Test and Certification for Citizens Broadband Radio Service (CBRS); Conformance and Performance Test Technical Specification; SAS as Unit Under Test (UUT)

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Test and Certification for CBRS; Conformance and Performance Test Technical Specification; SAS as UUT

1 Introduction

The present document contains the Protocol Implementation Conformance Statement (PICS), test cases to ensure conformance of the components of a three-tiered Spectrum Sharing Architecture to the specifications and Requirements defined by Federal Communications Commission (FCC) and Wireless Innovation Forum (WInnForum).

2 Scope

The present document specifies test procedures to demonstrate conformance of the requirements defined in [n.8 to n.17] for the components of the CBRS Architecture, detailed in Section 5. These procedures comprise transmit characteristics, receive characteristics, and performance requirements defined by the WInnForum, Spectrum Sharing Committee. The conformance tests include protocol and functional tests necessary to ensure the components comply with Part 96 of the FCC's rules [n.15] and the WInnForum CBRS Requirements as specified in [n.12].

Not all components and interfaces in [n.3] are covered by the certification and test cases defined in this document. Development of some of the interfaces and components are out of the scope of WInnForum, and therefore no test and certification process are provided for them. The scope of WInnForum test and certification specification includes:

- Conformance of the Spectrum Access System (SAS) for protecting federal incumbents from harmful interference.
- Conformance of SAS and potentially other components and interfaces, whose functionalities are standardized by WInnForum in [n.9], [n.11], and [n.12].
- Conformance of the SAS for protecting non-federal Incumbents and Priority access licensees from harmful interference.

The functionalities of Radio Access Network (RAN) or radio device operations and functions are outside the scope of this document.
More generally, tests are only applicable to those components that are intended to support the appropriate functionality. To indicate the circumstances in which tests apply, this is noted in the "*definition and applicability*" part of the test.

This document only covers the test cases required for certification of the SAS components of the CBRS, and does not include the proprietary tests performed by equipment vendors.

Moreover, this document only covers the test specifications and test cases for the CBRS Architecture components, and does not include the test software. The test software is described in a repository maintained by WInnForum Working Group 4 [i.1].

Certain elements of this published WINNF specifications are subject to change and update in this release. The test elements are identified in the traceability Matrix [i.5].

3 References

3.1 Normative references

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

[n.1] FCC Report and Order 15-47A1: "Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band", FCC, April 17 2015, https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-47A1.pdf

[n.2] FCC Report and Order 16-55A1: "Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band", FCC, May 2 2016, https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-55A1.pdf

[n.3] SSC- Wireless Innovation Forum, WG1&3 Task Group: "SAS Functional Architecture ", Working Document WINNF-15-P-0047 Version V1.0.0

[n.4] E. Drocella, et. al., "3.5 GHz Exclusion Zone Analyses and Methodology," NTIA Technical Report TR-15-517, June 2015. Available at http://www.its.bldrdoc.gov/publications/2805.aspx

[n.5] "NTIA Letter to FCC on Commercial Operations in the 3550-3650 MHz Band," GN Docket No. 12-354, April 14, 2015. Available online: http://www.ntia.doc.gov/fcc-filing/2015/ntia-letter-fcc-commercial-operations-3550-3650-MHz-band

[n.6] NOAA Maritime Boundaries, Available online: http://www.nauticalcharts.noaa.gov/csdl/mbound.htm Last accessed March 16, 2016

[n.7] https://www.census.gov/geo/maps-data/data/kml/kml_nation.html

[n.8] SSC-Wireless Innovation Forum, "CBRS Communications Security Technical Specification", WINNF-TS-0065 V1.1.0

[n.9] SSC-Wireless Innovation Forum, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): Spectrum Access System (SAS) - Citizens Broadband Radio Service Device (CBSD) Interface Technical Specification", WINNF-TS-0016 V1.1.0

[n.10] FCC List of protected FSS Sites in 3650-3700 MHz Band https://transition.fcc.gov/ib/sd/3650/grandftr.pdf

[n.11] SSC-Wireless Innovation Forum, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS); Spectrum Access System (SAS) - SAS Interface Technical Specification", WINNF-TS-0096 V1.1.0

[n.12] SSC-Wireless Innovation Forum, "Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band", WINNF-15-S-0112 V1.2.0

[n.13] "FSS Sites in 3650-3700 MHz", https://transition.fcc.gov/ib/sd/3650/grandftr.pdf, FCC.

[n.14] SSC-Wireless Innovation Forum, "Test and Certification for Citizens Broadband Radio Service (CBRS); Conformance and Performance Test Technical Specification; CBSD as Unit Under Test (UUT) – DRAFT, Request for Comment", WINNF-TS-0122 V1.0.0

[n.15] Electronic Code of Federal Regulations, Title 47, Chapter I, Subchapter D, Part 96, http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=0076fe7586178336d9db4c5146da8797&mc=true&n=pt47.5.96&r=PART&ty=HTML.

[n.16] SSC-Wireless Innovation Forum, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): WInnForum Recognized CBRS Air Interfaces and Measurements", WINNF-17-SSC-0002 V2.0.1

[n.17] RFC-2119, "Key words for use in RFCs to Indicate Requirement Levels", March 1997. Available at: https://tools.ietf.org/html/rfc2119

3.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] WG4 GitHub Repository, https://github.com/Wireless-Innovation-Forum/Spectrum-Access-System

[i.2] http://robotframework.org/

[i.3] Shapely Documentation: http://toblerity.org/shapely/manual.html Last accessed March 16, 2016

[i.4] GeoPy Documentation: http://geopy.readthedocs.org/en/latest/# Last accessed March 16, 2016

[i.5] SSC-Wireless Innovation Forum, "CBRS Requirements Traceability Matrix", WINNF-17-SSC-0003 V17

4 Definitions and Abbreviations

4.1 Abbreviations

CBRS: Citizens Broadband Radio Services

CBSD: Citizens Broadband Radio Service Device

CPI: Certified Professional Installer

DOD: Department of Defense

DPA: Dynamic Protection Area

EIRP: Effective Isotropic Radiated Power

ESC: Environment Sensing Capability

FCC: Federal Communications Commission

FSS: Fixed Satellite Service

GAA: General Authorized Access

GWBL: Grandfathered Wireless Broadband Licensee

GWPZ: Grandfathered Wireless Protection Zone

HAAT: Height Above Average Terrain

IAP: Iterative Allocation Process

IOT: Inter-Operability Test

NOAA: National Oceanic and Atmospheric Administration

NTIA: National Telecommunications and Information Administration

PAL: Priority Access License

PPA: PAL Protection Area

RAN: Radio Access Network

SAS: Spectrum Access System

TLS: Transport Layer Security

UUT: Unit Under Test

4.2 Definitions

Main Test Harness: is a collection of routines that can be configured by the test operator to interact with the SAS UUT in order to execute the test cases described in this document. It includes the reference models, Admin Test Harness, SAS Test Harnesses, DP Test Harnesses, CBSD Test Harnesses, and all other test harnesses defined in this document. The Main Test Harness software is stored in a public location specified in [i.1].

SAS Under Test: A Spectrum Access System (SAS) to which the sequence of steps listed in the test specifications in this document is applied via the SAS, CBSD, and ESC Test Harnesses, the SAS Under Test exchanges sequences of simulated messages with simulated Spectrum Access Systems, simulated CBSDs, and simulated Environmental Sensing Capabilities according to the test specifications in this document. In this document, we refer to it as SAS UUT (Unit Under Test)

SAS Test Harness:
A collection of routines that can be configured by the test operator to interact with the SAS UUT via interfaces specified in [n.11], and automates critical test sequences and procedures in this document and [n.14]. Via these interfaces and following the specified test procedures, the SAS Test Harness emulates the message sequences that would be generated by one or more SASs, and /or other systems identified in this document. The SAS Test Harness software is stored in a public location specified in [i.1].

CBSD Test Harness: A collection of routines that can be configured by the test operator to interact with the SAS UUT via interfaces specified in [n.9] and automates critical test sequences and procedures in this document and [n.14]. Via these interfaces and following the specified test procedures, the CBSD Test Harness emulates the SAS-CBSD Request Messages specified in [n.9] that would be generated by one CBSD, using a TLS connection with CBSD certificate to the SAS UUT. If multiple CBSD Test Harnesses are directly connected to the SAS UUT, each has its own TLS connection to the SAS UUT. The software without CBSD certificate is stored in a public location specified in [i.1].

DP Test Harness: A collection of routines that can be configured by the test operator to interact with the SAS UUT via interfaces specified in [n.9] and automates critical test sequences and procedures in this document and [n.14]. Via these interfaces and following the specified test procedures, the DP Test Harness emulates the SAS-CBSD Request Messages specified in [n.9] that would be generated by one or more CBSDs, using a TLS connection with DP certificate to the SAS UUT. If multiple DP Test Harnesses are connected to the SAS UUT, each has its own TLS connection to the SAS UUT. The DP function within the DP Test Harness merely aggregates the Request Messages of multiple single CBSDs and disaggregates the respective Response Messages of the SAS UUT and does nothing else (i.e., does not have any other unique functionality of a real Domain Proxy). The software without certificate is stored in a public location specified in [i.1].

ESC Test Harness: is a collection of routines that can be configured by the test operator to interact with the SAS UUT in order to execute the ESC functionalities of the test cases described in this document. Via these interfaces and following the specified test procedures, the ESC Test Harness emulates the message sequences that would be generated by one or more ESCs. The ESC Test Harness software is stored in a public location specified in [i.1].

Admin Test Harness: A collection of routines that can be configured by the test operator to inject data that is required for the purpose of the test cases, into the SAS UUT. The Admin Test Harness software is stored in a public location specified in [i.1].

Baseline State: Baseline State refers to the state of SAS UUT after it is triggered to reset by the test operator or Admin Test Harness.

Coordinated Periodic Activities among SASes (CPAS): Periodic coordination among SASes, which is comprised of external database synchronization, Full Activity Dump Exchange, IAP, and DPA move list calculation. In Release 1, these coordination activities happen daily among SASes.

PPA Information: PPA information includes PAL Database Record and PPA Zone Definition Message which includes the cluster list, list of PAL IDs, and the polygon describing the zone. When Admin Test Harness injects PPA information into SAS UUT, Admin Test Harness shall inject PAL Database Record first and then PPA Zone Definition Message.

JSON parameter of type "Number": The tests included in this document and any code which implements them will adopt the JSON Number-type parameter definitions in Appendix A for testing of Release 1 SASs.

5 General Principles of Certification Test Cases

The requirements, protocols, specifications, and interfaces are defined by SSC-Wireless Innovation Forum Work Groups 1, 2, and 3. The specifications are derived from FCC, NTIA, and DOD requirements. According to requirements and specifications defined by other work groups, Work Group 4 develops the test cases. The certification test cases can be classified in three classes as follows:

- **Functional Test (FT):** Test to validate the conformance of the Protocols and functionalities implemented in the SAS UUT to the requirements developed by WInnForum and supporting FCC/DoD requirements.

- **Interoperability Test (IOT):** Test to validate the interoperability between the components developed by different vendors, compliant to WInnForum Requirements.

- **Field/Performance Test (PT):** Test to check the capability of the SAS UUT to support various traffic models and actual operations in the field.

The Protocol and Functional test cases are converted to test scripts to facilitate the development of test apparatus (emulator), which have to be validated through a process defined by WInnForum

and FCC. The lab and performance testing require traffic/capacity modeling and measurement equipment.

Vendor testing could be either considered as a pre-requisite for certification process, or, by discretion of the certification management entity, they could be partially or fully considered as part of certification plan.

Certification is governed either directly by, or through a certification body designated by, the FCC, DOD, and WInnForum.

5.1 Test ID Definition

Each test case specified in this document has an associated test ID. A test ID shall be defined in the following format.

{*TestRequirement*}.{*TestCategory*}.{*UnitUnderTest*}.{*TestFunction*}.{*SubTestNumber*}

TestRequirement indicates whether a test is to verify if the Unit Under Test meets FCC requirements or Technical Specifications provided by WInnForum. The category of a test, which can be functional, interoperability, or performance, is shown in *TestCategory*. *UnitUnderTest* represents the entity under test, which can be SAS, CBSD, Domain Proxy, ESC or a combination of those entities. *TestFunction* indicates a particular function or requirement a test intends to verify. *SubTestNumber* is an integer larger than 0 to number different test cases in a group of tests performing similar test functions.

In the above Test ID format, the strings in the curly braces are replaced by values in the following tables depending on the characteristics of each test.

Table 5.1-1 The values of TestRequirement in Test ID

Value	Description
FCC	This test is to verify an FCC requirement
WINNF	This test is to verify a Technical Specifications provided by Wireless Innovation Forum

Table 5.1-2 The values of TestCategory in Test ID

Value	Description
FT	This test is a functional test
IT	This test is an interoperability test

PT	This test is a performance test

Table 5.1-3 The values of UnitUnderTest in Test ID

Value	Unit under test
S	SAS
C	CBSD/DP
E	ESC
SC	SAS and CBSD
SS	SAS and SAS

Table 5.1-4 The values of TestFunction in Test ID

Value	Description
EXZ	Exclusion Zone enforcement test
REG	CBSD Registration procedure
SIQ	CBSD Spectrum inquiry procedure
GRA	CBSD Grant procedure
HBT	CBSD Heartbeat procedure
MES	CBSD Measurement report
RLQ	CBSD Grant Relinquishment procedure
DRG	CBSD Deregistration procedure
SCS	SAS-CBSD Security validation
SDS	SAS-Domain Proxy Security validation
EPR	ESC Protection
IPR	Federal Incumbent Protection
FPR	FSS Protection

GPR	GWBL Protection
PPR	PPA Protection
MCP	Multi-Constraint Protection
BPR	Border Protection
PCR	PPA Creation
FDB	Federal Government Database
WDB	WINNF Database
PRO	Propagation Model Verification
ANT	Antenna Model
SSS	SAS-SAS Security, Authentication and Encryption Protocols
ARE	SAS-SAS Administrator Record Exchange
SIR	SAS Implementation record
ESM	ESC Sensor Message
CRD	CBSD Registration Data Message
ZRE	Zone Record Exchange
CEM	Coordination Event Message
FAD	Full Activity Dump Message

5.2 Test Triggers

Here is the list of causes that mandate performing the test:

- A SAS Implementation that has not gone through the certification tests, is being launched.
- Changes in a Certified SAS Implementation that may impact functionality, interoperability, or performance
- One or more changes in a Certified SAS Implementation, where the changes could impact to the Protocol and Functional Test Cases specified in this document.

5.3 Test Tools Required

The following modules and functionality shall be used for the conformance tests in this document:

- SAS UUT
  - An API to manually Blacklist CBSDs.
  - Ability to be preloaded with the "REG-Conditional" parameters
  - Ability to be triggered to request measurement report
  - Ability to be triggered to send SAS-SAS Push messages
  - Ability to be triggered to request SAS-SAS Pull messages
  - Ability to be triggered to perform CPAS, which is comprised of periodic daily coordination among SASes (external database synchronization, Full Activity Dump Exchange, IAP, and DPA move list calculations)
  - Ability to be injected with PPA/PAL information
    - If a PPA information is injected, it shall include PAL ID, CBSD Cluster list, PPA channel, and PPA zone boundary.
  - Ability to be configured to a certain operational state
  - Ability to be reset to Baseline State

- SAS Test Harness
  - message log to collect SAS UUT messages
  - Ability to perform FAD Exchange
  - The ability to pull Full Activity Dump generated files from SAS UUT

- CBSD Test Harness
  - Appropriate logging tool to collect SAS-CBSD response messages from SAS UUT
  - Appropriate configuration tool to send SAS-CBSD Request Messages to the SAS UUT

- Main Test Harness
  - For PAL-related test cases, ensure that the Main Test Harness can include the CBSD in PPA cluster list

- Admin Test Harness
  - Ability to inject information into the SAS UUT such as FCC ID whitelist, User ID whitelist, Blacklist Data, REG-Conditional registration data, zone data (PPA, GWPZ, DPA, Exclusion Zone, Quiet Zone), FSS station data, ESC Sensor data, PAL database record.
  - Ability to include CBSDs in the PPA cluster list
  - Ability to trigger SAS UUT specific function such as to reset SAS UUT to Baseline State, to request measurement report to send SAS-SAS Push messages, to request SAS-SAS Pull messages, to perform CPAS, to generate the Full Activity Dump"

- DP Test Harness
  - Appropriate logging tool to collect SAS-DP Response Messages from SAS UUT
  - Appropriate configuration tool to send SAS-DP Request Message to the SAS UUT

- ESC Test Harness:
  - A Test Harness entity that represents a ESC Sensors and ESC decision system. It provides the ability to simulate the ESC activities by a Test Harness (eg incumbent activity in a frequency range in a DPA). This element shall also be used to act as an active ESC sensor hosted (with its *EscSensorData* recorded) by SAS UUT.
  - Appropriate configuration tool to send messages to the SAS UUT
  - Appropriate logging tool to collect the messages from the SAS UUT; a message log to collect SAS UUT messages sent to any publicly available tool within ESC Test Harness.
  - At least provide the following parameters to SAS UUT:
    - DPA Index Number (s)
    - DPA Activation/Deactivation flag (s)
    - Channel Number (s) / frequency Range (s)

5.4 Baseline State of the SAS UUT

The Reset functionality causes the SAS UUT to delete at least the following data:

- FCC ID whitelist (A local cache of the "Equipment Authorization System" used by FCC)
- User ID whitelist
- Blacklist data
- CBSD data Record, (including Registration and grant data)
- Pre-loaded REG-Conditional registration data
- FSS data
- GWPZ data
- PAL database records
- PPAs
- CPI information
- All data obtained from other SASes (including SAS Test Harnesses)

The followings are NOT affected by Reset:

- International border data
- Census tract data
- United States Coast-line (Mean low Water line)
- Terrain Data and Land Cover

The followings are TBD:

- DPA
- In-land and offshore Exclusion zones

- Quiet Zone

6 SAS-CBSD Interface Conformance Test Specifications

This Section includes all test cases required to ensure the SAS-CBSD interface conforms to the specifications defined by WInnForum and as directed by the requirements established by the FCC.

6.1 CBSD Registration Procedure

6.1.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures to test the conformance of SAS implementation of CBSD Registration Procedure.

In this Section "Multi-Step Registration refers to the Registration procedure in which the “REG-Conditional” parameters are preloaded into the SAS UUT prior to initiating the CBSD Registration Procedure and excluded from the CBSD Registration Request Message.That is, when REG-Conditional data objects including *cpiSignatureData* is blank. Single-Step Registration refers to the Registration procedure where the REG-Conditional parameters are included in the "*RegistrationRequest* Object". That is, when REG-Conditional data objects are all included, regardless of whether a CPI provided the data or not.

The main approach is for each test to create necessary conditions to generate a SAS registration response to a request with all the *responseCode*s parameters defined in section 10.13 of [n.9], that pertain to the CBSD Registration Procedure in the same reference. This includes successful registration as well, which is signified by *responseCode* 0 (please see the table below)

Table 6.1-1 Response Codes for CBSD Registration Procedure Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**
0	SUCCESS	The SAS UUT completes the registration process with no error.	• Array Multi-Step Registration • Array Single-Step Registration • Array Re-registration of the multi-step registered CBSDs • Array Re-registration of the single-step registered CBSDs	WINNF.FT.S.REG.1 WINNF.FT.S.REG.2 WINNF.FT.S.REG.3 WINNF.FT.S.REG.4 WINNF.FT.S.REG.7 WINNF.FT.S.REG.8

100	VERSION	The version number of the SAS-CBSD protocol used by the CBSD Test Harness is not supported by the SAS UUT.	• The CBSD Test Harness sends the request message using the URL of the SAS UUT including the newer protocol version than the most recent SAS-CBSD Protocol version supported by the SAS UUT.	WINNF.FT.S.REG.10 WINNF.FT.S.REG.13
101	BLACKLISTED	The CBSD has been included in a blacklist of CBRS operation (SAS or FCC enforcement action) or the CBSD operating privileges have been revoked.	• Registered CBSD is manually blacklisted before re-registration.	WINNF.FT.S.REG.9
102	MISSING_PARAM	One or more "Required" parameters are missing.	• Array Multi-Step Registration missing "Required" parameter.	WINNF.FT.S.REG.5
103	INVALID_VALUE	Value of one or more parameters are invalid	• One or more "Required"/ "Optional" parameters with invalid value are provided to the SAS UUT. • One or more "REG-Conditional" parameters with invalid value are provided to the SAS UUT.	WINNF.FT.S.REG.7 WINNF.FT.S.REG.8
200	REG_PENDING	One or more "REG-Conditional" parameters have not yet been supplied to the SAS UUT.	• One or more "REG-Conditional" parameters or CPI-related parameters are missing	WINNF.FT.S.REG.6

6.1.2 Test Characteristics

Table 6.1-2: CBSD Registration Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.REG
2	**Title**	CBSD Registration Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification**	[n.9]

6.1.3 Method of test

6.1.3.1 Initial Conditions / Test Pre-conditions

1. All the message exchanges between the SAS UUT and the CBSD/DP Test Harness shall be done by using HTTPS.
2. Unless otherwise specified, CBSDs registered in the course of a test case are assumed to have their FCC IDs and user IDs already whitelisted by the SAS UUT.
3. The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.1.4 Test Procedure

6.1.4.1 [WINNF.FT.S.REG.1] Array Multi-Step registration for CBSDs (Cat A and B)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. All REG-Conditional parameters for the three CBSDs (a combination of both Cat A and Cat B) shall already be pre-loaded into the SAS.
2	Ensure that the DP Test Harness (containing both Cat A and Cat B CBSDs) sends correct Registration request in the form of one 3-element Array to the SAS: valid *userId*, *fccId*, and *cbsdSerialNumber*.
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for each CBSD. • The *responseCode* parameter contained in the *response* parameter is 0 for each CBSD concluding an approved Registration *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.2 [WINNF.FT.S.REG.2] Array Re-registration of multiple CBSDs

Step	Instructions
1	Ensure four CBSDs have already registered with the SAS. Make sure that their *cbsdId* parameters exists in the SAS. Record the *cbsdId* parameters (C1, C2, C3, and C4). Make sure no *cbsdId* parameter exists in the SAS for the fifth

	CBSD. All REG-Conditional parameters for these CBSDs shall already be pre-loaded into the SAS.
2	CBSDs C3 and C4 successfully request Grants (G3 and G4), and exchange Heartbeat to enter and stay in the *Authorized* state.
3	DP Test Harness sends a correct Registration request in the form of one 5-element Array to the SAS with valid *userId*, *fccId*, and *cbsdSerialNumber*. Ensure that *userId*, *fccId*, and *cbsdSerialNumber* of the elements match those in Step 1.
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 5-element Array to the DP Test Harness as follows: • SAS UUT response includes a valid *cbsdId* for each CBSD (C1', C2', C3', C4', C5'). • The *responseCode* parameter contained in the *response* parameter is 0 for each CBSD concluding an approved registration. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends a Heartbeat Request Message in an Array form with (C3, G3) and (C4, G4) before the *grantExpireTime* in Step 2.
CHECK	SAS UUT responds with a Heartbeat Response as follows: • The *responseCode* parameter contained in the response parameter set to 103, concluding a failed operation due to invalid parameters. The alternative *responseCode* of 500 is also a SUCCESS criterion. • *transmitExpireTime* shall be no later than the current time. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.3 [WINNF.FT.S.REG.3] Array Single-Step registration for CBSDs (Cat A and B)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. Ensure that information about a CPI is loaded into the SAS. Use the same CPI information for Step 2.
2	Ensure the DP Test Harness (containing two Cat A and one Cat B CBSDs) sends correct Registration request in the form of one 3-element Array to the SAS: valid *userId*, *fccId*, and *cbsdSerialNumber*, plus all REG-Conditional parameters for Cat A CBSDs. Additionally, for Cat B CBSD, ensure that: • All REG-Conditional parameters are included except *installationParam* outside *cpiSignatureData*.
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for each CBSD. • The *responseCode* parameter contained in the *response* parameter is 0 for each CBSD concluding an approved Registration

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.1.4.4 [WINNF.FT.S.REG.4] Array Re-registration of Single-step-registered CBSD (*cbsdId* exists)

Step	Instructions
1	Ensure that two CBSDs have already registered with SAS with correct Registration requests with valid *userId*, *fccId*, and *cbsdSerialNumber* (one Cat A and one Cat B). Make sure that their *cbsdId* parameters exists in the SAS. Record the two *cbsdId parameter*s (C1 and C2). Make sure no *cbsdId* exists in the SAS for the third CBSD. Ensure that information about a CPI is loaded into the SAS. Use the same CPI information for Step 3.
2	CBSDs C1 and C2 successfully request Grants (G1 and G2), and exchange Heartbeat to enter and stay in the *Authorized* state.
3	Ensure that the DP Test Harness sends correct Registration request in the form of one 3-element Array without de-registration to the SAS including valid *userId*, *fccId*, and *cbsdSerialNumber*. All REG-Conditional parameters for the CBSD shall be included regardless of any changes. For the CatB CBSD, ensure that: • *cpiSignatureData* has all the Required parameters, including: • *encodedCpiSignedData*, shall contain all the parameters in the *InstallationParam* object that is being certified by the CPI
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP Test Harness as follows: • SAS UUT response includes a valid *cbsdId* for each CBSD (C1', C2'). • The *responseCode* parameter contained in the *response* parameter is 0 for each CBSD concluding an approved Registration *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends a Heartbeat Request Message in an Array form with (C1, G1) and (C2, G2) after the *transmitExpireTime* but before the *grantExpireTime* in Step 2.
CHECK	SAS UUT responds with a Heartbeat Response as follows: • The *responseCode* parameter contained in the response parameter set to 103, concluding a failed operation due to invalid parameters. The alternative *responseCode* of 500 is also a SUCCESS criterion. • *transmitExpireTime* shall be no later than the current time. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.5 [WINNF.FT.S.REG.5] Missing Required parameters in Array Registration Request (*responseCode* 102)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. All REG-Conditional parameters for four CBSDs shall already be pre-loaded into the SAS.
2	Ensure that the DP Test Harness sends a Multi-Step Registration request in the form of one 4-element Array to the SAS with the following conditions: • valid *userId*, *fccId*, and *cbsdSerialNumber* for the first CBSD • valid *userId*, *fccId*, and missing *cbsdSerialNumber* for the second CBSD • valid *userId*, *cbsdSerialNumber*, and missing *fccId* for the third CBSD • valid *fccId*, *cbsdSerialNumber*, and missing *userId* for the fourth CBSD
CHECK	SAS UUT sends a CBSD Registration Response in the form of one 4-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for the first CBSD. • The *responseCode* parameter contained in the *response* parameter is 0 for the first CBSD concluding an approved registration • The *responseCode* parameter contained in the *response* parameter is 102 for the second, third, and fourth CBSDs, concluding failed Registrations. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.6 [WINNF.FT.S.REG.6] Pending registration in Array Registration Request (*responseCode* 200)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for five CBSDs being tested. Also make sure no REG-Conditional parameters for the CBSDs are pre-loaded into SAS except for the fifth CBSD, which shall have all REG-Conditional parameters pre-loaded into the SAS except for one missing REG-Conditional parameter for Cat B CBSD. Ensure that information about a CPI is loaded into the SAS. Use the same CPI information for Step 2.
2	Ensure that the DP Test Harness sends a Registration request in the form of one 5-element Array to the SAS as follows: • valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat A CBSD shall be included for the first and second CBSDs (Cat A), except that for the second CBSD at least one REG-Conditional parameter for a Cat A CBSD missing. • valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat B CBSD shall be included for the third CBSD (Cat B). *cpiSignatureData* has all the Required parameters except *digitalSignature*. *cpiSignatureData* has all the Required parameters, including *encodedCpiSignedData*, shall contain all the parameters in the *InstallationParam* object that is being certified by the CPI. .

	• valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat B CBSD shall be included for the fourth CBSD (Cat B). The *cpiId* in the *professionalInstallerData* object shall not exist. Otherwise, *cpiSignatureData* shall contain all the required parameters. *cpiSignatureData* has all the Required parameters, including *encodedCpiSignedData*, shall contain all the parameters in the *InstallationParam* object that is being certified by the CPI . • valid *userId*, *fccId*, and *cbsdSerialNumber* shall be included for the fifth CBSD (Cat B). The *encodedCpiSignedData* parameter in the *cpiSignatureData* parameter shall be set to the value generated by using the *CpiSignedData* object that contains installationParam parameter with all the required parameters being certified by the CPI, except for one REG-Conditional parameter.
CHECK	SAS UUT sends a CBSD Registration Response in the form of one 5-element Array to the DP test Harness as follows: • SAS response includes a valid *cbsdId* for the first CBSD. • The *responseCode* parameter contained in the *response* parameter is 0 for the first CBSD concluding an approved Registration • The *responseCode* parameter contained in the *response* parameter is 200 for the second, third, fourth and fifth CBSDs, concluding a failed Registration. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.7 [WINNF.FT.S.REG.7] Invalid parameters in Array Registration Request (*responseCode* 103)

Step	Instructions

1	Ensure no *cbsdId* exists in the SAS for sixteen CBSDs being tested.
	• For CBSDs 1 through 11 and 15 through 16, no REG-Conditional parameters are pre-loaded.
	• For CBSDs 12 through 14, the following REG-Conditional parameters are pre-loaded:
	  • For CBSD 12:
	  ▪ installationParam shall be 100% correct and complete
	  • For CBSD 13:
	  ▪ installationParam shall be 100% correct and complete
	  • For CBSD 14:
	  ▪ installationParam shall be 100% correct and complete
	• Ensure that information about a CPI is loaded into the SAS. Use the same CPI information for Step 2.

2	Ensure that the DP Test Harness sends a Registration request in the form of one 16-element Array to the SAS with the following conditions: • valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat A CBSD for the first CBSD

- valid *userId* and *fccId*, invalid *cbsdSerialNumber*, plus all REG-Conditional parameters for Cat A CBSD for the second CBSD
- valid *userId*, and *cbsdSerialNumber* invalid *fccId*, plus all REG-Conditional parameters for Cat A CBSD for the third CBSD
- valid *fccId*, and *cbsdSerialNumber*, invalid *userId*, plus all REG-Conditional parameters for Cat A CBSD for the fourth CBSD
- valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat A CBSD for the fifth CBSD, except an out-of-range value for latitude.
- valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat A CBSD for the sixth CBSD, except an invalid value for *measCapability*.
- For the seventh CBSD ensure:
  - *cbsdCategory* = "B"
  - *installationParam* parameter inside of *cpiSignatureData*: *eirpCapability* > 47 dBm/10MHz with valid CPI certification
- For the eighth CBSD ensure:
  - *cbsdCategory* = "A"
  - No *cpiSignatureData* is included.
  - Contents of the *installationParam* parameter:
    - *latitude* equals to 38° 52' 55.783" N
    - *longitude* equals to 77° 6' 49.518" W
    - *height* =4m
    - *heightType* = AGL
    - *indoorDeployment* = FALSE
  - All other REG-Conditional parameters valid and included
    (Note: *FCC web page-https://www.fcc.gov/media/radio/haat-calculator-calculates HAAT at the street level to be 20m for this location. Installed on a 2nd floor of a building at an AGL of ~4m, HAAT for this CBSD will be 24 meters*.)
- For the ninth CBSD ensure:
  - *cbsdCategory* = "A"
  - No *cpiSignatureData* is included.
  - Contents of the *installationParam* parameter:
    - *eirpCapability* > 30 dBm/10MHz
  - All other REG-Conditional parameters valid and included
- For the tenth CBSD ensure:
  - *cbsdCategory* = "B"
  - Contents of the *installationParam* parameter inside of *cpiSignatureData*:
    - *indoorDeployment* = TRUE
    - *eirpCapability* > 30 dBm/10MHz
  - All other REG-Conditional parameters valid and included by a CPI (pre-loaded into SAS)
  - No *installationParam* outside of *cpiSignatureData* is included.
- For the eleventh CBSD ensure:

	○ *cbsdCategory* = "B" ○ Contains ▪ *installationParam* parameter outside *encodedCpiSignedData* ○ All other REG-Conditional parameters valid and included • For the twelfth CBSD ensure: ○ *cbsdCategory* = "B" ○ *cpiSignatureData* object contains at least one invalid identification-related parameter for the CPI ○ No *installationParam* outside of *cpiSignatureData* is included. • For the thirteenth CBSD ensure: ○ *cbsdCategory* = "B" ○ *cpiSignatureData* has all the required parameters but has a mismatch on at least one parameter under *encodedCpiSignedData* compared to the preloaded REG-Conditional parameters ○ The *installationParam* parameter used for *encodedCpiSignedData* parameter shall contain all the required parameters being certified by the CPI. ○ No *installationParam* outside of *cpiSignatureData* is included. • For the fourteenth CBSD ensure: ○ *cbsdCategory* = "B" ○ all REG-Conditional parameters are included outside *cpiSignedData*. ○ No *cpiSignatureData* is included. • For the fifteenth CBSD ensure: ○ *cbsdCategory* = "A" ○ *eirpCapability* set to a value greater than the FCC-approved EIRP ○ No *cpiSignatureData* is included. • For the sixteenth CBSD ensure: ○ *cbsdCategory* = "B" ○ Contents of the *installationParam* parameter inside of *cpiSignatureData*: ▪ *eirpCapability* set to a value greater than the FCC-approved EIRP ○ No *installationParam* outside of *cpiSignatureData* is included.
CHECK	SAS UUT sends a CBSD Registration Response in the form of one 16-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for the first CBSD. • The *responseCode* in the *RegistrationResponse* Object is 0 for the first and the thirteenth CBSD concluding an approved Registration • The *responseCode* parameter contained in the *response* parameter is 103 for the rest of the CBSDs, concluding a failed Registration. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.8 [WINNF.FT.S.REG.8] Invalid REG-Conditional parameters in Array Registration Request (*responseCode* 103)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. No REG-Conditional parameters for CBSDs are pre-loaded into the SAS. Ensure that information about a CPI is loaded into the SAS. Use the same CPI information for Step 2.
2	Ensure that the DP Test Harness sends a Single-Step Registration request for 3 CBSDs in the form of one 3-element Array to the SAS including valid *userId*, *fccId*, and *cbsdSerialNumber*, as well as REG-Conditional parameters with the following conditions: • All valid REG-Conditional parameters for Cat A CBSD for the first CBSD • All valid REG-Conditional parameters for Cat A CBSD for the second CBSD except an out-of-range for azimuth. • All valid REG-Conditional parameters for Cat A CBSD for the third CBSD except an out-of-range for latitude.
CHECK	SAS sends a CBSD Registration Response in the form of one 3-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for the first CBSD. • The *responseCode* parameter contained in the *response* parameter is 0 for the first CBSD concluding an approved registration • The *responseCode* parameter contained in the *response* parameter is 103 for the second, and third CBSDs, concluding a failed Registration. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.9 [WINNF.FT.S.REG.9] Blacklisted CBSD in Array Registration Request (*responseCode* 101)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for three CBSDs being tested.
2	Manually Blacklist the third CBSD.
3	Ensure that the DP Test Harness containing the three CBSDs in Step 1 sends correct Single-step Registration requests in the form of one 3-element Array to the SAS including valid *userId*, *fccId*, and *cbsdSerialNumber*. All REG-Conditional parameters for the CBSD shall be included.
CHECK	SAS sends a CBSD Registration Response in the form of one 3-element Array to the DP Test Harness as follows: • SAS response includes a valid *cbsdId* for the first two CBSDs. • The *responseCode* parameter contained in the *response* parameter is 0 for the first two CBSDs concluding an approved registration • The *responseCode* parameter contained in the *response* parameter is 101 for the third CBSD, concluding a failed Registration.

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.1.4.10 [WINNF.FT.S.REG.10] Unsupported SAS protocol version in Array Registration Request (*responseCode* 100)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. Also make sure no REG-Conditional parameters for three CBSDs are pre-loaded into the SAS.
2	Ensure that the DP Test Harness sends a Single-Step Registration Request Message in the form of one 3-element Array to the SAS including valid *userId*, *fccId*, and *cbsdSerialNumber* plus all REG-Conditional parameters for Cat A CBSDs. However, make sure the request uses a protocol version newer than the most recent SAS-CBSD protocol version supported by SAS.
CHECK	SAS sends a CBSD Registration Response Message in the form of one 3-element Array to the DP Test Harness as follows: • SAS response does not include *cbsdId parameters* • The *responseCode* parameter contained in the *response* parameter is 100 for all three CBSDs concluding a failed Registration. Alternatively, the SAS can return HTTP status code 404 as a success criterion. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.11 [WINNF.FT.S.REG.11] [Configurable] One-time registration

This configurable test covers tests for both single-step and multi-step registration (and pending registrations) for CBSDs (Cat A and/or Cat B) with no existing *cbsdId*, and with varying combinations of valid, missing, and invalid required parameters, and Reg Conditional parameters, as specified in input configuration files. The test will check the number of and value of the SAS UUT responseCode(s) to verify if they match the expected respondCode(s) as specified in the respective input configuration file.

Step	**Instructions**
1	Configure the SAS UUT to whitelist N1 >= 0 FCC IDs and N2 >= 0 user IDs.
2	Pre-load the SAS UUT with conditional registration data for N3 >= 0 CBSDs.
3	Using a DP Test Harness, send a Registration Request Message for N4 > 0 CBSDs to the SAS UUT. The Registration Request Message shall be syntactically correct according to the SAS-CBSD specification but need not meet all application-level requirements (e.g. required fields may be missing).
CHECK	The SAS response to the Registration Request Message must satisfy all of the following conditions: • The response shall contain N4 *RegistrationResponse* objects. • For each *RegistrationResponse* object:

	○ The *responseCode* parameter contained in the *response* parameter shall match the corresponding expected response code listed in the configuration file. ○ If *responseCode* == SUCCESS, verify that the response contains a valid CBSD ID. ▪ Otherwise, verify that the response does *not* contain a CBSD ID. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.12 [WINNF.FT.S.REG.12] [Configurable] Re-registration (including intervening blacklist)

This configurable test covers single-step and multi-step re-registration of CBSDs (Cat A and/or Cat B). The test may blacklist selected CBSDs during re-registration. The test can use different sets of CBSDs for registration, blacklisting, and re-registration. The test will check the number of and value of the SAS UUT responseCode(s) to see if they match the expected responseCode(s) as specified in the respective input configuration file. This includes responseCode 101 (Blacklisted) where appropriate.

Step	**Instructions**
1	Configure the SAS UUT to whitelist N1 >= 0 FCC IDs and N2 >= 0 user IDs.
2	Admin Test Harness pre-loads the SAS UUT with conditional Registration data for N3 >= 0 CBSDs.
3	Using a DP Test Harness, send a valid Registration Request Message for N4 > 0 CBSDs to the SAS UUT. Ensure that the registration request messages are configured in such a way that the responseCode for all N4 CBSDs is SUCCESS.
4	Configure the SAS UUT to blacklist N5 >= 0 CBSDs.
5	Using a DP Test Harness, send a Registration request for N6 >= 0 CBSDs to the SAS UUT.
CHECK	The SAS response to the Registration Request Message must satisfy all of the following conditions: • The response shall contain N6 *RegistrationResponse* objects. • For each *RegistrationResponse* object: ○ The *responseCode* shall match the corresponding expected response code listed in the configuration file. ○ If *responseCode* == SUCCESS, verify that the response contains a valid CBSD ID. ▪ Otherwise, verify that the response does *not* contain a CBSD ID. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.13 [WINNF.FT.S.REG.13] [Configurable] Unsupported SAS protocol version

This configurable test covers single-step registration of CBSD(s) (Cat A and/or Cat B) where the CBSD registration request includes a SAS protocol version higher than the highest SAS-CBSD protocol version supported by the SAS UUT. The test will check the number of and value of the SAS UUT responseCode(s) to see if they match the expected responseCode(s) as specified in the respective input configuration file.

Step	Instructions
1	Configure the SAS UUT to whitelist N1 > 0 FCC IDs and N1 *userIds*.
2	Using a DP Test Harness, send a valid Registration Request Message for N1 CBSDs to the SAS UUT. This request shall use the URL specified in the test's configuration file
CHECK	The SAS response to the Registration Request Message must satisfy all of the following conditions: • EITHER the SAS shall respond with HTTP 404 ○ OR the response shall contain N1 *RegistrationResponse* objects, each with *responseCode* == 100 (VERSION). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2 CBSD Spectrum Inquiry Procedure

6.2.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS Spectrum Inquiry Response to a CBSD Spectrum Inquiry Request. It assumes as a precondition that CBSD has successfully registered with the SAS and has obtained a *cbsdId*.

The test cases specified in this section attempt to cover the response codes as described in Table 6.2-1.

Table 6.2-1 Response Codes for CBSD Spectrum Inquiry Procedure Test Cases (Informative)

response Code	Name	Condition	Test Scenario	Test ID
0	SUCCESS	The SAS UUT completes the channel availability assessment with no error.	• Response with a mix of PAL and GAA channels • Response with no available channel • CBSD inside DPA Neighborhood Area	WINNF.FT.S.SIQ.1 WINNF.FT.S.SIQ.2 WINNF.FT.S.SIQ.3 WINNF.FT.S.SIQ.4 WINNF.FT.S.SIQ.5 WINNF.FT.S.SIQ.9 WINNF.FT.S.SIQ.10

101	BLACKLISTED	The CBSD has been included in a blacklist of CBRS operation (SAS or FCC enforcement action) or the CBSD operating privileges have been revoked.	• Registered CBSD is manually blacklisted before re-registration.	WINNF.FT.S.SIQ.13
102	MISSING_PARAM	One or more "Required" parameters are missing.	• One of the frequency parameters is missing.	WINNF.FT.S.SIQ.10 WINNF.FT.S.SIQ.11
103	INVALID_VALUE	One or more parameters with invalid value are provided to the SAS UUT.	• The CBSD ID is different from assigned CBSD ID. • Parameters in the *inquiredSpectrum* parameter are mutually invalid.	WINNF.FT.S.SIQ.6 WINNF.FT.S.SIQ.7 WINNF.FT.S.SIQ.8 WINNF.FT.S.SIQ.10
300	UNSUPPORTED_SPECTRUM	The frequency range in the request is set to a value partially overlapping or completely outside the frequency range of the CBRS Band (3550-3700 MHz)	• The frequency range in the *inquiredSpectrum* parameter is partially overlapping with the CBRS Band. • The frequency range in the *inquiredSpectrum* parameter is completely outside the CBRS Band.	WINNF.FT.S.SIQ.1 WINNF.FT.S.SIQ.11

6.2.2 Test Characteristics

Table 6.2-2: CBSD Spectrum Inquiry Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.SIQ
2	**Title**	CBSD Spectrum Inquiry Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.2.3 Method of test

6.2.3.1 Initial Conditions / Test Pre-conditions

1. No Channel is declared unavailable due to Federal Incumbent Protection purposes (DPA active or inactive) for OPSEC reasons, for any DPA monitored by the SAS's associated ESC (s).
2. If CBSD is within 150 km of FSS station and a GWBL station is also within 150 km of FSS using any portion of the channel, SAS shall declare the FSS associated channel as unavailable
3. If CBSD is inside a PPA (CBSD is not part of PPA cluster list) or GWBL zone, the associated channel is declared unavailable.
4. For the purpose of this document, the Spectrum Inquiry response for other reasons (such as IAP) is per SAS discretion.
5. The SAS UUT must be reset at the beginning of each test case to a baseline state

6.2.4 Test Procedure

6.2.4.1 [WINNF.FT.S.SIQ.1] Reserved

6.2.4.2 [WINNF.FT.S.SIQ.2] Response has no available channel.

Step	Instructions
1	• Ensure that DP Test Harness has registered with the SAS and has obtained a *cbsdId* = C which is located inside GWPZ. • Configure the SAS UUT such that there is no available channel in the frequency range (FR) sent in the *inquiredSpectrum* parameter. ○ Inject a Grandfathered Wireless Protection Zone (GWPZ) to simulate database synchronization of GWPZ • Trigger CPAS to simulate coordination and synchronization tasks. (this will make the GWPZ active and protected.)

2	• DP Test Harness sends a spectrumInquiryRequest message to SAS UU with
	  ○ Frequency range in the *inquiredSpectrum* parameter is set to FR.
	  ○ *cbsdId* parameter set to C.

CHECK	SAS UUT approves the request by sending a Spectrum Inquiry Response as follows: • SAS response includes *cbsdId* = C. • *availableChannel* has zero elements. • *responseCode* = 0, indicating a successful inquiry of the spectrum *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.3 [WINNF.FT.S.SIQ.3] Multiple CBSDs inside and outside the Exclusion Zone

Step	Instructions
1	Admin Test Harness injects an FSS station into SAS UUT such that FSS operating channel starts from 3670MHz. The end frequency for the FSS station is 4200MHz.

2	Admin Test Harness injects an GWBL station within 150 km of the FSS station, with an operating frequency range of 3650-3700MHz. Also, Admin Test Harness injects the associated GWPZ in the SAS UUT.
3	Admin Test Harness injects PPA Information into SAS UUT with an operating channel F within 3600-3650MHz frequency range.
4	DP Test Harness registers five CBSDs into SAS UUT with the following characteristics: • CBSD with *cbsdId* C1 is outside 150 km range of the FSS station, and it is part of the PPA cluster list • CBSD with *cbsdId* C2 is outside 150 km range of the FSS station, is not part of the PPA cluster list**,** and is outside PPA boundary • CBSD with *cbsdId* C3 is within 150 km of the FSS station, and is part of the PPA cluster list • CBSD with *cbsdId* C4 is within 150 km of the FSS station, is not part of the PPA cluster list, and is outside PPA boundary • CBSD with *cbsdId* C5 is within 150 km of the FSS station, is not part of the PPA cluster list, and is outside PPA boundary. All CBSDs are outside GWPZ.
5	DP Test Harness sends an *spectrumInquiryRequest* in the form of a 5-element array for C1, C2, C3, C4, and C5, • The requested frequency range for the CBSDs C1, C2, C3, and C4 is 3550-3700MHz • The requested frequency range for the CBSD C5 is 3670-3700MHz
CHECK	SAS UUT sends correct *spectrumInquiryResponse* in the form of a 5-element array as follows: For C1: • *responseCode*=0 • the *availableChannel* includes <u>at least</u> the following frequency ranges with *channelType* set as GAA and *ruleApplied* as “FCC_PART_96” o 3550 MHz to the lower edge of F o upper edge of F to 3650 MHz, • *availableChannel* includes F, with *channelType* set as PAL and *ruleApplied* as ““FCC_PART_96” For C2: • *responseCode*=0 • the *availableChannel* includes <u>at least</u> the following frequency ranges with *channelType* set as GAA and *ruleApplied* as “FCC_PART_96” o 3550 MHz to the lower edge of F o upper edge of F to 3650 MHz, • *availableChannel* <u>does not</u> include any channel with *channelType* set as PAL For C3: • *responseCode*=0

	• the *availableChannel* includes <u>at least</u> the following frequency ranges with *channelType* set as GAA and *ruleApplied* as "FCC_PART_96"
	  ○ 3550 MHz to the lower edge of F
	  ○ upper edge of F to 3650 MHz,
	• *availableChannel* includes F, with *channelType* set as PAL and *ruleApplied* as "FCC_PART_96"
	• *availableChannel* **<u>does not</u>** include any frequency range from 3650-3700 MHz.
	For C4:
	• *responseCode*=0
	• the *availableChannel* includes **<u>at least</u>** the following frequency ranges with *channelType* set as GAA and *ruleApplied* as "FCC_PART_96"
	  ○ 3550 MHz to the lower edge of F
	  ○ upper edge of F to 3650 MHz,
	• *availableChannel* <u>does not</u> include any channel with *channelType* set as PAL
	• *availableChannel* <u>does not</u> include any frequency range from 3650-3700 MHz.
	For C5:
	• *responseCode* = 0
	• *availableChannel* is NULL
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.2.4.4 [WINNF.FT.S.SIQ.4] DPA activated for some channels, CBSD inside DPA Neighborhood

Step	Instructions
1	• ESC Test Harness communicates with the SAS UUT that all its fully monitored DPAs are inactive.
2	• ESC Test Harness communicates with the SAS UUT that DPA/Channel pair (Di, Ck) is active.
3	Pause 300 seconds
4	• Ensure that CBSD is located inside the DPA Neighborhood. • The location of the CBSD shall be away from the Neighborhood of the ESC sensor. • No other incumbent is present (FSS, PAL, GWBL…) • Ensure that CBSD Test Harness has registered with the SAS and has obtained a *cbsdId* = C
5	The CBSD Test Harness sends Spectrum Inquiry Request in which the frequency range is specified as FR. *cbsdId* parameter shall be set to C.
CHECK	SAS UUT approves the request by sending a Spectrum Inquiry Response as follows: • SAS response includes *cbsdId* = C. • *availableChannel* parameter includes all channels within frequency range FR. • *responseCode* = 0, indicating a successful inquiry of the spectrum.

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.2.4.5 [WINNF.FT.S.SIQ.5] Tests related to PAL Protection Area (PPA)

Step	Instructions
1	• Inject PPA Information with frequency range FR1 • Trigger CPAS • Ensure that DP Test Harness successfully registers a CBSD with cbsdId (C) that is located inside the PPA, but it is not part of the PPA's cluster list. • Select a frequency range (FR) such that it partially or fully overlaps with frequency range FR1. • A DP Test Harness sends Spectrum Inquiry Request in which the frequency range is specified as FR. *cbsdId* parameter shall be set to C.
CHECK	SAS UUT approves the request by sending a Spectrum Inquiry Response as follows: • SAS response includes *cbsdId* = C. • *availableChannel* parameter does not include the frequency range FR1. • *responseCode* = 0, indicating a successful inquiry of the spectrum. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.6 [WINNF.FT.S.SIQ.6] *cbsdId* sent in the Spectrum Inquiry Response is different from its assigned *cbsdId*, but the *cbsdId* does not exist in the SAS

Step	Instructions
1	• DP Test Harness registers a CBSD with the SAS UUT, obtaining a *cbsdId* = C1. • *cbsdId* (C) does not exist in the SAS.
2	A DP Test Harness sends a Spectrum Inquiry Request with *cbsdId* = C. frequencyRange shall be a valid value.
CHECK	SAS UUT rejects the request by sending a Spectrum Inquiry Response as follows: • SAS response does not include *cbsdId*. • *responseCode* =103, indicating invalid parameter (*cbsdId*, in this case) *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.7 [WINNF.FT.S.SIQ.7] *cbsdId* different from its assigned *cbsdId* and the *cbsdId* exists in the SAS.

Informative note: One recommended approach to detect the wrong *cbsdId* is to use the association between the *cbsdId* and CBSD certificate

Step	Instructions
1	Register two CBSDs with SAS UUT (*cbsdId* C1 and C2).

2	Ensure the CBSD Test Harness 1 (*cbsdId* =C1) sends a Spectrum Inquiry Request Message with *cbsdId* = C2. *frequencyRange* shall be a valid value.
CHECK	SAS UUT rejects the request by sending a Spectrum Inquiry Response as follows: • SAS response does not include *cbsdId*. • *responseCode* =103, indicating invalid parameter (*cbsdId*, in this case) *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.8 [WINNF.FT.S.SIQ.8] Parameters in *inquiredSpectrum* mutually invalid

Step	**Instructions**
1	Register a CBSD with SAS UUT.
2	Send a Spectrum Inquiry Request with its correct *cbsdId*, but the *lowFrequency* of *inquiredSpectrum* parameter is set to a value higher than the *highFrequency*. Make sure that both the *lowfrequency* and the *highFrequency* are within 3550 MHz to 3700 MHz.
CHECK	SAS UUT rejects the request by sending a Spectrum Inquiry Response as follows: • SAS response includes its correct *cbsdId*. • *responseCode* = 103, indicating invalid parameter. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.9 [WINNF.FT.S.SIQ.9] Multiple Requests as claimed PPAs or as GAAs

Step	**Instructions**

1	• DP Test Harness registers four CBSDs with the SAS UUT and obtains cbsdId parameters C1 with userId U1, C2 with userId U2, C3, and C4.
	• Admin Test Harness injects two PPA Information into SAS UUT, where for the first one userId is U1 and primaryAssignment parameter is set to the frequency range (FR1) within 3550 – 3650 MHz. For the second one, userId is U2 and primaryAssignment parameter is set to the frequency range (FR2) within 3550 – 3650 MHz.
	  ○ *cbsdId* = C1 is part of PPA1 over *frequencyRange* FR1 within 3550 – 3650 MHz
	  ○ *cbsdId* = C2 is part of PPA2 over *frequencyRange* FR2 within 3600 – 3650 MHz
	  ○ *cbsdId* = C3 and C4 are not part of any claimed PPA.
	• No other protected entities is present

2	DP Test Harness sends Spectrum Inquiry Request in which there are four *SpectrumInquiryRequest* objects each corresponding to *cbsdId* parameters C1, C2, C3, and C4 respectively. In addition: • *frequencyRange*=3550 – 3700 MHz for C1, C3, and C4 • *frequencyRange*=3600 – 3700 MHz for C2

CHECK	SAS UUT approves the request by sending a Spectrum Inquiry Response as follows: • The *spectrumInquiryResponse* has four objects • For the first object o *cbsdId* = C1. o The *availableChannel* parameter contains at least one element with *frequencyRange* (FR1) and *channelType* 'PAL', and the rest may be *channelType* GAA but *frequencyRange* shall be out of FR1 o The *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum • For the second object o *cbsdId* = C2. o The *availableChannel* parameter contains at least one element with *frequencyRange* (FR2) and *channelType* 'PAL', and the rest may be *channelType* GAA but *frequencyRange* shall be out of FR2 o The *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum • For the third object o *cbsdId* = C3. o If *availableChannel* parameter has any element, then *channelType* of all the available channels shall be "GAA" o The *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum • For the fourth object o *cbsdId* = C4. o If *availableChannel* parameter has any element, then *channelType* of all the available channels shall be "GAA" o The *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.10 [WINNF.FT.S.SIQ.10] Array request with successful and unsuccessful responses

Step	Instructions
1	Ensure that the DP Test Harness have registered six CBSDs with the SAS UUT and their *cbsdId*s are C1, C2, C3, C4, C5 and C6.
2	Using a DP Test Harness, send a Spectrum Inquiry Request with six request objects: • The first one has *cbsdId* = C1 and has all other parameters valid. • The second object has *cbsdId* = C2 and one parameter invalid (pick one case from the single request case), but all other parameters are valid.

	• The third object has *cbsdId* = C3. The *FrequencyRange* object representing the *inquiredSpectrum* parameter is present, but the *highFrequency* parameter is missing from this object. • The fourth object has *cbsdId* = C4. The *FrequencyRange* object representing the *inquiredSpectrum* parameter is present, but the *lowFrequency* parameter is missing from this object. • The fifth object has *cbsdId* = C5, but the *FrequencyRange* object representing the *inquiredSpectrum* parameter is completely missing. • The sixth object has *cbsdId* missing.
CHECK	SAS UUT sends a Spectrum Inquiry Response as follows: The *spectrumInquiryResponse* has six objects • For the first object o *cbsdId* = C1. o An array of *availableChannel* parameters (this may have zero element) o The *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum • For the second object o *cbsdId* = C2. o no *availableChannel* parameter o The *responseCode* shall be 103, indicating an invalid parameter • For the third object o *cbsdId* = C3. o no *availableChannel* parameter o The *responseCode* shall be 102, indicating a missing parameter • For the fourth object o *cbsdId* = C4. o no *availableChannel* parameter o The *responseCode* shall be 102, indicating a missing parameter • For the fifth object o *cbsdId* = C5. o no *availableChannel* parameter o The *responseCode* shall be 102, indicating a missing parameter • For the sixth object o *No cbsdId* o no *availableChannel* parameter o The *responseCode* shall be 102, indicating a missing parameter *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.11 [WINNF.FT.S.SIQ.11] Unsupported Spectrum (responseCode 300)

Step	**Instructions**

1	Ensure that the DP Test Harness registers 3 CBSDs have registered with the SAS UUT, *cbsdId*s (C1, C2, and C3).
2	DP Test Harness, sends a Spectrum Inquiry Request with three request objects. • The first one has *cbsdId* = C1 and has all other parameters valid. • The second one has *cbsdId* = C2, but both the *lowFrequency* and the *highFrequency* are set so that the *inquiredSpectrum* falls fully outside the range of 3550 MHz to 3700 MHz. • The second object has *cbsdId*=C3, but both the *lowFrequency* and the *highFrequency* are set so that the *inquiredSpectrum* falls partially outside the range of 3550 MHz to 3700 MHz (e.g. 3600-3800 MHz)
CHECK	SAS UUT sends a Spectrum Inquiry Response as follows: • The *spectrumInquiryResponse* has three objects • For the first object o *cbsdId* = C1. o An array of *availableChannel* parameters (this may have zero element) o If *availableChannel* parameter is not NULL, the *ruleApplied* shall be "FCC_PART_96" o The *responseCode* shall be 0, indicating a successful inquiry of the spectrum • For the second and third objects: o *cbsdId* = C2, and C3 respectively o no *availableChannel* parameter o The *responseCode* shall be 300, indicating unsupported spectrum. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.12 [WINNF.FT.S.SIQ.12] [Configurable] Spectrum inquiry in the presence of protected entities

This configurable array test covers spectrum inquiry request(s) in the (optional) presence of protected entities. The first step is to register valid CBSD(s). The next step is to inject protected entities (Grandfathered Wireless Broadband Licensee Protected Zones and PPAs) into the SAS. Then, submit a spectrum inquiry request from previously registered CBSD(s) with varying combinations of valid, missing, and invalid required parameters. The test will check the number of and value of the spectrum inquiry SAS UUT responseCode(s) to see if they match the expected responseCode(s) as specified in the respective input configuration file. The SAS UUT response shall also include a list of available channels.

Step	**Instructions**
1	Load information about N1 >= 0 Grandfathered Wireless Broadband Licensee Protected Zones (GWPZs) into the SAS UUT.
2	Configure the SAS UUT to whitelist the FCC IDs and user IDs corresponding to the *RegistrationRequest* which will be sent in Step 4.

3	Using a DP Test Harness, send a valid Registration Request Message with the *registrationRequest* parameter containing N2 > 0 CBSDs. Verify that the *responseCode* for each is SUCCESS.
4	Load N3 >= 0 PPA Information into the SAS UUT, each with a cluster list as defined in the configuration file. The cluster list may be empty for any and all PPAs.
5	If N1>0 or N3>0, instruct the SAS UUT to execute its CPAS and wait until completion.
6	Send a spectrum inquiry request with N2 elements (one per registered CBSD).
CHECK	The SAS UUT response to the spectrum inquiry request must satisfy all of the following conditions: • The response shall contain N2 *SpectrumInquiryResponse* objects. • For each *SpectrumInquiryResponse* object: o If the corresponding request contained a valid *cbsdId*, the response shall contain the same CBSD ID. o The *responseCode* shall match the corresponding expected response code listed in the configuration file. o For each *availableChannel* object in the response, the *ruleApplied* shall be "FCC_PART_96". o The response shall contain *at least* $M1_{cbsd}$ channels marked as available for GAA use. ▪ Note: the value of M is specified separately for each CBSD. o The response shall contain a*t most* $M2_{cbsd}$ channels marked as available for GAA use. o The response shall contain *at least* $M3_{cbsd}$ channels marked as available for PAL use. o The response shall contain *at most* $M4_{cbsd}$ channels marked as available for PAL use. o None of the available channels overlap with the frequency range(s) specified in FR_{cbsd}. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.2.4.13 [WINNF.FT.S.SIQ.13] Blacklisted CBSD in Array request (*responseCode* 101)

Step	**Instructions**
1	Ensure that three CBSDs register with SAS UUT; *cbsdId* (C1, C2, C3)
2	Manually Blacklist the third CBSD, *cbsdId* (C3)
3	DP Test Harness sends a Spectrum Inquiry Request Message with 3 request objects: • All three objects have valid *cbsdId*, as well as all other parameters.
CHECK	SAS responds with a Spectrum Inquiry Response Message in the form of one 3-element Array as follows:

	• SAS response includes the *cbsdId* that match the request from each CBSD in the array. • The *responseCode* is 0 for the first two CBSDs concluding a successful operation. • The *responseCode* is 101 for the third CBSD *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3 CBSD Spectrum Grant Procedure

6.3.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures to test the conformance of CBSD Grant Procedure.

The *responseCode* parameters in tables 40 and 41 of [n.9] outlines the possible conditions associated with a Grant Request and the expected Grant Response from a SAS UUT. (please see the table below)

Table 6.3-1 Response Codes for CBSD Grant Procedure Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**
0	SUCCESS	Either of followings: • The SAS UUT completes the spectrum accessibility process with no error. • Grant pending	• Grant request for PAL or GAA channel when no incumbent present • Grant pending when DPA is activated.	WINNF.FT.S.GRA.1 WINNF.FT.S.GRA.5 WINNF.FT.S.GRA.10 WINNF.FT.S.GRA.11 WINNF.FT.S.GRA.12 WINNF.FT.S.GRA.13
101	BLACKLISTED	The CBSD has been included in a blacklist of CBRS operation (SAS or FCC enforcement action) or the CBSD operating privileges have been revoked.	• Registered CBSD is manually blacklisted.	WINNF.FT.S.GRA.12
102	MISSING_PARAM	One or more parameters to be included in the request are missing.	• One or more parameters are missing.	WINNF.FT.S.GRA.2 WINNF.FT.S.GRA.15
103	INVALID_VALUE	One or more parameters with invalid value are provided to the SAS UUT.	• CBSD ID is different from the assigned CBSD ID. • Parameters in the *operationFrequencyRan*	WINNF.FT.S.GRA.3 WINNF.FT.S.GRA.4 WINNF.FT.S.GRA.7 WINNF.FT.S.GRA.8 WINNF.FT.S.GRA.11 WINNF.FT.S.GRA.15

			ge parameter are mutually invalid. • Requested operational parameter includes the frequency range with both PAL and GAA channels • Maximum EIRP specified in the grant request is higher than the certified maximum EIRP for the CBSD or its claimed *eirpCapability* during the registration.	
300	UNSUPPORTED_SPECTRUM	The frequency range in the request is set to a value partially overlapping or completely outside the frequency range of the CBRS Band (3550-3700 MHz)	• The frequency range in the *operationFrequencyRange* parameter is partially overlapping with the CBRS Band. • The frequency range in the *operationFrequencyRange* parameter is completely outside the CBRS Band.	WINNF.FT.S.GRA.7
400	INTERFERENCE	The requested grant is likely to result in too much interference.	• Frequency range requested by a CBSD overlaps with PAL channel but the CBSD is not a member of claimed PPA.	WINNF.FT.S.GRA.1 WINNF.FT.S.GRA.9
401	GRANT_CONFLICT	The requested operation parameters conflict with an existing Grant of the same CBSD.	• The requested operation parameters are partially or fully overlapped the frequency range of the existing Grant of the same CBSD. • One Grant Request Message includes two grant requests but the frequency ranges are overlapping with each other.	WINNF.FT.S.GRA.5 WINNF.FT.S.GRA.10 WINNF.FT.S.GRA.16

6.3.2 Test Characteristics

Table 6.3-2 CBSD Spectrum Grant Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.GRA
2	**Title**	CBSD Spectrum Grant Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.3.3 Method of test

6.3.3.1 Initial Conditions / Test Pre-conditions

The typical pre-conditions of the test case are the following:

- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.3.4 Test Procedure

6.3.4.1 [WINNF.FT.S.GRA.1] Federal Incumbent present in the PAL frequency range requested by the CBSD who is inside the DPA Neighborhood

Step	**Instructions**
1	Ensure that CBSD registers with SAS UUT, with *cbsdId* (C), and is inside the Neighborhood of the DPA in Step 2.
2	• Inject PPA Information into the SAS UUT such that *cbsdId* = C is part of the PPA. • Configure the SAS UUT such that a frequency range FR is available to this CBSD as a PAL channel. • Ensure that a DPA is inactive on frequency range FR. • No other Incumbent or PPA present.
3	• Activate the DPA on the frequency range FR.
4	DP Test Harness sends Grant Request to SAS. In which *cbsdId* = C, *operationFrequencyRange* = FR. Set *maxEirp* appropriately.
CHECK	Verify the following in the Grant Response Message from SAS • Verify that this *grantResponse* is valid. • *cbsdId* (Response) = *cbsdId* (Request) = C • *responseCode* = 0 or *responseCode* = 400 • A *grantId* (G) assigned by the SAS (when *responseCode* = 0). • *channelType* is "PAL" (when *responseCode* = 0). Note that, if *responseCode* = 0, the SAS will delay the transition of CBSD to *Authorized* state during exchange of Heartbeat messages.

	If any of the above conditions is not met, the SAS FAILS this test. If responseCode = 400, the SAS PASSES this test (do not perform any more steps). Otherwise, proceed.
4	DP Test Harness sends a HB Request with • *cbsdId* = C • *grantId* = G • *operationState* = GRANTED
CHECK	Verify the following in the HB Response message from the SAS • *cbsdId* = C • *grantId* = G • *transmitExpireTime* is no later than the current time. • *responseCode* = SUSPENDED_GRANT *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.2 [WINNF.FT.S.GRA.2] Grant Array with Missing parameters

Step	Instructions
1	Ensure that CBSDs have registered with the SAS and their *cbsdId* parameters are C1, C2, C3, C4 and C5.
2	DP Test Harness sends Grant Request in an array format to SAS such that: • The first CBSD is missing its *cbsdId* (C1) but all other parameters are valid. • The second one has *cbsdId* = C2 and has all other parameters valid, but *operationParam* parameter is NOT present. • The third one has *cbsdId* = C3 and has all other parameters valid. *operationParam* parameter is present in the Grant Request, but its *maxEirp* parameter is missing. Both *lowFrequency* and *highFrequency* elements are present with valid values. • The fourth one has *cbsdId* = C4 and has all other parameters valid. *operationParam* parameter is present in the Grant Request, with valid *maxEirp* parameter and *lowFrequency*, but *highFrequency* element is missing. • The fifth one has *cbsdId* = C5 and has all other parameters valid. *operationParam* parameter is present in the Grant Request, with valid *maxEirp* parameter and *highFrequency*, but *lowFrequency* element is missing.

CHECK	SAS sends a Grant Response Message in an array format as follows:
	• For the first element of the *grantResponse* parameter:
	  ○ No *cbsdId* in Response message.
	  ○ No *grantId* in the Response message
	  ○ *responseCode* = 102
	• For the second, third, fourth, and fifth elements of the *grantResponse* parameter:
	  ○ *cbsdId* = C2 to C5 respectively.
	  ○ No *grantId*
	  ○ The *responseCode* shall be 102, indicating am missing parameter
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.3.4.3 [WINNF.FT.S.GRA.3] *cbsdId* does not exist in SAS

Step	Instructions
1	Ensure the following conditions hold: • *cbsdId* (C) does not exist in SAS
2	DP Test Harness sends Grant Request Message to SAS including *cbsdId* (C) and other required parameters.
CHECK	Verify the following in the Grant Response Message from SAS: • No *cbsdId* • No *grantId* • *responseCode* = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.4 [WINNF.FT.S.GRA.4] *cbsdId* sent by the CBSD is not its *cbsdId*, but of some other CBSD which is currently registered with the SAS

Informative note: One recommended approach to detect the wrong *cbsdId* is to use the association between the *cbsdId* and CBSD certificate

Step	Instructions
1	Two CBSD Test Harnesses register with SAS UUT; *cbsdId* (C1 and C2)
2	CBSD Test Harness (C1) sends a Grant Request Message in which *cbsdId* is set to C2, with all other required parameters valid.
CHECK	Verify the following in the Grant Response Message from SAS • No *cbsdId* • No *grantId* • *responseCode* = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.5 [WINNF.FT.S.GRA.5] SAS rejects GrantRequest if the CBSD already has a Grant from another SAS

Step	Instructions
1	Configure the SAS Test Harness such that it contains a single record for CBSD C1 with Grant G1 and nothing else.
2	Admin Test Harness instructs the SAS UUT to send a pull command for a Full Activity Dump from the SAS Test Harness. SAS Test Harness responds with the data described in Step 1.
3	Register the same CBSD C1 (as mentioned in Step1), and another CBSD C2 to the SAS UUT. Both registrations shall be successful.
4	Send a valid Grant Request on behalf of C1 and C2 to the SAS UUT.

CHECK	SAS UUT sends correct Grant Response Messages as follows: • The *responseCode* in Response Object is 401 for the first CBSD concluding a failed Grant Request (grant conflict). • The *responseCode* in Response Object is 0 for the second CBSD concluding a successful grant request. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.6 [WINNF.FT.S.GRA.6] SAS terminates Grant upon learning that the CBSD has a Grant from another SAS

Step	Instructions
1	DP Test Harness successfully registers (*cbsdId*=C1) and gets a Grant G1 from SAS UUT.
2	Configure the SAS Test Harness such that it contains a single record for the same CBSD C1 (as mentioned in Step 1), with Grant G2 and nothing else.
3	Admin Test Harness instructs the SAS UUT to send a pull command for a Full Activity Dump from the SAS Test Harness. SAS Test Harness responds with the data described in step 2.
4	DP Test Harness sends a valid Heartbeat Request Message to the SAS UUT.
CHECK	SAS UUT sends a HeartBeat Response Message to the DP Test Harness as follows: • The *responseCode* is 500 for the CBSD concluding a terminated spectrum grant. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.7 [WINNF.FT.S.GRA.7] Invalid *operationFrequencyRange*

Step	Instructions
1	Ensure the following conditions hold: • Three CBSDs register with SAS UUT; *cbsdId* (C1, C2, C3)
2	DP Test Harness sends Grant Request in an Array form to SAS such that: • For *cbsdId* (C1), *operationParam* parameter is present in the Grant Request, but its *lowFrequency* value is set to a value higher than *highFrequency* value. *maxEirp* shall be a valid value • For *cbsdId* (C2), operationParam parameter is present in the Grant Request, but the values of the *lowFrequency* and *highFrequency* parameters are set to values such that the frequency range is completely outside the CBRS band • For *cbsdId* (C3), operationParam parameter is present in the Grant Request, but the values of the *lowFrequency* and *highFrequency* parameters are set to values such that the frequency range is partially overlapping with CBRS band
CHECK	Verify the following in the Grant Response Message in an Array form from SAS: • *cbsdId* (Response) = *cbsdId* (Request) = C1, C2, and C3 respectively

	• No *grantId*s • For *cbsdId* (C1) the *responseCode* = 103 • For *cbsdId* (C2 and C3) the *responseCode* = 300 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.8 [WINNF.FT.S.GRA.8] CBSD requests a frequency range which is a mix of PAL and GAA channel.

Step	Instructions
1	Admin Test Harness injects PPA Information into SAS UUT, with frequency range FR1
2	Ensure the following conditions hold: • CBSD registers with SAS UUT; *cbsdId* (C) • *cbsdId* = C is part of the PPA in Step 1
3	Ensure that frequency range FR2 is adjacent to FR1 and available for GAA use
4	DP Test Harness sends Grant Request to SAS such that • *cbsdId* = C • *operationFrequencyRange* = FR = FR1+FR2 (FR contains both PAL and GAA channel) • *maxEirp* is set appropriately
CHECK	Verify the following in the Grant Response Message from SAS • *cbsdId* = C • No *grantId* • *responseCode* = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.9 [WINNF.FT.S.GRA.9] Frequency range requested by a CBSD overlaps with PAL channel and the CBSD is inside the PPA boundary claimed by other CBSD User.

Step	Instructions
1	Ensure the following conditions hold: • Register *cbsdId* (C1) with SAS • Admin Test Harness injects PPA Information into SAS UUT for CBSD C1 over frequency range PAL_FR (PPA1) • Register CBSD 'C2' (located inside PPA1, but not part of it) with the SAS
2	Trigger CPAS
3	DP Test Harness sends Grant Request Message to SAS such that • *cbsdId* =C2 • *operationFrequencyRange* is set to G_FR, maxEirp is set appropriately. ○ Frequency range G_FR overlaps with PAL_FR.
CHECK	Verify the following in the Grant Response Message from SAS • *cbsdId* = C2 • No *grantId*

	• *responseCode* = 400 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.10 [WINNF.FT.S.GRA.10] First request granted as PAL or GAA channel, send next request for PAL or GAA channel for a partially or fully overlapped frequency range

Step	Instructions
1	DP Test Harness shall initiate the CBSD Registration Procedure for two CBSDs and obtains two *cbsdId* parameters (C1 and C2) from the SAS UUT for those CBSDs.
2	Inject the following into the SAS UUT: • PAL Database Record (PAL1), where the frequency range of primary channel assignment is 3,550 – 3,560 MHz (FR1) • Zone data of PPA boundary associated with PAL1, where the PPA boundary is set so that the location of C1 is within. • PPA Cluster List containing C1
3	The DP Test Harness shall initiate the CBSD Grant Procedure by sending a Grant Request Message to the SAS UUT, where the Grant Request Message shall meet the following conditions: • The Grant Request Message includes the *grantRequest* parameter which contains two *GrantRequest* objects • For the first *GrantRequest* object: o The *cbsdId* parameter set to C1. o The *operationParam* parameter which includes: o The *maxEirp* parameter set to valid value o The *operationFrequencyRange* parameter set to FR1 • For the second *GrantRequest* object: o The *cbsdId* parameter set to C2. o The *operationParam* parameter which includes: o The *maxEirp* parameter set to valid value o The *operationFrequencyRange* parameter set to 3,560 – 3,570 MHz (FR2)
CHECK	The DP Test Harness checks a Grant Response Message received from the SAS UUT. If the any of the following conditions is not met, the SAS UUT fails this test case. Otherwise, proceed to Step 4 • The Grant Response Message includes the *grantResponse* parameter which contains two *GrantResponse* objects • For the first *GrantResponse* object: o The *cbsdId* parameter (C1) o The *grantId* parameter set to valid value (G1) o The *grantExpireTime* parameter set to valid value with correct format. o The *heartbeatInterval* parameter set to valid value with correct format. o No *operationParam* parameter

	○ The *channelType* parameter set to "PAL" ○ The *responseCode* parameter in *Response* object is set to 0 (SUCCESS) • For the second *GrantResponse* object: ○ The *cbsdId* parameter set to C2 ○ The *grantId* parameter set to valid value (G2) ○ The *grantExpireTime* parameter set to valid value with correct format. ○ The *heartbeatInterval* parameter set to valid value with correct format. ○ No *operationParam* parameter ○ The *channelType* parameter set to "GAA" ○ The *responseCode* parameter in *Response* object is set to 0 (SUCCESS) *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	The DP Test Harness shall initiate the CBSD Grant Procedure by sending a Grant Request Message to the SAS UUT, where the Grant Request Message shall be same as sent in Step 3.
CHECK	The DP Test Harness checks a Grant Response Message received from the SAS UUT. If the any of the following conditions is not met, the SAS UUT fails this test case. • The Grant Response Message includes the *grantResponse* parameter which contains two *GrantResponse* objects • For the first *GrantResponse* object: ○ The *cbsdId* parameter (C1) ○ No *grantId* parameter ○ No *grantExpireTime* parameter ○ No *heartbeatInterval* parameter ○ No *operationParam* parameter ○ No *channelType* parameter ○ The *responseCode* parameter in *Response* object set to 401 (GRANT_CONFLICT) • For the second *GrantResponse* object: ○ The *cbsdId* parameter set to C2 ○ No *grantId* parameter ○ No *grantExpireTime* parameter ○ No *heartbeatInterval* parameter ○ No *operationParam* parameter ○ No *channelType* parameter ○ The *responseCode* parameter in *Response* object set to 401 (GRANT_CONFLICT) *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.11 [WINNF.FT.S.GRA.11] Un-Supported CBSD maximum EIRP

This test case tests SAS operation in response to a requested *maxEirp* specified in the *grantRequest* that is not supported for the CBSD claimed category, or compared with CBSDs certified (allowed) maximum EIRP in FCC-ID Whitelist (noted as FCC_EIRPCi for CBSD Ci below

Step	Instructions

1	Configure the SAS UUT to whitelist five FCC IDs with certified maximum EIRP as follows:
	• For the first CBSD (C1):
	  ○ FCC_EIRP_{C1} = 30 (dBm/10MHz)
	• For the second CBSD (C2):
	  ○ FCC_EIRP_{C2} = 20 (dBm/10MHz)
	• For the third CBSD (C3):
	  ○ FCC_EIRP_{C3} = 40 (dBm/10MHz)
	• For the fourth CBSD (C4):
	  ○ FCC_EIRP_{C4} = 47 (dBm/10MHz)
	• For the fifth CBSD (C5):
	  ○ FCC_EIRP_{C5} = 30 (dBm/10MHz)

2	DP Test Harness shall initiate the Registration Procedure for five CBSDs and obtains *cbsdId* parameters (C1, C2, C3, C4, C5) as follows:
	• For the first CBSD (C1):
	  ○ The *cbsdCategory* parameter set to "A"
	  ○ The *eirpCapability* parameter set to 20 (dBm/10MHz)
	• For the second CBSD (C2):
	  ○ The *cbsdCategory* parameter set to "A"
	  ○ No *eirpCapability* parameter included
	• For the third CBSD (C3):
	  ○ The *cbsdCategory* parameter set to "B"
	  ○ No *eirpCapability* parameter included
	• For the fourth CBSD (C4):
	  ○ The *cbsdCategory* parameter set to "B"
	  ○ The *eirpCapability* parameter set to 40 (dBm/10MHz)
	• For the fifth CBSD (C5):
	  ○ The *cbsdCategory* parameter set to "B"
	  ○ No *eirpCapability* parameter included

3	The DP Test Harness shall send a Grant Request Message with the *grantRequest* array containing five *GrantRequest* objects as follows:
	• For the first *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C1.
	  ○ The *operationParam* parameter which includes:
	  ▪ The *maxEirp* parameter set to 11 (dBm/MHz)
	  ▪ The *operationFrequencyRange* parameter is set to valid range.
	• For the second *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C2.
	  ○ The *operationParam* parameter which includes:
	  ▪ The *maxEirp* parameter set to 11 (dBm/MHz)
	  ▪ The *operationFrequencyRange* parameter is set to valid range.
	• For the third *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C3.

	○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 31 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the fourth *GrantRequest* object: ○ The *cbsdId* parameter set to C4. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 31 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the fifth *GrantRequest* object: ○ The *cbsdId* parameter set to C5. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 21 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range.
CHECK	SAS UUT responsed with a Grant Response Message containing five *GrantResponse* objects such that: • *cbsdId* (Response) = *cbsdId* (Request) = C1, C2, C3, C4, C5 respectively • No *grantIds* in the Response message • *responseCode* = 103 for all CBSDs *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	The DP Test Harness shall send a Grant Request with the *grantRequest* array containing five *GrantRequest* objects as follows: • For the first *GrantRequest* object: ○ The *cbsdId* parameter set to C1. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 10 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the second *GrantRequest* object: ○ The *cbsdId* parameter set to C2. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 10 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the third *GrantRequest* object: ○ The *cbsdId* parameter set to C3. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 20 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the fourth *GrantRequest* object: ○ The *cbsdId* parameter set to C4. ○ The *operationParam* parameter which includes: ▪ The *maxEirp* parameter set to 30 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range. • For the fifth *GrantRequest* object: ○ The *cbsdId* parameter set to C5. ○ The *operationParam* parameter which includes:

	▪ The *maxEirp* parameter set to 20 (dBm/MHz) ▪ The *operationFrequencyRange* parameter is set to valid range.
CHECK	SAS UUT responds with a Grant Response Message containing five *GrantResponse* objects such that: • *cbsdId* (Response) = *cbsdId* (Request) = C1, C2, C3, C4, C5 respectively • A *grantId* (G) assigned by the SAS UUT for every *GrantResponse* object • *responseCode* = 0 for all CBSDs *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.12 [WINNF.FT.S.GRA.12] Blacklisted CBSD in Array request (*responseCode* 101)

Step	Instructions
1	Ensure that three CBSDs register with SAS UUT; *cbsdId* (C1, C2, C3)
2	• Configure the SAS UUT such that frequency ranges (FRs) are frequency ranges available as "GAA". • Ensure that no incumbent is present in those frequency ranges.
3	Manually Blacklist the third CBSD, *cbsdId* (C3)
4	DP Test Harness sends Grant Request Message to SAS which has the *grantRequest* parameter containing 3 elements.
CHECK	SAS responds with a Grant Response in the form of one 3-element Array as follows: • SAS response includes the *cbsdId* that match the request from each CBSD in the array. • The *responseCode* is 0 for the first two CBSDs concluding a successful operation. *channelType* shall be set to GAA • The *responseCode* is 101 for the third CBSD *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.13 [WINNF.FT.S.GRA.13] Requests for multiple PAL channels and for multiple GAA channels; no incumbent present in the PAL and GAA frequency ranges used in the requests.

Step	Instructions
1	The Admin Test Harness injects two PAL Database Records into the SAS UUT, with corresponding *primaryAssignment* parameter indicated as FR1 and FR2. FR1 and FR2 do not overlap.
2	• The DP Test Harness initiates the CBSD Registration procedure for three CBSDs and obtains three cbsdId parameters (C1, C2 and C3) • C1 and C2 are each associated with one of the PPAs injected in the Step 3, the location of CBSDs are within the associated PPAs, and the userId parameters are same as the corresponding value in PAL Database Records injected in the Step 1

	• C3 is not associated with any of the PPAs • Make sure no other protected entity is present.
3	The Admin Test Harness injects the PPA Zone Definition Message for each of the two PPAs mentioned in Step 2

4	The DP Test Harness shall send a Grant Request Message with the *grantRequest* array containing three *GrantRequest* objects as follows:
	• For the first *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C1.
	  ○ The *operationFrequencyRange* parameter is set to FR1
	• For the second *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C2.
	  ○ The *operationFrequencyRange* parameter is set to FR2
	• For the third *GrantRequest* object:
	  ○ The *cbsdId* parameter set to C3.
	  ○ The *operationFrequencyRange* parameter is set to a frequency range FR3
	  ▪ FR3 do not overlap with FR1 or FR2

CHECK	Verify the following in the Grant Response Message from SAS:
	• The *grantResponse* parameter contains three elements:
	• The first element shall have
	  ○ *cbsdId* = C1
	  ○ *grantId* (G1)
	  ○ Verify that *grantExpireTime* parameter set to the value that does not extend beyond the corresponding PAL *licenseExpiration* in Step 1
	  ○ *channelType* is set to PAL
	  ○ *responseCode* = 0
	• The second element shall have
	  ○ *cbsdId* = C2
	  ○ *grantId* (G2)
	  ○ Verify that *grantExpireTime* parameter set to the value that does not extend beyond the corresponding PAL *licenseExpiration* in Step 1
	  ○ *channelType* is set to PAL
	  ○ *responseCode* = 0
	• The third element shall have
	  ○ *cbsdId* = C3
	  ○ *grantId* (G3)
	  ○ *channelType* is set to GAA
	  ○ *responseCode* = 0
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.3.4.14 [WINNF.FT.S.GRA.14] Reserved

6.3.4.15 [WINNF.FT.S.GRA.15] Both the requests result in unsuccessful Grant Response

Step	Instructions
1	Ensure that DP Test Harness registers two CBSDs with SAS UUT; *cbsdId* (C1, C2)
2	Configure the SAS UUT such that FR1 is a frequency range available as "GAA".
3	DP Test Harness sends Grant Request Message to SAS which has a *grantRequest* parameter containing two elements in it: • The first element has *cbsdId* = C1, *operationFrequencyRange* set to FR1, but its maxEirp is missing. • The second element has *cbsdId* = C2, but its highFrequency is set to a value lower than its lowFrequency value. Set maxEirp to a valid value.
CHECK	Verify the following in the Grant Response Message from SAS • The *grantResponse* parameter contains two elements: • The first element shall have o *cbsdId* = C1 o No *grantId*. o *responseCode* = 102 (MISSING_PARAM) • The second element shall have (for the example given in Step 3) o *cbsdId* = C2 o No *grantId*. o *responseCode* = 103 (invalid value) *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.3.4.16 [WINNF.FT.S.GRA.16] The two requests carry overlapping frequency range in the Grant Request from the same CBSD.

Step	Instructions
1	DP Test Harness registers a CBSD with SAS UUT; cbsdId (C)
2	Ensure that the frequency ranges FR1 and FR2 that are overlapping and available as GAA.
3	• DP Test Harness sends Grant Request message to SAS which has two GrantRequest objects in it. • The first GrantRequest object has *cbsdId* = C, frequencyRange = FR1. Set maxEirp appropriately. • The second GrantRequest object has *cbsdId* = C, frequencyRange = FR2. Set maxEirp appropriately
CHECK	Verify the following in the Grant Response Message from SAS The *grantRequest* parameter containing two elements: • Both elements shall have *cbsdId* = C • At least one element shall have *responseCode* = 401 (GRANT_CONFLICT) • The *grantExpireTime* with a correct format and range is included for the element with *responseCode* = 0 o The *heartbeatInterval* with a correct format and range is included

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.3.4.17 [WINNF.FT.S.GRA.17] [Configurable] Array grant request

This configurable test covers grant tests where there is no incumbent present (grant tests where an incumbent is present are covered in the functional tests), and can cover situations were the CBSD (Cat A and/or Cat B) grant request: includes frequency ranges covering GAA frequencies and/or PAL frequencies and/or combinations of GAA and PAL frequencies and/or frequencies ranges that are completely and/or partly outside the CBRS band; has a missing CBSD ID and/or a CBSD ID that does not exist in the SAS; has missing and/or invalid and/or valid operational parameters. The test can also include CBSD grant requests that fall within PPAs. The test will check the number and value of the Grant SAS UUT responseCodes (including the appropriate number of responseCodes) to see if they match the expected responseCodes as specified in the respective input configuration file, which will include codes of 0 (success), 102(missing parameter), 103 (invalid value), 300 (unsupported spectrum), 400 (Interference), 401(grant conflict).

Step	**Instructions**
1	Configure the SAS UUT to whitelist the FCC IDs and user IDs corresponding to the RegistrationRequest which will be sent in Step 2.
2	Send a valid registration request with the *registrationRequest* parameter containing N1 > 0 CBSDs. Verify that the *responseCode* for each is SUCCESS.
3	Load information about N2 >= 0 PPAs into the SAS UUT, each with a cluster list as defined in the configuration file. The cluster list may be empty for any and all PPAs.
4	If N2>0, instruct the SAS UUT to execute its CPAS and wait until completion.
5	Send a Grant Request Message with the *grantRequest* parameter containing N1 elements (one per registered CBSD).

CHECK	The Grant Response Message from the SAS UUT must satisfy all of the following conditions:
	The *grantResponse* parameter shall contain N1 elements:
	• For each element:
	  ○ The *responseCode* shall match the corresponding expected *responseCode* listed in the configuration file.
	  ○ If the corresponding request contained a valid *grantId*, the response shall contain the same *cbsdId*.
	  ○ If *responseCode* = SUCCESS, verify that the response contains a valid *grantId*.
	  ▪ Otherwise, verify that the response does *not* contain a *grantId*.
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.4 CBSD Heartbeat Procedure

6.4.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS Heartbeat Response Message to a CBSD Heartbeat Request Message.

The approach is for each test to create necessary conditions to generate a SAS Heartbeat Response Message to a CBSD Heartbeat Request Message with all the defined *responseCode* parameters pertaining to the CBSD Heartbeat Procedure in [n.9]. This includes successful Heartbeat Request as well, which is signified by *responseCode* 0. (please see the table below)

Table 6.4-1 Response Codes for CBSD Heartbeat Procedure Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**
0	SUCCESS	The SAS UUT completes the Heartbeat Processing with no error.	• Heartbeat Request with no incumbent or any other activity to affect the Grant • Grant renewal request	WINNF.FT.S.HBT.1 WINNF.FT.S.HBT.2 WINNF.FT.S.HBT.4 WINNF.FT.S.HBT.7 WINNF.FT.S.HBT.8 WINNF.FT.S.HBT.9
100	VERSION	The version number of the SAS-CBSD protocol used by the CBSD Test Harness is not supported by the SAS UUT, or the version number used by CBSD is invalid.	• The CBSD Test Harness sends the request message using the URL of the SAS UUT including the newer protocol version than the most recent SAS-CBSD Protocol version supported by the SAS UUT.	WINNF.FT.S.HBT.3
101	BLACKLISTED	The CBSD has been included in a blacklist of CBRS operation (SAS or FCC enforcement action) or the CBSD operating privileges have been revoked.	Registered CBSD is manually blacklisted.	WINNF.FT.S.HBT.8
102	MISSING_PARAM	One or more parameters required to be included in the request are missing.	• “Required” parameter is missing from the request.	WINNF.FT.S.HBT.4

103	INVALID_VALUE	One or more parameters with invalid value are provided to the SAS UUT	• "Required" parameter is set to an invalid value. • Heartbeat Procedure after Grant is relinquished. • Heartbeat Procedure after Grant is expired.	WINNF.FT.S.HBT.5 WINNF.FT.S.HBT.6 WINNF.FT.S.HBT.7 WINNF.FT.S.HBT.11
500	TERMINATED_GRANT	Grant is terminated due to permanent change in incumbent status, or CBSD located in an exclusion zone, or CBSD causing excessive interference to the incumbent as a result of IAP process, or CBSD being in a DPA Move List upon DPA activation.	• Activities of FSS Earth Station and GWBL are changed.	WINNF.FT.S.HBT.5 WINNF.FT.S.HBT.6 WINNF.FT.S.HBT.9 WINNF.FT.S.HBT.12
501	SUSPENDED GRANT	Pending grant cannot be enabled due to incumbent status	• Heartbeat Response after Grant Procedure concluding Grant pending (*responseCode* 0)	WINNF.FT.S.HBT.12
502	UNSYNC_OP_PARAM	Grant state is out-of-synchronization between the SAS UUT and the CBSD (emulated by the CBSD Test Harness).	• Grant state "AUTHORIZED" is indicated to the SAS UUT while the current Grant state in SAS UUT is "GRANTED".	WINNF.FT.S.HBT.11

6.4.2 Test Characteristics

Table 6.4-2 CBSD Heartbeat Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.HBT
2	**Title**	CBSD Heartbeat Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.4.3 Method of test

6.4.3.1 Initial Conditions / Test Pre-conditions

The typical pre-conditions of the test case are the following:

- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.4.4 Test Procedure

6.4.4.1 [WINNF.FT.S.HBT.1] Array request: Successful Heartbeat Request

This test case tests the scenario when the CBSDs move immediately into *Granted* State or following a Heartbeat Response.

Step	**Instructions**
1	Ensure the following conditions hold: • DP Test Harness registers three CBSDs with SAS UUT; *cbsdId* (C1, C2, C3) • DP Test Harness successfully requests Grants for a PAL or GAA channel for the CBSDs • DP Test Harness successfully exchanges Heartbeat with SAS UUT for the CBSDs and keeps them in the *Authorized* state
2	DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing 3 elements before the *grantExpireTime*. Each element contains *cbsdId*, *grantId*. Ensure no incumbent or any other activity to affect the Grant.
CHECK	SAS UUT responds with a Heartbeat Response Message with the *heartbeatResponse* parameter containing 3 elements as follows: • Each element includes the *cbsdId*, and *grantId* that matches the request from each CBSD in the array. • *transmitExpireTime* set to a valid UTC time in the future for each CBSD. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • The *responseCode* shall be 0 for all CBSDs concluding a successful operation. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.2 [WINNF.FT.S.HBT.2] Array request: Successful Heartbeat Request from CBSD for Grant renewal

Step	**Instructions**
1	Ensure the following conditions hold: • DP Test Harness registers 3 CBSDs with SAS UUT; *cbsdId* (C1, C2, C3) • DP Test Harness successfully requests Grant for a PAL or GAA channel for the CBSDs
2	DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing 3 elements before the expiration of the *grantExpireTime*. Ensure

	no incumbent or any other activity to affect the Grant. For each CBSD, this request shall include: • *cbsdId* • *grantId* • *grantRenew* set to True.
CHECK	SAS UUT responds with a Heartbeat Response Message with the *heartbeatResponse* parameter containing 3 elements as follows: • Each element includes the *cbsdId*, and *grantId* that matches the Heartbeat Request Message . • *transmitExpireTime* set to a valid UTC time in the future. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • *grantExpireTime* is set to a valid UTC time greater than or equal to the original *grantExpireTime* • The *responseCode* shall be 0 for the all CBSDs concluding a successful operation. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.3 [WINNF.FT.S.HBT.3] Array request: Unsuccessful VERSION (*responseCode* 100)

Initial Heartbeat Request (immediately after CBSD moves into *Granted* State) is from a CBSD with an unsupported protocol version by SAS.

Step	**Instructions**
1	Ensure the following conditions hold: • DP Test Harness registers 3 CBSDs with SAS UUT; *cbsdId* (C1, C2, C3) • DP Test Harness successfully requests Grant for a PAL or GAA channel for the CBSDs
2	DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing 3 elements (each element includes *cbsdId*, *grantId*) before the expiration of the *transmitExpireTime*, but with a protocol version newer than the most recent SAS-CBSD protocol version supported by SAS.
CHECK	SAS UUT responds with a Heartbeat Response with the *heartbeatResponse* parameter containing 3 elements as follows: • Each element includes the *cbsdId*, and *grantId* that match the request from each CBSD in the array • The *responseCode* for all CBSDs set to 100, concluding a failed operation due to protocol error. • *transmitExpireTime* set to a value equal or less than the *transmitExpireTime* in the previous successful Heartbeat response. If this is the first Heartbeat response, *transmitExpireTime* shall be no later than the current time. Alternatively, the SAS UUT can return HTTP status code 404. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.4 [WINNF.FT.S.HBT.4] Array request: Successful or Unsuccessful Heartbeat Request from CBSD in *Granted* or *Authorized* state due to missing required parameters.

This test case tests the scenario when the CBSDs move immediately into *Granted* State or following a Heartbeat Response has required parameters missing.

Step	Instructions
1	Ensure the following conditions hold: • DP Test Harness registers 4 CBSDs with SAS UUT; *cbsdId* (C1, C2, C3, C4) • DP Test Harness successfully requests Grant for a PAL or GAA channel for the CBSDs • No Protected Entity are present
2	DP Test Harness sends a Heartbeat Request Message with their *cbsdId*, *grantId* before the expiration of the *transmitExpireTime* in the form of one 4-element Array. In particular, the listed CBSDs have the following conditions: • CBSD 1 has all required parameters included • CBSD 2 has *cbsdId* missing • CBSD 3 has *grantId* missing • CBSD 4 has *operationState* (AUTHORIZED or GRANTED) missing
CHECK	SAS UUT responds with a Heartbeat Response Message in the form of one 4-element Array as follows: • CBSD 1 has included all required parameters. • SAS response includes the *cbsdId*, and *grantId* that match the request from CBSD 1, and 4 in the array. • The *responseCode* shall be 0 for the first CBSD concluding a successful operation. • *transmitExpireTime* is set to a valid UTC time in the future for the first CBSD. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • The *responseCode* for CBSDs 2 to 4 set to 102, concluding a failed operation due to missing parameters. • *transmitExpireTime* set to a time no later than the current time, for CBSDs 2 to 4. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.5 [WINNF.FT.S.HBT.5] Unsuccessful Heartbeat Request from CBSD in Registered state

This test case tests the scenario when the CBSD sends Heartbeat Request immediately after CBSD's Grant is terminated.

Step	Instructions
1	DP Test Harness shall successfully registers, successfully gets a Grant and exchange Heartbeat, and then relinquish the grant. No Protected Entity are present.

2	DP Test Harness sends a Heartbeat Request Message with its *cbsdId*, and its old (terminated) *grantId* after the *transmitExpireTime* but before the *grantExpireTime*. Ensure incumbent or any other activity stays the same as in Step 1.
CHECK	SAS UUT responds with a Heartbeat Response Message as follows: • It includes the *cbsdId*. • The *responseCode* set to o 103: concluding a failed operation due to invalid parameters. o 500: indicating a terminated Grant • *transmitExpireTime* shall be no later than the current time. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.6 [WINNF.FT.S.HBT.6] Unsuccessful Heartbeat Request from CBSD in Registered state (immediately after CBSD's grant is expired)

Step	Instructions
1	DP Test Harness shall successfully register, successfully get a Grant and exchange Heartbeat to enter and stay in the *Authorized* state. No Protected Entity are present.
2	DP Test Harness sends a Heartbeat Request Message after the *grantExpireTime*, with its old (expired) *grantId*.
CHECK	SAS UUT responds with a Heartbeat Response Message as follows: • It includes the *cbsdId*. • The *responseCode* set to: o 103: concluding a failed operation due to invalid parameters. o 500: indicating a terminated grant due to incumbent status • *transmitExpireTime* shall be no later than the current time. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.7 [WINNF.FT.S.HBT.7] Array request: Unsuccessful INVALID_VALUE (*responseCode* 103)

Heartbeat Request from CBSD in *Granted* or *Authorized* state (immediately after CBSD moves into *Granted* State or following a Heartbeat Response) has invalid required parameters.

Step	Instructions
1	Ensure the following conditions hold: • DP Test Harness registers 3 CBSDs with SAS UUT; *cbsdId* (C1, C2, C3) • DP Test Harness successfully requests Grant for a PAL or GAA channel for the CBSDs
2	DP Test Harness sends a Heartbeat Request Message with their *cbsdId*, *grantId* before the expiration of the *transmitExpireTime* in the form of one 3-element Array. The third CBSD has at least one of the following contain an invalid value:

	• *cbsdId* • *grantId*
CHECK	SAS UUT responds with a Heartbeat Response Message with the *heartbeatResponse* parameter containing 3 elements as follows: • The first and second elements include the *cbsdId*, and *grantId* that match the request from the first two CBSDs in the array. • SAS response includes the valid parameters for the third CBSD in Step 2 • The *responseCode* shall be 0 for the first two CBSDs concluding a successful operation. • *transmitExpireTime* is set to a valid UTC time in the future for the first two CBSDs. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • The *responseCode* for the third CBSD set to 103, concluding a failed operation due to invalid parameters. • *transmitExpireTime* shall be no later than the current time, for the third CBSD *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.8 [WINNF.FT.S.HBT.8] Array request: Unsuccessful BLACKLISTED (*responseCode* 101)

Step	**Instructions**
1	Ensure the DP Test Harness has 3 CBSDs in *Granted* or *Authorized* state. No Protected Entity are present.
2	The Admin Test Harness notifies the SAS UUT that the third CBSD is Blacklisted
3	DP Test Harness sends a Heartbeat Request Message with their *cbsdId*, *grantId* before the expiration of the *transmitExpireTime* in the form of one 3-element Array.
CHECK	SAS UUT responds with a Heartbeat Response Message with the *heartbeatResponse* parameter containing 3 elements as follows: • The first and second elements include the *cbsdId*, and *grantId* that match the request from CBSDs 1 and 2 in the array. • The *responseCode* shall be 0 for the first two CBSDs concluding a successful operation. • *transmitExpireTime* is set to a valid UTC time in the future for the first two CBSDs. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • The *responseCode* for the third CBSD set to 101 • *transmitExpireTime* shall be no later than the current time, for the third CBSD *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*
4	DP Test Harness sends a Heartbeat Request for the third CBSD to SAS UUT
CHECK	SAS UUT sends a Heartbeat Response as follows: • The *responseCode* is 101, or 103

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.4.4.9 [WINNF.FT.S.HBT.9] Array request: Heartbeat Request for the Grants in *Authorized* state results TERMINATED_GRANT

The CBSD Heartbeat Procedure for the Grants in *Authorized* state results in 500 (TERMINATED_GRANT) when incumbent status has changed permanently

Step	**Instructions**
1	DP Test Harness shall successfully register, successfully get Grants for 3 CBSDs and exchange Heartbeats to keep them in the *Authorized* state. The third CBSD shall be a GAA with its Grant in 3650-3700MHz range.
2	• An Exclusion Zone is created by injecting an FSS Station and injecting a GWBL station within the 150km of the FSS Station, such that only the third CBSD is inside of it. • The frequency of operation and location of the other 2 CBSDs shall be chosen to ensure that they do not both overlap with that of the FSS station.
3	Trigger CPAS
4	After a previous Heartbeat Response, the DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing 3 elements before the expiration of the *transmitExpireTime*. Each element includes *cbsdId, grantId*.
CHECK	SAS UUT responds with a Heartbeat Response Message with the *heartbeatResponse* parameter containing 3 elements as follows: • Each element includes the *cbsdId*, and *grantId* that match the request from each CBSD in the array. • The *responseCode* shall be 0 for the first two CBSDs concluding a successful operation. • *transmitExpireTime* is set to a valid UTC time in the future for the first two CBSDs. It shall be not later than 240 seconds in the future and not later than the *grantExpireTime*. • The *responseCode* for the third CBSD set to 500, concluding a failed operation due to termination of the Grant. • *transmitExpireTime* shall be set to no later than the current time, for the third CBSD *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.10 [WINNF.FT.S.HBT.10] [Configurable] Heartbeat with optional intervening grant termination or blacklist

This configurable array test covers Heartbeat Request Messages for CBSDs with existing grants where Heartbeat Request Messages come immediately after a CBSD moves into *Granted* State or following a Heartbeat Response Message; for Grant Renewal; Heartbeat Request Messages with and without missing, valid, and invalid required parameters; and Heartbeat Request

Messages requiring de-registration. The test will check the number of and value of the Heartbeat SAS UUT responseCode(s) to see if they match the expected *responseCode*(s) as specified in the respective input configuration file.

Step	Instructions
1	Configure the SAS UUT to whitelist the FCC ID and user ID parameters corresponding to the Registration Request Message which will be sent in Step 2. No Protected Entity are present.
2	Send a valid Registration Request Message with the *registrationRequest* parameter containing N1 > 0 CBSDs. Verify that the *responseCode* for each is SUCCESS.
3	Send a valid Grant Request Message with the *grantRequest* parameter containing N1 elements (one per registered CBSD). Verify that the *responseCode* for each is SUCCESS.
4	Instruct the SAS UUT to blacklist N2 >= 0 CBSDs. Set of N2 CBSDs may include CBSDs from N1 CBSDs in Step 2
5	Send a Heartbeat Request Message with the *heartbeatResponse* parameter containing N1 elements (one per CBSD/Grant).

CHECK	The Heartbeat Response Message must satisfy all of the following conditions:
	• The *heartbeatResponse* parameter shall contain N1 elements
	• For each element:
	  ○ The *responseCode* shall match the corresponding expected *responseCode* listed in the configuration file.
	  ○ If the corresponding request contained a valid *cbsdId*, the response shall contain the same *cbsdId*.
	  ○ If the corresponding request contained a valid *grantId*, the response shall contain the same *grantId*.
	  ○ If *responseCode* == SUCCESS,
	  ▪ Verify that *transmitExpireTime* exists and satisfies the following criteria:
	  • Is a valid UTC time
	  • Is in the future
	  • Is no later than 240 seconds in the future
	  • Is no later than the corresponding *grantExpireTime*
	  ▪ If *grantRenew*=TRUE in the corresponding grant request, verify that *grantExpireTime* exists and is set to a valid UTC time in the future.
	  ○ If *responseCode* != SUCCESS
	  ▪ verify that *transmitExpireTime* exists and shall be no later than the current time.
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.4.4.11 [WINNF.FT.S.HBT.11] Out of sync Grant state between the CBSD and the SAS

#	Test Execution Steps
1	The DP Test Harness registers one CBSD (C1) with the SAS UUT.
2	The DP Test Harness sends a Grant Request Message with the *grantRequest* parameter containing one *GrantRequest* object to the SAS UUT and obtains a Grant (G1) from the SAS UUT.
3	The DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing one *HeartbeatRequest* object just after the Step #2, and receives the Heartbeat Response Message from the SAS UUT. The *HeartbeatRequest* object shall include the following parameters: • *cbsdId*: C1 • *grantId*: G1 • *operationState*: *AUTHORIZED*

CHECK	The DP Test Harness receives the following Heartbeat Response Message:
	• The *heartbeatResponse* parameter containing one *HeartbeatResponse* object is included.
	• The *HeartbeatResponse* object includes:
	  ○ Valid *cbsdId* (C1)
	  ○ Valid *grantId* (G1)
	  ○ The *responseCode* parameter set to 502 (UNSYNC_OP_PARAM).
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.4.4.12 [WINNF.FT.S.HBT.12] The grant is Suspended or Terminated in the Heartbeat Response

#	Test Execution Steps
1	Ensure all DPAs are inactive.
2	Using a DP Test Harness, register CBSD C1 to the SAS UUT in the neighborhood of DPA D. Ensure that the parameters for C1 and its Grant G1 (obtained in Step 3) are such that it is guaranteed to be on the move list for DPA D.
3	Using a DP Test Harness, CBSD C1 sends a successful Grant request, getting *grantId* G1.
4	Using a DP Test Harness, CBSD successfully exchanges Heartbeat with SAS UUT for G1.
5	ESC Test Harness notifies the SAS UUT that DPA D has been activated.
6	Wait 300 seconds
7	Using a DP Test Harness, CBSD send a Heartbeat for G1.
CHECK	The SAS UUT response to the Heartbeat Request satisfies all of the following conditions: • The response shall contain 1 *heartbeatResponse* object. • For each *heartbeatResponse* object:

	○ The *responseCode* = 500 (TERMINATED_GRANT) or 501 (SUSPENDED_GRANT) ○ *cbsdId* (Response) == *cbsdId* (Request) ○ *grantId* (Response) == *grantId* (Request) *If any of the above conditions is not met, the SAS FAILS this test. If responseCode = 500, the SAS PASSES this test (do not perform any more steps). Otherwise, proceed.*
7	Wait 300 seconds, before the expiration of the Grant.
8	Using a DP Test Harness, CBSD send a Heartbeat for G1, with *operationState* = *GRANTED*.
CHECK	The SAS UUT response to the Heartbeat Request satisfies all of the following conditions: • The response shall contain 1 *heartbeatResponse* object. • For each *heartbeatResponse* object: ○ The *responseCode* = 500 (TERMINATED_GRANT) or 501 (SUSPENDED_GRANT) ○ *cbsdId* (Response) == *cbsdId* (Request) ○ *grantId* (Response) == *grantId* (Request) *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

6.5 CBSD Measurement Report

6.5.1 Definition, Applicability, and Scope of the Test Case

This section specifies test cases to validate SAS configuring CBSD measurement report based on CBSD measurement capability, based on CBSD measurement capability in the Registration Response Message. (please see the table below)

Table 6.5-1 Response Codes for CBSD Measurement Report Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**

0	SUCCESS	Either of followings: • The CBSD Registration Procedure is completed with no error when the measurement capability is provided to the SAS UUT in the registration request. • The CBSD Heart Procedure is completed with no error when the SAS UUT is triggered to notice the measurement configuration to the CBSD. • The other SAS-CBSD Procedure in which the request message includes the CBSD measurement report is completed with no error.	• Registration Request includes the measurement capability of the CBSD. • CBSD measurement report is provided through the Spectrum Inquiry Request. • CBSD measurement report is provided through the Grant Request. • CBSD measurement report is provided through the Heartbeat Request.	WINNF.FT.S.MES.1 WINNF.FT.S.MES.2
102	MISSING_ PARAM	One or more “Required” parameters for measurement report are missing.	• “Required” parameter is missing from the measurement report in the Spectrum Inquiry Request. • “Required” parameter is missing from the measurement report in the Grant Request. • “Required” parameter is missing from the measurement report in the Heartbeat Request.	WINNF.FT.S.MES.1 WINNF.FT.S.MES.2
103	INVALID_ VALUE	One or more parameters with invalid value is provided to the SAS UUT as part of measurement reporting.	• Parameter of the measurement report in the Spectrum Inquiry Request is invalid. • Parameter of the measurement report in the Grant Request is invalid. • Parameter of the measurement report in the Heartbeat Request is invalid.	WINNF.FT.S.MES.1 WINNF.FT.S.MES.2

6.5.2 Test Characteristics

Table 6.5-2 CBSD Measurement Report Test Characteristics

1	**Test ID**	WINNF.FT.S.MES
2	**Title**	CBSD Measurement Report
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9, 17]

6.5.3 Method of test

6.5.3.1 Initial Conditions / Test Pre-conditions

The typical pre-conditions of the test case are the following:

- The SAS UUT must be reset at the beginning of each test case to a baseline state.
- *cbsdId* is known (C)
- SAS has registered CBSD and for some of the test cases, issued approved a grant request with *grantId* G1.

6.5.4 Test Procedure

To exercise the possible types of successful measurement report mechanisms the following aspects are tested:

- CBSD measurement capability exchange
- CBSD measurement configuration through Registration Response
- CBSD measurement configuration through Grant Response
- CBSD measurement configuration through Heartbeat Response

6.5.4.1 [WINNF.FT.S.MES.1] Registration response with measurement report configuration

Step	**Instructions**
1	The DP Test Harness configures the SAS UUT to request measurement reporting based on the CBSD measurement capability. Make sure no *cbsdId* exists in SAS for the CBSD being tested. Ensure that the DP Test Harness sends a Registration Request Message with the *registrationRequest* parameter containing six elements, to the SAS UUT. All Required and REG-Conditional parameters are included. measCapability is set to "RECEIVED_POWER_WITHOUT_GRANT" for all CBSDs.
CHECK	SAS approves the requests by sending a CBSD Registration Response Message with *registrationResponse* parameter containing six elements: • Each element includes *cbsdId*.

	• Each element includes *measReportConfig* and sets it to "RECEIVED_POWER_WITHOUT_GRANT". • The *responseCode* is 0, concluding an approved registration *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
2	The DP Test Harness issues a Spectrum Inquiry Request Message with the *spectrumInquiryRequest* parameter containing six elements. Each element includes valid *cbsdId* and *inquiredSpectrum*. The following measurement report parameters are configured for each CBSD, as defined in [n.16]: • CBSD 1: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included with valid values. • CBSD 2: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. *measFrequency* and *measBandwidth* in the *rcvdPowerMeasReports* object are included with valid values. *measRcvdPower* is not included in *rcvdPowerMeasReports*. • CBSD 3: include *measReport*, which has an array of 10 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included with valid values. • CBSD 4: *measReport* is included, but *rcvdPowerMeasReports* is not included in *measReport* • CBSD 5: *measReport* is not included • CBSD 6: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included. *measBandwidth* is set to 15000000.
CHECK	The SAS UUT should send a Spectrum Inquiry Response Message with the following *responseCode* for each CBSD: • CBSD 1: *responseCode*=0 • CBSD 2: *responseCode*=102 • CBSD 3: *responseCode*=102 • CBSD 4: *responseCode*=102 • CBSD 5: *responseCode*=102 • CBSD 6: *responseCode*=103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	The DP Test Harness issues a Grant Request Message with the *grantRequest* parameter containing six elements. Each element includes valid *cbsdId* and *operationParam*. The following measurement report parameters are configured for each CBSD, as defined in [n.16]: • CBSD 1: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz

	channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included with valid values. • CBSD 2: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. *measFrequency* and *measBandwidth* in the *rcvdPowerMeasReports* object are included with valid values. *measRcvdPower* is not included in *rcvdPowerMeasReports*. • CBSD 3: include *measReport*, which has an array of 10 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included with valid values. • CBSD 4: *measReport* is included, but *rcvdPowerMeasReports* is not included in measReport • CBSD 5: *measReport* is not included • CBSD 6: include *measReport*, which has an array of 15 elements of *rcvdPowerMeasReports*, each covering a measurement report for a 10 MHz channel in the band. All required parameters in the *rcvdPowerMeasReports* object are included. *measBandwidth* is set to 15000000.
CHECK	The SAS UUT should send a Grant Response Message with the following *responseCode* for each CBSD: • CBSD 1: *responseCode*=0 • CBSD 2: *responseCode*=102 • CBSD 3: *responseCode*=102 • CBSD 4: *responseCode*=102 • CBSD 5: *responseCode*=102 • CBSD 6: *responseCode*=103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.5.4.2 [WINNF.FT.S.MES.2] Heartbeat response with measurement report configuration

Step	**Instructions**
1	The DP Test Harness configures the SAS UUT to request measurement reporting based on the CBSD measurement capability.
2	DP Test Harness sends a Registration Request for six CBSDs to the SAS UUT. *measCapability* shall be set to “RECEIVED_POWER_WITH_GRANT” for the first five CBSDs and set to “RECEIVED_POWER_WITHOUT_GRANT” for the sixth CBSD.
CHECK	The SAS response to the Registration Request Message must satisfy all of the following conditions: • The response shall contain six *RegistrationResponse* objects. • For each *registrationResponse* object:

	○ *responseCode* is 0 (success) ○ *measReportConfig* does not contain "RECEIVED_POWER_WITH_GRANT" *If all of the above conditions are met, the SAS PASSES this test. Otherwise, PROCEED*
3	DP Test Harness sends a Grant Request for six CBSDs to the SAS UUT. Verify that the *responseCode* for each is SUCCESS.
4	The DP Test Harness sends a Heartbeat Request Message for the six CBSDs in the form of a six-element array of *HeartbeatRequest*, each element with *cbsdId* and *grantId* of the previously approved Grant.
CHECK	SAS UUT approves the request by sending a CBSD Heartbeat Response with the *heartbeatResponse* parameter containing 6 elements as follows: • SAS response includes the same *cbsdId* and *grantId*. • *transmitExpireTime* is set to a valid UTC time in the future. • For the first five elements, SAS includes *measReportConfig* and set it to "RECEIVED_POWER_WITH_GRANT". RECEIVED_POWER_WITHOUT_GRANT" should not be included in *measReportConfig* • *measReportConfig* is not set for the sixth element. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	Before *transmitExpireTime* in the previous Stage, the DP Test Harness issues a Heartbeat Request Message with the *heartbeatRequest* parameter containing six elements, each including all required parameters. The following measurement report parameters are configured for each CBSD, as defined in [n.16]: • CBSD 1: include *measReport*, which has one element of *rcvdPowerMeasReports*. All required parameters in the *rcvdPowerMeasReports* object are included with valid values. • CBSD 2: include *measReport*, which has one element of *rcvdPowerMeasReports*. *measBandwidth* and *measRcvdPower* are included in the *rcvdPowerMeasReports*. *measFrequency* is not included in *rcvdPowerMeasReports*. • CBSD 3: include *measReport*, which has one element of *rcvdPowerMeasReports*. All required parameters in the *rcvdPowerMeasReports* object are included. *measFrequency* is set to 3540000000. • CBSD 4: include *measReport*, but does not include *rcvdPowerMeasReports* in *measReport*. • CBSD 5: does not include *measReport*. • CBSD 6: does not include *measReport.*
CHECK	The SAS UUT should send a Heartbeat Response Message with the following *responseCode* for each CBSD: • CBSD 1: *responseCode*=0 • CBSD 2: *responseCode*=102 • CBSD 3: *responseCode*=103 • CBSD 4: *responseCode*=102

	• CBSD 5: *responseCode*=102 • CBSD 6: responseCode=0 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6 CBSD Spectrum Relinquish Procedure

6.6.1 Definition, Applicability, and Scope of the Test Case

This section specifies test steps, conditions, and procedures to test the conformance of CBSD Relinquishment Procedure.

A Relinquishment Request is issued by a CBSD to inform a SAS that one or more grants are no longer being used by the CBSD.

The approach is for each test to create necessary conditions to trigger a Relinquish Response from SAS to a Relinquish request from a CBSD with all the defined *responseCode* parameters in [n.9], both successful relinquishments (*responseCode* 0) and unsuccessful relinquishments (other *responseCode*s). (please see the table below)

Table 6.6-1 Response Codes for CBSD Grant Relinquishment Procedure Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**
0	SUCCESS	The SAS UUT completes the Grant Relinquishment Process with no error.	• Multiple Iterative Grant Relinquishments • Array Grant relinquishment request	WINNF.FT.S.RLQ.1 WINNF.FT.S.RLQ.2
100	VERSION	The version number of the SAS-CBSD protocol used by the CBSD Test Harness is not supported by the SAS UUT.	• The CBSD Test Harness sends the request message using the URL of the SAS UUT including the newer protocol version than the most recent SAS-CBSD Protocol version supported by the SAS UUT.	WINNF.FT.S.RLQ.4
102	MISSING_ PARAM	One or more “Required” parameters are missing.	• “Required” parameter is missing from the request.	WINNF.FT.S.RLQ.5

103	INVALID_ VALUE	One or more parameters with invalid value are provided to the SAS UUT	• Invalid CBSD ID is provided to the SAS UUT • Invalid Grant ID is provided to the SAS UUT • Relinquished Grant ID is provided to the SAS UUT.	WINNF.FT.S.RLQ.3

6.6.2 Test Characteristics

Table 6.6-2 CBSD Spectrum Relinquish Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.RLQ
2	**Title**	CBSD Spectrum Relinquish Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS/CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.6.3 Method of test

6.6.3.1 Initial Conditions / Test Pre-conditions

The typical pre-conditions of the test case are the following:

- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.6.4 Test Procedure

To exercise the possible types of successful relinquishment requests the following three types of grant relinquishment requests are tested:

- Grant and relinquishment of a single grant
- Three grants, iteratively relinquished
- Three grants, simultaneously relinquished as an array of three relinquishment requests

For invalid relinquishment requests, the following types of grant relinquishment requests are tested:

- Grant and relinquishment of a single grant with an error
- Three grants, requested for release in an array, with an error in one element of the array

6.6.4.1 [WINNF.FT.S.RLQ.1] Multiple Iterative Grant Relinquishments:

Step	Instructions
1	Ensure the following conditions hold: • A CBSD registers with SAS UUT; *cbsdId* (C)
2	DP Test Harness successfully requests two Grants for two non-overlapping channels (G1, G2)
3	DP Test Harness sends Relinquishment Request Message to SAS including *cbsdId* (C) and *grantId* G1 in correct format
CHECK	Ensure the following in the Relinquishment Response Message from SAS • *cbsdId* = C • *grantId* = G1 • *responseCode* (Response) = 0 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends Relinquishment Request Message to SAS including *cbsdId* and *grantId* G2 in correct format
CHECK	Verify the following in the Relinquishment Response Message from SAS • *cbsdId* = C • *grantId* = G2 • *responseCode* (Response) = 0 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing two elements, before the *grantExpireTime* in Step 2. The elements include (C, G1) and (C, G2) respectively.
CHECK	SAS responds with a Heartbeat Response Message with *heartbeatResponse* parameter containing two elements as follows: • Each element includes the valid *cbsdId* C • The *responseCode* set to 103, concluding a failed operation due to invalid parameters. • *transmitExpireTime* set to a value equal or less than the *transmitExpireTime* in the previous successful Heartbeat response. If this is the first Heartbeat response, any value for *transmitExpireTime* is acceptable. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6.4.2 [WINNF.FT.S.RLQ.2] Multiple Grant Relinquishments: Successful Simultaneous Relinquishment Request of Multiple Grants (responseCode 0)

Step	Instructions
1	Ensure the following conditions hold: • A CBSD registers with SAS UUT; *cbsdId* (C)

2	DP Test Harness successfully requests three Grants for three non-overlapping channels (G1, G2, G3)
3	DP Test Harness sends Relinquishment Request Message to SAS including *cbsdId* and *grantId* Parameters G1-G3 in correct format.
CHECK	Verify the following for all Relinquishment objects in the Relinquishment Response Message from SAS: For the first element: • *cbsdId* = C • *grantId* = G1 • *responseCode* (Response) = 0 For the second element: • *cbsdId* = C • *grantId* = G2 • *responseCode* (Response) = 0 For the third element: • *cbsdId* = C • *grantId* = G3 • *responseCode* (Response) = 0 *I If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends a Heartbeat Request Message with the *heartbeatRequest* parameter containing 3 elements before the *grantExpireTime* in Step 2. The elements contain (C, G1) and (C, G2), and (C, G3) respectively.
CHECK	SAS sends a Heartbeat Response Message with the *heartbeatResponse* parameter containing three elements as follows: • Each element includes the valid *cbsdId* • The *responseCode* set to 103, concluding a failed operation due to invalid parameters. • *transmitExpireTime* set to a value equal or less than the *transmitExpireTime* in the previous successful Heartbeat response. If this is the first Heartbeat response, any value for *transmitExpireTime* is acceptable. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6.4.3 [WINNF.FT.S.RLQ.3] Invalid Parameter in Relinquishment Request-Array Request

Step	**Instructions**
1	Ensure: • *cbsdId* (C1) does not exist in SAS • *grantId* (G1) does not exist in SAS
2	Ensure the following conditions hold: • DP Test Harness registers 2 CBSDs with SAS UUT; *cbsdId* (C2, C4)
3	DP Test Harness successfully requests two Grants for two non-overlapping channels (G2, G3) for CBSD C2, and one Grant for CBSD C4 (G4)

4	DP Test Harness sends Relinquishment Request Message to SAS including *cbsdId* (C2) and *grantId* (G3) in correct format, and receives a successful response from SAS with *responseCode* (Response) = 0.
5	DP Test Harness sends Relinquishment Request Message with the *relinquishmentRequest* parameter containing 5 elements. The elements contain *cbsdId* and *grantId* parameters in correct format with the following pairings: • C1, G2 • C2, G1 • C1, G1 • C2, G4 • C2, G3
CHECK	Verify the following for all Relinquishment objects in the Relinquishment Response Message with the *relinquishmentResponse* parameter containing 5 elements as follows: For the first element: • No *cbsdId* • No *grantId* • *responseCode* (Response) = 103 For the second element: • *cbsdId* = C2 • No *grantId* • *responseCode* = 103 For the third element: • No *cbsdId* • No *grantId* • *responseCode* = 103 For the fourth element: • *cbsdId* = C2 • No *grantId* • *responseCode* = 103 For the fifth element: • *cbsdId* = C2 • No *grantId* • *responseCode* = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6.4.4 [WINNF.FT.S.RLQ.4] Protocol Not Supported by SAS-Array Request

Step	**Instructions**
1	Ensure the following conditions hold: • A CBSD registers with SAS UUT; *cbsdId* (C) • The CBSD successfully requests three Grants for three non-overlapping channels (G1, G2, G3)

	• The most recent SAS-CBSD protocol version is known
2	Configure DP Test Harness to use a protocol version newer than the most recent SAS-CBSD protocol version supported by SAS
3	DP Test Harness sends Relinquishment Request Message with the *relinquishmentRequest* parameter containing 3 elements. The elements contain *cbsdId* and *grantId* parameters G1-G3 in correct format with the following pairings: • C, G1 • C, G2 • C, G3
CHECK	Verify the following for all Relinquishment objects in the Relinquishment Response Message with the *relinquishmentResponse* parameter containing 3 elements as follows: For the first element: • *cbsdId* = C • *grantId* = G1 • *responseCode* = 100 For the second element: • *cbsdId* = C • *grantId* = G2 • *responseCode* = 100 For the third element: • *cbsdId* = C • *grantId* = G3 • *responseCode* = 100 Alternatively, the SAS can return HTTP status code 404. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6.4.5 [WINNF.FT.S.RLQ.5] Missing Parameter -Array Request

Step	**Instructions**
1	Ensure the following conditions hold: • A CBSD registers with SAS UUT; *cbsdId* (C)
2	The CBSD successfully requests three Grants for three non-overlapping channels (G1, G2, G3)
3	DP Test Harness sends Relinquishment Request Message with the *relinquishmentRequest* parameter containing 3 elements. The elements contain *cbsdId* and *grantId* parameters G1-G3 in correct format with the following pairings: • C, (Missing G1) • (Missing C, G2) • (Missing C), G3

CHECK	Verify the following for all Relinquishment objects in the Relinquishment Response Message with the *relinquishmentResponse* parameter containing 3 elements as follows: For the first element: • *cbsdId* = C • No *grantId* • *responseCode* (Response) = 102 For the second element: • No *cbsdId* • No *grantId* • *responseCode* = 102 For the third element: • No *cbsdId* • No *grantId* • *responseCode* = 102 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.6.4.6 [WINNF.FT.S.RLQ.6] [Configurable] Multiple relinquishments

This configurable array test covers relinquishment request(s) for CBSDs with existing Grants, including relinquishment requests for multiple iterative grants, simultaneous relinquishment of multiple grants and array relinquishment requests; and relinquishment requests with missing parameters. The test will check the number of and value of the relinquishment SAS UUT responseCode(s) to see if they match the expected responseCode(s) as specified in the respective input configuration file.

Step	**Instructions**
1	Configure the SAS UUT to whitelist the FCC IDs and user IDs corresponding to the RegistrationRequest which will be sent in Step 2.
2	DP Test Harness sends a valid Registration Request Message with the *registrationRequest* parameter containing N1 >= 0 CBSDs. Verify that the responseCode for each is SUCCESS.
3	DP Test Harness sends a valid Grant Request with the *grantRequest* parameter containing N2 >= 0 elements. Verify that the responseCode for each is SUCCESS.
4	DP Test Harness sends a Relinquishment Request Message with the *relinqushmentRequest* parameter containing N3 >= 0 elements.
CHECK	The SAS response to the Relinquishment Request must satisfy all of the following conditions: • The *relinquishmentResponse* parameter contains N3 elements. • For each element: ○ The *responseCode* shall match the corresponding expected *responseCode* listed in the configuration file.

	○ If the corresponding request contained a valid *cbsdId* and *grantId*, the response shall contain the same grantId. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	DP Test Harness sends a Relinquishment Request Message with the *relinqushmentRequest* parameter containing N4 >= 0 elements.
CHECK	The SAS response to the Relinquishment Request Message must satisfy all of the following conditions: • The *relinquishmentResponse* parameter contains N4 elements. • For each element: ○ The *responseCode* shall match the corresponding expected *responseCode* listed in the configuration file. ○ If the corresponding request contained a valid *cbsdId* and *grantId*, the response shall contain the same grantId. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7 CBSD Deregistration Procedure

6.7.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS Deregistration Response to a CBSD Deregistration Request. (please see the table below for the responseCodes)

Table 6.7-1 Response Codes for CBSD Deregistration Procedure Test Cases (Informative)

response Code	**Name**	**Condition**	**Test Scenario**	**Test ID**
0	SUCCESS	The SAS UUT completes the deregistration process with no error.	• Array Deregistration Request	WINNF.FT.S.DRG.1 WINNF.FT.S.DRG.2 WINNF.FT.S.DRG.3 WINNF.FT.S.DRG.4
102	MISSING_ PARAM	One or more “Required” parameters are missing.	• CBSD ID is missing.	WINNF.FT.S.DRG.2
103	INVALID_ VALUE	One or more parameters with invalid value is provided to the SAS UUT.	• Invalid CBSD ID is provided to the SAS UUT. • CBSD ID that has been deregistered is provided to the SAS UUT.	WINNF.FT.S.DRG.3 WINNF.FT.S.DRG.4 WINNF.FT.S.DRG.5

			• Heartbeat Procedure after the CBSD Deregistration Procedure for the CBSD that has a Grant.	

6.7.2 Test Characteristics

Table 6.7-2 CBSD Deregistration Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.DRG
2	**Title**	CBSD Deregistration Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.7.3 Method of test

6.7.3.1 Initial Conditions / Test Pre-conditions

The typical pre-conditions of the test case are the following:

- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.7.4 Test Procedure

6.7.4.1 [WINNF.FT.S.DRG.1] Valid and correct *cbsdId*: two *DeregistrationRequest* objects

Step	**Instructions**
1	DP Test Harness registers *cbsdId* (C1) and (C2) with SAS UUT.
2	DP Test Harness sends Deregistration Request Message with the *deregistrationRequest* parameter containing two elements to the SAS UUT. The two elements shall have *cbsdId* parameters C1 and C2 in that order.

CHECK	Verify the following in the Deregistration Response Message from SAS UUT:
	• The *deregistrationResponse* parameter contains two elements
	• The first element:
	  ○ *cbsdId* = C1.
	  ○ *responseCode* = 0
	• The second element:
	  ○ *cbsdId* = C2.
	  ○ *responseCode* = 0
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.

4	The CBSDs C1 and C2 send a Grant Request Message with their *cbsdId parameters* to SAS UUT
CHECK	SAS responds with a Grant Response as follows: • The *responseCode* is 103 for both CBSDs *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7.4.2 [WINNF.FT.S.DRG.2] Missing *cbsdId*: two elements in the *DeregistrationRequest* parameter

Step	**Instructions**
1	DP Test Harness registers *cbsdId* (C1) and (C2) with SAS UUT.
2	DP Test Harness sends Deregistration Request to the SAS UUT with the *deregistrationRequest* parameter containing two elements such that the first element has C1 as the *cbsdId*, but the second element does not have *cbsdId*
CHECK	Verify the following in the Deregistration Response Message from SAS UUT: • The *deregistrationResponse* parameter contains two elements • *cbsdId* in the first element = C1 • *responseCode* in the first element = 0 • No *cbsdId* in the element object • *responseCode* in the second element = 102 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7.4.3 [WINNF.FT.S.DRG.3] *cbsdId* initially exists, CBSD deregisters first by sending Deregistration request. Then sends another Deregistration request to check that SAS has indeed erased the CBSD information from its database.

Step	**Instructions**
1	DP Test Harness registers *cbsdId* (C) with SAS UUT.
2	DP Test Harness sends Deregistration Request Message with the *deregistrationRequest* parameter containing one element which has *cbsdId* = C.
CHECK	Verify the following in the Deregistration Response Message from SAS UUT: • The *deregistrationResponse* parameter contains one element • *cbsdId* = C • *responseCode* =0 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends another Deregistration Request Message with the *deregistrationResponse* parameter containing one element which has *cbsdId* = C, which was deregistered in the previous request.
CHECK	Verify the following in the Deregistration Response Message from SAS UUT: • The *deregistrationResponse* parameter contains one element • No *cbsdId*

	• *responseCode* = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7.4.4 [WINNF.FT.S.DRG.4] *cbsdId* value invalid: two request objects

Step	Instructions
1	Ensure the following conditions hold: • DP Test Harness registers *cbsdId* (C1) with SAS • *cbsdId* (C2) does not exist in SAS
2	DP Test Harness sends Deregistration Request Message to the SAS UUT with the *deregistrationResponse* parameter containing two elements such that the first element has C1 as the *cbsdId,* and the second element has C2 as *cbsdId.*
CHECK	Verify the following in the Deregistration Response Message from SAS UUT: • The *deregistrationResponse* parameter contains two elements • *cbsdId* in the first element = C1 • *responseCode* in the first element = 0 • No *cbsdId* in the second element • *responseCode* in the second element = 103 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7.4.5 [WINNF.FT.S.DRG.5] *cbsdId* initially exists with a grant, CBSD deregisters, then re-registers and attempts to use the old grant ID (verifying that SAS deletes grants on deregistration).

Step	Instructions
1	DP Test Harness registers *cbsdId* (C) with SAS UUT. No Protected Entity are present.
2	The DP Test Harness successfully requests Grant for a PAL or GAA channel. Ensure the CBSD successfully exchanges Heartbeat with SAS UUT and is in the *Authorized* state
3	DP Test Harness sends a successful Deregistration Request Message to the SAS UUT with the *deregistrationResponse* parameter containing one element which has *cbsdId* = C.
4	DP Test Harness sends a successful Registration Request Message with the *registrationRequest* parameter containing one element with the same registration parameters as was sent to get *cbsdId* = C in Step 1.
5	DP Test Harness sends a Heartbeat Request Message that is otherwise valid, except that it sets its *grantId* = G, which the SAS shall have deleted.
CHECK	SAS UUT shall respond with the *responseCode* set to 103, concluding a failed operation due to invalid parameters. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.7.4.6 [WINNF.FT.S.DRG.6] [Configurable] Array Deregistration

This configurable array test covers deregistration request(s) for existing CBSDs, and can include deregistration requests with valid and invalid CBSD IDs, missing CBSD IDs, iterative deregistrations, and where a CBSD attempts to reregister with an old grant ID. The test will check the number of and value of the deregistration SAS UUT *responseCode*(s) to see if they match the expected *responseCode*(s) as specified in the respective input configuration file.

Step	Instructions
1	Configure the SAS UUT to whitelist the FCC IDs and user IDs corresponding to the RegistrationRequest which will be sent in Step 2.
2	DP Test Harness sends a valid Registration Request Message the *registrationRequest* parameter containing N1 > 0 elements. Verify that the *responseCode* for each is SUCCESS.
3	DP Test Harness sends a valid Grant Request Message with the *grantRequest* parameter containing N1 elements (one per registered CBSD). Verify that the responseCode for each is SUCCESS.
4	DP Test Harness sends a valid Heartbeat Request Message with the *heartbeatRequest* parameter containing N1 elements. Verify that the responseCode for each is SUCCESS.
5	DP Test Harness sends a Deregistration Request Message with the *deregistrationRequest* parameter containing N1 elements.

CHECK	The SAS UUT response to the Deregistration Request Message must satisfy all of the following conditions:
	• The *deregistrationRequest* parameter contains N1 elements.
	• For each element:
	  ○ The *responseCode* shall match the corresponding expected response code listed in the configuration file.
	  ○ If *responseCode* == SUCCESS, verify that the response contains a valid *cbsdId*.
	  ▪ If the corresponding request contained a valid *cbsdId*, the response shall contain the same *cbsdId*.
	  ▪ Otherwise (i.e. if not SUCCESS), verify that the response does *not* contain a *cbsdId*.
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.

6	Send the Deregistration Request Message from step 5.

CHECK	The SAS UUT response to the Deregistration Request Message must satisfy all of the following conditions:
	• The *deregistrationResponse* parameter shall contain N1 elements.
	• For each element:
	  ○ The *responseCode* shall be INVALID_VALUE
	  ○ The response shall not contain a *cbsdId*.
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.

7	DP Test Harness sends the Registration Request Message from Step 2. Verify that the *responseCode* for each is SUCCESS.
8	DP Test Harness sends the Heartbeat Request Message from Step 4.
CHECK	The SAS UUT response to the Heartbeat Request Message must satisfy all of the following conditions: • The *heartbeatResponse* parameter shall contain N1 elements. • For each element: o The *responseCode* shall be either INVALID_VALUE or TERMINATED_GRANT. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

6.8 CBSD Device Security Validation

6.8.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS validation of CBSD security credentials.

6.8.2 Test Characteristics

Table 6.7-3 CBSD Device Security Validation Test Characteristics

1	**Test ID**	WINNF.FT.S.SCS
2	**Title**	CBSD Device Security Validation
3	**Working Group / Entity**	WG2/WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.8.3 Method of test

6.8.3.1 Initial Conditions / Test Pre-conditions

- The SAS may be placed in a test configuration so that test certificates can be used for testing.
- Valid certificates must be created according to the guidelines given in [n.8]. Sample code for creating test certificates is provided in [i.1]. If such test code is used, the SAS must be configured to use the test certificate root of trust.
- The certificates required to perform the test cases may be created by the sample code provided in [i.1] or provided by a valid CBRS root of trust CA
- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.8.4 Test Procedure

6.8.4.1 [WINNF.FT.S.SCS.1] New registration with TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite (No existing cbsdId)

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.2 [WINNF.FT.S.SCS.2] New registration with TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite (No existing cbsdId)

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions:

	• The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.3 [WINNF.FT.S.SCS.3] New registration with TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (No existing cbsdId)

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.4 [WINNF.FT.S.SCS.4] New registration with TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (No existing cbsdId)

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.5 [WINNF.FT.S.SCS.5] New registration with TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (No existing cbsdId)

Step	**Instructions**
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.6 [WINNF.FT.S.SCS.6] Unrecognized root of trust certificate presented during registration.

Step	**Instructions**
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a root of trust not recognized by the SAS.
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions:

	• The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.7 [WINNF.FT.S.SCS.7] Corrupted certificate presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being corrupted.
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.8 [WINNF.FT.S.SCS.8] Self-signed certificate presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being self-signed.
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.9 [WINNF.FT.S.SCS.9] Non-CBRS trust root signed certificate presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a non-CBRS trust root.
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite

CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.10 [WINNF.FT.S.SCS.10] Certificate of wrong type presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being a certificate of the wrong type but having correct signatures descending from the CBRS trust root (e.g. a SAS certificate, not a CBSD certificate)
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response satisfies all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If all of the above conditions are met, the SAS UUT PASSES this test. If a TLS session is established, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 104, concluding a failed registration. • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.11 [WINNF.FT.S.SCS.11] Blacklisted certificate presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate which the SAS has been configured to blacklist (from a test input of the form an enforcement action would take).
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.8.4.12 [WINNF.FT.S.SCS.12] Expired certificate presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be a valid but expired certificate.
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.13 [WINNF.FT.S.SCS.13] Disallowed TLS method attempted during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS handshake using a disallowed method (e.g. TLS v1.1 per [n.8]) with the SAS UUT
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.14 [WINNF.FT.S.SCS.14] Invalid ciphersuite presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS handshake with the SAS UUT using a ciphersuite specifically not allowed by [n.8].
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.15 [WINNF.FT.S.SCS.15] Certificate with inapplicable fields presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be valid except for being configured to contain at least one inapplicable field for ROLE:CBSD (FRN, CPIRID, ZONE, or FREQUENCY)
2	CBSD Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 104, concluding a failed registration. • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.16 [WINNF.FT.S.SCS.16] Certificate signed by a revoked CA presented during registration.

Step	Instructions
1	Replace the CBSD Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate signed by a previously valid certificate that has since been revoked
2	CBSD Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.17 [WINNF.FT.S.SCS.17] Invalid certificate following an approved registration request

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate, Cr1
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
5	CBSD Test Harness attempts to re-establish the TLS session established in Step 2
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.18 [WINNF.FT.S.SCS.18] Invalid certificate following an approved grant request

Step	Instructions
1	Replace the CBSD Test Harness certificate with a valid certificate, Cr1
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.
4	CBSD Test Harness sends a valid grant request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *grantId*, G1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
6	CBSD Test Harness attempts to re-establish the TLS session established in Steps 2 and 4
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.19 [WINNF.FT.S.SCS.19] Invalid certificate following an approved heartbeat request

Step	**Instructions**
1	Replace the CBSD Test Harness certificate with a valid certificate, Cr1
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	CBSD Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	CBSD Test Harness sends a valid grant request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *grantId*, G1

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.
5	CBSD Test Harness sends a valid heartbeat request to the SAS UUT
CHECK	The SAS UUT response to the heartbeat request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved heartbeat *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
6	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
7	CBSD Test Harness attempts to re-establish the TLS session established in Steps 2, 4, and 5
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.8.4.20 [WINNF.FT.S.SCS.20] SAS Certificate Validation

Step	**Instructions**
1	Replace the CBSD Test Harness certificate with a valid certificate
2	CBSD Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite

CHECK	The SAS UUT response must satisfy all of the following conditions:
	• The SAS UUT provided certificate has the following valid parameters:
	  ○ Issuer matches a WInnForum approved SAS Provider CA
	  ○ Subject is consistent with the SAS UUT
	  ○ Version = 2 (v3)
	  ○ Serial Number is a positive integer no longer than 20 octets
	  ○ Algorithm ID
	  ○ Validity
	  ▪ Not Before is encoded as UTCTime if before the year 2050, or GeneralizedTime for dates in 2050 or later
	  ▪ Not After is encoded as UTCTime if before the year 2050, or GeneralizedTime for dates in 2050 or later
	  ○ Subject Public Key Info
	  ▪ Public Key Algorithm = SHA-256, SHA-384, or SHA-512
	  ▪ Subject Public Key ≥ 2048 bits
	  ○ Subject: Common Name (CN)
	  ○ CA: FALSE
	  ○ Path Length Constraint = None
	  ○ ROLE = SAS

	○ FRN = SAS UUT administrator's assigned FRN ○ Signed by a valid CBRS root of trust • The SAS UUT provided certificate does not contain the following custom SAS OIDs: ○ ZONE ○ FREQUENCY ○ FCCID ○ SERIAL ○ CPIRID *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9 Domain Proxy Security Validation

6.9.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS validation of DP security credentials.

6.9.2 Test Characteristics

Table 6.7-4 Domain Proxy Security Validation Test Characteristics

1	**Test ID**	WINNF.FT.S.SDS
2	**Title**	Domain Proxy Security Validation
3	**Working Group / Entity**	WG2/WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification / Feature**	[n.9]

6.9.3 Method of test

6.9.3.1 Initial Conditions / Test Pre-conditions

- The SAS may be placed in a test configuration so that test certificates can be used for testing.
- Valid certificates must be created according to the guidelines given in [n.8]. Sample code for creating test certificates is provided in [i.1]. If such test code is used, the SAS must be configured to use the test certificate root of trust.
- The certificates required to perform the test cases may be created by the sample code provided in [i.1] or provided by a valid CBRS root of trust CA
- The SAS UUT must be reset at the beginning of each test case to a baseline state.

6.9.4 Test Procedure

6.9.4.1 [WINNF.FT.S.SDS.1] New registration with TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite (No existing cbsdId)

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.2 [WINNF.FT.S.SDS.2] New registration with TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite (No existing cbsdId)

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions:

	• The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.3 [WINNF.FT.S.SDS.3] New registration with TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (No existing cbsdId)

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.4 [WINNF.FT.S.SDS.4] New registration with TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (No existing cbsdId)

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.5 [WINNF.FT.S.SDS.5] New registration with TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (No existing cbsdId)

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.6 [WINNF.FT.S.SDS.6] Unrecognized root of trust certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a root of trust not recognized by the SAS.
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions:

	• The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.7 [WINNF.FT.S.SDS.7] Corrupted certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being corrupted.
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.8 [WINNF.FT.S.SDS.8] Self-signed certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being self-signed.
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.9 [WINNF.FT.S.SDS.9] Non-CBRS trust root signed certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a non-CBRS trust root.
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite

CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.10 [WINNF.FT.S.SDS.10] Certificate of wrong type presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being a certificate of the wrong type but having correct signatures descending from the CBRS trust root (e.g. a SAS certificate, not a CBSD certificate)
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response satisfies all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If all of the above conditions are met, the SAS UUT PASSES this test. If a TLS session is established, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 104, concluding a failed registration. • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.11 [WINNF.FT.S.SDS.11] Blacklisted certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate which the SAS has been configured to blacklist (from a test input of the form an enforcement action would take).
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session

	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.

6.9.4.12 [WINNF.FT.S.SDS.12] Expired certificate presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be a valid but expired certificate.
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.13 [WINNF.FT.S.SDS.13] Disallowed TLS method attempted during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS handshake using a disallowed method (e.g. TLS v1.1 per [n.8]) with the SAS UUT
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.14 [WINNF.FT.S.SDS.14] Invalid ciphersuite presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate
2	DP Test Harness attempts to establish a TLS handshake with the SAS UUT using a ciphersuite specifically not allowed by [n.8].
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.15 [WINNF.FT.S.SDS.15] Certificate with inapplicable fields presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be valid except for being configured to contain at least one inapplicable field for ROLE:OPERATOR (FCCID, SERIAL, CPIRID, ZONE, or FREQUENCY)
2	DP Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object is 104, concluding a failed registration. • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.16 [WINNF.FT.S.SDS.16] Certificate signed by a revoked CA presented during registration.

Step	Instructions
1	Replace the DP Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate signed by a previously valid certificate that has since been revoked
2	DP Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.17 [WINNF.FT.S.SDS.17] Invalid certificate following an approved registration request

Step	Instructions
1	Replace the DP Test Harness certificate with a valid certificate, Cr1

2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
5	DP Test Harness attempts to re-establish the TLS session established in Step 2
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.18 [WINNF.FT.S.SDS.18] Invalid certificate following an approved grant request

Step	**Instructions**
1	Replace the DP Test Harness certificate with a valid certificate, Cr1
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends a valid grant request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions:

	• The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *grantId*, G1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
6	DP Test Harness attempts to re-establish the TLS session established in Steps 2 and 4
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.9.4.19 [WINNF.FT.S.SDS.19] Invalid certificate following an approved heartbeat request

Step	**Instructions**
1	Replace the DP Test Harness certificate with a valid certificate, Cr1
2	DP Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	DP Test Harness sends a valid registration request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *cbsdId*, C1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
4	DP Test Harness sends a valid grant request to the SAS UUT
CHECK	The SAS UUT response to the registration request must satisfy all of the following conditions: • The *responseCode* in Response Data Object shall be 0, concluding an approved registration • Verify that the response contains a valid *grantId*, G1 *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
5	DP Test Harness sends a valid heartbeat request to the SAS UUT
CHECK	The SAS UUT response to the heartbeat request must satisfy all of the following conditions:

	• The *responseCode* in Response Data Object shall be 0, concluding an approved heartbeat *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
6	Make certificate, Cr1, invalid. This may be accomplished by waiting until a time after the validity period for the certificate or by adding the certificate to the OCSP server.
7	DP Test Harness attempts to re-establish the TLS session established in Steps 2, 4, and 5
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7 SAS-SAS Interface Conformance Test Specifications

This section specifies test cases required for SAS to verify the conformance with the technical specifications on procedures and protocols for SAS-SAS interface [n.11] and the requirements established by FCC and DOD.

7.1 SAS-SAS Security, Authentication, and Encryption Protocols

7.1.1 Definition, Applicability, and Scope of the Test Case

This section explains test steps, conditions, and procedures for SAS validation of SAS security credentials. The precondition is that the SAS UUT has been granted a valid certificate according to the processes described in [n.8].

7.1.2 Test Characteristics

Table 6.7-1 SAS Security Validation Test Characteristics

1	**Test ID**	WINNF.FT.S.SSS
2	**Title**	SAS-SAS Security, Authentication, and Encryption Protocols
3	**Working Group / Entity**	WG2/WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS ← → SAS
7	**Target Specification / Feature**	[n.11]

7.1.3 Method of test

7.1.3.1 Initial Conditions / Test Pre-conditions

- The SAS may be placed in a test configuration so that test certificates can be used for testing.
- Valid certificates must be created according to the guidelines given in [n.8]. Sample code for creating test certificates is provided in [i.1]. If such test code is used, the SAS must be configured to use the test certificate root of trust.
- The certificates required to perform the test cases may be created by the sample code provided in [i.1] or provided by a valid CBRS root of trust CA
- The SAS UUT must be reset at the beginning of each test case to a baseline state.
- Unless otherwise specified, SAS Test Harnesses used in the course of a test case are assumed to be whitelisted with the SAS UUT.

7.1.4 Test Procedure

7.1.4.1 [WINNF.FT.S.SSS.1] New registration with TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message that satisfies all the following conditions: • The message includes all required fields, and all fields are syntactically correct. • Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.2 [WINNF.FT.S.SSS.2] New registration with TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate

2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_RSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message that satisfies all the following conditions: • The message includes all required fields, and all fields are syntactically correct. • Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.3 [WINNF.FT.S.SSS.3] New registration with TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite

Step	**Instructions**
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message that satisfies all the following conditions: • The message includes all required fields, and all fields are syntactically correct. • Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.4 [WINNF.FT.S.SSS.4] New registration with TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message that satisfies all the following conditions: • The message includes all required fields, and all fields are syntactically correct. • Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.5 [WINNF.FT.S.SSS.5] New registration with TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT agrees to use the TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 ciphersuite • The SAS UUT agrees to use TLS Protocol Version 1.2 (server_version = 3.3) • Valid Finished message is returned by the SAS UUT immediately following the ChangeCipherSpec message *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message that satisfies all the following conditions: • The message includes all required fields, and all fields are syntactically correct.

	• Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.6 [WINNF.FT.S.SSS.6] Unrecognized root of trust certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a root of trust not recognized by the SAS.
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.7 [WINNF.FT.S.SSS.7] Corrupted certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being corrupted.
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.8 [WINNF.FT.S.SSS.8] Self-signed certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being self-signed.
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters:

	○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.9 [WINNF.FT.S.SSS.9] Non-CBRS trust root signed certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being signed by a non-CBRS trust root.
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.10 [WINNF.FT.S.SSS.10] Certificate of wrong type presented during full activity dump.

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being a certificate of the wrong type but having correct signatures descending from the CBRS trust root (e.g. a CBSD certificate, not a SAS certificate)
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response satisfies all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If all of the above conditions are met, the SAS UUT PASSES this test. If a TLS session is established, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	The SAS UUT response to the full activity dump request must satisfy all of the following conditions: • HTTP status code is 403 (Forbidden) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.11 [WINNF.FT.S.SSS.11] Blacklisted certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate which the SAS has been configured to blacklist (from a test input of the form an enforcement action would take).
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.12 [WINNF.FT.S.SSS.12] Expired certificate presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be a valid but expired certificate.
2	SAS Test Harness attempts to establish a TLS session with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.13 [WINNF.FT.S.SSS.13] Disallowed TLS method attempted by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS handshake using a disallowed method (e.g. TLS v1.1 per [n.8]) with the SAS UUT
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.14 [WINNF.FT.S.SSS.14] Invalid ciphersuite presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with a valid certificate
2	SAS Test Harness attempts to establish a TLS handshake with the SAS UUT using a ciphersuite specifically not allowed by [n.8].
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.15 [WINNF.FT.S.SSS.15] Certificate with inapplicable fields presented during full activity dump.

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be valid except for being configured to contain at least one inapplicable field for ROLE:CBSD (FRN, CPIRID, ZONE, or FREQUENCY)
2	SAS Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • A valid TLS session is established *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*
3	SAS Test Harness sends a valid full activity dump request to the SAS UUT
CHECK	The SAS UUT response to the full activity dump request must satisfy all of the following conditions: • HTTP status code is 403 (Forbidden) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.16 [WINNF.FT.S.SSS.16] Certificate signed by a revoked CA presented by SAS Test Harness

Step	Instructions
1	Replace the SAS Test Harness certificate with an invalid certificate. This certificate shall be a valid certificate signed by a previously valid certificate that has since been revoked
2	SAS Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite

CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.17 [WINNF.FT.S.SSS.17] Unknown SAS attempts to establish a TLS session

Step	**Instructions**
1	Replace the SAS Test Harness certificate with a valid certificate not known to the SAS UUT
2	SAS Test Harness attempts to establish a TLS handshake with the SAS UUT using a valid ciphersuite
CHECK	The SAS UUT response must satisfy all of the following conditions: • The SAS UUT sends a fatal alert message with the following parameters: ○ AlertLevel = 2 (fatal) • The SAS UUT immediately terminates the TLS session *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

7.1.4.18 [WINNF.FT.S.SSS.18] Security requirement for Full Activity Dump message request

This test verifies that a SAS UUT can successfully validate the appropriateness of the security credentials included in a Full Activity Dump Message request from the SAS Test Harness. If the FAD request security credentials are appropriate, the SAS UUT approves the FAD request and responds with the Full Activity Dump Message. If any of the certificates turns out to be invalid, the SAS UUT rejects the request. This test case shall be re-run for all possible iterations of an "invalid certificate"

#	**Test Execution Steps**
1	Ensure that the DP Test Harness registers with the SAS UUT with *cbsdId* (C)
2	DP Test Harness successfully requests Grant for a PAL or GAA channel
3	The SAS Test Harness sends a Full Activity Dump Request to the SAS UUT with an invalid certificate.
CHECK	SAS UUT approves the request and responds with a Full Activity Dump message. • The message includes all required fields, and all fields are syntactically correct. • Confirm that HTTP status code shall be 200 (SUCCESS). *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, proceed.*

4	Using one of the URLs, the SAS Test Harness attempts to retrieve the activity dump file with an invalid certificate.
CHECK	SAS UUT rejects the activity dump file retrieval request by the SAS Test Harness either by refusing the TLS handshake or by denying it with *HTTP code* 401 (UNAUTHORIZED) *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

7.2 SAS-SAS Full Activity Dump Message

7.2.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures of test cases for SAS validation of the Full Activity Dump exchange procedure. SAS UUT shall have valid certificates and information to send message to SAS Test Harness, and vice versa.

7.2.2 Test Characteristics

Table 7.2-1: SAS-SAS Full Activity Dump Test Characteristics

1	**Test ID**	WINNF.FT.S.FAD
2	**Title**	SAS-SAS Full Activity Dump Message
3	**Working Group / Entity**	WG3
4	**Test Type**	Functional
5	**Test Class**	Certification
6	**Component / Interface**	SAS / SAS ← → SAS
7	**Target Specification / Feature**	[n.11]

7.2.3 Method of test

7.2.3.1 Initial Conditions / Test Pre-conditions

- SAS UUT can establish a TLS session with SAS Test Harness, as well as the other way around.
- The SAS UUT must be reset at the beginning of each test case to a Baseline State.
- Unless otherwise specified, SAS Test Harnesses used in the course of a test case are assumed to be whitelisted with the SAS UUT.
- All SAS Administrators shall adhere to information sharing requirements as described in [n.12, R2-ISC-07]

7.2.4 Test Procedure

7.2.4.1 [WINNF.FT.S.FAD.1] [Configurable] SAS UUT Response to a Full Activity Dump Pull Request

This test verifies that a SAS UUT can successfully respond to a Full Activity Dump request from a SAS Test Harness.

Step	Instructions
1	Use Admin Test Harness to configure the SAS UUT to whitelist N1 > 0 FCC IDs and N1 user IDs.
2	Send a valid Registration Request Message for N1 CBSDs to the SAS UUT. Verify that the SAS UUT *responseCode* for each registrationRequest is SUCCESS.
3	Send a valid Grant Request Message with N1 elements (one per registered CBSD). Verify that the *responseCode* for each is SUCCESS.
4	Admin Test Harness injects information about N2 > 0 PPAs into the SAS UUT.
5	Admin Test Harness injects information about N3 > 0 ESC sensors into the SAS UUT.
6	Trigger the SAS UUT to generate a Full Activity Dump.
7	Send a Full Activity Dump request to the SAS UUT.
CHECK	The SAS UUT response to the request must satisfy all of the following conditions: • HTTP status code shall be 200 (success). • The message includes all required fields and the fields are syntactically correct. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, PROCEED.*
8	The SAS Test Harness retrieves all of the data in the Full Activity Dump.
CHECK	The SAS UUT response to each data retrieval request shall be HTTP 200 (success). The SAS responses must collectively satisfy all of the following conditions: • Exactly N1 CBSDs are included, each with parameters corresponding to the Registrations and Grants in Steps 2-3. • Exactly N2 PPAs are included, each with parameters corresponding to the information loaded in step 4. • Exactly N3 ESC sensors are included, each with parameters corresponding to the information loaded in step 5. • All required field exists, and no banned content [n.12, R2-ISC-06, R2-ISC-07] is included. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

7.2.4.2 [WINNF.FT.S.FAD.2] [Configurable] Full Activity Dump Pull Command by SAS UUT

This test verifies that a SAS UUT can successfully request a Full Activity Dump and utilize the retrieved data.

Step	Instructions
1	Configure the SAS Test Harness with information about 1 ESC sensor.
2	Configure the SAS Test Harness with information about 1 CBSD (C1) with 1 Grant (G1). Ensure that the CBSD is in the neighborhood area of the ESC sensor and that the *maxEIRP* for G1 is sufficiently high to support Step 4.
3	Configure the SAS UUT to whitelist the FCC IDs and user IDs that will be used in steps 4 and 8.
4	Send a valid registration request for 1 CBSD (C2) to the SAS UUT. Ensure that the CBSD is in the neighborhood area of the ESC sensor. Verify that the *responseCode* is SUCCESS.
5	Send a valid Grant Request Message for CBSD C2 to the SAS UUT. Set *maxEirp* such that that the Grant (G2) is initially accepted but, after exchanging data with the SAS Test Harness and executing IAP, the EIRP will need to be reduced. Verify that the *responseCode* is SUCCESS.
6	Configure the SAS Test Harness with information about 1 PPA.
7	Configure the SAS Test Harness with information about 1 CBSD (C3) with 1 Grant (G3). Ensure that the CBSD is in the neighborhood area of the PPA and that its EIRP is sufficiently high to support Step 8.
8	Send a valid Registration Request Message for 1 CBSD (C4) to the SAS UUT. Ensure that the CBSD is in the neighborhood area of the PPA. Ensure that the registration request message is configured in such a way that the *responseCode* is SUCCESS.
9	Send a valid Grant Request Message for CBSD C4 to the SAS UUT. Set *maxEirp* such that that the Grant (G4) is initially accepted but, after exchanging data with the SAS Test Harness and executing IAP, the EIRP will need to be reduced. Ensure that the grant request message is configured in such a way that the *responseCode* is SUCCESS.
10	Send a valid Heartbeat Request Message for Grants G2 and G4.
11	Notify the SAS UUT about the SAS Test Harness.
12	Trigger CPAS in the SAS UUT. Verify that the CPAS have completed.
13	Send a valid Heartbeat Request Message for Grants G2 and G4.
CHECK	The SAS response must satisfy all of the following conditions: • The response shall contain 2 *HeartbeatResponse* objects. • For each *HeartbeatResponse* object: ○ The *responseCode* shall be either GRANT_TERMINATED or INVALID_VALUE, indicating a terminated Grant. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

Appendix A

(Normative) Clarifications of JSON Number-type Parameters

The table below shows the clarifications of JSON Number-type parameters used in SAS-CBSD Protocol.

Table 7.2-2 Clarifications of JSON Number-type parameters

Integer	Value with decimal points
horizontalAccuracy	*latitude*
verticalAccuracy	*longitude*
antennaAzimuth	*height*
antennaDowntilt	*maxEirp*
antennaGain	
eirpCapability	
antennaBeamwidth	
responseCode	
lowFrequency	
highFrequency	
heartbeatInterval	