Test and Certification for Citizens Broadband Radio Service (CBRS); CBRS Release 2 Non-Regulatory Impacting (NRI) Test Specification for SAS as UUT

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Test and Certification for CBRS;
Conformance and Performance Test Technical Specification for Release 2 NRI; SAS as Unit Under Test (UUT)

1   Introduction

The present document contains the Protocol Implementation Conformance Statement (PICS), test cases to ensure conformance *to CBRS Release 2 NRI features* developed by Wireless Innovation Forum (WInnForum).

2   Scope

The scope of this present document is to specify test procedures to demonstrate conformance of the CBRS Release 2 requirements and protocols concerning Non-Regulatory Impacting (NRI) features defined in section 4.2 and the included conformance tests address only those features.

NOTE: For information on NRI features and their definitions please refer to section 4.2.

Not all components and interfaces in [n.3] are covered by the Release 2 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 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 NRI test cases required for Release 2 certification of the SAS to attest conformance to WInnForum-defined Release 2 features marked as NRI and does not include any conformance tests for 3rd Party Proprietary Features.

Moreover, this document only covers the test specifications and test cases for the CBRS Architecture components and does not include the test software. The process and policies regarding test code development and test procedures are captured in [n.16].

Certain elements of this published WINNF specifications are subject to change and update in this release.

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]   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 V1.2.2

[n.5]   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 V1.3.0

[n.6]   SSC-Wireless Innovation Forum, "Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band", WINNF-15-S-0112 V1.6.0

[n.7]   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)", WINNF-TS-0122 V1.1.1

[n.8]   FCC Report and Order 18-149A1: "Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band", FCC, Oct 24 2018, FCC-18-149A1.pdf

[n.9]   SSC-Wireless Innovation Forum, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): WInnForum Recognized CBRS Air Interfaces and Measurements", WINNF-SSC-0002

[n.10]   RFC-2119, "Key words for use in RFCs to Indicate Requirement Levels", March 1997. Available at: https://tools.ietf.org/html/rfc2119

[n.11]   SSC-Wireless Innovation Forum, "Extensions to SAS-CBSD Interface Technical Specification (Release 2)", WINNF-TS-3002 V1.0.0

[n.12]   SSC-Wireless Innovation Forum, "Extensions to Spectrum Access System (SAS) - SAS Interface Technical Specification (Release 2)", WINNF-TS-3003 V1.0.0

[n.13]   SSC-Wireless Innovation Forum, "Technical Specification; SAS as Unit Under Test (UUT)", WINNF-TS-0061 V1.5.1

[n.14]   SSC-Wireless Innovation Forum, "Signaling Protocols and Procedures for Citizens Broadband Radio Service (CBRS): WInnForum Recognized CBRS Grouping Information", WINNF-SSC-0010

[n.15]   SSC-Wireless Innovation Forum, "CBRS Operational and Functional Requirements (Release 2)", WINNF-TS-1001 V1.2

[n.16]   SSC-Wireless Innovation Forum, "CBRS Release 2 Self-Testing Policy", WINNF-TS-4005

[n.17]   SSC-Wireless Innovation Forum, "Test and Certification for Citizens Broadband Radio Service (CBRS); CBRS Release 2 Non-Regulatory Impacting (NRI) Test Specification for CBSD as UUT", WINNF-TS-4004

[n.18]   SSC-Wireless Innovation Forum, "CBSD antenna pattern database", WINNF-TS-5006

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.

4   Definitions and Abbreviations

4.1   Abbreviations

CBRS: Citizens Broadband Radio Service

CBSD: Citizens Broadband Radio Service Device

CPAS: Coordinated Periodic Activities among SASs

CPI: Certified Professional Installer

DOD: Department of Defense

DPA: Dynamic Protection Area

EIRP: Effective Isotropic Radiated Power

ESC: Environmental Sensing Capability

FCC: Federal Communications Commission

FSS: Fixed Satellite Service

GAA: General Authorized Access

IAP: Iterative Allocation Process

IOT: Inter-Operability Test

PAL: Priority Access License

PPA: PAL Protection Area

RAN: Radio Access Network

SAS: Spectrum Access System

UUT: Unit Under Test

4.2   Definitions

Main NRI Test Harness: A collection of routines that can be configured by the NRI test operator to interact with the SAS NRI UUT in order to execute the test cases described in this document. It includes Admin NRI Test Harness, SAS NRI Test Harnesses, DP NRI Test Harnesses, CBSD NRI Test Harnesses, and all other test harnesses defined in this document. The Main NRI Test Harness software for testing NRI features is vendor-specific.

SAS Under NRI 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 and CBSD NRI Test Harnesses, the SAS Under NRI Test exchanges sequences of simulated messages with simulated Spectrum Access Systems, simulated CBSDs, and simulated ESCs according to the test specifications in this document. In this document, it is referred to as SAS NRI UUT (Unit Under NRI Test). Unless otherwise specified, SAS UUT, or UUT in this document refers to SAS NRI UUT.

SAS NRI Test Harness: A collection of routines that can be configured by the NRI test operator to interact with the SAS NRI UUT via interfaces specified in [n.5, n.12], and automates critical test sequences and procedures in this document and [n.7, n.17]. Via these interfaces and following the specified test procedures, the SAS NRI Test Harness emulates the SAS-SAS Messages specified in [n.5, n.12] that would be generated by one SAS. The software without SAS certificate for testing NRI features is vendor-specific.

CBSD NRI Test Harness: A collection of routines that can be configured by the NRI test operator to interact with the SAS NRI UUT via interfaces specified in [n.4, n.11] and automates critical test sequences and procedures in this document and [n.7, n.17]. Via these interfaces and following the specified test procedures, the CBSD NRI Test Harness emulates the Release 2 SAS-CBSD Request Messages specified in [n.4, n.11] that would be generated by one CBSD, using a TLS connection with CBSD certificate to the SAS NRI UUT. If multiple CBSD NRI Test Harnesses are directly connected to the SAS NRI UUT, each has its own TLS connection to the SAS NRI UUT. The software without CBSD certificate for testing NRI features is vendor-specific.

DP NRI Test Harness: A collection of routines that can be configured by the NRI test operator to interact with the SAS NRI UUT via interfaces specified in [n.4, n.11] and automates critical test sequences and procedures in this document and [n.7, n.17]. Via these interfaces and following the specified test procedures, the DP Test Harness emulates the Release 2 SAS-CBSD Request Messages specified in [n.4. n.11] that would be generated by one or more CBSDs, using a TLS connection with DP certificate to the SAS NRI UUT. If multiple DP NRI Test Harnesses are connected to the SAS NRI UUT, each has its own TLS connection to the SAS NRI UUT. The DP function within the DP NRI 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 DP certificate for testing NRI features is vendor-specific.

Admin NRI Test Harness: A collection of routines that can be configured by the NRI test operator to inject data that is required for the purpose of the test cases, including SAS operationally supported FIDs, into the SAS NRI UUT. The Admin NRI Test Harness also has the ability to recognize the completion of CPAS executed by the SAS NRI UUT. The Admin NRI Test Harness software for testing NRI features is vendor-specific.

Non-Regulatory Impacting (NRI): The features defined by WInnForum used for operation not impacting Part 96 regulatory compliance [n.15]

The following terms are used within this document and should be interpreted as described in [n.10]:
- ***SHALL*** is a mandatory requirement (negative is ***SHALL NOT***)
- ***SHOULD*** is recommended requirement /best practice (negative is ***SHOULD NOT***)
- ***MAY*** is an optional requirement, i.e. something that is allowed (negative is ***NEED NOT***)

5 General Principles of Certification Test Cases

The requirements, protocols, specifications, and interfaces are defined by SSC-Wireless Innovation Forum Work Groups 1, 2, 3 and 5. 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, 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*}.REL{*X*}.NRI.{*TestFunction*}.{*SubTestNumber*}

Test Requirement indicates the test is to verify if the Unit Under Test meets the CBRS Release 2 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. REL *X* indicates the test as designated is for SAS Release *X* certification testing. *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 The values of TestRequirement in Test ID

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

Table 5-2 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 5-3 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 5-4 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
EPR	ESC Protection
IPR	Federal Incumbent Protection
FPR	FSS Protection
GPR	GWPZ Protection
PPR	PPA Protection
MCP	Multi-Constraint Protection
BPR	Border Protection
PCR	PPA Creation
FDB	Federal Government Database
WDB	WINNF Database
PAT	Propagation Model and Antenna gain
SSS	SAS-SAS Security, Authentication and Encryption Protocols
FAD	Full Activity Dump Message
FCE	Feature Capability Exchange
EGH	Enhanced CBSD Group Handling
EAP	Enhanced Antenna Pattern
CPE	CPE-CBSD Indicator

Table 5-5 The values of X in Test ID

Value	Description
2	Release 2

5.2   Test Triggers

Different from Release 1 testing as specified in WINNF-TS-0061 [n.13], Release 2 NRI testing needs to be performed on per-feature basis. The sub-section "*Definition, Applicability, and Scope of the Test Case*" of section 6 defines test triggers for each feature.

It is assumed that SAS UUT has already passed all the tests defined in [n.13] and has been certified by FCC for Release 1 CBRS operation.

5.3   Test Tools Required

In addition to test tools defined in [n.13], the following modules and functionality shall be used for the conformance tests specified in this document:

- Admin Test Harness
    - Ability to configure a SAS UUT's operationally supported features that require re-registration (see section 6.2)
    - Ability to configure a SAS UUT's operationally supported features that does not require re-registration (see section 6.2)
    - Ability to inject supported and non-supported Group types/IDs.
- As the Main NRI Test Harness software for testing NRI features is vendor-specific, the process and policies regarding test code development and test procedures are captured in [n.16].

5.4   Baseline State of the SAS UUT

Unless explicitly stated otherwise as part of the test procedure, the SAS UUT will be reset to the Baseline State at the beginning of every test case. Baseline State of SAS UUT defined in [n.13] applies to the Baseline State of SAS NRI UUT. In addition to the data defined in [n.13], the following data shall be deleted by the Reset functionality:
- SAS's operationally supported features configured by Admin NRI Test Harness
- Other SAS's Feature Capability Records
- All CBSD feature capabilities.
- List of supported and non-supported Group types/IDs injected by Admin NRI Test Harness

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 for Release 2.

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 Release 2 implementation of CBSD Registration Procedure.

6.1.2   Test Characteristics

Table 6-1: CBSD Registration Procedure Test Characteristics

1	**Test ID**	WINNF.PT.S.REL2.NRI.REG
2	**Title**	CBSD Registration Procedure
3	**Working Group / Entity**	WG3
4	**Test Type**	Protocol
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification**	[n.4, n.11]

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 NRI 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.PT.S.REL2.NRI.REG.1] Array Multi-Step Registration for <u>a combination of Release 1 and Release 2</u> CBSDs

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.

	SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FIDs offline.
2	Ensure that the DP NRI 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*, *cbsdSerialNumber*, and: • For at least one CBSD, *cbsdFeatureCapabilityList** is included • For at least one CBSD, *cbsdFeatureCapabilityList** is missing
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP NRI 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 • SAS response for CBSDs that included *cbsdFeatureCapabilityList** in their requests in Step 2, shall contain *sasFeatureCapabilityList* parameter with one or more SAS Operationally-Supported valid FIDs (FID_1, FID_2, etc), or with one set to [] (for zero FID). • SAS response for CBSDs that did not include c*bsdFeatureCapabilityList** in their requests in Step 2, shall not contain *sasFeatureCapabilityList* parameter *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES*

6.1.4.2 [WINNF.PT.S.REL2.NRI.REG.2] Array Single-Step Registration for <u>a combination of Release 1 and Release 2</u> CBSDs

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. SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FIDs offline.
2	Ensure the DP NRI 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*, *cbsdSerialNumber*, and c*bsdFeatureCapabilityList**, 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.* • For at least one CBSD, *cbsdFeatureCapabilityList** is included • For at least one CBSD, *cbsdFeatureCapabilityList** is missing
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP NRI 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

- SAS response for CBSDs that included *cbsdFeatureCapabilityList** in their requests in Step 2, shall contain *sasFeatureCapabilityList* parameter with one or more SAS Operationally-Supported valid FIDs (FID_1, FID_2, etc), or with one set to [] (for zero FID).
- SAS response for CBSDs that did not include *cbsdFeatureCapabilityList** in their requests in Step 2, shall not contain *sasFeatureCapabilityList* parameter

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

6.1.4.3 [WINNF.PT.S.REL2.NRI.REG.3] Invalid cbsdFeatureCapabilityList in Array Registration Request (responseCode 103)

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. All REG-Conditional parameters for two CBSDs shall already be pre-loaded into the SAS. SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FIDs offline.
2	Ensure that the DP NRI Test Harness sends a Multi-Step Registration Request in the form of one 2-element Array to the SAS with the following conditions: • valid *userId*, *fccId*, *cbsdSerialNumber*, and *cbsdFeatureCapabilityList*, for the first CBSD • valid *userId*, *fccId*, and *cbsdSerialNumber*, but a wrongly-formatted *cbsdFeatureCapabilityList* for the second CBSD. Examples of a wrongly-formatted *cbsdFeatureCapabilityList* are providing Boolean not an array, or a nested array
CHECK	SAS UUT sends a CBSD Registration Response in the form of one 2-element Array to the DP NRI Test Harness as follows: • SAS response includes a valid *cbsdId* for the first CBSD. • SAS response for the first CBSD shall contain *sasFeatureCapabilityList* parameter with one or more SAS Operationally-Supported valid FIDs (FID_1, FID_2, etc), or with one set to [] (for zero FID). • 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 CBSD, concluding failed Registrations. *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.1.4.4 [WINNF.PT.S.REL2.NRI.REG.4] [Configurable] CBSD Feature Capability List cbsdFeatureCapabilityList exchange

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 supported, missing, and invalid required parameters, and Reg Conditional parameters, as specified in input configuration files. All Registration Requests shall include cbsdFeatureCapabilityList parameter. 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. SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FIDs offline.
3	Using a DP NRI 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). • contain *cbsdFeatureCapabilityList* parameter with one set to [] (for zero FID), or one with one or more supported FIDs (FID_1, FID_2, etc)

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:
	    o The *responseCode* parameter contained in the *response* parameter shall match the corresponding expected response code listed in the configuration file.
	    o If *responseCode* == SUCCESS:
	        ▪ verify that the response contains a valid *cbsdId*.
	        ▪ verify *sasFeatureCapabilityList* is included with SAS Operationally-Supported valid FIDs (FID_1, FID_2, etc), or with one set to [] (for zero FID).
	    o If *responseCode* == FAILURE, 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, it PASSES.

6.2 CBSD Feature Capability Exchange Procedure

6.2.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures to test the conformance of SAS Release 2 implementation of CBSD Feature Capability Exchange Procedure.

6.2.2 Test Characteristics

Table 6-2: CBSD Feature Capability Exchange Request Procedure Test Characteristics

1	**Test ID**	WINNF.PT.S.REL2.NRI.FCE
2	**Title**	Feature Capability Exchange
3	**Working Group / Entity**	WG3
4	**Test Type**	Protocol
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification**	[n.4, n.11]

6.2.3 Method of test

6.2.3.1 Initial Conditions / Test Pre-conditions

1. All the message exchanges between the SAS UUT and the CBSD/DP NRI 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.

6.2.4 Test Procedure

6.2.4.1 [WINNF.PT.S.REL2.NRI.FCE.1] Array Feature Capability Exchange Request for CBSDs

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. • SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FID(s) offline. • SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FID(s) (offline) requiring re-registration.

2	Ensure the DP NRI Test Harness sends correct Registration Request in the form of one 3-element Array to the SAS. CBSD 1 and 2 shall have no *cbsdFeatureCapabilityList* included. • CBSD 3 shall have at least one feature included in its *cbsdFeatureCapabilityList*
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP NRI 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, • For CBSD 1 and CBSD 2, **NO** *sasFeatureCapabilityList* is included in the response. • For CBSD 3, SAS shall include *sasFeatureCapabilityList* with all its SAS Operationally-Supported FIDs.

3	The DP NRI Test Harness sends correct Feature Capability Exchange Request in the form of one 3-element Array to the SAS, such that:
	• *featureCapabilityExchangeRequest* contains 3 objects for 3 *cbsdId*s from the previous Step, and their corresponding c*bsdFeatureCapabilityList*s such that:
	    o For CBSD 1, c*bsdFeatureCapabilityList* is included but left blank. No *cbsdFeatureInfo* is included.
	    o If the list of Operationally-Supported FIDs for the SAS UUT that require Re-registration (see Step 1) is empty, skip CBSD 2. Otherwise, at least one feature is included in its *cbsdFeatureCapabilityList. cbsdFeatureInfo* contains corresponding array of properly formed *FeatureInfo* objects with at least one *featureId* requiring Re-registration, included in the SAS UUT Operationally-Supported FIDs requiring Re-registration.
	    o For CBSD 3, at least one feature is included in its *cbsdFeatureCapabilityList. cbsdFeatureInfo* contains corresponding array of properly formed *FeatureInfo* objects with at least one *featureId,* but none requiring Re-registration.

CHECK	SAS UUT responds by sending a Feature Capability Exchange Response in the form of one 3-element Array to the DP NRI Test Harness as follows: • *featureCapabilityExchangeResponse* contains 3 objects for 3 *cbsdId*s from the previous Step: o For CBSD 1 and 3, *sasFeatureCapabilityList* is included. *sasFeatureInfo* contains corresponding array of properly formed *FeatureInfo* objects including all SAS Operationally-Supported FIDs, and their associated parameters. The *responseCode* contained in the *response* parameter is 0 for the CBSDs, concluding a successful Feature Capability Exchange

	o If CBSD2 is not skipped, based on the criteria defined in Step 3, For CBSD 2, the *responseCode* contained in the *response* parameter is 105 requiring De-registration.
4	DP NRI Test Harness sends a Registration Request for CBSD 2: • The request includes *cbsdFeatureCapabilityList* with the FIDs identical to those in Step 3
CHECK	SAS UUT approves the request by sending a CBSD Registration Response as follows: • SAS response includes a valid *cbsdId*. • The *responseCode* parameter contained in the *response* parameter is 0 concluding an approved Registration • SAS shall include its *sasFeatureCapabilityList*, *sasFeatureInfo* contains corresponding array of properly formed *FeatureInfo* objects including all SAS Operationally-Supported FIDs, and their associated parameters.

6.2.4.2 [WINNF.PT.S.REL2.NRI.FCE.2] Invalid Array Feature Capability Exchange Request for CBSDs

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. • SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FID(s) offline
2	Ensure the DP NRI Test Harness sends correct Registration Request in the form of one 3-element Array to the SAS • CBSDs shall have no *cbsdFeatureCapabilityList* included
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 3-element Array to the DP NRI 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 **NO** *sasFeatureCapabilityList* is included in the response.
3	The DP NRI Test Harness sends correct Feature Capability Exchange Request in the form of one 3-element Array to the SAS, such that: • *featureCapabilityExchangeRequest* contains 3 objects for 3 *cbsdId*s from the previous Step, and their corresponding *cbsdFeatureCapabilityList*s: o For one CBSD, a wrongly-formatted *cbsdFeatureInfo* array shall be included.
CHECK	SAS UUT responds by sending a Feature Capability Exchange Response in the form of one 3-element Array to the DP NRI Test Harness as follows:

- *featureCapabilityExchangeResponse* contains 3 objects for 3 *cbsdId*s from the previous Step:
  - The *responseCode* contained in the *response* parameter is 103 for the CBSD with the wrongly-formatted *cbsdFeatureInfo*, concluding failed Feature Capability Exchange Request exchange.
  - For the other two CBSDs, *sasFeatureCapabilityList* is included. *sasFeatureInfo* contains corresponding array of properly formed *FeatureInfo* objects including all SAS Operationally-Supported FIDs, and their associated parameters. The *responseCode* contained in the *response* parameter is 0 for the CBSDs, concluding a successful Feature Capability Exchange.

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

6.2.4.3 [WINNF.PT.S.REL2.NRI.FCE.2] SAS triggering Feature Capability Exchange with registered CBSD

Step	Instructions
1	Ensure no *cbsdId* exists in the SAS for the CBSDs being tested. • SAS Administrator configures Admin NRI Test Harness with the SAS Operationally-Supported FIDs offline.
2	Ensure the DP NRI Test Harness sends correct Registration Request in the form of one 5-element Array to the SAS. • CBSD 1 shall have no *cbsdFeatureCapabilityList* included. • CBSD 2, CBSD 3, CBSD 4, and CBSD 5 shall have at least one feature included in its *cbsdFeatureCapabilityList*
CHECK	SAS UUT approves the request by sending a CBSD Registration Response in the form of one 5-element Array to the DP NRI 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, • For CBSD 1, **NO** *sasFeatureCapabilityList* is included in the response. • For CBSD 2, CBSD 3, CBSD 4, and CBSD 5 SAS shall include *sasFeatureCapabilityList* with all its SAS Operationally-Supported FIDs.
3	The DP NRI Test Harness sends Grant Request messages to the SAS for CBSD 1, CBSD 2, and CBSD 3 so that all grants are approved by the SAS
4	The DP NRI Test Harness sends Heartbeat Request messages to the SAS for CBSD 1, CBSD 2, and CBSD 3 so that all requests are approved by the SAS

5	SAS Administrator configures Admin NRI Test Harness with an additional Operationally-Supported FIDs offline.
6	The DP NRI Test Harness sends • Heartbeat Request messages to the SAS for CBSD 1 and CBSD 2. • Grant Relinquishment message to the SAS for CBSD 3 • Spectrum Inquiry message to the SAS for CBSD 4. • Grant Request message to the SAS for CBSD 5 so that the grant is approved by the SAS

CHECK	SAS UUT responds by sending the following messages:
	
	• A 2-element Array of Heartbeat Response to the DP NRI Test Harness for CBSD 1 and CBSD 2 as follows:
	    o For CBSD 1 *featureCapabilityExchangeTrigger* is not included in the response message
	    o For CBSD 2 *featureCapabilityExchangeTrigger* is included in the response message, and set to "TRUE"
	• A Grant Relinquishment Response to the DP NRI Test Harness for CBSD 3 by including *featureCapabilityExchangeTrigger* and setting that to "TRUE"
	• A Spectrum Inquiry Response to the DP NRI Test Harness for CBSD 4 by including *featureCapabilityExchangeTrigger* and setting that to "TRUE"
	• A Grant Response to the DP NRI Test Harness for CBSD 5 by including *featureCapabilityExchangeTrigger* and setting that to "TRUE"

6.3 Enhanced CBSD Group Handling Procedure

6.3.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures to test the conformance of a SAS that supports the Release 2 feature Enhanced CBSD Group Handling (FID: WF_ENH_GROUP_HANDLING). The section also includes test cases that tests the backward compatibility of a Release 2 SAS, supporting EGH, to support grouping information provided by Release 1 CBSDs.

6.3.2 Test Characteristics

Table 6-3: Enhanced CBSD Group Handling Procedure Test Characteristics

1	**Test ID**	WINNF.PT.S.REL2.NRI.EGH
2	**Title**	Enhanced CBSD Group Handling
3	**Working Group / Entity**	WG3
4	**Test Type**	Protocol
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification**	[n.4, n.11]

6.3.3 Method of test

6.3.3.1 Initial Conditions / Test Pre-conditions

1. All the message exchanges between the SAS UUT and the CBSD/DP NRI 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.

6.3.4 Test Procedure

6.3.4.1 [WINNF.PT.S.REL2.NRI.EGH.1]: Release 2 CBSDs exchange messages with Group types that are supported and not supported by SAS

This test case aims to test the conformance of a Release 2 SAS to successfully exchange messages consisting Grouping information with a Release 2 CBSD. The Group membership for the CBSDs would be a mix of SAS supported and not supported Group Types.

Step	Instructions
1	• Ensure no *cbsdIds* exists in the SAS for the 4 CBSDs being tested. • All REG-Conditional parameters for the CBSDs shall already be pre-loaded into the SAS UUT. • SAS Administrator configures Admin NRI Test Harness with the Group Types supported and NOT supported by the SAS UUT. If the SAS UUT supports all the defined Group Types, then the NOT

	supported Group Types list would be empty. Let the group types provisioned be denoted as G_1, G_2 and G_3 • Both Supported and Not Supported Group Types as registered in WINNF-SSC-0010 [n.14], provisioned by the SAS UUT

2	The CBSD/DP NRI Test Harness sends Registration Requests for the 4 CBSDs to the SAS UUT
	For all CBSDs
	• The Registration Request is in proper format and parameters are within acceptable ranges.
	For CBSD1:
	
	    • *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING
	    • *groupingParam* is included with values according to Group types provisioned in Step 1
	        o *groupType* is set to G_1
	
	For CBSD2:
	
	    • *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING
	    • *groupingParam* is included with values according to Group types provisioned in Step 1
	        o *groupType* is set to G_2
	
	For CBSD3:
	
	    • *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING
	    • *groupingParam* is an array of objects containing multiple group information included with values according to Group types provisioned in Step 1
	    o *GroupParam Object 1: groupType* is set to G_2
	    o *GroupParam Object 2: groupType* is set to G_3
	
	For CBSD4:
	
	    • *cbsdFeatureCapabilityList* does **NOT** include the FID: WF_ENH_GROUP_HANDLING
	    • *groupingParam* is included with values according to Group types provisioned in Step 1
	    o *groupType* is set to G_2

CHECK	SAS UUT approves the request and sends a Registration Response as follows: For CBSDs 1 to 3 • Includes valid *cbsdIds* for all the CBSDs. • The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration • *sasFeatureCapabilityList* shall be included with FID list containing atleast FID: WF_ENH_GROUP_HANDLING

- CBSD 1
    - *groupingConfig* parameter including one object of *GroupConfig* for Group Type G_1 shall be included with
        - *groupType* is set to G_1 that the CBSD belongs as defined in Group types provisioned in Step 1
        - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
        - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
        - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
            - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
- CBSD 2
    - *groupingConfig* parameter including one object of *GroupConfig* for Group Type G_2 shall be included with
        - *groupType* is set to G_2 that the CBSD belongs as defined in Group types provisioned in Step 1
        - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
        - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
        - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
            - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
- CBSD 3
    - *groupingConfig* parameter including two objects of *GroupConfig* shall be included with
    - *GroupConfig* Object 1
        - *groupType* is set to the G_2 that the CBSD belongs as defined in Group types provisioned in Step 1
        - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
        - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
        - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
            - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***

	o *GroupConfig* Object 2
	    ▪ *groupType* is set to G$_3$ that the CBSD belongs as defined in Group types provisioned in Step 1
	    ▪ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
	    ▪ Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
	    ▪ Optionally send additional Grouping information in the *groupConfigInfo* parameter.
	        • *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
	
	For CBSD 4
	
	    o Does not include a valid *cbsdId*
	    o The *responseCode* parameter is 201 (GROUP_ERROR) indicating a rejected Registration
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

3	The CBSD/DP NRI Test Harness sends a Spectrum Inquiry Request for the CBSDs registered in step 2
	    • The Spectrum Inquiry Request is in proper format and parameters are within acceptable ranges.
	For CBSD1:
	
	    • *groupingParam* is included with values according to Group types provisioned in Step 1
	        o *groupType* is set to G$_1$
	
	For CBSD2:
	
	    • *groupingParam* is included with values according to Group types provisioned in Step 1
	        o *groupType* is set to G$_2$
	
	For CBSD3:
	
	    • *groupingParam* is an array of objects containing multiple group information included with values according to Group types provisioned in Step 1
	    o *GroupParam Object 1: groupType* is set to G$_2$
	    o *GroupParam Object 2: groupType* is set to G$_3$

CHECK	SAS UUT approves the request and sends a Spectrum Response as follows:
	    • Includes the *cbsdId* for the CBSD.
	    • Includes a list of available channels in the *availableChannel* parameter
	    • The *responseCode* parameter is 0 (SUCCESS)

- CBSD 1
  - *groupingConfig* parameter including one object of
    GroupConfig for Group Type G_1 shall be included with
    - *groupType* is set to G_1 that the CBSD belongs as
      defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as
      specified in the *groupType* parameter as defined in
      Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas*
      parameter based on the list of Group types supported
      by SAS as provisioned.
    - Optionally send additional Grouping information in the
      groupConfigInfo parameter.
      - *groupConfigInfo* parameter is NOT included if
        the *supportedBySas* is set to ***false***
- CBSD 2
  - *groupingConfig* parameter including one object of
    GroupConfig for Group Type G_2 shall be included with
    - *groupType* is set to G_2 that the CBSD belongs as
      defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as
      specified in the *groupType* parameter as defined in
      Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas*
      parameter based on the list of Group types supported
      by SAS as provisioned.
    - Optionally send additional Grouping information in the
      groupConfigInfo parameter.
      - *groupConfigInfo* parameter is NOT included if
        the *supportedBySas* is set to ***false***
- CBSD 3
  - *groupingConfig* parameter including two objects of *GroupConfig*
    shall be included with
  - *GroupConfig* Object 1
    - *groupType* is set to the G_2 that the CBSD belongs as
      defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as
      specified in the *groupType* parameter as defined in
      Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas*
      parameter based on the list of Group types supported
      by SAS as provisioned.
    - Optionally send additional Grouping information in the
      groupConfigInfo parameter.
      - *groupConfigInfo* parameter is NOT included if
        the *supportedBySas* is set to ***false***

	o *GroupConfig* Object 2
	  ▪ *groupType* is set to G₃ that the CBSD belongs as defined in Group types provisioned in Step 1
	  ▪ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
	  ▪ Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
	  ▪ Optionally send additional Grouping information in the *groupConfigInfo* parameter.
	    • *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

4	The CBSD/DP NRI Test Harness sends a Grant Request message for CBSDs registered in Step 2
	  • The Grant Request is in proper format and parameters are within acceptable ranges.
	For CBSD1:
	  • *groupingParam* is included with values according to Group types provisioned in Step 1
	    o *groupType* is set to G₁
	
	For CBSD2:
	  • *groupingParam* is included with values according to Group types provisioned in Step 1
	    o *groupType* is set to G₂
	
	For CBSD3:
	  • *groupingParam* is an array of objects containing multiple group information included with values according to Group types provisioned in Step 1
	    o *GroupParam Object 1: groupType* is set to G₂
	    o *GroupParam Object 2: groupType* is set to G₃
	    o

CHECK	SAS UUT approves the request and sends a Grant Response as follows:
	  • Includes the *cbsdId* for the CBSD.
	  • A valid Grant Id is included
	  • The *responseCode* parameter is 0 (SUCCESS)
	  • CBSD 1
	    o *groupingConfig* parameter including one object of *GroupConfig* for Group Type G₁ shall be included with

- - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1
  - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
  - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
  - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
    - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to *false*
- CBSD 2
  - *groupingConfig* parameter including one object of *GroupConfig* for Group Type G₂ shall be included with
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
    - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
      - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to *false*
- CBSD 3
  - *groupingConfig* parameter including two objects of *GroupConfig* shall be included with
  - *GroupConfig* Object 1
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
    - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
      - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to *false*
  - *GroupConfig* Object 2
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1

	groupId is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1 - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned. - Optionally send additional Grouping information in the *groupConfigInfo* parameter. *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false** *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES*
5	The CBSD/DP NRI Test Harness sends a Heartbeat Request for the CBSDs registered in Step 2 - The Heartbeat Request is in proper format and parameters are within acceptable ranges. For CBSD1: *groupingParam* is included with values according to Group types provisioned in Step 1 *groupType* is set to G_1 For CBSD2: *groupingParam* is included with values according to Group types provisioned in Step 1 *groupType* is set to G_2 For CBSD3: *groupingParam* is an array of objects containing multiple group information included with values according to Group types provisioned in Step 1 *GroupParam Object 1: groupType* is set to G_2 *GroupParam Object 2: groupType* is set to G_3
CHECK	SAS UUT sends a Heartbeat Response as follows: - Includes a valid *cbsdId* for the CBSD. - A valid *grantId* *grantExpireTime* is set to UTC time greater than duration of the test - The *responseCode* parameter is 0 (SUCCESS) - CBSD 1 *groupingConfig* parameter including one object of *GroupConfig* for Group Type G_1 shall be included with *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1

- - - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
    - *Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
    - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
      - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
- CBSD 2
  - *groupingConfig* parameter including one object of *GroupConfig* for Group Type G$_2$ shall be included with
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
    - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
      - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
- CBSD 3
  - *groupingConfig* parameter including two objects of *GroupConfig* shall be included with
  - *GroupConfig* Object 1
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1
    - *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
    - Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
    - Optionally send additional Grouping information in the *groupConfigInfo* parameter.
      - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
  - *GroupConfig* Object 2
    - *groupType* is set to the Group that the CBSD belongs as defined in Group types provisioned in Step 1

- *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as defined in Group types provisioned in Step 1
- Appropriate values are set in the *supportedBySas* parameter based on the list of Group types supported by SAS as provisioned.
- Optionally send additional Grouping information in the *groupConfigInfo* parameter.
  - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**

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

6.3.4.2 [WINNF.PT.S.REL2.NRI.EGH.2]: Release 2 CBSD does not send the groupingParam object

This test case aims to test the conformance of a Release 2 SAS when the *groupingParam* is not available on the messages from a Release 2 CBSD that supports EGH.

Step	Instructions
1	- Ensure no *cbsdId* exists in the SAS for the CBSD being tested. - All REG-Conditional parameters for the CBSD shall already be pre-loaded into the SAS UUT. - Both Supported and Not Supported Group Types as registered in WINNF-SSC-0010 [n.14], provisioned by the SAS UUT
2	The CBSD/DP NRI Test Harness sends a Registration Request for a single CBSD to the SAS UUT - The Registration Request is in proper format and parameters are within acceptable ranges. *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING *groupingParam* is **NOT** included
CHECK	SAS UUT approves the request and sends a Registration Response as follows: - Includes a valid *cbsdId* for the CBSD. - The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration *sasFeatureCapabilityList* shall be included with FID list containing atleast FID: WF_ENH_GROUP_HANDLING ○

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

3	The CBSD/DP NRI Test Harness sends a Spectrum Inquiry Request for the CBSD registered in step 2
	   • The Spectrum Inquiry Request is in proper format and parameters are within acceptable ranges.
	   • *groupingParam* is **NOT** included

CHECK	SAS UUT approves the request and sends a Spectrum Response as follows:
	
	   • Includes the *cbsdId* for the CBSD.
	   • Includes a list of available channels in the *availableChannel* parameter
	   • The *responseCode* parameter is 0 (SUCCESS)
	   • *groupingConfig* parameter including one object of *GroupConfig* may be included with
	      ○ *groupType* is set to the Group that the SAS supports as provisioned in Step 1
	      ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as provisioned in Step 1
	      ○ *supportedBySas* set to **true**
	      ○ Optionally send additional Grouping information in the *groupConfigInfo* parameter.
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

4	The CBSD/DP NRI Test Harness sends a Grant Request message for CBSD registered in Step 2
	   • The Grant Request is in proper format and parameters are within acceptable ranges.
	   • *groupingParam* is **NOT** included

CHECK	SAS UUT approves the request and sends a Grant Response as follows:
	   • Includes the *cbsdId* for the CBSD.
	   • A valid Grant Id is included
	   • The *responseCode* parameter is 0 (SUCCESS)
	   • *groupingConfig* parameter including one object of *GroupConfig* may be included with
	      ○ *groupType* is set to the Group that the SAS supports as provisioned in Step 1
	      ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as provisioned in Step 1
	      ○ *supportedBySas* set to **true**
	Optionally send additional Grouping information in the *groupConfigInfo* parameter
	
	If any of the above conditions (A or B) are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

5	The CBSD/DP NRI Test Harness sends a Heartbeat Request for the CBSD registered in Step 2 • The Heartbeat Request is in proper format and parameters are within acceptable ranges. • *groupingParam* is **NOT** included

CHECK	SAS UUT sends a Heartbeat Response as follows:
	• Includes a valid *cbsdId* for the CBSD.
	• A valid *grantId*
	• *grantExpireTime* is set to UTC time greater than duration of the test
	• The *responseCode* parameter is 0 (SUCCESS)
	• *groupingConfig* parameter including one object of *GroupConfig* may be included with
	    ○ *groupType* is set to the Group that the SAS supports as provisioned in Step 1
	    ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter as provisioned in Step 1
	    ○ *supportedBySas* set to **true**
	    ○ Optionally send additional Grouping information in the *groupConfigInfo* parameter.
	    ○
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

6.3.4.3 [WINNF.PT.S.REL2.NRI.EGH.3]: Release 2 CBSD changes the Group it belongs to on the messages

This test case aims to test the conformance of a Release 2 SAS when a Release 2 CBSD changes the Group that it declared that it belongs to, in the Registration message, on subsequent messages to the SAS.

Step	Instructions
1	• Ensure no *cbsdIds* exists in the SAS for the 2 CBSDs being tested. • All REG-Conditional parameters for the CBSDs shall already be pre-loaded into the SAS UUT. • SAS Administrator configures Admin NRI Test Harness with the Group Types supported and NOT supported by the SAS. Let the group types provisioned be denoted as G_1, G_2 and G_3 • Both Supported and Not Supported Group Types as registered in WINNF-SSC-0010 [n.14], provisioned by the SAS UUT
2	The CBSD/DP NRI Test Harness sends Registration Requests for the 2 CBSDs to the SAS UUT For all CBSDs

	• The Registration Request is in proper format and parameters are within acceptable ranges.
	• *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING
	
	For CBSD1
	
	• Indicates membership in 1 Group: G_1
	• *groupingParam* is included with values according to Group types provisioned in Step 1
	    ○ *groupType* is set to a value **NOT** supported by SAS
	
	For CBSD2
	
	• Indicates membership in 3 Groups: G_1, G_2 and G_3
	• *groupingParam* is an array of objects containing membership to multiple groups is included with values according to Group types provisioned in Step 1
	    ○ *GroupParam Object 1: groupType* is set to a value supported by the SAS
	    ○ *GroupParam Object 2: groupType* is set to a value **NOT** supported by the SAS

CHECK	SAS UUT approves the request and sends a Registration Response as follows:
	• Includes valid *cbsdIds* for all the CBSDs.
	• The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration
	• *sasFeatureCapabilityList* shall be included with FID list containing atleast FID: WF_ENH_GROUP_HANDLING
	• CBSD 1
	    ○ *groupingConfig* parameter including one object of *GroupConfig* shall be included for the 1 Group (G_1) in the response message
	        ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	        ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**
	
	• CBSD 2
	    ○ *groupingConfig* parameter including three objects of *GroupConfig* shall be included for the 3 Groups (G_1, G_2 and G_3) in the response
	        ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	        ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**

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

3	The CBSD/DP NRI Test Harness sends a Spectrum Inquiry Request for the CBSDs registered in step 2
	    • The Spectrum Inquiry Request is in proper format and parameters are within acceptable ranges.
	For CBSD1
	
	    • Changes membership of its Group to G_2.
	
	For CBSD2
	
	    • No changes in its membership. Still indicates it belongs to Groups G_1, G_2 and G_3.

CHECK	SAS UUT approves the request and sends a Spectrum Response as follows:
	    • Includes the *cbsdId* for the CBSD.
	    • Includes a list of available channels in the *availableChannel* parameter
	    • The *responseCode* parameter is 0 (SUCCESS)
	    • CBSD 1
	        o *groupingConfig* parameter including one object of *GroupConfig* shall be included for the Group G_2 in the response message
	            ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	            ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**
	
	    • CBSD 2
	        o *groupingConfig* parameter including three objects of *GroupConfig* shall be included for the 3 Groups (G_1, G_2 and G_3) in the response
	            ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	            ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to **false**
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

4	The CBSD/DP NRI Test Harness sends a Grant Request message for CBSDs registered in Step 2 • The Grant Request is in proper format and parameters are within acceptable ranges.

	For CBSD1
	• Changes membership of its Group to G_2 and G_3.
	For CBSD2
	• Changes its membership to Groups G_1 and G_3.

CHECK	SAS UUT approves the request and sends a Grant Response as follows:
	 • Includes the *cbsdId* for the CBSD.
	 • A valid Grant Id is included
	 • The *responseCode* parameter is 0 (SUCCESS)
	 • CBSD 1
	     o *groupingConfig* parameter including two objects of *GroupConfig* shall be included for the Groups G_2 and G_3 in the response message
	        ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	        ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
	
	 • CBSD 2
	     o *groupingConfig* parameter including two objects of *GroupConfig* shall be included for Groups G_1 and G_3 in the response
	        ▪ Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
	        ▪ *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to ***false***
	
	 If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

5	The NRI Test Harness sends a Heartbeat Request for the CBSDs registered in Step 2 • The Heartbeat Request is in proper format and parameters are within acceptable ranges. For CBSD1 • No Changes in the membership of its Group. Still belongs to G_2 and G_3. For CBSD2 • Changes its membership to Groups G_1, G_2 and G_3.
CHECK	SAS UUT sends a Heartbeat Response as follows: • Includes a valid *cbsdId* for the CBSD. • A valid *grantId*

- *grantExpireTime* is set to UTC time greater than duration of the test
- The *responseCode* parameter is 0 (SUCCESS)
- CBSD 1
    - *groupingConfig* parameter including two objects of *GroupConfig* shall be included for the Groups G_2 and G_3 in the response message
        - Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
        - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to *false*

- CBSD 2
    - *groupingConfig* parameter including three objects of *GroupConfig* shall be included for Groups G_1, G_2 and G_3 in the response
        - Appropriate values are set in the *supportedBySas* parameter based on the Group types supported by SAS as provisioned.
        - *groupConfigInfo* parameter is NOT included if the *supportedBySas* is set to *false*

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

6.3.4.4 [WINNF.PT.S.REL2.NRI.EGH.4]: CBSD sends the groupingParam object with incorrect Group Type

This test case aims to test the conformance of a Release 2 SAS when the *groupingParam* contains non-standard Group Type.

Step	Instructions
1	- Ensure no *cbsdId* exists in the SAS for the CBSD being tested. - All REG-Conditional parameters for the CBSD shall already be pre-loaded into the SAS UUT. - Both Supported and Not Supported Group Types as registered in WINNF-SSC-0010 [n.14], provisioned by the SAS UUT
2	The CBSD/DP NRI Test Harness sends a Registration Request for a single CBSD to the SAS UUT - The Registration Request is in proper format and parameters are within acceptable ranges. *cbsdFeatureCapabilityList* is included with FID: WF_ENH_GROUP_HANDLING

	• *groupingParam* is included with values NOT according to Group types provisioned in Step 1

CHECK	SAS UUT approves the request and sends a Registration Response as follows:
	• Includes a valid *cbsdId* for the CBSD.
	• The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration
	• *sasFeatureCapabilityList* shall be included with FID list containing at least FID: WF_ENH_GROUP_HANDLING
	• *groupingConfig* parameter including one object of *GroupConfig* shall be included with
	    ○ *groupType* is set to the Group that the CBSD belongs
	    ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter
	    ○ *supportedBySas* set to **false**
	    ○
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

3	The CBSD/DP NRI Test Harness sends a Spectrum Inquiry Request for the CBSD registered in step 2 • The Spectrum Inquiry Request is in proper format and parameters are within acceptable ranges. • *groupingParam* is included with values NOT according to Group types provisioned in Step 1

CHECK	SAS UUT approves the request and sends a Spectrum Response as follows:
	• Includes the *cbsdId* for the CBSD.
	• Includes a list of available channels in the *availableChannel* parameter
	• The *responseCode* parameter is 0 (SUCCESS)
	• *groupingConfig* parameter including one object of *GroupConfig* shall be included with
	    ○ *groupType* is set to the Group that the CBSD belongs
	    ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter
	    ○ *supportedBySas* set to **false**
	
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

4	The CBSD/DP NRI Test Harness sends a Grant Request message for CBSD registered in Step 2 • The Grant Request is in proper format and parameters are within acceptable ranges. • *groupingParam* is included with values NOT according to Group types provisioned in Step 1
CHECK	SAS UUT approves the request and sends a Grant Response as follows: • Includes the *cbsdId* for the CBSD.

	• A valid Grant Id is included
	• The *responseCode* parameter is 0 (SUCCESS)
	• *groupingConfig* parameter including one object of *GroupConfig* shall be included with
	    ○ *groupType* is set to the Group that the CBSD belongs
	    ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter
	supportedBySas set to *false*
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

5	The CBSD/DP NRI Test Harness sends a Heartbeat Request for the CBSD registered in Step 2 • The Heartbeat Request is in proper format and parameters are within acceptable ranges. • *groupingParam* is included with values NOT according to Group types provisioned in Step 1

CHECK	SAS UUT sends a Heartbeat Response as follows:
	• Includes a valid *cbsdId* for the CBSD.
	• A valid *grantId*
	• *grantExpireTime* is set to UTC time greater than duration of the test
	• The *responseCode* parameter is 0 (SUCCESS)
	• *groupingConfig* parameter including one object of *GroupConfig* shall be included with
	    ○ *groupType* is set to the Group that the CBSD belongs
	    ○ *groupId* is set to a value corresponding to the Group as specified in the *groupType* parameter
	supportedBySas set to *false*
	If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES

6.3.4.5 [WINNF.PT.S.REL2.NRI.EGH.5]: Release 1 CBSDs sends a Registration message with Grouping Information to a Release 2 SAS operationally supporting EGH

This test case aims to test the conformance of a Release 2 SAS to successfully exchange messages consisting Grouping information with a Release 1 CBSD. The Group membership for the CBSDs would be a mix Release 1 WInnForum supported and not supported Group Types

Step	Instructions
1	• Ensure no *cbsdIds* exists in the SAS for a CBSD being tested. • All REG-Conditional parameters for the CBSDs shall already be pre-loaded into the SAS UUT. Both Supported and Not Supported Group Types as registered in WINNF-SSC-0010 [n.14], provisioned by the SAS UUT
2	The CBSD/DP NRI Test Harness sends Registration Requests for the CBSD to the SAS UUT • The Registration Request is in proper format and parameters are within acceptable ranges.

	cbsdFeatureCapabilityList is NOT included *groupingParam is included* *groupType* is set to "INTERFERENCE_COORDINATION"
CHECK	SAS UUT sends a Registration Response as follows: - Includes valid *cbsdId* for the CBSD. - The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration *sasFeatureCapabilityList* shall NOT be included *groupingConfig* shall NOT be included *If any of the above conditions are not met, the SAS UUT FAILS this test. Otherwise, it PASSES*

6.4   Testing for the Enhanced Antenna Pattern Feature

6.4.1   *Definition, Applicability, and Scope of the Test Case*

This section explains test steps, conditions, and procedures to verify that SAS supporting the enhanced antenna pattern feature correctly calculates the CBSD antenna gain toward a receiver based on Annex 5 in TS-1001 [n.15].

6.4.2   *Test Characteristics*

Table 6-4: Enhanced Antenna Pattern Procedure Test Characteristics

1	**Test ID**	WINNF.FT.S.REL2.NRI.EAP
2	**Title**	Enhanced Antenna Pattern Test
3	**Working Group / Entity**	WG1, WG3, WG5
4	**Test Type**	Functionality
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD $\leftarrow \rightarrow$ SAS
7	**Target Specification / Feature**	[n.4, n.11, n.18]

6.4.3   *Method of test*

A special test API is used for these tests so that the SAS UUT can be triggered to calculate CBSD antenna gains in certain directions using the Enhanced Antenna Pattern feature. The API shall be used to execute the test cases outlined in this section to validate SAS UUT implementation of the Enhanced Antenna Pattern feature. To execute these tests, the Admin NRI Test Harness shall first register a CBSD supporting the Enhanced Antenna Pattern feature with the SAS UUT using the SAS-CBSD interface. The Admin NRI Test Harness then sends the SAS UUT the location(s) of the receiver(s) through the test API. After receiving the receiver location(s) from the Admin NRI Test Harness, the SAS UUT shall compute the CBSD antenna gain toward each receiver and send the results back to the Admin NRI Test Harness through the test API. The Main NRI Test Harness calculates the CBSD antenna gains with the same configurations using the reference implementation. The SAS UUT passes the test if the calculated antenna gains are within a certain range of the results calculated by the reference implementation. This test can be configured differently to test different scenarios. It is recommended to test with a large number of receiver points at one time.

6.4.3.1   Initial Conditions / Test Pre-conditions

6.4.3.2   *Test Tools Required*

The test API used for these tests includes two parts. The first part allows the Admin NRI Test Harness to send the receiver location(s) in latitude, longitude and height to the SAS UUT. The second part allows the SAS UUT to send the antenna gain(s) in dBi toward each receiver to the Admin NRI Test Harness.

The CBSD Antenna Pattern database is required for the SAS UUT to access necessary antenna pattern information in the following tests. The CBSD Antenna Pattern database needs to be configured differently for different test cases.

6.4.4   Test Procedure

6.4.4.1   [WINNF.FT.S.REL2.NRI.EAP.1] Antenna gain calculation using the release 1 method

The purpose of this test is to verify that the SAS UUT uses release 1 antenna gain calculation under certain conditions.

Step	Instructions
1	Configure the CBSD Antenna Pattern database such that there is no record whose *antennaPatternId* matches the value of *antennaModel*. The CBSD NRI Test Harness initiates the CBSD Registration procedure for one CBSD with the SAS UUT. In the Registration Request, • CBSD indicates support of the Enhanced Antenna Pattern feature. • *antennaVerticalBeamwidth* is not provided. • *antennaModel* is provided. • All Required and REG-Conditional parameters are provided correctly.
CHECK	The SAS UUT indicates support of the Enhanced Antenna Pattern feature in the Registration Response with a SUCCESS response code.
2	The Admin NRI Test Harness sends a list of receiver locations to the SAS UUT.
3	The Main NRI Test Harness calculates the CBSD antenna gains toward the list of receivers using the reference implementation based on REL2-R3-SGN-52102(e) [n.15].
CHECK	• The SAS UUT sends the CBSD antenna gains in dBi toward receiver locations received from the Admin NRI Test Harness. • The CBSD antenna gain calculated by the SAS UUT shall be no less than the CBSD antenna gain calculated by the reference implementation minus 0.2 dB. • The CBSD antenna gain calculated by the SAS UUT shall be no more than the CBSD antenna gain calculated by the reference implementation plus 0.2 dB. *If any of the above conditions do not hold for at least 99.9% of trials (A trial is calculation of antenna gain toward one single receiver location), the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.2 [WINNF.FT.S.REL2.NRI.EAP.2] Antenna gain calculation using the horizontal antenna pattern

The purpose of this test is to verify that the SAS UUT uses the horizontal antenna pattern to calculate the CBSD antenna gains under certain conditions.

Step	Instructions
1	Configure the CBSD Antenna Pattern database such that the record whose *antennaPatternId* matches the value of *antennaModel* has the horizontal pattern available at the location specified in *azimuthRadiationPattern*. *elevationRadiationPattern* and *twoDimRadiationPattern* are not provided in the record. The CBSD NRI Test Harness initiates the CBSD Registration procedure for one CBSD with the SAS UUT and completes the Registration procedure successfully. In the Registration Request, • CBSD indicates support of the Enhanced Antenna Pattern feature. • *antennaVerticalBeamwidth* is not provided. • *antennaModel* is provided. • All Required and REG-Conditional parameters are provided correctly.
CHECK	The SAS UUT indicates support of the Enhanced Antenna Pattern feature in the Registration Response with a SUCCESS response code.
2	The Admin NRI Test Harness sends a list of receiver locations to the SAS UUT.
3	The Main NRI Test Harness calculates the CBSD antenna gains toward the list of receivers using the reference implementation based on REL2-R3-SGN-52102(d) [n.15].
CHECK	• The SAS UUT sends the CBSD antenna gains in dBi toward receiver locations received from the Admin NRI Test Harness. • The CBSD antenna gain calculated by the SAS UUT shall be no less than the CBSD antenna gain calculated by the reference implementation minus 0.2 dB. • The CBSD antenna gain calculated by the SAS UUT shall be no more than the CBSD antenna gain calculated by the reference implementation plus 0.2 dB. *If any of the above conditions do not hold for at least 99.9% of trials (A trial is calculation of antenna gain toward one single receiver location), the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.3 [WINNF.FT.S.REL2.NRI.EAP.3] Antenna gain calculation using the horizontal and vertical beamwidths

The purpose of this test is to verify that the SAS UUT uses the horizontal and the vertical beamwidths to calculate the CBSD antenna gains under certain conditions.

Step	Instructions
1	The CBSD Antenna Pattern database is not used in this test. The CBSD NRI Test Harness initiates the CBSD Registration procedure for one CBSD with the SAS UUT and completes the Registration procedure successfully. In the Registration Request, • CBSD indicates support of the Enhanced Antenna Pattern feature. • *antennalBeamwidth* is provided. • *antennaVerticalBeamwidth* is provided. • *antennaModel* is not provided. • All Required and REG-Conditional parameters are provided correctly.
CHECK	The SAS UUT indicates support of the Enhanced Antenna Pattern feature in the Registration Response with a SUCCESS response code.
2	The Admin NRI Test Harness sends a list of receiver locations to the SAS UUT.
3	The Main NRI Test Harness calculates the CBSD antenna gains toward the list of receivers using the reference implementation based on REL2-R3-SGN-52102(c) [n.15].
CHECK	• The SAS UUT sends the CBSD antenna gains in dBi toward receiver locations received from the Admin NRI Test Harness. • The CBSD antenna gain calculated by the SAS UUT shall be no less than the CBSD antenna gain calculated by the reference implementation minus 0.2 dB. • The CBSD antenna gain calculated by the SAS UUT shall be no more than the CBSD antenna gain calculated by the reference implementation plus 0.2 dB. *If any of the above conditions do not hold for at least 99.9% of trials (A trial is calculation of antenna gain toward one single receiver location), the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.4.4.4 [WINNF.FT.S.REL2.NRI.EAP.4] Antenna gain calculation using the horizontal and vertical antenna patterns

The purpose of this test is to verify that the SAS UUT uses the horizontal and the vertical antenna patterns to calculate the CBSD antenna gains under certain conditions.

Step	Instructions
1	Configure the CBSD Antenna Pattern database such that the record whose *antennaPatternId* matches the value of *antennaModel* has the horizontal pattern available at the location specified in *azimuthRadiationPattern* and the vertical antenna pattern available at the location specified in *elevationRadiationPattern*. *twoDimRadiationPattern* is not provided in the record.

	The CBSD NRI Test Harness initiates the CBSD Registration procedure for one CBSD with the SAS UUT and completes the Registration procedure successfully. In the Registration Request, • CBSD indicates support of the Enhanced Antenna Pattern feature. • • *antennaModel* is provided. • All Required and REG-Conditional parameters are provided correctly.
CHECK	The SAS UUT indicates support of the Enhanced Antenna Pattern feature in the Registration Response with a SUCCESS response code.
2	The Admin NRI Test Harness sends a list of receiver locations to the SAS UUT.
3	The Main NRI Test Harness calculates the CBSD antenna gains toward the list of receivers using the reference implementation based on REL2-R3-SGN-52102(b) [n.15].
CHECK	• The SAS UUT sends the CBSD antenna gains in dBi toward receiver locations received from the Admin NRI Test Harness. • The CBSD antenna gain calculated by the SAS UUT shall be no less than the CBSD antenna gain calculated by the reference implementation minus 0.2 dB. • The CBSD antenna gain calculated by the SAS UUT shall be no more than the CBSD antenna gain calculated by the reference implementation plus 0.2 dB. *If any of the above conditions do not hold for at least 99.9% of trials (A trial is calculation of antenna gain toward one single receiver location), the SAS UUT FAILS this test. Otherwise, it PASSES.*

6.5 CPE-CBSD Indicator Handling Procedure

6.5.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures to test the conformance of a SAS that supports the Release 2 feature CPE CBSD Indicator (FID: WF_CPE_CBSD_INDICATOR).

6.5.2 Test Characteristics

Table 6-5: CPE-CBSD Indicator Test Characteristics

1	**Test ID**	WINNF.PT.S.REL2.NRI.CPE
2	**Title**	CPE-CBSD Indicator
3	**Working Group / Entity**	WG3
4	**Test Type**	Protocol
5	**Test Class**	Certification
6	**Component / Interface**	SAS / CBSD ← → SAS
7	**Target Specification**	[n.4]

6.5.3 Method of test

6.5.3.1 Initial Conditions / Test Pre-conditions

1. All the message exchanges between the SAS UUT and the CBSD/DP NRI 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.

6.5.4 Test Procedure

6.5.4.1 [WINNF.PT.S.REL2.NRI.CPE.1]: Registration and Feature Capability Exchange of Release 2 CBSDs supporting the CPE CBSD Indicator feature.

This test case aims to test the conformance of a Release 2 SAS to successfully perform the Registration procedure and Feature Capability Exchange procedure with a Release 2 CBSD supporting the CPE CBSD Indicator feature.

Step	Instructions
1	• Ensure no *cbsdIds* exists in the SAS for the 3 CBSDs being tested. • All REG-Conditional parameters for the CBSDs shall already be pre-loaded into the SAS UUT except cbsdFeatureCapabilityList.
2	The NRI Test Harness sends Registration Requests for 3 CBSDs to the SAS UUT For all CBSDs • The Registration Request is in proper format and parameters are within acceptable ranges.

	For CBSD1:
	cbsdFeatureCapabilityList is included with FID: WF_CPE_CBSD_INDICATOR *cpeCbsdIndication* is included with value set to TRUE. For CBSD2: *cbsdFeatureCapabilityList* is included with FID: WF_CPE_CBSD_INDICATOR *cpeCbsdIndication* is included with value set to FALSE. For CBSD3: *cbsdFeatureCapabilityList* is included with FID: WF_CPE_CBSD_INDICATOR *cpeCbsdIndication* is **not** included
CHECK	SAS UUT approves the request and sends a Registration Response as follows: - The Registration Response includes valid *cbsdIds* for CBSD 1 and CBSD 2. - The *responseCode* parameter is 0 (SUCCESS) indicating an approved Registration for CBSD 1 and CBSD 2. - The *responseCode* parameter is 102 (MISSING_PARAM) for CBSD 3.
3	The NRI Test Harness sends Feature Capability Exchange Request for CBSD 1 and CBSD 2. For all CBSDs - The Feature Capability Exchange Request is in proper format and parameters are within acceptable ranges. For CBSD 1, a *cbsdFeatureInfo* object is included with *featureId set to* : WF_CPE_CBSD_INDICATOR *cbsdFeatureData* is included with *cpeCbsdIndication* set to FALSE. For CBSD 2, a *cbsdFeatureInfo* object is included with *featureId set to* : WF_CPE_CBSD_INDICATOR *cbsdFeatureData* is included with *cpeCbsdIndication* **not** included.
CHECK	SAS UUT approves the request and sends a Feature Capability Exchange Response as follows:

- The *responseCode* parameter is 0 (SUCCESS) for CBSD 1.
- The *responseCode* parameter is 102 (MISSING_PARAM) for CBSD 2.

7 SAS-SAS Interface Conformance Test Specifications

7.1 SAS-SAS Full Activity Dump Message

7.1.1 Definition, Applicability, and Scope of the Test Case

This section provides test steps, conditions, and procedures of test cases for SAS Release 2 implementation of the Full Activity Dump exchange procedure. SAS UUT shall have valid certificates and information to send message to SAS NRI Test Harness, and vice versa.

7.1.2 Test Characteristics

Table 7-1 SAS-SAS Full Activity Dump Test Characteristics

1	**Test ID**	WINNF.PT.S.REL2.NRI.FAD
2	**Title**	SAS-SAS Full Activity Dump Message
3	**Working Group / Entity**	WG3
4	**Test Type**	Protocol
5	**Test Class**	Certification
6	**Component / Interface**	SAS / SAS ← → SAS
7	**Target Specification / Feature**	[n.4]

7.1.3 Method of test

7.1.3.1 Initial Conditions / Test Pre-conditions

- SAS UUT can establish a TLS session with SAS NRI 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 NRI 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.6, R2-ISC-07]

- Only NRI features defined in WINNF-TS-3003 [n.12] are used in this test case.

7.1.4 Test Procedure

7.1.4.1 [WINNF.PT.S.REL2.NRI.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 NRI Test Harness, and that responses to all SAS NRI Test Harnesses are consistent.

Step	Instructions
1	Use Admin NRI Test Harness to configure the SAS UUT to whitelist N1 > 0 FCC IDs and N1 user IDs.
2	Admin NRI Test Harness injects SAS Feature Capability Record into SAS UUT that includes *SasFeatureCapability* object containing an array of *featureCapabilityList* Operationally-Supported by SAS UUT.
3	Send a valid Registration Request Message for N1 CBSDs to the SAS UUT. Verify that the SAS UUT *responseCode* for each *registrationRequest* is SUCCESS.
4	Admin NRI Test Harness injects information about N2 > 0 PPAs into the SAS UUT.
5	Send a valid Grant Request Message with N1 elements (one per registered CBSD). Verify that the *responseCode* for each is SUCCESS.
6	Admin NRI Test Harness injects information about N3 > 0 ESC sensors into the SAS UUT.
7	Notify the SAS UUT about N4 > 0 SAS NRI Test Harnesses
8	Trigger the SAS UUT to generate a Full Activity Dump.
9	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.*
10	The first SAS NRI 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 all Operationally-Supported FIDs are included • 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.6, R2-ISC-06, R2-ISC-07] is included. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, PROCEED.*
11	If N4 > 1, the remaining SAS NRI Test Harnesses retrieve all of the data in the Full Activity Dump from the SAS UUT.

CHECK	The data retrieved by each SAS NRI Test Harness is consistent with the data retrieved in Step 10. *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

7.1.4.2 [WINNF.PT.S.REL2.NRI.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 UUT to whitelist the FCC IDs and user IDs that will be used in Steps 5 and 9 and the FCC IDs that will be used in Steps 4 and 8.
2	Configure the SAS NRI Test Harness with an array of Operationally-Supported FIDs
3	Configure the SAS NRI Test Harness with information about 1 ESC sensor.
4	Configure the SAS NRI 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 6.
5	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.
6	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 NRI Test Harness and executing IAP, the EIRP will need to be reduced. Verify that the *responseCode* is SUCCESS.
7	Configure the SAS NRI Test Harness with information about 1 PPA.
8	Configure the SAS NRI 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 10.
9	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.
10	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 NRI 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.
11	Send a valid Heartbeat Request Message for Grants G2 and G4.
12	Notify the SAS UUT about the SAS NRI Test Harness.
13	Trigger CPAS in the SAS UUT. Verify that the CPAS have completed.
CHECK	The FAD Data retrieved by SAS UUT shall include exactly all Operationally-Supported FIDs in Step 2 for the SAS NRI Test Harness

	If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, PROCEED.
14	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. The Data retrieved by SAS UUT shall include exactly all Operationally-Supported FIDs in Step 2 *If the any of the above conditions is not met, the SAS FAILS this test. Otherwise, it PASSES.*

8 Appendix A (Informative) Document History

Table 8-1: Document History

Document history		
V1.0.0	3 May 2021	Initial release