

# ETSI EN 300 113-1 V1.6.2 (2009-11)

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*European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Land mobile service;  
Radio equipment intended for the transmission  
of data (and/or speech) using constant or non-constant  
envelope modulation and having an antenna connector;  
Part 1: Technical characteristics and  
methods of measurement**

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## Foreword

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

The present document is part 1 of a multi-part deliverable covering the Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector, as identified below:

**Part 1: "Technical characteristics and methods of measurement";**

Part 2: "Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".

<b>Proposed national transposition dates</b>	
Date of latest announcement of this EN (doa):	28 February 2010
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 August 2010
Date of withdrawal of any conflicting National Standard (dow):	31 August 2010

# 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 1 GHz, with channel separations of 12,5 kHz, 20 kHz and 25 kHz, intended for speech and/or data.

**Table 1: Radiocommunications service frequency bands**

Radiocommunications service frequency bands	
Transmit	30 MHz to 1 000 MHz
Receive	30 MHz to 1 000 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 handportable stations:
  - a) fitted with an antenna connector; or
  - b) without an external antenna connector, 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.

Handportable 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.

# 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.

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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] ETSI EN 300 086-1 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech; Part 1: Technical characteristics and methods of measurement".
- [2] ETSI EN 300 390-1 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment intended for the transmission of data (and speech) and using an integral antenna; Part 1: Technical characteristics and test conditions".
- [3] ETSI TR 100 028 (V1.4.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [4] ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [5] 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)".
- [6] IEC 60489-3 (1988): "Methods of measurement for radio equipment used in the mobiles services. Part 3: Receivers for A3E or F3E emissions".
- [7] CEPT/ERC/REC 74-01E: "Unwanted emissions in the spurious domain". (Siófok 1998, Nice 1999, Sesimbra 2002 Hradec Kralove 2005).
- [8] ETSI EN 300 793 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Presentation of equipment for type testing".

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 102 273 (V1.2.1) (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".

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# 3 Definitions, symbols and abbreviations

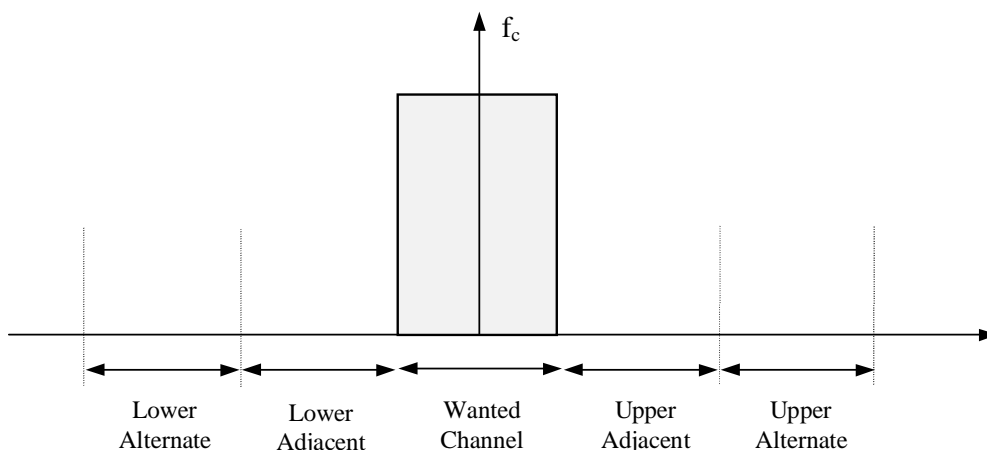
## 3.1 Definitions

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

**50 Ω:** 50 ohm non-reactive impedance

**adjacent channels:** channel offset from the wanted channel by the channel spacing

**alternate channels:** two channels offset from the wanted channel by double the channel spacing



**Figure 1: Adjacent and alternate channel definitions**

**angle modulation:** either phase modulation or frequency modulation

**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  $\Omega$  connection to the equipment under test

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

**handportable 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

**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

**Peak Envelope Power (PEP):** mean power delivered to the artificial antenna during a radio frequency cycle at the highest crest of the modulation envelope

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

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

NOTE: 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).

**switching range:** 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

**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:

D-M0, D-M1, etc. names of signals defined in clause 6.3.1

The symbols used in the clauses relating to transients and timings can be found in clause 7.9.1.

$f_{I1}$	1 <sup>st</sup> intermediate frequency
$f_{I2}$	2 <sup>nd</sup> intermediate frequency
$f_{In}$	n <sup>th</sup> intermediate frequency
$f_l$	frequency of the limited frequency range
$f_{LO}$	Local oscillator frequency
$V_{min}$	Minimum extreme test voltage
$V_{max}$	Maximum extreme test voltage
$T_{min}$	Minimum extreme test temperature
$T_{max}$	Maximum extreme test temperature

## 3.3 Abbreviations

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

CBW	Channel BandWidth
CSP	Channel SeParation
CW	Continuous Wave
dBc	decibels relative to the carrier power
emf	electromotive force
EUT	Equipment Under Test
FSK	Frequency Shift Keying
GMSK	Gaussian Minimum Shift Keying
IF	Intermediate Frequency
OATS	Open Area Test Site
PEP	Peak Envelope Power
PLL	Phase Locked Loop
PMR	Private Mobile Radio
RF	Radio Frequency
rms	root mean square
SINAD	Signal, Noise And Distortion
sr	switching range
Tx	Transmitter
VSWR	Voltage Standing Wave Ratio

---

# 4 General

## 4.1 Presentation of equipment for testing purposes

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

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.

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

Guidance on the presentation of equipment is also given in EN 300 793 [8].

### 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 a 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 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 Mechanical and electrical design

### 4.2.1 General

The equipment shall be designed, constructed and manufactured in accordance with good engineering practice, and with the aim of minimizing harmful interference to other equipment and services.

### 4.2.2 Controls

Those controls, which if maladjusted, might increase the interfering potentialities of the equipment shall not be accessible for adjustment by the user.

### 4.2.3 Transmitter shut-off facility

When a timer for an automatic shut-off facility is operative, at the moment of the time-out the transmitter shall automatically be switched off (the re-activation of the transmitter shall reset the timer).

A shut-off facility shall be inoperative for the duration of the measurements unless it has to remain operative to protect the equipment. If the shut-off facility is left operative the status of the equipment shall be indicated.

## 4.3 Marking

The equipment shall be marked in a visible place. This marking shall be legible, tamperproof and durable.

The marking shall be in accordance with EC Directives and/or CEPT decisions or recommendations as appropriate.

## 4.4 Testing using bit streams or messages

The manufacturer may elect to have the equipment tested using bit streams or messages. It should be noted that the methods of measurement using messages are usually more time consuming.

## 4.5 Measuring continuous mode equipment

In the case of measurements performed on equipment designed to operate only in continuous mode, requirements such as "equipment shall be set in continuous mode" shall be interpreted as "equipment shall be used in its normal transmission mode (in this case, the continuous mode)".

## 4.6 Measuring discontinuous mode equipment

When it is specified that the transmission shall be continuous for the duration of the measurement(s), the transmitter under test shall be set to operate in continuous mode. If this is not possible, the measurements shall be carried out in a period shorter than the duration of the transmitted burst. It may be necessary to extend the duration of the burst.

When measurements are made in discontinuous mode, the reported values can be average values. This averaging shall be made using a set of measurements, each of these measurements being made during a burst or a part of it.

## 4.7 Combined full bandwidth analogue speech/full bandwidth digital equipment

Equipment may be designed to fulfil the requirements of one or more standards.

In the case of combined full bandwidth analogue speech/full bandwidth digital equipment, if the analogue part of the equipment has already been measured according to EN 300 086-1 [1] only the following additional tests shall be performed:

- 7.4 Adjacent channel power.
- 7.5 Unwanted emissions in the spurious domain.
- 7.7 Transmitter attack time.
- 7.8 Transmitter release time.
- 7.9 Transient behaviour of the transmitter.
- 8.1 Maximum usable sensitivity (data or messages, conducted).
- 8.2 Average usable sensitivity (data or messages, field strength) in the case of equipment having an integral antenna.
- 8.4 Error behaviour at high input levels.
- 8.5 Co-channel rejection.
- 8.6 Adjacent channel selectivity.

More precisely, the measurement of the spurious emissions should be performed when equipment, previously measured to EN 300 086-1 [1], is being measured to the present document with an add-on data unit. If the equipment has been originally combined for analogue and digital operation, the measurement of the spurious emissions need not to be performed again if the data port(s) (and the data circuits/modules) were active while making this measurement for the test to EN 300 086-1 [1].