

9`Y_hfca U[bYfbUnXfi y`nj cghf0A7L]b`nUXYj Yj`nj Ynj`n`fUX]`g_`ja`gdY_hfca`f0FAŁ
 ĘGhcf]hYj`_cdYbg_`l`a`cV]b]`_ca`i`b]`UW^E`FUX]`g_`UcdfYa`U`n`bcfU`b]a`U]
 ni`bUb]a`F`!`_cbY_hcf`Ya`žbUa`Yb`YbUdfYXj`gYa`n`U`bUc[`b]`dfYbcg[`c]`cfU`E`%
 XY`HM`b]`bY`_U`U`h`f]`gh`Y]b`a`Yf]bY`a`YtcXY

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

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European Standard (Telecommunications series)

**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**

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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 with an internal or external RF connector intended primarily for analogue speech, 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:	23 February 2001
Date of latest announcement of this EN (doa):	31 May 2001
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2001
Date of withdrawal of any conflicting National Standard (dow):	30 November 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 300 086 [2].

Equipment similar to that covered by the present document, but having an integral antenna is covered by EN 300 296 (for details, see the scope of the present document as well as the scope of EN 300 296).

Equipment intended to transmit signals to initiate a specific response is covered by EN 300 219 (for details, see the scope of the present document as well as the scope of EN 300 219), or by EN 300 341 in the case of integral antenna equipment (for details, see the scope of the present document as well as the scope of EN 300 341).

Equipment intended for the transmission of data is covered by EN 300 113 (for details, see the corresponding scope), or by EN 300 390 in the case of integral antenna equipment (for details, see the corresponding scope).

Angle modulation is 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, 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 provides additional information concerning radiated measurements.

Annex B contains normative specifications for adjacent channel power measurement arrangements.

Annex C is a graphic representation corresponding to the selection of equipment for testing purposes.

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 [1]). 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 Decision 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 recommendation ERC/REC 01-06).

Decision 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 angle modulation systems for use in the land mobile service, operating on radio frequencies between 30 MHz and 1 000 MHz, with channel separations of 12,5 kHz, 20 kHz and 25 kHz, and is intended primarily for analogue speech.

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

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

- base station: equipment fitted with an antenna socket;
- mobile station: equipment fitted with an antenna socket;
- 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 R.F. connector which allows access to the transmitter output and the receiver input.

For the type of equipment defined in (b) the additional measurements which shall be made using the equipment antenna connected to the station (and not using any connector) are as follows:

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

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 300 296 for details, see the corresponding scope).

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] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [2] 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".

- [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 (1998): "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ETSI ETR 273: "Electromagnetic compatibility and Radio Spectrum Matters (ERM): Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties".
- [6] IEC 60489-3: "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions".
- [7] ANSI C63.5 (1998): "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] ITU-T Recommendation O.41 (1994): "Psophometer for use on telephone-type circuits".

3 Definitions, abbreviations and symbols

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 an 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 (G3) or frequency modulation (F3)

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 maximum usable sensitivity (field strength), clause 9.2, integral antenna equipment only;
- receiver adjacent channel selectivity, clause 9.5.

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

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

3.2 Abbreviations

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

SND/ND	(signal + noise + distortion)/(noise + distortion)
RF	radio frequency
IF	intermediate frequency
Tx	transmitter

3.3 Symbols

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

E _o	reference field strength, annex A
R _o	reference distance, annex A

4 General

4.1 Selection of equipment for testing purposes

For information regarding the selection of equipment for testing purposes, refer to EN 300 793 [3].

It is expected that the usage of similar measurement methodologies will make it more likely that different laboratories measuring the same equipment get comparable measurement results.

4.2 Mechanical and electrical design

4.2.1 General

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The equipment shall be designed, constructed and manufactured in accordance with sound engineering practice, and with the aim of minimizing harmful interference to other equipment and services.

4.2.2 Controls

Those controls which if maladjusted might increase the interfering potentialities of the equipment shall not be accessible to the user.

4.2.3 Transmitter shut-off facility

When a timer for an automatic shut-off facility is operative, at the moment of the time-out the transmitter shall automatically be switched off. The activation of the transmitter key shall reset the timer.

4.2.4 Marking

The equipment shall be marked in a visible place. This marking shall be legible, tamperproof and durable.

The marking shall be in accordance with EC Directives and/or CEPT decisions or recommendations as appropriate.

4.3 Interpretation of the measurement results

The interpretation of the results (e.g. results recorded in a test report) for the measurements described in the present document shall be as follows:

- a) the measured value related to the corresponding limit shall be used to decide whether an equipment meets the requirements for that parameter of the present document;
- b1) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in clause 11 (maximum acceptable values of the measurement uncertainties);
- b2) the actual measurement uncertainty of the laboratory carrying out the measurements, for each particular measurement, shall be included in the corresponding test report (if any).

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETR 028 [4] and shall correspond to an expansion factor (coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

The particular expansion factor used for the evaluation of the measurement uncertainty shall be stated.

5 Technical characteristics

This clause contains the limit values of the parameters defined in clauses 8 to 10.

5.1 Transmitter parameter limits

5.1.1 Frequency error

For the definition and the measuring method see clause 8.1.

The frequency error shall not exceed the values given in table 1 under normal, extreme or any intermediate set of conditions.

For practical reasons the measurements will be performed only under normal and extreme test conditions as stated in clause 8.1.

Table 1

Channel separation (kHz)	Frequency error limit (kHz)				
	below 47 MHz	47 MHz to 137 MHz	above 137 MHz to 300 MHz	above 300 MHz to 500 MHz	above 500 MHz to 1 000 MHz
20 & 25	$\pm 0,60$	$\pm 1,35$	$\pm 2,00$	$\pm 2,00$	$\pm 2,50$ (a)
12,5	$\pm 0,60$	$\pm 1,00$	$\pm 1,00$ (B) $\pm 1,50$ (M)	$\pm 1,00$ (B) $\pm 1,50$ (a) (M)	No value specified

NOTE:

- B = base station.
- M = mobile or hand portable station.
- (a) = for hand portable stations having integral power supplies, the frequency error shall not be exceeded over a temperature range of 0°C to +30°C.

Under extreme temperature conditions (clause 6.4.1), the frequency error shall not exceed $\pm 2,50$ kHz for a channel separation of 12,5 kHz between 300 MHz and 500 MHz, and $\pm 3,00$ kHz for channel separations of 20 kHz and 25 kHz between 500 MHz and 1 000 MHz.

5.1.2 Carrier power (conducted)

For the definition and the measuring method see clause 8.2.

The carrier output power (conducted) under normal test conditions shall be within $\pm 1,50$ dB of the rated output power.

Furthermore, the carrier output power (conducted) shall not exceed the maximum value allowed by the Administrations.

The carrier output power (conducted) under extreme test conditions shall be within $+2,0$ dB and $-3,0$ dB of the rated output power.

5.1.3 Effective radiated power

This measurement applies only to equipment without an external $50\ \Omega$ antenna connection.

For the definition and the measuring method see clause 8.3.

The effective radiated power under normal test conditions shall be within $\pm 7,5$ dB of the rated effective radiated power.

Furthermore, the effective radiated power shall not exceed the maximum value allowed by the Administrations.

The measurement shall be carried out under normal conditions only.

5.1.4 Frequency deviation

For the definition and the measuring method see clause 8.4.

5.1.4.1 Maximum permissible frequency deviation

The maximum permissible frequency deviation for modulation frequencies from the lowest frequency transmitted (f_1) by the equipment (as declared by the manufacturer) up to (f_2) shall be as given in table 2.

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Table 2

Channel separation (kHz)	Maximum permissible frequency deviation (kHz)
12,5	$\pm 2,5$
20	$\pm 4,0$
25	$\pm 5,0$

5.1.4.2 Response of the transmitter to modulation frequencies above 3 kHz

The frequency deviation at modulation frequencies between 3,0 kHz (for equipment operating with 20 kHz or 25 kHz channel separations) and 2,55 kHz (for equipment operating with 12,5 kHz channel separation) and 6,0 kHz shall not exceed the frequency deviation at a modulation frequency of 3,0 kHz/2,55 kHz. At 6,0 kHz the deviation shall be not more than 30,0 % of the maximum permissible frequency deviation.

The frequency deviation at modulation frequencies between 6,0 kHz and a frequency equal to the channel separation for which the equipment is intended shall not exceed that given by a linear representation of the frequency deviation (dB) relative to the modulation frequency, starting at the 6,0 kHz limit and having a slope of -14,0 dB per octave. These limits are illustrated in figure 1.