
**Elektromagnetna združljivost in zadeve v zvezi z radijskim spektrom (ERM) -
Naprave kratkega dosega (SRD), ki uporabljajo ultra širokopasovno (UWB)
tehnologijo - Oprema za sledenje, ki deluje v frekvenčnem območju od 6 GHz do 9
GHz - 1. del: Tehnične karakteristike in preskusne metode**

Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short Range Devices (SRD) using Ultra WideBand (UWB) technology - Location Tracking equipment operating in the frequency range from 6 GHz to 9 GHz - Part 1: Technical characteristics and methods of measurement

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**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Short Range Devices (SRD) using
Ultra WideBand (UWB) technology;
Location Tracking equipment operating in
the frequency range from 6 GHz to 9 GHz;
Part 1: Technical characteristics and
methods of measurement**

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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

The present document is part 1 of a multi-part deliverable covering Short Range Devices (SRD) using Ultra WideBand (UWB) technology; Location Tracking equipment operating in the frequency range from 6 GHz to 9 GHz, as identified below:

Part 1: "Technical characteristics and methods of measurement";

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

Clauses 1 and 3 provide a general description on the types of equipment covered by the present document and the definitions and abbreviations used.

Clause 4 provides a guide as to the number of samples required in order that type tests may be carried out, and any markings on the equipment which the provider shall provide.

Clauses 5 and 6 give guidance on the test and general conditions for testing of the device.

Clause 7 gives the interpretation of results and maximum measurement uncertainty values.

Clause 8 specifies the transmitter spectrum utilization parameters which are required to be measured. The clauses provide details on how the equipment should be tested and the conditions which should be applied.

Clause 9 specifies the receiver spectrum utilization parameters which are required to be measured. The clauses provide details on how the equipment should be tested and the conditions which should be applied.

Annex A (normative) provides specifications concerning radiated measurements.

Annex B (normative) provides information on the spectrum analyser specification.

Annex C (informative) provides information on measurement antenna and preamplifier specifications.

Annex D (informative) provides information on peak measurements within a 3 MHz measurement bandwidth.

Annex E (informative) covers other supplementary information.

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1 Scope

The present document specifies the requirements for Ultra Wideband location tracking equipment operating in all or part of the frequency range from 6 GHz to 9 GHz.

The present document applies for indoor as well as portable or mobile outdoor applications.

It covers Ultra Wideband location tracking tags which are attached to people or objects and tags are tracked using a fixed receiver infrastructure to only receive the UWB emission emitted by the tags. Equipment covered by the present document is fitted with an integral or dedicated antenna.

Transmitter equipment covered by the present document does not have a direct Detect-And-Avoid capability (see [4] and [5]).

The present document contains the technical characteristics and test methods for location tracking equipment and it does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] 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".
- [2] CISPR 16-1-1 (2010): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [3] ANSI C63.5 (2006): "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".
- [4] ETSI TS 102 754 (V1.2.1): "Electromagnetic compatibility and Radio spectrum matters (ERM); Short Range Devices (SRD); Technical characteristics of Detect-and-Avoid (DAA) mitigation techniques for SRD equipment using Ultra Wideband (UWB) technology".
- [5] ETSI EN 302 065 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications purposes; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ITU-R Recommendation SM.1754: "Measurement techniques of ultra-wideband transmissions".

- [i.2] ETSI TR 102 070-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide to the application of harmonized standards to multi-radio and combined radio and non-radio equipment; Part 2: Effective use of the radio frequency spectrum".
- [i.3] ETSI TR 102 273 (V1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

combined equipment: any combination of non-radio equipment and a plug-in radio device that would not offer full functionality without the radio device

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

effective radiated power (e.r.p.): product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction (RR 1.162)

equivalent isotropically radiated power (e.i.r.p.): product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain) (RR 1.161)

fixed-mounted station: station which is fixed mounted and which is not intended to be operated while in motion; however, it behaves otherwise in the system like a mobile station

host: host equipment is any equipment which has complete user functionality when not connected to the radio equipment part and to which the radio equipment part provides additional functionality and to which connection is necessary for the radio equipment part to offer functionality (02-500-1-v2-1-1-2010)

impulsive UWB signal: radiated, short transient Ultra Wideband signal whose occupied bandwidth is defined by its time duration rather than by frequency-hopping or other techniques

integral antenna: antenna designed to be connected to the equipment without the use of a standard connector and considered to be part of the equipment

NOTE: An integral antenna may be fitted internally or externally to the equipment.

Mobile Station (MS): station intended to be used while in motion or during halts at unspecified points

Non-Interference Mode operation (NIM): operational mode that allows the use of the radio spectrum on a non-interference basis without active mitigation techniques

plug-in radio device: radio equipment module intended to be used with or within host, combined or multi-radio equipment, using their control functions and power supply

portable station: mobile station that is portable but cannot comfortably be carried around by a person due to weight and/or size or having relatively high power consumption

provider: manufacturer or his authorized representative or the person responsible for placing on the market

pulse: radiated short transient UWB signal whose time duration is nominally the reciprocal of its -10 dB bandwidth

NOTE: See ITU-R Recommendation SM.1754 [i.1].

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

stand-alone radio equipment: equipment that is intended primarily as location tracking equipment and that is normally used on a stand-alone basis

Ultra WideBand (UWB): equipment incorporating, as an integral part or as an accessory, technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a frequency range wider than 50 MHz, which may overlap several frequency bands allocated to radiocommunication services

3.2 Symbols

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

dB	decibel
R	distance
λ	wavelength

3.3 Abbreviations

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

DAA	Detect And Avoid
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
LNA	Low Noise Amplifier
MS	Mobile Station
NIM	Non-Interference Mode
PRF	Pulse Repetition Frequency
R&TTE	Radio and Telecommunications Terminal Equipment
RBW	Resolution BandWidth
RF	Radio Frequency
rms	root mean square
SNR	Signal to Noise Ratio
SRD	Short Range Device
TX	Transmitter
UWB	Ultra WideBand
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

4 Technical requirement specifications

4.1 General requirements

Equipment supplied for testing against the present document shall be fitted with either an integral antenna or a dedicated antenna.

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.

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

These clauses are intended to give confidence that the requirements set out in the present document have been met without the necessity of performing measurements on all frequencies.

4.2.1 Choice of model for testing

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

If an equipment has several optional features, considered not to affect the RF parameters then tests need only 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.

For equipment which can be presented for testing with a 50 Ohm antenna connector, conducted transmitter measurements can be made providing suitable antenna calibrations data are available. See clause A.5.3.

4.2.1.1 Auxiliary test equipment

All necessary test signal sources, setting up instructions and other product information shall accompany the equipment when it is submitted for testing.

4.2.1.2 Declarations by the provider

The provider shall declare the necessary information regarding the equipment with respect to all technical requirements set by the present document, including:

- the operating frequency of the equipment (see clause 8.2.1);
- the type of the equipment (e.g. stand-alone equipment, plug-in radio device, combined equipment, etc.), (see also clause 6.4);
- the intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p. levels:
 - the nominal power supply voltages of the stand-alone radio equipment or the nominal power supply voltages of the host equipment or combined equipment in case of plug-in devices;
 - the test modulation to be used for testing (see also clause 6.1);
 - the implementation of any mitigation techniques.

4.3 Mechanical and electrical design

4.3.1 General

The equipment submitted by the provider or his representative, shall be designed, constructed and manufactured in accordance with good engineering practice, and with the aim of minimizing harmful interference to other equipment and services.

4.3.2 Controls

Those controls, which, if maladjusted, may increase the interfering potential of the equipment, shall not be easily accessible to the user.

4.3.3 Transmitter shut-off facility

If the equipment is equipped with an automatic transmitter shut-off facility, it shall be possible to disable this feature for the purposes of testing. See clause 8.

4.3.4 Marking

The equipment shall be marked in a visible place. This marking shall be legible and durable. In cases where the equipment is too small to carry the marking, it is sufficient to provide the relevant information in the users' manual.

4.3.4.1 Equipment identification

The marking shall include as a minimum:

- The name of the manufacturer or his trademark.
- The type designation. This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment.

4.3.4.2 Additional information for the user

The following additional information shall be included in the users' manual:

- statements that a UWB transmitter conforming to the present document shall not be:
 - installed at a fixed outdoor location;
 - installed or used in flying models, aircraft and other forms of aviation;
 - operated on board a road or rail vehicle running on a public network or highway.

4.4 Other device emissions

The equipment may contain digital circuit elements, radio circuit elements and other elements whose performance is not covered by the present document. These elements of the equipment shall meet the appropriate performance requirements for those components, as specified in other standards.

NOTE: For further information on this topic see TR 102 070-2 [i.2].

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5 Test conditions, power sources and ambient temperatures

5.1 Normal and extreme test conditions

Testing shall be performed under normal test conditions.

The test conditions and procedures shall be as specified in clauses 5.2 and 5.3.

5.2 Power sources

5.2.1 Power sources for stand-alone equipment

For non-battery-operated equipment, during testing the power source of the equipment shall be replaced by an external test power source capable of producing normal test voltages as specified in clause 5.3.2. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment. During tests the power source voltages shall be maintained within a tolerance of ± 1 % relative to the voltage at the beginning of each test.

For battery-operated equipment, fully-charged internal batteries shall be used. The batteries used shall be as supplied or recommended by the provider. If internal batteries are used, at the end of each test the voltage shall be within a tolerance of ± 5 % relative to the voltage at the beginning of each test. If the battery is not accessible (for example, it is internal to a sealed unit), then it is acceptable to determine the battery voltage at the start and end of the test by indirect means (e.g. battery health messages sent from the unit itself).

Alternatively, for battery-operated equipment, the external test power source may replace the supplied or recommended internal batteries at the required voltage - this shall be recorded and stated. In this case, the battery remains present, electrically isolated from the rest of the equipment, possibly by putting tape over its contacts.