

9`Y_fca U[bYfbUnXfi y`^j cgh]b`nUXYj Yj`nj Yn]`n`fUX]`g_`ja `gdY_fca `fØFAŁĚ
Ghcf]h`j`_cdYbg_`l`_a cV]b]`_ca i b]_UW]`Ě`FUX]`g_`UcdfYa UnUdfYbcg`dcXUh_cj
ft:n]fca U[cj cfUž_]i dcfUV`^Ua cXi`^UW]`c`g`_cbghUblbc`U]`bY`cbghUblbc`cj`c`b]Wc
]b`ja UUbhYbg_]df]`_4`_Y`_Ě`%`XY`_HY b] bY`_UfU`hY]gh_]Y]b`a Yf]bY`a YfcXY

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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**Electromagnetic compatibility
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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) 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".

NOTE: EN 300 113-1 (V1.4.1) covered both constant envelope angle modulation and non-constant envelope modulation equipment. The present document includes more detailed measurement methods covering equipment operating in continuous or discontinuous modes of transmission.

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Introduction

The present document is intended to specify the minimum performance and the methods of measurement of radio equipment for use in the land mobile service as specified in the scope.

The present document is based upon EN 300 113-1 (V1.4.1).

This is a general standard which may be overridden or complemented by specific standards addressing specific applications. It applies to equipment designed to operate within the professional mobile radio service and to the associated frequency planning.

Equipment similar to that covered by the present document, but using constant envelope modulation only (at the time of publication of present document) and having an integral antenna is covered by EN 300 390-1 [2] (for details, see the scope of the present document as well as the scope of EN 300 390-1 [2]).

Access protocols for equipment covered by the present document are the subject of other ETSI standards such as EN 300 471-1 [9].

Channel separations, maximum transmitter output power/effective radiated power, class of transmitter intermodulation attenuation and the inclusion of automatic transmitter shut-off facility may all be conditions relating to the issue of a licence by the appropriate administration.

- Annex A is normative and provides additional information concerning radiated measurements.
- Annex B is normative and gives the requirements for equipment to be used for the measurements of adjacent channel power.
- Annex C is normative and presents the technical characteristics to be fulfilled, when required by the appropriate national regulatory authority, for the identification of stations for professional mobile radio systems, that do not comply with other system protocols (e.g. trunking protocols); it is the responsibility of the manufacturer to ensure that the modulation that he has chosen for the identification, in accordance with the tables of this annex fulfils the requirements corresponding to the channels where the equipment is designed to operate, as specified in the main body of the present document. The tables of this annex are expected to be updated regularly in order to reflect the progress accomplished in the field of mobile data transmissions.
- Annex D is informative and gives a graphic representation corresponding to the selection of equipment for testing purposes (it is based on EN 300 793 [3]).
- Annex E is informative and provides guidance concerning the technical characteristics of the modulation, coding and format.

Clause 5 provides the appropriate limits. These limits have been chosen to ensure an acceptable grade of service and to minimize harmful interference to other equipment and services. They are based on the interpretation of the measurement results described in clause 4.3.

Provision for the placing on the market of radio equipment in EU Member States can be found in the R&TTE Directive (Directive 1999/5/EC). It can also be noted that some of the parameters considered as essential under the R&TTE Directive had already been listed as essential under the EMC Directive.

The present document may also be used in CEPT Countries that are not EU Member States. For the benefit of these countries, mechanisms for mutual recognition of type approval have been identified in CEPT/ERC/DEC(97).

Alternatively, another approach may be used in Countries that have not implemented this Decision: type test measurements performed in an accredited test laboratory in one country would be accepted by the Administration in another country provided that the national regulatory requirements are met (CEPT/ERC/REC 01-06).

Decision CEPT/ERC/DEC(97)10 also addresses issues related to total quality management.

The present document may, in particular, be used by accredited test laboratories for the assessment of the performance of the equipment. The performance of the equipment, in the case of conformity assessment measurements, shall be representative for the performance of the corresponding production model. In order to avoid any ambiguity in that assessment, the present document contains general instructions (see clause 4), conditions (see clauses 6 and 7) and methods of measurement (see clauses 8, 9 and 10).

The present document was drafted on the assumption that if equipment available on the market is required to be checked, it should be tested in accordance with the methods of measurement specified in the present document.

1 Scope

The present document covers the minimum characteristics considered necessary in order to avoid harmful interference and to make acceptable use of the available frequencies. It does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable.

The present document applies to either constant envelope angle modulation systems or to non-constant envelope modulation systems for 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 data transmissions. It applies to digital and combined analogue and digital radio equipment with an internal or external antenna connector intended for the transmission of data and/or speech.

It applies to equipment for continuous and/or discontinuous transmission of data and/or digital speech. Such equipment for discontinuous transmission can use, for example, the following techniques of transmission or access techniques:

- Packet data transmission in FDMA: Frequency Division Multiple Access;
- Bursty transmission in FDMA: Frequency Division Multiple Access;
- TDMA: Time Division Multiple Access;
- TDD: Time Division Duplex.

And for equipment providing digital speech they can use, for example:

- Regular cyclic bursts allocated in TDMA for Half-Duplex speech communication;
- Regular cyclic bursts allocated in TDMA for Full-Duplex speech communication;
- VoIP: Packetisation of speech for Voice-over-IP approaches.

The particular type of modulation will be chosen by the manufacturer, although it is recognized that in some countries national legislation may limit the use of certain code structures/data formats.

The technical characteristics given in the present document are independent of data rate but may in practice limit the maximum data rate achievable.

In the present document different requirements are given for the different radio frequency bands, channel separations, etc. where appropriate.

In the present document, data transmission systems are defined as systems which transmit and/or receive data. 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 socket, intended for use in a fixed location);
- mobile station (equipment fitted with an antenna socket, normally used in a vehicle or as a transportable);
- and those hand portable stations:
 - a) 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 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 (integral antenna equipment is covered by EN 300 390-1 [2] for details, see the corresponding scope).

Additional standards or specifications may also be required for equipment such as that intended for connection to the Public Switched Telephone Network (PSTN), or data networks.

Requirements to be fulfilled by equipment designed to meet several standards can be found in clause 4.

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.

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

- [1] ETSI EN 300 086-1: "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: "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 EN 300 793: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Presentation of equipment for type testing".
- [4] ETSI TR 100 028 (all parts): " Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ETSI TR 102 273 (standard.itchip) "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties".
- [6] ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [7] ANSI C63.5 (1988): "American National Standard For Calibration of Antennas Used for Radiated Emission Measurements in Electromagnetic Interference (EMI) Control".
- [8] IEC 60489-3 (1988): "Methods of measurement for radio equipment used in the mobiles services. Part 3: Receivers for A3E or F3E emissions".
- [9] ETSI EN 300 471-1: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land Mobile Service; Rules for Access and the Sharing of common used channels by equipment complying with EN 300 113; Part 1: Technical characteristics and methods of measurement".
- [10] CEPT/ERC/REC 74-01E "Spurious emissions". (Siófok 1998, Nice 1999, Sesimbra 2002).
- [11] ITU-T Recommendation V22: "1200 bits per second duplex modem standardized for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".
- [12] ITU-T Recommendation V23: "600/1200-baud modem standardized for use in the general switched telephone network".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

angle modulation: either phase modulation or frequency modulation

base station: equipment fitted with an antenna socket, 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

full tests: in all cases except where qualified as "limited", tests shall be performed according to EN 300 113-1

hand portable station: equipment either fitted with an antenna socket 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

limited tests: limited tests, as defined in EN 300 793, are as follows:

- transmitter frequency error, clause 8.1
- transmitter carrier power (conducted), clause 8.2
- transmitter effective radiated power, clause 8.3, integral antenna equipment only
- transmitter adjacent channel power, clause 8.5
- receiver maximum usable sensitivity (conducted): clause 9.1
- receiver average usable sensitivity (field strength), clause 9.2, integral antenna equipment only
- receiver adjacent channel selectivity, clause 9.6

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

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

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): the 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: 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)

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... names of signals defined in clause 7.3

The symbols used in the clauses relating to transients and timings can be found in clause 8.10.1.

3.3 Abbreviations

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

AR1, AR2 Categories of "alignment range"

NOTE: As defined in clause 4.1.

| | |
|-------|--|
| BS | Base Station |
| CRC | Cyclic Redundancy Code |
| CSP | Channel Separation |
| CBW | Channel BandWidth |
| CW | Continuous Wave |
| dBc | decibels relative to the carrier power |
| emf | electromotive force |
| FEC | Forward Error Correction |
| FFSK | Fast Frequency Shift Keying |
| FSK | Frequency Shift Keying |
| GMSK | Gaussian Minimum Shift Keying |
| IF | Intermediate Frequency |
| LSB | Least Significant Bit |
| MSB | Most Significant Bit |
| MSK | Minimum Shift Keying |
| OQAM | Offset Quadrature Amplitude Modulation |
| OQPSK | Offset Quaternary Phase Shift Keying |
| PEP | Peak Envelope Power |
| PLL | Phase Locked Loop |
| PSK | Phase Shift Keying |
| PSTN | Public Switched Telephone Network |
| QAM | Quadrature Amplitude Modulation |
| RF | Radio Frequency |
| rms | root mean square |
| Rx | Receiver |
| sr | switching range |
| Tx | Transmitter |