

ETSI TS 103 655-1 V1.2.1 (2022-09)



Reconfigurable Radio Systems (RRS); Radio Interface Engine (RIE); Part 1: Technical requirements

[ETSI TS 103 655-1 V1.2.1 \(2022-09\)](https://standards.iteh.ai/catalog/standards/sist/9126ec2f-54f1-432d-87b8-b23c1d0838d0/etsi-ts-103-655-1-v1-2-1-2022-09)

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Reference

RTS/RRS-0153

Keywords

mobile, radio, requirements, system

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 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS). <https://standards.iteh.ai/catalog/standards/sist/9126ec2f-54f1-432d-87b8-b23cd4083840/etsi-ts-103-655-1-v1-2-1-2022-09>

The present document is part 1 of a multi-part deliverable covering the Radio Interface Engine (RIE), as identified below:

Part 1: "Technical requirements";

Part 2: "Architecture".

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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Introduction

The radio interface engine comprises context information and communication needs to improve both depending on the demands. In ETSI TR 103 587 [i.1], several use cases are identified and described that are used as base for the requirements of the radio interface engine. The concept demands requirements for a future architecture of the radio interface engine. The requirements are split into two categories: the functional and the performance requirements. The functional requirements consist of three groups. These are the radio and hardware processing resources, the functions that are supporting the reconfiguration and the mobile device mobility and connectivity management.

The performance requirements comprise communication as well as context information indicators. Context information includes positioning performance indicators and is proposed in 3GPP TR 22.872 [i.2] where positioning relevant KPIs are identified. The context information performance KPIs steer the potential of the radio interface engine to improve and reach the communication performance requirements of the network.

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1 Scope

The present document specifies the system requirements for Reconfigurable Radio Systems operating in different environments and bands to apply the concept of the radio interface engine that is introduced in ETSI TR 103 587 [i.1] together with use cases comprising different key performance indicators in radio systems.

The documented key performance indicators are described and followed by the requirements on the wireless systems which are structured in the following requirement categories:

- Requirements for radio and hardware processing resources.
- Requirements for functions supporting the reconfiguration.
- Requirements for mobile device mobility and connectivity management.

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.

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2.2 Informative references

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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 TR 103 587: "Reconfigurable Radio Systems (RRS); Feasibility study of a Radio Interface Engine (RIE)".
- [i.2] 3GPP TR 22.872 (V16.1.0): "Study on positioning use cases (Release 16)", SA WG1.
- [i.3] ETSI TS 103 154 (V1.1.1): "Reconfigurable Radio Systems (RRS); System requirements for operation of Mobile Broadband Systems in the 2 300 MHz - 2 400 MHz band under Licensed Shared Access (LSA)".
- [i.4] TEDDI database: TErms and Definitions Database Interactive (TEDDI).

NOTE: Available at <https://webapp.etsi.org/Teddi/>.

- [i.5] Void.

[i.6] ETSI TS 103 652-1: "Reconfigurable Radio Systems (RRS); evolved Licensed Shared Access (eLSA); Part 1: System requirements".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

allowance zone: geographical area within which a radio equipment is allowed to operate radio transmitters on its assigned spectrum resource

NOTE 1: An allowance zone is defined using specific measurement quantities and thresholds, e.g. a maximum field strength level expressed in dB μ V/m/MHz, along the border of its geographical area.

NOTE 2: An allowance zone is normally applicable for a defined frequency range and time period.

NOTE 3: The term of "allowance zone" as used here is an extension of the term used in [i.6].

exclusion zone: geographical area within which only designated incumbent technologies are allowed to have active radio transmitters

NOTE 1: An exclusion zone is normally applicable for a defined frequency range and time period.

NOTE 2: The term of "exclusion zone" as used here is an extension of the term used in [i.6].

incumbent: current holder of spectrum rights of use

protection zone: geographical area within which incumbent receivers will not be subject to harmful interference caused by unauthorized radio equipment transmissions

NOTE 1: A protection zone is defined using specific measurement quantities and thresholds (e.g. a mean field strength that does not exceed a defined value in dB μ V/m/MHz at a defined receiver antenna height above ground level). A protection zone is normally applicable for a defined frequency range and time period.

NOTE 2: The term of "protection zone" as used here is an extension of the term used in [i.6].

radio equipment: product or relevant component thereof capable of communication by means of the emission and/or reception of radio waves utilizing the spectrum allocated to terrestrial/space radio communication

NOTE: This definition is taken from the TEDDI database [i.4].

restriction zone: geographical area within an allowance zone where a radio equipment has to operate under certain additional restrictive conditions (e.g. maximum EIRP limits and/or constraints on antenna parameters)

NOTE 1: A restriction zone is normally applicable for a defined frequency range and time period.

NOTE 2: The term of "restriction zone" as used here is an extension of the term used in [i.3].

spectrum resource: resource or set of resources defined in time, space and frequency domains

3.2 Symbols

Void.

3.3 Abbreviations

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

3GPP	3G (mobile) Partnership Project
COM	Communications
CON	Context
dBμ	deciBel relative to one microvolt
EIRP	Effective Isotropic Radiated Power
EU	European Union
FPGA	Field Programmable Gate Array
FUNC	Functional aspects
GNSS	Global Navigation Satellite System
GPP	General Purpose Processor
HPR	Hardware Processing Resources
ID	IDentifier
KPI	Key Performance Indicator
LB	Location-Based
LTE-U	Long Term Evolution-Unlicensed
MAC	Message Authentication Code
MOB	Mobility aspects
PERF	Performance aspects
PHY	PHYsical layer
QoS	Quality of Service
RBS	Random Binary Sequence
RE	Radio Equipment
REC	Reconfiguration aspects
R-FUNC	Requirements Function
RHR	Radio and Hardware Resources
RIE	Radio Interface Engine
R-PERF	Performance Requirements
RR	Radio Resources
RRS	Reconfigurable Radio Systems
TEDDI	Terms and Definitions Database Interactive
TR	Technical Report
TS	Technical Specification
WD	Wireless Device
Wi-Fi	Wireless Fidelity

4 Requirement Organization and Methodology

4.1 Requirement Organization

The requirements are organized into two categories. Category one defines the function requirements and category two the performance requirements. Both categories are further split up into different groups. Figure 1 visualizes the categories and its enclosed groups.

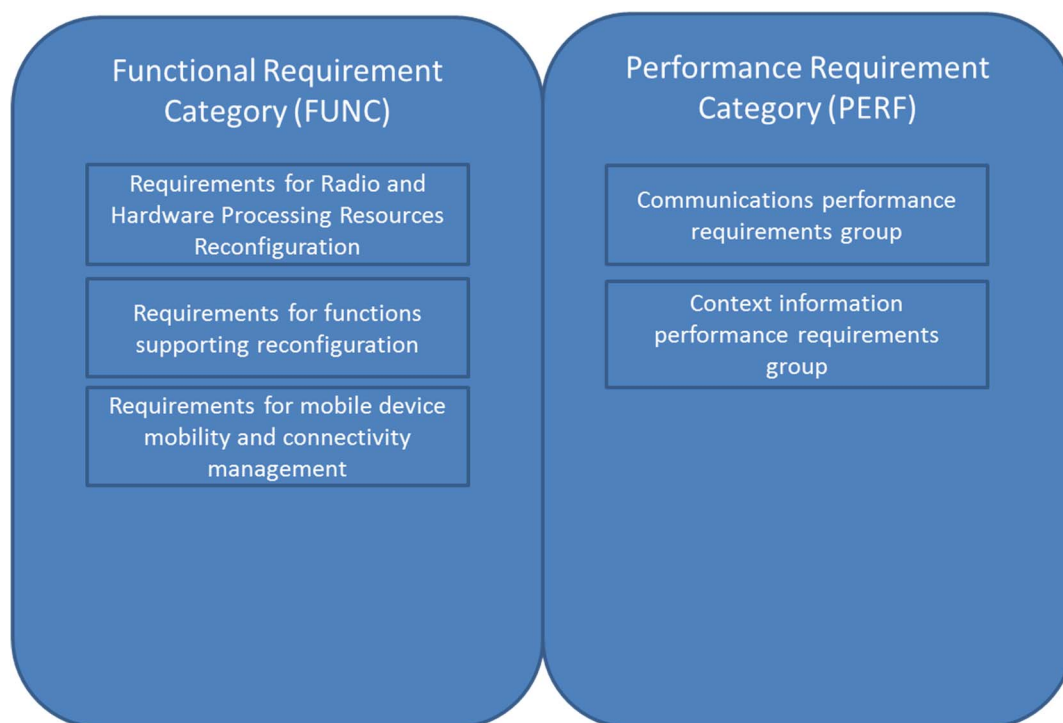


Figure 1: Requirements Operations

4.2 Requirement Format

A letter code is defined to uniquely identify each requirement R<CAT><GROUP><XX>. It is constructed as follows:

- R-:standard requirement prefix.
- <CAT>: <https://standards.iteh.ai/catalog/standards/sist/9126ec2f-54f1-432d-87b8-b23e1d083840/etsi-ts-103-655-1-v1-2-1-2022-09>

Code	Category
FUNC	Functional aspects
PERF	Performance aspects

- <GROUP>: Requirement group identifier. A three letter code will be used for this identifier.
- <XX>: Requirement identifier within requirement group; range 01 → 99.

EXAMPLE: R-FUNC-RHR-01: Requirements-Function-Radio_and_Hardware_Resources_01.

4.3 Requirement Formulation

A requirement is formulated in such a way that it is uniquely defined. It is built as follows:

- Title: <Title Description>

5 Working Assumptions

The working assumptions described below are based on ETSI TR 103 587 [i.1]. There a radio interface engine is defined to comprise the following use cases which all rely on context information, such as current and predictive location information of the wireless device:

- Decision making based on context information of either the mobile device or the base station identifying if a single or multiple links are best.

- User circumstance trigger context information management that adapts the communication KPIs.
- Considering context information to download and install a different PHY/MAC protocol of wireless devices.
- Tracking context information to decide where the processing unit shall be executed.
- Considering context information to adapt PHY and MAC to improve the location estimation of the WD iteratively further.

Relevant performance indicators are categorized in two groups:

- Communications performance indicators, such as data rate, latency, spectrum and power efficiency.
- Context information performance indicators, such as waveform, location accuracy, integrity of sensor data, and used spectrum for ranging and outdated sensor data.

6 Functional System Requirements

6.1 Requirements for radio and hardware processing resources

6.1.1 R-FUNC-RHR-01: Reconfiguration for each WD

The system shall support the reconfiguration of both the Hardware Processing Resources (HPR) and the Radio Resources (RR) for each supported Wireless Device (WD).

Explanation: The system should be able to perform resource reconfiguration of both the hardware processing resources and the radio resources for each supported WD. The radio resources assigned to each supported WD can be dynamically modified, which includes bandwidth, frequencies, power levels, spectrum masks, etc. Meanwhile, the percentage of hardware processing resources devoted to each supported WD should be dynamically modified. For example, sufficient HPR should be configured to a WD when a new channel is assigned to it.

6.1.2 R-FUNC-RHR-02: Reconfiguration between WDs

The system shall support reconfiguration of both HPR and RR between different WDs.

Explanation: The system can reconfigure multiple WDs with flexibility in terms of the percentage of HPR and RR between different WDs according to the status of the network.

6.2 Requirements for functions supporting the reconfiguration

6.2.1 R-FUNC-REC-01: Gathering and processing function

The system shall support a gathering and processing function to gather and process radio related metrics and parameters.

Explanation: After having gathered radio related metrics and parameters, the gathering and processing function may process them to make decisions on reconfiguration in order to optimize radio performance. The identification of the radio related metrics and parameters which can be used for reconfiguration purposes may vary according the specific use case. These are expected to include traffic variations, channel bandwidth, interference, transmit power and QoS.

6.2.2 R-FUNC-REC-02: Support of trigger events for reconfiguration

The system shall support trigger events for reconfiguration.