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Reconfigurable Radio Systems (RRS); System requirements for Operation in UHF TV Band White Spaces

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**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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1 Scope

The scope of the present document is to define the high level system requirements for operation of Reconfigurable Radio Systems within UHF TV band White Spaces. The requirements are based on the Use Cases described in TR 102 907 [i.1]. Security requirements are not covered within the present document.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at http://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.

2.1 Normative references

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

Not applicable.

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 TR 102 907: "Reconfigurable Radio Systems (RRS); Use Cases for Operation in White Space Frequency Bands".

[i.2] Recommendation ITU-T G.1010 (2001): "Quality of service and performance".

[i.3] Recommendation ITU-T E.800 (2008): "Definitions of terms related to quality of service".

[i.4] Recommendation ITU-T G.1080 (2008): "Multimedia quality of service and performance - Generic and user-related aspects, Quality of experience requirements for IPTV services".

[i.5] Recommendation ITU-T P.10/G.100 (2006): "Vocabulary for performance and quality of service".

[i.6] ECC Report 186 (2013): "Technical and operational requirements for the operation of white space devices under geo-location approach".

3 Definitions and abbreviations

3.1 Definitions

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

geo-location database: database approved by the relevant national regulatory authority which can communicate with WSDs and provide information on TVWS channel availability

incumbent radio service: radio authorized for operation on a given frequency band with a regulatory priority

NOTE: In the frequency band 470-790 MHz, the following radio services are considered as incumbent radio services:

- Terrestrial Broadcasting Service (BS) including DVB-T in particular.
- Program Making and Special Event (PMSE) services including radio microphones in particular.
- Radio Astronomy Service (RAS) in the 608-614 MHz band.
- Aeronautical Radio Navigation Service (ARNS) in the 645-790 MHz band.

master WSD: WSD which communicates with a geo-location database and obtains operating parameters specific to its geo-location and which controls radio transmission resources of slave WSDs

Quality of Service (QoS): totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service

NOTE: This is the definition given in Recommendation ITU-T E.800 [i.3].

Quality of Experience (QoE): overall acceptability of an application or service, as perceived subjectively by the end-user

NOTE 1: Quality of Experience includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc.).

NOTE 2: Overall acceptability may be influenced by user expectations and context.

NOTE 3: This is the definition given in Recommendation ITU-T P.10/G.100 [i.5].

slave WSD: White Space Device operating under control of a master WSD

spectrum sensor: White Space Device with sensing capability or a dedicated device which measures incumbent signals and/or interference signals

system: set of physical and logical entities and related functions that take part in the operation in UHF TV band White Spaces

NOTE: The system consists of one or more TV White Space CRSs, and system functions which enable or enhance TV White Space CRS operation in UHF TV band White Spaces.

system function: clearly defined task or set of tasks that the system can implement (e.g. coexistence function providing management and/or information services)

TVWS channel: TV Channel in the range of frequencies from 470 - 790 MHz which is available for radio systems at a given time in a given geographical area on a non-interfering / non-protected basis with regard to primary services and other services with a higher priority on a national basis

NOTE: Such a channel is 8 MHz bandwidth in Europe.

TV White Space CRS: one or more WSDs operating in UHF TV White Spaces on non-interference, non-protection basis

White Space Device (WSD): wireless device controlled by a geo-location database capable of operating in UHF TV band White Spaces on a non-interference, non-protection basis

NOTE: User terminals (e.g. mobile terminals), base stations, and access points may be WSDs.

3.2 Abbreviations

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

3GPP	3rd Generation Partnership Project
ARNS	Aeronautical Radio Navigation Service
BS	Broadcasting Service
CRS	Cognitive Radio System
CSMA	Carrier Sense Multiple Access
DL	Downlink
DTT	Digital Terrestrial Television
DVB-T	Digital Video Broadcasting - Terrestrial
EIRP	Equivalent Isotropically Radiated Power
eNB	evolved Node B
EPG	Electronic Program Guide
FDD	Frequency Division Duplex
GLDB	Geo-Location DataBase
GSM	Global System for Mobile communication
IPTV	Internet Protocol based Television
LTE	Long Term Evolution
MME	Mobility Management Entity
PDB	Packet Delay Budget
PMSE	Program Making and Special Events
QoE	Quality of Experience
QoS	Quality of Service
RAS	Radio Astronomy Service
RAT	Radio Access Technology
RRS	Reconfigurable Radio Systems
TDD	Time Division Duplex
TR	Technical Report
TV	Television
TVWS	TV White Space
UHF	Ultra High Frequency
UL	Uplink
WS	White Space
WSD	White Space Device

4 Requirement Organization and Methodology

This clause describes how the requirements are organized and the related format.

4.1 Requirement Organization

As shown in Figure 1, the requirements described in the present document belong to two different categories: the functional requirements and the performance requirements. Each category, in turn, is organized into groups.

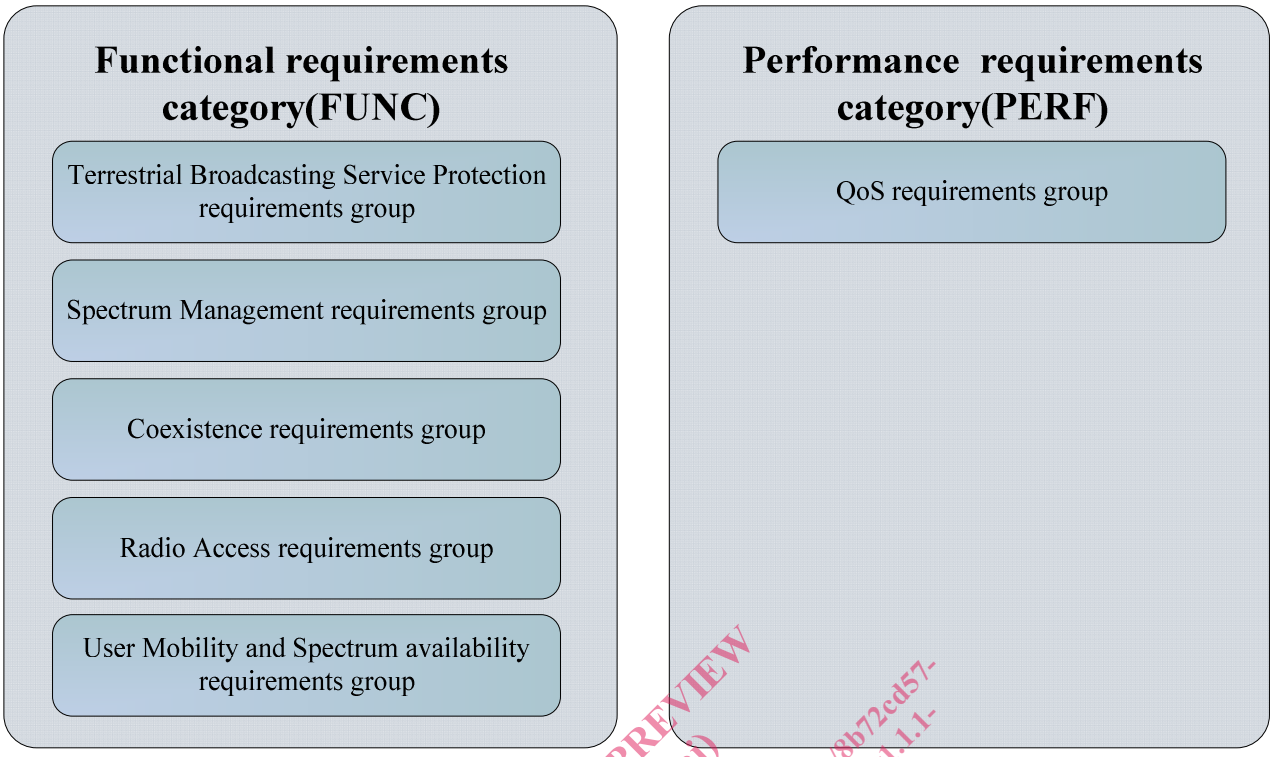

Figure 1: Overall requirements structure

4.2 Requirement Format

A letter code system is defined which makes a unique identification of each requirement R-<CAT>-<GROUP>-<XX>. It should be constructed as follows:

- R- : Standard requirement prefix
- <CAT>-

Code	Category
FUNC	Functional aspects
PERF	Performance aspects

- GROUP>: Requirement group identifier. A letter code will be used for this identifier. The three first letters will give the identifier of the group.

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>

- Description: the description of a requirement will be formulated using one of the following terms:
  - "shall" is used to express mandatory requirements (i.e. provisions that have to be followed);
  - "should" is used to express recommendations (provisions that an implementation is expected to follow unless there is a strong reason for not doing so);
  - "May" is used to express permissible actions (provisions that an implementation is able to follow or not follow.

5 Working assumptions

There are two approaches for use of TVWS channels by each CRS, uncoordinated approach and coordinated approach:

- Uncoordinated use of TV White Space implies that each CRS independently uses available TV White Space resources obtained with the help of geo-location database without any help from a spectrum coordination function to coordinate spectrum usage with its neighbour CRSs.
- Coordinated use of TV White Space implies that each CRS uses available TV White Space resources obtained with the help of geo-location database and with additional knowledge of spectrum usage by its neighbour CRSs and/or decision making from a spectrum coordination function.

The tag "COOR" in the requirement identifier indicates that the requirement applies only to the coordinated use and any requirement without the "COOR" tag applies either to the uncoordinated use or to the coordinated use.

6 Metrics

The present document derives the requirements from the use cases and technical challenges as defined in TR 102 907 [i.1]. It requires the availability of metrics related to the operational state of the network (or parts of it) and the user requirements. This clause describes these metrics on which the requirements are based.

6.1 Quality of Service (QoS) & Quality of Experience (QoE) Metrics

The relationship and scope of QoS and QoE is defined by Recommendation ITU-T G.1080 [i.4] and it is illustrated in Figure 2.

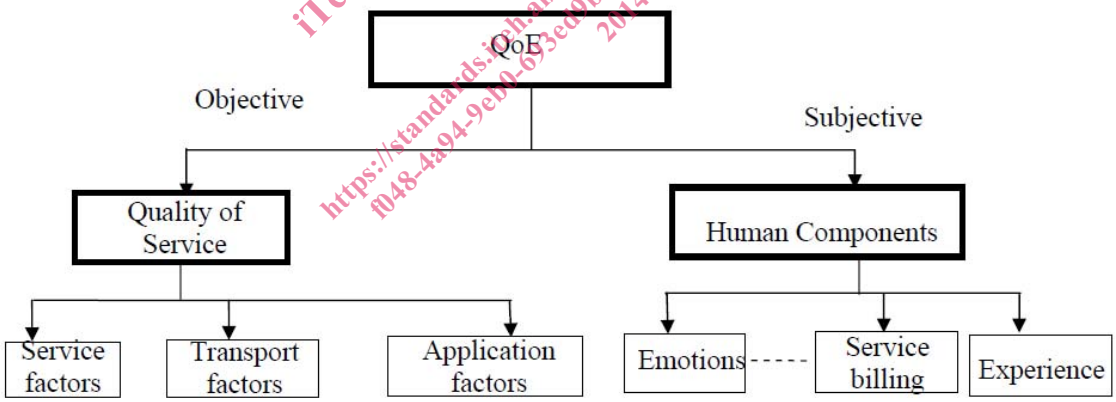

Figure 2: Quality of Experience (QoE) Dimension

The definition of suitable QoS is based on Recommendation ITU-T G.1010 [i.2] and the definitions specified in Recommendation ITU-T E.800 [i.3]. Figure 3 shows the User-centric QoS categories as defined in Recommendation ITU-T G.1010 [i.2].