

ETSI TS 103 567 V1.1.1 (2019-09)



Requirements on signal interferer handling

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Foreword

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

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).

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Executive summary

The present document provides a limited set of baseline receiver requirements to address the spectrum efficiency requirements of the RED and provides a sound basis to justify the use of this set in Harmonised Standards to claim presumption of conformity. It addresses the Assessment of Compliance of Documents drafted by the ESOs clause 7 of [i.7].

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

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

Baseline comprises the following parameters:

- receiver baseline sensitivity; and
- receiver baseline resilience.

These baseline parameters are put in relation to existing receiver parameters given in ETSI EG 203 336 [i.1].

The present document specifies this baseline parameter concept and the corresponding test and measurement procedures, but it does not specify receiver parameter values. These values should be derived from technical specifications defined by the responsible ETSI Technical Committees (see clause 2.8.2 in [i.8]) and/or the findings of regulatory studies conducted by the relevant bodies like CEPT ECC WG SE or other sources of state of the art requirements.

An example mapping of the baseline parameters to radiodetermination (Annex C) and CEN DSRC Tolling systems (Annex B) is proposed.

RX measurements have to be done in a normal operational environment covering the typical interference scenarios. This operational environment can be derived from the intended use of the device to be tested. The relevant interfering signals can be chosen based on the methodology specified in ETSI TS 103 361 [i.3] where a similar approach has been taken for UWB based devices.

Introduction

Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (the RED [i.4]) was ratified by the European Parliament at Strasbourg on 16 April 2014. The previous legislation (the R&TTE Directive [i.13]) was repealed with effect from 13 June 2016. The RED came into force on 13 June 2016 with a one-year transition period, during which both the old and new Directives could be used for declaring product compliance. The European Commission requested ETSI to provide harmonised standards in support of the RED in response to Standardisation Request M/536.

The scope of the RED is broader than that of the R&TTE Directive [i.13]. In addition, its Essential Requirements were clarified, especially with respect to receivers. Receiver (RX) parameters were to be included in the standards to support a more efficient use of the spectrum. In Annex F, a current list from DG GROW [i.5] is available mapping receiver parameters from ETSI Guide [i.1] to relevant standards. This list is part of the assessment of compliance of harmonised standards, see clause 7 in Vademecum Part I [i.7]. ETSI was required to create new or update its existing harmonised standards accordingly. This task has presented new technical challenges in relation to certain equipment categories, specifically for:

- receive-only equipment;
- radio determination equipment;
- radio equipment operating at frequencies below 9 kHz;
- radio equipment/systems in which the receiver should be tested within the system (e.g. inductive systems).

Some of these challenges have already been addressed by ETSI STF 494 (06/2015 - 03/2016) which developed a new concept for RX requirements and tests for UWB devices, which is documented in ETSI TS 103 361 [i.3].

The subject of efficient use of radio spectrum is broad in scope but the theoretical basis for making statements about spectrum efficiency is lacking. Factors that affect spectrum efficiency include transmit power, modulation rates, receiver sensitivity and robustness to interference as well as medium access mechanisms and data transfer protocols. The present document addresses receiver aspects only. For this purpose, it provides a limited set of applicable baseline receiver requirements that address the spectrum efficiency requirement of the RED. Depending on the choice of parameters, these baseline RX requirements encompass the classical parameters given in [i.1], see also Table 1.

1 Scope

The present document specifies a limited set of baseline receiver requirements aiming to meet the *essential requirements* of Article 3.2 of the Radio Equipment Directive [i.4] by developing provisions for harmonised standards, see clauses 2.8.2 and 2.10.2 in Vademecum Part III [i.8] to support assessment of compliance of harmonised standards, see clause 7 in Vademecum Part I [i.7].

These receiver requirements are related to effective and efficient use of the radio spectrum and not to quality aspects of products.

These baseline receiver parameters are equivalent to the receiver parameter as given in ETSI EG 203 336 [i.1].

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/>.

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

Not applicable.

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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 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); 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 103 361: "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.4] 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.

[i.5] ETSI OCG RED EMCD (19)071009r1: "Revised draft map of receiver parameters by EC".

NOTE: Available at [https://docbox.etsi.org/OCG/OCG_Red-Emcd/05-CONTRIBUTIONS/2019//OCGREDEMCD\(19\)071009r1_Revised_draft_map_of_receiver_parameters_by_EC.zip](https://docbox.etsi.org/OCG/OCG_Red-Emcd/05-CONTRIBUTIONS/2019//OCGREDEMCD(19)071009r1_Revised_draft_map_of_receiver_parameters_by_EC.zip).

[i.6] ETSI EN 300 674-2-2: "Transport and Traffic Telematics (TTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5 795 MHz to 5 815 MHz frequency band; Part 2: Harmonised Standard for access to radio spectrum; Sub-part 2: On-Board Units (OBU)".

[i.7] Ref. Ares(2015)4888382 - 06/11/2015 Commission Staff working document: "Vademecum on European Standardisation in support of Union legislation and policies; Part I: Role of the Commission's Standardisation requests to the European standardisation organisations".

NOTE: Available at <https://ec.europa.eu/docsroom/documents/13507/>.

[i.8] Ref. Ares(2015)4888510 - 06/11/2015 Commission Staff working document: "Vademecum on European standardisation in support of Union legislation and policies; Part III: Guidelines for the execution of standardisation requests".

NOTE: Available at <https://ec.europa.eu/docsroom/documents/13509/>.

[i.9] Recommendation ITU-R SM.332-4: "Selectivity of receivers".

[i.10] ETSI EN 300 676-1: "Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation; Part 1: Technical characteristics and methods of measurement".

[i.11] ERC/REC 74-01: "ERC Recommendation of 1998 on unwanted Emissions in the Spurious Domain".

[i.12] Recommendation ITU-R F.1191: "Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems".

[i.13] 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.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TR 103 566 [i.2] apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI TR 103 566 [i.2] and the following apply:

d_{RBS}	reference distance for the definition of receiver sensitivity
d_{RBR}	reference distance for the definition of receiver resilience
$d_{\text{RBR_int}}$	reference distance for the interfering signal

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TR 103 566 [i.2] and the following apply:

NZIF	using Near-Zero Intermediate-Frequency technology
RBR	Receiver Baseline Resilience
RBS	Receiver Baseline Sensitivity
RED	Radio Equipment Directive
RUT	Receiver Under Test

4 Existing RX requirements and Spectrum Efficiency

4.1 Introduction

Article 3.2 of the RED [i.4] calls of "effective and efficient use of radio spectrum" without providing guidance on the means or methods nor on the criteria to judge such use. Ideally, these criteria should be extractable from the relevant regulatory documents including ECC reports, decisions and recommendations.

In order to assist its Technical Body members with the development of Harmonised Standards, ETSI adopted ETSI EG 203 336 [i.1]. ETSI EG 203 336 [i.1] lists a variety of equipment parameters including many receiver parameters that the TBs should consider in their work. This list is inclusive and does not provide guidance on the applicability of the parameters to different technologies or types of equipment. Specific guidance on the relationship between these parameters and their impact on efficient use of radio spectrum is not given.

Several of the RX parameters given in ETSI EG 203 336 [i.1] and ETSI TR 103 566 [i.2] can be classified into groups of RX parameters covering the same or at least similar RX properties. These parameters are partly specific to a given technology as are the corresponding test suites. In order to make sure that the spectrum efficiency aspects of non-classical receivers are adequately covered, a classification of the existing parameters is needed.

4.2 Classification of existing RX parameters [i.1]

4.2.1 Overview

4.2.1.1 Introduction

In general, two receiver properties contribute to the effectiveness and efficiency of spectrum utilization of a radio system: receiver sensitivity with regard to the wanted signal and receiver resilience with regard to unwanted signals.

In this clause, a classification proposal for existing classical RX parameters is given based on above receiver properties and on the frequency band in relation to the operational frequency band of the system under evaluation.

NOTE: Although antenna parameters determine overall receiver performance, they are not considered here.

4.2.1.2 RX parameters related to sensitivity

Receiver sensitivity is determined by a number of factors, including receiver thermal noise, implementation margins, operating bandwidth, received signal modulation and the resistance to strong unwanted signals. Of these factors, operating bandwidth and signal modulation are fundamental determinants of receiver performance; the other factors are subject to design and implementation considerations. For further details, see clause 4.2.2 below.

4.2.1.3 RX parameters related to resilience

A receiver's performance in the presence of unwanted signals, its resilience, is affected by signals in different frequency bands:

- **In-band RX parameters:** In this class, RX parameters related to in-band effects are summarized. In most cases no additional out-of-band interfering signals are considered in the test suites for these parameters. All interfering signals considered are in-band signals, e.g. a signal from the same type of system in the same band (co-channel rejection) or any other signals (desensitization based on in-band signals).
- **Adjacent channel RX parameters:** In this class, RX parameters are related to effects caused by signals in the neighbour/adjacent channel or more general frequency bands. For channelized systems these are the first and second adjacent channel, for non-channelized systems the related frequency band corresponds mainly to the out-of-band domain up to the spurious domain (250 % rule).
- **Remote band RX parameters:** In this class, RX parameters are related to effects caused by signals in frequency bands with a significant distance from the centre frequency of the system under evaluation. In most cases, these effects are related to frequency bands in the spurious domain, thus 250 % of the operational bandwidth from the centre frequency.
- **Combined band RX parameters:** In this class, RX parameters are related to combined effects of signals in different frequency bands.

For further details, see clause 4.2.3 below.

4.2.2 Receiver Parameters proposed in ETSI EG 203 336

ETSI EG 203 336 [i.1] lists a number of receiver parameters together with testing considerations. These RX parameters are listed in Table 1 below.

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Table 1: RX parameters proposed in ETSI EG 203 336 [i.1]

Performance criterion (PC): Objective testable BER, PER, FAR etc. at the edge between go/no-go of the EUT fc: centre frequency of the wanted signal									
	Scenario	Effect	Typical Wanted signal	Unwanted signal	Unwanted signal frequencies	Unwanted signal modulation	Unwanted signal strength	Applicable Classification	Comment
Sensitivity	EUT with counter-part	Minimum possible Rx power to be determined	Representative signal	/	/	/	/	Receiver sensitivity	A minimum sensitivity does not necessarily improve spectrum efficiency; it may improve spectrum efficiency when linked to the Tx power
Co-channel rejection	EUT with counter-part + one unwanted signal	Degradation of performance by a co-channel interferer	Sensitivity + 3 dB degradation	Typically a similar signal within same allocated band	fc	Any modulation	Power of the expected signal at the EUT (depends on use case)		
Adjacent channel selectivity	EUT with counter-part + one unwanted signal	Degradation of performance by an adjacent signals	Sensitivity + 3 dB	Typically a similar signal within same allocated band or in the close OOB domain of the transmitter	e.g. at $fc \pm OBW$	modulation of the expected signals	Power of the expected radio user at the EUT (minimum x dBm)	Receiver resilience wrt in-band signals	See note
Blocking	EUT with counter-part + one unwanted signal	Degradation of performance by a remote band signals	Sensitivity + 3 dB	strong signals in remote bands (e.g. spurious domain of the transmitter)	At a minimum of two frequencies (e.g. one test with $f1=fc+2,5 \times OBW$ and one test with $f2=fc+10 \times O$)	CW	Power of the expected radio user at the EUT (minimum y dBm)	Receiver resilience wrt remote band signals	
Intermodulation	EUT with counter-part + two unwanted signals	Degradation of performance (non-linear effect of the amplifier) by two adjacent/remote signals	Sensitivity + 3 dB	Two strong signals at f1 and f2 produce an intermodulation product at fc	f1, f2	One signal CW, the other modulated	Power of the expected radio users at the EUT (minimum a dBm)	Receiver resilience wrt multiple in-band signals	
Spurious response rejection				Image frequencies are hard to be find by measurements without knowledge of the receiver concept (e.g. heterodyne, etc. IF frequency, etc.)				Receiver resilience wrt one or more strong out of band signals	Can be tested with the blocking test when choosing the image frequencies

NOTE: Adjacent channel requirements are applicable to narrow band/channelized systems.