



**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Short Range Devices (SRD);
Conformance test procedure for the exterior limit tests in
EN 302065-3 UWB applications in the ground based vehicle
environment**

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Contents

Intellectual Property Rights	5
Foreword.....	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	6
3 Definitions, symbols and abbreviations	7
3.1 Definitions.....	7
3.2 Symbols.....	7
3.3 Abbreviations	7
4 Summary Of ECC Consideration	8
5 Fundamental Channel Measurements	8
5.1 Calibration and Test Measurement.....	9
5.1.1 Measurement Setup.....	9
5.1.2 Antenna Pattern Analysis.....	10
5.1.3 Reference Antenna Pattern	11
5.1.4 Maximum Measureable Distance	12
5.2 Car shielding/car influence measurement.....	14
5.2.1 Car shielding and fading analysis: TX antenna in the middle of the car.....	14
5.2.2 Measurements at 3 m using UWB transmission power (-41,3 dBm).....	19
5.2.3 In-Car measurements position on the roof of the car	19
5.3 Surface and Application Specific Location Measurements.....	21
5.3.1 TX antenna mounted below the car on the exhaust pipe.....	21
5.3.2 TX antenna mounted on the side mirror	23
5.3.3 TX Antenna on the wheel in the fender	25
5.3.4 Conclusions.....	26
6 Conclusions and Recommendations from the Measurements	27
7 Test Procedure.....	27
8 Conclusions	29
Annex A: Measurement Hardware	30
A.1 Measurement Hardware	30
A.2 Link Budget.....	30
Annex B: Spherical Scan	31
B.1 Spherical scan with automatic test antenna placement.....	31
B.1.1 Calibrated setup.....	32
B.1.2 Substitution method.....	32
B.2 Spherical scan with rotating device	33
B.2.1 Calibrated setup.....	33
B.2.2 Substitution method.....	34
Annex C: Tire Related Applications.....	35
C.1 Introduction	35
C.2 Procedure to establish the shielding characterization of the tire	35
C.3 Main influencing elements of a road vehicle	45
C.4 Relevant area for the case of the UWB device inside tire	53

C.5	Measurement in a relevant area for the case of the UWB device inside tire or inside the fender space.	54
C.6	Summary	62
History		63

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Foreword

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

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1 Scope

The present document specifies a measurement procedure for the exterior limit for road and rail vehicle applications defined in ECC DEC (06)04 [i.2] from 2011. The procedure is intended to be used in the upcoming standard EN 302 065-3 [i.8].

The measurement procedure has been developed based on an extensive measurement campaign with a full car inside a semi-anechoic chamber, in which the radio channel from the inside to the outside, from the transmission of the surface, from below the car and from the tyre are studied in detail.

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 referenced 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.

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] ETSI EN 302 065 V1.2.1 (2010-10): "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".
- [i.2] ECC Decision (06) 04 of 24 March 2006 amended 15 December 2011 on the harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10,6 GHz.
- [i.3] F. Berens, H. Dunger, S. Czamecki, T. Bock, R. Reuter, S. Zeisberg, J. Weber and J.F. Guasch: "UWB car attenuation measurements", 16th IST Mobile and Wireless Communications Summit, 2007.
- [i.4] R. Zetik, A. P. Garcia Ariza, R. Thomä, W. Kotterman: "Application-specific MIMO-UWB channel measurements and parameter extraction: Integrated Project - EUWB", Deliverable D3.1.2b, 2009.
- [i.5] ETSI TS 102 883 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB); Measurement Techniques".
- [i.6] ECC TG3: "UWB Screening Attenuation of Cars", TG3#16-21R0, European Commission JRC, Ispra, Italy, 2006.
- [i.7] M. Cheikh, J. David, J.-G. Tartarin, S. Kessler, A. Morin: "RF source characterization of Tire Pressure Monitoring System"; 2nd European Wireless Technology Conference, 2009 (EuWIT 2009), Rome, Page(s): 176 - 179.

- [i.8] ETSI EN 302 065-3: "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 Part 3: Requirements for UWB devices for road and rail vehicles".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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)

3.2 Symbols

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

d	Distance
θ	Elevation angle
δ	Loss factor
ϵ_r	Dielectric constant
f	Frequency
Γ_{RX}	Receive antenna reflection coefficient
Γ_{TX}	Transmit antenna reflection coefficient
G_{RX}	Receive antenna gain
G_{TX}	Transmit antenna gain
λ	Wavelength
$L_{RX,cable}$	Receive cable losses
$L_{TX,cable}$	Transmitter cable losses
φ	Azimuth angle
P_{RX}	Receive power
P_{out}	Signal generator output power
σ_r	Conductivity
ρ_{RX}	Direction of the received electrical field
ρ_{TX}	Direction of the transmitted electrical field

3.3 Abbreviations

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

BW	BandWidth
CW	Continuous Wave
DAA	Detect And Avoid
DIT	Device Inside the Tire
DUT	Device Under Test
e.i.r.p.	equivalent isotropically radiated power
EM	ElectroMagnetic
GTX	Gain Transmitter
LACE	Laboratory of Antennas and Electromagnetic Compatibility
LAN	Local Area Network
LDC	Low Duty Cycle
LNA	Low Noise Amplifier
LOS	Line Of Sight
ML	MessLabor
NF	Noise Figure
PEC	Perfect Electric Conductor