

Joint Tactical Networking Center Test and Evaluation Laboratory

Software Communications Architecture Test and Evaluation Plan

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1 Introduction

1.1 Intended Readership

This document is intended for organizations with Software Defined Radio (SDR) Set development, waveform application development, or Test and Evaluation (T&E) responsibilities. The organizations listed include radio application developers, SDR Set manufacturers, SDR Set integrators, the Joint Tactical Networking Center (JTNC), and other test personnel.

1.2 Purpose

The purpose of this document is to describe the Software Communications Architecture (SCA) T&E plan and processes defined by the JTNC Test and Evaluation Laboratory (JTEL) to test Applications (APPs), Operating Environments (OEs), and OE components, such as Radio Services (RSs), for SCA compliance. This document lists the responsibilities of related organizations and personnel associated with the SCA compliance testing process.

1.3 Scope

The scope of this document includes all testing and support activities performed or provided by the JTEL to complete the SCA testing process. This document describes the methods, tools, and procedures used to perform testing against both the SCA v2.2 and SCA v2.2.2 specifications for both JTNC products. This document also clarifies SCA testing process and the roles of the test and certification authority.

1.4 Program Overview

The mission of JTNC is to ensure interoperable, secure, and cost efficient waveforms and wireless communications by recommending standards, conducting compliance and certification analyses in accordance with Department of Defense (DoD) policies, and maintaining a DoD Waveform Information Repository.

JTEL has been assigned by JTNC as the test authority for compliance against the Software Communications Architecture (SCA) Specifications and the JTNC Standard APIs. JTEL is a branch of the JTNC Standards, Compliance and Certification (SC&C) Directorate.

Adherence to the SCA, JTNC Standard APIs, and other JTNC Standards allows standardization of the SDR Set infrastructure and is the basis for application portability. Portability of applications is one of the primary means of reducing development costs and providing for interoperability.

JTEL is responsible for developing test capabilities and providing excellence in testing and reporting with the highest integrity and quality. The primary functions of JTEL are the following:

- Support Waveform, Application, Operating Environment, and Radio Service verifications for JTNC based on the JTNC Standards.
- Provide API verification reports on the JTNC Standard API compliance of the tested products.
- Provide SCA compliance test reports on the SCA compliance of the tested products.

1.5 SCA Compliance

For ease of discussion, this document will use the terms OE and Applications to differentiate what components are under test. JTEL's involvement occurs during the JTR product development lifecycle. Upon submission of the completed radio set OE or Application by the developer, JTEL completes the tests and assessments described herein and returns the results and recommendations to JTNC. The JTEL will execute the applicable process outlined in this document, create a test report documenting the results of the verification, and provide this report with recommendation to the JTNC. JTNC will make the final SCA compliance certification recommendation. There are 3 potential decisions:

- SCA Compliant - based on passing 100% of testable SCA requirements
- SCA Compliant with Waivers – based on all identified deficiencies being formally requested and approved prior to SCA compliance testing via the JTNC waiver process, and
- SCA Non-Compliant – based on not receiving waivers on requirements found to be deficient.

JTNC is the only individual authorized to formally certify SCA compliance. Figure 1-1 illustrates the JTEL Business Model and the high-level steps involved in the SCA compliance certification process.

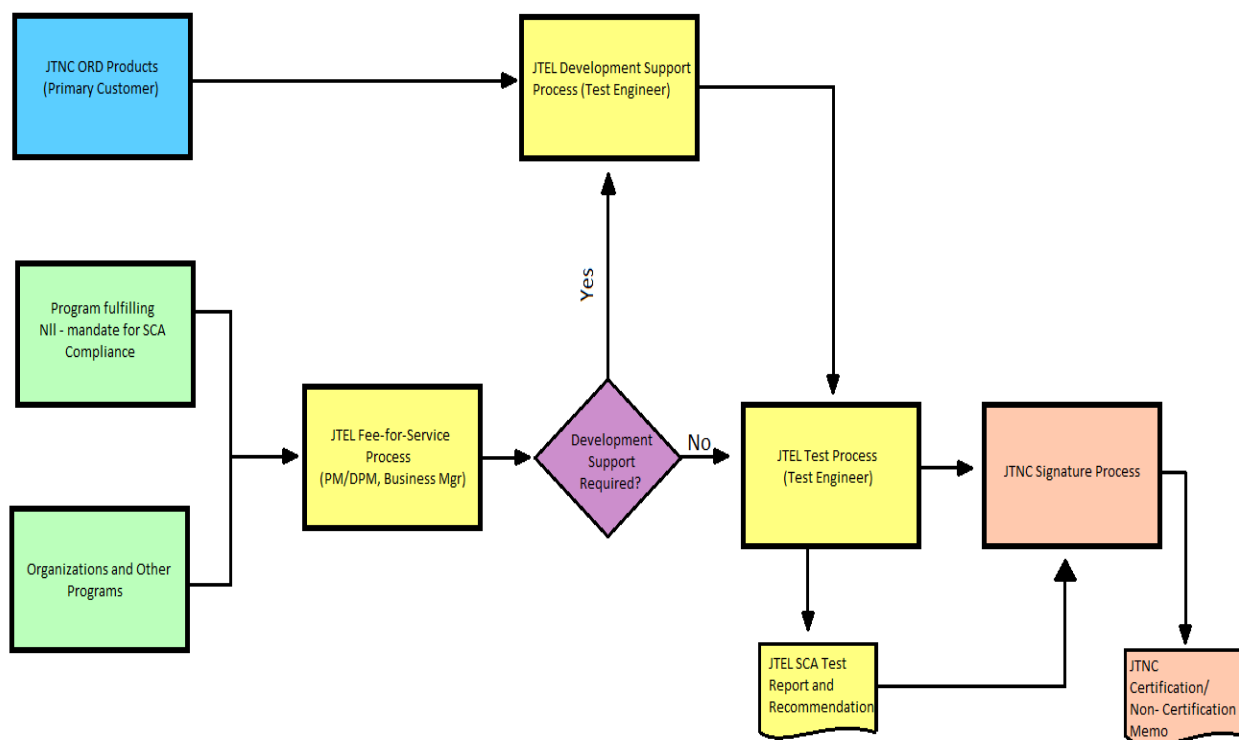


Figure 1-1: JTEL Business Model

A favorable SCA compliance recommendation requires a product to be verified to satisfy 100% of the applicable and testable requirements within the appropriate SCA specification. A product that meets this criteria would be recommended to be certified as SCA compliant.

Should the product developer or acquisition agency know that the product will not be able to fulfill a particular SCA requirement, this issue should be communicated and a Waiver documented. Waivers are to be submitted early in the process. If the submitted waivers are approved or accepted by the JTNC, these waived requirements will be factored into the testing activity and mentioned in the recommendation. Products that have waivers that have been accepted and are verified to meet the remainder of the applicable requirements will be recommended to be certified as Compliant with Waivers.

1.6 Document Overview

This JTEL SCA Test and Evaluation Plan extends for format of MIL-STD-498 and uses the content requirements of IEEE/EIA 12207.1-1997 as a guide. This document is organized as follows:

Section 1: Introduction

This section provides background on the JTNC organization and generally defines the criteria for SCA and JTNC Compliance.

Section 2: Referenced Documents

This section cites documents referenced by this plan.

Section 3: Test Environments

This section describes the roles and responsibilities of organizations and personnel involved in JTEL SCA T&E activities. This section describes the environments, tools, test procedures, and configurations used by JTEL in testing radio set Operating Environments and Applications. This section also defines the Operating Environment and Applications scope from the SCA compliance certification perspective.

Section 4: Test Approach

This section describes the Test Models for the SCA compliance certification process for both candidate Operating Environments and Applications. The path to SCA compliance certification for JTR products and the services that JTEL can provide are detailed. This section describes the process to the level where a detailed categorical description (i.e. organization responsible, description of activity, reporting, exit criteria for activity) emerges for every step in the process. This section also describes the development support provided by JTEL during the product's development.

Appendix A: Acronyms

This appendix defines the acronyms used in this document and provides a definition of technical terms used in this document.

Appendix B: Additional Required Information

This appendix includes a list of additional documentation that must be submitted by the radio set manufacturer prior to SCA compliance testing.

2 Referenced Documents

Table 2-1 below lists all documents related to the creation, understanding, and use of this document.

Table 2-1: Related Documents

Index	Short Title	Document Title and Reference
1	SCA v2.2	Software Communications Architecture Specification MSRC-5000 v2.2, 17Nov2001
2	SCA v2.2.2	Software Communications Architecture Specification v2.2.2, dated 15May2006

3 Test Environment

3.1 Software Items

The following software products will be provided by JTEL and used during the SCA testing.

- JTNC Test Application (JTAP) – A software application that runs on a Windows-based PC and is networked to the radio configuration via IP connection. This software is provided on CD media during the formal testing activity and installed using the appropriate installation utility. For Application testing, the JTAP is used to exercise many of the requirements. For OE testing, there are portions of test code, which are also referred to as PseudoComponents that are provided by the JTAP for the developer to integrate into their radio environment. The JTAP will exercise the OE and interface with the PseudoComponents to confirm that the SCA described behaviors were correctly performed. The JTAP is used for SCA v2.2 testing of Operating Environments and SCA v2.2.2 testing of both Applications and Operating Environments.
- Waveform Test Tool (WTT) – A software application that runs on a Windows-based PC and is networked to the radio configuration via IP connection. This software is provided on CD media during the formal testing activity and installed using the appropriate installation utility. This software is only used for testing Applications built to SCA v2.2 [Reference 1].
- Data Reduction Parser (DRP) – A software application that runs on a Windows-based PC and exercises the source and object code to help determine potential violations of boundary requirements in the SCA. The specific boundaries are those of the CORBA middleware, the Application Environment Profile (AEP), and the File Services. The DRP is a tool that allows searching through many lines of code for particular keywords.
- Global Regular Expression, Print (GREP) – A software application that performs logical checks and searches. Similar to the DRP, this tool is used to identify potential source code violations of SCA requirements.
- Source Code Review and Analysis Software – Various source code reviewing tools may be used during the manual testing portion of the test. These tools will generally take the form of development environments and source code analysis tools. The standard tool is generally Microsoft Visual C++ software.

The following software items will be provided by the developer under test.

- Application – The software Application that will be tested by the JTEL for SCA compliance. This software will be installed on the radio and provided to JTEL on CD media or via the JTNC Information Repository. The CD will include the source code, XML, Interface Description Language (IDL), and any additional software artifacts required to build the application.
- Operating Environment – The software packages and components that are installed on the radio to create an implementation of the SCA Operating Environment. This software will be installed on the radio and provided to JTEL on CD media or via the JTNC Information Repository. The CD will include the source code, XML, IDL, and any additional software artifacts required to build the application.

3.2 Hardware Items

The following hardware items will be used during the SCA testing.

- Radio Set – For both Application and Operating Environment testing activities, the radio set that the software runs on must be provided. This asset is utilized during the automated portion of the SCA testing.
- Network Cables – A network connection will need to be established between the JTEL PC with the JTEL tools installed and the radio under test. These network cables will be unique based on the type of connection that is supported by the radio.
- Windows PC – The JTEL tools will be installed on a network ready Windows-based PC and used for automated testing while connected to the radio set. Although not required, the manual testing and source code reviews will also generally occur on a Windows-based PC.
- Power Supplies – Supplies and adapters may be required to support the power requirements of both the radio and other PCs utilized during the testing activity.

3.3 Test Procedures

JTEL will be supporting testing and certification activities for SCA v2.2 and SCA v2.2.2 products. The SCA v2.2 capability will be maintained while at the same time developing the SCA v2.2.2 capability. Errata documentation will be produced to document defects with these procedures and tools referenced by these procedures as necessary. When there are identified issues with automated tools (SCA v2.2 or SCA v2.2.2), manual verification or inspection will be the default verification method.

3.3.1 SCA v2.2

The SCA v2.2 testing will utilize the following baselines for verification:

- The JTeL OE SCA Compliance Test Procedures to exercise the Operating Environments that are submitted for SCA compliance certification testing,
- The JTeL WF SCA Compliance Test Procedures to exercise the Applications that are submitted for SCA compliance certification Testing.

JTEL will use these procedures, errata, and the SCA v2.2 documented requirements to confirm appropriate fulfillment of the Software Communications Architecture.

3.3.2 SCA v2.2.2

The SCA v2.2.2 testing will utilize the following baselines for the manual portion of the verification:

- The JTEL Manual Operating Environment Software Test Description to exercise the Operating Environments that are submitted for SCA compliance certification testing,
- The JTEL Manual Application Software Test Description to exercise the Applications that are submitted for SCA compliance certification testing.

The SCA v2.2.2 testing will utilize the following baselines for automated portion of the verification:

- The JTEL Automated Operating Environment Software Test Description to exercise the Operating Environments that are submitted for SCA compliance certification testing,
- The JTEL Automated Application Software Test Description to exercise the Applications that are submitted for SCA compliance certification testing.

In addition to these specific procedures, additional documents may be established to help with test coordination and identify the components to be tested or their relative results.

3.4 Proprietary Nature, Acquirer's Rights, and Licensing

3.4.1 JTNC Products

The SCA Test Report generated as a result of an SCA compliance certification test for JTNC products will contain markings appropriate for distribution throughout the JTNC Community. It is intended that these results be posted to the JTNC Information Repository for the JTNC Community to access. Efforts will be made to ensure that these reports will have the appropriate distribution.

3.4.2 Non-JTNC Products

The SCA Test Report generated as a result of an SCA compliance certification tests for non-JTNC products will contain the most open markings available as coordinated with the particular program or company. Since funding separate of JTNC is provided for this testing, tighter distribution markings may be required based on the desires of the customer.

3.5 Installation, Testing, and Control

SCA testing and product installation will be in accordance with this document, the appropriate test procedures, or tool documentation. Product compilation and installation will occur as a part of the testing process in accordance with the compilation documentation managed by the product developers. All product code and other documentation will be placed into a JTEL internal configuration repository to ensure control of the test environment and reproducible results. All JTEL tools and other products critical to maintaining the testing process will be provided by the JTEL Configuration Manager. JTEL Quality Assurance (QA) may observe or inspect the testing process at any time to confirm adequate controls.

3.6 Participating Organizations

This section presents the organizational entities which participate in the SCA compliance T&E processes described in this document. The roles and responsibilities described for each organization are only as they relate to the JTEL development support and SCA verification processes. The contract Statement of Work (SOW) and the SCA [Reference 1 or 2] provide specific guidance and requirements for the product developer's activities.

3.6.1 JTNC

The responsibilities of JTNC are to:

- Provide leadership and direction in satisfying all mission requirements.
- Review the SCA & API test reports and provide the official compliance Certification Memorandum for the product under test if applicable.
- Coordinate with JTNC stakeholders to address compliance issues and waiver requests.

3.6.2 JTNC Standards

The responsibilities of the DoD Waveform Standards Division are to:

- Develop, maintain, and evolve JTNC Standard APIs & SCA specifications.
- Provide technical expertise to the API verifications and SCA assessments.
- Review the API and SCA assessment reports.

3.6.3 JTNC Test and Evaluation Laboratory

The JTEL is responsible for the SCA and API compliance assessments described in sections 3 and 4 of this document as well as:

- Coordinate and plan the test activities.
- Perform API verification and SCA assessment activities and provide feedback to the stakeholder with respect to achieving API compliance.
- Facilitate communications with JTNC Standards with respect to questions and interpretation issues.
- Complete the API and SCA assessment reports.
- Provide feedback to the stakeholder at the conclusion of the test event.

3.6.4 Product Developer and Program Management Office

The responsibilities of the product developer and Program Management Office (PMO) (hereinafter referred to as “the Product PMO”) are to:

- Submit a complete Request for Service form to JTEL.
- Provide a complete software package and documentation to JTEL.
- Provide JTEL test engineers access to the facilities and resources needed to perform the test activities.
- Support the JTEL test report peer review process, if desired.

3.7 Tests to be Performed

The tests of the SCA Operating Environment and Application components are described below.

3.7.1 Software Communications Architecture Specification

The SCA establishes a framework for the development of JTNC software defined radios. The SCA defines the interface, behavioral, and infrastructure requirements for the software that is integral to the radio set OE and Applications that utilize that infrastructure. The goal of the SCA specification is to provide for the deployment, management, interconnection, and intercommunication of software components in embedded, distributed-computing communication systems.

3.7.1.1 SCA Operating Environment Description

The Operating Environment of a radio set, as defined in the SCA, is made up of a collection of executable software components including; an operating system, a CORBA middleware layer, and an SCA defined Core Framework. The purpose of the Operating Environment is to abstract the hardware and to improve portability of application software by providing a system that provides predictable behavior and defined interfaces. Hardware devices are abstracted to software proxies (SCA devices) that can be utilized by the remaining Operating Environment or the Application software.

3.7.1.1.2 Operating System

The JTNC requires a standard operating system interface in order to facilitate portability of applications. Portable Operating System Interface (POSIX) is a widely accepted industry standard, but a complete POSIX implementation encompasses more features than are required for a radio set. The SCA specification defines an Application Environment Profile (AEP) that is based on the Real-time Controller System Profile PSE52 as defined in POSIX 1003.13. The AEP identifies a set of operations

that are required to be provided by the Operating System. Only required operations are allowed to be utilized by SCA Applications.

3.7.1.1.3 CORBA Middleware

CORBA is used in the Core Framework as the message passing technique for the distributed processing environment. CORBA is used to standardize client/server operations when using distributed processing. A minimum subset of CORBA and CORBA services are required to be provided to support application portability. SCA Applications and devices are limited to using only the SCA required set of CORBA and CORBA services.

3.7.1.1.4 Core Framework

The Core Framework provides an open set of application program interfaces and services that provide an abstraction of the underlying software and hardware for application developers. All Core Framework interfaces are defined in Interface Definition Language (IDL) and compiled into the appropriate CORBA middleware. The IDL defines attributes and operations that serve as a contract between the Core Framework and application components. The Core Framework includes:

- Base Application Interfaces that can be used by all software applications,
- Framework Control and Base Device Interfaces that provide control of the system,
- Framework Services that support core and non-core applications, such as FileSystem, FileManager and Log,
- Domain Profiles that describe the properties and capabilities of the hardware devices and software components that make up a system.

Per this description, the devices will be verified during the OE test.

3.7.1.2 SCA Application Description

SCA Applications, also referred to as Waveform Applications in JTNC, are a collection of software resources with SCA defined interfaces and behaviors. Applications are required to be compliant with the requirements specified in the SCA which limits the calls made to the Operating System and CORBA middleware. The SCA Application under test will be made up of the components specified in the Application's Software Assembly Descriptor (SAD) file which describes the instantiated CORBA and non-CORBA enabled components and connections that will be established upon deployment by the OE.

The Application software and documentation is delivered to the JTNC Information Repository. Application software will be developed and associated with a particular development environment. This software will also be pulled from the JTNC Information Repository and ported to SCA compliant OEs.

4 Test Approach

The following sections describe the Test Models for the SCA compliance certification Process. A Test Model describes a high-level scenario for the SCA compliance certification testing. Three Test Models are described in Section 4.5 below which apply to both the Operating Environment and Application testing. The Test Models are similar to the Service Delivery Models, described in previous SCA test plans, which described the testing process and responsibilities based on the tools utilized, location, and which personnel or resources were in charge of running the testing activities. The terminology change to Test Models is to describe the testing process with respect to when and how the testing activity will occur. This change is based on the JTNC Community's desire to have the SCA compliance testing occurring earlier in the development process. The below sections describe paths to address this goal.

Each JTNC product is assigned a JTEL Test Engineer who operates as a liaison between the developer and the product acquisition representatives. The JTEL Test Engineer is responsible for coordinating with these representatives to determine and execute a Test Model. The decision regarding the Test Model needs to be one that factors in the level of JTEL involvement during the development period, the product development schedule, and available resources.

JTEL is responsible for providing both support during the development of the products and also SCA compliance certification testing. The test and evaluation process described in these sections is separated into two categories. The first category, entitled Product Development Support, encompasses those activities in which JTEL is involved prior to the final delivery of a product from the developer or acquisition representative. The second category, entitled JTEL SCA compliance certification testing Process, describes the official JTEL SCA test and evaluation activities leading to the report and recommendation being submitted to the JTNC. As a reminder, the JTNC will make the final decisions regarding the SCA compliance certification of the product. Figure 4-1 provides an overview of the testing process.

SCA test events are subject to JTEL's Configuration Management and Quality Assurance processes.

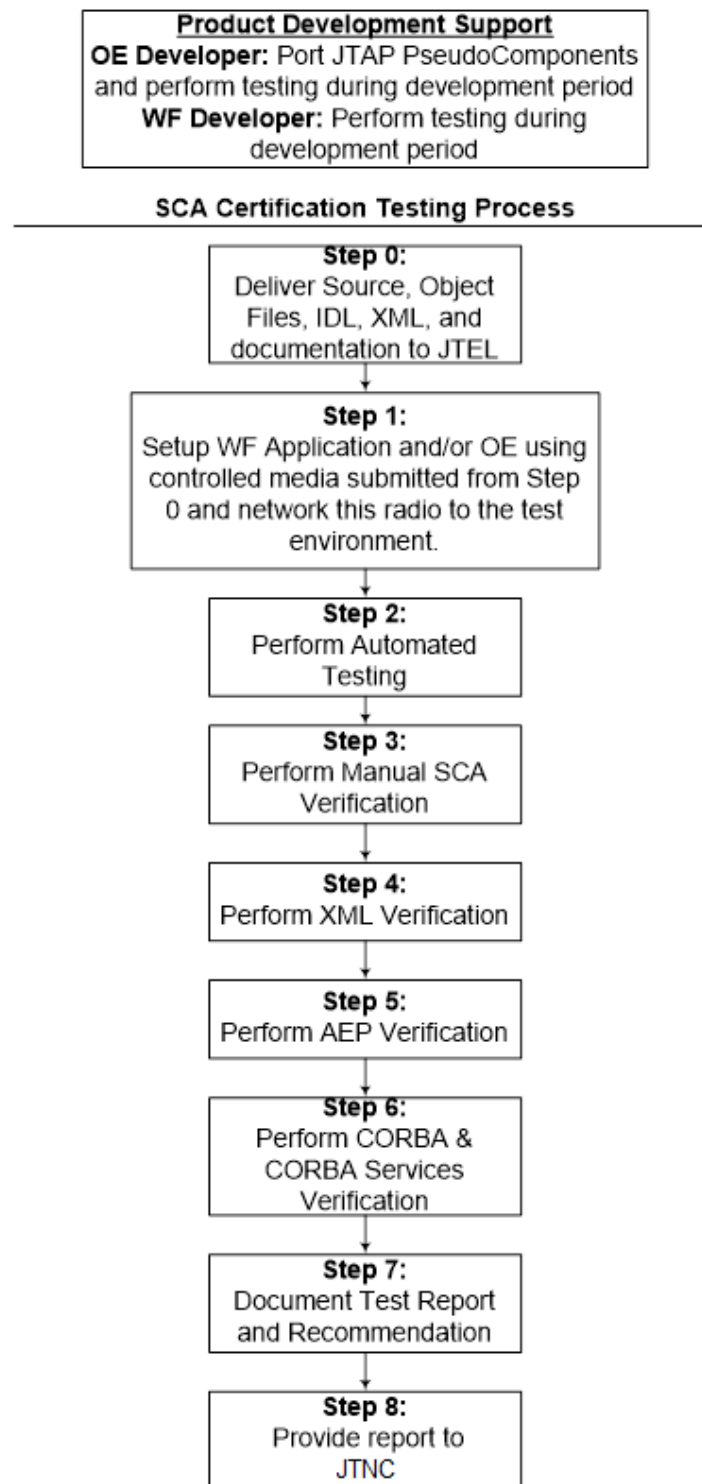


Figure 4-1: JTEL SCA Compliance Certification Testing Process

The Product Development Support box is described in Section 4.1. The steps of the SCA compliance testing process are:

- **Step 0: Deliver software and documentation on Compact Disc (CD) to JTEL** – Supplied software will include the source code, object code, executables, and XML (all code necessary to create the automated testing environment and support the manual verification). This CD will be utilized for Step 1's set up activity and will be placed into JTEL's internal CM library.
- **Step 1: Setup Application and/or OE using controlled media submitted from Step 0 and network this radio to the test environment** – For OE testing activities, only the OE and JTAP PseudoComponents will be installed along with the JTAP PC setup. For Application testing activities, both the OE and the Application will need to be installed on the radio set along with the appropriate JTEL test tool for the Application. The source code from the controlled media will be recompiled and installed onto the radio by the developer to help ensure a controlled testing environment.
- **Step 2: Perform Automated Testing** – After the testing environment is setup and configured, the automated testing will begin. The automated testing is performed first to assist in determining the full set of requirements that need to be manually verified. Requirements that are not able to be verified via one of the JTEL tools, will be verified manually.
- **Step 3: Perform Manual SCA Verification** – There are many SCA requirements that cannot be automatically tested and will require verification by inspection. This applies to both the Application and the OE. The manual verification may include some requirements that were not able to be automatically tested by the JTEL tools.
- **Step 4: Perform XML Verification** – The Domain Profile provided with the products will be verified against Appendix D of the respective SCA document. For Applications and OEs, the verification will be according to the documented procedures referenced in Section 4.2 below with additional verification scripts to supplement the design requirements contained within the specification.
- **Step 5: Perform AEP Verification** – This is a client/server type requirement. The OE behaves as a server and is required to provide a minimum set of interfaces in the Operating System for Application usage. The OE documentation of the Operating System interfaces will be inspected to confirm that all of the SCA Appendix B required interfaces are properly implemented. The Application, behaving as the client, is limited in its interfacing to the Operating System to that which is required by the SCA Appendix B. This verification is a source and object code review to confirm that the Application does not utilize more than the required interfaces.
- **Step 6: Perform CORBA and CORBA Services Verification** – This is also a client/server type requirement. The OE behaves as a server and is required to supply middleware that provides at least minimum CORBA and CORBA Services required by the SCA. Some of the interfaces are exercised automatically via the JTAP tool. The Application, behaving as the client, is limited in its interfacing to the required CORBA and CORBA Services. The OE devices also have this limitation on its usage of CORBA and CORBA Services. The Application resources and OE devices are exercised via inspection, automated scripts, and/or the Data Reduction Parser (DRP).
- **Step 7: Document Test Report and Recommendation** – JTEL will collect the data from the testing activities described in Steps 2-6 and will document a test report and recommendation. The recommendation will factor in any approved waivers.

- **Step 8: Provide report to JTNC** – JTEL will provide the test report and recommendations (from Step 7) to JTNC. The JTNC holds the authority to provide the SCA compliance certification. In addition to the formal submission to the JTNC, the report will be provided to the non-JTNC project representative and maintained within JTEL's Configuration Management library. For JTNC products, these reports will also be uploaded to the JTNC Information Repository.

4.1 Operating Environment Testing

The OE evaluation involves automated and manual verification. The automated testing utilizes an external tool that is networked to the OE under test via an IP-based interface. The automated testing for operating environments requires a sample set of common SCA components (PseudoComponents), provided by JTEL, to be integrated within the OE to confirm that the OE is mature enough to properly handle these types of SCA components. The automated testing and troubleshooting generally occurs first in the testing process. The manual verification, a combination of documentation and source code reviews, may follow the automated testing to exercise requirements that have not or cannot be automated or those requirements that were unable to be verified via the automated method. Manual verification is the default approach when the automated tools are unable to perform verification of the requirements. JTEL will evaluate all of the SCA devices and services available on the JTR Radio Set during the OE SCA compliance testing.

4.1.1 Operating Environment Automated Testing

JTEL utilizes a software tool called the JTNC Test Application (JTAP). This tool has previously been designed to test the SCA compliance of OE for SCA v2.0 and SCA v2.2 [Reference 1]. JTEL is expanding this tool to also incorporate SCA v2.2.2 [Reference 2] OE testing functionality. The JTAP analyzes a set's OE for compliance with the interfaces and behaviors described in the SCA. For the OE, the JTAP supports testing much of the Core Framework, CORBA and CORBA Services, and Domain Profile verification. The JTAP will be provided to set manufacturers, who are strongly encouraged to make use of this resource early in their development. The JTAP will be used to perform the automated testing by JTEL.

Figure 4-2 below illustrates the architecture of the JTAP. Part of the JTAP is hosted on a Microsoft Windows PC and is interfaced to the radio set under test through an IP capable network connection such as Ethernet. JTAP also requires minimal implementations of several SCA compliant components such as an Application (called a PseudoWaveform), a Device (called a PseudoDevice), and a service (called PseudoService). These executable components represent common SCA components that the Core Framework must properly interact with. These Pseudocomponents must be ported to and installed on the radio set under test by the set developer. The effort involved in this porting is based on the developers' knowledge of CORBA, the Operating System, and the SCA. Additional information can be found in the documentation set provided by the JTAP tool. If security is implemented within the environment under test, steps will need to be taken to allow the JTAP access to the components under test.

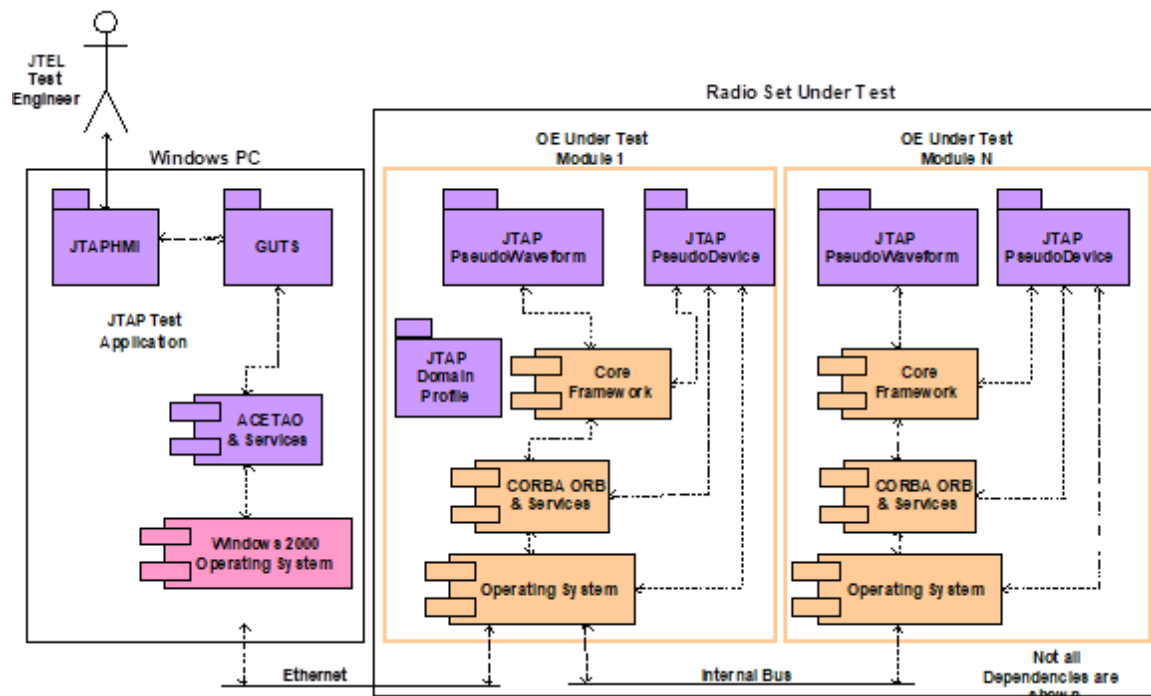


Figure 4-2: JTAP Architecture

4.1.2 Operating Environment Manual Testing

It is necessary for JTEL to have access to the Radio Set software (source, executables, XML, IDL) and documentation to perform SCA compliance testing. The portions of the Radio Set that are manually tested include:

- **AEP Verification** – The Operating Environment, specifically the Operating System, is required to provide a minimum set of interfaces that are accessible to the Applications. This verification is currently done by inspecting Operating System or Radio Developer provided function-level documentation to confirm that all of the required interfaces are provided. It is currently expected that this documentation will be provided by the Operating System developing company. As development activities continue, JTEL may develop other methods of verification to fully exercise these interfaces.
- **CORBA Middleware Verification** – The Operating Environment is required to provide the CORBA (minimumCORBA) and CORBA Services (NamingService, Event Service, Log Service) mandated by the SCA. This verification is currently done by inspecting the CORBA ORB documentation and also exercising the automated tests within the JTAP. For the manual portions of the test, documentation provided by the vendor will be used to confirm that the required interfaces are provided.
- **Core Framework SCA Requirement Verification** – This covers the SCA requirements that are not able to be fully verified via the automated methods utilized by the JTEL tools. The device CORBA and CORBA Services verification would also fall into this category of manual verification.

- **Domain Profile Verification** – The Operating Environment will have a set of eXtensible Markup Language (XML) files that describe how the combination of SCA components are to be deployed. JTEL will confirm that these files meet the descriptions provided in the SCA text including Appendix D Domain Profile [Reference 1 or 2]. This portion of the testing is done via inspection which may involve a combination of scripts or tools to confirm the correct formatting and correctness of content.

Note that the JTAP automated tool for SCA v2.2 only tests the SCA compliance of the Core Framework and Devices. The radio set manufacturer must provide sufficient documentation for JTEL to evaluate the SCA compliance of the CORBA middleware and the Operating System used in the radio Set OE. The list of required information is given in Appendix B to this document. Delivery of this information, or documentation of a Test Plan for verifying the SCA compliance of the CORBA middleware and operating system, will be one of the entry criteria for conducting the SCA compliance test on the radio set. For SCA v2.2.2, the JTAP tool will be expanded, but similar documentation based methods will be utilized for the AEP and CORBA verifications.

The appropriate procedures are documented in Section 3.3 above. Deficiencies identified during the automated testing will be confirmed during the manual testing.

4.2 Application Testing

The Application evaluation involves both automated and manual verification. The automated testing utilizes an external tool that is networked to the radio set and OE to reach the Application under test via an IP-based interface. The automated testing and troubleshooting generally occurs first in the testing process. The manual verification, a combination of documentation and source code reviews, follows the automated testing to exercise requirements that have not or cannot be automated or those requirements that were unable to be verified via the automated method. Manual verification is the default approach when the automated tools are unable to perform verification of the requirements.

In addition to the testing of the Application product, an OE Characterization is required to identify whether there are compliance issues with the OE that may affect the Application's development and ability to meet its requirements. Additional detail on the OE Characterization activity can be found in Section 4.2.1.

4.2.1 Operating Environment Characterization

There is an identified risk of attempting to certify an Application on an unqualified Operating Environment. JTEL requires the Operating Environment in which the Application is running to be characterized to identify any issues that may prevent the Application from meeting the SCA requirements. This characterization activity may also support or help identify potential required waivers for the application. The OE Characterization activity involves verifying a subset of SCA requirements that would potentially negatively impact the operations or design resulting in a failed SCA requirement for the Application. JTEL will provide a list of requirements to be verified for this characterization activity.

This activity requires developer support to assist in analyzing the Operating Environment and help identify potential impacts. This analysis will assist the identification of potential waivers for the Application and will support the JTEL's recommendations to the JTNC regarding submitted waivers.

This activity is expected to take two to three weeks for the verification, depending on the knowledge of the developer and maturity of the OE, and approximately two weeks for the analysis of the results by JTEL.

- **Step 0: Establish Timeframe** – JTEL Test Engineer coordinates with the developer to determine an appropriate time during the Application development to perform the OE Characterization activity. The OE Characterization activity is intended to take no more than two weeks effort assuming the developer performs the automated testing prior to JTEL coming onsite to perform the Manual Testing.
- **Step 1: Provide Requirements Set** – JTEL Test Engineer provides a subset of SCA requirements, automated test cases, and manual test cases to be exercised during the OE Characterization activity.
- **Step 2: Identify OE Components Under Test** – Developer will provide the OE and Application XML, source code, design documentation, and API documentation to JTEL. The JTEL Test Engineer, with the assistance of the product developers, will identify the OE components that will be subjected to this OE Characterization activity. The JTEL Test Engineer may provide data on identified deficiencies in the XML at this time. The developer may also provide a set of known deficiencies at this time.
- **Step 3: Perform Automated Testing** – Developer will run automated tests using the JTEL tools identified by this document. If JTEL support is requested or required, then JTEL will be onsite to support this activity. The testing logs from this activity will be saved and provided to JTEL. This activity is expected to take one week.
- **Step 4: Perform Manual Testing** – JTEL Test Engineers, with the assistance of the developer, will perform manual source code (including XML) verifications. The developer will guide the JTEL Test Engineers through the product code. JTEL Test Engineers will prioritize requirements based on identified areas of concern and general criticality. This step is intended to take about two weeks.
- **Step 5: Analysis and Results** – JTEL will perform analysis of the data received and provide overall findings relative to the impact on the Application. The developer will need to be available to potentially support questions during the analysis period. No reports will be generated from this activity unless required/requested by the PMO. The analysis will take approximately two weeks and will be completed with an optional out brief of the potential impact.

4.2.2 Application Automated Testing

For SCA v2.2 [Reference 1], JTEL will utilize the Waveform Test Tool (WTT) to perform compliance testing on submitted Applications. The tool provides capabilities to automate some of the required testing and also assists in manual test scenarios. The usage requirements for the WTT are documented in the WTT Software Users Manual which is installed when you install the tool.

For SCA v2.2.2 [Reference 2], JTEL is enhancing the current JTAP capabilities (described above in the Operating Environment automated testing Section 4.1.1) to include testing of SCA Applications. This will create a tool that is capable of testing both the OEs and Applications for compliance to the SCA v2.2.2 [Reference 2].

Both the WTT and JTAP automated tools require an IP-based connection and for any security implemented to allow the automated tools access to the components under test. The tester, utilizing both tools, will need to be knowledgeable of the SCA to assist with troubleshooting and determining requirement fulfillment. JTEL will be assisting the JTNC Community to understand which requirements should be verified.

4.2.3 Application Manual Testing

It is necessary for JTEL to have access to the application software (source, object files, executables, XML, IDL) and documentation to perform SCA compliance testing. Portions of the application that are manually tested include:

- AEP Verification – Applications are limited to the Operating System services that are designated mandatory in the Application Environment Profile,
- CORBA Verification – Applications are limited in their interfacing to CORBA (minimumCORBA) and CORBA Services (NamingService, Event Service, Log Service) mandated by the SCA,
- SCA Requirement Verification – This covers the SCA requirements that are not able to be satisfied via the automated methods utilized by the JTEL tools,
- Domain Profile Verification – The Application will have a set of XML files that describe how the combination of SCA components are to be deployed. JTEL will confirm that these files meet the descriptions provided in the SCA [Reference 1 or 2] text.

JTEL Test Engineers can utilize software tools such as the Data Reduction Parser (DRP) to assist the manual portion of SCA compliance verification. The DRP is a parsing tool that supports keyword searches and assists with the verification of AEP and minimumCORBA. In addition to the DRP, code inspection and Domain Profile inspection is performed.

The appropriate procedures are documented in Section 3.3 above.

4.3 Product Development Support

The following sections detail the development support activities for the JTNC Set and Application developments. Development support includes those activities occurring early in the product development and prior to the SCA compliance certification activities. Development support is provided by default to all JTNC Products. JTNC products that desire JTEL development support will need to provide funding to supplement this activity. Development support is provided as a risk mitigation to the SCA and JTNC Compliance activities.

4.3.1 JTEL Involvement in Radio Set Development Activities

JTEL will participate in the radio set manufacturer's development activities as specified in the product SOW. The JTEL representatives will attend the Software Requirements Reviews (SRR), Preliminary Design Review (PDR), and Critical Design Review (CDR) for each software product integral to the radio set development. The JTEL evaluation team will review the required documentation, including the Software Requirements Specifications (SRS), Software Design Description (SDD), and Formal Qualification Test (FQT) plans. The FQT participation includes the Test Readiness Review (TRR) where the tested configuration is locked down. By participating in these reviews the JTEL and the developer can reach agreement on the requirements, the interpretation and implementation of those

requirements, and how to properly validate these requirements during formal testing. JTEL early involvement, as a precursor to subsequent T&E activities, will inform and expedite the T&E process, and will greatly enhance the chances for a successful SCA compliance test. The JTEL will provide technical representatives to witness FQT testing in accordance with the product SOW. Table 4-1 summarizes JTEL involvement in radio set software development activities prior to the radio set OE testing and evaluation. This involvement will take place prior to any of the three OE T&E processes described in the following sections.

Table 4-1. JTEL Involvement in Radio Set Development Milestones

Development Milestone	Purpose	JTEL Activities
SRR	Review requirements and functional allocations	Attend SRR, participate in walkthrough, review FQT Plan, SRS, SDD
PDR	Review design, assess requirements adherence, risk, test strategies	Attend PDR, review Design Specifications
CDR	Determine requirements satisfaction, assess risks, supportability	Attend CDR, review Design Specifications
TRR/FQT	Verify software performance compliance with SRS, including vendor SCA compliance testing	Witness testing, review FQT Procedures, Report

4.3.2 JTEL Involvement in Application Development Activities

Before JTEL receives the final delivery of an Application from the PMO, JTEL will participate in reviewing the developer's development activities. This early involvement is a precursor to subsequent T&E activities and will, over time, expedite the T&E process as well as reduce the technical support required of the Application developer.

JTEL will review all released documentation for each application to be tested. This includes but is not limited to the Waveform Design Specification (WDS), Software Requirements Specification (SRS), Software Design Description (SDD), and the Software Test Plan (STP). JTEL and its representatives may also attend the major milestones of the application development cycle which correlate with this documentation, including but not limited to the Software Requirements Review (SRR), Preliminary Design Review (PDR), Critical Design Review (CDR), and Formal Qualification Test (FQT). JTEL may also review code released as incremental developments of the application.

These reviews occur so that JTEL will be closely familiar with the application prior to its delivery in an effort to reduce testing time and to ensure that the application will encounter as few problems as possible during testing by addressing possible issues early in the development cycle. Reviews of these events or documents will be made by JTEL under one or more of its assessment areas, specifically addressing the SCA compliance of the application. These reviews are forwarded to the JTNC at their request.

Table 4-2: JTEL Involvement in Application Development Milestones summarizes JTEL involvement in application development activities prior to submission of the application for testing.

Table 4-2. JTEL Involvement in Application Development Milestones

Development Milestone	Purpose	Associated JTEL Activities
SRR	To review the application requirements and functional allocations. To confirm that the product will be developed to meet all of the applicable requirements from the JTNC Standards specifications (SCA, API Standardization, Software Standards, etc.)	Review of WDS and SRS
PDR	To review the application design and assess requirements adherence, risk, and test strategies applicable to the development.	Review SDD and updated WDS
CDR	To determine the satisfaction of requirements and supportability of the application code and to assess developmental risks and issues.	Review updated SDD and WDS
TRR/FQT	To assess the readiness of test plans and resources. To verify software performance compliance with the SRS.	Review of Software Test Plan and Software Test Procedures. Witness FQT testing.

4.3.3 Interim Assessments

In addition to the above-mentioned support during the development of the various Operating Environments and Applications, JTEL is available to perform Interim Assessments for the SCA, APIs, or other areas that are within the scope of JTEL. These Interim Assessments are coordinated by the JTEL Test Engineer in conjunction with the product development plans and schedule as requested by the developers or acquisition office. The Assessments provide an opportunity for JTEL to provide the developers with the expectations and compliance details that JTEL will pursue during the SCA compliance certification activity. Interim Assessments are not official results and do not count toward the SCA compliance certification activity.

The Interim Assessments are intended to be flexible in duration and scope. In most cases, these activities will be scoped to one or two week durations. The intention is not to interfere with the product schedule, but to provide the early feedback to have a more mature product at the end of the development cycle. There is significant benefit to the products and the acquisition offices to have these assessments performed at appropriate times throughout the development periods. The intention of these activities are not to spread negative performance data regarding the various developments. It is purely a risk mitigation method to help ensure success during the SCA compliance certification activity. JTEL will provide notes gathered during the event to both the developer and the acquisition representatives and will generally put together a report that captures the findings.

As these Assessments are, in most cases, performed based on a limited amount of time, spot checks will be performed for requirements that require a significant amount of time to confirm. JTEL will need access to the product source code, object code, IDL, and XML to perform a more thorough analysis of the product. JTEL expects to be able to access these items via the JTNC Information Repository, which will be receiving occasional deliveries for JTNC products. If regular submissions are not being placed into the Information Repository, JTEL will need to coordinate with the developer

and acquisition office to secure a software delivery to JTEL. Deliveries received outside of the JTNC Information Repository will only be maintained within JTEL's internal configuration repository.

All test events are subject to JTEL's internal Configuration Management and Quality Assurance processes.

4.4 JTEL SCA Compliance Certification Testing Process

The JTEL T&E Process is intended to collect enough information about the radio set Operating Environment or Application under test to allow the JTNC to make a decision regarding its compliance and if agreed to provide an SCA compliance certification memo. JTEL will perform all testing in accordance with the procedures identified in Section 4.3 above, any identified deficiencies in these procedures, and the requirements documented in the appropriate specification. JTEL will document the results of the testing in a test report and will submit this report and recommendation to the JTNC. A decision on any submitted waivers will need to be resolved ahead of the start of the testing activity. Program Offices are encouraged to submit potential required waivers in advance of the start of the SCA compliance certification activity. Not having these waivers processed prior to the beginning of the testing process will result in a delay in the completion of the report-writing phase of the testing process.

The following subsection provides categorical information about steps in the T&E process and follow the outline presented in Table 4-3.

Table 4-3. Description of Process Step Subsections

Entrance Criteria	Identifies the conditions necessary to begin this step in the process. Software and documentation delivery entrance criteria for SCA compliance certification activities can be found in Appendix B of this document.
Environment	Describes tools and configuration used for this step in the process
Description	Provides details about the activity performed in this step
Requirements	Identifies the source of the requirements mandating and governing the test or assessment activity
Responsibility	Identifies responsible organizations; for JTEL, identifies the technical personnel responsible for scheduling the activity (not necessarily the person performing the action)
Reporting	Describes how the results of the activity in the process step will be reported
Exit Criteria	Identifies what must occur to advance in the process

The JTEL Test Execution Lead will review all phases of the JTEL T&E process and will be responsible for the maintenance of this process, including improvements. The JTEL Test Engineers will be the principal points of contact for details on the JTEL T&E Process and status on a particular test event.

The Product FQT is identified in each of the test models with the assumption that the product development will be complete at that time. The JTEL Test Engineer will need to coordinate with the acquisition office to determine the most appropriate test model. All models are subject to JTEL CM & QA processes.

4.4.1 Test Model-A (Pre-FQT Model)

Majority of Compliance Testing Occurs Prior to FQT

This process involves JTEL performing the majority of the SCA compliance certification activity two to three months prior to the FQT event. This first round of testing would be a for-score run and the results would be included in the JTEL SCA Test Report. Figure 4-3 shows a high-level flow of events for this test model.

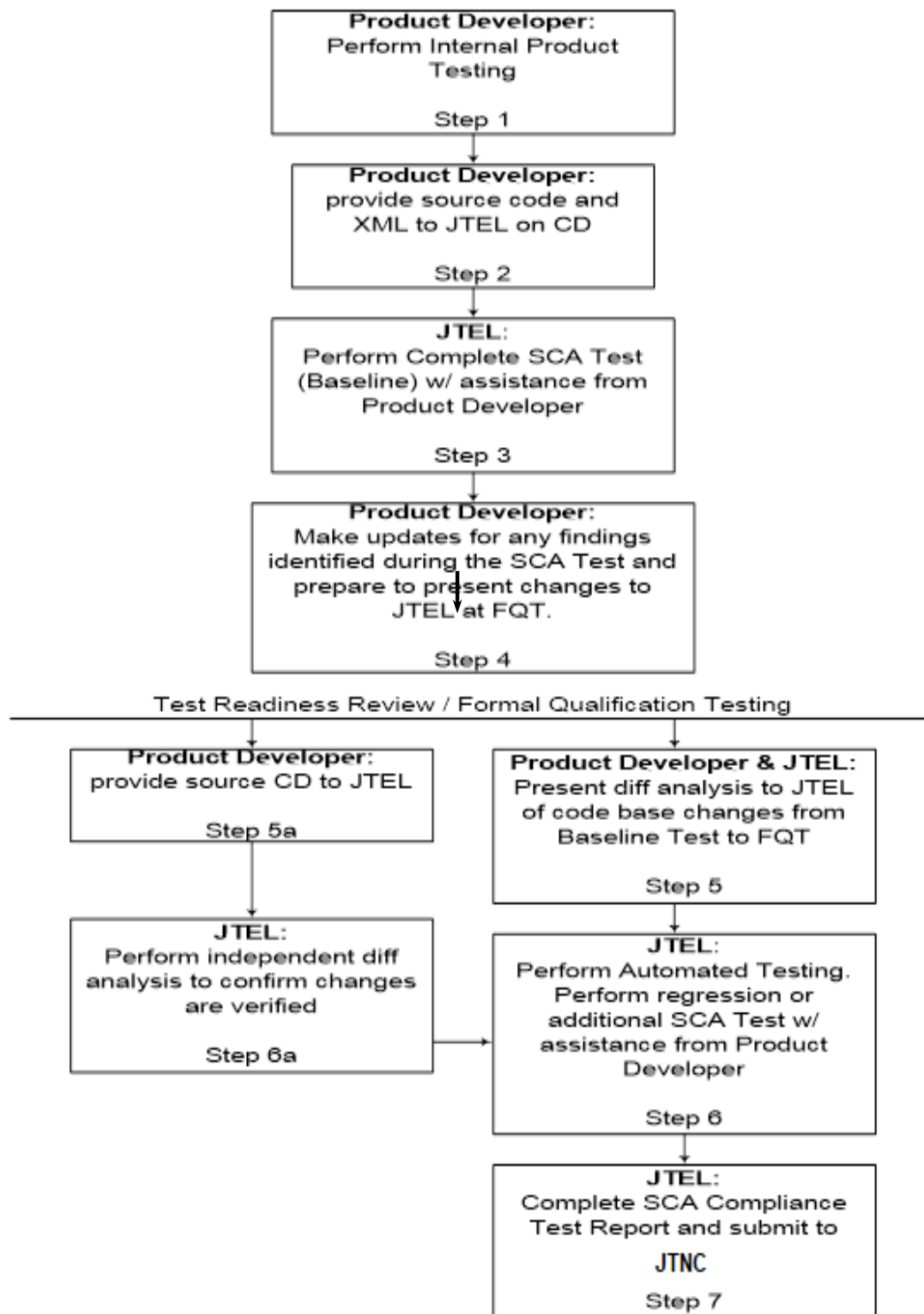


Figure 4-3: Test Model-A (Pre-FQT Model)

4.4.1.1 Entrance Criteria

Step 1: OE or Application Product exists to exercise testing.

Step 2: Coordinate with JTEL Test Engineer to confirm support for this Test Model.

Step 3: For Applications, a full OE Characterization is required to determine and confirm whether there will be portions of the OE that will affect the Application Compliance. This will provide support for any waiver requests. For OEs, the JTAP PseudoComponents have been successfully integrated into the radio set.

Step 4: JTEL provides feedback from Step 3 activity.

Step 5: Any identified waivers have been processed (decisions made) by JTNC.

Step 5a: Implementation is complete for SCA compliance certification Activity.

Step 6: Step 5 analysis is completed. System is configured to allow automated testing.

Step 6a: CD is provided by Product Developer in Step 5a and placed into JTEL CM.

Step 7: All data is collected from Steps 3 and 6.

4.4.1.2 Environment

Except for the activities in Steps 6a and the feedback provided by JTEL as a result of Step 2, the testing activities will occur at the developers' location unless a duplicate testing environment can be provided to or obtained by JTEL. JTEL's preference is for all testing to occur in the JTEL facilities in San Diego.

OE: The JTAP utilizes several SCA compliant modules, the JTAP Target Components, to facilitate complete SCA compliance testing of the target Operating Environment. The JTAP Target Components are installed on and uninstalled from the target radio set during the execution of applicable selected tests. Manual verification will be a source code and documentation level review. The JTAP requires an open (whitebox) testing environment to be able to access all of the components under test.

Application: The WTT, for SCA v2.2, and the JTAP, for SCA v2.2.2, both interface to the Application via an IP-based interface. Manual verification will be a source code level review.

4.4.1.3 Description

This Test Model provides earlier official test results to the Product Developer and acquisition representatives so that any additional fixes can be incorporated prior to the FQT period and the completion of the SCA compliance testing. This test model also potentially shrinks the SCA related activities during the FQT event and assists JTEL in providing a test report earlier for SCA compliance certification activities.

There is an assumption that there will not be significant changes in the product between the baseline testing activity and that which is verified during the FQT period. Because of this assumption, it is expected that the automated testing results will be consistent or will improve as any changes should not negatively affect the testing results. Performing this automated testing at the end of the testing cycle provides additional confirmation that the product continues to meet the SCA requirements.

4.4.1.4 Requirements

The requirements are those identified in the appropriate SCA document.

JTEL also requires the support of the Product Developer to assist the verification. The product will be verified for its compliance to applicable and testable SCA requirements from the appropriate SCA specification.

4.4.1.5 Responsibility

4.4.1.5.2 Operating Environment

Step 1: The Product Developer is responsible for porting the JTAP Target Components to the radio set under test, performing unit and system level testing, securing OS and CORBA documentation for AEP, minimumCORBA, and CORBA Services verification. The JTAP Target Components, and associated XML files, must be ported to the radio set under test. Automated and manual verification should be performed by the developer in preparation for JTEL official testing.

Step 2: The Product Developer or acquisition representative will provide a CD with product source code, XML, and IDL to JTEL with the software that will be verified in Step 3. For JTNC Products, the submission will generally be to the JTNC Information Repository.

Step 3: JTEL will perform a complete SCA test of the OE product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide JTEL through the source code to confirm the individual SCA requirements that cannot be automatically tested. JTEL may perform additional verifications in parallel and provide feedback utilizing the CD contents provided in Step 2.

Step 4: The Product Developer will make product updates based on identified deficiencies from this testing activity or create waivers for requirements that will not be correctly implemented.

Step 5: The Product Developer will present a source code diff analysis reflecting the changes implemented from the time of the testing in Step 3.

Step 5a: The Product Developer or acquisition representative will provide a CD with product source code, XML, and IDL to JTEL with the software that will be verified in Step 6 and 6a. For JTNC Products, the submission will generally be to the JTNC Information Repository.

Step 6: JTEL will re-run the automate testing previously performed in Step 3 and will perform manual verification for identified code or XML changes from Step 5. The re-run of the automated testing is to confirm that none of the changes made have broken the product. The results should be similar to that produced during Step 3 above.

Step 6a: JTEL will perform its own diff analysis to confirm that all of the identified changes are verified with the developer. Any concerns for the changes in the code will be communicated to the JTEL representative on-site to confirm any effects on the product compliance.

Step 7: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process

and presenting the findings to the developer. Official decisions made on submitted waivers will be factored into this test report.

4.4.1.5.3 Application

Step 1: The Product Developer is responsible for performing unit and system level testing, exercising the JTEL tools and procedures against the product to identify errors and make corrections.

Step 2: The Product Developer or acquisition representative will provide a CD with product source code, object code, XML, and IDL to JTEL with the software that will be verified in Step 3. The object code is utilized to assist with the CORBA and AEP verifications. For JTNC Products, the submission will generally be to the JTNC Information Repository.

Step 3: JTEL will perform a complete SCA test of the Application product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide the JTEL Test Engineers through the source code to confirm the individual SCA requirements that cannot be automatically tested. JTEL may perform additional verifications in parallel and provide feedback utilizing the CD contents provided in Step 2.

Step 4: The Product Developer will make product updates based on identified deficiencies from this testing activity or create waivers for requirements that will not be correctly implemented.

Step 5: The Product Developer will present a source code diff analysis reflecting the changes implemented from the time of the testing in Step 3.

Step 5a: The Product Developer or acquisition representative will provide a CD with product source code, object code, XML, and IDL to JTEL with the software that will be verified in Step 6 and 6a. The object code is utilized to assist with the CORBA and AEP verifications. For JTNC Products, the submission will generally be to the JTNC Information Repository.

Step 6: JTEL will re-run the automate testing previously performed in Step 3 and will perform manual verification for identified code or XML changes from Step 5. The re-run of the automated testing is to confirm that none of the changes made have broken the product. The results should be similar to that produced during Step 3 above.

Step 6a: JTEL will perform its own diff analysis to confirm that all of the identified changes are verified with the developer. Any concerns for the changes in the code will be communicated to the JTEL representative on-site to confirm any effects on the product compliance.

Step 7: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process and presenting the findings to the developer. Any submitted waivers will be factored into this test report.

4.4.1.6 Reporting

JTEL will provide comments on issues as they are identified, will provide feedback and status from the Step 3 effort, and will prepare and submit the SCA Test Report and Recommendation to the JTNC following the completion of the SCA compliance certification activity.

4.4.1.7 Exit Criteria

JTEL will provide the SCA Test Report and Recommendation to the JTNC.

4.4.2 Test Model-B (FQT-Model)

Compliance Testing Activity Occurs at FQT

This process has JTEL performing the SCA compliance certification activity during the developer's FQT activity. This takes advantage of the opportunity to reduce re-work. Generally the developer has a requirement to demonstrate their SCA compliance at FQT time. Figure 4-4 below provides a high-level view of the steps involved in this test model.

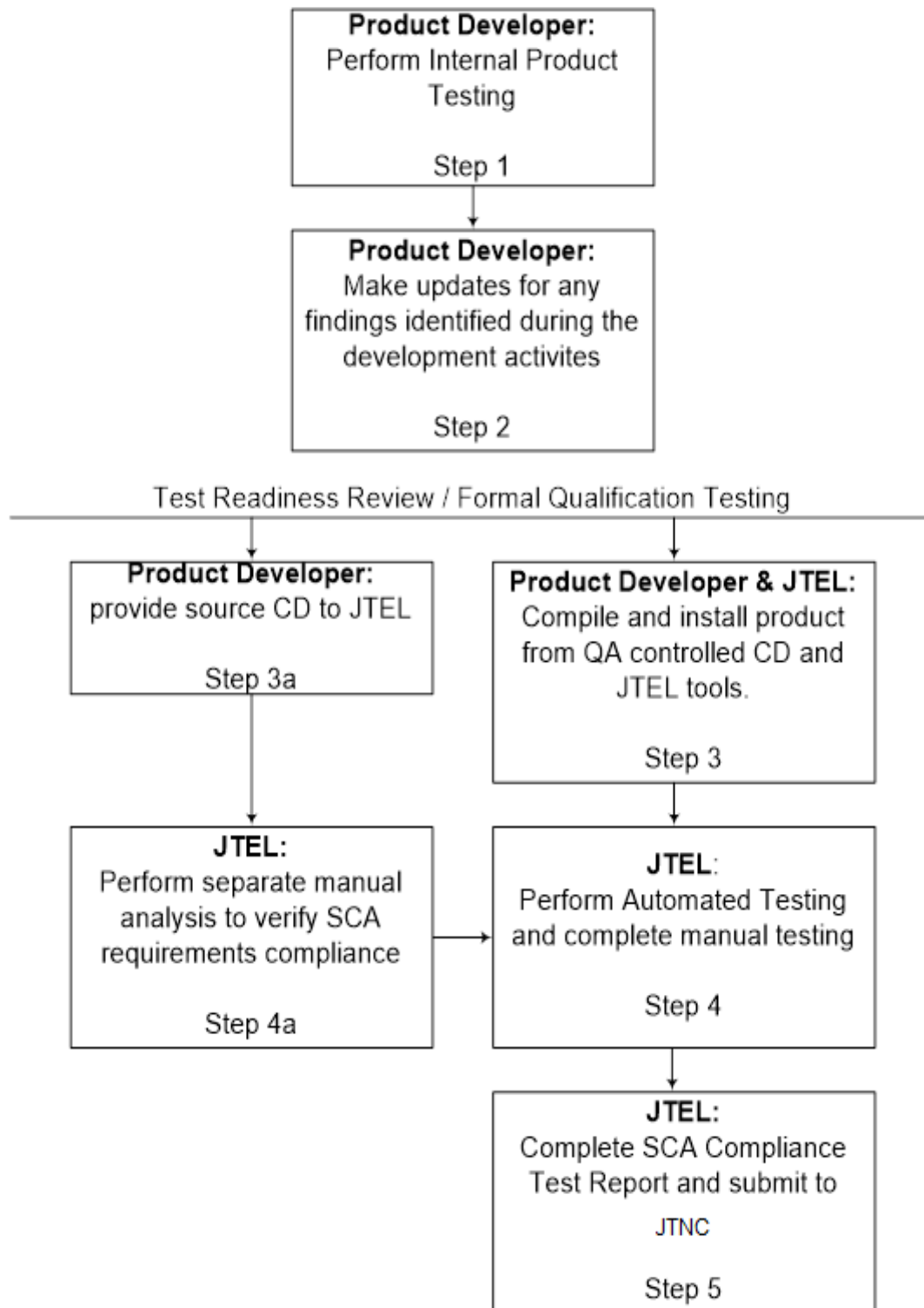


Figure 4-4: Test Model-B (FQT-Model)

4.4.2.1 Entrance Criteria

Step 1: OE or Application Product exists to exercise testing. For OEs, the JTAP PseudoComponents have been successfully integrated into the radio set. Developer should have corresponded with JTEL regarding any identified deficiencies and can provide evidence that they are ready for formal testing.

Step 2: JTEL receives feedback from Step 1.

Step 3: Controlled CD with all source, object files, executables, XML, IDL files and documentation provided for the product under test by the developer or acquisition office. This CD should also include the ported PseudoComponents for OE testing that will be utilized. Coordinate with JTEL Test Engineer to confirm support for this Test Model. This CD will be placed in JTEL CM.

Step 4: Any identified waivers have been submitted and processed (decisions made) by JTNC. CD is provided by Product Developer in Step 3. For Applications, a full OE Characterization is required to determine and confirm whether there will be portions of the OE that will effect the Application Compliance. This will provide support for any waiver requests. Implementation of product is complete for SCA compliance certification Activity.

Step 5: All data is collected from Step 4 and tested versions are controlled and provided to JTEL.

4.4.2.2 Environment

Except for the activities in Steps 4a and the feedback provided by JTEL as a result of Step 2, the testing activities will occur at the developers' location unless a duplicate testing environment can be provided to or obtained by JTEL. JTEL's preference is for all testing to occur in the JTEL facilities in San Diego.

OE: The JTAP utilizes several SCA compliant modules, the JTAP Target Components, to facilitate complete SCA compliance testing of the target Operating Environment. The JTAP Target Components are installed on and uninstalled from the target radio set during the execution of applicable selected tests. The JTAP requires an open (whitebox) testing environment to be able to access all of the components under test. Manual verification will be a source code and documentation level review.

Application: The WTT, for SCA v2.2, and the JTAP, for SCA v2.2.2, both interface to the Application via an IP-based interface. Manual verification will be a source code level review.

4.4.2.3 Description

This Test Model provides SCA compliance decision information at the FQT event to provide information to the acquisition representative prior to the FQT completion. This option also reduces the potential re-work associated with Test Model C. This test model also assists JTEL in providing a test report earlier for submission to the JTNC.

There is an assumption that there will be an SCA demonstration at the FQT time that can be capitalized upon. There is also an assumption that the Developer's necessary resources will be available. The JTEL tools and procedures with known and identified errata will be utilized during the testing process.

4.4.2.4 Requirements

The requirements are those identified in the appropriate SCA document.

JTEL also requires the support of the Product Developer to assist the verification. The product will be verified for its compliance to applicable and testable SCA requirements from the appropriate SCA specification.

4.4.2.5 Responsibility

4.4.2.5.2 Operating Environment

Step 1: The Product Developer is responsible for porting the JTAP Target Components to the radio set under test, performing unit and system level testing, securing OS and CORBA documentation for AEP, minimum CORBA, and CORBA Services verification. The JTAP Target Components, and associated XML files, must be ported to the radio set under test. Automated and manual verification should be performed by the developer in preparation for JTEL Official testing.

Step 2: The Product Developer will make product updates based on identified deficiencies from this testing activity or create and submit waivers for requirements that will not be correctly implemented.

Step 3: The Product Developer will setup the product for automated testing utilizing the QA controlled CD. JTEL tools and components will also be installed to support the automated testing.

Step 3a: The Product Developer or acquisition representative will provide a CD with product source code, XML, IDL and documentation to JTEL with the software that will be verified in Step 4 and 4a. For JTNC products, the submission will generally be to the JTNC Information Repository. For non-JTNC products, the submission will generally be to JTEL CM.

Step 4: JTEL will perform a complete SCA test of the OE product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide JTEL through the source code to confirm the individual SCA requirements that cannot be automatically tested. JTEL may perform additional verifications in parallel and provide feedback utilizing the CD contents provided in Step 3.

Step 4a: JTEL will perform a separate manual analysis and feed any potential issues to the JTEL Test Engineer participating in the SCA compliance certification activities. As part of the certification, additional Test Engineers may be brought in to perform some of the manual inspection in parallel.

Step 5: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process and presenting the findings to the developer. Any officially approved waivers will be factored into this test report.

4.4.2.5.3 Application

Step 1: The Product Developer is responsible for performing unit and system level testing, exercising the JTEL tools and procedures against the product to identify errors and make corrections.

Step 2: The Product Developer will make product updates based on identified deficiencies from this testing activity or create and submit waivers for requirements that will not be correctly implemented.

Step 3: The Product Developer will setup the product for automated testing utilizing the QA controlled CD. JTEL tools and components will also be installed to support the automated testing.

Step 3a: The Product Developer or acquisition representative will provide a CD with product source code, object code, XML, IDL and documentation to JTEL with the software that will be verified in Steps 4 and 4a. The object code is utilized to assist with the CORBA and AEP verifications. For JTNC Products, the submission will generally be to the JTNC Information Repository. For non-JTNC products, the submission will generally be to JTEL CM.

Step 4: JTEL will perform a complete SCA test of the Application product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide the JTEL Test Engineers through the source code to confirm the individual SCA requirements that cannot be automatically tested. JTEL may perform additional verifications in parallel and provide feedback utilizing the CD contents provided in Step 3.

Step 4a: JTEL will perform a separate manual analysis and feed any potential issues to the JTEL Test Engineer participating in the SCA compliance certification activities. As part of the certification, additional Test Engineers may be brought in to perform some of the manual inspection in parallel.

Step 5: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process and presenting the findings to the developer. Any officially approved waivers will be factored into this test report.

4.4.2.6 Reporting

JTEL will provide comments on issues as they are identified, will provide feedback and status from the Step 4 effort, and will prepare and submit the SCA Test Report and Recommendation to the JTNC following the completion of the SCA compliance certification activity.

4.4.2.7 Exit Criteria

JTEL will provide the SCA Test Report and Recommendation to the JTNC.

4.4.3 Test Model-C (Post-FQT Model)

Compliance Testing Activity Occurs Following the Product's FQT

This test model is the default process for SCA verification. It will be exercised in the case where JTEL is unable to coordinate one of the other two models with the development activity. This is the least flexible model in that products generally are not able to change their product code to account for deficiencies. This model does provide higher assurance that the product is completed and has been formally tested. The following sections describe the steps illustrated in Figure 4-5.

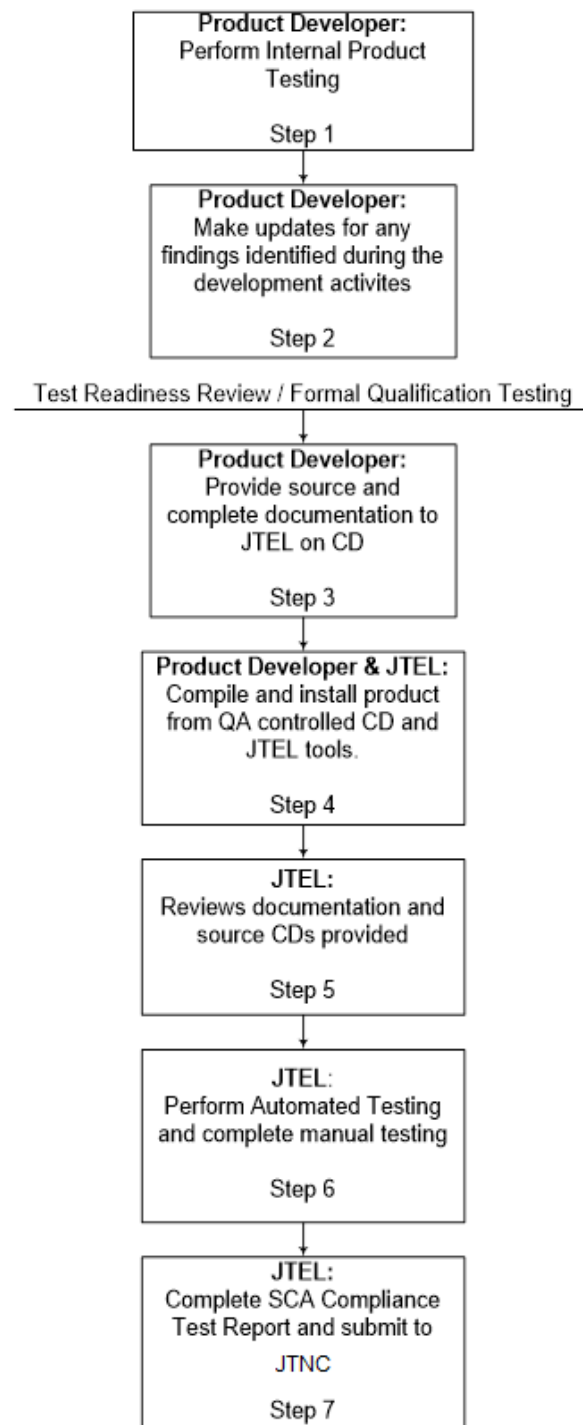


Figure 4-5: Test Model-C (Post-FQT Model)

4.4.3.1 Entrance Criteria

Step 1: OE or Application Product exists to exercise testing. For OEs, the JTAP PseudoComponents have been successfully integrated into the radio set. Developer should have corresponded with JTEL regarding any identified deficiencies and can provide evidence that they are ready for formal testing.

Step 2: Feedback from Step 1.

Step 3: Controlled CD with all source, object files, executables, XML, IDL files and documentation provided for the product under test. This CD should also include the ported PseudoComponents for OE testing that will be utilized. Coordinate with JTEL Test Engineer to confirm support for this Test Model.

Step 4: CD is received from Step 3.

Step 5: CD is received from Step 3.

Step 6: Any identified waivers have been processed (decisions made) by JTNC. CD is provided by Product Developer in Step 3. For Applications, a full OE Characterization is required to determine and confirm whether there will be portions of the OE that will effect the Application Compliance. This will provide support for any waiver requests. Implementation is complete for SCA compliance certification Activity.

Step 7: All data is collected from Step 6 and tested versions are controlled and provided to JTEL.

4.4.3.2 Environment

Unless there is significant rationale for this activity occurring at the developer's location, the testing activities will occur at the JTEL facilities in San Diego. The radio assets should be available at this point in the development as the software is complete.

OE: The JTAP utilizes several SCA compliant modules, the JTAP Target Components, to facilitate complete SCA compliance testing of the target Operating Environment. The JTAP Target Components are installed on and uninstalled from the target radio set during the execution of applicable selected tests. The JTAP requires an open (whitebox) testing environment to be able to access all of the components under test. Manual verification will be a source code and documentation level review.

Application: The WTT, for SCA v2.2, and the JTAP, for SCA v2.2.2, both interface to the Application via an IP-based interface. Manual verification will be a source code level review.

4.4.3.3 Description

This Test Model ensures that the product being submitted for SCA compliance verification is complete and has successfully fulfilled the FQT activities.

The JTEL tools and procedures with known and identified errata will be utilized during the testing process.

4.4.3.4 Requirements

The requirements are those identified in the appropriate SCA document.

JTEL also requires the support of the Product Developer to assist the verification. The product will be verified for its compliance to applicable and testable SCA requirements from the appropriate SCA specification.

4.4.3.5 Responsibility

4.4.3.5.2 Operating Environment

Step 1: The Product Developer is responsible for porting the JTAP Target Components to the radio set under test, performing unit and system level testing, securing OS and CORBA documentation for AEP, minimumCORBA, and CORBA Services verification. The JTAP Target Components, and associated XML files, must be ported to the radio set under test. Automated and manual verification should be performed by the developer in preparation for JTEL Official testing.

Step 2: The Product Developer will make product updates based on identified deficiencies from this testing activity or create and submit waivers for requirements that will not be correctly implemented.

Step 3: The Product Developer or acquisition representative will provide a CD with product source code, XML, and IDL to JTEL with the software that will be verified in Step 4. For JTNC Products, the submission will generally be to the JTNC Information Repository. For non-JTNC products, the submission will generally be to JTEL CM.

Step 4: The Product Developer will setup the product for automated testing utilizing the JTEL controlled CD. JTEL tools and components will also be installed to support the automated testing.

Step 5: This step only applies to products that do not have development support. It is included in this test model as many of the non-JTNC products may follow this model. JTEL will review the requirements, design, OS, and ORB documentation to get a better idea of the product under test and know whether additional information is required.

Step 6: JTEL will perform a complete SCA test of the OE product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide JTEL through the source code to confirm the individual SCA requirements that cannot be automatically tested.

Step 7: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process and presenting the findings to the developer. Any officially approved waivers will be factored into this test report.

4.4.3.5.3 Application

Step 1: The Product Developer is responsible for performing unit and system level testing, exercising the JTEL tools and procedures against the product to identify errors and make corrections.

Step 2: The Product Developer will make product updates based on identified deficiencies from this testing activity or create and submit waivers for requirements that will not be correctly implemented.

Step 3: The Product Developer or acquisition representative will provide a CD with product source code, object code, XML, IDL and documentation to JTEL with the software that will be verified in Steps 4. The object code is utilized to assist with the CORBA and AEP verifications. For JTNC Products, the submission will generally be to the JTNC Information Repository. For non-JTNC products, the submission will generally be to JTEL CM.

Step 4: The Product Developer will setup the product for automated testing utilizing the JTEL controlled CD. JTEL tools and components will also be installed to support the automated testing.

Step 5: This step only applies to products that do not have development support. It is included in this test model as many of the non-JTNC products may follow this model. JTEL will review the requirements, design, OS, and ORB documentation to get a better idea of the product under test and know whether additional information is required.

Step 6: JTEL will perform a complete SCA test of the Application product. The Product Developer will need to provide assistance for the automated testing and manual testing. The Product Developer will guide JTEL through the source code to confirm the individual SCA requirements that cannot be automatically tested.

Step 7: JTEL will capture all relevant data and document the SCA compliance Test Report and Recommendation. The report will be submitted to the JTNC after completing the Peer Review process and presenting the findings to the developer. Any officially approved waivers will be factored into this test report.

4.4.3.6 Reporting

JTEL will provide comments on issues as they are identified, will provide feedback and status from the Step 6 effort, and will prepare and submit the SCA Test Report and Recommendation to the JTNC following the completion of the SCA compliance certification activity.

4.4.3.7 Exit Criteria

JTEL will provide the SCA Test Report and Recommendation to the JTNC.

4.4.4 Testing and Reporting Timelines

This section provides estimates for performing the testing and report writing for SCA compliance testing activities. An SCA event is not considered completed until the SCA Test Report is documented and submitted to the JTNC. Waiver decisions occurring during the documentation process have been observed to lengthen out the completion of the SCA Test Report.

Estimates for duration of a testing cycle are dependent on many factors. Key factors that effect this timeline include the availability and knowledge of the product developers, proper configuration management, and the number of components that make up the product under test, and pre-testing activities to ensure interoperability with the JTEL tools. Proper preparation also requires the product developer to be familiar with the procedures to be utilized during the testing period.

Upon officially starting, the SCA compliance certification period is expected to take approximately four to five weeks. The first two weeks are generally dedicated to the automated verifications while

the final two to three weeks are focused on the manual verifications. For the Application testing, the automated testing may be limited to one week in duration, with manual testing taking the remainder of the period. There are pretest activities that occur to try to get a better estimate for each product. Some products have a significant amount of components that will require more time than what is generally expected.

Upon completion of the actual testing activity, the JTEL Test Engineers will document a Test Report with the findings from the evaluation. This test report will include overall status regarding product compliance to the applicable and testable SCA requirements and also a recommendation on whether this product should be provided an SCA compliance certification. The documenting of this test report is expected to take about seven to eight weeks. Around the 6-week time, the document will be provided to the PMO for peer review.

Appendix A: Acronym List

A.1 Acronym List

Listed below are acronyms and abbreviations important to understanding the document:

Acronym	Definition
AEP	Application Environment Profile
API	Application Program Interface
BoD	Board of Directors
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CD	Compact Disc
CDR	Critical Design Review
CF	(SCA) Core Framework
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
DISA	Defense Information Systems Agency
DoD	Department of Defense
DRP	Data Reduction Parser
DT&E	Developmental Test and Evaluation
FAQT	First Article Qualification Test
FPGA	Field Programmable Gate Array
FQT	Formal Qualification Test
GREP	Global Regular Expression, Print
GUTS	General Unit Test Suite
HCI	Human Computer Interface
IA	Information Assurance
IDD	Interface Description Document
IDL	Interface Description Language

IEEE	Institute of Electrical and Electronics Engineers
IR	Information Repository
JITC	Joint Interoperability Test Command
JTAP	JTNC Test Application
JTEL	JTNC Test and Evaluation Laboratory
JTR	Joint Tactical Radio
JTNC	Joint Tactical Networking Center
NIWCPAC	Naval Information Warfare Center Pacific
NSA	National Security Agency
OE	Operating Environment
ORB	Object Request Broker
ORD	Operational Requirements Document
OS	Operating System
OT&E	Operational Test and Evaluation
PCR	Problem/Change Report
PDR	Preliminary Design Review
PMO	Program Management Office
PMP	Project Management Plan
POC	Point of Contact
POSIX	Portable Operating System Interface
PRR	Porting Readiness Review
QA	Quality Assurance
RSA	Radio System Application
SCA	Software Communications Architecture
SDD	Software Design Description
SDP	Software Development Plan
SEP	Systems Engineering Plan

SME	Subject Matter Expert
SOW	Statement of Work
SPS	Software Product Specification
SRR	Software Requirements Review
SRS	Software Requirements Specification
SSA	Software Support Activity
STD	Software Test Description
STP	Software Test Plan
STR	Software Test Report
SVD	Software Version Description
SVT	Security Verification Test
SW	Software
T&E	Test and Evaluation
TBD	To Be Determined
TRR	Test Readiness Review
UML	Unified Modeling Language
UUT	Unit Under Test
VDD	Version Description Document
WCP	Wireless Communication Product
WDS	Waveform Design Specification
WF	Waveform or Application
WTT	Waveform Test Tool
XML	Extensible Markup Language

A.2 Glossary

The rightmost column in the table of definitions below provides a reference document for the corresponding definition where applicable. See section 2 for full identification of references.

Term	Definition	Source
Application	An executable software program, consisting of one or more software units, that implements pre-determined functionality (such as for a waveform).	SCA
Application Program Interface (API)	The definition of the operations and attributes contained in a set of related interfaces that provide a coherent functional capability.	SCA
Certification	Official statement or memo pertaining to or denoting verification of repeatable compliance and conformance to specifications.	
Compliant	Meeting the applicable specification requirement(s).	
Component	A software unit or element that implements an integral set of functionality. A component instantiation resides within a single processor.	SCA
CORBA	The Common Object Request Broker Architecture, a middleware framework maintained by the Object Management Group consortium for transactions between objects on diverse computers, operating systems, programming languages, and networks.	
Core Framework	The essential (core) set of open application-layer interfaces and services to provide an abstraction of the underlying software and hardware layers for software application designers.	SCA
Developer	An organization that performs development activities (including requirements analysis, design, testing) during a product's software life cycle through acceptance testing, IEEE 12207.1 "developer".	IEEE 12207.1
Device	A software abstraction for a physical hardware device.	SCA
Interoperability	The condition achieved among communications electronics systems or items of equipment when information or services can be exchanged directly and satisfactorily between them and their users.	ORD
JTAP PseudoComponents	Minimal implementations of several SCA compliant components such as an Application (called a PseudoWaveform), and Device (called a PseudoDevice), and a service (called a PseudoService) that represent common executable SCA components that the Core Framework must properly interact with. These Pseudocomponents must be ported to and installed on the radio set under test by the set developer to complete the Operating Environment formal test.	

Term	Definition	Source
JTR Set	A completely functional configuration of radio communications hardware and software integrated on a user platform.	ORD
Operating Environment	The common support software on the radio set consisting of the POSIX-compliant operating system, the CORBA middleware, and a Core Framework.	
Radio Service Applications	Radio set software applications which provide auxiliary (non-waveform application specific) functionalities.	
Software Support Activity (SSA)	An organization that performs software maintenance activities after acceptance testing occurs; IEEE 12207.1 “maintainer”	IEEE 12207.1
Waveform	The entire set of transformations applied to user information content in order to transmit it as a radio signal over the air and the corresponding set of transformations to convert received radio signals back to their user information content.	SCA

Appendix B: Additional Required Documentation

B.1 Required Information

As the JTAP test tool validates only the SCA compliance of the radio set Core Framework, the following information is required for JTEL to evaluate the SCA compliance of the other components of a radio set Operating Environment (OE):

- 1 The radio set manufacturer must supply sufficient documentation for JTEL to evaluate the SCA compliance of the CORBA middleware to be used in the radio set under test. Generally this documentation will be in the form of a Certification memo from a third party certification agency or function level documentation that states which interfaces are implemented. It is expected that the OE provider will secure this document from the Object Request Broker vendor.
- 2 The radio set manufacturer must supply sufficient documentation for JTEL to evaluate the SCA compliance of the POSIX compliant operating system to be used in the radio set under test. Generally this documentation will be in the form of a Certification memo from a third party certification agency or function level documentation that states which interfaces are implemented. It is expected that the OE provider will secure this document from the OS vendor.

If the CORBA middleware or operating system chosen for the radio set is on a list of approved products maintained by JTEL, then this information will not be required to be re-submitted.