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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

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**Technical characteristics and test conditions for non - speech  
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an internal or external antenna connector intended for  
the transmission of data**

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## Foreword

This Interim European Telecommunication Standard (I-ETS) has been prepared by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI). This I-ETS has been adopted having undergone the ETSI standards approvals procedure.

This I-ETS will in future be likely to be superseded or complemented by a corresponding ETS.

This standard is based upon CEPT Recommendation T/R 24-01 [1], and is complementary to ETS 300 086 [2], which covers radio equipment for use in the land mobile service and intended primarily for analogue speech.

This is a general standard which may be superseded or complemented by specific standards addressing specific applications.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

This standard is voluntary in application, however, it may be made mandatory by national administrations as a part of the conditions attached to the issue of licenses for the use or sale of radio apparatus.

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.

Constant envelope modulation should be used. 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.

Channel separations, temperature range, maximum transmitter output power/effective radiated power, class of transmitter intermodulation attenuation and channel access timings may be conditions to the issue of a licence by the appropriate administration.

This standard does not cover requirements for radiated emissions below 30 MHz. It is anticipated that methods of measurements and minimum standards for such emissions will be covered by standards supporting EMC Directive 89/336/EEC.

All transmissions according to this standard should include at specified moments, an information establishing the identity of the transmitter.

The means of system identification should be approved by the appropriate national regulatory authority.

- Annex A: provides additional information concerning radiated measurements.
- 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 gives a graphic representation of subclause 4.1.2, referring to the presentation of equipment for testing purpose.
- Annex D: is informative 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 this standard. 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. It is envisaged that this annex could be normative in the future when I-ETS 300 113 will be turned, when mature, into an ETS.

- Annex E: is informative and provides guidance concerning the technical characteristics of the modulation, coding and format.
- Annex F: is normative, it applies to equipment to be operated in shared channels (for further details, see Clause F.1); it also contains two methods of measurement used for the assessment of receiver timing parameters. No other access protocol and occupation rules shall be made mandatory for cases where this annex is applicable.

## Introduction

This standard 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.

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

This standard will 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, this standard contains instructions for the presentation of equipment for type testing purposes, Clause 4, measurement methods, Clauses 8, 9 and 10, and conditions, Clauses 6 and 7.

This standard may also be used by monitoring services in particular for the identification of stations (see Annex D).

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This standard was drafted on the assumption that:

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- the type test measurements will be performed only once in one of the accredited test laboratories and the measurement accepted by the various authorities in order to grant type approval;
- if equipment available on the market is required to be checked it should be tested in accordance with the methods specified in this standard.

This standard covers base stations, mobile stations and two categories of handportable stations. One category is fitted with an antenna socket or connector. The other category has no external antenna socket, but either:

- it is fitted with a permanent internal 50  $\Omega$  Radio Frequency (RF) connector;
- or, it can be fitted with a temporary internal 50  $\Omega$  RF connector, so that conducted measurements can be performed.

The means to access and/or implement the internal connector should be provided by the manufacturer.

Details of the means actually used during the type testing should be recorded by the accredited test laboratory in the test report (see subclause 4.2.4).

## 1 Scope

This Interim European Telecommunication Standard (I-ETS) 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. It 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 1000 MHz, with channel separations of 12,5 kHz, 20 kHz and 25 kHz intended for data transmissions. It applies to non-speech and combined analogue speech/non-speech radio equipment for the transmission of data.

It is also recognised that mobile data systems using high bit rates may have an occupied bandwidth which is excessive for the existing channel separation. Equipment for such systems operating with modulation bit rates higher than 2400 bits/s may be the subject of another standard, with different limits, although the methods of measurement may be the same.

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

In this standard, data transmission systems are defined as systems which transmit and/or receive data. The equipment shall comprise of a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder.

The types of equipment covered by this standard 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 Handportable 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  $\Omega$  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 shall be made with the equipment antenna connected (and not through any connector):

- transmitter effective radiated power;
- transmitter radiated spurious emissions;
- receiver maximum usable sensitivity (data, field strength);
- receiver radiated spurious radiations.

Handportable equipment without an external or internal R.F. connector and without the possibility of having a temporary internal 50  $\Omega$  RF connector is not covered by this standard.

In the case of combined full bandwidth analogue speech/full bandwidth non-speech equipment, if the speech part of the equipment has already been type approved according to ETS 300 086 [2], only some

additional measurements have to be performed. They shall ensure that the equipment fulfils the requirements of the following subclauses:

- 5.1.4 (Adjacent channel power);
- 5.1.5 (Spurious emission);
- 5.1.7 (Transmitter attack time);
- 5.1.8 (Transmitter release time);
- 5.1.9 (Transient behaviour of the transmitter);
- 5.2.1 (Maximum usable sensitivity (data, conducted));
- 5.2.2 (Maximum usable sensitivity (data, field strength));
- 5.2.3 (Bit error rate in normal operation);
- 5.2.4 (Co-channel rejection);
- 5.2.5 (Adjacent channel selectivity);
- 5.2.10 (Carrier sense delay); and,
- 5.2.11 (Receiver opening delay).

The measurement in subclause 8.6 (Spurious emissions) shall be performed when testing an add-on data unit to an equipment previously type approved to ETS 300 086 [2]. In the case of equipment originally combined for speech and data, the measurement does not need to be performed when the data-part is operational while making the test corresponding to ETS 300 086 [2].

In the case where an equipment has already been type approved according to this standard, and is resubmitted with an add-on device, using another type of modulation, only some additional measurements have to be performed. They shall ensure that the equipment fulfils the requirements of the following subclauses:

- 5.1.4 (Adjacent channel power);
- 5.1.5 (Spurious emission);
- 5.2.1 (Maximum usable sensitivity (data, conducted));
- 5.2.2 (Maximum usable sensitivity (data, field strength));
- 5.2.3 (Bit error rate in normal operation);
- 5.2.4 (Co-channel rejection);
- 5.2.5 (Adjacent channel selectivity);
- 5.2.11 (Receiver opening delay).

In the case where low bit rate data is transmitted together with speech, the speech part of the equipment is tested according to ETS 300 086 [2], and it will also be checked that the low bit rate data does not make the adjacent channel power and spurious emissions fall outside the appropriate limits.

## 2 Normative references

This I-ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to, or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] CEPT Recommendation T/R 24-01: "Specifications of equipments for use in the Land Mobile Service".
- [2] ETS 300 086: "Radio Equipment and Systems; Land mobile group; Technical characteristics and test conditions for radio equipment with an internal or external RF connector intended primarily for analogue speech".
- [3] ETR 028: "Radio Equipment and Systems; Uncertainties in the measurement of mobile radio equipment characteristics".
- [4] CCITT Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".

### 3 Definitions, abbreviations and symbols

#### 3.1 Definitions

For the purpose of this standard the following 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 integral antenna, or both, normally used on a stand-alone basis, to be carried on a person or held in the hand.
- Integral antenna:** An 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. 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 this standard.
- Limited tests:** Receiver maximum usable sensitivity (conducted): subclause 9.1.  
Receiver maximum usable sensitivity (field strength), subclause 9.2  
integral antenna equipment only.  
Receiver adjacent channel selectivity, subclause 9.6.  
Transmitter frequency error, subclause 8.1.  
Transmitter carrier power (conducted), subclause 8.2.  
Transmitter effective radiated power, subclause 8.3, integral antenna  
equipment only.  
Transmitter adjacent channel power, subclause 8.5.
- 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.
- Bit:** Binary digit.
- Block:** The smallest quantity of information that shall be sent over the radio channel. A constant number of useful bits shall always be 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.
- Burst (physical):** Transmission of a small number of packets in a "stealing mode" for the access protocol (see Annex F).
- Transmission (physical):** One or several packets transmitted between power on and power off of a particular transmitter.