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ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Land mobile service;
Radio equipment intended for the transmission of data (and speech) and having an
antenna connector; Part 1: Technical characteristics and methods of measurement

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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 speech) and having an antenna connector;
Part 1: Technical characteristics and methods of measurement**

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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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 Land mobile service; Radio equipment intended for the transmission of data (and 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".

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National transposition dates

Date of adoption of this EN:	9 March 2001
Date of latest announcement of this EN (doa):	30 June 2001
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2001
Date of withdrawal of any conflicting National Standard (dow):	31 December 2001

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 ETS 300 113 Edition 2.

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 having an integral antenna is covered by EN 300 390 [2] (for details, see the scope of the present document as well as the scope of EN 300 390 [2]).

Access protocols for equipment covered by the present document are the subject of other ETSI standards such as ETS 300 471.

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)10.

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 (clause 4), conditions (clauses 6 and 7) and methods of measurement (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 constant envelope angle modulation systems for use in the land mobile service, using the available bandwidth, 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.

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. Future editions of the present document may be prepared to allow complex modulation methods, together with their appropriate limits, for use at higher bit rates.

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: [SIST EN 300 113-1 V1.3.1:2003](https://standards.iteh.ai/catalog/standards/sist/4be831e4-0535-4352-bfa7-c2087816d0f3/sist-en-300-113-1-v1-3-1-2003)
 - a) fitted with an antenna socket;
 - 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 [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.

- [1] ETSI EN 300 086 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech".
- [2] ETSI EN 300 390 (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".
- [3] ETSI EN 300 793: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Presentation of equipment for type testing".
- [4] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ETSI ETR 273 (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".
- [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 Calibration of Antennas (9 kHz to 40 GHz)".
- [8] IEC 60489-3 (1988): "Methods of measurement for radio equipment used in the mobiles services. Part 3: Receivers for A3E or F3E emissions".

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 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

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

angle modulation: either phase modulation or frequency modulation

full tests: in all cases except where qualified as "limited", tests shall be performed according to the present document

limited tests: limited tests, as defined in EN 300 793 [3], 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.

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

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

bit: binary digit

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

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:

E _o	Reference field strength
R _o	Reference distance
dBd	Antenna gain relative to $\lambda/2$ dipole (clause A.1.3)
dBi	Antenna gain relative to an isotropic radiator (clause A.1.3)
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" as defined in clause 4.1
BS	Base Station
CRC	Cyclic Redundancy Code
dBc	decibels relative to the carrier power
emf	electromotive force
erp	effective radiated power
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
PLL	Phase Locked Loop
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
RF	Radio Frequency
rms	root mean square
Rx	Receiver
sr	switching range
Tx	Transmitter

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4 General (standards.iteh.ai)

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], only some additional measurements have to be performed; they shall ensure that the equipment fulfils the requirements of the following clauses:

- 5.1.4 (8.5) Adjacent channel power;
- 5.1.5 (8.6) Spurious emissions;
- 5.1.7 (8.8) Transmitter attack time;
- 5.1.8 (8.9) Transmitter release time;
- 5.1.9 (8.10) Transient behaviour of the transmitter;
- 5.2.1 (9.1) Maximum usable sensitivity (data or messages, conducted);
- 5.2.2 (9.2) Average usable sensitivity (data or messages, field strength) in the case of equipment having an integral antenna;
- 5.2.3 (9.4) Error behaviour at high input levels;
- 5.2.4 (9.5) Co-channel rejection;
- 5.2.5 (9.6) Adjacent channel selectivity.

More precisely, the measurement of the spurious emissions (clauses 5.1.5 and 8.6) should be performed when an equipment, previously measured to EN 300 086 [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].