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

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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].

National transposition dates

Date of adoption of this EN:	20 April 2016
Date of latest announcement of this EN (doa):	31 July 2016
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Date of withdrawal of any conflicting National Standard (dow):	31 January 2018

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)	Downlink	1 452 MHz to 1 496 MHz
	Uplink	N/A

NOTE: 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.

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

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.

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 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.

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_{out} : 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:

Δf	The separation between the nominal pass band edge frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency
Δf_{max}	The largest value of Δf used for defining the requirement
$BW_{Channel}$	Channel bandwidth
BW_{Config}	Transmission bandwidth configuration, expressed in MHz, where $BW_{Config} = N_{RB} \times 180$ kHz in the uplink and $BW_{Config} = 15$ kHz + $N_{RB} \times 180$ kHz in the downlink
BW_{Meas}	Measurement bandwidth
$BW_{Pass\ band}$	Bandwidth of the repeater pass band
$f_{offset_{max}}$	The largest value of f_{offset} used for defining the requirement
$F_{DL_{low}}$	The lowest frequency of the downlink operating band
$F_{DL_{high}}$	The highest frequency of the downlink operating band
F_{filter}	Filter centre frequency

F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
N_{DL}	Downlink EARFCN
$N_{Offs-DL}$	Offset used for calculating downlink EARFCN
$N_{Offs-UL}$	Offset used for calculating uplink EARFCN
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{UL}	Uplink EARFCN
$P_{EM,N}$	Declared emission level for channel N
$P_{EM,B32,ind}$	Declared emission level in Band 32, ind=a, b, c, d, e
P_{max}	Maximum output power
P_{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
WCDMA	Wideband Code Division Multiple 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 supplier. 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 supplier 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		
Transmitter unwanted emissions in the out-of-band domain	4.2.2 Operating band unwanted emissions	5.3.1
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		
Receiver desensitization	4.2.5 Input intermodulation	5.3.4
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 supplier 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 table 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:

- Δf 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.
- Δf_{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.