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Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector; Part 1: Technical characteristics and methods of measurement

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# ETSI EN 301 166-1 V1.1.2 (2001-12)

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*European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Land Mobile Service;  
Radio equipment for analogue and/or digital  
communication (speech and/or data) and operating on  
narrow band channels 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 Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector, as identified below:

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

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

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## Introduction

The present document is intended to specify the minimum performance for co-existence of land mobile radio equipment as specified in the scope. Methods of measurement are also included.

The present document is also intended to be used by accredited test laboratories for the assessment of the performance of equipment. The performance of the equipment submitted for type testing is expected to be representative of the performance of the corresponding production model (see appropriate CEPT documents e.g. application forms for type testing). In order to avoid ambiguity in that assessment, the present document contains instructions for the presentation of equipment for type testing purposes, methods of measurement and test conditions.

The present document was drafted on the assumption that:

- type test measurements performed in an accredited testing laboratory in one country would be accepted by the administration in another country provided that the national regulatory requirements are met (in accordance with CEPT/ERC Recommendation 01-06 [2]);
- if equipment available on the market is required to be checked it should be tested in accordance with the methods specified in the present document.

Mechanisms for mutual recognition of type approval have been defined in ERC/DEC(97)10 [6].

Decision ERC/DEC(97)10 [6] also addresses issues related to "total quality management".

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# 1 Scope

The present document covers the co-existence 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 narrow channel separations (CSP) (less than 10 kHz) and intended for speech and/or data. It is the intention of the present document to cover any Channel Bandwidths (CBW) permitted by CEPT for such systems e.g. 6,25 kHz.

In the present document different requirements are given for the different radio frequency bands, environmental conditions and types of equipment where appropriate.

In the present document, data transmission systems are defined as systems which transmit and/or receive data and/or digitized voice. The equipment comprises a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder.

The present document covers equipment which may use constant envelope or non-constant envelope modulation.

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

- base station: equipment fitted with antenna socket;
- mobile station: equipment fitted with antenna socket.

Handportable stations:

- a) either fitted with an antenna socket; or
- b) without an external antenna socket (integral antenna equipment) but fitted with a permanent internal or a temporary internal 50  $\Omega$  RF connector which allows access to the transmitter output and the receiver input.

For the type of equipment defined in b) the following additional measurements are made using the equipment antenna connected to the station (and not using any connector): 301 166-1 V1.1.2:2003

- transmitter effective radiated power; <https://standards.iteh.ai/catalog/standards/sist/452877b3-1045-4f98-9ddd-bc4faef7571/sist-en-301-166-1-v1-1-2-2003>
- transmitter radiated spurious emissions;
- receiver maximum usable sensitivity (field strength);
- receiver spurious radiations.

Handportable station equipment without an external or internal Radio Frequency (RF) connector and without the possibility of having a temporary internal 50  $\Omega$  RF connector is not covered by the present document.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- 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.
- For a non-specific reference, the latest version applies.

[1] ETSI ETR 028 (1994): "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[2] CEPT/ERC Recommendation 01-06: "Procedure for mutual recognition of type testing and type approval for radio equipment".

- [3] ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [4] IEC 60489-3: "Methods of measurement for radio equipment used in the mobile services; Part 3: Receivers for A3E or F3E emissions" Second edition (1988) appendix F".
- [5] ETSI ETR 273 (1995): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties".
- [6] CEPT/ERC/DEC(97)10: "ERC Decision of 30 June 1997 on the mutual recognition of conformity assessment procedures including marking of radio equipment and radio terminal equipment".
- [7] ANSI C63.5 (1988): "Electromagnetic Compatibility; Radiated Emission Measurements in Electromagnetic Interference (EMI) Control; Calibration of Antennas".
- [8] ETSI EN 300 279: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for Private land Mobile Radio (PMR) and ancillary equipment (speech and/or non-speech)".
- [9] ITU-R Recommendation SM.329-7 (1997): "Spurious emissions".
- [10] ITU-T Recommendation O.41 (1984): "Psophometer for use on telephone-type circuits".
- [11] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility".

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

SIST EN 301 166-1 V1.1.2:2003

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

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

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

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

**audio frequency input socket:** socket normally intended for connection to a microphone for the purpose of voice transmission

NOTE: (In some cases, this socket could be expected to be used for the input of an audio sub-carrier, modulated to carry data, such as FFSK).

**facilities socket:** any socket intended for purposes other than the transmission of voice

NOTE 1: The purpose of the socket and required input signals are specified by the manufacturer.

NOTE 2: The audio frequency input socket and the facilities socket may be the same physical socket in some implementations.

**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.

**full tests:** In all cases except where qualified as "limited", tests are performed according to the present document. The receiver tests performed will be selected from clause 8, as appropriate, depending upon whether the equipment is intended for either analogue voice or data/digitized voice reception. In the case where equipment is capable of both analogue voice and data reception, both sets of tests shall be conducted.

**limited tests:** The limited tests are as follows:

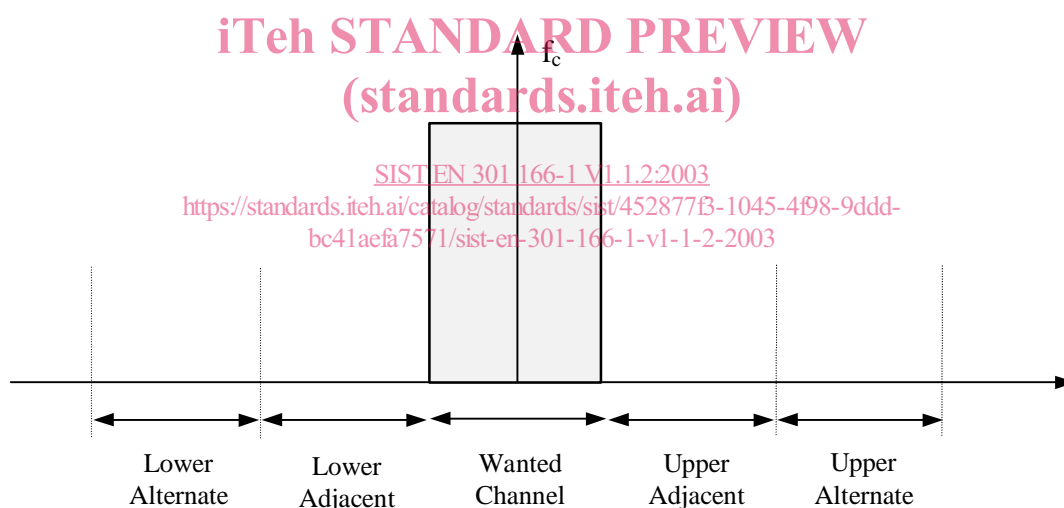
- receiver maximum usable sensitivity (conducted) (see clauses 8.1 and 8.3);
- receiver maximum usable sensitivity (field strength) (see clauses 8.2 and 8.4), integral antenna equipment only;
- receiver adjacent channel selectivity (see clause 8.5);
- transmitter peak envelope power (PEP) (conducted) (see clause 7.1);
- transmitter effective radiated power (see clause 7.2), integral antenna equipment only;
- transmitter adjacent and alternate channels power (see clause 7.3);
- frequency error (see clause 7.7).

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

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

**50  $\Omega$ :** 50 ohm non-reactive impedance

**adjacent and alternate channels:**



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

**necessary bandwidth:** For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions, see ITU-R Recommendation SM.329-7.

**bit:** binary digit

**block:** 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.

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

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

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

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

NOTE: A session 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).

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

## 3.2 Symbols

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

AR	Alignment Range (see clause 4.1)
AR0, AR1,...	Categories of alignment range as defined in clause 4.1.2.2
dB	decibel
dBm	dB relative to 1 mW
dB $\mu$ V	dB relative to 1 $\mu$ V
FT	Full tests
LT	Limited tests
M1, M2,...	names of test signals defined in clause 6.1
PX	See clause 7.1.1
PR	rms power
Tx	transmitter
$\lambda$	wavelength

## 3.3 Abbreviations

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

ac	alternating current
Bit	Binary digit
CBW	Channel BandWidth
CRC	Cyclic Redundancy Code
CSP	Channel Separation
CW	Continuous Wave
EMC	ElectroMagnetic Compatibility
emf	electro-motive force
$f_c$	Channel centre frequency
LSB	Least Significant Bit
MSB	Most Significant Bit
OFR	Operating Frequency Range
PEP	Peak Envelope Power
PMR	Professional Mobile Radio
rms	root mean square
RF	Radio Frequency
SR	Switching Range
SINAD	(signal + noise + distortion)/(noise + distortion)

# 4 General

## 4.1 Presentation of equipment for testing purposes

Each equipment submitted for type testing shall fulfil the requirements of the present document on all channels over which it is intended to operate.

The manufacturer should choose the appropriate frequencies for testing in consultation with the administration(s) from whom type approval is sought and in accordance with clauses 4.1.5 to 4.1.12 (see also annex C).