

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Short range devices;
Radio equipment to be used
in the 1 GHz to 40 GHz frequency range;
Part 1: Technical characteristics and
test methods**

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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 ETSI standards One-step Approval Procedure.

For non EU countries the present document may be used for regulatory (Type Approval) purposes.

The present document includes improvements to the previous version of the standard that take advantage of technical developments within the SRD industry. In particular this includes optional features such as Listen Before Talk (LBT) and Detect And Avoid (DAA).

The present document is part 1 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range, as identified below:

- Part 1:** "Technical characteristics and test methods";
- Part 2:** "Harmonized EN covering 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

1 Scope

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

- Generic Short Range Devices, including alarms, telecommand, telemetry, data transmission in general, etc.
- Radio Frequency IDentification (RFID).
- Radiodetermination, including detection, movement and alert applications.

These radio equipment types are capable of operating in the permitted frequency bands within the 1 GHz to 40 GHz 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 by the European Commission Decisions on Short Range Devices [i.6], [i.7] and the CEPT/ERC Recommendation 70-03 [i.1] as known at the date of publication of the present document.

Table 1: Short Range Devices within the 1 GHz to 40 GHz permitted frequency bands

	Frequency Bands	Applications	Notes
Transmit and Receive	2 400 MHz to 2 483,5 MHz	Generic use	
Transmit and Receive	2 400 MHz to 2 483,5 MHz	Detection, movement and alert applications	
Transmit and Receive	(a) 2 446 MHz to 2 454 MHz	RFID	See annex C
Transmit and Receive	(b) 2 446 MHz to 2 454 MHz	RFID	See annex C
Transmit and Receive	5 725 MHz to 5 875 MHz	Generic use	
Transmit and Receive	9 200 MHz to 9 500 MHz	Radiodetermination: radar, detection, movement and alert applications	
Transmit and Receive	9 500 MHz to 9 975 MHz	Radiodetermination: radar, detection, movement and alert applications	
Transmit and Receive	10,5 GHz to 10,6 GHz	Radiodetermination: radar, detection, movement and alert applications	
Transmit and Receive	13,4 GHz to 14,0 GHz	Radiodetermination: Radar, detection, movement and alert applications	
Transmit and Receive	17,1 GHz to 17,3 GHz	Radiodetermination: GBSAR detecting, movement and alert applications	See annex E
Transmit and Receive	24,00 GHz to 24,25 GHz	Generic use and for Radiodetermination: detection, movement and alert applications	
NOTE:	(a) and (b) refer to two different operational restrictions for different power levels in the same frequency band.		

NOTE 1: Table 1 represents the most widely implemented position within the European Union [i.6], [i.7] and the CEPT countries [i.1], 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 1 GHz to 40 GHz covered by the present document. See the European Commission Decisions on Short Range Devices [i.6], [i.7] and the CEPT ERC Recommendation 70-03 [i.1] as implemented through National Radio Interfaces (NRI) and additional NRI as relevant.

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 or general licence, or as a condition for the issuing of 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 Wide Band (UWB) technology are not covered by the present document.

The present document does not require measurements for radiated emissions below 25 MHz.

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.

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For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

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] | CISPR 16 (2006) (parts 1-1, 1-4 and 1-5): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus". |
| [2] | ITU-T Recommendation O.41: "Psophometer for use on telephone-type circuits". |
| [3] | ITU-T Recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate". |

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- | | |
|-------|--|
| [i.1] | CEPT/ERC Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)". |
|-------|--|

- [i.2] ITU-R Recommendation SM.1755: "Characteristics of ultra-wideband technology".
- [i.3] 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).
- [i.4] ETSI TR 100 028 (V1.4.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.5] ETSI EN 300 440-2 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".
- [i.6] European Commission Decision (2006/771/EC) of 9 November 2006 on harmonization of the radio spectrum for use by short-range devices.
- [i.7] European Commission Decision (2008/432/EC) of 23 May 2008 (amending Decision 2006/771/EC) on harmonization of the radio spectrum for use by short-range devices.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

adjacent channels: those two channels offset from the nominal channel by the nominal channel bandwidth

alarm: use of radio communication for indicating an alarm condition at a distant location

alternate adjacent channels: those two channels offset from the nominal channel by double the channel bandwidth

NOTE 1: The wanted channel is described by the occupied bandwidth (see definition below) of the wanted emissions; i.e. the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0,5 % of the total mean power of a given emission. In addition, the necessary bandwidth of the emissions as defined by the ITU-R radio regulations is not to exceed the wanted channel.

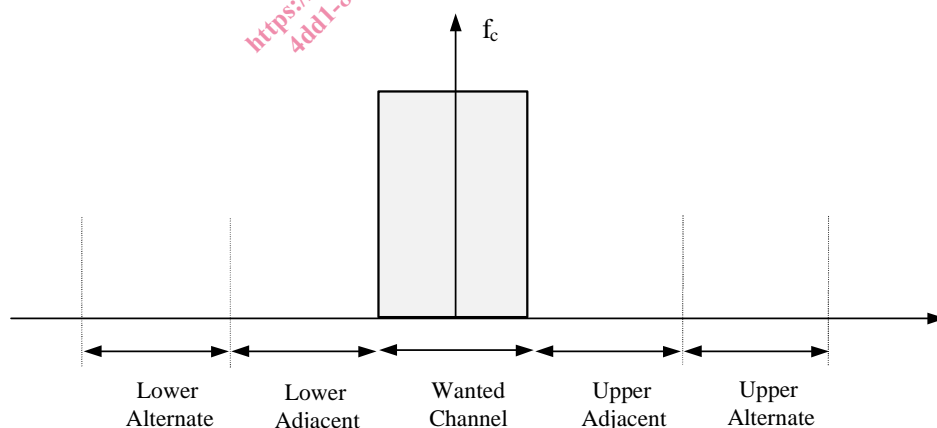


Figure 1: Adjacent and alternate adjacent channel definitions

NOTE 2: For equipment to be used in a frequency band where channelization is not defined by regulation, the channel spacing of the equipment is defined by the provider.

artificial antenna: non-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 and to perform the intended function of the equipment

chip: unit of modulation used in Direct Sequence Spread Spectrum (DSSS) modulation

chip rate: number of chips per second

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

Direct Sequence Spread Spectrum (DSSS): form of modulation where a combination of data to be transmitted and a fixed code sequence (chip sequence) is used to directly modulate a carrier, e.g. by phase shift keying

NOTE: The code rate determines the occupied bandwidth.

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

fixed station: equipment intended for use in a fixed location

Frequency Hopping Spread Spectrum (FHSS): spread spectrum technique in which the transmitter signal occupies a number of frequencies in time, each for some period of time, referred to as the dwell time

NOTE: Transmitter and receiver follow the same frequency hop pattern. The number of hop positions and the bandwidth per hop position determine the occupied bandwidth.

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: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

mobile station: equipment normally fixed in a vehicle or used as a transportable station

necessary bandwidth: width of the emitted frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

NOTE: The necessary bandwidth including the frequency tolerances is accommodated within the assigned frequency band.

occupied bandwidth: width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0,5 % of the total mean power of a given emission

operating frequency: nominal frequency at which equipment is operated; this is also referred to as the operating centre frequency

NOTE: Equipment may be able to operate at more than one operating frequency.

operating frequency range: range of operating frequencies over which the equipment can be adjusted through tuning, switching or reprogramming

out of band emissions: emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions

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

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

radio determination: determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves

spread spectrum: modulation technique in which the energy of a transmitted signal is spread throughout a large portion of the frequency spectrum

spurious emissions: emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

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 which responds to an interrogation signal

Ultra Wide Band (UWB) technology: technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a very large frequency range, which may overlap several frequency bands allocated to radiocommunication services as defined in ITU-R Recommendation SM.1755 [i.2]

wanted channel: the occupied bandwidth of the wanted emissions

3.2 Symbols

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

D_{ant}	Aperture dimension of the radiating antenna
E	Electrical field strength
E_o	Reference electrical field strength, (see annex A)
f	Frequency
P	Power
R	Distance
R_o	Reference distance, (see annex A)
t	Time
λ	wavelength

3.3 Abbreviations

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

AFA	Adaptive Frequency Agility
CW	Continuous Wave (transmission)
DAA	Detect And Avoid spectrum access technique
dB	Decibel
dBi	gain in decibels relative to an isotropic antenna
DSSS	Direct Sequence Spread Spectrum
e.i.r.p.	equivalent isotropically radiated power
EMC	ElectroMagnetic Compatibility
ERC	European Radiocommunication Committee
EUT	Equipment Under Test
FHSS	Frequency Hopping Spread Spectrum
GBSAR	Ground Based Synthetic Aperture Radar
ISM	Industrial Scientific Medical (frequency band)
ITU-R	International Telecommunications Union, Radio Sector
ITU-T	International Telecommunications Union, Telecommunications Sector
LBT	Listen Before Talk
NRI	National Radio Interfaces
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
RFID	Radio Frequency Identification
SCU	System Control Unit
SF-CW	Step Frequency Continuous Wave (spread spectrum)
SND/ND	Signal + Noise + Distortion divided by Noise + Distortion
SRD	Short Range Device
Tx	Transmitter
UWB	Ultra Wide Band
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 General requirements

4.1.1 Receiver category

The product family of short range radio devices is divided into three receiver categories, see table 2, each having a set of relevant receiver requirements and minimum performance criteria. The set of receiver requirements depends on the choice of receiver category by the equipment provider.

The provider shall specify the receiver category of his choice and this shall be declared in the product literature provided to the user. In particular where an SRD which may have an 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 receiver categories are defined in table 2.

Table 2: Receiver categories

Receiver category	Relevant receiver clauses	Risk assessment of receiver performance
1	8.1, 8.2 and 8.3	Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person).
2	8.2 and 8.3	Medium reliable SRD communication media e.g. causing inconvenience to persons, which cannot simply be overcome by other means.
3	8.3	Standard reliable SRD communication media e.g. Inconvenience to persons, which can simply be overcome by other means (e.g. manual).

If receiver category 1 or 2 is selected, this shall be stated in both the test report and in the user's manual for the equipment.

4.1.2 General performance criteria

For the purpose of the receiver performance tests, the receiver shall 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 [2]; or
- after demodulation, a data signal with a bit error ratio of 10^{-2} without correction; or
- after demodulation, a message acceptance ratio of 80 %;
- an appropriate false alarm rate or sensing criteria as declared by the provider.

Where the indicated performance cannot be achieved, the performance criteria used to determine the performance of the receiver shall be declared and published by the provider.

4.2 Presentation of equipment for testing purposes

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

Where appropriate testing should be carried out on suitable frequencies for the equipment concerned.

If an equipment is designed to operate with different carrier powers, measurements of each transmitter parameter shall be performed at the highest power level at which the transmitter is intended to operate.