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# SLOVENSKI STANDARD
# SIST EN 303 681-2 V1.1.2:2020

**01-september-2020**

**Radijski sistemi z možnostjo preoblikovanja (RRS) - Informacijski modeli in protokoli za radijsko opremo (RE) za splošno arhitekturo preoblikovanja programske opreme - 2. del: Splošni spremenljivi radiofrekvenčni vmesnik (gRRFI)**

Reconfigurable Radio Systems (RRS) - Radio Equipment (RE) information models and protocols for generalized software reconfiguration architecture - Part 2: generalized Reconfigurable Radio Frequency Interface (gRRFI)

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**Ta slovenski standard je istoveten z:** **ETSI EN 303 681-2 V1.1.2 (2020-06)**

**ICS:**

| | | |
|---|---|---|
| 33.060.01 | Radijske komunikacije na splošno | Radiocommunications in general |
| 35.200 | Vmesniška in povezovalna oprema | Interface and interconnection equipment |

**SIST EN 303 681-2 V1.1.2:2020** **en**

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# ETSI EN 303 681-2 V1.1.2 (2020-06)

**EUROPEAN STANDARD**

**Reconfigurable Radio Systems (RRS);
Radio Equipment (RE) information models and protocols
for generalized software reconfiguration architecture;
Part 2: generalized Reconfigurable
Radio Frequency Interface (gRRFI)**

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# Contents

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# Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

The present document is part 2 of a multi-part deliverable covering the Radio Equipment (RE) information models and protocols, as identified below:

Part 1:     "generalized Multiradio Interface (gMURI)";

**Part 2:     "generalized Reconfigurable Radio Frequency Interface (gRRFI)";**

Part 3:     "generalized Unified Radio Application Interface (gURAI)";

Part 4:     "generalized Radio Programming Interface (gRPI)".

| **National transposition dates** | |
|---|---|
| Date of adoption of this EN: | 22 June 2020 |
| Date of latest announcement of this EN (doa): | 30 September 2020 |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 31 March 2021 |
| Date of withdrawal of any conflicting National Standard (dow): | 31 March 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.

# 1        Scope

The present document defines an information model and protocol for generalized reconfigurable radio frequency interface for reconfigurable REs except for reconfigurable mobile devices which are covered in [i.7] to [i.12]. The work is based on the Use Cases defined in ETSI TR 103 585 [i.1], on the system requirements defined in ETSI EN 303 641 [1] and on the radio reconfiguration related architecture for reconfigurable RE defined in ETSI EN 303 648 [i.2].

The present document will be based on ETSI EN 303 146-2 [i.10] and provide a generalized interface definition for the generalized Reconfigurable Radio Frequency Interface.

# 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.

[1]            ETSI EN 303 641: "Reconfigurable Radio Systems (RRS); Radio Equipment (RE) reconfiguration requirements".

## 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 TR 103 585: "Reconfigurable Radio Systems (RRS); Radio Equipment (RE) reconfiguration use cases".

[i.2]          ETSI EN 303 648: "Reconfigurable Radio Systems (RRS); Radio Equipment (RE) reconfiguration architecture".

[i.3]          IEEE 1900.4™-2009: "IEEE Standard for Architectural Building Blocks Enabling Network-Device Distributed Decision Making for Optimized Radio Resource Usage in Heterogeneous Wireless Access Networks".

[i.4]          DigRFSM Working Group: "MIPI® Alliance Specification for DigRFSM v4".

[i.5]          Recommendation ITU-T X.680: "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

[i.6]          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.7] ETSI EN 302 969: "Reconfigurable Radio Systems (RRS); Radio Reconfiguration related Requirements for Mobile Devices".

[i.8] ETSI EN 303 095: "Reconfigurable Radio Systems (RRS); Radio reconfiguration related architecture for Mobile Devices (MD)".

[i.9] ETSI EN 303 146-1: "Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 1: Multiradio Interface (MURI)".

[i.10] ETSI EN 303 146-2: "Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 2: Reconfigurable Radio Frequency Interface (RRFI)".

[i.11] ETSI EN 303 146-3: "Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 3: Unified Radio Application Interface (URAI)".

[i.12] ETSI EN 303 146-4: "Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 4: Radio Programming Interface (RPI)".

[i.13] ETSI EN 303 681-1: "Reconfigurable Radio Systems (RRS); Radio Equipment (RE) information models and protocols for generalized software reconfiguration architecture; Part 1: generalized Multiradio Interface (gMURI)".

[i.14] ETSI EN 303 681-3: "Reconfigurable Radio Systems (RRS); Radio Equipment (RE) information models and protocols for generalized software reconfiguration architecture; Part 3: generalized Unified Radio Application Interface (gURAI)".

[i.15] ETSI EN 303 681-4: "Reconfigurable Radio Systems (RRS); adio Equipment (RE) information models and protocols for generalized software reconfiguration architecture; Part 4: generalized Radio Programming Interface (gRPI)".

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

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

**association:** logical communication link to a Radio Access Network or a peer equipment

NOTE 1: Typically, some control signalling is necessary to maintain the association. No user data transfer may occur with only an association present, but a data flow may be established into an association for this purpose.

NOTE 2: Peer equipment is any communication counterpart of a reconfigurable Radio Equipment. It can be reached by establishing a logical communication link (i.e. an association) between the reconfigurable Radio Equipment and peer equipment.

**channel:** designated part of the information transfer capability having specified characteristics, provided at the user network interface

NOTE: It is the over-the-air wireless propagation channel which is used to convey an information signal from transmitter to receiver. This definition is specified in ETSI EN 303 648 [i.2].

**Communication Services Layer (CSL):** layer related to communication services supporting generic applications

NOTE: A communication services layer supports generic applications like Internet access. In the present document, it consists of Administrator, Mobility Policy Manager (MPM), Networking stack and Monitor.

**link:** connection from one location to another through a given Radio Access Technology for the purpose of transmitting and receiving digital information

NOTE: Each Link is conveyed over a given Channel.

**Radio Application (RA):** software which enforces the generation of the transmit RF signals or the decoding of the receive RF signals

> NOTE 1:  The software is executed on a particular radio platform or an RVM as part of the radio platform.

> NOTE 2:  RAs might have different forms of representation. They are represented as:

> > ▪ source codes including Radio Library calls of Radio Library native implementation and Radio HAL calls;

> > ▪ IRs including Radio Library calls of Radio Library native implementation and radio HAL calls;

> > ▪ executable codes for a particular radio platform.

**Radio Computer (RC):** part of Radio Equipment working under ROS control and on which RAs are executed

> NOTE:    A Radio Computer typically includes programmable processors, hardware accelerators, peripherals, software, etc. RF part is considered to be part of peripherals.

**Radio Control Framework (RCF):** control framework which, as a part of the OS, extends OS capabilities in terms of radio resource management

> NOTE:    RCF is a control framework which consists of Configuration Manager (CM), Radio Connection Manager (RCM), Flow Controller (FC), Multiradio Controller (MRC) and Resource Manager (RM) which is typically part of OS.

**Radio Equipment (RE):** *"an electrical or electronic product, which intentionally emits and/or receives radio waves for the purpose of radio communication and/or radiodetermination, or an electrical or electronic product which must be completed with an accessory, such as antenna, so as to intentionally emit and/or receive radio waves for the purpose of radio communication and/or radiodetermination".*

> NOTE:    The definition above is as defined in the Radio Equipment Directive, Article 2(1)(1) [i.6].

**Radio Frequency (RF) transceiver:** part of radio platform converting, for transmission, baseband signals into radio signals, and, for reception, radio signals into baseband signals

**Radio Operating System (ROS):** any appropriate OS empowered by RCF

> NOTE:    ROS provides RCF capabilities as well as traditional management capabilities related to management of radio platform such as resource management, file system support, unified access to hardware resources, etc.

**radio platform:** part of radio equipment hardware which relates to radio processing capability, including programmable components, hardware accelerators, RF transceiver, and antenna(s)

> NOTE:    A Radio Platform is a piece of hardware capable of generating RF signals or receiving RF signals. By nature, it is heterogeneous hardware including different processing elements such as fixed accelerators, e.g. Application-Specific Integrated Circuit (ASIC), or reconfigurable accelerators, e.g. FPGAs, etc.

**Radio Virtual Machine (RVM):** abstract machine which supports reactive and concurrent executions

> NOTE:    An RVM may be implemented as a controlled execution environment which allows the selection of a trade-off between flexibility of base band code development and required (re-)certification efforts.

**reconfigurable mobile device:** mobile device with radio communication capabilities providing support for radio reconfiguration

> NOTE:    Reconfigurable mobile devices include but are not limited to: smartphones, feature phones, tablets, and laptops.

**reconfigurable Radio Equipment:** Radio Equipment with radio communication capabilities providing support for radio reconfiguration

> NOTE:    Reconfigurable Radio Equipment includes Smartphones, Feature phones, Tablets, Laptops, Connected Vehicle communication platform, Network platform, IoT device, etc.

## 3.2     Symbols

Void.

## 3.3     Abbreviations

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

| | |
|---|---|
| ACK | ACKnowledgement |
| ACKM | ACKnowledgement with Modification |
| AP | Application Processor |
| ASIC | Application-Specific Integrated Circuit |
| ASN.1 | Abstract Syntax Notation One |
| BBIC | Base-Band Integrated Circuit |
| BLER | Block Error Rate |
| CSL | Communication Services Layer |
| EU | European Union |
| gMURI | generalized Multiradio Interface |
| gRPI | generalized Radio Programming Interface |
| gRRFI | generalized Reconfigurable Radio Frequency Interface |
| gURAI | generalized Unified Radio Applications Interface |
| MIMO | Multiple Input Multiple Output |
| MPM | Mobility Policy Manager |
| NACK | Negative ACKnowledgement |
| OOB | Out Of Band |
| OS | Operating System |
| RA | Radio Application |
| RAN | Radio Access Network |
| RAP | Radio Application Package |
| RAT | Radio Access Technology |
| RC | Radio Computer |
| RCF | Radio Control Framework |
| RCID | Radio Computer Identification |
| RE | Radio Equipment |
| RERC | Radio Equipment Reconfiguration Class |
| RF | Radio Frequency |
| RFIC | Radio Frequency Integrated Circuit |
| ROS | Radio Operating System |
| RRFI | Reconfigurable Radio Frequency Interface |
| RVM | Radio Virtual Machine |
| RX | Reception |
| SINR | Signal to Interference plus Noise Ratio |
| TR | Technical Report |
| UML | Unified Modeling Language |
| URA | Unified Radio Applications |

# 4       Introduction

A reconfigurable RE is capable of running multiple radios simultaneously, changing the set of radios by loading new
Radio Application Packages (RAP) and setting their parameters. All Radio Applications (RAs) are called Unified Radio
Applications (URAs) when they exhibit a common behaviour from the reconfigurable RE's point of view in ETSI
EN 303 648 [i.2]. In order to run multiple URAs, the reconfigurable RE will include Communication Services Layer
(CSL), Radio Control Frameworks (RCFs), Radio Platforms and 4 sets of interfaces for their interconnection.
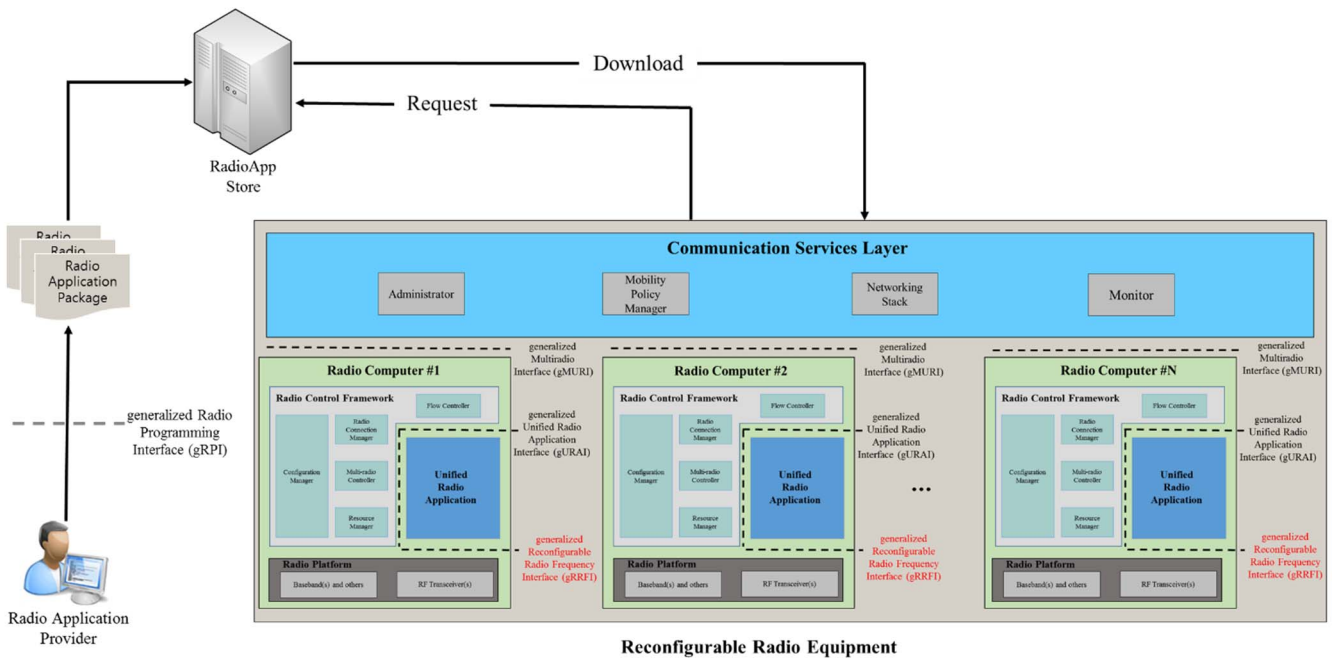
**Figure 4.1: Four sets of interfaces for reconfigurable RE**

Figure 4.1 illustrates the reconfigurable RE architecture with the 4 sets of interfaces, i.e.:

- gMURI for interfacing CSL and RCF (in ETSI EN 303 681-1 [i.13]).

- gRRFI for interfacing URA and RF Transceiver, which is the scope of the present document.

- gURAI for interfacing URA and RCF (in ETSI EN 303 681-3 [i.14]).

- gRPI for allowing an independent and uniform production of RAs (in ETSI EN 303 681-4 [i.15]).
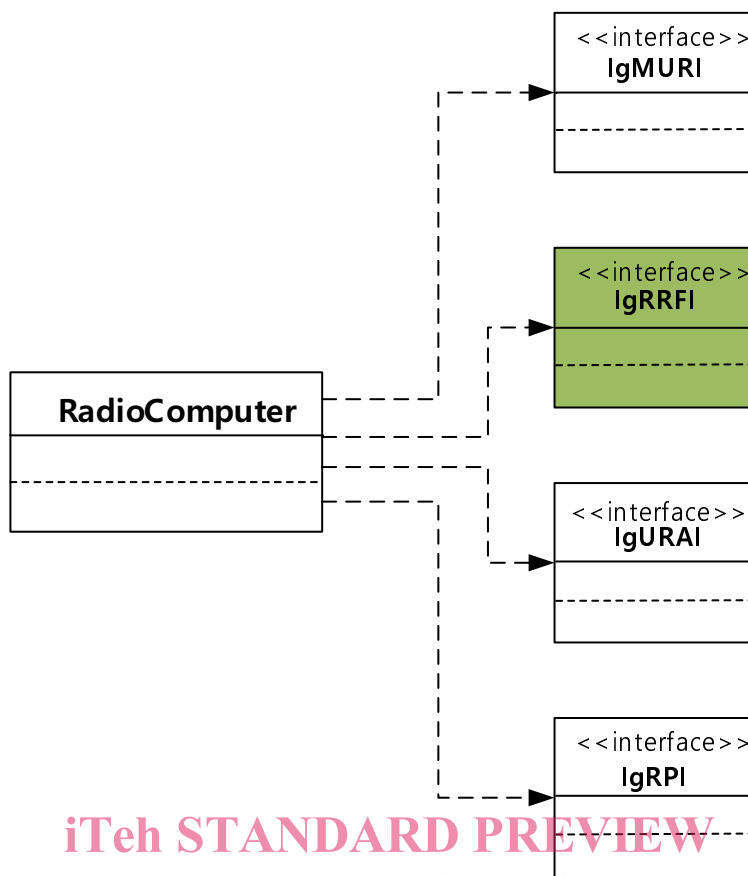
The present document defines gRRFI.

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**Figure 4.2: UML class diagram for RC interfaces**

Figure 4.2 illustrates UML class diagram for RC interfaces. The reconfigurable RE may be seen as RCs where individual URAs are engineered as software entities in ETSI EN 303 648 [i.2].

The present document is organized as follows:

- clause 5 describes the system identification;

- clause 6 describes the notational tool for defining both information model classes and interface classes;

- clause 7 describes the information model for RC; and

- clause 8 describes the interface definition.

While UML is used for defining the information model and protocol related to gRRFI, other modelling languages could be used as well.

# 5       System Identification

## 5.1      Radio Computer Structure

Figure 5.1 illustrates how URA and RF Transceiver interacts with each other using gRRFI.