

ETSI TR 102 495-3 V1.3.1 (2008-02)

Technical Report

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
System Reference Document;
Short Range Devices (SRD);
Technical characteristics for SRD equipment using
Ultra Wide Band Sensor technology (UWB);
Part 3: Location tracking applications type 1 operating
in the frequency band from 6 GHz to 8,5 GHz
for indoor, portable and mobile outdoor applications**

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document is part 3 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical characteristics for SRD equipment using Ultra Wide Band technology (UWB) as identified below:

- Part 1: "Building material analysis and classification applications operating in the frequency band from 2,2 GHz to 8 GHz";
- Part 2: "Object Discrimination and Characterization (ODC) applications operating in the frequency band from 2,2 GHz to 8,5 GHz";
- Part 3: "Location tracking applications type 1 operating in the frequency band from 6 GHz to 8,5 GHz for indoor, portable and mobile outdoor applications";**
- Part 4: "Object identification for surveillance applications operating in the frequency band from 2,2 GHz to 8 GHz";
- Part 5: "Location tracking applications type 2 operating in the frequency bands from 3,4 GHz to 4,8 GHz and from 6 GHz to 8,5 GHz for personnel tracking and industrial applications";
- Part 6: "Object Detection for industrial Mobile, construction, agriculture and other off-road applications operating in the frequency band from 6 GHz to 7,25 GHz (ODM)";
- Part 7: "Location tracking and sensor applications for automotive and transportation environments operating in the frequency band from 3.1 GHz to 4.8 GHz and 6 GHz to 9 GHz".

The difference between version 1.1.1 of TR 102 495-3 and version 1.2.1 of TR 102 495-3 is that in version 1.1.1 operation is limited to indoor usage. Version 1.2.1 covers indoor and portable outdoor applications.

The difference between version 1.2.1 of TR 102 495-3 and version 1.3.1 of TR 102 495-3 is that this new version covers indoor and portable or mobile outdoor applications under the conditions of the generic ECC decision as amended in July 2007.

Introduction

Ultra Wide Band (UWB) technology enables a new generation of Location Tracking devices and opens new markets with very different applications. UWB radio location devices with an operating bandwidth of several GHz allow centimetre-level localization and positioning even in the presence of severe multipath effects caused by walls, furniture etc.

It is a viable positioning technology that meets industrial requirements in the following markets:

- 1) Healthcare.
- 2) Workplace/Smart Office.
- 3) Public buildings.
- 4) Security.
- 5) Defence training.
- 6) Entertainment.
- 7) Logistics, warehouses.
- 8) Manufacturing assembly lines.
- 9) Road and rail vehicles.

The purpose of producing the present document is to lay a foundation for industry to quickly bring innovative and useful products to the market while avoiding any harmful interference with other services and equipment.

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1 Scope

The present document defines the requirements for radio frequency usage for Ultra Wide Band (UWB) location tracking devices type 1. These devices are operating in the frequency range from 6 GHz to 8,5 GHz. Operation is foreseen for indoor, portable and mobile outdoor applications and the operating distance is limited to a maximum of about 100 metres. It will include applications from all different markets (see list of markets in introduction).

The type 1 equipment complies with the conditions of the amended generic ECC decision [5]. Type 2 is covered in part 5 of TR 102 495 [9] and corresponds to a future generation of the equipment.

The present document 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.

The present document includes necessary information to support the co-operation between ETSI and the Electronic Communications Committee (ECC) of the European Conference of Post and Telecommunications Administrations (CEPT), including:

- Detailed market information (annex A).
- Technical information (annex B).
- Expected compatibility issues (annex C).

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.
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2.1 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.

- [1] CEPT/ECC Report 64: "The protection requirements of radiocommunications systems below 10,6 GHz from generic UWB applications", Helsinki, February 2005
<http://www.ero.dk/doc98/Official/pdf/ECCREP064.pdf>.
- [2] CEPT/ERC Report 25: "The European table of frequency allocations and utilizations covering the frequency range 9 kHz to 275 GHz" Lisboa January 2002 - Dublin 2003 - Turkey 2004 - Copenhagen 2004.
- [3] Document TG3#7-19R0: ("Effects of PSD limits on UWB positioning systems"), submitted to ECC TG3 meeting, Brest, 1-3 March 2005.
- [4] FCC 03-33: "Revision of Part 15 of the Commission's Rules Regarding UWB Transmission Systems".
- [5] ECC/DEC/(06)04: "ECC Decision of 24 March 2006 amended 6. July 2007 at Constanta on the harmonized conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz."
- [6] Revised Terms of reference for ECC TG3 (July 2006).
- [7] Report developed by the European Conference of Postal and Telecommunications Administrations (CEPT) in response to the European Commission (EC) under the Mandate dealing with the harmonized technical conditions for the use in the European Union of the mitigation techniques for UWB applications.
- [8] ITU-R, Radio Regulation, Geneva, 2004.
- [9] ETSI TR 102 495: " Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical characteristics for SRD equipment using Ultra Wide Band Sensor technology (UWB); System Reference Document".
- [10] ETSI EN 302 500 (V1.2.1): "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 8,5 GHz; Part 1: Technical characteristics and test methods".
- [11] ETSI EN 302 500 (V1.1.1): "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 8,5 GHz; Part 2: Harmonized EN covering essential requirements of article 3.2 of 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:

activity factor: reflects the effective transmission time ratio

light licensing: individual regulatory approval (or notification duty) required for each specific installation based on location and scope

mobile equipment : equipment intended to be used while in motion or during halts at unspecified points

portable equipment: equipment normally used on a stand-alone basis and to be carried around

range resolution: ability to resolve two targets at different ranges

3.2 Symbols

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

c	velocity of light in a vacuum
δR	range resolution or multipath rejection resolution
dBm	decibel relative to 1 mW
T_p	pulse width

3.3 Abbreviations

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

2D/3D	Two Dimensional/Three Dimensional
CCTV	Closed Circuit TeleVision
CEPT	Conference Europeenne des administrations de Postes et des Telecommunications
ECC	Electronic Communications Committee
ERC	European Radiocommunications Committee
ERM	Electromagnetic compatibility and Radio spectrum Matters
GPS	Global Positioning System
ITU	International Telecommunication Union
LAN	Local Area Network
LORAN	LOng RANGE Navigation
OoB	Out of Band
PRF	Pulse Repetition Frequency
PSD	Power Spectral Density
RF	Radio Frequency
SRD	Short Range Device
ToR	Terms of Reference
UWB	Ultra Wide Band

4 Executive summary

The present document describes devices using Ultra Wide Band Sensor technology for location tracking applications.

In UWB location tracking, small, mobile tags, operating as either transmitters or receivers, or both, are attached to the objects to be located, or are carried by personnel. A network of reference stations around the area to be covered communicate with the tags. By analysing, e.g. the time-of-arrival and/or angle-of-arrival of the radio signal relative to the known reference stations, the 2D/3D position of the tag can be found. Typically, the range between a tag and a reference station might be up to 100 m, depending on the area to be observed.

There is evidence that these devices can address versatile industrial requirements in many different markets and therefore, a socio-economic benefit is given.

It is also possible that such a system will significantly enhance the security and safety of persons monitored in different applications such as health care.

A high precision in range measurement is required. This means that the required signals necessarily demand short pulse length resulting in a high bandwidth to provide the required accuracy.

4.1 Status of the present document

A previous version of the present document has been agreed by TG31C and included several inputs from ECC TG3.

The present document (TR 102 495-3 V1.3.1) is approved by TC-ERM, for publication. It takes into account the recent changes in the draft EN 302 500 [10].

4.2 Market information

For detailed market information, see annex A.

4.3 Technical system description

For a detailed technical information, see annex B.

5 Current regulations

Location tracking devices described in the present document are covered by the amended Generic UWB decision [5].

The FCC has released an UWB regulation which included UWB imaging devices in 04/2002 and revised it in 03/2003 [4].

However, there are neither current regulations permitting the operation of UWB location tracking installed at a fixed outdoor location nor in aircraft and other aviation applications available.

6 Proposed regulations

Based on the needs of the intended applications described in the scope of the present document, the following limits are proposed.

Table 6.1: Proposed regulation for the equipment

Frequency	Area of operation	Maximum Average power density (EIRP) (dBm/MHz)
6 GHz to 8,5 GHz	Indoor, portable or mobile outdoor usage Design requirement: objects or persons being traced must use tags.	-41,3 The PRF shall not be less than 1 MHz according to [5]

The devices permitted under the ECC decision for UWB [5] are exempt from individual licensing and operate on a non-interference, non-protected basis

7 Main conclusions

Ultra wideband technology enables the operation of location tracking devices. The short pulses used by UWB location devices enable accurate signal measurements, allowing centimetre-level positioning even in the presence of severe multipath interference (caused by reflections off doors, windows, walls and furniture).

Devices according to the present document address versatile industrial requirements in many different markets and therefore, a socio-economic benefit is given.

It is also possible that such a system will significantly enhance the security and safety of persons monitored in different applications such as health care.

A high precision in range measurement is required. This means that the required signals necessarily demand short pulse length resulting in a high bandwidth to provide the required accuracy.