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Technical Report

Reconfigurable Radio Systems (RRS);
User Requirements for Public Safety

ETSI

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

Introduction

The present document provides an overview of the User Requirements for the application of RRS in the Public Safety and Defense domain.

1   Scope

The present document describes needs, applications and drivers for the application of RRS to the public safety.

2   References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

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2.1   Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2   Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1]   ETSI TS 102 181: "Emergency Communications (EMTEL); Requirements for communication between authorities/organizations during emergencies".

[i.2]   SDR Forum: "Use Cases for Cognitive Applications in Public Safety Communications Systems - Volume 1: Review of the 7 July Bombing of the London Underground".

NOTE: Available at: http://www.sdrforum.org/pages/documentLibrary/documents/SDRF-07-P-0019-V1_0_0.pdf

[i.3]   ETSI TS 170 001 (V3.3.1): "Project MESA; Service Specification Group - Services and Applications; Statement of Requirements (SoR)".

[i.4]   SAFECOM, US communications program of the Department of Homeland Security. "Public safety Statements of Requirements for communications and interoperability v I and II".

[i.5]   ETSI TR 102 182: "Emergency Communications (EMTEL); Requirements for communications from authorities/organisations to the citizens during emergencies".

[i.6]   ETSI TR 102 180: "Basis of requirements for communication of individuals with authorities/organizations in case of distress (Emergency call handling)".

ETSI

[i.7]   ETSI TR 102 410: "Emergency Communications (EMTEL); Basis of requirements for communications between individuals and between individuals and authorities whilst emergencies are in progress".

[i.8]   ETSI TR 102 021: "Terrestrial Trunked Radio (TETRA); User Requirement Specification TETRA Release 2".

[i.9]   ITU-R Recommendation BO.1774: "Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief".

[i.10]   ITU-R Recommendation S.1001: "Use of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations".

[i.11]   ETSI TR 170 003: "Project MESA; Service Specification Group - Services and Applications; Basic requirements".

[i.12]   ETSI TR 102 682: "Reconfigurable Radio Systems (RRS); Functional Architecture (FA) for the Management and Control of Reconfigurable Radio Systems".

[i.13]   ETSI TS 102 734: "Electronic Signatures and Infrastructures; Profiles of CMS Advanced Electronic Signatures based on TS 101 733 (CAdES)".

[i.14]   ETSI TR 102 733: "Reconfigurable Radio Systems (RRS); System Aspects for Public Safety".

[i.15]   ITU-R Report M. 2033: "Radiocommunication objectives and requirements for public protection and disaster relief".

[i.16]   ECC REPORT 102. Public protection and disaster relief spectrum requirements, Helsinki, January 2007.

[i.17]   SeBoCom Pre-Study - A preliminary study on Secure Border Communications. European Commission Technical Report - EUR 23536 EN.

[i.18]   World Radiocommunication Conference in 2003, resolution 646: "Public protection and disaster relief".

[i.19]   SDR Forum: "Use Cases for Cognitive Applications in Public Safety Communications Systems" - Volume 1: Review of the 7 July Bombing of the London Underground.

[i.20]   SDR Forum: "Utilization of Software Defined Radio Technology for the 700 MHz Public/Private Partnership".

[i.21]   SDR Forum: "High Level SDR Security Requirements".

[i.22]   CHORIST Project: "Report on user requirements and initial support cases".

[i.23]   CHORIST Project: "Report on user needs and interoperability requirements".

[i.24]   OASIS Project: "Definition of the OASIS Tactical Situation Object (D-TA2_06).

[i.25]   OASIS Project: "OASIS User Requirements synthesis (D-TA2_01).

[i.26]   WIDENS Project: "Users Requirements and First System Architecture Design (D2.1)".

[i.27]   WIN Project: "User Requirements Specifications".

[i.28]   WISECOM Project: "Survey of Use Cases. Deliverable 1.1-1".

[i.29]   WISECOM Project: "User and System Requirements for Emergency Telecommunication Services. Deliverable 1.2-1".

[i.30]   TETRA RELEASE 2: "User Requirement Specifications. URS 101-021-1 General Overview User Requirement Specification (URS) and URS 101-021-2 High Speed Data (HSD)".

3 Definitions and abbreviations

3.1 Definitions

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

cognitive radio: radio, which has the following capabilities:

- to obtain the knowledge of radio operational environment and established policies and to monitor usage patterns and users' needs;

- to dynamically and autonomously adjust its operational parameters and protocols according to this knowledge;

- in order to achieve predefined objectives, e.g. more efficient utilization of spectrum; and to learn from the results of its actions in order to further improve its performance.

Cognitive Radio System (CR): radio system, which has the following capabilities:

- to obtain the knowledge of radio operational environment and established policies and to monitor usage patterns and users' needs;

- to dynamically and autonomously adjust its operational parameters and protocols according to this knowledge in order to achieve predefined objectives, e.g. more efficient utilization of spectrum; and

- to learn from the results of its actions in order to further improve its performance.

NOTE 1: Radio operational environment encompasses radio and geographical environments, and internal states of the Cognitive Radio System.

NOTE 2: To obtain knowledge encompasses, for instance, by sensing the spectrum, by using knowledge data base, by user collaboration, or by broadcasting and receiving of control information.

NOTE 3: Cognitive Radio System comprises a set of entities able to communicate with each other (e.g. network and terminal entities and management entities).

NOTE 4: Radio system is typically designed to use certain radio frequency band(s) and it includes agreed schemes for multiple access, modulation, channel and data coding as well as control protocols for all radio layers needed to maintain user data links between adjacent radio devices.

public safety organization: organization responsible for the prevention and protection from events that could endanger the safety of the general public

NOTE: Such events could be natural or man-made. Example of Public Safety organizations are police, fire-fighters and others.

radio technology: technology for wireless transmission and/or reception of electromagnetic radiation for information transfer

3.2 Abbreviations

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

AAF	Adaptive Ad-hoc Freeband
BAPCO	British Association of Public Safety Communications Officers
BER	Bit Error Rate
CEPT	Conférence des Administrations Européenes des Postes et Télécommunications
COI	Community of Interest
ECC	Electronic Communication Committee of the CEPT
EVM	Error Vector Magnitude
FA	Functional Architecture
GMDSS	Global Maritime Distress Safety System
PMR	Private Mobile Radio, Professional Mobile Radio

PPDR   Public Protection and Disaster Relief
PSRG   Public Safety Radiocommunications Group
RAT   Radio Access Technology
RRS   Reconfigurable Radio Systems
SDR   Software Defined Radio
TETRA   TErrestrial Trunked RAdio
USR   User Requirement Specification

4   Relevant input from other organizations

This clause provides the list of input documents and information sources, which are relevant to the present document. The list includes deliverables and other documentation produced by organizations or projects.

NOTE: As described in clause 1, the scope of the present document is to define the User Requirements for the application of RRS in the Public Safety and Defense domain. The scope is not to define a new radio system for Public Safety.

This means that some of the listed references will not be a direct input to the present document, even if they may still provide useful information.

Furthermore existing Public Safety standards already satisfy many Public Safety requirements, which are automatically supported by the RRS through the related waveforms.

4.1   Organizations

4.1.1   BAPCO (British Association of Public Safety Communication Officers)

BAPCO is an independent, user led, professional members Association to promote, influence and advance the development and use of communications and information management systems for the safety and security of the public.

One of the objectives of BAPCO is to promote the development of efficient and effective communications and supporting information technologies to provide value for money and effective systems to enhance delivery of public safety and civil contingency services for the benefit of the public and for the benefit of individual public safety and civil contingency services and personnel.

4.1.2   ECC

The Electronic Communications Committee (ECC) is part of the CEPT (European Conference of Postal and Telecommunications Administrations).

ECC is responsible for:

1)   considering and developing policies on electronic communications and activities in a European context, taking account of European and international legislation and regulations;

2)   develop European common positions and proposals, as appropriate, for use in the framework of international and regional bodies;

3)   forward plan and harmonize within Europe the efficient use of the radio spectrum, satellite orbits and numbering resources, so as to satisfy the requirements of users and industry;

4)   take decisions on the management of the work of the ECC.

The following documents are relevant for system and technology aspects, especially in relation to spectrum usage by the public safety domain:

*   ECC REPORT 102. Public protection and disaster relief spectrum requirements, Helsinki, January 2007 [i.16], clause 7 presents the operational requirements for public safety radio communication.

4.1.3 ETSI EMTEL

ETSI Special Committee EMTEL is responsible for identifying the operational and technical requirements of those involved in the provision of emergency communications, for conveying these requirements to other ETSI committees and for liaison with other organizations involved in this field.

The activities of TC EMTEL will follow the broad areas of:

- preparation of ETSI deliverables used to describe requirements for Users, Network Architectures, Network Resilience, Contingency planning, Priority Communications, Priority Access Technologies (e.g. Twisted Pair, Cable/ HFC, Satellite, Radio Frequencies/ fixed and mobile, new solutions) and Network management;

- studies of the issues related to National Security and Public Protection and Disaster Relief (PPDR);

The following documents are relevant for requirements definition:

- Requirements for communication of citizens with authorities/organizations in case of distress (emergency call handling), see TR 102 180 [i.6].

- Emergency Communications (EMTEL); Requirements for communication between authorities/organizations during emergencies, see TS 102 181 [i.1].

- Emergency Communications (EMTEL); Requirements for communications from authorities/organizations to individuals, groups or the general public during emergencies, see TR 102 182 [i.5].

- Communications between individuals and between individuals and authorities during emergencies, see TR 102 410 [i.7].

4.1.4 ETSI TETRA

TErrestrial Trunked RAdio (TETRA) is a digital trunked mobile radio standard developed to meet the needs of traditional Professional Mobile Radio (PMR) user organizations such as:

- Public Safety

- Transportation

- Utilities

- Government

- Military

- PAMR

- Commercial & Industry

- Oil & Gas

The following documents are relevant for requirements definition:

- User Requirement Specification TETRA Release 2. See TR 102 021 [i.8].

- Technical Reports from TETRA Working Group 1, which is responsible for producing the User Requirement Specification (URS) for development and enhancement of TETRA.

4.1.5 FRONTEX

Frontex, the EU agency based in Warsaw, was created as a specialized and independent body tasked to coordinate the operational cooperation between Member States in the field of border security.

A number of joint operations (Sea, Land and Air) have been organized by FRONTEX at European level, which can provide useful input for the requirements definition.

FRONTEX has also organized a number of workshops, where representatives from Public Safety organizations present and discuss operational needs and requirements. Recently the SEBOCOM workshop was organized with JRC - EC for "Secure Border Communications".

The output of the workshop can also be relevant for requirements definition:

- SeBoCom Pre-Study - A preliminary study on Secure Border Communications. European Commission Technical Report - EUR 23536 EN. [i.17].

4.1.6   ITU

International Telecommunication Union (ITU) has investigated the use of communications for public protection and disaster relief (PPDR).

An important agreement concerning public protection and disaster relief was reached at the World Radiocommunication Conference in 2003 (WRC-03) in Resolution 646 [i.18]. It supports the deployment of new technologies for enhanced applications involving higher data rates, real-time full motion video and multimedia services that should facilitate the work of PPDR agencies around the world.

The following documents are relevant for requirements definition:

- ITU-R Report M. 2033 [i.15]. Radiocommunication Objectives and Requirements for Public Protection and Disaster Relief (PPDR). The document defines objectives and needs for the implementation of future PPDR solutions. The document focuses on operational needs around 2010.

- ITU-R Recommendation BO.1774 [i.9]
  "Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief".

- ITU-R Recommendation S.1001 [i.10]
  "Use of systems in the fixed-satellite service in the event of natural disasters and similar emergencies for warning and relief operations".

4.1.7   NATO

The NATO C3 Organization (NC3O) was created in 1996 to ensure the provision of a NATO-wide cost-effective, interoperable and secure C3 capability, meeting the NATO users' requirements by making use of common funded, multinational and national assets.

NATO has produced a number of documents relevant for requirements definition especially in case of joint interoperability between Public Safety and Defense.

4.1.8   PSRG (Public Safety Radio communication Group)

The objectives from the PSRG is to create a co-operative forum to exchange information to facilitate the introduction, deployment and benefits realization of digital mobile radio services for (national) Public Safety bodies, covering issues like user aspects, technical (e.g. frequency aspects), procurement, project management, operational, education/training benefits and knowledge regarding the different projects. The members should have a role in the project from their country.

4.1.9   PSCE (Public Safety Communication Europe)

PSCE is also called the NARTUS project. It is focused on establishing and facilitating a Forum for regular exchange of ideas, information, experiences and best practices, and on seeking agreement among participating stakeholders.

Project NARTUS is completed on June 2009 and PSCE is continuing in self-sustaining mode.

The following documents are relevant for requirements definition:

- D1.3 "Test case and validation scenarios".

- D2.2 "Report on mapping of technologies on first operational scenarios".

- D3.13 "Market Studies Report".

4.1.10 SAFECOM

SAFECOM is an US communications program of the Department of Homeland Security. SAFECOM provides research, development, testing and evaluation, guidance, tools, and templates on interoperable communications-related issues to local, tribal, state, and Federal emergency response agencies.

The following documents are relevant for requirements definition:

- Reference [i.4] "Public safety Statements of Requirements for communications and interoperability v I and II. Volume I explains the qualitative requirements and identifies the applications and services critical for public safety communications. Volume II describes the quantitative requirements and provides detailed quality of service methods of measurement for the applications and services identified in Volume I, along with network parameters to specify the minimum acceptable performance of public safety communications systems carrying these services" (from Safecom web site).

In the document Public safety Statements of Requirements for communications and interoperability v I and II, a number of scenarios are described.

From [i.4]:

- EMS: Routine Patient Services and Car Crash Scenario. A voice conference call is set up between the ambulance and the hospital, while the vehicle's geolocation as well as the vital measurements and treatments of the patient are recorded and transmitted wirelessly.

- A residential fire scenario: as in the first scenario, geolocation and vital measurements of multiple victims, first responders and vehicles is wirelessly transmitted; additionally, GIS information on building plans, fire hydrant locations, etc. is accessible.

- A traffic stop scenario: the situation message, the police vehicle's ID and geolocation are transmitted; the suspect car's license plate is read and sent to dispatch, where it is queried against several law enforcement databases, and the results are sent back to the police officer; a video stream of the action is available on demand to dispatch; the officer decides to request backup, the nearest vehicle is located by the backup system and the request is forwarded; when the suspect is arrested, information about the crime, the police officer, etc. is loaded onto the RFID embedded in the handcuffs; after the arrest, biometric data from the suspect is sent to dispatch, queried against databases, and the answers are sent back; the officer communicates with the tow truck company; evidence and other information is transmitted to the sheriff's office; the case report is sent electronically to the officer's supervisor.

- An explosion scenario: here the communications analysis is from the incident commander's point-of-view, while all the first-responder requirements described in the previous scenarios are still considered valid; the various (diverse) units that arrive on the scene form an ad-hoc overlay network and provide information about their location and status; GIS information is available on demand to the commanders; distributed sensors on the first-responders relay their readings to central command; a secondary perimeter is set up, and a reverse 911 call is sent to fixed and mobile users (civilian) inside the perimeter to evacuate or find shelter; at the same time, the Department of Transportation is notified to divert traffic from the area; critical infrastructure (gas, electricity) is shut down; the commander decides the explosion is not an accident, and directs field agents to treat it as a crime scene, while calling in detectives to investigate; the number of casualties is assessed too high for local hospitals, so coordination with other medical centres is necessary; at the end of the incident all-but-one of each type of team is released.

4.1.11 SDR Forum

The Software Defined Radio Forum (SDRF) is a non-profit organization comprised of approximately 100 corporations from around the globe dedicated to promoting the development, deployment and use of software defined radio technologies for advanced wireless systems.

The following documents are relevant for requirements definition:

- Use Cases for Cognitive Applications in Public Safety Communications Systems - Volume 1: Review of the 7 July Bombing of the London Underground [i.19].