

## CBSD Test Report

**Report No.:** RFBEIH-WTW-P23110582-1

**FCC ID:** 2ASK53SM0065

**Test Model:** Nokia AiOSCSMn48

**Received Date:** Nov. 22, 2023

**Test Date:** Jan. 18 ~ Feb. 29, 2024

**Issued Date:** Mar. 07, 2024

**Applicant:** Nokia

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**FCC Registration /  
Designation Number:** 788550 / TW0003



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### Release Control Record

Issue No.	Description	Date Issued
RFBEIH-WTW-P23110582-1	Original release	Mar. 07, 2024



## 2 Summary of Test Results

WINNF-TS-0122			
Classes	Test Case Items	Pass Items	Pass Rate (%)
FT(CBSD, DP/CBSD)	24	24	100
PT(CBSD, DP/CBSD)	1	1	100
Total	25	25	100

Note:

1. Functional Test (FT): Test to validate the conformance of the Protocols and functionalities implemented in the CBSD/DP UUT to the requirements developed by WINnForum and supporting FCC/DoD requirements.
2. Field/Performance Test (PT): Test to check the capability of the CBSD/DP UUT to support various traffic models and actual operations in the field.

Supported Features in details:

WINNF-TS-0122 Test Case		
Definitions	Test Case ID	Supported
C1	WINNF.FT.D.REG.2	Yes
C2	NA	No
C3	NA	No
C4	NA	No
C5	NA	No
C6	NA	No

Note : The Grantee confirms that only C1 conditional test case is supported for this device. CPI is required to manually enter registration information into the SAS interface during installation.

## WINNF-TS-0122 Test Case

Section	Test Case ID	Test Case Title	Test Result
6.1.4.1.1	WINNF.FT.C.REG.1	Multi-Step registration	NA
6.1.4.1.2	WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	Pass
6.1.4.1.3	WINNF.FT.C.REG.3	Single-Step registration for Category A CBSD	NA
6.1.4.1.4	WINNF.FT.D.REG.4	Domain Proxy Single-Step registration for Cat A CBSD	NA
6.1.4.1.5	WINNF.FT.C.REG.5	Single-Step registration for CBSD with CPI signed data	NA
6.1.4.1.6	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	NA
6.1.4.1.7	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	NA
6.1.4.2.1	WINNF.FT.C.REG.8	Missing Required parameters (responseCode 102)	NA
6.1.4.2.2	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	Pass
6.1.4.2.3	WINNF.FT.C.REG.10	Pending registration (responseCode 200)	NA
6.1.4.2.4	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	Pass
6.1.4.2.5	WINNF.FT.C.REG.12	Invalid parameter (responseCode 103)	NA
6.1.4.2.6	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	Pass
6.1.4.2.7	WINNF.FT.C.REG.14	Blacklisted CBSD (responseCode 101)	NA
6.1.4.2.8	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	Pass
6.1.4.2.9	WINNF.FT.C.REG.16	Unsupported SAS protocol version (responseCode 100)	NA
6.1.4.2.10	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	Pass
6.1.4.2.11	WINNF.FT.C.REG.18	Group Error (responseCode 201)	NA
6.1.4.2.12	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	Pass
6.1.4.3.1	WINNF.FT.C.REG.20	Category A CBSD location update	NA

## WINNF-TS-0122 Test Case

Section	Test Case ID	Test Case Title	Test Result
6.3.4.2.1	WINNF.FT.D.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Pass
6.3.4.2.2	WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	Pass
6.4.4.1.1	WINNF.FT.C.HBT.1	Heartbeat Success Case (first Heartbeat Response)	NA
6.4.4.1.2	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	Pass
6.4.4.2.1	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	Pass
6.4.4.2.2	WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	NA
6.4.4.2.3	WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	Pass
6.4.4.2.4	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Pass
6.4.4.2.5	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	Pass
6.4.4.2.6	WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TERMINATED_GRANT)	Pass
6.4.4.3.1	WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	Pass
6.4.4.3.2	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Pass
6.4.4.4.1	WINNF.FT.C.HBT.11	Successful Grant Renewal in Heartbeat Test Case	NA
6.5.4.2.1	WINNF.FT.C.MES.1	Registration Response contains measReportConfig	NA
6.5.4.2.2	WINNF.FT.D.MES.2	Domain Proxy Registration Response contains measReportConfig	NA
6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	NA
6.5.4.2.4	WINNF.FT.C.MES.4	Heartbeat Response contains measReportConfig	NA
6.5.4.2.5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	NA

## WINNF-TS-0122 Test Case

Section	Test Case ID	Test Case Title	Test Result
6.6.4.1.1	WINNF.FT.C.RLQ.1	Successful Relinquishment	NA
6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	Pass
6.6.4.2.1	WINNF.FT.C.RLQ.3	Unsuccessful Relinquishment, responseCode=102	NA
6.6.4.2.2	WINNF.FT.D.RLQ.4	Domain Proxy Unsuccessful Relinquishment, responseCode=102	NA
6.6.4.3.1	WINNF.FT.C.RLQ.5	Unsuccessful Relinquishment, responseCode=103	NA
6.6.4.3.2	WINNF.FT.D.RLQ.6	Domain Proxy Unsuccessful Relinquishment, responseCode=103	NA
6.7.4.1.1	WINNF.FT.C.DRG.1	Successful Deregistration	NA
6.7.4.1.2	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	Pass
6.7.4.2.1	WINNF.FT.C.DRG.3	Deregistration responseCode=102	NA
6.7.4.2.2	WINNF.FT.D.DRG.4	Domain Proxy Deregistration responseCode=102	NA
6.7.4.3.1	WINNF.FT.C.DRG.5	Deregistration responseCode=103	NA
6.8.4.1.1	WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	Pass
6.8.4.2.1	WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	Pass
6.8.4.2.2	WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	Pass
6.8.4.2.3	WINNF.FT.C.SCS.4	TLS failure when SAS Test Harness certificate is issue by unknown CA	Pass
6.8.4.2.4	WINNF.FT.C.SCS.5	TLS failure when certificate at the SAS Test Harness is corrupted	Pass
7.1.4.1.1	WINNF.PT.C.HBT	UUT RF Transmit Power Measurement	Pass

Note: Section as per WINNF-TS-0122 If the product as tested complies with the specification, the UUT is deemed to comply with the standard and is deemed a "Pass" grade. If not "Fail" grade is issued. Where "NA" is stated this means the test case is not applicable.

## 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the UUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ( $\pm$ )
Conducted Emissions above 1 GHz	1GHz ~ 18GHz	1 dB

## 2.2 Modification Record

There were no modifications required for compliance.



### 3 General Information

#### 3.1 General Description of EUT

Product	Nokia AiO Small Cell Strand Mount n48
Brand	Nokia
Test Model	Nokia AiOSCSMn48
Sample Status	Engineering sample
Power Supply Rating	44Vac / 60Vac / 100Vac
Hardware Version	Rev 1.0
Firmware Version	BSR-23.01.115.aio
Domain Proxy SW Version	ESXi_NCDP24.1_02.00
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	N/A
Cable Supplied	N/A

Note:

- The following antennas were provided to the EUT.

Antenna Type	Patch			
Antenna Connector	NEX 10 Female			
Ant. No.	Ant. 0 (Port 1)	Ant. 1 (Port 2)	Ant. 2 (Port 3)	Ant. 3 (Port 4)
Band	Gain (dBi)			
Band 48	8	7.8	8.3	8.6

\*The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

Note:

#### 3.55GHz correlated calculation for P1&P3, P2&P4:

Maximum correlated gain for port1 and port3:9.41dBi. This occurs at: 3550MHz: phi 315 / theta 90  
 $= 10 * \text{LOG}(((10^{(\text{Port1}/20)}) + 10^{(\text{Port3}/20)})^{2/2}) = 10 * \text{LOG}(((10^{(5.0/20)}) + 10^{(7.6/20)})^{2/2})$

Maximum correlated gain for port2 and port4:9.28dBi. This occurs at: 3550MHz: phi 315 / theta 90  
 $= 10 * \text{LOG}(((10^{(\text{Port2}/20)}) + 10^{(\text{Port4}/20)})^{2/2}) = 10 * \text{LOG}(((10^{(4.4/20)}) + 10^{(8.0/20)})^{2/2})$

#### 3.55GHz uncorrelated calculation for two cross-polarized pairs:

Maximum uncorrelated gain for two cross-polarized pairs:9.35. This occurs at: 3550MHz: phi 315 / theta 90  
 $= 10 * \text{LOG}(((10^{(\text{P1\&P3 Correlated}/10)}) + 10^{(\text{P2\&P4 Correlated}/10)})/2) =$   
 $10 * \text{LOG}(((10^{(9.41/10)}) + 10^{(9.28/10)})/2)$

#### Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
WINNF-TS-0122	23deg. C, 66%RH	60Vac	Matthew Yang

### 3.2 General Description of Applied Standards

The UUT is a BTS-CBSD product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

**Test standard:**

FCC 47 CFR Part 96

All test items have been performed and recorded as per the above standards.

**References Test Guidance:**

KDB 940660 D01 Part 96 CBRS Eqpt v03

All test items have been performed as a reference to the above KDB test guidance.

## 4 Measurement

### 4.1 CBSD Measurement

The CBSD shall validate and ensure that the Conformance and Performance Test results from compliance with SAS functional requirements.

### 4.2 CBSD Test Procedure

- a. Connect the UUT to SAS Test Harness system and RF Test instruments via the CBSD interface and RF components. The highest level is set to test configuration.
- b. UUT shall be UTC time synchronized
- c. The frequency band is granted and set as UUT supported Modulation and Channels, transmitted power of the UUT according to it granted parameters from the SAS Test Harness.
- d. Each test case results was recorded and validated by SAS Test Harness system and RF instruments test cases was recorded test results from SAS Test Harness system.

### 4.3 Test Environment

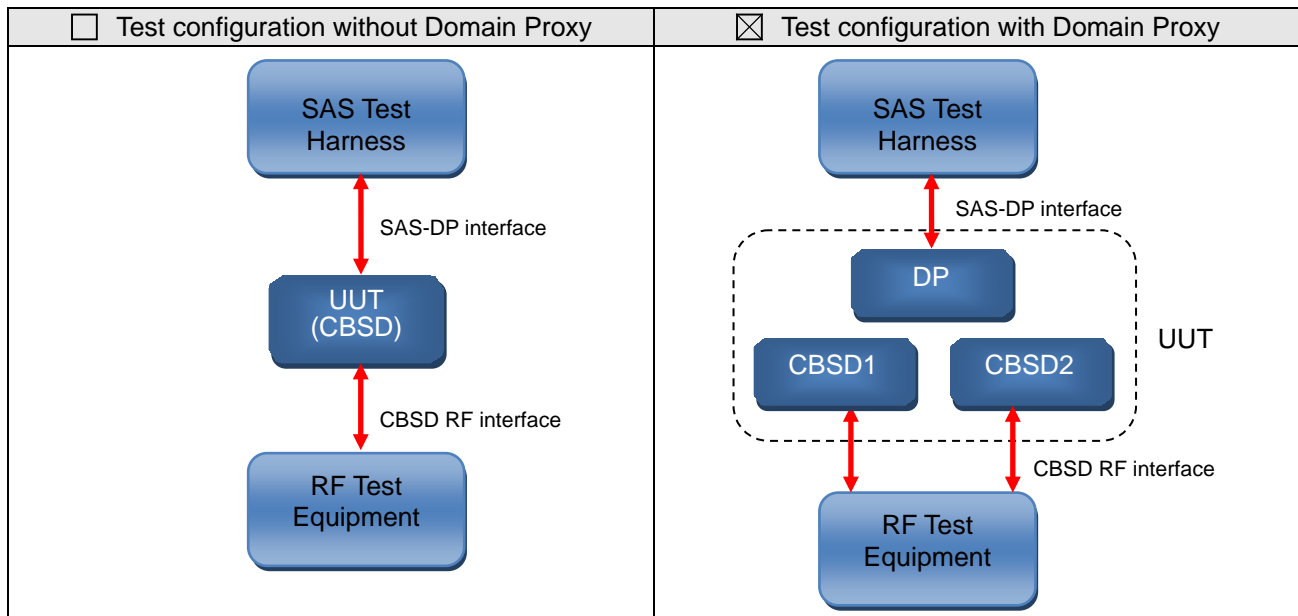
Test Harness Version	V1.0.0.3
Operating System	Microsoft Windows 10
TLS Version	1.2
Python	2.7.13

#### 4.4 Test Equipment

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
KEYSIGHT Signal Analyzer	MXE N9038A	E2-010530	May 03, 2023	May 02, 2024
Temperature & Humidity Chamber TERCHY	TFA 452019	E2-010883	Dec. 14, 2023	Dec. 13, 2024
Laptop Lenovo	P137G	P137G001	NA	NA

Note: 1. The test was performed in InfoSec Test Room.  
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

#### 4.5 Test Setup



## 4.6 Test Results

### 4.6.1 Successful registration (responseCode 0)

#### 4.6.1.1 Domain Proxy Multi-Step registration

Test Case ID : WINNF.FT.D.REG.2       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>	--	--
2	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: <ul style="list-style-type: none"> <li>The required <i>userId</i>, <i>fcld</i> and <i>cbsdSerialNumber</i> registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges.</li> <li>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.</li> </ul> Note: It is outside the scope of this document to test the Registration information that is supplied via another means.	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	<ul style="list-style-type: none"> <li>SAS Test Harness sends a CBSD Registration Response as follows:               <ul style="list-style-type: none"> <li><i>cbsdId</i> = <i>Ci</i></li> <li><i>measReportConfig</i> shall not be included</li> <li><i>responseCode</i> = 0 for each CBSD</li> </ul> </li> </ul>	--	--
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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.1.2 Domain Proxy Missing Required parameters (responseCode 102)

Test Case ID : WINNF.FT.D.REG.9  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>● SAS response does not include a cbsdId.</li> <li>● responseCode = Ri for CBSD1 and CBSD2</li> </ul>	--	--
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 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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.1.3 Domain Proxy Pending registration (responseCode 200)

Test Case ID : WINNF.FT.D.REG.11  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>- SAS response does not include a <i>cbsdId</i>.</li> <li>- <i>responseCode</i> = Ri for CBSD1 and CBSD2</li> </ul>	--	--
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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.1.4 Domain Proxy Invalid parameters (responseCode 103)

Test Case ID : WINNF.FT.D.REG.13       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>- SAS response does not include a <i>cbstdId</i>.</li> <li>- <i>responseCode</i> = Ri for CBSD1 and CBSD2</li> </ul>	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response ( <i>responseCode</i> R1 = 0 for CBSD1 and R2 = 103 for CBSD2) 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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail



#### 4.6.1.5 Domain Proxy Blacklisted CBSD (responseCode 101)

■ Test Case ID : WINNF.FT.D.REG.15  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>- SAS response does not include a <i>cbsdId</i>.</li> <li>- <i>responseCode</i> = Ri for CBSD1 and CBSD2</li> </ul>	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response ( <i>responseCode</i> R1 = 0 for CBSD1 and R2 = 101 for CBSD2) 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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.1.6 Domain Proxy Unsupported SAS protocol version (responseCode 100)

Test Case ID : WINNF.FT.D.REG.17
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>- SAS response does not include a <i>cbsdId</i>.</li> <li>- <i>responseCode</i> = Ri for CBSD1 and CBSD2</li> </ul>	--	--
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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.1.7 Domain Proxy Group Error (responseCode 201)

Test Case ID : WINNF.FT.D.REG.19     NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● UUT is in the Unregistered state</li> </ul>	--	--
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"> <li>- SAS response does not include a <i>cbstdId</i>.</li> <li>- <i>responseCode</i> = Ri for CBSD1 and CBSD2</li> </ul>	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response ( <i>responseCode</i> R1 = 0 for CBSD1 and R2 = 201 for CBSD2.) 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"> <li>● UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.2 CBSD Spectrum Grant Process

##### 4.6.2.1 Unsuccessful Grant responseCode=400 (INTERFERENCE)

Test Case ID : WINNF.FT.C.GRA.1       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>UUT has registered successfully with SAS Test Harness, with <i>cbsdId</i> = C</li> </ul>	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including <ul style="list-style-type: none"> <li><i>cbsdId</i>=C</li> <li><i>responseCode</i> = R = 400</li> </ul>	--	--
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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.2.2 Unsuccessful Grant responseCode=401(GRANT\_CONFLICT)

Test Case ID : WINNF.FT.C.GRA.2       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>UUT has registered successfully with SAS Test Harness, with <i>cbsdId = C</i></li> </ul>	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including <ul style="list-style-type: none"> <li><i>cbsdId=C</i></li> <li>responseCode = R = 401</li> </ul>	--	--
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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

### 4.6.3 CBSD Heart Beat Process

#### 4.6.3.1 Domain Proxy Heartbeat Success Case (first Heartbeat Response)

Test Case ID : WINNF.FT.D.HBT.2
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● DP has two CBSD has registered successfully with SAS Test Harness, with <math>cbsdId = Ci, i=\{1,2\}</math></li> </ul>	--	--
2	DP sends a message: <ul style="list-style-type: none"> <li>● If message is type Spectrum Inquiry Request, go to step 3, or</li> <li>● If message is type Grant Request, go to step 5</li> </ul>	--	--
3	DP sends 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 CBSDi, $i=\{1,2\}$ : <ul style="list-style-type: none"> <li>● <math>cbsdId = Ci</math></li> <li>● List of frequencyRange objects sent by DP are within the CBRS frequency range</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
4	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.  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.  Verify parameters for each CBSD within the Spectrum Inquiry Response message are as follows, for CBSDi, $i=\{1,2\}$ : <ul style="list-style-type: none"> <li>● <math>cbsdId = Ci</math></li> <li>● availableChannel is an array of availableChannel objects</li> <li>● responseCode = 0</li> </ul>	--	--
5	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 CBSDi, $i=\{1,2\}$ : <ul style="list-style-type: none"> <li>● <math>cbsdId = Ci</math></li> <li>● maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96</li> <li>● operationFrequencyRange, F, sent by UUT is a valid range within the CBRS band</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
6	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.  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.  Verify parameters for each CBSD within the Grant Response message are as follows, for CBSDi, $i=\{1,2\}$ : <ul style="list-style-type: none"> <li>● <math>cbsdId = Ci</math></li> <li>● <math>grantId = Gi =</math> a valid grant ID</li> <li>● grantExpireTime = UTC time greater than duration of the test</li> <li>● responseCode = 0</li> </ul>	--	--

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"> <li>● cbsdId = Ci, i={1,2}</li> <li>● grantId = Gi, i={1,2}</li> <li>● operationState = "GRANTED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
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"> <li>● cbsdId = Ci</li> <li>● grantId = Gi</li> <li>● transmitExpireTime = current UTC time + 200 seconds</li> <li>● responseCode = 0</li> </ul>		
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"> <li>● cbsdId = Ci</li> <li>● grantId = Gi</li> <li>● operationState = "AUTHORIZED"</li> </ul> <p>and SAS Test Harness responds with a Heartbeat Response message including the following parameters, for CBSDi</p> <ul style="list-style-type: none"> <li>● cbsdId = Ci</li> <li>● grantId = Gi</li> <li>● transmitExpireTime = current UTC time + 200 seconds</li> <li>● responseCode = 0</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
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"> <li>● UUT does not transmit at any time prior to completion of the first heartbeat response</li> <li>● UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range Fi.</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

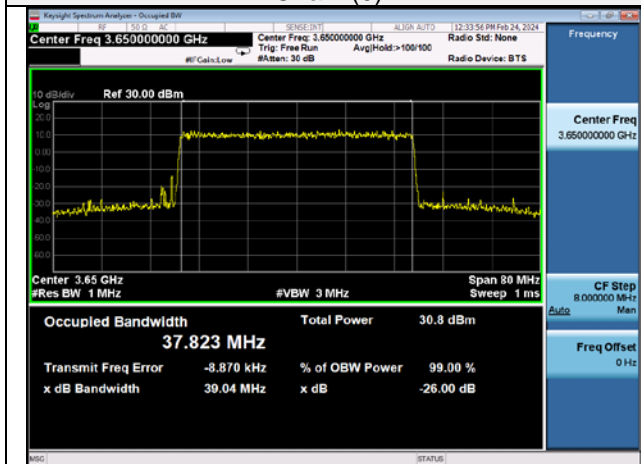
- UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F.

CBSD 1 :

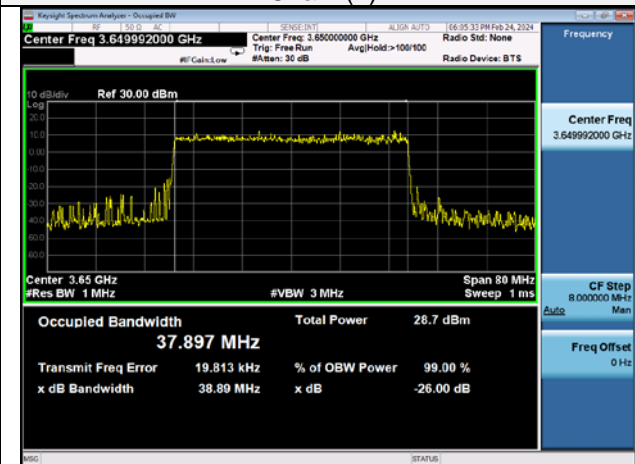
Channel	Freq. (MHz)	OCP 99 Band Width (MHz)			
		F = 40MHz			
		Chain (0)	Chain (1)	Chain (2)	Chain (3)
Middle	3650	37.823	37.897	37.501	37.595

Spectrum Plot

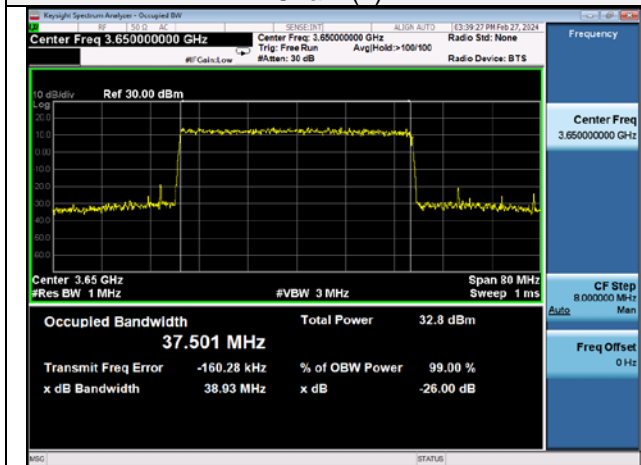
Chain (0)



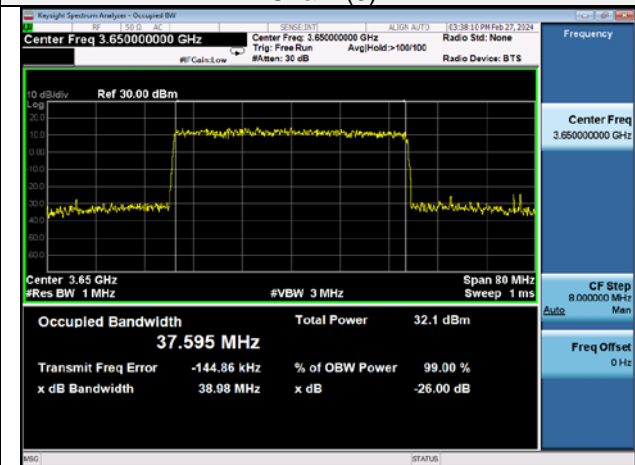
Chain (1)



Chain (2)



Chain (3)



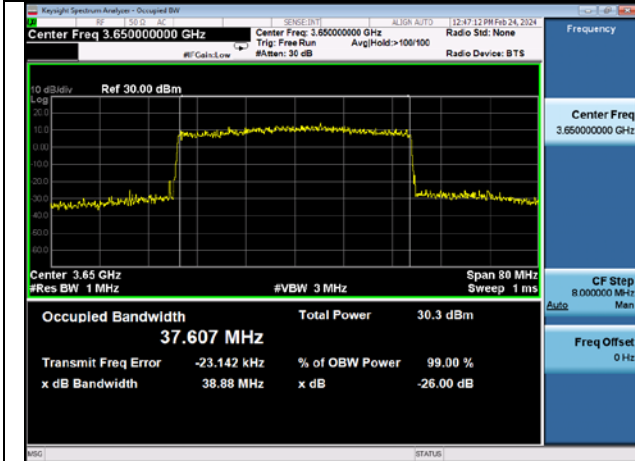


CBSD 2 :

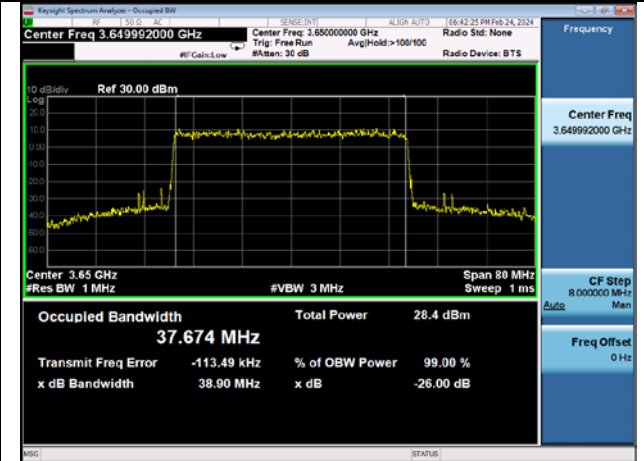
Channel	Freq. (MHz)	OCP 99 Band Width (MHz)			
		F = 40MHz			
		Chain (0)	Chain (1)	Chain (2)	Chain (3)
Middle	3570	37.607	37.674	37.506	37.590

Spectrum Plot

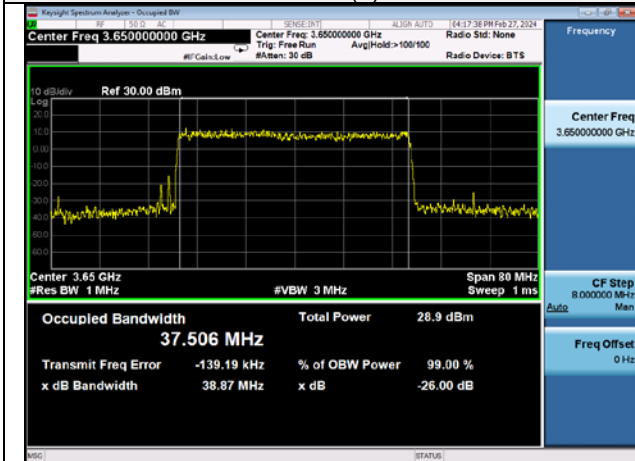
Chain (0)



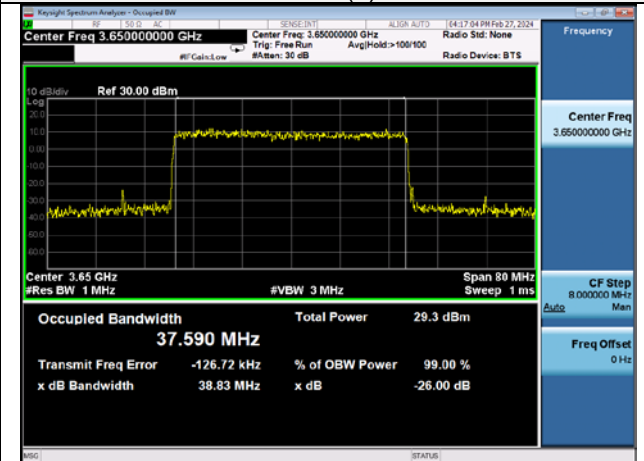
Chain (1)



Chain (2)



Chain (3)



#### 4.6.3.2 Heartbeat responseCode=105 (DEREGISTER)

Test Case ID : WINNF.FT.C.HBT.3
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has registered successfully with SAS Test Harness</li> <li>● UUT has a valid single grant as follows:               <ul style="list-style-type: none"> <li>○ valid <i>cbsdId</i> = C</li> <li>○ valid <i>grantId</i> = G</li> <li>○ grant is for frequency range F, power P</li> <li>○ <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface</li> </ul>	--	--
2	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: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "AUTHORIZED"</li> </ul>	--	--
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>transmitExpireTime</i> = T = Current UTC time</li> <li>● <i>responseCode</i> = 105 (DEREGISTER)</li> </ul>	--	--
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"> <li>● UUT shall stop transmission within (T + 60 seconds) of completion of step 3</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.3.3 Heartbeat responseCode=501 (SUSPENDED\_GRANT) in First Heartbeat Response

Test Case ID : WINNF.FT.C.HBT.5
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has registered successfully with SAS Test Harness</li> <li>● UUT has a valid single grant as follows:               <ul style="list-style-type: none"> <li>○ valid <i>cbsdId</i> = C</li> <li>○ valid <i>grantId</i> = G</li> <li>○ grant is for frequency range F, power P</li> <li>○ <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request)</li> </ul>	--	--
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "GRANTED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>transmitExpireTime</i> = T = current UTC time</li> <li>● <i>responseCode</i> = 501 (SUSPENDED_GRANT)</li> </ul>	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the SAS-CBSD interface. Verify either A OR B occurs: <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"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "GRANTED"</li> </ul> <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> <li>● <i>cbdsId</i> = C</li> <li>● <i>grantId</i> = G</li> </ul> <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> <li>● UUT does not transmit at any time</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.3.4 Heartbeat responseCode=501 (SUSPENDED\_GRANT) in Subsequent Heartbeat Response

Test Case ID : WINNF.FT.C.HBT.6
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has registered successfully with SAS Test Harness</li> <li>● UUT has a valid single grant as follows:               <ul style="list-style-type: none"> <li>○ valid <i>cbsdId</i> = C</li> <li>○ valid <i>grantId</i> = G</li> <li>○ grant is for frequency range F, power P</li> <li>○ <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface</li> </ul>	--	--
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "AUTHORIZED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>transmitExpireTime</i> = T = current UTC time</li> <li>● <i>responseCode</i> = 501 (SUSPENDED_GRANT)</li> </ul>	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the SAS-CBSD interface. Verify either A OR B occurs: <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"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "GRANTED"</li> </ul> <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> </ul> <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> <li>● UUT shall stop transmission within (T+60) seconds of completion of step 3</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.3.5 Heartbeat responseCode=502 (UNSYNC\_OP\_PARAM)

Test Case ID : WINNF.FT.C.HBT.7       NA

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

#### 4.6.3.6 Domain Proxy Heartbeat responseCode=500 (TERMINATED\_GRANT)

Test Case ID : WINNF.FT.D.HBT.8
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● DP has two CBSD registered successfully with SAS Test Harness</li> <li>● Each CBSD {1,2} has a valid single grant as follows:               <ul style="list-style-type: none"> <li><input type="checkbox"/> valid <i>cbsdId</i> = Ci, i={1,2}</li> <li><input type="checkbox"/> valid <i>grantId</i> = Gi, i={1,2}</li> <li><input type="checkbox"/> grant is for frequency range Fi, power Pi</li> <li><input type="checkbox"/> <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● Both CBSD are in AUTHORIZED state and transmitting within their granted bandwidth on RF interface</li> </ul>	--	--
2	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. 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}: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = Ci, i = {1,2}</li> <li>● <i>grantId</i> = Gi, i = {1,2}</li> <li>● <i>operationState</i> = "AUTHORIZED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	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.  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.  Parameters for each CBSD within the Heartbeat Response message should be as follows, for CBSDi:  <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = Ci</li> <li>● <i>grantId</i> = Gi</li> <li>● For CBSD1:               <ul style="list-style-type: none"> <li><input type="checkbox"/> <i>transmitExpireTime</i> = current UTC time + 200 seconds</li> <li><input type="checkbox"/> <i>responseCode</i> = 0</li> </ul> </li> <li>● For CBSD2:               <ul style="list-style-type: none"> <li><input type="checkbox"/> <i>transmitExpireTime</i> = T = current UTC time</li> <li><input type="checkbox"/> <i>responseCode</i> = 500 (TERMINATED_GRANT)</li> </ul> </li> </ul>	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.  If CBSD sends further Heartbeat Request messages for CBSD1, SAS Test Harness shall respond with a Heartbeat Response message with parameters: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C1</li> <li>● <i>grantId</i> = G1</li> <li>● <i>transmitExpireTime</i> = current UTC time + 200 seconds</li> </ul>	--	--

	<ul style="list-style-type: none"> <li>● <i>responseCode</i> = 0</li> <li>● Heartbeat Request message is within <i>heartbeatInterval</i> of previous Heartbeat Request message</li> </ul>		
5	Monitor the RF output of CBSD2. Verify: <ul style="list-style-type: none"> <li>● CBSD2 shall stop transmission within bandwidth F2 within (T + 60 seconds) of completion of step 3</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.3.7 Heartbeat Response Absent (First Heartbeat)

Test Case ID : WINNF.FT.C.HBT.9
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has registered successfully with SAS Test Harness</li> <li>● UUT has a valid single grant as follows:               <ul style="list-style-type: none"> <li>○ valid <i>cbsdId</i> = C</li> <li>○ valid <i>grantId</i> = G</li> <li>○ grant is for frequency range F, power P</li> <li>○ <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● UUT is in GRANTED, but not AUTHORIZED state(i.e. has not performed its first Heartbeat Request)</li> </ul>	--	--
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "GRANTED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	After completion of step 2, SAS Test Harness does not respond to any further messages from UUT to simulate loss of network connection	--	--
4	Monitor the RF output of the UUT from start of test to 60 seconds after step 3. Verify: <ul style="list-style-type: none"> <li>● At any time during the test, UUT shall not transmit on RF interface</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail



#### 4.6.3.8 Heartbeat Response Absent (Subsequent Heartbeat)

Test Case ID : WINNF.FT.C.HBT.10       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has registered successfully with SAS Test Harness</li> <li>● UUT has a valid single grant as follows:               <ul style="list-style-type: none"> <li>○ valid <i>cbsdId</i> = C</li> <li>○ valid <i>grantId</i> = G</li> <li>○ grant is for frequency range F, power P</li> <li>○ <i>grantExpireTime</i> = UTC time greater than duration of the test</li> </ul> </li> <li>● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface</li> </ul>	--	--
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i> , and is formatted correctly, including: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>operationState</i> = "AUTHORIZED"</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> <li>● <i>cbsdId</i> = C</li> <li>● <i>grantId</i> = G</li> <li>● <i>transmitExpireTime</i> = T = current UTC time + 200 seconds</li> <li>● <i>responseCode</i> = 0</li> </ul>	--	--
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"> <li>● UUT shall stop all transmission on RF interface within (<i>transmitExpireTime</i> + 60 seconds), using the <i>transmitExpireTime</i> sent in Step 3.</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

#### 4.6.4 CBSD Relinquishment Process

##### 4.6.4.1 Domain Proxy Successful Relinquishment

Test Case ID : WINNF.FT.D.RLQ.2       NA

#	Test Execution Steps	Results	
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> <li>● DP has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId=Ci</i>, <i>i={1,2}</i></li> <li>● DP has received a valid grant with <i>grantId = Gi</i>, <i>i={1,2}</i> for each CBSD</li> <li>● Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</li> </ul> <p>Invoke trigger to relinquish each UUT Grant from the SAS Test Harness</p>	--	--
2	<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"> <li>● <i>cbsdId = Ci</i></li> <li>● <i>grantId = Gi</i></li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
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"> <li>● <i>cbsdId = Ci</i></li> <li>● <i>grantId = Gi</i></li> <li>● <i>responseCode = 0</i></li> </ul>	--	--
4	<p>After completion of step 3, SAS Test Harness will not provide any additional positive response (<i>responseCode=0</i>) 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"> <li>● UUT shall stop RF transmission at any time between triggering the relinquishments and UUT sending the relinquishment requests for each CBSD.</li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

## 4.6.5 CBSD Deregistration Process

### 4.6.5.1 Domain Proxy Successful Deregistration

Test Case ID : WINNF.FT.D.DRG.2       NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● Each UUT has successfully registered with SAS Test Harness</li> <li>● Each UUT is in the authorized state</li> <li>● DP has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>● DP has successfully registered 2 CBSD with SAS Test Harness, each with <i>cbsdId=Ci</i>, <i>i={1,2}</i></li> <li>● DP has received a valid grant with <i>grantId = Gi</i>, <i>i={1,2}</i> for each CBSD</li> <li>● Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</li> </ul> Invoke trigger to deregister each UUT from the SAS Test Harness	--	--
2	UUT sends a Relinquishment request and receives Relinquishment response with <i>responseCode=0</i>	--	--
3	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: <ul style="list-style-type: none"> <li>● <i>cbsdId = Ci</i></li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
4	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.  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.  Parameters for each CBSD within the Deregistration Response shall be as follows: <ul style="list-style-type: none"> <li>● <i>cbsdId = Ci</i></li> <li>● <i>responseCode = 0</i></li> </ul>	--	--
5	After completion of step 4, SAS Test Harness will not provide any positive response ( <i>responseCode=0</i> ) to further request messages from the UUT.	--	--
6	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: <ul style="list-style-type: none"> <li>● UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs:               <ul style="list-style-type: none"> <li>A. UUT sending a Registration Request message, as this is not mandatory</li> <li>B. UUT sending a Deregistration Request message</li> </ul> </li> </ul>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

## 4.6.6 CBSD Security Validation

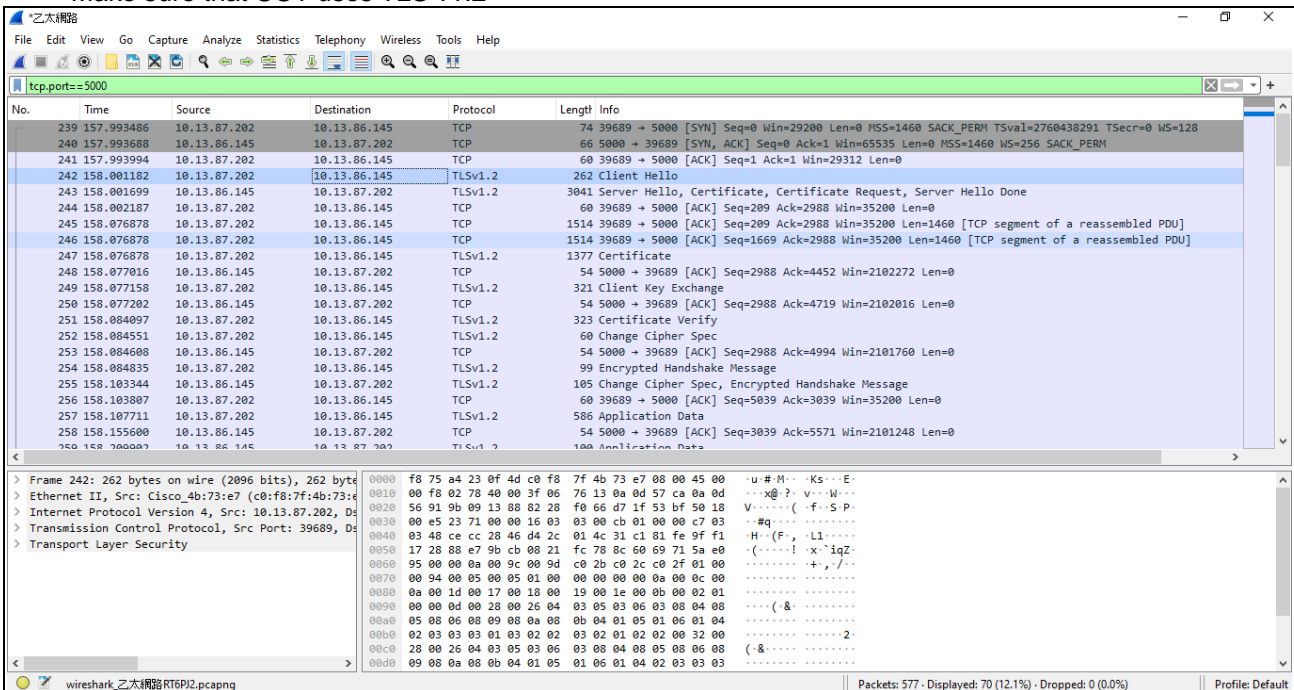
### 4.6.6.1 Successful TLS connection between UUT and SAS Test Harness

Test Case ID : WINNF.FT.C.SCS.1  NA

#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> <li>UUT shall start CBSD-SAS communication with the security procedure</li> <li>The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate.</li> <li>Configure the SAS Test Harness to accept the security procedure and establish the connection</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
2	<ul style="list-style-type: none"> <li>Make sure that Mutual authentication happens between UUT and the SAS Test Harness.</li> <li>Make sure that UUT uses TLS v1.2</li> <li>Make sure that cipher suites from one of the following is selected,             <ul style="list-style-type: none"> <li>TLS_RSA_WITH_AES_128_GCM_SHA256</li> <li>TLS_RSA_WITH_AES_256_GCM_SHA384</li> <li>TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256</li> <li>TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384</li> <li>TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256</li> </ul> </li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
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"> <li>UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with <i>responseCode = 0</i> and <i>cbstdId</i>.</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Wireshark Capture Example for Test Case :

Make sure that UUT uses TLS v1.2



The screenshot shows a Wireshark capture of a TLS handshake. The filter is 'tcp.port==5000'. The capture shows a sequence of frames from source 10.13.87.202 to destination 10.13.86.145. Key frames include:

- 242: 262 Client Hello (TLSv1.2)
- 243: 3041 Server Hello, Certificate, Certificate Request, Server Hello Done (TLSv1.2)
- 244: 60 Change Cipher Spec (TCP)
- 245: 1514 Change Cipher Spec, Encrypted Handshake Message (TCP)
- 246: 1514 Change Cipher Spec, Encrypted Handshake Message (TCP)
- 247: 1377 Certificate (TLSv1.2)
- 248: 54 Change Cipher Spec (TCP)
- 249: 321 Client Key Exchange (TLSv1.2)
- 250: 54 Change Cipher Spec (TCP)
- 251: 323 Certificate Verify (TLSv1.2)
- 252: 60 Change Cipher Spec (TLSv1.2)
- 253: 54 Change Cipher Spec (TCP)
- 254: 99 Encrypted Handshake Message (TLSv1.2)
- 255: 105 Change Cipher Spec, Encrypted Handshake Message (TLSv1.2)
- 256: 60 Change Cipher Spec (TCP)
- 257: 586 Application Data (TLSv1.2)
- 258: 54 Change Cipher Spec (TCP)

The packet details for frame 242 (Client Hello) are expanded, showing the TLSv1.2 protocol structure. The packet bytes are displayed in hexadecimal and ASCII.

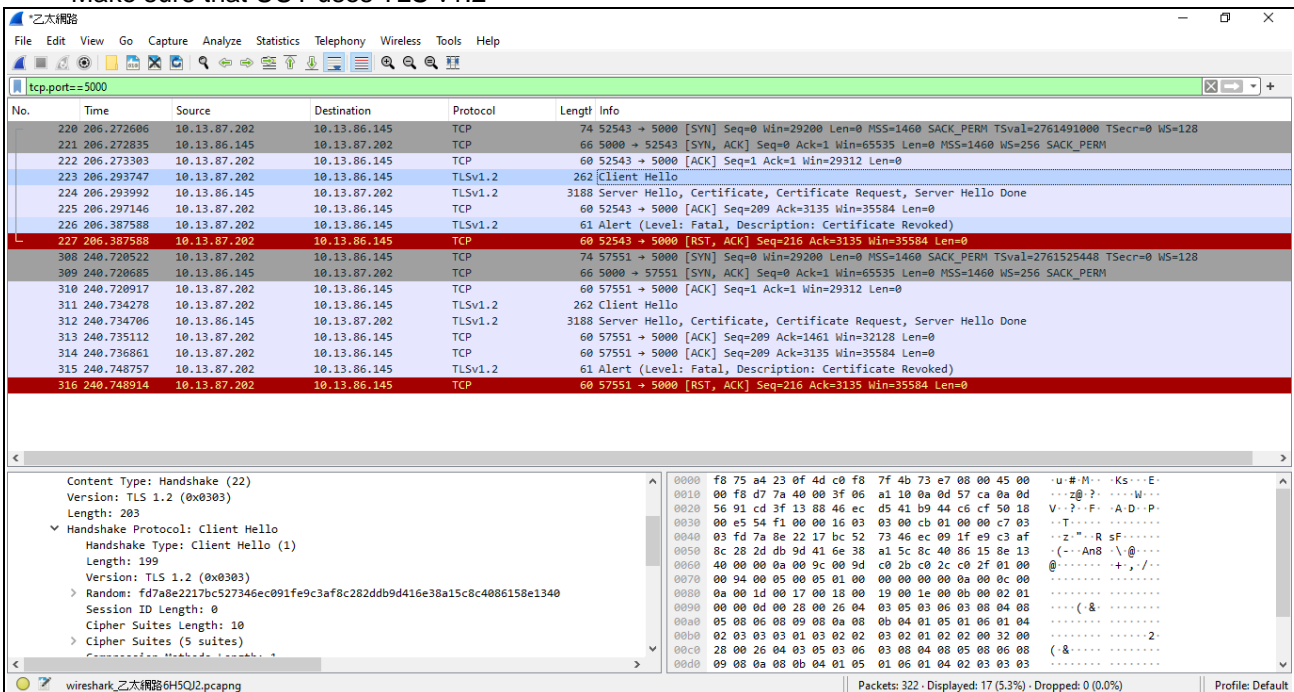
#### 4.6.6.2 TLS failure due to revoked certificate

Test Case ID : WINNF.FT.C.SCS.2  NA

#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> <li>UUT shall start CBSD-SAS communication with the security procedures</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
2	<ul style="list-style-type: none"> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> <li>Make sure UUT selects the correct cipher suite.</li> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate.</li> <li>Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
3	UUT may retry for the security procedure which shall fail.	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> 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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

#### Wireshark Capture Example for Test Case :

- Make sure that UUT uses TLS v1.2



The screenshot shows a Wireshark capture of a network session. The packet list pane displays several packets, with packet 227 highlighted in red, indicating an error. The details pane for packet 227 shows the following information:

```

Content Type: Handshake (22)
Version: TLS 1.2 (0x0303)
Length: 203
  Handshake Protocol: Client Hello
    Handshake Type: Client Hello (1)
    Length: 199
    Version: TLS 1.2 (0x0303)
    Random: fd7a8e2217bc527346ec091fe9c3af8c282ddb9d416e38a15c8c4086158e1340
    Session ID Length: 0
    Cipher Suites Length: 10
    Cipher Suites (5 suites)
  
```

The packet bytes pane shows the raw data of the handshake, including the 'Alert' field which contains the error message: 'Fatal: Certificate Revoked'.

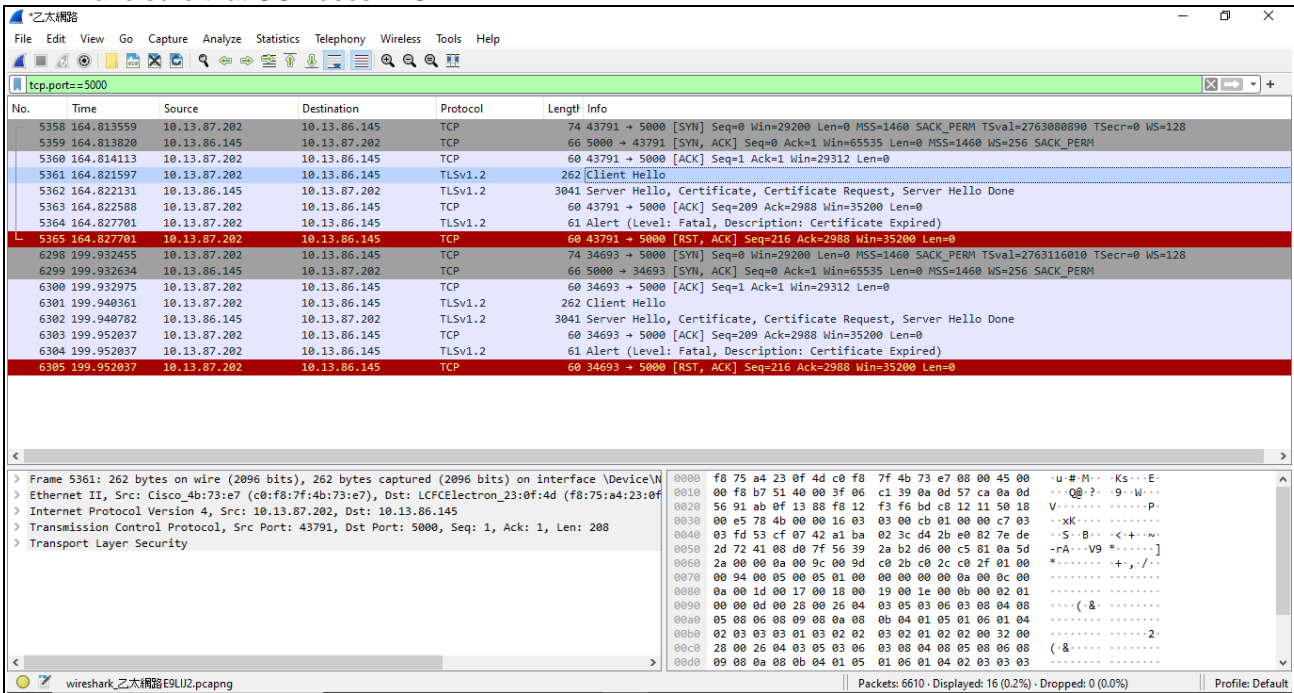
### 4.6.6.3 TLS failure due to expired server certificate

Test Case ID : WINNF.FT.C.SCS.3  NA

#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> <li>UUT shall start CBSD-SAS communication with the security procedures</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
2	<ul style="list-style-type: none"> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> <li>Make sure UUT selects the correct cipher suite.</li> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate.</li> <li>Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
3	UUT may retry for the security procedure which shall fail.	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> 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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

#### Wireshark Capture Example for Test Case :

- Make sure that UUT uses TLS v1.2



The screenshot shows a Wireshark capture of a network session. The packet list pane shows the following key packets:

- 5358: TCP, 164.813559 → 10.13.86.145, Seq=0 Win=29200 Len=0 MSS=1460 SACK\_PERM TSval=2763080890 TSecr=0 WS=128
- 5359: TCP, 164.813820 → 10.13.86.145, Seq=66 5000 → 43791 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK\_PERM
- 5360: TCP, 164.814113 → 10.13.87.202, Seq=60 43791 → 5000 [ACK] Seq=1 Ack=1 Win=29312 Len=0
- 5361: TLSv1.2, 164.821597 → 10.13.87.202, 262 Client Hello
- 5362: TLSv1.2, 164.822131 → 10.13.86.145, 3041 Server Hello, Certificate, Certificate Request, Server Hello Done
- 5363: TCP, 164.822588 → 10.13.87.202, Seq=60 43791 → 5000 [ACK] Seq=209 Ack=2988 Win=35200 Len=0
- 5364: TLSv1.2, 164.827791 → 10.13.87.202, 61 Alert (Level: Fatal, Description: Certificate Expired)
- 5365: TCP, 164.827791 → 10.13.87.202, Seq=60 43791 → 5000 [RST, ACK] Seq=216 Ack=2988 Win=35200 Len=0

The packet details pane for packet 5364 shows:

```

Alert (Level: Fatal, Description: Certificate Expired)
  Type: Alert
  Length: 1
  Description: Certificate Expired
  
```

The packet bytes pane shows the raw hex and ASCII data for the alert packet.

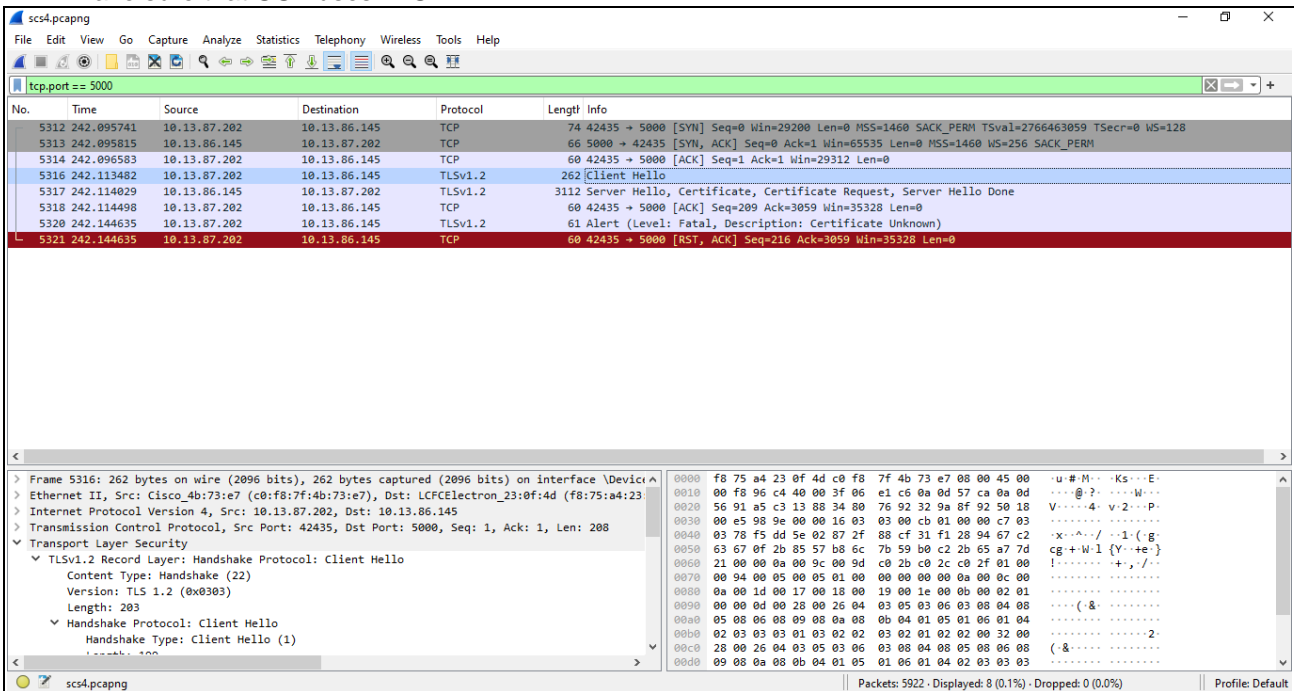
#### 4.6.6.4 TLS failure when SAS Test Harness certificate is issued by an unknown CA

Test Case ID : WINNF.FT.C.SCS.4  NA

#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> <li>UUT shall start CBSD-SAS communication with the security procedures</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
2	<ul style="list-style-type: none"> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> <li>Make sure UUT selects the correct cipher suite.</li> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate</li> <li>Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
3	UUT may retry for the security procedure which shall fail.	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> 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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Wireshark Capture Example for Test Case :

- Make sure that UUT uses TLS v1.2



The screenshot shows a Wireshark capture of a network session. The packet list pane shows several packets, with packet 5316 highlighted. The packet details pane shows the structure of the Client Hello message, including the TLSv1.2 Record Layer, Handshake Protocol, and Client Hello fields. The packet bytes pane shows the raw hex and ASCII data of the Client Hello message.



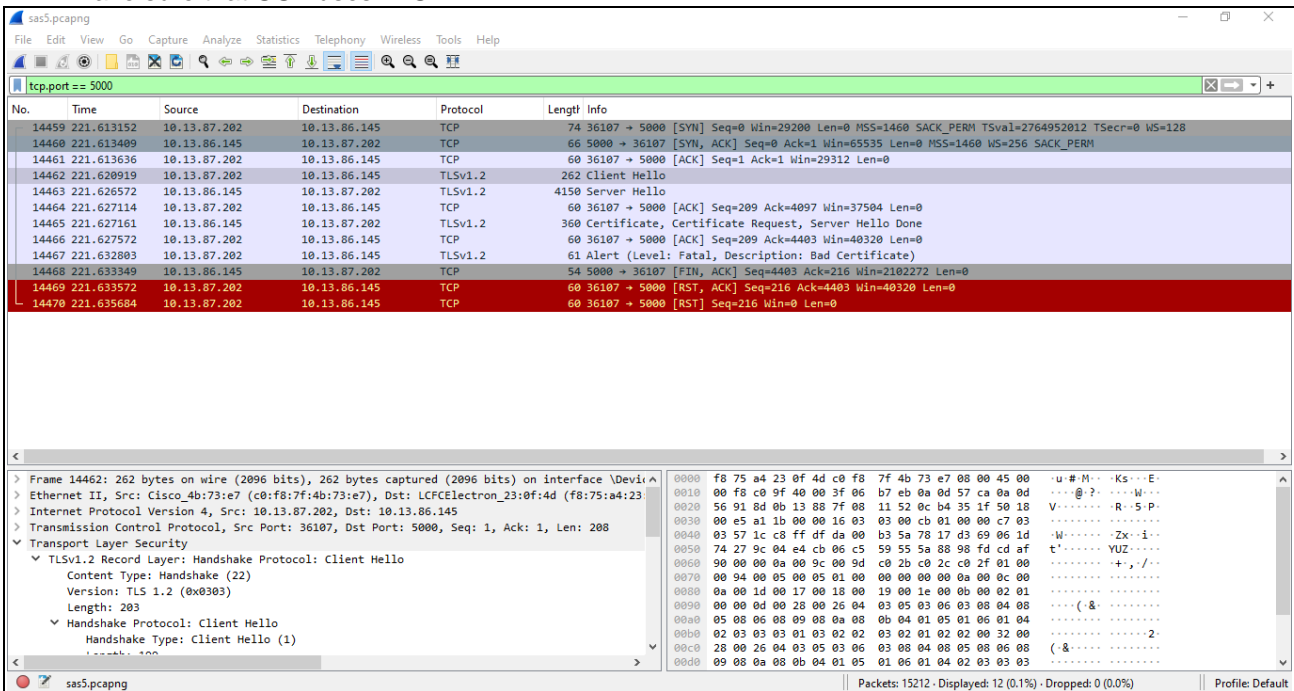
#### 4.6.6.5 TLS failure when certificate at the SAS Test Harness is corrupted

Test Case ID : WINNF.FT.C.SCS.5  NA

#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> <li>UUT shall start CBSD-SAS communication with the security procedures</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
2	<ul style="list-style-type: none"> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> <li>Make sure UUT selects the correct cipher suite.</li> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate</li> <li>Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
3	UUT may retry for the security procedure which shall fail.	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> 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"> <li>UUT shall not transmit RF</li> </ul>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Wireshark Capture Example for Test Case :

- Make sure that UUT uses TLS v1.2



The screenshot shows a Wireshark capture of a network session. The filter is 'tcp.port == 5000'. The packet list shows the following key frames:

- 14459: TCP [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK\_PERM TSval=2764952012 TSecr=0 WS=128
- 14460: TCP [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK\_PERM
- 14461: TCP [ACK] Seq=1 Ack=1 Win=29312 Len=0
- 14462: TLSv1.2 262 Client Hello
- 14463: TLSv1.2 4150 Server Hello
- 14464: TCP [ACK] Seq=209 Ack=4097 Win=37504 Len=0
- 14465: TLSv1.2 360 Certificate, Certificate Request, Server Hello Done
- 14466: TCP [ACK] Seq=209 Ack=4403 Win=40320 Len=0
- 14467: TLSv1.2 61 Alert (Level: Fatal, Description: Bad Certificate)
- 14468: TCP [FIN, ACK] Seq=4403 Ack=216 Win=2102272 Len=0
- 14469: TCP [RST, ACK] Seq=216 Ack=4403 Win=40320 Len=0
- 14470: TCP [RST] Seq=216 Win=0 Len=0

The packet details for frame 14467 show:

```

Alert (Level: Fatal, Description: Bad Certificate)
  Length: 2
  Payload: 0000 f8 75 a4 23 0f 4d c0 f8 7f 4b 73 e7 08 00 45 00
  0010 00 f8 c0 9f 40 00 3f 06 b7 eb 0a 0d 57 ca 0a 0d
  0020 56 91 8d 0b 13 88 7f 08 11 52 0c b4 35 1f 50 18
  0030 00 e5 a1 1b 00 00 16 03 03 00 cb 01 00 00 c7 03
  0040 03 57 1c c8 ff 0f da 00 b3 5a 78 17 d3 69 06 1d
  0050 74 27 9c 04 e4 cb 06 c5 59 55 5a 08 9b fd cd af
  0060 90 00 00 0a 00 9c 00 9d c8 2b c0 2c c0 2f 01 00
  0070 00 94 00 05 00 05 01 00 00 00 00 0a 00 0c 00
  0080 0a 00 1d 00 17 00 18 00 19 00 1e 00 00 00 02 01
  0090 00 00 0d 00 28 00 26 04 03 05 03 06 03 08 04 08
  00a0 05 08 06 08 09 08 0a 08 0b 04 01 05 01 06 01 04
  00b0 02 03 03 01 03 02 02 03 02 01 02 02 00 32 00
  00c0 28 00 26 04 03 05 03 06 03 08 04 08 05 08 06 08
  00d0 09 00 0a 08 0b 04 01 05 01 06 01 04 02 03 03 03
  
```



#### 4.6.7 CBSD RF Power Measurement

##### 4.6.7.1 WINNF.PT.C.HBT.1

Test Case ID : WINNF.PT.C.HBT.1
  NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> <li>● UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness</li> <li>● UUT has registered with the SAS, with CBSID ID = C</li> <li>● UUT has a single valid grant G with parameters {lowFrequency = FL, highFrequency = FH, maxEirp = Pi}, with grant in AUTHORIZED state, and grantExpireTime set to a value far past the duration of this test case</li> </ul> <p><i>Note: in order for the UUT to request a grant with the parameters {lowFrequency, highFrequency, maxEirp}, the SAS Test Harness may need to provide appropriate guidance in the availableChannel object of the spectrumInquiry response message, and the operationParam object of the grant response message. Alternately, the UUT vendor may provide the ability to set those parameters on the UUT so that the UUT will request a grant with those parameters</i></p>	--	--
2	UUT and SAS Test Harness perform a series of Heartbeat Request/Response cycles, which continues until the other test steps are complete. Messaging for each cycle is as follows: <ul style="list-style-type: none"> <li>● UUT sends Heartbeat Request, including:               <ul style="list-style-type: none"> <li>○ cbsdId = C</li> <li>○ grantId = G</li> </ul> </li> <li>● SAS Test Harness responds with Heartbeat Response, including:               <ul style="list-style-type: none"> <li>○ cbsdId = C</li> <li>○ grantId = G</li> <li>○ transmitExpireTime = current UTC time + 200 seconds</li> <li>○ responseCode = 0</li> </ul> </li> </ul>	--	--
3	Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill the requirements of the power measurement method. <p><i>Note: it may be required for the vendor to provide a method or configuration to bring the UUT to a mode which is required by the measurement methodology. Any such mode is vendor-specific and depends upon UUT behavior and the measurement methodology.</i></p>	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail

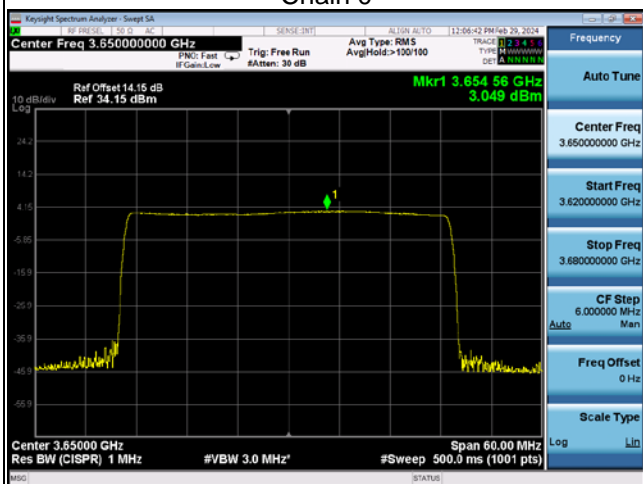
RF measurement plot for Test Case :

- Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill the requirements of the power measurement method.

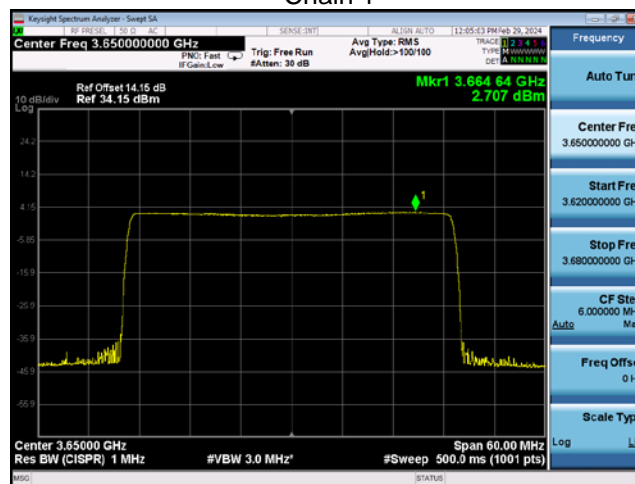
Channel	Freq. (MHz)	40MHz						Limit	Pass / Fail
		Conducted Power Density (dBm/MHz)					Gain(dBi)		
		Chain 0	Chain 1	Chain 2	Chain 3	Total	EIRP (dBm/MHz)		
Middle	3650	3.049	2.707	2.165	4.363	9.17	18.52	20.0	Pass
Middle	3650	7.236	6.904	6.651	6.993	12.972	22.322	24.0	Pass
Middle	3650	12.389	12.008	11.564	11.949	18.008	27.358	29.0	Pass
Middle	3650	12.316	11.909	11.905	14.203	18.715	28.065	37.0	Pass

maxEirp = 20 dBm/MHz

Chain 0



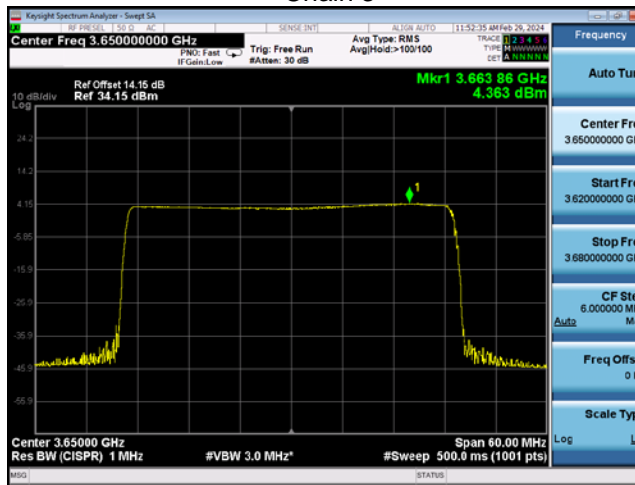
Chain 1



Chain 2

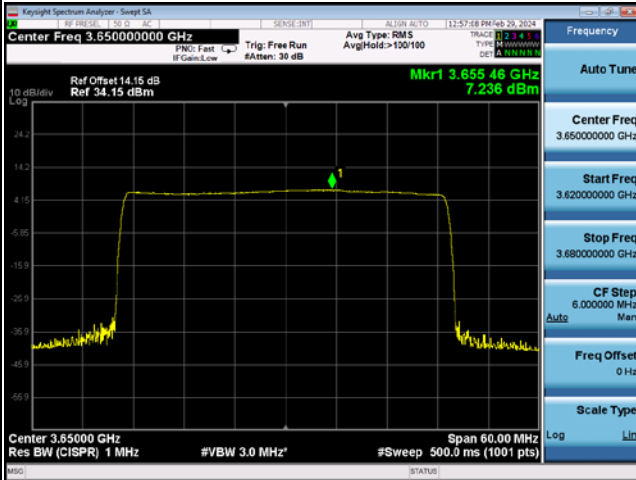


Chain 3

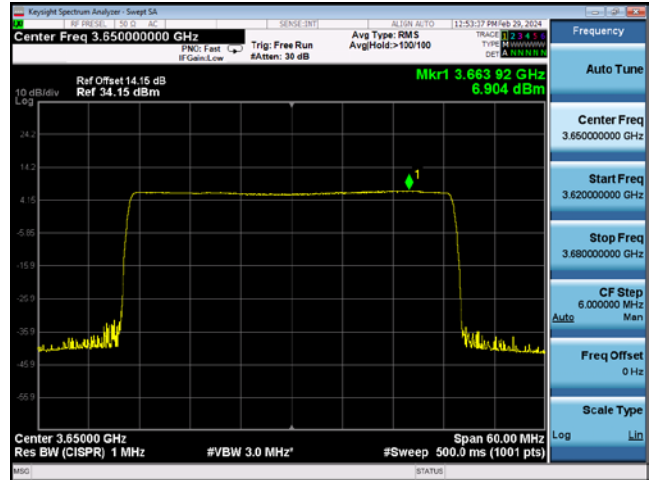


maxEirp = 24 dBm/MHz

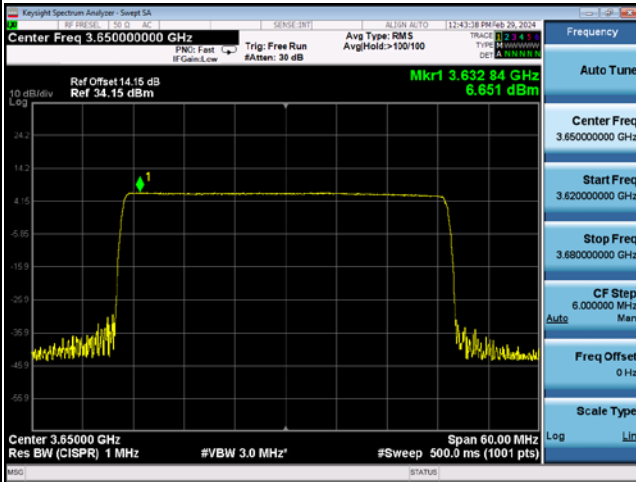
Chain 0



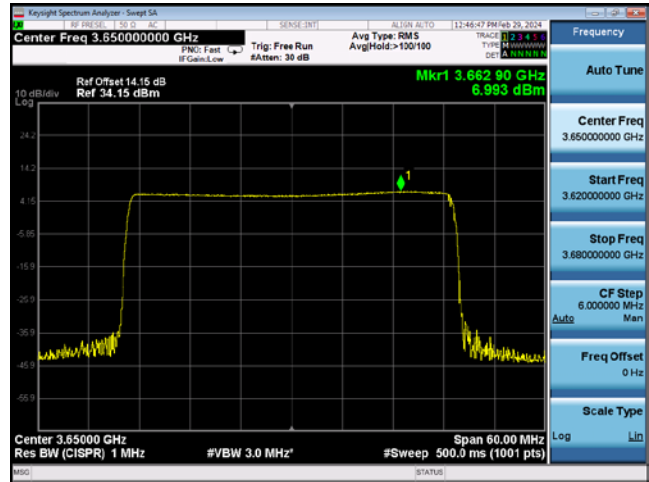
Chain 1



Chain 2

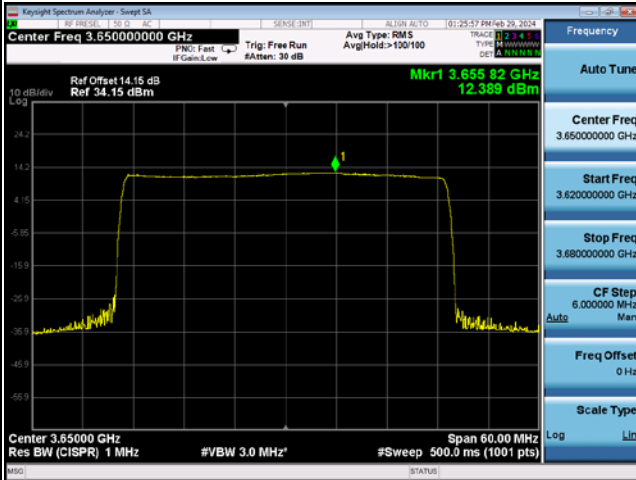


Chain 3

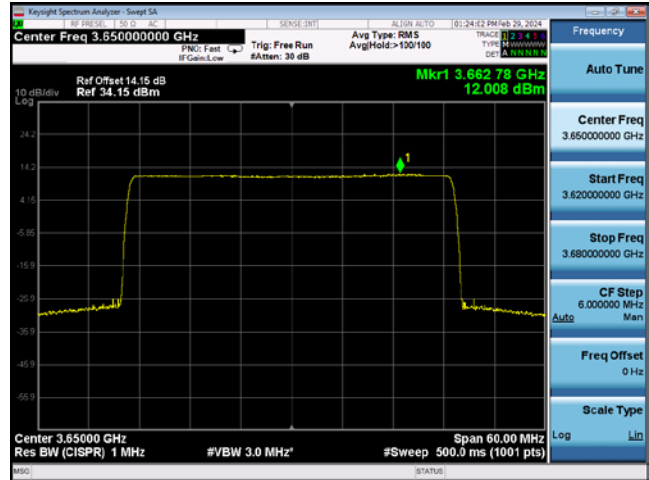


maxEirp = 29 dBm/MHz

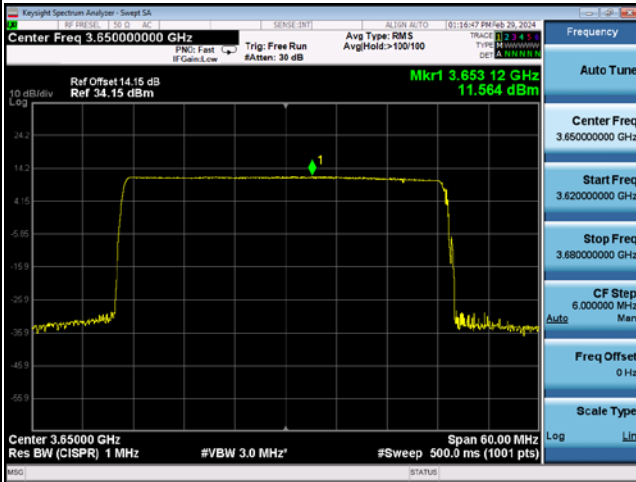
Chain 0



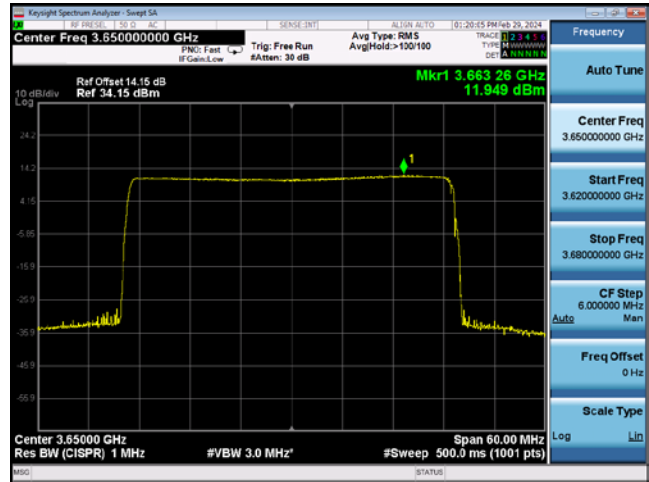
Chain 1



Chain 2

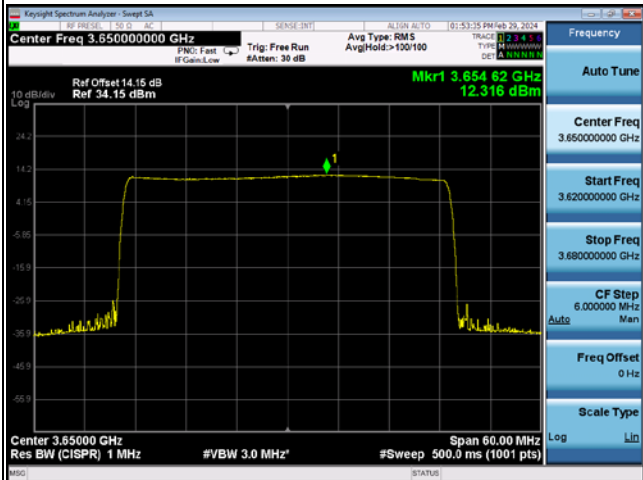


Chain 3

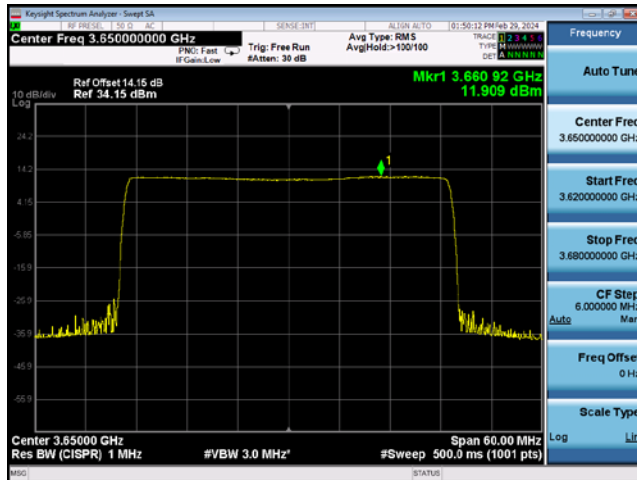


maxEirp = 37 dBm/MHz

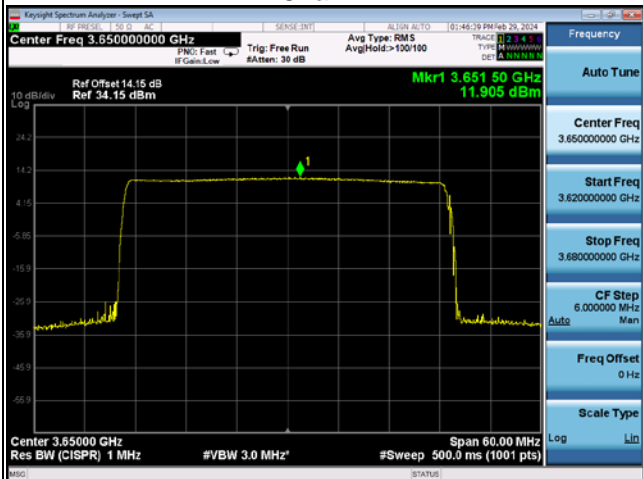
Chain 0



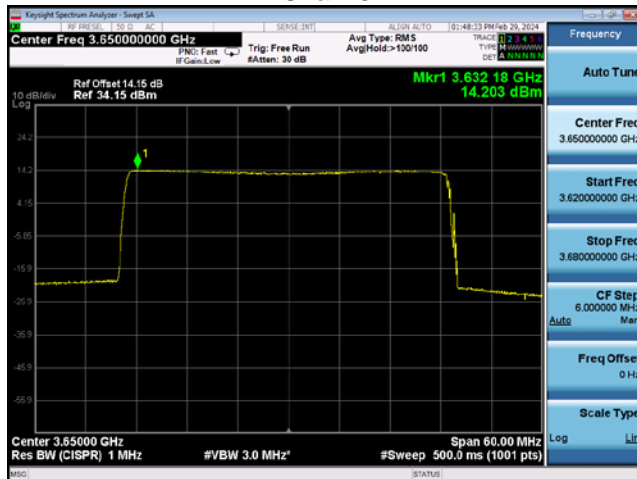
Chain 1



Chain 2



Chain 3



## **5 Pictures of Test Arrangements**

Please refer to the attached file (Test Setup Photo).

## **6 WinnForum Logs**

Please refer to the attached file (Test Logs).

## Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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