# SCA Test, Evaluation and Certification Model Realization

**Document WINNF-10-P-0012**

Version V1.0.0

27 June 2012

# TERMS, CONDITIONS & NOTICES

This document has been prepared by the SCA Test, Evaluation, and Certification Work Group to assist The Software Defined Radio Forum Inc. (or its successors or assigns, hereafter "the Forum"). It may be amended or withdrawn at a later time and it is not binding on any member of the Forum or of the SCA Test, Evaluation, and Certification Work Group.

Contributors to this document that have submitted copyrighted materials (the Submission) to the Forum for use in this document retain copyright ownership of their original work, while at the same time granting the Forum a non-exclusive, irrevocable, worldwide, perpetual, royalty-free license under the Submitter's copyrights in the Submission to reproduce, distribute, publish, display, perform, and create derivative works of the Submission based on that original work for the purpose of developing this document under the Forum's own copyright.

Permission is granted to the Forum's participants to copy any portion of this document for legitimate purposes of the Forum. Copying for monetary gain or for other non-Forum related purposes is prohibited.

THIS DOCUMENT IS BEING OFFERED WITHOUT ANY WARRANTY WHATSOEVER, AND IN PARTICULAR, ANY WARRANTY OF NON-INFRINGEMENT IS EXPRESSLY DISCLAIMED. ANY USE OF THIS SPECIFICATION SHALL BE MADE ENTIRELY AT THE IMPLEMENTER'S OWN RISK, AND NEITHER THE FORUM, NOR ANY OF ITS MEMBERS OR SUBMITTERS, SHALL HAVE ANY LIABILITY WHATSOEVER TO ANY IMPLEMENTER OR THIRD PARTY FOR ANY DAMAGES OF ANY NATURE WHATSOEVER, DIRECTLY OR INDIRECTLY, ARISING FROM THE USE OF THIS DOCUMENT.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the specification set forth in this document, and to provide supporting documentation.

This document was developed following the Forum's policy on restricted or controlled information (Policy 009) to ensure that that the document can be shared openly with other member organizations around the world. Additional Information on this policy can be found here: http://www.wirelessinnovation.org/page/Policies_and_Procedures

Although this document contains no restricted or controlled information, the specific implementation of concepts contain herein may be controlled under the laws of the country of origin for that implementation. Readers are encouraged, therefore, to consult with a cognizant authority prior to any further development.

Wireless Innovation Forum ™ and SDR Forum ™ are trademarks of the Software Defined Radio Forum Inc.

# Table of Contents

# List of Figures

# List of Tables

# 1 Introduction

## 1.1 References

In 2009 the Forum issued the first part of this series of "Certification Guides" (SDRF-08-P-0007-V1.0.0):

**Test and Certification Guide for SDRs based on SCA: Part 1: SCA**

This document has been well received in the community and it has been taken as the starting point for the present document.

### *1.1.1 JPEO JTRS References*

**Table 1: JPEO JTRS References Table**

| # | JPEO JTRS Released References |
|---|---|
| 1 | Joint Program Executive Office (JPEO) Joint Tactical Radio System (JTRS) (2006). *Software Communication Architecture Specification*. v2.2.2 |
| 2 | Joint Program Executive Office (JPEO) Joint Tactical Radio System (JTRS), JTRS Test and Evaluation Laboratory (JTEL) SCA v2.2.2 Operating Environment Requirements List, version 2.1, 18 May 2009, *sca2_2_2_oe_requirements_list_v2_1.pdf* |
| 3 | Joint Program Executive Office (JPEO) Joint Tactical Radio System (JTRS), JTRS Test and Evaluation Laboratory (JTEL) SCA v2.2.2 Application s Requirements List, version 2.1, 18 February 2009, *sca2_2_2_app_req_list_v2_0.pdf* |

### *1.1.2 Other References*

**Table 2: Other References Table**

| # | Other References |
|---|---|
| 1 | ISO/IEC 17025: (2005) General Requirements for the competence of testing and calibration laboratories |
| 2 | ISO/IEC 17000: (2005) Conformity assessment ; Vocabulary and general principles |
| 3 | The International Traffic in Arms Regulations (ITAR); available at http://www.pmddtc.state.gov/regulations_laws/itar.html |
| 4 | SCA 2.2.2 Endorsement SDRF-08-R-0006-V0.6.0; Document of the SDR Forum |
| 5 | "Certification Guides" (SDRF-08-P-0007-V1.0.0): Test and Certification Guide for SDRs based on SCA: Part 1: SCA |

## 1.2 Scope

This recommendation is addressing procurement authorities as well as producers of radios, radio components and tools, who are active in markets where the SCA specification is relevant and compliance is required. The target of this document is to give guidance to establish test and certification capabilities for "category 1" standards to ensure that compliance is met in an efficient way including time to market and cost.

This recommendation aims to define the realization aspects (including business models) of the role based, generic certification process of SCA based SDRs, as defined in "Test and Certification Guide for SDRs based on SCA, Part 1: SCA" (SDRF-08-P-0007-V1.0.0). It defines and analyzes candidate approaches and gives recommendations to satisfy the responsibilities of the roles, identified in SDRF-08-P-0007-V1.0.0 (e.g. the "Test Developer Role").

This Guide is different from other products like JPEO installations and procedures, which are tailored to the specific, national situation in the US (which includes "category 1 to 3 standards"), do not take into account the multitude of nations as well as the difference in the business models in other nations and have potential for improvement in the area of cost, time-to-market and IP handling.

This product proposes the realization aspects of the framework in (SDRF-08-P-0007-V1.0.0) for the establishment of test and certification capabilities for the SCA, which maximizes the potential for multinational synergy and simultaneously protects interests of different nations and industries. This product is open and internationally accessible and has the potential to be officially introduced in various countries.

The project is extending SDRF-08-P-0007-V1.0.0 by defining "personas", which can be regarded as instantiations of the generic roles. The "personas" are applied within five use cases in order to model realistic scenes one can find within the community.

The main areas of consideration will be platform software compliancy aspects.

- SCA Operating Environment
- SCA Application or Waveform
- Application Programming Interface (API)

Not included in this document are details of SCA test cases or test procedures. Also not considered here are all questions of interoperability and compliance at the RF interface, or the subject and nature of SDR Security.

## 1.3 Methodology

A basic decision was to proceed with the content of the "Certification Guide Part1, SDRF-08-P-0007-V1.0.0" and add the realization aspects like the personas and the use cases accordingly.

There will be 5 (five) uses cases selected and the respective personas will be assigned.

For each use case the following questions shall be answered:

- How can the use case be described?
- Who are the personas involved?
- What is the basic flow of events?
- Which conclusion can be drawn in terms of portability support, time to market, certification cost and intellectual property rights?

The realization aspects can change the generic roles due to new insight. The way to cope with this was to make only those changes in the generic process, which bring a significant new value. Otherwise keep the existing view.

This new document shall contain all the relevant material of the existing document "Certification Guide Part1, SDRF-08-P-0007-V1.0.0" and will supersede it, so that this will become a historic document.

# 2 Executive Summary

SDR technology provides the technical prerequisites to simplify porting of waveform applications to SDR platforms developed by different suppliers. The porting effort is dependent to a high degree on the availability of agreed architectures and interfaces, a significant part of which require standardization. A product that is certified indicates that it conforms to the architectures and interfaces of the standard.

The SCA (Software Communications Architecture) represents an open architecture framework that provides designers information on how elements of hardware and software are to interoperate within a Software Defined Radio (SDR). The SCA together with the associated APIs is a baseline for the mentioned agreed architecture. However, to make full use of this standard, a certification against this standard is required. Unfortunately, for the time being no international effective certification process is established.

This document provides the bridge to establish such a process by

- defining a role based generic certification model
- investigating the different types of stakeholders to fill in the roles (called "personas")
- Detailing five example use cases in terms of involved personas, interaction between the personas, information flow and money flow.

  Use Case #1: National, Industry Driven Certification
  Use Case #2: Multinational Project
  Use Case #3: Government Sponsored Model - JTRS
  Use Case #4: Developing Nation Purchase, Industry Driven Certification
  Use Case #5: Independent Industrial initiative or Procurement Authority Driven Certification

The document concludes with a set of recommendations to allow ecosystems to develop and overcome potential divergence of certification which are summarized as follows:

- Allow an ecosystem to develop by providing an open process
- An Accreditation Body shall accredit test labs and the test suite developers
- Only one Definition Body exists for a standard
- Ensure that the Definition Body is an independent, internationally recognized organization
- A Certification Body may be a national entity or an independent organization
- Radio Providers and Test Suite Developers must be empowered to perform self-evaluations

# 3 General Considerations on Test and Certification of SDRs

## 3.1 The Problem

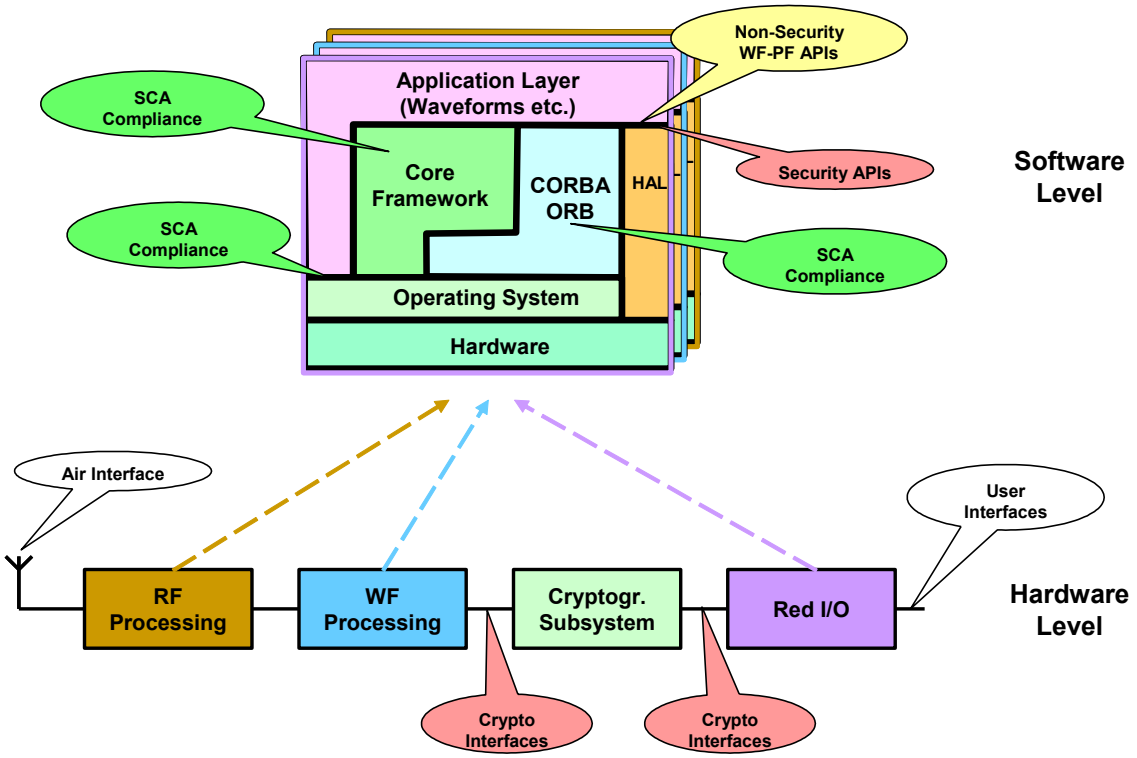


**Figure 1: Certification Scene around an SDR**

### *3.1.1 Introduction*

SDR technology provides the technical prerequisites for porting waveform software from one SDR platform to another. The porting effort depends to a high degree on the availability of agreed architectures and interfaces, which require standardization. A certification of products can prove that architectures and interfaces are in fact in accord with the standard.

There are already certification activities of SDRs in the context of the JTRS program of the United States (US) Department of Defense (DoD). Only a minor part of the relevant documents from the JTRS program have been published. The existing procedures within the JTRS program are not suited for international application for various reasons.

On an international basis however there are no standardization and certification activities currently defined. The objective of this document is to start activities for certification of SDRs on an international basis and pave the way for next steps.

Figure 1: Certification Scene around an SDR shows the range of potential certification topics. The green colored topics are those which are mature enough to be covered by this document. There are others, e.g. the API area or the security area, which also are of high relevance but are

not considered in this document either because there is missing information or they must be under national/alliance control.

Figure 2: Certification Topics in the SDR Area shows various topics of certification in the SDR area with a colored classification.

| Platform | |
|---|---|
| **Topic** | **Criteria** |
| Operating System OS | Posix AEP |
| ORB | Corba |
| Core Framework CF | SCA |
| Security | Specification e.g. red/black separation |
| Security APIs | Specification |
| WF-PF APIs | Specification |
| Performance | Comp. power, memory, latency, RF parameters etc. |
| Intraplatform Interfaces | Intraprocessor interfaces etc. |

| Security Module | |
|---|---|
| **Topic** | **Criteria** |
| Security | Specification e.g. Key stream generation, encyphering, bypass |
| Security APIs | Specification |

| Waveform | |
|---|---|
| **Topic** | **Criteria** |
| SCA compliance | SCA |
| WF-PF APIs | Specification |
| Security | Specification e.g. TRANSEC |
| Security APIs | Specification |
| Portability | e.g porting evaluation |
| Intrawaveform APIs | e.g. PHY/MAc -- NET |

| Radio | |
|---|---|
| **Topic** | **Criteria** |
| Security | tbd Specification e.g. tamper, tempest |
| Interoperability (Air Interface) | WF specification |
| User Interface | e.g. Audio IF specification |
| Crypto Interface | e.g. physical IF specification |

**Legend:**

| | |
|---|---|
| green | mature; within scope of the SCA Certification Guide |
| yellow | important for portability; |
| red | under national/alliance sovereignty |
| grey | not recommended or not applicable |

**Figure 2: Certification Topics in the SDR Area**

### *3.1.2 Scope of SCA Test, Evaluation and Certification*

There are several types of SCA related test and evaluation which could be certified for levels of compliance, including:

- SCA compliance with specification requirements; need to consider provisions for handling optional requirements and potential divergence of specifications and versions.
- Portability assessment of an application implementation (i.e. waveforms).
- Communications interoperability (i.e. waveforms, networks).

- Information Assurance assessment with respect to defined requirements and relevant threat models.
- Performance assessment which can include both quantitative analysis, qualitative appraisal of RF signal characteristics, battery life and other usability factors.

SCA compliance testing is the foundation of this document and will be the focus of the remainder of this document. Consideration needs to be given to compliance with respect to multiple versions of SCA specifications, backwards compatibility, scope and relevance of changes from existing specifications.

### *3.1.3 Scope of the document*

The aim of this project is to define a generic certification process for application in various certification topics of SDR. This generic process then is applied to the SCA certification process of SDRs for the international community.

Objects for the certification are

- Platform software
- Waveform software
- Components of these two entities (e.g. the Core Framework)

The certification process defined in this document is meant for waveform software implemented on a hardware architecture that meets all processing and latency requirements of that implementation. Because of differing hardware designs and capabilities, certification of the SDR waveform does not guarantee that it will function properly on all certified SDR hardware implementations.

Requirements of international stakeholders for test and certification of SDRs are derived as far as it is necessary for this objective. One example for such a paradigm is that for a national military customer security details must be kept undisclosed.

The process to be defined will make use of the experience from the public mobile radio business.

In the mobile radio business the sequence of the certification process is:

- Identify the relevant standard or profile
- Derive a test specification
- Identify test scenarios and test cases
- Develop test cases and automated test tools
- Validate test tools and test platforms
- Perform accreditation of test labs
- Verify the test cases

It is intended to adapt this certification process according to SCA structures.

Recommendations for the following questions will be given:

- What is the proposed certification structure?
- How does this structure support the requirements of the potential stakeholders?
- How can national and international institutions cooperate while maintaining their individual requirements?
- How can test cases be derived?
- What test tools (platform test tool, waveform test tool, test platform etc.) are required?

To accomplish this, existing material from questionnaires, workshops, presentations etc. will be evaluated, and used where applicable.

Not included in this project are details of test cases or test procedures. Also not considered here are all questions of interoperability at the RF interface.

## 3.2 Stakeholders, Paradigms and Operating Model Considerations

### *3.2.1 Stakeholders*

There is a diverse set of stakeholders for SCA test, evaluation and certification, including:

- Product and system users (the mission communicators).
- Governments and associated procurement authorities (those who specify the requirements and procure the products and systems).
- Radio Providers (developers and manufacturer of SCA based products and systems).
- Third Party software developers (e.g., Applications or middleware providers).
- Test Suite Developers (support development, manufacturing and testing).
- Others (i.e., independent test and certification organizations).

Though in detail each of these stakeholders has a particular perspective and set of objectives, at a very high level they all have a similar set of requirements which is to meet:

- Low cost
- Schedule (Time-to-Market)
- Performance
- Security

In more detail this leads to the following strong requirements on the certification process:

- Portability is improved significantly compared with non-standardized solutions
- Certification costs are minimized
- Time delay for the products to hit the market is tolerable
- Industry's intellectual property is protected
- National security is maintained
- National sovereignty is maintained

- Enough flexibility is given to handle tailored solutions
- Transparency is ensured in the certification process

### *3.2.2 Value Statement*

The value of SCA based product test, evaluation and certification is primarily focused on providing assurance of compliance with established standards as a foundation for enabling waveform portability and, as a consequence, a widespread opportunity for interoperable communications. Users and procurement authorities have confidence that the products and systems acquired to accomplish mission operations will meet expectations. Users also increases their awareness and positive feedback on the versatility of the hardware, now proved for being able to deploy different waveforms, according to the SDR paradigm of portability. Radio providers are assured that their products meet requirements of the customer community for both current and future communications needs. In addition, radio providers can potentially leverage certified implementations across multiple platforms to reduce aggregate development costs and time-to-market.

### *3.2.3 Operating Model Considerations*

There are several candidate models for SCA test, evaluation and certification across multiple types of entities including the following:

- Government (Nations, Multi-National Organizations)
- Radio Provider
- Independent Third Party (i.e. Wireless Innovation Forum)
- Various combinations of the above

A set of constituent roles and interfaces will be defined for SCA test, evaluation and certification in Part 2 of this document. These roles can be applied in different manners to achieve specific objectives. Consideration needs to be given to the following criteria when choosing an operating model for SCA test, evaluation and certification, including:

- Consistency and assurance of results (certified compliance should be the same across the global marketplace).
- Protection of National, Organizational and Industry interests (i.e., security, interoperability).
- Protection of Radio Provider investment and intellectual property - needs to be a viable business model for radio providers, which includes relatively frequent and periodic updated releases of platform software.

Benchmarking shall not be part of SCA testing, evaluation and certification; the focus should be on compliance.

“Black Box” (product and system level) vs. “White Box” (component level) testing considerations has very different levels of intrusion into Intellectual Property, non-disclosure protection and licensing terms.

The ultimate objective is to deploy capability to the field for users to accomplish mission objectives in a timely manner – if the SCA test, evaluation and certification process is too costly or takes too long to complete then flow of capability to the field will be slow, potentially minimizing the benefits and value of Software Defined Radio solutions.

Sufficient test and evaluation capacity will be required to ensure that backlogs of radio products and systems do not develop. Consideration needs to be given to levels of automation which can be applied to the SCA test and evaluation process to ensure reasonable levels of efficiency. In addition, avoidance of duplicative effort also needs to be considered both from an execution perspective, and a capital investment perspective.

# 4 Generic Certification Process

The SCA Certification process consists of rigorous SDR testing, verifying, and validating that SDR adheres to SCA requirements. Certification is awarded after the SDR successfully completes and passes a particular and specific set of verification and validation tests.

The advantages of an SDR being certified by an independent third party are:

- Gain measureable confidence the SDR aligns with the SCA
- Increase marketability of the SDR
- Contribute standard practices to the SDR
- Have committed to a code of professional conduct that separates from all other SDR developers.

The tasks to be performed to achieve certification of a device under test can be divided into a phase with non recurrent actions to install the process and recurrent actions to perform the validation and certification of the respective device under test:

- Certification Preparation Phase
- Certification Execution Phase

Remark: If examples within the description of the generic process are given for clarity, these examples often have been taken from the certification of SCA conformity.

## 4.1 Terms

When describing the certification processes it is very important to minimize conflicts which may come up when using terms. Generally, an inflation of terms shall be avoided and existing terms shall be used as much as possible. On the other hand conflicts in interpretation must be minimized.

Therefore, definitions mainly from ISO/IEC 17000 are used and complemented by some others which are necessary.

The target is to stay as close as possible to ISO/IEC standards and guides.

A collection of the terms used throughout this document is given in the glossary (chapter 5).

## 4.2 Certification Preparation Phase

The certification preparation can be carried out for the platform (in the scope of this document equivalent with the Operating Environment) or for the waveform.

### *4.2.1 Various Roles in the Certification Preparation Phase*

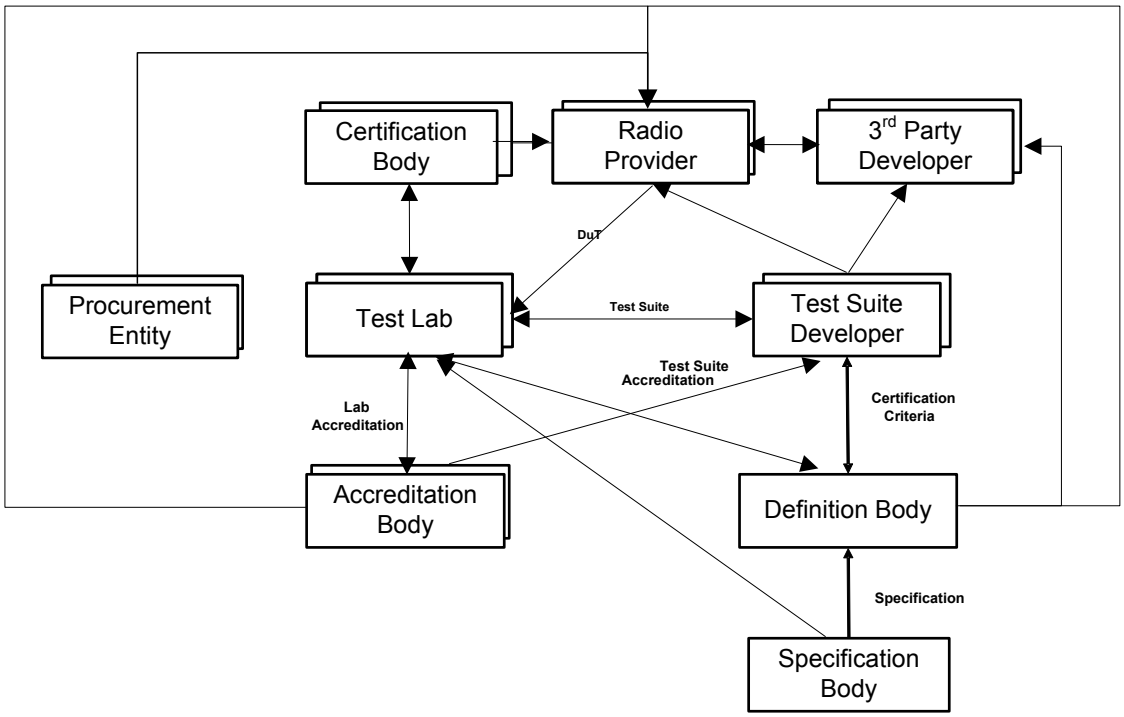


**Figure 3: Roles and Interactions in the Certification Preparation Phase**

Figure 3 displays the flow of information and interaction between personas or bodies for the Certification process. The intent of this section is to provide the reader with a description on the interaction between the bodies or personas for the Certification Process. This document will not delve into the aspects of how each body or persona can be filled.

Each body or persona could possibly be performed by different entities (e.g governments, Radio Providers, and/or independent third party companies). It's also plausible the same organization can have several roles. Likewise, it's also possible, some roles may potentially be executed by more than one entity (e.g. in different countries). In Figure 3 this is indicated by showing two boxes behind each other.

Figure 3 can be divided into three groups:

- The first group consists of the definition of the specification which includes the certification criteria (Specification Body and Definition Body)
- The second group consists of bodies that execute or conducts the testing activities (Test Suite Developer, Test Lab and Accreditation Body).
- The third group finally does have product related activities (Radio Provider, 3rd Party Developer and Procurement Entity)

### *4.2.2 Specification Provision*

Each evaluation and certification process requires the availability of a specification to certify against.

The specification has to be available in a stable, reproducible form (document) in well defined editions.

A standard is a specification, which is under the configuration control of a recognized Standards Development Organization.

For an international evaluation and certification process, it is highly desirable that standard be under the control of an international host (Standards Body). For example, the Wireless Innovation Forum (WInnF) recently has endorsed the SCA 2.2.2, as it was published by the US DoD.

The standard or specification, used for international certification, should be the same for all organizations in all nations, participating in this certification process. If there is a need for an adaptation of the standard to get a better match for certain applications this should preferably be achieved by profiling the standard (see Section 2.2.2.2).

However it shall be possible to perform the certification process also with other standards, which may be derived from the original SCA.

### *4.2.3 Certification Criteria*

The Certification Criteria tell what to evaluate. The question how to do this is left to the Test Procedure.

The Certification Criteria are derived from the standard and represent the specified requirements, which shall be verified during the tests.

These certification criteria represent the minimal criteria, covering the essential requirements necessary to support portability. It should be agreeable by all interested parties.

The Certification Criteria shall be supported by the delivery of test scenarios and have to be detailed enough to avoid any ambiguities.

The Definition Body to perform this process step shall be an international organization like the Wireless Innovation Forum (WInnF), where the expertise is available to perform this task. There might be a situation where the Definition Body also has to be under national control; however, this is not recommended because this does not support the idea of portability.

#### *4.2.4 Test Procedure Development*

The Test Procedure is the detailed and complete description of how to perform required tests and is a part of the Test Suite.

The Standard, along with the Certification Criteria, is the basis for the development of the test procedures.

From the Certification Criteria, test cases will be derived and implemented in the test procedures eventually implemented into one or more test tools.

Test procedure development requires a specific understanding of both the SCA and its components of the JTRS, as well as in the process of writing a test procedure.

The actual development of Test Procedures is performed by the Test Suite Developer. The Test Procedures should be the same for the various test labs which will be accredited.

#### *4.2.5 Test Suite Developer*

Test Suite development consists of designing and developing protocols and methodologies (e.g. software automated testing applications, software test protocols, et al) that are based on certification criteria established by the Definition Body. This includes test procedures, test tools and test forms that are use by Test Labs. The Test Suite Developer develops automated applications to verify and validate SCA requirements.

Commercial industry is expected to develop and implement Test Suite protocols, established by the Test Suite Developer, for use by all SDR developers and Test Labs.

#### *4.2.6 Test Suite Validation*

All Test Suites developed should be uniform and consistent in their test methodology. Therefore, the Accreditation Body provides an unbiased opinion indicating if Test Suite tools properly verify and validate SCA requirements.

Test Suite validation is completed via a cooperating action by the Test Suite Developer, the Accredited Test Labs and the Definition Body. Once the Test Suite has been verified by the Test Lab and the Definition Body, the Accreditation Body provides the accreditation for the Test Suite.

Test Procedures developed for a particular part of the Standard should be reviewed by the Definition Body to ensure interpretations from the Certification Criteria are correctly incorporated into the procedure.

#### *4.2.7 Test Labs Accreditation*

A Test Lab that has the authority to carry out an SDR assessment of SCA Requirements shall be officially endorsed by the Accreditation body.

The Accreditation Body assesses the Test Lab to ensure it conforms to the test capability, testing assets and authority of the respective test lab. It's also recognized that the Test Lab will also issue the test report assessment for each SDR under test.

Under the scenario where the Test Lab is a National lab, the endorsement and accreditation can be issued by its respective national authorities. Accreditation should follow any accreditation guidelines provided by the Definition Body where practical, to ensure that the test lab will support the harmonized certification guidelines (certification criteria etc) the Definition Body may have established.

It's more than feasible that a National Test Lab can be accredited by an industry accepted Accreditation Body from a different nation. With the accreditation, the respective and participating nation accepts and confirms the certificates and test reports issued by the respective Test Lab.

#### *4.2.8 Network of Test Labs*

It is foreseen there will be many Test Labs around the world and within each country there can be more than one. Each Test Lab may contain a set of common test capabilities and practices to verify and validate more common elements of an SDR. In addition, each Test Lab may also contain unique and country specific capabilities and practices due to their differing SDR capabilities.

Therefore, different Test Labs may include the capability to test and certify the following, or may contain all:

- SCA conformance of Operating Environment (OE)
- SCA conformance of Applications
- Application Programming Interface (API)
- Platform execution performance

We envision four (4) to six (6) SDR Test Labs in Europe, one (1) SDR Test Lab in each Asian country and more than one (1) in the United States. SDR Test Labs consists of government test labs, industrial labs and labs of international organizations with cross accreditations respectively.

Each of the Test Labs share a common set of test methodologies, test procedures and test tools to ensure a higher level of portability (and possibly interoperability) across all SDR Test Labs. The common test methodologies, test procedures and test tools will be augmented and supplemented by nation specific test procedures for unique capabilities of nation specific SDRs. These labs shall mutually accept certifications from each other.

Each Test Lab requires an accreditation by one or more national Accreditation Bodies. A Test Lab of a certain country for example shall be accredited by its national Accreditation Body plus a number of Accreditation Bodies of other nations, which may use this Test Lab for certification of their radios (Multiple Accreditation). Thus certification done by one of the Test Labs in the network of labs shall be recognized by other nations or international organizations.

Rules for this Multiple Accreditation have to be worked out and agreed upon.

## 4.3 Certification Execution Phase

The Certification Execution phase consists of conducting and executing verification and validation procedures using Test Suite tools and/or manual procedures.

In this phase, test engineers begin the initial stages of evaluating the implementation and effectiveness of the Customer or Radio Provider's SDR system. During this phase, the Accredited Test Lab interacts with the Radio Provider to ascertain the overall development and maturity of the SDR. Towards the final stages of the Certification Execution Phase, a test report is generated by the Accredited Test Lab, containing their opinion based upon their independent analysis and test results accumulated during the entire Certification Execution Phase. This test report is forwarded and sent to the Certification Body, as shown in Figure 4.

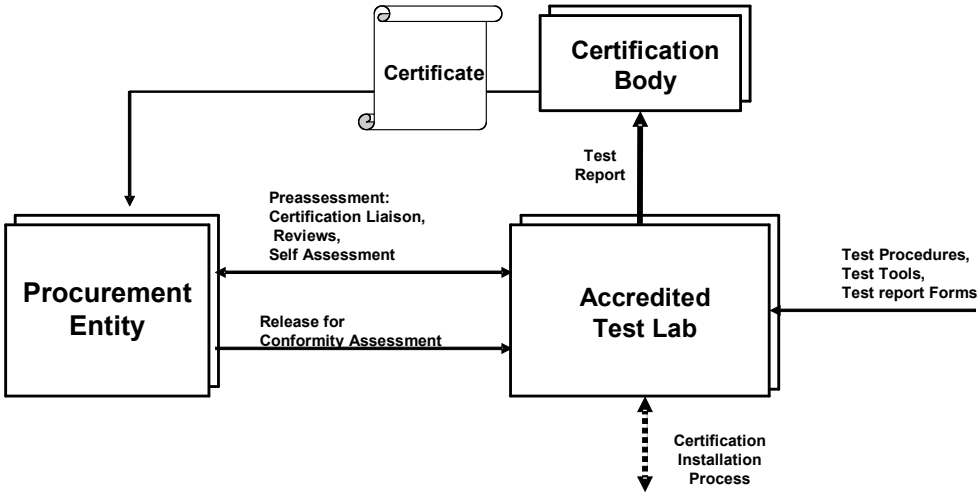


**Figure 4: Roles in the Certification Execution Phase**

### *4.3.1 Steps in the Certification Execution*

#### 4.3.1.1 Pre-assessment

A potential SDR Radio Provider or client of the Test Lab is asked to provide the following information for the purpose of ascertaining the Radio Provider's level of preparation.

- Desired scope (SCA 2.2, or SCA 2.2.2., OE, or WF, or API) of the certification
- General features of their organization and any relevant legal or security obligations
- General information relevant for the field of SDR certification applied for, concerning their organization, such as its activities, technical resources, functions, and relationship in a larger corporation, if any.
- Information concerning all outsourced processes used by the organization that will affect conformity to requirements (e.g. third party software used or implemented)
- Information concerning the use of consultancy relating to the SDR system.

Once this is accepted by the Test Lab, a liaison or auditor is assigned to the client to establish a personal interaction with the Test Lab and the client. We recommend this interaction between the Test Lab and the client occur at the beginning stages of the design and development of the SDR.

During this phase of the interaction between the Test Lab and the client, the following occurs:

- Auditing of the clients SDR system design documentation for SCA accuracies
- Evaluation of the client's location and site-specific conditions and discussions with the client's personnel to determine the preparedness for SCA testing.
- Review of the client's stratus and understanding regarding requirements of the SCA standard, in particular with respect to the identification of key performance or significant aspects, processes, objectives, and operations of the SDR system;
- Collecting necessary information regarding the scope of the SDR system, processes, and location of the client and related statutory and regulatory aspects and compliance (e.g. quality, legal aspects of the client's operations, associated risks, etc.);
- Gaining a sufficient understanding of the client's SDR system and site operations in the context of possible significant aspects to provide a focus for planning;
- Evaluation to determine if internal audits and SDR review is being planned and performed, and that the level of implementation of the SDR system substantiates if the client is ready.

During this phase, a partial self-assessment by, and for, the Radio Provider will help mitigate the certification effort to be done by the Test Lab. The Test Lab can also perform an interim and partial SCA Verification and Validation test before formal SCA testing to gauge the level of conformity. During this pre-assessment phase, if issues with the test procedures and/or the Test Suite tools arise, or if tests have been missed, the client and the Test Lab may probe deeper to resolve possible issues.

#### 4.3.1.2 Release for Conformity Assessment

With the release for Conformity Assessment the customer (typically the Radio Provider) formally delivers the device under test for assessment. At this point all the preparations including exchange of early requests must be completed. The customer is not involved any longer.

#### 4.3.1.3 Certification Assessment

During the Certification Assessment phase, the Radio Provider's SDR is assessed and evaluated by the Test Lab using test Procedures and Test Suite Tools. An audit is conducted to evaluate the implementation and effectiveness of the Radio Provider's SDR system and includes the following:

- Information and evidence about conformity to all SCA requirements of the application SDR system standard or other normative documents;
- Performance monitoring, reporting, and reviewing against key objectives and targets (consistent with the expectations in the application SDR system standard)
- The client's SDR system as regards to legal compliance
- Operational control of the client's SDR;
- Internal auditing and SDR review;
- SDR responsibilities for the client's policies;
- Links between normative requirements, policy, requirements objectives, and targets (consistent with expectations in the application SDR system standard or other normative documents) any applicable legal requirements, responsibilities, competence of personnel, operations, procedures, performance data, and internal audit findings and conclusions.

Upon completion of the Certification Assessment, the audit team will analyze and review all information and audit evidence gathered during the pre-assessment stage and testing stage, agree on audit findings and conclusions and generate a report of its findings and conclusions. The Test Lab provides the report to the Certification Body and the Radio Provider.

- Where no concerns (discrepancies or non-compliance) have been raised, certification will be recommended by the lead auditor of the Test Lab
- Where there are minor concerns (discrepancies) raised, the client will need to close out the concerns prior to certification being recommended
- Major concerns (non-compliance) raised also needs to be closed out by the client, however, a limited re-audit of the client may be required to effectively close out the major concerns prior to certification being recommended.

The Certification Assessment ends with the delivery of the test report to the Certification Body and to the Radio Provider.

#### 4.3.1.4 Issue of Certificate

Upon reviewing the Test Lab's report and recommendation, the Certification Body can issue a certificate for the SDR stating the SDR adhere and aligns to SCA requirements. This serves as public evidence the SDR has been successfully assessed by an independent body.

# 5 SCA Certification Specifics

## 5.1 The SCA Specification

The SCA 2.2.2 as published by the U.S. DoD Joint Program Executive Office (JPEO) of the Joint Tactical Radio System (JTRS) was developed to assist in the development of Software Defined Radio (SDR) communication systems.

The SCA 2.2.2 specification has been adopted by the Wireless Innovation Forum (Reference 1) and can be used for International activities.

The SCA is not a system specification but an implementation independent set of "rules" that confine and restrict the design of "communication" systems. Although the SCA was developed for the US market, the SCA was intended to becoming a self-sustaining standard, where a wide cross-section of industry is invited to participate in the development and validation of the SCA.

## 5.2 SCA Certification

SCA Certification is awarded after the SDR under test successfully completes and passes a particular and specific set of verification and validation tests to ensure the SDR abides to the SCA specification (for additional explanation on the SCA Certification Process, please refer to Section 4.0 Generic Certification Process).

There are three (3) distinct units for SCA testing. SCA units, and requirements within units, that are applicable to a particular SCA product are determined by the Certification Body. The three possible units for SCA testing are as follows:

- Operating Environment (OE) Requirements of the SCA
- Applications or Waveform (WF) Requirements of the SCA
- Application Programming Interface (API) Requirements of the SCA

Each distinct unit is describes in the following sections.

### *5.2.1 SCA Operating Environment (OE) Certification*

The following shall apply for certification of an SCA Operating Environment:

- Specific SCA requirements that are applicable to the Operating Environment;
- SCA criteria or behavioral characteristics that are relevant for portability and apply within the Operating Environment;
- Country specific SCA requirements that apply within the respective country

SCA Operating Environment requirements can be identified within the OE that are part of, and interact with, the Core Framework of the SCA. This includes, but is not limited to, the *DomainManager*, the *DeviceManager*, the *Devices*, and *Services* to name a few.

### *5.2.2 SCA Application Certification*

The following shall apply for the certification of an SCA Application:

- Specific SCA requirements that are applicable to the Application or Waveform;
- SCA-specific criteria and/or behavioral characteristics which are relevant within the Application or Waveform;
- Country-specific SCA Application requirements that apply within the respective country

SCA Application requirements can be identified within the SCA that are part of an external Application, but communicates with the Core Framework.

### *5.2.3 SCA Application Programming Interface (API) Certification*

An SCA Application may implement one or more SCA APIs. Certification of these APIs is part of, but distinct from, the certification of the SCA Application as a whole (which focuses on common criteria). Generally, requirements are grouped by the APIs implemented by the Application, with applicable requirements within each group being determined by the Certification Body.

The following shall apply for the certification of APIs implemented as part of an Application or Waveform:

- Concentrate on criteria which are relevant for portability;
- Use as much of published US material as possible;
- Interpret and tailor for international purpose

It is recommended to start with the most recent version of the SCA APIs (currently Release 1.3), which includes an introduction to the Standard APIs (see also Reference 1). Although this is a US Department of Defense (DoD) Government document, it has been officially released, and contains the required "Distribution Statement A", indicating the document is for public consumption. This document describes the role, format, and design patterns of the public APIs.

## 5.3 Evaluating Compliance

Compliance to the SCA Specification requires an SDR product meet all applicable SCA requirements identified within the scope of the specification. SDR products are submitted to the Test Lab Body for compliance verification. Results of that compliance verification are submitted to the Certification body for evaluation.

## 5.4 SCA Test Procedures

The Test Lab will use resources and/or solutions that enable the Test Lab to properly verify and validate compliance of an SDR to the SCA.

The Test Lab can use Test Procedures that provide the basic instructions how to verify and validate specific SCA Requirements. Test procedures are detailed test descriptions that explain how to verify specific SCA requirements.

The Certification Criteria, derived from the standard, will be the basis for the Test Procedures.

Test procedures and test tools that define the verification and validation of SCA requirements must be defined and developed.

## 5.5 SCA Test Tools and Test Platforms

Automated test tools provide the benefit of efficiently and effectively conducting SCA compliance for the SCA Test Lab body. Utilizing Test Suite tools is an effective solution to lowering the cost of conducting SCA Compliance. It's widely understood Test Suite tools decrease the amount of test time, and reduces the amount of errors.

Therefore, the SCA Test Lab is encouraged to incorporate the use of SCA verification and validation Test Suite tools (software and platforms).

It is the responsibility of the Test Suite Developers to design and develop automated SCA Test Suite tool applications for industry. Under this scenario, it is the Definition Body which develops the requirements for software Test Suite that must align to the SCA requirements.

Test Suite Developers may acquire test software and/or platforms from 3rd Party Developers. Any third party software tool must be approved by the Accreditation body compliance of the requirements.

Test Suites, such as JTAP, allow for the inclusion of custom implementations. They are an example of how the Test Suite Developer may implement the test methods required by a specific certification criterion, which may deviate from the implemented criteria. The Test Suite Developer should check the feasibility to implement such a specialized test mechanism in the existing tool. The implementation of these custom test methods should also be validated by the Definition Body.

Test Platforms should be able to support the basic elements of the Operating Environment, e.g. CORBA communication, file system, or Naming Service. They should have sufficient resources to be able to host more than one waveform simultaneously and provide for communication of modulated data between waveforms.

# 6 Personas

A persona is a representation of goals and behaviors that act as an interested party within the SCA arena. In most cases, personas are synthesized from data collected from interviews with users. They are captured in the following description that includes behavior patterns, goals, skills, attitudes, and environment, with a few fictional personal details to make the personas a realistic character. For each product, more than one persona is usually created, but one persona should always be the primary focus for the design.

## 6.1 Specification Body

The Specification Body is mainly responsible for developing and maintaining radio requirements. The specification may be developed by a Standards Developing Organization (in this case it is called a standard) or alternatively in a less formal way by other providers of specifications.

There may also be a reference to existing standards - i.e., SCA Specifications - in entirety or in part, or augmenting where applicable, for a specific application need e.g. specific National interests.

This section details two (2) possible Specification Bodies that contain two distinct responsibilities. In each case, the responsibilities are detailed.

### *6.1.1 Specification Body #1 (Standards Development Organization)*

The Specification Body #1 is a recognized Standards Development Organization (e.g. OMG, or ETSI), where a specification is developed or adopted and converted into a standard according to recognized standards development rules.

During the *Certification Preparation Phase* the Standard Development Organization (SDO – a.k.a. Standard Body) will be involved in defining the applicable Certification Criteria.

### *6.1.2 Specification Body #2 (Misc. Specification Provider)*

The Specification Body #2 is an organization, producing the specification e.g. for procurement purposes (e.g. JPEO). Often the specification is not open. In some cases the specification is an input for Specification Body #1, who will create a standard out of it.

**Table 3: Specification Bodies**

| | Specification Body #1 | Specification Body #2 |
|---|---|---|
| **Goals** | Create and maintain a standard under its own control which can happen in the following ways:<br><br>**Horizontal Convergence of the Standard**<br><br>Several specifications (still maintaining their own identity) can horizontally converge to a single Worldwide Recognized Standard in order to achieve a stable, agreed and unique specification to be adopted by the community.<br><br>**Vertical Scalability of the Standard**<br><br>The vertical convergences imply the possible extendibility of the specification to various application fields that could require different levels of compliance with the basic specification, for example through definition of profiles. | Deliver a specification for certification purpose |
| **Tasks** | Create and maintain the standard, horizontal Convergence of the Standard, vertical Scalability of the Standard, provide an input for the certification process, provide certification support.<br><br>Hereafter, it is quoted a list of different activities that the standard body can play also when interacting with other personas.<br><br>• SDO can endorse a Technical Specification already developed "as it is" or SDO can develop the Specification which is to be issued as a Standard once consolidated, following the Standard Body makes the Technical specification(s) to be standardized converge, in accordance to the procedure foreseen in the Standard Development Organization (SDO)<br>• SDO may take part in the test definition phase interacting with the Definition Body. The SDO checks that the elaborated criteria and standard/requirements interpretation made by the Definition body fulfill and are coherent with the original specification. | Create and maintain the specification, provide an input for the certification process |

| | Specification Body #1 | Specification Body #2 |
|---|---|---|
| | • The SDO does not directly interact with the definition body in elaborating criteria and standard/requirements interpretation but just receive periodical reports on them. | |
| **Customers** | Definition Body, Test Suite Developer, or Test Lab | Definition Body, Test Suite Developer, or Test Lab |
| **Suppliers** | Industry, Procurement organizations, Miscellaneous | None |
| **Finance Flow** | In-flow = Definition Body, Test Suite Developer, Test Lab (Selling Standards)<br><br>Out-flow = None | In-flow = None<br><br>Out-flow = None |
| **Information and Material** | In-flow = Specifications from Industry, procurement authorities and others<br><br>Out-flow = Standards to Definition Body, Test Suite Developer, Test Lab, & Radio Provider | In-flow =Inputs for specification from Industry<br><br>Out-flow = Specification to Definition Body, Test Suite Developer, Test Lab, & Radio Provider |

## 6.2 Radio Providers

The task of the radio provider is to develop and sell either complete radios (platform, waveform and auxiliary items) or parts (e.g. just the platform). The radio provider may have other capabilities like development of test tools or self evaluation. These additional capabilities are handled in the respective sections e.g. Test Lab #2 (Radio Provider).

### *6.2.1 Radio Provider #1 (Development Contractor)*

Radio Provider #1 receives development contracts from a government Procurement Entity to research, develop and produce SCA-compliant SDRs. It receives development money from the PA, as well as sells finished radios to its national defense/public safety customers. Its customers require that the radios they purchase be SCA-compliant. Certification is initiated and driven by the procurement entity.

### *6.2.2 Radio Provider #2 (Own Funded National Delivery)*

Radio Provider #2 funds its own development of SCA-compliant SDRs. It sells finished radios to its national defense/public safety customers. Its customers require that the radios they purchase be SCA-compliant.

### *6.2.3 Radio Provider #3 (Export Business with Local Participation)*

Radio Provider #3 wants to sell radios to customers in other countries. Its customers require that:

- The completed radios meet its specs
- The radios they purchase be SCA-compliant.

A variant of this might be that local content in the development of the radio. In that case 3rd Party SW suppliers would be involved and are shown below as a (variant)

**Table 4: Radio Providers**

| | Radio Provider #1 (Development Contractor) | Radio Provider #2 (Own Funded National Delivery) | Radio Provider #3 (Export Business with Local Participation) |
|---|---|---|---|
| **Goals** | Provide SCA based radios to satisfy procurement requirements | Provide SCA based radios to satisfy demand as a direct purchase | Provide SCA based radios to satisfy demand as a direct purchase |
| **Tasks** | Radio development based on SCA standards and test procedures to produce a certified SCA compliant implementation | Radio development based on SCA standards and test procedures to produce a certified SCA compliant implementation and Evaluation of SCA and Application Programmer Interfaces (APIs) implementation for compliance | Radio development based on SCA standards and test procedures to produce a certified SCA compliant implementation.<br><br>Evaluation of SCA and Application Programmer Interfaces (APIs) implementation for compliance (see Section 6.8.2)<br><br>(variant) Integrate 3rd party (local) SCA compliant WF or WF components (Requires the delivered components be certified) |

| | Radio Provider #1 (Development Contractor) | Radio Provider #2 (Own Funded National Delivery) | Radio Provider #3 (Export Business with Local Participation) |
|---|---|---|---|
| **Customer** | Procurement Entity | Procurement Entity | Procurement Entity or Certification Body |
| **Suppliers** | Procurement Entity or Certification Body | Definitions Body, Specification Body, Test Suite Developer, or Certification Body | Specification Body, Definitions Body, (variant) Third Party Software Developer, or Certification Body |
| **Finance Flow** | In-flow = Procurement Entity<br><br>Out-flow = None | In-flow = Procurement Entity<br><br>Out-flow = Accreditation Body, Specification Body, Test Suite Developer, or the Test Lab | In-flow = Procurement Entity<br><br>Out-flow = Certification Body or (variant) Third Party SW Developers |
| **Information & Material Flow** | In-flow = of Program Requirements, Standards Specification, Test Suite (test tools, test procedures, test form), and Test Report and Certification<br><br>Out-flow = of Work Product to be certified and Radio Product Delivery | In-flow = of Radio capability requirements, Standards Specification, Certification Criteria, Test Suite or Certificate.<br><br>Out-flow = of Radio Product Deliverable | In-flow = of Radio capability requirements, Standards Specification, Certification Criteria, Certificate, or (variant) Components for integration into the radio<br><br>Out-flow = of Radio deliverable or (variant) Component Requirements |

### 6.3 Accreditation Body

The Accreditation Body is the organization that ensures the test processes in which certification of competency, or creditability is present. The process is quantifiable and acceptable for properly verifying and validating SCA requirements.

The Accreditation Body provides accreditation to the Test Labs and the Test Suite (consisting of the test tools, test procedures and test forms). An Accreditation Body can be a national or multinational organization as well as an independent, non-governmental based organization (private company or not-for-profit). There can potentially be an Accreditation Body in each country and for each Body, it is expected that the Accreditation Body has sufficient domain expertise to perform their functions for their respective country. However it is possible they could rely on another organization (such as the Definition Body) for the subject matter expertise. It's plausible the Accreditation Body can be the same entity as the Test Suite Developer or a

different entity. The accreditation delivered will authorize the particular laboratory to run all necessary Test Procedures, and generate a Test Report upon the conclusion of all tests. It is the responsibility of the Test Lab and/or Test Tool Provider to maintain their accreditation.

Test Lab Accreditation is a certification of competency, authority, or credibility of a Test Lab. The accreditation process ensures the Test Lab processes and practices are acceptable, typically meaning that they are competent to test third parties, behave ethically, and employ suitable quality assurance. The accreditation delivered will authorize the particular laboratory to run the Test Specification and provide the Test Report to the Certification Body.

In the case of Self-Evaluation, a Radio Provider, or SDR manufacturer can serve as a Test Lab. Self-Evaluation of SCA compliance provides for both cost and time-to-market efficiencies in addition to facilitating test laboratory capacity. However, the drawback to this case is self-evaluation test procedures can be stale or outdated, and/or possibly over look or misinterpret SCA requirements.

Test Suite Accreditation is a certification that a Test Suite produces proper results in keeping with the Test Procedure and Certification Criteria. An accreditation is not of a Test Suite Developer, it is for a specific Test Suite. The Accreditation delivered will provide assurance to users of the Test Suite and Certification Bodies that the Test Suite executes tests according to the Test Procedure. The Test Suite Developer will be responsible for maintaining the accreditation of the tool as newer versions are developed and utilized.

### *6.3.1 Accreditation Body #1 (International)*

The Accreditation Body #1 is defined as an International organization or entity having the capacity and capability to certify the competency of a test lab or test suite that is acceptable from an International perspective.

### *6.3.2 Accreditation Body #2 (Coalition)*

The Accreditation Body #2 is defined as an Organization or Entity comprised of individual Countries acting on the behalf of more than one country. This specific body has the capacity and capability to recognize and certify the competency of a test lab and/or test suite that is acceptable to the Coalition.

### *6.3.3 Accreditation Body #3 (National)*

The Accreditation Body #3 is defined as a National organization or entity having the capacity and capability to certify the competency of a test lab and/or test suite as it pertains and directed specifically for the respective country's IP.

**Table 5: Accreditation Bodies**

| | Accreditation Body #1 (International Body) | Accreditation Body #2 (Coalition Body) | Accreditation Body #3 (National Body) |
|---|---|---|---|
| **Goals** | Validate the Test Lab is qualified to execute the Test Procedure and is suited for evaluation on international level and Validate that a Test Suite is suited to achieve the certification targets | Validate the Test Lab is qualified to execute the Test Procedure and is suited for evaluation on coalition level, and Validate that a Test Suite is suited to achieve the certification targets on coalition level. | Validate the Test Lab is qualified to execute the Test Procedure and is suited for evaluation on national level, and validate that a Test Suite is suited to achieve the certification targets on national level |
| **Tasks** | Establish accreditation criteria, have subject matter experts (SMEs) travel to test lab and test developer or perform inspections and issue the accreditation document locations | Establish accreditation criteria on coalition level, Have subject matter experts travel to test lab and test developer locations, or Perform inspections and issue the accreditation document. | Establish accreditation criteria, have subject matter experts travel to test lab and test developer locations, and Perform inspections and issue the accreditation document. |
| **Customer** | Test Lab, Radio Providers, or Test Suite Developer. | Test Lab, or Test Suite Developer | Test Lab, or Test Suite Developer |
| **Suppliers** | Specification Body, Definition Body, Test Suite Developer, or Definition Body as Test Suite Evaluator | Specification Body, Definition Body, Test Suite Developer, or Definition Body as Test Suite Evaluator | Specification Body, Definition Body, Test Suite Developer, or Definition Body as Test Suite Evaluator. |
| **Finance Flow** | In-flow = Test Lab or Test Suite Developer<br><br>Out-flow = None | In-flow = Test Lab, or Test Suite Developer<br><br>Out-flow = None | In-flow = Test Lab or Test Developer<br><br>Out-flow = None |
| **Information & Material Flow** | In-flow = of Test Lab info and credentials, Specification, Certification Criteria, Test Suite, or Test Suite evaluation.<br><br>Out-flow = of Lab Accreditation, or Test Suite Accreditation | In-flow = of Test Lab info and credentials, Specification, Certification Criteria, Test Suite, or Test Suite evaluation<br><br>Out-flow = of Lab Accreditation, or Test Suite Accreditation. | In-flow = of test Lab info and credentials, Specification, Certification Criteria, Test Suite, or Test Suite evaluation.<br><br>Out-flow = of Lab Accreditation or Test Suite Accreditation |

## 6.4 Third Party Software Developer

A Third Party Software Developer is an entity that supplies COTS software usually to the main SDR contractor. The main SDR contractor often is a radio provider, who has the responsibility for the whole radio system.

### *6.4.1 Third Party Software Developer #1 (SW not subject to SCA certification)*

Third Party software developer #1 provides COTS software that is not subject to SCA Certification (e.g. SCA development and deployment tooling).

### *6.4.2 Third Party Software Developer #2 (SW subject to SCA certification)*

Third Party software developer #2 provides COTS software that could be subject to SCA Certification (e.g. RTOS, middleware, Core Framework, SCA waveform software, SCA platform software)

**Table 6: Third Party Software Developers**

| | Third Party Software Developer #1 (SW not subject to SCA certification) | Third Party Software Developer #2 (SW subject to SCA certification) |
|---|---|---|
| **Goals** | Provide COTS software to run radio internal or external, that does not need to be SCA certified | Provide certified COTS software that can be used in the development of SCA certified applications |
| **Tasks** | Supply one of the SDR contractors with COTS software | Supply one of the SDR contractors with SCA certified COTS software |
| **Customer** | Radio Integrator, Radio Provider, Primary waveform software provider, or Primary platform software provider. | Radio Integrator, Radio Provider, Primary waveform software provider, Primary platform software provider or Test Suite Developer |
| **Suppliers** | none | Certification Body, or Test Suite Developer |
| **Finance Flow** | In-flow = from Radio Integrator, Radio Provider, Primary waveform SW provider, or Primary platform SW provider<br><br>Outflow = None | In-flow = from Radio Integrator, Radio Provider, Primary waveform SW provider, Primary platform SW provider or Test Suite Developer<br><br>Out-flow = to Certification Body, or Test Suite Developer |
| **Information & Material Flow** | In-flow = None<br><br>Out-flow = SW products | In-flow = of Standards, Test Suite, or Certificate<br><br>Out-flow = of Certified SW Components |

## 6.5 Procurement Entity

Procurement Entity #1 is an organization that is responsible for the acquisition of goods and/or services which allows the organization to enter contracts based upon acceptable notions of commercial reasonableness. The reasonableness consists of negotiating the best possible cost to meet the needs of the purchaser in terms of quality and quantity, time and location. The following sub-sections, describe different and possible Procurement Authorities.

### *6.5.1 Procurement Entity #1: (Large entity with the wherewithal in funding)*

Procurement Entity #1 consists of a government agency within a country with deep experience designing, development and testing Software Defined Radios (SDR). Under this scenario, this Procurement Entity has funded more than one SCA-compliant SDR R&D programs in its country.

The Procurement Entity in this persona enters into a contract with Radio Providers specifically requesting Software Defined Radios to align and abide to the SCA.

A precondition or requirement to Radio Providers, by the Procurement Entity #1, is their SDRs must be SCA based. To ensure SDRs are designed and aligned with SCA requirements, the Procurement Entities #1 & #2 must receive independent analysis and information from the Certification Body indicating the level of conformity of their SDR to the SCA. This information provides the Procurement Entity #1 with a level of confidence that the SDRs meet the requirements of the contract.

### *6.5.2 Procurement Entity #2: (Small to medium entity with limited financial resource)*

It is plausible that Procurement Entity #2 can also be a government agency within a country. However, under this scenario it's assumed the respective country does not have deep experience of designing, developing and testing Software Defined Radios, but has a limited knowledge of SDR and the SCA. It is plausible Procurement Entity #2 is in the beginning phase of SDR design and development.

The Procurement Entity within this country might not have the desire to fund a complete R&D SDR program. This country prefers limited involvement in the development of SCA based SDR that it purchases (e.g., development of a national waveform, specific security requirements, etc.).

Radio Providers are the only customers for the Procurement Entities #1 & #2. The Procurement Entity is primarily concerned with taking ownership of SCA based SDRs.

A precondition or requirement to Radio Providers, by the Procurement Entity #1, is their SDRs must be SCA based. To ensure SDRs are designed and aligns with SCA requirements, the Procurement Entities #1 & #2 must receive independent analysis and information from the Certification Body indicating the level of conformity of their SDR to the SCA. This information provides the Procurement Entity #1 with a level of confidence the SDRs meets the requirements of the contract.

### *6.5.3 Procurement Entity #3: (Entity with limited financial resources)*

Procurement Entity #3 is a (A) government agency of a country that does not have the budget to fund development of its own SCA-compliant SDRs, or (B) an agency of any country that desires to simply buy SCA-compliant SDRs.

### *6.5.4 Procurement Entity #4: (Corporate entity funding development)*

Procurement Entity #4 is a radio provider that is buying software components for its radios.

In this role the radio provider acquires software to support SCA compliant radio development. Software purchased by the radio provider is not independently resold. It is either integrated into a radio or other product or used in support of product development.

The radio provider as a Procurement Entity #4 is interested in the following types of 3rd party software suppliers:

- Software Component providers for items such as Core Frameworks, Radio Devices/Service, or network protocol stacks.
- Providers of tools to aid in the development and certification of SCA compliant radios. Types of tools that a radio provider may purchase would include:
    - Component modeling tool that generate SCA compliant code (i.e. Component XML definition files).
    - Tools that can be used in the self evaluation of a radio providers SCA based Operating Environment

As part of the contract terms, the radio provider procurement entity would require the supplier to provide proof of SCA compliance for the products that are being delivered. To accomplish this, there must be an independent agency that will certify the products delivered by a 3rd party software supplier are SCA compliant.

**Table 7: Procurement Entities**

| | Procurement Entity #1<br><br>(Large entity with the wherewithal in funding) | Procurement Entity #2<br><br>(Small to medium entity with limited financial resource) | Procurement Entity #3<br><br>(Entity with limited financial resources) | Procurement Entity #4<br><br>(Corporate entity funding development) |
|---|---|---|---|---|
| **Goals** | Procure SCA compliant Software Defined Radios (SDR) for its respective country. | The goal of the Procurement Entity #1 & #2 is to attain Software Defined Radios (SDR) for its respective country. | Purchase radios that are according the SCA standard and avoid the need to establish own certification infrastructure. | Purchase components that are according the SCA standard and avoid the need to care about certification |
| **Tasks** | Enter into contracts with Radio Providers to supply its government with SCA based SDRs. | Enter into contracts with Radio Providers to supply its government with SCA based SDRs. | Place the contract to the radio supplier. | Place the contract to the component supplier |
| **Customer** | Radio Providers | Radio Providers | None | None |
| **Suppliers** | Certification Body | Certification Body | Radio Providers | Component Supplier |
| **Finance Flow** | In-flow = None<br><br>Out-flow = to Radio Providers | In-flow = Funding for the Procurement Entity #1 & #2 (originates from the respective government).<br><br>Out-flow = As the Procurement Entity #1 & #2 enters into contract with a Radio Provider to provide SCA based SDRs. | In-flow = None<br><br>Out-flow = to radio procurement including cost for certification | In-flow = None<br><br>Out-flow = to component procurement including cost for certification |

| | Procurement Entity #1<br><br>(Large entity with the wherewithal in funding) | Procurement Entity #2<br><br>(Small to medium entity with limited financial resource) | Procurement Entity #3<br><br>(Entity with limited financial resources) | Procurement Entity #4<br><br>(Corporate entity funding development) |
|---|---|---|---|---|
| **Information & Material Flow** | In-flow = of Purchased radio products or Certification.<br><br>Out-flow = None | In-flow = Customers of the Procurement Entity #1 & #2 are Radio Providers who have the expertise to fulfill the contract stipulations and requirements.<br><br>Out-flow = The Certification Body provides the Procurement Entity #1 & #2 with a report and a certification determining if their delivery of SDRs meet the SCA requirement. | In-flow = of Purchased radio products or Certification.<br><br>Out-flow = None | In-flow = of Certified components.<br><br>Out-flow = of type of certification required |

## 6.6 Definition Body

As it is the responsibility of the Specification Body to issue and maintain the standard, the role of the Definition Body is to interpret the standard, provide clarifications and guidance, if necessary, and provide SCA requirements for test certification criteria. As such, the Definition Body must have significant domain expertise.

It is the responsibility of the Definition Body to define and describe the meaning of a term (a word, phrase or set of symbols) or requirement of a standard or a type of thing. A term and/or requirement may have many different senses or meaning.

The difficulty of managing definitions is the need to use other terms that are already understood or whose definitions are easily obtainable. Therefore, the Definition Body has the task of interpreting, defining and providing guidance to the community, regarding requirements of the standard.

The Definition Body is also responsible to provide guidance on methodologies or process or steps on how to verify and validate requirements of the standard. This is known as Test Certification Criteria. Test Certification Criteria are defined guidance or "sign posts" that provide an understanding to verify and validate requirements of the standard. By providing Test Certification Criteria, it defines a common reference or common understanding for all SDR manufacturers which paves the way for consistent and transparent verification and validation for requirements of the standard.

Customers of the Definitions Body require the need to understand SCA requirements and industry wide guidance for interpretation of SCA requirements. Customers of the Definition Body also consist of folks that need Test Certification Criteria. This information will help them understand the methods used to validate SCA requirements.

On the other hand, the Definition Body is dependent on the SCA Specification. To successfully accomplish its tasks, the Definition Body requires a stable and released SCA Specification from the Specification Body.

### *6.6.1 Definition Body #1: (Government Standards Organization)*

Definition Body #1 is a government agency within a country having the desire to fund a complete R&D SDR program (e.g., development of a national waveform, specific security requirements, etc.).

The Definition Body under this scenario provides guidance on defining requirements, interpretation of requirements for their specific SDR program based upon the SCA Specification, which originates from the Specification Body.

**Table 8: Definition Bodies**

| | Definition Body #1 |
|---|---|
| **Goals** | The role of the Definition Body is to interpret the Standard, provide clarifications and guidance. |
| **Tasks** | The task of the Definition Body is to evaluate and assess the SCA Specification and provide a clear and concise interpretation of all SCA requirements. Within this scope, the Definition Body will also provide clear Test Certification Criteria for all SCA requirements. |
| **Customer** | Radio Providers, Third Party Software Developers, or Test Suite Developers. |
| **Suppliers** | Standards Body |
| **Finance Flow** | In-flow = the Definition Body, Radio Providers, Test Tools Developers, Test Suite Validators, and Third Party Software developers<br><br>Out-flow = the Definition Body |
| **Information & Material Flow** | In-flow = of Radio Providers, Test Tools Developers, Test Suite Validators, and Third Party Software Developers, & Specification Body<br><br>Out-flow = Test Suite Developers |

## 6.7 Test Suite Developer

The Test Suite Developer will develop the Test Suite for use by the Test Labs. The Test Suite shall be based on the certification criteria that the Definition Body has defined.

Test Suite Developer is an entity (government agency, private company, not-for-profit, etc.), which develops and licenses the actual SCA-compliance testing software, tools, procedures, processes, reports etc. (the Test Suite). The Test Suite tests radios and/or source codes to the standards set by the Standards Bodies. The Test Suite Developer will maintain the Test Suite, fixing bugs, adding features and upgrading the Test Suite based on feedback from the Test Labs and the Radio Providers. The Test Suite Developer will be responsible for configuration management, including managing versions of the Test Suite as well as ensuring that the Test Suite works on the required target platforms. A relationship between the Test Suite Developer and Test Labs is envisaged, since the tests shall be developed in compliancy with the tools, instruments, and people available in the Test Lab; further, the Test Suite Developer should control also the correct execution of the tests to be sure that the overall effort of the conceived test does not result in too much testing expense.

The Test Suite Developers would interact with the Definition body, in order to be sure that the tests would be developed with full compliancy to the Standard.

Test Suite Developers could also procure test software and platforms from 3rd Party Developers. This would allow the Test Suite Developers to benefit from the use of commercial test tools and/or re-use of common SCA test tool technology.

### *6.7.1 Test Suite Developer #1: (Government agency)*

Test Suite Developer #1 is a government agency that is funded by a Procurement Entity of a country to develop Test Procedures and Test Tools.

### *6.7.2 Test Suite Developer #2: (Self funded developer)*

Test Suite Developer #2 is private company that self-funds the development of its Test Suite (Test Procedures, Test Tools and Test Forms) which can be licensed commercially to third parties.

### *6.7.3 Test Suite Developer #3: (Radio Provider)*

Test Tool Developer #3 is Radio Provider that self-funds the development of its own Test Procedures and Test Tools.

**Table 9: Test Suite Developers**

| | Test Suite Developer #1 (Government agency) | Test Suite Developer #2 (Self funded developer) | Test Suite Developer #3 (Radio Provider) |
|---|---|---|---|
| **Goals** | Provide the Test Suite for certification and pre-certification. | Provide commercially licensed Test Suite for certification and pre-certification. | Provide develop Test Suite, possibly for self certification and pre-certification. |
| **Tasks** | Develop the Test Suite based on Certification Criteria and Test Procedures. | Develop Test Suite based on Certification Criteria. | Develop Test Suite based on Certification Criteria. |
| **Customer** | Testing Labs, Radio Providers, Waveform Developers, or Third Party Software Developers | Test Labs, Radio Providers, Waveform Developers, or Third Party Software Developers | Radio Provider |
| **Suppliers** | Definition Body, or Accreditation Body | Definition Body, or Accreditation Body | Definition Body, Accreditation Body or Procurement |
| **Finance Flow** | In-flow = from Test Tools Developer<br><br>Out-flow = None | In-flow = from Test Labs, Radio Providers, Waveform developers, Third Party Software Developers<br><br>Out-flow = to Accreditation Body | In-flow = None<br><br>Out-flow = to Accreditation Body |
| **Information & Material Flow** | In-flow = of Certification Criteria, Accreditation Certificate<br><br>Out-flow = to Test Suite | In-flow = of Certification Criteria, Accreditation Certificate<br><br>Out-flow = of Test Suite | In-flow = of Certification Criteria, Accreditation Certificate<br><br>Out-flow = of Test Suite |

## 6.8 Test Lab

The Test Lab is a facility that provides controlled conditions to achieve reproducible test results and has the credibility to perform the tests. The test laboratory shall have accreditation for performing validations tests. It will use test procedures and test tools developed by the Test Suite Developer. The Test Lab also interacts with the Definition Body on clarifications and refinements of the Test Procedure and/or requirements.

Test Laboratories are accredited by the Accreditation Body. The Test Lab takes a radio and/or the source code and executes test procedures and determines compliance of the radio to the Test Procedures. The Test Laboratory may be a government entity, an independent entity or the testing laboratory of a Radio Provider. The Test Laboratory will provide feedback to the Test

Developer on the Test Procedures. The Test Laboratory will be responsible for maintaining its ongoing accreditation as a Test Laboratory. The Test Lab supplies a Validation Test Report to the Certification Body; it does not provide the certification.

### *6.8.1 Test Lab #1: (Government Test Lab)*

This is a Test Laboratory that is controlled by a national agency. It can provide test services for radios/software developed as part of procurement or independently developed.

### *6.8.2 Test Lab #2: (Radio Provider)*

This is a Test Laboratory that is an organization within a Radio Provider. It can provide test services for radios/software developed as part of procurement or independently developed. A Test Lab operated by a radio provider supports the Self-Evaluation for SCA Compliance model. It is not expected that a Radio Provider would perform validation testing for another Radio Provider.

### *6.8.3 Test Lab #3 (Independent Test Lab)*

This is a Test Laboratory that is an independent organization, not part of a government or Radio Provider. It can provide test services for radios/software developed independently or as part of procurement.

**Table 10: Test Laboratories**

| | Test Lab #1 (Government Test Lab) | Test Lab #2 (Radio Provider) | Test Lab #3 (Independent Test Lab) |
|---|---|---|---|
| **Goals** | Evaluate a radio or SW component for SCA Compliance | Provide Self-Evaluation capabilities for radio or SW component SCA Compliance | Provide evaluation capabilities to external entities for radio or SW component SCA Compliance |
| **Tasks** | Establish a lab to perform validation tests on the SCA Specification according to the Test Procedure, obtain Test Lab accreditation, execute the Test Procedure, or generate a Validation Test Report | Establish a lab to perform validation tests on the SCA Specification according to the Test Procedure, obtain Test Lab accreditation, execute the Test Procedure, or generate a Validation Test Report | Establish a lab to perform validation tests on the SCA Specification according to the Test Procedure, obtain Test Lab accreditation, execute the Test Procedure, and generate a Validation Test Report |
| **Customer** | Procurement Entity, Radio Providers, 3rd Party SW Developer, or Certification Body | Procurement Entity, 3rd Party SW Developer, or Certification Body | Procurement Entity, 3rd Party SW Developer, Radio Provider, or Certification Body |

| | Test Lab #1 (Government Test Lab) | Test Lab #2 (Radio Provider) | Test Lab #3 (Independent Test Lab) |
|---|---|---|---|
| **Suppliers** | Specification Body, Definition Body, Accreditation Body, or Test Suite Developer | Specification Body, Definition Body, Accreditation Body, or Test Suite Developer | Specification Body, Definition Body, Accreditation Body, or Test Suite Developer |
| **Finance Flow** | In-flow = from Procurement Entity, Radio Provider, or 3rd Party SW Developer<br><br>Out-flow = to Accreditation Body, or Test Suite Developer | In-flow = from Procurement Entity, 3rd Party SW Developer<br><br>Out-flow = to Accreditation Body, or Test Suite Developer | In-flow = from Procurement Entity, 3rd Party SW Developer, or Radio Provider<br><br>Out-flow = to Accreditation Body, or Test Suite Developer |
| **Information & Material Flow** | In-flow = of Standards Specification, Accreditation Criteria, Accreditation Certification, Test Suite, or Radio and/or SW to be validated<br><br>Out-flow = of Validation Test Report | In-flow = of Standards Specification, Accreditation Criteria, Accreditation Certification, Test Suite, or Radio and/or SW to be validated.<br><br>Out-flow = of Validation Test Report | In-flow = of Standards Specification, Accreditation Criteria, Accreditation Certification, Test Procedure, Test Report Forms, Test Tools, or Radio and/or SW to be validated<br><br>Out-flow = of Validation Test Report |

## 6.9 Certification Body

The Certification Body has the right to grant the certificate. The certification body has the authority to issue waivers for requirements that were not satisfied. This judgment is based on the criticality of the requirement and the deviation of performance from the specification. This typically would result in a certification with waivers. It is a national issue to decide which organization is the relevant Certification Body.

### *6.9.1 Certification Body #1: (International Body)*

This persona is performing certification according category 1 standards (open standards). It can be e.g. a European institution or an international forum.

### *6.9.2 Certification Body #2: (Coalition Body)*

This persona is performing certification according category 2 standards (coalition level standards). It can be e.g. a European institution or a closed forum.

### *6.9.3 Certification Body #3: (National Body)*

This persona is performing certification according category 3 standards (national level standards including national security). It will be a national institution.

**Table 11: Certification Bodies**

| | Certification Body #1 (International Body) | Certification Body #2 (Coalition Body) | Certification Body #3 (National Body) |
|---|---|---|---|
| **Goals** | Provide a formal certificate for products, which fulfill the requirements for certification without exposing confidential data of national, coalition or commercial concern | Provide a formal certificate for products, which fulfill the requirements for certification, without exposing confidential data of national or commercial concern | Provide a formal certificate for products, which fulfill the requirements for certification without exposing confidential data of commercial concern |
| **Tasks** | Check, whether the test report from the test lab recommends issuing a certificate, check other prerequisites for issuing the certificate, and issue the certificate and send it to the radio or component provider. | Check, whether the test report from the test lab recommends issuing a certificate, check other prerequisites for issuing the certificate, and issue the certificate and send it to the radio or component provider | Check, whether the test report from the test lab recommends issuing a certificate, check other prerequisites for issuing the certificate, and issue the certificate and send it to the radio or component provider |
| **Customer** | Radio or component provider | Radio or component provider | Radio or component provider |
| **Suppliers** | Test lab with accreditation | Test lab with coalition accreditation | Test lab with national accreditation |
| **Finance Flow** | In-flow = fees for certification<br><br>Out-flow = none | In-flow = Fees for certification<br><br>Out-flow = None | In-flow = Fees for certification<br><br>Out-flow = None |
| **Information & Material Flow** | In-flow = of Validation Test Report<br><br>Out-flow = of Certificate | In-flow = of Validation Test Report<br><br>Out-flow = of Certificate | In-flow = of validation Test Report<br><br>Out-flow = of Certificate |

# 7 Use Cases

This certification guide has identified five (5) possible use cases where the certification process is relevant:

- Use Case #1: National, Industry Driven Certification
- Use Case #2: Multinational Project
- Use Case #3: Government Sponsored
- Use Case #4: Developing Nation Purchase, Industry Driven Certification
- Use Case #5: Independent Industrial initiative or Procurement Authority Driven Certification

## 7.1 Use Case #1: National, Industry Driven Certification

### *7.1.1 Use Case Description*

In this use case, a national government purchases radios meeting their respective requirements, which includes SCA requirements and certification. While the SCA specification is referenced, it is not part of the contract. Financial funding is provided for the development of the radio to meet the specifications and/or for certification. The radio is being provided by a company in the same nation as the purchasing government.

The radio was developed using company funds and certification is done independently of the procurement. In the development of the radio, 3rd party content was incorporated (i.e. RTOS and middleware) which was not directly subject to SCA certification but will be certified as part of the radio. The radio provider self evaluated their radio for SCA compliance and submitted the results to the government for certification. As opposed to developing their own test procedures and tools, the radio manufacturer purchased those developed by a 3rd party commercial entity. As such both the radio supplier's evaluation lab and the test suite (test tools, procedures and forms) need to be accredited.

### *7.1.2 Personas Involved*

**Table 12: Use Case #1: Personas Interaction Table**

| Body | Persona # | Purpose |
|---|---|---|
| Specification Body | 2 | |
| Radio Provider | 2 | Funds its own development of SCA-compliant SDRs. It sells finished radios to its national defense/public safety customers. |
| Accreditation body | | National body representing the government |
| Third Party SW developer | 2 | This type of SW provider supplies COTS software that typically not subject to direct SCA Certification. |
| Procurement Entity | 2 | Nation does not have significant SCA-SDR knowledge and capabilities. |

| Body | Persona # | Purpose |
|---|---|---|
| Definition body | 2 | Independent organization not affiliated with the government purchasing the SW. |
| Test Suite Developer | 2 | The Test Suite Developer is a company that self-funds the development of SCA Test Procedures and SCA Test Tools. Doing so, the company generates revenue by licensing the software. |
| Test Laboratory | 2 | This is a Test Laboratory that is an organization within a Radio Provider. It can provide test services for radios/software developed as part of a procurement or independently developed. A Test Lab operated by a radio provider supports the Self-Evaluation for SCA Compliance model. |
| Certification body | 3 | This persona is a national institution, performing certification according category 3 standards (up to national level standards including national security). |

### *7.1.3 Pre-condition*

At the start of this scenario the Radio Provider has developed a radio providing an Operating Environment (OE) in accordance with the requirements specified in the SCA. The radio must be certified SCA compliant. SCA Specification is publically available

### *7.1.4 Basic flow of events*

1. Radio Provider develops SCA based SDR
2. Test Suite Developer obtains Certification Criteria from the Definition Body.
3. Test Suite Developer creates test tools and procedures based on the usage of the tools
4. Test Suite Developer gets the Test Suite accredited by the Accreditation Body
5. Radio Provider purchases test tools and procedures from the Test Provider
6. Radio Provider gets their Test Lab accredited by the Accreditation Body
7. Radio Provider performs Self Evaluation testing against the SCA Specification and presents test results to the Certification Body
8. Certification Body reviews test results and provides SCA Certification for the radio tested
9. Procurement Entity issues specification for radio purchase
10. Radio provider responds to request including proof of SCA certification for radio to be purchased.
11. Procurement Entity purchases radios

There are three sequences that happen in parallel in preparation for the certification and delivery of the SDRs. One preparation sequence is getting the process started and finished and is shown below.

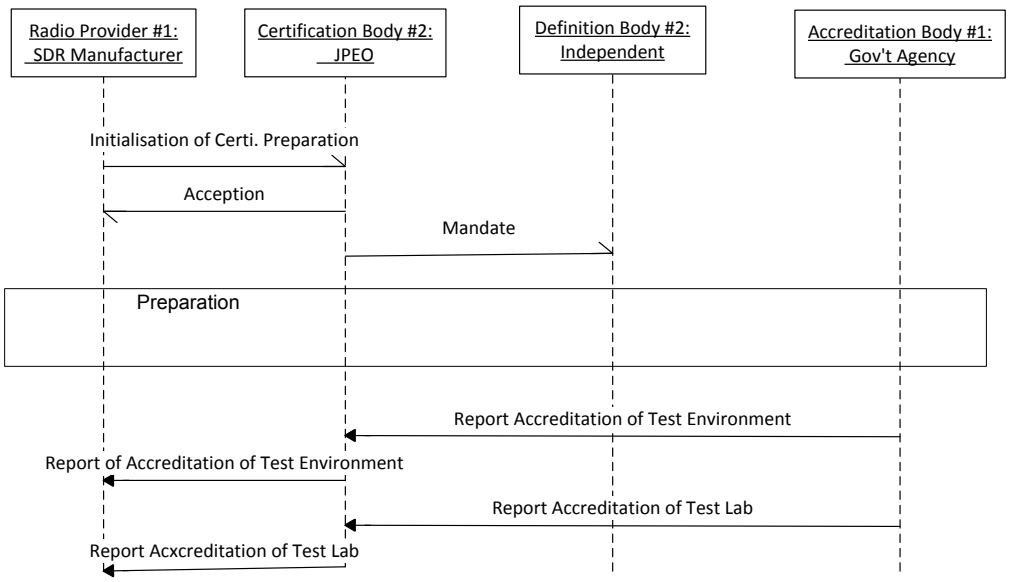


**Figure 5: National, Industry Driven UC - Preparation Phase - Initialization and Finalization**

Another preparation sequence is getting the Radio Providers Test Lab accredited and is shown below:

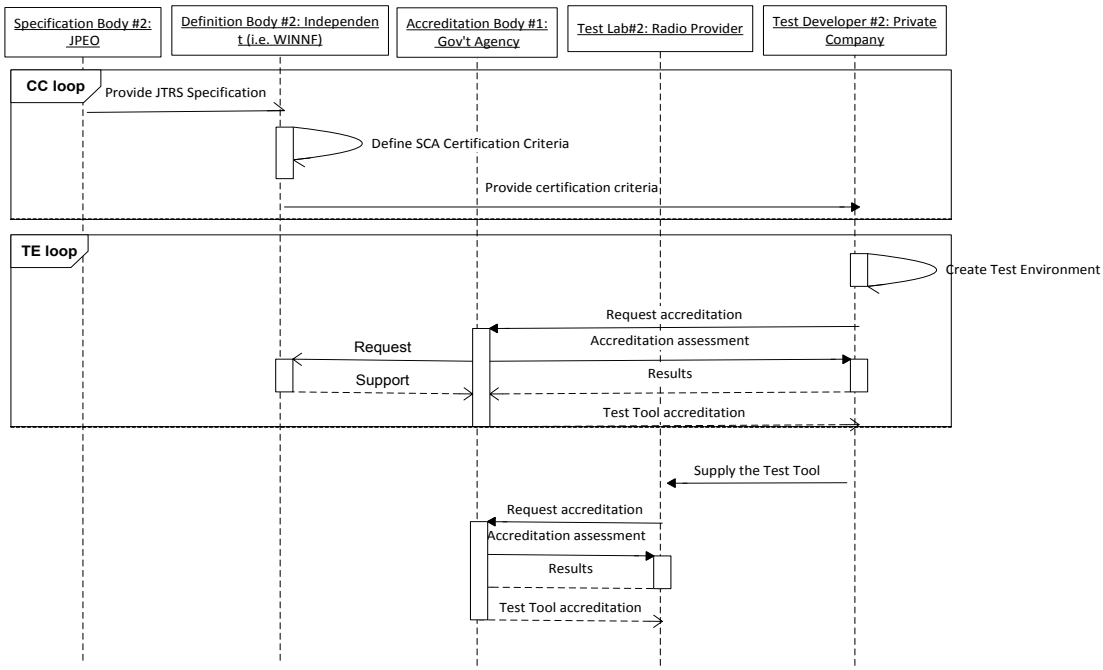


**Figure 6: National, Industry Driven UC - Preparation Phase - Test Lab View**

The third sequence that happens in preparation of certification and delivery is the development of the SDR by the Radio Provider. That sequence is shown next.

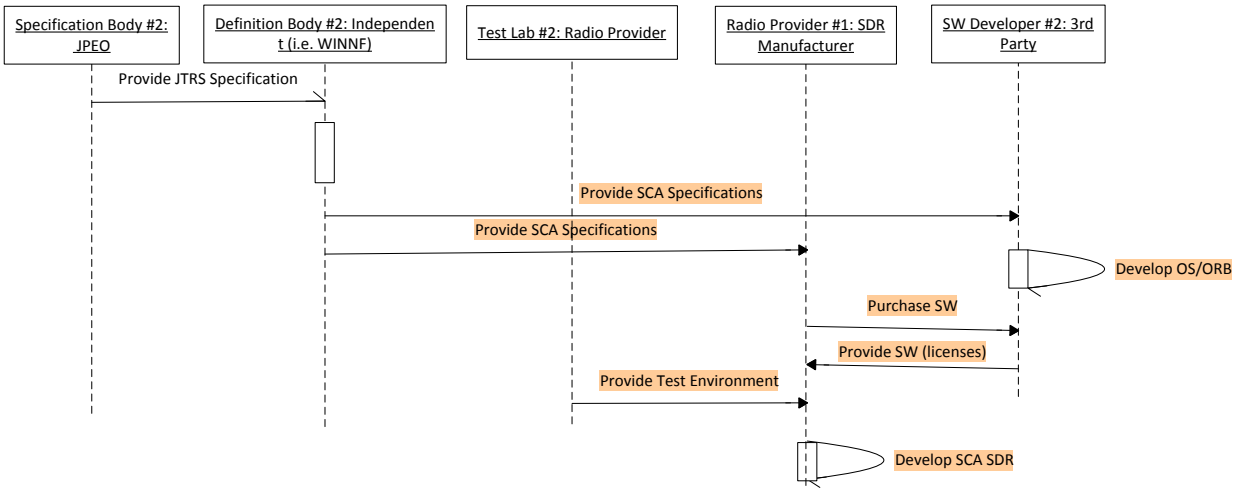


**Figure 7: National, Industry Driven UC - Preparation Phase - Radio Provider View**

Once both of the preparation phases are complete, the SDR is certified and delivered as the result of a Purchase request. This execution is shown here:

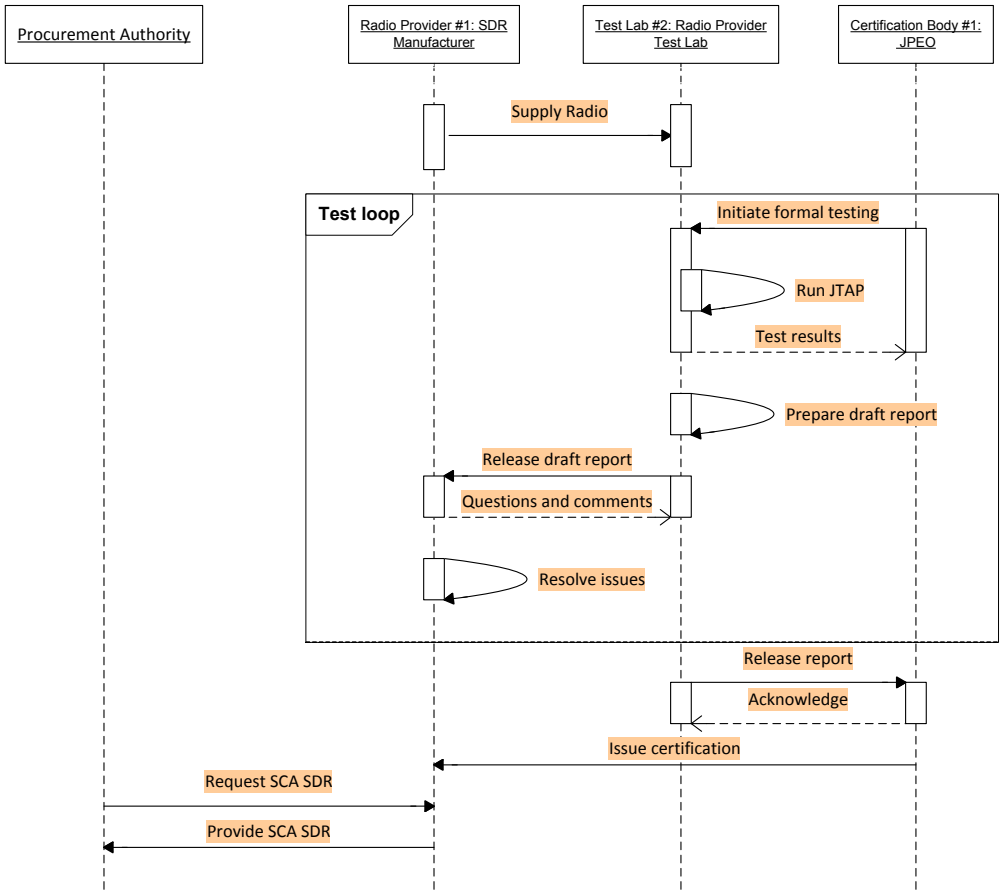


**Figure 8: National, Industry Driven UC - Execution Phase**

### *7.1.5 Post-conditions*

- Test Suite is accredited
- Test Suite Developer sells Test Suite license to the Radio Provider's Test Lab
- Radio Provider Test Lab accredited for SCA/API test evaluation
- Radio Provider receives SCA certification for the SDR
- Government Procurement Entity purchases SCA Certified SDRs from the Radio Provider

### *7.1.6 Financial Flow*

**Table 13: Use Case #1: Financial Flow Table**

| Body | Persona # | In Flows | Out Flows |
|---|---|---|---|
| Specification Body | 2 | None | None |
| Radio Provider | 2 | Procurement Entity | 3rd Party SW Developer<br><br>Test Suite Developer<br><br>Certification Body<br><br>Accreditation Body |
| Third Party SW developer | 2 | Radio Provider | |
| Procurement Entity | 2 | | Radio Provider |
| Definition body | 2 | None | None |
| Test Suite Developer | 2 | Radio Provider | |
| Test Laboratory | 2 | None | None |
| Certification body | 3 | Radio Provider | |

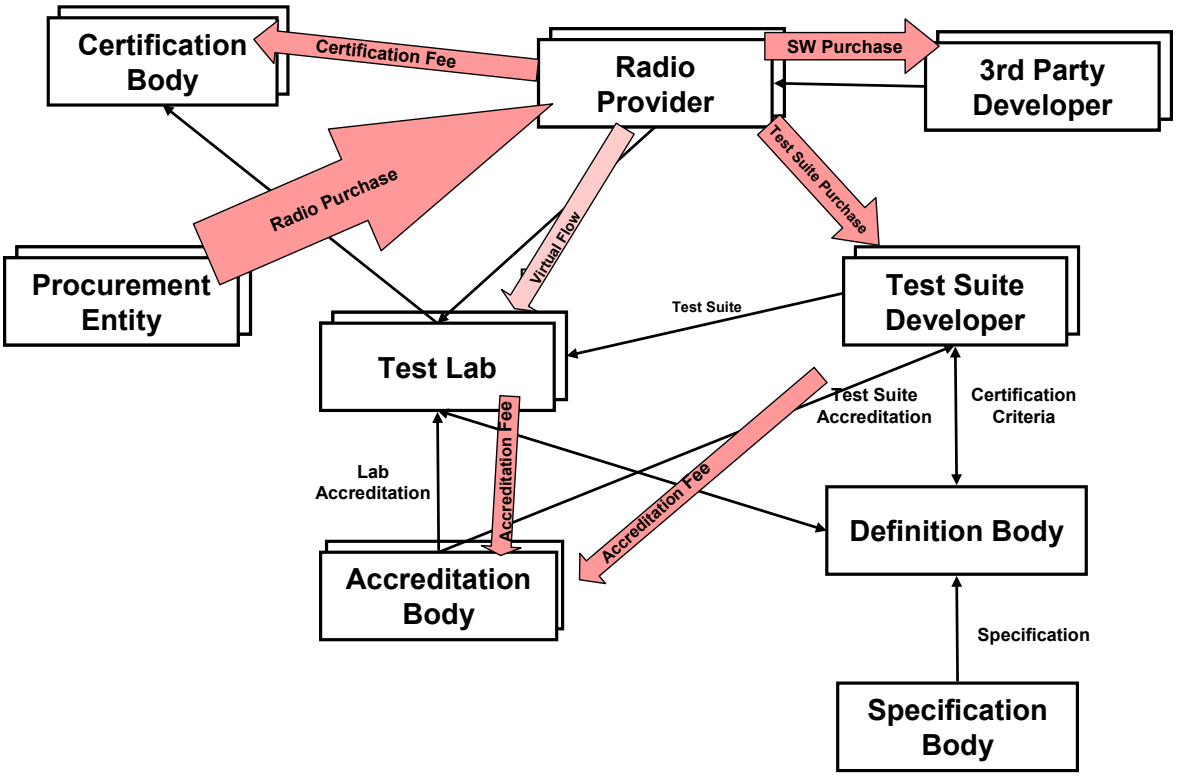


**Figure 9: Finance Flow Use Case #1**

### *7.1.7 Conclusion*

#### 7.1.7.1 Specifics of the Use Case

This use case presents the breadth of the SCA ecosystem with a high level of collaboration between industry, international organizations and government agencies. An SCA industry exists in which tools, applications, services and radios are developed using a commercial model.

Certification activities occur outside of radio procurement and with minimal involvement of government agencies. Accreditation of both the Test Suite and Test Lab is performed independently from the radio procurement but is still subject to the oversight of the purchasing government. As the purchasing government does not have significant SCA experience, the Accreditation Body relies on an independent organization for their expertise. The SCA Certification is accomplished via self evaluation utilizing tools and services purchased from a Test Suite Developer.

#### 7.1.7.2 Portability Support

Portability is supported by the fact that certification artifacts are developed by organizations, which are accredited by an independent international authority and test tools respectively test procedures are accredited as well by an independent international authority. Compatibility of interfaces with equipment certified elsewhere under comparable conditions is maximized by the fact that on an international basis there is just a single entity to define the certification criteria (ideally one Definition Body worldwide). An independently developed and accredited Test Suite that is available for purchase by any interested party places no restrictions on where it can be used.

#### 7.1.7.3 Time to Market

There are a number of aspects of this use case that reduce the time to market:

- The radios are developed and certified prior to purchase, significantly reducing the acquisition timeline
- The Test Suite and middleware are developed outside the scope of the radio development project. For the radio provider, this reduces the effort and time required by the radio provider in developing their radio
- The ability of the radio provider to perform an SCA self evaluation eliminates the bottleneck of certification testing being performed by a single entity
- The radio provider knows the certification criteria at the start of development,
- Since radio development and the test lab are within the same company, informal pretests can be done during development with minimal overhead and coordination

#### 7.1.7.4 Certification Cost

The cost of certification is reduced based as a result of the time to market characteristics. In addition the cost is reduced because when a self evaluation is performed a Certification Fee will not be paid to an external organization. Certification costs are also reduced by purchasing the Test Suite and 3rd party software components as opposed to developing those capabilities in house.

#### 7.1.7.5 Intellectual Property Rights

The Intellectual Property Rights of the radio provider are protected since they do not have to deliver the source code developed by internal funding to any entity outside of their company.

The IP of the 3rd party SW provider (middleware/OS) is not completely protected since it may be required that the radio provider have access to their source code for the purpose of certification. This could be resolved with independent certification of SW components.

The IP of the Test Suite is protected since they received the accreditation requirements from an independent organization and need only provide their test results. SW they developed is not delivered to either the Accreditation Body or the purchaser of their product (the radio provider)

## 7.2 Use Case #2: Multinational Project

### *7.2.1 Use Case Description*

In use case scenario #2, the governments in more than one (1) country collectively bring together their resources to design, develop and purchase radios meeting their SDR requirements, which include SCA requirements and certification. Under this scenario, the SDR requirement is based upon the Software Communication Architecture (SCA), and required certification to be used collectively by all countries.

It's expected the software defined radio in this scenario is developed for one or more countries that have agreed to pool their resource together and develop a tactical radio that is based upon the Software Communication Architecture. It is expected that financial resources are limited in this scenario, due to the countries pooling their resources together. Therefore, the tactical radio being developed should emphasize cost restraint. Under this assumption, any contract for a tactical radio would be developed using known hardware and software platforms. This includes incorporating utilizing third party software and software development kits to reduce development and integration time.

To ensure the SDR meets all requirements, the SDR will be independently verified and validated and certified by an independent third party having no affiliation or ties to the development of the SDR. The independent third party company will also verify and validate the tactical radio for accurate alignment to the SCA requirements.

### 7.2.2 Personas Involved

**Table 14: Use Case #2: Personas Table**

| Body | Persona # | Purpose |
|---|---|---|
| Specification | 2 | Standards coming from an open or defined standard. |
| Radio Provider | 1 | Developing a customized SDR – At the request of a Procurement Entity, developing a customized SCA based SDR. |
| Accreditation body | n/a | n/a |
| Third Party SW Developer | 2 | COTS SW products for SDRs – Software development companies that specialize in specific software components of an SDR (e.g. RTOS, ORB, CF, et al.). Under this body, the COTS SW developer could be subjected to SCA requirements. |
| Procurement Entity | 2 | Limited SDR Knowledge – A government entity within a country that has shallow and thin knowledge and experience in Software Defined Radios. |
| Definition body | 3 | Program Specific – Under the Definition model at the Programmatic level this body is responsible for interpreting and defining SCA requirements as they apply to the Specific Program. |
| Test Suite Developer | 1 | Government developed – Under this use case, the ESSOR or the respective government funds the development for software test tools. |
| Test Laboratory | 3 | Third party test lab – Independent Verification & Validation of an SCA based SDR. |
| Certification body | 3 | National body – Providing opinions regarding SCA based SDRs for national guidance. |

### 7.2.3 Pre-condition

This scenario depicts more than one single country pooling their resources together with the major goal of procuring tactical radios for the use in their respective countries. Therefore, a pre-condition for any participants in this scenario is all interested parties or countries must agree to collectively fund the effort to purchase tactical radios.

It's assumed the tactical radios shall be based upon the Software Communication Architecture and it's further assumed this collective of countries will build up or use existing organizations to exercise the agreements. For example, OCCARS is an international organization in Europe that manages contracts for its host countries.

### 7.2.4 Basic Flow of Events

1. Collective of countries agree to pool their financial resource to purchase tactical radios.
2. Collective of countries agree on a management organization to carry the effort to fruition.
3. Independent management organization acts as Procurement Entity #3 on behalf of all countries to procure tactical radios from a Radio Provider #1.

4. Radio Provider #1 begins design and development effort for the tactical radio based upon requirements from the Procurement Entity #3
5. Radio Provider #1 reaches out to Third Party Software Developer #2 for SCA Certified software development kits and/or test software applications.
6. Procurement Entity #3 contracts for Test Lab #3 to independently verify and validate the tactical radio being developed by Radio Provider #1.
7. Upon certification of the tactical radio by the independent Test Lab #3, Radio Provider #1 can begin delivery of its tactical radio to Procurement Entity #3.

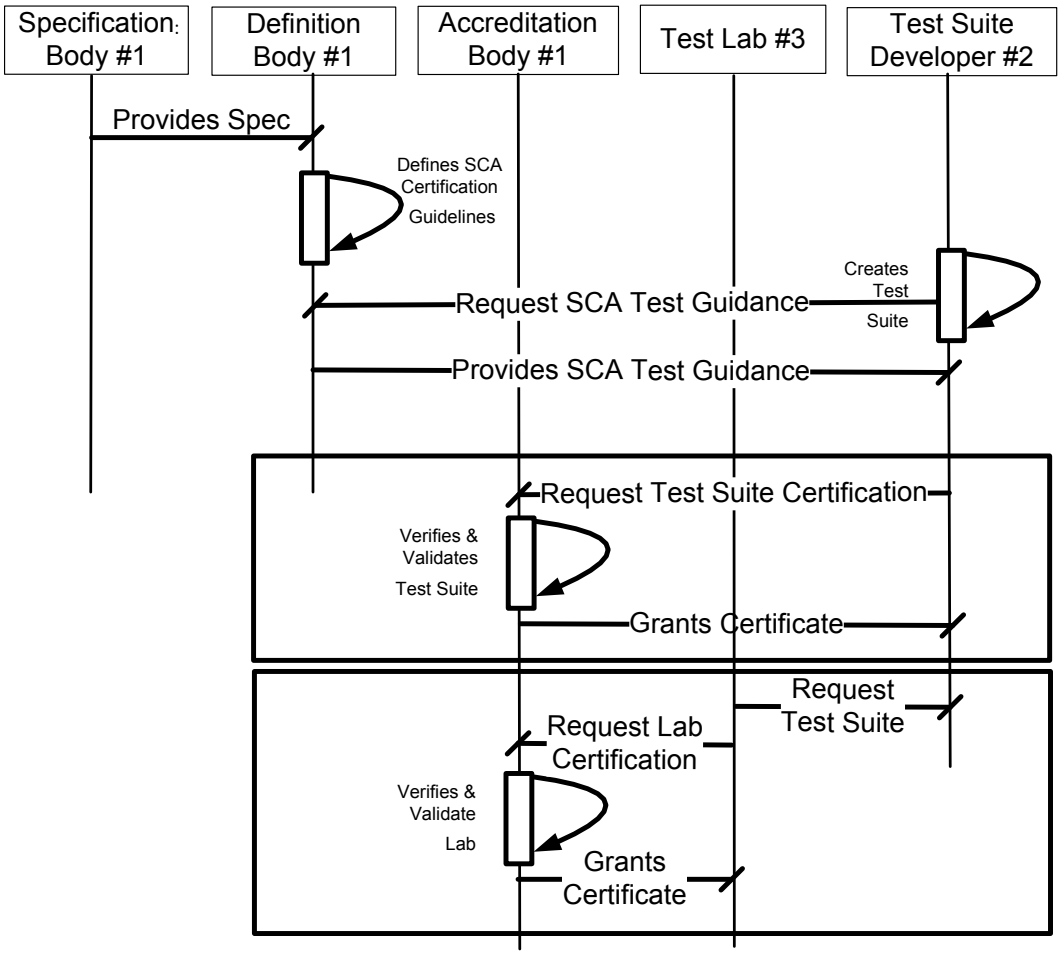


**Figure 10: Multi-National Certification Phase**

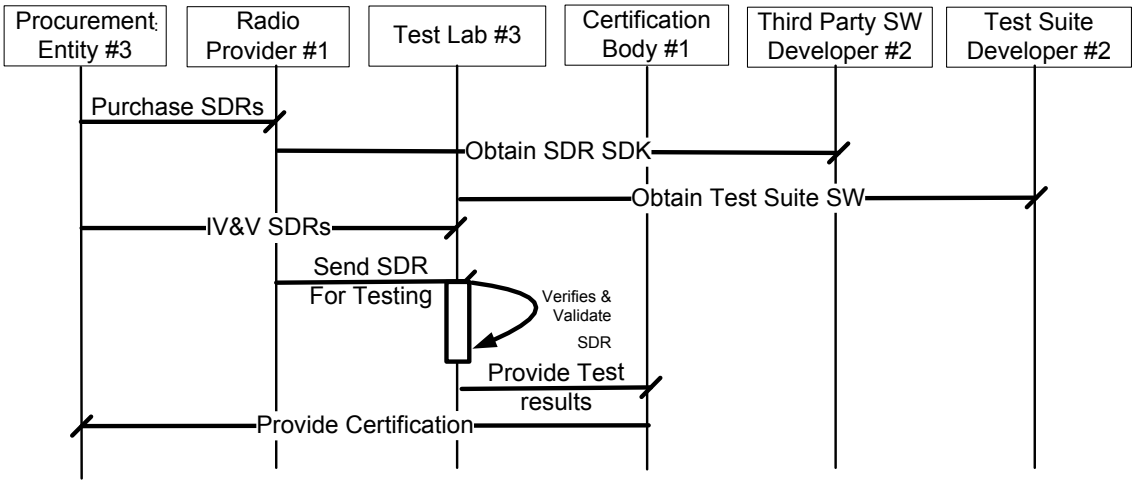


**Figure 11: Multi-National SDR Procurement Phase**

### *7.2.5 Post-condition*

The post-conditions that are expected from the collective of countries and the procurement authority are:

- The Test Lab #3 must use methodologies and practices that are certified by the International Certification Body #1. It is the International Certification Body #1 that can independently verify the Test Lab #3 is using practices that align with Independent Verification and Validation (IV&V) procedures.

### *7.2.6 Financial Flow*

**Table 15: Use Case #2: Financial Flow**

| Body | In Flows | Out Flows |
|---|---|---|
| Specification Body | None | None |
| Radio Provider | Procurement Entity #3 | 3rd Party SW Developer #2, Test Suite Developer #2, Certification Body #1, Accreditation Body |
| Accreditation body | Radio Provider #1 | |
| Third Party SW developer | Radio Provider #1 | |
| Procurement Entity | | Radio Provider #1<br><br>Test Lab #3 |
| Definition body | None | None |
| Test Suite Developer | Radio Provider #1 | |
| Test Laboratory | Procurement Entity #3 | None |

| Body | In Flows | Out Flows |
|---|---|---|
| Certification body | Procurement Entity #3, Test Lab #3 | Procurement Entity #3 |

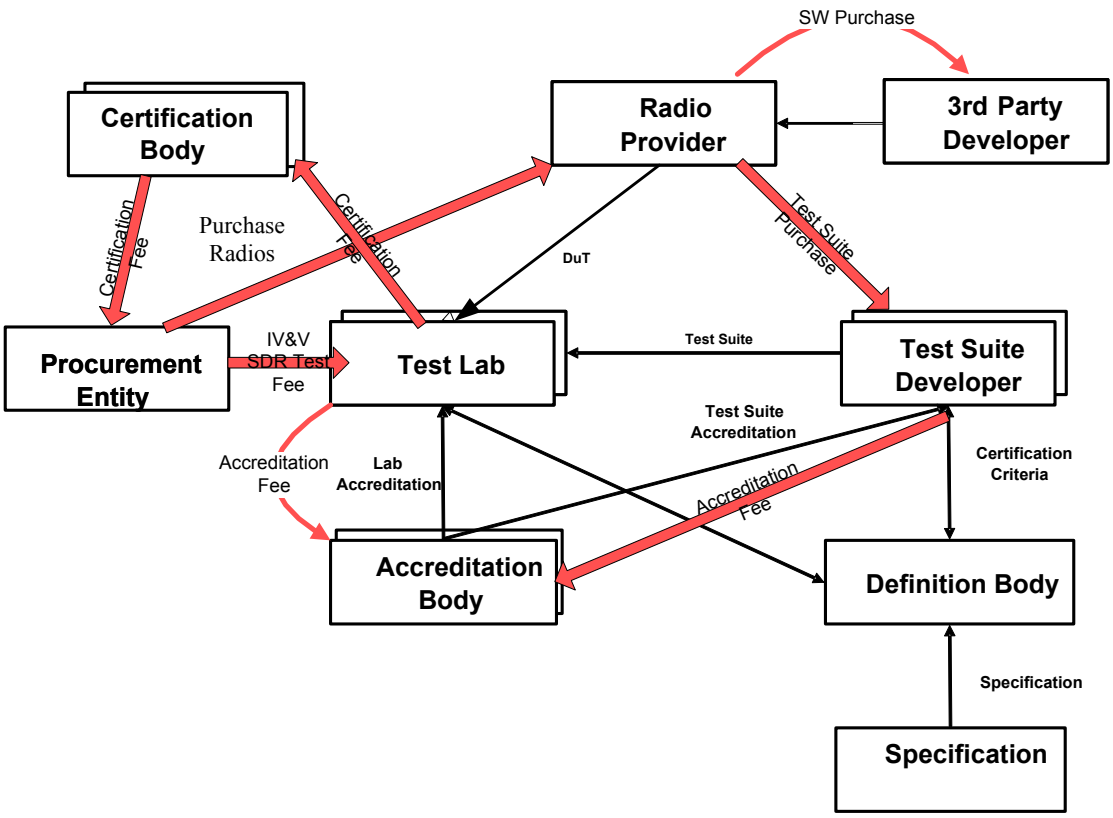


**Figure 12: Multi-National Process flow**

### *7.2.7 Conclusion*

#### 7.2.7.1 Specifics of the Use Case

In this use case, one or more countries collectively act in unison to purchase and procure software defined radios for their respective countries, which we will call a "collective". It is assumed the collective organization establishes a procurement entity to follow specific instructions from the collective as to the quantity and requirements of the software defined radio.

Therefore, the procurement entity is guided and directed by the collective which will have the authorization to carry out its purchase agreements.

While, the procurement entity has the capability to purchase SDRs from a Radio Provider, the procurement entity also enters into agreement with an independent test lab to conduct an independent analysis of the SDR to ensure the SDR conforms to all requirements. If the SDR has met all SDR requirements as it conforms to the SCA, the Procurement entity receives a certification from the Certification Body.

Certification activities occur outside of radio procurement and with minimal involvement of all respective government agencies.

#### 7.2.7.2 Portability Support

Portability is supported with open artifacts developed by organizations within the SCA. The artifacts and products within each body are accredited by an independent international authority. Additionally, test tools and test procedures used are also accredited by an independent international authority. This will ensure a higher degree of alignment to the requirements.

#### 7.2.7.3 Time to Market

From the point of time the procurement entity has the capability to purchase radios, to the time the procurement entity receives its deliverables of SDRs, is defined as the period of "Time to Market". The following factors influence the ability to bring product to market in an efficient and timely manner:

- All SDR requirements are completed and thorough.
- All third party SDR software used in the SDR project is developed outside the scope of the radio development effort.
- SCA test tools and test methodologies are completed outside the scope of the radio development effort.
- The radio provider understands SCA certification criteria at the beginning stages of development.
- Test Lab is continually providing SCA test guidance and assistance to the Radio provider.

#### 7.2.7.4 Certification Cost

The certification expense consists of an independent test lab to verify and validate the SDR, and the Certification body to provide an independent opinion of the SDR aligning to its original stated SCA requirements.

The certification expense can be reduced by ensuring the Radio provider designs, develops and implements the SDR according to SCA requirements. Additionally, the certification expense can be reduced by conducting interim test assessments to quickly reduce possible development issues.

7.2.7.5 Intellectual Property Rights

The Intellectual Property Rights is minimized due to the relationship between the Radio provider and the Procurement entity.

The Intellectual Property Rights of a third party SDR software developer are also protected due to an independent test lab conducting the actual test of the SDR.

The Intellectual Property Rights of the Test Suite software are also protected. The Test Suite software has undergone and received accreditation from a separate and independent organization assuring the Test Suite properly aligns with the SCA. Furthermore, the software developed is not delivered to either the Accreditation Body or to the Procurement Entity.

## 7.3 Use Case #3 Government Sponsored

### *7.3.1 Use Case Description*

As part of the JTRS program the US government funds a major US radio manufacturer to develop an SCA certified Multichannel Ground and Vehicular radio (HF, VHF, and UHF). Certification will be carried out by the JTRS program's own test lab and against Certification Criteria defined by JPEO. The JTR manufacturer will build the radio using COTS RTOS and ORB components. The SCA Core Framework used is an "in-house" implementation developed by the JTR manufacturer.

### *7.3.2 Personas Involved*

**Table 16: Use Case #3: Personas Table**

| Body | Persona # | Purpose |
|---|---|---|
| Specification Body | 2 | The US governments Joint Tactical Radio System (JTRS) Joint Program Executive Office (JPEO) who maintain the Software Communications Architecture (SCA) standard. |
| Radio Provider | 1 | JTR manufacturer receiving funding from the US government to build SCA compliant radios for the program. |
| Accreditation body | | |
| Third Party SW developer | 2 | Independent software companies (e.g. ORB and RTOS) supplying COTS software components of an SCA OE. |
| Procurement Entity | 1 | US government who places contract with a US Radio Provider for the acquisition of SCA compliant radios. |
| Definition body | 1 | JTRS program's JPEO who define the requirements for a SCA compliant OE or waveform. |
| Test Suite Developer | 1 | JTRS Test and Evaluation Laboratory (JTEL) under the JPEO have developed test procedures and tools to support SCA compliance testing. |

| Body | Persona # | Purpose |
|---|---|---|
| Test Lab | 1 | JTEL established by the JPEO to perform SCA compliance testing for all SDRs |
| Certification body | 3 | Based upon test results from the Test Lab, certification is provided by the JPEO ascribing to aligning with the SCA |

### *7.3.3 Pre-conditions*

The Radio Provider has developed the new radio providing an Operating Environment (OE) in accordance with the requirements specified in the SCA.

### *7.3.4 Basic Flow of Events*

1. JTEL provides JTR manufacturer with a copy of the JTRS Test Application (JTAP) and User Documentation
2. JTR manufacturer ports JTAP pseudo components to the new JTR set.
3. JTR manufacturer runs the JTAP until all tests are passed successfully.
4. JTR manufacturer requests official independent validation and verification from JTEL.
5. At the JTR manufacturer's site and under the supervision of JTEL the tests are performed.
6. JTEL and JTR manufacturer will perform any manual testing ether at JTR manufacturer's site and/or JTEL site.
7. JTEL will prepare a draft report using the results running the JTAP and other supporting material.
8. JTEL starts official internal process of releasing report.
9. JTEL releases report to JTR manufacturer for any questions and/or comments.
10. JTEL and JTR manufacturer work to resolve any issues identified in the report.
11. JTEL begins formal process of drafting official report recommending for or against SCA certification.
12. JTEL releases report to JPEO and JTR manufacturer with the certification recommendation.
13. JPEO will certify the new JTR set if the recommendation from the JTEL is for certification
14. The use case ends.

**Alternative Flows**

1. If in step 3 of the basic flow of events any issues are encountered when running the JTAP then the JTR manufacturer will fix the problem before re-running the tests.
2. If in step 10 of the basic flow of events JTEL identifies a problem that cannot be waivered or clarified, then they may insist that the JTR manufacturer fixes the problem and repeats Step 5.
3. If in step 12 the JTEL does not recommend certification of then the JPEO may not certify the new radio.

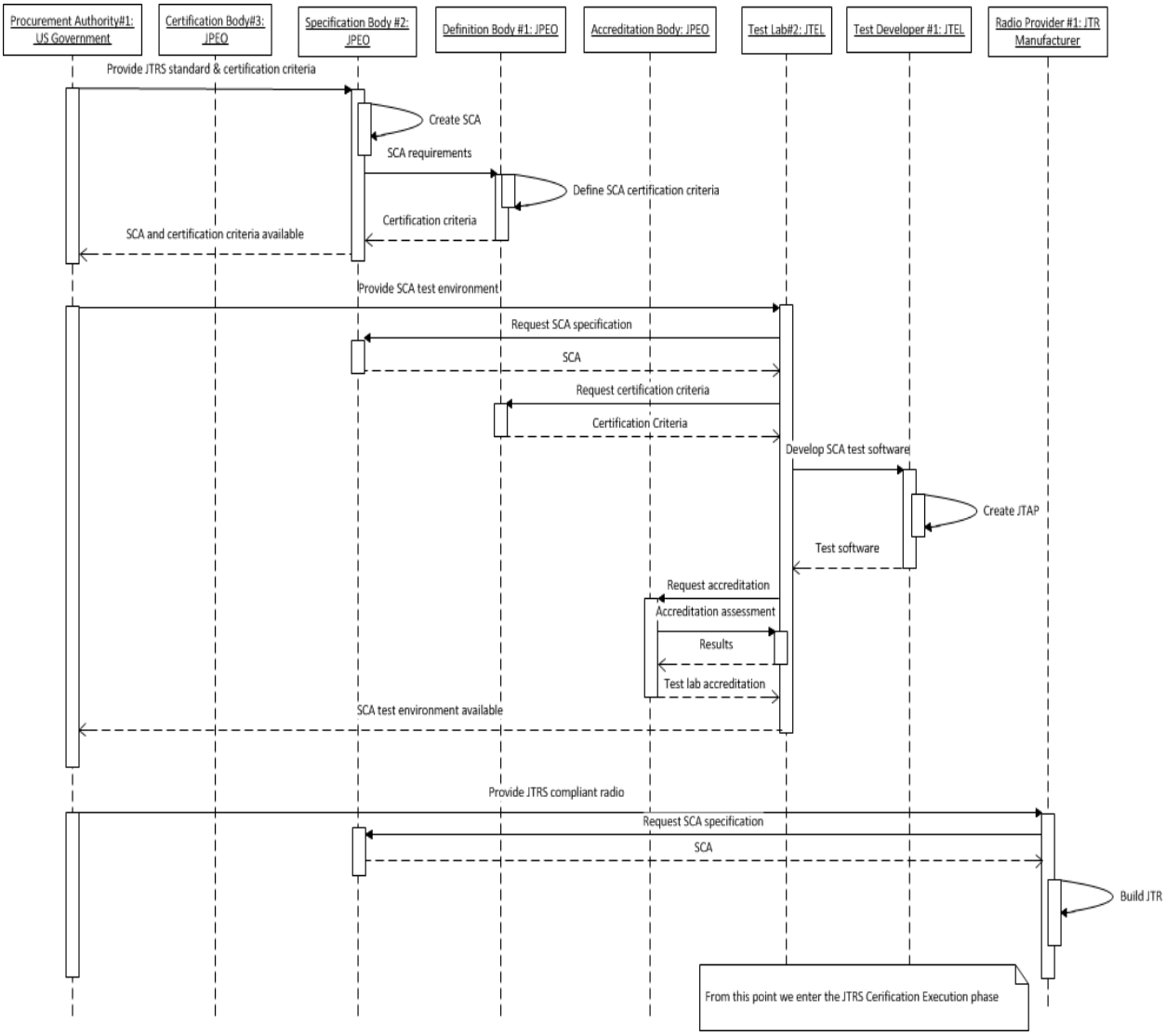


**Figure 13: JTRS Use Case Preparation Phase**

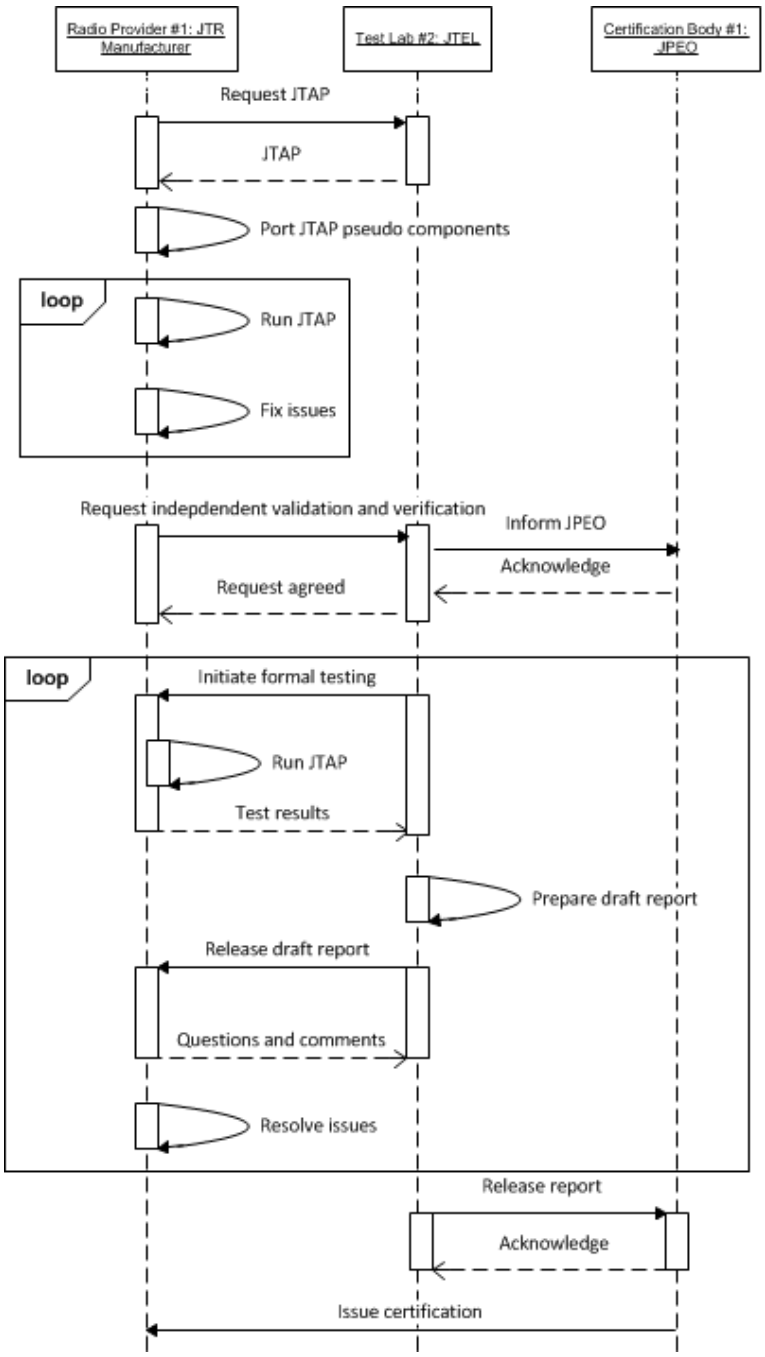


**Figure 14: JTRS Use Case Execution Phase**

### *7.3.5 Post-conditions*

The JTR manufacturer's new radio receives its SCA certification from the JPEO.

### 7.3.6 *Financial Flow*

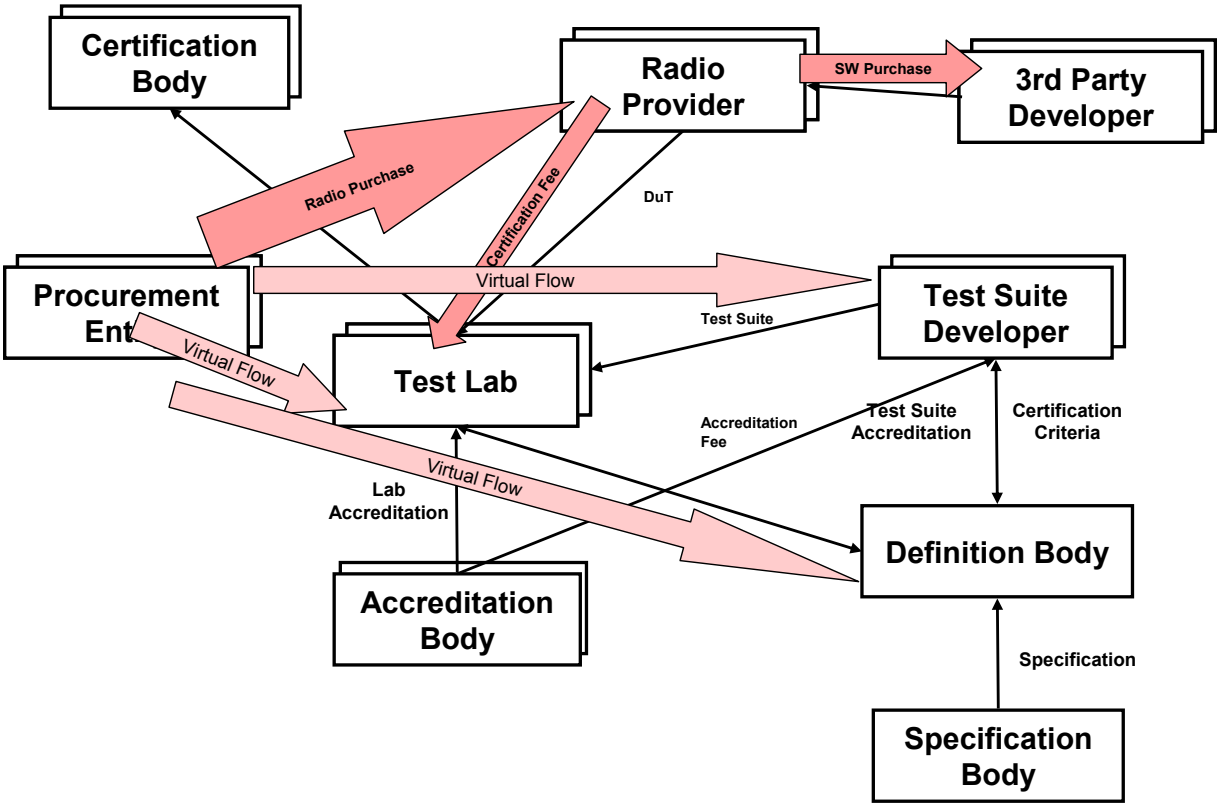


**Figure 15: Financial Flow Use Case #3**

### 7.3.7 *Conclusion*

#### 7.3.7.1 Specifics of the Use Case

In this use case the US government is the prime driver of the process. Not only are they the Procurement Entity – the JPEO, acting as the Specification, Definition, and Certification Body – the JPEO is also the sponsor of JTEL who acts as both the Test Suite Developer and Test Lab. This is in effect a two-party certification process between the US government and the Radio Provider.

There is no independent accreditation of the Test Suite and Test Lab. The Radio Provider Test Lab is also not independent or accredited it merely acts as a proxy for the JTEL during radio development.

The Test Suite is provided free-of-charge to the Radio Provider for the latter's use. There is no investment required by the Provider which reduces their costs and preparation time for its Test

Lab. There is also a direct relationship between the criteria (specified by the Definition Body) and the Test Suite Developer and Lab (the parties responsible for implementing the criteria).

#### 7.3.7.2 Portability Support

Portability is strongly supported within the JTRS due to the centralized control of the standards, specifications, certification criteria, test tools and procedures, as well the actual testing and certification.

#### 7.3.7.3 Time to Market

Time to market is minimized to a high degree by the following points:

- The Radio Provider knows very well the certification criteria, in best case already at the beginning of the development phase
- The Radio Provider does not have to procure or develop Test Tools. They just need to adapt the standard tool to their radio.
- The Radio Provider can quickly establish an informal Test Lab without the need for an accreditation cycle.
- Informal pre-tests can be done during development using the same Test Tool as the formal Lab
- Since the Test Lab (JTEL) is involved in the Radio Provider testing, problems will be identified earlier and resolved before formal submission at the Test Lab
- The JTEL Test Lab re-applies test and procedures that have already been passed which increases the chances of passing first time around.
- The official report should be accepted by the Certification Body since it has a direct relationship to the testing criteria and Lab.

The delay in the time-to-market of this case is the serial nature of transforming the JTRS standard into a certification process. The Radio Provider is required to wait for all the US government personas. There is also little parallelism in the Test Suite Developer role since it is sole sourced.

#### 7.3.7.4 Certification Cost

For the Radio Provider, this case offers potentially the lowest cost of certification. If the Test Suite Developer is able to provide a state-of-the-art Test Suite in a timely manner, then the Provider will be able to minimize their costs.

For the other personas, this case is the most expensive approach. There is little or no leveraging of the work of other Body's work. By directly funding the Test Suite Developer and Test Labs, there is little incentive/opportunity to leverage independent COTS developments and labs. Radio Providers are also discouraged from independent investment in improved test suites that cannot be approved by the Certification Body.

The major cost saving is accrued from not having to establish an Accreditation Body(s) and processes.

7.3.7.5 Intellectual Property Rights

For the Radio Provider, their intellectual property is only exposed to an agent of the Procurement Entity (the US government) so this case minimizes their risks.

The Test Suite Developer and Lab (JTEL) can (and does) control the intellectual property of the test suite.

## 7.4 Use Case #4: Developing Nation

### *7.4.1 Use Case Description*

Background of this use case is a developing country, willing to buy SCA compliant equipment without significant native radio industry. Within the procurement organization and governmental research labs there is some limited knowledge about state of the art radio communications.

The contract is a procurement contract without paying for development.

The contractor shall deliver 800 units of tactical VHF/UHF radios for vehicular installation including an installed waveform. The waveform is a current product of the radio supplier in some slight modifications. To allow eventually later extension in terms of additional waveforms the radios shall be SCA compliant. An SCA 2.2.2 certificate is required for both platform and waveform

In this use case the certification is part of the product development of the radio provider, which is prior to the procurement process.

### *7.4.2 Personas Involved*

**Table 17: Use Case #4: Personas Table**

| Body | Persona # | Purpose |
|---|---|---|
| Specification Body | 2 | Under this scenario the Specification Body #2 is not a recognized standards organization; the SCA and the API specification have been published by JPEO; directly involved neither in the procurement nor in the certification process: no money flow |
| Radio Provider | 3 | Various international businesses, own resources for platform and waveform development |
| Accreditation body | 3 | International recognized, independent organization to accredit test lab, test tool, test procedure and test form; requires fees from the radio provider for accreditation |

| Body | Persona # | Purpose |
|---|---|---|
| Third Party SW developer | 2 | Independent organization providing products, which require SCA certification (like OE, CF etc); certification of its products are under their own responsibility; provide a certificate with their sold products |
| Procurement Entity | 3 | Does not have significant radio development in the its respective country |
| Definition body | 2 | Independent and recognized organization (e.g. international forum), requires fees from the radio provider for definition services |
| Test Suite Developer | 2 | Company, providing TT, TP and TF according its own business case; needs to be accredited; paid according to their efforts by the radio provider |
| Test Laboratory | 2 | Test lab associated with the radio provider to perform self-evaluation and provide the filled test forms to the Certification Body; needs to be accredited; has not to be paid by the radio provider directly |
| Certification body | 1 | Independent and recognized organization (e.g international forum), paid for the service by the radio provider. |

### *7.4.3 Pre-conditions*

At the start of this scenario the Radio Provider has developed a radio providing an Operating Environment (OE) in accordance with the requirements specified in the SCA. The radio must be certified as SCA and API compliant. SCA and API Specs are publicly available.

### *7.4.4 Basic Flow of Events*

1. Radio Provider requests Certification for their SDR
2. Certification Body works with the Definition body to ascertain its policies regarding specific SCA requirements
3. Certification Body works to provide details of SCA requirements alignment for its policies and procedures
4. Accreditation Body reviews and verifies its test results for its test environment
5. The Accreditation Body reviews and verifies the test lab's policies and procedures
6. Both reports are sent to the Radio Provider

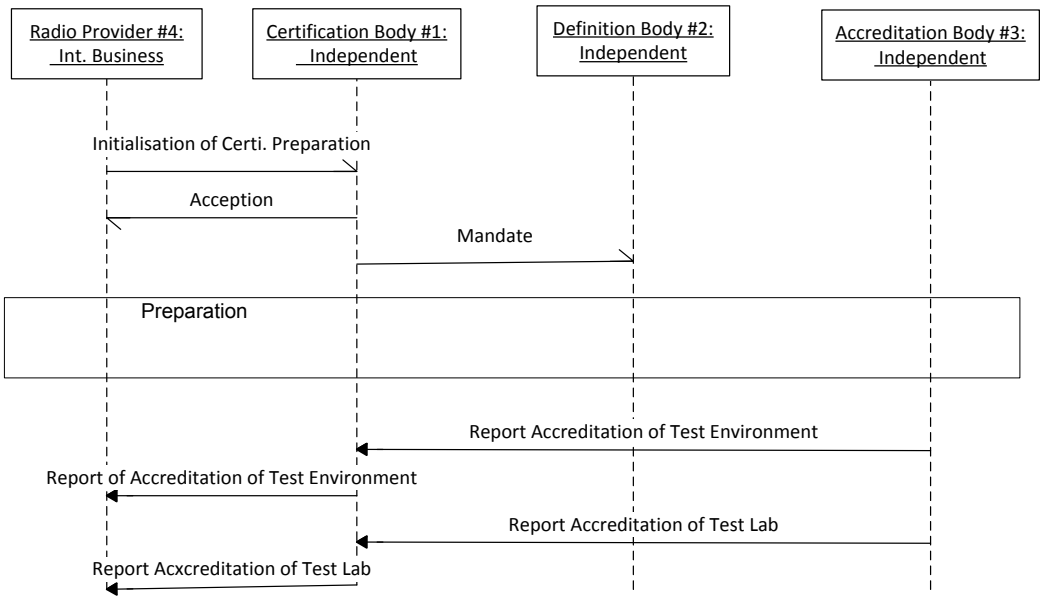


**Figure 16: Developing Nation, Industry Driven UC - Preparation Phase - Initialization and Finalization**

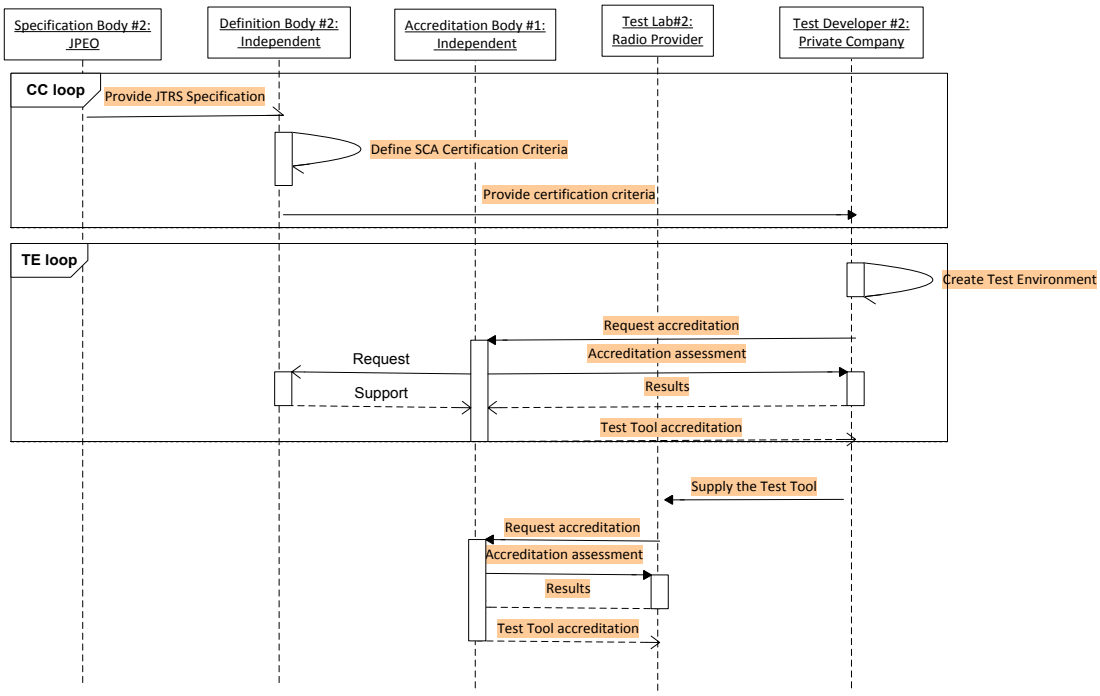


**Figure 17: Developing Nation, Industry Driven UC - Preparation Phase - Test Lab View**

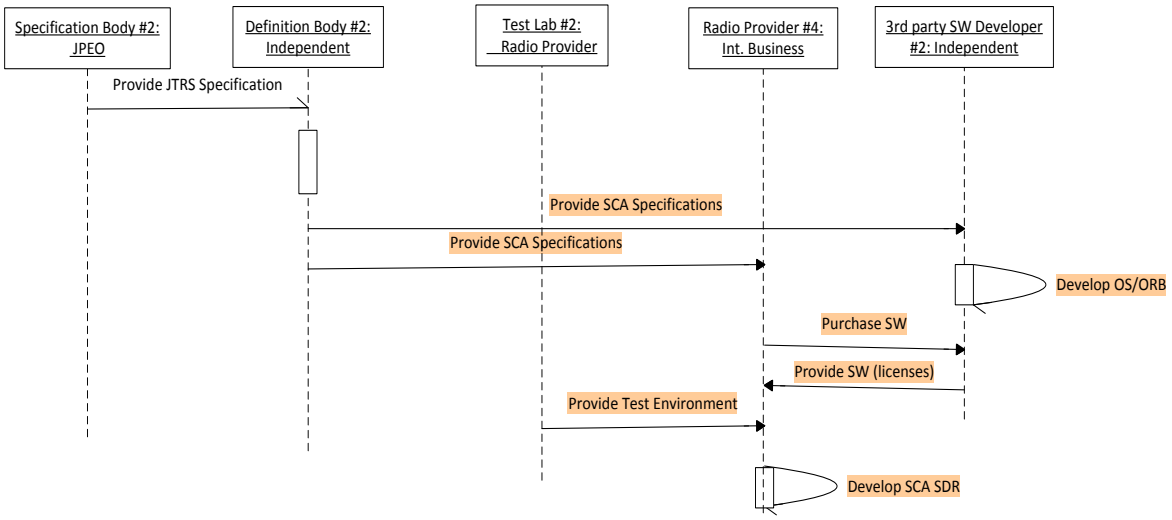


**Figure 18: Developing Nation, Industry Driven UC - Preparation Phase - Radio Provider View**

#### 7.4.4.1 Certification Execution Phase

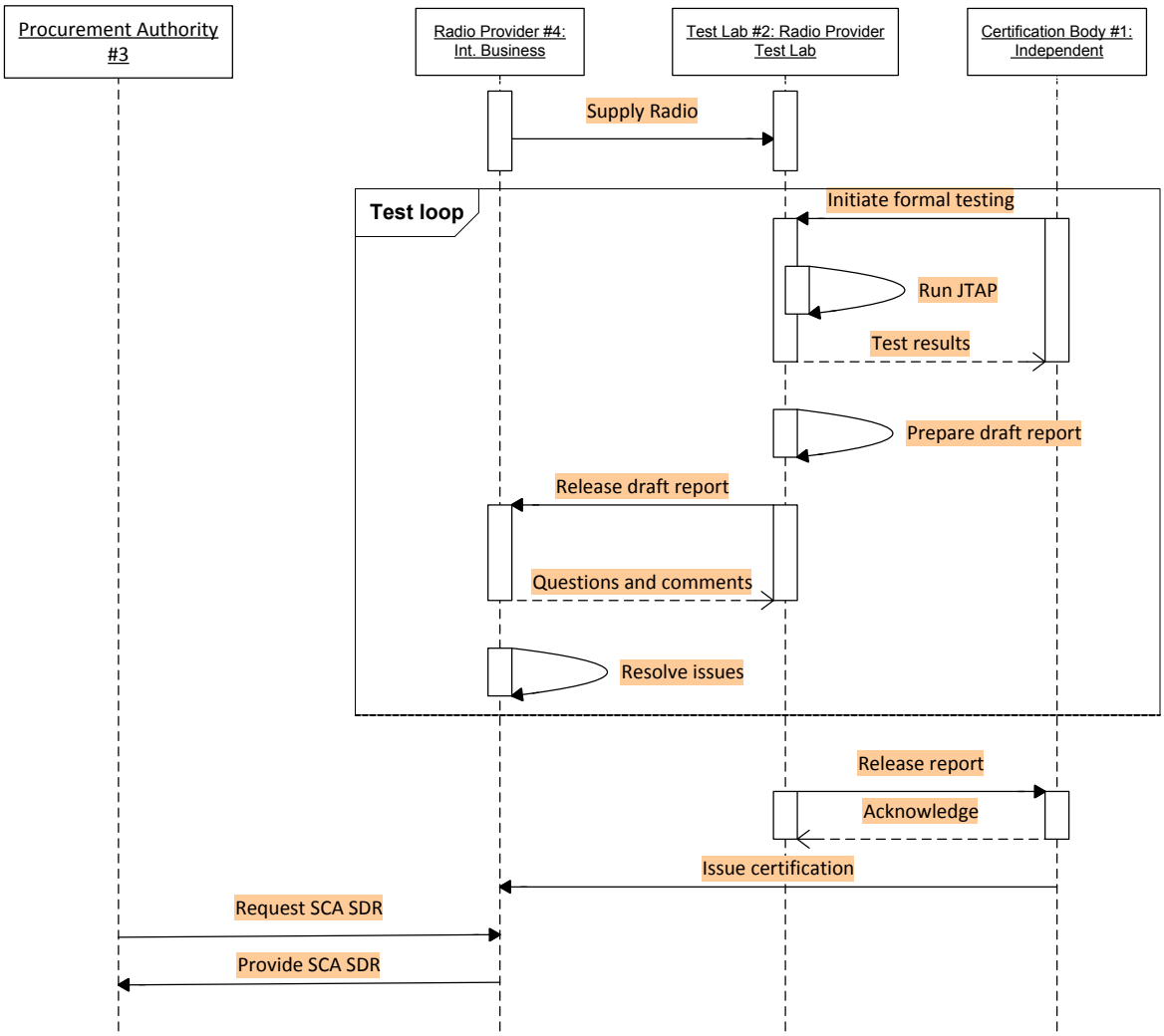


**Figure 19: Developing Nation, Industry Driven UC - Execution Phase**

### 7.4.5 Post-condition

The radios and waveforms under consideration have a type certificate emphasizing they are compliant with the certification criteria derived from SCA and API specifications and thus portability is supported. Certificates are available upon delivery of the radio equipment.

### 7.4.6 Financial Flow

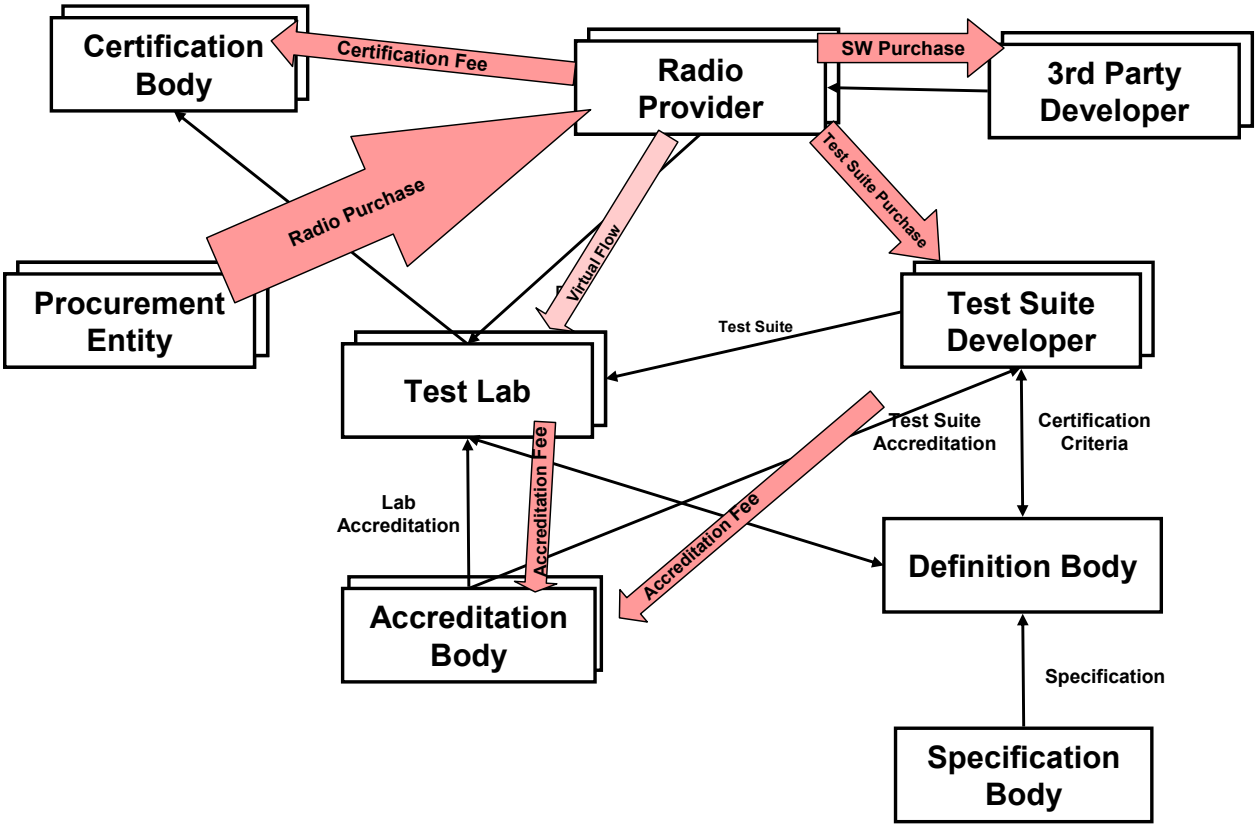


**Figure 20: Financial Flow Use Case 4**

### 7.4.7 Conclusion

#### 7.4.7.1 Specifics of the Use Case

This use case is characterized by the fact, that within the customer environment there is generally limited knowledge about modern radio technologies, architectures and certification know how. The intention of the customer is to prepare later extensions or modifications to be done at moderate cost.

#### 7.4.7.2 Portability Support

Portability is supported by the fact that certification artifacts are developed by organizations, which are accredited by an independent international authority and test tools respectively test procedures that are accredited as well by an independent international authority. Compatibility of interfaces with equipment certified elsewhere under comparable conditions is maximized by the fact that on an international basis there is just a single entity to define the certification criteria (ideally one Definition Body worldwide).

#### 7.4.7.3 Time to Market

Time to market is minimized to a high degree by the following points:

- The developing company knows very well the certification criteria, in best case already at the beginning of the development phase
- The developing company does have experience with the test procedures and the handling of the test tools
- Informal Pretests can be done during development
- Modifications of waveforms or platforms do not require a complete recertification but just evaluation of the deltas
- Minimize bureaucracy since development and evaluation is probably done at the same location

#### 7.4.7.4 Certification Cost

In principle all the arguments from "Time to Market" apply as well. In addition cost for certification will decrease because of larger quantities and the evaluation will be more efficient because the device under test is already well known to the evaluators (at least at an organizational level).

#### 7.4.7.5 Intellectual Property Rights

Evaluation partially will go deeply into details of equipment and software code. In this use case the devices under test do not leave the area of the manufacturer and are not disclosed to third parties of any kind.

## 7.5 Use Case #5: Independent Industrial Initiative or Procurement Authority Driven Certification

### *7.5.1 Use Case Description*

In this use case scenario #5, an Industry or a generic Procurement Authority (PA) requests a software defined radio systems meeting SDR requirements to be SCA Certified.

Under this scenario, an Industry or PA seeks to purchase SCA based SDRs, but also seeks to minimize its costs. As a solution to reduce and minimize costs, the software defined radio being developed under this Use Case seeks the SDR to be tested in a separate test lab.

Under this assumption, the additional time and costs for accrediting a Radio Provider Test Lab are saved.

To ensure the SDR meets all requirements, the SDR is independently verified, and validated. It is also certified by an independent Certification lab having no affiliation or ties to the development of the SDR. The independent third party Test Lab will verify and validate the tactical radio for accurate alignment to the SCA requirements.

### *7.5.2 Personas Involved*

**Table 18: Use Case #5: Personas Table**

| Body | Persona # | Purpose |
|---|---|---|
| Specification | 2 | Standards coming from an open or defined standard. |
| Radio Provider | 1/2/3 | Developing a customized SDR – At the request of a Procurement Entity or with self funding, developing a customized SCA based SDR. |
| Accreditation body | 1/2/3 | Accreditation Body has accredited the independent Test Lab |
| Third Party SW Developer | 2 | COTS SW products for SDRs – Software development companies that specialize in specific software components of an SDR (e.g. RTOS, ORB, CF, et al.). Under this body, the COTS SW developer could be subjected to SCA requirements. |
| Procurement Entity | 1/2/3/4 | Limited SDR Knowledge – A government entity within a country that has shallow and thin knowledge and experience in Software Defined Radios. |
| Definition body | 1 | Program Specific – Under the Definition model at the Programmatic level this body is responsible for interpreting and defining SCA requirements as they apply to the Specific Program. |
| Test Suite Developer | 1/2 | Government developed – government funds the development for software test tools or they are developed and provided by a Private Company. The Test Suite is taken as COTS by the Radio Provider to initially verify its own implementation, before going to certification by the Independent Test Lab |
| Test Laboratory | 3 | Third party test lab – Independent Verification & Validation of an SCA based SDR. |
| Certification body | 1/2/3 | National, International and Coalition body – Providing opinions regarding SCA based SDRs for national guidance. |

### *7.5.3 Pre-condition*

This scenario depicts the case in which one Industry, by its own initiative or because requested by a Procurement Authority, is willing to certify its radio system without investing in its own Test Lab, using instead an already accredited one.

By using a separate and independent SCA Test lab to conduct the SCA Certification, the overall costs are reduced and minimized by side-stepping the need to support an "in-house" test laboratory and associated accreditation expenses. However, under this scenario, a third party independent test lab is needed to ensure the SDR is verified, validated and eventually certified.

The SDRs developed in this use case are based upon the Software Communication Architecture (SCA). The Radio Provider, or Procurement Authority, will design, and develop using existing SDR organizations to properly exercise its agreements.

### *7.5.4 Basic Flow of Events*

1. The Industry/Procurement Authority has limited financial resource to develop and/or purchase tactical software defined radios.
2. Radio Provider #1 begins design and development effort for the tactical radio based upon requirements from the Procurement Entity.
3. Radio Provider #1 reaches out to Third Party Software Developer #2 for SCA Certified software development kits and/or test software applications.
4. Radio Provider #1 reaches out to Test Lab #3 to independently verify and validate the tactical radio being developed by Radio Provider #1.
5. Upon certification of the tactical radio by the independent Test Lab #3, Radio Provider #1 can begin delivery of its tactical radio to its reference Procurement Entity.

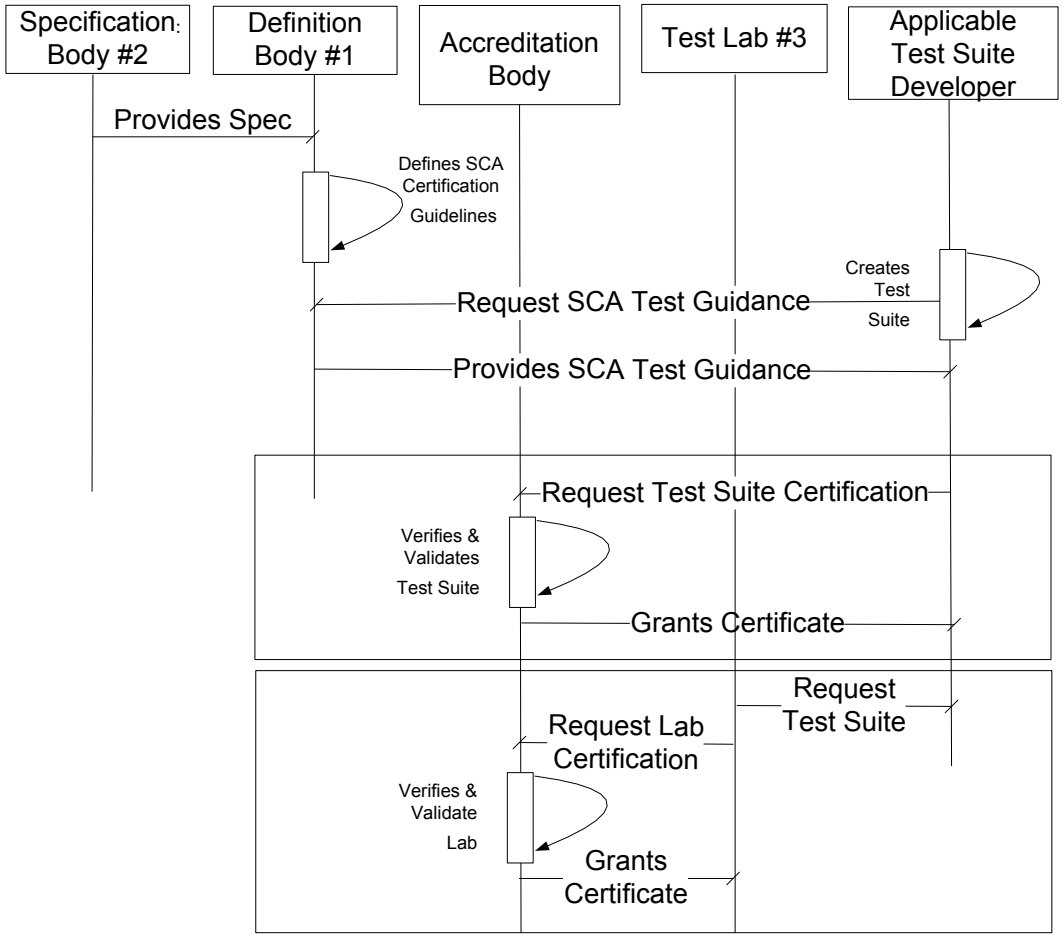


**Figure 21: Industrial / Procurement Authority initiative - Accreditation Phase**

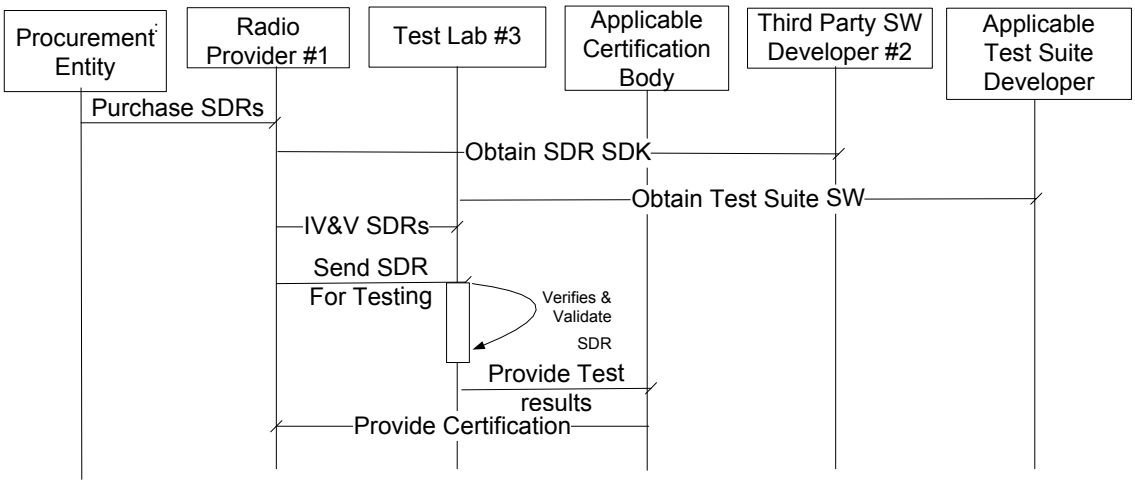


**Figure 22: Industrial/Procurement Authority initiative - Certification Phase**

### *7.5.5 Post-condition*

The post-conditions that are expected from the single Radio Provider, the procurement authority and/or the collective of countries and are:

- **In case of both Independent Industrial or Procurement Authority initiative** the Test Lab #3 must use methodologies and practices that are certified by the applicable Certification Body through the Independent Test Lab #3.

### *7.5.6 Financial Flow*

**Table 19: Use Case #5: Financial Flow**

| Body | In Flows | Out Flows |
|---|---|---|
| Specification Body | None | None |
| Radio Provider | Procurement Entity | 3rd Party SW Developer #2, Test Suite Developer #2, Certification Body #1,2 Accreditation Body |
| Accreditation body | Radio Provider #1 | |
| Third Party SW developer | Radio Provider #1 | |
| Procurement Entity | | Radio Provider #1 |

| Body | In Flows | Out Flows |
|---|---|---|
| Definition body | None | None |
| Test Suite Developer | Radio Provider #1 | |
| Test Laboratory | Procurement Entity | None |
| Certification body | Procurement Entity | Procurement Entity |

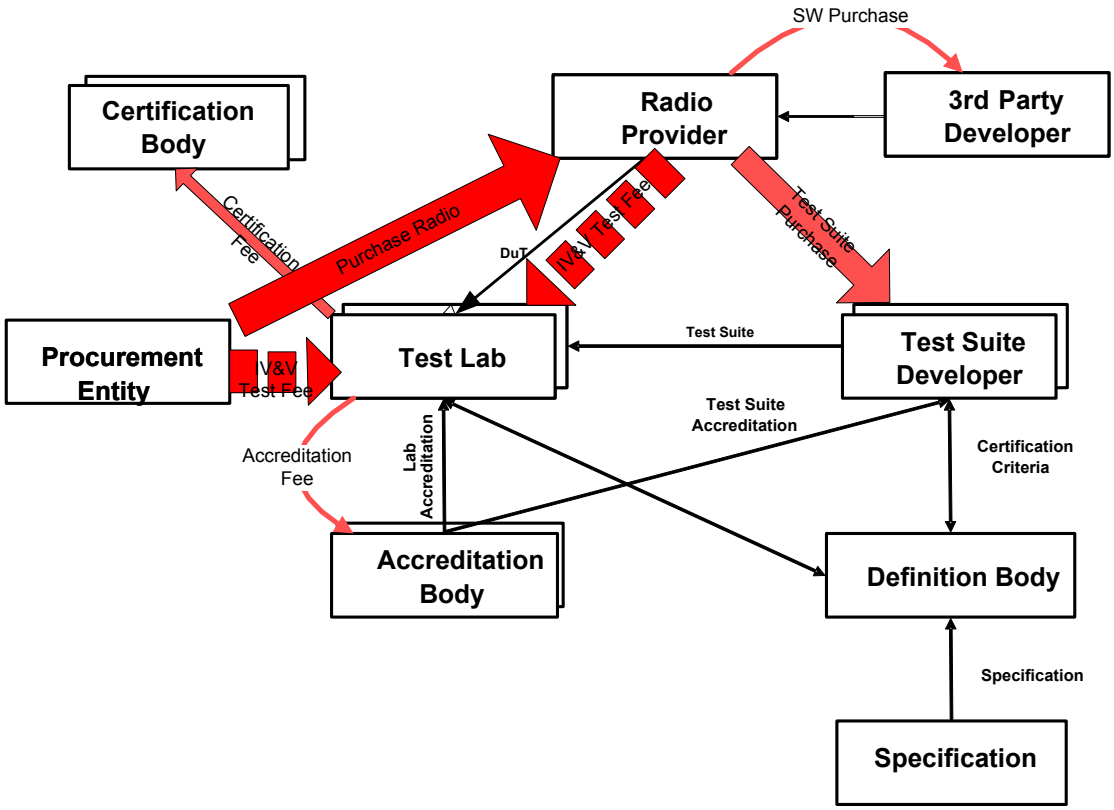


**Figure 23: Use Case #5 - Financial flow**

Please note that the dashed flows for "IV&V Test Fee" are mutually exclusive.

### *7.5.7 Conclusion*

#### 7.5.7.1 Specifics of the Use Case

In this use case, one Industry, on its own initiative or for a request of a Procurement Authority, has the goal to certify its radio system.

While the procurement entity has the capability to purchase SDRs from a Radio Provider, the procurement entity also enters into agreement (directly or through the Radio Provider) with an independent test lab to conduct an independent analysis of the SDR to ensure the SDR conforms to all requirements. If the SDR has met all SDR requirements as it conforms to the SCA, the Procurement entity receives a certification from the Certification Body.

#### 7.5.7.2 Portability Support

Portability is supported with open artifacts developed by organizations within the SCA. The artifacts and products are accredited by an independent authority. Additionally, test tools and test procedures used are also accredited by an independent authority. This will ensure a higher degree of alignment to the requirements.

#### 7.5.7.3 Time to Market

From the point of time the Radio Provider/Procurement entity has the capability to develop/purchase radios, to the time the SDR devices are actually available, is defined as the period of "Time to Market". The following factors influence the ability to bring product to market in an efficient and timely manner:

- All SDR requirements are completed and thorough.
- All third party SDR software used in the SDR project is developed outside the scope of the radio development effort.
- SCA test tools and test methodologies are completed outside the scope of the radio development effort.
- The radio provider understands SCA certification criteria at the beginning stages of development.
- Test Lab is providing SCA test guidance and assistance to the Radio provider.

#### 7.5.7.4 Certification Cost

The certification expense consists of an independent test lab to verify and validate the SDR, and the Certification body to provide an independent opinion of the SDR aligning to its original stated SCA requirements.

The certification expense can be reduced by ensuring the Radio provider designs, develops and implements the SDR according to SCA requirements. Additionally, the certification expense can be reduced by conducting interim test assessments to quickly reduce possible development

issues. Finally, additional cost reduction is achieved by relying on already accredited Test infrastructure (Labs).

#### 7.5.7.5 Intellectual Property Rights

Infringement on Intellectual Property Rights is minimized due to the independent initiative by the Radio Provider or the relationship between the Radio provider and the Procurement entity.

The Intellectual Property Rights of a third party SDR software developer are also protected due to an independent test lab conducting the actual test of the SDR.

The Intellectual Property Rights of the Test Suite software are also protected. The Test Suite software has undergone and received accreditation from a separate and independent organization assuring the Test Suite properly aligns with the SCA. Furthermore, the developed software is not expected to be delivered to either the Accreditation Body or to the Procurement Entity.

# 8 Conclusions and Recommendations

The personas defined as concrete instantiations of the generic role based model and use case scenarios provided show that there is a distinct need for an environment that supports SCA Certification beyond the scope of the services that are currently provided exclusively by the JTRS JPEO. There are a number of conditions that must be met while driving to the attainment of that ecosystem which are defined as follows:

1. **Allow an ecosystem to develop by providing an open process**

   A proper ecosystem supporting the development of SCA compliant SDR and Applications will significantly reduce cost and time for certification. If there is e.g. a market for certification tools the effort to develop these can be shared between several certification projects

2. **Only one Definition Body exists for a standard**

   The Definition Body defines the certification criteria and also provides technical support for accreditation of labs and tools. In order to eliminate differing interpretations of a standard and minimize the divergence of tests, it is essential that there is just one body per standard to perform this task.

3. **Ensure that the Definition Body is an independent, internationally recognized organization**

   The Definition Body must be an international recognized and trusted organization with the relevant domain expertise. It could be an international forum like the WInnF

4. **Accreditation Bodies shall accredit test labs and test suite developers**

   In order for a test lab to be trusted when it is outside the authority of the procuring entity, an accreditation and certification of the test lab and test environment by a trusted independent Accreditation Body must take place. There can be more than one Accreditation Body depending on the category (e.g. category 1 for open specifications) of the certification and also national and/or regional concerns.

5. **Independent Certification Bodies**

   In most cases the Certification Body will be a national entity or one that is associated with a specific procurement. However, consideration should also be given to the scenario in which a nation does not have native SCA expertise but still has the requirement for an SCA certified solution. In this case an independent Certification Body would be appropriate to provide the certification services

6. **Radio Providers and Test Suite Developers must be empowered to perform self-evaluations**

   In order to minimize the overall cost and effort, time to market and ensure a company's Intellectual Property Rights are observed, self evaluation is critical. This can be achieved by providing accreditations for the test lab (preferably within the radio provider facilities and the test environment (test tools, test procedures etc). Customers and Certification Body representatives could witness the tests is so desired.

Given that these conditions are met, the execution model provided below based on the roles defined is recommended. In this model, the roles highlighted in blue could be provided by the WInnF. It is recognized that there are a number of potential variants on the model, especially involving the Certification and Accreditation Bodies where national and regional concerns must be accommodated. It is anticipated there will be multiple instances of these bodies with the possibility that the WInnF fill one of those instances. The other significant aspect of this model is that roles within the red/solid region can be assumed by the Radio Provider, Test Suite developer or an independent Test Lab.

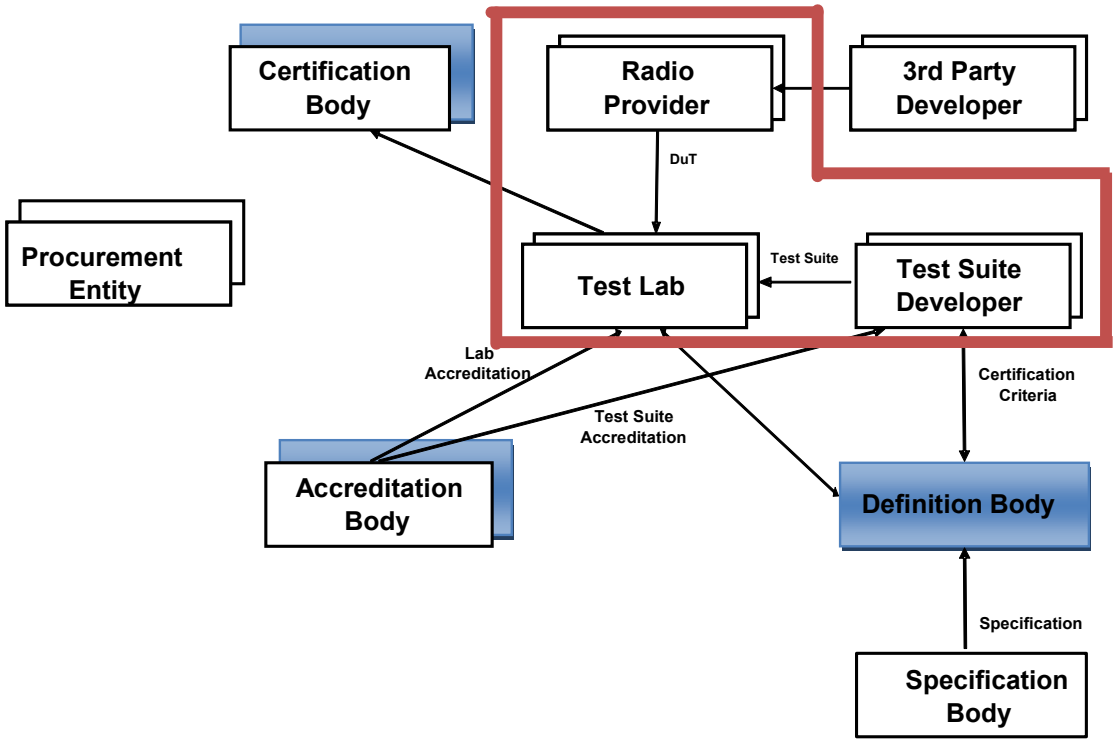


**Figure 24: Conclusion and Recommendations**

# 9 Glossary

**Table 20: Table of Definitions**

| Term | Definition |
|---|---|
| Accreditation | Third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks<br>(ISO/IEC 17000: 2005) |
| Accreditation Body | Authoritative body that performs accreditation (5.6) NOTE: The authority of an accreditation body is generally derived from government.<br>(ISO/IEC 17000: 2005) |
| Category 1 | Category of specification or certification, characterized by open access |
| Category 2 | Category of specification or certification, characterized by restricted access e.g. on coalition level |
| Category 3 | Category of specification or certification, characterized by pure national access (often national confidential or secret) |
| Certificate | Document stating the successful performance of the Conformity Assessment |
| Certification | third-party attestation related to products, processes, systems or persons<br>(ISO/IEC 17000: 2005) |
| Certification Body | National body or independent body related to international organizations, formally issues the Certification after receiving the evaluation results (Test Report) |
| Certification Criteria | Certification Criteria are derived from the standard and represent the specified requirements, which shall be verified during the tests |
| Conformity Assessment | Demonstration that specified requirements relating to a product, process, system, person or body are fulfilled. Conformity assessment is a series of three functions that satisfy a need or demand for demonstration that specified requirements are fulfilled:<br>• selection;<br>• determination; and<br>• review and attestation |

| Term | Definition |
|---|---|
| | Conformity assessment activities can be characterized as "first-party", "second-party" or "third-party".<br>(ISO/IEC 17000: 2005) |
| Conformity Assessment Body | Body that performs conformity assessment services (ISO/IEC 17000: 2005) |
| Definition Body | Body to define the Certification Criteria |
| Device under Test | Device that is undergoing the evaluation by the Test Lab (e.g. radio platform, waveform, complete radio or software component |
| First Party Conformity Assessment Activity | Conformity assessment activity that is performed by the person or organization that provides the object<br>(ISO/IEC 17000: 2005) |
| Inspection | Examination of a product design, product, process or installation and determination of its conformity with specific requirements or, on the basis of professional judgment, with general requirements<br>(ISO/IEC 17000: 2005) |
| Procedure | Specified way to carry out an activity or a process<br>(ISO/IEC 17000: 2005) |
| Self Assessment | Term used as a synonym for First Party Conformity Assessment Activity as defined by ISO/IEC 17000: 2005 |
| Specified Requirement | Need or expectation that is stated<br>NOTE: Specified requirements may be stated in normative documents such as regulations, standards and technical specifications.<br>(ISO/IEC 17000: 2005) |
| Standard | Specification, which is under the configuration control of an recognized Standards Developing Organization |
| Standards Body | Body to define and maintain a standard |
| Test Case | The specific implementation of a Method of Test on a Means of Test. |
| Test Lab | Term used as a synonym for Conformity Assessment Body as defined by ISO/IEC 17000: 2005 |
| Test Report | Report of the results of a test according to the test procedure |

| Term | Definition |
|---|---|
| Test Report Form | Form of the test report |
| Test Suite | Complete set of test procedures and test tools needed to perform assessment of Certification Criteria |
| Test Suite Developer | Entity to develop Test Suites |
| Test Tool | Tool, used to perform certification assessment of some or all the certification criteria |
| Testing | Determination of one or more characteristics of an object of conformity assessment, according to a procedure (ISO/IEC 17000: 2005) |
| Third-party conformity assessment activity | Conformity assessment activity that is performed by a person or body that is independent of the person or organization that provides the object and of user interests in that object<br>(ISO/IEC 17000: 2005) |
| Validation | To declare that a document or tool is according the requirements |

# 10 Acronyms

**Table 21: Table of Acronyms**

| Acronym | Definition |
|---|---|
| AEP | Application Environment Profile |
| API | Application Programming Interface |
| CF | Core Framework |
| CORBA | Common Object Request Broker Architecture |
| COTS | Commercial Off The Shelf |
| DoD | Department of Defense |
| ETSI | European Telecommunications Standards Institute |
| HF | High Frequency |
| IEC | International Electrotechnical Commission |
| IP | Intellectual Property |
| ISO | International Organization for Standards |
| ITAR | International Traffic in Arms Regulations |
| IV&V | Independent Verification and Validation |
| JPEO | Joint Program Executive Office |
| JTAP | JTRS Test Application |
| JTEL | JTRS Test and Evaluation Laboratory |
| JTRS | Joint Tactical Radio System |
| OE | Operating Environment |
| OMG | Object Management Group |
| ORB | Object Request Broker |
| OS | Operating System |
| PA | Procurement Authority |
| R&D | Research and Development |

| Acronym | Definition |
|---|---|
| RF | Radio Frequency |
| RTOS | Real Time Operating System |
| SCA | Software Communications Architecture |
| SDK | Software Development Kit |
| SDR | Software Defined Radio |
| SDO | Standards Development Organization |
| SDRF | Software Defined Radio Forum |
| SIG | Special Interest Group |
| SW | Software |
| T&E | Test and Evaluation |
| TP | Test Procedures |
| TT | Test Tools |
| UHF | Ultra High Frequency |
| US | United States |
| VHF | Very High Frequency |
| WG | Working Group |
| WInnF | Wireless Innovation Forum |
| WF | Waveform |
| XML | eXtensible Markup Language |