

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Short Range Devices (SRD);
Radio equipment in the frequency range
9 kHz to 25 MHz and inductive loop systems
in the frequency range 9 kHz to 30 MHz;
Part 1: Technical characteristics and test methods**

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Contents

Intellectual Property Rights	7
Foreword.....	7
Introduction	7
1 Scope	8
2 References	9
2.1 Normative references	10
2.2 Informative references	10
3 Definitions, symbols and abbreviations	11
3.1 Definitions	11
3.2 Symbols	11
3.3 Abbreviations	12
4 Technical requirements specifications	12
4.1 General requirements	12
4.1.1 Receiver categorization	12
4.1.2 General performance criteria	13
4.2 Presentation of equipment for testing purposes	13
4.2.1 Choice of model for testing	13
4.2.2 Testing of equipment with alternative radiated H-field strengths	13
4.2.3 Testing of equipment that does not have an external 50 Ω RF connector (integral antenna equipment)	14
4.2.3.1 Equipment with an internal permanent or temporary antenna connector	14
4.2.3.2 Equipment with a temporary antenna connector	14
4.2.4 On-site testing	14
4.3 Mechanical and electrical design	14
4.3.1 General	14
4.3.2 Controls	14
4.3.3 Transmitter shut-off facility	14
4.3.4 Receiver mute or squelch	14
4.3.5 Marking (equipment identification)	14
4.3.5.1 Equipment identification	15
4.3.5.2 Equipment marking	15
4.4 Declarations by the provider	15
4.5 Auxiliary test equipment	15
4.6 Interpretation of the measurement results	15
5 Test conditions, power sources and ambient temperatures	15
5.1 Normal and extreme test conditions	15
5.2 Test power source	15
5.2.1 External test power source	16
5.2.2 Internal test power source	16
5.3 Normal test conditions	16
5.3.1 Normal temperature and humidity	16
5.3.2 Normal test power source	16
5.3.2.1 Mains voltage	16
5.3.2.2 Regulated lead-acid battery power sources	16
5.3.2.3 Other power sources	16
5.4 Extreme test conditions	17
5.4.1 Extreme temperatures	17
5.4.1.1 Procedure for tests at extreme temperatures	17
5.4.1.1.1 Procedure for equipment designed for continuous operation	17
5.4.1.1.2 Procedure for equipment designed for intermittent operation	17
5.4.1.2 Extreme temperature ranges	17
5.4.2 Extreme test source voltages	18
5.4.2.1 Mains voltage	18

5.4.2.2	Regulated lead-acid battery power sources	18
5.4.2.3	Power sources using other types of batteries.....	18
5.4.2.4	Other power sources.....	18
6	General conditions.....	18
6.1	Normal test signals and test modulation.....	18
6.1.1	Normal test signals for analogue speech.....	19
6.1.2	Normal test signals for data	19
6.2	Artificial antenna.....	19
6.2.1	Artificial antenna for inductive transmitters (non 50 Ω).....	19
6.2.2	Artificial antenna for transmitters with 50 Ω impedance connector	19
6.3	Test fixture	20
6.4	Test sites and general arrangements for radiated measurements	20
6.5	Modes of operation of the transmitter	20
6.6	Measuring receiver	21
7	Transmitter requirements	21
7.1	Transmitter definitions	21
7.1.1	The inductive loop coil transmitters	22
7.1.2	The large size loop transmitters	22
7.1.3	Other transmitters	22
7.1.4	Product Classes	22
7.2	Transmitter carrier output levels	25
7.2.1	H-field (radiated)	25
7.2.1.1	Definition	25
7.2.1.2	Methods of measurement	25
7.2.1.3	Limits	25
7.2.2	RF carrier current (Product Class 3 only).....	26
7.2.2.1	Definition	26
7.2.2.2	Methods of measurement	26
7.2.2.3	Limits	27
7.2.3	Radiated E-field (Product Class 4 only).....	27
7.2.3.1	Definition	27
7.2.3.2	Methods of measurement	27
7.2.3.3	Limits	27
7.3	Permitted range of operating frequencies.....	28
7.3.1	Definition.....	28
7.3.2	Method of measurement	28
7.3.3	Limits.....	28
7.4	Permitted frequency range of the modulation bandwidth.....	28
7.4.1	Definition.....	28
7.4.2	Method of measurement	29
7.4.3	Limits.....	29
7.5	Spurious domain emission limits.....	29
7.5.1	Definition.....	29
7.5.2	Conducted spurious emissions (Product class 3 only)	30
7.5.2.1	Methods of measurement (< 30 MHz)	30
7.5.2.2	Limits	30
7.5.2.3	Methods of measurement (\geq 30 MHz)	30
7.5.2.4	Limits	30
7.5.3	Radiated field strength	31
7.5.3.1	Methods of measurement (< 30 MHz)	31
7.5.3.2	Limits	31
7.5.4	Effective radiated power	31
7.5.4.1	Methods of measurement (\geq 30 MHz)	31
7.5.4.2	Limits	32
8	Receiver requirement	32
8.1	Adjacent channel selectivity - in band.....	32
8.1.1	Definition.....	33
8.1.2	Method of measurement	33
8.1.3	Limits.....	33
8.2	Blocking or desensitization (Receiver category 1 and 2 only)	33

8.2.1	Definition.....	33
8.2.2	Methods of measurement.....	34
8.2.3	Limits.....	35
8.3	Receiver spurious radiation.....	35
8.3.1	Definition.....	35
8.3.2	Methods of measurement.....	35
8.3.3	Limits.....	36
8.3.3.1	Radiated emissions below 30 MHz.....	36
8.3.3.2	Radiated emissions above 30 MHz.....	36
9	Measurement uncertainty.....	36
10	Interpretation of results.....	37
10.1	Measurement uncertainty is equal to or less than maximum acceptable uncertainty.....	37
Annex A (normative): Radiated measurement.....		38
A.1	Test sites and general arrangements for measurements involving the use of radiated fields.....	38
A.1.1	Anechoic chamber.....	38
A.1.2	Anechoic chamber with a conductive ground plane.....	39
A.1.3	Open Area Test Site (OATS).....	40
A.1.4	Test antenna.....	41
A.1.5	Substitution antenna.....	42
A.1.6	Measuring antenna.....	42
A.2	Guidance on the use of radiation test sites.....	42
A.2.1	Verification of the test site.....	42
A.2.2	Preparation of the EUT.....	42
A.2.3	Power supplies to the EUT.....	42
A.2.4	Range length.....	43
A.2.4.1	Far-field length above 30 MHz.....	43
A.2.4.2	Near-field and Far-field length below 30 MHz.....	43
A.2.5	Site preparation.....	44
A.3	Coupling of signals.....	44
A.3.1	General.....	44
A.3.2	Data signals.....	44
A.4	Standard test position.....	44
A.5	Test fixture.....	45
A.5.1	Description.....	45
A.5.2	Calibration.....	46
A.5.3	Mode of use.....	46
A.6	Technical performance of the spectrum analyser.....	47
Annex B (normative): H-field limit correction factor for generated E-fields.....		48
Annex C (normative): Customized loop antennas.....		49
C.1	Product classes related to the antenna loop.....	49
C.1.1	Antenna loops below 1 MHz.....	49
C.1.2	Antenna loops above 1 MHz.....	50
Annex D (informative): Test fixture for measuring inductive transmitter carrier and harmonic currents by use of an artificial antenna (Product Class 3 only).....		51
Annex E (informative): E-fields in the near field at low frequencies.....		53
Annex F (normative): H-field measurements and limits at 3 m and 30 m.....		55
F.1	Limits for measurements at 30 m distance.....	55
F.2	Limits for measurements at 3 m distance.....	56

Annex G (normative):	Transmitter emission levels and spectrum mask measurements.....	57
Annex H (informative):	Generic inductive loop limit in the frequency range 148,5 kHz to 30 MHz	59
H.1	Introduction	59
H.2	Radiated H-field strength	59
H.2.1	Methods of measurements.....	59
H.2.2	Radiated H-field strength limit.....	59
H.2.2.1	Radiated total H-field and H-field density limits according to the measurements in clause H.2.1 indent a)	59
H.2.2.2	Radiated bandwidth and H-field density limits according to the measurements in clause H.2.1 indent b).....	60
H.3	Other requirements	60
Annex I (informative):	Determination and use of the measurement bandwidth.....	61
Annex J (informative):	Other limits.....	62
Annex K (informative):	Bibliography.....	63
History		64

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document includes improvements to the previous version of the standard that take advantage of technical developments within the SRD industry.

The present document is part 1 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems, as identified below:

Part 1: "Technical characteristics and test methods";

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

Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Introduction

The present document has been prepared to include the frequency band for RFID systems in the range of 119 kHz to 135 kHz and the alignment of the emission levels in the range of 9 kHz to 135 kHz.

1 Scope

The present document applies to the following Short Range Device major equipment types:

- 1) Generic Short range Devices including transmitters operating in the range from 9 kHz to 25 MHz; and
- 2) inductive loop transmitters operating from 9 kHz to 30 MHz including Radio Frequency Identification (RFID) and EAS equipments;
- 3) receivers operating from 9 kHz to 30 MHz.

These radio equipment types are capable of operating in the permitted frequency bands within the 9 kHz to 30 MHz range as specified in table 1:

- either with a Radio Frequency (RF) output connection and dedicated antenna or with an integral antenna;
- for all types of modulation;
- with or without speech.

Table 1 shows a list of the frequency bands as designated to Short Range Devices and the CEPT/ERC/REC 70-03 [i.1] as known at the date of publication of the present document.

When selecting parameters for new SRDs, which may have inherent safety of human life implications, manufacturers and users should pay particular attention to the potential for interference from other systems operating in the same or adjacent bands.

The present document covers fixed stations, mobile stations and portable stations. If a system includes transponders, these are measured together with the transmitter.

All types of modulation for radio devices are covered by the present document, provided the requirements of clause 7.3 are met.

The radio equipment, covered by the classification SRD is divided into several classes based on the maximum radiated magnetic field strength. The field strength designation in the present document is based on CEPT/ERC/REC 70-03 [i.1] and National SRD-frequency designations.

Three types of measuring methods are defined in the present document due to the varied nature of the antenna types for equipment used in this band. One method measures the RF carrier current, another measures the radiated H-field and the third the conducted power.

The present document covers requirements for radiated emissions below as well as above 30 MHz.

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

Table 1: Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 135 kHz	Inductive devices, Generic use
Transmit and Receive	135 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148,5 kHz	Inductive devices, Generic use
Transmit and Receive	148,5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 kHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	4 234 kHz	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10,200 kHz to 11,000 MHz	Inductive devices, Generic use
Transmit and Receive	12,5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13,553 MHz to 13,567 MHz	Inductive devices, Generic use
Transmit and Receive	26,957 MHz to 27,283 MHz	Inductive devices, Generic use
Transmit and Receive	27,095 MHz	Inductive devices, Railway applications

NOTE 1: It should be noted that table 1 represents the most widely implemented position within the European Union and the CEPT countries, but it should not be assumed that all designated bands are available in all countries.

NOTE 2: In addition, it should be noted that other frequency bands may be available in a country within the frequency range 9 kHz to 30 MHz covered by the present document.

NOTE 3: On non-harmonized parameters, national administrations may impose certain conditions such as the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated power, duty cycle, and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an Individual Rights for use of spectrum or General Authorization, or as a condition for use under "licence exemption" as it is in most cases for Short Range Devices.

The present document covers fixed stations, mobile stations and portable stations.

Applications using Ultra- WideBand (UWB) technology are not covered by the present document.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

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

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- [2] 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).
- [3] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [4] ITU-T Recommendation O.41: "Psophometer for use on telephone-type circuits".
- [5] CISPR 16-2-3: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements".

2.2 Informative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [i.1] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.2] ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [i.3] ANSI C63.5: "American National Standard for Electromagnetic Compatibility-Radiated Emission Measurements in Electromagnetic Interference (EMI) Control-Calibration of Antennas (9 kHz to 40 GHz)".
- [i.4] IEC 60489-3: "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions".
- [i.5] ETSI TR 102 273-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 2: Anechoic chamber".
- [i.6] ETSI TR 102 273-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 3: Anechoic chamber with a ground plane".
- [i.7] ETSI TR 102 273-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 4: Open area test site".
- [i.8] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

alarm: use of radio communication or a sensing device for indicating alert information at a distant location

artificial antenna: tuned reduced-radiating dummy load equal to the nominal impedance specified by the provider

assigned frequency band: frequency band within which the device is authorized to operate

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

customized antenna: antenna built according to manufacturers' antenna design rules inside tested limits

dedicated antenna: removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment

NOTE: The antenna has been designed or developed for one or more specific types of equipment. It is the combination of dedicated antenna and radio equipment that is expected to be compliant with the regulations.

fixed station: equipment intended for use in a fixed location

H-field test antenna: electrically screened loop or equivalent antenna, with which the magnetic component of the field can be measured

identification system: equipment consisting of a transmitter(s), receiver(s) (or a combination of the two) and an antenna(s) to identify objects by means of a transponder

integral antenna: antenna designed as a fixed part of the equipment, without the use of an external connector and as such which cannot be disconnected from the equipment by the user

magnetic dipole moment: product of (Number of coil turns) \times (coil area) \times (coil current)

NOTE: Air coils only.

mobile station: equipment normally installed in a vehicle

portable station: equipment intended to be carried, attached or implanted

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

telecommand: use of radio communication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance

telemetry: use of radio communication for indicating or recording data at a distance

transponder: device that responds to an interrogation signal

type designation: providers' marking of the equipment

3.2 Symbols

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

A	loop antenna area
C	correction factor
E	electrical field strength
f	frequency
f_C	carrier frequency in Hz
H	magnetic field strength

Hef	H field-strength generated by an e-field antenna
Hf	H-field-strength limit
H _C	carrier H-field strength
H _S	H-field-strength limit for radiated spurious emissions
I _C	transmitter carrier output current
I _S	transmitter spurious output current
λ	Wave length
m	magnetic dipole moment
N	number of turns for a loop antenna
P	Power
t	time

3.3 Abbreviations

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

EAS	Electronic Article Surveillance
EMC	ElectroMagnetic Compatibility
erp	effective radiated power
EUT	Equipment Under Test
ISM	Industrial, Scientific and Medical
ND	Noise and Distortion
NRI	National Radio Interfaces
OATS	Open Area Test Site
PSTN	Public Switched Telephone Network
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
RFID	Radio Frequency IDentification
SND	Signal, Noise and Distortion
SRD	Short Range Device
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 General requirements

4.1.1 Receiver categorization

The product family of short range radio devices is divided into three receiver categories, see table 2, each having its own set of minimum performance criteria. This classification is based upon the impact on persons in case the equipment does not operate above the specified minimum performance level.

Table 2

Receiver categories	Relevant receiver clauses	Risk assessment of receiver performance
1	8.1, 8.2 and 8.3	Safety critical SRD communication media; i.e. for devices serving systems where failure may result in a physical risk to a person.
2	8.2 and 8.3	Function critical SRD communication media; i.e. when a failure to operate correctly causes loss of function but does not constitute a safety hazard.
3	8.3	Non-critical SRD communication media whose failure to operate correctly causes loss of function which can be overcome by parallel means.

NOTE: With reference to the present document manufacturers are recommended to declare the categorization of their devices in accordance with table 2, as relevant. In particular where an SRD which may have an inherent safety of human life implication, manufacturers and users should pay particular attention to the potential for interference from other systems operating in the same or adjacent bands.

4.1.2 General performance criteria

For the purpose of the receiver performance tests, the receiver will produce an appropriate output under normal conditions as indicated below:

- a SND/ND ratio of 20 dB, measured at the receiver output through a telephone psophometric weighting network as described in ITU-T Recommendation O.41 [4]; or
- after demodulation, a data signal with a bit error ratio of 10^{-2} ; or
- after demodulation, a message acceptance ratio of 80 %.

Where the indicated performance cannot be achieved or if it is defined differently, the manufacturer shall declare and publish the performance criteria used to determine the performance of the receiver.

4.2 Presentation of equipment for testing purposes

Each equipment submitted for testing shall fulfil the requirements of the present document on all frequencies over which it is intended to operate.

The provider shall declare the frequency ranges, the range of operating conditions and power requirements as applicable, to establish the appropriate test conditions.

Additionally, technical documentation and operating manuals, sufficient to make the test, shall be supplied.

A test fixture for equipment with an integral antenna may be supplied by the provider (see clause 6.3). For equipment supplied without an antenna i.e. Product Class 3 as defined in clause 7.1.4, the provider will supply either a tuned reduced radiating load (see clause 6.2.1) or an artificial antenna as defined by annex E.

If an equipment is designed to operate with different transmitter radiated field strengths or power level, measurement of each transmitter parameter shall be performed, according to the present document, on samples of equipment defined in clause 4.2.1.

To simplify and harmonize the testing procedures between different testing laboratories, measurements shall be performed, according to the present document, on samples defined in clauses 4.2.1 to 4.2.4.

4.2.1 Choice of model for testing

The provider shall provide one or more samples of the equipment, as appropriate for testing.

Stand alone equipment shall be offered by the provider complete with any ancillary equipment needed for testing.

If an equipment has several optional features, considered not to affect the RF parameters then the tests need only to be performed on the equipment configured with that combination of features considered to be the most complex, as proposed by the provider and agreed by the test laboratory.

Where practicable, equipment offered for testing shall provide a 50 Ω connector for conducted RF power level measurements.

In the case of integral antenna equipment, if the equipment does not have an internal permanent 50 Ω connector then it is permissible to supply a second sample of the equipment with a temporary antenna connector fitted to facilitate testing, see clause 4.2.3.

The performance of the equipment submitted for testing shall be representative of the performance of the corresponding production model.

4.2.2 Testing of equipment with alternative radiated H-field strengths

If a family of equipment has alternative radiated field strengths provided by the use of separate power modules or add on stages, then these shall be declared by the provider. Each module or add on stage shall be tested in combination with the equipment. As a minimum, measurements of the radiated H-field strength and spurious emissions shall be performed for each combination and shall be stated in the test report.