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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 using an
integral antenna; Part 1: Technical characteristics and test conditions

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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 using an integral antenna;
Part 1: Technical characteristics and test conditions**

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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 EN covering the 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, as identified below:

Part 1: "Technical characteristics and test conditions";

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

The EN is a general standard which may be superseded by specific standards covering specific applications.

The present document is complementary to I-ETS 300 113 [2] and ETS 300 113 [2] which cover digital and combined analogue and digital radio equipment with an internal or external RF connector for use in the land mobile service. It is primarily intended for omnidirectional applications.

For combined analogue speech/data equipment, the present document is complementary to ETS 300 296 [6] which covers radio equipment using an integral antenna or use in the land mobile service and intended primarily for analogue speech.

Integral antenna equipment transmitting signals to initiate a response in the receiver is covered by ETS 300 341 [7].

Annex A is normative and provides additional information concerning radiated measurements. Detailed descriptions of the radiated measurement arrangements are included in this annex. It is common to several (I-)ETSS, in particular covering analogue speech equipment.

Annex B is normative and gives the requirements for equipment to be used for the measurement 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 type approved for private 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 of the subclause 4.1, referring to the presentation of equipment for testing purposes.

Annex E is informative and provides guidance concerning the technical characteristics of the modulation, coding and format.

National transposition dates	
Date of adoption of this EN:	21 July 2000
Date of latest announcement of this EN (doa):	31 October 2000
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 April 2001
Date of withdrawal of any conflicting National Standard (dow):	30 April 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 methods of measurement have been adapted from ETR 027 [3], I-ETS 300 113 [2], ETS 300 296 [6] and ETS 300 341 [7] as appropriate.

Clause 5 provides the corresponding 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 subclause 4.4.

Constant envelope modulation should be used for radio equipment covered by the present document, but individual national administrations are free to choose the type of modulation. Channel separations, maximum transmitter output power/effective radiated power and the inclusion of automatic transmitter shut-off facility may all be conditions attached to the issue of a licence by the appropriate administration.

The present document may be used by accredited test laboratories for the assessment of the performance of the equipment. The performance of the equipment submitted for type testing should be representative of the performance of the corresponding production model. In order to avoid any ambiguity in that assessment, the present document contains instructions for the presentation of equipment for type testing purposes in clause 4, conditions in clause 6 and methods of measurement in clauses 8 and 9.

The present document may also be used by monitoring services in particular for the identification of stations (annex C).

Equipment built according to the present document can be designed to support the BIIS 1200 protocol (I-ETS 300 230 [8]).

The present document was drafted on the assumption that:

- the type test measurements performed in an accredited test laboratory in one country are accepted by the administration in another country provided that the national regulatory requirements are met (in accordance to CEPT Recommendation T/R 71-03 [9]);
- if equipment available on the market is required to be checked it is 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 make the best 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 1 000 MHz, 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 which is hand portable, using an integral antenna and intended for the transmission of data and/or speech.

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 which may allow complex modulation methods, together with their appropriate limits, for use at higher bit rates.

In the present document, a digital radio equipment is defined as a radio equipment which transmits and/or receives data.

Data equipment is understood as equipment handling continuous bit streams or messages.

The equipment comprises a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder. The encoder and/or decoder may be a separate piece of equipment, in which case the present document covers the combination of encoder and/or decoder and transmitter and/or receiver equipment.

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

Access protocols for equipment covered by the present document are the subject of other ETSI standards.

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

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In the cases of:

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- combined full bandwidth analogue/full bandwidth digital equipment, if the analogue part of the equipment has already been type approved according to ETS 300 296 [6];
- equipment which has already been type approved according to the present document, and is resubmitted with an add-on device, using another type of modulation without affecting any other characteristics of the equipment;

only some of the requirements of the present document apply. These requirements are given 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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] ETSI ETS 300 086: "Radio Equipment and Systems (RES); Land mobile group; Technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech".

- [2] ETSI I-ETS 300 113 (1992): "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for non-speech and combined analogue speech/non-speech equipment with an internal or external antenna connector, intended for the transmission of data".
- [3] ETSI ETR 027: "Radio Equipment and Systems (RES); Methods of measurement for private mobile radio equipment".
- [4] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ITU-T Recommendation O.153 (1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [6] ETSI ETS 300 296: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment using integral antennas intended primarily for analogue speech".
- [7] ETSI ETS 300 341: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment using an integral antenna transmitting signals to initiate a specific response in the receiver".
- [8] ETSI I-ETS 300 230: "Radio Equipment and Systems (RES); Land mobile service; Binary interchange of Information and Signalling (BIIS) at 1 200 bit/s (BIIS 1 200)".
- [9] CEPT Recommendation T/R 71-03: "Procedures for Type Testing and Approval for Radio Equipment Intended for Non-Public Systems".
- [10] IEC 60489-3: "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions".
- [11] CCITT Recommendation V.22 (1988): "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".
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- [12] CCITT Recommendation V.23 (1988): "600/1200-baud modem standardized for use in the general switched telephone network".

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of this family of ENs, the following terms and definitions apply. Not all of the terms are used in the present document.

constant envelope angle modulation: either phase modulation (G3) or frequency modulation (F3).

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.

Types of measurements:

conducted measurements: measurements which are made using a direct RF connection to the equipment under test.

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

Types of station:

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

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.

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

Types of tests:

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

limited tests: as required by subclause 4.1, the limited tests are as follows:

- transmitter frequency error, subclause 8.1;
- transmitter effective radiated power, subclause 8.2;
- transmitter adjacent channel power, subclause 8.3;
- receiver average usable sensitivity (field strength, data or messages), subclause 9.1;
- receiver adjacent channel selectivity, subclause 9.4.

bit: binary digit.

block: smallest quantity of information 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 resulting from the action of the "initiating transmitter", and limited in time by an appropriate access protocol and corresponding occupation rules.

session: set of inter-related exchanges of packets occupying one or several windows or parts 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. two 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 Abbreviations

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

AR1, AR2	categories of Alignment Range as defined in subclause 4.1.3
dBc	dB relative to the carrier power
emf	electro-motive force
FFSK	Fast Frequency Shift Keying
FSK	Frequency Shift Keying
IF	Intermediate Frequency
MSB	Most Significant Bit
RF	Radio Frequency
Rx	Receiver
Tx	Transmitter
VSWR	Voltage Standing Wave Ratio

3.3 Symbols

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

X _o	Reference field strength (annex A)
R _o	Reference distance (annex A)
D-M0, D-M1	signals defined in subclause 7.1

The symbols relating to transients and timings are defined in subclause 8.7.1.

4 General

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

In the case of combined full bandwidth analogue/full bandwidth digital equipment, if the analogue part of the equipment has already been type tested according to ETS 300 296 [6], only some additional measurements have to be performed. They shall ensure that the equipment fulfils the requirements of the following subclauses:

- 5.1.3 (8.3) Adjacent channel power;
- 5.1.4 (8.4) Radiated spurious emissions;
- 5.1.5 (8.5) Transmitter attack time;
- 5.1.6 (8.6) Transmitter release time;
- 5.1.7 (8.7) Transient behaviour of the transmitter;
- 5.2.1 (9.1) Average usable sensitivity (field strength, data or messages);
- 5.2.2 (9.2) Error behaviour at high input levels;
- 5.2.3 (9.3) Co-channel rejection;
- 5.2.4 (9.4) Adjacent channel selectivity.

More precisely, the measurement of radiated spurious emissions in subclause 8.4 should be performed when testing an add-on data unit to an equipment previously type approved to ETS 300 296 [6]. In the case of equipment originally combined for analogue and digital operation, the measurement does not need to be performed when the data-part is active while making the test corresponding to ETS 300 296 [6].

In the case where an equipment has already been type approved according to the present document, and is resubmitted with an add-on device using another type of modulation without affecting any other characteristics of the equipment, only some additional measurements should be performed. They shall ensure that the equipment fulfils the requirements of the following subclauses:

- 5.1.3 (8.3) Adjacent channel power;
- 5.1.4 (8.4) Radiated spurious emissions;
- 5.1.7 (8.7) Transient behaviour of the transmitter;
- 5.2.1 (9.1) Average usable sensitivity (field strength, data or messages);
- 5.2.2 (9.2) Error behaviour at high input levels;
- 5.2.3 (9.3) Co-channel rejection;
- 5.2.4 (9.4) Adjacent channel selectivity.

The foregoing seven measurements shall be performed on one piece of equipment tuned to a frequency in the centre of the band.