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TECHNICAL SPECIFICATION

**LTE;  
Evolved Universal Terrestrial Radio Access (E-UTRA);  
FDD repeater radio transmission and reception  
(3GPP TS 36.106 version 19.1.0 Release 19)**



A GLOBAL INITIATIVE

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**Keywords**

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# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	5
1 Scope .....	6
2 References .....	6
3 Definitions, symbols and abbreviations .....	6
3.1 Definitions .....	6
3.2 Symbols.....	7
3.3 Abbreviations .....	8
4 General .....	8
4.1 Relationship between Minimum Requirements and Test Requirements .....	8
4.2 Regional requirements.....	9
5 Operating bands and channel arrangement.....	10
5.1 General .....	10
5.2 Void.....	11
5.3 Void.....	11
5.4 Void.....	11
5.5 Operating bands.....	11
5.6 Channel bandwidth.....	11
5.7 Channel arrangement.....	12
5.7.1 Channel spacing .....	12
5.7.2 Channel raster .....	12
5.7.3 Carrier frequency and EARFCN.....	12
6 Output power.....	13
6.1 Minimum requirement.....	14
7 Frequency stability .....	14
7.1 Minimum requirement.....	14
8 Out of band gain .....	14
8.1 Minimum requirement.....	14
9 Unwanted emissions.....	16
9.1 Operating band unwanted emissions .....	16
9.1.1 Operating band unwanted emissions (Category A) .....	16
9.1.1.1 Minimum Requirements.....	16
9.1.2 Operating band unwanted emissions (Category B).....	18
9.1.2.1 Minimum Requirement .....	18
9.1.2.1.1 Category B requirements (Option 1) .....	18
9.1.2.1.2 Category B requirements (Option 2) .....	21
9.1.3 Additional requirements .....	22
9.1.4 Protection of the BS receiver in the operating band .....	25
9.1.4.1 Minimum Requirement .....	25
9.2 Spurious emissions .....	26
9.2.1 Mandatory requirements .....	26
9.2.1.1 Spurious emissions (Category A).....	26
9.2.1.1.1 Minimum Requirement .....	26
9.2.1.2 Spurious emissions (Category B).....	27
9.2.1.2.1 Minimum Requirement .....	27
9.2.2 Co-existence with other systems in the same geographical area .....	27
9.2.2.1 Minimum requirement .....	27
9.2.3 Co-location with base stations .....	29
9.2.3.1 Minimum Requirements.....	29

10	Error Vector Magnitude .....	31
10.1	Downlink Error Vector Magnitude.....	31
10.1.1	Minimum requirement .....	31
10.2	Uplink Error Vector Magnitude .....	31
10.2.1	Minimum requirement .....	31
11	Input Intermodulation.....	31
11.1	General requirement .....	31
11.1.1	Minimum requirement .....	31
11.2	Co-location with BS in other systems .....	32
11.2.1	Minimum requirement .....	32
11.3	Co-existence with other systems .....	38
11.3.1	Minimum requirement .....	38
12	Output intermodulation .....	43
12.1	Minimum requirement.....	43
13	Adjacent Channel Rejection Ratio (ACRR).....	45
13.1	Definitions and applicability .....	45
13.1.1	Minimum Requirements .....	45
13.2	Co-existence with UTRA .....	45
13.2.1.	Minimum Requirements .....	45
<b>Annex A (normative):</b>	<b>Environmental requirements for the Repeater equipment.....</b>	<b>46</b>
<b>Annex B (informative):</b>	<b>Change history .....</b>	<b>47</b>
History .....		50

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# Foreword

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# 1 Scope

The present document establishes the minimum RF characteristics of E-UTRA FDD Repeater.

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## 2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] ITU-R Recommendation SM.329, "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 36.143: "Evolved Universal Terrestrial Radio Access (E-UTRA); FDD Repeater conformance testing"
- [5] 3GPP TR 25.942: "RF system scenarios".
- [6] 3GPP TS.36.104: "E-UTRA Base Station (BS) radio transmission and reception".
- [7] IEC 60721-3-3 (2002): "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weather protected locations".
- [8] IEC 60721-3-4 (1995): "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations".
- [9] CEPT ECC Decision (13)03, "The harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)".
- [10] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD)"

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**Carrier:** The modulated waveform conveying the E-UTRA or UTRA physical channels

**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.

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

**Donor coupling loss:** is the coupling loss between the repeater and the donor base station.

**Downlink:** Signal path where base station transmits and mobile receives.

**Downlink operating band:** The part of the operating band designated for downlink.

**Maximum output power, P<sub>max</sub>:** This is the mean power level per carrier measured at the antenna connector of the Repeater in specified reference condition.

**Operating band:** A frequency range in which E-UTRA operates (paired or unpaired), that is defined with a specific set of technical requirements.

NOTE1: The operating band(s) for an E-UTRA Repeater is declared by the manufacturer according to the designations in clause 5.5 table 5.5-1.

NOTE2: Unless specified, operating band refers to the uplink operating band and downlink operating band.

**Output power, P<sub>out</sub>:** This is the mean power of one carrier at maximum repeater gain delivered to a load with resistance equal to the nominal load impedance of the transmitter.

**Pass band:** The frequency range in which the repeater operates in with operational configuration. This frequency range can correspond to one or several consecutive nominal channels. If they are not consecutive each subset of channels shall be considered as an individual pass band. A repeater can have one or several pass bands.

**Rated output power:** Rated output power of the repeater is the mean power level per carrier that the manufacturer has declared to be available at the antenna connector.

**Repeater:** A device that receives, amplifies and transmits the radiated or conducted RF carrier both in the downlink direction (from the base station to the mobile area) and in the uplink direction (from the mobile to the base station) ~~in operating bands with one exclusive link direction, only the dedicated link direction is repeated.~~

In operating bands specified with only down-link or up-link, only the up-link or down-link as specified for the operating band is repeated.

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

**Transmission bandwidth configuration:** The highest transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units.

**Uplink:** Signal path where mobile transmits and base station receives.

**Uplink operating band:** The part of the operating band designated for uplink.

## 3.2 Symbols

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

$BW_{\text{Channel}}$	Channel bandwidth
$BW_{\text{Config}}$	Transmission bandwidth configuration, expressed in MHz, where $BW_{\text{Config}} = N_{\text{RB}} \times 180$ kHz in the uplink and $BW_{\text{Config}} = 15$ kHz + $N_{\text{RB}} \times 180$ kHz in the downlink.
$BW_{\text{Meas}}$	Measurement bandwidth
$BW_{\text{Signal}}$	Bandwidth of the repeater input signal filling the repeater pass band
$F_{\text{DL\_low}}$	The lowest frequency of the downlink operating band
$F_{\text{DL\_high}}$	The highest frequency of the downlink operating band
$F_{\text{filter}}$	Filter centre frequency
$F_{\text{UL\_low}}$	The lowest frequency of the uplink operating band
$F_{\text{UL\_high}}$	The highest frequency of the uplink operating band
$f_{\text{offset\_PB}}$	Distance from the channel edge frequency of the first or last channel in the pass band
$N_{\text{DL}}$	Downlink EARFCN
$N_{\text{Offs-DL}}$	Offset used for calculating downlink EARFCN
$N_{\text{Offs-UL}}$	Offset used for calculating uplink EARFCN
$N_{\text{RB}}$	Transmission bandwidth configuration, expressed in units of resource blocks
$N_{\text{UL}}$	Uplink EARFCN

$P_{EM,B32,ind}$	Declared emission level in Band 32, ind=a, b, c, d, e
$P_{EM,N}$	Declared emission level for channel N
$P_{max}$	Maximum output power
$P_{out}$	Output power

### 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].

ACRR	Adjacent Channel Rejection Ratio
BS	Base Station
DTT	Digital Terrestrial Television
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EIRP	Effective Isotropic Radiated Power
EVM	Error Vector Magnitude
IDFT	Inverse Discrete Fourier Transform
PB	Pass Band
TBD	To Be Defined

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## 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 36.143 [4] Annex B 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 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements or set by local and regional regulation as mandatory requirements. It is normally not stated in the 3GPP specifications under what exact circumstances that the requirements apply, since this is defined by local or regional regulation.

Table 4.2-1 lists all requirements that may be applied differently in different regions.

**Table 4.2-1: List of regional requirements**

Clause number	Requirement	Comments
5.5	Operating bands	Some bands may be applied regionally.
5.6	Channel bandwidth	Some channel bandwidths may be applied regionally.
5.7	Channel arrangement	The requirement is applied according to what operating bands in clause 5.5 that are supported by the Repeater.
6.1	Maximum output power	In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.
9.1.1.1	Operating band unwanted emissions (Category A)	This requirement is mandatory for regions where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [2] apply.
9.1.2.1	Operating band unwanted emissions (Category B)	This requirement is mandatory for regions where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [2], apply.
9.1.3	Operating band unwanted emissions : Additional requirements	These requirements may be applied regionally for some operating bands.
9.2.1.1	Spurious emissions (Category A)	This requirement is mandatory for regions where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [2] apply.
9.2.1.2	Spurious emissions (Category B)	This requirement is mandatory for regions where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [2], apply.
9.2.2	Spurious emissions: Co-existence with other systems in the same geographical area	These requirements may apply in geographic areas in which both E-UTRA –FDD repeater and a system operating in another frequency band are deployed.
9.2.3	Spurious emissions: Co-location with base stations	These requirements may be applied for the protection of other BS receivers when a BS operating in another frequency band is co-located with an E-UTRA-FDD repeater.
11.2	Input Intermodulation: Co-location with BS in other systems	These requirements may be applied for the protection of FDD Repeater input when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS are co-located with an E-UTRA FDD Repeater.
11.3	Input Intermodulation: Co-existence with other systems	These requirements may be applied when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS operating in another frequency band co-exist with an E-UTRA FDD Repeater

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## 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 FDD is designed to operate in the operating bands defined in Table 5.5-1.

**Table 5.5-1 E-UTRA operating bands**

E-UTRA operating band	Uplink (UL) operating band		Downlink (DL) operating band		Duplex Mode
	F <sub>UL_low</sub>	F <sub>UL_high</sub>	F <sub>DL_low</sub>	F <sub>DL_high</sub>	
1	1920 MHz	1980 MHz	2110 MHz	2170 MHz	FDD
2	1850 MHz	1910 MHz	1930 MHz	1990 MHz	FDD
3	1710 MHz	1785 MHz	1805 MHz	1880 MHz	FDD
4	1710 MHz	1755 MHz	2110 MHz	2155 MHz	FDD
5	824 MHz	849 MHz	869 MHz	894 MHz	FDD
6 (NOTE 1)	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	698 MHz	716 MHz	728 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		
16	Reserved		Reserved		
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	FDD
20	832 MHz	862 MHz	791 MHz	821 MHz	FDD
21	1447.9 MHz	1462.9 MHz	1495.9 MHz	1510.9 MHz	FDD
22	3410 MHz	3490 MHz	3510 MHz	3590 MHz	FDD
23	2000 MHz	2020 MHz	2180 MHz	2200 MHz	FDD
24	1626.5 MHz	1660.5 MHz	1525 MHz	1559 MHz	FDD
25	1850 MHz	1915 MHz	1930 MHz	1995 MHz	FDD
26	814 MHz	849 MHz	859 MHz	894 MHz	FDD
27	807 MHz	824 MHz	852 MHz	869 MHz	FDD
28	703 MHz	748 MHz	758 MHz	803 MHz	FDD
29	N/A		717 MHz	728 MHz	FDD
30	2305 MHz	2315 MHz	2350 MHz	2360 MHz	FDD
31	452.5 MHz	457.5 MHz	462.5 MHz	467.5 MHz	FDD
32	N/A		1452 MHz	1496 MHz	FDD
72	451 MHz	456 MHz	461 MHz	466 MHz	FDD

Note 1: Band 6 is not applicable.

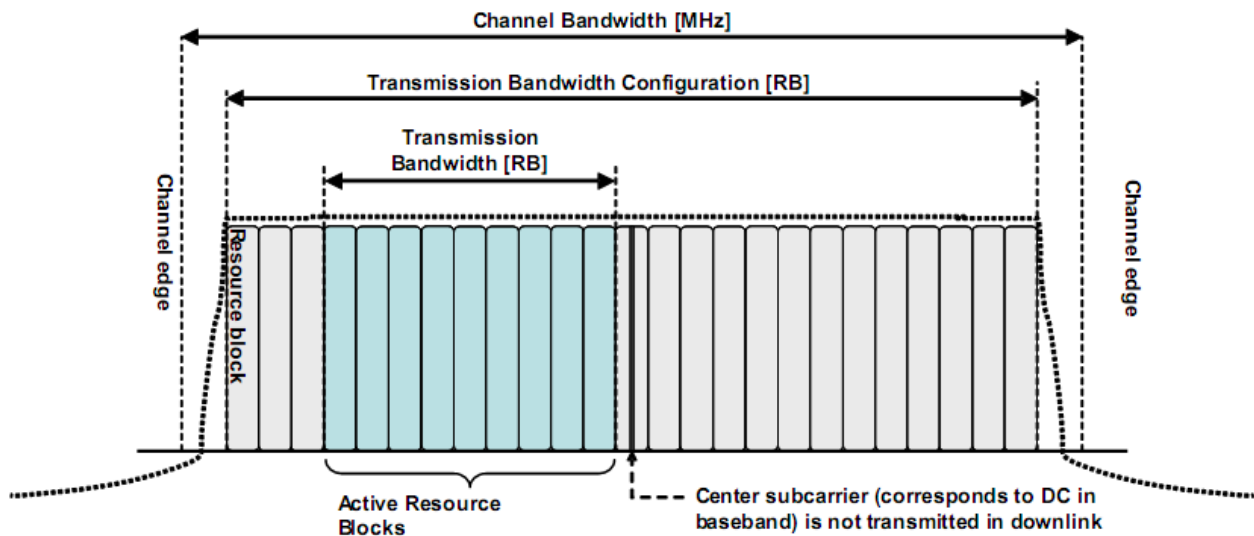
## 5.6 Channel bandwidth

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 $BW_{Channel}$ [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  $F_C \pm BW_{Channel}/2$ .



**Figure 5.6-1 Definition of Channel Bandwidth and Transmission Bandwidth Configuration for one E-UTRA carrier**

## 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:

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

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.

### 5.7.2 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.

### 5.7.3 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  $N_{Off-DL}$  are given in table 5.7.3-1 and  $N_{DL}$  is the downlink EARFCN.

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

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.

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

**Table 5.7.3-1 E-UTRA channel numbers**

E-UTRA operating band	Downlink			Uplink		
	$F_{DL\_low}$ [MHz]	$N_{Offs-DL}$	Range of $N_{DL}$	$F_{UL\_low}$ [MHz]	$N_{Offs-UL}$	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 – 4999	1427.9	22750	22750 – 22999
12	728	5000	5000 – 5179	698	23000	23000 – 23179
13	746	5180	5180 – 5279	777	23180	23180 – 23279
14	758	5280	5280 – 5379	788	23280	23280 – 23379
15	Reserved			Reserved		
16	Reserved			Reserved		
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
26	859	8690	8690 – 9039	814	26690	26690 - 27039
27	852	9040	9040 – 9209	807	27040	27040 – 27209
28	758	9210	9210 – 9659	703	27210	27210 – 27659
29	717	9660	9660 – 9769	N/A		
30	2350	9770	9770 – 9869	2305	27660	27660 – 27759
31	462.5	9870	9870 – 9919	452.5	27760	27760 – 27809
32	1452	9920	9920 – 10359	N/A		
72	461	68936	68936-68985	451	133472	133472-133521

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.

## 6 Output power

Output power,  $P_{out}$ , of the repeater is the mean power of one carrier at maximum repeater gain delivered to a load with resistance equal to the nominal load impedance of the transmitter.

Maximum output power,  $P_{max}$ , of the repeater is the mean power level per carrier measured at the antenna connector in a specified reference condition.

## 6.1 Minimum requirement

The requirements shall apply at maximum gain, with E-UTRA signals in the pass band of the repeater, at levels that produce the maximum rated output power per channel.

When the power of all signals is increased by 10 dB, compared to the power level that produce the maximum rated output power, the requirements shall still be met.

In normal conditions, the Repeater maximum output power shall remain within limits specified in Table 6.1-1 relative to the manufacturer's rated output power.

**Table 6.1-1: Repeater output power; normal conditions**

Rated output power	Limit
$P \geq 31$ dBm	+2 dB and -2 dB
$P < 31$ dBm	+3 dB and -3 dB

In extreme conditions, the Repeater maximum output power shall remain within the limits specified in Table 6.1-2 relative to the manufacturer's rated output power.

**Table 6.1-2: Repeater output power; extreme conditions**

Rated output power	Limit
$P \geq 31$ dBm	+2,5 dB and -2,5 dB
$P < 31$ dBm	+4 dB and -4 dB

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the ranges of conditions defined as normal.

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## 7 Frequency stability

Frequency stability is the ability to maintain the same frequency on the output signal with respect to the input signal.

### 7.1 Minimum requirement

The frequency deviation of the output signal with respect to the input signal shall be no more than  $\pm 0,01$  PPM.

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## 8 Out of band gain

Out of band gain refers to the gain of the repeater outside the pass band.

### 8.1 Minimum requirement

The intended use of a repeater in a system is to amplify the in band signals and not to amplify the out of band emission of the donor base station.

In the intended application of the repeater, the out of band gain is less than the donor coupling loss.

The repeater minimum donor coupling loss shall be declared by the manufacturer. This is the minimum required attenuation between the donor BS and the repeater for proper repeater operation.

The gain outside the pass band shall not exceed the maximum level specified in table 8.1-1, where:

- $f_{\text{offset\_CW}}$  is the offset between the outer channel edge frequency of the outer channel in the pass band and a CW signal.

**Table 8.1-1: Out of band gain limits 1**

Frequency offset, $f_{\text{offset\_CW}}$	Maximum gain
$0,2 \leq f_{\text{offset\_CW}} < 1,0$ MHz	60 dB
$1,0 \leq f_{\text{offset\_CW}} < 5,0$ MHz	45 dB
$5,0 \leq f_{\text{offset\_CW}} < 10,0$ MHz	45 dB
$10,0 \text{ MHz} \leq f_{\text{offset\_CW}}$	35 dB

For  $10,0 \text{ MHz} \leq f_{\text{offset\_CW}}$  the out of band gain shall not exceed the maximum gain of table 8.1-2 or the maximum gain stated in table 8.1-1 whichever is lower.

**Table 8.1-2: Out of band gain limits 2**

Frequency offset, $f_{\text{offset\_CW}}$	Maximum gain
$10 \text{ MHz} \leq f_{\text{offset\_CW}}$	Out of band gain $\leq$ minimum donor coupling loss

## 9 Unwanted emissions

Unwanted emissions consist of out-of-band emissions and spurious emissions [2]. Out of band emissions are unwanted emissions immediately outside the pass band bandwidth resulting from the modulation process and non-linearity in the transmitter, but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The out-of-band emissions requirement for repeater is specified both in terms operating band unwanted emissions and protection of the BS receiver in the uplink operating band. The Operating band unwanted emissions define all unwanted emissions in the repeater operating band plus the frequency ranges 10 MHz above and 10 MHz below that band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

### 9.1 Operating band unwanted emissions

The Operating band unwanted emission limits are defined from 10 MHz below the lowest frequency of the repeater operating band up to 10 MHz above the highest frequency of the repeater operating band.

The requirements shall apply whatever the type of repeater considered (single carrier or multi-carrier) and for all configurations foreseen by the manufacturer's specification.

Emissions shall not exceed the maximum levels specified in the tables below, where:

- $\Delta f$  is the separation between the nominal pass band edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency.
- $BW_{\text{Meas}}$  is the measurement bandwidth.
- $BW_{\text{Pass band}}$  is the bandwidth of the repeater' s pass band.
- $f_{\text{offset}}$  is the separation between the nominal pass band edge frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\text{max}}}$  is the offset to the frequency 10 MHz outside the repeater operating band.
- $\Delta f_{\text{max}}$  is equal to  $f_{\text{offset}_{\text{max}}}$  minus half of the bandwidth of the measuring filter.

The requirements of either subclause 9.1.1 (Category A limits) or subclause 9.1.2 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for spurious emissions (Mandatory Requirements) in subclause 9.2.1.

The Additional operating band unwanted emission limits defined in subclause 9.1.3 below may be mandatory in certain regions. In other regions it may not apply.

Unless otherwise stated, all requirements are measured as mean power (RMS).

#### 9.1.1 Operating band unwanted emissions (Category A)

##### 9.1.1.1 Minimum Requirements

This requirement applies to the uplink and downlink of the repeater, at maximum gain, and with the following input signals:

- without E-UTRA input signal
- with E-UTRA input signals in the pass band of the repeater, at levels that produce the maximum rated power output per channel
- with 10 dB increased E-UTRA input signals in all channels in the pass band, compared to the input level producing the maximum rated output power.

For E-UTRA FDD repeater operating in Bands 5, 6, 8, 12, 13, 14, 17, 18, 19, 26, 27, 28, 29, 31 and 72 emissions shall not exceed the maximum levels specified in Tables 9.1.1.1-1 and 9.1.1.1-2.

**Table 9.1.1.1-1: General operating band unwanted emission limits for repeater pass band bandwidth lower than 5 MHz (E-UTRA bands <1GHz) for Category A**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth
0 MHz ≤ Δf < BW <sub>Pass band</sub>	BW <sub>Meas</sub> /2 ≤ f_offset < BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}\left[-2.1875 * BW_{Passband} + 2.0625; -1.25 * BW_{Passband} - 0.75\right]dB + \frac{\text{Max}\left[-10; BW_{Passband} - 12\right]}{BW_{Passband}} * \left(f\_offset - \frac{BW_{meas}}{2}\right)dB$	100 kHz
BW <sub>Pass band</sub> ≤ Δf < 2*BW <sub>Pass band</sub>	BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < 2* BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}\left[-1.43 * BW_{Passband} - 9.0; -0.45 * BW_{Passband} - 11.73\right]dBm$	100 kHz
2*BW <sub>Pass band</sub> ≤ Δf ≤ Δf <sub>max</sub>	2* BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < f_offset <sub>max</sub>	-13 dBm	100 kHz

Note: Frequencies and bandwidth are given in MHz.

**Table 9.1.1.1-2: General operating band unwanted emission limits for repeater pass band bandwidth 5 MHz and above (E-UTRA bands <1GHz) for Category A**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (Note 1)
0 MHz ≤ Δf < 5 MHz	0.05 MHz ≤ f_offset < 5.05 MHz	$-7dBm - \frac{7}{5} * \left(\frac{f\_offset}{MHz} - 0.05\right)dB$	100 kHz
5 MHz ≤ Δf < 10 MHz	5.05 MHz ≤ f_offset < 10.05 MHz	-14 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf <sub>max</sub>	10.05 MHz ≤ f_offset < f_offset <sub>max</sub>	-13 dBm	100 kHz

Note: Frequencies and bandwidth are given in MHz.

For E-UTRA FDD repeaters operating in Bands 1, 2, 3, 4, 7, 9, 10, 11, 21, 22, 23, 24, 25, 30, and 32, emissions shall not exceed the maximum levels specified in Tables 9.1.1.1-3 and 9.1.1.1-4:

**Table 9.1.1.1-3: General operating band unwanted emission limits for repeater pass band bandwidth lower than 5 MHz (E-UTRA bands >1GHz) for Category A**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth
0 MHz ≤ Δf < BW <sub>Pass band</sub>	BW <sub>Meas</sub> /2 ≤ f_offset < BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}\left[-2.5 * BW_{Passband} + 2.5; -1 * BW_{Passband} - 2\right]dBm + \frac{\text{Max}\left[-10; 1.5 * BW_{Passband} - 14.5\right]}{BW_{Passband}} * \left(f\_offset - \frac{BW_{meas}}{2}\right)dB$	100 kHz
BW <sub>Pass band</sub> ≤ Δf < 2*BW <sub>Pass band</sub>	BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < 2* BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}\left[-2.5 * BW_{Passband} - 7.5; 0.5 * BW_{Passband} - 16.5\right]dBm$	100 kHz
2*BW <sub>Pass band</sub> ≤ Δf ≤ Δf <sub>max</sub>	2* BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < f_offset <sub>max</sub>	-13 dBm	1MHz

Note: Frequencies and bandwidth are given in MHz.

**Table 9.1.1.1-4: General operating band unwanted emission limits for repeater pass band bandwidth 5 MHz and above (E-UTRA bands >1GHz) for Category A**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth (Note 1)
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 5.05 \text{ MHz}$	$-7 \text{ dBm} - \frac{7}{5} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$5.05 \text{ MHz} \leq f_{\text{offset}} < 10.05 \text{ MHz}$	-14 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10.5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-13 dBm	1MHz

Note: Frequencies and bandwidth are given in MHz.

## 9.1.2 Operating band unwanted emissions (Category B)

### 9.1.2.1 Minimum Requirement

For Category B Operating band unwanted emissions, there are two options for the limits that may be applied regionally. Either the limits in subclause 9.1.2.1.1 or subclause 9.1.2.1.2 shall be applied.

This requirement applies to the uplink and downlink of the repeater, at maximum gain, and with the following input signals:

- without E-UTRA input signal
- with E-UTRA input signals in the pass band of the repeater, at levels that produce the maximum rated power output per channel
- with 10 dB increased E-UTRA input signals in all channels in the pass band, compared to the input level producing the maximum rated output power.

#### 9.1.2.1.1 Category B requirements (Option 1)

For E-UTRA FDD repeater operating in Bands 5, 6, 8, 12, 13, 14, 17, 20, 26, 27, 28, 29, 31 and 72 emissions shall not exceed the maximum levels specified in Tables 9.1.2.1.1-1 and 9.1.2.1.1-2:

**Table 9.1.2.1.1-1: General operating band unwanted emission limits for repeater pass band bandwidth lower than 5 MHz (E-UTRA bands <1GHz) for Category B**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < \text{BW}_{\text{Pass band}}$	$\text{BW}_{\text{Meas}}/2 \leq f_{\text{offset}} < \text{BW}_{\text{Pass band}} + \text{BW}_{\text{Meas}}/2$	$\text{Max}[-2.5 * \text{BW}_{\text{Passband}} + 2.5; -1 * \text{BW}_{\text{Passband}} - 2] \text{ dBm} + \frac{\text{Max}[-10; 1.5 * \text{BW}_{\text{Passband}} - 14.5]}{\text{BW}_{\text{Passband}}} * \left( f_{\text{offset}} - \frac{\text{BW}_{\text{meas}}}{2} \right) \text{ dB}$	100 kHz
$\text{BW}_{\text{Pass band}} \leq \Delta f < 2 * \text{BW}_{\text{Pass band}}$	$\text{BW}_{\text{Pass band}} + \text{BW}_{\text{Meas}}/2 \leq f_{\text{offset}} < 2 * \text{BW}_{\text{Pass band}} + \text{BW}_{\text{Meas}}/2$	$\text{Max}[-2.5 * \text{BW}_{\text{Passband}} - 7.5; 0.5 * \text{BW}_{\text{Passband}} - 16.5] \text{ dBm}$	100 kHz
$2 * \text{BW}_{\text{Pass band}} \leq \Delta f \leq \Delta f_{\text{max}}$	$2 * \text{BW}_{\text{Pass band}} + \text{BW}_{\text{Meas}}/2 \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-16 dBm	100 kHz

NOTE 1: Frequencies and bandwidth are given in MHz.

NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-3 supersedes Table 9.1.2.1.1-1 and Table 9.1.2.1.1-2 for applicable frequency offsets.

NOTE 3: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-4 supersedes Table 9.1.2.1.1-1 and Table 9.1.2.1.1-2 for applicable frequency offsets.

**Table 9.1.2.1.1-2: General operating band unwanted emission limits for repeater pass band bandwidth 5 MHz and above (E-UTRA bands <1GHz) for Category B**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth (Note 1)
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 5.05 \text{ MHz}$	$-7 \text{ dBm} - \frac{7}{5} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$5.05 \text{ MHz} \leq f_{\text{offset}} < 10.05 \text{ MHz}$	-14 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10.05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset,max}}$	-16 dBm	100 kHz

NOTE 1: Frequencies and bandwidth are given in MHz.  
 NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-3 supersedes Table 9.1.2.1.1-1 and Table 9.1.2.1.1-2 for applicable frequency offsets.  
 NOTE 3: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-4 supersedes Table 9.1.2.1.1-1 and Table 9.1.2.1.1-2 for applicable frequency offsets.

**Table 9.1.2.1.1-3: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 1.4 MHz**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1.05 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 1.1 \text{ MHz}$	$-1 \text{ dBm} - \frac{10}{1.4} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz

Note: Frequencies and bandwidth are given in MHz

**Table 9.1.2.1.1-4: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 3 MHz**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1.05 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 1.1 \text{ MHz}$	$-5 \text{ dBm} - \frac{10}{3} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz

Note: Frequencies and bandwidth are given in MHz

For E-UTRA FDD repeater operating in Bands 1, 2, 3, 4, 7, 9, 10, 22, 25, and 30 emissions shall not exceed the maximum levels specified in Tables 9.1.2.1.1-5 and 9.1.2.1.1-6:

**Table 9.1.2.1.1-5: General operating band unwanted emission limits for repeater pass band bandwidth lower than 5 MHz (E-UTRA bands >1GHz) for Category B**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth
0 MHz ≤ Δf < BW <sub>Pass band</sub>	BW <sub>Meas</sub> /2 ≤ f_offset < BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}[-2.5 * BW_{Passband} + 2.5; -1 * BW_{Passband} - 2] \text{dBm} + \frac{\text{Max}[-10; 1.5 * BW_{Passband} - 14.5]}{BW_{Passband}} * \left( f\_offset - \frac{BW_{meas}}{2} \right) \text{dB}$	100 kHz
BW <sub>Pass band</sub> ≤ Δf < 2 * BW <sub>Pass band</sub>	BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < 2 * BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2	$\text{Max}[-2.5 * BW_{Passband} - 7.5; 0.5 * BW_{Passband} - 16.5] \text{dBm}$	100 kHz
2 * BW <sub>Pass band</sub> ≤ Δf ≤ Δf <sub>max</sub>	2 * BW <sub>Pass band</sub> + BW <sub>Meas</sub> /2 ≤ f_offset < f_offset <sub>max</sub>	-15 dBm	1MHz

NOTE 1: Frequencies and bandwidth are given in MHz.  
 NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-7 supersedes Table 9.1.2.1.1-5 and Table 9.1.2.1.1-6 for applicable frequency offsets.  
 NOTE 3: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-8 supersedes Table 9.1.2.1.1-5 and Table 9.1.2.1.1-6 for applicable frequency offsets.

**Table 9.1.2.1.1-6: General operating band unwanted emission limits for repeater pass band bandwidth 5 MHz and above (E-UTRA bands >1GHz) for Category B**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth (Note 1)
0 MHz ≤ Δf < 5 MHz	0.05 MHz ≤ f_offset < 5.05 MHz	$-7 \text{dBm} - \frac{7}{5} * \left( \frac{f\_offset}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz
5 MHz ≤ Δf < 10 MHz	5.05 MHz ≤ f_offset < 10.05 MHz	-14 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf <sub>max</sub>	10.5 MHz ≤ f_offset < f_offset <sub>max</sub>	-15 dBm	1MHz

NOTE 1: Frequencies and bandwidth are given in MHz.  
 NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-7 supersedes Table 9.1.2.1.1-5 and Table 9.1.2.1.1-6 for applicable frequency offsets.  
 NOTE 3: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.1-8 supersedes Table 9.1.2.1.1-5 and Table 9.1.2.1.1-6 for applicable frequency offsets.

**Table 9.1.2.1.1-7: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 1.4 MHz**

Frequency offset of measurement filter -3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Minimum requirement	Measurement bandwidth
0 MHz ≤ Δf < 1.05 MHz	0.05 MHz ≤ f_offset < 1.1 MHz	$-1 \text{dBm} - \frac{10}{1.4} * \left( \frac{f\_offset}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz

Note: Frequencies and bandwidth are given in MHz

**Table 9.1.2.1.1-8: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 3 MHz**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
0 MHz $\leq \Delta f < 1.05$ MHz	0.05 MHz $\leq f_{\text{offset}} < 1.1$ MHz	$-5\text{dBm} - \frac{10}{3} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz
Note: Frequencies and bandwidth are given in MHz			

**9.1.2.1.2 Category B requirements (Option 2)**

The limits in this subclause are intended for Europe and may be applied regionally for E-UTRA FDD Repeater operating in band 1, 3, 8, and 32.

For E-UTRA FDD repeater operating in Bands 1, 3, 8, and 32, emissions shall not exceed the maximum levels specified in Tables 9.1.2.1.2-1 and 9.1.2.1.2-2:

**Table 9.1.2.1.2-1: General operating band unwanted emission limits for repeater pass band lower than 5 MHz**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
0 MHz $\leq \Delta f < 0.2$ MHz	0.015 MHz $\leq f_{\text{offset}} < 0.215$ MHz	-14 dBm	30 kHz
0.2 MHz $\leq \Delta f < 1$ MHz	0.215 MHz $\leq f_{\text{offset}} < 1.015$ MHz	$-14\text{dBm} - 15 \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.215 \right) \text{dB}$	30 kHz
(Note 3)	1.015 MHz $\leq f_{\text{offset}} < 1.5$ MHz	-26 dBm	30 kHz
1 MHz $\leq \Delta f < 2 \cdot \text{BW}_{\text{Pass band}}$	1.5 MHz $\leq f_{\text{offset}} < 2 \cdot \text{BW}_{\text{Pass band}} + 0.5$ MHz	-13 dBm	1 MHz
$2 \cdot \text{BW}_{\text{Pass band}} \leq \Delta f \leq \Delta f_{\text{max}}$	$2 \cdot \text{BW}_{\text{Pass band}} + 0.5$ MHz $\leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-15 dBm	1 MHz

NOTE 1: Frequencies and bandwidth are given in MHz.

NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz or 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.2-3 supersedes Table 9.1.2.1.2-1 for applicable frequency offsets.

NOTE 3: This frequency range ensures that the range of values of  $f_{\text{offset}}$  is continuous

**Table 9.1.2.1.2-2: General operating band unwanted emission limits for repeater pass band 5 MHz and above**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0.2 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.215 \text{ MHz}$	-14 dBm	30 kHz
$0.2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.215 \text{ MHz} \leq f_{\text{offset}} < 1.015 \text{ MHz}$	$-14 \text{ dBm} - 15 * \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.215 \right) \text{ dB}$	30 kHz
(Note 3)	$1.015 \text{ MHz} \leq f_{\text{offset}} < 1.5 \text{ MHz}$	-26 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$1.5 \text{ MHz} \leq f_{\text{offset}} < 10.5 \text{ MHz}$	-13 dBm	1 MHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10.5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-15 dBm	1 MHz

NOTE 1: Frequencies and bandwidth are given in MHz.

NOTE 2: If the repeater input signal consists of E-UTRA signals with a channel bandwidth of 1.4 MHz or 3 MHz placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in Table 9.1.2.1.2-3 supersedes Table 9.1.2.1.2-2 for applicable frequency offsets.

NOTE 3: This frequency range ensures that the range of values of  $f_{\text{offset}}$  is continuous

**Table 9.1.2.1.2-3: Conditional operating band unwanted emission limits**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0.05 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.065 \text{ MHz}$	$5 \text{ dBm} - 60 \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.015 \right) \text{ dB}$	30 kHz
$0.05 \text{ MHz} \leq \Delta f < 0.15 \text{ MHz}$	$0.065 \text{ MHz} \leq f_{\text{offset}} < 0.165 \text{ MHz}$	$2 \text{ dBm} - 160 \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0.065 \right) \text{ dB}$	30 kHz
$0.15 \text{ MHz} \leq \Delta f < 0.2 \text{ MHz}$	$0.165 \text{ MHz} \leq f_{\text{offset}} < 0.215 \text{ MHz}$	-14 dBm	30 kHz

NOTE: Frequencies and bandwidth are given in MHz.

### 9.1.3 Additional requirements

These requirements may be applied for the protection of other systems operating inside or near the E-UTRA Repeater downlink operating band. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the E-UTRA, or they may be set by local or regional regulation as a mandatory requirement for an E-UTRA operating band. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in subclause 4.2.

In certain regions the following requirement may apply. For E-UTRA FDD repeaters operating in Band 5, 26, 27 or 28, emissions shall not exceed the maximum levels specified in Table 9.1.3-1.

**Table 9.1.3-1: Additional operating band unwanted emission limits for E-UTRA bands <1GHz**

Input signal bandwidth	Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth (Note 1)
1.4 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.005 \text{ MHz} \leq f_{\text{offset}} < 0.995 \text{ MHz}$	-14 dBm	10 kHz
3 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.985 \text{ MHz}$	-13 dBm	30 kHz
5 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.985 \text{ MHz}$	-15 dBm	30 kHz
10 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-13 dBm	100 kHz
15 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-13 dBm	100 kHz
20 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-13 dBm	100 kHz
All	$1 \text{ MHz} \leq \Delta f < \Delta f_{\text{max}}$	$1.05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-13 dBm	100 kHz

In certain regions the following requirement may apply. For E-UTRA FDD repeaters operating in Bands 2, 4, 10, 23, 25, and 30, emissions shall not exceed the maximum levels specified in Table 9.1.3-2.

**Table 9.1.3-2: Additional operating band unwanted emission limits for E-UTRA bands >1GHz**

Input signal bandwidth	Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth (Note 1)
1.4 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.005 \text{ MHz} \leq f_{\text{offset}} < 0.995 \text{ MHz}$	-14 dBm	10 kHz
3 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.985 \text{ MHz}$	-13 dBm	30 kHz
5 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.985 \text{ MHz}$	-15 dBm	30 kHz
10 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-13 dBm	100 kHz
15 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-15 dBm	100 kHz
20 MHz	$0 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0.05 \text{ MHz} \leq f_{\text{offset}} < 0.95 \text{ MHz}$	-16 dBm	100 kHz
All	$1 \text{ MHz} \leq \Delta f < \Delta f_{\text{max}}$	$1.5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-13 dBm	1 MHz

In certain regions the following requirement may apply. For E-UTRA FDD repeaters operating in Bands 12, 13, 14, 17, and 29, emissions shall not exceed the maximum levels specified in Table 9.1.3-3.

**Table 9.1.3-3: Additional operating band unwanted emission limits for E-UTRA (bands 12, 13, 14, 17, and 29)**

Input signal bandwidth	Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth (Note 1)
All	$0 \text{ MHz} \leq \Delta f < 100 \text{ kHz}$	$0.015 \text{ MHz} \leq f_{\text{offset}} < 0.085 \text{ MHz}$	-13 dBm	30 kHz
All	$100 \text{ kHz} \leq \Delta f < \Delta f_{\text{max}}$	$150 \text{ kHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-13 dBm	100 kHz

In certain regions the following requirement may apply for protection of DTT. For E-UTRA Repeater operating in Band 20, the level of emissions in the band 470-790 MHz, measured in an 8MHz filter bandwidth on centre frequencies  $F_{\text{filter}}$  according to Table 9.1.3-3-4, shall not exceed the maximum emission level  $P_{\text{EM,N}}$  declared by the manufacturer. This requirement applies in the frequency range 470-790 MHz even though part of the range falls in the spurious domain.

**Table 9.1.3-4: Declared emissions levels for protection of DTT**

Filter centre frequency, $F_{\text{filter}}$	Measurement bandwidth	Declared emission level [dBm]
$F_{\text{filter}} = 8 \cdot N + 306 \text{ (MHz)};$ $21 \leq N \leq 60$	8 MHz	$P_{\text{EM,N}}$

Note: The regional requirement is defined in terms of EIRP (effective isotropic radiated power), which is dependent on both the repeater emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the repeater needed to verify compliance with the regional requirement. Compliance with the regional requirement can be determined using the method outlined in TS.36.104 [6] Annex G.

This requirement may be applied for the protection in bands adjacent to bands 1, as defined in clause 5.5 in geographic areas in which both an adjacent band service and E-UTRA are deployed.

The requirement applies only to the down-link direction of the repeater.

The power of any spurious emission shall not exceed:

**Table 9.1.3-5 E-UTRA Repeater down-link spurious emissions limits for protection of adjacent band services**

Operating Band	Band	Maximum Level	Measurement Bandwidth	Note
1	2100-2105 MHz	-30 + 3.4 (f - 2100 MHz) dBm	1 MHz	
	2175-2180 MHz	-30 + 3.4 (2180 MHz - f) dBm	1 MHz	

In regions where FCC regulation applies, requirements for protection of GPS according to FCC Order DA 10-534 applies for operation in Band 24. The following normative requirement covers the Repeater to be used together with other information about the site installation to verify compliance with the requirement in FCC Order DA 10-534. The requirement applies to repeater operating in Band 24 to ensure that appropriate interference protection is provided to the 1559 – 1610 MHz band. This requirement applies to the frequency range 1559-1610 MHz even though part of this range falls within the operating band unwanted emissions domain.

The level of emissions in the 1559 – 1610 MHz band, measured in measurement bandwidth according to Table 6.6.4.3.1-4 shall not exceed the maximum emission levels  $P_{E\_1\text{MHz}}$  and  $P_{E\_1\text{kHz}}$  declared by the manufacturer.

**Table 9.1.3-5A: Declared emissions levels for protection of the 1559-1610 MHz band**

Operating Band	Frequency range	Declared emission level [dBW] (Measurement bandwidth = 1 MHz)	Declared emission level [dBW] of discrete emissions of less than 700 Hz bandwidth (Measurement bandwidth = 1 kHz)
24	1559 - 1610 MHz	$P_{E\_1\text{MHz}}$	$P_{E\_1\text{kHz}}$

Note: The regional requirement in FCC Order DA 10-534 is defined in terms of EIRP (effective isotropic radiated power), which is dependent on both the repeater emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The EIRP level is calculated using:  $P_{\text{EIRP}} = P_E + G_{\text{ant}}$  where  $P_E$  denotes the Repeater unwanted emission level at the antenna connector,  $G_{\text{ant}}$  equals the Repeater antenna gain minus feeder loss. The requirement defined above provides the characteristics of the Repeater needed to verify compliance with the regional requirement.

In certain regions, the following requirements may apply to E-UTRA repeaters operating in Band 32 within 1452-1492 MHz. The level of unwanted emissions, measured on centre frequencies  $f_{\text{offset}}$  with filter bandwidth, according to Table 9.1.3-6 shall neither exceed the maximum emission level  $P_{EM,B32,a}$ ,  $P_{EM,B32,b}$  nor  $P_{EM,B32,c}$  declared by the manufacturer.

**Table 9.1.3-6: Declared operating band 32 unwanted emission within 1452-1492 MHz**

Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Declared emission level [dBm]	Measurement bandwidth
2.5 MHz	$P_{EM,B32,a}$	5 MHz
7.5 MHz	$P_{EM,B32,b}$	5 MHz
$12.5 \text{ MHz} \leq f_{\text{offset}} \leq f_{\text{offset,max}, B32}$	$P_{EM,B32,c}$	5 MHz
NOTE: $f_{\text{offset,max}, B32}$ denotes the frequency difference between the lower pass band edge frequency and 1454.5 MHz, and the frequency difference between the upper pass band edge frequency and 1489.5 MHz for the set channel position.		

NOTE: The regional requirement, included in [9], is defined in terms of EIRP per antenna, which is dependent on both the repeater emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in Annex H of TS36.104 [6].

In certain regions, the following requirement may apply to E-UTRA repeaters operating in Band 32 within 1452-1492 MHz for the protection of services in spectrum adjacent to the frequency range 1452-1492 MHz. The level of emissions, measured on centre frequencies  $F_{\text{filter}}$  with filter bandwidth according to Table 9.1.3-7 shall neither exceed the maximum emission level  $P_{\text{EM,B32,d}}$  nor  $P_{\text{EM,B32,e}}$  declared by the manufacturer. This requirement applies in the frequency range 1429-1518 MHz even though part of the range falls in the spurious domain.

**Table 9.1.3-7: Operating band 32 declared emission outside 1452-1492 MHz**

Filter centre frequency, $F_{\text{filter}}$	Declared emission level [dBm]	Measurement bandwidth
$1429.5 \text{ MHz} \leq F_{\text{filter}} \leq 1448.5 \text{ MHz}$	$P_{\text{EM,B32,d}}$	1 MHz
$F_{\text{filter}} = 1450.5 \text{ MHz}$	$P_{\text{EM,B32,e}}$	3 MHz
$F_{\text{filter}} = 1493.5 \text{ MHz}$	$P_{\text{EM,B32,e}}$	3 MHz
$1495.5 \text{ MHz} \leq F_{\text{filter}} \leq 1517.5 \text{ MHz}$	$P_{\text{EM,B32,d}}$	1 MHz

NOTE: The regional requirement, included in [9], is defined in terms of EIRP, which is dependent on both the repeater emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The requirement defined above provides the characteristics of the base station needed to verify compliance with the regional requirement. The assessment of the EIRP level is described in Annex H of TS36.104 [6].

The following notes are common to all subclauses in 9.1.3

NOTE 1: As a general rule for the requirements in Clause 9.1.3, 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.

NOTE 2: For signal bandwidths between the values given in Table's 9.1.3-1 and 9.1.3-2, the requirements can be calculated by linearly interpolating between the requirements closest to the wanted signal bandwidth.

## 9.1.4. Protection of the BS receiver in the operating band

This requirement shall be applied for the protection of E-UTRA FDD BS receiver in geographic areas in which E-UTRA-FDD Repeater and E-UTRA-FDD BS are deployed.

The requirement applies at frequencies that are more than 10 MHz below or more than 10 MHz above the repeater pass band.

### 9.1.4.1 Minimum Requirement

This requirement applies to the uplink of the repeater, at maximum gain.

The power of any operating band unwanted emission shall not exceed the limits in Table 9.1.4.1-1.

**Table 9.1.4.1-1: Uplink operating band unwanted emissions limits for protection of the BS receiver**

Maximum Level	Measurement Bandwidth	Note
-53 dBm	100 kHz	

NOTE 1: These requirements in Table 9.1.4.1-1: for the uplink direction of the Repeater reflect what can be achieved with present state of the art technology and are based on a coupling loss of 73 dB between a Repeater and an E-UTRA FDD BS receiver.

NOTE 2: The requirements shall be reconsidered when the state of the art technology progresses.

NOTE 3: The protection of R-GSM is for further study.

## 9.2 Spurious emissions

The spurious emission limits apply from 9 kHz to 12.75 GHz, (or above, as indicated in Table 9.2.1.1.1-1 and 9.2.1.2.1-1), excluding the frequency range from 10 MHz below the lowest frequency of the repeaters operating band up to 10 MHz above the highest frequency of the repeaters operating band. Exceptions are the requirement in Table 9.2.2.1-2 and 9.2.2.1-3 that apply also closer than 10 MHz from repeaters operating band.

The requirements shall apply whatever the type of repeater considered (one or several pass bands). It applies for all configurations foreseen by the manufacturer's specification.

Unless otherwise stated, all requirements are measured as mean power (RMS).

### 9.2.1 Mandatory requirements

The requirements of either subclause 9.2.1.1 (Category A limits) or subclause 9.2.1.2 (Category B limits) shall apply. The application of either Category A or Category B limits shall be the same as for Operating band unwanted emissions in subclause 9.1.

The requirements of either subclause 9.2.1.1 or subclause 9.2.1.2 apply to the uplink and downlink of the repeater, at maximum gain, and with the following input signals:

- without E-UTRA input signal
- with E-UTRA input signals in the pass band of the repeater, at levels that produce the maximum rated power output per channel
- with 10 dB increased E-UTRA input signals in all channels in the pass band, compared to the input level producing the maximum rated output power.

#### 9.2.1.1 Spurious emissions (Category A)

##### 9.2.1.1.1 Minimum Requirement

The power of any spurious emission shall not exceed the limits in Table 9.2.1.1.1-1.

**Table 9.2.1.1.1-1: Spurious emission limits, Category A**

Frequency range	Maximum level	Measurement Bandwidth	Note
9kHz - 150kHz	-13 dBm	1 kHz	Note 1
150kHz - 30MHz		10 kHz	Note 1
30MHz - 1GHz		100 kHz	Note 1
1GHz - 12.75 GHz		1 MHz	Note 2
12.75 GHz – 5 <sup>th</sup> harmonic of the upper frequency edge of the DL or UL operating band for DL or UL spurious emissions, respectively		1 MHz	Note 2, Note 3
NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1			
NOTE 2: Bandwidth as in ITU-R SM.329 [2], s4.1. Upper frequency as in ITU-R SM.329 [2], s2.5 table 1			
NOTE 3: Applies only for Bands 22.			

## 9.2.1.2 Spurious emissions (Category B)

### 9.2.1.2.1 Minimum Requirement

The power of any spurious emission shall not exceed the limits in Table 9.2.1.2.1-1.

**Table 9.2.1.2.1-1: Spurious emissions limits, Category B**

Frequency range	Maximum Level	Measurement Bandwidth	Note
9 kHz ↔ 150 kHz	-36 dBm	1 kHz	Note 1
150 kHz ↔ 30 MHz	-36 dBm	10 kHz	Note 1
30 MHz ↔ 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz ↔ 12.75 GHz	-30 dBm	1 MHz	Note 2
12.75 GHz – 5 <sup>th</sup> harmonic of the upper frequency edge of the DL or UL operating band for DL or UL spurious emissions, respectively	-30 dBm	1 MHz	Note 2, Note 3
NOTE 1: Bandwidth as in ITU-R SM.329 [2], s4.1			
NOTE 2: Bandwidth as in ITU-R SM.329 [2], s4.1. Upper frequency as in ITU-R SM.329 [2], s2.5 table 1			
NOTE 3: Applies only for Bands 22.			

## 9.2.2 Co-existence with other systems in the same geographical area

These requirements may be applied for the protection of system operating in frequency ranges other than the E-UTRA Repeater operating band. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the E-UTRA Repeater, or they may be set by local or regional regulation as a mandatory requirement for an E-UTRA operating band. It is in some cases not stated in the present document whether a requirement is mandatory or under what exact circumstances that a limit applies, since this is set by local or regional regulation. An overview of regional requirements in the present document is given in Clause 4.2.

Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, UTRA, E-UTRA, etc.) as listed below.

### 9.2.2.1 Minimum requirement

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

The power of any spurious emission shall not exceed the limits of Table 9.2.2.1-1 for an E-UTRA Repeater where requirements for co-existence with the system type listed in the first column apply.

**Table 9.2.2.1-1: Spurious emissions limits for E-UTRA-FDD repeater in geographic coverage area of systems operating in other frequency bands**

System type to co-exist with (Note 5)	Frequency range for co-existence requirement (MHz) (Note 6)	Basic limits (dBm)	Measurement bandwidth	Notes
GSM850 or CDMA850	869 - 894	-57	100kHz	Note 1
	824 - 849	-61		
GSM900	921 - 960	-57		
	876 - 915	-61		
DCS1800	1805 - 1880	-47		
	1710 - 1785	-61		
PCS1900	1930 - 1990	-47		
	1850 - 1910 MHz	-61		
UTRA or E-UTRA	Frequency range of downlink <i>operating band</i> of the E-UTRA FDD Repeater to co-exist with	-52	1MHz	Note 1, Note 7
	Frequency range of uplink <i>operating band</i> of the E-UTRA FDD Repeater to co-exist with	-49		Note1

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-existence requirements in Table 9.2.2.1-1 do not apply for the 10 MHz frequency range immediately outside the repeaters operating band frequency range of an operating band (see Table 5.5-1). This is also the case when the repeaters operating band frequency range is adjacent to the band for the co-existence requirement in the Table 9.2.2.1-1. Emission limits for this excluded frequency range may also be covered by local or regional requirements.

NOTE 2: The Table 9.2.2.1-1 assumes that two operating bands, where the frequency ranges in Table 5.5-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: The requirements of -53dBm/100kHz in Table 9.2.2.1-1 for the up link direction of the Repeater reflect what can be achieved with present state of the art technology and are based on a coupling loss of 73 dB between a Repeater and a UTRA TDD BS receiver.

NOTE 4: The requirements of -53dBm/100kHz in Table 9.2.2.1-1 shall be reconsidered when the state of the art technology progresses.

NOTE 5: Does not apply for co-existence with standalone downlink bands (SDO) defined in TS 36.104 [6], table 5.5-1.

NOTE 6: Frequency range of UTRA and E-UTRA bands, as described in TS 25.104 [10] clause 5.2 and TS 36.104 [6] clause 5.5, respectively.

NOTE 7: For TDD bands, -52dBm/MHz basic limit applies.

The following requirement may be applied for the protection of PHS in geographic areas in which both PHS and E-UTRA-FDD repeaters are deployed. This requirement is also applicable at specified frequencies falling between 10 MHz below the lowest frequency of the repeaters operating band and 10 MHz above the highest frequency of the repeaters operating band.

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

The power of any spurious emission shall not exceed:

**Table 9.2.2.1-2: Spurious emissions limits for E-UTRA-FDD repeater in geographic coverage area of PHS**

Frequency range	Maximum Level	Measurement Bandwidth	Note
1884.5 - 1915.7 MHz	-41 dBm	300 kHz	Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz

The following requirement shall be applied to E-UTRA-FDD repeaters operating in Bands 13 and 14 to ensure that appropriate interference protection is provided to 700 MHz public safety operations. This requirement is also applicable at specified frequencies falling between 10 MHz below the lowest frequency of the repeaters operating band and 10 MHz above the highest frequency of the repeaters operating band

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

The power of any spurious emission shall not exceed:

**Table 9.2.2.1-3: Spurious emissions limits for E-UTRA-FDD repeater for protection of 700 MHz public safety operations**

Operating Band	Frequency range	Maximum Level	Measurement Bandwidth	Note
13	763 - 775 MHz	-46 dBm	6.25 kHz	
13	793 - 805 MHz	-46 dBm	6.25 kHz	
14	769 - 775 MHz	-46 dBm	6.25 kHz	
14	799 - 805 MHz	-46 dBm	6.25 kHz	

This requirement shall be applied to repeaters operating in Band 26 to ensure that appropriate interference protection is provided to 800 MHz public safety operations. This requirement is also applicable at specified frequencies falling between 12.5 MHz below the first carrier frequency used and 12.5 MHz above the last carrier frequency used.

The power of any spurious emission shall not exceed:

**Table 9.2.2.1-3: Spurious emissions limits for the up-link and down-link of UTRA Repeater for protection of 800 MHz public safety operations**

Operating Band	Band	Maximum Level	Measurement Bandwidth	Note
26	851 - 859 MHz	-13 dBm	100 kHz	Applicable for offsets > 37.5kHz from the channel edge

### 9.2.3 Co-location with base stations

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850 UTRA FDD, UTRA TDD and/or E-UTRA BS are co-located with an E-UTRA FDD Repeater.

Unless otherwise stated the requirements assume a 30 dB coupling loss between transmitter and receiver.

NOTE: For co-location with UTRA, the requirements are based on co-location with Wide Area UTRA FDD or TDD base stations.

#### 9.2.3.1 Minimum Requirements

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

The power of any spurious emission shall not exceed the limits of Table 9.2.3.1-1 for an E-UTRA FDD Repeater where requirements for co-location with a system type listed in the second column apply.

**Table 9.2.3.1-1: Spurious emissions limits for E-UTRA-FDD Repeater co-located with Base Stations**

Frequency range of uplink operating band of the repeater to co-locate with (MHz) (Note 6)	System type to co-locate with	Basic limits (dBm/100kHz)
824 - 849	GSM850 or CDMA850	-98
876 - 915	GSM900	-98
1710 - 1785	DCS1800	-98
1850 - 1910	PCS1900	-98
a) or 33, when to co-locate with E-UTRA FDD Repeater operating in band 1, 2, 25	UTRA or E-UTRA	-53
a) or 34, when to co-locate with E-UTRA FDD Repeater operating in band 1	UTRA or E-UTRA	-83
b) or 35, when to co-locate with E-UTRA FDD Repeater operating in band 2, 25	UTRA or E-UTRA	-53
b) or 36, when to co-locate with E-UTRA FDD Repeater operating in band 1	UTRA or E-UTRA	-53
c) or 37, when to co-locate with E-UTRA FDD Repeater operating in band 1, 2, 25	UTRA or E-UTRA	-53
d) or 38, when to co-locate with E-UTRA FDD Repeater operating in band 7	UTRA or E-UTRA	-53
f) or 39, when to co-locate with E-UTRA FDD Repeater operating in band 1, 2, 25	UTRA or E-UTRA	-53
Other operating band	UTRA or E-UTRA	-96

NOTE 1: As defined in the scope for spurious emissions in this clause, the co-location requirements in Table 9.2.3.1-1 do not apply for the 10 MHz frequency range immediately outside the repeaters operating band frequency range of an operating band (see Table 5.5-1). This is also the case when the repeaters operating band frequency range is adjacent to the frequency range of the co-location requirement in the Table 9.2.3.1-1. The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30dB Repeater-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [5].

NOTE 2: The Table 9.2.3.1-1 assumes that two operating bands, where the corresponding eNode B transmit and receive frequency ranges in Table 5.5-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

NOTE 3: The requirements of -53dBm/100kHz in Table 9.2.3.1-1 for the up link direction of the Repeater reflect what can be achieved with present state of the art technology and are based on a coupling loss of 73 dB between a Repeater and a UTRA TDD BS receiver.

NOTE 4: The requirements of -83dBm/100kHz in Table 9.2.3.1-1 for the up link direction of the Repeater reflect what can be achieved with present state of the art technology and are based on a coupling loss of 43 dB between a Repeater and a UTRA TDD BS receiver.

NOTE 5: The requirements of -53dBm/100kHz and -83dBm/100kHz in Table 9.2.3.1-1 shall be reconsidered when the state of the art technology progresses.

NOTE 6: Frequency range of UTRA and E-UTRA bands, as described in TS 25.104 [10] clause 5.2 and TS 36.104 [6] clause 5.5, respectively.

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## 10 Error Vector Magnitude

### 10.1 Downlink Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the ideal symbols and the measured symbols after the equalization. This difference is called the error vector. The equaliser parameters are estimated as defined in TS36.104 [6] Annex E. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power expressed in percent.

#### 10.1.1 Minimum requirement

For all E-UTRA channel bandwidths, as defined in sub-clause 5.6, applicable to the repeater, the EVM measurement shall be performed over all allocated resource blocks and subframes within a frame. The EVM value is then calculated as the mean square root of the measured values.

For the downlink of the repeater the Error Vector Magnitude shall not be worse than 8 %.

### 10.2 Uplink 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 IQ origin offset 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 is one slot in the time domain.

#### 10.2.1 Minimum requirement

For the uplink of the repeater the RMS average of the basic EVM measurements for 10 consecutive sub-frames for the different modulations schemes shall not exceed 8 %.

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## 11 Input Intermodulation

The input intermodulation is a measure of the capability of the repeater to inhibit the generation of interference in the pass band, in the presence of interfering signals on frequencies other than the pass band.

### 11.1 General requirement

The following requirement applies for interfering signals in the operating bands defined in sub-clause 5.5, depending on the repeaters pass band.

This requirement applies to the uplink and downlink of the repeater, at maximum gain.

#### 11.1.1 Minimum requirement

For the parameters specified in table 11.1.1-1, the power in the pass band shall not increase with more than 10 dB at the output of the repeater as measured in the centre of the pass band, compared to the level obtained without interfering signals applied.

The frequency separation between the two interfering signals shall be adjusted so that the 3<sup>rd</sup> order intermodulation product is positioned in the centre of the pass band.

Table 11.1.1-1 specifies the parameters for two interfering signals, where:

- $f_1$  offset is the offset from the channel edge frequency of the first or last channel in the pass band of the closer carrier.

**Table 11.1.1-1: Input intermodulation requirement**

<b><math>f_1</math> offset</b>	<b>Interfering Signal Levels</b>	<b>Type of signals</b>	<b>Measurement bandwidth</b>
1,0 MHz	-40 dBm	2 CW carriers	1 MHz

## 11.2 Co-location with BS in other systems

This additional input intermodulation requirement may be applied for the protection of E-UTRA FDD Repeater input when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS are co-located with an E-UTRA FDD Repeater.

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

### 11.2.1 Minimum requirement

For the parameters specified in table 11.2.1-1, the power in the pass band shall not increase with more than 10 dB at the output of the repeater as measured in the centre of the pass band, compared to the level obtained without interfering signals applied.

The frequency separation between the two interfering signals shall be adjusted so that the lowest order intermodulation product is positioned in the centre of the pass band.

NOTE 1: The lowest intermodulation products correspond to the 4<sup>th</sup> and 3<sup>rd</sup> order for the GSM 900 and DCS 1800 bands, respectively.

**Table 11.2.1-1: Input intermodulation requirements for interfering signals in co-located other systems**

Co-located other systems	Frequency of interfering signals	Interfering Signal Levels	Type of signals	Measurement bandwidth	Note
GSM900	921 - 960 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
DCS1800	1805 - 1880 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
PCS1900	1930 - 1990 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
GSM850 or CDMA850	869 - 894 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 5 or 26, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band I or E-UTRA Band 1	2110 - 2170 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 1, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band II or E-UTRA Band 2	1930 - 1990 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band III or E-UTRA Band 3	1805 - 1880 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3 or band 9, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band IV or E-UTRA Band 4	2110 - 2155 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 4 or band 10, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band V or E-UTRA Band 5	869 - 894 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 5 or 26, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band VI,XIX or E-UTRA Band 6, 18, 19	860 - 890 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 6, 18, 19, or 26 since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.

UTRA-FDD Band VII or E-UTRA Band 7	2620 - 2690 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 7, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band VIII or E-UTRA Band 8	925 - 960 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band IX or E-UTRA Band 9	1844.9 - 1879.9 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3 or band 9, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band X or E-UTRA Band 10	2110 - 2170 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 4 or band 10, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band XI or XXI or E-UTRA Band 11 or 21	1475.9 - 1510.9 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 11 or band 21, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port. This requirement does not apply to E-UTRA FDD Repeater operating in band 32, between 1475.9 MHz and 1496 MHz, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA FDD Band XII or E-UTRA Band 12	728 - 746 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 12, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA FDD Band XIII or E-UTRA Band 13	746 - 756 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 13, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA FDD Band XIV or E-UTRA Band 14	758 - 768 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 14, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
E-UTRA Band 17	734 - 746 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 17, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA FDD Band XX or E-UTRA Band 20	791 - 821 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 20, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.

UTRA Band XXII or E-UTRA Band 22	3510 - 3590 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 22, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
E-UTRA Band 23	2180 – 2200 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 23, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
E-UTRA Band 24	1525 - 1559 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 24, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA FDD Band XXV or E-UTRA Band 25	1930 – 1995 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between base station and the repeater DL receive port.
UTRA-FDD Band XXVI or E-UTRA Band 26	859 - 894 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 26, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port. For E-UTRA FDD Repeater operating in band 5, it applies from 859 MHz to 869 MHz, while the rest is covered in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.
E-UTRA Band 27	852 - 869 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 27, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port. For E-UTRA FDD Repeater operating in band 26, it applies from 852 MHz to 859 MHz, while the rest is covered in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.
E-UTRA Band 28	758 - 803 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 28, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.
E-UTRA Band 29	717 - 728 MHz	+16 dBm	2 CW carriers	1 MHz	
E-UTRA Band 30	2350 - 2360 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 30, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.
E-UTRA Band 31	462.5 – 467.5 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 31 or band 72, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.

UTRA-FDD Band XXXII or E-UTRA Band 32	1452 - 1496 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 11, 21 or 32, since it is already covered by the requirement in sub-clause 11. 1, but requires a 86dB coupling loss between BS and the repeater DL receive port.
UTRA TDD in Band a) or E-UTRA Band 33	1900 - 1920 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1, band 2 or band 25.
UTRA TDD in Band a) or E-UTRA Band 34	2010 - 2025 MHz	+16 dBm	2 CW carriers	1 MHz	
UTRA TDD in Band b) or E-UTRA Band 35	1850 – 1910 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to the downlink of E-UTRA FDD Repeater operating in band 3 or band 9. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 2 or band 25.
UTRA TDD in Band b) or E-UTRA Band 36	1930 – 1990 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to the downlink of E-UTRA FDD Repeater operating in band 2 or band 25. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1.
UTRA TDD in Band c) or E-UTRA Band 37	1910 - 1930 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1. This unpaired band is defined in ITU-R M.1036, but is pending any future deployment.
UTRA TDD in Band d) or E-UTRA Band 38	2570 – 2620 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 7.
UTRA TDD Band f) or E-UTRA Band 39	1880 – 1920 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 1, band 2 or band 25.
UTRA TDD Band e) or E-UTRA Band 40	2300 – 2400 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 30.
E-UTRA Band 41	2496 – 2690 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 7.
E-UTRA Band 42	3400 – 3600 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 22.
E-UTRA Band 43	3600 – 3800 MHz	+16 dBm	2 CW carriers	1 MHz	
E-UTRA Band 44	703 - 803 MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 28.
E-UTRA Band 72	461 - 466MHz	+16 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 31 or band 72, since it is already covered by the requirement in sub-clause 11.1, but requires a 86dB coupling loss between BS and the repeater DL receive port.

NOTE 1: The co-location requirements in Table 11.2.1-1 do not apply when the repeaters pass band frequency range is adjacent to the frequency range of the co-location requirement in the Table 11.2.1-1. The current state-of-the-art technology does not allow a single generic solution for co-location with other system on adjacent frequencies for 30dB Repeater-BS minimum coupling loss. However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [5].

NOTE 2: The Table 11.2.1-1 assumes that two operating bands, where the corresponding eNode B transmit and receive frequency ranges in Table 5.5-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-location requirements may apply that are not covered by the 3GPP specifications.

## 11.3 Co-existence with other systems

This additional input intermodulation requirement may be applied when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS operating in another frequency band co-exist with an E-UTRA FDD Repeater.

Unless otherwise stated this requirement applies to the uplink and downlink of the repeater, at maximum gain.

### 11.3.1 Minimum requirement

For the parameters specified in table 11.3.1-1, the power in the pass band shall not increase with more than 10 dB at the output of the repeater as measured in the centre of the pass band, compared to the level obtained without interfering signals applied.

The frequency separation between the two interfering signals shall be adjusted so that the lowest order intermodulation product is positioned in the centre of the pass band.

NOTE 1: The lowest intermodulation products correspond to the 4<sup>th</sup> and 3<sup>rd</sup> order for the GSM 900 and DCS 1800 bands, respectively.

**Table 11.3.1-1: Input intermodulation requirements for interfering signals in co-existing other systems**

Co-existence with other systems	Frequency of interfering signals	Interfering Signal Levels	Type of signals	Measurement bandwidth	Note
GSM900	876 - 915 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in sub-clause 11.1.
DCS1800	1710 - 1785 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in sub-clause 11.1.
PCS1900	1850 - 1910 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25, since it is already covered by the requirement in sub-clause 11.1.
GSM850 or CDMA850	824 - 849 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 5 or 26, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band I or E-UTRA Band 1	1920 - 1980 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 1, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band II or E-UTRA Band 2	1850 - 1910 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band III or E-UTRA Band 3	1710 - 1785 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3 or band 9, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band IV or E-UTRA Band 4	1710 - 1755 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 4 or band 10, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band V or E-UTRA Band 5	824 - 849 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 5 or 26, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band VI or XIX or E-UTRA Band 6, 18 or 19	815 - 830 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 18, since it is already covered by the requirement in sub-clause 11.1. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 5, 6, 19 or 20.
	830 - 845 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 6 or band 19, since it is already covered by the requirement in sub-clause 11.1. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 5, 18 or 20.
UTRA FDD Band VII or E-UTRA Band 7	2500 - 2570 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 7, since it is already covered by the requirement in sub-clause 11.1.

UTRA FDD Band VIII or E-UTRA Band 8	880 - 915 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band IX or E-UTRA Band 9	1749.9 - 1784.9 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 3 or band 9, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band X or E-UTRA Band 10	1710 - 1770 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 4 or band 10, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XI or XXI or E-UTRA Band 11 or 21	1427.9 - 1447.9 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 11, since it is already covered by the requirement in sub-clause 11.1.
	1447.9 - 1462.9 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 21, since it is already covered by the requirement in sub-clause 11.1. For E-UTRA FDD Repeater operating in band 32, it applies from 1447.9 MHz to 1452 MHz, while the rest is covered in sub-clause 11.1.
UTRA FDD Band XII or E-UTRA Band 12	698 - 716 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 12, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XIII or E-UTRA Band 13	777 - 787 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 13, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XIV or E-UTRA Band 14	788 - 798 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 14, since it is already covered by the requirement in sub-clause 11.1.
E-UTRA Band 17	704 - 716 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 17, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XX or E-UTRA Band 20	832 - 862 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 20, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XXII or E-UTRA Band 22	3410 - 3490 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 22, since it is already covered by the requirement in sub-clause 11.1.
E-UTRA Band 23	2000 - 2020 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 23, since it is already covered by the requirement in sub-clause 11.1.
E-UTRA Band 24	1626.5 – 1660.5 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 24, since it is already covered by the requirement in sub-clause 11.1.
UTRA FDD Band XXV or E-UTRA Band 25	1850 - 1915 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 25, since it is already covered by the requirement in sub-clause 11.1. For E-UTRA FDD Repeater operating in band 2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in sub-clause 11.1.

UTRA-FDD Band XXVI or E-UTRA Band 26	814 - 849 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 26, since it is already covered by the requirement in sub-clause 11.1. For E-UTRA FDD Repeater operating in band 5, it applies from 814MHz to 824 MHz, while the rest is covered in sub-clause 11.1. For E-UTRA FDD Repeater operating in band 27, it applies from 824MHz to 849 MHz, while the rest is covered in sub-clause 11.5.1
E-UTRA Band 27	807 - 824 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 27, since it is already covered by the requirement in sub-clause 11.1. For E-UTRA FDD Repeater operating in band 26, this requirement applies from 807MHz to 814 MHz, while the rest is covered in sub-clause 11.1.
E-UTRA Band 28	703 - 748 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 28, since it is already covered by the requirement in sub-clause 11.1.
E-UTRA Band 30	2305 - 2315 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 30, since it is already covered by the requirement in sub-clause 11.1.
E-UTRA Band 31	452.5 – 457.5 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 31 or band 72, since it is already covered by the requirement in sub-clause 11.1.
UTRA TDD in Band a) or E-UTRA Band 33	1900 - 1920 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1, band 2 or band 25.
UTRA TDD in Band a) or E-UTRA Band 34	2010 - 2025 MHz	-15 dBm	2 CW carriers	1 MHz	
UTRA TDD in Band b) or E-UTRA Band 35	1850 – 1910 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to the downlink of E-UTRA FDD Repeater operating in band 3 or band 9. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 2 or band 25.
UTRA TDD in Band b) or E-UTRA Band 36	1930 – 1990 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to the downlink of E-UTRA FDD Repeater operating in band 2 or band 25. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1.
UTRA TDD in Band c) or E-UTRA Band 37	1910 - 1930 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 2 or band 25. This requirement does not apply to the uplink of E-UTRA FDD Repeater operating in band 1. This unpaired band is defined in ITU-R M.1036, but is pending any future deployment.
UTRA TDD in Band d) or E-UTRA Band 38	2570 – 2620 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to the uplink E-UTRA FDD Repeater operating in band 7.

UTRA TDD Band f) or E-UTRA Band 39	1880 – 1920 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 1, band 2 or band 25.
UTRA TDD Band e) or E-UTRA Band 40	2300 – 2400 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 30.
E-UTRA Band 41	2496 – 2690 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 7.
E-UTRA Band 42	3400 – 3600 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 22.
E-UTRA Band 43	3600 – 3800 MHz	-15 dBm	2 CW carriers	1 MHz	
E-UTRA Band 44	703 - 803 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 28.
E-UTRA Band 72	451 – 456 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement does not apply to E-UTRA FDD Repeater operating in band 31 or band 72, since it is already covered by the requirement in sub-clause 11.1.

NOTE 1: The co-existence requirements in Table 11.3.1-1 do not apply when the repeaters pass band frequency range is adjacent to the frequency range of the co-existence requirement in the Table 11.3.1-1. The current state-of-the-art technology does not allow a single generic solution for co-existence.

NOTE 2: The Table 11.3.1-1 assumes that two operating bands, where the frequency ranges in Table 5.5-1 would be overlapping, are not deployed in the same geographical area. For such a case of operation with overlapping frequency arrangements in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.

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## 12 Output intermodulation

The output intermodulation requirement is a measure of the ability of the repeater to inhibit the generation of intermodulation products signals created by the presence of an interfering signal reaching the repeater via the output port.

The requirement shall apply to the downlink of the Repeater.

### 12.1 Minimum requirement

The output intermodulation level is the power of the intermodulation products when an interfering signal is injected into the output port. The wanted signal channel bandwidth  $BW_{\text{Channel}}$  shall be the maximum bandwidth supported by the repeater. The offset of the interfering signal from the wanted signal shall be as in Table 12.1-1.

**Table 12.1-1 Interfering and wanted signals for the output intermodulation requirement**

<b>Parameter</b>	<b>Value</b>
Wanted signal	E-UTRA signal of maximum channel bandwidth $BW_{\text{Channel}}$
Interfering signal type	E-UTRA signal of channel bandwidth 5 MHz
Interfering signal level	Mean power level 30 dB below the mean power of the wanted signal
Interfering signal centre frequency offset from wanted signal carrier centre frequency	- $BW_{\text{Channel}}/2$ - 12.5 MHz - $BW_{\text{Channel}}/2$ - 7.5 MHz - $BW_{\text{Channel}}/2$ - 2.5 MHz $BW_{\text{Channel}}/2$ + 2.5 MHz $BW_{\text{Channel}}/2$ + 7.5 MHz $BW_{\text{Channel}}/2$ + 12.5 MHz
NOTE:	Interfering signal positions that are partially or completely outside of the downlink operating band of the repeater are excluded from the requirement.

The output intermodulation level shall not exceed the unwanted emission limits in clause 9 in the presence of an interfering signal according to Table 12.1-1. The measurement may be limited to frequencies on which third and fifth order intermodulation products appear, considering the width of these products.

## 13 Adjacent Channel Rejection Ratio (ACRR)

### 13.1 Definitions and applicability

Adjacent Channel Rejection Ratio (ACRR) is the ratio of the RRC weighted gain per carrier of the repeater in the pass band to the RRC weighted gain of the repeater on an adjacent channel outside the repeater pass band. The carrier in the pass band and in the adjacent channel shall be of the same type (reference carrier).

The requirement shall apply to the uplink and downlink of the Repeater, at maximum gain, where the donor link is maintained via antennas (over the air Repeater).

#### 13.1.1 Minimum Requirements

There is no minimum requirement for E-UTRA signals.

### 13.2 Co-existence with UTRA

This requirement shall be applied for the protection of UTRA signals in geographic areas in which E-UTRA-FDD Repeater and UTRA BS are deployed so that they serve adjacent channels. The reference carrier is a UTRA-FDD carrier.

#### 13.2.1. Minimum Requirements

In normal conditions the ACRR shall be higher than the value specified in the Table 13.2.1-1.

**Table 13.2.1-1: Repeater ACRR**

Co-existence with other systems	Repeater maximum output power	Channel offset from the centre frequency of the first or last 5MHz channel within the pass band.	ACRR limit
UTRA	$P \geq 31$ dBm	5 MHz	33dB
	$P \geq 31$ dBm	10 MHz	33dB
	$P < 31$ dBm	5 MHz	20dB
	$P < 31$ dBm	10 MHz	20dB

Note1: Repeater maximum output power as defined in TS25.143 clause 9.1.1.

Note2: For co-existence with TDD, a narrow band requirement is for further study.

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## Annex A (normative): Environmental requirements for the Repeater equipment

The Repeater equipment shall fulfil all the requirements in the full range of environmental conditions for the relevant environmental class from the relevant IEC specifications listed below

60 721-3-3 "Stationary use at weather protected locations" [7];

60 721-3-4 "Stationary use at non weather protected locations" [8].

Normally it is sufficient for all tests to be conducted using normal test conditions except where otherwise stated. For guidance on the use of test conditions to be used in order to show compliance refer to TS 36.143.

## Annex B (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2008-05	RAN4#47	R4-080859			TS skeleton created from 3GPP TS template.		0.0.1
2008-06	RAN4#47 bis	R4-080484			TS skeleton with the TP agreed at RAN4#47 R4-080860 Text proposal 36.106: Frequency band and channel arrangement R4-080861 Text proposal 36.106: Output Power R4-080862 Text proposal 36.106: Out of band gain R4-080863 Text proposal 36.106: Input Intermodulation	0.0.1	0.1.0
2008-08	RAN4#48	R4-081754			TS with the TP agreed at RAN4#47bis R4-081488 Text proposal 36.106: Clause3 Definition R4-081490 Text proposal 36.106: Frequency stability R4-081491 Text proposal 36.106: Operating band unwanted emissions R4-081639 Text proposal 36.106: Spurious emissions R4-081640 Text proposal 36.106:ACRR R4-081641 Text proposal 36.106: Input intermodulation co-existence and co-location R4-081642 Text proposal 36.106: Clause 4 General	0.1.0	0.2.0
2008-08	RAN4#48	R4-081755			TS with the TP agreed at RAN4#48 R4-081756 Text proposal 36.106: Unwanted emissions R4-081856 Text proposal 36.106: Output Intermodulation R4-082040 Text proposal 36.106: Annex D Environmental req. Presentation to TSG	0.2.0	1.0.0
2008-10	RAN4#48 bis	R4-082274			R4-082273 Protection of the BS receiver in the operating band: Sortorder changed	1.0.0	1.1.0
2008-11	RAN4#49	R4-082900			TS with the TP agreed at RAN4#48bis R4-082397Correction to the figure with the Transmission Bandwidth Configuration	1.1.0	1.2.0
2008-11	RAN4#49	R4-082912			TS with the Text proposals agreed at RAN4#49 R4-082902 TS36.106 Out of band gain correction R4-083143 TS36.106: Operating band unwanted emission: Correction of formula R4-083143 TS36.106 Clean up Presentation to TSG RAN	1.2.0	1.3.0
2008-12	RAN #42	RP-080864			Approved in TSG RAN	2.0.0	8.0.0
2009-03	RAN #43	RP-090191	1		Alignment with 36.143 conformance testing	8.0.0	8.1.0
2009-03	RAN #43	RP-090191	2		Clarification of PHS band including the future plan	8.0.0	8.1.0
2009-03	RAN #43	RP-090191	3	1	Introduction of EVM	8.0.0	8.1.0
2009-03	RAN #43	RP-090191	5		Clarification of EARFCN for 36.106	8.0.0	8.1.0
2009-05	RAN #44	RP-090552	6		Alignment with test spec and clean-up	8.1.0	8.2.0
2009-05	RAN #44	RP-090552	7		Frequency stability	8.1.0	8.2.0
2009-09	RAN #45	RP-090819	9		EVM for LTE Repeater	8.2.0	8.3.0
2009-09	RAN #45	RP-090819	8		Introduction of band 17	8.2.0	8.3.0
2009-12	RAN #46	RP-091282	10		Update of operating band unwanted emissions for LTE Repeater	8.3.0	8.4.0
					Automatic upgrade from previous Release	8.4.0	9.0.0
2010-03	RAN #47	RP-100262	14	1	Adding missing references	9.0.0	9.1.0
2010-09	RAN #49	RP-100925	015		Introduction of operating band 18, 19, 20 and 21 and correction of band 11.	9.1.0	9.2.0
2010-12	RP #50	RP-101333	021		Clarification on emission requirements	9.2.0	9.3.0
2010-12	RP #50	RP-101336	019		Protection of CDMA	9.2.0	9.3.0
2010-12	RP #50	RP-101337	023		Removal of brackets	9.2.0	9.3.0
2010-12	RP #50	RP-101347	016		Corrections to the symbols and abbreviations clause related to DTT requirement	9.2.0	9.3.0
2010-12	RP #50	RP-101347	017		Co-existence with services in adjacent frequency bands	9.2.0	9.3.0
2010-12	RP #50				Automatic upgrade from previous Release	9.3.0	10.0.0
2011-04	RP-51	RP-110360	024	2	Adding Band 24 specification to TS36.106	10.0.0	10.1.0
2011-12	RP-54	RP-111734	025	1	Introduction of operating frequency band 22	10.1.0	10.2.0
2011-12	RP-54	RP-111734	027		Introduction of protection limits towards frequency band 41, 42 and 43	10.1.0	10.2.0
2012-03	RP-55	RP-120303	029	1	Introduction of operating frequency bands 23 and 25	10.2.0	10.3.0
2012-03	RP-55	RP-120303	031		Correction on the table of Regional requirements	10.2.0	10.3.0
06-2012	RP-56	RP-120780	034		Definition clause updates with improved repeater pass band definition and introduction of minor editorial changes for for better alignment with BS core specification	10.3.0	10.4.0
06-2012	RP-56	RP-120783	035		Update of the upper frequency limit for Spurious Emissions	10.3.0	10.4.0
06-2012	RP-56	RP-120783	036	1	Update of the protection limits tables for spurious emission and input intermodulation	10.3.0	10.4.0

06-2012	RP-56	RP-120762	040		Correction of PHS protection requirements for TS 36.106	10.3.0	10.4.0
09-2012	RP-57	RP-121312	041		Update on the upper frequency limit for Spurious Emissions for Repeater	10.4.0	10.5.0
09-2012	RP-57	RP-121313	042	1	Introduction of missing uplink Spurious Emission limits for E-UTRA Band 36, 41 and 42	10.4.0	10.5.0
2012-09	SP-57	-	-	-	Update to Rel-11 version (MCC)	10.5.0	11.0.0
2012-09	RP-57				Editorial correction in Table 11.3.1-1	11.0.0	11.0.1
2012-12	RP-58	RP-121858	045		Modifications of frequency ranges for E-UTRA Band 6, 18, 19 in the Tables for Spurious Emission limits and Input Intermodulation requirements	11.0.1	11.1.0
2012-12	RP-58	RP-121867	046		The special cases for protection of E-UTRA Band 3 and Band 10 in co-existence and co-location with E-UTRA Repeaters	11.0.1	11.1.0
2012-12	RP-58	RP-121867	048		The special cases for protection of E-UTRA Band 42 in co-existence and co-location with E-UTRA FDD Repeaters	11.0.1	11.1.0
03-2013	RP-59	RP-130268	050		Co-existence between adjacent FDD and TDD bands	11.1.0	11.2.0
09-2014	SP-65-	-	-	-	Update to Rel-12 version (MCC)	11.2.0	12.0.0
12-2014	RP-66	RP-142154	052		Update with regard to operating bands of TS36.106	12.0.0	12.1.0
2016-01	SP-70	-	-	-	Update to Rel-13 version (MCC)	12.1.0	13.0.0
2017-03	RP-75	-	-	-	Update to Rel-14 version (MCC)	13.0.0	14.0.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-12	RP-78	RP-172601	0053	-	B	Introduction of Band 72	15.0.0
2020-06	SA#88	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0
2022-03	SA#95					Update to Rel-17 version (MCC)	17.0.0
2024-03	RAN#103					Update to Rel-18 version (MCC)	18.0.0
2025-09	RAN#109					Update to Rel-19 version (MCC)	19.0.0
2025-12	RAN#110	RP-253627	0058	1	F	(TEI19)CR for 36.106, on framework simplification for co-location/co-existence requirement[BDaT_simp_improvement]	19.1.0

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## History

<b>Version</b>	<b>Date</b>	<b>Status</b>
V19.0.0	October 2025	Publication
V19.1.0	February 2026	Publication