frequency Offset	5MHz	10MHz	10MHz	20MHz	15MHz	30MHz	20MHz	40MHz
Interference CW Signal Level		-40dBc						
Intermodulation Product	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc
Measurement bandwidth	4.5MHz	4.5MHz	9.0MHz	9.0MHz	13.5MHz	13.5MHz	18MHz	18MHz

6.7.1A Minimum requirement for CA

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product on both component carriers when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna

port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1A-1.

For intra-band contiguous carrier aggregation the requirement of transmitting intermodulation is specified in Table 6.7.1A-1.

CA bandwidth class(UL)

Interference Signal Frequency Offset

Interference CW Signal Level

Intermodulation Product

C

BWchannel_CA

2*BWchannel_CA

2*BWchannel_CA

-40dBc

-40dBc

-35dBc

Table 6.7.1A-1: Transmit Intermodulation

BW_{Channel CA}- 2* BW_{GB}

6.7.1B Minimum requirement for UL-MIMO

Measurement bandwidth

For UE supporting UL-MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.7.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.7.1 apply.

- 6.8 Void
- 6.8.1 Void
- 6.8A Void

6.8B Time alignment error for UL-MIMO

For UE(s) with multiple transmit antenna connectors supporting UL-MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

6.8B.1 Minimum Requirements

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

7 Receiver characteristics

7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sections below.

With the exception of subclause 7.3, the requirements shall be verified with the network signalling value NS_01 configured (Table 6.2.4-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1

7.2 Diversity characteristics

The requirements in Section 7 assume that the receiver is equipped with two Rx port as a baseline. These requirements apply to all UE categories unless stated otherwise. Requirements for 4 ports are FFS. With the exception of subclause 7.9 all requirements shall be verified by using both (all) antenna ports simultaneously.

7.3 Reference sensitivity power level

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

7.3.1 Minimum requirements (QPSK)

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2

Table 7.3.1-1: Reference sensitivity QPSK PREFSENS

		Ch	annel bar	ndwidth			
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1			-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6			-100	-97			FDD
7			-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD
9			-99	-96	-94.2	-93	FDD
10			-100	-97	-95.2	-94	FDD
11			-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14			-97	-94			FDD
17			-97	-94			FDD
18			-100	-97	-95.2		FDD
19			-100	-97	-95.2		FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97	-95.2	-94	FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
33			-100	-97	-95.2	-94	TDD
34			-100	-97	-95.2		TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37			-100	-97	-95.2	-94	TDD
38			-100	-97	-95.2	-94	TDD
39			-100	-97	-95.2	-94	TDD
40			-100	-97	-95.2	-94	TDD
41			-98	-95	-93.2	-92	TDD
42			-99	-96	-94.2	-93	TDD
43			-99	-96	-94.2	-93	TDD

NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3: The signal power is specified per port

NOTE 4: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

NOTE 5: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1-1 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1-2.

NOTE: Table 7.3.1-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

For the UE which supports inter-band carrier aggregation configuration in Table 7.3.1-1A with uplink in one E-UTRA band, the minimum requirement for reference sensitivity in Table 7.3.1-1 shall be increased by the amount given in $\Delta R_{IB,c}$ in Table 7.3.1-1A for the applicable E-UTRA bands.

Table 7.3.1-1A: ΔR_{IB,c}

Inter-bai		E-UTRA Band	ΔR _{IB,c} [dB]						
Configu	ration		_						
CA_1A	Δ-5Δ	1	0						
OA_17	1-0/1	5	0						
NOTE 1:	The ab	ove additional tolerances are only app	plicable for the E-UTRA operating						
	bands t	that belong to the supported inter-ban	nd carrier aggregation						
	configu	rations							
NOTE 2:	The ab	ove additional tolerances also apply in	n intra-band CA and non-						
		ated operation for the supported E-U							
		ported inter-band carrier aggregation							
NOTE 3:		the UE supports more than one of th	•						
110120.		ation configurations and a E-UTRA of							
		er-band carrier aggregation configura							
	-	When the E-UTRA operating band							
	_		all be the average of the tolerances						
		in Table 7.3.1-1A, truncated to on	<u> </u>						
		for that operating band among the							
		case there is a harmonic relation	•						
			ance among the different supported						
		carrier aggregation configurations	involving such band shall be						
		applied							
	-	When the E-UTRA operating band frequency range is >1GHz, the							
		applicable additional tolerance sh							
		Table 7.3.1-1A that would apply for	or that operating band among the						
		supported CA configurations							

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

Table 7.3.1-2: Uplink configuration for reference sensitivity

	E-UTRA E	Band / Ch	annel bai	ndwidth / I	N _{RB} / Duple	ex mode	
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1			25	50	75	100	FDD
2	6	15	25	50	50 ¹	50 ¹	FDD
3	6	15	25	50	50 ¹	50 ¹	FDD
4	6	15	25	50	75	100	FDD
5	6	15	25	25 ¹			FDD
6			25	25 ¹			FDD
7			25	50	75	75¹	FDD
8	6	15	25	25 ¹			FDD
9			25	50	50 ¹	50 ¹	FDD
10			25	50	75	100	FDD
11			25	25 ¹			FDD
12	6	15	20 ¹	20 ¹			FDD
13			20 ¹	20 ¹			FDD
14			15 ¹	15 ¹			FDD
17			20 ¹	20 ¹			FDD
18			25	25 ¹	25 ¹		FDD
19			25	25 ¹	25 ¹		FDD
20			25	20 ¹	20 ³	20 ³	FDD
21			25	25 ¹	25 ¹		FDD
22			25	50	50 ¹	50 ¹	FDD
23	6	15	25	50	75	100	FDD
24			25	50			FDD
25	6	15	25	50	50 ¹	50 ¹	FDD
33			25	50	75	100	TDD
34			25	50	75		TDD
35	6	15	25	50	75	100	TDD
36	6	15	25	50	75	100	TDD
37			25	50	75	100	TDD
38			25	50	75	100	TDD
39			25	50	75	100	TDD
40			25	50	75	100	TDD
41			25	50	75	100	TDD
42			25	50	75	100	TDD
43			25	50	75	100	TDD

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: For the UE which supports both Band 11 and Band 21 the uplink configuration for reference sensitivity is FFS.

NOTE 3: ³ refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16

Unless given by Table 7.3.1-3, the minimum requirements specified in Tables 7.3.1-1 and 7.3.1-2 shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Network E-UTRA Signalling **Band** value 2 NS 03 4 NS_03 10 NS_03 12 NS_06 13 NS 06 14 NS 06 17 NS_06 19 NS_08 21 NS_09 23 NS 03

Table 7.3.1-3: Network signalling value for reference sensitivity

7.3.1A Minimum requirements (QPSK) for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2. The reference sensitivity is defined to be met with both downlink component carriers active and either of the uplink carriers active. The uplink resource blocks shall be located as close as possible to the primary downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1). The primary downlink operating band is the downlink band of the active uplink operating band. The UE shall meet the requirements specified in subclause 7.3.1.

For intra-band contiguous carrier aggregation the throughput of each component carrier shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1A-1. Table 7.3.1A-1 specifies the maximum number of allocated uplink resource blocks for which the intra-band contiguous carrier aggregation reference sensitivity requirement shall be met. The PCC and SCC allocations as defined in Table 7.3.1A-1 form a contiguous allocation where TX-RX frequency separations of the component carriers are as defined in Table 5.7.4-1. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than the downlink SCC center frequency.

Table 7.3.1A-1: Intra-band CA uplink configuration for reference sensitivity

CA	CA configuration / CC combination / N _{RB_agg} / Duplex mode									
Unlink CA configuration	100RB+50RB		75RB+75RB		100RB+100RB		Dunley Made			
Uplink CA configuration	PCC	scc	PCC	scc	PCC	scc	Duplex Mode			
CA_1C	N/A	N/A	75	54	100	30	FDD			
CA_40C	100	50	75	75	100	100	TDD			

NOTE 1: The carrier centre frequency of SCC in the UL operating band is configured closer to the DL operating band.

NOTE 2: The transmitted power over both PCC and SCC shall be set to Pumax as defined in subclause 6.2.5A.

NOTE 3: The UL resource blocks in both PCC and SCC shall be confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

7.3.1B Minimum requirements (QPSK) for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.3.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{UMAX} is the total transmitter power over the two transmit antenna connectors.

7.3.2 Void

7.4 Maximum input level

This is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

7.4.1 Minimum requirements

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1-1

Table 7.4.1-1: Maximum input level

Rx Parameter	Units	Channel bandwidth						
	1.4 3 5 10 15 20 MHz MHz MHz MHz MHz MHz MHz							
Power in Transmission Bandwidth Configuration	dBm	-25						
NOTE 1: The transmitter shall specified in Table 7. NOTE 2: Reference measure	3.1-2 with	Pcmax_L a	is defined i	in subclau	se 6.2.5.	· ·		

dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

7.4.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the maximum input level is defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.4.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier. The downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.4.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels over each component carrier as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1A-1.

Table 7.4.1A-1: Maximum input level for intra-band contiguous CA

Rx Parameter	Units	s CA Bandwidth Class							
		Α	В	С	D	E	F		
Power in largest Transmission Bandwidth Configuration CC	dBm			-25					
Power in each other CC	dBm			-25 + 10log(N RB,c /NRB,larg est BW)					

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L or Pcmax_L_ca as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

7.4.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements in Clause 7.4.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter $P_{\text{CMAX_L}}$ is defined as the total transmitter power over the two transmit antenna connectors.

7.4A Void

7.4A.1 Void

7.5 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

7.5.1 Minimum requirements

The UE shall fulfil the minimum requirement specified in Table 7.5.1-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1-2 and Table 7.5.1-3 where the throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

Table 7.5.1-1: Adjacent channel selectivity

			Channel bandwidth				
Rx Parameter	Units	1.4	3	5	10	15	20
		MHz	MHz	MHz	MHz	MHz	MHz
ACS	dB	33	33	33	33	30	27

Table 7.5.1-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units		Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
Power in	dBm									
Transmission Bandwidth Configuration				REFSENS	s + 14 dB					
	dBm	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS			
Pinterferer		+45.5dB	+45.5dB	+45.5dB	+45.5dB	+42.5dB	+39.5dB			
BWInterferer	MHz	1.4	3	5	5	5	5			
Finterferer (offset)	MHz	1.4+0.0025	3+0.0075	5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025			
		/	/	/	/	/	/			
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-0.0025			

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

Rx Parameter	Units	Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in Transmission Bandwidth Configuration	dBm	-56.5	-56.5	-56.5	-56.5	-53.5	-50.5		
PInterferer	dBm			-2	5				
BWInterferer	MHz	1.4	3	5	5	5	5		
FInterferer (offset)	MHz	1.4+0.0025 /	3+0.0075 /	5+0.0025 /	7.5+0.0075 /	10+0.0125 /	12.5+0.0025 /		
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-0.0025		

Table 7.5.1-3: Test parameters for Adjacent channel selectivity, Case 2

NOTE 1: The transmitter shall be set to 24dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

7.5.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band, the adjacent channel requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.5.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.5.1A-2 or 7.5.1A-3 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement specified in Table 7.5.1A-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3.

Table 7.5.1A-1: Adjacent channel selectivity

		CA Bandwidth Class						
Rx Parameter	Units	В	B C D E F					
ACS	dB		24					

Table 7.5.1A-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units		CA	A Bandwidth	Class	
		В	С	D	E	F
Pw in Transmission Bandwidth Configuration, per CC			REFSENS + 14 dB			
PInterferer	dBm		Aggregated power + 22.5 dB			
BW _{Interferer}	MHz		5			
F _{Interferer} (offset)	MHz		2.5 + F _{offset} / -2.5 - F _{offset}			

NOTE 1: The transmitter shall be set to 4dB below P_{CMAX_L,c} or P_{CMAX_L} as defined in subclause 6.2.5A.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

NOTE 3: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $\big \lfloor F_{\text{interferer}} \big / 0.015 + 0.5 \big \rfloor 0.015 + 0.0075 \, \text{MHz} \text{ to be offset from the sub-carrier raster}.$

Table 7.5.1 A-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units	CA Bandwidth Class						
		В	С	D	E	F		
Pw in Transmission Bandwidth Configuration, per CC	dBm		-47.5+10 log ₁₀ (N _{RB,c} / N _{RB agg})					
PInterferer	dBm			-25				
BWInterferer	MHz		5					
F _{Interferer} (offset)	MHz		2.5+ F _{offset}					
			/ -2.5- F _{offset}					

- NOTE 1: The transmitter shall be set to 24dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1
- NOTE 3: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $|F_{interferer}|/0.015 + 0.5|0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.

7.5.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.5.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

7.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels..

7.6.1.1 Minimum requirements

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1-1 and 7.6.1.1-2.

Table 7.6.1.1-1: In band blocking parameters

Rx parameter	Units	Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Power in			REFSENS	S + channel bandy	width specific va	ilue below	I.	
Transmission Bandwidth Configuration	dBm	6	6	6	6	7	9	
BW _{Interferer}	MHz	1.4	3	5	5	5	5	
Floffset, case 1	MHz	2.1+0.0125	4.5+0.0075	7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125	
Floffset, case 2	MHz	3.5+0.0075	7.5+0.0075	12.5+0.0075	12.5+0.0125	12.5+0.0025	12.5+0.0075	

NOTE 1: The transmitter shall be set to 4dB below Pcmax L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

Table 7.6.1.1-2: In-band blocking

E-UTRA band	Parameter	Unit	Case 1	Case 2	Case 3	Case 4
	Pinterferer	dBm	-56	-44		
	F _{Interferer} (offset)	MHz	=-BW/2 - Floffset,case 1 & =+BW/2 + Floffset,case 1	≤-BW/2 - F _{loffset,case 2} & ≥+BW/2 + F _{loffset,case 2}		
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 25, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43	F _{Interferer}	MHz	(Note 2)	F _{DL_low} – 15 to F _{DL_high} + 15	Void	Void

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - $F_{\text{loffset, case 1}}$ and

b. the carrier frequency +BW/2 + Floffset, case 1

NOTE 3: Finterferer range values for unwanted modulated interfering signal are interferer center frequencies.

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{Interferer}$ power defined in Table 7.6.1.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.6.1.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the in-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier while both downlink carriers are active. For the UE which supports inter band CA configuration in Table 7.3.1-1A , $P_{Interferer}$ power defined in Table 7.6.1.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A .

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.1.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.1.1A-1 and Tables 7.6.1.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1A-1 and 7.6.1.1A-2.

Table 7.6.1.1A-1: In band blocking parameters

Rx Parameter	Units	CA Bandwidth Class								
		В	С	D	E	F				
Pw in Transmission	dBm	REFSENS + CA Bandwidth Class specific value below								
Bandwidth	ubili		12							
Configuration, per CC			12							
BWInterferer	MHz		5							
F _{loffset, case 1}	MHz		7.5							
Floffset, case 2	MHz		12.5							

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

Table 7.6.1.1A-2: In-band blocking

CA configuration	Parameter	Unit	Case 1	Case 2
	PInterferer	dBm	-56	-44
	F _{Interferer} (offset)	MHz	=-F _{offset} — F _{loffset,case 1} & =+F _{offset} + F _{loffset,case 1}	≤-F _{offset} - F _{loffset,case 2} & ≥+F _{offset} + F _{loffset,case 2}
CA_1C, CA_40C	F _{Interferer} (Range)	MHz	(Note 2)	F _{DL_low} – 15 to F _{DL_high} + 15

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency - F_{offset} - $F_{\text{Ioffset, case 1}}$ and

b. the carrier frequency $+ F_{offset} + F_{Ioffset, case 1}$

NOTE 3: Foffset is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.

NOTE 4: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\left|F_{interferer}/0.015+0.5\right|0.015+0.0075\,\text{MHz}$ to be offset from the sub-carrier raster.

7.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1 and subclause 7.6.1 shall be applied.

7.6.2.1 Minimum requirements

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1-2.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to $\max(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and L_{CRBs} is the

number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Table 7.6.2.1-1: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		REFSENS + channel bandwidth specific value below					e below
Transmission Bandwidth Configuration	dBm	6	6	6	6	7	9

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.

Table 7.6.2.1-2: Out of band blocking

E-UTRA band	Parameter	Units		Fre	quency	•
			range 1	range 2	range 3	range 4
	Pinterferer	dBm	-44	-30	-15	-15
1, 2, 3, 4, 5 6, 7, 8, 9, 10,			F _{DL_low} -15 to F _{DL_low} -60	F _{DL_low} -60 to F _{DL_low} -85	F _{DL_low} -85 to 1 MHz	-
11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 (NOTE 2), 43 (NOTE 2)	Finterferer (CW)	MHz	F _{DL_high} +15 to F _{DL_high} + 60	F _{DL_high} +60 to F _{DL_high} +85	F _{DL_high} +85 to +12750 MHz	-
2, 5, 12, 17	Finterferer	MHz	-	-	-	Ful low - Ful i

NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.

NOTE 2: The power level of the interferer (P_{Interferer}) for Range 3 shall be modified to -20 dBm for F_{Interferer} > 2800 MHz and F_{Interferer} < 4400 MHz.

7.6.2.1A Minimum requirements for CA

For inter-band carrier aggregation with the uplink assigned to one E-UTRA band, the out-of-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput in the downlink measured shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1A-0. The UE shall meet these requirements for each component carrier while both downlink carriers are active.

Table 7.6.2.1A-0: out-of-band blocking for inter-band carrier aggregation with one active uplink

Parameter	3		Range 2	Range 3			
P_w	dBm	Table 7.6.	2.1-1 for both component	carriers			
Pinterferer	dBm	$-44 + \Delta R_{IB,c}$	$-30 + \Delta R_{IB,c}$	-15 + $\Delta R_{IB,c}$			
Finterferer	MHz	$-60 < f - F_{DL_Low(1)} < -15$	$-85 < f - F_{DL_Low(1)} \le -60$	$1 \le f \le F_{DL_Low(1)} - 85$			
(CW)		or	or	or			
		$-60 < f - F_{DL_Low(2)} < -15$	$-85 < f - F_{DL_Low(2)} \le -60$	F _{DL_High(1)} + 85 ≤ f			
		or	or	$\leq F_{DL_Low(2)} - 85$			
		$15 < f - F_{DL_High(1)} < 60$	$60 \le f - F_{DL_High(1)} < 85$	or			
		or	or	F _{DL_High(2)} + 85 ≤ f			
		$15 < f - F_{DL_High(2)} < 60$	$60 \le f - F_{DL_High(2)} < 85$	≤ 12750			
NOTE 1: F	DL_Low(1)	and F _{DL_High(1)} denote the I	respective lower and uppe	er frequency limits of			
th	ne lower	r operating band, FDL_Low(2)	and FDL_High(2) the respect	ive lower and upper			
		y limits of the upper operat					
NOTE 2: F	or F _{DL_L}	$_{\text{ow}(2)} - F_{\text{DL_High}(1)} < 145 \text{ MHz}$	z and $F_{Interferer}$ in $F_{DL_High(1)}$	$< f < F_{DL_Low(2)}, F_{Interferer}$			
С	an be in	both Range 1 and Range	2. Then the lower of the F	Pinterferer applies.			
NOTE 3: F	or FDL_L	$low(1) - 15 MHz \le f \le F_{DL_Hig}$	$_{h(1)}$ + 15 MHz and F_{DL_Low}	₂₎ – 15 MHz ≤ f ≤			
F	F _{DL_High(2)} + 15 MHz the appropriate adjacent channel selectivity and in-band						
b	locking	in the respective subclause	es 7.5.1A and 7.6.1.1A sh	all be applied.			
NOTE 4: Δ	R _{IB,c} ac	cording to Table 7.3.1-1A	applies when serving cell	c is measured.			

For Table 7.6.2.1A-0 in frequency ranges 1, 2 and 3, up to $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions per downlink are allowed for spurious response frequencies when measured using a step size of 1 MHz. For these exceptions the requirements in clause 7.7.1A apply.

For intra-band contiguous carrier aggregations the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.2.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.2.1A-1 and Tables 7.6.2.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For Table 7.6.2.1A-2 in frequency range 1, 2 and 3, up to $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

Table 7.6.2.1A-1: Out-of-band blocking parameters

Rx Parameter			CA B	andwidth C	Class	
		В	С	D	E	F
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSE	NS + CA B	andwidth C below	lass specifi	c value
CC			9			
NOTE 1: The transmitter shall be set to 4dB below NOTE 2: Reference measurement channel is speci FDD/TDD as described in Annex A.5.1.1/	ified in Anr					ern OP.1

Table 7.6.2.1A-2: Out of band blocking

CA configuration	Parameter	Units	Frequency				
			Range 1 Range 2		Range 3		
	PInterferer	dBm	-44	-30	-15		
			F _{DL_low} -15 to	F _{DL_low} -60 to	F _{DL_low} -85 to		
CA_1C, CA_40C	FInterferer (CW)	MHz	F _{DL_low} -60	F _{DL_low} -85	1 MHz		
CA_10, CA_400			F _{DL_high} +15 to	F _{DL_high} +60 to	F _{DL_high} +85 to		
			FDL high + 60	FDL high +85	+12750 MHz		

7.6.3 Narrow band blocking

This requirement is measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

7.6.3.1 Minimum requirements

The relative throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1-1

Table 7.6.3.1-1: Narrow-band blocking

Parameter	Unit	Channel Bandwidth					
Farameter	Offic	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
D	dDm	P _R	EFSENS + cha	nnel-bandwi	dth specific	value belo	w
Pw	dBm	22	18	16	13	14	16
P _{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55
F_{uw} (offset for $\Delta f = 15 \text{ kHz}$)	MHz	0.9075	1.7025	2.7075	5.2125	7.7025	10.2075
F_{uw} (offset for $\Delta f = 7.5 \text{ kHz}$)	MHz						

NOTE 1: The transmitter shall be set a 4 dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, P_{UW} power defined in Table 7.6.3.1-1 is increased by the amount given by $\Delta R_{B,c}$ in Table 7.3.1-1A.

7.6.3.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the narrow-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.3.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1A-1.

Table 7.6.3.1A-1: Narrow-band blocking

Parameter	Unit	CA Bandwidth Class					
Parameter	Onit	В	С	D	E	F	
Pw in Transmission Bandwidth	dBm	REF	SENS + CA Band	width Class	specific value	e below	
Configuration, per CC	UDIII		16 ⁴				
P _{uw} (CW)	dBm		-55				
F _{uw} (offset for $\Delta f = 15 \text{ kHz}$)	MHz		- F _{offset} - 0.2 / + F _{offset} + 0.2				
F_{uw} (offset for $\Delta f = 7.5 \text{ kHz}$)	MHz						

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The F_{uw} (offset)is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\lfloor F_{interferer} / 0.015 + 0.5 \rfloor 0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.
- NOTE 4: The requirement is applied for the band combinations whose component carriers' BW≥5 MHz.

7.6A Void

<Reserved for future use>

7.6B Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.6 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.7 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in subclause 7.6.2 is not met.

7.7.1 Minimum requirements

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2.

Table 7.7.1-1: Spurious response parameters

Rx parameter	Units	Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in		REF	REFSENS + channel bandwidth specific value below						
Transmission	dBm								
Bandwidth	ubili	6	6	6	6	7	9		
Configuration									

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2.

N OTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

Table 7.7.1-2: Spurious response

Parameter	Unit	Level
P _{Interferer} (CW)	dBm	-44
F _{Interferer}	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, $P_{interferer}$ power defined in Table 7.7.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.7.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the spurious response requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput measured in each downlink with $F_{interferer}$ in Table 7.6.2.1A-0 at spurious response frequencies shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. The UE shall meet these requirements for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.7.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2.

Table 7.7.1A-1: Spurious response parameters

Rx Parameter	Units	CA Bandwidth Class					
		В	C	D	E	F	
Pw in Transmission Bandwidth	dBm	REFSE	NS + CA Bar	ndwidth Class	specific value	e below	
Configuration, per CC	иын		9				
NOTE 4 TI 4 19 19 19 19 19 19 19 19 19 19 19 19 19							

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern
OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

Table 7.7.1A-2: Spurious response

Parameter	Unit	Level
P _{Interferer} (CW)	dBm	-44
F _{Interferer}	MHz	Spurious response frequencies

7.7.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.8 Intermodulation characteristics

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.

7.8.1 Wide band intermodulation

The wide band intermodulation requirement is defined following the same principles using modulated E-UTRA carrier and CW signal as interferer.

7.8.1.1 Minimum requirements

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1.1 for the specified wanted signal mean power in the presence of two interfering signals

Units Channel bandwidth **Rx Parameter** 15 MHz 1.4 MHz 3 MHz 5 MHz 10 MHz 20 MHz Power in REFSENS + channel bandwidth specific value below Transmission dBm Bandwidth 12 8 7 9 Configuration dBm PInterferer 1 -46 (CW) PInterferer 2 dBm -46 (Modulated) BW_{Interferer 2} 1.4 3 5 MHz -BW/2 -2.1 -BW/2 -4.5 -BW/2 - 7.5 Finterferer 1 (Offset) +BW/2+ 2.1 +BW/2 + 4.5 +BW/2 + 7.5MHz FInterferer 2 2*FInterferer 1 (Offset)

Table 7.8.1.1-1: Wide band intermodulation

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{interferer1}$ and $P_{interferer2}$ powers defined in Table 7.8.1.1-1 are increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.8.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the wide band intermodulation requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggegation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.8.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggreagation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.8.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1A-1

Table 7.8.1A-1: Wide band intermodulation

Rx parameter	Units	CA Bandwidth Class							
•		В	С	D	E	F			
Pw in		RE	FSENS + CA B	andwidth Class	specific value b	elow			
Transmission Bandwidth Configuration, per CC	dBm		12						
P _{Interferer 1} (CW)	dBm		-46						
P _{Interferer 2} (Modulated)	dBm			-46					
BWInterferer 2	MHz		5						
F _{Interferer 1} (Offset)	MHz		-F _{offset} -7.5 / + F _{offset} +7.5						
F _{Interferer 2} (Offset)	MHz			2*FInterferer 1					

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1.
- NOTE 4: The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz.
- NOTE 5: The F_{interferer 1} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and F_{interferer 2} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

7.8.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter $P_{\text{CMAX_L}}$ is defined as the total transmitter power over the two transmit antenna connectors.

7.8.2 Void

7.9 Spurious emissions

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

7.9.1 Minimum requirements

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1-1

Table 7.9.1-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	Note
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 5 th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	1

NOTE 1: Applies only for Band 22, Band 42 and Band 43

NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given

by PDCCH_RA/RB as defined in Annex C.3.1.

7.10 Receiver image

7.10.1 Void

7.10.1A Minimum requirements for CA

Receiver image rejection is a measure of a receiver's ability to receive the E-UTRA signal on one component carrier while it is also configured to receive an adjacent aggregated carrier. Receiver image rejection ratio is the ratio of the wanted received power on a sub-carrier being measured to the unwanted image power received on the same sub-carrier when both sub-carriers are received with equal power at the UE antenna connector.

For intra-band contiguous carrier aggregation the UE shall fulfil the minimum requirement specified in Table 7.10.1A-1 for all values of aggregated input signal up to -22 dBm.

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Table 7.10.1A-1: Receiver image rejection

		CA bandwidth class							
Rx parameter	Units	Α	В	C	D	Е	F		
Receiver image rejection	dB			25					

8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

Note: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

8.1 General

8.1.1 Dual-antenna receiver capability

The performance requirements are based on UE(s) that utilize a dual-antenna receiver.

For all test cases, the SNR is defined as

$$SNR = \frac{\hat{E}_s^{(1)} + \hat{E}_s^{(2)}}{N_{oc}^{(1)} + N_{oc}^{(2)}}$$

where the superscript indicates the receiver antenna connector. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

Table 8.1.1-1: Void

8.1.1.1 Simultaneous unicast and MBMS operations

8.1.1.2 Dual-antenna receiver capability in idle mode

8.1.2 Applicability of requirements

8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1.

Table 8.1.2.2-1: Definition of CA capability with 2DL CCs

CA Capability		CA Capability Description		
CA2_0	\sim	Intra-band contiguous CA		
CA2_A	.2	Inter-band CA		
Note 1:	CA	2_C corresponds to E-UTRA CA configurations and bandwidth		
	nbination sets defined in Table 5.6A.1-1 for 2 DL CCs.			
CA2_A2 corresponds to E-UTRA CA configurations and bandwidth				
	con	nbination sets defined in Table 5.6A.1-2 for 2 DL CCs.		

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

CA Capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA
CA2_C	20+20MHz	20+20MHz
CA2_A2	10+10MHz	NA

Note 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers.

8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3-1: Applicability and test rules for CA UE demodulation tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.1.1.1, 8.2.1.4.3	Any one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20MHz
CA tests with 2CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability	10+10 MHz, 20+20 MHz
CA tests with 2CCs in Clause 8.2.1.3.1A, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.1.7.1	CA_C	Supported FDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.2.1.1, 8.2.2.4.3	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1A, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in 8.2.2.7.1 CA_C		Supported TDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations

Note 1: The applicability and test rules are specified in this table, unless otherwise stated. Note 2: Number of the supported bandwidth combinations to be tested from each selected

CA configuration is one.

8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.2.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

8.2.1.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.1.1-1: Test Parameters

				Propa-	Correlation	Reference	ce value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.2 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.1	3-8 (Note 2)
2	2x20 MHz	R.42 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.3	5-8

Note 1: The OCNG pattern applies for each CC.

Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.

Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Parameter		Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
Davinlink navian	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
	σ	dB	0	0	0	0	0
$N_{\it oc}$ at antenna	a port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for unused PRBs			OCNG (Note 2)				
Modulation			QPSK	16QAM	64QAM	16QAM	QPSK
PDSCH transmission mode			1	1	1	1	1

Note 1: $P_{_{B}} = 0$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK

modulated.

Note 3: Void. Note 4: Void.

Table 8.2.1.1.1-2: Minimum performance (FRC)

Test	Band-	ind-		Propa- gation	Correlation matrix and	Reference value		UE - cate-
num.	width	Referencechannel	pattern	condi- tion			SNR (dB)	gory
1	10 MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	1-8
2	10 MHz	R.2 FDD	OP.1 FDD	ETU70	1x2 Low	70	-0.4	1-8
3	10 MHz	R.2 FDD	OP.1 FDD	ETU300	1x2 Low	70	0.0	1-8
4	10 MHz	R.2 FDD	OP.1 FDD	HST	1x2	70	-2.4	1-8
5	1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	0.0	1-8
	10 MHz	R.3 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	2-8
6	5 MHz	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	2-8
, ,	5 MHz	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	2-8
0	5 MHz	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	1
9	3 MHz	R.5 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	1-8
10	5 MHz	R.6 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.4	2-8
10	5 MHz	R.6-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.5	1
11	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	2-8
11	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1

40	10 MHz	R.7 FDD	OP.1 FDD	ETU70	1x2 Low	70	19.0	2-8
12	10 MHz	R.7-1 FDD	OP.1 FDD	ETU70	1x2 Low	70	18.1	1
13	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 High	70	19.1	2-8
13	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 High	70	17.8	1
14	15 MHz	R.8 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	2-8
14	15 MHz	R.8-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.8	1
	20 MHz	R.9 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	3-8
15	20 MHz	R.9-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.3	2
	20 MHz	R.9-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1
16	3 MHz	R.0 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	1-8
17	10 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	1-8
18	20 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	1-8
19	10 MHz	R.41 FDD	OP.1 FDD	EVA5	1x2 Low	70	-5.4	1-8
Note 1:	Void.							

Table 8.2.1.1.1-3: Test Parameters for CA

Parameter		Test 1-2
$ ho_{\scriptscriptstyle A}$	dB	0
$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
σ	dB	0
ntenna port	dBm/15kHz	-98
unused PRBs		OCNG (Note 2)
Modulation		QPSK
PDSCH transmission mode		1
	$ ho_{\scriptscriptstyle A}$ $ ho_{\scriptscriptstyle B}$ $ ho$ ntenna port unused PRBs ulation	$ ho_{\scriptscriptstyle A}$ dB dB $ ho_{\scriptscriptstyle B}$ dB σ dB dB or dB ntenna port dBm/15kHz unused PRBs ulation

Note 1: $P_B = 0$

Note 2:

Note 3:

Void.

Void.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Note 4: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA

				Propa-	Correlation	Referen	ce value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory

1	2x10 MHz	R.2 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.1	3-8 (Note 2)
2	2x20 MHz	R.42 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.3	5-8

Note 1: The OCNG pattern applies for each CC.

Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.

Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

8.2.1.1.2 Void

8.2.1.1.3 Void

8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.1.1.4-1: Test Parameters for Testing 1 PRB allocation

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)
PDSCH transmission	on mode		1

Note 1: $P_R = 0$

Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

first slot.

Note 3: The MBSFN portion of the MBSFN subframes shall contain

QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes,

QPSK modulated MBSFN data is used instead.

Table 8.2.1.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	Reference value	
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.29 FDD	OP.3 FDD	ETU70	1x2 Low	30	2.0	1-8

8.2.1.2 Transmit diversity performance

8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		2
Note 1: $P_B = 1$.			

Table 8.2.1.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	Category
1	10 MHz	R.11 FDD	OP.1 FDD	EVA5	2x2 Medium	70	6.8	2-8
	5 MHz	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	1
2	10 MHz	R.10 FDD	OP.1 FDD	HST	2x2	70	-2.3	1-8

8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.1.2.2-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3		
	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)		
	σ	dB	0		
N_{oc} at antenna	port	dBm/15kHz	-98		
PDSCH transmission	on mode		2		
Note 1: $P_B = 1$.					

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

ĺ	Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
	number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum (dB) Throughput (%)		Category
ſ	1	1.4 MHz	R.12 FDD	OP.1 FDD	EPA5	4x2 Medium	70	0.6	1-8
ſ	2	10 MHz	R.13 FDD	OP.1 FDD	ETU70	4x2 Low	70	-0.9	1-8

8.2.1.2.3 Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.2.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configura	tion		Non-MBSFN	Non-MBSFN
Time Offset between	Cells	μs	2.5 (synchror	nous cells)
Cell Id			0	1
ABS pattern (Note	5)		N/A	11000100 11000000 11000000 11000000 11000000
RLM/RRM Measurement (Spattern (Note 6)	Subframe		10000000 10000000 10000000 10000000 1000000	N/A
COL Cubfrage Color (Net 7)	Ccsi,0		11000100 11000000 11000000 11000000 11000000	N/A
CSI Subframe Sets (Note7)	C _{CSI,1}		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDM symbols			2	2
PDSCH transmission	mode		2	N/A
Cyclic prefix			Normal	Normal

- Note 1: $P_B = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Note 5:

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	Pattern Conditi		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11-4 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA5	EVA 5	2x2 Medium	70	3.4	2-8
Note 1:					Cell2 are	e statistically indep	pendent.		
Note 2:	SNR correspo	NR corresponds to \widehat{E}_s/N_{oc2} of cell 1.							
Note 3: Note 4:						apply for Cell 1 and er than SIB1/pagir		iated	

PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

8.2.1.3 Open-loop spatial multiplexing performance

8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas. For CA the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

Parameter	1	Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3
Note 1: $P_B = 1$.			
Note 2: Void. Note 3: Void.			

Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC)

Test num.	Band- width	Referencechannel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Reference v Fraction of maximum Throughput	SNR (dB)	UE cate- gory
1	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	(%) 70	13.0	2-8
Note 1:	Void.		•					

Note 2: Test 1 may not be executed for UE-s for which Test 1 or 2 in Table 8.2.1.3.1-4 is applicable.

Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Test 1-2
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3
	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna port		dBm/15kHz	-98
PDSCH transmission	on mode		3

Note 1: $P_{p} = 1$.

Note 2: PUCCH format 1b with channel selection is used to

feedback ACK/NACK.

Note 3: The same PDSCH transmission mode is applied to each

component carrier.

Table 8.2.1.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

			Propa- Correlation		Correlation	Reference	e value		
Test		Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate- gory	
1	2x10 MHz	R.11 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.7	3-8	
2	2x20 MHz	R.30 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.2	5-8	

Note 1: The OCNG pattern applies for each CC.

Note 2: Void.

Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.1.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation.

Table 8.2.1.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Param	eter	Unit	Test 1-2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
PDSCH transmissio	PDSCH transmission mode		3

Note 1: $P_B = 1$

Note 2: For CA test cases, PUCCH format 1b with channel selection is used to

feedback ACK/NACK.

Note 3: For CA test cases, the same PDSCH transmission mode is applied to

each component carrier.

Table 8.2.1.3.1A-2: Minimum performance for soft buffer management test (FRC) for CA

				Propa-	Correlation	Reference	value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	Correlation matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate- gory
1	2x20 MHz	R.30 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.2	3
2	2x20 MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.8	4

Note 1: For CA test cases, the OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.1.3.2-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
David lateratura	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3
Note 1: $P_B = 1$			

Table 8.2.1.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 FDD	OP.1 FDD	EVA70	4x2 Low	70	14.3	2-8

8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.3.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configura	ation		Non-MBSFN	Non-MBSFN
Cell Id			0	1
Time Offset between	Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Note	÷ 5)		N/A	11000100, 11000000, 11000000, 11000000, 11000000
RLM/RRM Measurement Pattern(Note 6)			1000000 1000000 1000000 1000000 1000000	N/A
CSI Subframe Sets (Note	Ccsi,0		11000100 11000000 11000000 11000000 11000000	N/A
7)	C _{CSI,1}		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDN			2	2
PDSCH transmission	mode		3	N/A
Cyclic prefix			Normal	Normal

Note 1: $P_B = 1$.

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.

Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG Pattern		n Propagation Correlation Conditions Matrix and (Note 1) Antenna		Reference Value		UE Category	
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	13.3	2-8
Note 1:					Cell2 are	statistically indepe	endent.		
Note 2:	SNR correspo	SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.							
Note 2:	The correlatio	n matrix a	nd antan	na confiai	iration an	ply for Call 1 and	Call 2		

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) - MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	
	σ	dB	0	N/A	
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A	
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A	
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.3.3-4	6	
BW _{Channel}		MHz	10	10	
Subframe Configura	ation		Non-MBSFN	MBSFN	
Cell Id			0	126	
Time Offset between	Cells	μs	2.5 (synchro	nous cells)	
ABS pattern (Note	÷ 5)		N/A	0001000000 0100000010 0000001000 0000000	
RLM/RRM Measurement Pattern (Note 6			0001000000 0100000010 0000001000 0000000	N/A	
CSI Subframe Sets (Note	Ccsi,0		0001000000 0100000010 0000001000 0000000	N/A	
7)	C _{CSI,1}		1110111111 1011111101 1111110111 1111111	N/A	
MBSFN Subframe Allocation	,		N/A	001000 100001 000100 000000	
Number of control OFDN			2	2	
PDSCH transmission	mode		3	N/A	
Cyclic prefix			Normal Normal		

- Note 1: $P_B = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9]. The 4th, 12th, 19th and 27th subframes indicated by ABS pattern are MBSFN ABS subframes.
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.
- Note 11: The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.

Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) - MBSFN ABS

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	12.0	2-8

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 4 subframes, averaged over 40ms.

8.2.1.4 Closed-loop spatial multiplexing performance

8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	Test 2			
Deventink news	$ ho_{\scriptscriptstyle A}$	dB	-3	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)			
	σ dB 0		0				
$N_{\it oc}$ at antenna $_{\it I}$	oort	dBm/15kHz	-98	-98			
Precoding granul	arity	PRB	6	50			
PMI delay (Note	2)	ms	8	8			
Reporting interv	/al	ms	1	1			
Reporting mod	е		PUSCH 1-2	PUSCH 3-1			
CodeBookSubsetRoon bitmap	estricti		001111	001111			
PDSCH transmis mode	sion		4	4			
Nata di Di d							

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame

SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink

before SF#(n+4).

Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	Reference value	
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.10 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.5	1-8
2	10 MHz	R.10 FDD	OP.1 FDD	EPA5	2x2 High	70	-2.3	1-8

8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
N_{oc} at antenna p	ort	dBm/15kHz	-98
Precoding granula	arity	PRB	6
PMI delay (Note	2)	ms	8
Reporting interv	al	ms	1
Reporting mode	æ		PUSCH 1-2
CodeBookSubsetRe	estricti		0000000000000000
on bitmap			0000000000000000
			0000000000000000
			11111111111111111
PDSCH transmiss	sion		4
mode			

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be

applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

	Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
	number	width	Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
						Antenna	Maximum	(dB)	
						Configuration	Throughput		
							(%)		
ĺ	1	10 MHz	R.13 FDD	OP.1 FDD	EVA5	4x2 Low	70	-3.2	1-8

8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2,with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1-2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	50
PMI delay (Not	e 2)	ms	8
Reporting inter	rval	ms	1
Reporting mo	de		PUSCH 3-1
CodeBookSubsetRe	estriction		110000
bitmap			
PDSCH transmission	on mode		4

Note 1: $P_R = 1$.

Note 2: If the UE reports in an available uplink reporting instance

at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.35 FDD	OP.1 FDD	EPA5	2x2 Low	70	18.9	2-8
2	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.3	2-8

8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-2 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Paramete	7	Unit	Test 1
Daniel Landin	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
anocation	σ	dB	3

N_{oc} at antenna port	dBm/15kHz	-98
Precoding granularity	PRB	6
PMI delay (Note 2)	ms	8
Reporting interval	ms	1
Reporting mode		PUSCH 1-2
CodeBookSubsetRestriction bitmap		0000000000000 0000000000000 000000111111
PDSCH transmission mode		4

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be

applied at the eNB downlink before SF#(n+4).

Note 3: Void. Note 4: Void. Note 5: Void.

Table 8.2.1.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test num.	Band- width	Referencechannel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Reference Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x2 Low	70	14.7	2-8
Note 1	: Void.							

Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Test 1	Test 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)	-6 (Note 1)
	σ	dB	3	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	-98
Precoding granu	ılarity	PRB	6	8
PMI delay (Not	e 2)	ms	8	8
Reporting inte	rval	ms	1	1
Reporting mo	de		PUSCH 1-2	PUSCH 1-2
CodeBookSubsetRe	estriction		0000000000000	0000000000000
bitmap			0000000000000	0000000000000
			0000001111111	0000001111111
			1111111110000	1111111110000
			00000000000	00000000000
CSI request field (Note 3)			'1	0'
PDSCH transmission mode			4	1

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher layers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 1b with channel selection configured.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

				Propa-	Correlation	Reference	e value	
Test num.	Band- width	Referencechannel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.14 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.8	3-8
2	2x20 MHz	R.14-3 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	[10.9]	5-8

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.1.5 MU-MIMO

8.2.1.6 [Control channel performance: D-BCH and PCH]

8.2.1.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

8.2.1.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.7.1-1: Test Parameters for CA

Paramete	r	Unit	Test 1		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
	σ	dB	0		
$\hat{E}_{s-PCell}$ at anten PCell	na port of	dBm/15kHz	-85		
$\hat{E}_{s-SCell}$ at anten Scell	na port of	dBm/15kHz	-79		
$N_{\it oc}$ at antenn	a port	dBm/15kHz	Off (Note 2)		
Symbols for unus	ed PRBs		OCNG (Note 3)		
Modulatio	n		64 QAM		
Maximum number transmission			1		
Redundancy version	_		{0}		
PDSCH transmiss of PCell	ion mode		1		
PDSCH tramsmiss of SCell	sion mode		3		
Note 1: $P_B = 0$.					
Note 2: No external noise sources are applied These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over					

Table 8.2.1.7.1-2: Minimum performance (FRC) for CA

pseudo random data.

Void

Note 4:

the OCNG PDSCHs shall be uncorrelated

Test Number	Band- width		rence nnel	OCNG Pattern			gation itions	Correlation Matrix and Antenna		Reference value Fraction of Maximum Throughput (%)		UE Category
		PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	
1	2x20M Hz	R.49 FDD	NA	OP.1 FDD	OP.5 FDD	Clause B.1	Clause B.1	1x2	2x2	85%	NA	≥5
Note 1:		he OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill he control channel and PDSCH.										
Note 2:	The ap in 8.1.2		of requi	rements f	or differ	ent CA d	configura	ations ar	nd band	width comb	ination sets	s is defined

8.2.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.2.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value				
Uplink downlink configuration (Note 1)		1				
Special subframe configuration (Note 2)		4				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ processes per component carrier	Processes	7				
Maximum number of HARQ transmission		4				
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM				
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths				
Cross carrier scheduling		Not configured				
Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4].						

8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

8.2.2.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.1.1-1: Test Parameters

Paramete	r	Unit	Test 1- 5	Test 6- 8	Test 9- 15	Test 16- 18	Test 19
Davislink	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)
allocation	σ	dB	0	0	0	0	0

$N_{\it oc}$ at antenna	dBm/15kHz	-98	-98	-98	-98	-98
port						
Symbols for		OCNG	OCNG	OCNG	OCNG	OCNG
unused PRBs		(Note 2)				
Modulation		QPSK	16QAM	64QAM	16QAM	QPSK
ACK/NACK		Multiplexing	Multiplexing	Multiplexing	Multiplexing	Multiplexing
feedback mode						
PDSCH		1	1	1	1	1
transmission mode						

Note 1: $P_B = 0$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data, which is QPSK modulated.

Note 3: Void. Note 4: Void.

Table 8.2.2.1.1-2: Minimum performance (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2	1-8
2	10 MHz	R.2 TDD	OP.1 TDD	ETU70	1x2 Low	70	-0.6	1-8
3	10 MHz	R.2 TDD	OP.1 TDD	ETU300	1x2 Low	70	-0.2	1-8
4	10 MHz	R.2 TDD	OP.1 TDD	HST	1x2	70	-2.6	1-8
5	1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	0.0	1-8
6	10 MHz	R.3 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	2-8
	5 MHz	R.3-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	2-8
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	2-8
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	1
9	3 MHz	R.5 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1-8
10	5 MHz	R.6 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	2-8
	5 MHz	R.6-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
11	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	2-8
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
12	10 MHz	R.7 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	2-8
	10 MHz	R.7-1 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	1
13	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	2-8
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	1
14	15 MHz	R.8 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	2-8
	15 MHz	R.8-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	1
15	20 MHz	R.9 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	3-8
	20 MHz	R.9-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	2
	20 MHz	R.9-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	1
16	3 MHz	R.0 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	1-8
17	10 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.0	1-8
18	20 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	1-8
19	10 MHz	R.41 TDD	OP.1 TDD	EVA5	1x2 Low	70	-5.3	1-8
Note 1:	Void.					- 		

Table 8.2.2.1.1-3: Test Parameters for CA

Pa	arameter	Unit	Test 1
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)

	σ	dB	0
$N_{\it oc}$ at	t antenna port	dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 2)
M	odulation		QPSK
ACK/NAC	K feedback mode		PUCCH format 1b with channel selection
PDSCH tra	ansmission mode		1

Note 1: $P_{\scriptscriptstyle B}=0$

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG Note 2:

PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

The same PDSCH transmission mode is applied to each component carrier. Note 3:

Table 8.2.2.1.1-4: Minimum performance (FRC) for CA

Test number	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference Fraction of Maximum Throughput (%)	SNR (dB)	UE Category
1	2x20MHz	R.42 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	-1.2	5-8

The OCNG pattern applies for each CC. Note 1:

The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. Note 2:

8.2.2.1.2 Void

8.2.2.1.3 Void

8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

	Unit	Test 1
$ ho_{\scriptscriptstyle A}$	dB	0
$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
σ	dB	0
port	dBm/15kHz	-98
		OCNG (Note 3)
ck mode		Multiplexing
on mode		1
	$ ho_{\scriptscriptstyle B}$	$ ho_A$ dB $ ho_B$ dB $ ho$ dB $ ho$ dB $ ho$ dB $ ho$ port dBm/15kHz $ ho$ portion of (Note 2) ck mode

Note 1: $P_B = 0$

Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

first slot.

Note 3: The MBSFN portion of the MBSFN subframes shall contain

QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN

subframes, QPSK modulated MBSFN data is used instead.

Table 8.2.2.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE	l
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	
1	10 MHz	R.29 TDD	OP.3 TDD	ETU70	1x2 Low	30	2.0	1-8	

8.2.2.2 Transmit diversity performance

8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Multiplexing
PDSCH transmission	on mode		2
Note 1: $P_B = 1$			

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation		Reference	value	UE
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	2-8
1	5 MHz	R.11-2 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	1
2	10 MHz	R.10 TDD	OP.1 TDD	HST	2x2	70	-2.3	1-8

8.2.2.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)		
	σ	dB	0		
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98		
ACK/NACK feedba	ck mode		Multiplexing		
PDSCH transmission	on mode		2		
Note 1: $P_B = 1$					

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	1.4 MHz	R.12 TDD	OP.1 TDD	EPA5	4x2 Medium	70	0.2	1-8
2	10 MHz	R.13 TDD	OP.1 TDD	ETU70	4x2 Low	70	-0.5	1-8

8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.2.3-2, with the addition of parameters in Table 8.2.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2
Uplink downlink conf	iguration		1	1
Special subframe con	figuration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.2.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configu	ıration		Non-MBSFN	Non-MBSFN
Time Offset between	en Cells	μs	2.5 (synch	ronous cells)
Cell Id			0	1
ABS pattern (No	te 5)		N/A	0000010001 0000000001
RLM/RRM Measuremer Pattern (Note			0000000001 0000000001	N/A
CSI Subframe Sets	C _{CSI,0}		0000010001 000000001	N/A
(Note 7)	Ccsi,1		1100101000 1100111000	N/A
Number of control OFD	M symbols		2	2
ACK/NACK feedbac			Multiplexing	N/A
PDSCH transmission	n mode		2	N/A
Cyclic prefix			Normal	Normal

Note 1: $P_B = 1$

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.

Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference Value		Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)			
1	R.11-4 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Medium	70	3.8	2-8		

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.3 Open-loop spatial multiplexing performance

8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

•	Unit	Test 1
$ ho_{\scriptscriptstyle A}$	dB	-3
$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
σ	dB	0
port	dBm/15kHz	-98
ck mode		Bundling
on mode		3
		$egin{array}{c c} egin{array}{c c} eta_A & \mathrm{dB} \\ \hline eta_B & \mathrm{dB} \\ \hline \sigma & \mathrm{dB} \\ \hline \end{array}$

Note 1: $P_B = 1$ Note 2: Void.

Note 3: Void.

Table 8.2.2.3.1-2: Minimum performance Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuratio n	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.1	2-8
Note 1:	Void.							

Table 8.2.2.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parameter	•	Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		PUCCH format 1b with channel selection
PDSCH transmissi	on mode		3
Note 1: P = 1		·	

 $P_B = 1$

The same PDSCH transmission mode is applied to each component carrier. Note 2:

Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

					Correlation	Referenc		
Test number	Bandwidth	Reference Channel	OCNG Pattern	Condition Antenna		Fraction of Maximum Throughput (%)	SNR (dB)	UE Ca
1	2x20 MHz	R.30-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.7	5

Note 1: The OCNG pattern applies for each CC.

The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. Note 2:

8.2.2.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management (FRC) for CA

Paramete	r	Unit	Test 1-2
Daniel La accesa	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port	N_{oc} at antenna port		-98
ACK/NACK feedbac	k mode		- (Note 2)
PDSCH transmissio	n mode		3

Note 1: $P_{B} = 1$

PUCCH format 1b with channel selection is used to feedback ACK/NACK. Note 2: Note 3:

For CA test cases, the same PDSCH transmission mode is applied to each

component carrier.

Table 8.2.2.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

Test	Bandwidth		OCNG	Propagation	Correlation	Reference	value	UE	
number		Channel	Pattern	Condition	Matrix and Antenna Configuratio	Fraction of Maximum Throughput	SNR (dB)	Category	сај
					n	(%)			
1	2x20 MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.2	3	(
2	2x20 MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA5	2x2 Low	70	15.7	4	(

Note 1: For CA test cases, the OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.2.3.2-1: Test Parameters for Large Delay CDD (FRC)

Paramete	r	Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ick mode		Bundling
PDSCH transmissi	on mode		3
Note 1: $P_B = 1$.			

Table 8.2.2.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 TDD	OP.1 TDD	EVA70	4x2 Low	70	14.2	2-8

8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink confi	guration		1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.3.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configur	ation		Non-MBSFN	Non-MBSFN
Cell Id			0	1
Time Offset between	n Cells	μs	2.5 (synchron	nous cells)
ABS pattern (Not	e 5)		N/A	0000010001, 0000000001
RLM/RRM Measuremen Pattern (Note 6			000000001, 000000001	N/A
CSI Subframe Sets	Ccsi,0		0000010001, 000000001	N/A
(Note 7)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDM symbols			2	2
ACK/NACK feedback			Multiplexing	N/A
PDSCH transmission	n mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1: $P_B = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)				Reference Value	
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	14.0	2-8

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

SNR corresponds to \hat{E}_{s}/N_{oc2} of cell 1. Note 2:

The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated Note 4: PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

Note 5:

Table 8.2.2.3.3-3: Test Parameters for Large Delay CDD (FRC) - MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink confi	guration		1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.3.3-4	6
BW _{Channel}		MHz	10	10
Subframe Configu	ration		Non-MBSFN	MBSFN
Cell Id			0	126
Time Offset betwee	n Cells	μs	2.5 (synchroi	nous cells)
ABS pattern (Not	e 5)		N/A	000000001 000000001
RLM/RRM Measuremen Pattern (Note 6			000000001 000000001	N/A
CSI Subframe Sets	C _{CSI,0}		000000001 000000001	N/A
(Note 7)	C _{CSI,1}		1100111000 1100111000	N/A
MBSFN Subframe Alloc 10)	ation (Note		N/A	000010
Number of control OFD	M symbols		2	2
ACK/NACK feedbac			Multiplexing	N/A
PDSCH transmission	n mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1: $P_B = 1$
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10,#11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.

Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) - MBSFN ABS

est mber	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	12.2	2-8

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.4 Closed-loop spatial multiplexing performance

8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	Test 2
Daniel a acces	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	-98
Precoding granular	ity	PRB	6	50
PMI delay (Note 2	2)	ms	10 or 11	10 or 11
Reporting interva		ms	1 or 4 (Note 3)	1 or 4 (Note 3)
Reporting mode			PUSCH 1-2	PUSCH 3-1
CodeBookSubsetRest	riction		001111	001111
bitmap				
ACK/NACK feedback	mode		Multiplexing	Multiplexing
PDSCH transmission	mode		4	4

Note 1: $P_B = 1$

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput	SNR (dB)	Category
						(%)		
1	10 MHz	R.10 TDD	OP.1 TDD	EVA5	2x2 Low	70	-3.1	1-8
2	10 MHz	R.10 TDD	OP.1 TDD	EPA5	2x2 High	70	-2.8	1-8

8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna $_{ m I}$	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note	2)	ms	10 or 11
Reporting interv	/al	ms	1 or 4 (Note 3)
Reporting mod	le		PUSCH 1-2
CodeBookSubsetR	estricti		00000000000000000
on bitmap			00000000000000000
			0000000000000111
			1111111111111
ACK/NACK feedb	oack		Multiplexing
mode			
PDSCH transmis	sion		4
mode			
Note 1: $P_{B} = 1$.		·	

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.13 TDD	OP.1 TDD	EVA5	4x2 Low	70	-3.5	1-8

8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1-2
Dawalink nawar	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	50
PMI delay (Not		ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 3-1
ACK/NACK feedba	ck mode		Bundling
CodeBookSubsetRe	estriction		110000
bitmap			
PDSCH transmission	on mode		4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at

subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval

will alternate between 1ms and 4ms.

Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.35 TDD	OP.1 TDD	EPA5	2x2 Low	70	19.5	2-8
2	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Low	70	13.9	2-8

8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Paramete	r	Unit	Test 1
Daniel I. a. a	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3

$N_{\it oc}$ at antenna port	dBm/15kHz	-98					
Precoding granularity	PRB	6					
PMI delay (Note 2)	ms	10 or 11					
Reporting interval	ms	1 or 4 (Note 3)					
Reporting mode		PUSCH 1-2					
ACK/NACK feedback mode		Bundling					
CodeBookSubsetRestriction		000000000000					
bitmap		0000000000000					
		0000001111111					
		1111111110000					
		00000000000					
PDSCH transmission mode		4					
Note 1: $P_B = 1$.							
Note 2: If the UE reports in an available uplink reporting instance at							
subrame SF#n based on PMI estimation at a downlink SF							

not later than SF#(n-4), this reported PMI cannot be

applied at the eNB downlink before SF#(n+4). For Uplink - downlink configuration 1 the reporting interval

Note 3: will alternate between 1ms and 4ms.

Note 4: Void. Note 5: Void. Note 6: Void.

Table 8.2.2.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagatio	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.36 TDD	OP.1 TDD	EPA5	4x2 Low	70	15.7	2-8
Note 1:	Void.							

Table 8.2.2.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Test 1
Danielinkanania	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	8
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
ACK/NACK feedba	ck mode		PUCCH format 1b with channel
			selection
CodeBookSubsetRe	estriction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
			0000000
CSI request field (CSI request field (Note 4)		'10'
PDSCH transmission	on mode		4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Multiple CC-s under test are configured as the 1st set of serving cells by high Note 4: layers.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

Test	Band-	Reference	OCNG	Propagatio	Correlation	Referen	ce value	UE Cat
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	
1	2x20 MHz	R.43 TDD	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	11.1	5-{

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.2.5 MU-MIMO

8.2.2.6 [Control channel performance: D-BCH and PCH]

8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

8.2.2.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.7.1-1: Test Parameters for CA

Paramete	r	Unit	Test 1
Develiels news	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
$\hat{E}_{s-PCell}$ at anten PCell	na port of	dBm/15kHz	-85
$\hat{E}_{s-SCell}$ at anten Scell	na port of	dBm/15kHz	-79
$N_{\it oc}$ at antenn	a port	dBm/15kHz	Off (Note 2)
Symbols for unus	ed PRBs		OCNG (Note 3)
Modulatio	n		64 QAM
Maximum number transmission	-		1
Redundancy version	J		{0}
PDSCH transmiss of PCell	ion mode		1
PDSCH transmiss of SCell	ion mode		3
Note 1: D O			

Note 1: $P_B = 0$.

Note 2: No external noise sources are applied.

Note 3: These physical resource blocks are assigned to

an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data.

Table 8.2.2.7.1-2: Minimum performance (FRC) for CA

Test Number	Band- width		rence nnel	OCNG I	Pattern		gation itions	Matri	lation x and enna	Referen Fracti Maxi Through	ion of mum	UE Category
		PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	
1	2x20M Hz	R.49 TDD	NA	OP.1 TDD	OP.5 TDD	Clause B.1	Clause B.1	1x2	2x2	85%	NA	≥5

Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRG for Transmission mode 9 Time domain: 1 ms
Note 1: Void Note 2: Void		

8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

parameter		Unit	Test 1	Test 2	
Downlink nover	$ ho_{\scriptscriptstyle A}$	dB	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
	σ	dB	-3	-3	
Cell-specific reference signals			Antenna ports 0,1		
CSI reference signals			Antenna ports 15,,18	Antenna ports 15,,18	
Beamforming model			Annex B.4.1	Annex B.4.1	
CSI-RS periodicity and subframe offset TCSI-RS / \(\Delta \text{CCSI-RS} \)		Subframes	5/2	5/2	
CSI reference signal configuration			0	3	
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitmap		Subframes / bitmap	3 / 00010000000000000	3 / 00010000000000000	
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	-98	
Symbols for unused PRBs			OCNG (Note 4)	OCNG (Note 4)	
Number of allocated resource blocks (Note 2)		PRB	50	50	
Simultaneous transmission			No	Yes (Note 3, 5)	
PDSCH transmission mode			9	9	
Note 1: $P_B = 1$. Note 2: The mod	ulation	symbols of the	signal under test are m	napped onto antenna	

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the

OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK

modulated.

Note 5: The two UEs' scrambling identities $\,n_{\rm SCID}\,$ are set to 0 for CDM-multiplexed

DM RS with interfering simultaneous transmission test cases.

Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Te num		Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference Fraction of Maximum Throughpu t (%)	value SNR (dB)	UE Category
1	10 MHz QPSK 1/3	R.43 FDD	OP.1 FDD	EVA5	2x2 Low	70	-1	1-8

Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
2	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x2 Low	70	21.9	2-8
Note 1: The reference channel applies to both the input signal under test and the interfering signal.								

8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

parameter		Unit	Test 1		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0		
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
	σ	dB	-3		
Cell-specific reference signals	ence		Antenna ports 0 and 1		
CSI reference sig	nals		Antenna ports 15,16		
Beamforming mo	del		Annex B.4.2		
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et s	Subframes	5/2		
CSI reference signal configuration			8		
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitmap		Subframes / bitmap	3 / 00100000000000000		
N_{oc} at antenna port		dBm/15kHz	-98		
Symbols for unused PRBs			OCNG (Note 2)		
Number of allocated resource blocks (Note 2)		PRB	50		
Simultaneous transmission			No		
PDSCH transmission mode			9		

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	EPA5	2x2 Low	70	13.3	2-8

8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value
Uplink downlink configuration (Note 1)		1
Special subframe configuration (Note 2)		4
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	7
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission mode 9 Time domain: 1 ms
ACK/NACK feedback mode		Multiplexing
	Table 4.2-2 in TS 36 Table 4.2-1 in TS 36	

8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

Table 8.3.2.1-1: Test Parameters for Testing DRS

Parameter		Unit	Test 1	Test 2	Test 3	Test 4		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	0	0	0	0		
Cell-specific refere	ence		Antenna port 0					
Beamforming mo	del		Annex B.4.1					
$N_{\it oc}$ at antenna p	ort	dB/15kHz	-98	-98	-98	-98		
Symbols for unused PRBs			OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)		
PDSCH transmission mode			7	7	7	7		

Note 1: $P_{R} = 0$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.1-2: Minimum performance DRS (FRC)

Test Bandwidth		Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.25 TDD	OP.1 TDD	EPA5	2x2 Low	70	-0.8	1-5
2	10 MHz 16QAM 1/2	R.26 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	2-5
	5MHz 16QAM 1/2	R.26-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	1
3	10 MHz 64QAM 3/4	R.27 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	2-5
	10 MHz 64QAM 3/4	R.27-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	1
4	10 MHz 16QAM 1/2	R.28 TDD	OP.1 TDD	EPA5	2x2 Low	30	1.7	1-5

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	Test 5		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	-3	-3	-3	-3	-3		
Cell-specific reference signals	е		Antenna port 0 and antenna port 1						
Beamforming mode					Annex B.4.1				
$N_{\scriptscriptstyle oc}$ at antenna port	t	dBm/15kHz	-98	-98	-98	-98	-98		
Symbols for unused PRBs			OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)		
Simultaneous transmission			No	No	No	Yes (Note 3, 5)	Yes (Note 3, 5)		
PDSCH transmission m	ode		8	8	8	8	8		

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

Test	Test Bandwidt		OCNG	Propagation	Correlation	Reference	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	-1.0	1-5
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	2-5
	5MHz 16QAM 1/2	R.32-1 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	1
3	10 MHz 64QAM 3/4	R.33 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	2-5
	10 MHz 64QAM 3/4	R.33-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	1

Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	Reference value	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
4	10 MHz	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.9	2-5
	16QAM 1/2	(Note 1)						
5	10 MHz	R.34 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.0	2-5
	64QAM 1/2	(Note 1)						
Note 1:	The reference	channel applie	s to both the i	input signal unde	er test and the inte	rfering signal.		

8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1	Test 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3
Cell-specific reference signals			Antenna	ports 0,1
CSI reference sig	nals		Antenna ports 15,,22	Antenna ports 15,,18
Beamforming mo	odel		Annex B.4.1	Annex B.4.1
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$		Subframes	5/4	5 / 4
CSI reference sig configuration	,		1	3
Zero-power CSI-RS configuration lcsi-Rs / ZeroPowerCSI-RS bitmap		Subframes / bitmap	4 / 0010000100000000	4 / 001000000000000000
$N_{\it oc}$ at antenna $_{ m I}$	oort	dBm/15kHz	-98	-98
Symbols for unus PRBs	sed		OCNG (Note 4)	OCNG (Note 4)
Number of allocated resource blocks (Note 2)		PRB	50	50
Simultaneous transmission			No	Yes (Note 3, 5)
PDSCH transmis mode	sion		9	9

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	ridt Reference OCNG Propagation Co		Correlation	Reference value		UE	
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.50 TDD	OP.1 TDD	EVA5	2x2 Low	70	-0.6	1-8

Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE		
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
2	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.1	2-8		
Note 1:	Note 1: The reference channel applies to both the input signal under test and the interfering signal.									

8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Parame	ter	Unit	Test 1	Test 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0	
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
allocation	σ	dB	-3	-3	
Cell-specific reference symbols			Antenna port 0 a	and antenna port	
Beamforming model			Annex B.4.2		
N_{oc} at ant	enna	dBm/15kHz	-98	-98	
Symbols			OCNG	OCNG	
unused P	RBs		(Note 2)	(Note 2)	
Number of allocated resource blocks		PRB	50	50	
PDSCI transmiss mode	sion		8	8	

Note 1: $P_R = 1$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	Reference value	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	4.5	2-5
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.7	2-5

8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

parameter		Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Cell-specific reference signals	ence		Antenna ports 0 and 1
CSI reference sig	nals		Antenna ports 15,16
Beamforming mo	del		Annex B.4.2
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-R}}$	et	Subframes	5/4
CSI reference sig configuration	ınal		8
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitmap		Subframes / bitmap	4 / 001000000000000000
$N_{\it oc}$ at antenna $ m p$	oort	dBm/15kHz	-98
Symbols for unus PRBs	sed		OCNG (Note 2)
Number of alloca resource blocks (N		PRB	50
Simultaneous transmission			No
PDSCH transmission mode			9

Note 1: $P_R = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Ī	Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
	number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
	1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	EPA5	2x2 Low	70	14.5	2-8

8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH.

8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

Parame	Parameter		Single antenna port	Transmit diversity
Number of PDC	CH symbols	symbols	2	2
PHICH Ng (Note 1)		1	1
PHICH du	ration		Normal	Normal
Unused RE-s a	and PRB-s		OCNG	OCNG
Cell II)		0	0
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
$N_{\it oc}$ at anter	nna port	dBm/15kHz	-98	-98
Cyclic pr	efix		Normal	Normal
Note 1: According	g to Clause 6.9	in TS 36.211 [4]		

8.4.1.1 Single-antenna port performance

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		level	Channel	Pattern	Condition	configuration	Pm-dsg (%)	SNR (dB)
						and		
						correlation		
						Matrix		
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x2 Low	1	-1.7

8.4.1.2 Transmit diversity performance

8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference value	
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 2 Low	1	-0.6

8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 2 Medium	1	6.3

8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2. and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. In Table 8.4.1.2.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete		Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\widehat{E}_s/N_{oc}		dB	Reference Value in Table 8.4.1.2.3-2	1.5
BW _{Channe}	le le	MHz	10	10
Subframe Confi	guration		Non-MBSFN	Non-MBSFN
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	1
ABS pattern (N	Note 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets	Ccsi,0		00000100 00000100 00000100 01000100 00000100	N/A
(Note 6)	Ccsi,1		11111011 11111011 11111011 10111011 11111011	N/A
Number of control OFDM symbols			3	3
PHICH Ng (N	ote 9)		1	N/A
PHICH dura			extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pre	fix	vmb ala #1 #2 #2 #2	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]:
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test
- Note 9: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Numb er	Aggregati on Level	Referen ce Channel	OCNG Pattern		Propagation Conditions (Note 1)		Conditions		Correlation Matrix and Antenna		rence lue
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)		
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-3.9		

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Paramet		Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{od}	2	dB	Reference Value in Table 8.4.1.2.3-	1.5
BW _{Chann}	el	MHz	10	10
Subframe Conf	iguration		Non-MBSFN	MBSFN
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	126
ABS pattern (Note 4)		N/A	0001000000 0100000010 0000001000 0000000
[RLM/RRM Measurer Pattern (No			0001000000 0100000010 0000001000 0000000	N/A
CSI Subframe Sets	Ccsi,0		0001000000 0100000010 0000001000 0000000	N/A
(Note 6)	C _{CSI,1}		1110111111 1011111101 1111110111 1111111	N/A
MBSFN Subframe Allo	ocation (Note 9)		N/A	001000 100001 000100 000000
Number of control O			3	3
PHICH Ng (N			1	N/A
PHICH dura			extended	N/A
Unused RE-s ar			OCNG	OCNG
Cyclic pre	etix		Normal	Normal

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13
	of a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. The 4 th , 12 th , 19 th and 27 th subframes indicated by ABS pattern
	are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is
	overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in
	the definition of the reference channel.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in

- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in this test.
- Note 9: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.
- Note 10: The maximum number of uplink HARQ transmission is \leq 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.
- Note 11: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH – MBSFN ABS

Test Numb er	Aggregati on Level	Reference Channel		OCNG Propagation Pattern Conditions (Note 1)		itions	Correlation Matrix and Antenna	Referer	nce Value
			Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-4.2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

8.4.2 TDD

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

Parame	Parameter		Single antenna port	Transmit diversity
Uplink downlink (Note	•		0	0
Special subframe (Note	•		4	4
Number of PDC	CH symbols	symbols	2	2
PHICH Ng (Note 3)		1	1
PHICH du	ration		Normal	Normal
Unused RE-s	and PRB-s		OCNG	OCNG
Cell I	D		0	0
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
$N_{_{oc}}$ at ante	nna port	dBm/15kHz	-98	-98
Cyclic p	refix		Normal	Normal
ACK/NACK feed	dback mode		Multiplexing	Multiplexing
		-2 in TS 36.211 [4 -1 in TS 36.211 [4	•	

According to Clause 6.9 in TS 36.211 [4] Note 3:

8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	ridth Aggregation	Reference	OCNG	Propagation	Antenna	Reference value		
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)	
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x2 Low	1	-1.6	

8.4.2.2 Transmit diversity performance

8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	n Aggregation	Reference	OCNG	Propagation	Antenna	Reference value		
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)	
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 2 Low	1	0.1	
	I O IVII IZ	4 GOL	10.10	01.11100	LVATO	Z X Z LOW	<u> </u>	0.1	

8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 2 Medium	1	6.5

8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2. and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-4. In Table 8.4.2.2.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Uplink downlink co	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}	,	dB	Reference Value in Table 8.4.2.2.3-2	1.5
BW _{Channe}	I	MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μS	2.5 (synchro	onous cells)
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	0000010001 0000000001
RLM/RRM Measurement Pattern(Note			000000001 000000001	N/A
CSI Subframe	C _{CSI,0}		0000010001 0000000001	N/A
Sets(Note 6)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (No	ote 9)		1	N/A
PHICH dura			extended	N/A
Unused RE-s and	d PRB-s		OCNG	OCNG
Cyclic pref	ix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test
- Note 9: According to Clause 6.9 in TS 36.211 [4].

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Numbe r	Aggregatio n Level	Referenc e Channel	OCNG Pattern		Cond	Propagation Correlations Matrix a (Note 1 Antenions)			rence lue
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-3.9

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH - MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Uplink downlink co	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc}		dB	Reference Value in Table 8.4.2.2.3-4	1.5
BW _{Channe}	l	MHz	10	10
Subframe Confi	guration		Non-MBSFN	MBSFN
Time Offset between	een Cells	μS	2.5 (synchro	onous cells)
Cell Id			0	126
ABS pattern (N	lote 4)		N/A	000000001 000000001
RLM/RRM Measurem Pattern(Note			0000000001 0000000001	N/A
CSI Subframe	C _{CSI,0}		000000001 000000001	N/A
Sets(Note 6)	Ccsi,1		1100111000 1100111000	N/A
MBSFN Subframe Allocation (Note 9)			N/A	000010
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (No	ote 10)		1	N/A
PHICH dura	tion		extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pref	fix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in this test.
- Note 9: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG	Pattern		Propagation Conditions(Note 1)		Referen	ce Value
			Cell 1	Cell 2	Cell 1	Cell 1 Cell 2		Pm-dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-4.1

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to E_s/N_{ac2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

8.5.1 FDD

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.5.1-1: Test Parameters for PHICH

Parame	eter	Unit	Single antenna port	Transmit diversity
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	٠3
PHICH du	ıration		Normal	Normal
PHICH Ng	(Note 1)		Ng = 1	Ng = 1
PDCCH C	Content			be included with the aligned with A.3.6.
Unused RE-s	and PRB-s		OCNG	OCNG
Cell ID			0	0
N_{oc} at antenna port		dBm/15kHz	-98	-98
Cyclic p	refix		Normal	Normal
Note 1: according	g to Clause 6.9 in	TS 36.211 [4]		

8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 2 Low	0.1	5.5
2	10 MHz	R.24	OP.1 FDD	ETU70	1 x 2 Low	0.1	0.6

8.5.1.2 Transmit diversity performance

8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 2 Low	0.1	4.4

8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 2 Medium	0.1	6.1

8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.1.2.3-1: Test Parameters for PHICH

Paramete		Unit	Cell 1	Cell 2
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8. 5.1.2.3-2	1.5
BW _{Channe}	el	MHz	10	10
Subframe Configuration			Non-MBSFN	Non-MBSFN
Time Offset betw	een Cells	μs	2.5 (synchro	onous cells)
Cell Id			0	1
ABS pattern (N	Note 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (No			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets	C _{CSI,0}		00000100 00000100 00000100 01000100 00000100	N/A
(Note 6)	Ccsi,1		11111011 11111011 11111011 10111011 11111011	N/A
Number of control OFDM symbols			3	3
PHICH Ng (Note 9)			1	N/A
PHICH dura			extended	N/A
Unused RE-s an			OCNG	OCNG
Cyclic pre	fix	umbolo #1 #2 #2 #E	Normal Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26th subframe indicated by the ABS pattern.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test
- Note 9: According to Clause 6.9 in TS 36.211 [4].

Table 8.5.1.2.3-2: Minimum performance PHICH

Test Number	Reference Channel	OCNG Pattern		Propagation Antenna Conditions Configuration (Note 1) and		Configuration	Refere	nce Value
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)
1	R.19	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	0.1	4.6
Note 1:					ell 2 are s	tatistically independ	dent.	
Note 2:	SNR corresponds to \widehat{E}_s/N_{oc2} of cell 1.							
Note 3:	The correlation	matrix ar	nd antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.	

8.5.2 **TDD**

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.5.2-1: Test Parameters for PHICH

Param	eter	Unit	Single antenna port	Transmit diversity			
Uplink downlink cor 1)	nfiguration (Note		1	1			
Special subframe (Note			4	4			
	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3			
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3			
PHICH do	uration		Normal	Normal			
PHICH Ng	(Note 3)		Ng = 1	Ng = 1			
PDCCH C	Content			I be included with the on aligned with A.3.6.			
Unused RE-s	and PRB-s		OCNG	OCNG			
Cell	D		0	0			
N_{oc} at antenna port		dBm/15kHz	-98	-98			
Cyclic p	refix		Normal	Normal			
ACK/NACK fee	dback mode		Multiplexing	Multiplexing			
Note 1: as specified in Table 4.2-2 in TS 36.211 [4] Note 2: as specified in Table 4.2-1 in TS 36.211 [4]							

according to Clause 6.9 in TS 36.211 [4] Note 3:

Single-antenna port performance 8.5.2.1

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 2 Low	0.1	5.8
2	10 MHz	R.24	OP.1 TDD	ETU70	1 x 2 Low	0.1	1.3

8.5.2.2 Transmit diversity performance

8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 2 Low	0.1	4.2

8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 2 Medium	0.1	6.2

8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.2.2.3-1: Test Parameters for PHICH

Paramete	r	Unit	Cell 1	Cell 2
Uplink downlink cor	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.5.2.2.3-2	1.5
BW _{Channe}		MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchronous cells)	
Cell Id			0	1
ABS pattern (N	ote 4)		N/A	0000010001 0000000001
RLM/RRM Measureme Pattern (Note			000000001 000000001	N/A
CSI Subframe Sets	C _{CSI,0}		0000010001 0000000001	N/A
(Note 6)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDM symbols ACK/NACK feedback mode PHICH Ng (Note 9) PHICH duration Unused RE-s and PRB-s Cyclic prefix			3	3
			Multiplexing	N/A
			1	N/A
			extended	N/A
			OCNG	OCNG
			Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test
- Note 9: According to Clause 6.9 in TS 36.211 [4].

Table 8.5.2.2.3-2: Minimum performance PHICH

Test Number	Reference Channel	OCNG Pattern				Configuration	Refere	nce Value
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)
1	R.19	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	0.1	4.6
Note 1:					ell 2 are s	tatistically independ	dent.	
Note 2:	SNR corresponds to \widehat{E}_s/N_{oc2} of cell 1.							
Note 3:	The correlation	matrix ar	nd antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.	

8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch).

8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

Parameter		Unit	Single antenna port	Transmit diversity	
Downlink power	PBCH_RA	dB	0	-3	
allocation	PBCH_RB	dB	0	-3	
$N_{\it oc}$ at anter	nna port	dBm/15kHz	-98	-98	
Cyclic pr	efix		Normal	Normal	
Cell II)		0	0	
Note 1: as speci	fied in Table 4.2	-2 in TS 36.211 [4]	<u>.</u>	
Note 2: as speci	fied in Table 4.2	!-1 in TS 36.211 [4]		

8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.1

8.6.1.2 Transmit diversity performance

8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.1-1: Minimum performance PBCH

I	Test	Bandwidth	Reference	Propagation	on Antenna Reference va		ce value
	number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
	1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.2-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-3.5

8.6.2 TDD

Table 8.6.2-1: Test Parameters for PBCH

Parame	eter	Unit	Single antenna port	Transmit diversity	
Uplink downlink configuration (Note 1)			1	1	
Special subframe configuration (Note 2)			4	4	
Downlink power PBCH_RA		dB	0	-3	
allocation	allocation PBCH_RB		0	-3	
N_{oc} at antenna port		dBm/15kHz	-98	-98	
Cyclic prefix			Normal	Normal	
Cell ID			0	0	
Note 1: as speci	fied in Table 4.2	2-2 in TS 36.211 [4].		
Note 2: as speci	fied in Table 4.2	2-1 in TS 36.211 [4	1.		

8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.4

8.6.2.2 Transmit diversity performance

8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.2-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-4.1

8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available.

8.7.1 FDD

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.7.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured

The requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.1-2: test parameters for sustained downlink data rate (FDD)

Param	eter	Unit	Test 1	Test 2	Test 3,4,6	Test 3A	Test 3B	Test 4A	Test 3C, 4B	Test 6A
Bandv	vidth	MHz	10	10	20	10	2x10	2x10	15	2x20
Transmissi	on mode		1	3	3	3	3	3	3	3
Antenna cor	nfiguration		1 x 2	2 x 2	2 x 2	2 x 2	2x2	2x2	2 x 2	2 x 2
Propagation	condition				Static pro	opagation	condition	(Note 1)		
CodeBookSubs bitm			n/a	10	10	10	10	10	10	10
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3	-3	-3	-3	-3	-3
power	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3	-3	-3	-3	-3	-3
allocation	σ	dB	0	0	0	0	0	0	0	0
\hat{E}_{s} at antenna port		dBm/15kHz	-85	-85	-85	-85	-85	-85	-85	-85
Symbols for unused PRBs			OP.6 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD

Note 1: No external noise sources are applied.

Note 2: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Table 8.7.1-3: Minimum requirement (FDD)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value
	block received within a TTI		TB success rate [%]
1	10296	R.31-1 FDD	95
2	25456	R.31-2 FDD	95
3	51024	R.31-3 FDD	95
3A	36696 (Note 2)	R.31-3A FDD	85
3B	25456	R.31-2 FDD	95
3C	51024	R.31-3C	85
4	75376 (Note 3)	R.31-4 FDD	85
4A	36696 (Note 2)	R.31-3A FDD	85
4B	55056 (Note 5)	R.31-4B FDD	85
6	75376 (Note 3)	R.31-4 FDD	85
6A	75376 (Note 3)	R.31-4 FDD	85

Note 1: For 2 layer transmissions, 2 transport blocks are

received within a TTI.

Note 2: 35160 bits for sub-frame 5. Note 3: 71112 bits for sub-frame 5.

Note 4: The TB success rate is defined as TB success rate =

100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks, NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of

correctly received DL transport blocks.

Note 5: 52752bits for sub-frame 5.

Table 8.7.1-4: Test points for sustained data rate (FRC)

CA config	Maximum supported Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
Cingle	10	1	2	3A	3A	-	-
Single	15	-	-	3C	4B	-	-
carrier	20	-	-	3	4	6	6
CA with	10+10	-	-	3B	4A	6A	6A
2CCs	20+20	-	-	3 (Note 4)	4 (Note 4)	6A	6A

Note 1: Void.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single carrier test is selected, i.e., Test 3 for UE category 3 and Test 4 for UE category 4.

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.7.2 TDD

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value
Special subframe configuration (Note 1)		4
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured
Note 1: as specified in	Table 4.2-1 in TS 36.	211 [4].

The requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.2-2: test parameters for sustained downlink data rate (TDD)

Paramet	er	Unit	Test 1	Test 2	Test 3	Test 3A	Test 4,6	Test 6A
Bandwid	th	MHz	10	10	20	15	20	2x20
Transmission	mode		1	3	3	3	3	3
Antenna config	guration		1 x 2	2 x 2	2 x 2	2 x 2	2 x 2	2 x 2
Propagation co	ondition			St	atic propaga	ition condition ((Note 1)	
CodeBookSubset bitmap			n/a 10 10 10 10 10					
Daniel a access	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3	-3	-3	-3
	σ	dB	0	0	0	0	0	0
$\hat{E}_{\scriptscriptstyle s}$ at antenna port		dBm/15kHz	-85	-85	-85	-85	-85	-85
Symbols for unused PRBs		OP.6 TDD	OP.1 TDD	OP.1 TDD	OP.2 TDD	OP.1 TDD	OP.1 TDD	
ACK/NACK feedback mode			Bundling	Bundling	Bundling	Multiplexing	Multiplexing	- (Note 2)
Note 1: No exte								

Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Table 8.7.2-3: Minimum requirement (TDD)

within a TTI for normal/special sub-frame TB succe rate [%] 1 10296/0 R31-1 TDD 95 2 25456/0 R31-2 TDD 95 3 51024/0 R31-3 TDD 95 3A 51024/0 R31-3A TDD 85	
1 10296/0 R31-1 TDD 95 2 25456/0 R31-2 TDD 95 3 51024/0 R31-3 TDD 95	
3 51024/0 R31-3 TDD 95	
3A 51024/0 R31-3A TDD 85	
0/1 0/10Z+/0 101 0/1 10D 00	
4 75376/0 (Note 2) R31-4 TDD 85	
6 75376/0 (Note 2) R.31-4 TDD 85	
6A 75376/0 (Note 2) R.31-4 TDD 85	

Note 1: For 2 layer transmissions, 2 transport blocks are received within a

TTI.

Note 2: 71112 bits for sub-frame 5.

Note 3: The TB success rate is defined as TB success rate =

100%* $N_{DL_correct_rx}$ / ($N_{DL_newtx} + N_{DL_retx}$), where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the

number of correctly received DL transport blocks.

Table 8.7.2-4: Test points for sustained data rate (FRC)

CA config	Maximum supported Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
Single carrier	10	1	2	-	-	-	-
	15	-	-	3A	3A	-	-
	20	-	-	3	4	6	6
CA with 2CCs	20+20			3 (Note 4)	4 (Note 4)	6A	6A

Note 1: Void.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, single carrier test is selected

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

9 Reporting of Channel State Information

9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section,

the definition of SNR is in accordance with the one given in clause 8.1.1, where $SNR = \frac{\sum \hat{I}_{or}^{(j)}}{\sum N_{oc}^{(j)}}$

9.1.1 Applicability of requirements

9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set. The definition of CA capability is specified in 8.1.2.2.

Table 9.1.1.2-1: Applicability and test rules for CA UE CQI tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order				
CA tests with 2CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz				
CA tests with 2CCs in Clause 9.6.1.2	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination				
Note 1: The applicability and test rules are specified in this table, unless otherwise stated. Note 2: Number of the supported bandwidth combinations to be tested from each selected							

CA configuration is one.

9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

9.2.1.1 **FDD**

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Test 1		Test 2		
Bandwidth		MHz	10				
PDSCH transmission mode			1				
Downlink power	$ ho_{\scriptscriptstyle A}$	dB			0		
allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB	0				
Propagation condition and antenna configuration			AWGN (1 x 2)				
SNR (Note 2)		dB	0	1	6	7	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
Max number of HARQ transmissions			1				
Physical channel for CQI reporting			PUCCH Format 2				
PUCCH Report Type			4				
Reporting periodicity		ms	$N_{pd} = 5$				
cqi-pmi-Configurati	onIndex		6				

Reference measurement channel according RC.1 FDD to Table A.4-1 with one sided dynamic Note 1: OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) Note 2:

and the respective wanted signal input level.

9.2.1.2 **TDD**

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Test 1		Te	Test 2	
Bandwidth		MHz	10				
PDSCH transmission mode			1				
Uplink downlink configuration			2				
Special subframe configuration			4				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB	0				
Propagation condition and antenna configuration			AWGN (1 x 2)				
SNR (Note 2)		dB	0	1	6	7	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
Max number of HARQ transmissions			1				
Physical channel for CQI reporting			PUSCH (Note 3)				
PUCCH Report Type			4				
Reporting periodicity		ms	$N_{pd} = 5$				
cqi-pmi-ConfigurationIndex			3				
ACK/NACK feedback mode			Multiplexing				

- Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{\text{CSI},1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets $C_{\text{CSI},1}$ shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.3-1: PUCCH 1-0 static test (FDD)

D				Test 1			Test 2		
Parameter		Unit	Cell 1		Cell 2	Cell 1		Cell 2	
Bandwidth		MHz	1(0	
PDSCH transmission mode			2		Note 10		2	Note 10	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3					3	
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3		3	-3			
	σ	dB	0				(0	
Propagation condi- antenna configu			Clause B.1 (2x2)		Clause B.1 (2x2)		3.1 (2x2)		
\widehat{E}_s/N_{oc2} (No		dB	4	5	6	4	5	-12	
(<i>i</i>)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (Note 7)		N/A	-98(Note 7)		N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	,	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (Note 9)	N/A	-98(Note 9)		N/A	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110	
Subframe Config	uration		Non-M	IBSFN	Non-MBSFN	Non-N	IBSFN	Non-MBSFN	
Cell Id			0		1	0		1	
Time Offset between	en Cells	μs	2.5 (synchron		,	2.5 (synchro			
ABS pattern (Note 2)			N/A		01010101 01010101 01010101 01010101 01010101	N/A		01010101 01010101 01010101 01010101 01010101	
RLM/RRM Measurement Subframe Pattern (Note 4)			00000100 00000100 00000100 00000100 00000100		N/A	00000100 00000100 00000100 00000100 00000100		N/A	
CSI Subframe Sets	Ccsi,0		0101 0101 0101 0101 0101	0101 0101 0101 0101	N/A	01010101 01010101 01010101 01010101 01010101 10101010 10101010 10101010 10101010		N/A	
(Note 3)	Ccsi,1		1010 1010 1010	1010 1010 1010 1010 1010	N/A			N/A	
Number of control symbols	Number of control OFDM		3		3				
Max number of HARQ transmissions			1		1		1		
Physical channel for C _{CSI,0} CQI reporting			PUCCH Format 2		PUCCH Format 2		Format 2		
Physical channel for C _{CSI,1} CQI reporting			PUSCH (Note 12)		PUSCH (Note 12)				
PUCCH Report Type		Ms	4		$\frac{4}{N_{\text{pd}} = 5}$		•		
cqi-pmi-Configurati	Reporting periodicity cqi-pmi-ConfigurationIndex		$N_{\text{pd}} = 5$		= 5 N/A	N _{pd}		= 5 N/A	
Ccsi,o (Note 13) cqi-pmi-ConfigurationIndex2 Ccsi,1 (Note 14)			5		N/A		5	N/A	

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for Ccsi.o.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C_{CSI,1}.

9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ minus the median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

Parameter		I I mit	Test 1			Test 2		
		Unit	Ce		Cell 2	Ce	II 1	Cell 2
Bandwidth		MHz			0			0
PDSCH transmission mode			2 Note 10		2 Note 10		Note 10	
Uplink downlink con			1				1	
Special subfra configuratio			4			4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-	3		-3	
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3			-3		3
	σ	dB	0			0		
Propagation condi antenna configu			Clause B.1 (2x2)		Clause B.1 (2x2)			
\widehat{E}_s/N_{oc2} (No	te 1)	dB	4	5	6	4	5	-12
(:)	$N_{oc1}^{(j)}$	dBm/15kHz	-102(N	Note 7)	N/A	-98(N	ote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98(N	ote 8)	N/A	-98(N	ote 8)	N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8(1	Note 9)	N/A	-98(Note 9)		N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110
Subframe Config	uration		Non-M	IBSFN	Non-MBSFN	Non-M	IBSFN	Non-MBSFN
Cell Id			0 1		0 1			
Time Offset betwe	en Cells	μs	2.5 (synchronous cells)		2.5 (synchronous cells)			
ABS pattern (Note 2)			N/A		0100010001 0100010001	N/A		0100010001 0100010001
RLM/RRM Measurement Subframe Pattern (Note 4)			000000001 000000001		N/A	0000000001 0000000001 N/A		N/A
CSI Subframe Sets	Ccsi,0		0100010001 0100010001		N/A	0100010001 0100010001		N.A
(Note 3)	Ccsi,1		1000101000 1000101000		N/A	1000101000 1000101000		N/A
Number of control OFDM symbols			3		3			
Max number of HARQ transmissions			1		1			
Physical channel for C _{CSI,0} CQI reporting			PUCCH Format 2		PUCCH Format 2			
Physical channel for C _{CSI,1} CQI reporting			PUSCH (Note 12)		PUSCH (Note 12)		(Note 12)	
PUCCH Report Type			4		4		4	
Reporting periodicity		ms	$N_{\rm pd} = 5$		$N_{pd} = 5$		= 5	
cqi-pmi-ConfigurationIndex Ccsi,0 (Note 13)			3	3	N/A	3	3	N/A
cqi-pmi-ConfigurationIndex2 Ccsi,1 (Note 14)			2	1	N/A	2	1	N/A
ACK/NACK feedback mode			Multiplexing		Multiplexing			

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1 and Annex A.5.2.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for Ccsl,o.
- Note 14: cgi-pmi-ConfigurationIndex2 is applied for Ccsl.1.

9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.2.2.1 FDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

Parameter		Unit	Tes	Test 1 Test 2		
Bandwidth		MHz			10	
PDSCH transmission	on mode		4			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3			
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3			
	σ	dB			0	
Propagation condit antenna configur				Clause I	B.1 (2 x 2)	
CodeBookSubsetRestriction bitmap			010000			
SNR (Note 2)		dB	10	11	16	17
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-87	-82	-81
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of F transmission			1			
Physical channel for reporting	CQI/PMI		PUCCH Format 2			
PUCCH Report Ty CQI/PMI	pe for		2			
PUCCH Report Type for RI					3	
Reporting periodicity		ms		Np	d = 5	-
cqi-pmi-Configurati			6			
ri-ConfigInde	X		1 (Note 3)			

- Note 1: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test.

9.2.2.2 TDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Co RC.2 TDD deword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Parameter		Unit	Te	st 1	Tes	st 2	
Bandwidth		MHz	10				
PDSCH transmission	on mode		4				
Uplink downlink configuration					2		
Special subframe configuration			4				
$\rho_{\scriptscriptstyle A}$		dB	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3				
	σ	dB			0		
Propagation condition and antenna configuration			Clause B.1 (2 x 2)				
CodeBookSubsetRestriction bitmap			010000				
SNR (Note 2	2)	dB	10	11	16	17	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-87	-82	-81	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
Max number of F transmission			1				
Physical channel for reporting	CQI/PMI		PUSCH (Note 3)				
PUCCH Report Type			2				
Reporting period		ms		Np	d = 5		
cqi-pmi-ConfigurationIndex					3		
ri-ConfigIndex			805 (Note 4)				
ACK/NACK feedba	ck mode		Multiplexing				

Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

- Note 1: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.2.3.1 FDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1 +1} for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0 – 1 and median CQI_1 – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median $CQI_0 + 1$ and median $CQI_1 + 1$ shall be greater than or equal to 0.1.

Parameter		Unit	Test 1 Test 2		t 2		
Bandwidth	Bandwidth				10		
PDSCH transmission	on mode				9		
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	P_c	dB	-3				
	σ	dB			-3		
Cell-specific reference					ports 0, 1		
CSI reference si	gnals				orts 15,,18		
Beamforming m	nodel			As specified i	n Section B.4.3	3	
CSI-RS periodicity an	d subframe						
offset				5	5/1		
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$	RS						
CSI reference signal configuration			0				
Propagation condition a	Propagation condition and antenna		Clause B.1 (4 x 2)				
configuration			Clause B.1 (4 x 2)				
CodeBookSubsetRestr	iction bitmap		0x0000 0000 0100 0000				
SNR (Note 2	2)	dB	7	8	13	14	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-91	-90	-85	-84	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		8		
Max number of HARQ t	ransmissions				1		
Physical channel for	· CQI/PMI			DUISCL	I (Noto 2)		
reporting				PUSCE	H (Note3)		
PUCCH Report Type f	or CQI/PMI				2		
Physical channel for F				PUCCH	Format 2		
PUCCH Report Typ	oe for RI				3		
Reporting perio		ms	$N_{\rm pd} = 5$				
CQI delay	•	ms	8				
cqi-pmi-Configurati	ionIndex		2				
ri-ConfigIndex 1							
		annel RC 7 FDD acc	ording to Ta	hle A 4-1 with	one sided dyn	amic OCNG	

- Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

9.2.3.2 TDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.3.2-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter	r	Unit	Test 1 Test		st 2		
Bandwidth		MHz	10				
PDSCH transmissi	on mode				9		
Uplink downlink con					2		
Special subframe co	nfiguration		4				
	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	P_{c}	dB			-6		
	σ	dB			-3		
CRS reference s	ignals			Antenna	ports 0, 1		
CSI reference si	ignals			Antenna p	orts 15,,22		
Beamforming m	nodel				n Section B.4.3	3	
CSI-RS periodicity an	d subframe			•			
offset				5	5/ 3		
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$							
CSI reference signal configuration			0				
Propagation condition and antenna			Clause B.1 (8 x 2)				
configuration			, ,				
CodeBookSubsetRestriction bitmap			0x0000 0000 0020 0000 0000 0001 0000				
SNR (Note 2)		dB	4 5 10		11		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-88	-87	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-98		
Max number of HARQ t	ransmissions				1		
Physical channel for reporting	CQI/PMI		PUSCH (Note 3)				
PUCCH Report Type fo	r CQI/second		2b				
Physical channel for F	21 reporting		PUSCH				
PUCCH Report Type fo					5		
Reporting perio		ms		Mo	d = 5		
CQI delay		ms			or 11		
cqi-pmi-Configurat		0		10	3		
	ri-ConfigIndex			805 (Note 4)			
ACK/NACK feedba			Multiplexing				
Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the							

- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.3 CQI reporting under fading conditions

9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under

frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

Parameter		Unit	Test 1 Test		st 2		
Band	Bandwidth		10 MHz				
Transmiss	sion mode		1 (port 0)				
Downlink	Downlink $ ho_{\scriptscriptstyle A}$		0				
power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	σ	dB			0		
SNR (Note 3)	dB	9	10	14	15	
	$\hat{I}_{or}^{(j)}$		-89	-88	-84	-83	
N	$N_{oc}^{(j)}$		-98 -98		98		
Propagation	Propagation channel		Clause B.2.4 with $\tau_d = 0.45 \mu$ a = 1, $f_D = 5 \mathrm{Hz}$				
Antenna co	onfiguration		1 x 2				
Reportin	g interval	ms	5				
CQI	CQI delay		8				
Reporting mode				PUSC	CH 3-0		
Sub-band size		RB		6 (ful	l size)		
Max number of HARQ transmissions			1				

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE Category	1-8	1-8

9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

Parameter		Unit	Te	Test 1 Test 2			
Band	width	MHz		10 MHz			
Transmiss	sion mode		1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0				
power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	σ	dB			0		
config	lownlink uration				2		
	subframe uration				4		
SNR (Note 3)	dB	9	10	14	15	
\hat{I}_{a}^{c}	$\hat{I}_{or}^{(j)}$		-89	-88	-84	-83	
N	(j) oc	dB[mW/15kHz]	-98 -98			8	
Propagation	Propagation channel		7	Clause B.2.4 with $ au_d=0.45~\mu\mathrm{s},~a=1,$ $f_D=5~\mathrm{Hz}$			
Antenna co	onfiguration			1 x 2			
Reporting	g interval	ms		5			
CQI	delay	ms		10 (or 11		
Reporting mode				PUSCH 3-0			
	nd size	RB 6 (full size)					
	er of HARQ issions		1				
ACK/NACK fe	edback mode	-		Multip	olexing		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE Category	1-8	1-8

9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.1-1 Sub-band test for FDD

Parai	neter	Unit	Te	Test 1 Test 2			
Band	width	MHz		10	MHz		
Transmiss	sion mode		9				
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	P_c	dB			0		
	σ	dB			0		
SNR (Note 3)	dB	4	5	11	12	
\hat{I}_{c}^{c}	(j) or	dB[mW/15kHz]	-94	-93	-87	86	
N	(j) oc	dB[mW/15kHz]	-(98	-6)8	
			Clause	Clause B.2.4 with $\tau_d = 0.45 \mu\text{s}$,			
Propagation channel			$a = 1, f_D = 5 \text{ Hz}$				
Antenna co	onfiguration			2x2			
CRS refere	nce signals			Antenna ports 0			
CSI refere	nce signals				orts 15, 1		
	ing model		As s	pecified in	n Section	B.4.3	
CSI-RS periodicity	and subframe offset			5	/ 1		
	$^{\prime}$ Δ csi-rs			J,	' I		
CSI-RS reference s	signal configuration				4		
CodeBookSubset	Restriction bitmap			000	0001		
Reporting into	erval (Note 4)	ms	5				
·	delay	ms		8			
Reportir	ng mode			PUSC	CH 3-1		
Sub-ba	nd size	RB		6 (full size)			
Max number of HA					1		
	reports in an available						
CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband							
	nd CQI cannot be app						
	e measurement chann					:WO	
sided dyn	amic OCNG Pattern C	DP.1/2 FDD as describ	oed in Ar	nex A.5.	1.1/2.		

- For each test, the minimum requirements shall be fulfilled for at least one of the two Note 3: SNR(s) and the respective wanted signal input level.
- PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink Note 4: SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.1.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	1-8	1-8

9.3.1.2.2 **TDD**

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.2-1 Sub-band test for TDD

neter	Unit	Test 1 Test 2		st 2	
width	MHz		10	MHz	
sion mode			9		
k configuration					
Special subframe configuration				4	
$ ho_{\scriptscriptstyle A}$	15				
$ ho_{\scriptscriptstyle B}$	dB			0	
P_c	dB		-	0	
σ	dB			0	
Note 3)	dB	4	5	11	12
j) r	dB[mW/15kHz]	-94	-93	-87	-86
$N_{oc}^{(j)}$		-98 -98			98
		Clause B.2.4 with $ au_{\scriptscriptstyle d}=0.45\mu$).45 <i>μ</i> s,
on channel			a = 1, f	$T_D = 5 \text{ Hz}$	
nfiguration		2x2			
nce signals		Antenna port 0			
			Antenna port 15,16		
		As sp	pecified in	n Section	B.4.3
and subframe offset			5	/ 3	
			0,		
			000001		
	ms		5		
	ms		10		
			PUSCH 3-1		
	RB		6 (full size)		
				1	
edback mode					
	width ion mode c configuration ρ_A ρ_B ρ_C σ Note 3) σ In channel Infiguration Ince signals In	width sion mode configuration ρ_A dB ρ_B dB ρ_B dB ρ_B dB ρ_C dB	width sion mode configuration ρ_A dB ρ_B dB	width MHz 10 ion mode ion mod	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.8 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7.

Table 9.3.1.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	1-8	1-8

9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

Table 9.3.2.1.1-1 Fading test for single antenna (FDD)

		_				
Para	meter	Unit	Test 1 Test 2		st 2	
Band	dwidth	MHz	10 MHz			
Transmis	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB		()	
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
SNR (Note 3)	dB	6	7	12	13
	(j) or	dB[mW/15kHz]	-92	-91	-86	-85
Λ	$Q_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-6	98
Propagati	on channel		EPA5			
Correla	ition and		High (1 x 2)			
	onfiguration		riigii (1 X 2)			
	ng mode		PUCCH 1-0			
	periodicity	ms			= 2	
	delay	ms		- 8	3	
,	channel for			PUSCH	(Note 4)	
	eporting		PUSCH (Note 4)			
	Report Type		4			
	-pmi-				1	
	ationIndex				•	
	er of HARQ				1	
	nissions	<u> </u>	·			
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later						
), this reported wide	band CQ	i cannot	be applie	a at the
		before SF#(n+4))D 0000"	dina to Ta	hla
		easurement channe				
		egory 2-8 with one s				
FDD as described in Annex A.5.1.1 and RC.4 FDD according to						

Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.

Table 9.3.2.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	1-8	1-8

9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

Para	meter	Unit	Tes	st 1	Tes	st 2
	lwidth	MHz			MHz	
Transmis	sion mode				ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB		()	
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
Uplink o	downlink uration			2	2	
Special	subframe uration			4	4	
SNR (Note 3)	dB	6	7	12	13
		-				
I_{c}	(j) or	dB[mW/15kHz]	-92	-91	-86	-85
N	oc (j)	dB[mW/15kHz]	-6	8	-9	8
	on channel			EP	A5	
	tion and			High ((1 x 2)	
	onfiguration ng mode			-	CH 1-0	
	periodicity	ms	$N_{\rm pd} = 5$			
	delay	ms	10 or 11			
Physical of	channel for			DUSCH	(Note 4)	
	porting		PUSCH (Note 4)			
	eport Type pmi-				4	
	pm- ationIndex			3	3	
Max numb	er of HARQ					
	issions			•	1	
ACK/NAC	K feedback			Multin	lexing	
	ode			•	•	
		rts in an available u				
		n based on CQI es				
		, this reported wide before SF#(n+4).	band CQ	i cannot i	be applie	d at the
		easurement channe	I DC 1 TF)D accor	ding to To	hlo
		egory 2-8 with one s				
		ibed in Annex A.5.2				
	Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.					
		st, the minimum requirements shall be fulfilled for at				
I	east one of th	ne two SNR(s) and t				
	evel. Fo avoid collis	sions between CQI	renorts a	nd HARC)-ACK it is	s
1,4010 4.	necessary to	report both on PUS	CH instea	ad of PUC	CCH. PD	CCH
		shall be transmitted				
	periodic CQI t	o multiplex with the	HARQ-A	CK on P	USCH in	uplink
	subframe SF#					

Table 9.3.2.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	1-8	1-8

9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.1-1 Fading test for FDD

Parar	meter	Unit	Test 1 Test 2		st 2	
Band	Bandwidth			10 N	ИНz	
Transmiss	Transmission mode			(9	
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	P_{c}	dB		-:	3	
	σ	dB		-	3	
SNR (f	Note 3)	dB	2	3	7	8
\hat{I}_{c}^{i}	(j) or	dB[mW/15kHz]	-96	-95	-91	-90
N	(j) oc	dB[mW/15kHz]	-9	98	-6	8
Propagation	on channel		EPA5			
	Correlation and antenna configuration		ULA High (4 x 2)			
Cell-specific re	ference signals		Antenna ports 0,1			
	nce signals		Antenna ports 15,,18			
	ning model		As specified in Section B.4.3		B.4.3	
	and subframe offset			5.	/1	
T _{CSI-RS}	$^{\prime}\Delta_{ extsf{CSI-RS}}$					
	signal configuration				2	
	Restriction bitmap		0x0		0 0000 0	001
Reportir					CH 1-1	
	Reporting periodicity				= 5	
	delay	ms			3	
-	nel for CQI/ PMI		PUSCH (Note 4)			
repo			, ,			
PUCCH Report Type for CQI/PMI			2			
PUCCH channe			PUCCH Format 2			
PUCCH repo			3			
	gurationIndex				2	
	igIndex				1	
Max number of HA	ARQ transmissions		1			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Table 9.3.2.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	2-8	2-8

9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.2-1 Fading test for TDD

Parameter		Unit	Test 1 Test 2		st 2	
Bandwidth		MHz		10 N	ИHz	
Transmiss	sion mode			ę	9	
Uplink downlink configuration					2	
Special subfran	ne configuration			4	1	
	$ ho_{\scriptscriptstyle A}$	dB		()	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	P_c	dB		-(6	
	σ	dB		-:	3	
SNR (N	Note 3)	dB	1	2	7	8
\hat{I}_o^i	(j) r	dB[mW/15kHz]	-97	-96	-91	-90
N_{c}	(j) oc	dB[mW/15kHz]	-98 -98		8	
Propagation	on channel		EPA5			
Correlation and ant	tenna configuration		XP High (8 x 2)			
CRS reference signals			Antenna ports 0, 1			
CSI referer			Antenna ports 15,,22			22
Beamform	ing Model		As specified in Section B.4.3		B.4.3	
CSI-RS periodicity a	and subframe offset			5/	3	
	$^{\prime}\Delta$ csi-rs			3/	3	
CSI-RS reference s	signal configuration			2	2	
CodeBookSubset	Restriction bitmap		0x0000 0000 0000 0020 0000 0000 0001		0000	
Reportir			PUC	CH 1-1 (Sub-mod	e: 2)
Reporting	periodicity	ms		N_{pd}	= 5	
CQI		ms		10		
Physical chann	nel for CQI/ PMI			PUSCH	(Noto 4)	
reporting				FUSCII	(14016 4)	
PUCCH Report Type for CQI/ PMI					С	
Physical channel for RI reporting				PUCCH	Format 2	
PUCCH repo				3		
	gurationIndex			3		
ri-Conf				805 (N	lote 5)	
Max number of HA				1	1	
ACK/NACK feedback mode				Multip	lexing	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.2.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
<i>α</i> [%]	20	20
γ	1.05	1.05
UE Category	2-8	2-8

9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least α % for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

Para	meter	Unit	Test 1	Test 2		
	dwidth	MHz	10 MHz	10 MHz		
Transmis	sion mode		1 (port 0)	1 (port 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0		
power	$ ho_{\scriptscriptstyle B}$	dB	0	0		
allocation	σ	dB	0	0		
$I_{ot}^{(j)}$ for	RB 05	dB[mW/15kHz]	-102	-93		
$I_{ot}^{(j)}$ for I	RB 641	dB[mW/15kHz]	-93 -93		15kHz] -93 -	
$I_{ot}^{(j)}$ for F	RB 4249	dB[mW/15kHz]	-93 -102			
Î	(j) or	dB[mW/15kHz]	-94 -94			
	er of HARQ nissions			1		
			Clause B.2.4 wi	th $\tau_d = 0.45 \mu \text{s}$,		
Propagati	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Reportin	g interval	ms	5			
Antenna co	onfiguration		1:	x 2		
	delay	ms		8		
	ng mode			CH 3-0		
Sub-ba	and size	RB	6 (ful	l size)		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Table 9.3.3.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	1-8	1-8

9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least $\alpha\%$ for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

MHz e dB	10 MHz 1 (port 0)	10 MHz
	1 (port 0)	4 /
dB		1 (port 0)
	0	0
dB	0	0
dB	0	0
	2	2
	2	4
dB[mW/15kHz]	-102	-93
dB[mW/15kHz]	-93	-93
dB[mW/15kHz]	-93	-102
dB[mW/15kHz]	-94	-94
Q	,	1
	Clause B.2.4 wit	th $ au_d=0.45\mu\mathrm{s}$,
ei	a = 1, f	$_{D} = 5 \mathrm{Hz}$
on	1 2	x 2
ms		5
ms		or 11
	PUSC	CH 3-0
RB	6 (full	size)
	Multiplexing	
	dB[mW/15kHz] dB[mW/15kHz] dB[mW/15kHz] dB[mW/15kHz] dB[mW/15kHz] RQ el nn ms ms RB	dB 0 dB 0 dB 0 dB[mW/15kHz] -102 dB[mW/15kHz] -93 dB[mW/15kHz] -93 dB[mW/15kHz] -94 Clause B.2.4 with a = 1, f f f f f f f f f f f f f f f f f f

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

Table 9.3.3.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	1-8	1-8

9.3.3.2 Void

9.3.3.2.1 Void

9.3.3.2.2 Void

9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband COI median on a randomly selected subband in set S shall be $> \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the $N_{\rm PRB}$ entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

Para	meter	Unit	Tes	Test 1 Test :		st 2
Band	dwidth	MHz	10 MHz			
Transmis	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power allocation	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
SNR	(Note 3)	dB	9	10	14	15
	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
Λ	oc	dB[mW/15kHz]	-9	98	-9	8
			Clause	B.2.4 wit	$\tau_d = 0$.45 <i>μ</i> s,
Propagati	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Reportir	g interval	ms		į	5	
CQI	delay	ms	<u>5</u> 8			
Reporti	ng mode		PUSCH 2-0			
	er of HARQ nissions		1			
	d size (<i>k</i>)	RBs		3 (full	sizo)	
	of preferred	TO5		,		
	nds (<i>M</i>)				5	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)					CQI	
	Reference measurement channel RC.5 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as					
	described in Annex A.5.1.1/2.					
Note 3:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.					

Table 9.3.4.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	1-8	1-8

9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the N_{PRB} entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

Parai	meter	Unit	Tes	st 1	Tes	st 2
Band	width	MHz	10 MHz			
Transmiss	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		()	
power $ ho_{\scriptscriptstyle B}$		dB		()	
allocation	σ	dB		()	
	lownlink uration			2	2	
	subframe uration			4	4	
SNR (Note 3)	dB	9	10	14	15
\hat{I}_{a}	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
N	(j) oc	dB[mW/15kHz]	-6	98	-6)8
			Clause	B.2.4 wit	th $\tau_d = 0$	$0.45 \mu s$,
Propagation	on channel		$a = 1, f_D = 5 \text{ Hz}$,
Reportin	g interval	ms	5		5	
	delay	ms		10 c	or 11	
	ng mode			PUSC	CH 2-0	
	er of HARQ				1	
	issions					
	d size (k)	RBs		3 (full	size)	
	f preferred			į	5	
	nds (<i>M</i>) K feedback					
	de			Multip	lexing	
Note 2: F	Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.5 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.					
	east one of the	ne two SNR(s) and t	the respe	ctive war	nted signa	al input

Table 9.3.4.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	1-8	1-8

9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the $N_{\rm PRB}$ entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

Parameter		Unit	Tes	st 1	Tes	st 2
	ndwidth	MHz	10 MHz			
Transmi	ssion mode		1 (port 0)			
Downlink $\rho_{\scriptscriptstyle A}$		dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
SNR	(Note 3)	dB	8	9	13	14
	$\hat{m{I}}_{or}^{(j)}$	dB[mW/15kHz]	-90	-89	-85	-84
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-9	8
			Clause	B.2.4 wit	th $\tau_d = 0$.45 μs,
Propaga	tion channel					
Reportin	g periodicity	ms		a = 1, f	= 2	
CQ	l delay	ms		8	3	
Physical channel for			PUSCH (Note 4)			
CQI reporting					(11010 1)	
PUCCH Report Type			4			
for wideband CQI PUCCH Report Type			+			
	band CQI		1			
	ber of HARQ			,	1	
	missions		-			
	nd size (<i>k</i>)	RBs	6 (full size)			
	of bandwidth			3	3	
ра	rts (J)					
	K				1	
	ConfigIndex	urto in on cuallable :	inlink ===	antina ia -	l topos st	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)						
Note 2:						
	described in Annex A.5.1.1/2.					
Note 3:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input					
Note 4:	level. To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9					

- to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.
- Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.
- In the case where wideband CQI is reported, data is to be Note 6: scheduled according to the most recently used subband CQI report.

Table 9.3.4.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	1-8	1-8

9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the N_{PRB} entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

Parameter		Unit	Tes	st 1	Tes	st 2
	dwidth	MHz		10 MHz		
	ssion mode			1 (pc		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
	downlink				2	
	guration				<u>-</u>	
	subframe			4	1	
	guration (Note 3)	dB	8	9	13	14
	$\hat{f}(j)$					
I	or	dB[mW/15kHz]	-90	-89	-85	-84
Λ	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-9	18
Propagat	ion channel		Clause	B.2.4 wit	th $ au_d=0$	$.45 \mu$ s,
FTOpagat	ion channe			a = 1, f	$_D = 5 \mathrm{Hz}$	
	periodicity	ms		N₽		
	delay	ms		10 c	or 11	
	channel for eporting			PUSCH	(Note 4)	
PUCCH F	Report Type			4	1	
	band CQI Report Type					
	band CQI		1			
	er of HARQ		1			
	nissions					
	nd size (k)	RBs	6 (full size)			
	of bandwidth ts (<i>J</i>)			3	3	
,	K			•	1	
	ConfigIndex		3			
	K feedback		Multiplexing			
	ode	l orts in an available υ	ınlink ron			
	subframe SF# not later than	#n based on CQI es SF#(n-4), this repor	timation a	at a down and or wi	ılink subfı ideband (
		olied at the eNB dove easurement channe				ble
		e/two sided dynamic				
	described in A	Annex A.5.2.1/2.				
		the minimum requi				
	least one of the	ne two SNR(s) and t	ne respe	ctive war	itea signa	ii input
Note 4:	To avoid collisions between CQI reports and HARQ-ACK it is					
	necessary to report both on PUSCH instead of PUCCH. PDCCH					
	DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink					
	periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.					upiii ik
Note 5:						
	bandwidth part) are to be disregarded and data scheduling					
	•	he most recent subl	band CQ	report fo	or bandwi	dth part
	with j=1. In the case wi	nere wideband CQI	is reporte	ed data i	s to be	
		cording to the most				I
report.						

Table 9.3.4.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	1-8	1-8

9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6 with 1 TX and transmission mode 9 with 4 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}} \cdot$$

In the definition of γ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements, t_{rnd} is 60% of the maximum throughput obtained at SNR_{rnd} using random precoding, and t_{ue} the throughput measured at SNR_{rnd} with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement, t_{md} is 60% of the maximum throughput obtained at SNR_{rnd} using random precoding on a randomly selected full-size subband in set S subbands, and t_{ue} the throughput measured at SNR_{rnd} with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements, t_{rnd} is 60% of the maximum throughput obtained at SNR_{rnd} using random precoding on a randomly selected full-size subband in set S subbands, and t_{ue} the throughput measured at SNR_{rnd} with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of γ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements, $t_{follow1,follow2}$ is 70% of the maximum throughput obtained at $SNR_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t_{md1,md2}$ is the throughput measured at $SNR_{follow1,follow2}$ with random precoding.

9.4.1 Single PMI

9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

Table 9.4.1.1.1-1 PMI test for single-layer (FDD)

Parar	neter	Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Propagation	on channel		EVA5
Precoding	granularity	PRB	50
	tion and Infiguration		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
N	(j) oc	dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 3-1
Reporting	g interval	ms	1
PMI dela	y (Note 2)	ms	8
Measureme	ent channel		R. 10 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ			4
transmissions			4
coding s		va a a da v a a la ati a va th	{0,1,2,3}

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting

instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Table 9.4.1.1.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.1
UE Category	1-8

9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

Table 9.4.1.1.2-1 PMI test for single-layer (TDD)

Parar	neter	Unit	Test 1
Band	width	MHz	10
Transmiss	sion mode		6
Uplink d	lownlink		1
	uration		· · · · · · · · · · · · · · · · · · ·
	subframe		4
	uration .		
	on channel		EVA5
	granularity	PRB	50
	tion and		Low 2 x 2
antenna co	nfiguration		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
N	(j) oc	dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 3-1
Reporting	g interval	ms	1
PMI delay	/ (Note 2)	ms	10 or 11
	ent channel		R.10 TDD
	Pattern		OP.1 TDD
Max number of HARQ			4
transmissions			'
Redundancy version			{0,1,2,3}
	equence		(-, -, -, -,
	K feedback		Multiplexing
Note 1: E		recoder selection th	o procedor

Note 1: For random precoder selection, the precoder shall be updated in each available downlink

transmission instance.

Note 2: If the UE reports in an available uplink reporting

instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Table 9.4.1.1.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.1
UE Category	1-8

9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

Table 9.4.1.2.1-1 PMI test for single-layer (FDD)

Parameter		Unit	Test 1
	dwidth	MHz	10
Transmi	ssion mode		6
Propagat	ion channel		EVA5
	ation and		Low 4 x 2
antenna d	configuration		LOW 4 X Z
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
Λ	$V_{oc}^{(j)}$	dB[mW/15kHz]	-98
PM	delay	ms	8 or 9
Report	ing mode		PUCCH 2-1 (Note 6)
Reporting	g periodicity	ms	$N_{pd} = 2$
	channel for eporting		PUSCH (Note 3)
	Report Type		
for wideba	and CQI/PMI		2
	Report Type band CQI		1
Measuren	nent channel		R.14-1 FDD
OCNG Pattern			OP.1/2 FDD
Precoding	granularity	PRB	6 (full size)
Number of bandwidth			3
pa	rts (<i>J</i>)		Ŭ
	K		1
	ConfigIndex		1
	per of HARQ		4
	missions		•
	ncy version		{0,1,2,3}
	sequence	1 1 2 4	
Note 1:			ne precoder shall be updated
Note 2:		(2 ms granularity).	plink reporting instance at
Note 2.			imation at a downlink SF not later
			cannot be applied at the eNB
	downlink befo		carriot be applied at the civi
Note 3:		\ /	Q-ACK and wideband CQI/PMI or
11010 01			eport both on PUSCH instead of
PUCCH. PDCCH DCI format 0 shall be transmitted in downlink			
	SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the		
	HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.		
Note 4:	Reports for the short subband (having 2RBs in the last bandwidth		
	part) are to be disregarded and instead data is to be transmitted on		
	the most recently used subband for bandwidth part with j=1.		
Note 5:			is reported, data is to be
transmitted on the most recently used subband.			
Note 6: The bit field for PMI confirmation in DCI format 1B shall be map			
to "0" and TPMI information shall indicate the codebook index use			

Table 9.4.1.2.1-2 Minimum requirement (FDD)

in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI report on PUCCH.

	Test 1
γ	1.2
UE Category	1-8

9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

Table 9.4.1.2.2-1 PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
Uplink downlink configuration			1
	subframe guration		4
Propaga	tion channel		EVA5
Correl	ation and configuration		Low 4 x 2
Downlink	$\rho_{\scriptscriptstyle A}$	dB	-6
power	$\rho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-98
PM	l delay	ms	10
Report	ting mode		PUCCH 2-1 (Note 6)
	g periodicity	ms	<i>N</i> _P = 5
	channel for eporting		PUSCH (Note 3)
PUCCH Report Type for wideband CQI/PMI			2
PUCCH	Report Type		1
	nent channel		R.14-1 TDD
	3 Pattern		OP.1/2 TDD
	g granularity	PRB	6 (full size)
Number of	of bandwidth		,
pa	rts (<i>J</i>)		3
	K		1
cqi-pmi-	ConfigIndex		4
Max num	ber of HARQ missions		4
	ancy version sequence		{0,1,2,3}
ACK/NA	CK fedback		Multiplexing
Note 1:		recoder selection. the	ne precoder shall be updated in
Note 2:	each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later		
Note 3:	subband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK		
Nata 4.	on PUSCH in	uplink subframe SF	*#8 and #3.

report on PUCCH.

Note 4:

Note 5:

Note 6:

Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.

The bit field for PMI confirmation in DCI format 1B shall be mapped to "0" and TPMI information shall indicate the codebook index used in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI

In the case where wideband PMI is reported, data is to be

transmitted on the most recently used subband.

Table 9.4.1.2.2-2 Minimum requirement (TDD)

	Test 1
γ	1.2
UE Category	1-8

9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

Table 9.4.1.3.1-1 PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Propagation	on channel		EPA5
Precoding	granularity	PRB	50
Correlat	tion and		Low
antenna co			ULA 4 x 2
Cell-specific			Antenna ports
sigr	nals		0,1
CSI referer	nce signals		Antenna ports 15,,18
Beamform			Annex B.4.3
CSI-RS periodicity and subframe offset T _{CSI-RS} / ∆ _{CSI-RS}			5/ 1
CSI-RS r signal cor	eference		6
CodeBookS iction t	SubsetRestr		0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
N.	(j) oc	dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	8
Measurement channel			R.44 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ transmissions			4
Redundan coding s	•		{0,1,2,3}
2221g 0	1-1-000	L	_

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#/n-

estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.1.3.1-2 Minimum requirement (FDD)

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Parameter	Test 1	
γ	1.2	
UE Category	1-8	

9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

Table 9.4.1.3.2-1 PMI test for single-layer (TDD)

Paran	Devemates Huit Test 4			
Pand		Unit MHz	Test 1 10	
Bandwidth Transmission mode		IVI□∠	9	
Uplink downlink			9	
configuration			1	
Special s				
configu			4	
Propagatio			EVA5	
Precoding		PRB	50	
Antenna co			8 x 2	
			High, Cross	
Correlation	modeling		polarized	
Cell-specific	reference		Antenna ports	
sign	als		0,1	
CSI referen	co signals		Antenna ports	
			15,,22	
Beamform			Annex B.4.3	
CSI-RS peri				
subfram			5/ 4	
T _{CSI-RS} /				
CSI-RS re			0	
signal con	ilguration		0,000 0000	
CodoBooks	ubcotBoots		0x0000 0000 001F FFE0	
CodeBookS iction b			0000 0000	
ICTION D	πιπαρ		FFFF	
		-ID		
	$ ho_{\scriptscriptstyle A}$	dB	0	
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0	
power		٩D	6	
allocation	Pc	dB	-6	
	σ	dB	-3	
$N_{\cdot}^{(}$	<i>j</i>)	dD[m\\//4.Ek.U=1	-98	
0	C	dB[mW/15kHz]		
Reportin			PUSCH 3-1	
Reporting		ms	5	
PMI delay	(Note 2)	ms	10	
			R.45-1 TDD	
			for UE	
Measureme	nt channel		Category 1,	
			R.45 TDD for	
			UE Category	
			2-8	
			OD 7 TDD 1	
			OP.7 TDD for	
OCNC !	Dattorn		UE Category	
OCNG F	Pattern		UE Category 1, OP.1 TDD	
OCNG F	Pattern		UE Category 1, OP.1 TDD for UE	
			UE Category 1, OP.1 TDD for UE Category 2-8	
Max numbe	r of HARQ		UE Category 1, OP.1 TDD for UE	
Max numbe transmi	r of HARQ ssions		UE Category 1, OP.1 TDD for UE Category 2-8	
Max numbe transmi Redundand	r of HARQ ssions cy version		UE Category 1, OP.1 TDD for UE Category 2-8	
Max numbe transmi	r of HARQ ssions cy version equence		UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3}	
Max numbe transmi Redundand coding se ACK/NACK	r of HARQ ssions cy version equence feedback de		UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1:	r of HARQ ssions cy version equence feedback de or random p	recoder selection, th	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1: F	r of HARQ ssions cy version equence feedback de or random p nall be upda	ted in each TTI (1 m	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder as granularity).	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1: F	r of HARQ ssions cy version equence feedback de or random p nall be updat the UE repo	ted in each TTI (1 m orts in an available u	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting	
Max numbe transmi Redundand coding se ACK/NACK mode 1: F sl Note 2: If in	r of HARQ ssions by version equence feedback de or random p nall be updat the UE repo	ted in each TTI (1 m orts in an available u ibrame SF#n based	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder s granularity). plink reporting on PMI	
Max numbe transmi Redundand coding se ACK/NACK moor Note 1: Find sin the second	r of HARQ ssions by version equence feedback de or random phall be updathe UE reposistance at sustimation at a	ted in each TTI (1 m orts in an available u obrame SF#n based a downlink SF not la	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI ater than SF#(n-	
Max numbe transmi Redundand coding se ACK/NACK moor Note 1: Find sin the second	r of HARQ ssions by version equence feedback de or random p hall be updat the UE repo- stance at su stimation at a), this reporte	ted in each TTI (1 m orts in an available u obrame SF#n based a downlink SF not la ed PMI cannot be ap	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI ater than SF#(n-	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1: Find slip se Si Note 2: If sin es Si Note 4'	r of HARQ ssions by version equence feedback de or random phall be updathe UE repostance at sustimation at a b, this reporte NB downlink	ted in each TTI (1 m orts in an available u dbrame SF#n based a downlink SF not la ed PMI cannot be ap before SF#(n+4).	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI atter than SF#(n-oplied at the	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1: F sl Note 2: If in es	r of HARQ ssions by version equence feedback de or random phall be updathe UE repostance at sustimation at a b, this reporte NB downlink DCCH DCI f	ted in each TTI (1 morts in an available unbrame SF#n based a downlink SF not lated PMI cannot be appleted before SF#(n+4).	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI atter than SF#(n- oplied at the er for aperiodic	
Max numbe transmi Redundand coding se ACK/NACK mod Note 1: Fight slip sin es 4 4 el Note 3: P	r of HARQ ssions by version equence feedback de or random phall be updathe UE repostance at sustimation at a b, this reporte NB downlink DCCH DCI for QI shall be to serious particular to the propertion of the properties of the p	ted in each TTI (1 morts in an available unbrame SF#n based a downlink SF not laced PMI cannot be apple before SF#(n+4). Format 0 with a triggoransmitted in downling available.	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI atter than SF#(n- poplied at the er for aperiodic ink SF#4 and #9	
Max number transmit Redundand coding set ACK/NACK mode 1: Find set Additional set ACK and the set Additional set ACK and the s	r of HARQ ssions by version equence feedback de or random phall be updathe UE repostance at sustimation at a b, this reporte NB downlink DCCH DCI for QI shall be to serious particular to the propertion of the properties of the p	ted in each TTI (1 morts in an available unbrame SF#n based a downlink SF not laced PMI cannot be applicated by the strings of	UE Category 1, OP.1 TDD for UE Category 2-8 4 {0,1,2,3} Multiplexing ne precoder is granularity). plink reporting on PMI atter than SF#(n- poplied at the er for aperiodic ink SF#4 and #9	

Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4

Table 9.4.1.3.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	3
UE Category	1-8

9.4.1a Void

9.4.1a.1 Void

9.4.1a.1.1 Void

9.4.1a.1.2 Void

9.4.2 Multiple PMI

9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

Table 9.4.2.1.1-1 PMI test for single-layer (FDD)

			
Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
	on channel		EPA5
Precoding granularity (only for reporting and following PMI)		PRB	6
	tion and onfiguration		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
N	(j) oc	dB[mW/15kHz]	-98
	ng mode		PUSCH 1-2
	g interval	ms	1
PMI	delay	ms	8
Measurement channel			R.11-3 FDD for UE Category 1, R.11 FDD for UE Category 2-8
OCNG	Pattern		OP.1/2 FDD
	er of HARQ issions		4
	cy version equence		{0,1,2,3}
Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity). Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).			
Note 3: One/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2 shall be			

Table 9.4.2.1.1-2 Minimum requirement (FDD)

used.

Parameter	Test 1
γ	1.2
UE Category	1-8

9.4.2.1.2 TDD

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

Table 9.4.2.1.2-1 PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
Uplink downlink configuration			1
	subframe		
	uration		4
Propagati	on channel		EPA5
Precoding granularity (only for reporting and		PRB	6
followi	ng PMI)		
	tion and onfiguration		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
N	oc (j)	dB[mW/15kHz]	-98
	ng mode		PUSCH 1-2
	g interval	ms	1
PMI	delay	ms	10 or 11
Measurement channel			R.11-3 TDD for UE Category 1 R.11 TDD for UE Category 2-8
OCNG	Pattern		OP.1/2 TDD
Max number of HARQ transmissions			4
	ncy version		{0,1,2,3}
	sequence K feedback		,
me	ode		Multiplexing
		recoder selection, th	
		ted in each available	e downlink
transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-		on PMI ater than SF#(n-	
4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be used.			attern OP.1/2

Table 9.4.2.1.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	1-8

9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

Table 9.4.2.2.1-1 PMI test for single-layer (FDD)

Parameter		Unit	Test 1	
Bandwidth		MHz	10	
Transmiss	sion mode		6	
Propagation	on channel		EVA5	
	tion and onfiguration		Low 4 x 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6	
power	$ ho_{\scriptscriptstyle B}$	dB	-6	
allocation	σ	dB	3	
N	(j) oc	dB[mW/15kHz]	-98	
PMI	delay	ms	8	
Reportir	ng mode		PUSCH 2-2	
Reportin	g interval	ms	1	
Measureme	ent channel		R.14-2 FDD	
OCNG	Pattern		OP.1/2 FDD	
Subband	d size (<i>k</i>)	RBs	3 (full size)	
Number of preferred subbands (<i>M</i>)			5	
Max number of HARQ transmissions			4	
Redundancy version coding sequence			{0,1,2,3}	
Note 1: For random precoder selection, the precoder shall be undated in				

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Table 9.4.2.2.1-2 Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	1-8

9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

Table 9.4.2.2.2-1 PMI test for single-layer (TDD)

Parameter	Unit	Test 1
Bandwidth	MHz	10
Transmission mode		6
Uplink downlink configuration		1
Special subframe configuration		4

Propagation channel			EVA5
Correlation and antenna configuration			Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N_{c}	(j) oc	dB[mW/15kHz]	-98
PMI	delay	ms	10
Reporting mode			PUSCH 2-2
Reporting interval		ms	1
Measurement channel			R.14-2 TDD
OCNG Pattern			OP.1/2 TDD
Subband	d size (<i>k</i>)	RBs	3 (full size)
Number of subbar	f preferred nds (<i>M</i>)		5
	er of HARQ issions		4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing

Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.4.2.2.2-2 Minimum requirement (TDD)

	Test 1
γ	1.15
UE Category	1-8

9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

Table 9.4.2.3.1-1 PMI test for single-layer (FDD)

Parar	neter	Unit	Test 1
Band	width	MHz	10
Transmiss			9
Propagation			EVA5
Precoding (only for re following		PRB	6
Correla	tion and		Low
antenna co			ULA 4 x 2
Cell-specifi			Antenna ports
sigr	nals		0,1
CSI refere			Antenna ports 15,,18
Beamform			Annex B.4.3
	ie offset ′ ∆csi-Rs		5/ 1
CSI-RS r signal cor	figuration		8
CodeBookS iction I	SubsetRestr		0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
N		dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
Reporting		ms	5
PMI (delay	ms	8
Measureme	ent channel		R.45-1 FDD for UE Category 1, R.45 FDD for UE Category 2-8
OCNG			OP.7 FDD for UE Category 1 OP.1 FDD for UE Category 2-8
Max number			4
Redundan coding s	cy version		{0,1,2,3}
T		·	

Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.2.3.1-2 Minimum requirement (FDD)

Parameter	Test 1		
γ	1.3		
UE Category	1-8		

9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

Table 9.4.2.3.2-1 PMI test for single-layer (TDD)

	meter	Unit	Test 1
Band	lwidth	MHz	10
Transmis	sion mode		9
Uplink o	downlink		1
config	uration		•
Special	subframe		4
config	uration		·
Propagation	on channel		EVA5
Precoding	granularity		
(only for re	porting and	PRB	6
followi	ng PMI)		
Antenna co	onfiguration		8 x 2
Correlatio	o modolina		High, Cross
Correlation	n modeling		polarized
Cell-specif	c reference		Antenna ports
sig	nals		0,1
CSI refere	nco cianale		Antenna ports
	nce signals		15,,22
	ning model		Annex B.4.3
	riodicity and		
	ne offset		5/ 4
	/ Δcsi-rs		
	reference		4
signal cor	nfiguration		
			0x0000 0000
	SubsetRestr		001F FFE0
iction	bitmap		0000 0000
			FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	db	-6
anocation	σ	dB	-3
		-	
N	oc (j)	dB[mW/15kHz]	-98
Reportii	ng mode		PUSCH 1-2
Reportin	g interval	ms	5 (Note 4)
PMI	delay	ms	10
			R.45-1 TDD
			for UE
Measurem	ent channel		Category 1,
Measureni	ent chamile		R.45 TDD for
			UE Category
			2-8
			OP.7 TDD for
_	_		UE Category 1
OCNG	Pattern		OP.1 TDD for
			UE Category
	,		2-8
	er of HARQ		4
	issions		•
	ncy version		{0,1,2,3}
	equence		
	K feedback		Multiplexing
	ode For random n	rocodor coloctico	,
		recoder selection, the ted in each TTI (1 m	
		orts in an available u	
		ibrame SF#n based	
1			

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4). Note 3: Void.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic

CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted

on uplink SF#3 and #8.

Note 5: Randomization of the principle beam direction

shall be used as specified in B.2.3A.4.

Table 9.4.2.3.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	3.5
UE Category	1-8

9.4.3 Void

9.4.3.1 Void

9.4.3.1.1 Void

9.4.3.1.2 Void

9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3.

For fixed rank 1 transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

Table 9.5.1.1-1 RI Test (FDD)

Parameter	Parameter		Test 1	Test 2	Tes	t 3		
Bandwidth		MHz	10					
PDSCH transmission mode			4					
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB		-;	3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3				
	σ	dB		()			
Propagation condit antenna configur				2 x 2 EPA5				
CodeBookSubsetRe bitmap	estriction			000011 for 010000 for 010011 for U	fixed RI = 2			
Antenna correla	ation		Low	Low	Hiç	gh		
RI configuration			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI		
SNR		dB	0	20	20	20		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	-78		
Maximum number of transmission			1					
Reporting mo			PUCCH 1-1 (Note 4)					
Physical channel for reporting	CQI/PMI		PUCCH Format 2					
PUCCH Report Ty CQI/PMI			2					
Physical channel for RI reporting			PUSCH (Note 3)					
PUCCH Report Type for RI			3					
Reporting period		ms	N _{pd} = 5					
PMI and CQI d		ms		8				
cqi-pmi-Configurati			6					
ri-ConfigurationInd			1 (Note 5)					

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:
 - For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1
 - For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2
 - For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0
- Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9 (Note 1)
72	1	N/A	1.1 (Note 1)
UE Category	2-8	2-8	2-8

Note 1: For Test 3, the minimum requirements shall be fulfilled for at least one of γ or γ_2 .

9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

Table 9.5.1.2-1 RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Tes	st 3
Bandwidth		MHz		1	0	
PDSCH transmission	on mode			4	ļ	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB		-:	3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-(3	
	σ	dB		C)	
Uplink downlink con			2			
Special subfra configuration	n			4	ļ	
Propagation condition antenna configu				2 x 2	EPA5	
CodeBookSubsetRe	estriction		000011 for fixed RI = 1			
bitmap	ootriotiori		010000 for fixed $RI = 2$			
<u>'</u>			010011 for UE reported RI			
Antenna correlation			Low Low High			9
			Fixed RI=2	Fixed RI=1	Fixed RI=1	Fixed RI=2
RI configuration			and follow RI	and follow RI	and follow RI	and follow RI
SNR		dB	0	20	20	20
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	-78
Maximum number of	of HARQ			1	1	
transmission	ns					
Reporting mode			PUSCH 3-1 (Note 3)			
Reporting inte		ms	5			
PMI and CQI d	elay	ms	10 or 11			
ACK/NACK feedback mode			Bundling			

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

Table 9.5.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2	Test 3				
21	N/A	1.05	0.9 (Note 1)				
72	1	N/A	1.1 (Note 1)				
UE Category	2-8	2-8	2-8				

Note 1: For Test 3, the minimum requirements shall be fulfilled for at least one of γ or γ .

9.5.2 Minimum requirement (CSI Reference Symbols)

9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

Table 9.5.2.1-1 RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz		10	
PDSCH transmission	n mode		9		
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power $ ho_{\!{}_B}$		dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Propagation condit antenna configur				2 x 2 EPA5	
Cell-specific reference			Ar	ntenna ports 0	
CSI reference si				nna ports 15, 16	
Beamforming M				fied in Section B.	4.3
CSI-RS periodicit subframe offs Tcsi-Rs / ∆csi-r	y and et २ऽ			5/1	
CSI reference si configuration				6	
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI		2
Antenna correla	ation		Low Low Hig		High
RI configuration	RI configuration		Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI
SNR		dB	0	20	20
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78
Maximum number of transmission				1	
Reporting mo	de			PUCCH 1-1	
Physical channel for reporting	CQI/PMI		Pl	JSCH (Note 3)	
PUCCH Report Ty CQI/PMI	pe for		2		
Physical channel for RI reporting			PUCCH Format 2		
PUCCH Report Typ	e for RI		3		
Reporting periodicity ms		ms	N _{pd} = 5		
PMI and CQI de		ms		8	
cqi-pmi-Configurati				2	
ri-Configuration	nInd			1 (Note 4)	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.
- Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	2-8	2-8	2-8

9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

Table 9.5.2.2-1 RI Test (TDD)

Parameter		Unit	Test 1 Test 2 Test 3			
Bandwidth				10		
PDSCH transmission	on mode			9		
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	Pc	dB		0		
	σ	dB		0		
Uplink downlink con	figuration			1		
Special subfra configuration				4		
Propagation condit antenna configur	ration			2 x 2 EPA5		
Cell-specific reference	ce signals		A	ntenna ports 0		
CSI reference si			Ante	enna ports 15, 16		
Beamforming M			As spec	ified in Section B.	.4.3	
CSI reference s configuration	n			4		
CSI-RS periodicit subframe offs $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-II}}$	set		5/4			
CodeBookSubsetRe bitmap	estriction		000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI			
Antenna correla	ation		Low	Low	High	
RI configuration	on				Fixed RI=1 and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	
Maximum number of transmission				1		
Reporting mo	de			PUCCH 1-1		
Physical channel for reporting	CQI/ PMI		PUSCH (Note 3)			
PUCCH report type PMI			2			
reporting	Physical channel for RI reporting		PUCCH Format 2			
Reporting period		ms	N _{pd} = 5			
PMI and CQI d		ms	10			
ACK/NACK feedback				Bundling		
cqi-pmi-Configurati	onIndex			4		
ri-ConfigurationInd				11		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.9 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8.

Table 9.5.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	2-8	2-8	2-8

9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

Table 9.5.3.1-1 RI Test (FDD)

Downwater		l lm!4	Tes	t 1	Te	st 2
Parameter		Unit	Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth		MHz	10			0
PDSCH transmission		-ID	3	Note 10	3	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3			3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	B		3
D (1 12	σ	dB	0		()
Propagation condit antenna configui			2 x 2 E	PA5	2 x 2	EPA5
g			01 for fixed		01 for fixed	
			RI = 1		RI = 1	
CodeBookSubsetRe	estriction		10 for fixed RI = 2	N/A	10 for fixed RI = 2	N/A
Ditinap			11 for UE		11 for UE	
			reported RI		reported RI	
Antenna correla	ation		Lo	W	Lo	OW
DI # #			Fixed RI=1	N1/A	Fixed RI=1	N1/A
RI configuration	on		and follow RI	N/A	and follow RI	N/A
\hat{E}_s/N_{oc2}		dB	0	-12	20	6
	$N_{oc1}^{(j)}$		-98 (Note 3)	N/A	-102 (Note 3)	N/A
$N_{oc}^{(j)}$	$N_{oc2}^{(j)}$	dBmW/1 5kHz	-98 (Note 4)	N/A	-98 (Note 4)	N/A
	$N_{oc3}^{(j)}$		-98 (Note 5)	N/A	-94.8 (Note 5)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/1 5kHz]	-98	-110	-78	-92
Subframe Configu	ıration		Non- MBSFN	Non- MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset between	en Cells	μs	2.5 (synchro		2.5 (synchr	onous cells)
				10000000 10000000		10000000 10000000
ABS Pattern (No	te 6)		N/A	10000000 10000000	N/A	10000000
·						10000000
			1000000	10000000	1000000	10000000
			10000000 10000000		10000000 10000000	
RLM/RRM Measu			10000000	N/A	10000000	N/A
Subframe Pattern (Note 7)		10000000	,, .	10000000	
			10000000		10000000	
			10000000 10000000		10000000 10000000	
	Ccsi,0		10000000		10000000	
	,		10000000		10000000	
CSI Subframe Sets			10000000	N/A	10000000	N/A
(Note 8)			01111111	,,, .	01111111	,
	Ccsi.1		01111111 01111111		01111111 01111111	
	OCSI, I		01111111		01111111	
			01111111		01111111	
Number of control Symbols	OFDM		3	3	3	3
Maximum number of HARQ transmissions			1			1
Reporting mode			PUCC	H 1-0	PUCC	CH 1-0
Physical channel for CQI reporting			PUCCH F	ormat 2	PUCCH	Format 2
PUCCH Report Type	e for CQI		4			4
Physical channel			PUCCH F			Format 2
reporting PLICCH Report Tvr	e for RI					
PUCCH Report Type for RI		l	3		3	

cqi-pmi-ConfigurationIndex 11 11 ri-ConfigurationIndex2 10 10 ri-ConfigurationIndex2 10 10 cqi-pmi-ConfigurationIndex2 10 10 Cyclic prefix Normal Normal Normal Normal Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4). Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8:	Rep	orting periodicity	ms	<i>N</i> _{pd} = 10		<i>N</i> _{pd} = 10	
cqi-pmi-ConfigurationIndex2 Cyclic prefix Normal No	cqi-pmi	-ConfigurationIndex		1	1	11	
Tri-ConfigurationInd2 Cyclic prefix Normal Nore Sprite (n-4), this reported wideband CQI cannoth A.5.1.1. Note 2: Reference measurement on Poll according to Nertheney, #10,#12,#13 of a subframe overlapping with the aggressor nor-ABS Note 5: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12,#13 of a subframe overlapping with the aggre	ri-C	ConfigurationInd		5	5	5	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4). Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	cqi-pmi-	ConfigurationIndex2		1	0	10)
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4). Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	ri-C	onfigurationInd2		2	2	2	
estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4). Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG							
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 Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG 						eported wideban	d CQI cannot
dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG							
 Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG 	Note 2:						ith one sided
overlapping with the aggressor ABS. Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG							
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aggressor ABS. Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	1					_	
 Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG 	Note 4:		n OFDM syr	nbols #0, #4, #7	7, #11 of a sub	frame overlapping	g with the
Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	. =						4.00
PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG							
with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	Note 6:						
reference channel. Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG							
Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG			e or aggress	sor cell and the	subframe is av	allable in the deli	nition of the
 [7]. Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG 	Note 7:		omont rocou	ree restriction r	attorn for DCa	Il moscuromonte	as defined in
Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	Note 7.		ement resou	ice restriction p	ballelli loi FCe	ii iiieasureiiieiiis	as delined in
measurements defined in [7]. Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	Note 8:	• 1					
Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	14010 0.			ic domain mea		arce restriction pe	
and Cell 2 is the same. Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	Note 9:						
Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG	1.13.00.	•	·				
	Note 10:			n Cell 2 in acco	ordance with Ar	nnex C.3.3 applyi	na OCNG
pattern as defined in Annex A.5.1.5.							3

Table 9.5.3.1-2 Minimum requirement (FDD)

	Test 1	Test 2
21	0.9	1.05
UE Category	2-8	2-8

9.5.3.2 TDD

The minimum performance requirement in Table 9.5.3.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$.

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

Table 9.5.3.2-1 RI Test (TDD)

Parameter		Unit	Test1		Test 2		
			Cell 1	Cell 2	Cell 1	Cell 2	
Bandwidth		MHz		10 Note 44	3		
PDSCH transmission Uplink downlink conf			3	Note 11 1	3	Note 11	
Special subfraconfiguration	me			4		4	
comigaration	$ ho_{\scriptscriptstyle A}$	dB		-3	-3	\	
Downlink power		dB		-3	-3		
allocation	$ ho_{\scriptscriptstyle B}$ σ	dB		0	0		
Propagation condit antenna configur	ion and	<u> </u>		EPA5	2 x 2 E	PA5	
CodeBookSubsetRe bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	
Antenna correla	ition			ow	Lov	W	
RI configuration	on		Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A	
\widehat{E}_s/N_{oc2}		dB	0	-12	20	6	
	$N_{\rm ocl}^{(j)}$		-98 (Note 4)	N/A	-102 (Note 4)	N/A	
$N_{oc}^{(j)}$	$N_{\rm oc2}^{(j)}$	dB[mW/1 5kHz	-98 (Note 5)	N/A	-98 (Note 5)	N/A	
	$N_{\text{oc}3}^{(j)}$		-98 (Note 6)	N/A	-94.8 (Note 6)	N/A	
$\hat{I}_{or}^{(j)}$		dB[mW/1 5kHz]	-98	-110	-78	-92	
Subframe Configu	ıration		Non- MBSFN	Non- MBSFN	Non-MBSFN	Non-MBSFN	
Cell Id			0	1	0	1	
Time Offset between	en Cells	μs	2.5 (synchronous cells)		2.5 (synchronous cells)		
ABS Pattern (No	te 7)		N/A	000000000 1 000000000 1	N/A	0000000001 0000000001	
RLM/RRM Measur Subframe Pattern (00000000 01 00000000 01	N/A	0000000001 0000000001	N/A	
CSI Subframe Sets	Ccsi,0		00000000 01 00000000 01	N/A	0000000001 0000000001	N/A	
(Note 9)	C _{CSI,1}		11001110 00 11001110 00	14/7	1100111000 1100111000	1471	
Number of control Symbols	OFDM		3	3	3	3	
Maximum number of	Maximum number of HARQ			1	1		
transmission				-		14.0	
Reporting mod				CH 1-0	PUCCH 1-0		
and RI reporti			PUCCH	Format 2	PUCCH F	ormat 2	
PUCCH Report Type	e for CQI		<u> </u>	4	4	4	

Physical channel for C _{CSI,1} CQI and RI reporting		PUSCH (Note 3)		PUSCH	(Note 3)
PUCCH Report Type for RI		(3	3	3
Reporting periodicity	ms	N _{pd} =	= 10	N _{pd} = 10	
ACK/NACK feedback mode		Multiplexing		Multiplexing	
cqi-pmi-ConfigurationIndex		8	3	8	
ri-ConfigurationInd		Į.	5	5	
cqi-pmi-ConfigurationIndex2		9		9	
ri-ConfigurationInd2		0		()
Cyclic prefix		Normal	Normal	Normal	Normal

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 TDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#3.
- Note 4: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 5: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 6: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 7: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 8: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 9: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 10: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.
- Note 11: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5.

Table 9.5.3.2-2 Minimum requirement (TDD)

	Test 1	Test 2
21	0.9	1.05
UE Category	2-8	2-8

9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

9.6.1.1 FDD

The following requirements apply to UE Category 3-8. For the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQI_{Pcell} – wideband $CQI_{Scell} \ge 2$

for more than 90% of the time.

Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD)

Parameter		Unit	Pcell	Scell	
PDSCH transmission	on mode			1	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condit antenna configur			AWGN (1 x 2)		
SNR	•		10	4	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88 -94		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	
Physical channel f reporting	or CQI		PUCCH Format 2		
PUCCH Report Type			4		
Reporting period	Reporting periodicity		$N_{pd} = 10$		
cqi-pmi-ConfigurationIndex			11	16 [shift of 5 ms relative to Pcell]	

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Table 9.6.1.1-2: PUCCH 1-0 static test (FDD)

Test nu	ımber	Bandwidth combination				
1		10MHz for both cells				
2		20MHz for both cells				
		olicability of requirements for different CA configurations and other combination sets is defined in 9.1.1.2.				

9.6.1.2 TDD

The following requirements apply to UE Category 3-8. For the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQI_{Pcell} – wideband $CQI_{Scell} \ge 2$

for more than 90% of the time.

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD)

Parameter		Unit	Pcell	Scell			
PDSCH transmission	on mode			1			
Uplink downlink con	figuration		2				
Special subframe configuration			4				
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0				
allocation	$ ho_{\scriptscriptstyle B}$	dB		0			
Propagation condit antenna configur			AWGN (1 x 2)				
SNR		dB	10	4			
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94			
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98			
Physical channel t reporting	for CQI		PUC	PUCCH Format 2			
PUCCH Report	Туре		4				
Reporting periodicity		ms	$N_{\rm pd} = 10$				
cqi-pmi-ConfigurationIndex			8 13 [shift of 5 ms				
		14 000011 11 000		10.00.0			

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Table 9.6.1.2-2: PUCCH 1-0 static test (TDD)

Test nu	ımber	Bandwidth combination
1		20MHz for both cells
Note 1:	The app	olicability of requirements for different CA configurations
	and bar	ndwidth combination sets is defined in 9.1.1.2.

10 Performance requirement (MBMS)

10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value					
Number of HARQ processes	Processes	None					
Subcarrier spacing	kHz	15 kHz					
Allocated subframes per Radio Frame (Note 1)		6 subframes					
Number of OFDM symbols for PDCCH		2					
Cyclic Prefix		Extended					
Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.							

10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

Parameter Unit Test 1-4 dB 0 $\rho_{\scriptscriptstyle A}$ Downlink power dB 0 (Note 1) $\rho_{\scriptscriptstyle B}$ allocation σ dB 0 N_{ac} at antenna port dBm/15kHz -98 Note 1: $P_{\scriptscriptstyle B}=0\,.$

Table 10.1.1-1: Test Parameters for Testing

Table 10.1.1-2: Minimum performance

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Referen	ce value	MBMS
number		Channel	Pattern	condition	Matrix and antenna	BLER (%)	SNR(dB)	UE Category
1	10 MHz	R.37 FDD	OP.4				4.1	1-8
			FDD					
2	10 MHz	R.38 FDD	OP.4	MBSFN			11.0	1-8
			FDD	channel	1x2 low	4		
3	10 MHz	R.39 FDD	OP.4	model (Table	1 X∠ IOW	ı	20.1	2-8
			FDD	B.2.6-1)				
	5.0MHz	R.39-1 FDD	OP.4				20.5	1
			FDD					

10.2 TDD (Fixed Reference Channel)

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to $0~\mathrm{dB}$ as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value					
Number of HARQ processes	Processes	None					
Subcarrier spacing	kHz	15 kHz					
Allocated subframes per Radio Frame (Note 1)		5 subframes					
Number of OFDM symbols for PDCCH		2					
Cyclic Prefix		Extended					
Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.							

10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

Table 10.2.1-1: Test Parameters for Testing

Parameter		Unit	Test 1-4
	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle A}$ dB	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
Note 1: $P_B = 0$.			

Table 10.2.1-2: Minimum performance

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Referen	ce value	MBMS
number		Channel	Pattern	condition	Matrix and antenna	BLER (%)	SNR(dB)	UE Category
1	10 MHz	R.37 TDD	OP.4 TDD				3.4	1-8
2	10 MHz	R.38 TDD	OP.4 TDD	MBSFN			11.1	1-8
3a	10 MHz	R.39 TDD	OP.4 TDD	channel model (Table	1x2 low	1	20.1	2-8
3b	5MHz	R.39-1 TDD	OP.4 TDD	B.2.6-1)			20.5	1
4	1.4 MHz	R.40 TDD	OP.4 TDD				5.8	1-8

Annex A (normative): Measurement channels

A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

A.2 UL reference measurement channels

A.2.1 General

The measurement channels in the following subclauses are defined to derive the requirements in clause 6 (Transmitter Characteristics) and clause 7 (Receiver Characteristics). The measurement channels represent example configurations of physical channels for different data rates.

A.2.1.1 Applicability and common parameters

The UL reference measurement channels comprise assume transmission of PUSCH and Demodulation Reference signals only. The following conditions apply:

- 1 HARQ transmission
- Cyclic Prefix normal
- PUSCH hopping off
- Link adaptation off
- Demodulation Reference signal as per TS 36.211 [4] subclause 5.5.2.1.2.

Where ACK/NACK is transmitted, it is assumed to be multiplexed on PUSCH as per TS 36.212 [5] subclause 5.2.2.6.

- ACK/NACK 1 bit
- ACK/NACK mapping adjacent to Demodulation Reference symbol
- ACK/NACK resources punctured into data
- Max number of resources for ACK/NACK: 4 SC-FDMA symbols per subframe
- No CQI transmitted, no RI transmitted

A.2.1.2 Determination of payload size

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation N_{RR}

- 1. Calculate the number of channel bits N_{ch} that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24)/N_{ch}|,$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of N_{RB} resource blocks.
- b) Segmentation is not included in this formula, but should be considered in the TBS calculation.
- c) For RMC-s, which at the nominal target coding rate do not cover all the possible UE categories for the given modulation, reduce the target coding rate gradually (within the same modulation), until the maximal possible number of UE categories is covered.
- 3. If there is more than one A that minimises the equation above, then the larger value is chosen per default.

A.2.1.3 Overview of UL reference measurement channels

In Table A.2.1.3-1 are listed the UL reference measurement channels specified in annexes A.2.2 and A.2.3 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.2.2 and A.2.3 as appropriate.

Table A.2.1.3-1: Overview of UL reference measurement channels

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Fu	II RB allocation, QP	SK							
FDD	Table A.2.2.1.1-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.1.1-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.1.1-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.1.1-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.1.1-1		15	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.1.1-1		20	QPSK	1/6	100		≥ 1	
FDD, Fu	II RB allocation, 16	QAM							
FDD	Table A.2.2.1.2-1		1.4	16QAM	3/4	6		≥ 1	
FDD	Table A.2.2.1.2-1		3	16QAM	1/2	15		≥ 1	
FDD	Table A.2.2.1.2-1		5	16QAM	1/3	25		≥ 1	
FDD	Table A.2.2.1.2-1		10	16QAM	3/4	50		≥ 2	
FDD	Table A.2.2.1.2-1		15	16QAM	1/2	75		≥ 2	
FDD	Table A.2.2.1.2-1		20	16QAM	1/3	100		≥ 2	
	rtial RB allocation,			T	ı	1	ı		
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	1		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	8		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	9		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	10		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	12		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	16		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	18		≥1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	20		≥1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	24		≥1	
FDD FDD	Table A.2.2.2.1-1 Table A.2.2.2.1-1		10 - 20	QPSK QPSK	1/3	25 27		≥ 1 ≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3			≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	30		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	36		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	40		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	45		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	48		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	80		≥ 1	
	1 4010 / 1.2.2.2.1-1			<u> </u>	1,0	- 00	<u> </u>	_ '	

FDD	Table A.2.2.2.1-1		20	QPSK	1/5	81	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	90	≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	96	≥ 1	
	tial RB allocation,	16-OAM	20	QFSK	1/0	90	21	
FDD, Fai	Table A.2.2.2.2-1	IO-QAIVI	1.4 - 20	16QAM	3/4	1	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	2	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	3	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM				
					3/4	4	≥ 1	
FDD	Table A.2.2.2.1		1.4 - 20	16QAM	3/4	5	≥ 1	
FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	6 8	≥1 ≥1	
FDD FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	9		
	Table A.2.2.2.1		3 - 20	16QAM	3/4		≥ 1	
FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	10	≥ 1	
FDD	Table A.2.2.2.1		3 - 20	16QAM	3/4	12	≥ 1	
FDD	Table A.2.2.2.1		5 - 20	16QAM	1/2	15	≥ 1	
FDD	Table A.2.2.2.1		5 - 20	16QAM	1/2	16	≥ 1	
FDD	Table A.2.2.2.1		5 - 20	16QAM	1/2	18	≥ 1	
FDD	Table A.2.2.2.1		5 - 20	16QAM	1/3	20	≥ 1	
FDD	Table A.2.2.2.1		5 - 20	16QAM	1/3	24	≥ 1	
FDD	Table A.2.2.2.1		10 - 20	16QAM	1/3	25	≥ 1	
FDD	Table A.2.2.2.1		10 - 20	16QAM	1/3	27	≥1	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	30	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	32	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	36	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	40	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	45	≥ 2	
FDD	Table A.2.2.2.1		10 - 20	16QAM	3/4	48	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	3/4	50	≥ 2	
FDD	Table A.2.2.2.1		15 - 20	16QAM	3/4	54	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	60	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	64	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	1/2	72	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	75	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	80	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	81	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	2/5	90	≥ 2	
FDD	Table A.2.2.2.1		20	16QAM	2/5	96	≥ 2	
	I RB allocation, QP	SK						
TDD	Table A.2.3.1.1-1		1.4	QPSK	1/3	6	≥ 1	
TDD	Table A.2.3.1.1-1		3	QPSK	1/3	15	≥ 1	
TDD	Table A.2.3.1.1-1		5	QPSK	1/3	25	≥ 1	
TDD	Table A.2.3.1.1-1		10	QPSK	1/3	50	≥ 1	
TDD	Table A.2.3.1.1-1		15	QPSK	1/5	75	≥ 1	
TDD	Table A.2.3.1.1-1		20	QPSK	1/6	100	≥ 1	
	I RB allocation, 16-	QAM						
TDD	Table A.2.3.1.2-1		1.4	16QAM	3/4	6	≥ 1	
TDD	Table A.2.3.1.2-1		3	16QAM	1/2	15	≥ 1	
TDD	Table A.2.3.1.2-1		5	16QAM	1/3	25	≥ 1	

TDD	Table A.2.3.1.2-1		10	16QAM	3/4	50		≥ 2	
TDD	Table A.2.3.1.2-1		15	16QAM	1/2	75		≥ 2	
TDD	Table A.2.3.1.2-1		20	16QAM	1/3	100		≥ 2	
	tial RB allocation, 0)PSK	20	100071111	170	100			
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	1		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	6		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	8		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	9		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	10		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	12		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	15		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	16		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	18		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	20		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	24		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	25		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	27		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	30		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	32		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	36		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	40		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	45		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	48		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	50		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	75		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	80		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	81		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	90		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	96		≥ 1	
	tial RB allocation, 1						T I		
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	1		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	2		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	3		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	4		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	5		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	6		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	8		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	9		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	10		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	12		≥ 1	

TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	15	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	16	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	18	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/3	20	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/3	24	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	1/3	25	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	1/3	27	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	30	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	32	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	36	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	40	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	45	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	48	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	3/4	50	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	3/4	54	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	2/3	60	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	2/3	64	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	1/2	72	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	75	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	80	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	81	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	2/5	90	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	2/5	96	≥ 2	

A.2.2 Reference measurement channels for FDD

A.2.2.1 Full RB allocation

A.2.2.1.1 QPSK

Table A.2.2.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12	
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6	
Payload size	Bits	600	1544	2216	5160	4392	4584	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of code blocks per Sub-Frame (Note 1)		1	1	1	1	1	1	
Total number of bits per Sub-Frame	Bits	1728	4320	7200	14400	21600	28800	
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400	
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	
Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)								

A.2.2.1.2 16-QAM

Table A.2.2.1.2-1 Reference Channels for 16-QAM with full RB allocation

Parameter	Unit			Va	lue			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12	
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM	
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3	
Payload size	Bits	2600	4264	4968	21384	21384	19848	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of code blocks per Sub-Frame (Note 1)		1	1	1	4	4	4	
Total number of bits per Sub-Frame	Bits	3456	8640	14400	28800	43200	57600	
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400	
UE Category		≥ 1	≥ 1	≥ 1	≥ 2	≥2	≥ 2	
Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)								

A.2.2.1.3 64-QAM

[FFS]

A.2.2.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

A.2.2.2.1 QPSK

Table A.2.2.2.1-1 Reference Channels for QPSK with partial RB allocation

Param eter	Ch BW	Alloca ted RBs	DFT- OFDM Symb ols per Sub- Frame	Mod'n	Target Codin g rate	Payloa d size	Trans port block CRC	Numb er of code blocks per Sub- Frame (Note 1)	Total numbe r of bits per Sub- Frame	Total symbo Is per Sub- Frame	UE Categ ory
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	≥ 1
	3-20	12	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20	24	12	QPSK	1/3	2472	24	1	6912	3456	≥ 1
	10-20	25	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	12	QPSK	1/3	2792	24	1	7776	3888	≥ 1
	10-20	30	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	12	QPSK	1/4	4264	24	1	17280	8640	≥1
	15 - 20	64	12	QPSK	1/4	4584	24	1	18432	9216	≥1
	15 - 20	72	12	QPSK	1/4	5160	24	1	20736	10368	≥1
	20	75	12	QPSK	1/5	4392	24	1	21600	10800	≥1
	20	80	12	QPSK	1/5	4776	24	1	23040	11520	≥1
	20	81	12	QPSK	1/5	4776	24	1	23328	11664	≥1
	20	90	12	QPSK	1/6	4008	24	1	25920	12960	≥1
	20	96	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.2.2 16-QAM

Table A.2.2.2.2-1 Reference Channels for 16-QAM with partial RB allocation

_		l able A.2									
Param	Ch BW	Alloca	DFT-	Mod'n	Target	Payloa	Trans	Numb	Total	Total	UE
eter		ted	OFDM		Codin	d size	port	er of	numbe	symbo	Categ
		RBs	Symb		g rate		block	code	r of	Is per	ory
			ols per				CRC	blocks	bits	Sub-	
			Sub-					per	per	Frame	
			Frame					Sub-	Sub-		
								Frame	Frame		
								(Note			
								`1)			
Unit	MHz					Bits	Bits	,	Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	12	16QAM	3/4	1288	24	1	1728	432	≥1
	1.4 - 20	4	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	12	16QAM	3/4	2152	24	1	2880	720	≥1
	3-20	6	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	12	16QAM	3/4	3880	24	1	5184	1296	≥1
	3-20	10	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	12	16QAM	3/4	12960	24	3	17280	4320	≥2
	10-20	32	12	16QAM	3/4	13536	24	3	18432	4608	≥2
	10-20	36	12	16QAM	3/4	15264	24	3	20736	5184	≥2
	10-20	40	12	16QAM	3/4	16992	24	3	23040	5760	≥2
	10-20	45	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	12	16QAM	3/4	20616	24	4	27648	6912	≥2
	15 - 20	50	12	16QAM	3/4	21384	24	4	28800	7200	≥2
	15 - 20	54	12	16QAM	3/4	22920	24	4	31104	7776	≥2
	15 - 20	60	12	16QAM	2/3	23688	24	4	34560	8640	≥2
	15 - 20	64	12	16QAM	2/3	25456	24	4	36864	9216	≥2
	15 - 20	72	12	16QAM	1/2	20616	24	4	41472	10368	≥2
	20	75	12	16QAM	1/2	21384	24	4	43200	10800	≥2
	20	80	12	16QAM	1/2	22920	24	4	46080	11520	≥2
	20	81	12	16QAM	1/2	22920	24	4	46656	11664	≥2
	20	90	12	16QAM	2/5	20616	24	4	51840	12960	≥2
	20	96	12	16QAM	2/5	22152	24	4	55296	13824	≥ 2
Note 1:			ode Block					of L = 24		ched to ea	

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.2.3 64-QAM

[FFS]

A.2.2.3 Void

Table A.2.2.3-1: Void

A.2.3 Reference measurement channels for TDD

For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL:2UL.

A.2.3.1 Full RB allocation

A.2.3.1.1 QPSK

Table A.2.3.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1		
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6		
Payload size									
For Sub-Frame 2,3,7,8	Bits	600	1544	2216	5160	4392	4584		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of code blocks per Sub-Frame									
(Note 1)									
For Sub-Frame 2,3,7,8		1	1	1	1	1	1		
Total number of bits per Sub-Frame									
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	14400	21600	28800		
Total symbols per Sub-Frame									
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400		
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1		

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

A.2.3.1.2 16-QAM

Table A.2.3.1.2-1 Reference Channels for 16-QAM with full RB allocation

Parameter	Unit	Value								
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks		6	15	25	50	75	100			
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1			
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12			
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM			
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3			
Payload size										
For Sub-Frame 2,3,7,8	Bits	2600	4264	4968	21384	21384	19848			
Transport block CRC	Bits	24	24	24	24	24	24			
Number of code blocks per Sub-Frame										
(Note 1)										
For Sub-Frame 2,3,7,8		1	1	1	4	4	4			
Total number of bits per Sub-Frame										
For Sub-Frame 2,3,7,8	Bits	3456	8640	14400	28800	43200	57600			
Total symbols per Sub-Frame										
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400			
UE Category		≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	≥ 2			

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

A.2.3.1.3 64-QAM

[FFS]

A.2.3.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

A.2.3.2.1 QPSK

Table A.2.3.2.1-1 Reference Channels for QPSK with partial RB allocation

Para meter	Ch BW	Allo cate d RBs	UDL Confi gurati on (Note 2)	DFT- OFDM Symb ols per Sub- Fram e	Mod'n	Targe t Codin g rate	Paylo ad size for Sub- Fram e 2, 3, 7, 8	Trans port block CRC	Numb er of code block s per Sub- Fram e (Note 1)	Total numb er of bits per Sub- Fram e for Sub- Fram e 2, 3, 7, 8	Total symb ols per Sub- Fram e for Sub- Fram e 2, 3, 7, 8	UE Categ ory
Unit	MHz				0.7017		Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	1	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	1	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	1	12	QPSK	1/3	872	24	1	2880	1440	≥ 1
	3-20	12	1	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	1	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	1	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	1	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	1	12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20	24	1	12	QPSK	1/3	2472	24	1	6912	3456	≥ 1
	10-20	25	1	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	1	12	QPSK	1/3	2792	24	1	7776	3888	≥ 1
	10-20	30	1	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	1	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	1	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	1	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	1	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	1	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	1	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	1	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	1	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	1	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	1	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	1	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	1	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	1	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	1	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
	20	96	1	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

A.2.3.2.2 16-QAM

Table A.2.3.2.2-1 Reference Channels for 16QAM with partial RB allocation

Para meter	Ch BW	Allo cate d RBs	UDL Confi gurati on (Note 2)	DFT- OFDM Symb ols per Sub- Fram e	Mod'n	Tar get Cod ing rate	Paylo ad size for Sub- Fram e 2, 3, 7, 8	Trans port block CRC	Numb er of code block s per Sub- Fram e (Note 1)	Total numb er of bits per Sub- Fram e for Sub- Fram e 2, 3, 7, 8	Total symb ols per Sub-Fram e for Sub-Fram e 2, 3, 7, 8	UE Categ ory
Unit	MHz					- / -	Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	1	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	1	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	1	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	1	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	1	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	1	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	1	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	1	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	1	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	1	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	1	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	1	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	1	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	1	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	1	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	1	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	1	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	1	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	1	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	1	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	1	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	1	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	1	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	1	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	1	12	16QAM	2/3	23688	24	4	34560	8640	≥ 2
	15 - 20	64	1	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	1	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	1	12	16QAM	1/2	21384	24	4	43200	10800	≥ 2
	20	80	1	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	1	12	16QAM	1/2	22920	24	4	46656	11664	≥ 2
	20	90 96	1	12 12	16QAM 16QAM	2/5 2/5	20616 22152	24 24	4	51840 55296	12960 13824	≥ 2 ≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each

Code Block (otherwise L = 0 Bit)
Note 2: As per Table 4.2-2 in TS 36.211 [4]

A.2.3.2.3 64-QAM

[FFS]

A.2.3.3 Void

Table A.2.3.3-1: Void

A.3 DL reference measurement channels

A.3.1 General

The number of available channel bits varies across the sub-frames due to PBCH and PSS/SSS overhead. The payload size per sub-frame is varied in order to keep the code rate constant throughout a frame.

No user data is scheduled on subframes #5 in order to facilitate the transmission of system information blocks (SIB).

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation N_{RR}

- 1. Calculate the number of channel bits N_{ch} that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min \left| R - (A + 24) / N_{ch} \right|,$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of N_{RB} resource blocks.
- b) Segmentation is not included in this formula, but should be considered in the TBS calculation.
- 3. If there is more than one A that minimizes the equation above, then the larger value is chosen per default.
- 4. For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL+DwPTS (12 OFDM symbol): 2UL

A.3.1.1 Overview of DL reference measurement channels

In Table A.3.1.1-1 are listed the DL reference measurement channels specified in annexes A.3.2 to A.3.9 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.3.2 to A.3.9 as appropriate.

Table A.3.1.1-1: Overview of DL reference measurement channels

Duplex	Table	Name	вw	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Rece	eiver requirements								
FDD	Table A.3.2-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.2-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.2-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.2-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.2-1		15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.2-1		20	QPSK	1/3	100		≥ 1	
	eiver requirements	T	T	T	ı	T	T		
TDD	Table A.3.2-2		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.2-2		3	QPSK	1/3	15		≥ 1	
TDD	Table A.3.2-2		5	QPSK	1/3	25		≥ 1	
TDD	Table A.3.2-2		10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.2-2		15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.2-2	Nai	20	QPSK	1/3	100		≥ 1	
FDD, Reco	Table A.3.2-3	iviaximum inp	T T	64QAM	3/4	ı	l		<u> </u>
FDD	Table A.3.2-3 Table A.3.2-3		1.4	64QAM	3/4	6 15		-	
FDD	Table A.3.2-3		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3		10	64QAM	3/4	50			
FDD	Table A.3.2-3		15	64QAM	3/4	75			
FDD	Table A.3.2-3		20	64QAM	3/4	100			
	eiver requirements,	Maximum inr							
FDD	Table A.3.2-3a		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3a		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3a		5	64QAM	3/4	18		-	
FDD	Table A.3.2-3a		10	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		15	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		20	64QAM	3/4	17		-	
FDD, Rece	eiver requirements,	Maximum inp	out level	for UE Ca	tegorie	s 2			
FDD	Table A.3.2-3b		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3b		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3b		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3b		10	64QAM	3/4	50		-	
FDD	Table A.3.2-3b		15	64QAM	3/4	75		-	
FDD	Table A.3.2-3b		20	64QAM	3/4	83		-	
	eiver requirements,	Maximum inp	1	T T		1	I		
TDD	Table A.3.2-4		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4		5	64QAM	3/4	25		-	
TDD	Table A.3.2-4		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4		15	64QAM	3/4	75		-	
TDD Poor	Table A.3.2-4	Movimum im	20	64QAM	3/4	100		-	
TDD, Reco	eiver requirements, Table A.3.2-4a		1.4	64QAM	3/4	S 1			
					-			-	
TDD	Table A.3.2-4a		3	64QAM	3/4	15		-	

	T	1		1		1			1
TDD	Table A.3.2-4a		5	64QAM	3/4	18		-	
TDD	Table A.3.2-4a		10	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		15	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		20	64QAM	3/4	17		-	
TDD, Rec	eiver requirements,	Maximum inp	ut level	for UE Ca	tegorie	s 2			
TDD	Table A.3.2-4b		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4b		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4b		5	64QAM	3/4	25		1	
TDD	Table A.3.2-4b		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4b		15	64QAM	3/4	75		-	
TDD	Table A.3.2-4b		20	64QAM	3/4	83		-	
FDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	(S)				
FDD	Table A.3.3.1-1	R.4 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.1-1	R.42 FDD	20	QPSK	1/3	100		≥ 1	
FDD	Table A.3.3.1-1	R.2 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.1-2	R.3-1 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.1-2	R.3 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.1-3	R.5 FDD	3	64QAM	3/4	15		≥ 1	
FDD	Table A.3.3.1-3	R.6 FDD	5	64QAM	3/4	25		≥ 2	
FDD	Table A.3.3.1-3	R.7 FDD	10	64QAM	3/4	50		≥ 2	
FDD	Table A.3.3.1-3	R.8 FDD	15	64QAM	3/4	75		≥ 2	
FDD	Table A.3.3.1-3	R.9 FDD	20	64QAM	3/4	100		≥ 3	
FDD	Table A.3.3.1-3a	R.6-1 FDD	5	64QAM	3/4	18		≥ 1	
FDD	Table A.3.3.1-3a	R.7-1 FDD	10	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.8-1 FDD	15	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-1 FDD	20	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-2 FDD	20	64QAM	3/4	83		≥ 2	
FDD	Table A.3.3.1-6	R.41 FDD	10	QPSK	1/10	50		≥ 1	
FDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	S), Sin	gle PR	B (Cha	nnel e	edge)
FDD	Table A.3.3.1-4	R.0 FDD	3	16QAM	1/2	1		≥ 1	
FDD	Table A.3.3.1-4	R.1 FDD	10 /	16QAM	1/2	1		≥ 1	
FDD PDS	L SCH Performance, S	ingle-antenna	20 transm		S) Sin	ale PR	R (MR	SEN C	onfiguration)
FDD	Table A.3.3.1-5	R.29 FDD	10	16QAM	1/2	1	D (141D	≥ 1	omigaration,
	CH Performance: C	l.						'	
		R.49 FDD		1	0.84-			\ F	
FDD	Table A.3.3.1-7		20	64QAM	0.87	100		≥ 5	
	CH Performance, N	1			Ī		na port		
FDD	Table A.3.3.2.1-1	R.10 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.11 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-2 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-3 FDD	10	16QAM	1/2	40		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-4 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.30 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.1-1	R.35 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-1 FDD	20	64QAM	0.39	100		4	
	CH Performance, N	1			Ī		na por		
FDD	Table A.3.3.2.2-1	R.12 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.13 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.2.2-1	R.14 FDD	10	16QAM	1/2	50		≥ 2	

FDD	Table A.3.3.2.2-1	R.14-1 FDD	10	16QAM	1/2	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-2 FDD	10	16QAM	1/2	3		≥ 1	
FDD	Table A.3.3.2.2-1	R.14-3 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.2-1	R.36 FDD	10	64QAM	1/2	50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS) Two ar	ntenna poi	ts (CSI	-RS)			
FDD	Table A.3.3.3.1-1	R.51 FDD	10	16QAM	1/2	50		≥ 2	
FDD, PDS	CH Performance (U	E specific RS) Four a	ntenna po	rts (CS	I-RS)			
FDD	Table A.3.3.3.2-1	R.43 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.50 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.44 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-2	R.45 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.45-1 FDD	10	16QAM	1/2	39		≥ 1	
TDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	(S)				
TDD	Table A.3.4.1-1	R.4 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.1-1	R.42 TDD	20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.4.1-1	R.2 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.1-2	R.3-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.1-2	R.3 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.1-3	R.5 TDD	3	64QAM	3/4	15		≥ 1	
TDD	Table A.3.4.1-3	R.6 TDD	5	64QAM	3/4	25		≥ 2	
TDD	Table A.3.4.1-3	R.7 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.1-3	R.8 TDD	15	64QAM	3/4	75		≥ 2	
TDD	Table A.3.4.1-3	R.9 TDD	20	64QAM	3/4	100		≥ 3	
TDD	Table A.3.4.1-3a	R.6-1 TDD	5	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.1-3a	R.7-1 TDD	10	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.8-1 TDD	15	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-1 TDD	20	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-2 TDD	20	64QAM	3/4	83		≥ 2	
TDD	Table A.3.4.1-6	R.41 TDD	10	QPSK	1/10	50		≥ 1	
TDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	S), Sin	gle PR	B (Cha	nnel e	edge)
TDD	Table A.3.4.1-4	R.0 TDD	3	16QAM	1/2	1		≥ 1	
TDD	Table A.3.4.1-4	R.1 TDD	10 / 20	16QAM	1/2	1		≥ 1	
TDD PDS	CH Performance, S		-	ission (CR	S) Sin	ale PR	B (MB	SEN C	onfiguration)
TDD	Table A.3.4.1-5	R.29 TDD	10	16QAM	1/2	1	(≥ 1	
	CH Performance: C					ce			
TDD	Table A.3.4.1-7	R.49 TDD	20	64QAM	0.81-	100		≥ 5	
					087				
	CH Performance, N					ı	na port		
TDD	Table A.3.4.2.1-1	R.10 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.2.1-1	R.11 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.11-1 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.11-2 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.2.1-1	R.11-3 TDD	10	16QAM	1/2	40		≥ 1	
TDD	Table A.3.4.2.1-1	R.11-4 TDD	10	QPSK	1/2	50		≥ 1	
TDD	Table A.3.4.2.1-1	R.30 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-1 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-2 TDD	20	16QAM	1/2	100		3	
TDD	Table A.3.4.2.1-1	R.35 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.35-1 TDD	20	64QAM	0.39	100		4	

TDD, PDS	SCH Performance, N	lulti-antenna t	ransmis	sion (CRS), Four	anten	na por	ts	
TDD	Table A.3.4.2.2-1	R.12 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.13 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.2.2-1	R.14 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.2-1	R.14-1 TDD	10	16QAM	1/2	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.14-2 TDD	10	16QAM	1/2	3		≥ 1	
TDD	Table A.3.4.2.2-1	R.43 TDD	20	16QAM	1/2	100		≥2	
TDD	Table A.3.4.2.2-1	R.36 TDD	10	64QAM	1/2	50		≥ 2	
TDD, PDS	SCH Performance, S	ingle antenna	port (DI	RS)					
TDD	Table A.3.4.3.1-1	R.25 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.1-1	R.26 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.26-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.3.1-1	R.27 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.27-1 TDD	10	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.3.1-1	R.28 TDD	10	16QAM	1/2	1		≥ 1	
TDD, PDS	SCH Performance, T	wo antenna p	orts (DR	S)					
TDD	Table A.3.4.3.2-1	R.31 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.2-1	R.32 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.32-1 TDD	5	16QAM	1/2	[25]		≥ 1	
TDD	Table A.3.4.3.2-1	R.33 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.33-1 TDD	10	64QAM	3/4	[18]		≥ 1	
TDD	Table A.3.4.3.2-1	R.34 TDD	10	64QAM	1/2	50		≥ 2	
TDD, PDS	SCH Performance (U	JE specific RS) Two ar	ntenna por	ts (CSI	-RS)			
TDD	Table A.3.4.3.3-1	R.51 TDD	10	16QAM	1/2	50		≥ 2	
TDD, PDS	SCH Performance (U	JE specific RS) Four a	ntenna po	rts (CS	I-RS)	Ī		
TDD	Table A.3.4.3.4-1	R.44 TDD	10	64QAM	1/2	50		≥ 2	
	SCH Performance (U	JE specific RS) Eight a	-	orts (CS	SI-RS)	T	ı	
TDD	Table A.3.4.3.5-1	R.50 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.5-2	R.45 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.5-2	R.45-1 TDD	10	16QAM	1/2	39		≥ 1	
	CCH / PCFICH Perfo	1			I	ı	I	ı	
FDD	Table A.3.5.1-1	R.15 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.15-1 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.17 FDD	5	PDCCH					
,	CCH / PCFICH Perfo	1	40	PPCCII					l
TDD	Table A.3.5.2-1	R.15 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.15-1 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16 TDD	10	PDCCH					
TDD / TDI	Table A.3.5.2-1	R.17 TDD	5	PDCCH					
FDD / TDL	D, PHICH Performar								
TDD	Table A.3.6-1	R.18	10	PHICH					
FDD /				PHICH					
TDD	Table A.3.6-1	R.19	10	1111011					
FDD /	Table A.3.6-1 Table A.3.6-1	R.19 R.20	10 5	PHICH					
FDD / TDD FDD /	Table A.3.6-1	R.20	5	PHICH					
FDD / TDD FDD / TDD	Table A.3.6-1 Table A.3.6-1	R.20 R.24							
FDD / TDD FDD / TDD	Table A.3.6-1	R.20 R.24	5	PHICH	40/				

FDD / TDD	Table A.3.7-1	R.22	1.4	QPSK	40/ 1920			
FDD / TDD	Table A.3.7-1	R.23	1.4	QPSK	40/ 1920			
FDD, PMC	H Performance							
FDD	Table A.3.8.1-1	R.40 FDD	1.4	QPSK	1/3	6	≥ 1	
FDD	Table A.3.8.1-1	R.37 FDD	10	QPSK	1/3	50	≥ 1	
FDD	Table A.3.8.1-2	R.38 FDD	10	16QAM	1/2	50	≥ 1	
FDD	Table A.3.8.1-3	R.39-1 FDD	5	64QAM	2/3	25	≥ 1	
FDD	Table A.3.8.1-3	R.39 FDD	10	64QAM	2/3	50	≥ 2	
TDD, PMC	H Performance							
TDD	Table A.3.8.2-1	R.40 TDD	1.4	QPSK	1/3	6	≥ 1	
TDD	Table A.3.8.2-1	R.37 TDD	10	QPSK	1/3	50	≥ 1	
TDD	Table A.3.8.2-2	R.38 TDD	10	16QAM	1/2	50	≥ 1	
TDD	Table A.3.8.2-3	R.39-1 TDD	5	64QAM	2/3	25	≥ 1	
TDD	Table A.3.8.2-3	R.39 TDD	10	64QAM	2/3	50	≥ 2	
FDD, Sust	tained data rate (CF	RS)						
FDD	Table A.3.9.1-1	R.31-1 FDD	10	64QAM	0.40		≥ 1	
FDD	Table A.3.9.1-1	R.31-2 FDD	10	64QAM	0.59- 0.64		≥ 2	
FDD	Table A.3.9.1-1	R.31-3 FDD	20	64QAM	0.59- 0.62		≥ 2	
FDD	Table A.3.9.1-1	R.31-3A FDD	10	64QAM	0.85- 0.90		≥ 2	
FDD	Table A.3.9.1-1	R.31-3C FDD	15	64QAM	0.87- 0.91		≥ 3	
FDD	Table A.3.9.1-1	R.31-4 FDD	20	64QAM	0.87- 0.90		≥ 3	
FDD	Table A.3.9.1-1	R.31-4B FDD	15	64QAM	0.85- 0.88		≥ 4	
TDD, Sust	tained data rate (CF	RS)						
TDD	Table A.3.9.2-1	R.31-1 TDD	10	64QAM	0.40		≥ 1	
TDD	Table A.3.9.2-1	R.31-2 TDD	10	64QAM	0.59- 0.64		≥ 2	
TDD	Table A.3.9.2-1	R.31-3 TDD	20	64QAM	0.59- 0.62		≥ 2	
TDD	Table A.3.9.2-1	R.31-3A TDD	15	64QAM	0.87- 0.90		≥ 2	
TDD	Table A.3.9.2-1	R.31-4 TDD	20	64QAM	0.87- 0.90		≥ 3	

A.3.2 Reference measurement channel for receiver characteristics

Tables A.3.2-1 and A.3.2-2 are applicable for measurements on the Receiver Characteristics (clause 7) with the exception of sub-clause 7.4 (Maximum input level).

Tables A.3.2-3, A.3.2-3a, A.3.2-3b, A.3.2-4, A.3.2-4a and A.3.2-4b are applicable for sub-clause 7.4 (Maximum input level).

Tables A.3.2-1 and A.3.2-2 also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

Table A.3.2-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit	Value						
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
Subcarriers per resource block		12	12	12	12	12	12	
Allocated subframes per Radio Frame		9	9	9	9	9	9	
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	
Number of HARQ Processes	Processes	8	8	8	8	8	8	
Maximum number of HARQ transmissions		1	1	1	1	1	1	
Information Bit Payload per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1320	2216	4392	6712	8760	
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0	Bits	152	872	1800	4392	6712	8760	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of Code Blocks per Sub-Frame (Note 3)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	2	2	
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0	Bits	1	1	1	1	2	2	
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3780	6300	13800	20700	27600	
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0	Bits	528	2940	5460	12960	19860	26760	
Max. Throughput averaged over 1 frame	kbps	341.6	1143.	1952.	3952.	6040.	7884	
			2	8	8	8		
UE Category		≥ 1	≥ 1	≥ 1	≥1	≥ 1	≥ 1	

² symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to Note 1: PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz
Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to

Note 2:

Note 3: each Code Block (otherwise L = 0 Bit)

Table A.3.2-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit	Value							
Channel Bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1		
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2		
Number of HARQ Processes	Processes	7	7	7	7	7	7		
Maximum number of HARQ transmission		1	1	1	1	1	1		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3		
Information Bit Payload per Sub-Frame	Bits								
For Sub-Frame 4, 9		408	1320	2216	4392	6712	8760		
For Sub-Frame 1, 6		n/a	968	1544	3240	4968	6712		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		208	1064	1800	4392	6712	8760		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frame 4, 9		1	1	1	1	2	2		
For Sub-Frame 1, 6		n/a	1	1	1	1	2		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		1	1	1	1	2	2		
Binary Channel Bits Per Sub-Frame	Bits								
For Sub-Frame 4, 9		1368	3780	6300	13800	20700	27600		
For Sub-Frame 1, 6		n/a	3276	5556	11256	16956	22656		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		672	3084	5604	13104	20004	26904		
Max. Throughput averaged over 1 frame	kbps	102.4	564	932	1965.	3007.	3970.		
					6	2	4		
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1		

- For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz Note 1: channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs. For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with
- Note 2: insufficient PDCCH performance
- Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3:
- If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to Note 4: each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]

Table A.3.2-3 Fixed Reference Channel for Maximum input level for UE Categories 3-8 (FDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Subcarriers per resource block		12	12	12	12	12	12		
Allocated subframes per Radio Frame		8	9	9	9	9	9		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	8	8	8	8	8	8		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	61664		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6456	12576	28336	45352	61664		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame (Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	11		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	3	5	8	11		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	82800		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	8820	16380	38880	59580	80280		
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	55498		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3a Fixed Reference Channel for Maximum input level for UE Category 1 (FDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	18	17	17	17		
Subcarriers per resource block		12	12	12	12	12	12		
Allocated subframes per Radio Frame		8	9	9	9	9	9		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	8	8	8	8	8	8		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	10296	10296	10296	10296		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6456	8248	10296	10296	10296		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame (Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	2	2	2	2		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	2	2	2	2		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	13608	14076	14076	14076		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	8820	11088	14076	14076	14076		
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	9079.6	9266.4	9266.4	9266.4		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3b Fixed Reference Channel for Maximum input level for UE Category 2 (FDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	83		
Subcarriers per resource block		12	12	12	12	12	12		
Allocated subframes per Radio Frame		8	9	9	9	9	9		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	8	8	8	8	8	8		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	51024		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6456	12576	28336	45352	51024		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	9		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	3	5	8	9		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	68724		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	8820	16380	38880	59580	66204		
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	45922		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-4 Fixed Reference Channel for Maximum input level for UE Categories 3-8 (TDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Subcarriers per resource block		12	12	12	12	12	12		
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1		
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	7	7	7	7	7	7		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	61664		
For Sub-Frames 1,6	Bits	n/a	6968	11448	23688	35160	46888		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6968	12576	30576	45352	61664		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frames 4,9		1	2	3	5	8	11		
For Sub-Frames 1,6		n/a	2	2	4	6	8		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	3	5	8	11		
Binary Channel Bits per Sub-Frame									
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	82800		
For Sub-Frames 1,6		n/a	9828	16668	33768	50868	67968		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	9252	16812	39312	60012	80712		
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	27877		

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4a Fixed Reference Channel for Maximum input level for UE Category 1 (TDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	18	17	17	17		
Subcarriers per resource block		12	12	12	12	12	12		
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1		
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	7	7	7	7	7	7		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 4,9	Bits	2984	8504	10296	10296	10296	10296		
For Sub-Frames 1,6	Bits	n/a	6968	8248	7480	7480	7480		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6968	8248	10296	10296	10296		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frames 4,9		1	2	2	2	2	2		
For Sub-Frames 1,6		n/a	2	2	2	2	2		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	2	2	2	2		
Binary Channel Bits per Sub-Frame									
For Sub-Frames 4,9	Bits	4104	11340	13608	14076	14076	14076		
For Sub-Frames 1,6		n/a	9828	11880	11628	11628	11628		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	9252	11520	14076	14076	14076		
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	4533.6	4584.8	4584.8	4584.8		

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4b Fixed Reference Channel for Maximum input level for UE Category 2 (TDD)

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	83		
Subcarriers per resource block		12	12	12	12	12	12		
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1		
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4		
Number of HARQ Processes	Processes	7	7	7	7	7	7		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	51024		
For Sub-Frames 1,6	Bits	n/a	6968	11448	23688	35160	39232		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	6968	12576	30576	45352	51024		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frames 4,9		1	2	3	5	8	9		
For Sub-Frames 1,6		n/a	2	3	5	7	7		
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0		n/a	2	3	5	8	9		
Binary Channel Bits per Sub-Frame									
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	68724		
For Sub-Frames 1,6		n/a	9828	16668	33768	50868	56340		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	n/a	9252	16380	39312	60012	66636		
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	23154		

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

A.3.3 Reference measurement channels for PDSCH performance requirements (FDD)

A.3.3.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.3.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit			Value	
Reference channel		R.4	R.42	R.2	
		FDD	FDD	FDD	
Channel bandwidth	MHz	1.4	20	10	
Allocated resource blocks (Note 4)		6	100	50	
Allocated subframes per Radio Frame		9	9	9	
Modulation		QPSK	QPSK	QPSK	
Target Coding Rate		1/3	1/3	1/3	
Information Bit Payload (Note 4)					
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	8760	4392	
For Sub-Frame 5	Bits	n/a	n/a	n/a	
For Sub-Frame 0	Bits	152	8760	4392	
Number of Code Blocks					
(Notes 3 and 4)					
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	1	
For Sub-Frame 5		n/a	n/a	n/a	
For Sub-Frame 0		1	2	1	
Binary Channel Bits (Note 4)					
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	27600	13800	
For Sub-Frame 5	Bits	n/a	n/a	n/a	
For Sub-Frame 0	Bits	528	26760	12960	
Max. Throughput averaged over 1 frame	Mbps	0.342	7.884	3.953	
(Note 4)					
UE Category		≥ 1	≥1	≥1	

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Table A.3.3.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter	Unit	Value					
Reference channel				R.3-1 FDD	R.3 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Allocated subframes per Radio Frame				9	9		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			6456	14112		
For Sub-Frame 5	Bits			n/a	n/a		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9				2	3		
For Sub-Frame 5				n/a	n/a		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			12600	27600		
For Sub-Frame 5	Bits			n/a	n/a		
For Sub-Frame 0	Bits			10920	25920	•	
Max. Throughput averaged over 1 frame	Mbps			5.738	12.586		
UE Category				≥ 1	≥2		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Va	lue		
Reference channel			R.5	R.6	R.7	R.8	R.9 FDD
			FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Allocated subframes per Radio Frame			9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		8504	14112	30576	46888	61664
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits		6456	12576	28336	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			2	3	5	8	11
For Sub-Frame 5			n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		11340	18900	41400	62100	82800
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits		8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	Mbps		7.449	12.547	27.294	42.046	55.498
UE Category			≥ 1	≥2	≥ 2	≥ 2	≥ 3

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3a: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit		Value						
Reference channel		F	₹.6-1	R.7-1	R.8-1	R.9-1	R.9-2		
			FDD	FDD	FDD	FDD	FDD		
Channel bandwidth	MHz		5	10	15	20	20		
Allocated resource blocks (Note 3)			18	17	17	17	83		
Allocated subframes per Radio Frame			9	9	9	9	9		
Modulation		64	4QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate			3/4	3/4	3/4	3/4	3/4		
Information Bit Payload									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	0296	10296	10296	10296	51024		
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits		8248	10296	10296	10296	51024		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9			2	2	2	2	9		
For Sub-Frame 5			n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0			2	2	2	2	9		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	3608	14076	14076	14076	68724		
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	1	1088	14076	14076	14076	66204		
Max. Throughput averaged over 1 frame	Mbps	9	9.062	9.266	9.266	9.266	45.922		
UE Category			≥ 1	≥ 1	≥1	≥1	≥ 2		

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: Localized allocation started from RB #0 is applied.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-4: Fixed Reference Channel Single PRB (Channel Edge)

Parameter	Unit	Value						
Reference channel			R.0 FDD		R.1 FDD			
Channel bandwidth	MHz	1.4	3	5	10/20	15	20	
Allocated resource blocks			1		1			
Allocated subframes per Radio Frame			9		9			
Modulation			16QAM		16QAM			
Target Coding Rate			1/2		1/2			
Information Bit Payload								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		224		256			
For Sub-Frame 5	Bits		n/a		n/a			
For Sub-Frame 0	Bits		224		256			
Number of Code Blocks per Sub-Frame (Note 3)								
For Sub-Frames 1,2,3,4,6,7,8,9			1		1			
For Sub-Frame 5			n/a		n/a			
For Sub-Frame 0			1		1			
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		504		552			
For Sub-Frame 5	Bits		n/a		n/a			
For Sub-Frame 0	Bits		504		552			
Max. Throughput averaged over 1 frame	Mbps		0.202		0.230			
UE Category			≥ 1		≥ 1			

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value				
Reference channel		R.29 FDD				
		(MBSFN)				
Channel bandwidth	MHz	10				
Allocated resource blocks		1				
MBSFN Configuration (Note 3)		111111				
Allocated subframes per Radio Frame		3				
Modulation		16QAM				
Target Coding Rate		1/2				
Information Bit Payload						
For Sub-Frames 4,9	Bits	256				
For Sub-Frame 5	Bits	n/a				
For Sub-Frame 0	Bits	256				
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)				
Number of Code Blocks per Sub-Frame						
(Note 4)						
For Sub-Frames 4,9		1				
For Sub-Frame 5		n/a				
For Sub-Frame 0		1				
For Sub-Frame 1,2,3,6,7,8		0 (MBSFN)				
Binary Channel Bits Per Sub-Frame						
For Sub-Frames 4,9	Bits	552				
For Sub-Frame 5	Bits	n/a				
For Sub-Frame 0	Bits	552				
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)				
Max. Throughput averaged over 1 frame	kbps	76.8				
UE Category		≥ 1				
Note 1: 2 symbols allocated to PDCCH.						
Note 2: Reference signal, synchronization	n signals a	and PBCH				
allocated as per TS 36.211 [4].						
Note 3: MBSFN Subframe Allocation as of		,				
with 6 bits is chosen for MBSFN :	with 6 bits is chosen for MBSFN subframe allocation.					

Note 4: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.3.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit			Va	alue		
Reference channel					R.41 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame					9		
Modulation					QPSK		
Target Coding Rate					1/10		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				1384		
For Sub-Frame 5	Bits				n/a		
For Sub-Frame 0	Bits				1384		
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9					1		
For Sub-Frame 5					n/a		
For Sub-Frame 0					1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				13800		
For Sub-Frame 5	Bits				n/a		
For Sub-Frame 0	Bits		•		12960	•	
Max. Throughput averaged over 1 frame	Mbps				1.246		
UE Category					≥ 1		

² symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. Note 1:

Note 2:

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]. If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 3:

Table A.3.3.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit	Value
Reference channel		R.49 FDD
Channel bandwidth	MHz	20
Allocated resource blocks		100
Allocated subframes per Radio Frame		9
Modulation		64QAM
Coding Rate		
For Sub-Frame 1,2,3,4,6,7,8,9,		0.84
For Sub-Frame 5		N/A
For Sub-Frame 0		0.87
Information Bit Payload		
For Sub-Frames 0,1,2,3,4,6,7,8,9	Bits	63776
For Sub-Frame 5	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 3)		
For Sub-Frames 0,1,2,3,4,6,7,8,9	Code	11
	Blocks	
For Sub-Frame 5	Code	N/A
	Blocks	
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	75600
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	73080
Max. Throughput averaged over 1 frame	Mbps	57.398
UE Category		≥ 5

Note 1:

3 symbols allocated to PDCCH.
Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]. Note 2:

If more than one Code Block is present, an additional Note 3: CRC sequence of L = 24 Bits is attached to each Code

Block (otherwise L = 0 Bit).

A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

A.3.3.2.1 Two antenna ports

Table A.3.3.2.1-1: Fixed Reference Channel two antenna ports

Parameter	Unit				V	alue			
Reference channel		R.10	R.11	R.11-2	R.11-3	R.11-	R.30	R.35-1	R.35
		FDD	FDD	FDD	FDD	4 FDD	FDD	FDD	FDD
					Note 5				
Channel bandwidth	MHz	10	10	5	10	10	20	20	10
Allocated resource blocks (Note 4)		50	50	25	40	50	100	100	50
Allocated subframes per Radio Frame		9	9	9	9	9	9	8	9
Modulation		QPSK	16QA	16QA	16QA	QPSK	16QAM	64QAM	64QAM
			M	М	M				
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	0.39	1/2
Information Bit Payload (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392	12960	5736	10296	6968	25456	30576	19848
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	4392	12960	4968	10296	6968	25456	n/a	18336
Number of Code Blocks									
(Notes 3 and 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	3	1	2	2	5	5	4
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	1	3	1	2	2	5	n/a	3
Binary Channel Bits (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	12000	21120	13200	52800	79200	39600
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	12384	24768	10368	19488	12384	51168	n/a	37152
Max. Throughput averaged over 1	Mbps	3.953	11.664	5.086	9.266	6.271	22.910	24.461	17.712
frame (Note 4)									
UE Category		≥ 1	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	4	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Note 5: For R.11-3 resource blocks of RB6-RB45 are allocated.

A.3.3.2.2 Four antenna ports

Table A.3.3.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit				Value			
Reference channel		R.12	R.13	R.14	R.14-	R.14-	R.14-	R.36
		FDD	FDD	FDD	1 FDD	2 FDD	3 FDD	FDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10
Allocated resource blocks (Note 4)		6	50	50	6	3	100	50
Allocated subframes per Radio Frame		9	9	9	8	8	9	9
Modulation		QPSK	QPSK	16QA	16QA	16QA	16QA	64QA
				М	M	М	M	M
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2
Information Bit Payload (Note 4)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	4392	12960	1544	744	25456	18336
For Sub-Frame 5	Bits	n/a						
For Sub-Frame 0	Bits	152	3624	11448	n/a	n/a	22920	18336
Number of Code Blocks								
(Notes 3 and 4)								
For Sub-Frames 1,2,3,4,6,7,8,9		1	1	3	1	1	5	3
For Sub-Frame 5		n/a						
For Sub-Frame 0		1	1	2	n/a	n/a	4	3
Binary Channel Bits (Note 4)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1248	12800	25600	3072	1536	51200	38400
For Sub-Frame 5	Bits	n/a						
For Sub-Frame 0	Bits	480	12032	24064	n/a	n/a	49664	36096
Max. Throughput averaged over 1	Mbps	0.342	3.876	11.51	1.235	0.595	22.65	16.50
frame (Note 4)				3			68	2
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 2	≥ 2

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Given per component carrier per codeword.

A.3.3.3 Reference Measurement Channel for UE-Specific Reference Symbols

A.3.3.3.1 Two antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.3.3.1-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

Parameter	Unit	Value			
Reference channel		R.51 FDD			
Channel bandwidth	MHz	10			
Allocated resource blocks		50 (Note 3)			
Allocated subframes per Radio Frame		9			
Modulation		16QAM			
Target Coding Rate		1/2			
Information Bit Payload					
For Sub-Frames 1,4,6,9	Bits	11448			
For Sub-Frames 2,3,7,8	Bits	11448			
For Sub-Frame 5	Bits	n/a			
For Sub-Frame 0	Bits	9528			
Number of Code Blocks (Note 4)					
For Sub-Frames 1,4,6,9	Code	2			
	blocks				
For Sub-Frames 2,3,7,8	Code	2			
	blocks				
For Sub-Frame 5	Bits	n/a			
For Sub-Frame 0	Bits	2			
Binary Channel Bits					
For Sub-Frames 1,4,6,9	Bits	24000			
For Sub-Frames 2,7		23600			
For Sub-Frames 3,8		23200			
For Sub-Frame 5	Bits	n/a			
For Sub-Frame 0	Bits	19680			
Max. Throughput averaged over 1	Mbps	10.1112			
frame					
UE Category		≥ 2			
Note 1: 2 symbols allocated to PDCCH	l				
Note 2: Reference signal, synchronizat	tion signal	s and PBCH			
allocated as per TS 36.211 [4].					
Note 3: 50 resource blocks are allocate	ed in sub-f	rames 1, 2, 3,			

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and

RB30-RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code

Block (otherwise L = 0 Bit).

A.3.3.3.2 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value			
Reference channel		R.43	R.50 FDD		
		FDD			
Channel bandwidth	MHz	10	10		
Allocated resource blocks		50 (Note	50 (Note 3)		
		3)			
Allocated subframes per Radio Frame		9	9		
Modulation		QPSK	64QAM		
Target Coding Rate		1/3	1/2		
Information Bit Payload					
For Sub-Frames 1,4,6,9	Bits	3624	18336		
For Sub-Frames 2,3,7,8	Bits	3624	16416		
For Sub-Frame 5	Bits	n/a	n/a		
For Sub-Frame 0	Bits	2984	14688		
Number of Code Blocks (Note 4)					
For Sub-Frames 1,4,6,9	Code	1	3		
	blocks				
For Sub-Frames 2,3,7,8	Code	1	3		
	blocks				
For Sub-Frame 5	Bits	n/a	n/a		
For Sub-Frame 0	Bits	1	3		
Binary Channel Bits					
For Sub-Frames 1,4,6,9	Bits	12000	36000		
For Sub-Frames 2,7		11600	34800		
For Sub-Frames 3,8		11600	34800		
For Sub-Frame 5	Bits	n/a	n/a		
For Sub-Frame 0	Bits	9840	29520		
Max. Throughput averaged over 1	Mbps	3.1976	15.3696		
frame					
UE Category		≥ 1	≥ 2		

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

The reference measurement channels in Table A.3.3.3.2-2 apply for verifying FDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-2: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit		Value	
Reference channel		R.44	R.45	R.45-1
		FDD	FDD	FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 ³	50 ³	39
Allocated subframes per Radio Frame		10	10	10
Modulation		QPSK	16QAM	16QAM
Target Coding Rate		1/3	1/2	1/2
Information Bit Payload				
For Sub-Frames (Non CSI-RS subframe)	Bits	3624	11448	8760
For Sub-Frames (CSI-RS subframe)	Bits	3624	11448	8760
For Sub-Frames (ZeroPowerCSI-RS	Bits	n/a	n/a	n/a
subframe)				
For Sub-Frame 5	Bits	n/a	n/a	n/a
For Sub-Frame 0	Bits	2984	9528	8760
Number of Code Blocks per Sub-Frame				
(Note 4)				
For Sub-Frames (Non CSI-RS subframe)		1	2	2
For Sub-Frames (CSI-RS subframe)		1	2	2
For Sub-Frames (ZeroPowerCSI-RS	Bits	n/a	n/a	n/a
subframe)				
For Sub-Frame 5		n/a	n/a	n/a
For Sub-Frame 0		1	2	2
Binary Channel Bits Per Sub-Frame				
For Sub-Frames (Non CSI-RS subframe)	Bits	12000	24000	18720
For Sub-Frames (CSI-RS subframe)	Bits	11600	23200	18096
For Sub-Frames (ZeroPowerCSI-RS	Bits	n/a	n/a	n/a
subframe)				
For Sub-Frame 5	Bits	n/a	n/a	n/a
For Sub-Frame 0	Bits	9840	19680	18720
Max. Throughput averaged over 1 frame	Mbps	3.1976	10.1112	7.884
UE Category		≥ 1	≥ 2	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: For R.44 and R.45, 50 resource blocks are allocated in sub-frames 1,2,3,4,6,7,8,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.45-1, 39 resource blocks are allocated in all subframes (RB0–RB20 and RB30–RB47).

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.3.4 Reference measurement channels for PDSCH performance requirements (TDD)

A.3.4.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.4.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit			Value	
Reference channel		R.4	R.42	R.2	
		TDD	TDD	TDD	
Channel bandwidth	MHz	1.4	20	10	
Allocated resource blocks (Note 6)		6	100	50	
Uplink-Downlink Configuration (Note 4)		1	1	1	
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	
Modulation		QPSK	QPSK	QPSK	
Target Coding Rate		1/3	1/3	1/3	
Information Bit Payload (Note 6)					
For Sub-Frames 4,9	Bits	408	8760	4392	
For Sub-Frames 1,6	Bits	n/a	7736	3240	
For Sub-Frame 5	Bits	n/a	n/a	n/a	
For Sub-Frame 0	Bits	208	8760	4392	
Number of Code Blocks					
(Notes 5 and 6)					
For Sub-Frames 4,9		1	2	1	
For Sub-Frames 1,6		n/a	2	1	
For Sub-Frame 5		n/a	n/a	n/a	
For Sub-Frame 0		1	2	1	
Binary Channel Bits (Note 6)					
For Sub-Frames 4,9	Bits	1368	27600	13800	
For Sub-Frames 1,6	Bits	n/a	22656	11256	
For Sub-Frame 5	Bits	n/a	n/a	n/a	
For Sub-Frame 0	Bits	672	26904	13104	
Max. Throughput averaged over 1 frame	Mbps	0.102	4.175	1.966	
(Note 6)					
UE Category		≥ 1	≥1	≥1	

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Given per component carrier per codeword.

Table A.3.4.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter	Unit			Va	lue		
Reference channel				R.3-1	R.3		
				TDD	TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Uplink-Downlink Configuration (Note 3)				1	1		
Allocated subframes per Radio Frame (D+S)				3+2	3+2		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits			6456	14112		
For Sub-Frames 1,6	Bits			5160	11448		
For Sub-Frame 5	Bits			n/a	n/a		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9				2	3		
For Sub-Frames 1,6				1	2		
For Sub-Frame 5				n/a	n/a		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits			12600	27600		
For Sub-Frames 1,6	Bits			11112	22512		
For Sub-Frame 5	Bits			n/a	n/a		
For Sub-Frame 0	Bits			11208	26208		
Max. Throughput averaged over 1 frame	Mbps			2.897	6.408		
UE Category				≥ 1	≥ 2		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Val	ue		
Reference channel			R.5	R.6 TDD	R.7	R.8	R.9
			TDD		TDD	TDD	TDD
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Uplink-Downlink Configuration (Note 3)			1	1	1	1	1
Allocated subframes per Radio Frame (D+S)			3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate			3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 4,9	Bits		8504	14112	30576	46888	61664
For Sub-Frames 1,6	Bits		6968	11448	23688	35160	46888
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits		6968	12576	30576	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9			2	3	5	8	11
For Sub-Frames 1,6			2	2	4	6	8
For Sub-Frame 5			n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits		11340	18900	41400	62100	82800
For Sub-Frames 1,6	Bits		9828	16668	33768	50868	67968
For Sub-Frame 5	Bits		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits		9252	16812	39312	60012	80712
Max. Throughput averaged over 1 frame	Mbps		3.791	6.370	13.910	20.945	27.877
UE Category			≥1	≥ 2	≥2	≥ 2	≥ 3

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-3a: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit		Val	ue		
Reference channel		R.6-1	R.7-1	R.8-1	R.9-1	R.9-2
		TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	5	10	15	20	20
Allocated resource blocks (Note 3)		18	17	17	17	83
Uplink-Downlink Configuration (Note 4)		1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4
Information Bit Payload						
For Sub-Frames 4,9	Bits	10296	10296	10296	10296	51024
For Sub-Frames 1,6	Bits	8248	7480	7480	7480	39232
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	8248	10296	10296	10296	51024
Number of Code Blocks per Sub-Frame						
(Note 5)						
For Sub-Frames 4,9		2	2	2	2	9
For Sub-Frames 1,6		2	2	2	2	7
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0		2	2	2	2	9
Binary Channel Bits Per Sub-Frame						
For Sub-Frames 4,9	Bits	13608	14076	14076	14076	68724
For Sub-Frames 1,6	Bits	11880	11628	11628	11628	56340
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	11520	14076	14076	14076	66636
Max. Throughput averaged over 1 frame	Mbps	4.534	4.585	4.585	4.585	23.154
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: Localized allocation started from RB #0 is applied.

Note 4: As per Table 4.2-2 TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-4: Fixed Reference Channel Single PRB

Parameter	Unit	Value								
Reference channel			R.0 TDD		R.1 TDD					
Channel bandwidth	MHz	1.4	3	5	10/20	15	20			
Allocated resource blocks			1		1					
Uplink-Downlink Configuration (Note 3)			1		1					
Allocated subframes per Radio Frame (D+S)			3+2		3+2					
Modulation			16QAM		16QAM					
Target Coding Rate			1/2		1/2					
Information Bit Payload										
For Sub-Frames 4,9	Bits		224		256					
For Sub-Frames 1,6	Bits		208		208					
For Sub-Frame 5	Bits		n/a		n/a					
For Sub-Frame 0	Bits		224		256					
Number of Code Blocks per Sub-Frame (Note 4)										
For Sub-Frames 4,9			1		1					
For Sub-Frames 1,6			1		1					
For Sub-Frame 5			n/a		n/a					
For Sub-Frame 0			1		1					
Binary Channel Bits Per Sub-Frame										
For Sub-Frames 4,9	Bits		504		552					
For Sub-Frames 1,6	Bits		456		456					
For Sub-Frame 5	Bits		n/a		n/a					
For Sub-Frame 0	Bits		504		552					
Max. Throughput averaged over 1 frame	Mbps		0.109		0.118					
UE Category			≥ 1		≥ 1					

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value
Reference channel		R.29 TDD
		(MBSFN)
Channel bandwidth	MHz	10
Allocated resource blocks		1
MBSFN Configuration (Note 3)		010010
Uplink-Downlink Configuration (Note4)		1
Allocated subframes per Radio Frame (D+S)		1+2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	208
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	256
Number of Code Blocks per Sub-Frame		
(Note 5)		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	1
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	1
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	456
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	552
Max. Throughput averaged over 1 frame	kbps	67.2
UE Category		≥ 1

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.

Note 4: as per Table 4.2-2 in TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit			Va	lue		
Reference channel					R.41		
					TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Uplink-Downlink Configuration (Note 4)					1		
Allocated subframes per Radio Frame (D+S)					3+2		
Modulation					QPSK		
Target Coding Rate					1/10		
Information Bit Payload							
For Sub-Frames 4,9	Bits				1384		
For Sub-Frames 1,6	Bits				1032		
For Sub-Frame 5	Bits				n/a		
For Sub-Frame 0	Bits				1384		
Number of Code Blocks per Sub-Frame							
(Note 5)							
For Sub-Frames 4,9					1		
For Sub-Frames 1,6					1		
For Sub-Frame 5					n/a		
For Sub-Frame 0					1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits				13800		
For Sub-Frames 1,6	Bits				11256		
For Sub-Frame 5	Bits				n/a		
For Sub-Frame 0	Bits				13104		
Max. Throughput averaged over 1 frame	Mbps				0.622		
UE Category					≥1		

- 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated Note 1: to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3:
- Note 4:
- As per Table 4.2-2 in TS 36.211 [4]. If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to Note 5: each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit	Value
Reference channel		R.49 TDD
Channel bandwidth	MHz	20
Allocated resource blocks		100
Uplink-Downlink Configuration (Note 1)		1
Allocated subframes per Radio Frame		3+2
(D+S)		
Modulation		64QAM
Number of OFDM symbols for PDCCH		
per component carrier		
For Sub-Frames 0,4,5,9	OFDM	3
	symbols	
For Sub-Frames 1,6	OFDM	2
	symbols	
Target Coding Rate		
For Sub-Frames 4,9		0.84
For Sub-Frames 1,6		0.81
For Sub-Frames 5		N/A
For Sub-Frames 0		0.87
Information Bit Payload		
For Sub-Frames 0, 4, 9	Bits	63776
For Sub-Frame 1,6	Bits	55056
For Sub-Frame 5	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 2)		
For Sub-Frames 0, 4, 9	Code	11
	Blocks	
For Sub-Frame 1,6	Code	9
	Blocks	
For Sub-Frame 5	Code	N/A
	Blocks	
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9	Bits	75600
For Sub-Frame 1,6	Bits	67968
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	73512
Max. Throughput averaged over 1 frame	Mbps	30.144
UE Category		≥ 5

Reference signal, synchronization signals and PBC allocated as per TS 36.211 [4].

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 2:

A.3.4.2 Multi-antenna transmission (Common Reference Signals)

A.3.4.2.1 Two antenna ports

Table A.3.4.2.1-1: Fixed Reference Channel two antenna ports

Parameter	Unit						Value			
Reference channel		R.10 TDD	R.11 TDD	R.11-1 TDD	R.11-2 TDD	R.11-3 TDD Note 6	R.11-4 TDD	R.30 TDD	R.30-1 TDD	R.30-2 TDD
Channel bandwidth	MHz	10	10	10	5	10	10	20	20	20
Allocated resource blocks (Note 5)		50	50	50	25	40	50	100	100	100
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	2+2	3+2	3+2	2	3+2	2+2	2
Modulation		QPSK	16QAM	16QAM	16QAM	16QAM	QPSK	16QAM	16QAM	16QAM
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Information Bit Payload (Note 5)										
For Sub-Frames 4,9	Bits	4392	12960	12960	5736	10296	6968	25456	25456	25456
For Sub-Frames 1,6		3240	9528	9528	5160	9144	n/a	22920	21384	n/a
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	4392	12960	n/a	4968	10296	n/a	25456	n/a	n/a
Number of Code Blocks (Notes 4 and 5)										
For Sub-Frames 4,9		1	3	3	1	2	2	5	5	5
For Sub-Frames 1,6		1	2	2	1	2	n/a	4	4	n/a
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0		1	3	n/a	1	2	n/a	5	n/a	n/a
Binary Channel Bits (Note 5)										
For Sub-Frames 4,9	Bits	13200	26400	26400	12000	21120	13200	52800	52800	52800
For Sub-Frames 1,6		10656	21312	21312	10512	16992	10656	42912	42912	n/a
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	12528	25056	n/a	10656	19776	12528	51456	n/a	n/a
Max. Throughput averaged over 1 frame (Note 5)	Mbps	1.966	5.794	4.498	2.676	4.918	1.39	12.221	9.368	5.091
UE Category		≥ 1	≥ 2	≥2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	3

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz a symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (other

Note 5: Given per component carrier per codeword.

Note 6: For R.11-3 resource blocks of RB6-RB45 are allocated.

A.3.4.2.2 Four antenna ports

Table A.3.4.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit				Value			
Reference channel		R.12	R.13	R.14	R.14-1	R.14-2	R.43	R.36
		TDD	TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10
Allocated resource blocks (Note 6)		6	50	50	6	3	100	50
Uplink-Downlink Configuration (Note 4)		1	1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	2+2	2	2	2+2	2+2
Modulation		QPSK	QPSK	16QAM	16QAM	16QAM	16QAM	64QAM
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2
Information Bit Payload (Note 6)								
For Sub-Frames 4,9	Bits	408	4392	12960	1544	744	25456	18336
For Sub-Frames 1,6	Bits	n/a	3240	9528	n/a	n/a	21384	15840
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	208	4392	n/a	n/a	n/a	n/a	n/a
Number of Code Blocks (Notes 5 and 6)								
For Sub-Frames 4,9		1	1	3	1	1	5	3
For Sub-Frames 1,6		n/a	1	2	n/a	n/a	4	3
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0		1	1	n/a	n/a	n/a	n/a	n/a
Binary Channel Bits (Note 6)								
For Sub-Frames 4,9	Bits	1248	12800	25600	3072	1536	51200	38400
For Sub-Frames 1,6		n/a	10256	20512	n/a	n/a	41312	30768
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	624	12176	n/a	n/a	n/a	n/a	n/a
Max. Throughput averaged over 1 frame (Note 6)	Mbps	0.102	1.966	4.498	0.309	0.149	9.368	6.835
UE Category		≥ 1	≥ 1	≥2	≥ 1	≥ 1	≥ 2	≥2

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Given per component carrier per codeword.

A.3.4.3 Reference Measurement Channels for UE-Specific Reference Symbols

A.3.4.3.1 Single antenna port (Cell Specific)

The reference measurement channels in Table A.3.4.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

Table A.3.4.3.1-1: Fixed Reference Channel for DRS

Parameter	Unit			Val	ue		
Reference channel		R.25 TDD	R.26 TDD	R.26-1 TDD	R.27 TDD	R.27-1 TDD	R.28 TDD
Channel bandwidth	MHz	10	10	5	10	10	10
Allocated resource blocks		50 ⁴	50 ⁴	25 ⁴	50 ⁴	18 ⁶	1
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2	3+2
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	16QAM
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2
Information Bit Payload							
For Sub-Frames 4,9	Bits	4392	12960	5736	28336	10296	224
For Sub-Frames 1,6	Bits	3240	9528	4584	22920	8248	176
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	2984	9528	3880	22152	10296	224
Number of Code Blocks per Sub-Frame (Note 5)							
For Sub-Frames 4,9		1	3	1	5	2	1
For Sub-Frames 1,6		1	2	1	4	2	1
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0		1	2	1	4	2	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits	12600	25200	11400	37800	13608	504
For Sub-Frames 1,6	Bits	10356	20712	10212	31068	11340	420
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	10332	20664	7752	30996	13608	504
Max. Throughput averaged over 1 frame	Mbps	1.825	5.450	2.452	12.466	4.738	0.102
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 1

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: as per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Localized allocation started from RB #0 is applied.

A.3.4.3.2 Two antenna ports (Cell Specific)

The reference measurement channels in Table A.3.4.3.2-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports.

Table A.3.4.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS

Reference channel		R.31	R.32	R.32-1	R.33	R.33-1	R.34	
		TDD	TDD	TDD	TDD	TDD	TDD	
Channel bandwidth	MHz	10	10	5	10	10	10	
Allocated resource		50 ⁴	50 ⁴	25 ⁴	50 ⁴	18 ⁶	50 ⁴	
blocks								
Uplink-Downlink		1	1	1	1	1	1	
Configuration (Note 3)								
Allocated subframes		3+2	3+2	3+2	3+2	3+2	3+2	
per Radio Frame (D+S)								
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	64QAM	
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2	
Information Bit Payload								
For Sub-Frames 4,9	Bits	3624	11448	5736	27376	9528	18336	
For Sub-Frames 1,6		2664	7736	3112	16992	7480	11832	
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0	Bits	2984	9528	3496	22152	9528	14688	
Number of Code Blocks								
per Sub-Frame								
(Note 5)								
For Sub-Frames 4,9		1	2	1	5	2	3	
For Sub-Frames 1,6		1	2	1	3	2	2	
For Sub-Frame 5		n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0		1	2	1	4	2	3	
Binary Channel Bits Per								
Sub-Frame								
For Sub-Frames 4,9	Bits	12000	24000	10800	36000	12960	36000	
For Sub-Frames 1,6		7872	15744	6528	23616	10368	23616	
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a	n/a	n/a	
For Sub-Frame 0	Bits	9840	19680	7344	29520	12960	29520	
Max. Throughput	Mbps	1.556	4.79	2.119	11.089	4.354	7.502	
averaged over 1 frame								
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 2	
•								

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: as per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.31, R.32, R.33and R.34, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.32-1, 25 resource blocks are allocated in sub-frames 4,9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1, 6.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Localized allocation started from RB #0 is applied.

A.3.4.3.3 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.3-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.4.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

	Parameter	Unit	Value	
Reference	e channel		R.51 TDD	
Channel bandwidth		MHz	10	
	resource blocks		50 (Note 5)	
			1	
Uplink-Downlink Configuration (Note 3) Allocated subframes per Radio Frame			3+2	
Allocated subframes per Radio Frame (D+S)			372	
Modulation	on.		16QAM	
			1/2	
Target Coding Rate		+	1/2	
Information Bit Payload		Bits	11448	
For Sub-Frames 4,9 (non CSI-RS		DIIS	11440	
subframe) For Sub-Frame 4,9		Dita	44.440	
		Bits	11448	
	-Frames 1,6	Bits	7736	
	-Frame 5	Bits	n/a	
	-Frame 0	Bits	9528	
	of Code Blocks			
(Note 4)				
	-Frames 4, 9 (non CSI-RS	Code	2	
subframe	9)	blocks		
For Sub	-Frames 4,9	Code	2	
		blocks		
For Sub	-Frames 1,6	Code	2	
		blocks		
For Sub-Frame 5			n/a	
For Sub-Frame 0		Code	2	
		blocks		
Binary Channel Bits				
For Sub	-Frames 4, 9 (non CSI-RS	Bits	24000	
subframe	e)			
For Sub	-Frames 4,9		22800	
For Sub	-Frames 1,6		15744	
For Sub-Frame 5		Bits	n/a	
For Sub	-Frame 0	Bits	19680	
Max. Throughput averaged over 1		Mbps	4.7896	
frame				
UE Category			≥ 2	
Note 1:	2 symbols allocated to PDCCh	1.		
Note 2:	Reference signal, synchroniza		s and PBCH	
	allocated as per TS 36.211 [4]		· · ·	
Note 3:	as per Table 4.2-2 in TS 36.211 [4].			
Note 4:	If more than one Code Block is present, an additional			
	CRC sequence of L = 24 Bits is attached to each Code			
Block (otherwise L = 0 Bit).				
Note 5:				
41 resource blocks (RB0–RB20 and RB30–RB49) are				
	allocated in sub-frame 0 and the DwPTS portion of			
	sub-frames 1,6.	_	•	
	/ - -			

A.3.4.3.4 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.4-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value		
Reference channel	Offic	R.44 TDD		
Channel bandwidth	MHz	10		
	IVITIZ			
Allocated resource blocks		50 (Note 4) 1		
Uplink-Downlink Configuration		1		
(Note 3) Allocated subframes per Radio		3+2		
		3+2		
Frame (D+S) Modulation		64001		
		64QAM		
Target Coding Rate		1/2		
Information Bit Payload	D.,	40000		
For Sub-Frames 4,9 (non CSI-RS	Bits	18336		
subframe)	D:4-	40440		
For Sub-Frames 4,9 (CSI-RS	Bits	16416		
subframe)		44000		
For Sub-Frames 1,6	D.,	11832		
For Sub-Frame 5	Bits	n/a		
For Sub-Frame 0	Bits	14688		
Number of Code Blocks per Sub-				
Frame				
(Note 5)				
For Sub-Frames 4,9 (non CSI-RS		3		
subframe)				
For Sub-Frames 4,9 (CSI-RS		3		
subframe)				
For Sub-Frames 1,6		2		
For Sub-Frame 5		n/a		
For Sub-Frame 0		3		
Binary Channel Bits Per Sub-				
Frame	5	2222		
For Sub-Frames 4,9 (non CSI-RS	Bits	36000		
subframe)	5	2222		
For Sub-Frames 4,9 (CSI-RS	Bits	33600		
subframe)		00040		
For Sub-Frames 1,6	5	23616		
For Sub-Frame 5	Bits	n/a		
For Sub-Frame 0	Bits	29520		
Max. Throughput averaged over 1	Mbps	7.1184		
frame		_		
UE Category		≥ 2		
Note 1: 2 symbols allocated to PDCCH.				
Note 2: Reference signal, synchro		gnals and PBCH		
allocated as per TS 36.21				
	as per Table 4.2-2 in TS 36.211 [4].			
	50 resource blocks are allocated in sub-frames 4,9			
	and 41 resource blocks (RB0–RB20 and RB30– RB49) are allocated in sub-frame 0 and the DwPTS			
	portion of sub-frames 1,6.			
	If more than one Code Block is present, an additional			

A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

Code Block (otherwise L = 0 Bit).

CRC sequence of L = 24 Bits is attached to each

Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

Parameter	Unit	Value	
Reference channel		R.50 TDD	
Channel bandwidth	MHz	10	
Allocated resource blocks		50 (Note 4)	
Uplink-Downlink Configuration (Note		1	
3)			
Allocated subframes per Radio		3+2	
Frame (D+S)			
Modulation		QPSK	
Target Coding Rate		1/3	
Information Bit Payload			
For Sub-Frames 4,9 (non CSI-RS	Bits	3624	
subframe)			
For Sub-Frames 4,9 (CSI-RS	Bits	3624	
subframe)			
For Sub-Frames 1,6		2664	
For Sub-Frame 5	Bits	n/a	
For Sub-Frame 0	Bits	2984	
Number of Code Blocks per Sub-			
Frame			
(Note 5)			
For Sub-Frames 4,9 (non CSI-RS		1	
subframe)			
For Sub-Frames 4,9 (CSI-RS		1	
subframe)			
For Sub-Frames 1,6		1	
For Sub-Frame 5		n/a	
For Sub-Frame 0		1	
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 4,9 (non CSI-RS	Bits	12000	
subframe)			
For Sub-Frames 4,9 (CSI-RS	Bits	10400	
subframe)			
For Sub-Frames 1,6		7872	
For Sub-Frame 5	Bits	n/a	
For Sub-Frame 0	Bits	9840	
Max. Throughput averaged over 1	Mbps	1.556	
frame			
UE Category		≥ 1	
Note 1: 2 symbols allocated to PDCCH.			
Note 2: Reference signal, synchronization signals and PBCH			

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-

frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-2: Fixed Reference Channel for eight antenna ports (CSI-RS)

Parameter	Unit		Value	
Reference channel		R.45	R.45-1	
		TDD	TDD	
Channel bandwidth	MHz	10	10	
Allocated resource blocks		50 ⁴	39	
Uplink-Downlink Configuration (Note 3)		1	1	
Allocated subframes per Radio Frame		4+2	4+2	
(D+S)				
Allocated subframes per Radio Frame		10	10	
Modulation		16QAM	16QAM	
Target Coding Rate		1/2	1/2	
Information Bit Payload				
For Sub-Frames 4 and 9	Bits	n/a	n/a	
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	11448	8760	
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	7736	7480	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	9528	8760	
Number of Code Blocks per Sub-Frame				
(Note 5)				
For Sub-Frames 4 and 9		n/a	n/a	
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9		2	2	
(CSI-RS subframe)				
For Sub-Frames 1,6		2	2	
For Sub-Frame 5		n/a	n/a	
For Sub-Frame 0		2	2	
Binary Channel Bits Per Sub-Frame				
For Sub-Frames 4 and 9	Bits	n/a	n/a	
(Non CSI-RS subframe)				
For Sub-Frames 4 and 9	Bits	22400	17472	
(CSI-RS subframe)				
For Sub-Frames 1,6	Bits	15744	14976	
For Sub-Frame 5	Bits	n/a	n/a	
For Sub-Frame 0	Bits	19680	18720	
Max. Throughput averaged over 1 frame	Mbps	4.7896	4.1240	
UE Category		≥ 2	≥ 1	

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.45, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.45-1, 39 resource blocks are allocated in sub-frames 0,4,9 and the DwPTS portion of sub-frames 1,6 (RB0–RB20 and RB30–RB47).
- Note 5: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).
- Note 6: Localized allocation started from RB #0 is applied.

A.3.5 Reference measurement channels for PDCCH/PCFICH performance requirements

A.3.5.1 FDD

Table A.3.5.1-1: Reference Channel FDD

Parameter	Unit	Value							
Reference channel		R.15 FDD	R.15-1 FDD	R.16 FDD	R.17 FDD				
Number of transmitter antennas		1	2	2	4				
Channel bandwidth	MHz	10	10	10	5				
Number of OFDM symbols for PDCCH	symbols	2	3	2	2				
Aggregation level	CCE	8	8	4	2				
DCI Format		Format 1	Format 1	Format 2	Format 2				
Cell ID		0	0	0	0				
Payload (without CRC)	Bits	31	31	43	42				

A.3.5.2 TDD

Table A.3.5.2-1: Reference Channel TDD

Parameter	Unit	Value							
Reference channel		R.15 TDD	R.15-1 TDD	R.16 TDD	R.17 TDD				
Number of transmitter antennas		1	2	2	4				
Channel bandwidth	MHz	10	10	10	5				
Number of OFDM symbols for PDCCH	symbols	2	3	2	2				
Aggregation level	CCE	8	8	4	2				
DCI Format		Format 1	Format 1	Format 2	Format 2				
Cell ID		0	0	0	0				
Payload (without CRC)	Bits	34	34	46	45				

A.3.6 Reference measurement channels for PHICH performance requirements

Table A.3.6-1: Reference Channel FDD/TDD

Parameter	Unit	Value							
Reference channel		R.18	R.19	R.20	R.24				
Number of transmitter antennas		1	2	4	1				
Channel bandwidth	MHz	10	10	5	10				
User roles (Note 1)		W I1 I2	W I1 I2	W I1 I2	W I1				
Resource allocation (Note 2)		(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1)				
Power offsets (Note 3)	dB	-4 0 -3	-4 0 -3	-4 0 -3	+3 0				
Payload (Note 4)		ARR	ARR	ARR	AR				

Note 1: W=wanted user, I1=interfering user 1, I2=interfering user 2.

Note 2: The resource allocation per user is given as (N_group_PHICH, N_seq_PHICH).

Note 3: The power offsets (per user) represent the difference of the power of BPSK modulated symbol per PHICH relative to the first interfering user.

Note 4: A=fixed ACK, R=random ACK/NACK.

A.3.7 Reference measurement channels for PBCH performance requirements

Table A.3.7-1: Reference Channel FDD/TDD

Parameter	Unit	Value						
Reference channel		R.21	R.23					
Number of transmitter antennas		1	2	4				
Channel bandwidth	MHz	1.4	1.4	1.4				
Modulation		QPSK	QPSK	QPSK				
Target coding rate		40/1920	40/1920	40/1920				
Payload (without CRC)	Bits	24	24	24				

A.3.8 Reference measurement channels for MBMS performance requirements

A.3.8.1 FDD

Table A.3.8.1-1: Fixed Reference Channel QPSK R=1/3

Parameter				РМСН			
	Unit	Value					
Reference channel		R.40 FDD			R.37 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Allocated subframes per Radio Frame		6			6		
(Note 1)							
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits	408			3624		
For Sub-Frames 0,4,5,9	Bits	n/a			n/a		
Number of Code Blocks per Subframe		1			1		
(Note 3)							
Binary Channel Bits Per Subframe							
For Sub-Frames 1,2,3,6,7,8	Bits	1224			10200		
For Sub-Frames 0,4,5,9	Bits	n/a			n/a		
MBMS UE Category		≥ 1			≥ 1		

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.8.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter		PMCH					
	Unit				Value		
Reference channel					R.38 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame (Note 1)					6		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits				9912		
For Sub-Frames 0,4,5,9	Bits				n/a		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 1,2,3,6,7,8	Bits				20400		
For Sub-Frames 0,4,5,9	Bits				n/a		
MBMS UE Category					≥ 1		

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.8.1-3: Fixed Reference Channel 64QAM R=2/3

Parameter PMCH							
Unit		Value					
			.39-1 FDD	R.39 FDD			
MHz	1.4	3	5	10	15	20	
			25	50			
			6	6			
			64QAM	64QAM			
			2/3	2/3			
Bits			9912	19848			
Bits			n/a	n/a			
			2	4			
	•						
Bits			15300	30600			
Bits			n/a	n/a			
			≥ 1	≥ 2			
	MHz Bits Bits Bits	MHz 1.4 Bits Bits Bits	MHz 1.4 3 Bits Bits Bits	Unit 39-1 FDD MHz 1.4 3 5 25 6 6 64QAM 2/3 Bits 9912 Bits n/a 2 2 Bits 15300 Bits n/a	Unit Value 39-1 FDD R.39 FDD MHz 1.4 3 5 10 25 50 6 6 6 6 64QAM 64QAM 2/3 2/3 2/3 Bits 9912 19848 Bits n/a n/a Bits 15300 30600 Bits n/a n/a	Unit Value 39-1 FDD R.39 FDD MHz 1.4 3 5 10 15 25 50 6 6 6 64QAM 64QAM 64QAM 2/3 2/3 Bits 9912 19848	

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.8.2 TDD

Table A.3.8.2-1: Fixed Reference Channel QPSK R=1/3

Parameter				PMCH			
	Uni	Value					
	t						
Reference channel		R.40 TDD			R.37 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Uplink-Downlink Configuration(Note 1)		5			5		
Allocated subframes per Radio Frame		5			5		
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)		.,,					1
For Sub-Frames 3,4,7,8,9	Bits	408			3624		
For Sub-Frames 0,1,2,5,6	Bits	n/a			n/a		
Number of Code Blocks per Subframe		1			1		
(Note 3)							
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits	1224			10200		
For Sub-Frames 0,1,2,5,6	Bits	n/a			n/a		
MBMS UE Category		≥ 1			≥ 1		

- Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.
- Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211.
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.2-2: Fixed Reference Channel 16QAM R=1/2

Parameter	PMCH						
	Unit				Value		
Reference channel					R.38 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Uplink-Downlink Configuration(Note 1)					5		
Allocated subframes per Radio Frame					5		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits				9912		
For Sub-Frames 0,1,2,5,6	Bits				n/a		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits				20400		
For Sub-Frames 0,1,2,5,6	Bits				n/a		
MBMS UE Category					≥ 1		

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211. Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.8.2-3: Fixed Reference Channel 64QAM R=2/3

Parameter				PMCH				
	Unit	Value						
Reference channel				R.39-1TDD	R.39 TDD			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks				25	50			
Uplink-Downlink Configuration(Note 1)				5	5			
Allocated subframes per Radio Frame				5	5			
Modulation				64QAM	64QAM			
Target Coding Rate				2/3	2/3			
Information Bit Payload (Note 2)								
For Sub-Frames 3,4,7,8,9	Bits			9912	19848			
For Sub-Frames 0,1,2,5,6	Bits			n/a	n/a			
Number of Code Blocks per Sub-Frame (Note 3)				2	4			
Binary Channel Bits Per Subframe								
For Sub-Frames 3,4,7,8,9	Bits			15300	30600			
For Sub-Frames 0,1,2,5,6	Bits			n/a	n/a			
MBMS UE Category				≥ 1	≥ 2			

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211. Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

A.3.9 Reference measurement channels for sustained downlink data rate provided by lower layers

A.3.9.1 FDD

Table A.3.9.1-1: Fixed Reference Channel for sustained data-rate test (FDD)

Parameter	Unit				Value			
Reference channel		R.31-1	R.31-2	R.31-3	R.31-3A	R.31-3C	R.31-4	R.31-4B
		FDD	FDD	FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 9	Note 7	Note 10
Allocated subframes per Radio Frame		10	10	10	10	10	10	10
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.40	0.59	0.59	0.85	0.87	0.88	0.85
For Sub-Frame 5		0.40	0.64	0.62	0.89	0.88	0.87	0.87
For Sub-Frame 0		0.40	0.63	0.61	0.90	0.91	0.90	0.88
Information Bit Payload (Note 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056
Number of Code Blocks								
(Notes 3 and 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9
Binary Channel Bits (Note 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352
Number of layers		1	2	2	2	2	2	2
Max. Throughput averaged over 1 frame	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826
(Note 8)								
UE Categories		≥1	≥ 2	≥ 2	≥ 2	≥3	≥ 3	≥ 4

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 5: Resource blocks n_{PRB} = 6..14,30..49 are allocated for the user data in all sub-frames.
- Note 6: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Given per component carrier per codeword.
- Note 9: Resource blocks $n_{PRB} = 4..71$ are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.
- Note 10: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.

A.3.9.2 TDD

Table A.3.9.2-1: Fixed Reference Channel for sustained data-rate test (TDD)

Parameter	Unit			Value		
Reference channel		R.31-1	R.31-2	R.31-3	R.31-3A	R.31-4
		TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	10	10	20	15	20
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	Note 8
Uplink-Downlink Configuration (Note 3)		5	5	5	1	1
Number of HARQ Processes per	Proces	15	15	15	7	7
component carrier	ses					
Allocated subframes per Radio Frame		8+1	8+1	8+1	4	4
(D+S)						
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate						
For Sub-Frames 4,9		0.40	0.59	0.59	0.87	0.88
For Sub-Frames 3,7,8		0.40	0.59	0.59	n/a	n/a
For Sub-Frames 1		n/a	n/a	n/a	n/a	n/a
For Sub-Frames 5		0.40	0.64	0.62	0.88	0.87
For Sub-Frames 6		0.40	0.60	0.60	n/a	n/a
For Sub-Frames 0		0.40	0.62	0.61	0.90	0.90
Information Bit Payload						
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376
For Sub-Frames 3,7,8	Bits	10296	25456	51024	0	0
For Sub-Frame 1	Bits	0	0	0	0	0
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112
For Sub-Frame 6	Bits	10296	25456	51024	0	0
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376
Number of Code Blocks per Sub-Frame						
(Note 4)						
For Sub-Frames 4,9		2	5	9	9	13
For Sub-Frames 3,7,8		2	5	9	n/a	n/a
For Sub-Frame 1		n/a	n/a	n/a	n/a	n/a
For Sub-Frame 5		2	5	9	9	12
For Sub-Frame 6	Bits	2	5	9	n/a	n/a
For Sub-Frame 0		2	5	9	9	13
Binary Channel Bits Per Sub-Frame			_			-
For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400
For Sub-Frames 3,7,8	Bits	26100	43200	86400	0	0
For Sub-Frame 1	Bits	0	0	0	0	0
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512
For Sub-Frame 6	Bits	26100	42768	85968	n/a	n/a
For Sub-Frame 0	Bits	26100	41184	84384	56736	84384
Number of layers		1	2	2	2	2
Max. Throughput averaged over 1 frame	Mbps	8.237	20.365	40.819	20.409	29.724
(Note 10)						
UE Category		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3
	1					

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).
- Note 5: Resource blocks $n_{PRB} = 0..2$ are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks $n_{PRB} = 6..14,30..49$ are allocated for the user data in all subframes.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,3,4,6,7,8,9.
- Note 8: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,3,4,6,7,8,9.
- Note 9: Resource blocks nprB = 4..71 are allocated for the user data in all sub-frames
- Note10: Given per component carrier per codeword.

A.4 CSI reference measurement channels

This section defines the DL signal applicable to the reporting of channel status information (Clause 9.2, 9.3 and 9.5).

In Table A.4-1 are specified the reference channels. Table A.4-15 specifies the mapping of CQI index to modulation coding scheme, which complies with the CQI definition specified in Section 7.2.3 of [6].

Table A.4-0: Void

Table A.4-1: CSI reference measurement channels

RMC Name	Duple x	CH-BW	Alloc. RB-s	UL/DL Config	Alloc. SF-s	MCS Scheme	Nr. HARQ Proc.	Max. nr HARQ Trans.	Notes
1 CRS Port									
RC.1 FDD	FDD	10	50	-		MCS.1	8	1	
RC.1 TDD	TDD	10	50	Note 3		MCS.1	10	1	
RC.3 FDD	FDD	10	6	-		MCS.10	8	1	
RC.3 TDD	TDD	10	6	Note 3		MCS.10	10	1	
RC.4 FDD	FDD	10	15	-		MCS.15	8	1	Note 6
RC.4 TDD	TDD	10	15	Note 3		MCS.15	10	1	Note 6
RC.5 FDD	FDD	10	3	-		MCS.17	8	1	
RC.5 TDD	TDD	10	3	Note 3		MCS.17	10	1	
2 CRS Ports	5								
RC.2 FDD	FDD	10	50	-		MCS.2	8	1	
RC.2 TDD	TDD	10	50	Note 3		MCS.2	10	1	
RC.6 FDD	FDD	10	15	-		MCS.16	8	1	Note 6
RC.6 TDD	TDD	10	15	Note 3		MCS.16	10	1	Note 6
1 CRS Port	+ CSI-RS	;							
RC.8 FDD	FDD	10	6	-	Non CSI-RS	MCS.11	8	1	
					2 CSI-RS	MCS.12			
RC.8 TDD	TDD	10	6	Note 3	Non CSI-RS	MCS.11	10	1	
					2 CSI-RS	MCS.12			
RC.9 FDD	FDD	10	50	_	Non CSI-RS	MCS.3	8	1	
					2 CSI-RS	MCS.4			
RC.9 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.3	10	1	
					2 CSI-RS	MCS.4			
2 CRS Port	+ CSI-RS								
RC.7 FDD	FDD	10	50	_	Non CSI-RS	MCS.5	8	1	
				4 CSI-RS MCS.7					
RC.7 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.5	10	1	
Note 4. 2					8 CSI-RS	MCS.8			

Note 1: 3 symbols allocated to PDCCH.

Note 2: For FDD only subframes 1, 2, 3, 4, 6, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.

Note 3: TDD UL-DL configuration as specified in the individual tests.

Note 4: For TDD when UL-DL configuration 1 is used only subframes 4 and 9 are allocated to avoide PBCH and synchronizaiton signal overhead.

Note 5: For TDD when UL-DL configuration 2 is used only subframes 3, 4, 8, and 9 are allocated to avoid PBCH and synchronization signal overhead.

Note 6: Centered within the Transmission Bandwidth Configuration (Figure 5.6-1).

Table A.4-1a: Void

Table A.4-1b: Void

Table A.4-2: Void

Table A.4-2a: Void

Table A.4-2b: Void

Table A.4-3: Void

Table A.4-3a: Void

Table A.4-3b: Void

Table A.4-3c: Void

Table A.4-3d: Void

Table A.4-3e: Void

Table A.4-3f: Void

Table A.4-3g: Void

Table A.4-4: Void

Table A.4-4a: Void

Table A.4-5: Void

Table A.4-5a: Void

Table A.4-6: Void

Table A.4-6a: Void

Table A.4-6b: Void

Table A.4-7: Void

Table A.4-8: Void

Table A.4-9: Void

Table A.4-10: Void

Table A.4-11: Void

Table A.4-12: Void

Table A.4-13: Void

Table A.14: Void

DTX

DTX

DTX

DTX

DTX

DTX

DTX

DTX

MCS.1

MCS.2

MCS.3

MCS.4

MCS.5

MCS.6

MCS.7

MCS.8

CQI Index 0.0762 0.1885 0.3008 0.4385 0.5879 0.4785 0.5537 0.8525 0.6504 OOR 0.455 **Target Coding Rate Notes** Modulation OOR **QPSK** 16QAM 64QAM MCS Available PRB **Scheme** RE-s **Imcs**

Table A.4-15: Mapping of CQI Index to Modulation coding scheme (MCS)

MCS.9 DTX MCS.10 DTX MCS.11 DTX MCS.12 DTX MCS.13 DTX MCS.14 DTX MCS.15 DTX MCS.16 DTX MCS.17 DTX Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6]. Note 1:

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

OFDMA Channel Noise Generator (OCNG) **A.5**

A.5.1OCNG Patterns for FDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed

$$\gamma_i = PDSCH_i RA/OCNG_RA = PDSCH_i RB/OCNG_RB$$

³ symbols allocated to PDCCH. Note 2:

section 7.1 in 3GPP TS 36.213.

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for each CC.

A.5.1.1 OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.1.1-1: OP.1 FDD: One sided dynamic OCNG FDD Pattern

		Relative power level $\gamma_{\it PRB}$ [dl	3]			
Subframe						
	0 5 1-4,6-9					
	Allocation					
First	First unallocated PRB First unallocated PRB First unallocated PRB					
Last	unallocated PRB	Last unallocated PRB	Last unallocated PRB			
	0	0	0	Note 1		
Note 1:	Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random					
	data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.					
Note 2:	7					
	parameter $\gamma_{\it PRB}$ ap	plies to each antenna port separ	rately, so the transmit power is eq	ual between all		

A.5.1.2 OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{\scriptscriptstyle RR}$ -1.

the transmit antennas with CRS used in the test. The antenna transmission modes are specified in

Table A.5.1.2-1: OP.2 FDD: Two sided dynamic OCNG FDD Pattern

Re			
0	5	1 – 4, 6 – 9	PDSCH Data
	Allocation		PDSCH Data
0 – (First allocated PRB-1) and	0 – (First allocated PRB-1) and	0 – (First allocated PRB-1) and	
(Last allocated PRB+1) – $(N_{\it RB}-1)$	(Last allocated PRB+1) – $(N_{RB}-1)$	(Last allocated PRB+1) – $(N_{\it RB}-1)$	
0	0	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRR} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.3 OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.1.3-1: OP.3 FDD: OCNG FDD Pattern 3

	Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					
Allocation		PDSCH Data	PMCH Data			
$n_{\it PRB}$	0	0 5 4, 9		1 – 3, 6 – 8	Data	Data
1 – 49	0	0 (Allocation: all empty PRB-s)	0	N/A	Note 1	N/A
0 – 49	N/A	N/A	N/A	0	N/A	Note 2

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The parameter γ_{PRB} is used to scale the power of PMCH.

Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

N/A: Not Applicable

A.5.1.4 OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.1.4-1: OP.4 FDD: One sided dynamic OCNG FDD Pattern for MBMS transmission

	Re	Relative power level $\gamma_{\it PRB}$ [dB]				
Allocation		Subframe				
$n_{\it PRB}$	0, 4, 9	5	1 – 3, 6 – 8	Data	Data	
First unallocated PRB – Last unallocated PRB	0	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A	
First unallocated PRB Last unallocated PRB	N/A	N/A	N/A	N/A	Note 2	
			ssigned to an arbitrary numb			
uncorrelated pseudo random data, which is QPSK modulated. The parameter $\gamma_{_{PRB}}$ is						
used to scale the power of PDSCH. Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The						

parameter γ_{PRB} is used to scale the power of PMCH.

Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

N/A: Not Applicable

A.5.1.5 OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of DL sub-frames, when the unallocated area is continuous in the frequency domain (one sided).

Table A.5.1.5-1: OP.5 FDD: One sided dynamic 16QAM modulated OCNG FDD Pattern

Relative power level $\gamma_{\it PRB}$ [dB]				
Subframe				
0	5	1 – 4, 6 – 9	PDSCH Data	
Allocation				
First unallocated PRB	First unallocated PRB	First unallocated PRB		
	-			
Last unallocated PRB	Last unallocated PRB	Last unallocated PRB		
0	0	0	Note 1	

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is 16QAM modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay CDD). The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.6 OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB $N_{\scriptscriptstyle RR}-1$.

Table A.5.1.6-1: OP.6 FDD: OCNG FDD Pattern when user data is in 2 non-contiguous blocks

Re			
0	5	1 – 4, 6 – 9	
	Allocation		PDSCH Data
0 – (First allocated PRB of first block -1) and (Last allocated PRB of first block +1) – (First allocated PRB of second block -1)	first block -1) and first block -1) and (Last allocated PRB of first block +1) – (First allocated block +1) – (First allocated		
0	0	PRB of second block -1) 0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.7 OCNG FDD pattern 7: dynamic OCNG FDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB $N_{Start,m}$ and ends with PRB $N_{End,m}-1$, where m=1,...,M. The system bandwidth starts with RPB 0 and ends with $N_{RR}-1$.

Table A.5.1.7-1: OP.7 FDD: OCNG FDD Pattern when user data is in multiple non-contiguous blocks

F			
	Subframe		
0	5	1 – 4, 6 – 9	
	Allocation		
$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	
			PDSCH Data
$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	
$N_{Start,m}-1)$	$N_{Start,m}-1)$	$N_{Start,m}-1$)	
$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	
$N_{RB}-1$)	$N_{RB}-1$)	$N_{RB}-1$)	
Λ	Λ	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2 OCNG Patterns for TDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i RA/OCNG RA = PDSCH_i RB/OCNG RB,$$

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

A.5.2.1 OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.1-1: OP.1 TDD: One sided dynamic OCNG TDD Pattern

		Relative power	level $\gamma_{\it PRB}$ [dB]			
Subframe (only if available for DL)						
	3, 4, 7, 8, 9 1 0 5 and 6 (as normal and 6 (as special subframe) Note 2 subframe) Note 2		PDSCH Data			
		Allo	cation			
First unal	located PRB	First unallocated PRB	First unallocated PRB	First unallocated PRB		
Last unal	located PRB	Last unallocated PRB	Last unallocated PRB	Last unallocated PRB		
	0	0	0	0	Note 1	
Note 1:			ssigned to an arbitrary num ne OCNG PDSCHs shall b		•	
	which is QPS	SK modulated. The param	neter $\gamma_{\it PRB}$ is used to scale	the power of PDSCH.		
Note 2:	Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211					
Note 3:	Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The					
	parameter $\gamma_{\scriptscriptstyle PRB}$ applies to each antenna port separately, so the transmit power is equal between all the					
	transmit ante 7.1 in 3GPP		ne test. The antenna transr	mission modes are specifi	ed in section	

A.5.2.2 OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{\it RB}$ –1.

Table A.5.2.2-1: OP.2 TDD: Two sided dynamic OCNG TDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					
	Subframe (only if	f available for DL)		Data	
0 5 3, 4, 6, 7, 8, 9 1,6 (6 as normal subframe) (6 as special subframe) Note 2					
	Alloc	ation			
0 –	0 –	0 –	0 –		
(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)		
and	and	and	and		
(Last allocated PRB+1) -	(Last allocated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –		
$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$		
0	0	0	0	Note 1	

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRR} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.3 OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.2.3-1: OP.3 TDD: OCNG TDD Pattern 3 for 5ms downlink-to-uplink switch-point periodicity

		Relative power	level γ_{PRB} [dB]			
Allocation	Subframe				PDSCH Data	PMCH Data
$n_{\it PRB}$ 0	5	4, 9 ^{Note 2}	1, 6			
1 – 49	0	0 (Allocation: all empty PRB-s)	N/A	0	Note 1	N/A
0 – 49	N/A	N/A	0	N/A	N/A	Note 3

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211.
- Note 3: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- Note 4: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

A.5.2.4 OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.2.4-1: OP.4 TDD: One sided dynamic OCNG TDD Pattern for MBMS transmission

$ \begin{array}{c c} \textbf{Allocation} & \textbf{Subframe (only for DL)} \\ n_{PRB} & 0 \text{ and 6 (as normal subframe)} & 1 \text{ (as special subframe)} & 5 & 3, \\ \hline First & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & & & \\ -inst & & & & & & & & & & & & \\ -inst & & & & & & & & & & & & \\ -inst & & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & & \\ -inst & & & & & & & & & & \\ -inst & & & & & & & & & & \\ -inst & & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & & & & \\ -inst & & & & \\ -inst & & & & & \\ -inst & & & & \\ -i$	PDSCH , 4, 7 – 9	Data PMCH Data
First unallocate d PRB — 0 (Allocation: all empty PRB-s of DwPTS) (Allocation: all empty PRB-s)	, 4, 7 – 9	Data PMCH Data
unallocate d PRB Last 0 (Allocation: all empty PRB-s of DwPTS) (Allocation: all empty PRB-s)	N/A Note	
d PRB	Note Note	• 1 N/A
First unallocate d PRB - N/A N/A N/A Last unallocate d PRB	N/A N/A	A Note2

- which is QPSK modulated. The parameter $\gamma_{\it PRB}$ is used to scale the power of PDSCH.
- Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be Note 2: uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users Note 3: by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

A.5.2.5 OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.5-1: OP.5 TDD: One sided dynamic 16QAM modulated OCNG TDD Pattern

Relative power level γ_{PRB} [dB]					
Subframe (only if available for DL)					
0		0 5		1 and 6 (as special subframe) ^{Note 2}	PDSCH Data
		Allo	cation		
First una	located PRB -	First unallocated PRB -	First unallocated PRB -	First unallocated PRB -	
Last unal	Last unallocated PRB				
0 0 0					
Note 1:	Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data,				
	which is 16QAM modulated. The parameter $\gamma_{_{PRB}}$ is used to scale the power of PDSCH.				
Note 2:					
Note 3:	Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay				
	CDD). The parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is equal				
	between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.				

A.5.2.6 OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB $N_{RB}-1$.

Table A.5.2.6-1: OP.6 TDD: OCNG TDD Pattern when user data is in 2 non-contiguous blocks

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					
Subframe (only if available for DL)					
0	5	3, 4, 6, 7, 8, 9	1,6		
		(6 as normal subframe)	(6 as special subframe) Note 2		
	Alloc	ation			
0 – (First allocated PRB					
of first block -1)	of first block -1)	of first block -1)	of first block -1)		
and	and	and	and		
(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of		
first block +1) - (First	first block +1) – (First	first block +1) – (First	first block +1) – (First		
allocated PRB of second	allocated PRB of second	allocated PRB of second	allocated PRB of second		
block -1)	block -1)	block -1)	block -1)		
0	0	0	0	Note 1	
loto 1: Those physical i		 	rtual LIEs with and DDSCH a		

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.7 OCNG TDD pattern 7: dynamic OCNG TDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB $N_{Start,m}$ and ends with PRB $N_{End,m}-1$, where m=1,...,M. The system bandwidth starts with RPB 0 and ends with $N_{RB}-1$.

Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]				PDSCH Data			
	Subframe (only it	f available for DL)		Data			
0	5	3, 4, 6, 7, 8, 9 (6 as normal subframe)	1,6 (6 as special subframe)				
	Alloc	ation					
$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$				
			•••				
$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$				
(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)				
$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$				
$N_{RB}-1$)	$N_{RB}-1$)	$N_{RB}-1$)	$N_{RB}-1$)				
0	0	0	0	Note 1			

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

Annex B (normative): Propagation conditions

B.1 Static propagation condition

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$
.

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j & -j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j \\ 1 & 1 & 1 & 1 - j - j - j - j \end{bmatrix}$$

B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.
- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency
- A set of correlation matrices defining the correlation between the UE and eNodeB antennas in case of multi-antenna systems.
- Additional multi-path models used for CQI (Channel Quality Indication) tests

B.2.1 Delay profiles

The delay profiles are selected to be representative of low, medium and high delay spread environments. The resulting model parameters are defined in Table B.2.1-1 and the tapped delay line models are defined in Tables B.2.1-2, B.2.1-3 and B.2.1-4.

Table B.2.1-1 Delay profiles for E-UTRA channel models

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)
Extended Pedestrian A (EPA)	7	43 ns	410 ns
Extended Vehicular A model (EVA)	9	357 ns	2510 ns
Extended Typical Urban model (ETU)	9	991 ns	5000 ns

Table B.2.1-2 Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

Table B.2.1-3 Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table B.2.1-4 Extended Typical Urban model (ETU)

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

B.2.2 Combinations of channel model parameters

Table B.2.2-1 shows propagation conditions that are used for the performance measurements in multi-path fading environment for low, medium and high Doppler frequencies

Table B.2.2-1 Channel model parameters

Model	Maximum Doppler frequency
EPA 5Hz	5 Hz
EVA 5Hz	5 Hz
EVA 70Hz	70 Hz
ETU 30Hz	30 Hz
ETU 70Hz	70 Hz
ETU 300Hz	300 Hz

B.2.3 MIMO Channel Correlation Matrices

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both eNodeB and UE.

B.2.3.1 Definition of MIMO Correlation Matrices

Table B.2.3.1-1 defines the correlation matrix for the eNodeB

Table B.2.3.1-1 eNodeB correlation matrix

	One antenna	Two antennas	Four antennas
eNode B Correlation	$R_{eNB} = 1$	$R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$	$R_{eNB} = \begin{pmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} \\ \alpha^* & \alpha^{4/9} & \alpha^{1/9} & 1 \end{pmatrix}$

Table B.2.3.1-2 defines the correlation matrix for the UE:

Table B.2.3.1-2 UE correlation matrix

	One antenna	Two antennas	Four antennas	
UE Correlation	$R_{UE} = 1$	$R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$	$R_{UE} = \begin{pmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{pmatrix}$	

Table B.2.3.1-3 defines the channel spatial correlation matrix R_{spat} . The parameters, α and β in Table B.2.3.1-3 defines the spatial correlation between the antennas at the eNodeB and UE.

4x4 case

1x2 case $R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$ $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha \beta \\ \beta^* & 1 & \alpha \beta^* & \alpha \\ \alpha^* & \alpha^* \beta & 1 & \beta \\ \alpha^* & \beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$ 2x2 case $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{\sqrt{9}}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{\sqrt{9}}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{\sqrt{9}}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{\sqrt{9}}} & \alpha^{\frac{1}{\sqrt{9}}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^{*} & 1 \end{bmatrix}$ 4x2 case $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} \end{bmatrix}$

Table B.2.3.1-3: R_{spat} correlation matrices

For cases with more antennas at either eNodeB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of R_{eNB} and R_{UE} according to $R_{spat} = R_{eNB} \otimes R_{UE}$.

B.2.3.2 MIMO Correlation Matrices at High, Medium and Low Level

The α and β for different correlation types are given in Table B.2.3.2-1.

Table B.2.3.2-1

Low correlation		Medium Correlation		High Correlation	
α	β	α	β	α	β
0	0	0.3	0.9	0.9	0.9

The correlation matrices for high, medium and low correlation are defined in Table B.2.3.1-2, B.2.3.2-3 and B.2.3.2-4,as below.

The values in Table B.2.3.2-2 have been adjusted for the 4x2 and 4x4 high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spatial} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 4x2 high correlation case, a=0.00010. For the 4x4 high correlation case, a=0.00012.

The same method is used to adjust the 4x4 medium correlation matrix in Table B.2.3.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00012.

Table B.2.3.2-2: MIMO correlation matrices for high correlation

1x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$								
2x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$								
4x2 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$								
4x4 case	$R_{high} = \begin{cases} 1.0000 \ 0.9882 \ 0.9541 \ 0.8999 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.8894 \ 0.9541 \ 0.9430 \ 0.9105 \ 0.8587 \ 0.8999 \ 0.8894 \ 0.8587 \ 0.8099 \\ 0.9882 \ 1.0000 \ 0.9882 \ 0.9541 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.8894 \ 0.8999 \ 0.8894 \ 0.8999 \ 0.8894 \ 0.8999 \ 0.8894 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.8587 \ 0.9105 \ 0.9430 \ 0.9541 \ 0.9430$								

Table B.2.3.2-3: MIMO correlation matrices for medium correlation

case	N/A
case	$R_{medium} = \begin{pmatrix} 1 & 0.9 & 0.3 & 0.27 \\ 0.9 & 1 & 0.27 & 0.3 \\ 0.3 & 0.27 & 1 & 0.9 \\ 0.27 & 0.3 & 0.9 & 1 \end{pmatrix}$

				1.0000	0.9000	0.8748	3 0.7873	0.5856	0.5271	0.3000	0.2700		
				0.9000	1.0000	0.7873	3 0.8748	0.5271	0.5856	0.2700	0.3000		
				0.8748	0.7873	1.0000	0.9000	0.8748	0.7873	0.5856	0.5271		
				0.7873	0.8748	0.9000	0 1.0000	0.7873	0.8748	0.5271	0.5856		
case		$R_{medium} =$	=	0.5856	0.5271	0.8748		1.0000		0.8748	0.7873		
				0.5650	0.3271	0.6740	3 0.7673	1.0000	0.9000	0.6746	0.7673		
				0.5271	0.5856	0.7873	3 0.8748	0.9000	1.0000	0.7873	0.8748		
				0.3000	0.2700	0.585	6 0.5271	0.8748	0.7873	1.0000	0.9000		
				0.2700	0.3000	0.527	1 0.5856	0.7873	0.8748	0.9000	1.0000		
											,		
case	-	1.0000 0.9	882	0.9541 0.8	8999 0.8747	0.8645	0.8347 0.7872	0.5855 (0.5787 0.5588	0.5270	0.3000 0.2965	0.2862	0.2700
		0.9882 1.00	000	0.9882 0.9	9541 0.8645	0.8747	0.8645 0.8347	0.5787	0.5855 0.5787	0.5588	0.2965 0.3000	0.2965	0.2862
		0.9541 0.9	882	1.0000 0.9	9882 0.8347	0.8645	0.8747 0.8645	0.5588	0.5787 0.5855	0.5787	0.2862 0.2965	0.3000	0.2965
		0.8999 0.9	541	0.9882 1.0	0000 0.7872	0.8347	0.8645 0.8747	0.5270	0.5588 0.5787	0.5855	0.2700 0.2862	0.2965	0.3000
		0.8747 0.8	645	0.8347 0.7	7872 1.0000	0.9882	0.9541 0.8999	0.8747	0.8645 0.8347	0.7872	0.5855 0.5787	0.5588	0.5270
		0.8645 0.8	747	0.8645 0.8	3347 0.9882	1.0000	0.9882 0.9541	0.8645	0.8747 0.8645	0.8347	0.5787 0.5855	0.5787	0.5588
		0.8347 0.8	645	0.8747 0.8	8645 0.9541	0.9882	1.0000 0.9882	0.8347	0.8645 0.8747	0.8645	0.5588 0.5787	0.5855	0.5787
	р _	0.7872 0.8	347	0.8645 0.8	3747 0.8999	0.9541	0.9882 1.0000	0.7872	0.8347 0.8645	0.8747	0.5270 0.5588	0.5787	0.5855
	R_{medium} =	0.5855 0.5	787	0.5588 0.5	5270 0.8747	0.8645	0.8347 0.7872	1.0000 (0.9882 0.9541	0.8999	0.8747 0.8645	0.8347	0.7872
		0.5787 0.5	855	0.5787 0.5	5588 0.8645	0.8747	0.8645 0.8347	0.9882 1	1.0000 0.9882	0.9541	0.8645 0.8747	0.8645	0.8347
		0.5588 0.5	787	0.5855 0.5	5787 0.8347	0.8645	0.8747 0.8645	0.9541 (0.9882 1.0000	0.9882	0.8347 0.8645	0.8747	0.8645
		0.5270 0.5	588	0.5787 0.5	5855 0.7872	0.8347	0.8645 0.8747	0.8999 (0.9541 0.9882	1.0000	0.7872 0.8347	0.8645	0.8747
		0.3000 0.2	965	0.2862 0.2	2700 0.5855	0.5787	0.5588 0.5270	0.8747 (0.8645 0.8347	0.7872	1.0000 0.9882	0.9541	0.8999
		0.2965 0.3	000	0.2965 0.2	2862 0.5787	0.5855	0.5787 0.5588	0.8645 (0.8747 0.8645	0.8347	0.9882 1.0000	0.9882	0.9541
		0.2862 0.2	965	0.3000 0.2	2965 0.5588	0.5787	0.5855 0.5787	0.8347	0.8645 0.8747	0.8645	0.9541 0.9882	1.0000	0.9882
		0.2700 0.2	862	0.2965 0.3	3000 0.5270	0.5588	0.5787 0.5855	0.7872	0.8347 0.8645	0.8747	0.8999 0.9541	0.9882	1.0000

Table B.2.3.2-4: MIMO correlation matrices for low correlation

1x2 case	$R_{low} = \mathbf{I}_2$
2x2 case	$R_{low} = \mathbf{I}_4$
4x2 case	$R_{low} = \mathbf{I}_8$
4x4 case	$R_{low} = \mathbf{I}_{16}$

In Table B.2.3.2-4, \mathbf{I}_d is the $d \times d$ identity matrix.

B.2.3A MIMO Channel Correlation Matrices using cross polarized antennas

The MIMO channel correlation matrices defined in B.2.3A apply for the antenna configuration using cross polarized antennas at both eNodeB and UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

For the cross-polarized antennas, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of transmit or receive antennas.

B.2.3A.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

Where

- R_{UE} is the spatial correlation matrix at the UE with same polarization,
- R_{eNB} is the spatial correlation matrix at the eNB with same polarization,
- Γ is a polarization correlation matrix, and
- $(\bullet)^T$ denotes transpose.

The matrix Γ is defined as

$$\Gamma = \begin{bmatrix}
1 & 0 & -\gamma & 0 \\
0 & 1 & 0 & \gamma \\
-\gamma & 0 & 1 & 0 \\
0 & \gamma & 0 & 1
\end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i \text{ and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i \text{ and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt + i, \\ 0 & \text{otherwise} \end{cases}$$

where N_t and N_r is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3A.

B.2.3A.2 Spatial Correlation Matrices using cross polarized antennas at eNB and UE sides

B.2.3A.2.1 Spatial Correlation Matrices at eNB side

For 2-antenna transmitter using one pair of cross-polarized antenna elements, $R_{\it eNB}=1$.

For 4-antenna transmitter using two pairs of cross-polarized antenna elements, $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$.

For 8-antenna transmitter using four pairs of cross-polarized antenna elements, $R_{eNB} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{1}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix}.$

B.2.3A.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements, $R_{UE}=1$.

For 4-antenna receiver using two pairs of cross-polarized antenna elements, $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$.

B.2.3A.3 MIMO Correlation Matrices using cross polarized antennas

The values for parameters α , β and γ for high spatial correlation are given in Table B.2.3A.3-1.

Table B.2.3A.3-1

High spatial correlation								
α β γ								
0.9	0.9	0.3						
Note 1: Value of α applies when more than one pair of cross-polarized antenna elements at eNB side								

Note 1: Value of α applies when more than one pair of cross-polarized antenna elements at eNB side Note 2: Value of β applies when more than one pair of cross-polarized antenna elements at UE side.

The correlation matrices for high spatial correlation are defined in Table B.2.3A.3-2 as below.

The values in Table B.2.3A.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8x2 high spatial correlation case, a=0.00010.

Table B.2.3A.3-2: MIMO correlation matrices for high spatial correlation

•		1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000	
		0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700	
		0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	
		0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	
		0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	
		0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	
		0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	-0.2700	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	
	$R_{high}=$	_	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000
8x2 case		-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	
		0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	
		-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	
			0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.9883	0.0000	1 0000	0,0000	0.9883	0.0000	0.9542
			-0.2862	0, 00				0, 00		000-	0.9542				1.0000			
		0.0000	0.0000							0.0000						0.0000		
		0.0000	0.0000						0> 00	0.8999							0.0000	
		0.2700	0.0000	0.2002						0.0000						0.0000		
	1 L	0.000	0.2700	0.000	0.2002	0.0000	0.2900	0.000	0.5000	0.0000	0.0999	0.0000	0.5542	0.0000	0.2003	0.0000	1.0000	

B.2.3A.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3A.1, the corresponding random channel matrix \mathbf{H} can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_{k}}Wx + n$$

Where

- H is the Nr xNt channel matrix per subcarrier.

$$\begin{array}{lll} - & D_{\theta_k} \text{ is the steering matrix, which is } D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_k} & 0 & 0 \\ 0 & 0 & e^{j2\theta_k} & 0 \\ 0 & 0 & 0 & e^{j3\theta_k} \end{bmatrix}, \\ \end{array}$$

- θ_k controls the phase variation, and the phase for k-th subframe is denoted by $\theta_k = \theta_0 + \Delta\theta \cdot k$, where θ_0 is the random start value with the uniform distribution, i.e., $\theta_0 \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation, which is defined in Table B.2.3A.4-1, and k is the linear increment of 1 for every subframe throughout the simulation,
- W is the precoding matrix for 8 transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3A.4-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta heta$	1.2566×10 ⁻³

B.2.4 Propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(-i2\pi f_D t)\delta(\tau - \tau_d),$$

in continuous time (t, τ) representation, with τ_d the delay, a a constant and f_D the Doppler frequency. The same $h(t, \tau)$ is used to describe the fading channel between every pair of Tx and Rx.

B.2.5 Void

B.2.6 MBSFN Propagation Channel Profile

Table B.2.6-1 shows propagation conditions that are used for the MBSFN performance requirements in multi-path fading environment in an extended delay spread environment.

Table B.2.6-1: Propagation Conditions for Multi-Path Fading Environments for MBSFN Performance Requirements in an extended delay spread environment

Extended Delay Spread								
Maximum Doppler frequency [5Hz]								
Relative Delay [ns]	Relative Mean Power [dB]							
0	0							
30	-1.5							
150	-1.4							
310	-3.6							
370	-0.6							
1090	-7.0							
12490	-10							
12520	-11.5							
12640	-11.4							
12800	-13.6							
12860	-10.6							
13580	-17.0							
27490	-20							
27520	-21.5							
27640	-21.4							
27800	-23.6							
27860	-20.6							
28580	-27.0							

B.3 High speed train scenario

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1}$$

where $f_s(t)$ is the Doppler shift and f_d is the maximum Doppler frequency. The cosine of angle $\theta(t)$ is given by

$$\cos \theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.2)

$$\cos \theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.3)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), t > 2D_s/v$$
(B.3.4)

where $D_s/2$ is the initial distance of the train from eNodeB, and D_{\min} is eNodeB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

Doppler shift and cosine angle are given by equation B.3.1 and B.3.2-B.3.4 respectively, where the required input parameters listed in table B.3-1 and the resulting Doppler shift shown in Figure B.3-1 are applied for all frequency bands.

Parameter	Value
D_s	300 m
$D_{ m min}$	2 m
v	300 km/h
f_{J}	750 Hz

Table B.3-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3-1 including f_d and Doppler shift trajectories presented on figure B.3-1 were derived for Band 7.

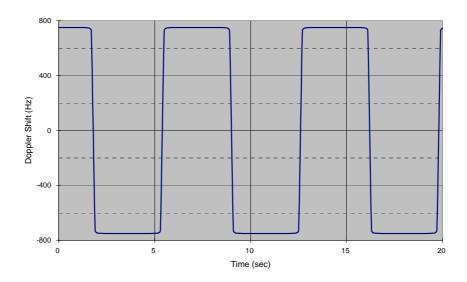


Figure B.3-1: Doppler shift trajectory

For 1x2 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx. For 2x2 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx with

phase shift according to
$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}$$
.

B.4 Beamforming Model

B.4.1 Single-layer random beamforming (Antenna port 5, 7, or 8)

Single-layer transmission on antenna port 5 or on antenna port 7 or 8 without a simultaneous transmission on the other antenna port, is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal $y^{(p)}(i)$, $i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1$, for antenna port $p\in\{5,7,8\}$, with $M_{\mathrm{symb}}^{\mathrm{ap}}$ the number of modulation symbols including the user-specific reference symbols (DRS), and generates a block of signals $y_{bf}(i)=\left[y_{bf}(i) \quad \widetilde{y}_{bf}(i)\right]^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i)$$

Single-layer transmission on antenna port 7 or 8 with a simultaneous transmission on the other antenna port, is defined by using a pair of precoder vectors $W_1(i)$ and $W_2(i)$ each of size 2×1 , which are not identical and randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} (W_1(i) y^{(7)}(i) + W_2(i) y^{(8)}(i))$$

The precoder update granularity is specific to a test case.

The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 1$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $y_{bf}(i)$. The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 0$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $\widetilde{y}_{bf}(i)$.

B.4.2 Dual-layer random beamforming (antenna ports 7 and 8)

Dual-layer transmission on antenna ports 7 and 8 is defined by using a precoder matrix W(i) of size 2×2 randomly selected with the number of layers v=2 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input a block of signals for antenna ports 7 and 8, $y(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) \end{bmatrix}^T$, $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$, with $M_{\text{symb}}^{\text{ap}}$ being the number of modulation symbols per antenna port including the user-specific reference symbols, and generates a block of signals $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \widetilde{y}_{bf}(i) \end{bmatrix}^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix},$$

The precoder update granularity is specific to a test case.

The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 1$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $y_{bf}(i)$. The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 0$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $\widetilde{y}_{bf}(i)$.

B.4.3 Generic beamforming model (antenna ports 7-14)

The transmission on antenna port(s) $p=7,8,...,\upsilon+6$ is defined by using a precoder matrix W(i) of size $N_{CSI}\times\upsilon$, where N_{CSI} is the number of CSI reference signals configured per test and υ is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) $p=7,8,...,\upsilon+6$, $y^{(p)}(i)=\left[y^{(7)}(i)\quad y^{(8)}(i)\quad \cdots\quad y^{(6+\upsilon)}(i)\right],\ i=0,1,...,M_{\text{symb}}^{\text{ap}}-1,$ with $M_{\text{symb}}^{\text{ap}}$ being the number of modulation symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals $y_{bf}^{(q)}(i)=\left[y_{bf}^{(0)}(i)\quad y_{bf}^{(1)}(i)\quad \ldots\quad y_{bf}^{(N_{CSI}-1)}(i)\right]^T$ the elements of which are to be mapped onto the same time-frequency index pair (k,l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

The precoder matrix W(i) is specific to a test case.

The physical antenna elements are identified by indices $j = 0,1,...,N_{ANT} - 1$, where $N_{ANT} = N_{CSI}$ is the number of physical antenna elements configured per test.

Modulation symbols $y_{bf}^{(q)}(i)$ with $q \in \{0,1,...,N_{CSI}-1\}$ (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j=q.

Modulation symbols $y^{(p)}(i)$ with $p \in \{0,1,...,P-1\}$ (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols $a_{k,l}^{(p)}$ with $p \in \{0,1,...,P-1\}$ (i.e. CRS) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols $a_{k,l}^{(p)}$ with $p \in \{15,16,...,14+N_{CSI}\}$ (i.e. CSI-RS) are mapped to the physical antenna index j=p-15, where N_{CSI} is the number of CSI reference signals configured per test.

Annex C (normative): Downlink Physical Channels

C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

C.2 Set-up

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Table C.2-1: Downlink Physical Channels required for connection set-up

Physical Channel							
PBCH							
SSS							
PSS							
PCFICH							
PDCCH							
PHICH							
PDSCH							

C.3 Connection

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.3.1 Measurement of Receiver Characteristics

Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7).

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio	
PBCH	PBCH_RA = 0 dB	
	PBCH_RB = 0 dB	
PSS	PSS_RA = 0 dB	
SSS	$SSS_RA = 0 dB$	
PCFICH	PCFICH_RB = 0 dB	
PDCCH	PDCCH_RA = 0 dB	
	PDCCH_RB = 0 dB	
PDSCH	PDSCH_RA = 0 dB	
	PDSCH_RB = 0 dB	
OCNG	OCNG_RA = 0 dB	
	OCNG_RB = 0 dB	

NOTE 1: No boosting is applied.

Table C.3.1-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Transmitted power spectral density I_{or}	dBm/15 kHz	Test specific	1. I_{or} shall be kept constant throughout all OFDM symbols
Cell-specific reference		0 dB	
signal power ratio $E_{\it RS}$ / $I_{\it or}$			

C.3.2 Measurement of Performance requirements

Table C.3.2-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels.

Table C.3.2-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio	
PBCH	PBCH_RA = ρ_A + σ	
	PBCH_RB = ρ_B + σ	
PSS	PSS_RA = 0 (Note 3)	
SSS	$SSS_RA = 0$ (Note 3)	
PCFICH	PCFICH_RB = ρ_B + σ	
PDCCH	PDCCH_RA = ρ_A + σ	
	PDCCH_RB = ρ_B + σ	
PDSCH	PDSCH_RA = ρ_A	
	PDSCH_RB = ρ _B	
PMCH	PMCH_RA = ρ _A	
	$PMCH_RB = \rho_B$	
MBSFN RS	MBSFN RS_RA = ρ _A	
	MBSFN RS_RB = ρ _B	
OCNG	OCNG_RA = ρ_A + σ	
	OCNG_RB = ρ_B + σ	

NOTE 1: $\rho_A = \rho_B = 0$ dB means no RS boosting.

NOTE 2: MBSFN RS and OCNG are not defined downlink physical channels in [4].

NOTE 3: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 4: ρ_A , ρ_B and σ are test specific.

NOTE 5: For TM 8 and TM 9 ρ_A , ρ_B are used for the purpose of the test set up only.

Table C.3.2-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Total transmitted power spectral density $I_{\it or}$	dBm/15 kHz	Test specific	1. I_{or} shall be kept constant throughout all OFDM symbols
Cell-specific reference		Test specific	1. Applies for antenna
signal power ratio $E_{\it RS}$ / $I_{\it or}$			port p
Energy per resource element EPRE		Test specific	1. The complex-valued symbols $y^{(p)}(i)$ and
			$a_{k,l}^{(p)}$ defined in [4] shall
			conform to the given EPRE value. 2. For TM8 and TM9 the reference point for EPRE is before the precoder in Annex B.4.

C.3.3 Aggressor cell power allocation for Measurement of Performance Requirements when ABS is Configured

For the performance requirements and channel state information reporting when ABS is configured, the power allocation for the physical channels of the aggressor cell in non-ABS and ABS is listed in Table C.3.3-1.

Table C.3.3-1: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell

Dhysical Channel	Parameters	Unit	EP	RE Ratio
Physical Channel			Non-ABS	ABS
PBCH	PBCH_RA	dB	ρΑ	Note 1
РВСП	PBCH_RB	dB	ρв	Note 1
PSS	PSS_RA	dB	ρΑ	Note 1
SSS	SSS_RA	dB	ρΑ	Note 1
PCFICH	PCFICH_RB	dB	ρв	Note 1
DUICH	PHICH_RA dB		ρΑ	Note 1
PHICH	PHICH_RB	dB	ρв	Note 1
PDCCH	PDCCH_RA	dB	ρΑ	Note 1
PDCCH	PDCCH_RB	dB	ρв	Note 1
PDSCH	PDSCH_RA	dB	N/A	Note 1
PDSCH	PDSCH_RB	dB	N/A	Note 1
OCNG	OCNG_RA	dB	ρΑ	Note 1
OCNG	OCNG_RB	dB	ρв	Note 1
Note 1: -∞ dB is allocated	for this channel in this test.	<u> </u>		

Annex D (normative): Characteristics of the interfering signal

D.1 General

When the channel band width is wider or equal to 5MHz, a modulated 5MHz full band width E-UTRA down link signal and CW signal are used as interfering signals when RF performance requirements for E-UTRA UE receiver are defined. For channel band widths below 5MHz, the band width of modulated interferer should be equal to band width of the received signal.

D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel band width options.

Table D.2-1: Description of modulated E-UTRA interferer

	Channel bandwidth								
	1.4 MHz	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz							
BWInterferer	1.4 MHz	3 MHz	5 MHz	5 MHz	5 MHz	5 MHz			
RB	6	15	25						

Annex E (normative): Environmental conditions

E.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

E.2 Environmental

The requirements in this clause apply to all types of UE(s).

E.2.1 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table E.2.1-1

+15°C to +35°C	for normal conditions (with relative humidity of 25 % to 75 %)
-10°C to +55°C	for extreme conditions (see IEC publications 68-2-1 and 68-2-2)

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation.

E.2.2 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The manufacturer shall declare the lower and higher extreme voltages and the approximate shutdown voltage. For the equipment that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified below.

Table E.2.2-1

Power source	Lower extreme	Higher extreme	Normal conditions	
	voltage	voltage	voltage	
AC mains	0,9 * nominal	1,1 * nominal	nominal	
Regulated lead acid battery	0,9 * nominal	1,3 * nominal	1,1 * nominal	
Non regulated batteries:				
Leclanché	0,85 * nominal	Nominal	Nominal	
Lithium	0,95 * nominal	minal 1,1 * Nominal 1,		
Mercury/nickel & cadmium	0,90 * nominal		Nominal	

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

Table E.2.3-1

Frequency	ASD (Acceleration Spectral Density) random vibration
5 Hz to 20 Hz	$0.96 \text{ m}^2/\text{s}^3$
20 Hz to 500 Hz	0,96 m ² /s ³ at 20 Hz, thereafter –3 dB/Octave

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 36.101 for extreme operation.

Annex F (normative): Transmit modulation

Note: this annex applies for single carrier and in case of carrier aggregation for the component carrier, with PRBs allocated.

F.1 Measurement Point

Figure F.1-1 shows the measurement point for the unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).

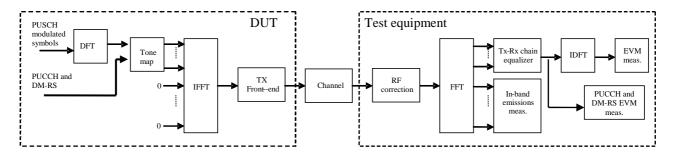


Figure F.1-1: EVM measurement points

F.2 Basic Error Vector Magnitude measurement

The EVM is the difference between the ideal waveform and the measured waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{v \in T_m} |z'(v) - i(v)|^2}{|T_m| \cdot P_0}},$$

where

 T_m is a set of $|T_m|$ modulation symbols with the considered modulation scheme being active within the measurement period,

z'(v) are the samples of the signal evaluated for the EVM,

i(v) is the ideal signal reconstructed by the measurement equipment, and

 P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

The basic EVM measurement interval is defined over one slot in the time domain for PUCCH and PUSCH and over one preamble sequence for the PRACH.

F.3 Basic in-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks. The in-band emission requirement is evaluated for PUCCH and PUSCH transmissions. The in-band emission requirement is not evaluated for PRACH transmissions.

The in-band emissions are measured as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{max(f_{\min}, f_{t}+12 \cdot \Delta_{RB} * \Delta f) \\ \min(f_{\max}, f_{h}+12 \cdot \Delta_{RB} * \Delta f)}} |Y(t, f)|^{2}, \Delta_{RB} < 0 \\ \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{f_{h}+(12 \cdot \Delta_{RB} - 11) * \Delta f \\ f_{h}+(12 \cdot \Delta_{RB} - 11) * \Delta f}} |Y(t, f)|^{2}, \Delta_{RB} > 0 \end{cases}$$

where

 T_s is a set of $|T_s|$ SC-FDMA symbols with the considered modulation scheme being active within the measurement period,

 Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB),

 f_{\min} (resp. f_{\max}) is the lower (resp. upper) edge of the UL system BW,

 $f_{\boldsymbol{l}}$ and $f_{\boldsymbol{h}}$ are the lower and upper edge of the allocated BW, and

Y(t, f) is the frequency domain signal evaluated for in-band emissions as defined in the subsection (ii)

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{\left|T_{s}\right| \cdot N_{RB}} \sum_{t \in T} \sum_{f_{t}}^{f_{t} + (12 \cdot N_{RB} - 1) \Delta f} \left|Y(t, f)\right|^{2}}$$

where

 N_{RB} is the number of allocated RBs

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

In the evaluation of in-band emissions, the timing is set according to $\Delta \tilde{t} = \Delta \tilde{c}$, where sample time offsets $\Delta \tilde{t}$ and $\Delta \tilde{c}$ are defined in subclause F.4.

F.4 Modified signal under test

Implicit in the definition of EVM is an assumption that the receiver is able to compensate a number of transmitter impairments.

The PUSCH data or PRACH signal under test is modified and, in the case of PUSCH data signal, decoded according to::

$$Z'(t,f) = IDFT \left\{ \frac{FFT \left\{ z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{f}v} \right\} e^{j2\pi f\Delta \tilde{t}}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}} \right\}$$

where

z(v) is the time domain samples of the signal under test.

The PUCCH or PUSCH demodulation reference signal or PUCCH data signal under test is equalised and, in the case of PUCCH data signal decoded according to:

$$Z'(t,f) = \frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi \Delta \tilde{f}v}\right\} e^{j2\pi f\Delta \tilde{t}}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}}$$

where

z(v) is the time domain samples of the signal under test.

To minimize the error, the signal under test should be modified with respect to a set of parameters following the procedure explained below.

Notation:

 $\Delta \widetilde{t}$ is the sample timing difference between the FFT processing window in relation to nominal timing of the ideal signal.

 $\Delta \tilde{f}$ is the RF frequency offset.

 $\widetilde{\varphi}(t,f)$ is the phase response of the TX chain.

 $\tilde{a}(t, f)$ is the amplitude response of the TX chain.

In the following $\Delta \tilde{c}$ represents the middle sample of the EVM window of length W (defined in the next subsections) or the last sample of the first window half if W is even.

The EVM analyser shall

- ightharpoonup detect the start of each slot and estimate $\Delta \widetilde{t}$ and $\Delta \widetilde{f}$,
- \triangleright determine $\Delta \tilde{c}$ so that the EVM window of length W is centred
 - on the time interval determined by the measured cyclic prefix minus 16 samples of the considered OFDM symbol for symbol 0 for normal CP, i.e. the first 16 samples of the CP should not be taken into account for this step. In the determination of the number of excluded samples, a sampling rate of 30.72MHz was assumed. If a different sampling rate is used, the number of excluded samples is scaled linearly.
 - on the measured cyclic prefix of the considered OFDM symbol symbol for symbol 1 to 6 for normal CP and for symbol 0 to 5 for extended CP.
 - on the measured preamble cyclic prefix for the PRACH

To determine the other parameters a sample timing offset equal to $\Delta \tilde{c}$ is corrected from the signal under test. The EVM analyser shall then

 \succ correct the RF frequency offset $\Delta \widetilde{f}$ for each time slot, and

> apply an FFT of appropriate size. The chosen FFT size shall ensure that in the case of an ideal signal under test, there is no measured inter-subcarrier interference.

The carrier leakage shall be removed from the evaluated signal before calculating the EVM and the in-band emissions; however, the removed relative carrier leakage power also has to satisfy the applicable requirement.

At this stage the allocated RBs shall be separated from the non-allocated RBs. In the case of PUCCH and PUSCH EVM, the signal on the non-allocated RB(s), Y(t, f), is used to evaluate the in-band emissions.

Moreover, the following procedure applies only to the signal on the allocated RB(s).

- In the case of PUCCH and PUSCH, the UL EVM analyzer shall estimate the TX chain equalizer coefficients $\tilde{a}(t,f)$ and $\tilde{\varphi}(t,f)$ used by the ZF equalizer for all subcarriers by time averaging at each signal subcarrier of the amplitude and phase of the reference and data symbols. The time-averaging length is 1 slot. This process creates an average amplitude and phase for each signal subcarrier used by the ZF equalizer. The knowledge of data modulation symbols may be required in this step because the determination of symbols by demodulation is not reliable before signal equalization.
- In the case of PRACH, the UL EVM analyzer shall estimate the TX chain coefficients $\widetilde{a}(t)$ and $\widetilde{\varphi}(t)$ used for phase and amplitude correction and are seleted so as to minimize the resulting EVM. The TX chain coefficients are not dependent on frequency, i.e. $\widetilde{a}(t,f)=\widetilde{a}(t)$ and $\widetilde{\varphi}(t,f)=\widetilde{\varphi}(t)$. The TX chain coefficient are chosen independently for each preamble transmission and for each $\Delta \widetilde{t}$.

At this stage estimates of $\Delta \widetilde{f}$, $\widetilde{\alpha}(t,f)$, $\widetilde{\varphi}(t,f)$ and $\Delta \widetilde{c}$ are available. $\Delta \widetilde{t}$ is one of the extremities of the window W, i.e. $\Delta \widetilde{t}$ can be $\Delta \widetilde{c} + \alpha - \left\lfloor \frac{W}{2} \right\rfloor$ or $\Delta \widetilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$, where $\alpha = 0$ if W is odd and $\alpha = 1$ if W is even. The EVM analyser shall then

- ightharpoonup calculate EVM₁ with $\Delta \tilde{t}$ set to $\Delta \tilde{c} + \alpha \left\lfloor \frac{W}{2} \right\rfloor$,
- ightharpoonup calculate EVM_h with $\Delta \tilde{t}$ set to $\Delta \tilde{c} + \left| \frac{W}{2} \right|$.

F.5 Window length

F.5.1 Timing offset

As a result of using a cyclic prefix, there is a range of $\Delta \tilde{t}$, which, at least in the case of perfect Tx signal quality, would give close to minimum error vector magnitude. As a first order approximation, that range should be equal to the length of the cyclic prefix. Any time domain windowing or FIR pulse shaping applied by the transmitter reduces the $\Delta \tilde{t}$ range within which the error vector is close to its minimum.

F.5.2 Window length

The window length W affects the measured EVM, and is expressed as a function of the configured cyclic prefix length. In the case where equalization is present, as with frequency domain EVM computation, the effect of FIR is reduced. This is because the equalization can correct most of the linear distortion introduced by the FIR. However, the time domain windowing effect can't be removed.

F.5.3 Window length for normal CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for normal CP. The nominal window length for 3 MHz is rounded down one sample to allow the window to be centered on the symbol.

Table F.5.3-1 EVM window length for normal CP

Channel Bandwidth MHz	$\begin{array}{c} \text{Cyclic prefix} \\ \text{length}^1 \\ N_{cp} \text{ for} \\ \text{symbol } 0 \end{array}$	Cyclic prefix length N_{cp} for symbols 1 to 6	Nominal FFT size	Cyclic prefix for symbols 1 to 6 in FFT samples	EVM window length W in FFT samples	Ratio of W to CP for symbols 1 to 6 ²
1.4			128	9	5	55.6
3			256	18	12	66.7
5	160	144	512	36	32	88.9
10	160	144	1024	72	66	91.7
15			1536	108	102	94.4
20			2048	144	136	94.4

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative and apply to symbols 1 through 6. Symbol 0 has a longer CP and therefore a lower percentage.

F.5.4 Window length for Extended CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for extended CP. The nominal window lengths for 3 MHz and 15 MHz are rounded down one sample to allow the window to be centered on the symbol.

Table F.5.4-1 EVM window length for extended CP

Channel Bandwidth MHz	$\begin{array}{c} \text{Cyclic} \\ \text{prefix} \\ \text{length}^{\text{1}} N_{cp} \end{array}$	Nominal FFT size	Cyclic prefix in FFT samples	EVM window length W in FFT samples	Ratio of W to CP ²
1.4		128	32	28	87.5
3		256	64	58	90.6
5	512	512	128	124	96.9
10	312	1024	256	250	97.4
15		1536	384	374	97.4
20		2048	512	504	98.4

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative

F.5.5 Window length for PRACH

The table below specifies the EVM window length for PRACH preamble formats 0-4.

Preamble format	$\begin{array}{c c} \text{prefix} & \text{Nominal} \\ \text{length}^1 \ N_{cp} & \text{FFT size}^2 \end{array}$		EVM window length W in FFT samples	Ratio of W to CP*
0	3168	24576	3072	96.7%
1	21024	24576	20928	99.5%
2	6240	49152	6144	98.5%
3	21024	49152	20928	99.5%
4	448	4096	432	96.4%

Table F.5.5-1 EVM window length for PRACH

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed

Note 2: The use of other FFT sizes is possible as long as appropriate

scaling of the window length is applied Note 3: These percentages are informative

F.6 Averaged EVM

The general EVM is averaged over basic EVM measurements for 20 slots in the time domain.

$$\overline{EVM} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_i^2}$$

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus $\overline{\text{EVM}}_1$ is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_l$ in the expressions above and $\overline{\text{EVM}}_h$ is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_h$.

Thus we get:

$$EVM = \max(\overline{EVM}_1, \overline{EVM}_h)$$

The calculation of the EVM for the demodulation reference signal, EVM_{DMRS} , follows the same procedure as calculating the general EVM, with the exception that the modulation symbol set T_m defined in clause F.2 is restricted to symbols containing uplink demodulation reference signals.

The basic EVM_{DMRS} measurements are first averaged over 20 slots in the time domain to obtain an intermediate average \overline{EVM}_{DMRS} .

$$\overline{EVM}_{DMRS} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_{DMRS,i}^2}$$

In the determination of each $EVM_{DMRS,i}$, the timing is set to $\Delta \tilde{t} = \Delta \tilde{t}_l$ if $\overline{EVM}_l > \overline{EVM}_h$, and it is set to $\Delta \tilde{t} = \Delta \tilde{t}_l$ otherwise, where \overline{EVM}_l and \overline{EVM}_h are the general average EVM values calculated in the same 20 slots over which the intermediate average \overline{EVM}_{DMRS} is calculated. Note that in some cases, the general average EVM may be calculated only for the purpose of timing selection for the demodulation reference signal EVM.

Then the results are further averaged to get the EVM for the demodulation reference signal, EVM_{DMRS} ,

$$EVM_{DMRS} = \sqrt{\frac{1}{6} \sum_{j=1}^{6} \overline{EVM}_{DMRS,j}^{2}}$$

The PRACH EVM, EVM_{PRACH} , is averaged over two preamble sequence measurements for preamble formats 0, 1, 2, 3, and it is averaged over 10 preamble sequence measurements for preamble format 4.

The EVM requirements shall be tested against the maximum of the RMS average at the window *W* extremities of the EVM measurements:

Thus $\overline{\text{EVM}}_{\text{PRACH,h}}$ is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_l$ and $\overline{\text{EVM}}_{\text{PRACH,h}}$ is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_h$.

Thus we get:

$$EVM_{PRACH} = \max(\overline{EVM}_{PRACH,1}, \overline{EVM}_{PRACH,h})$$

F.7 Spectrum Flatness

The data shall be taken from FFT coded data symbols and the demodulation reference symbols of the allocated resource block.

Annex G (informative): Reference sensitivity level in lower SNR

This annex contains information on typical receiver sensitivity when HARQ transmission is enabled allowing operation in lower SNR regions (HARQ is disabled in conformance testing), thus representing the configuration normally used in live network operation under noise-limited conditions.

G.1 General

The reference sensitivity power level P_{SENS} with HARQ retransmission enabled (operation in lower SNR) is the minimum mean power applied to both the UE antenna ports at which the residual BLER after HARQ shall meet the requirements for the specified reference measurement channel. The residual BLER after HARQ transmission is defined as follows:

$$BLER_{residual} = 1 - \frac{A}{B}$$

A: Number of correctly decoded MAC PDUs

B: Number of transmitted MAC PDUs (Retransmitted MAC PDUs are not counted)

G.2 Typical receiver sensitivity performance (QPSK)

The residual BLER after HARQ shall be lower than 1% for the reference measurement channels as specified in Annexes G.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table G.2-1 and Table G.2-2

Table G.2-1: Reference sensitivity QPSK PSENS

		Ch	annel bar	dwidth			
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1				[-102]			FDD
2				TBD			FDD
3				TBD			FDD
4				TBD			FDD
5				TBD			FDD
6				TBD			FDD
7				TBD			FDD
8				TBD			FDD
9				TBD			FDD
10				TBD			FDD
11				TBD			FDD
12				TBD			FDD
13				TBD			FDD
14				TBD			FDD
17				TBD			FDD
18				TBD			FDD
19				TBD			FDD
20				TBD			FDD
21				TBD			FDD
22				TBD			TBD
23				TBD			FDD
33				[-102]			TDD
34				[-102]			TDD
35				[-102]			TDD
36				[-102]			TDD
37				[-102]			TDD
38				[-102]			TDD
39				[-102]			TDD
40				[-102]			TDD
41				[-102]			TDD
42				[-102]			TDD
Note 1: Th	ne transmitter	shall be set		as defined			IO D-#

Note 2: Reference measurement channel is G.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

Note 3: The signal power is specified per port

Note 4: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

Note 5: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

Table G.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement in lower SNR must be met.

Table G.2-2: Minimum uplink configuration for reference sensitivity

E-UTRA Band / Channel bandwidth / NRB / Duplex mode									
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode		
1				[6] ¹			FDD		
2				[6] ¹			FDD		
3				[6] ¹			FDD		
4				[6] ¹			FDD		
5				[6] ¹			FDD		
6				[6] ¹			FDD		
7				[6] ¹			FDD		
8				[6] ¹			FDD		
9				[6] ¹			FDD		
10				[6] ¹			FDD		
11				[6] ¹			FDD		
12				[6] ¹			FDD		
13				[6] ¹			FDD		
14				[6] ¹			FDD		
17				[6] ¹			FDD		
18				[6] ¹			FDD		
19				[6] ¹			FDD		
20				[6] ¹			FDD		
21				[6] ¹			FDD		
22				[6] ¹			FDD		
23				[6] ¹			FDD		
33				50			TDD		
34				50			TDD		
35				50			TDD		
36				50			TDD		
37				50			TDD		
38				50			TDD		
39				50			TDD		
40				50			TDD		
41				50			TDD		
42				50			TDD		

Note

- 1. The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).
- 2. For the UE which supports both Band 11 and Band 21 the minimum uplink configuration for reference sensitivity is FFS.
- 4. For Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RBstart _11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RBstart _16

Unless given by Table G.2-3, the minimum requirements specified in Tables G.2-1 and G.2-2 shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Table G.2-3: Network Signalling Value for reference sensitivity

E-UTRA Band	Network Signalling value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03
35	NS_03
36	NS_03

G.3 Reference measurement channel for REFSENSE in lower SNR

Tables G.3-1 and G.3-2 are applicable for Annex G.2 (Reference sensitivity level in lower SNR).

Table G.3-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit	Value
Channel bandwidth	MHz	10
Allocated resource blocks		50
Subcarriers per resource block		12
Allocated subframes per Radio Frame		10
Modulation		QPSK
Target Coding Rate		1/3
Number of HARQ Processes	Processes	8
Maximum number of HARQ transmissions		[4]
Information Bit Payload per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	4392
Transport block CRC	Bits	24
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	1 1
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13800
For Sub-Frame 5	Bits	n/a
For Sub-Frame 0	Bits	12960
Max. Throughput averaged over 1 frame	kbps	3952.
- · ·		8
UE Category		1-8

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 4: Redundancy version coding sequence is {0, 1, 2, 3} for QPSK.

Table G.3-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit	Value		
Channel Bandwidth	MHz	10		
Allocated resource blocks		50		
Uplink-Downlink Configuration (Note 5)		1 1		
Allocated subframes per Radio Frame		4+2		
(D+S)				
Number of HARQ Processes	Processes	7		
Maximum number of HARQ transmission		[4]		
Modulation		QPSK		
Target coding rate		1/3		
Information Bit Payload per Sub-Frame	Bits			
For Sub-Frame 4, 9		4392		
For Sub-Frame 1, 6		3240		
For Sub-Frame 5		n/a		
For Sub-Frame 0		4392		
Transport block CRC	Bits	24		
Number of Code Blocks per Sub-Frame				
(Note 5)				
For Sub-Frame 4, 9		1 1		
For Sub-Frame 1, 6		1		
For Sub-Frame 5		n/a		
For Sub-Frame 0		1		
Binary Channel Bits Per Sub-Frame	Bits			
For Sub-Frame 4, 9		13800		
For Sub-Frame 1, 6		11256		
For Sub-Frame 5		n/a		
For Sub-Frame 0		13104		
Max. Throughput averaged over 1 frame	kbps	1965.		
		6		
UE Category		1-5		

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]
- Note 6: Redundancy version coding sequence is {0, 1, 2, 3} for QPSK.

Annex H (normative): Modified MPR behavior

H.1 Indication of modified MPR behavior

This annex contains the definitions of the bits in the field *modifiedMPRbehavior* indicated in the IE UE Radio Access Capability [7] by a UE supporting an MPR or A-MPR modified in a later release of this specification.

Table H.1-1: Definitions of the bits in the field modifiedMPRbehavior

Index of field	Definition	Notes
(bit number)	(description of the supported functionality if indicator	
	set to one)	
0 (leftmost bit)	- The MPR for intra-band contiguous carrier	- This bit can be set to 1 by
	aggregation bandwidth class C with non-contiguous	a UE supporting intra-band
	resource allocation specified in Clause 6.2.3A in	contiguous CA bandwidth
	version 12.5.0 of this specification	class C
1	- The A-MPR associated with NS_05 for Band 1 in	- This bit can be set to 1 by
	Clause 6.2.4 in version 12.10.0 of this specification.	a UE supporting A-MPR
		associated to NS_05 for
		Band 1.
2	The A-MPR associated with NS_04 for Band 41 in	This bit can be set to 1 by a
	Table 6.2.4-4 in version 14.1.0 of this specification.	power class 3 UE
		supporting A-MPR
		associated to NS_04 for
		Band 41.

Annex I (informative): Change history

Table H-1: Change History

Date	Meeti ng	TDoc	CR	Rev	Cat	Subject/Comment	New version
11-2007	R4#45	R4-72206				TS36.101V0.1.0 approved by RAN4	
12-2007	RP#38	RP-070979				Approved version at TSG RAN #38	8.0.0
03-2008	RP#39	RP-080123	3			TS36.101 - Combined updates of E-UTRA UE requirements	8.1.0
05-2008	RP#40	RP-080325	4			TS36.101 - Combined updates of E-UTRA UE requirements	8.2.0
09-2008	RP#41	RP-080638	5r1			Addition of Ref Sens figures for 1.4MHz and 3MHz Channel bandwiidths	8.3.0
09-2008	RP#41	RP-080638	7r1			Transmitter intermodulation requirements	8.3.0
09-2008	RP#41	RP-080638	10			CR for clarification of additional spurious emission requirement	8.3.0
09-2008	RP#41	RP-080638	15			Correction of In-band Blocking Requirement	8.3.0
09-2008	RP#41	RP-080638	18r1			TS36.101: CR for section 6: NS_06	8.3.0
09-2008	RP#41	RP-080638	19r1			TS36.101: CR for section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080638	20r1			TS36.101: CR for UE minimum power	8.3.0
09-2008	RP#41	RP-080638	21r1			TS36.101: CR for UE OFF power	8.3.0
09-2008	RP#41	RP-080638	24r1			TS36.101: CR for section 7: Band 13 Rx sensitivity	8.3.0
09-2008	RP#41	RP-080638	26			UE EVM Windowing	8.3.0
09-2008	RP#41	RP-080638	29			Absolute ACLR limit	8.3.0
09-2008	RP#41	RP-080731	23r2			TS36.101: CR for section 6: UE to UE co-existence	8.3.0
09-2008	RP#41	RP-080731	30			Removal of [] for UE Ref Sens figures	8.3.0
09-2008	RP#41	RP-080731	31			Correction of PA, PB definition to align with RAN1 specification	8.3.0
09-2008	RP#41	RP-080731	37r2			UE Spurious emission band UE co-existence	8.3.0
09-2008	RP#41	RP-080731	44			Definition of specified bandwidths	8.3.0
09-2008	RP#41	RP-080731	48r3			Addition of Band 17	8.3.0
09-2008	RP#41	RP-080731	50			Alignment of the UE ACS requirement	8.3.0
09-2008	RP#41	RP-080731	52r1			Frequency range for Band 12	8.3.0
09-2008	RP#41	RP-080731	54r1			Absolute power tolerance for LTE UE power control	8.3.0
09-2008	RP#41	RP-080731	55			TS36.101 section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080732	6r2			DL FRC definition for UE Receiver tests	8.3.0
09-2008	RP#41	RP-080732	46			Additional UE demodulation test cases	8.3.0
09-2008	RP#41	RP-080732	47			Updated descriptions of FRC	8.3.0
09-2008	RP#41	RP-080732	49			Definition of UE transmission gap	8.3.0
09-2008	RP#41	RP-080732	51			Clarification on High Speed train model in 36.101	8.3.0
09-2008	RP#41	RP-080732	53			Update of symbol and definitions	8.3.0
09-2008	RP#41	RP-080743	56			Addition of MIMO (4x2) and (4x4) Correlation Matrices	8.3.0
12-2008	RP#42	RP-080908	94r2			CR TX RX channel frequency separation	8.4.0
12-2008	RP#42	RP-080909	105r1			UE Maximum output power for Band 13	8.4.0
12-2008	RP#42	RP-080909	60			UL EVM equalizer definition	8.4.0
12-2008	RP#42	RP-080909	63			Correction of UE spurious emissions	8.4.0
12-2008	RP#42	RP-080909	66			Clarification for UE additional spurious emissions	8.4.0
12-2008	RP#42	RP-080909	72			Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803	8.4.0
12-2008	RP#42	RP-080909	75		1	Removal of [] from Section 6 transmitter characteristics	8.4.0
12-2008	RP#42	RP-080909	81		1	Clarification for PHS band protection	8.4.0
12-2008	RP#42	RP-080909	101			Alignement for the measurement interval for transmit signal quality	8.4.0
12-2008	RP#42	RP-080909	98r1		1	Maximum power	8.4.0
12-2008	RP#42	RP-080909	57r1	1	1	CR UE spectrum flatness	8.4.0
12-2008	RP#42	RP-080909	71r1		1	UE in-band emission	8.4.0
12-2008	RP#42	RP-080909	58r1			CR Number of TX exceptions	8.4.0
12-2008	RP#42	RP-080951	99r2			CR UE output power dynamic	8.4.0
12-2008	RP#42	RP-080951	79r1		1	LTE UE transmitter intermodulation	8.4.0
12-2008	RP#42	RP-080910	91		1	Update of Clause 8	8.4.0
12-2008	RP#42	RP-080950	106r1			Structure of Clause 9 including CSI requirements for PUCCH mode 1-0	8.4.0

12-2008	RP#42	RP-080911	59	CR UE ACS test frequency offset	8.4.0
12-2008	RP#42	RP-080911	65	Correction of spurious response parameters	8.4.0
12-2008	RP#42	RP-080911	80	Removal of LTE UE narrowband intermodulation	8.4.0
12-2008	RP#42	RP-080911	90r1	Introduction of Maximum Sensitivity Degradation	8.4.0
12-2008	RP#42	RP-080911	103	Removal of [] from Section 7 Receiver characteristic	8.4.0
12-2008	RP#42	RP-080912	62	Alignement of TB size n Ref Meas channel for RX characteristics	8.4.0
12-2008	RP#42	RP-080912	78	TDD Reference Measurement channel for RX characterisctics	8.4.0
12-2008	RP#42	RP-080912	73r1	Addition of 64QAM DL referenbce measurement channel	8.4.0
12-2008	RP#42	RP-080912	74r1	Addition of UL Reference Measurement Channels	8.4.0
12-2008	RP#42	RP-080912	104	Reference measurement channels for PDSCH performance requirements (TDD)	8.4.0
12-2008	RP#42	RP-080913	68	MIMO Correlation Matrix Corrections	8.4.0
12-2008	RP#42	RP-080915	67	Correction to the figure with the Transmission Bandwidth configuration	8.4.0
12-2008	RP#42	RP-080916	77	Modification to EARFCN	8.4.0
12-2008	RP#42	RP-080917	85r1	New Clause 5 outline	8.4.0
12-2008	RP#42	RP-080919	102	Introduction of Bands 12 and 17 in 36.101	8.4.0
12-2008	RP#42	RP-080927	84r1	Clarification of HST propagation conditions	8.4.0
03-2009	RP#43	RP-090170	156r2	A-MPR table for NS_07	8.5.0
03-2009	RP#43	RP-090170	170	Corrections of references (References to tables and figures)	8.5.0
03-2009	RP#43	RP-090170	108	Removal of [] from Transmitter Intermodulation	8.5.0
03-2009	RP#43	RP-090170	155	E-UTRA ACLR for below 5 MHz bandwidths	8.5.0
03-2009	RP#43	RP-090170	116	Clarification of PHS band including the future plan	8.5.0
03-2009	RP#43	RP-090170	119	Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts	8.5.0
03-2009	RP#43	RP-090170	120	Removal of "Out-of-synchronization handling of output power" heading	8.5.0
03-2009	RP#43	RP-090170	126	UE uplink power control	8.5.0
03-2009	RP#43	RP-090170	128	Transmission BW Configuration	8.5.0
03-2009	RP#43	RP-090170	130	Spectrum flatness	8.5.0
03-2009	RP#43	RP-090170	132r2	PUCCH EVM	8.5.0
03-2009	RP#43	RP-090170	134	UL DM-RS EVM	8.5.0
03-2009	RP#43	RP-090170	140	Removal of ACLR2bis requirements	8.5.0
03-2009	RP#43	RP-090171	113	In-band blocking	8.5.0
03-2009	RP#43	RP-090171	127	In-band blocking and sensitivity requirement for band 17	8.5.0
03-2009	RP#43	RP-090171	137r1	Wide band intermodulation	8.5.0
03-2009	RP#43	RP-090171	141	Correction of reference sensitivity power level of Band 9	8.5.0
03-2009	RP#43	RP-090172	109	AWGN level for UE DL demodulation performance tests	8.5.0
03-2009	RP#43	RP-090172	124	Update of Clause 8: additional test cases	8.5.0
03-2009	RP#43	RP-090172	139r1	Performance requirement structure for TDD PDSCH	8.5.0
03-2009	RP#43	RP-090172	142r1	Performance requirements and reference measurement channels for TDD PDSCH demodulation with UEspecific reference symbols	8.5.0
03-2009	RP#43	RP-090172	145	Number of information bits in DwPTS	8.5.0
03-2009	RP#43	RP-090172	160r1	MBSFN-Unicast demodulation test case	8.5.0
03-2009	RP#43	RP-090172	163r1	MBSFN-Unicast demodulation test case for TDD	8.5.0
03-2009	RP#43	RP-090173	162	Clarification of EARFCN for 36.101	8.5.0
03-2009	RP#43	RP-090369	110	Correction to UL Reference Measurement Channel	8.5.0
03-2009	55	RP-090369	114	Addition of MIMO (4x4, medium) Correlation Matrix	8.5.0
	RP#43	KF-090309			
03-2009	RP#43 RP#43	RP-090369	121	Correction of 36.101 DL RMC table notes	8.5.0
03-2009 03-2009			121	Correction of 36.101 DL RMC table notes Update of Clause 9	8.5.0 8.5.0
	RP#43	RP-090369			
03-2009	RP#43 RP#43	RP-090369 RP-090369	125	Update of Clause 9	8.5.0
03-2009 03-2009	RP#43 RP#43 RP#43	RP-090369 RP-090369 RP-090369	125 138r1	Update of Clause 9 Clarification on OCNG	8.5.0 8.5.0

03-2009	RP#44			Editoria	al correction in Table 6.2.4-1	8.5.1
					ary between E-UTRA fOOB and spurious	
05-2009	RP#44	RP-090540	167		on domain for 1.4 MHz and 3 MHz bandwiths. ically Endorsed CR in R4-50bis - R4-091205)	8.6.0
05-2009	RP#44	RP-090540	168		CN correction for TDD DL bands. (Technically led CR in R4-50bis - R4-091206)	8.6.0
05-2009	RP#44	RP-090540	169	Editoria	al correction to in-band blocking table. ically Endorsed CR in R4-50bis - R4-091238)	8.6.0
05-2009	RP#44	RP-090540	171		ACH EVM. (Technically Endorsed CR in R4-50bis	8.6.0
05-2009	RP#44	RP-090540	172	CR EV	M correction. (Technically Endorsed CR in R4- R4-091309)	8.6.0
05-2009	RP#44	RP-090540	177	CR po	wer control accuracy. (Technically Endorsed CR i0bis - R4-091418)	8.6.0
05-2009	RP#44	RP-090540	179	Correc	tion of SRS requirements. (Technically Endorsed R4-50bis - R4-091426)	8.6.0
05-2009	RP#44	RP-090540	186	Clarific	ation for EVM. (Technically Endorsed CR in R4- R4-091512)	8.6.0
05-2009	RP#44	RP-090540	187	Remov	ral of [] from band 17 Refsens values and ACS requencies	8.6.0
05-2009	RP#44	RP-090540	191		etion of band17 requirements	8.6.0
05-2009	RP#44	RP-090540	192	Remov	ral of 1.4 MHz and 3 MHz bandwidths from bands and 17.	8.6.0
05-2009	RP#44	RP-090540	223		QAM EVM	8.6.0
05-2009	RP#44	RP-090540	201	CR In-	pand emissions	8.6.0
05-2009	RP#44	RP-090540	203	CR EV	M exclusion period	8.6.0
05-2009	RP#44	RP-090540	204	CR In-	pand emissions timing	8.6.0
05-2009	RP#44	RP-090540	206	CR Mir	nimum Rx exceptions	8.6.0
05-2009	RP#44	RP-090540	207	CR UL	DM-RS EVM	8.6.0
05-2009	RP#44	RP-090540	218r1	A-MPR	table for NS_07	8.6.0
05-2009	RP#44	RP-090540	205r1	CR In-	pand emissions in shortened subframes	8.6.0
05-2009	RP#44	RP-090540	200r1	CR PU	CCH EVM	8.6.0
05-2009	RP#44	RP-090540	178r2		litional emission mask indication. (Technically led CR in R4-50bis - R4-091421)	8.6.0
05-2009	RP#44	RP-090540	220r1	Spectr	um emission requirements for band 13	8.6.0
05-2009	RP#44	RP-090540	197r2	CR on	aggregate power tolerance	8.6.0
05-2009	RP#44	RP-090540	196r2	CR: R	IP2 performance	8.6.0
05-2009	RP#44	RP-090541	198r1		um output power relaxation	8.6.0
05-2009	RP#44	RP-090542	166	with MI R4-50b	e of performance requirement for TDD PDSCH BSFN configuration. (Technically Endorsed CR in bis - R4-091180)	8.6.0
05-2009	RP#44	RP-090542	175		AWGN levels for some TDD DL performance ments. (Technically Endorsed CR in R4-50bis - 406)	8.6.0
05-2009	RP#44	RP-090542	182	OCNG Requir R4-091	Patterns for Single Resource Block FRC ements. (Technically Endorsed CR in R4-50bis - 504)	8.6.0
05-2009	RP#44	RP-090542	170r1	Endors	of Clause 8: PHICH and PMI delay. (Technically ed CR in R4-50bis - R4-091275)	8.6.0
05-2009	RP#44	RP-090543	183		ements for frequency-selective fading test. ically Endorsed CR in R4-50bis - R4-091505)	8.6.0
05-2009	RP#44	RP-090543	199		quirements under AWGN conditions	8.6.0
05-2009	RP#44	RP-090543	188r1	catego		8.6.0
05-2009	RP#44	RP-090543	193r1	measu	tion of the LTE UE downlink reference rement channels	8.6.0
05-2009	RP#44	RP-090543	184r1	(Techn	ements for frequency non-selective fading tests. ically Endorsed CR in R4-50bis - R4-091506)	8.6.0
05-2009	RP#44	RP-090543	185r1	CR in I	ements for PMI reporting. (Technically Endorsed R4-50bis - R4-091510)	8.6.0
05-2009	RP#44	RP-090543	221r1	suppor	tion to DL RMC-s for Maximum input level for ting more UE-Categories	8.6.0
05-2009	RP#44	RP-090543	216	38	n of 15 MHz and 20 MHz bandwidths into band	8.6.0
05-2009	RP#44	RP-090559	180	(Techn	ction of Extended LTE800 requirements. ically Endorsed CR in R4-50bis - R4-091432)	9.0.0
09-2009	RP#45	RP-090826	239		for Band 19	9.1.0
09-2009	RP#45	RP-090822	225	and 3 f	FRA ACLR1 centre frequency definition for 1.4 MHz BW	9.1.0
09-2009	RP#45	RP-090822	227		nization of text for LTE Carrier leakage	9.1.0
09-2009	RP#45	RP-090822	229		vity requirements for Band 38 15 MHz and 20 and widths	9.1.0

00.0000	DD#45	DD 000000		Operating band edge relaxation of maximum output	0.1.0
09-2009	RP#45	RP-090822	236	power for Band 18 and 19	9.1.0
09-2009	RP#45	RP-090822	238	Addition of 5MHz channel bandwidth for Band 40 Removal of unnecessary requirements for 1.4 and 3	9.1.0
09-2009	RP#45	RP-090822	245	MHz bandwidths on bands 13 and 17	9.1.0
09-2009	RP#45	RP-090877	261	Correction of LTE UE ACS test parameter	9.1.0
09-2009	RP#45	RP-090877	263R1	Correction of LTE UE ACLR test parameter	9.1.0
09-2009 09-2009	RP#45 RP#45	RP-090877 RP-090877	286 320	Uplink power and RB allocation for receiver tests CR Sensitivity relaxation for small BW	9.1.0 9.1.0
				Correction of Band 3 spurious emission band UE co-	
09-2009	RP#45	RP-090877	324	existence	9.1.0
09-2009	RP#45	RP-090877	249R1	CR Pcmax definition (working assumption)	9.1.0
09-2009	RP#45	RP-090877	330	Spectrum flatness clarification Transmit power: removal of TC and modification of	9.1.0
09-2009	RP#45	RP-090877	332	REFSENS note	9.1.0
09-2009	RP#45	RP-090877	282R1	Additional SRS relative power requirement and update of measurement definition	9.1.0
09-2009	RP#45	RP-090877	284R1	Power range applicable for relative tolerance	9.1.0
09-2009	RP#45	RP-090878	233	TDD UL/DL configurations for CQI reporting	9.1.0
09-2009	RP#45	RP-090878	235	Further clarification on CQI test configurations	9.1.0
09-2009	RP#45	RP-090878	243	Corrections to UL- and DL-RMC-s	9.1.0
09-2009	RP#45	RP-090878	247	Reference measurement channel for multiple PMI requirements	9.1.0
09-2009	RP#45	RP-090878	290	CQI reporting test for a scenario with frequency-selective	9.1.0
09-2009	RP#45	RP-090878	265R2	interference CQI reference measurement channels	9.1.0
09-2009	RP#45	RP-090878	321R1	CR RI Test	9.1.0
09-2009	RP#45	RP-090875	231	Correction of parameters for demodulation performance	9.1.0
				requirement UE categories for performance tests and correction to	
09-2009	RP#45	RP-090875	241R1	RMC references	9.1.0
09-2009	RP#45	RP-090875	333	Clarification of Ês definition in the demodulation requirement	9.1.0
00 0000	DD#45	DD 000075	200	Editorial corrections and updates to PHICH PBCH test	0.1.0
09-2009	RP#45	RP-090875	326	cases.	9.1.0
09-2009	RP#45	RP-090875	259R3	Test case numbering in section 8 Performance tests Test case numbering in TDD PDSCH performance test	9.1.0
12-2009	RP-46	RP-091264	335	(Technically endorsed at RAN 4 52bis in R4-093523)	9.2.0
12-2009	RP-46	RP-091261	337	Adding beamforming model for user-specfic reference signal (Technically endorsed at RAN 4 52bis in R4-	9.2.0
12-2009	RP-46	RP-091263	339R1	093525) Adding redundancy sequences to PMI test (Technically endorsed at RAN 4 52bis in R4-093581)	9.2.0
				Throughput value correction at FRC for Maximum input	9.2.0
12-2009	RP-46	RP-091264	341	level (Technically endorsed at RAN 4 52bis in R4-	9.2.0
40.0000	DD 40	DD 004004	040	093660) Correction to the modulated E-UTRA interferer	9.2.0
12-2009	RP-46	RP-091261	343	(Technically endorsed at RAN 4 52bis in R4-093662)	
12-2009	RP-46	RP-091264	345R1	OCNG: Patterns and present use in tests (Technically endorsed at RAN 4 52bis in R4-093664)	9.2.0
12-2009	RP-46	RP-091264	347	OCNG: Use in receiver and performance tests	9.2.0
				(Technically endorsed at RAN 4 52bis in R4-093666) Miscellaneous corrections on CSI requirements	9.2.0
12-2009	RP-46	RP-091263	349	(Technically endorsed at RAN 4 52bis in R4-093676)	
12-2009	RP-46	RP-091261	351	Removal of RLC modes (Technically endorsed at RAN 4 52bis in R4-093677)	9.2.0
12-2009	RP-46	RP-091261	353	CR Rx diversity requirement (Technically endorsed at RAN 4 52bis in R4-093703)	9.2.0
12-2009	RP-46	RP-091261	355	A-MPR notation in NS_07 (Technically endorsed at RAN 4 52bis in R4-093706)	9.2.0
12-2009	RP-46	RP-091263	359	Single- and multi-PMI requirements (Technically endorsed at RAN 4 52bis in R4-093846)	9.2.0
12-2009	RP-46	RP-091263	363	CQI reference measurement channel (Technically endorsed at RAN 4 52bis in R4-093970)	9.2.0
12 2000	111 -40				9.2.0
12-2009	RP-46	RP-091292	364	LTE MBSFN Channel Model (Technically endorsed at RAN 4 52bis in R4-094020)	
		RP-091292 RP-091264	364 367	RAN 4 52bis in R4-094020) Numbering of PDSCH (User-Specific Reference	9.2.0
12-2009	RP-46			RAN 4 52bis in R4-094020)	

12-2009	RP-46	RP-091264	373R1		Corrections to RMC-s for Maximum input level test for low UE categories	9.2.0
12-2009	RP-46	RP-091261	377		Correction of UE-category for R.30	9.2.0
12-2009	RP-46	RP-091286	378		Introduction of Extended LTE1500 requirements for TS36.101	9.2.0
12-2009	RP-46	RP-091262	384		CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from additional spurious emissions requirements for Band 1 PHS protection	9.2.0
12-2009	RP-46	RP-091262	386R3		Clarification of measurement conditions of spurious emission requirements at the edge of spurious domain	9.2.0
12-2009	RP-46	RP-091262	390		Spurious emission table correction for TDD bands 33 and 38.	9.2.0
12-2009	RP-46	RP-091262	392R2		36.101 Symbols and abreviations for Pcmax	9.2.0
12-2009	RP-46	RP-091262	394		UTRAACLR1 requirement definition for 1.4 and 3 MHz BW completed	9.2.0
12-2009	RP-46	RP-091263	396		Introduction of the ACK/NACK feedback modes for TDD requirements	9.2.0
12-2009	RP-46	RP-091262	404R3		CR Power control exception R8	9.2.0
12-2009	RP-46	RP-091262	416R1		Relative power tolerance: special case for receiver tests	9.2.0
12-2009	RP-46	RP-091263	420R1		CSI reporting: test configuration for CQI fading requirements	9.2.0
12-2009	RP-46	RP-091284	421R1		Inclusion of Band 20 UE RF parameters	9.2.0
12-2009	RP-46	RP-091264	425		Editorial corrections and updates to Clause 8.2.1 FDD demodulation test cases	9.2.0
12-2009	RP-46	RP-091262	427		CR: time mask	9.2.0
12-2009	RP-46	RP-091264	430		Correction of the payload size for PDCCH/PCFICH performance requirements	9.2.0
12-2009	RP-46	RP-091263	432		Transport format and test point updates to RI reporting test cases	9.2.0
12-2009	RP-46	RP-091263	434		Transport format and test setup updates to frequency- selective interference CQI tests	9.2.0
12-2009	RP-46	RP-091263	436		CR RI reporting configuration in PUCCH 1-1 test	9.2.0
12-2009	RP-46	RP-091261	438		Addition of R.11-1 TDD references	9.2.0
12-2009	RP-46	RP-091292	439		Performance requirements for LTE MBMS	9.2.0
12-2009	RP-46	RP-091262	442R1		In Band Emissions Requirements Correction CR	9.2.0
12-2009	RP-46	RP-091262	444R1		PCMAX definition	9.2.0
03-2010	RP-47	RP-100246	453r1		Corrections of various errors in the UE RF requirements	9.3.0
03-2010	RP-47	RP-100246	462r1		UTRA ACLR measurement bandwidths for 1.4 and 3 MHz	9.3.0
03-2010	RP-47	RP-100246	493		Band 8 Coexistence Requirement Table Correction	9.3.0
03-2010	RP-47	RP-100246	489r1	İ	Rel 9 CR for Band 14	9.3.0
03-2010	RP-47	RP-100246	485r1		CR Band 1- PHS coexistence	9.3.0
03-2010	RP-47	RP-100247	501	i i	Fading CQI requirements for FDD mode	9.3.0
03-2010	RP-47	RP-100247	499		CR correction to RI test	9.3.0
03-2010	RP-47	RP-100247	451		Reporting mode, Reporting Interval and Editorial corrections for demodulation	9.3.0
03-2010	RP-47	RP-100249	464r1		Corrections for demodulation Corrections to 1PRB PDSCH performance test in presence of MBSFN.	9.3.0
03-2010	RP-47	RP-100249	458r1		OCNG corrections	9.3.0
03-2010	RP-47	RP-100249	467		Addition of ONCG configuration in DRS performance test	9.3.0
03-2010	RP-47	RP-100249	465r1	ļļ	PDSCH performance tests for low UE categories	9.3.0
03-2010	RP-47	RP-100250	460r1		Use of OCNG in CSI tests	9.3.0
03-2010	RP-47	RP-100250	491r1		Corrections to CQI test configurations	9.3.0
03-2010	RP-47	RP-100250	469r1		Corrections of some CSI test parameters	9.3.0
03-2010	RP-47	RP-100251	456r1		TBS correction for RMC UL TDD 16QAM full allocation BW 1.4 MHz	9.3.0
03-2010	RP-47	RP-100262	449		Editorial corrections on Band 19 REFSENS	9.3.0
03-2010	RP-47	RP-100263	470r1		Band 20 UE RF requirements	9.3.0
03-2010	RP-47	RP-100264	446r1	 	A-MPR for Band 21	9.3.0
				 		
03-2010	RP-47	RP-100264	448	 	RF requirements for UE in later releases	9.3.0
03-2010	RP-47	RP-100268	445		36.101 CR: Editorial corrections on LTE MBMS reference measurement channels	9.3.0
03-2010	RP-47	RP-100268	454		The definition of the Doppler shift for LTE MBSFN	9.3.0

				Channel Model	
03-2010	RP-47	RP-100239	478r3	Modification of the spectral flatness requirement	9.3.0
00 2010	101 47	141 100200	47010	and some editorial corrections Corrections of tables for Additional Spectrum Emission	0.0.0
06-2010	RP-48	RP-100619	559	Mask	9.4.0
06-2010				Correction of transient time definition for EVM	9.4.0
06-2010	RP-48 RP-48	RP-100619 RP-100619	538 557r2	requirements CR on UE coexistence requirement	9.4.0
06-2010	KF-40	KF-100019	33712	Correction of antenna configuration and beam-forming	
	RP-48	RP-100619	547r1	model for DRS	9.4.0
06-2010	RP-48	RP-100619	536r1	CR: Corrections on MIMO demodulation performance requirements	9.4.0
06-2010	RP-48	RP-100619	528r1	Corrections on the definition of PCMAX	9.4.0
06-2010				Relaxation of the PDSCH demodulation requirements	9.4.0
06-2010	RP-48 RP-48	RP-100619 RP-100619	568 566	due to control channel errors Correction of the UE output power definition for RX tests	9.4.0
06-2010	RP-48	RP-100620	505r1	Fading CQI requirements for TDD mode	9.4.0
06-2010	RP-48	RP-100620	521	Correction to FRC for CQI index 0	9.4.0
06-2010	RP-48	RP-100620	516r1	Correction to CQI test configuration	9.4.0
06-2010	RP-48	RP-100620	532	Correction of CQI and PMI delay configuration description for TDD	9.4.0
06-2010	RP-48	RP-100620	574	Correction to FDD and TDD CSI test configurations	9.4.0
06-2010	RP-48	RP-100620	571	Minimum requirements for Rank indicator reporting	9.4.0
06-2010 06-2010	RP-48 RP-48	RP-100628 RP-100628	563	LTE MBMS performance requirements (FDD)	9.4.0
06-2010	RP-48	RP-100628 RP-100629	564 553r2	LTE MBMS performance requirements (TDD) Performance requirements for dual-layer beamforming	9.4.0 9.4.0
06-2010	RP-48	RP-100630	524r2	CR: low Category CSI requirement	9.4.0
06-2010	RP-48	RP-100630	519	Correction of FRC reference and test case numbering	9.4.0
06-2010	RP-48	PD 100630	526	Correction of carrier frequency and EARFCN of Band 21 for TS36.101	9.4.0
06-2010	KF-40	RP-100630	320	Addition of PDSCH TDD DRS demodulation tests for	
	RP-48	RP-100630	508r1	Low UE categories	9.4.0
06-2010	DD 40	DD 400000	500	Specification of minimum performance requirements for	9.4.0
06-2010	RP-48	RP-100630	539	low UE category Addition of minimum performance requirements for low	
00-2010	RP-48	RP-100630	569	UE category TDD CRS single-antenna port tests	9.4.0
06-2010				Introduction of sustained downlink data-rate	9.4.0
06-2010	RP-48 RP-48	RP-100631 RP-100683	549r3 530r1	performance requirements Band 20 Rx requirements	9.4.0
09-2010	RP-49	RP-100003	614r2	Add OCNG to MBMS requirements	9.5.0
09-2010	RP-49	RP-100916	599	Correction of PDCCH content for PHICH test	9.5.0
09-2010	55.45	55 40000		Beamforming model for transmission on antenna port	
	RP-49	RP-100920	597r1	7/8 Correction of full correlation in frequency-selective CQI	9.5.0
09-2010	RP-49	RP-100920	600r1	test	9.5.0
09-2010	55.40	55 40000		Correction on single-antenna transmission fixed	
	RP-49	RP-100920	601	reference channel Reference sensitivity requirements for the 1.4 and 3	9.5.0
09-2010	RP-49	RP-100914	605	MHz bandwidths	9.5.0
09-2010	RP-49	RP-100920	608r1	CR for DL sustained data rate test	9.5.0
09-2010	RP-49	RP-100919	611	Correction of references in section 10 (MBMS performance requirements)	9.5.0
09-2010	RP-49	RP-100919	613	Band 13 and Band 14 spurious emission corrections	9.5.0
09-2010	RP-49	RP-100919	617r1	Rx Requirements	9.5.0
09-2010	RP-49	RP-100926	576r1	Clarification on DL-BF simulation assumptions	9.5.0
09-2010	RP-49	RP-100920	582r1	Introduction of additional Rel-9 scenarios	9.5.0
09-2010	RP-49	RP-100925	575r1	Correction to band 20 ue to ue Co-existence table	9.5.0
09-2010	RP-49	RP-100916	581r1	Test configuration corrections to CQI reporting in AWGN	9.5.0
09-2010	RP-49	RP-100916	595	Corrections to RF OCNG Pattern OP.1 and 2	9.5.0
09-2010	RP-49	RP-100919	583	Editorial corrections of 36.101	9.5.0
09-2010	RP-49	RP-100920	586	Addition of minimum performance requirements for low UE category TDD tests	9.5.0
09-2010	RP-49	RP-100914	590r1	Downlink power for receiver tests	9.5.0
09-2010	RP-49	RP-100920	591	OCNG use and power in beamforming tests	9.5.0
09-2010	RP-49	RP-100916	593	Throughput for multi-datastreams transmissions	9.5.0
09-2010	RP-49	RP-100914	588	Missing note in Additional spurious emission test with NS 07	9.5.0
09-2010	RP-49	RP-100914	596r2	CR LTE_TDD_2600_US spectrum band definition	10.0.0
				additions to TS 36.101	
12-2010	RP-50	RP-101309	680	Demodulation performance requirements for dual-layer	10.1.0
10.0010	RP-50	RP-101325	672	beamforming Correction on the statement of TB size and subband	10.1.0
12-2010			. ~. –		
12-2010 12-2010	RP-50			selection in CSI tests Correction to Band 12 frequency range	10.1.0

12-2010	RP-50	RP-101329	630	Removal of [] from TDD Rank Indicator requirements	10.1.0
12-2010	RP-50	RP-101329	635r1	Test configuration corrections to CQI TDD reporting in	10.1.0
				AWGN (Rel-10)	
12-2010	RP-50	RP-101330	645	EVM window length for PRACH	10.1.0
12-2010	RP-50	RP-101330	649	Removal of NS signalling from TDD REFSENS tests	10.1.0
12-2010	RP-50	RP-101330	642r1	Correction of Note 4 In Table 7.3.1-1: Reference sensitivity QPSK PREFSENS	10.1.0
12-2010	RP-50	RP-101341	627	Add 20 RB UL Ref Meas channel	10.1.0
12-2010	RP-50	RP-101341	654r1	Additional in-band blocking requirement for Band 12	10.1.0
12-2010	RP-50	RP-101341	678	Further clarifications for the Sustained Downlink Data Rate Test	10.1.0
12-2010 12-2010	RP-50 RP-50	RP-101341 RP-101349	673r1 667r3	Correction on MBMS performance requirements	10.1.0 10.1.0
12-2010	RP-50	RP-101349	666r2	CR Removing brackets of Band 41 reference sensitivity to TS 36.101 Band 42 and 43 parameters for UMTS/LTE 3500 (TDD)	10.1.0
12 2010	111 30	101330	00012	for TS 36.101	10.1.0
12-2010	RP-50	RP-101359	646r1	CR for CA, UL-MIMO, eDL-MIMO, CPE	10.1.0
12-2010	RP-50	RP-101361	620r1	Introduction of L-band in TS 36.101	10.1.0
12-2010	RP-50	RP-101379	670r1	Correction on the PMI reporting in Multi-Laye Spatial Multiplexing performance test	10.1.0
12-2010	RP-50	RP-101380	679r1	Adding antenna configuration in CQI fading test case	10.1.0
01-2011			1	Clause numbering correction	10.1.1
03-2011	RP-51	RP-110359	695	Removal of E-UTRA ACLR for CA	10.2.0
03-2011	RP-51	RP-110338	699	PDCCH and PHICH performance: OCNG and power settings	10.2.0
03-2011	RP-51	RP-110336	706r1	Spurious emissions measurement uncertainty	10.2.0
03-2011 03-2011	RP-51 RP-51	RP-110352 RP-110338	707r1 710	REFSENSE in lower SNR PMI performance: Power settings and precoding	10.2.0 10.2.0
03-2011	RP-51	RP-110359	715r2	granularity Definition of configured transmitted power for Rel-10	10.2.0
03-2011	RP-51	RP-110359	717	Introduction of requirement for adjacent intraband CA	10.2.0
00 2011	1 01	111 110000	' '	image rejection	10.2.0
03-2011	RP-51	RP-110343	719	Minimum requirements for the additional Rel-9 scenarios	10.2.0
03-2011	RP-51	RP-110343	723	Corrections to power settings for Single layer	10.2.0
		DD 440040		beamforming with simultaneous transmission	
03-2011 03-2011	RP-51 RP-51	RP-110343 RP-110338	726r1 730	Correction to the PUSCH3-0 subband tests for Rel-10 Removing the square bracket for TS36.101	10.2.0 10.2.0
03-2011	RP-51	RP-110336	739	Removal of square brackets for dual-layer beamforming demodulation performance requirements	10.2.0
03-2011	RP-51	RP-110359	751	CR: Maximum input level for intra band CA	10.2.0
03-2011	RP-51	RP-110349	754r2	UE category coverage for dual-layer beamforming	10.2.0
03-2011	RP-51	RP-110343	756r1	Further clarifications for the Sustained Downlink Data Rate Test	10.2.0
03-2011	RP-51	RP-110343	759	Removal of square brackets in sustained data rate tests	10.2.0
03-2011	RP-51	RP-110337	762r1	Clarification to LTE relative power tolerance table	10.2.0
03-2011	RP-51	RP-110343	764	Introducing UE-selected subband CQI tests	10.2.0
03-2011	RP-51	RP-110343	765	Verification framework for PUSCH 2-2 and PUCCH 2-1 reporting	10.2.0
04-2011	RP-52	DD 110004	766	Editorial: Spec Title correction, removal of "Draft"	10.2.1 10.3.0
06-2011 06-2011	RP-52	RP-110804 RP-110795	768	Add Expanded 1900MHz Band (Band 25) in 36.101 Fixing Band 24 inclusion in TS 36.101	10.3.0
06-2011	RP-52	RP-110788	772	CR: Corrections for UE to UE co-existence requirements of Band 3	10.3.0
06-2011	RP-52	RP-110812	774	Add 2GHz S-Band (Band 23) in 36.101	10.3.0
06-2011	RP-52	RP-110789	782	CR: Band 19 A-MPR refinement	10.3.0
06-2011	RP-52	RP-110796	787	REFSENS in lower SNR	10.3.0
06-2011	RP-52	RP-110789	805	Clarification for MBMS reference signal levels	10.3.0
06-2011	RP-52	RP-110792	810	FDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110787	814	Correction on CQI mapping index of RI test	10.3.0
06-2011 06-2011	RP-52 RP-52	RP-110789 RP-110794	824 826	Corrections to in-band blocking table Correction of TDD Category 1 DRS and DMRS RMCs	10.3.0 10.3.0
06-2011	RP-52	RP-110794 RP-110794	828	TDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110794	829	Correction of TDD RMC for Low SNR Demodulation test	10.3.0
06-2011	RP-52	RP-110796	830	Informative reference sensitivity requirements for Low SNR for TDD	10.3.0
06-2011	RP-52	RP-110787	778r1	Minor corrections to DL-RMC-s for Maximum input level	10.3.0
06-2011	RP-52	RP-110789	832	PDCCH and PHICH performance: OCNG and power settings	10.3.0
06-2011	RP-52	RP-110789	818r1	Correction on 2-X PMI test for R10	10.3.0
06-2011	RP-52	RP-110791	816r1	Addition of performance requirements for dual-layer beamforming category 1 UE test	10.3.0
06-2011	RP-52	RP-110789	834	Performance requirements for PUCCH 2-0, PUCCH 2-1 and PUSCH 2-2 tests	10.3.0
06-2011	RP-52	RP-110807	835r1	CR for UL MIMO and CA	10.3.0

09-2011	RP-53	RP-111248	862r1	Removal of unnecessary channel bandwidths from REFSENS tables	10.4.0
09-2011	RP-53	RP-111248	869r1	Clarification on BS precoding information field for RI FDD and PUCCH 2-1 PMI tests	10.4.0
09-2011	RP-53	RP-111248	872r1	CR for B14Rx requirement Rrel 10	10.4.0
09-2011	RP-53	RP-111248	890r1	CR to TS36.101: Correction on the accuracy test of CQI.	10.4.0
09-2011	RP-53	RP-111248	893	CR to TS36.101: Correction on CQI mapping index of TDD RI test	10.4.0
09-2011	RP-53	RP-111248	904	Correction of code block numbers for some RMCs	10.4.0
09-2011	RP-53	RP-111248	907	Correction to UL RMC for FDD and TDD	10.4.0
09-2011	RP-53	RP-111248	914r1	Adding codebook subset restriction for single layer closed-loop spatial multiplexing test	10.4.0
09-2011	RP-53	RP-111251	883	Sustained data rate: Correction of the ACK/NACK feedback mode	10.4.0
09-2011	RP-53	RP-111251	929	36.101 CR on MBSFN FDD requirements(R10)	10.4.0
09-2011	RP-53	RP-111251	938	TDD MBMS performance requirements for 64QAM mode	10.4.0
09-2011	RP-53	RP-111252	895	Further clarification for the dual-layer beamforming demodulation requirements	10.4.0
09-2011	RP-53	RP-111255	908r1	Introduction of Band 22	10.4.0
09-2011	RP-53	RP-111255	939	Modifications of Band 42 and 43	10.4.0
09-2011	RP-53	RP-111260	944	CR for TS 36.101 Annex B: Static channels for CQI tests	10.4.0
09-2011	RP-53	RP-111262	878r1	Correction of CSI reference channel subframe description	10.4.0
09-2011	RP-53	RP-111262	887	Correction to UL MIMO	10.4.0
09-2011	RP-53	RP-111262	926r1	Power control accuracy for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	927r1	In-band emissions requirements for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	930r1	Adding the operating band for UL-MIMO	10.4.0
09-2011	RP-53	RP-111265	848	Corrections to intra-band contiguous CA RX requirements	10.4.0
09-2011	RP-53	RP-111265	863	Intra-band contiguos CA MPR requirement refinement	10.4.0
09-2011	RP-53	RP-111265	866r1	Intra-band contiguous CA EVM	10.4.0
09-2011	RP-53	RP-111266	935	Introduction of the downlink CA demodulation requirements	10.4.0
09-2011	RP-53	RP-111266	936r1	Introduction of CA UE demodulation requirements for TDD	10.4.0
12-2011	RP-54	RP-111684	947	Corrections of UE categories of Rel-10 reference channels for RF requirements	10.5.0
12-2011	RP-54	RP-111684	948	Alternative way to define channel bandwidths per operating band for	10.5.0
12-2011	RP-54	RP-111686	949	CR for TS36.101: Adding note to the function of MPR	10.5.0
12-2011	RP-54	RP-111680	950	Clarification on applying CSI reports during rank switching in RI FDD test - Rel-10	10.5.0
12-2011	RP-54	RP-111734	953r1	Corrections for Band 42 and 43 introduction	10.5.0
12-2011	RP-54	RP-111680	956	UE spurious emissions	10.5.0
12-2011	RP-54	RP-111682	959	Add scrambling identity n_SCID for MU-MIMO test	10.5.0
12-2011	RP-54	RP-111690	960r1	P-MPR definition	10.5.0
12-2011	RP-54	RP-111693	962	Pcmax,c Computation Assumptions	10.5.0
12-2011	RP-54			Correction of frequency range for spurious emission	10.5.0
		RP-111733	963r1	requirements	
12-2011	RP-54	RP-111680	966	General review of the reference measurement channels	10.5.0
12-2011	RP-54	RP-111691	945	Corrections of Rel-10 demodulation performance	10.5.0
				requirements This CR is only partially implemented due to confliction	
				with CR 966	
12-2011	RP-54	RP-111684	946	Corrections of UE categories for Rel-10 CSI requirements	10.5.0
				This CR is only partially implemented due to confliction with CR 966	
12-2011	RP-54	RP-111691	982r2	Introduction of SDR TDD test scenario for CA UE demodulation	10.5.0
				This CR is only partially implemented due to confliction with CR 966	
12-2011	RP-54	RP-111693	971r1	CR on Colliding CRS for non-MBSFN ABS	10.5.0
12-2011	RP-54	RP-111693	972r1	Introduction of eICIC demodulation performance requirements for FDD and TDD	10.5.0
12-2011	RP-54			Adding missing UL configuration specification in some UE receiver requirements for case of 1 CC UL capable	10.5.0
12-2011	RP-54	RP-111686	985	UE Correction and maintenance on CQI and PMI	10.5.0
	1	RP-111684	998	requirements (Rel-10)	
12-2011	RP-54	RP-111735	1004	MPR for CA Multi-cluster	10.5.0
12-2011	RP-54			CA demodulation performance requirements for LTE	10.5.0
		RP-111691	1005	FDD	

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12-2011	RP-54	RP-111692	1006	CQI reporting accuracy test on frequency non-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54			CQI reporting accuracy test on frequency-selective	10.5.0
		RP-111692	1007	scheduling on eDL MIMO	
12-2011	RP-54	RP-111692	1008	PMI reporting accuracy test for TDD on eDL MIMO	10.5.0
12-2011	RP-54		1009r		10.5.0
		RP-111692	1	CR for TS 36.101: RI performance requirements	
12-2011	RP-54		1010r	CR for TS 36.101: Introduction of static CQI tests (Rel-	10.5.0
		RP-111692	1	10)	
03-2012	RP-55	RP-120291	1014	RF: Updates and corrections to the RMC-s related annexes (Rel-10)	10.6.0
03-2012	RP-55	RP-120300	1015r	On elCIC ABS pattern	10.6.0
03-2012	KF-55	KF-120300	10131	On eloic Abs pattern	10.0.0
03-2012	RP-55	RP-120300	1016r	On elCIC interference models	10.6.0
			1		
03-2012	RP-55	RP-120299	1017r	TS36.101 CR: on eDL-MIMO channel model using	10.6.0
		DD 100001	1	cross-polarized antennas	
03-2012	RP-55	RP-120304	1020r	TS36.101 CR: Correction to MBMS Performance Test	10.6.0
00.0040	DD CC	DD 400000	1	Parameters	40.00
03-2012	RP-55	RP-120303	1021	Harmonic exceptions in LTE UE to UE co-ex tests	10.6.0
03-2012	RP-55	RP-120304	1023	Unified titles for Rel-10 CSI tests	10.6.0
03-2012	RP-55	RP-120300	1033r	Introduction of reference channel for eICIC demodulation	10.6.0
00.0040	DD 55	DD 400004	1 1010	Operation of Astroduction de Cor COLDMO	40.00
03-2012	RP-55	RP-120304	1040r	Correction of Actual code rate for CSI RMCs	10.6.0
03-2012	RP-55	RP-120304	1041r	Definition of synchronized operation	10.6.0
03-2012	KF-55	KP-120304	10411	Definition of Synchronized operation	10.0.0
03-2012	RP-55	RP-120296	1048r	Intra band contiguos CA Ue to Ue Co-ex	10.6.0
00 2012	111 00	111 120200	1	Third band configure on the color of	10.0.0
03-2012	RP-55	RP-120296	1049r	REL-10 CA specification editorial consistency	10.6.0
			1		
03-2012	RP-55	RP-120299	1053	Beamforming model for TM9	10.6.0
03-2012	RP-55	RP-120296	1054	Requirement for CA demodulation with power imbalance	10.6.0
03-2012	RP-55	RP-120298	1057	Updating Band 23 duplex specifications	10.6.0
03-2012	RP-55	RP-120298	1058r	Correcting UE Coexistence Requirements for Band 23	10.6.0
05 2012	101 33	101 120250	1	Contesting of Coexistence Requirements for Band 25	10.0.0
03-2012	RP-55	RP-120304	1059r	CA demodulation performance requirements for LTE	10.6.0
00 20 .2	00	2000 .	1	TDD	
03-2012	RP-55	RP-120304	1061	Requirement for CA SDR FDD test scenario	10.6.0
03-2012	RP-55	RP-120293	1064r	TS36.101 RF editorial corrections Rel 10	10.6.0
			1		
03-2012	RP-55	RP-120299	1067r	Introduction of TM9 demodulation performance	10.6.0
			1	requirements	
03-2012	RP-55	RP-120304	1071r	Introduction of a CA demodulation test for UE soft buffer	10.6.0
			1	management testing	
03-2012	RP-55	RP-120296	1072	MPR formula correction For intra-band contiguous CA	10.6.0
				Bandwidth Class C	
03-2012	RP-55	RP-120303	1077r	CR for 36.101: B41 REFSENS and MOP changes to	10.6.0
			1	accommodate single filter architecture	
03-2012	RP-55	RP-120300	1082	TM3 tests for elCIC	10.6.0
03-2012	RP-55	RP-120300	1083r	Introduction of requirements of CQI reporting definition	10.6.0
00.0075	DD	DD 40000 :	1	for eclClC	40.0.0
03-2012	RP-55	RP-120304	1084	eDL MIMO CSI requirements	10.6.0
06 0040	DD 50	DD 400777	1086r	Carrier aggregation Relative power tolerance, removal of	10.7.0
06-2012	RP-56	RP-120777	1	TBD.	10.7.0
06-2012	RP-56	RP-120783	1088	UE spurious emissions for Band 7 and Band 38 coexistence	10.7.0
00-2012	111 -00	141 - 120103	1000	Deleting square brackets in Reference Measurement	10.7.0
06-2012	RP-56	RP-120780	1091	Channels	10.7.0
06-2012	RP-56	RP-120730	1093	Addition of Maximum Throughput for R.30-1 TDD RMC	10.7.0
00 2012	1.1 00	7.1. 120770	. 555	CR to TS36.101: Correction on parameters for the eDL-	10.7.0
06-2012	RP-56	RP-120779	1095	MIMO CQI and PMI tests	10.7.0
	1		1	CR to TS36.101: Fixed reference channel for PDSCH	
				demodulation performance requirements on eDL-MIMO	
			1096r	 NOT implemented as it is based on a wrong version of 	
06-2012	RP-56	RP-120780	1	the Spec	10.7.0
			1100r	CR for 36.101: The clarification of MPR and A-MPR for	
06-2012	RP-56	RP-120779	1	CA	10.7.0
	RP-56	RP-120784	1101	Corrections for elCIC demod test case with MBSN ABS	10.7.0
06-2012		RP-120774	1106	RMC correction on eDL-MIMO RI test	10.7.0
06-2012 06-2012	RP-56			FRC correction on frequency selective CQI and PMI test	
06-2012			1109r		
	RP-56 RP-56	RP-120774	1	(Rel-10)	10.7.0
06-2012	RP-56	RP-120774		· · · · · · · · · · · · · · · · · · ·	
06-2012			1	(Rel-10)	10.7.0 10.7.0 10.7.0

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06-2012	RP-56	RP-120784	1116r 1	Corrections and clarifications on elCIC CSI tes	10.7.0
06-2012	RP-56	RP-120783	1118r 1	Corrections on UE performance requirements	10.7.0
06-2012	RP-56	RP-120769	1126r 1	Addition of ETU30 channel model	10.7.0
			1129r		
06-2012	RP-56	RP-120779	1146r	CR for EVM and global in channel test for Intra-Band CA	10.7.0
06-2012	RP-56	RP-120784	1 1148r	Extension of static elCIC CQI test Introduction of PDCCH test with colliding RS on MBSFN-	10.7.0
06-2012	RP-56	RP-120784	2 1152r	ABS Some clarifications and OCNG pattern for eICIC	10.7.0
06-2012	RP-56	RP-120784	2	demodulation requirements	10.7.0
06-2012	RP-56	RP-120773	1154	Introduction of TDD CA Soft Buffer Limitation	10.7.0
06-2012	RP-56	RP-120779	1160	Corrections on CQI and PMI test	10.7.0
06-2012	RP-56	RP-120780	1162 1164r	FRC for TDD PMI test	10.7.0
06-2012	RP-56	RP-120778	1	Clean-up of UL-MIMO for TS36.101	10.7.0
06-2012	RP-56	RP-120782	1168r 1	SNR definition	10.7.0
				Removal of unnecessary references to single carrier	
06-2012	RP-56	RP-120782	1170	requirements from Interband CA sub-clauses	10.7.0
06-2012	RP-56	RP-120780	1172	Editorial simplification to CA REFSENS UL allocation table	10.7.0
06-2012	RP-56	RP-120781	1173	PDCCH wrong detection in receiver spurious emissions test	10.7.0
06-2012	RP-56	RP-120776	1183	Corrections to 3500 MHz	10.7.0
06-2012	RP-56	RP-120784	1192r 1	Target SNR setting for elCIC demodulation requirement	10.7.0
06-2012	RP-56	RP-120778	1198	Correction of wrong table references in CA receiver tests	10.7.0
00 0040	DD 50	DD 400700	1201r	OND reference control for EDD OA refit to ffeet tests	40.70
06-2012	RP-56	RP-120782	2	SNR reference values for FDD CA soft buffer tests	10.7.0 10.7.0
06-2012	RP-56	RP-120764	1211 1214r	Correction of PHS protection requirements for TS 36.101	10.7.0
06-2012	RP-56	RP-120781	1 1216r	Proposed revision of subclause 4.3A for TS36.101	10.7.0
06-2012	RP-56	RP-120781	12 161	Proposed revision on subclause 6.3.4A for TS36.101	10.7.0
06-2012	RP-56	RP-120778	1222	Correction of CSI configuraiton for CA TM4 tests R10	10.7.0
06-2012	RP-56	RP-120773	1224	CR on CA UE receiver timing window R10	10.7.0
09-2012	RP-57	RP-121294	1229	Correct Transport Block size in 9RB 16QAM Uplink	10.8.0
09-2012	RP-57	RP-121313	1232r	Reference Measurement Channel RF: Corrections to power allocation parameters for	10.8.0
09-2012	RP-57	RP-121304	1234	transmission mode 8 RF-CA: non-CA notation and applicability of test points	10.8.0
				in scenarios without and with CA operation	
09-2012	RP-57	RP-121305	1236	ACK/NACK feedback modes for FDD and TDD TM4 CA demodulation requirements (Rel-10)	10.8.0
09-2012	RP-57	RP-121305	1238	Correction of feedback mode for CA TDD demodulation requirements (resubmission of R4-63AH-0194 for Rel-10)	10.8.0
09-2012	RP-57	RP-121302	1240	ABS pattern setup for MBSFN ABS test (resubmission of	10.8.0
09-2012	RP-57	RP-121302	1242	R4-63AH-0204 for Rel-10) CR on eICIC CQI definition test (resubmission of R4-	10.8.0
09-2012	RP-57	RP-121302	1244r	63AH-0205 for Rel-10) Transmission of CQI feedback and other corrections	10.8.0
09-2012	RP-57	RP-121302	1 1246r	(Rel-10) Target SNR setting for elCIC MBSFN-ABS demodulation	10.8.0
	5,		1	requirements (Rel-10)	
	םם כד	DD 404000	4050	Corrections of spurious emission band UE co-existence	10.8.0
09-2012	RP-57	RP-121300	1250	applicable in Japan	
09-2012	RP-57	RP-121300 RP-121306	1250 1252	· · · · · · · · · · · · · · · · · · ·	10.8.0
			1252 1254r	applicable in Japan	
09-2012	RP-57	RP-121306	1252 1254r 1 1256r	applicable in Japan Correction on RMC for frequency non-selective CQI test	10.8.0
09-2012 09-2012	RP-57 RP-57	RP-121306 RP-121306 RP-121302	1252 1254r 1	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS	10.8.0
09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57	RP-121306 RP-121306 RP-121302 RP-121313	1252 1254r 1 1256r 1 1261r	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS Applicability of statement allowing RBW < Meas BW for spurious	10.8.0 10.8.0 10.8.0
09-2012 09-2012 09-2012 09-2012	RP-57 RP-57	RP-121306 RP-121306 RP-121302 RP-121313 RP-121298	1252 1254r 1 1256r 1 1261r	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests	10.8.0 10.8.0 10.8.0 10.8.0 10.8.0
09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57	RP-121306 RP-121306 RP-121302 RP-121313	1252 1254r 1 1256r 1 1261r 1 1264 1266r	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS Applicability of statement allowing RBW < Meas BW for spurious	10.8.0 10.8.0 10.8.0
09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57	RP-121306 RP-121306 RP-121302 RP-121313 RP-121298	1252 1254r 1 1256r 1 1261r 1 1264	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests Removal of brackets for CA Tx Corrections of FRC subframe allocations and other	10.8.0 10.8.0 10.8.0 10.8.0 10.8.0
09-2012 09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57 RP-57 RP-57	RP-121306 RP-121306 RP-121302 RP-121313 RP-121298 RP-121304	1252 1254r 1 1256r 1 1261r 1 1264 1266r 1	applicable in Japan Correction on RMC for frequency non-selective CQI test Requirements for the eDL-MIMO CQI test Clarification on PDSCH test setup under MBSFN ABS Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests Removal of brackets for CA Tx	10.8.0 10.8.0 10.8.0 10.8.0 10.8.0 10.8.0

			1	Limitation	
09-2012	RP-57	RP-121307	1275r 1	Correction of eDL-MIMIO CSI RMC tables and references	10.8.0
09-2012	RP-57	RP-121307	1277	Correction of MIMO channel model for polarized antennas	10.8.0
09-2012	RP-57	RP-121303	1279r 1	Addition of 15 and 20MHz Bandwidths for Band 23 to TS 36.101 (Rel-10)	10.8.0
09-2012	RP-57	RP-121304	1284r 1	CR for A-MPR masks for NS_CA_1C	10.8.0
09-2012	RP-57	RP-121446	1287r 2	Introduction of Japanese Regulatory Requirements to LTE Band 8(R10)	10.8.0
09-2012	RP-57	RP-121306	1297r 1	Requirements for eDL-MIMO RI test	10.8.0
09-2012	RP-57	RP-121306	1303	Corrections to TM9 demodulation tests	10.8.0
09-2012	RP-57	RP-121313	1305	Correction to PCFICH power parameter setting	10.8.0
09-2012	RP-57	RP-121306	1308r 1	Correction on frequency non-selective CQI test	10.8.0
09-2012	RP-57	RP-121306	1311r 1	eDL-MIMO CQI/PMI test	10.8.0
09-2012	RP-57	RP-121313	1315	Correction of the definition of unsynchronized operation	10.8.0
09-2012	RP-57	RP-121304	1319r 1	Correction to Transmit Modulation Quality Tests for Intra- Band CA	10.8.0
09-2012	RP-57	RP-121304	1331r 1	Bandwidth combination sets for intra-band and inter- band carrier aggregation	10.8.0
09-2012	RP-57	RP-121306	1349r 1	FRC for TM9 FDD	10.8.0
09-2012	RP-57	RP-121295	1350	Random precoding granularity in PMI tests	10.8.0
09-2012	RP-57	RP-121302	1357	Introduction of RI test for elCIC	10.8.0
09-2012	RP-57	RP-121304	1359	Notes for deltaTib and deltaRib tables	10.8.0
12-2012	RP-58	RP-121861	1365r 1	Some changes related to CA tests and overview table of DL measurement channels	10.9.0
12-2012	RP-58	RP-121860	1367	Correction of eICIC CQI tests	10.9.0
12-2012	RP-58	RP-121860	1369	Correction of eICIC demodulation tests	10.9.0
12-2012	RP-58	RP-121862	1372r 1	Correction of SNR definition	10.9.0
12-2012	RP-58	RP-121862	1373	Correction on CSI-RS subframe offset parameter	10.9.0
12-2012	RP-58	RP-121862	1375r 1	Correction on FRC table in CSI test	10.9.0
12-2012	RP-58	RP-121862	1381	Correction of reference channel table for TDD eDL- MIMIO RI test	10.9.0
12-2012	RP-58	RP-121850	1385	OCNG patterns for Sustained Data rate testing	10.9.0
12-2012	RP-58	RP-121867	1387r 1	Introduction of one periodic CQI test for CA deployments	10.9.0
12-2012	RP-58	RP-121850	1400	Introducing the additional frequency bands of 5 MHz x 2 in 1.7 GHz in Japan to Band 3	10.9.0
12-2012	RP-58	RP-121860	1403	CR on elCIC RI test	10.9.0
12-2012	RP-58	RP-121861	1404	Correction of some errors in reference sensitivity for CA in TS 36.101 (R10)	10.9.0
12-2012	RP-58	RP-121862	1408r 1	Cleaning of 36.101 Performance sections Rel-10	10.9.0
12-2012	RP-58	RP-121861	1415r 1	Out-of-band blocking requirements for inter-band carrier aggregation	10.9.0
12-2012	RP-58	RP-121860	1417r 1	Brackets clean up for elCIC CSI/demodulation	10.9.0
12-2012	RP-58	RP-121867	1430	Clean up of specification R10	10.9.0
12-2012	RP-58	RP-121867	1435r 1	Band 1 to Band 33 and Band 39 UE coexistence requirements	10.9.0
12-2012	RP-58	RP-121862	1441	Correction of eDL-MIMO RI test and RMC table for the CSI test	10.9.0
12-2012	RP-58	RP-121861	1443	Minor correction to ceiling function example - rel10	10.9.0
12-2012	RP-58	RP-121860	1454r 1	CR on elCIC RI testing (Rel-10)	10.9.0
12-2012	RP-58	RP-121862	1458	Correction on FRC table	10.9.0
12-2012	RP-58	RP-121862	1463	Adding references to the appropriate beamforming model (Rel-10)	10.9.0
12-2012	RP-58	RP-121866	1466	Maintenance of Band 23 UE Coexistence	10.9.0
12-2012	RP-58	RP-121849	1493	Low-channel Band 1 coexistence with PHS	10.9.0
12-2012	RP-58	RP-121852	1508	UE-UE coexistence between bands with small frequency separation	10.9.0
12-2012	RP-58	RP-121860	1512	Applicable OFDM symbols of Noc_2 for PDCCH/PCFICH ABS-MBSFN test cases	10.9.0
12-2012	RP-58	RP-121851	1514	Corrections to TM4 rank indicator Test 3	10.9.0
12-2012	RP-58	RP-121861	1516	Correction of test configurations and FRC for CA demodulation with power imbalance	10.9.0
03-2013	RP-59	RP-130268	1522	Brackets removal in Rel-10 TM4 rank indicator Test 3	10.10.0

Gaz-2013 RP-59 RP-130264 1533r CR for CA performance requirements 10.10	00.0040	DD 50	DD 400050	4507	Operations to OOI managers	10.10.0
2	03-2013	RP-59	RP-130258	1527	Corrections to CQI reporting	10.10.0
93-2013 RP-59 RP-130262 1535 Corrections for elCIC performance requirements (rel-10) 10.10	03-2013	RP-59	RP-130264		CR for CA performance requirements	10.10.0
03-2013 RP-59 RP-130263 1542r 1538 Correction of CA power imbalance performance 10.10	03-2013	RP-59	RP-130262		Corrections for elCIC performance requirements (rel-10)	10 10 0
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3 36.101 (R10)					requirements	
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Based on New Regulatory Order in the US	03-2013	RP-59	RP-130263		CA_1C: CA_NS_02 and CA_NS_03 A-MPR REL-10	10.10.0
03-2013 RP-59 RP-130269 1573 Remove I from CSI test case parameters 0.10	03-2013	RP-59	RP-130267		Addition of UE Regional Requirements to Band 23 Based on New Regulatory Order in the US	10.10.0
03-2013 RP-59 RP-130268 1578 UE-UE co-existence between Band 1 and Band 33/39 10.10	03-2013	RP-59	RP-130260			10.10.0
03-2013 RP-59 RP-130263 1583f Cleanup for CA UE RF requirements 10.10						10.10.0
Revision of Transmit modulation quality requirements 10.10	03-2013	RP-59	RP-130263	1583r	Cleanup for CA UE RF requirements	10.10.0
G3-2013 RP-59 RP-130268 1589 RP-130268 1601 Correction of CACQI test setup 10.10	03-2013	RP-59	RP-130263	1585		10.10.0
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03-2013 RP-59 RP-130263 1601 Correction of CA CQI test setup 10.10	03-2013	RP-59	RP-130268	1589	Revision of Common Test Parameters for User-specific	10.10.0
03-2013 RP-50 RP-130765 1603 Correction of table reference 10.10	03-2013	RP-50	RP-130264	1596		10 10 0
06-2013 RP-60 RP-130765 1603 Complementary description for definition of MIMO Correlation Matrices using cross polarized antennas 10.11						10.10.0
Correlation Martices using cross polarized antennas Correlation Martices using cross polarized antennas 10.11						10.11.0
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1	06-2013	RP-60	RP-130765	1609	(Rel-10)	10.11.0
requirements	06-2013	RP-60	RP-130765	1	requirements	10.11.0
1	06-2013	RP-60	RP-130765	1624		10.11.0
06-2013 RP-60 RP-130765 1655r 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	06-2013	RP-60	RP-130765		Correction of resource allocation for the multiple PMI Cat	10.11.0
1	06-2013	RP-60	RP-130767	1630	Minor correction for CA CQI test setup	10.11.0
06-2013 RP-60 RP-130765 1680r 1 Correction for TS 36.101 10.11 06-2013 RP-60 RP-130763 1683 RF: Corrections to RMC-s for sustained data rate test 10.11 06-2013 RP-60 RP-130766 1688 Carrier aggregation in multi RAT and multiple band combination terminals 10.11 06-2013 RP-60 RP-130766 1690r 1 Completion of out-of-band blocking requirements for inter-band CA with one UL 10.11 06-2013 RP-60 RP-130767 1694r 1 CR on the bandwidth coverage issue of CA demodulation performance (Rel-10) 10.11 06-2013 RP-60 RP-130765 1696r 1 Correction to UE maximum output power for intra-band CA (R10) 10.11 06-2013 RP-60 RP-130767 1702 CR on the bandwidth coverage issue of CA CQI performance(Rel-10) 10.11 06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130770 1708 Corrections for co-existence(Rel-10) 10.11 06-2013 RP-61 RP-130785 1715 Correct				1655r	Modification of configured output power to account for	10.11.0
06-2013 RP-60 RP-130763 1683 RF: Corrections to RMC-s for sustained data rate test 10.11 06-2013 RP-60 RP-130766 1688 Carrier aggregation in multi RAT and multiple band combination terminals 10.11 06-2013 RP-60 RP-130766 1690r inter-band CA with one UL 10.11 06-2013 RP-60 RP-130767 1694r inter-band CA with one UL CR on the bandwidth coverage issue of CA demodulation performance (Rel-10) 10.11 06-2013 RP-60 RP-130765 1696r inter-band CA with one UL Correction on UE maximum output power for intra-band CA (R10) 10.11 06-2013 RP-60 RP-130767 1702 Correction on UE maximum output power for intra-band CA (R10) 10.11 06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130766 1704 Corrections to NS_11 A-MPR Table 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 06-2013 RP-61 RP-61 RP-131281 1734 CR on app	06-2013	RP-60	RP-130765			10.11.0
06-2013 RP-60 RP-130766 1688 Carrier aggregation in multi RAT and multiple band combination terminals 10.11 06-2013 RP-60 RP-130766 1690r 1 combination terminals 10.11 06-2013 RP-60 RP-130767 1694r 1 combination performance (Rel-10) 10.11 06-2013 RP-60 RP-130765 1696r 1 correction on UE maximum output power for intra-band CA (R10) 10.11 06-2013 RP-60 RP-130767 1702 CR on the bandwidth coverage issue of CA CQI performance(Rel-10) 10.11 06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130770 1708 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130765 1715 Corrections for co-existence(Rel-10) 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 09-2013 RP-61 RP-131281 1734 Crecions to Sustained data rate tests (Rel-10) 09-2013 RP-61 RP-131281 1759r	06-2013	RP-60	RP-130763		RF: Corrections to RMC-s for sustained data rate test	10.11.0
06-2013 RP-60 RP-130766 1690r 1 1 1 1 1 1 1 1 1	06-2013	RP-60	RP-130766	1688	Carrier aggregation in multi RAT and multiple band	10.11.0
RP-60	06-2013	RP-60	RP-130766	1690r	Completion of out-of-band blocking requirements for	10.11.0
06-2013 RP-60 RP-130765 1696r 1 Correction on UE maximum output power for intra-band CA (R10) 10.11 06-2013 RP-60 RP-130767 1702 CR on the bandwidth coverage issue of CA CQI performance(Rel-10) 10.11 06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130770 1708 Corrections to NS_11 A-MPR Table 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 09-2013 RP-61 RP-131281 1734 CR on applicability of CA sustained data rate tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1759r Correction of the CA capabilities for the soft buffer tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1765 UE REFSENS when supporting intra-band CA and interband CA 10.12 09-2013 RP-61 RP-131279 1770 Corrections to sustained data rate test (Rel-10) 10.12 09-2013 RP-61 RP-131280 1774 Corrections to sustained data rate test (Rel-10)	06-2013	RP-60	RP-130767		CR on the bandwidth coverage issue of CA	10.11.0
06-2013 RP-60 RP-130767 1702 CR on the bandwidth coverage issue of CA CQI performance(Rel-10) 10.11 06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130770 1708 Corrections for co-existence(Rel-10) 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 09-2013 RP-61 RP-131281 1734 CR on applicability of CA sustained data rate tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1737 Correction of the CA capabilities for the soft buffer tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1759r Correction of the missing frequency range for B7 UE coexistence requirements in R10 10.12 09-2013 RP-61 RP-131281 1765 UE REFSENS when supporting intra-band CA and interband CA 10.12 09-2013 RP-61 RP-131280 1774 Corrections to sustained data rate test (Rel-10) 10.12 09-2013 RP-61 RP-131281 1792r Clarification of "multi-cluste	06-2013	RP-60	RP-130765	1696r	Correction on UE maximum output power for intra-band	10.11.0
06-2013 RP-60 RP-130766 1704 Corrections to ACLR for Rel-10 CA 10.11 06-2013 RP-60 RP-130770 1708 Corrections for co-existence(Rel-10) 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 09-2013 RP-61 RP-131281 1734 CR on applicability of CA sustained data rate tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1737 Correction of the CA capabilities for the soft buffer tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1759r Correction of the missing frequency range for B7 UE coexistence requirements in R10 10.12 09-2013 RP-61 RP-131281 1765 UE REFSENS when supporting intra-band CA and interband CA 10.12 09-2013 RP-61 RP-131279 1770 Correlation matrix for high speed train demodulation scenarios (Rel-10) 10.12 09-2013 RP-61 RP-131280 1774 Corrections to sustained data rate test (Rel-10) 10.12 09-2013 RP-61 RP-131281 1792r Clarification of "multi	06-2013	RP-60	RP-130767		CR on the bandwidth coverage issue of CA CQI	10.11.0
06-2013 RP-60 RP-130770 1708 Corrections for co-existence(Rel-10) 10.11 06-2013 RP-60 RP-130765 1715 Corrections to NS_11 A-MPR Table 10.11 09-2013 RP-61 RP-131281 1734 CR on applicability of CA sustained data rate tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1737 Correction of the CA capabilities for the soft buffer tests (Rel-10) 10.12 09-2013 RP-61 RP-131281 1759r Correction of the missing frequency range for B7 UE coexistence requirements in R10 10.12 09-2013 RP-61 RP-131281 1765 UE REFSENS when supporting intra-band CA and interband CA 09-2013 RP-61 RP-131279 1770 Correlation matrix for high speed train demodulation scenarios (Rel-10) 10.12 09-2013 RP-61 RP-131280 1774 Corrections to sustained data rate test (Rel-10) 10.12 09-2013 RP-61 RP-131281 1792r Clarification of "multi-cluster" transmission 10.12	06 2042	DD CO	DD 420700	1704		10 11 0
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Scenarios (Rel-10) 09-2013 RP-61 RP-131280 1774 Corrections to sustained data rate test (Rel-10) 10.12 09-2013 RP-61 RP-131281 1792r Clarification of "multi-cluster" transmission 10.12					band CA	10.12.0
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					Corrections to sustained data rate test (Rel-10)	10.12.0
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	09-2013	RP-61	RP-131281	1798r	CA UE Coexistence Table update (Release 10)	10.12.0
	09-2013	RP-61	RP-131281		Incorrect REFSENS UL allocation for CA 1C	10.12.0
						10.12.0
09-2013 RP-61 RP-131281 1817 Correction to Rel-10 A-MPR for CA_NS_04: This CR is NOT implemented as it is based on a wrong					Correction to Rel-10 A-MPR for CA_NS_04: This	

	1	1		version of the Spec	1
09-2013	RP-61	RP-131281	1818r	The Pcmax clauses restructured	10.12.0
			1		
12-2013	RP-62	RP-131928	1845r 1	Corrections to the notes in the band UE co-existence requirements table (Rel-10)	10.13.0
12-2013	RP-62	RP-131924	1850	Clean-up of uplink reference measurement channels (Rel-10)	10.13.0
12-2013	RP-62	RP-131928	1875r 2	Intraband CA channel bandwidth combination table restructuring	10.13.0
12-2013	RP-62	RP-131926	1902	Correction on the UE category for elCIC CQI test	10.13.0
12-2013	RP-62	RP-131928	1914r 2	Allowed power reductions for multiple transmissions in a subframe	10.13.0
12-2013	RP-62	RP-131927	1920	CR on correction of FRC of power imbalance test	10.13.0
12-2013	RP-62	RP-131927	1935	UE-UE coexistence for Band 40	10.13.0
12-2013	RP-62	RP-131927	1943	CR Removing Addition of DTc to P-MPR	10.13.0
12-2013	RP-62	RP-131928	1982r 1	Correction to blocking requirements and use of Delta_Rib	10.13.0
12-2013 12-2013	RP-62 RP-62	RP-131924 RP-131928	2012 2033r	P-max for Band 38 to Band 7 coexistence Nominal guard bands for CA bandwidth classes A and C	10.13.0 10.13.0
12-2013	KF-02	KF-131920	1	Norminal guard bands for CA bandwidth classes A and C	10.13.0
12-2013	RP-62	RP-131926	2038	CA_1C: Correction on CA_NS_02 A-MPR table	10.13.0
12-2013	RP-62	RP-131924	2063	Simplification of Band 12/17 in-band blocking test cases CR was not implemented as it was not based on the	10.13.0
			_	latest version of the spec	
03-2014 03-2014	RP-63 RP-63	RP-140368 RP-140368	2090 2087r	CR for structure change of CA soft buffer tests in Rel-10 CR for introduction of15MHz based SDR tests and test	10.14.0 10.14.0
			1	point table in Rel-10	
03-2014	RP-63	RP-140368	2145	Correction of coding rate for 18RBs in UL RMC table	10.14.0
03-2014	RP-63 RP-63	RP-140368 RP-140368	2135 2120	Configured transmitted power for CA CR for 36.101. Editorial correction on OCNG pattern	10.14.0 10.14.0
06-2014	RP-64	RP-140911	2231	Clarification of Intra-band contiguous CA class C Narrow	10.14.0
06-2014	RP-64	RP-140911	2267r	band blocking requirements	10.15.0
			1	Additional correction to In-band blocking case nubering re-establisment	
06-2014	RP-64	RP-140909	2300r 3	RF: Corrections to spurious emission requirements with NS different than NS_01 (Rel-10)	10.15.0
06-2014	RP-64	RP-140911	2312r 2	UE to UE co-existence between B42/B43	10.15.0
06-2014	RP-64	RP-140911	2316	Perf: Corrections to CA (Class C) performance with power imbalance (Rel-10)	10.15.0
06-2014	RP-64	RP-140911	2326	Clean-up CR for demodulation requirements (Rel-10)	10.15.0
06-2014	RP-64	RP-140911	2331	Throughput calculation for elCIC demodulation requirements	10.15.0
06-2014	RP-64	RP-140911	2339	Cleanup of terminology for Rx requirements	10.15.0
06-2014	RP-64	RP-140911	2342	CR on separating CA UE demodulation tests from single carrier tests in Rel-10	10.15.0
06-2014	RP-64	RP-140911	2345	CR on correction on CA capability in Rel-10	10.15.0
06-2014	RP-64	RP-140911	2349	Test configuration for intra-band contiguous carrier aggregation power control	10.15.0
06-2014	RP-64	RP-140911	2363	Clarification on CA bandwidth classes	10.15.0
06-2014 06-2014	RP-64 RP-64	RP-140911 RP-140911	2364	Clarification on CA bandwidth classes Clarification on CA bandwidth classes	10.15.0 10.15.0
06-2014	RP-64	RP-140911	2365 2375	Corrections on CA CQI tests	10.15.0
06-2014	RP-64	RP-140911	2389	CR on PDSCH transmission for elCIC CSI requirements (Rel-10)	10.15.0
06-2014	RP-64	RP-140911	2426	Simplification of Band 12/17 in-band blocking test cases	10.15.0
09-2014	RP-65	RP-141525	2502	Perf: Cleanup and better description of DL-RMC-s with dynamic coding rate for CSI requirements (Rel-10)	10.16.0
09-2014	RP-65	RP-141525	2563	Corrections to UE coex table	10.16.0
09-2014	RP-65	RP-141527	2432	Correction on support of a bandwidth combination set	10.16.0
09-2014	RP-65	RP-141527	2451	Remove the invalid TDD single-antenna test and maintenance of applicability table for CA sustained data rate test (Rel-10)	10.16.0
09-2014	RP-65	RP-141527	2464	Unequal DL CC RB allocations in Maximum input level	10.16.0
09-2014	RP-65	RP-141527	2467	Intra-band contiguous CA ACS case 2 test clarification	10.16.0
09-2014	RP-65	RP-141527	2476	CQI reporting under fading: CQI indices in set	10.16.0
09-2014	RP-65	RP-141527	2482r 1	Corrections on delta Tc for UE MOP for intra-band contiguous CA	10.16.0
09-2014	RP-65	RP-141527	2485	Removal of Class B in UE TX requirement	10.16.0
09-2014	RP-65	RP-141527	2514r 1	CR for CA applicability rule in 36.101 in Rel-10	10.16.0
09-2014	RP-65	RP-141527	2517	Editorial CR for CA performance tests in 36.101 in Rel-	10.16.0
09-2014	RP-65	RP-141527	2520	CR on CA power imbalance tests in Rel-10	10.16.0

00.0044	DD CE	DD 444507	0540	Correction to NC 20 A MDD for Donal 22	40.40.0
09-2014	RP-65	RP-141527	2546	Correction to NS_20 A-MPR for Band 23	10.16.0
12-2014	RP-66	RP-142144	2577	Correction on out-of-band blocking for intra-band CA	10.17.0
12-2014	RP-66	RP-142142	2585	CR for 1 PRB allocation performance in presence of MBSFN (rel-10)	10.17.0
12-2014	RP-66	RP-142144	2588	Maintenance of CA demodulation performance requirements (Rel-10)	10.17.0
12-2014	RP-66	RP-142144	2635	Defintion of the bits in the bitmap for indication of modified MPR behavior	10.17.0
12-2014	RP-66	RP-142147	2618r 1	CQI reporting in AWGN: CQI indices in set	10.17.0
12-2014	RP-66	RP-142144	2572r 1	CR for REFSENSE in lower SNR and change history	10.17.0
12-2014	RP-66	RP-142144	2686	Removal of bracket for UL MIMO	10.17.0
12-2014	RP-66	RP-142144	2698	Delete the incorrect notes for FDD DMRS demodulation tests (Rel-10)	10.17.0
12-2014	RP-66	RP-142144	2718	Band 22 correction in UE to UE co-existance table.	10.17.0
12-2014	RP-66	RP-142144	2748	Correction to Transmit Modulation Quality for CA	10.17.0
12-2014	RP-66	RP-142144	2674r	CR to remove CA capability column in CA performance	10.17.0
12-2014	RP-66	RP-142144	1 2725r	test tables (Rel-10) CR for CA applicability rule in 36.101 in Rel-10	10.17.0
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12-2014	RP-66	RP-142144	2708r 1	Clarification of UL and DL CA configuration	10.17.0
12-2014	RP-66	RP-142144	2715r 1	Clarification of notes relating to interferer offsets in intrabnd CA receiver requirement tables.	10.17.0
12-2014	RP-66	RP-142144	2756	Correction to Note 2 of Harmonic Signal Exceptions in Spurious Emissions	10.17.0
12-2014	RP-66	RP-142144	2749r 1	Removal of brackets and TBD from CA feature	10.17.0
12-2014	RP-66	RP-142144	2695r	Maintenance of CA performance requirements (Rel-10)	10.17.0
12-2014	RP-66	RP-142144	2702r 2	UE to UE co-existence between B42/B43	10.17.0
03-2015	RP-67	RP-150382	2795	UL HARQ in PDSCH and PDCCH/PCFICH demod test cases for elCIC with MBSFN ABS	10.18.0
03-2015	RP-67	RP-150382	2798	Correction to eICIC aggressor cell configurations	10.18.0
03-2015	RP-67	RP-150382	2803	Removal of eDL-MIMO term from specification	10.18.0
03-2015	RP-67	RP-150382	2817	UE to UE co-existence between B42/B43	10.18.0
03-2015	RP-67	RP-150382	2820	Corrections to CA in-band emissions requirement	10.18.0
03-2015	RP-67	RP-150381	2828	Uplink RMCs for sustained data rate test	10.18.0
03-2015	RP-67	RP-150382	2831	Corrections to the CA power imbalance test	10.18.0
03-2015	RP-67	RP-150392	2840	Editorial CR for CA UE performance tests in 36.101 in Rel-10	10.18.0
02 2015	RP-67	RP-150382	2845	UE spurious emissions structure correction for CA	10.18.0
03-2015 03-2015	RP-67	RP-150382	2848r	Removal of Pcmax requirements for UL inter-band CA in	10.18.0
			1	early release	
07-2015	RP-68	RP-150954	2868	Intra-band contiguous CA reference sensitivity definition for Class D	10.19.0
07-2015	RP-68	RP-150954	2899	UE to UE co-existence between B42/B43	10.19.0
07-2015	RP-68	RP-150954	2929r 1	3.5 GHz out-of-band blocking	10.19.0
07-2015	RP-68	RP-150958	2945	Updates to the definitions of CA capability (Rel-10)	10.19.0
07-2015	RP-68	RP-150954	2954r 1	NS value for intra-band contiguous CA configurations not allowed A-MPR	10.19.0
07-2015	RP-68	RP-150954	2969r 1	Corrections to NS_22 and NS_23	10.19.0
07-2015	RP-68	RP-150954	2990	Clarification to spurious emission requirement for the edge of spurious domain	10.19.0
07-2015	RP-68	RP-150958	3000	CR for updating CA applicability rule in 36.101 in Rel-10	10.19.0
07-2015	RP-68	RP-150954	3014r	Clarification to Inter-band CA test configuration	10.19.0
07-2015	RP-68	RP-150954	3015	requirement EVM for Intra-band contiguous UL CA for non-equal	10.19.0
09-2015	RP-69	RP-151475	3037	Channel BWs Correction to RI test parameters in TS 36.101 (Rel-10)	10.20.0
09-2015	RP-69	RP-151483	3047	UE co-existence requirements between Band 42 and Japanese bands	10.20.0
09-2015	RP-69	RP-151475	3073	Correction to PDCCH/PCFICH test parameters in TS 36.101 (Rel-10)	10.20.0
09-2015	RP-69	RP-151475	3077	Correction to PMI delay in PMI test for TDD	10.20.0
09-2015	RP-69	RP-151475	3099	Correction to Pivil delay in Pivil test for TBB Correction on UE maximum output power class of Band	10.20.0
				22 for UL MIMO	
09-2015	RP-69	RP-151475	3162	Correction of applicability of CA_NS_31	10.20.0
12-2015	RP-70	RP-152131	3168a	Corrections to applicability of CSI requirements for low UE categories (Rel-10)	10.21.0

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12-2015	RP-70	RP-152130	3229			Correction to reference channel for CQI requirements	10.21.0
12-2015	RP-70	RP-152131	3266r			Clarification of Pcell support in 36.101 Rel-11 in CA	10.21.0
			1			scenarios	
12-2015	RP-70	RP-152131	3282			Missing RB allocation and OCNG Pattern for Cat 1 UEs	10.21.0
						in Multiple PMI CSI Reference Symbol tests	
03/2016	RP-71	RP-160487	3470		D	CR of editorial change on PHICH group and Ng in Rel-	10.22.0
22/22/2	55.51	DD 40040=				FD 1 (2) NO 25 NO 11 (DIVO 11 1 1 1 1	
03/2016	RP-71	RP-160487	3400	1	F	[Rel-10] NS_05 modification for PHS protection in Japan	10.22.0
09/2016	RP-73	RP-161632	3652		F	Improving the single antenna port description in UL-	10.23.0
						MIMO clauses	
09/2016	RP-73	RP-161632	3795		F	Correction of OCNG (Rel-10)	10.23.0
12/2016	RP-74	RP-162411	4018		F	RMCs and applicabilility of core RF requirements	10.24.0
12/2016	RP-74	RP-162411	4027		F	Correction of spurious emissions requirements for Band	10.24.0
						9 range and intra-band CA	
12/2016	RP-74	RP-162406	4098		F	Versioning indicator bit for NS_04 A-MPR table	10.24.0
01/2017	RP-74					Update of the page header information	10.24.1
09/2017	RP-77	RP-171965	4519	2	F	Correction of band 43 spurious emissions limit (Rel-10)	10.25.0
09/2017	RP-77	RP-171964	4593		Α	Correction for EPA delay profiles of r.m.s delay spread	10.25.0
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History

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V10.7.0	July 2012	Publication				
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