



Test Lab
Cert 2764.01

Test report No:
NIE: 02590BRCB.004A2

Test report

Test and Certification for Citizens

Broadband Radio Service (CBRS): WINNF-TS-0122

Identification of item tested	CPE9000-PRO-1D-3X
Trademark	Telrad
Model and /or type reference	WLTMS-110_B48
Other identification of the product	FCC ID: ARA-CPE9KPRO3XHG
Features	4G TD LTE
Final HW Version:	Not provided
Final SW Version:	CPE-CBSD: 01.01.02.133.10 DP: 7.0.0.028
Manufacturer	Telrad Network LTD 1 Bat-Sheva St, Lod Israel 7116002
Test method requested, standard	WINNF-TS-0122
Approved by (name / position & signature)	Gonzalo Casado Lab Manager
Date of issue	2020-April-23
Report template No	FDT08_22

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Competences and guarantees

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Abbreviations

Abbreviation	Meaning
CBRS	Citizens Broadband Radio Services
CBSD	Citizens Broadband Radio Service Device
DP	Domain Proxy
DUT	Device Under Test
SAS	Spectrum Access System
UUT	Unit Under Test
CPI	Certified Professional Installer
N/A	Not Applicable

Usage of samples

Samples undergoing test have been selected by: the client

Sample M/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
02209.002	CPE-CBSD	WLMS-110	GMK171204000024	05/11/2018
N/A	DOMAIN PROXY	Breeze View	N/A	05/11/2018

1. Sample M/01 has undergone the test(s) specified in subclause “Test method requested”.

Supported Features

Condition	Feature Description	Supported
C1	Mandatory for UUT which supports multi-step registration message.	Y
C2	Mandatory for UUT which supports single-step registration with no CPI-signed data in the registration message. By definition, this is a subset of Category A devices which determine all registration information, including location, without CPI intervention.	N
C3	Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message.	N
C4	Mandatory for UUT which supports RECEIVED_POWER_WITHOUT_GRANT measurement report type.	N
C5	Mandatory for UUT which supports RECEIVED_POWER_WITH_GRANT measurement report type.	Y
C6	Mandatory for UUT which supports parameter change being made at the UUT and prior to sending a deregistration.	N

Identification of the client

Telrad Network LTD
1st Bath-Sheva St, Lod Israel 7116002

Testing period and place

Test Location	DEKRA Certification Inc 405 Glenn Drive, Suite 12, Sterling, Virginia, USA, 20164
Date (start)	2018-May-23
Date (finish)	2018-May-26

Document history

Report number	Date	Description
02590bRCB.004	2020-Apr-02	First release
02590bRCB.004A1	2020-Apr-07	Second release(Modifications performed are described in the subclause “Modifications to the reference test report”)
02590bRCB.004A2	2020-Apr-23	Third release(Modifications performed are described in the subclause “Modifications to the reference test report”)

Modifications to the reference test report

It was introduced the following modifications in respect to the test report number 2590RCB.004A1 related with the same samples, in the next clauses and sub-clauses:

Clauses/ Sub-Clauses	Modification	Justification
Appendix A	Test Verdicts and Test Summary sections moved to Appendix B	Added for clarification purposes

Remarks and comments

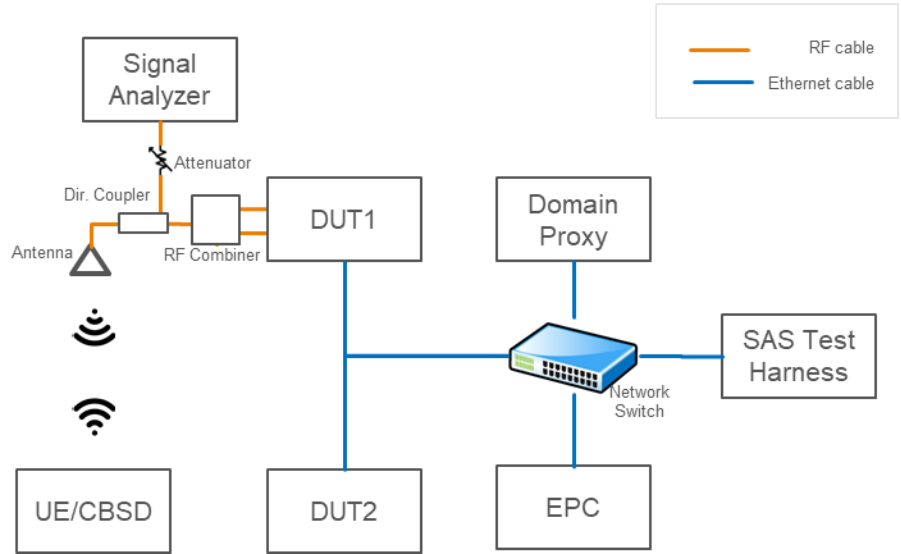
Testing performed by Vinayak Thotton

List of equipment used during the test

Description	Model	Test Equipment		
		Control Number	SW Version	Serial Number
Signal Analyzer	MXAN9010A	0018	A.12.13	MY47191206
Test SAS Harness	N/A	N/A	V1.0.2	N/A

Test Setup Diagram

Domain Proxy Configuration



Appendix A: Test results

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Test Results Summary

Test Cases Verdicts	Number of Test Cases
Pass :	33
Total Number of Test Cases	33

The following test cases were performed, and results are reported from the information verified automatically with the WinnForum SAS Test Harness tool.

Ref	Name	Date	Test sample	Result
WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	6/21/2018	02209.002	P
WINNF.FT.C.REG.7	Registration due to change of an installation parameter	6/21/2018	02209.002	P
WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	6/21/2018	02209.002	P
WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	6/21/2018	02209.002	P
WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	6/21/2018	02209.002	P
WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	6/21/2018	02209.002	P
WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	6/21/2018	02209.002	P
WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	6/21/2018	02209.002	P
WINNF.FT.D.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	6/21/2018	02209.002	P
WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	6/21/2018	02209.002	P
WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	6/21/2018	02209.002	P
WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	6/21/2018	02209.002	P
WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	6/21/2018	02209.002	P

WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TERMINATED_GRANT)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	6/21/2018	02209.002	P
WINNF.FT.C.HBT.11	Successful Grant Renewal in Heartbeat Test Case	6/21/2018	02209.002	P
WINNF.FT.C.MES.3	Grant Response contains measReportConfig	6/26/2018	02209.002	P
WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	6/22/2018	02209.002	P
WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	6/22/2018	02209.002	P
WINNF.FT.D.RLQ.4	Domain Proxy Unsuccessful Relinquishment, responseCode=102	6/22/2018	02209.002	P
WINNF.FT.D.RLQ.6	Domain Proxy Unsuccessful Relinquishment, responseCode=103	6/22/2018	02209.002	P
WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	6/22/2018	02209.002	P
WINNF.FT.D.DRG.4	Domain Proxy Deregistration responseCode=102	6/22/2018	02209.002	P
WINNF.FT.C.DRG.5	Deregistration responseCode=103	6/22/2018	02209.002	P
WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	5/23/2018	02209.002	P
WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	5/23/2018	02209.002	P
WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	5/23/2018	02209.002	P
WINNF.FT.C.SCS.4	TLS failure when SAS Test Harness certificate is issue by unknown CA	5/23/2018	02209.002	P
WINNF.FT.C.SCS.5	TLS failure when certificate at the SAS Test Harness is corrupted	5/23/2018	02209.002	P

WINNF.PT.C.HBT	UUT RF Transmit Power Measurement	5/23/2018	02209.002	P
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Appendix B: Test Cases Details

1) [WINNF.FT.D.REG.2] Domain Proxy Multi-Step registration

This test is mandatory for the Domain proxy that is controlling CBSDs which support multi-step registration. This test validates that each of the required parameters appear within the registration request message. This test case applies to Domain Proxy supervising two CBSDs. The following are the test execution steps:

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none">• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness• UUT is in the Unregistered state

2	<p>DP with two CBSD sends correct Registration request information, as specified in [n.5], in the form of one 2-element Array or as individual messages to the SAS Test Harness:</p> <ul style="list-style-type: none"> • The required <i>userId</i>, <i>fccId</i> and <i>cbsdSerialNumber</i> registration parameters shall be sent for each CBSD and conform to proper format and acceptable ranges. • Any REG-conditional or optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges. <p>Note: It is outside the scope of this document to test the Registration information that is supplied via another means.</p>
3	<ul style="list-style-type: none"> • SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or individual messages as follows: <ul style="list-style-type: none"> – <i>cbsdId</i> = Ci – <i>measReportConfig</i> shall not be included – <i>responseCode</i> = 0 for each CBSD
4	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
5	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <ul style="list-style-type: none"> • UUT shall not transmit RF

2) [WINNF.FT.D.REG.6] Domain Proxy Single-Step registration for CBSD with CPI signed data

This test is mandatory for DP with CBSDs which report all Required and REG-Conditional parameters in the Registration request to the SAS using CPI signed data. This test validates that each of the required and REG-Conditional parameters appear within the registration request message. This test case applies to Domain Proxy supervising two CBSDs.

All Category B devices, and Category A devices not able to determine its own location require installation by a CPI. This test is for devices where the CPI enters data into the CBSD and this information along with the CPI signature are sent in the request message. Excluded from this test are devices which require the CPI to enter the information into a SAS interface. These devices would follow the multiple step registration test [WINNF.FT.D.REG.2].

The following are the test execution steps:

#	Test Execution Steps
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1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none">• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness• UUT is in the Unregistered state• All of the required and REG-Conditional parameters shall be configured and CPI signature provided
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2	<p>The DP with two CBSDs sends Registration requests in the form of one 2-element Array or as individual messages to the SAS Test Harness:</p> <ul style="list-style-type: none"> • The required <i>userId</i>, <i>fccId</i> and <i>cbsdSerialNumber</i> and REG- Conditional <i>cbsdCategory</i>, <i>airInterface</i>, <i>measCapability</i> and <i>cpiSignatureData</i> registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges. • Any optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges.
3	<ul style="list-style-type: none"> • SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – <i>cbsdId</i> = Ci – <i>measReportConfig</i> for each CBSD shall not be included. – <i>responseCode</i> = 0 for each CBSD
4	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
5	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <ul style="list-style-type: none"> • UUT shall not transmit RF

If a waiver for the measurement capability has been obtained from the FCC for the CBSD, the WINNF.FT.D.REG.6_waiver test case shall be executed which is the same as above, but where *measCapability* is not required in the request message.

3) [WINNF.FT.D.REG.9] Domain Proxy Missing Required parameters (*responseCode* 102)

This test case applies to Domain Proxy supervising two CBSDs. The following are the test execution steps where the Registration response contains *responseCode* (Ri) = 102 for each CBSD:

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	<p>The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.</p>
3	<p>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows:</p> <ul style="list-style-type: none"> – SAS response does not include a <i>cbsdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2

4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

4) [WINNF.FT.D.REG.11] Domain Proxy Pending registration (*responseCode* 200)

The same steps provided for WINNF.FT.D.REG.9 shall be executed for this test, with the exception that the Registration response contains *responseCode* (Ri) = 200 for each CBSD.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – SAS response does not include a <i>cbstdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

5) [WINNF.FT.D.REG.13] Domain Proxy Invalid parameters (*responseCode* 103)

The same steps provided for WINNF.FT.D.REG.9 shall be executed for this test, with the exception that the Registration response contains *responseCode* R1 = 0 for CBSD1 and R2 = 103 for CBSD2.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.

3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – SAS response does not include a <i>cbsdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

6) [WINNF.FT.D.REG.15] Domain Proxy Blacklisted CBSD (responseCode 101)

The same steps provided for WINNF.FT.D.REG.9 shall be executed for this test, with the exception that the Registration response contains *responseCode* R1 = 0 for CBSD1 and R2 = 101 for CBSD2.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – SAS response does not include a <i>cbsdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

7) [WINNF.FT.D.REG.17] Domain Proxy Unsupported SAS protocol version (responseCode 100)

The same steps provided for WINNF.FT.D.REG.9 shall be executed for this test, with the exception that the Registration response contains *responseCode* (Ri) = 100 for each CBSD.

#	Test Execution Steps
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1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – SAS response does not include a <i>cbsdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

8) [WINNF.FT.D.REG.19] Domain Proxy Group Error (responseCode 201)

The registrationRequest groupingParam is an optional field and will be validated by the SAS Test Harness if provided in the Registration Request message. This test will validate that the CBSD will remain Unregistered after receiving responseCode 201.

The same steps provided for WINNF.FT.D.REG.9 shall be executed for this test, with the exception that the Registration response contains *responseCode* R1 = 0 for CBSD1 and R2 = 201 for CBSD2.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> – SAS response does not include a <i>cbsdId</i>. – <i>responseCode</i> = Ri for CBSD1 and CBSD2
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

9) [WINNF.FT.C.GRA.1] Unsuccessful Grant *responseCode=400* (INTERFERENCE) The following steps describe the test execution where the Grant response contains *responseCode* (R) = 400.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness, with <i>cbstdId = C</i>
2	UUT sends valid Grant Request.
3	SAS Test Harness sends a Grant Response message, including <ul style="list-style-type: none"> • <i>cbstdId=C</i> • <i>responseCode = R</i>
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode=0</i>) to further request messages from the UUT.

5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF
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10) WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401
(GRANT_CONFLICT)

The same steps provided for WINNF.FT.C.GRA.1 shall be executed for this test, with the exception that the Grant response contains *responseCode* (R) = 401.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness, with <i>cbsdId</i> = C
2	UUT sends valid Grant Request.
3	SAS Test Harness sends a Grant Response message, including <ul style="list-style-type: none"> • <i>cbsdId</i>=C • <i>responseCode</i> = R
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.

5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF
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11) [WINNF.FT.D.HBT.2] Domain Proxy Heartbeat Success Case (first Heartbeat Response)

This test case incorporates validation of successful Spectrum Inquiry messaging (if present) and successful Grant messaging into the Heartbeat Success case.

This test case applies to Domain Proxy supervising two CBSDs. The

following are the test execution steps.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry:

	<ul style="list-style-type: none"> DP has two CBSD registered successfully with SAS Test Harness, with $cbsdId = C_i, i=\{1,2\}$
2	<p>DP sends a message:</p> <ul style="list-style-type: none"> If message is a Spectrum Inquiry Request, go to step 3 If message is a Grant Request, go to step 5
3	<p>DP sends a Spectrum Inquiry Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Spectrum Inquiry Request message is formatted correctly for each CBSD, including for $CBSD_i, i=\{1,2\}$:</p> <ul style="list-style-type: none"> $cbsdId = C_i$ List of frequencyRange objects sent by DP are within the CBRS frequency range
4	<p>If a separate Spectrum Inquiry Request message was sent for each CBSD, the SAS Test Harness shall respond to each Spectrum Inquiry Request message with a separate Spectrum Inquiry Response message.</p> <p>If a single Spectrum Inquiry Request message was sent containing a 2- object array (one per CBSD), the SAS Test Harness shall respond with a single Spectrum Inquiry Response message containing a 2-object array.</p> <p>Verify parameters for each CBSD within the Spectrum Inquiry Response message are as follows, for $CBSD_i, i=\{1,2\}$:</p> <ul style="list-style-type: none"> $cbsdId = C_i$ availableChannel is an array of availableChannel objects $responseCode = 0$
5	<p>DP sends a Grant Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Grant Request message is formatted correctly for each CBSD, including for $CBSD_i, i=\{1,2\}$:</p> <ul style="list-style-type: none"> $cbsdId = C$ maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 operationFrequencyRange, F_i, sent by UUT is a valid range within the CBRS band
6	<p>If a separate Grant Request message was sent for each CBSD, the SAS Test Harness shall respond to each Grant Request message with a separate Grant Response message.</p>

	<p>If a single Grant Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Grant Response message containing a 2-object array.</p> <p>Verify parameters for each CBSD within the Grant Response message are as follows, for CBSDi, i={1,2}:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>grantId</i> = Gi = a valid grant ID • <i>grantExpireTime</i> = UTC time greater than duration of the test • <i>responseCode</i> = 0
7	<p>Ensure DP sends first Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify Heartbeat Request message is formatted correctly for each CBSD, including, for CBSDi i={1,2}:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci, i={1,2} • <i>grantId</i> = Gi, i={1,2} • <i>operationState</i> = "GRANTED"
8	<p>If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message.</p> <p>If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array.</p> <p>Verify parameters for each CBSD within the Heartbeat Response message are as follows, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>grantId</i> = Gi • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0

9	<p>For further Heartbeat Request messages sent from DP after completion of step 8, validate message is sent within latest specified heartbeatInterval for CBSDi:</p> <ul style="list-style-type: none">• <i>cbsdId</i> = Ci• <i>grantId</i> = Gi• <i>operationState</i> = "AUTHORIZED" <p>and SAS Test Harness responds with a Heartbeat Response message including the following parameters, for CBSDi</p> <ul style="list-style-type: none">• <i>cbsdId</i> = Ci• <i>grantId</i> = Gi• <i>transmitExpireTime</i> = current UTC time + 200 seconds
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	<ul style="list-style-type: none"> • <i>responseCode</i> = 0
10	<p>Monitor the RF output of the UUT from start of test until UUT transmission commences. Monitor the RF output of the UUT from start of test until RF transmission commences. Verify:</p> <ul style="list-style-type: none"> • UUT does not transmit at any time prior to completion of the first heartbeat response • UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range Fi.

12) [WINNF.FT.C.HBT.3] Heartbeat responseCode=105 (DEREGISTER) The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface
2	<p>UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED"
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G

	<ul style="list-style-type: none"> • <i>transmitExpireTime</i> = <i>T</i> = Current UTC time • <i>responseCode</i> = 105 (DEREGISTER)
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.
5	Monitor the RF output of the UUT. Verify: <ul style="list-style-type: none"> • UUT shall stop transmission within (T + 60 seconds) of completion of step 3

13) [WINNF.FT.C.HBT.5] Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response

The following are the test execution steps.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request)
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED"
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = current UTC time • <i>responseCode</i> = 501 (SUSPENDED_GRANT)
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.

5	<p>Monitor the SAS-CBSD interface. Verify either A OR B occurs:</p> <p>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED" <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT does not transmit at any time
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14) [WINNF.FT.C.HBT.6] Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface
2	<p>UUT sends a Heartbeat Request message. Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED"
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = current UTC time • <i>responseCode</i> = 501 (SUSPENDED_GRANT)

4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.
5	<p>Monitor the SAS-CBSD interface. Verify either A OR B occurs:</p> <p>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED" <p>B. UUT sends a Relinquishment Request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p>

	<ul style="list-style-type: none"> • UUT shall stop transmission within ($T + 60$ seconds) of completion of step 3
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15) [WINNF.FT.C.HBT.7] Heartbeat responseCode=502 (UNSYNC_OP_PARAM) The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface
2	<p>UUT sends a Heartbeat Request message. Verify Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i>, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED"
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = Current UTC Time • <i>responseCode</i> = 502 (UNSYNC_OP_PARAM)
4	<p>After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.</p>
5	<p>Monitor the SAS-CBSD interface. Verify:</p> <ul style="list-style-type: none"> • UUT sends a Grant Relinquishment Request message. Verify message is correctly formatted with parameters: <ul style="list-style-type: none"> ○ <i>cbdsId</i> = C ○ <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop transmission within (T+60) seconds of completion of step 3.

16) [WINNF.FT.D.HBT.8] Domain Proxy Heartbeat responseCode=500 (TERMINATED_GRANT)

This test case applies to Domain Proxy supervising two CBSDs. The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has two CBSD registered successfully with SAS Test Harness • Each CBSD {1,2} has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = Ci, i={1,2} ○ valid <i>grantId</i> = Gi, i={1,2} ○ grant is for frequency range Fi, power Pi ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • Both CBSD are in AUTHORIZED state and transmitting within their granted bandwidth on RF interface
2	<p>DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of size 2.</p> <p>Verify Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i>, and is formatted correctly for each CBSD, including, for CBSDi i={1,2}:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci, i = {1,2} • <i>grantId</i> = Gi, i = {1,2} • <i>operationState</i> = "AUTHORIZED"
3	<p>If separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message.</p> <p>If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Heartbeat Response message should be as follows, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>grantId</i> = Gi • For CBSD1: <ul style="list-style-type: none"> ○ <i>transmitExpireTime</i> = current UTC time + 200 seconds
Report No:	<p>(NIE) 02590BRCB.004A2P <ul style="list-style-type: none"> • For CBSD2: <ul style="list-style-type: none"> ○ <i>transmitExpireTime</i> = T = current UTC time </p>

	o <i>responseCode</i> = 500 (TERMINATED_GRANT)
4	<p>After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.</p> <p>If CBSD sends further Heartbeat Request messages for CBSD1, SAS Test Harness shall respond with a Heartbeat Response message with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C1 • <i>grantId</i> = G1 • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0 • Heartbeat Request message is within <i>heartbeatInterval</i> of previous Heartbeat Request message
5	<p>Monitor the RF output of CBSD2. Verify:</p> <ul style="list-style-type: none"> • CBSD2 shall stop transmission within bandwidth F2 within (T + 60 seconds) of completion of step 3

17) [WINNF.FT.C.HBT.9] Heartbeat Response Absent (First Heartbeat) The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test • UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request)
2	<p>UUT sends a Heartbeat Request message.</p> <p>Ensure Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i>, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G

19) [WINNF.FT.C.HBT.11] Successful Grant Renewal in Heartbeat Test Case The following are the test execution steps.

#	Test Execution Steps
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> ● UUT has registered successfully with SAS Test Harness ● UUT has a valid single grant as follows: <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface. ● Grant has the following parameters at the start of the test: <ul style="list-style-type: none"> ○ <i>grantExpireTime</i> = UTC time equal to time at start of test + 300 seconds = Tgrant_expire ○ <i>transmitExpireTime</i> = UTC time equal to time at start of test + 200 seconds ○ <i>heartbeatInterval</i> = 60 seconds
2	UUT sends a Heartbeat Request message. If Heartbeat Request message contains grantRenew = TRUE, go to Step 6, else go to Step 3.
3	Verify Heartbeat Request message is sent within the latest specified <i>heartbeatInterval</i> , and is formatted correctly, including: <ul style="list-style-type: none"> ● <i>cbsdId</i> = C ● <i>grantId</i> = G ● <i>operationState</i> = "AUTHORIZED"
4	SAS Test Harness sends a Heartbeat Response message, with the following parameters: <ul style="list-style-type: none"> ● <i>cbsdId</i> = C ● <i>grantId</i> = G ● <i>transmitExpireTime</i> = current UTC + 200 seconds ● <i>grantExpireTime</i> = same as Step 1 ● <i>responseCode</i> = 0
5	Go to Step 2
6	Verify Heartbeat Request message is sent within the latest specified <i>heartbeatInterval</i> , and is formatted correctly, including: <ul style="list-style-type: none"> ● <i>cbsdId</i> = C ● <i>grantId</i> = G
	<ul style="list-style-type: none"> ● <i>operationState</i> = "AUTHORIZED" ● <i>grantRenew</i> = TRUE

7	<p>SAS Test Harness sends a Heartbeat Response message, with the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdlId</i> = C • <i>grantId</i> = G • <i>grantExpireTime</i> = UTC time set far in the future • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0
8	<p>Continue to respond to any subsequent Heartbeat Request from CBSD with Heartbeat Response with the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdlId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = same as Step 7 • <i>responseCode</i> = 0
9	<p>Monitor RF transmission of UUT from start of test until Tgrant_expire + 60 seconds and ensure UUT continues to transmit throughout the time period.</p>

20) [WINNF.FT.D.MES.2] Domain Proxy Registration Response contains *measReportConfig*

This test case is mandatory for Domain Proxy supervising CBSD which support RECEIVED_POWER_WITHOUT_GRANT.

The following steps describes the test execution steps:

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness

2	<p>DP sends a Registration Request message for each of two CBSD. This may occur in a separate Request message per CBSD, or together in a single Request message with array of 2.</p> <p>Verify Registration Request message contains all required parameters properly formatted for CBSDi, i={1,2}, and specifically:</p> <ul style="list-style-type: none"> • <i>userId</i> is present and correct • <i>fccId</i> is present and correct • <i>cbsdSerialNumber</i> is present and correct • <i>measCapability</i> = "RECEIVED_POWER_WITHOUT_GRANT"
3	<p>If a separate Registration Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Registration Request message with a separate Registration Response message.</p> <p>If a single Registration Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Registration Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Registration Response message should be as follows, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>measReportConfig</i> = "RECEIVED_POWER_WITHOUT_GRANT" • <i>responseCode</i> = 0
4	<p>UUT sends a message:</p> <ul style="list-style-type: none"> • If message is type Spectrum Inquiry Request, go to step 5, or • If message is type Grant Request, go to step 7
5	<p>UUT sends message type Spectrum Inquiry Request. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Spectrum Inquiry Request message contains all required parameters properly formatted for CBSDi, i= {1,2}, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>measReport</i> is present, and is a properly formatted <i>rcvdPowerMeasReport</i>.

6	<p>If a separate Spectrum Inquiry Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Spectrum Inquiry Request message with a separate Spectrum Inquiry Response message.</p> <p>If a single Spectrum Inquiry Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness</p>
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	<p>shall respond with a single Spectrum Inquiry Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Spectrum Inquiry Response message should be as follows:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>availableChannel</i> is an array of <i>availableChannel</i> objects • <i>responseCode</i> = 0
7	<p>UUT sends message type Grant Request message. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify the Grant Request message contains all required parameters properly formatted for CBSDi, i= {1,2}, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>measReport</i> is present, and is a properly formatted <i>rcvdPowerMeasReport</i>.

2I) [WINNF.FT.C.MES.3] Grant Response contains *measReportConfig*

This test case is mandatory for UUT supporting RECEIVED_POWER_WITH_GRANT measurement reports. The following steps describes the test execution steps:

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT has successfully registered with SAS Test Harness, with <i>cbsdId</i>=C and <i>measCapability</i> = "RECEIVED_POWER_WITH_GRANT"
2	<p>UUT sends a Grant Request message. Verify Grant Request message contains all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>operationParam</i> is present and format is valid

3	<p>SAS Test Harness sends a Grant Response message, with the following parameters:</p> <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>grantId</i> = G = valid grant ID• <i>grantExpireTime</i> = UTC time in the future• <i>heartbeatInterval</i> = 60 seconds
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	<ul style="list-style-type: none"> • <i>measReportConfig</i>= “RECEIVED_POWER_WITH_GRANT” • <i>channelType</i> = “GAA” • <i>responseCode</i> = 0
4	<p>UUT sends a Heartbeat Request message. Verify message contains all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = “GRANTED”
5	<p>If Heartbeat Request message (step 4) contains <i>measReport</i> object, then:</p> <ul style="list-style-type: none"> • verify <i>measReport</i> is properly formatted as object <i>rcvdPowerMeasReport</i> • end test, with PASS result <p>else, if Heartbeat Request message (step 4) does not contain <i>measReport</i> object, then:</p> <p style="padding-left: 40px;">If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then stop test with result of FAIL</p>
6	<p>SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0 <p>Go to Step 4, above</p>

22) [WINNF.FT.D.MES.5] Domain Proxy Heartbeat Response contains *measReportConfig*

This test case is mandatory for Domain Proxy supervising CBSD which support RECEIVED_POWER_WITH_GRANT measurement reports.

The following steps describes the test execution steps:

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> ● DP has successfully completed SAS Discovery and Authentication with SAS Test Harness ● DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, <i>i</i>={1,2} and <i>measCapability</i> = "RECEIVED_POWER_WITH_GRANT" ● DP has received a valid grant with <i>grantId</i> = Gi, <i>i</i>={1,2} for each CBSD ● Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. ● Grants have <i>heartbeatInterval</i> =60 seconds
2	<p>Verify DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Heartbeat Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> ● <i>cbsdId</i> = Ci ● <i>grantId</i> = Gi ● <i>operationState</i> = "AUTHORIZED"
3	<p>If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message.</p> <p>If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Heartbeat Response message containing all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> ● <i>cbsdId</i> = Ci ● <i>grantId</i> = Gi ● <i>measReportConfig</i>= "RECEIVED_POWER_WITH_GRANT" ● <i>responseCode</i> = 0
4	<p>Verify DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Heartbeat Request message contains all required parameters properly formatted for each CBSD, and specifically, for CBSDi, <i>i</i> = {1,2}:</p> <ul style="list-style-type: none"> ● <i>cbsdId</i> = Ci ● <i>grantId</i> = Gi ● <i>operationState</i> = "AUTHORIZED"

	<ul style="list-style-type: none"> Check whether <i>measReport</i> is present, and if present, ensure it is a properly formatted <i>rcvdPowerMeasReport</i> object, and record its reception for each CBSDi, $i = \{1,2\}$.
5	<p>If Heartbeat Request message (step 4) contains <i>measReport</i> object, then:</p> <ul style="list-style-type: none"> Verify <i>measReport</i> is properly formatted as object <i>rcvdPowerMeasReport</i> record which CBSD have successfully sent a <i>measReport</i> object <p>If all CBSDi, $i = \{1,2\}$ have successfully sent a <i>measReport</i> object, then</p> <ul style="list-style-type: none"> end test, with PASS result <p>else, if the number of Heartbeat Requests sent per CBSD is 5 or more, then stop test with result of FAIL</p>
6	<p>If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message.</p> <p>If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Heartbeat Response message containing all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> <i>cbsdId</i> = Ci <i>grantId</i> = Gi <i>responseCode</i> = 0 <p>Go to Step 4, above.</p>

23) [WINNF.FT.D.RLQ.2] Domain Proxy Successful Relinquishment The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> DP has successfully completed SAS Discovery and Authentication with SAS Test Harness DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, $i=\{1,2\}$ DP has received a valid grant with <i>grantId</i> = Gi, $i=\{1,2\}$ for each CBSD <p>Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</p> <p>Invoke trigger to relinquish each UUT Grant from the SAS Test Harness</p> <p>Verify DP sends a Relinquishment Request message for each CBSD. This message can be a separate message per CBSD, or together in a single</p>

3	<p>If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Relinquishment Response shall be as follows:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • <i>grantId</i> = Gi • <i>responseCode</i> = 0
4	<p>After completion of step 3, SAS Test Harness will not provide any additional positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
5	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop RF transmission at any time between triggering the relinquishments and UUT sending the relinquishment requests for each CBSD.

24) [WINNF.FT.D.RLQ.4] Domain Proxy Unsuccessful Relinquishment, *responseCode*=102

This test case applies to Domain Proxy supervising two CBSDs. The following are the test execution steps where the Relinquishment response contains *responseCode* (Ri) = 102 for each CBSD.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, i={1,2} • DP has received a valid grant with <i>grantId</i> = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger on UUT to Relinquish Grant from the SAS Test Harness</p>

2	<p>DP with two CBSDs sends Relinquishment Request with two objects to the SAS Test Harness.</p> <p>This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify DP sends a Relinquishment Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify Relinquishment Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none">• <i>cbstdId</i> = Ci• <i>grantId</i> = Gi
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3	<p>If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Relinquishment Response Message shall be as follows:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • No <i>grantId</i> • <i>responseCode</i> = Ri
4	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
5	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <p>A. UUT stopped RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request</p>

25) [WINNF.FT.D.RLQ.6] Domain Proxy Unsuccessful Relinquishment, *responseCode*=103

The same steps provided for WINNF.FT.D.RLQ.4 shall be executed for this test, with the exception that the Relinquishment response contains *responseCode* (Ri) = 103 and *responseData* = “grantId” for each CBSD.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, i={1,2} • DP has received a valid grant with <i>grantId</i> = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger on UUT to Relinquish Grant from the SAS Test Harness</p>

2	<p>DP with two CBSDs sends Relinquishment Request with two objects to the SAS Test Harness.</p> <p>This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify DP sends a Relinquishment Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify Relinquishment Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none">• <i>cbsdId</i> = Ci• <i>grantId</i> = Gi
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3	<p>If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Relinquishment Response Message shall be as follows:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci • No <i>grantId</i> • <i>responseCode</i> = Ri
4	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
5	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <p>A. UUT stopped RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request</p>

26) [WINNF.FT.D.DRG.2] Domain Proxy Successful Deregistration The following are the test execution steps.

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • Each UUT has successfully registered with SAS Test Harness • Each UUT is in the authorized state • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, i={1,2} • DP has received a valid grant with <i>grantId</i> = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger to deregister each UUT from the SAS Test Harness</p>
2	<p>UUT may send a Relinquishment request and receives Relinquishment response with <i>responseCode</i>=0</p>
3	<p>Verify DP sends a Deregistration Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p>
3	<p>Verify Deregistration Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci

	<ul style="list-style-type: none"> • UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: A. UUT sending a Registration Request message, as this is not mandatory B. UUT sending a Deregistration Request message
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27) [WINNF.FT.D.DRG.4] Domain Proxy Deregistration responseCode=102

The following are the test execution steps where the Deregistration response contains *responseCode* (Ri) = 102 for each CBSD..

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, i={1,2} • DP has received a valid grant with <i>grantId</i> = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger to deregister each UUT from the SAS Test Harness</p>
2	<p>UUT may send a Relinquishment request and receives Relinquishment response with <i>responseCode</i>=0 for each CBSD</p>
3	<p>Verify DP sends a Deregistration Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Deregistration Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci

4	<p>If a separate Deregistration Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Deregistration Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Deregistration Response Message shall be as follows:</p> <ul style="list-style-type: none"> • No cbsdId in either response • <i>responseCode</i> = Ri <p>□</p>
5	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
6	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 4 is complete. This is the end of the test. Verify:</p>

	<ul style="list-style-type: none"> • UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: A. UUT sending a Registration Request message, as this is not mandatory B. UUT sending a Deregistration Request message
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28) [WINNF.FT.C.DRG.5] Deregistration responseCode=103

The same steps provided for WINNF.FT.C.DRG.3 shall be executed for this test, with the exception that the Deregistration response contains *responseCode* (R) = 103 and *responseData* = "cbsdId".

#	Test Execution Steps
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId</i>=Ci, i={1,2} • DP has received a valid grant with <i>grantId</i> = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger to deregister each UUT from the SAS Test Harness</p>
2	<p>UUT may send a Relinquishment request and receives Relinquishment response with <i>responseCode</i>=0 for each CBSD</p>
3	<p>Verify DP sends a Deregistration Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Deregistration Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = Ci

4	<p>If a separate Deregistration Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Deregistration Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Deregistration Response Message shall be as follows:</p> <ul style="list-style-type: none"> ● No cbsdId in either response ● <i>responseCode</i> = Ri <p>□</p>
5	<p>After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>
6	<p>Monitor the RF output of each UUT from start of test until 60 seconds after Step 4 is complete. This is the end of the test. Verify:</p>

	<ul style="list-style-type: none"> • UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: C. UUT sending a Registration Request message, as this is not mandatory D. UUT sending a Deregistration Request message
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29) [WINNF.FT.C.SCS.1] Successful TLS connection between UUT and SAS Test Harness

The following are the test execution steps.

#	Test Execution Steps
1	<ul style="list-style-type: none"> • UUT shall start CBSD-SAS communication with the security procedure

	<ul style="list-style-type: none"> The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate. Configure the SAS Test Harness to accept the security procedure and establish the connection
2	<ul style="list-style-type: none"> Make sure that Mutual authentication happens between UUT and the SAS Test Harness. Make sure that UUT uses TLS v1.2 Make sure that cipher suites from one of the following is selected, <ul style="list-style-type: none"> TLS_RSA_WITH_AES_128_GCM_SHA256 TLS_RSA_WITH_AES_256_GCM_SHA384 TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
3	<p>A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability.</p> <ul style="list-style-type: none"> UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with <i>responseCode</i> = 0 and <i>cbsdId</i>.
4	<p>Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</p> <ul style="list-style-type: none"> UUT shall not transmit RF

30) [WINNF.FT.C.SCS.2] TLS failure due to revoked certificate Testpre-

requisite:

The certificate at the SAS Test Harness shall be marked as revoked The following are the

test execution steps.

#	Test Execution Steps
1	<ul style="list-style-type: none"> UUT shall start CBSD-SAS communication with the security procedures
2	<ul style="list-style-type: none"> Make sure that UUT uses TLS v1.2 for security establishment. Make sure UUT selects the correct cipher suite.

	<ul style="list-style-type: none"> • UUT shall use CRL or OCSP to verify the validity of the server certificate. • Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.
3	UUT may retry for the security procedure which shall fail
4	SAS Test-Harness shall not receive any Registration request or any application data.
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

31) [WINNF.FT.C.SCS.3] TLS failure due to expired server certificate

Test case pre-requisite:

Configure the SAS Test Harness such that server certificate is valid but expired.

The following are the test execution steps.

#	Test Execution Steps
1	<ul style="list-style-type: none"> • UUT shall start CBSD-SAS communication with the security procedures
2	<ul style="list-style-type: none"> • Make sure that UUT uses TLS v1.2 for security establishment. • Make sure UUT selects the correct cipher suite. • UUT shall use CRL or OCSP to verify the validity of the server certificate. • Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.
3	UUT may retry for the security procedure which shall fail.
4	SAS Test-Harness shall not receive any Registration request or any application data.
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

32) [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

Test case pre-requisite:

Equip the SAS Test Harness with certificate signed by an unknown CA to the CBSD. The following are the test execution steps.

#	Test Execution Steps	Results
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1	<ul style="list-style-type: none"> • UUT shall start CBSD-SAS communication with the security procedures
2	<ul style="list-style-type: none"> • Make sure that UUT uses TLS v1.2 for security establishment. • Make sure UUT selects the correct cipher suite. • UUT shall use CRL or OCSP to verify the validity of the server certificate • Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.
3	UUT may retry for the security procedure which shall fail.
4	SAS Test-Harness shall not receive any Registration request or any application data.
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF

33) [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

Test case pre-requisite:

- The end-entity certificate at the SAS Test Harness shall be corrupted The following

steps describe the test execution.

#	Test Execution Steps
1	<ul style="list-style-type: none"> • UUT shall start CBSD-SAS communication with the security procedures
2	<ul style="list-style-type: none"> • Make sure that UUT uses TLS v1.2 for security establishment. • Make sure UUT selects the correct cipher suite. • UUT shall use CRL or OCSP to verify the validity of the server certificate. • Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.
3	UUT may retry for the security procedure which shall fail.
4	SAS Test-Harness shall not receive any Registration request or any application data.
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: <ul style="list-style-type: none"> • UUT shall not transmit RF