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Harmonized European Standard (Telecommunications series)

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 essential requirements of article 3.2 of the R&TTE Directive

Reference
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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Vote phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the 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 ("the R&TTE Directive").

Technical specifications relevant to Directive 1999/5/EC are given in annex A.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

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. The modular structure is shown in EG 201 399 (see bibliography).

1 Scope

The present document covers the technical requirements for radio transmitters and receivers used in stations 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 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);
- 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 Ω 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 Ω 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 (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 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 a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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 indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ITU-T Recommendation O.153 (1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".

[2] ETSI TR 100 028 (1.4.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[3] ETSI TR 102 273 (1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) 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): "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

2.2 Informative references

[6] ITU-R Recommendation SM.329-10 (2003): "Unwanted emissions in the spurious domain".

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.

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

conducted measurements: measurements which are made using direct 50 Ω connection to the equipment under test

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

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 Ω 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 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

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

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:

α	Filter rolloff factor
dB	decibel
dBm	dB relative to 1 mW
dBµV	dB relative to 1 µV
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
λ	wavelength

3.3 Abbreviations

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

ac	alternating current
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
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
Tx	Transmitter
VSWR	Voltage Standing Wave Ratio

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. 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.

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 Ω connector for conducted RF power level measurements.

In the case of integral antenna equipment, if the equipment does not have a internal permanent 50 Ω 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 Ω RF connector (integral antenna equipment)

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

Equipment may also have a temporary internal 50 Ω 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.

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.

During tests of DC powered equipment the power source voltages shall be maintained within a tolerance of < ±1 % relative to the voltage at the beginning of each test. The value of this tolerance is critical for power measurements, using a smaller tolerance will provide better measurement uncertainty values.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

temperature: +15 °C to +35 °C;

relative humidity: 20 % to 75 %.

When it is impracticable to carry out the tests under these conditions, a note to this effect, stating the ambient temperature and relative humidity during the tests, shall be added to the test report.

5.3.2 Normal test power source

5.3.2.1 Mains voltage

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of the test power source corresponding to the ac mains shall be between 49 Hz and 51 Hz.

5.3.2.2 Regulated lead-acid battery power sources used on vehicles

When the radio equipment is intended for operation from the usual types of regulated lead-acid battery power source used on vehicles the normal test voltage shall be 1,1 times the nominal voltage of the battery (for nominal voltages of 6 V and 12 V, these are 6,6 V and 13,2 V respectively).

5.3.2.3 Other power sources

For operation from other power sources or types of battery (primary or secondary), the normal test voltage shall be that declared by the equipment manufacturer.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with the procedures specified in clause 5.5, at the upper and lower temperatures of one of the following two ranges:

- -20 °C to +55 °C;
  All mobile and handportable equipment.
  Base stations for outdoor/uncontrolled climate conditions.

- 0 °C to +40 °C;
  Base stations for indoor/controlled climate conditions.

In the case of base stations equipment, the manufacturer shall declare which conditions the equipment is intended to be installed in.

5.4.2 Extreme test source voltages

5.4.2.1 Mains voltage

The extreme test voltage for equipment to be connected to an ac mains source shall be the nominal mains voltage ± 10 %.

5.4.2.2 Regulated lead-acid battery power sources used on vehicles

When the equipment is intended for operation from the usual types of regulated lead-acid battery power sources used on vehicles the extreme test voltages shall be 1,3 and 0,9 times the nominal voltage of the battery (for a nominal voltage of 6 V, these are 7,8 V and 5,4 V respectively and for a nominal voltage of 12 V, these are 15,6 V and 10,8 V respectively).

5.4.2.3 Power sources using other types of batteries

The lower extreme test voltages for equipment with power sources using batteries shall be as follows:

- for the nickel metal-hydride, leclanché or lithium type: 0,85 times the nominal battery voltage;
- for the mercury or nickel-cadmium type: 0,9 times the nominal battery voltage.

No upper extreme test voltages apply.

In the case where no upper extreme test voltage the nominal voltage is applicable, the corresponding four extreme test conditions are:

- V_{min}/T_{min}, V_{min}/T_{max};
- (V_{max} = nominal)/T_{min}, (V_{max} = nominal)/T_{max}.

5.4.2.4 Other power sources

For equipment using other power sources, or capable of being operated from a variety of power sources, the extreme test voltages shall be those declared by the equipment manufacturer.