

# ETSI EN 301 908-15 V11.1.2 (2017-01)



HARMONISED EUROPEAN STANDARD

**IMT cellular networks;  
Harmonised Standard covering the essential requirements  
of article 3.2 of Directive 2014/53/EU;  
Part 15: Evolved Universal Terrestrial Radio Access  
(E-UTRA FDD) Repeaters**

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Reference

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## Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Mobile Standards Group (MSG).

For non EU countries the present document may be used for regulatory (Type Approval) purposes.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.8] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A-1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is part 15 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.3].

<b>National transposition dates</b>	
Date of latest announcement of this EN (doa):	30 April 2017
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 October 2017
Date of withdrawal of any conflicting National Standard (dow):	31 October 2018

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## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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## Introduction

The present document is part of a set of standards developed by ETSI that are designed to fit in a modular structure to cover radio equipment within the scope of the Radio Equipment Directive [i.1]. The present document is produced following the guidance in ETSI EG 203 336 [i.2] as applicable.

# 1 Scope

The present document applies to the following equipment types:

- 1) Repeaters for Evolved Universal Terrestrial Radio Access (E-UTRA) (FDD).

This radio equipment type is capable of operating in all or any part of the frequency bands given in table 1-1.

**Table 1-1: E-UTRA Repeater operating bands**

E-UTRA FDD band	Direction of transmission	E-UTRA Repeater operating bands
1	Downlink	2 110 MHz to 2 170 MHz
	Uplink	1 920 MHz to 1 980 MHz
3	Downlink	1 805 MHz to 1 880 MHz
	Uplink	1 710 MHz to 1 785 MHz
7	Downlink	2 620 MHz to 2 690 MHz
	Uplink	2 500 MHz to 2 570 MHz
8	Downlink	925 MHz to 960 MHz
	Uplink	880 MHz to 915 MHz
20	Downlink	791 MHz to 821 MHz
	Uplink	832 MHz to 862 MHz
22	Downlink	3 510 MHz to 3 590 MHz
	Uplink	3 410 MHz to 3 490 MHz
28	Downlink	758 MHz to 803 MHz
	Uplink	703 MHz to 748 MHz
32 (note 1) (note 2)	Downlink	1 452 MHz to 1 496 MHz
	Uplink	N/A

NOTE 1: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.

NOTE 2: Radio equipment in band XXXII is only allowed to operate between 1 452 MHz and 1 492 MHz.

The present document covers requirements for E-UTRA Repeaters for Release 8, 9, 10 and 11. This includes the requirements for E-UTRA Repeater operating bands and E-UTRA CA operating bands from 3GPP Release 12.

The present document contains requirements to demonstrate that Radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI TS 136 143 (V11.2.0) (04-2013): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing (3GPP TS 36.143 version 11.2.0 Release 11)".
- [2] IEC 60068-2-1 (2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".

- [3] IEC 60068-2-2 (2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".
- [4] ETSI TS 136 141 (V11.14.0) (01-2016): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (3GPP TS 36.141 version 11.14.0 Release 11)".
- [5] ETSI TS 125 141 (V11.12.0) (01-2016): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) conformance testing (FDD) (3GPP TS 25.141 version 11.12.0 Release 11)".

## 2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Directive 2014/53/EU of the European parliament and of the council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] ETSI EG 203 336 (V1.1.1) (08-2015): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.3] ETSI EN 301 908-1 (V11.1.1): "IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements".
- [i.4] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.5] ETSI TS 136 104 (V11.14.0) (01-2016): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception (3GPP TS 36.104 version 11.14.0 Release 11)".
- [i.6] Recommendation ITU-R SM.329-12 (09-2012): "Unwanted emissions in the spurious domain".
- [i.7] ETSI EN 301 908-11 (V11.1.1): "IMT cellular networks; Harmonised EN covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 11: CDMA Direct Spread (UTRA FDD) Repeaters".
- [i.8] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**carrier:** modulated waveform conveying the E-UTRA or UTRA (WCDMA) physical channels

**channel bandwidth:** RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell

NOTE: The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

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

**donor coupling loss:** coupling loss between the repeater and the donor Base Station

**downlink:** signal path where Base Station transmits and mobile receives

**downlink operating band:** part of the operating band designated for downlink

**nominal passband edge:** lowest and highest frequency of the pass band of the repeater

**operating band:** frequency range that is defined with a specific set of technical requirements, in which E-UTRA FDD operates

NOTE: The operating band(s) for an E-UTRA Repeater is declared by the manufacturer according to the designations in clause 1, table 1-1. Operating bands for UTRA are designated with Roman numerals, while the corresponding operating bands for E-UTRA are designated with Arabic numerals. Unless specified, operating band refers to the uplink operating band and downlink operating band.

**output power, P<sub>out</sub>:** 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:** frequency range that the repeater operates in with operational configuration

NOTE: This frequency range can correspond to one or several consecutive nominal channels. If they are not consecutive each subset of channels is considered as an individual pass band. The 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:** 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)

NOTE: 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:** 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:** part of the operating band designated for uplink

## 3.2 Symbols

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

$\Delta f$	The separation between the nominal pass band edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency
$\Delta f_{\max}$	The largest value of $\Delta f$ used for defining the requirement



$BW_{\text{Channel}}$	Channel bandwidth
$BW_{\text{Config}}$	Transmission bandwidth configuration, expressed in MHz, where $BW_{\text{Config}} = N_{\text{RB}} \times 180 \text{ kHz}$ in the uplink and $BW_{\text{Config}} = 15 \text{ kHz} + N_{\text{RB}} \times 180 \text{ kHz}$ in the downlink
$BW_{\text{Meas}}$	Measurement bandwidth
$BW_{\text{Pass band}}$	Bandwidth of the repeater pass band
$f_{\text{offset\_max}}$	The largest value of $f_{\text{offset}}$ used for defining the requirement
$F_{\text{DL\_low}}$	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
$N_{\text{DL}}$	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
$P_{\text{EM,N}}$	Declared emission level for channel N
$P_{\text{EM,B32,ind}}$	Declared emission level in Band 32, ind=a, b, c, d, e
$P_{\text{max}}$	Maximum output power
$P_{\text{out}}$	Output power

### 3.3 Abbreviations

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

ACLR	Adjacent Channel Leakage Ratio
ACRR	Adjacent Channel Rejection Ratio
BS	Base Station
BW	BandWidth
CA	Carrier Aggregation
CW	Continuous Wave
DTT	Digital Terrestrial Television
DUT	Device Under Test
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EFTA	European Free Trade Association
ERM	Electromagnetic compatibility and Radio spectrum Matters
E-TM	E-UTRA Test Model
EUT	Equipment Under Test
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
GSM	Global System for Mobile communications
IMT	International Mobile Telecommunications
ITU-R	International Telecommunication Union - Radiocommunication
LTE	Long Term Evolution, also known as E-UTRA
MS	Mobile Station
MSG	Mobile Standards Group
PCCPCH	Primary Common Control Physical Channel
RF	Radio Frequency
RMS	Root Mean Square (value)
RRC	Root Raised Cosine
RSS	Root Sum Square
SCCPCH	Secondary Common Control Physical Channel
TDD	Time Division Duplex
TFES	Task Force for European Standards for IMT
UARFCN	UTRA Absolute Radio Frequency Channel Number
UMB	Ultra Mobile Broadband
UTRA	Universal Terrestrial Radio Access

## 4 Technical requirements specifications

### 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

For guidance on how a manufacturer can declare the environmental profile, see annex C.

### 4.2 Conformance requirements

#### 4.2.1 Introduction

The requirements in the present document are based on the assumption that the operating band (see table 1-1) is shared between systems of the IMT family (for bands 3 and 8 also GSM) or systems having compatible characteristics.

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.1] for IMT Repeaters, a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.3] have been identified. Table 4.2.1-1 provides a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

**Table 4.2.1-1: Cross references**

Essential parameter	Corresponding technical requirements	Corresponding test suites
Transmitter spectrum mask	4.2.2 Operating band unwanted emissions	5.3.1
Transmitter unwanted emissions in the out-of-band domain		
Transmitter and receiver unwanted emissions in the spurious domain	4.2.3 Spurious emissions	5.3.2
Transmitter power accuracy	4.2.4 Maximum output power	5.3.3
Receiver radio-frequency intermodulation	4.2.5 Input intermodulation	5.3.4
Receiver desensitization		
Receiver adjacent signal selectivity	4.2.6 Out of band gain	5.3.5
	4.2.7 Adjacent Channel Rejection Ratio	5.3.6
Transmitter intermodulation attenuation	4.2.8 Output intermodulation	5.3.7

NOTE: Some of the essential parameters of the ETSI EG 203 336 [i.2] are not included into the present document since those requirements are not applicable for repeater equipment.

The manufacturer shall declare operating band(s) for the Repeater. The technical requirements apply for the declared operating band(s) as outlined for each requirement. For a Repeater supporting more than one operating band, conformance testing for each technical requirement in clause 5 shall be performed.

The technical requirements also apply to Repeater configurations described in annex B.

For a Repeater declared to support Band 20, the manufacturer shall additionally declare the following quantities associated with the applicable test conditions of table 4.2.2.2.4-1 and information in annex G of ETSI TS 136 104 [i.5]:

- $P_{EM,N}$  Declared emission level for channel N
- $P_{10MHz}$  Maximum output Power in 10 MHz

For a Repeater declared to support Band 32, the manufacturer shall additionally declare the following quantities associated with the applicable test conditions of tables 4.2.2.2.5-1 and 4.2.2.2.5-2 and information in annex H of ETSI TS 136 104 [i.5]:

- $P_{EM,B32,a}$ ,  $P_{EM,B32,b}$ ,  $P_{EM,B32,c}$ ,  $P_{EM,B32,d}$  and  $P_{EM,B32,e}$  Declared emission levels in band 32

## 4.2.2 Operating band unwanted emissions

### 4.2.2.1 Definition

Unwanted emissions consist of out of band emissions and spurious emissions (Recommendation ITU-R SM.329-12 [i.6]). Out of band emissions are 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.

### 4.2.2.2 Limit

#### 4.2.2.2.0 General

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 -3 dB point of the measuring filter closest to the carrier frequency.
- Nominal passband edge is the lowest and highest frequency of the pass band of the repeater.
- $BW_{Meas}$  is the measurement bandwidth.
- $BW_{Pass\ band}$  is the bandwidth of the repeaters pass band.
- $f_{offset}$  is the separation between the nominal pass band edge frequency and the centre of the measuring filter.
- $f_{offset_{max}}$  is the offset to the frequency 10 MHz outside the repeater operating band.
- $\Delta f_{max}$  is equal to  $f_{offset_{max}}$  minus half of the bandwidth of the measuring filter.

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

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.

#### 4.2.2.2.1 General operating band unwanted emissions

For E-UTRA FDD repeater operating in bands 1, 3, 8 or 32 emissions shall not exceed the maximum levels specified in tables 4.2.2.2.1-1 and 4.2.2.2.1-2. The measurements shall apply to both paths uplink and downlink of the Repeater.

**Table 4.2.2.2.1-1: General operating band unwanted emission limits for repeater pass band lower than 5 MHz for (E-UTRA bands 1, 3, 8 or 32)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{\text{offset}} < 0,215 \text{ MHz}$	-12,5 dBm	30 kHz
$0,2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0,215 \text{ MHz} \leq f_{\text{offset}} < 1,015 \text{ MHz}$	$-12,5 \text{ dBm} - 15 * \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,215 \right) \text{ dB}$	30 kHz
	$1,015 \text{ MHz} \leq f_{\text{offset}} < 1,5 \text{ MHz}$	-24,5 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f < 2 \times \text{BW}_{\text{Pass band}}$	$1,5 \text{ MHz} \leq f_{\text{offset}} < 2 \times \text{BW}_{\text{Pass band}} + 0,5 \text{ MHz}$	-11,5 dBm	1 MHz
$2 \times \text{BW}_{\text{Pass band}} \leq \Delta f \leq \Delta f_{\text{max}}$	$2 \times \text{BW}_{\text{Pass band}} + 0,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-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 4.2.2.2.1-3 supersede table 4.2.2.2.1-1 for applicable frequency offsets.

**Table 4.2.2.2.1-2: General operating band unwanted emission limits for repeater pass band 5 MHz and above for (E-UTRA band 1, 3, 8 or 32)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{\text{offset}} < 0,215 \text{ MHz}$	-12,5 dBm	30 kHz
$0,2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0,215 \text{ MHz} \leq f_{\text{offset}} < 1,015 \text{ MHz}$	$-12,5 \text{ dBm} - 15 * \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,215 \right) \text{ dB}$	30 kHz
	$1,015 \text{ MHz} \leq f_{\text{offset}} < 1,5 \text{ MHz}$	-24,5 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$1,5 \text{ MHz} \leq f_{\text{offset}} < 10,5 \text{ MHz}$	-11,5 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 4.2.2.2.1-3 supersede table 4.2.2.2.1-2 for applicable frequency offsets.

**Table 4.2.2.2.1-3: Conditional operating band unwanted emission limits for (E-UTRA band 1,3, 8 or 32)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,05 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{\text{offset}} < 0,065 \text{ MHz}$	$6,5 \text{ dBm} - 60 \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,015 \right) \text{ dB}$	30 kHz
$0,05 \text{ MHz} \leq \Delta f < 0,15 \text{ MHz}$	$0,065 \text{ MHz} \leq f_{\text{offset}} < 0,165 \text{ MHz}$	$3,5 \text{ dBm} - 160 \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,065 \right) \text{ dB}$	30 kHz
$0,15 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,165 \text{ MHz} \leq f_{\text{offset}} < 0,215 \text{ MHz}$	-12,5 dBm	30 kHz

NOTE: Frequencies and bandwidth are given in MHz.

For E-UTRA FDD repeater operating in bands 7 and 22 emissions shall not exceed the maximum levels specified in tables 4.2.2.2.1-3 and 4.2.2.2.1-4. The measurements shall apply to both paths uplink and downlink of the Repeater.

**Table 4.2.2.2.1-4: General operating band unwanted emission limits for repeater pass band lower than 5 MHz (E-UTRA bands 7 and 22)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < BW_{\text{Pass band}}$	$BW_{\text{Meas}}/2 \leq f_{\text{offset}} < BW_{\text{Pass band}} + BW_{\text{Meas}}/2$	$Max[-2,5 * BW_{\text{Passband}} + 2,5; -1 * BW_{\text{Passband}} - 2] \text{ dBm} + \frac{Max[-10; 1,5 * BW_{\text{Passband}} - 14,5]}{BW_{\text{Passband}}} * \left( f_{\text{offset}} - \frac{BW_{\text{meas}}}{2} \right) \text{ dB} + 1,5 \text{ dB}$	100 kHz
$BW_{\text{Pass band}} \leq \Delta f < 2 * BW_{\text{Pass band}}$	$BW_{\text{Pass band}} + BW_{\text{Meas}}/2 \leq f_{\text{offset}} < 2 * BW_{\text{Pass band}} + BW_{\text{Meas}}/2$	$Max[-2,5 * BW_{\text{Passband}} - 7,5; 0,5 * BW_{\text{Passband}} - 16,5] \text{ dBm} + 1,5 \text{ dB}$	100 kHz
$2 * BW_{\text{Pass band}} \leq \Delta f \leq \Delta f_{\text{max}}$	$2 * BW_{\text{Pass band}} + BW_{\text{Meas}}/2 \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-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 placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in table 4.2.2.2.1-6 supersede tables 4.2.2.2.1-4 and 4.2.2.2.1-5 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 4.2.2.2.1-7 supersede tables 4.2.2.2.1-4 and 4.2.2.2.1-5 for applicable frequency offsets.

**Table 4.2.2.2.1-5: General operating band unwanted emission limits for repeater pass band 5 MHz and above (E-UTRA bands 7 and 22)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-5,5 \text{ dBm} - \frac{7}{5} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$5,05 \text{ MHz} \leq f_{\text{offset}} < 10,05 \text{ MHz}$	-12,5 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-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 placed so that the channel edge is less than 200 kHz from the pass band edge, the requirements in table 4.2.2.2.1-6 supersede tables 4.2.2.2.1-4 and 4.2.2.2.1-5 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 4.2.2.2.1-7 supersede tables 4.2.2.2.1-4 and 4.2.2.2.1-5 for applicable frequency offsets.

**Table 4.2.2.2.1-6: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 1,4 MHz (E-UTRA bands 7 and 22)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1,05 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 1,1 \text{ MHz}$	$+0,5 \text{ dBm} - \frac{10}{1,4} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz

**Table 4.2.2.2.1-7: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 3 MHz (E-UTRA bands 7 and 22)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1,05 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 1,1 \text{ MHz}$	$-3,5 \text{ dBm} - \frac{10}{3} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz

For E-UTRA FDD repeater operating in bands 20 and 28 emissions shall not exceed the maximum levels specified in tables 4.2.2.2.1-8 and 4.2.2.2.1-9. The measurements shall apply to both paths uplink and downlink of the Repeater.

**Table 4.2.2.2.1-8: General operating band unwanted emission limits for repeater pass band bandwidth lower than 5 MHz (E-UTRA bands 20 and 28)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < BW_{\text{Pass band}}$	$BW_{\text{Meas}}/2 \leq f_{\text{offset}} < BW_{\text{Pass band}} + BW_{\text{Meas}}/2$	$Max[-2,5 * BW_{\text{Passband}} + 2,5; -1 * BW_{\text{Passband}} - 2] \text{ dBm}$ $\frac{Max[-10; 1,5 * BW_{\text{Passband}} - 14,5]}{BW_{\text{Passband}}} * \left( f_{\text{offset}} - \frac{BW_{\text{meas}}}{2} \right) \text{ dB}$ + 1,5 dB	100 kHz
$BW_{\text{Pass band}} \leq \Delta f < 2 * BW_{\text{Pass band}}$	$BW_{\text{Pass band}} + BW_{\text{Meas}}/2 \leq f_{\text{offset}} < 2 * BW_{\text{Pass band}} + BW_{\text{Meas}}/2$	$Max[-2,5 * BW_{\text{Passband}} - 7,5; 0,5 * BW_{\text{Passband}} - 16,5] \text{ dBm}$ + 1,5 dB	100 kHz
$2 * BW_{\text{Pass band}} \leq \Delta f \leq \Delta f_{\text{max}}$	$2 * BW_{\text{Pass band}} + BW_{\text{Meas}}/2 \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-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 4.2.2.2.1-10 supersedes tables 4.2.2.2.1-8 and 4.2.2.2.1-9 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 4.2.2.2.1-11 supersedes tables 4.2.2.2.1-8 and 4.2.2.2.1-9 for applicable frequency offsets.

**Table 4.2.2.2.1-9: General operating band unwanted emission limits for repeater pass band bandwidth 5 MHz and above (E-UTRA bands 20 and 28)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-5,5 \text{ dBm} - \frac{7}{5} * \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < 10 \text{ MHz}$	$5,05 \text{ MHz} \leq f_{\text{offset}} < 10,05 \text{ MHz}$	-12,5 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-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 4.2.2.2.1-10 supersedes tables 4.2.2.2.1-8 and 4.2.2.2.1-9 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 4.2.2.2.1-11 supersedes tables 4.2.2.2.1-8 and 4.2.2.2.1-9 for applicable frequency offsets.

**Table 4.2.2.2.1-10: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 1,4 MHz (E-UTRA bands 20 and 28)**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1,05 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 1,1 \text{ MHz}$	$+0,5 \text{ dBm} - \frac{10}{1,4} * \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right)$	100 kHz

NOTE: Frequencies and bandwidth are given in MHz.

**Table 4.2.2.2.1-11: Conditional operating band unwanted emission limits for repeater input signal bandwidth of 3 MHz (E-UTRA bands 20 and 28)**

Frequency offset of measurement filter -3dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Test requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 1,05 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 1,1 \text{ MHz}$	$-3,5 \text{ dBm} - \frac{10}{3} \cdot \left( \frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz

NOTE: Frequencies and bandwidth are given in MHz.

#### 4.2.2.2.2 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.

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 4.2.2.2.2-1.

**Table 4.2.2.2.2-1: 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 4.2.2.2.2-1 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.		

#### 4.2.2.2.3 Co-existence with services in adjacent frequency bands

This requirement shall be applied for the protection in bands adjacent to band 1.

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

The power of any operating band unwanted emission shall not exceed the limits in table 4.2.2.2.3-1.

**Table 4.2.2.2.3-1: UTRA Repeater down-link operating band unwanted emission limits for protection of adjacent band services**

Operating Band	Band	Maximum Level	Measurement Bandwidth
1	2 100 MHz to 2 105 MHz	$-30 + 3,4 (f - 2 100 \text{ MHz}) \text{ dBm}$	1 MHz
	2 175 MHz to 2 180 MHz	$-30 + 3,4 (2 180 \text{ MHz} - f) \text{ dBm}$	1 MHz

#### 4.2.2.2.4 Protection of DTT

The following requirement shall apply for protection of DTT. For E-UTRA Repeater operating in band 20, the level of emissions in the band 470 MHz to 790 MHz, measured in an 8 MHz filter bandwidth on centre frequencies  $F_{\text{filter}}$  according to table 4.2.2.2.4-1, shall not exceed the maximum emission level  $P_{\text{EM,N}}$  declared by the manufacturer. This requirement applies in the frequency range 470 MHz to 790 MHz even though part of the range falls in the spurious domain.



**Table 4.2.2.2.4-1: Declared emissions levels for protection of DTT**

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

NOTE: Compliance with the declared emission levels above provides the characteristics of the E-UTRA Repeater needed to verify compliance with the corresponding CEPT/ECC technical condition using the method outlined in annex G of ETSI TS 136 104 [i.5].

#### 4.2.2.2.5 Limits for operation in Band 32

For a repeaters operating in Band 32 within 1 452 MHz to 1 492 MHz. The level of unwanted emissions, measured on centre frequencies  $f_{\text{offset}}$  with filter bandwidth, according to table 4.2.2.2.5-1 shall not exceed the maximum emission level  $P_{\text{EM},B32,a}$ ,  $P_{\text{EM},B32,b}$  nor  $P_{\text{EM},B32,c}$  declared by the manufacturer.

**Table 4.2.2.2.5-1: Declared operating band 32 unwanted emission within 1 452 MHz to 1 492 MHz**

Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Declared emission level [dBm]	Measurement bandwidth
2,5 MHz	$P_{\text{EM},B32,a}$	5 MHz
7,5 MHz	$P_{\text{EM},B32,b}$	5 MHz
$12,5 \text{ MHz} \leq f_{\text{offset}} \leq f_{\text{offset}_{\text{max}}, B32}$	$P_{\text{EM},B32,c}$	5 MHz
NOTE: $f_{\text{offset}_{\text{max}}, B32}$ denotes the frequency difference between the lower pass band edge frequency and 1 454,5 MHz, and the frequency difference between the upper pass band edge frequency and 1 489,5 MHz for the set channel position.		

NOTE 1: Compliance with the declared emission levels above provides the characteristics of the base station needed to verify compliance with the corresponding CEPT/ECC technical condition using the method outlined in annex H of ETSI TS 136 104 [i.5].

For a repeaters operating in Band 32 within 1 452 MHz to 1 492 MHz for the protection of services in spectrum adjacent to the frequency range 1 452 MHz to 1 492 MHz. The level of emissions, measured on centre frequencies  $F_{\text{filter}}$  with filter bandwidth according to table 4.2.2.2.5-2 shall not 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 1 429 MHz to 1 518 MHz even though part of the range falls in the spurious domain.

**Table 4.2.2.2.5-2: Operating band 32 declared emission outside 1 452 MHz to 1 492 MHz**

Filter centre frequency, $F_{\text{filter}}$	Declared emission level [dBm]	Measurement bandwidth
$1\ 429,5 \text{ MHz} \leq F_{\text{filter}} \leq 1\ 448,5 \text{ MHz}$	$P_{\text{EM},B32,d}$	1 MHz
$F_{\text{filter}} = 1\ 450,5 \text{ MHz}$	$P_{\text{EM},B32,e}$	3 MHz
$F_{\text{filter}} = 1\ 493,5 \text{ MHz}$	$P_{\text{EM},B32,e}$	3 MHz
$1\ 495,5 \text{ MHz} \leq F_{\text{filter}} \leq 1\ 517,5 \text{ MHz}$	$P_{\text{EM},B32,d}$	1 MHz

NOTE 2: Compliance with the declared emission levels above provides the characteristics of the base station needed to verify compliance with the corresponding CEPT/ECC technical condition using the method outlined in annex H of ETSI TS 136 104 [i.5].

#### 4.2.2.3 Conformance

Conformance tests described in clause 5.3.1 shall be carried out.

## 4.2.3 Spurious emissions

### 4.2.3.1 Definition

Unwanted emissions consist of out of band emissions and spurious emissions (Recommendation ITU-R SM.329-12 [i.6]). Out of band emissions are 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 spurious emission limits apply from 9 kHz to 12,75 GHz (or above, as indicated in table 4.2.3.2.1-1), 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.

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. The measurements shall apply to both paths uplink and downlink of the Repeater.

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

### 4.2.3.2 Limit

#### 4.2.3.2.0 General

The requirements 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.

#### 4.2.3.2.1 Spurious emissions

The power of any spurious emission shall not exceed the limits in table 4.2.3.2.1-1.

**Table 4.2.3.2.1-1: General spurious emissions limits**

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 downlink or uplink operating band for downlink or uplink spurious emissions, respectively	-30 dBm	1 MHz	Note 2, note 3
NOTE 1: Bandwidth as in Recommendation ITU-R SM.329-12 [i.6], section 4.1.			
NOTE 2: Bandwidth as in Recommendation ITU-R SM.329-12 [i.6], section 4.1. Upper frequency as in Recommendation ITU-R SM.329-12 [i.6], section 2.5, table 1.			
NOTE 3: Applies only for Bands 22.			

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

These requirements may be applied for the protection of UE, MS and/or BS operating in other frequency bands in the same geographical area. The requirements may apply in geographic areas in which both E-UTRA-FDD Repeater and a system operating in another frequency band than the E-UTRA operating band are deployed. The system operating in the other frequency band may be GSM900, DCS1800, UTRA FDD/TDD and/or E-UTRA.

The power of any spurious emission shall not exceed the limits of table 4.2.3.2.2-1 for an E-UTRA Repeater where requirements for co-existence with the system listed in the first column apply.

**Table 4.2.3.2.2-1: Spurious emissions limits for E-UTRA-FDD repeater in geographic coverage area of systems operating in other frequency bands**

Protected system	Frequency range for co-existence requirement	Maximum Level	Measurement Bandwidth	Note
GSM900	921 MHz to 960 MHz	-57 dBm	100 kHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 8.
	876 MHz to 915 MHz	-61 dBm	100 kHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in clause 4.2.2.2.2.
DCS1800	1 805 MHz to 1 880 MHz	-47 dBm	100 kHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 3.
	1 710 MHz to 1 785 MHz	-61 dBm	100 kHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band I or E-UTRA Band 1	2 110 MHz to 2 170 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 1.
	1 920 MHz to 1 980 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 1, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band III or E-UTRA Band 3	1 805 MHz to 1 880 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 3.
	1 710 MHz to 1 785 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band VII or E-UTRA Band 7	2 620 MHz to 2 690 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 7.
	2 500 MHz to 2 570 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 7, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band VIII or E-UTRA Band 8	925 MHz to 960 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 8.
	880 MHz to 915 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band XX or E-UTRA Band 20	791 MHz to 821 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 20 or 28.
	832 MHz to 862 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 20, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band XXII or E-UTRA Band 22	3 510 MHz to 3 590 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 22.
	3 410 MHz to 3 490 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 22, since it is already covered by the requirement in clause 4.2.2.2.2.
E-UTRA Band 28	758 MHz to 803 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 20 or 28.

Protected system	Frequency range for co-existence requirement	Maximum Level	Measurement Bandwidth	Note
	703 MHz to 748 MHz	-49 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 28, since it is already covered by the requirement in clause 4.2.2.2.2.
UTRA FDD Band XXXII or E-UTRA Band 32	1 452 MHz to 1 496 MHz	-52 dBm	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 32.
UTRA TDD in Band a) or E-UTRA Band 33	1 900 MHz to 1 920 MHz	-52 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 1.
		-53 dBm	100 kHz	This requirement shall apply only to the uplink of E-UTRA FDD Repeater operating in band 1.
UTRA TDD in Band a) or E-UTRA Band 34	2 010 MHz to 2 025 MHz	-52 dBm	1 MHz	
UTRA TDD in Band d) or E-UTRA Band 38	2 570 MHz to 2 620 MHz	-52 dBm	1 MHz	This requirement shall not apply to the uplink of E-UTRA FDD Repeater operating in band 7.
		-53 dBm	100 kHz	This requirement shall apply only to the uplink of E-UTRA FDD Repeater operating in band 7.
NOTE 1: As set out in the definition in clause 4.2.3.1, the co-existence requirements in this table shall not apply for the 10 MHz frequency range immediately outside the repeaters operating band frequency range of an operating band (see table 1-1). This is also the case when the repeaters operating band frequency range is adjacent to the band for the protected system in the table.				
NOTE 2: Where the table has two entries for the same or overlapping frequency ranges, both limits shall be applied.				
NOTE 3: The requirements of -53 dBm/100 kHz in this table 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 a UTRA TDD BS receiver.				

### 4.2.3.3 Conformance

Conformance tests described in clause 5.3.2 shall be carried out.

## 4.2.4 Maximum output power

### 4.2.4.1 Definition

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 specified reference condition.

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

### 4.2.4.2 Limit

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 4.2.4.2-1 relative to the rated output power.

**Table 4.2.4.2-1: Repeater output power; normal conditions**

Rated output power	Carrier frequency	Limit
P ≥ 31 dBm	f ≤ 3,0 GHz	+2,7 dB and -2,7 dB
	3,0 GHz < f ≤ 4,2 GHz	+3,0 dB and -3,0 dB
P < 31 dBm	f ≤ 3,0 GHz	+3,7 dB and -3,7 dB
	3,0 GHz < f ≤ 4,2 GHz	+4,0 dB and -4,0 dB

In extreme conditions, the Repeater maximum output power shall remain within limits specified in table 4.2.4.2-2 relative to the rated output power.

**Table 4.2.4.2-2: Repeater output power; extreme conditions**

Rated output power	Carrier frequency	Limit
P ≥ 31 dBm	f ≤ 3,0 GHz	+3,2 dB and -3,2 dB
	3,0 GHz < f ≤ 4,2 GHz	+3,5 dB and -3,5 dB
P < 31 dBm	f ≤ 3,0 GHz	+4,7 dB and -4,7 dB
	3,0 GHz < f ≤ 4,2 GHz	+5,0 dB and -5,0 dB

#### 4.2.4.3 Conformance

Conformance tests described in clause 5.3.3 shall be carried out.

### 4.2.5 Input intermodulation

#### 4.2.5.1 Definition

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.

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the Repeater to maintain the wanted frequency free of internally created interference.

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.

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

#### 4.2.5.2 Limit

##### 4.2.5.2.1 General input intermodulation requirement

The intermodulation performance should be met when the following signals are applied to the Repeater.

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

**Table 4.2.5.2.1-1: General input intermodulation requirement**

$f_1$ offset	Interfering signal levels	Type of signals	Measurement bandwidth
1,0 MHz	-40 dBm	2 CW carriers	1 MHz

For the parameters specified in table 4.2.5.2.1-1, the power in the pass band shall not increase with more than the limit in table 4.2.5.2.1-2 at the output of the Repeater as measured in the centre of the pass band, compared to the level obtained without interfering signals applied.

**Table 4.2.5.2.1-2: General input intermodulations limit**

<b>Limit for the increase of power in the pass band</b>
+11,2 dB

#### 4.2.5.2.2 Co-existence with other systems

The intermodulation performance should be met when the following signals are applied to the Repeater.

**Table 4.2.5.2.2-1: 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 MHz to 915 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in clause 4.2.5.2.1.
DCS1800	1 710 MHz to 1 785 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band I or E-UTRA band 1	1 920 MHz to 1 980 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 1, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band III or E-UTRA band 3	1 710 MHz to 1 785 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 3, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band VII or E-UTRA band 7	2 500 MHz to 2 570 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 7, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band VIII or E-UTRA band 8	880 MHz to 915 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 8, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band XX or E-UTRA band 20	832 MHz to 862 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 20 or 28, since it is already covered by the requirement in clause 4.2.5.2.1.
UTRA FDD band XX or E-UTRA band 22	3 410 MHz to 3 490 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 22, since it is already covered by the requirement in clause 4.2.5.2.1.
E-UTRA band 28	703 MHz to 748 MHz	-15 dBm	2 CW carriers	1 MHz	This requirement shall not apply to E-UTRA FDD Repeater operating in band 20 or 28, since it is already covered by the requirement in clause 4.2.5.2.1.
NOTE: The co-existence requirements in this table shall not apply when the repeaters pass band frequency range is adjacent to the frequency range of the co-existence requirement in this table. The current state-of-the-art technology does not allow a single generic solution for co-existence.					

For the parameters specified in table 4.2.5.2.2-1, the power in the pass band shall not increase with more than the limit in table 4.2.5.2.2-2 at the output of the Repeater as measured in the centre of the pass band, compared to the level obtained without interfering signals applied.

**Table 4.2.5.2.2-2: General input intermodulations limit**

<b>Limit for the increase of power in the pass band</b>
+11,2 dB

### 4.2.5.3 Conformance

Conformance tests described in clause 5.3.4 shall be carried out.

## 4.2.6 Out of band gain

### 4.2.6.1 Definition

Out of band gain refers to the gain of the Repeater immediately outside the pass band.

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

### 4.2.6.2 Limits

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 4.2.6.2-1, 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 4.2.6.2-1: Out of band gain limits 1**

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

For  $10 \text{ MHz} \leq f_{\text{offset\_CW}}$  the out of band gain shall not exceed the maximum gain of table 4.2.6.2-2 or the maximum gain stated in table 4.2.6.2-2 whichever is lower.

**Table 4.2.6.2-2: Out of band gain limits 2**

Frequency offset, $f_{\text{offset\_CW}}$	Carrier frequency	Maximum gain
$10 \text{ MHz} \leq f_{\text{offset\_CW}}$	$f \leq 3,0$ GHz	Out of band gain $\leq$ minimum donor coupling loss + 0,5 dB
	$3,0 \text{ GHz} < f \leq 4,2$ GHz	Out of band gain $\leq$ minimum donor coupling loss + 0,8 dB

### 4.2.6.3 Conformance

Conformance tests described in clause 5.3.5 shall be carried out.

## 4.2.7 Adjacent Channel Rejection Ratio

### 4.2.7.1 Definition

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).

### 4.2.7.2 Limit

#### 4.2.7.2.1 ACRR

There is no minimum requirement for E-UTRA signals.

#### 4.2.7.2.2 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.

In normal conditions the ACRR shall be higher than the value specified in the table 4.2.7.2.2-1.

**Table 4.2.7.2.2-1: Repeater ACRR**

Co-existence with other systems	Repeater maximum output power	Channel offset from the centre frequency of the first or last 5 MHz channel within the pass band	ACRR limit
UTRA	$P \geq 31$ dBm	5 MHz	32,3 dB
	$P \geq 31$ dBm	10 MHz	32,3 dB
	$P < 31$ dBm	5 MHz	19,3 dB
	$P < 31$ dBm	10 MHz	19,3 dB

NOTE: Repeater maximum output power as defined in ETSI EN 301 908-11 [i.7].

### 4.2.7.3 Conformance

Conformance tests described in clause 5.3.6 shall be carried out.

## 4.2.8 Output intermodulation

### 4.2.8.1 Definition

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 output intermodulation level is the power of the intermodulation products when an E-UTRA signal of channel bandwidth 5 MHz as an interference signal is injected into the output port at a level of 30 dB lower than that of the wanted signal. The wanted signal channel bandwidth  $BW_{\text{Channel}}$  shall be the maximum bandwidth supported by the repeater. The interfering signal centre frequency offset from wanted signal carrier centre frequency shall be according to table 4.2.8.1-1.

The requirement shall apply to the downlink of the Repeater, at maximum gain.



**Table 4.2.8.1-1: Interfering and wanted signals for the output intermodulation requirement**

Parameter	Value
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	$-BW_{\text{Channel}}/2 - 12,5 \text{ MHz}$ $-BW_{\text{Channel}}/2 - 7,5 \text{ MHz}$ $-BW_{\text{Channel}}/2 - 2,5 \text{ MHz}$ $BW_{\text{Channel}}/2 + 2,5 \text{ MHz}$ $BW_{\text{Channel}}/2 + 7,5 \text{ MHz}$ $BW_{\text{Channel}}/2 + 12,5 \text{ MHz}$
NOTE:	Interfering signal positions that are partially or completely outside of the downlink operating band of the repeater are excluded from the requirement.

#### 4.2.8.2 Limit

The output intermodulation level shall not exceed the operating band unwanted emissions of clause 4.2.2.2 nor the downlink spurious emission requirements clause 4.2.3.2.1.

#### 4.2.8.3 Conformance

Conformance tests described in clause 5.3.7 shall be carried out.

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## 5 Testing for compliance with technical requirements

### 5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

Normally it should be sufficient for all tests to be conducted using normal test conditions except where otherwise stated. For guidance on the use of other test conditions to be used in order to show compliance reference can be made to ETSI TS 136 143 [1], annex A.

### 5.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 5.2-1.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor)  $k = 1,96$  (which provides confidence levels of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.4], in particular in annex D of the ETSI TR 100 028-2 [i.4].

Table 5.2-1 is based on such expansion factors.

**Table 5.2-1: Maximum measurement uncertainty**

Parameter	Condition	Uncertainty
Operating band unwanted emission (except Protection of the BS receiver in the operating band)	$f \leq 3,0$ GHz $3,0$ GHz $< f \leq 4,2$ GHz The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station according to ETSI TS 136 141 [4]	$\pm 1,5$ dB $\pm 1,8$ dB
Protection of the BS receiver in the operating band	for results $> -60$ dBm for results $< -60$ dBm	$\pm 2,0$ dB $\pm 3,0$ dB
Spurious emissions	In E-UTRA and coexistence receive bands: for results $> -60$ dBm for results $< -60$ dBm  Outside above range: emission power $9$ kHz $< f \leq 4$ GHz $f > 4$ GHz  The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station according to ETSI TS 136 141 [4]	$\pm 2,0$ dB $\pm 3,0$ dB  $\pm 2,0$ dB $\pm 4,0$ dB
Output power	$f \leq 3,0$ GHz $3,0$ GHz $< f \leq 4,2$ GHz	$\pm 0,7$ dB $\pm 1,0$ dB
Input intermodulation characteristics	Formula: $\sqrt{(CW1\_level\_error)^2 + (2 \cdot CW2\_level\_error)^2 + (measurement\_error)^2}$ RSS: CW1 level error, 2 x CW2 level error, and measurement error (using all errors = $\pm 0,5$ dB)	$\pm 1,2$ dB
Out of band gain	$f \leq 3,0$ GHz $3,0$ GHz $< f \leq 4,2$ GHz Calibration of test set-up shall be made without DUT in order to achieve the accuracy	$\pm 0,5$ dB $\pm 0,8$ dB
Output intermodulation	Operating band unwanted emission:  The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station according to ETSI TS 136 141 [4] For spurious emission:  In UTRA and coexistence receive bands: for results $> -60$ dBm for results $< -60$ dBm  Outside above range: emission power; $9$ kHz $< f \leq 4$ GHz $f > 4$ GHz  The interference signal shall have a spurious emission level at least 10 dB below the spurious levels required in clause 4.2.3.2	$\pm 2,1$ dB  $\pm 2,0$ dB $\pm 3,0$ dB  $\pm 2,0$ dB $\pm 4,0$ dB

Parameter	Condition	Uncertainty
Adjacent Channel Rejection Ratio		$\pm 0,7$ dB
NOTE 1: For RF tests it should be noted that the uncertainties in this table apply to the Test System operating into a nominal 50 $\Omega$ load and do not include system effects due to mismatch between the EUT and the Test System.		
NOTE 2: If the Test System for a test is known to have a measurement uncertainty greater than that specified in this table, this equipment can still be used, provided that an adjustment is made as follows: Any additional uncertainty in the Test System over and above that specified in this table is used to tighten the Test Requirements - making the test harder to pass (for some tests, e.g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a Test System not compliant with this table does not increase the probability of passing an EUT that would otherwise have failed a test if a Test System compliant with this table had been used.		

## 5.3 Essential radio test suites

### 5.3.0 Introduction

This clause describes the test suites for E-UTRA (FDD).

### 5.3.1 Operating band unwanted emissions

#### 5.3.1.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1) Connect a signal generator to the input port of the Repeater.
- 2) Detection mode: True RMS.

#### 5.3.1.2 Procedures

- 1) Set the Repeater to maximum gain.
- 2) Set the signal generator to generate signal(s) in accordance to table 5.3.1.2-1.

**Table 5.3.1.2-1: Stimulus signal for operating band unwanted emissions testing**

Repeater under test link and passband bandwidth	Stimulus reference	Note
Downlink pass band BW < 2,8 MHz	Repeater stimulus signal 4	The signal is defined in ETSI TS 136 143 [1], clause D.4
Uplink pass band BW < 2,8 MHz	Repeater stimulus signal 3	The signal is defined in ETSI TS 136 143 [1], clause D.3
Downlink pass band BW $\geq$ 2,8 MHz	Repeater stimulus signal 2	The signal is defined in ETSI TS 136 143 [1], clause D.2
Uplink pass band BW $\geq$ 2,8 MHz	Repeater stimulus signal 1	The signal is defined in ETSI TS 136 143 [1], clause D.1

At centre frequencies such that the whole signal can be fitted inside the repeater pass band and at level(s) which produce the manufacturer specified maximum output power at maximum gain.

- 3) The detecting device shall be configured with a measurement bandwidth as stated in the test requirement tables.
- 4) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value. To select the table and the maximum level, use the repeater pass band and stimulus signal if necessary.
- 5) Increase the input power with 10 dB compared to the level obtained in step 2).

- 6) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value. To select the table and the maximum level, use the repeater pass band and stimulus signal if necessary.
- 7) If the pass band is wider than 2,8 MHz, repeat steps 1) to 6) with a new stimulus signal of the same kind, but using different centre frequencies such that the whole signal fitted in the repeater pass band.
- 8) Switch off the input signal to the repeater.
- 9) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value. To select the table and the maximum level, use the repeater pass band.

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

### 5.3.1.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.2.2 in order to prove compliance.

## 5.3.2 Spurious emissions

### 5.3.2.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1) Connect a signal generator to the input port of the repeater.
- 2) Detection mode: True RMS.

### 5.3.2.2 Procedures

- 1) Set the Repeater to maximum gain.
- 2) Set the signal generator to generate signal(s) in accordance to table 5.3.2.2-1.

**Table 5.3.2.2-1: Stimulus signal for operating band unwanted emissions testing**

Repeater under test link and passband bandwidth	Stimulus reference	Note
Downlink pass band BW < 2,8 MHz	Repeater stimulus signal 4	The signal is defined in ETSI TS 136 143 [1], clause D.4
Uplink pass band BW < 2,8 MHz	Repeater stimulus signal 3	The signal is defined in ETSI TS 136 143 [1], clause D.3
Downlink pass band BW ≥ 2,8 MHz	Repeater stimulus signal 2	The signal is defined in ETSI TS 136 143 [1], clause D.2
Uplink pass band BW ≥ 2,8 MHz	Repeater stimulus signal 1	The signal is defined in ETSI TS 136 143 [1], clause D.1

At centre frequencies such that the whole signal can be fitted inside the repeater pass band and at level(s) which produce the manufacturer specified maximum output power at maximum gain.

- 3) The detecting device shall be configured with a measurement bandwidth as stated in the test requirement tables.
- 4) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.

- 5) Increase the input power with 10 dB compared to the level obtained in step 2).
- 6) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.
- 7) If the pass band is wider than 2,8 MHz, repeat steps 1) to 6) with a new stimulus signal of the same kind, but using different centre frequencies such that the whole signal fitted in the repeater pass band in the repeaters pass band.
- 8) Switch off the input signal to the repeater.
- 9) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.

### 5.3.2.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to prove compliance.

## 5.3.3 Maximum output power

### 5.3.3.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

In addition, on one UARFCN only, the test shall be performed under extreme power supply as defined in clause A.5.

NOTE: Tests under extreme power supply also test extreme temperature, see ETSI TS 136 143 [1].

- 1) Connect the signal generator equipment to the Repeater input port.
- 2) Connect the power measuring equipment to the Repeater output port.

### 5.3.3.2 Procedures

- 1) Set the signal generator to transmit signal(s) in accordance to table 5.3.3.2-1.

**Table 5.3.3.2-1: Stimulus signal for output power testing**

Repeater under test link and pass band bandwidth	Stimulus reference	Note
Downlink	One E-TM1.1 of the widest possible bandwidth to fit into the Repeater pass band	The signal is defined in ETSI TS 136 141 [4]
Uplink pass band BW < 2,8 MHz	Repeater stimulus signal 3	The signal is defined in ETSI TS 136 143 [1], clause D.3
Uplink pass band BW ≥ 2,8 MHz	Repeater stimulus signal 1	The signal is defined in ETSI TS 136 143 [1], clause D.1

At centre frequencies such that the whole signal can be fitted inside the repeater pass band and at level(s) which produce the manufacturer specified maximum output power at maximum gain.

- 2) Adjust the input power to the Repeater to create the maximum nominal Repeater output power at maximum gain.
- 3) Measure the mean power at the RF output port over a certain slot.
- 4) Increase the power with 10 dB compare to the level obtained in step 2).
- 5) Measure the mean power at the RF output port over a certain slot.

### 5.3.3.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.4.2 in order to prove compliance.

## 5.3.4 Input intermodulation

### 5.3.4.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1) Set the Repeater to maximum gain.
- 2) Connect two signal generators with a combining circuit or one signal generator with the ability to generate several CW carriers to the input.
- 3) Connect a spectrum analyser to the output of the Repeater. Set the resolution bandwidth to 1 MHz in the centre of the pass band. Set averaging to 1 second or more.

### 5.3.4.2 Procedures

- 1) Adjust the frequency of the input signals, either below or above the pass band, so that one carrier,  $f_1$ , is 1 MHz outside the channel edge frequency of the first or last channel in the pass band, and the lowest order intermodulation product from the two carriers is positioned in the centre of the pass band, according to clause 4.2.5.2.
- 2) Take the measurement of the rise of the output signal.
- 3) Repeat the measurement for the opposite path of the Repeater.

### 5.3.4.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.5.2 in order to prove compliance.

## 5.3.5 Out of band gain

### 5.3.5.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1)  $f_{\text{offset\_CW}}$  is the offset between the outer channel edge frequency of the outer channel in the pass band and a CW-signal.
- 2) The test shall be performed with an  $f_{\text{offset\_CW}}$  of 0,2 MHz, 0,5 MHz, 1 MHz, 5 MHz, 7,5 MHz, 10 MHz, 12,5 MHz, 15 MHz and 20 MHz, excluding other pass bands. In addition the test shall also be performed for all harmonic frequencies of the repeaters pass band up to 12,75 GHz, for carrier frequency  $f \leq 3,0$  GHz, or up to the 5<sup>th</sup> harmonic of the upper frequency edge of the downlink or uplink operating band, for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ .

### 5.3.5.2 Procedures

- 1) Set the Repeater to maximum gain.
- 2) Set the signal generator to generate a CW-signal, applied to the input port of the Repeater. The power level of the RF input signal shall be at least 5 dB below the power level which, when applied within the pass band, would produce the maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

- 3) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the Repeater and the net gain shall be recorded and compared to tables 4.2.6.2-1 or 4.2.6.2-2 whichever is lower.
- 4) With the same input power as in step 1) set the repeater gain to the minimum specified by the manufacturer.
- 5) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the repeater and the net gain shall be recorded and compared to tables 4.2.6.2-1 or 4.2.6.2-2 whichever is lower.

### 5.3.5.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.6.2 in order to prove compliance.

## 5.3.6 Adjacent Channel Rejection Ratio

### 5.3.6.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1) Connect a signal generator to the input port of the Repeater.
- 2) Connect a power measuring equipment to the output port of the Repeater.
- 3) The measurement device characteristics shall be:
  - measurement filter bandwidth: defined in clause 4.2.7.1;
  - detection mode: true RMS voltage or true average power.

### 5.3.6.2 Procedures

- 1) Set the signal generator to transmit a signal modulated with a combination of PCCPCH, SCCPCH and Dedicated Physical Channels specified as test model 1 in ETSI TS 125 141 [5] at the first or last 5 MHz channel within the pass band.
- 2) Adjust the input power to the Repeater to create the maximum nominal Repeater output power at maximum gain.
- 3) Measure the RRC filtered mean power at the RF output port over a certain slot.
- 4) Set the signal generator to transmit the same signal and the same input power at one of the channel offsets outside the repeater pass band according to table 4.2.7.2.2-1.
- 5) Measure the RRC filtered mean power at the RF output port over a certain slot.
- 6) Calculate the ratio of the measured power in the pass band to the measured power at the channel offset.
- 7) Repeat steps 4) to 6) until all channel offsets in table 4.2.7.2.2-1 are measured.

### 5.3.6.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.7.2 in order to prove compliance.

## 5.3.7 Output intermodulation

### 5.3.7.1 Initial conditions

Test environment: normal, see ETSI TS 136 143 [1], clause A.2.

A measurement set-up is shown in ETSI TS 136 143 [1], annex C.

- 1) Connect a signal generator to the input port of the Repeater (wanted signal). Connect a signal generator to the circulator on the output port (interfering signal) and make sure the signal generator power is directed to the repeater output port.
- 2) Detection mode: True RMS.

### 5.3.7.2 Procedures

- 1) Set the Repeater to maximum gain.
- 2) Set the signal generator at the repeater input port (wanted signal) to generate a signal in accordance to test model E-TM 1.1, ETSI TS 136 141 [4], clause 6.1.1.1, with a bandwidth as defined in table 4.2.8.1-1, at the level which produce the manufacturer specified maximum output power at maximum gain.
- 3) Set the signal generator at the repeater output port (interference signal) to generate a signal in accordance to test model E-TM 1.1, ETSI TS 136 141 [4], clause 6.1.1.1, with a bandwidth, level and frequency offset as defined in table 4.2.8.1-1.
- 4) Measure the emission at the specified frequencies with specified measurement bandwidth as described in the test requirements and note that the measured value does not exceed the specified value. Measurements in the band of the interfering signal shall be excluded. The measurements can be limited to the power of all third and fifth order intermodulation products.
- 5) Repeat the test from step 3) on until all interfering signal centre frequency offsets in table 4.2.8.1-1 has been tested, but exclude interfering signal frequencies that are outside of the allocated frequency band for E-UTRA downlink specified in clause 1.

NOTE: As a general rule the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth can 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.

### 5.3.7.3 Test requirement

The results obtained shall be compared to the limits in clause 4.2.8.2 in order to prove compliance.



## Annex A (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.8] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A-1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

**Table A-1: Relationship between the present document and the essential requirements of Directive 2014/53/EU**

<b>Harmonised Standard ETSI EN 301 908-15</b>				
The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.1]				
<b>Requirement</b>			<b>Requirement Conditionality</b>	
<b>No</b>	<b>Description</b>	<b>Reference: Clause No</b>	<b>U/C</b>	<b>Condition</b>
1	Operating band unwanted emissions	4.2.2	U	
2	Spurious emissions	4.2.3	U	
3	Maximum output power	4.2.4	U	
4	Input intermodulation	4.2.5	U	
5	Out of band gain	4.2.6	U	
6	Adjacent Channel Rejection Ratio	4.2.7	U	
7	Output intermodulation	4.2.8	U	

### Key to columns:

#### Requirement:

**No** A unique identifier for one row of the table which may be used to identify a requirement.

**Description** A textual reference to the requirement.

**Clause Number** Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

#### Requirement Conditionality:

**U/C** Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

**Condition** Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

## Annex B (normative): Repeater configurations

### B.1 Power supply

When extreme power supply conditions are specified for a test, the test shall be performed at the standard upper and lower limits of operating voltage defined by manufacturer's declaration for the equipment under test.

#### Upper voltage limit:

The equipment shall be supplied with a voltage equal to the upper limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, in accordance with the methods described in IEC 60068-2-1 [2] Test Ab/Ad and IEC 60068-2-2 [3] Test Bb/Bd: Dry Heat.

#### Lower voltage limit:

The equipment shall be supplied with a voltage equal to the lower limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, in accordance with the methods described in IEC 60068-2-1 [2] Test Ab/Ad and IEC 60068-2-2 [3] Test Bb/Bd: Dry Heat.

### B.2 Power supply options

If the Repeater is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

### B.3 Combining of Repeaters

If the Repeater is intended for combination with additional apparatus connected to a Repeater port and this combination is supplied as a system, the combination of Repeater together with the additional apparatus shall also fulfil the Repeater requirements. E.g. if the Repeater is intended for combination such that multiple Repeaters amplify the same signals into the same ports the combination shall also fulfil the Repeater requirements.

An example of such a configuration is shown in figure B.3-1.

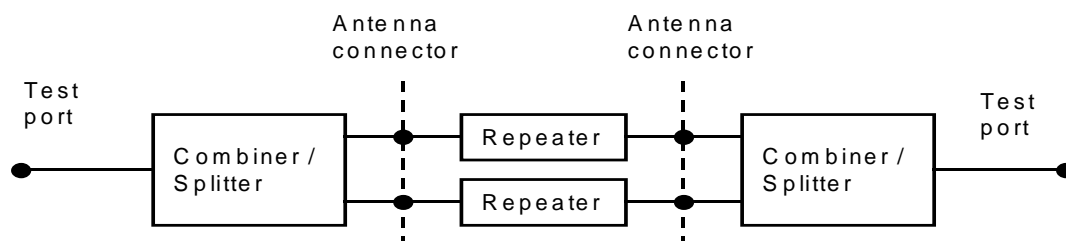


Figure B.3-1: Example of Repeater configuration

## Annex C (normative): Repeater stimulus signal spectral purity requirements

The reference channels or test models constituting the repeater stimulus signal shall fulfil the spectral purity requirements defined by table C-1, where:

- the reference spectral density shall be taken 200 kHz off the carrier centre frequency with an integration bandwidth of 30 kHz;
- $\Delta f$  is the separation between the channel edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency;
- $f_{\text{offset}}$  is the separation between the channel edge frequency and the centre of the measuring filter;
- $f_{\text{offset}_{\text{max}}}$  is the offset to the frequency 10 MHz outside the downlink operating band;
- $\Delta f_{\text{max}}$  is equal to  $f_{\text{offset}_{\text{max}}}$  minus half of the bandwidth of the measuring filter;
- the minimum spectral density suppression is related to the reference spectral density.

**Table C-1: Repeater stimulus signal spectral purity requirements**

Frequency offset of measurement filter -3 dB point, $\Delta f$	Frequency offset of measurement filter centre frequency, $f_{\text{offset}}$	Minimum requirement	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,15 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{\text{offset}} < 0,165 \text{ MHz}$	$-40 + 20 \times (f_{\text{offset}} - 0,015) \text{ dBc}$	30 kHz
$0,15 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,165 \text{ MHz} \leq f_{\text{offset}} < 0,215 \text{ MHz}$	-37 dBc	30 kHz
$0,2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0,215 \text{ MHz} \leq f_{\text{offset}} < 1,015 \text{ MHz}$	$-94 \text{ dBm} - 15 * (f_{\text{offset}} - 0,215) \text{ dB}$	30 kHz
	$1,015 \text{ MHz} \leq f_{\text{offset}} < 1,5 \text{ MHz}$	-106 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f < 2,8 \text{ MHz}$	$1,5 \text{ MHz} \leq f_{\text{offset}} < 2,85 \text{ MHz}$	-78 dBm	1 MHz
$2,8 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$2,85 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-80 dBm	1 MHz

NOTE: Frequencies and bandwidth are given in MHz.

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## Annex D (informative): Environmental profile specification

The following environmental conditions may be declared by the manufacturer:

- barometric pressure: minimum and maximum;
- temperature: minimum and maximum;
- relative humidity: minimum and maximum;
- power supply: lower and upper voltage limit.

When operating outside the boundary limits of the declared operational environmental profile the equipment should not make ineffective use of the radio frequency spectrum so as to cause harmful interference.

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## Annex E (informative): Bibliography

- Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC (text with EEA relevance (EMC Directive)).
- Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).
- CEPT/ERC/REC 74-01 (Siófok 1998, Nice 1999, Sesimbra 2002, Hradec Kralove 2005, Cardiff 2011): "Unwanted Emissions in the Spurious Domain".
- Commission Decision 2008/477/EC of 13 June 2008 on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community.
- Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.
- Commission Decision (EU) 2015/750 of 8 May 2015 on the harmonisation of the 1 452-1 492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union.
- Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No1673/2006/EC of the European Parliament and of the Council.
- ECC Decision (15)01: "Harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink)", Approved 06 March 2015.
- Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.

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## History

<b>Document history</b>		
V4.2.1	March 2010	Publication
V5.2.1	July 2011	Publication
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V11.1.2	January 2017	Publication