EUROPEAN COMMISSION
ENTERPRISE AND INDUSTRY DIRECTORATE-GENERAL

Resources Based, Manufacturing and Consumer Goods Industries
Engineering Industries

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STANDARDISATION MANDATE TO CEN, CENELEC AND ETSI FOR RECONFIGURABLE RADIO SYSTEMS

1. INTRODUCTION AND BACKGROUND

1.1. Introduction

Reconfigurable Radio Systems (RRS) are expected to become important drivers for the evolution of wireless communications and to bring substantial benefits: from reconfigurable flexible and cost-effective architectures for wireless devices to a better utilization of the radio frequency spectrum, thereby helping to mitigate the "spectrum scarcity" problem.

RRS, in particular Software Defined Radio (SDR) and Cognitive Radio (CR) technologies have been investigated in the commercial, public safety and military areas. While each area has specific operational and technical requirements, a consistent approach should bring benefits for all areas.

This standardisation mandate identifies an approach and a number of issues where standardisation should enable the development and use of RRS technologies in Europe.

1.2. Assessment of the current situation

1.2.1. Commercial Domain

A number of approaches to spectrum policy and to underlying technologies have been proposed in the area of commercial communications in order to exploit the potential of RRS technologies to increase efficiency and flexibility in the use of spectrum.

There are still substantial uncertainties with regard to decisions relating to spectrum regulation, to the co-existence between incumbent and possible new spectrum users and applications, and to the attractiveness for different stakeholders of associated business models. Nevertheless, in both the EU and the US, significant demand already exists for the use of RRS and especially for CR technologies. These technologies are an enabler for the introduction of new users and applications in co-existence with incumbent uses in some frequency bands, such as, for example, the so-called TV White Spaces in the UHF band. Among the different possibilities for implementation of CR concepts in the short to

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medium term, regulators have identified communication between a CR device and a geo-location database (GLDB) as the most feasible approach (see *reference R1*[1]).

The US Federal Communications Commission has already taken regulatory steps for the use of CR technologies in the area of TV White Spaces, and other trading areas could quickly follow. It will be challenging for Europe not to lose the competitive edge on these new technologies, and the time window for the EU to take action is therefore limited. Some EU member states are already in the process of or considering implementing regulations to enable white space devices (WSD) with access to a GLDB to operate in the UHF TV band. The concept of a CR device getting access to a band through a geo-location database (GLDB) also creates further spectrum access opportunities, for example, under the so-called Licensed Shared Access (LSA) regime (*see Reference R8*).

Taking these elements into account, this mandate intends to stimulate standardisation so as to position Europe at the forefront of experimentation with RRS technologies in the area of pre-commercial and commercial applications. This should make it possible to exploit the opportunities for use of RRS technologies in a timely way, supported by market demand and by adaptations in the regulatory framework.[2]

1.2.2. Civil Security Domain

Civil security services bring value to society by creating a stable and secure environment for citizens. The protection to be ensured by the different civil security organizations primarily concerns people but also the environment and property, and addresses a large number of threats, both natural and man-made, including acts of terrorism and technological, radiological or environmental accidents, occurring inside or outside the EU. The Civil Security domain is also known as PPDR: an acronym for Public Protection and Disaster Relief domain.

The Civil Security/PPDR organizations have different operative scenarios categorized as PP1 (day-to-day operations encompassing the routine operations that PPDR agencies conduct within their jurisdiction), PP2 (large emergency and/or public events, that PP and potentially DR agencies respond to in a particular area of their jurisdiction); DR Disaster Relief (operations caused by either natural or human activity).

The provision of adequate capabilities to civil security organizations is a priority subject for citizens, National Governments and the European Union. This is also highlighted by the following communications and decisions:

- Council Decision 2007/162/EC, Euratom of 5 March 2007 establishing a Civil Protection Financial Instrument.

- Council Decision 2008/615/JHA of 23 June 2008 on the stepping up of cross-border cooperation, particularly in combating terrorism and cross-border crime.

[1] A list of references is included in annex

[2] This standardisation mandate may need to be complemented with other regulatory and standardisation elements facilitating market uptake of RRS technologies. For example, the issue of software having the potential to negatively affect the compliance of a SDR with the essential requirements in the RTTE Directive will be addressed in the context of the coming revision of the R&TTE Directive

- COM (2008) 130 Communication from the Commission to the European Parliament and the Council on reinforcing the Union's Disaster Response Capacity.

- COM (2010) 600 Towards a stronger European disaster response: the role of civil protection and humanitarian assistance.

In particular, the capability of exchanging information (e.g., voice and data) is essential to improving the coordination of civil security officers in field operations. Wireless communications are particularly important in the response and mitigation phases of emergency crises to support the mobility of first responders.

The evolution of wireless communications in civil security should address three significant challenges:

a) lack of interoperability due to different technology standards and systems;

b) lack of broadband connectivity to support a wide range of new applications;

c) economic sustainability.

Civil security organizations can use different wireless communications systems including dedicated networks (e.g. TETRA), satellite communications and commercial systems (e.g. GPRS or LTE in the future). Lack of interoperability at European level has been highlighted in the "Council Recommendation on improving communication between operational units in border areas" [*R2*]. Spectrum requirements for broadband connectivity in civil security are described in *R3* and *R4* and are currently being investigated in the CEPT FM49 Project Committee.

Some organizations make use of dedicated networks for emergency situations as well as for safety purposes. This is, for example, the case for the dedicated network for railways (GSM-R). Intermodulation and interferences, which are currently creating problems, might be overcome through the development of Reconfigurable Radio Systems (RRS).

New technologies like Software Defined Radio, Cognitive Radio, Multi-standard and multi-band terminals can provide new capabilities to mitigate these challenges. The application of these technologies in the civil security domain has already been investigated in ETSI Technical Committee (TC) Reconfigurable Radio System (RRS) Working Group in various technical reports (references *R5*, *R6* and *R7*). These reports have also identified the benefits of these technologies for civil security including an improved equipment lifecycle and the potential for creating synergies with other domains to increase the size of the market and decrease equipment costs.

European industries in the security domain have developed significant experience in the design and deployment of SDR technologies in civil security. This experience has been partially acquired in Framework Programme (FP) projects like WINTSEC, HELP and EULER, which are described in 1.3.

1.2.3. Military Domain

The initial drive for SDR standardization has been the US JTRS programme, which proposed the Software Communications Architecture (SCA) as a framework to integrate the hardware and software components. Today, the SCA is the de-facto standard reference for a military SDR architecture.

SCA is a framework on which SDR systems are based, where a framework is defined as a set of cooperating classes that make up a reusable design for a specific class of software.

The interfaces among the classes and the other elements of the framework must be clearly defined to facilitate the activity of development, integration and validation.

SCA relies on a middleware providing the definitions and basic rules for the main components and functions of the framework, which are:

- Radio management functions,
- Domain Manager,
- Application Factories,
- Applications,
- Device Managers and Devices.

The Software Defined Radio architecture is based on the Software Communication Architecture, which, in turn, is based on certain "Application Programming Interfaces (APIs)" offering dedicated standard functionalities, which, in turn, use a middleware and an operating system (loaded on a generic specialised hardware) where all these software entities run.

The SCA 2.2.2 release, current baseline for both European and US SDR developments, recently evolved to a newer version, referenced as “SCA-Next”. For this new release, non-US Industries have been given the possibility to provide feedback on some topics through the WINNF SCA-Next Working Group. Hence, some EU Member States/Industries took the opportunity to provide contributions, possibly to be included into the SCA-Next specification for the sake of convergence and compatibility for their respective work on some new areas of definition.

The issue with the SDR architecture is that “specification development” is being managed as a “procurement activity” supported with government funding. Consequently, specific issues like Security architecture implementation have national or regional interest and can therefore best be handled through government programmes. Another consequence is that there are currently 3 different developments of 'SDR architectures' running in parallel (US SDR architecture, ESSOR SDR architecture and German SDR architecture). Additionally, the evolution of the SDR architecture should be managed in order to maximize the benefit for all SDR (European and US) stakeholders.

The obvious solution is to establish a coordinating committee on European/international SCA based standards where representatives from all relevant national and regional programmes are encouraged to provide broader coordination for the evolution of the SDR architecture worldwide and to facilitate faster and less costly deployment of capabilities into the field.

Finally, we should also not forget that SDR technology is a precursor and an enabler of Cognitive Radio technology, which can provide the benefit of improved spectrum utilization and can greatly increase the operational capability both in the military and civil security domains.

1.3. The R&D Environment

Commercial Domain

Several projects have looked into SDR in Framework Programmes FP5 and FP6. The recent body of research has advanced from SDR towards the areas of cognitive radio and dynamic spectrum allocation, including sensing the eventual free spectrum, aggregating radio resources, cooperative schemes, efficient sharing of TV White Spaces and interference management.

A Cognitive Radio System (CRS) could enable devices to operate efficiently in multiple different frequency bands of the radio spectrum, including those with existing users. Such a radio would hop into unused bands of the radio spectrum and quickly hop out again if a primary user of a band required that spectrum.

Most of today's radio systems are not aware of their radio environment - they are designed to operate in a specific frequency band using a specific access system. A CR senses its local radio environment to identify temporarily vacant spectrum to operate in. This ability in principle allows CRs to coexist with primary users of a band. CRs can stop transmitting when the primary user requires access to the spectrum, potentially switching to a different band to provide continuous service.

The following ongoing research is looking to provide the technological advancement that is necessary to make the transition towards CR communication:

– QoSMOS (Quality of Service and MObility driven cognitive radio Systems) is developing a framework for cognitive radio systems and a test-bed;

– Saphyre (Sharing Physical Resources – Mechanisms and Implementations for Wireless Networks) is making new self-organising physical layer resource sharing models, co-ordination mechanisms and a framework for infrastructure sharing;

– COGEU (COgnitive radio systems for efficient sharing of TV white spaces in EUropean context) is developing CR systems for use of TV White Spaces through the introduction and promotion of real-time secondary spectrum trading and the creation of a new spectrum commons regime and has created a very good database for TV White Spaces;

– SACRA (Spectrum and energy efficiency through multi-band cognitive radio) is looking into multi-band cognitive radio technology;

– Faramir (Flexible and spectrum-Aware Radio Access through Measurements and modelling In cognitive Radio systems) is developing techniques for increasing the radio environmental and spectral awareness of future wireless systems;

– Samurai (Spectrum Aggregation and Multi-User MIMO: Real-world Impact) is demonstrating the benefits of Spectrum Aggregation and Multi-User MIMO (MU-MIMO) at system level;

– QUASAR (Quantitative Assessment of Secondary Spectrum Access) is assessing and quantifying the "real-world" benefits of secondary (opportunistic) access to primary (licensed) spectrum;

– OneFit (Opportunistic networks and Cognitive Management Systems for Efficient Application Provision in the Future InterneT) is doing opportunistic networks that are managed, and coordinated with the infrastructure, by advanced cognitive systems;

– CROWN (Cognitive Radio Oriented Wireless Networks) is deriving (information theoretic) benchmarks for the maximum spectrum efficiency bounds and is developing an experimental platform;

– ACROPOLIS (Advanced coexistence technologies for radio optimisation in licensed and unlicensed spectrum) is performing integration of relevant research groups and competencies, targeting not only the integration of individual highly recognised European groups and institutions, but also research integration towards more practical and robust coexisting and cooperating networks.

Civil security domain

The application of SDR technologies to the civil security and military domain have been investigated in the FP7 projects WINTSEC, EULER and HELP.

WINTSEC was a preparatory project with the objective of investigating the application of SDR technologies to mitigate the interoperability barriers among civil security organizations. The use of SDR-based devices (Terminals and Base-stations), integrated with solutions defined for interoperability in the Core Network Layer, was used to support the next generation of European civil security communication systems, with the possibility of implementing different interoperability layers according to each operational scenario.

The EULER project aimed to leverage SDR to bring novel efficient interoperability capabilities to wireless systems used by European civil security organizations when confronted by large disaster scenarios where joint collaboration with military organizations is needed. EULER had the objective of implementing a demonstrator system.

Important tasks of the EULER project were:

- To prove the concept of waveform portability across different SDR hardware platforms. EULER intended to yield the first portable waveform libraries of waveforms on to SDR platforms (i.e., EULER SDR node) for civil security and, in particular, for international interoperability needs. The target environment and deployment included base stations, vehicular terminals (i.e. mounted on a truck) and handheld terminals used by Civil security officers.

- To address the lack of broadband connectivity of current civil security wireless communication technologies, the development of high data rate waveform (HDR WF) required a specific effort in the EULER project. This concerned a radio with processing capability to transport data at the rate in the range of 10-100Mbit/s.

Project HELP is establishing the technical foundations and a strategic development roadmap for a solution framework aimed at increasing the wireless communication capabilities of public safety organisations by proposing innovative approaches for the management of network and spectrum resources. On that basis, the detailed objectives of Project HELP are as follows:

- To identify operational user requirements, scenarios and overall system requirements.
- To define a solution framework (system concept) for the provision of public safety communications over diverse wireless infrastructures.
- To define a framework for the management of the composite emergency network.
- To conduct a techno-economic analysis.
- To establish a consolidated basis and roadmap for the realisation of the envisioned solution framework.

These objectives are designed to maximise the visibility and the effect of Project HELP results in the regulation and standardisation processes.

European industries have acquired considerable experience in WINTSEC, EULER and HELP projects and some others (DITSEF, SECRICOM) which can be successfully applied to standardization of SDR in the civil security domain.

Military Domain

The ESSOR programme was set up at the end 2008 (the programme office is established in OCCAR), in order to give the EU a capacity to develop autonomously military SDR and to increase interoperability among EU forces, USA and NATO.

Initial objectives are covered by the current contract (ESSOR Phase 1) which, in general terms, is expected to design, develop and implement the ESSOR Architecture and a High data Rate WaveForm (HDR WF). Both the ESSOR Architecture and the HDR WF will be implemented on the 6 Radio Platforms of the 6 Nations participating in the ESSOR Programme (Finland, France, Italy, Poland, Spain and Sweden).

The main programme milestones of ESSOR phase 1 are:

- **Mid 2010** – Definition of the ESSOR Architecture.
- **End 2010** – Definition of the HDR WF Specification supported by Simulations.
- **End 2011** – Complete the development of the ESSOR Architecture, with National validation.
- **Beginning 2012** – start the development of the HDR Base WF
- **Mid 2013** – Porting of the HDR Base WF and National validation.
- **End 2013** – Multinational HDR WF interoperability demonstration.

Long term objectives (aiming towards a fully compliant development with the Nations' operational requirements) need additional activities, hence the ESSOR partners are considering the possibility of launching a phase 2 of the ESSOR programme. For the time being the following packages are considered as potential phase 2 objectives (2014-mid 2017):

- **Package 1**, Standardization, certification and management of the ESSOR products delivered under phase 1 and phase 2

- **Package 2**, Technical enhancement of the ESSOR Architecture and HDRWF in a real environment (Technical field Tests)

- **Package 3**, Preparation of operational deployment (Full system realisation and Operational field tests).

At the end of 2008, Germany launched its own SDR programme called "Streitkräftegemeinsame verbundfähige Funkgeräteausstattung" (SVFuA). Currently under development, the SVFuA will help to close the capability gap in the area of highly mobile, interoperable, flexible and reliable networking. The SVFuA will provide a secure, modular, scalable, programmable and reconfigurable SCA-based SDR radio platform which allows the parallel operation of waveforms on multiple lines and in various frequency bands.

Among several other features, the SDR architecture of SVFuA exhibits some exceptional interfaces which allow integrating modules and components to be developed by different vendors. One prominent example is the so-called IQ-baseband interface between digital hardware units, which performs digital baseband signal processing, and the band limited transceiver modules, which realize the RF operations. This interface has been adapted from interfaces known in the commercial/civil domain while additionally taking particular constraints from the military domain into account. The resulting interface specification has already been offered to the Wireless Innovation Forum as well as to NATO for international standardization.

2. OBJECTIVES AND LEGAL CONTEXT

Work undertaken under this standardisation mandate should contribute to the following objectives.

Objective A, in the area of commercial applications, to enable the deployment and operation of cognitive radio systems (CRSs) including white space devices (WSD) and devices under Licensed Shared Access regime, dependent for their use of radio spectrum on information obtained from geo-location databases (GLDB). This includes the following goals:

- To allow CRSs to comply with EU and national legislation on the placing on the market and the use of radio equipment, in particular with the Directive on Radio Equipment & Telecommunications Terminal Equipment (R&TTE Directive[3]);

- To ensure that implementation of CRS technologies does not create barriers to the Single Market;

- To ensure that the standardisation of CRS technologies happens in a timely way in Europe in order to lead or keep pace with global developments.

[3] Directive on Radio and Telecommunications Terminal Equipment, 1999/5/EC, OJ L 91, 7.4.1999, p. 10–28

Objective B, in the area of civil security and military applications, to ensure the standardization of suitable SDR architecture(s) (SCA-based for the military domain). The ideal situation would be a single architecture fulfilling the requirements of both domains. This objective includes the following goals:

- To facilitate waveform portability and support for intra-border interoperability at national level, cross-border interoperability at the European level as well as for joint civil security-military operational scenarios;

- To support coordination on SDR architectures with other similar initiatives, such as the Joint Tactical Radio System (JTRS) programme in the USA;

- To standardize suitable SDR architecture(s) meeting the specific requirements of civil security and military domains, aiming to facilitate the design of SDR equipment.

- To identify validation and measurement procedures, supporting certification activities.

Objective C: to explore potential areas of synergy among commercial, civil security and military applications. These include the following:

- Architectures and interfaces for dynamic use of spectrum resources among commercial, civil security and/or military domains for disaster relief. This objective will require collaboration with spectrum regulatory organizations.

- Reconfigurable mobile device architecture for commercial and civil security applications.

- Other potential synergies to be identified.

3. DESCRIPTION OF THE MANDATED WORK

The Commission requests CEN, CENELEC and ETSI to perform the following work:

Within Objective A:

A1) To develop harmonised standards providing presumption of conformity with Article 3(2) of the R&TTE Directive covering cognitive radio systems (CRSs) dependent for their use of radio spectrum on information obtained from geo-location databases (GLDB). Such standards may address different use cases across the radio spectrum but should at least cover the use case of CRSs operating in TV White Spaces and consider the use case of CRSs operating under LSA regime. These standards should support the use of CRSs in the UHF band in the short to medium term, taking into account the state of play in the industry. These harmonised standards should cover:

- Identification and access between CR systems (terminals, gateways etc) and GLDBs;

- Parameters and other information to be exchanged between CRSs and a GLDBs;

- The procedures for such information exchange, addressing integrity, security and reliability aspects;

- Instructions for measurements and tests in support of the R&TTE Directive

A2) To develop European standards complementing the above harmonised standards enabling the operation of CRS dependent for their use of radio spectrum on information obtained from GLDBs, and in particular covering:

- The information to be exchanged between different GLDBs;

- The parameters and procedures for such information exchange, including security and reliability aspects.

Within Objective B:

B1) **Phase 1**- Programming Phase: Definition of a standardization Work Programme

This phase involves the development of a comprehensive work programme, including a description of tasks and roadmap. This phase may also include the identification of user requirements and a risk analysis. The definition of the work programme should be based on inputs from ESSOR and other European/national projects (e.g. SVFuA, EDA projects and FP7 Security projects) as appropriate.

The work programme should identify short-term, mid-term and long-term activities and clearly identify the standardization tasks.

For the programming phase a Joint Programming Group shall be set up, as a minimum, with representatives of the relevant technical committee of the ESOs, representatives of the relevant European programs (ESSOR and SVFuA) and the European Defence Agency (EDA). Representatives of EC/EFTA, as well as the public safety community, and NATO as appropriate, will be also invited to join the group.

B2) **Phase 2** - Execution of the Work Programme

The objective of this phase is to deliver the following set of standardisation deliverables:

a) European SCA-based SDR architecture (and related interfaces) for the military domain;
b) European SDR architecture (and related interfaces) for the civil security domain.

The architectures and interfaces defined in a) and b) should meet the military/civil security interoperability requirements. Furthermore, commonalities in the architectures should be evaluated. In this regard, the ideal situation would be a single architecture fulfilling the requirements of both domains.

The elaboration of the standards shall take into due account the work done in European Programmes such as ESSOR and SVFuA, complemented by research projects such as the FP7 WINTSEC, EULER and HELP projects and the ongoing work in ETSI TC RRS. The deliverables produced will be Technical Specifications (TS), which later on could evolve to European Standards (EN) for civil security and military.

In addition, updated versions of the work programme will be provided every year.

Within Objective C:

C1) **Phase 1**- Feasibility study

This phase will explore potential synergies across the commercial, civil security and military domains in the medium/long term (5-15 years in the future) as described in Objective C.

C2) Phase 2 - Proposal of a Work Programme

This phase involves the development of a comprehensive work programme addressing one or more tasks identified in Objective C. This phase may also include the identification of user requirements and a risk analysis.

C3) Phase 3 - Execution of the Work Programme

Depending on the definition of the work programme from Phase 1, this phase will deliver one or more standardization deliverables related to:

a) Definition of the network interfaces and architectures for dynamic use of spectrum resources among commercial, civil security and/or military domains for disaster relief.

b) Definition of the architecture and interfaces for reconfigurable mobile devices for commercial and civil security applications.

c) Other potential synergies to be identified.

4. EXECUTION OF THE MANDATE

Upon receiving the standardisation mandate:

(1) CEN, CENELEC and ETSI are requested to communicate to the Commission within 1 month the acceptance of the mandate.

(2) CEN, CENELEC and ETSI are requested to communicate to the Commission, within 7 months of the acceptance of the mandate, an interim report on the progress of the tasks set out in this mandate, indicating any eventual difficulties encountered for objectives A and B.

(3) CEN, CENELEC and ETSI are requested to communicate to the Commission, within 12 months, a list including:

– The draft harmonised standard(s) referenced in 3-A1). Note: these early drafts should be available in order to be proposed to early experimentations in Europe;

– The work programme identified in 3-B1);

– The feasibility study identified in 3-C1).

(4) Within 15 months of the acceptance of the mandate, the Commission will communicate the decision on the work programme for objective B.

(5) CEN, CENELEC and ETSI are requested to communicate to the Commission, within 24 months of the acceptance of the mandate:

– the list of harmonised and European standards referenced in 3-A1) and 3-A2);

– the work programme identified in 3-C2) if the 3-C1) study has shown the feasibility for synergies.

(6) Within 27 months of the acceptance of the mandate, the Commission will communicate the decision on the work programme identified in 3-C2).

(7) CEN, CENELEC and ETSI are requested to communicate to the Commission, within 42 months of the acceptance of the work programme:

– for objective B, the list of European standard(s) referenced in 3-B2);

– for objective C, the list of European standard(s) referenced in 3-C3).

The detailed time plan of Objectives A, B and C is described in Table 1.

The following intermediate milestones are identified:

- T0 – reception of the mandate.
- T1 – acceptance of the mandate.

Table 1 Time plan

	Objective A	***Objective B***	***Objective C***
	Within T0 + 1 month: Acceptance of the mandate. (This time is defined as T1).	**Within T0 + 1 month:** Acceptance of the mandate (This time is defined as T1).	**Within T0 + 1 month:** Acceptance of the mandate (This time is defined as T1).
	Within T1 + 7 months: Interim report on the progress of the tasks set out in this mandate.	**Within T1 + 7 months:** Interim report on the progress of the tasks set out in this mandate	
	Within T1 + 12 months: Delivery of the draft-harmonised standard(s) referenced in 3-A1).	**Within T1 + 12 months:** Delivery of the work programme identified in 3-B1).	**Within T1 + 12 months**: Communication to the Commission of the feasibility study 3-C1)
		Within T1 + 15 months= Acceptance of the work programme for objective B.	
	Within T1 + 24 months: Delivery of a list of harmonised and European standards referenced in 3-A1) and 3-A2).		**Within T1 + 24 months:** Delivery of the work programme identified in 3-C2).
			Within T1 + 27months = Acceptance of the work programme for objective C.
		Within T1 + 42 months: Delivery of the list of European standard(s) referenced in 3-B2).	**Within T1 + 42 months:** Delivery of the standards identified in 3-C3).

CEN, CENELEC and ETSI are requested to draw up the work plan and execute the abovementioned tasks in close cooperation in order to ensure consistency, to avoid overlapping standards and, where possible, to exploit potential synergies among the different tasks including, in particular, those mentioned under Objective C above.

In order to take into account the needs of existing radio services and users (e.g. railroad communications GSM-R, wireless microphones or PMSE for TV White Spaces), CEN,

CENELEC and ETSI are requested to collaborate with CEPT[4] as necessary during the execution of the standardisation mandate.

The standardisation work shall include the necessary coordination with international standardisation bodies, in particular with ITU-T, and consultation with other SDOs such as IEEE and organisations such as the Wireless Innovation Forum as appropriate.

With regard to Objective B, the only two Programmes in Europe developing SCA-based SDR architecture are the ESSOR and the SVFuA. It is assumed that the participating Nations will make all efforts to:

- Establish an adequate and efficient co-operation mechanism;

- Collaborate and exchange information in order to evaluate commonality and differences between the two SDR architectures with the aim of synchronizing the respective activities and set the ground for convergence towards a single architecture.

Based on these assumptions and in order to avoid duplication of work, it is suggested to establish close liaisons between present and future European programmes. To establish close liaisons with other international programmes, the experts should take utmost account of the work already performed in other international bodies and cooperate as appropriate. It is highly recommended to coordinate the work with the Joint Tactical Radio System (JTRS**)** programme.

Harmonised standards the references of which are intended to be published in the OJEU in support of the R&TTE Directive shall include an indication of the relationship between the clauses of the standard and the essential requirement of the Directive.

The lists of harmonised standards shall include the titles of the standards in all the official languages of the EU.

CEN, CENELEC and ETSI are requested to make available to the Commission the texts of the standards developed on the basis of this mandate (including the European standards based on international standards) in English, French and German.

Acceptance of this mandate by CEN, CENELEC and ETSI, as applicable, starts the standstill period referred to in article 7 of the Directive 98/34/EC of 22 June 1998.

5. ORGANISATIONS TO BE INVOLVED IN THE STANDARDISATION WORK

As appropriate, CEN, CENELEC and ETSI will invite representatives of Digital Europe, Orgalime, GSMA, ANEC, ECOS and NORMAPME to take part in the standardisation work in the commercial domain.

As appropriate, CEN, CENELEC and ETSI will invite representatives of, Ministries of Defence (MOD), JPEO-JTRS (Joint Programme execution Office - Joint tactical Radio System), WINNF (Wireless Innovation Forum), PSCE, EDA, OCCAR-EA, FRONTEX, Europol, ERA, relevant civil security organisations and NATO, APCO, as appropriate, in the standardisation work in the civil security/military domain.

[4] Compatibility within the context of frequency management issues is outside the context of this mandate.

ANNEXES

A1. Reference documentation

R1. RSPG10-348 Final. RSPG OPINION ON COGNITIVE TECHNOLOGIES

R2. Council Recommendation on improving communication between operational units in border areas. Council of the European Union Brussels, 3 October 2008. 13716/08 ENFOPOL 176 COMIX 690.

R3. ECC Report 102. Public Protection and Disaster Relief Spectrum Requirements. Helsinki, January 2007. Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT).

R4. ETSI TR 102 628 V1.1.1 (2010-08). System reference document; Land Mobile Service; Additional spectrum requirements for future Public Safety and Security (PSS) wireless communication systems in the UHF frequency range.

R5. ETSI TR 102 745 V1.1.1 (2009-10). Technical Report. Reconfigurable Radio Systems (RRS); User Requirements for Public Safety.

R6. ETSI TR 102 733 V1.1.1 (2010-03). Technical Report. Reconfigurable Radio Systems (RRS); System Aspects for Public Safety.

R7. ETSI TR 103 064 V1.1.1 (2011-04). Business and Cost considerations of Software Defined Radio (SDR) and Cognitive Radio (CR) in the Public Safety domain.

R8. RSPG11-392 Final. Radio Spectrum Policy Group 2011. Report on Collective Use of Spectrum (CUS) and other spectrum sharing approaches

Acronyms:

ANEC - European Association for the Co-ordination of Consumer Representation in Standardisation

APCO - Association of Public-Safety Communications Officials

CEN – Commité Européen de Normalisation

CENELEC - European Committee for Electrotechnical Standardization

CEPT - European Conference of Postal and Telecommunications Administrations

CR - Cognitive Radio

CRS - Cognitive Radio Systems

DG - Directorate General

DG INFSO - Information and Society

DG ENTR - Enterprise

DG JRC - Joint Research Centre

EC - European Commission

ECOS – European environmental Citizens Organization for Standardization

EDA - European Defense Agency

ERA – European Railway Agency

ERM - Electromagnetic Radio Matters

ESSOR - European Secure Software Radio Programme

ETSI - European Telecommunication Standards Institute

EN - European Norm / Standards

EULER - EUropean Software Defined radio for wireless in joint security operations

EUROPOL - European Police Office

FP - Framework Programme

FRONTEX - *Frontières extérieures*. European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union

GLDB - Geo-Location DataBase

GPRS - General Packet Radio Service

GSMA - GSM Association

GSM-R - Global System for Mobile Communications - Railway or GSM-Railway is an international wireless communications standard for railway communication and applications.

HDR WF - High Data Rate WaveForm

HELP - Enhanced Communications in Emergencies by Creating and Exploiting Synergies in Composite Radio Systems

IEEE - Institute of Electrical and Electronics Engineers

ITU - International Telecommunication Union

ITU-T - ITU Telecommunication Standardisation Sector

JPEO - Joint Programme Executive Office

JTRS - Joint Tactical Radio System

LSA – Licensed Shared Access

LTE - Long Term Evolution

MIMO – Multiple Input Multiple Output

NORMAPME - European Office of Crafts, Trades and Small and Medium sized Enterprises for Standardisation

OCCAR - Organisation for Joint Armament Cooperation

OJEU – Official Journal of European Union

PMSE - Programme Making and Special Events

PPDR – Public Protection and Disaster Relief

PSCE - Public Safety Communication Europe

RRS - Reconfigurable Radio Systems

R&TTE - Radio Equipment & Telecommunications Terminal Equipment

SCA - Software Communications Architecture

SDO - Standards Developing Organization

SDR - Software Defined Radio

TETRA - Terrestrial Trunked Radio

TC - Technical Committee

TS - Technical Specifications

TVWS – Television White Spaces

WF – WaveForm

WINNF – Wireless Innovation Forum

WINTSEC - Wireless INTeroperability for SECurity

WSD – White Space Devices

Glossary:

Civil Security organization or agency - A service or agency, recognized as such by the Member State, that provides immediate and rapid assistance in situations where there is a direct risk to life or limb, individual or public health or safety, to private or public property, or the environment but not necessarily limited to these situations (Source: Commission Recommendation C(2003)2657)).

Work programme – In this mandate, the term “work programme” identifies the document, which describes the list of tasks and the roadmap.

Work plan – In this mandate, the term "work plan" identifies the document which describes in detail the list of deliverables to be produced, the related deadlines and the entities responsible for each task described in the work programme.

Cognitive Radio System (CRS) - A radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state, and to dynamically and autonomously adjust its operational parameters and protocols according to the knowledge obtained in order to achieve predefined objectives and to learn from the results obtained. (Source: ITU-R Report SM.2152).

White space devices (WSDs) - Devices that can use White Space spectrum without causing harmful interference to protected services by employing required cognitive capabilities. (Source: ECC Report 159).