

# ETSI EN 303 883-2 V1.2.1 (2021-02)



**Short Range Devices (SRD) and  
Ultra Wide Band (UWB);  
Part 2: Measurement techniques  
for receiver requirements**

<https://standards.iteh.ai/catalog/standards/sist/53b300df-be01-4d5d-aba8-683a489ca837/etsi-en-303-883-2-v1-2-1-2021-02>

---

**Reference**REN/ERM-TGUWB-149-2

---

---

**Keywords**measurement, receiver, testing, UWB

---

**ETSI**

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

---

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

---

**Important notice**

---

ETSI EN 303 883-2 V1.2.1 (2021-02)  
<https://standards.iteh.ai/catalog/standards/sist/53b300df-be01-4d5d-aba8-683a43293a7e/etsi-en-303-883-2-v1-2-1-2021-02>  
The present document can be downloaded from:  
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at <https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:  
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

---

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2021.  
All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

**GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	6
Introduction .....	7
1 Scope .....	8
2 References .....	8
2.1 Normative references .....	8
2.2 Informative references.....	8
3 Definition of terms, symbols and abbreviations.....	9
3.1 Terms.....	9
3.2 Symbols.....	10
3.3 Abbreviations .....	11
4 General .....	12
5 Receiver Requirements.....	12
5.1 General Guidance on RX measurement .....	12
5.2 Receiver Spurious Emissions .....	12
5.2.1 Description.....	12
5.2.2 Limits.....	12
5.2.3 Conformance.....	13
5.2.3.1 General.....	13
5.2.3.2 Step 1: Measurement with Peak Detector.....	13
5.2.3.3 Step 2: Measurement with RMS Detector.....	14
5.3 Use-Case Specific Input Parameters for Receiver Baseline Requirements .....	14
5.3.1 Introduction.....	14
5.3.2 Technical Wanted Performance Criteria.....	15
5.3.3 Examples of Use-Case Specific Input Parameter for Receiver Tests .....	15
5.3.3.1 Communication/Location Tracking Device .....	15
5.3.3.2 Radio Determination Device (non-contact based) .....	16
5.3.3.3 Material contact-based radio determination device.....	18
5.4 Receiver Baseline Sensitivity (RBS).....	20
5.4.1 Description.....	20
5.4.2 Limits.....	20
5.4.3 Conformance.....	21
5.4.3.1 General .....	21
5.4.3.2 Conducted measurements for radio communication devices .....	21
5.4.3.2.0 General .....	21
5.4.3.2.1 Step 1: Technical Wanted Performance Criteria .....	21
5.4.3.2.2 Step 2: Sensitivity Requirement (Power) .....	21
5.4.3.2.3 Step 3: Measurement Procedure .....	21
5.4.3.2.4 Step 4: Technical Wanted Performance Criteria Assessment.....	23
5.4.3.3 Radiated Measurements for Radio Communication Devices with Power Limit.....	23
5.4.3.3.0 General .....	23
5.4.3.3.1 Step 1: Technical Wanted Performance Criteria .....	23
5.4.3.3.2 Step 2: Sensitivity Requirement (Power) .....	23
5.4.3.3.3 Step 3: Measurement Procedure .....	23
5.4.3.3.4 Step 4: Technical Wanted Performance Criteria Assessment.....	25
5.4.3.4 Radiated measurements for radio communication devices with distance limit.....	25
5.4.3.4.0 General .....	25
5.4.3.4.1 Step 1: Technical Wanted Performance Criteria .....	25
5.4.3.4.2 Step 2: Sensitivity Requirement (Distance).....	25
5.4.3.4.3 Step 3: Measurement Procedure .....	26
5.4.3.4.4 Step 4: Technical Wanted Performance Criteria Assessment.....	26
5.4.3.5 Radiated Measurements for Radiodetermination Applications with Distance Limit .....	26

5.4.3.5.0	General .....	26
5.4.3.5.1	Step 1: Technical Performance Criteria.....	26
5.4.3.5.2	Step 2: Sensitivity Requirement (Distance).....	27
5.4.3.5.3	Step 3: Measurement Procedure .....	27
5.4.3.5.4	Step 4: Technical Wanted Performance Criteria Assessment.....	28
5.4.3.6	Conducted measurements for radio determination devices .....	28
5.4.3.6.0	General .....	28
5.4.3.6.1	Step 1: Technical Wanted Performance Criteria .....	28
5.4.3.6.2	Step 2: Sensitivity Requirement (Power) .....	28
5.4.3.6.3	Step 3: Measurement Procedure .....	29
5.4.3.6.4	Step 4: Technical Wanted Performance Criteria Assessment.....	30
5.5	Receiver Baseline Resilience (RBR) .....	30
5.5.1	Description.....	30
5.5.2	RBR Requirements .....	30
5.5.2.1	Interferer test signal.....	30
5.5.2.2	RBR wanted performance criteria.....	30
5.5.3	Conformance.....	31
5.5.3.1	General .....	31
5.5.3.2	Conducted Measurements for Radio Communication Devices.....	31
5.5.3.2.1	Step 1: Start with the RBS Setup.....	31
5.5.3.2.2	Step 2: Adding Interfering Signal Source.....	31
5.5.3.2.3	Step 3: Degradation of Sensitivity Requirement .....	31
5.5.3.2.4	Step 4: Test of Technical Wanted Performance Criteria .....	31
5.5.3.2.5	Step 5: Measurement Assessment .....	32
5.5.3.2.6	Step 6: Repetition of steps 4 and 5 .....	32
5.5.3.3	Radiated Measurements for Radio Communication Devices with Power Limit .....	32
5.5.3.3.1	Step 1: Start with the RBS Setup.....	32
5.5.3.3.2	Step 2: Adding Interfering Signal Source.....	32
5.5.3.3.3	Step 3: Degradation of Sensitivity Requirement .....	32
5.5.3.3.4	Step 4: Test of Technical Wanted Performance Criteria .....	33
5.5.3.3.5	Step 5: Measurement Assessment .....	33
5.5.3.3.6	Step 6: Repetition of steps 4 and 5 .....	33
5.5.3.4	Radiated Measurements for Radio Communication Devices with Distance Limit .....	33
5.5.3.4.1	Step 1: Start with the RBS setup.....	33
5.5.3.4.2	Step 2: Adding interfering signal source .....	33
5.5.3.4.3	Step 3: Degradation of Sensitivity Requirement .....	34
5.5.3.4.4	Step 4: Test of Technical Wanted Performance Criteria .....	34
5.5.3.4.5	Step 5: Measurement Assessment .....	34
5.5.3.4.6	Step 6: Repetition of steps 4 and 5 .....	34
5.5.3.5	Radiated Measurements for Radiodetermination Applications with Distance Limit .....	34
5.5.3.5.1	Step 1: Start with the RBS Setup.....	34
5.5.3.5.2	Step 2: Adding interfering signal source .....	34
5.5.3.5.3	Step 3: Degradation of Sensitivity Requirement .....	35
5.5.3.5.4	Step 4: Test of Technical Wanted Performance Criteria .....	36
5.5.3.5.5	Step 5: Measurement Assessment .....	36
5.5.3.5.6	Step 6: Repetition of steps 4 and 5 .....	36
5.5.3.6	Conducted Measurements for Radio Determination Devices .....	36
5.5.3.6.1	Step 1: Start with the RBS Setup.....	36
5.5.3.6.2	Step 2: Adding Interfering Signal Source.....	36
5.5.3.6.3	Step 3: Degradation of Sensitivity Requirement .....	36
5.5.3.6.4	Step 4: Test of Technical Performance Criteria.....	37
5.5.3.6.5	Step 5: Measurement Assessment .....	37
5.5.3.6.6	Step 6: Repetition of steps 4 and 5 .....	37
<b>Annex A (normative):</b>	<b>Choose interferer for RBR.....</b>	<b>38</b>
A.1	Introduction .....	38
A.2	Limits for the Interfering Signals .....	39
A.2.1	Interferer within OFR .....	39
A.2.1.0	Introduction.....	39
A.2.1.1	Option 1 .....	39
A.2.1.2	Option 2 .....	39

A.2.2	Interferer outside OFR.....	40
A.3	Guidance to Setup the Power Level of the Interfering Signals @ EUT for RBR tests .....	40
A.3.1	Radiated tests.....	40
A.3.2	Conducted tests .....	42
<b>Annex B (informative):</b>	<b>Guidance on Scaling Receiver Sensitivity.....</b>	<b>43</b>
B.1	General .....	43
B.2	Scaling of power at the EUT .....	43
B.3	Scaling distance.....	44
<b>Annex C (informative):</b>	<b>Justification of receiver requirements from ETSI EG 203 336 .....</b>	<b>45</b>
C.1	General .....	45
C.2	Justification .....	45
C.3	Summary for the RBR requirement.....	47
C.4	Justification RBS-requirement for radio determination devices .....	48
<b>Annex D (informative):</b>	<b>Object and Radar Cross Section .....</b>	<b>50</b>
D.1	Wanted objects .....	50
D.2	Direct Object Reflectors.....	52
D.3	Delay Line Object Reflectors .....	54
D.4	Electronic Object Reflectors .....	54
D.5	Test Setup with Conventional RCS within Chamber .....	55
D.6	Test Setup with Radar Object Generator.....	56
D.6.1	General .....	56
<b>Annex E (informative):</b>	<b>Change History .....</b>	<b>58</b>
History .....		59

## Intellectual Property Rights

### Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

### Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

## Foreword

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

The present document is part 2 of a multi-part deliverable covering Short Range Devices (SRD) and Ultra Wide Band (UWB), as identified below:

Part 1: "Measurement techniques for transmitter requirements";

Part 2: "Measurement techniques for receiver requirements".

### National transposition dates

Date of adoption of this EN:	22 February 2021
Date of latest announcement of this EN (doa):	31 May 2021
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 November 2021
Date of withdrawal of any conflicting National Standard (dow):	30 November 2021

## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

## Introduction

The present document provides measurement procedures for receiver requirements to address the spectrum efficiency requirements of the RED [i.10].

The basis for this RX concept was developed by ETSI during two Special Task Forces.

**First Special Task Force:** ETSI STF 494; Update of the UWB related Harmonised Standards covering the essential requirements of article 3.2 of the RED [i.10].

The STF 494:

- Started: 2015-05-25
- Ended: 2016-03-31

Outcome:

- ETSI TS 103 361 [i.4]

**The second Special Task Force:** ETSI STF 541; Signal interferer handling, a new RX requirement to cover the essential requirements of article 3.2 of the RED [i.10], was a continuation to implement and consider comments received after the publication of the ETSI TS 103 361 [i.4].

The STF 541:

- Started: 2017-10-06
- Ended: 2019-05-31

Outcome:

- ETSI TR 103 566 [i.2]
- ETSI TS 103 567 [i.3]

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

[ETSI EN 303 883-2 V1.2.1 \(2021-02\)](https://standards.iteh.ai/catalog/standards/sist/53b300df-be01-4d5d-aba8-683a489ca837/etsi-en-303-883-2-v1-2-1-2021-02)

<https://standards.iteh.ai/catalog/standards/sist/53b300df-be01-4d5d-aba8-683a489ca837/etsi-en-303-883-2-v1-2-1-2021-02>

There is no specification of receiver parameter values within the present document. These values will be derived from technical specification defined by the responsible ETSI Technical Committees and/or the findings of regulatory studies conducted by the relevant bodies like CEPT ECC WG SE. The limits/values for the baseline RX-conformance requirements will be specified in the related standard.

In addition to the two receiver baseline requirements it can be necessary that the RX spurious emission requirement could be a further RX requirement in the related standard. This could be necessary if the EUT has a receive only mode or if it is not collocated to the transmitter. The present document specifies the receiver spurious emission requirement and the corresponding test and measurement procedure in clause 5.2.

The present document provides practical information and guidance for the compliance receiver tests of UWB and Short Range technology and devices.

It is recommended that, in drafting the related standards, a thorough analysis is conducted on all possible applicable receiver parameters (see annex C), selecting the most appropriate RX-requirements and having a robust reasoning for those that are disregarded.

---

# 1 Scope

The present document provides measurement procedures for receiver requirements to address the spectrum efficiency requirements of the RED [i.10].

The baseline receiver concept is a set of two parameters given in clause 5 of the present document providing guidance for HS development, which can be further refined by the responsible TB.

Baseline receiver concept comprises the following parameters:

- Receiver Baseline Sensitivity (RBS); and
- Receiver Baseline Resilience (RBR).

The Baseline receiver concept is a further development of the signal interferer handling concept, see ETSI TS 103 361 [i.4].

---

## 2 References

### 2.1 Normative 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.

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

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

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

Not applicable.

### 2.2 Informative 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.

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

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 EG 203 336 (V1.2.1): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.2] ETSI TR 103 566 (V1.1.1): "Evaluation status on receiver requirement on Signal interferer handling".
- [i.3] ETSI TS 103 567 (V1.1.1): "Requirements on signal interferer handling".
- [i.4] ETSI TS 103 361 (V1.1.1): "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Receiver technical requirements, parameters and measurement procedures to fulfil the requirements of the Directive 2014/53/EU".



- [i.5] ERC REC 74-01: "Unwanted emissions in the spurious domain", approved 1998, amended 29 May 2019.
- [i.6] ETSI EN 303 883-1 (V1.2.1): "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements".
- [i.7] "RCS measurement results for automotive related objects at 23-27 GHz"; Tom Schipper; Joaquim Fortuny-Guasch; Dario Tarchi; Lars Reichardt; Thomas Zwick. Proceedings of the 5<sup>th</sup> European Conference on Antennas and Propagation (EUCAP).
- [i.8] EUR - Scientific and Technical Research Reports: "Radar Cross Section Measurements of Pedestrian Dummies and Humans in the 24/77 GHz Frequency Band". FORTUNY GUASCH Joaquim and CHAREAU Jean-Marc, 2013.
- [i.9] ETSI TR 103 181-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band (UWB); Transmission characteristics Part 2: UWB mitigation techniques".
- [i.10] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (RED).
- [i.11] European Communications Office: "EFIS: ECO Frequency Information System".
- NOTE: Available at <https://efis.cept.org/>.
- [i.12] ETSI TR 103 181-1 (V1.1.1): "Short Range Devices (SRD) using Ultra Wide Band (UWB); Technical Report Part 1: UWB signal characteristics and overview CEPT/ECC and EC regulation".

STANDARD PREVIEW  
(standards.iteh.ai)

## 3 Definition of terms, symbols and abbreviations

ETSI EN 303 883-2 V1.2.1 (2021-02)

<https://standards.iteh.ai/catalog/standards/sist/53b300df-be01-4d5d-aba8-683a489ca837/etsi-en-303-883-2-v1-2-1-2021-02>

### 3.1 Terms

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

**antenna port:** physical port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy

**co-located:** receiver is located in the same device/EUT housing as the transmitter

**event failure rate:** ratio of failed tests compared to total number of tests

**mainbeam:** direction of maximum radiation

**Received Power at the EUT ( $P_{@EUT}$ ):** received power at the EUT and represents the signal the EUT is able to detect.  $P_{@EUT}$  is similar to the specified sensitivity level for the EUT as specified in the related standard (kind of power (e.g. dBm or dBm/MHz) and limit, see note)

NOTE:  $Sensitivity @ EUT = P_{@EUT}$ .

**Receiver Baseline Resilience (RBR):** capability to maintain a pre-determined minimum acceptable level of performance in the presence of unwanted signals over the frequency band of operation, applicable adjacent and remote frequency bands

**Receiver Baseline Sensitivity (RBS):** capability to receive a wanted signal at application related defined input signal levels while providing a pre-determined minimum acceptable level of technical performance

NOTE 1: The pre-determined minimum acceptable level of technical performance is the basis for all other receiver parameters.

NOTE 2: The purpose of the sensitivity requirement is to assure a basic measure of efficient use of spectrum that strikes balance between sensitivity and the need to avoid being sensitive to interference.

## 3.2 Symbols

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

$\sigma$	Radar Cross Section
$\Delta D$	degradation of the distance from RBR test
$\Delta f$	additional frequency range to increase the range ( $ORF_{RBR}$ ) for the RBR interferer assessment
$A$	size of the antenna aperture
$A_{eff}$	effective area of the antenna [m <sup>2</sup> ]
$att$	attenuation of the "Variable Attenuator" in [dB]
$c$	the velocity of light [m/s]
$ca$	cable attenuation
$cf$	coupling factor of the coupler in [dB]
$d_g$	degradation of the sensitivity in [dB]
$dB$	decibel
$dB_i$	gain in decibels relative to an isotropic antenna
$dB_m$	gain in decibels relative to one milliwatt
$dl$	attenuation of the "Delay Line" in [dB]
$D_{int}$	distance between interfering antenna and EUT
$D_{min}$	minimum distance from EUT to a specified object the EUT is able to detect
$D_{real}$	real distance between EUT and target simulator in [m]
$D_{sens}$	minimum range from an ideal/companion source to the EUT (RX) value in [m]
$D_{scal}$	scaled distance for the RBS tests
$D_{sim}$	simulated target distance within target simulator in [m]
$f$	test frequency in [GHz]
$f_c$	centre frequency of the EUT OFR
$F_{LOWER}$	lowest frequency of receiver spurious emission test
$F_{UPPER}$	highest frequency of receiver spurious emission test
$g_{measure}$	measurement antenna gain in [dBi] at test frequency $f$
$g_t$	measurement test antenna gain in [dBi] at test frequency $f$
$g_e$	EUT antenna gain in [dBi]
$g_{rt}$	measurement receiving test antenna gain in [dBi] at test frequency $f$
$G_{int}$	interfering transmit antenna
$g_{int}$	antenna gain of test antenna to transmit interfering signal [dBi]
$G_{RX}$	gain of the receiving antenna
$G_{TX}$	gain of the transmitting antenna
$il$	insertion loss of the coupler in [dB]
$IP_{@EUT}$	interfering Power@EUT
$IP_{out}$	output power of the interference signal source (generator)
$ORF_{RBR}$	Frequency range for the RBR interferer assessment
$P_{@EUT}$	Sensitivity @ EUT
$P_{EUT}$	measured transmitted power of the EUT [e.g. dBm/MHz] or in [W]
$P_{meas}$	measured received power with the spectrum analyser
$P_{out}$	output power of the signal generator A
$P_{reg}$	maximum regulated radiated emission for ideal TX/companion device
$P_{RX}$	power received back from the object by the EUT [W]
$P_{trans}$	measured transmitted power from the EUT in [dB]
$P_{TX}$	transmitter power [W]
$RBR_{in-band}$	frequency range for the RBR interferer assessment ( $ORF_{RBR} + 2\Delta f$ )
$RX_{ref}$	sensitivity limit at antenna port
$RX_{refsense}$	scaled sensitivity limit for the RBS test
$SCP$	Scaling factor (absolute value)
$X_{VALUE}$	symbol for a value/limit specified in the related standard

### 3.3 Abbreviations

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

ACS	Adjacent Channel Selectivity
ADM	Accuracy in Distance Measurement
BER	Bit Error Rate
CATR	Compliant And TRansportable far-field
CEPT	European Conference of Postal and Telecommunications administrations
CW	Continuous Wave
DAA	Detect And Avoid
ECC	Electronic Communications Committee
ECO	European Communications Office
EFIS	ECO Frequency Information System
EFR	Event Failure Ratio
EN	European Norm
ENAP	EN Approval Process
ERM	Electromagnetic compatibility and Radio spectrum Matters
EUT	Equipment Under Test
EUT-RX	Receiver of the Equipment Under Test
FCC	Federal Communications Commission
FMCW	Frequency Modulated Continuous Wave
HH	Horizontal - Horizontal
LAES	Location tracking Applications for Emergency Services
LBT	Listen Before Talk
LT1	Location Tracking type 1
LT2	Location Tracking type 2
MIMO	Multiple Input Multiple Output
NA	Not Applicable
ODP	Object Detection Probability
OFR	Operating Frequency Range
OOB	Out Of Band
OTA	Over The Air
PER	Packet Error Rate
RBR	Receiver Baseline Resilience
RBS	Receiver Baseline Sensitivity
RBW	Resolution BandWidth
RC	Remote Consensus
RCS	Radar Cross Section
RED	Radio Equipment Directive
RF	Radio Frequency
RMS	Root Mean of Squares
RP	Radiated Power
RX	Receiver
SE	Spectrum Engineering
SRD	Short Range Device
STF	Special Task Force of ETSI
TB	Technical Body
TG	Technical Group
TPC	Total Power Control
TX	Transmitter
UWB	Ultra Wide Band
VBW	Video BandWidth
VV	Vertical - Vertical
WG	Working Group

---

## 4 General

The present document provides practical information and guidance for the compliance receiver tests of UWB and Short Range technology and devices.

The baseline receiver requirements were developed based on the findings of ETSI TR 103 566 [i.2] and ETSI TS 103 567 [i.3], where the signal interferer handling concept from ETSI TS 103 361 [i.4] has been analysed on its applicability for the RED [i.10].

The baseline receiver concept is a set of two parameters given in clause 5 of the present document providing guidance for harmonised standard development, which can be further refined by the responsible TB.

Baseline receiver concept comprises the following parameters:

- Receiver Baseline Sensitivity (RBS); see clause 5.4; and
- Receiver Baseline Resilience (RBR); see clause 5.5.

The baseline receiver concept is a further development of the signal interferer handling concept, see ETSI TS 103 361 [i.4].

In annex C these two parameters are put in relation to existing receiver parameters given in ETSI EG 203 336 [i.1] and the assessments prepared by ETSI STF 494 and 541. Annex C additionally provides the summary assessment/justification for this new baseline receiver concept described in the present document.

---

## 5 Receiver Requirements

### 5.1 General Guidance on RX measurement

Complementary information to the conformance tests in the clauses below are provided in annexes A and B of ETSI EN 303 883-1 [i.6], for example:

- test conditions, power supply and ambient temperatures (see clause A.5 of ETSI EN 303 883-1 [i.6]);
- measurement uncertainty and the interpretation of the measurement results (see clause A.8 of ETSI EN 303 883-1 [i.6]);
- test setups and radiated measurements (see annex B of ETSI EN 303 883-1 [i.6]).

### 5.2 Receiver Spurious Emissions

#### 5.2.1 Description

The RX spurious emissions shall be measured within the frequency range defined in table 2.

Only applicable for receive only EUT (TX not present) or for EUT which has a receive only mode (TX inactive).

#### 5.2.2 Limits

The limit for RX spurious emissions could be provided in the applicable related standard

If no limits for RX spurious emissions are provided in the related standard, then the limits in table 1 shall apply.

**Table 1: Receiver spurious emission limits in line with ERC REC 74-01 [i.5]**

Frequency range	Limit values
$F_{\text{LOWER}}$ to 1 000 MHz (see note)	-57 dBm
1 GHz < $f \leq F_{\text{UPPER}}$ (see note)	-47 dBm
NOTE: $F_{\text{UPPER}}$ and $F_{\text{LOWER}}$ are linked with the OFR of the EUT, see table 2.	

**Table 2: Frequency range for the RX spurious emission test, linked with EUT OFR in line with ERC REC 74-01 [i.5]**

Fundamental frequency range defined by $f_L$ and $f_H$ (see note 2)	Frequency range for measurements	
	Lower frequency ( $F_{\text{LOWER}}$ ) (see note 3)	Upper frequency ( $F_{\text{UPPER}}$ )
300 - 600 MHz	30 MHz	3 GHz
600 MHz - 5,2 GHz	30 MHz	5 <sup>th</sup> harmonic (see note 1)
5,2 - 13 GHz	30 MHz	26 GHz
13 - 150 GHz	30 MHz	2 <sup>nd</sup> harmonic (see note 1)
150 - 300 GHz	30 MHz	300 GHz
NOTE 1: $F_{\text{UPPER}}$ is the stated harmonic of $f_H$ (the upper edge of the OFR, which is measured in ETSI EN 303 883-1 [i.6], clause 5.2).		
NOTE 2: $F_{\text{LOWER}}$ has to be selected based on $f_L$ and $F_{\text{UPPER}}$ based on $f_H$ ( $f_L$ and $f_H$ can be measured according to ETSI EN 303 883-1 [i.6], clause 5.2); for receive only devices $f_H$ and $f_L$ of the related EUT/companion device shall be used.		
NOTE 3: For EUT operating below 300 MHz the spurious emissions limits below 30 MHz shall be specified in the related standard.		

## 5.2.3 Conformance

### 5.2.3.1 General

The following conformance test shall be used for RX unwanted emissions (OOB and spurious emissions) if not otherwise specified in the related standard.

The conformance test shall be performed in two steps:

- step 1: pre-scan with peak detector (see clause 5.2.3.2);
- step 2: if necessary, measurement with RMS detector (see clause 5.2.3.3).

NOTE: The split in two steps is done because: a complete scan with RMS could take a long time. The measurement with peak detector is an "overestimation" of the emission and is only to find the frequencies with the highest emissions that will be verified in step 2.

### 5.2.3.2 Step 1: Measurement with Peak Detector

The following spectrum analyser settings shall be used:

- Start frequency:  $F_{\text{LOWER}}$
- Stop frequency:  $F_{\text{UPPER}}$

NOTE 1: There could be a need to split the measurement into different frequency ranges depending on the measurement set-up (e.g. external mixers, bandwidth of antennas and waveguides, RBW).

- Resolution BandWidth (RBW):
  - $\geq 100$  kHz between 30 MHz and 1 GHz
  - $\geq 1$  MHz above 1 GHz
- Video BandWidth (VBW):  $\geq$  RBW
- Detector mode: peak

- Trace mode: max hold
- Sweep time: wait until the reading in the display is stable

NOTE 2: The peak detector is sensitive to corruption by events occurring only once or for a very small amount of time and/or caused by different devices than the EUT.

NOTE 3: If the signal repetition of the EUT is known the measurement time per measurement point is equal or larger of the signal repetition time.

NOTE 4: The number of measurement points has to be at least equal or higher than the span of the spectrum analyser divided by the RBW.

**Assessment of step 1:** Compare the measurement results with the limit (see related standard and table 1) and record the frequencies where the limit is exceeded. For these frequencies go to step 2 (clause 5.2.3.3).

### 5.2.3.3 Step 2: Measurement with RMS Detector

- Set the spectrum analyser to zero span mode
- Resolution BandWidth (RBW):
  - 100 kHz between 30 MHz and 1 GHz
  - 1 MHz above 1 GHz
- Video BandWidth (VBW):  $\geq$  RBW
- Detector mode: peak
- Trace mode: clear write
- Sweep time: 1 s; if nothing different is specified in the related standard:
  - a) Set the spectrum analyser to the first recorded frequency from step 1 (clause 5.2.3.2).
  - b) Measure and record the spurious emission value over the sweep time.
  - c) Calculate the RMS value over the sweep time, using the post processing capability function of the spectrum analyser.
  - d) Record the calculated RMS value and compare it against the limit (see related standard and table 1).
  - e) Repeat b) - d) for all frequencies from step 1.

## 5.3 Use-Case Specific Input Parameters for Receiver Baseline Requirements

### 5.3.1 Introduction

A meaningful test of receiver requirements is only possible with knowledge of the intended use (use cases) of the EUT. Therefore, the related standard (which is mostly use case specific) needs to provide all required use case specific input parameters for the receiver tests, such as:

- Technical wanted performance criteria to quantify the EUT output (e.g. BER in [%], PER in [%], False alarm rate, detection probability in [%], distance degradation).
- Sensitivity or distance limit for a radio communication application and/or a radiodetermination application.
- The RCS and the movement/velocity of the reference target for a radiodetermination application.

More information on possible parameters to be made available in related standards are offered in clauses 5.3.2 and 5.3.3.

## 5.3.2 Technical Wanted Performance Criteria

For radio communication applications the following technical wanted performance criteria might be possible:

- after demodulation, a raw data signal with a Bit Error Ratio of  $10^{-3}$  without correction; or
- after demodulation, a message acceptance ratio of 80 %; or
- Packet Error Ratio (PER) [X] in %.

NOTE 1: For communication devices.

- Event Failure Ratio (EFR) [X] in %.

NOTE 2: For location tracking devices.

For radiodetermination applications the following technical wanted performance criteria might be possible:

- a false alarm rate of X %; or
- a detection probability of X %;
- measurement accuracy in  $\pm X$  of the distance, speed, material parameter.

The lists of technical wanted performance criteria above are non-exhaustive lists, other requirements can be specified in the related standard.

## 5.3.3 Examples of Use-Case Specific Input Parameter for Receiver Tests

### 5.3.3.1 Communication/Location Tracking Device

Examples of use case specific input parameters for receiver tests for all kind of communication are provided in table 3 below. Such systems could be for example:

- Generic communication devices.
- Location tracking applications including Location Tracking type 1 (LT1), Location Tracking type 2 (LT2), and Location tracking Applications for Emergency Services (LAES), see ETSI TR 103 181-1 [i.12].
- Active/comfort keyless entry systems.

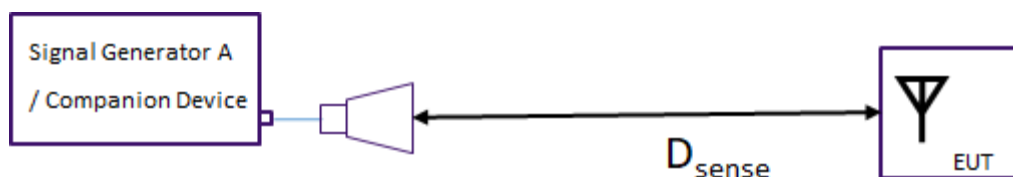


Figure 1: Generic communication (test) scenario