

# ETSI EN 302 561 V1.3.2 (2014-10)



**HARMONIZED EUROPEAN STANDARD**

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Land Mobile Service;**

**Radio equipment using constant or non-constant  
envelope modulation operating in a channel bandwidth  
of 25 kHz, 50 kHz, 100 kHz or 150 kHz;**

**Harmonized EN covering the essential requirements  
of article 3.2 of the R&TTE Directive**

*STANDARD FOR REVIEW  
https://standards.itec.ai/catalog/standards/sist/442-472-c870-  
4fde-a20b-4651-fdce-11e9-8000/etsi-en-302-561-v1-3-2-2014-10*

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**Reference**

REN/ERM-TGDMR-316

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**Keywords**

data, mobile, PMR, radio, repeater, TETRA

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## Foreword

This Harmonized European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been produced by ETSI in response to mandate M/284 issued from the European Commission under Directive 98/34/EC [i.5] as amended by Directive 98/48/EC [i.6].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [i.4].

See article 5.1 of Directive 1999/5/EC [i.4] for information on presumption of conformity and Harmonized Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

The requirements relevant to Directive 1999/5/EC [i.4] are summarized in annex A.

### National transposition dates

Date of adoption of this EN:	25 September 2014
Date of latest announcement of this EN (doa):	31 December 2014
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2015
Date of withdrawal of any conflicting National Standard (dow):	30 June 2016

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## Modal verbs terminology

In the present document **"shall"**, **"shall not"**, **"should"**, **"should not"**, **"may"**, **"may not"**, **"need"**, **"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 and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive [i.4]. The modular structure is shown in EG 201 399 [i.3].

# 1 Scope

The present document covers the technical requirements for radio transmitters and receivers used in stations and technical requirements for TMO repeater in the Private Mobile Radio (PMR) service.

It applies to use in the land mobile service, operating on radio frequencies between 30 MHz and 3 GHz, with channel separations of 25 kHz, 50 kHz, 100 kHz and 150 kHz.

**Table 1: Radiocommunications service frequency bands**

Radiocommunications service frequency bands	
Transmit	30 MHz to 3 000 MHz
Receive	30 MHz to 3 000 MHz

It applies to equipment for continuous and/or discontinuous transmission of data and/or digital speech.

The equipment (base station and mobile station) comprises a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder.

The types of equipment covered by the present document are as follows:

- base station (equipment fitted with an antenna connector, intended for use in a fixed location);
- mobile station (equipment fitted with an antenna connector, normally used in a vehicle or as a transportable);
- TMO Repeater; and
- those hand portable stations:
  - a) fitted with an antenna connector; or
  - b) without an external antenna connector (integral antenna equipment), but fitted with a permanent internal or a temporary internal 50  $\Omega$  Radio Frequency (RF) connector which allows access to the transmitter output and the receiver input.

Hand portable equipment without an external or internal RF connector and without the possibility of having a temporary internal 50  $\Omega$  RF connector is not covered by the present document.

These specifications do not necessarily include all the characteristics which may be required by a user of equipment, nor do they necessarily represent the optimum performance achievable.

The present document is intended to cover the provisions of article 3.2 of Directive 1999/5/EC [i.4] (R&TTE Directive), which states that "... radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive [i.4] may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site <http://www.newapproach.org>.



## 2 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.

### 2.1 Normative references

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

- [1] Recommendation ITU-T O.153 (10-1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [2] ETSI TR 100 028 (V1.4.1) (12-2001) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [3] ETSI TR 102 273 (V1.2.1) (12-2001) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".
- [4] ANSI C63.5 (2004): "American National Standard for Electromagnetic Compatibility-Radiated Emission Measurements in Electromagnetic Interference (EMI) Control-Calibration of Antennas (9 kHz to 40 GHz)".
- [5] ETSI EN 300 392-2 (V3.2.1) (09-2007): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

### 2.2 Informative references

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] Recommendation ITU-R SM.329-10 (2003): "Unwanted emissions in the spurious domain".
- [i.2] CEPT/ERC/REC 74-01 (2005): "Unwanted Emissions in the Spurious domain".
- [i.3] ETSI EG 201 399 (V2.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [i.4] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.5] 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.
- [i.6] 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.
- [i.7] ETSI TS 101 789-1 (V1.1.2): "Terrestrial Trunked Radio (TETRA); TMO Repeaters; Part 1: Requirements, test methods and limits".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**base station:** equipment fitted with an antenna connector, for use with an external antenna, and intended for use in a fixed location

**bit:** binary digit

**block:** the smallest quantity of information that is sent over the radio channel

NOTE: A constant number of useful bits are always sent together with the corresponding redundancy bits.

**broadband repeater:** repeater which is designed for operation on any combination of carriers (up to a specified maximum number) within the operating band of the repeater

**burst or transmission (physical):** one or several packets transmitted between power on and power off of a particular transmitter

**channelized repeater:** repeater which is designed for operation on a specified subset of carriers within the operating band of the repeater

NOTE: The subset of the channels may be determined during the manufacture of the repeater, or may be programmable.

**conducted measurements:** measurements which are made using direct 50  $\Omega$  connection to the equipment under test

**data transmission systems:** systems which transmit and/or receive data and/or digitized voice

**downlink:** signal path where base station transmits and mobile or hand portable station receives

**hand portable station:** equipment either fitted with an antenna connector or integral antenna, or both, normally used on a stand-alone basis, to be carried on a person or held in the hand

**integral antenna:** antenna designed to be connected to the equipment without the use of a 50  $\Omega$  external connector and considered to be part of the equipment

NOTE: An integral antenna may be fitted internally or externally to the equipment.

**Listen Before Transmit mode (LBT):** monitoring mode in which the RF channel is checked for activity before transmitting

NOTE: Examples for LBT are transceivers or systems implementing squelch or RSSI (Receiver Signal Strength Indicator) algorithms for evaluating the status of the channel.

**message:** user data to be transferred in one or more packets in a session

**mobile station:** mobile equipment fitted with an antenna connector, for use with an external antenna, normally used in a vehicle or as a transportable station

**packet:** one block or a contiguous stream of blocks sent by one (logical) transmitter to one particular receiver or one particular group of receivers

**radiated measurements:** measurements which involve the absolute measurement of a radiated field

**receive band of the equipment:** maximum frequency range (declared by the manufacturer) over which the receiver can be operated without reprogramming or realignment

**session:** set of inter-related exchange of packets occupying one or several windows or part thereof (if applicable)

NOTE: It corresponds to a complete interactive procedure for interchanging data between users, comprising initiation, data transmission and termination procedures. The session can be short (e.g. 2 packets), or long (e.g. one full page of text).

**spurious emissions:** unwanted emissions in the spurious domain

**switching range (sr):** maximum frequency range, as specified by the manufacturer, over which the receiver or the transmitter can be operated within the alignment range without reprogramming or realignment

**testing laboratory:** laboratory that performs tests

**TMO Repeater:** bi-directional Radio Frequency (RF) amplifier which can amplify and transmit a received Mobile Station (MS) signal in the MS transmit band, simultaneously it can amplify and transmit a received Base Station (BS) RF signal in the BS transmit band

**transmit band of the equipment:** maximum frequency range (declared by the manufacturer) over which the transmitter can be operated without reprogramming or realignment

**Trunked Mode Operation (TMO):** mode of operation where a network is used for communication

**uplink:** signal path where mobile or hand portable station transmits and base station receives

**window:** set of inter-related transmissions which may be limited in time by an appropriate access protocol and corresponding occupation rules

## 3.2 Symbols

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

$\alpha$	Filter rolloff factor
dB	decibel
dBm	dB relative to 1 mW
dB $\mu$ V	dB relative to 1 $\mu$ V
$f_c$	channel centre frequency
$f_{LO}$	Local Oscillator frequency
$f_{rb}$	the frequency offset corresponding to the near edge of the receive band
M1, M2, etc	names of test signals defined in clause 6.3
PR	rms power
PX	maximum Power (Peak Envelope Power)
$V_{min}$	minimum extreme test Voltage
$V_{max}$	maximum extreme test Voltage
$T_{min}$	minimum extreme test Temperature
$T_{max}$	maximum extreme test Temperature
$\lambda$	wavelength

## 3.3 Abbreviations

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

ac	alternating current
ACP	Adjacent Channel Power
ARQ	Automatic Repeat reQuest
BS	Base Station
BW	BandWidth
CBW	Channel BandWidth

CSP	Channel SeParation
CW	Continuous Wave
dBc	decibels relative to the transmitter power
DC	Direct Current
EUT	Equipment Under Test
GMSK	Gaussian Minimum Shift Keying
IF	Intermediate Frequency
LBT	Listen Before Transmit
MBW	Measurement BandWidth
MS	Mobile Station
OATS	Open Area Test Site
PEP	Peak Envelope Power
PMR	Private Mobile Radio
ppm	parts per million
RF	Radio Frequency
rms	root mean square
RSSI	Received Signal Strength Indicator
Rx	Receiver
sr	switching range
TETRA	TErrestrial Trunked RAdio
TMO	Trunked Mode Operation
Tx	Transmitter
VSWR	Voltage Standing Wave Ratio
$\pi/4$ -DQPSK	$\pi/4$ -shifted Differential Quaternary Phase Shift Keying

## 4 General

### 4.1 Presentation of equipment for testing purposes

Each equipment submitted to be tested shall fulfil the requirements of the present document on all frequencies over which it is intended to operate.

The radio tests shall be performed on the lowest, the highest and the middle radio frequency channels of either the transmit or receive band of the equipment, whichever is appropriate.

The provider or manufacturer shall declare the frequency ranges, the range of operating conditions and power requirements as applicable, to establish the appropriate test conditions. For non TMO repeater equipment information related to radio sub-system of equipment includes the transmit and receive frequency bands, first local oscillator frequency and intermediate frequencies of the receiver.

Additionally, technical documentation and operating manuals, sufficient to make the test, shall be supplied.

For TMO Repeater Equipment manufacturer declarations shall include:

- a) the operating band or bands of the repeater;
- b) the maximum rated output power per channel;
- c) the number of channels supported by the repeater.

#### 4.1.1 Choice of model for testing

The provider or manufacturer shall provide one or more samples of the equipment, as appropriate for testing.

Stand-alone equipment shall be complete with any ancillary equipment needed for testing.

If an equipment has several optional features, considered not to affect the RF parameters then the tests need only to be performed on the equipment configured with the combination of features considered to be the most complex. Where practicable, equipment to be tested shall provide a 50  $\Omega$  connector for conducted RF power level measurements.

In the case of integral antenna equipment, if the equipment does not have an internal permanent 50  $\Omega$  connector then it is permissible to supply a second sample of the equipment with a temporary antenna connector fitted to facilitate testing.

The test connector shall also provide any test signalling data.

The performance of the equipment to be tested shall be representative of the performance of the corresponding production model.

#### 4.1.1.1 Auxiliary test equipment

All necessary test signal sources, setting up instructions and other product information shall accompany the equipment to be tested.

#### 4.1.1.2 Declarations by the provider

The provider or manufacturer shall declare the necessary information of the equipment with respect to all technical requirements set by the present document.

### 4.2 Multi-Mode equipment

In the case of equipment supporting more than one channel bandwidth, measurements shall be performed on each channel bandwidth implemented.

### 4.3 Testing of equipment that does not have an external 50 $\Omega$ RF connector (integral antenna equipment)

Where equipment has an internal 50  $\Omega$  connector it shall be permitted to perform the tests at this connector.

Equipment may also have a temporary internal 50  $\Omega$  connector installed for the purposes of testing.

No connection shall be made to any internal permanent or temporary antenna connector during the performance of radiated emissions measurements, unless such action forms an essential part of the normal intended operation of the equipment, as declared by the manufacturer.

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## 5 Test conditions, power sources and ambient temperatures

### 5.1 Normal and extreme test conditions

Testing shall be performed under normal test conditions, and also, where stated, under extreme test conditions.

The test conditions and procedures shall be as specified in clauses 5.2 to 5.5.

### 5.2 Test power source

During testing the power source of the equipment shall be replaced by a test power source capable of producing normal and extreme test voltages as specified in clauses 5.3.2 and 5.4.2. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment.

For battery operated equipment the battery shall be removed and the test power source shall be applied as close to the battery terminals as practicable.