ELEMENT WASHINGTON DC LLC
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TEST REPORT
CBSD-SAS Interoperability

Applicant Name:
Skylark Wireless, LLC
4011 Garrott St.
Houston, TX 77006
USA

Date of Testing:
11/29/2023 - 9/3/2024
Test Report Issue Date:
01/28/2025
Test Site/Location:
Element lab. Columbia, MD, USA
Test Report Serial No.:
1M2401230005-03.2AS22

FCC ID:	**2AS22-FLCOCH2**
APPLICANT:	**Skylark Wireless, LLC**

Application Type:	Certification
Model:	FLCOCH2
EUT Type:	CBRS CPE
Frequency Range:	3550 – 3700 MHz
FCC Classification:	Citizens Broadband Customer Premise Equipment CBSDs (CBC)
FCC Rule Part(s):	Part 96
Test Procedure(s):	KDB 940660 D01 v02, KDB 940660 D02 v01 WINNF-TS-0122-V1.0.2, CBRSA-TS-9001 V.1.0.0, WINNF-19-IN-00033

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in the test procedures listed above. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President

Authorized Test Lab

ACCREDITED
CERT #2041.01

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 Element Test Location

These measurement tests were conducted at the Element laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046.

1.3 Test Facility / Accreditations

Measurements were performed at Element lab located in Columbia, MD 21046, U.S.A.

- Element is a CBRS Alliance (OnGo) Approved Test Lab
- Element is a WInnForum Approved Test Lab
- Element is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for CBRS Alliance Certification Test Plan and WInnForum Conformance and Performance Test Technical Standard.
- Element is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element facility is a registered (2451B) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreement.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Skylark Wireless, LLC. CBRS CPE FCC ID: 2AS22-FLCOCH2.** The test data contained in this report pertains only to CBSD-SAS interoperability. The EUT operates as a category B CBSD. The EUT is not a domain proxy.

Test Device Serial Number(s): FL2B000036, FL2B000061
Test Device Software Version: 2023.07.01

2.2 Device Capabilities

This device contains the following capabilities:

Band 48

This device supports the following conditional features:

	Conditional Test Case Definitions	Supported
C1	Mandatory for UUT which supports multi-step registration message	☒
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.	☐
C3	Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message.	☒
C4	Mandatory for UUT which supports RECEIVED_POWER_WITHOUT_GRANT measurement report type.	☒
C5	Mandatory for UUT which supports RECEIVED_POWER_WITH_GRANT measurement report type.	☐
C6	Mandatory for UUT which supports parameter change being made at the UUT and prior to sending a deregistration	☐

Table 2-1. Conditional Features

2.3 Test Configuration

The EUT was connected to the SAS Test Harness developed by WINNF WG4-CBSD. The SAS Test Harness (V1.0.0.2) provided by CBRS Alliance was used. The SAS Test Harness is synchronized to UTC time.

2.4 Modifications

No modifications were made to EUT during testing.

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3.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	US46470561
Dell	Latitude 5580	Test Harness Laptop	N/A	N/A	N/A	N/A

Table 3-1 Annual Test Equipment Calibration Schedule

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date ranges care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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4.0 ENVIRONMENTAL CONDITIONS

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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5.0 EVALUATION PROCEDURE

The measurement procedure described in KDB 940660 D01 v03, KDB 940660 D02 v01 and WINNF-TS-0122-V1.0.2 was used in the measurement of the EUT.

Deviation from measurement procedure…….....None

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6.0 TEST SUMMARY

6.1 Summary

Company Name: Skylark Wireless LLC

FCC ID: 2AS22-FLCOCH2

Table 6-1. Summary of Test Results

FCC Part Section(s)	KDB940660 D01 Section 3.3 a)	Test Case Description	WInnForum Test Case	Test Result
96.39 (c)	1	Confirm that the device will only transmit after it receives authorization from a SAS	WINNF.FT.C.REG.1 WINNF.FT.C.REG.5 WINNF.FT.C.REG.8 WINNF.FT.C.REG.10 WINNF.FT.C.REG.12 WINNF.FT.C.REG.14 WINNF.FT.C.REG.16 WINNF.FT.C.REG.18 WINNF.FT.C.GRA.1 WINNF.FT.C.GRA.2 WINNF.FT.C.HBT.5	Pass
96.39 (c)	2	Check the device registration and authorization with the SAS – determine if the device behaves appropriately for successful and unsuccessful registrations. The device should not be transmitting without authorization from the SAS.	WINNF.FT.C.REG.1 WINNF.FT.C.REG.8 WINNF.FT.C.REG.10 WINNF.FT.C.REG.12 WINNF.FT.C.REG.14 WINNF.FT.C.REG.16 WINNF.FT.C.REG.18	Pass
96.39(c)(1)	3	Confirm that the device changes its operating power and/or channel in response to a command from the SAS.	WINNF.FT.C.HBT.1	Pass
96.39	4	Confirm that the device correctly configures based on the different license classes	N/A	Pass
96.39(c)(1)	5	Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS.	WINNF.PT.C.HBT.1	Pass
96.39(b)(c)	6	Confirm that the device transmits with a bandwidth less than or equal to the SAS specified bandwidth.	WINNF.FT.C.HBT.1	Pass
96.39(c)(2)	7	Confirm that the device transmits on the SAS specified frequency.	WINNF.FT.C.HBT.1	Pass
96.39(c)(2)	8	Confirm that the device stops transmission in response to a command from the SAS, within a period as required by Part 96.	WINNF.FT.C.HBT.3 WINNF.FT.C.HBT.4 WINNF.FT.C.HBT.6 WINNF.FT.C.HBT.7 WINNF.FT.C.HBT.10 WINNF.FT.C.RLQ.1 WINNF.FT.C.DRG.1	Pass

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96.39 (c)	9	Confirm that the device sends measurements data in response to the command from the SAS.	N/A	Pass
96.39(a)	10	For devices with geo-location, confirm that it notifies the SAS of a new location when it is beyond the required distance parameter (±50 m) within the required time frame.	N/A	N/A
96.39 (c)	11	Confirm that the device is capable of reporting the signal level (measurement data) and frequency to SAS.	N/A	Pass
96 E	12	When CBSDs communicate through a management system, confirm compliance with all requirements.	N/A	Pass
96.39	13	When communication between the CBSD and SAS is lost: i) Describe how the CBSD would react if the communications between the device and the SAS is lost. Confirm that the CBSD stops transmission once it loses the link to the SAS. ii) Describe the process for re-establishment of the communications and confirm that the CBSD acts accordingly. iii) Confirm power-on restart process for registration (re-registration) occurs as expected. iv) Confirm the process for de-registration occurs as expected.	WINNF.FT.C.HBT.9 WINNF.FT.C.HBT.10	Pass
96.39(f)	KDB940660 D01 Section 4	SAS and Device Security Requirements	WINNF.FT.C.SCS.1 WINNF.FT.C.SCS.2 WINNF.FT.C.SCS.3 WINNF.FT.C.SCS.4 WINNF.FT.C.SCS.5	Pass
96.39(e)	N/A	The CBSD must report to the SAS which available channels of frequencies it will use	WINNF.PT.C.HBT.1 WINNF.FT.C.HBT.1 WINNF.FT.C.HBT.3 WINNF.FT.C.HBT.4 WINNF.FT.C.HBT.5 WINNF.FT.C.HBT.7 WINNF.FT.C.HBT.9 WINNF.FT.C.HBT.10 WINNF.FT.C.RLQ.1 WINNF.FT.C.DRG.1	Pass

Notes:

- Test cases denoted as “N/A” in the table above are not applicable to the EUT and are either Optional or Conditional per Section 6 of WINNF-TS-0122.
- Please see Appendices for test data.
- Proper message formatting and protocol are verified by the Winnforum SAS Harness software. Test results may be verified via the SAS harness logs.
- As a CPE CBSD, the UUT may transmit within the spectrum grant of the associated BTS-CBSD at EUD levels at any time, and at CBSD levels within the constraints of KDB 940660 D02 without a SAS authorization.

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7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Skylark Wireless LLC CBRS CPE FCC ID: 2AS22-FLCOCH2** has been tested to show compliance with Part 96 and WINNF-TS-0122.

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APPENDIX A – TEST RESULT AND DATA

A1 [WINNF.FT.C.REG.1] Multi-Step registration

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness • UUT is in the Unregistered state CBSD sends correct Registration request information, as specified in [n.5], to the SAS Test Harness:	--	--
2	• The required userId, fccId and cbsdSerialNumber registration parameters shall be sent from the 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. Note: It is outside the scope of this document to test the Registration information that is supplied via another means.	☒	☐
3	• SAS Test Harness sends a CBSD Registration Response as follows: - cbsdId = Ci - measReportConfig shall not be included - responseCode = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

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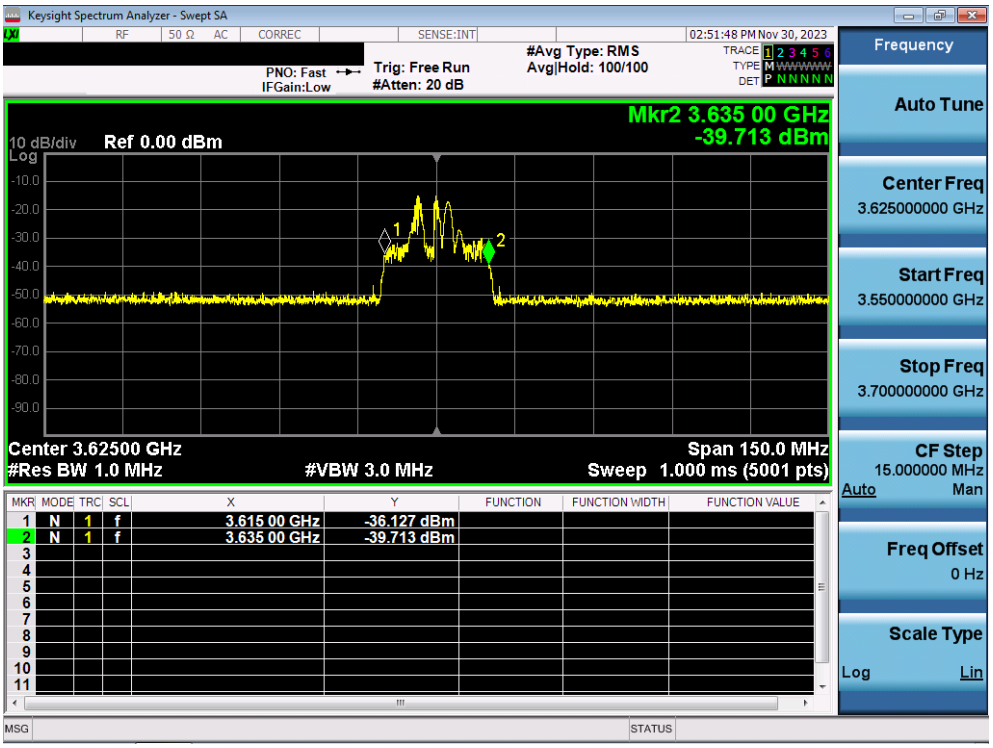
Test Plots:



Plot 1. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.1)

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A3 [WINNF.FT.C.REG.5] Single-Step registration for CBSD with CPI signed data

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • 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	--	--
2	CBSD sends Registration request to the SAS Test Harness: • The required userId, fccId and cbsdSerialNumber and REG-Conditional cbsdCategory, airInterface, measCapability and cpiSignatureData 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	• SAS Test Harness sends a CBSD Registration Response as follows: - cbsdId = C - measReportConfig shall not be included - responseCode = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

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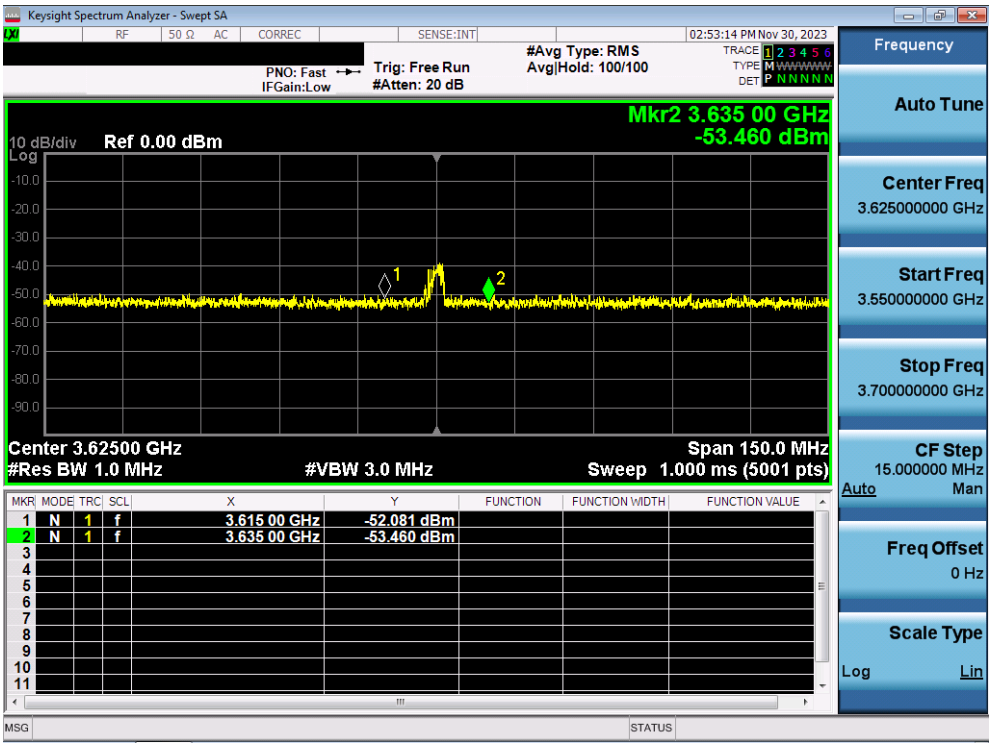

Plot 2. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.5)

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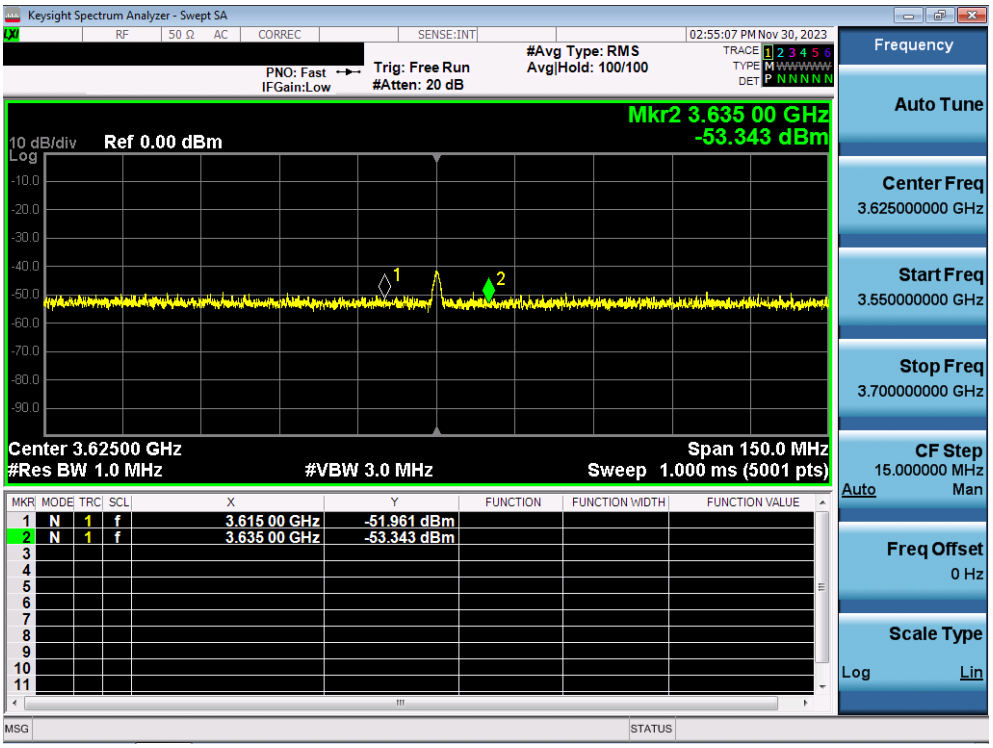
A4 [WINNF.FT.C.REG.8] Missing Required parameters (responseCode 102)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 3. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.8)

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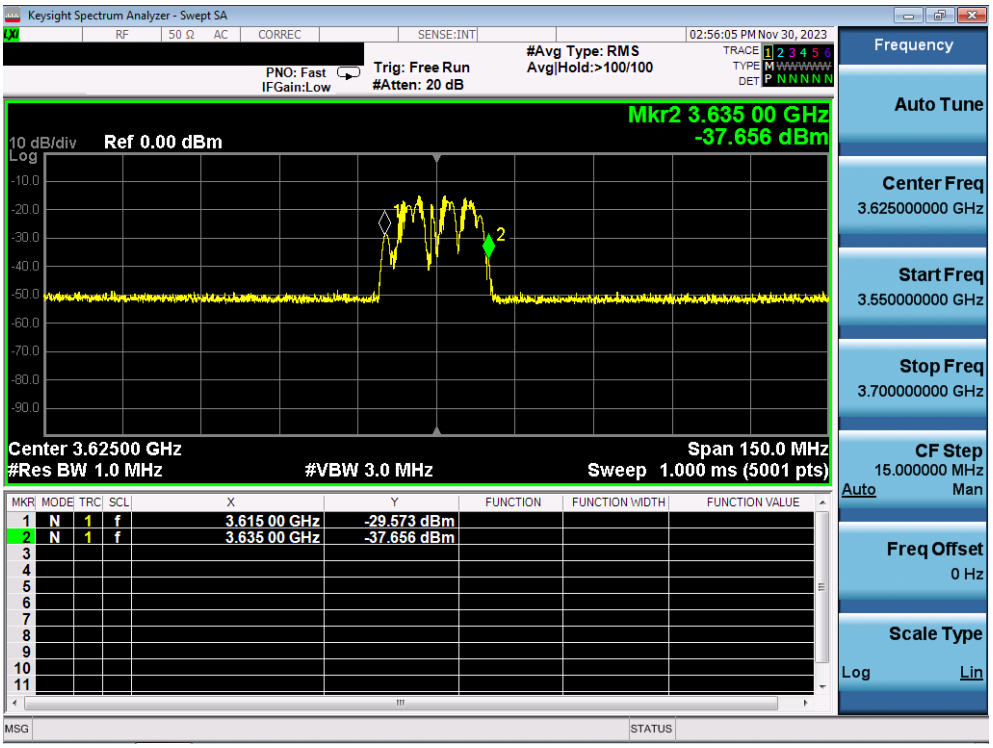
A5 [WINNF.FT.C.REG.10] Pending registration (responseCode 200)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 4. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.10)

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A6 [WINNF.FT.C.REG.12] Invalid parameter (responseCode 103)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:

Plot 5. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.12)

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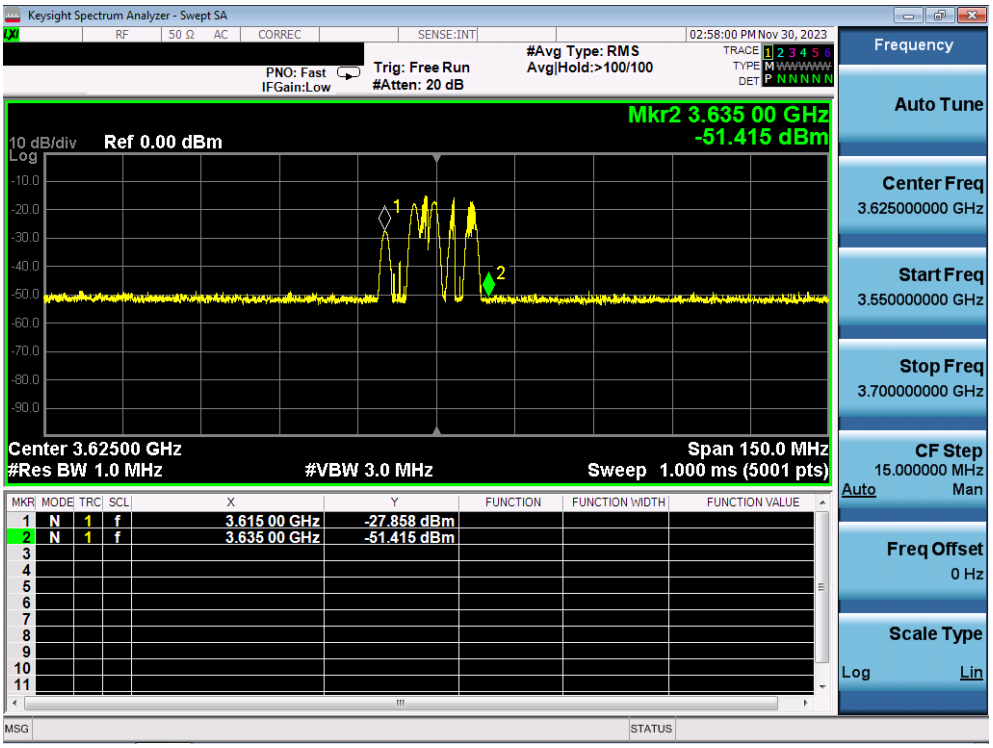
A7 [WINNF.FT.C.REG.14] Blacklisted CBSD (responseCode 101)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 6. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.14)

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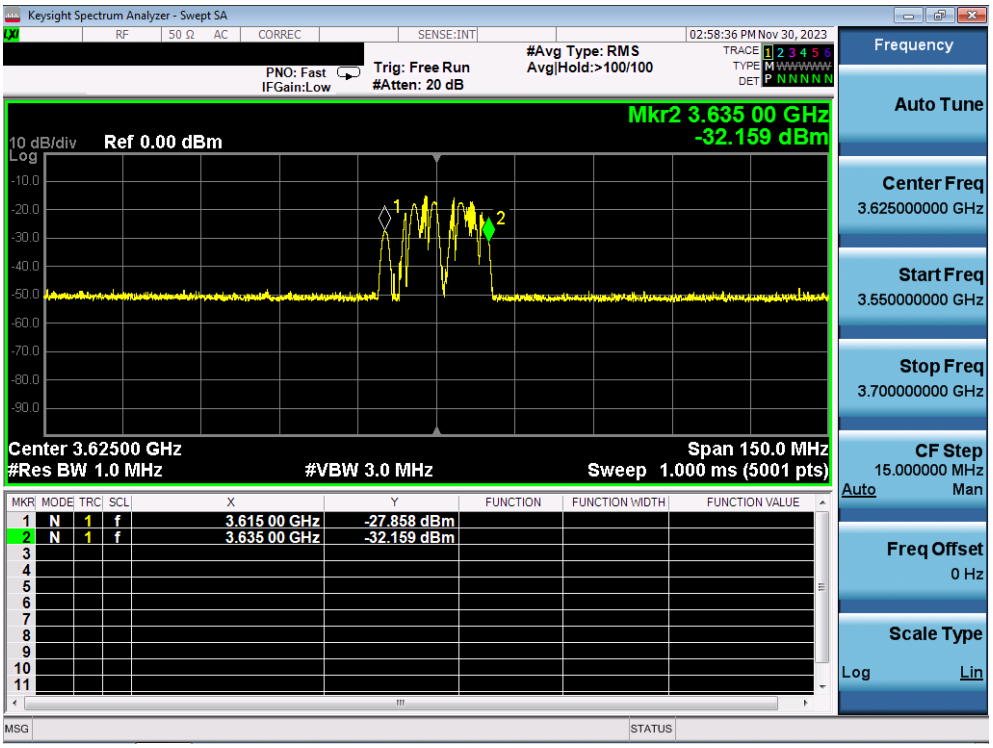
A8 [WINNF.FT.C.REG.16] Unsupported SAS protocol version (responseCode 100)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 7. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.16)

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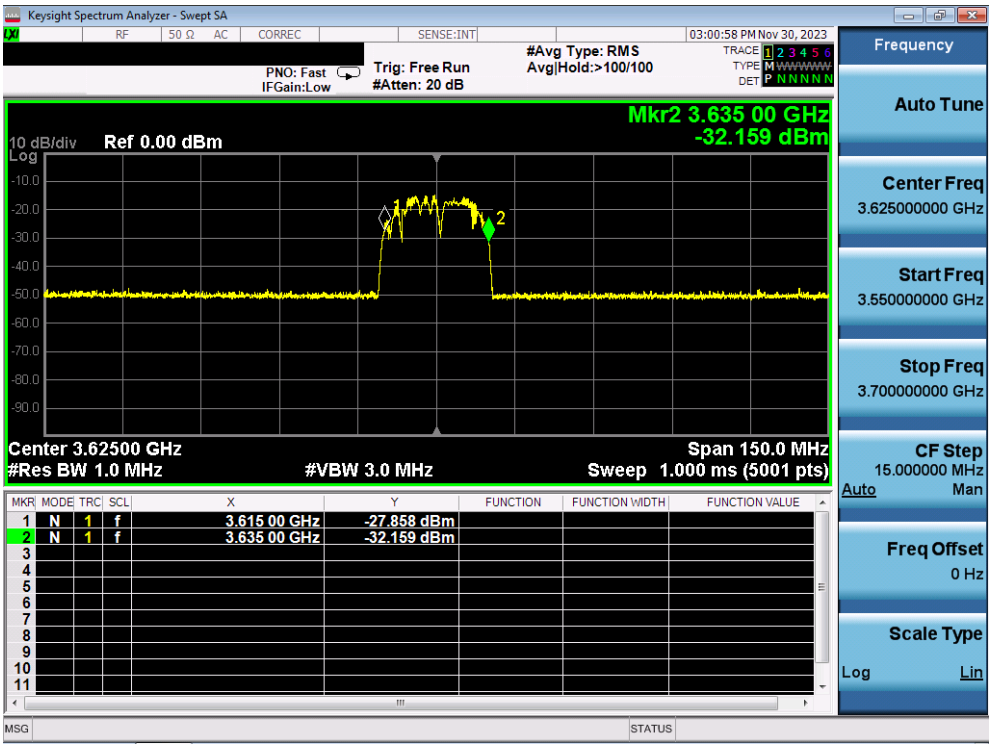
A9 [WINNF.FT.C.REG.18] Group Error (responseCode 201)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include cbsdId - responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 8. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.REG.18)

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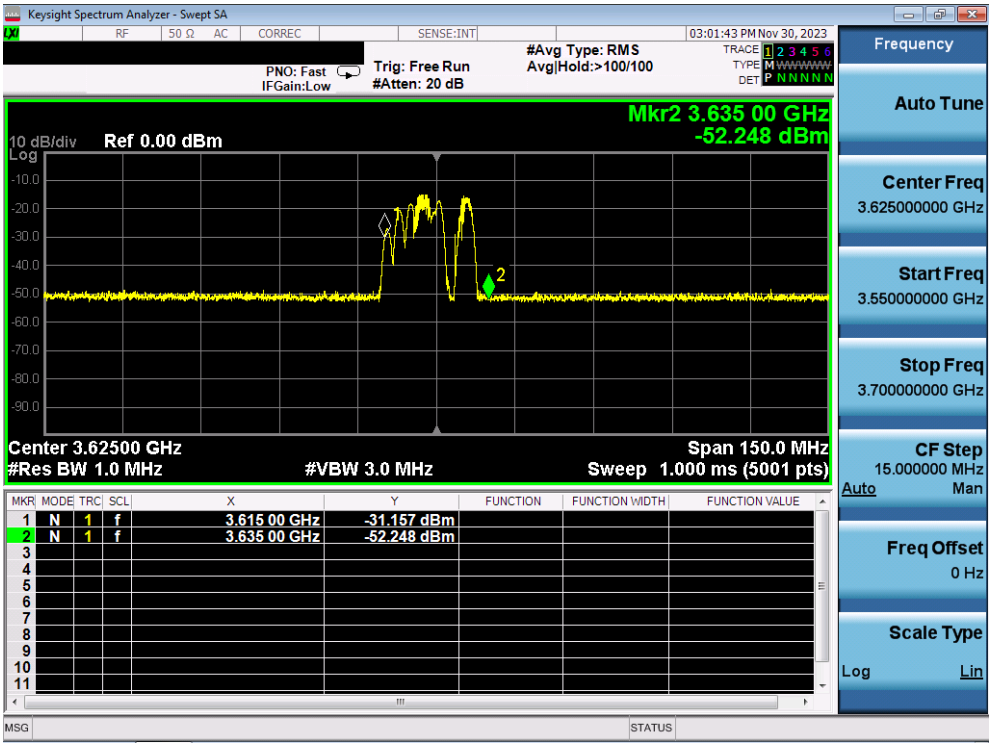
A10 [WINNF.FT.C.GRA.1] Unsuccessful Grant responseCode=400 (INTERFERENCE)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness, with cbsdId = C	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including • cbsdId=C • responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 9. Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.GRA.1)

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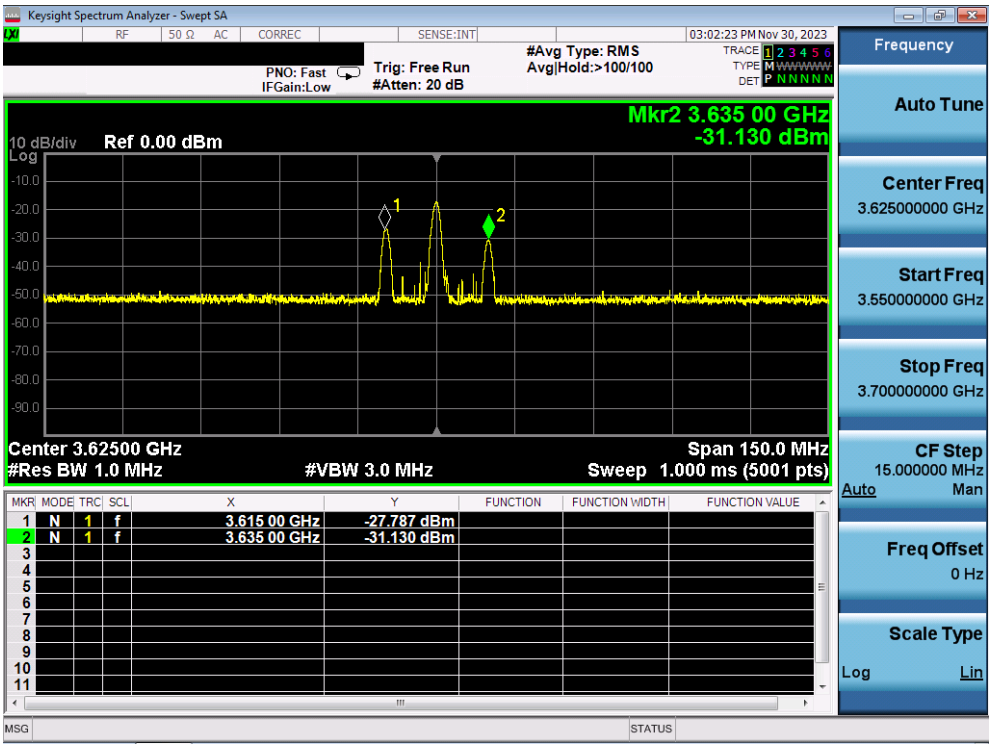
A11 [WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness, with cbsdId = C	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including • cbsdId=C • responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD	☒	☐

Test Plots:



Plot 10.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.GRA.2)

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A12 [WINNF.FT.C.HBT.1] Heartbeat Success Case (first Heartbeat Response)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness, with cbsdId = C	--	--
2	UUT sends a message: • If message is type Spectrum Inquiry Request, go to step 3, or • If message is type Grant Request, go to step 5	--	--
3	UUT sends Spectrum Inquiry Request. Validate: • cbsdId = C • List of frequencyRange objects sent by UUT are within the CBRS frequency range	☒	☐
4	SAS Test Harness sends a Spectrum Inquiry Response message, including the following parameters: • cbsdId = C • availableChannel is an array of availableChannel objects • responseCode = 0	--	--
5	UUT sends Grant Request message. Validate: • cbsdId = C • maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 • operationFrequencyRange, F, sent by UUT is a valid range within the CBRS band	☒	☐
6	SAS Test Harness sends a Grant Response message, including the parameters: • cbsdId = C • grantId = G = a valid grant ID • grantExpireTime = UTC time greater than duration of the test • responseCode = 0	--	--
7	UUT sends a first Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: • cbsdId = C • grantId = G • operationState = “GRANTED”	☒	☐
8	SAS Test Harness sends a Heartbeat Response message, with the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0	--	--
9	For further Heartbeat Request messages sent from UUT after completion of step 8, validate message is sent within latest specified heartbeatInterval, and: • cbsdId = C • grantId = G • operationState = “AUTHORIZED” and SAS Test Harness responds with a Heartbeat Response message including the following parameters: • cbsdId = C	☒	☐

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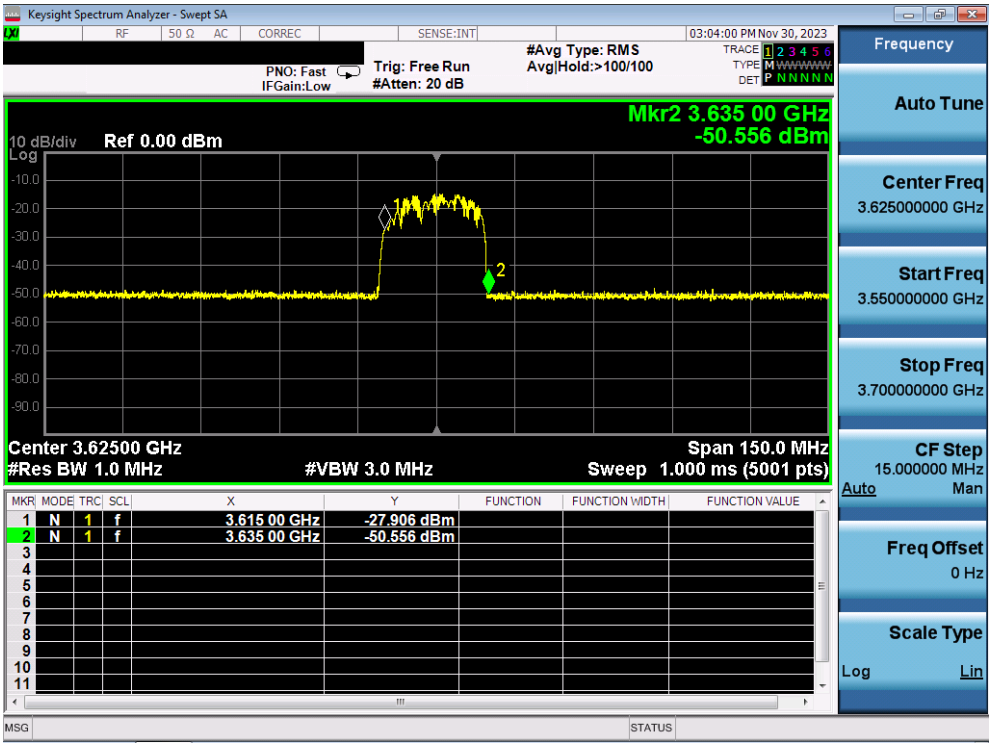
	• grantId = G • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0		
10	Monitor the RF output of the UUT from start of test until UUT transmission commences. Verify: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time prior to completion of the first heartbeat response • UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F	☒	☐

Test Plots:



Plot 11.Conducted Measurement - UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.1)

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A13 [WINNF.FT.C.HBT.3] Heartbeat responseCode=105 (DEREGISTER)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	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: • cbsdId = C • grantId = G • operationState = “AUTHORIZED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = T = Current UTC time • responseCode = 105 (DEREGISTER)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--

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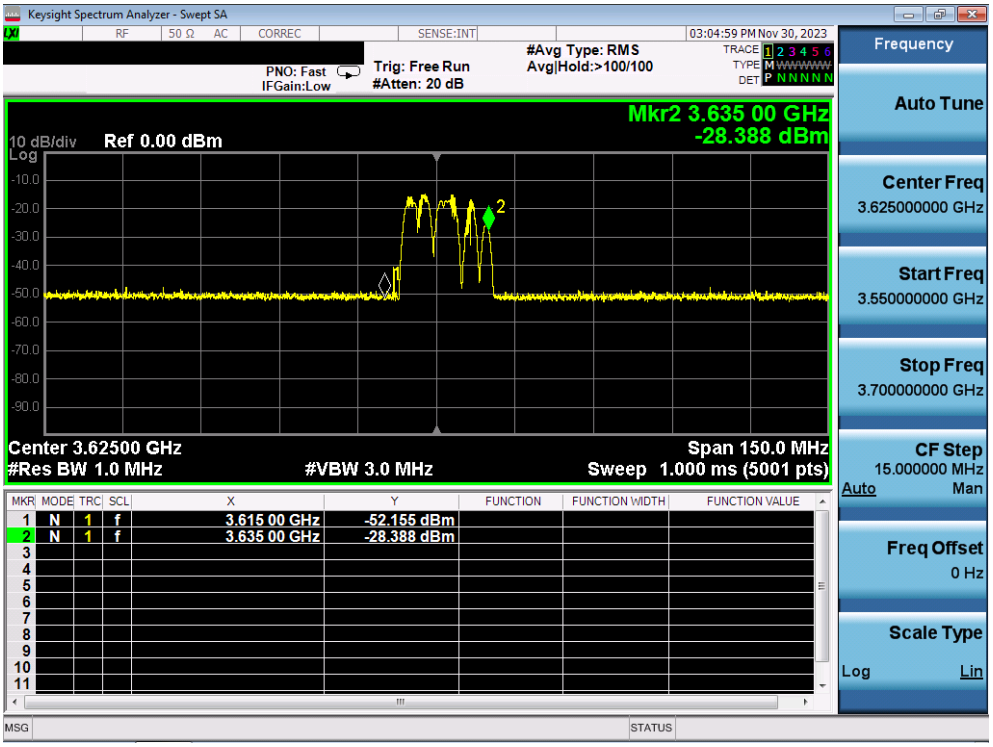
Test Plots:



Plot 12.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.3)

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A14 [WINNF.FT.C.HBT.4] Heartbeat responseCode=500 (TERMINATED_GRANT)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	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: • cbsdId = C • grantId = G • operationState = “AUTHORIZED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = T = Current UTC time • responseCode = 500 (TERMINATED_GRANT)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--

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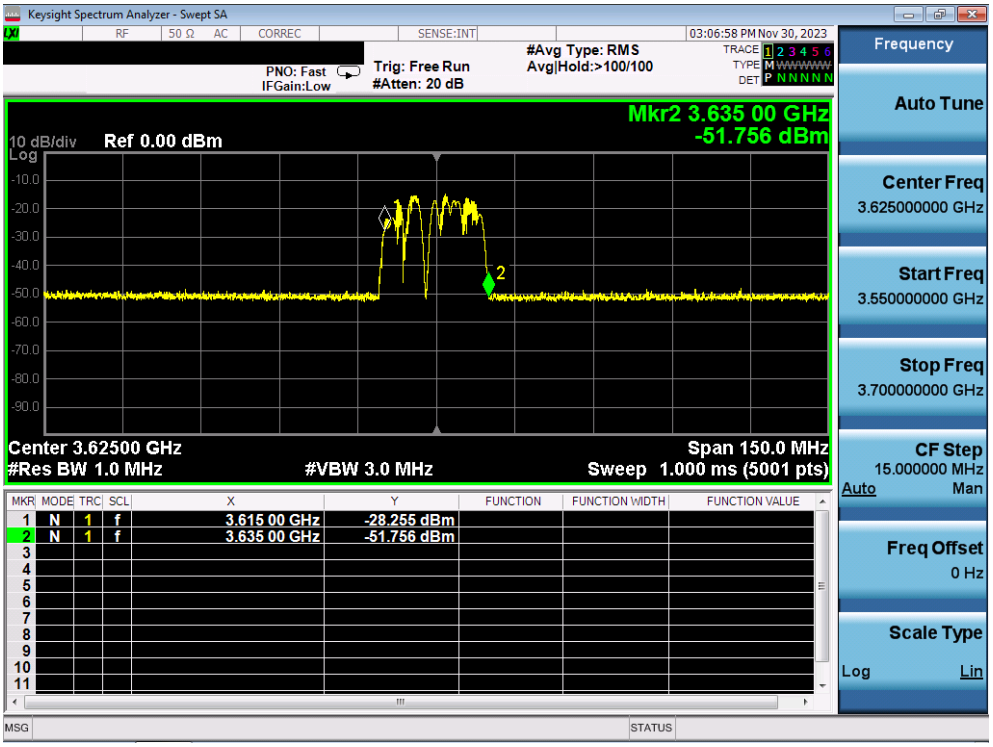
Test Plots:



Plot 13.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.4)

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A15 [WINNF.FT.C.HBT.5] Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	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: • cbsdId = C • grantId = G • operationState = “GRANTED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = T = Current UTC time • responseCode = 501 (SUSPENDED_GRANT)	--	--
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: A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters: • cbsdId = C • grantId = G • operationState = “GRANTED” B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters: • cbdsId = C • grantId = G Monitor the RF output of the UUT. Verify: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time.	☒	☐

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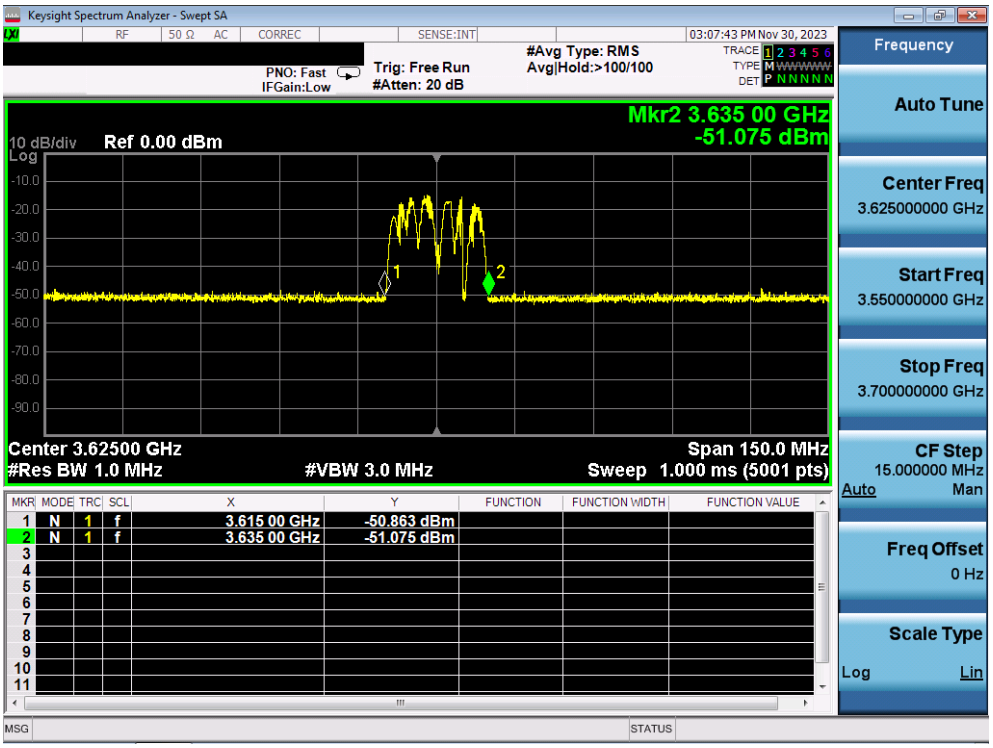
Test Plots:



Plot 14.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.5)

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A16 [WINNF.FT.C.HBT.6] Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	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: • cbsdId = C • grantId = G • operationState = “AUTHORIZED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = T = Current UTC time • responseCode = 501 (SUSPENDED_GRANT)	--	--
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: A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters: • cbsdId = C • grantId = G • operationState = “GRANTED” B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters: • cbdsId = C • grantId = G	☒	☐

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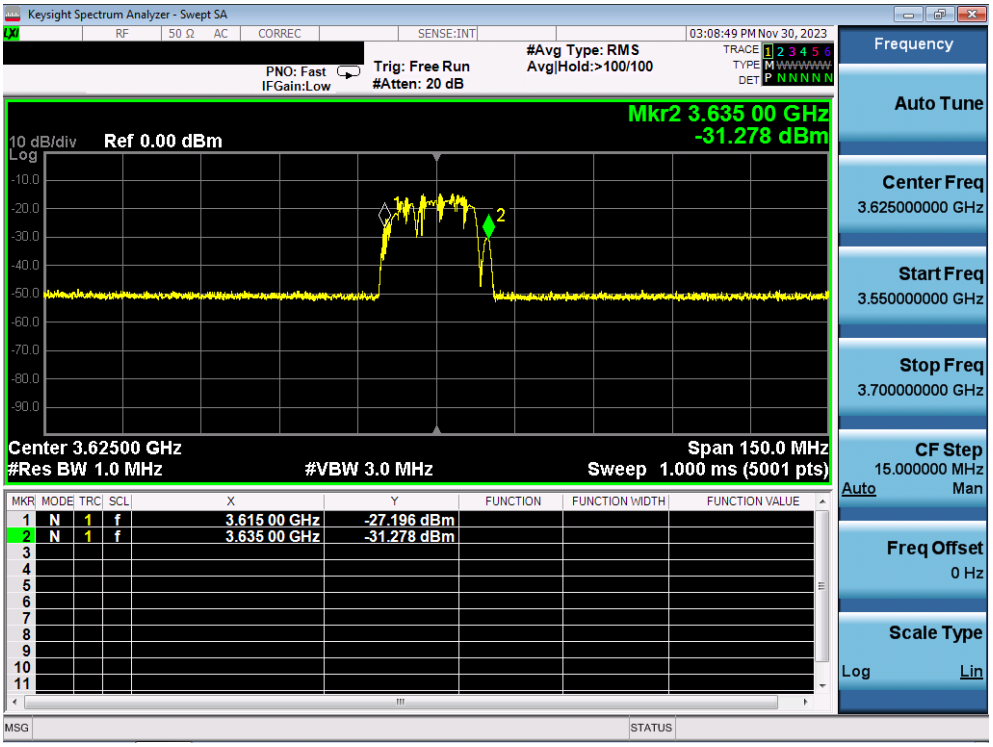
Test Plots:



Plot 15.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.6)

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A17 [WINNF.FT.C.HBT.7] Heartbeat responseCode=502 (UNSYNC_OP_PARAM)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	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: • cbsdId = C • grantId = G • operationState = “AUTHORIZED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = T = Current UTC time • responseCode = 502 (UNSYNC_OP_PARAM)	--	--
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: • UUT sends a Grant Relinquishment Request message. Verify message is correctly formatted with parameters: o cbdsId = C o grantId = G	☒	☐

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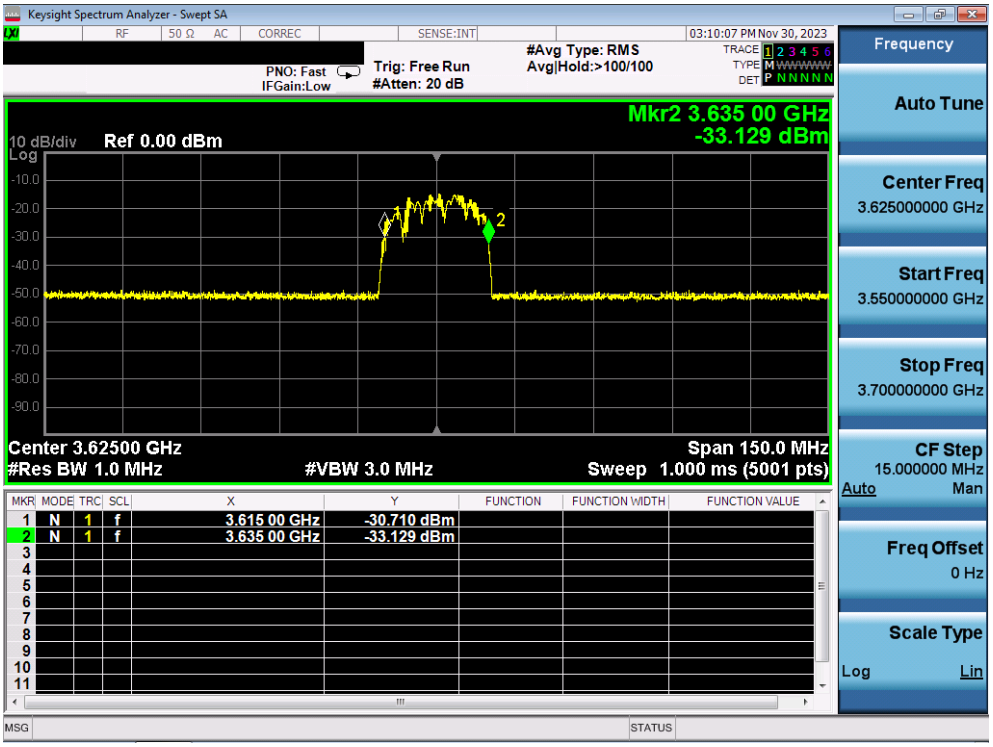
Test Plots:



Plot 16.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.7)

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A18 [WINNF.FT.C.HBT.9] Heartbeat Response Absent (First Heartbeat)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: • cbsdId = C • grantId = G • operationState = “GRANTED”	☒	☐
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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time	☒	☐

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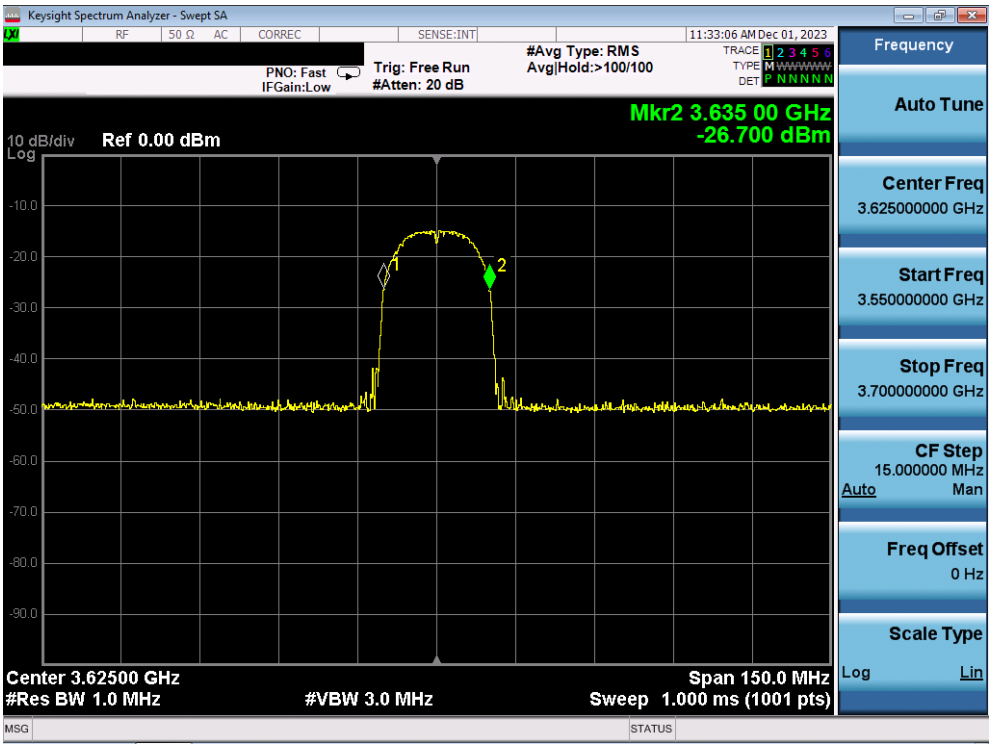
Test Plots:



Plot 17.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.HBT.9)

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A19 [WINNF.FT.C.HBT.10] Heartbeat Response Absent (Subsequent Heartbeat)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: o valid cbsdId = C o valid grantId = G o grant is for frequency range F, power P o grantExpireTime = 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	UUT sends a Heartbeat Request message. Verify Heartbeat Request message issent within the latest specified heartbeatInterval, and is formatted correctly, including: • cbsdId = C • grantId = G • operationState = “AUTHORIZED”	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: • cbsdId = C • grantId = G • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0	--	--
4	After completion of Step 3, SAS Test Harness does not respond to any further messages from UUT	--	--

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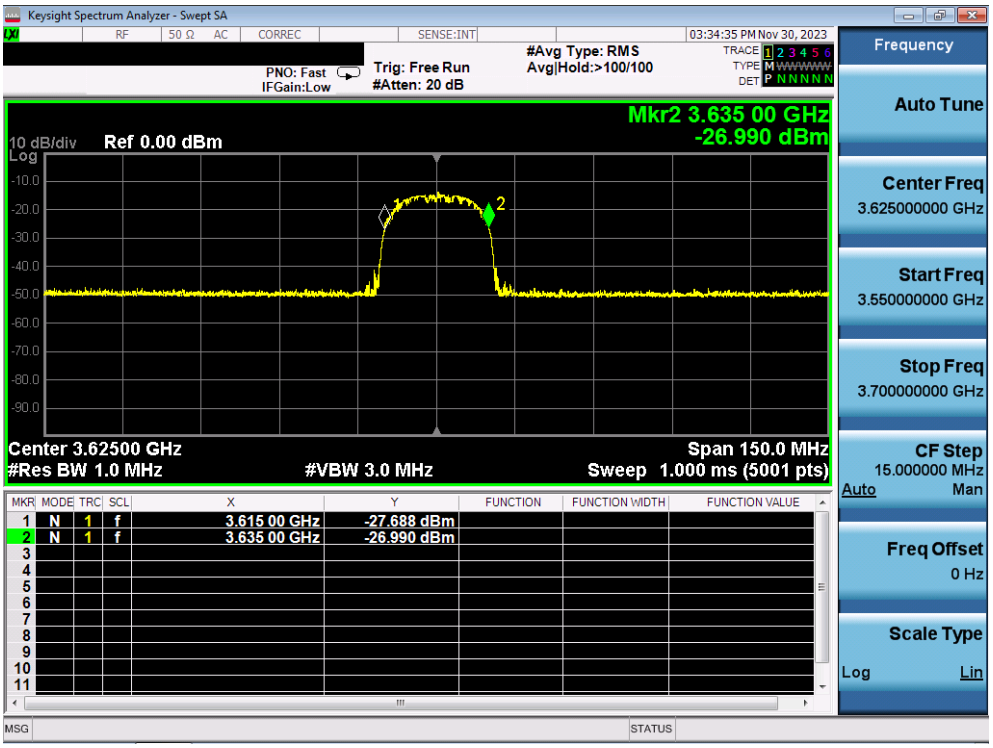
Test Plots:



Plot 18.Conducted Measurement - UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD) (WINNF.FT.C.HBT.10)

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A20 [WINNF.FT.C.RLQ.1] Successful Relinquishment

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT has successfully registered with SAS Test Harness, with cbsdId=C • UUT has received a valid grant with grantId = G • UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant. Invoke trigger to relinquish UUT Grant from the SAS Test Harness	--	--
2	UUT sends a Relinquishment Request message. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G	☒	☐
3	SAS Test Harness shall approve the request with a Relinquishment Response message with parameters: • cbsdId = C • grantId = G • responseCode = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any additional positive response (responseCode=0) to further request messages from the UUT.	--	--

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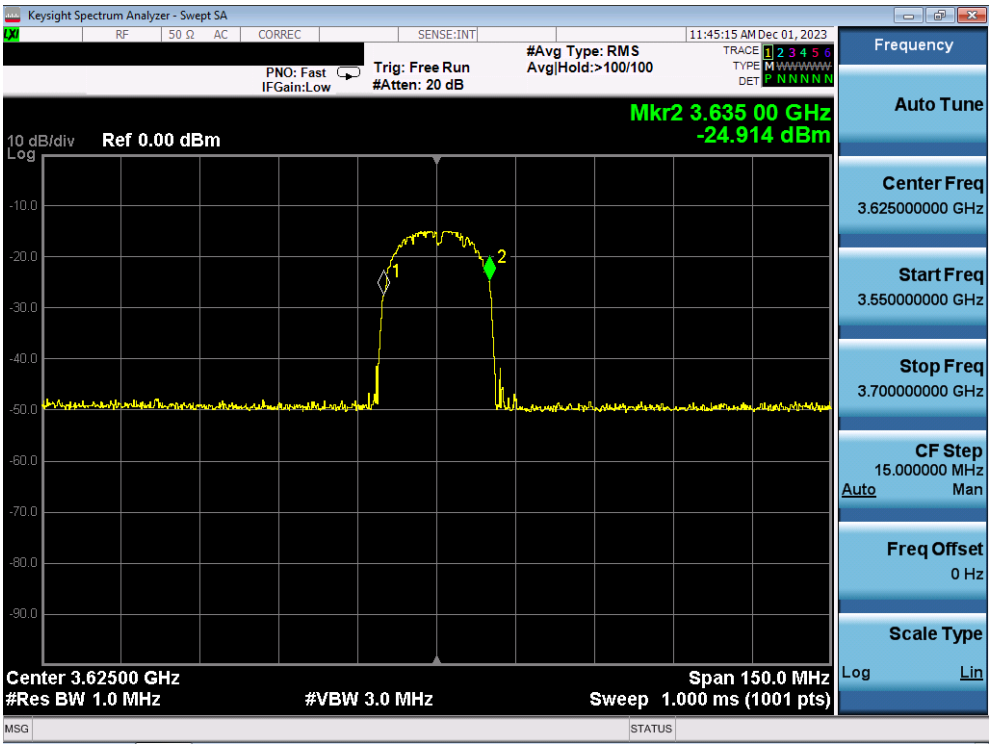
Test Plots:



Plot 19.Conducted Measurement - UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.RLQ.1)

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A21 [WINNF.FT.C.MES.1] Registration Response contains measReportConfig

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness	--	--
2	UUT sends a Registration Request message. Validate the Registration Request message is formatted correctly, including: • userId is present and correct • fccId is present and correct • cbsdSerialNumber is present and correct • measCapability = “RECEIVED_POWER_WITHOUT_GRANT”	☒	☐
3	SAS Test Harness sends a Registration Response message, with the following parameters: • cbsdId = C = valid cbsdId for this UUT • measReportConfig= “RECEIVED_POWER_WITHOUT_GRANT” • responseCode = 0	--	--
4	UUT sends a message: • If message is type Spectrum Inquiry Request, go to step 5, or • If message is type Grant Request, go to step 7	--	--
5	UUT sends message type Spectrum Inquiry Request. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • measReport is present, and is a properly formatted rcvdPowerMeasReport.	☒	☐
6	SAS Test Harness sends a Spectrum Inquiry Response, with the following parameters: • cbsdId = C • availableChannel is an array of availableChannel objects • responseCode = 0	--	--
7	UUT sends message type Grant Request message. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • measReport is present, and is a properly formatted rcvdPowerMeasReport.	☒	☐

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```
"measReport": {
    "rcvdPowerMeasReports": [
        {
            "measBandwidth": 10000000,
            "measFrequency": 3550000000,
            "measRcvdPower": -99
        },
        {
            "measBandwidth": 10000000,
            "measFrequency": 3560000000,
            "measRcvdPower": -99
        },
        {
            "measBandwidth": 10000000,
            "measFrequency": 3570000000,
            "measRcvdPower": -99
        },
        {
            "measBandwidth": 10000000,
            "measFrequency": 3580000000,
            "measRcvdPower": -99
        },
        {
            "measBandwidth": 10000000,
            "measFrequency": 3590000000,
            "measRcvdPower": -99
        },
        {
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            "measFrequency": 3600000000,
            "measRcvdPower": -99
        },
        {
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            "measFrequency": 3610000000,
            "measRcvdPower": -99
        },
        {
            "measBandwidth": 10000000,
            "measFrequency": 3620000000,
            "measRcvdPower": -99
        },
        {
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        },
        {
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            "measFrequency": 3640000000,
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            "measRcvdPower": -99
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            "measBandwidth": 10000000,
            "measFrequency": 3690000000,
            "measRcvdPower": -99
        }
```


Plot 20. Measurement Report

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A22 [WINNF.FT.C.DRG.1] Successful Deregistration

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT has successfully registered with SAS Test Harness, with cbsdId=C • UUT has received a valid grant with grantId = G • UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant. Invoke trigger to deregister UUT from the SAS Test Harness	--	--
2	UUT sends a Relinquishment request and receives Relinquishment response with responseCode=0	--	--
3	UUT sends Deregistration Request to SAS Test Harness with cbsdId = C.	☒	☐
4	SAS Test Harness shall approve the request with a Deregistration Response message with parameters: • cbsdId = C • responseCode = 0	--	--
5	After completion of step 3, SAS Test Harness will not provide any additional positive response (responseCode=0) to further request messages from the UUT	--	--
6	Monitor the RF output of the UUT from start of test until 60 seconds after Step 4 is complete. This is the end of the test. Verify: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time prior to completion of the first heartbeat response	☒	☐

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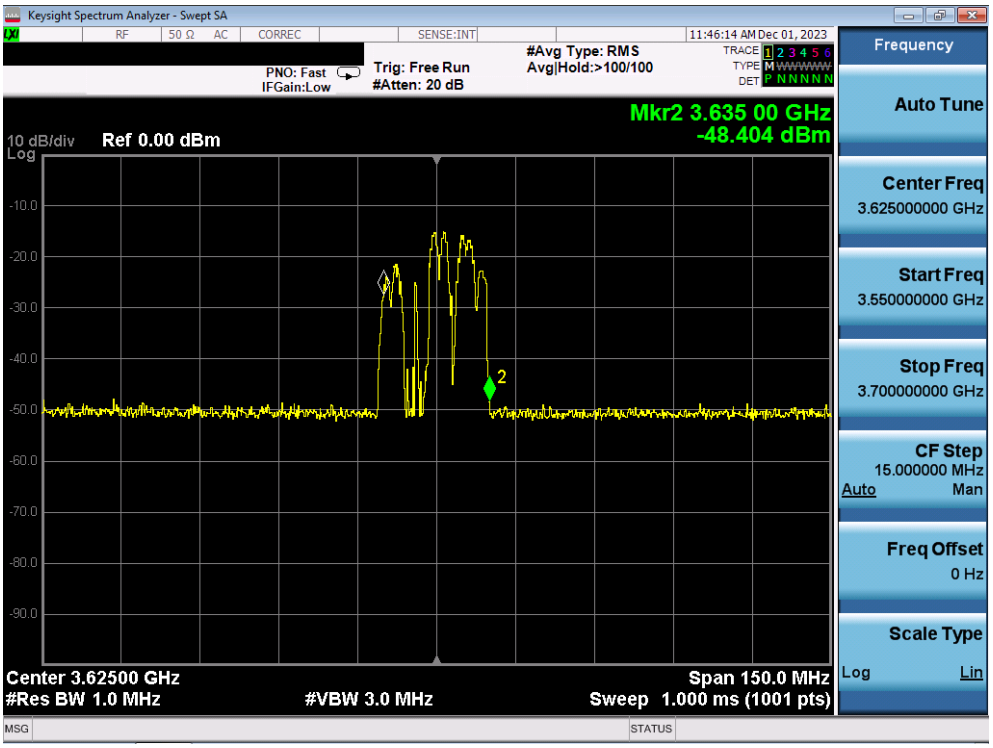
Test Plots:



Plot 21. Conducted Measurement - UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.DRG.1)

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A23 [WINNF.FT.C.SCS.1] Successful TLS connection between UUT and SAS Test Harness

	Test Execution Steps	PASS	FAIL
1	• UUT shall start CBSD-SAS communication with the security procedure • 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	• 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, • 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	A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability. • UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with responseCode = 0 and cbsdId.	☒	☐
4	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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time.	☒	☐

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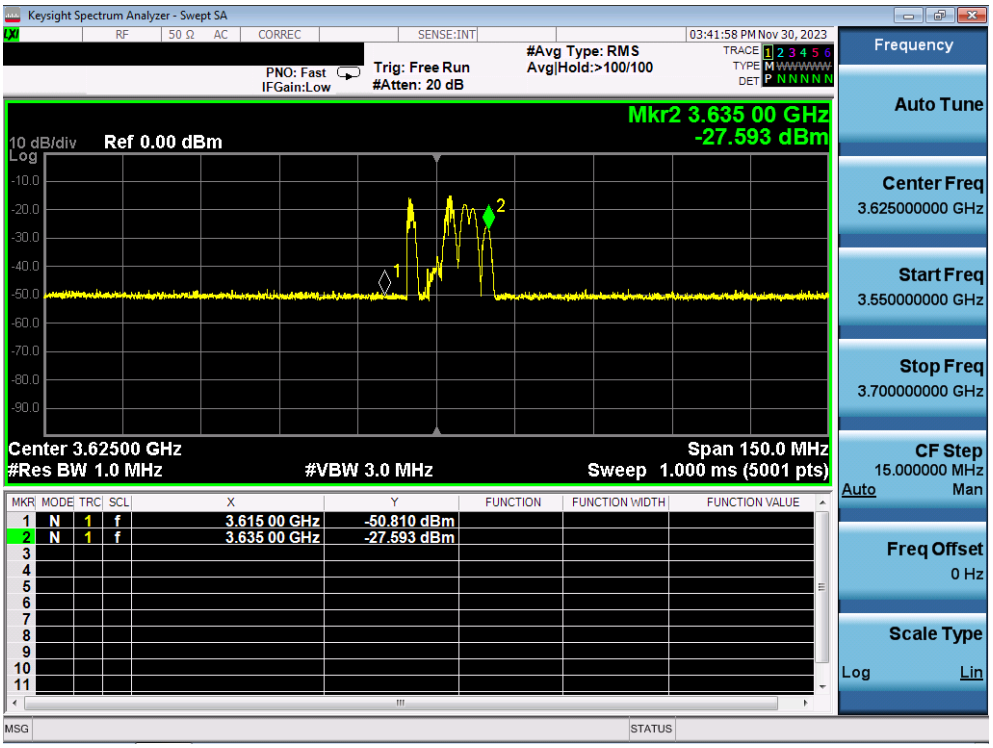
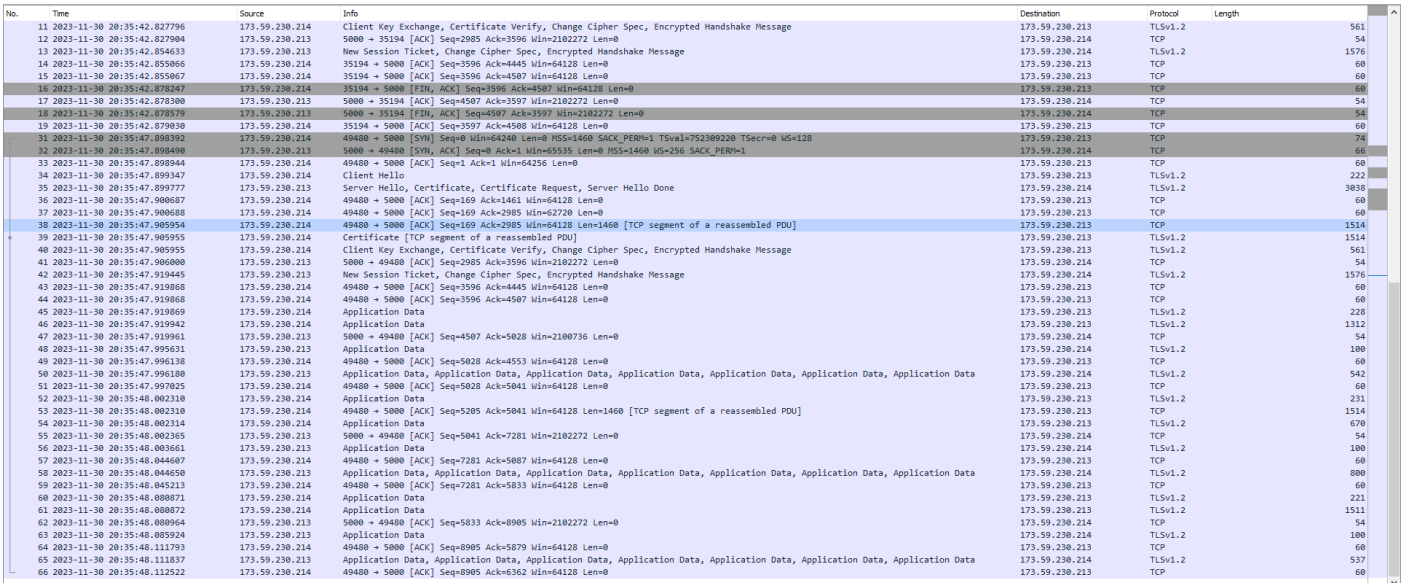
Test Plots:



Plot 22.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.SCS.1)



Plot 23.WireShark Screenshot – Successful Handshake (WINNF.FT.C.SCS.1)

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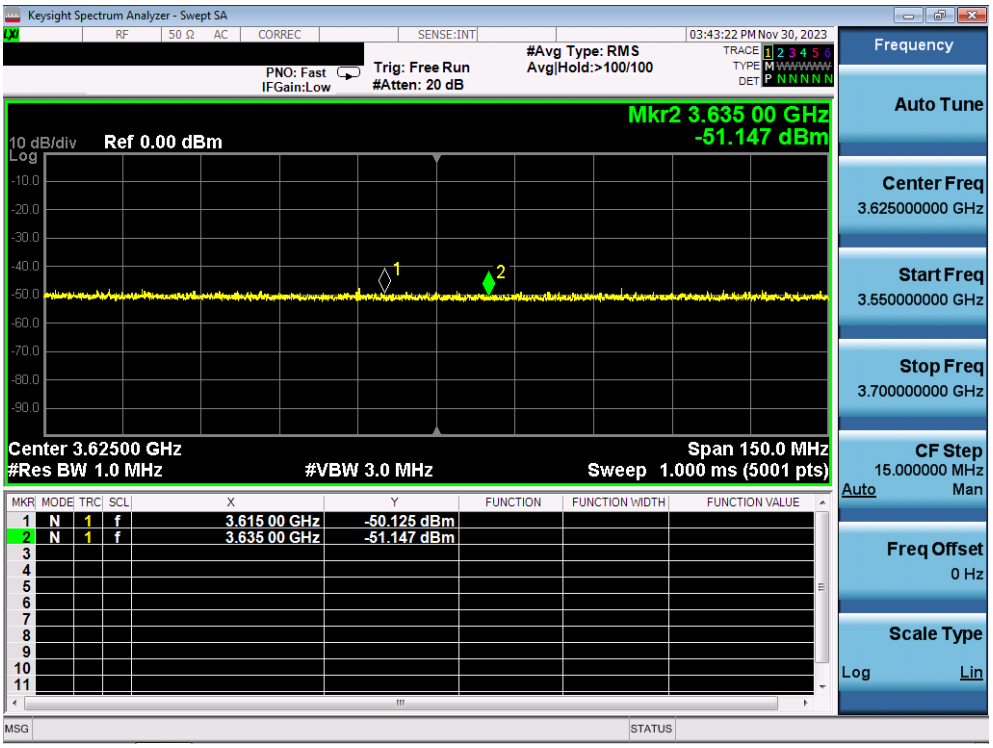
A24 [WINNF.FT.C.SCS.2] TLS failure due to revoked certificate

	Test Execution Steps	PASS	FAIL
1	• UUT shall start CBSD-SAS communication with the security procedure	☒	☐
2	• 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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time	☒	☐

Test Plots:



Plot 24.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.SCS.2)

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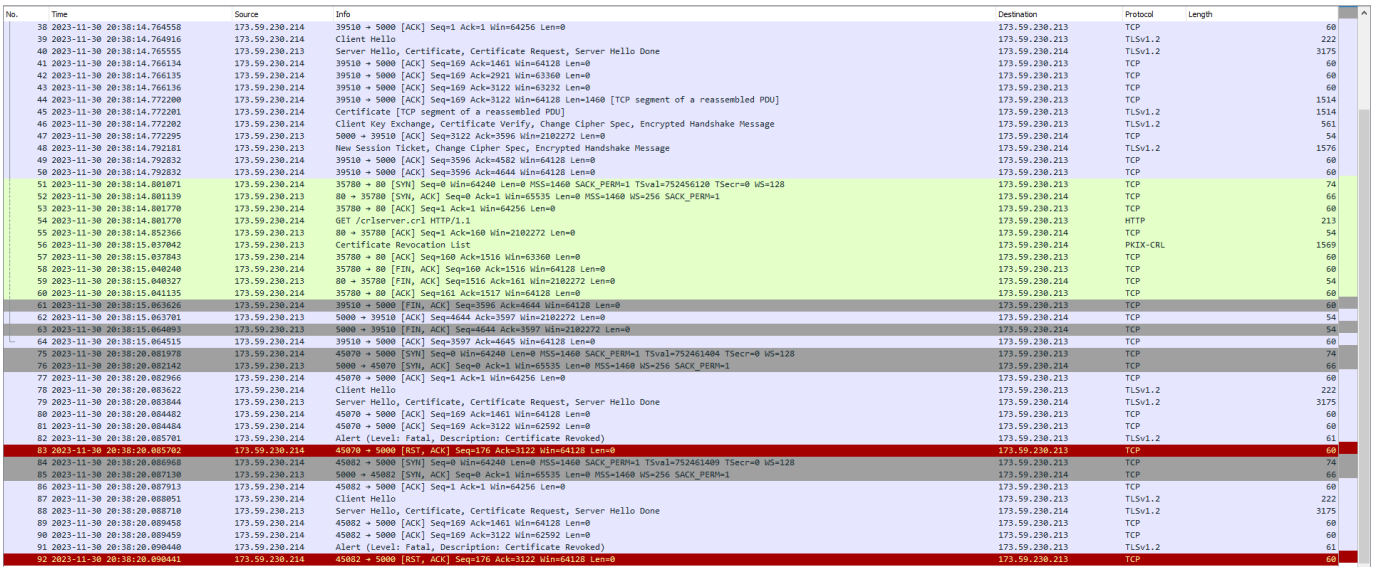

No.	Time	Source	Info	Destination	Protocol	Length
38	2023-11-30 20:38:14.764558	173.59.230.214	39510 → 5000 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
39	2023-11-30 20:38:14.764916	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	222
40	2023-11-30 20:38:14.765555	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3175
41	2023-11-30 20:38:14.766134	173.59.230.214	39510 → 5000 [ACK] Seq=169 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
42	2023-11-30 20:38:14.766135	173.59.230.214	39510 → 5000 [ACK] Seq=169 Ack=2921 Win=63360 Len=0	173.59.230.213	TCP	60
43	2023-11-30 20:38:14.766136	173.59.230.214	39510 → 5000 [ACK] Seq=169 Ack=3122 Win=63232 Len=0	173.59.230.213	TCP	60
44	2023-11-30 20:38:14.772200	173.59.230.214	39510 → 5000 [ACK] Seq=169 Ack=3122 Win=64128 Len=1460 [TCP segment of a reassembled PDU]	173.59.230.213	TCP	1514
45	2023-11-30 20:38:14.772201	173.59.230.214	Certificate [TCP segment of a reassembled PDU]	173.59.230.213	TLSv1.2	1514
46	2023-11-30 20:38:14.772202	173.59.230.214	Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message	173.59.230.213	TLSv1.2	561
47	2023-11-30 20:38:14.772295	173.59.230.213	5000 → 39510 [ACK] Seq=3122 Ack=3596 Win=2102272 Len=0	173.59.230.214	TCP	54
48	2023-11-30 20:38:14.792181	173.59.230.213	New Session Ticket, Change Cipher Spec, Encrypted Handshake Message	173.59.230.214	TLSv1.2	1576
49	2023-11-30 20:38:14.792832	173.59.230.214	39510 → 5000 [ACK] Seq=3596 Ack=4582 Win=64128 Len=0	173.59.230.213	TCP	60
50	2023-11-30 20:38:14.792832	173.59.230.214	39510 → 5000 [ACK] Seq=3596 Ack=4644 Win=64128 Len=0	173.59.230.213	TCP	60
51	2023-11-30 20:38:14.801071	173.59.230.214	35780 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=752456120 TSecr=0 WS=128	173.59.230.213	TCP	74
52	2023-11-30 20:38:14.801139	173.59.230.213	80 → 35780 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
53	2023-11-30 20:38:14.801770	173.59.230.214	35780 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
54	2023-11-30 20:38:14.801770	173.59.230.214	GET /crlserver.crl HTTP/1.1	173.59.230.213	HTTP	213
55	2023-11-30 20:38:14.852366	173.59.230.213	80 → 35780 [ACK] Seq=1 Ack=160 Win=2102272 Len=0	173.59.230.214	TCP	54
56	2023-11-30 20:38:15.037042	173.59.230.213	Certificate Revocation List	173.59.230.214	PKIX-CRL	1569
57	2023-11-30 20:38:15.037843	173.59.230.214	35780 → 80 [ACK] Seq=160 Ack=1516 Win=63360 Len=0	173.59.230.213	TCP	60
58	2023-11-30 20:38:15.040240	173.59.230.214	35780 → 80 [FIN, ACK] Seq=160 Ack=1516 Win=64128 Len=0	173.59.230.213	TCP	60
59	2023-11-30 20:38:15.040327	173.59.230.213	80 → 35780 [FIN, ACK] Seq=1516 Ack=161 Win=2102272 Len=0	173.59.230.214	TCP	54
60	2023-11-30 20:38:15.041135	173.59.230.214	35780 → 80 [ACK] Seq=161 Ack=1517 Win=64128 Len=0	173.59.230.213	TCP	60
61	2023-11-30 20:38:15.063626	173.59.230.214	39510 → 5000 [FIN, ACK] Seq=3596 Ack=4644 Win=64128 Len=0	173.59.230.213	TCP	60
62	2023-11-30 20:38:15.063701	173.59.230.213	5000 → 39510 [ACK] Seq=4644 Ack=3597 Win=2102272 Len=0	173.59.230.214	TCP	54
63	2023-11-30 20:38:15.064093	173.59.230.213	5000 → 39510 [FIN, ACK] Seq=4644 Ack=3597 Win=2102272 Len=0	173.59.230.214	TCP	54
64	2023-11-30 20:38:15.064515	173.59.230.214	39510 → 5000 [ACK] Seq=3597 Ack=4645 Win=64128 Len=0	173.59.230.213	TCP	60
75	2023-11-30 20:38:20.081978	173.59.230.214	45070 → 5000 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=752461404 TSecr=0 WS=128	173.59.230.213	TCP	74
76	2023-11-30 20:38:20.082142	173.59.230.213	5000 → 45070 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
77	2023-11-30 20:38:20.082966	173.59.230.214	45070 → 5000 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
78	2023-11-30 20:38:20.083622	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	222
79	2023-11-30 20:38:20.083844	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3175
80	2023-11-30 20:38:20.084482	173.59.230.214	45070 → 5000 [ACK] Seq=169 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
81	2023-11-30 20:38:20.084484	173.59.230.214	45070 → 5000 [ACK] Seq=169 Ack=3122 Win=62592 Len=0	173.59.230.213	TCP	60
82	2023-11-30 20:38:20.085701	173.59.230.214	Alert (Level: Fatal, Description: Certificate Revoked)	173.59.230.213	TLSv1.2	61
83	2023-11-30 20:38:20.085702	173.59.230.214	45070 → 5000 [RST, ACK] Seq=176 Ack=3122 Win=64128 Len=0	173.59.230.213	TCP	60
84	2023-11-30 20:38:20.086968	173.59.230.214	45082 → 5000 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=752461409 TSecr=0 WS=128	173.59.230.213	TCP	74
85	2023-11-30 20:38:20.087130	173.59.230.213	5000 → 45082 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
86	2023-11-30 20:38:20.087913	173.59.230.214	45082 → 5000 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
87	2023-11-30 20:38:20.088051	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	222
88	2023-11-30 20:38:20.088710	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3175
89	2023-11-30 20:38:20.089458	173.59.230.214	45082 → 5000 [ACK] Seq=169 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
90	2023-11-30 20:38:20.089459	173.59.230.214	45082 → 5000 [ACK] Seq=169 Ack=3122 Win=62592 Len=0	173.59.230.213	TCP	60
91	2023-11-30 20:38:20.090440	173.59.230.214	Alert (Level: Fatal, Description: Certificate Revoked)	173.59.230.213	TLSv1.2	61
92	2023-11-30 20:38:20.090441	173.59.230.214	45082 → 5000 [RST, ACK] Seq=176 Ack=3122 Win=64128 Len=0	173.59.230.213	TCP	60

Plot 25.WireShark Screenshot 1 - Failed Handshake (WINNF.FT.C.SCS.2)

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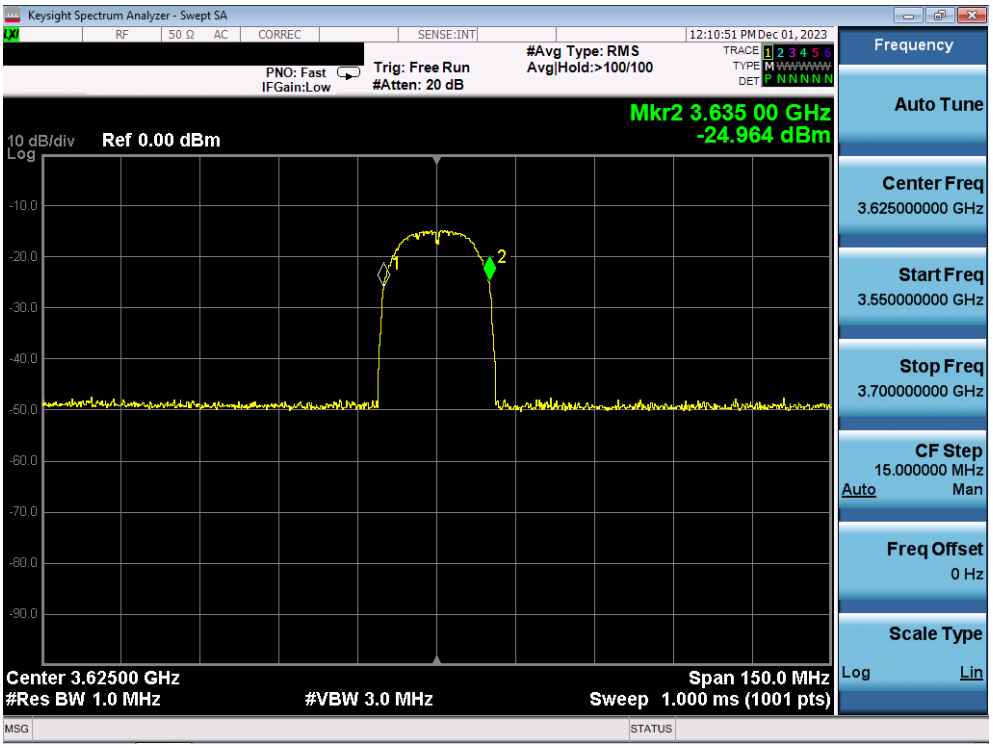
A25 [WINNF.FT.C.SCS.3] TLS failure due to expired server certificate

	Test Execution Steps	PASS	FAIL
1	• UUT shall start CBSD-SAS communication with the security procedure	☒	☐
2	• 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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time	☒	☐

Test Plots:



Plot 26.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.SCS.3)

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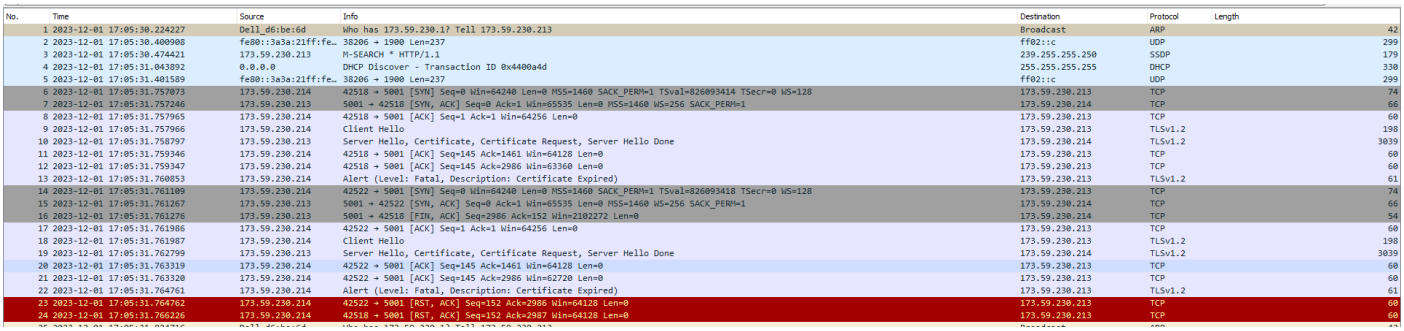

No.	Time	Source	Info	Destination	Protocol	Length
1	2023-12-01 17:05:30.224227	Dell_d6:be:6d	Who has 173.59.230.1? Tell 173.59.230.213	Broadcast	ARP	42
2	2023-12-01 17:05:30.400908	fe80::3a3a:21ff:fe…	38206 → 1900 Len=237	ff02::c	UDP	299
3	2023-12-01 17:05:30.474421	173.59.230.213	M-SEARCH * HTTP/1.1	239.255.255.250	SSDP	179
4	2023-12-01 17:05:31.043892	0.0.0.0	DHCP Discover - Transaction ID 0x4400a4d	255.255.255.255	DHCP	330
5	2023-12-01 17:05:31.401589	fe80::3a3a:21ff:fe…	38206 → 1900 Len=237	ff02::c	UDP	299
6	2023-12-01 17:05:31.757073	173.59.230.214	42518 → 5001 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=826093414 TSecr=0 WS=128	173.59.230.213	TCP	74
7	2023-12-01 17:05:31.757246	173.59.230.213	5001 → 42518 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
8	2023-12-01 17:05:31.757965	173.59.230.214	42518 → 5001 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
9	2023-12-01 17:05:31.757966	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	198
10	2023-12-01 17:05:31.758797	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3039
11	2023-12-01 17:05:31.759346	173.59.230.214	42518 → 5001 [ACK] Seq=145 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
12	2023-12-01 17:05:31.759347	173.59.230.214	42518 → 5001 [ACK] Seq=145 Ack=2986 Win=63360 Len=0	173.59.230.213	TCP	60
13	2023-12-01 17:05:31.760853	173.59.230.214	Alert (Level: Fatal, Description: Certificate Expired)	173.59.230.213	TLSv1.2	61
14	2023-12-01 17:05:31.761109	173.59.230.214	42522 → 5001 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=826093418 TSecr=0 WS=128	173.59.230.213	TCP	74
15	2023-12-01 17:05:31.761267	173.59.230.213	5001 → 42522 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
16	2023-12-01 17:05:31.761276	173.59.230.213	5001 → 42518 [FIN, ACK] Seq=2986 Ack=152 Win=2102272 Len=0	173.59.230.214	TCP	54
17	2023-12-01 17:05:31.761986	173.59.230.214	42522 → 5001 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
18	2023-12-01 17:05:31.761987	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	198
19	2023-12-01 17:05:31.762799	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3039
20	2023-12-01 17:05:31.763319	173.59.230.214	42522 → 5001 [ACK] Seq=145 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
21	2023-12-01 17:05:31.763320	173.59.230.214	42522 → 5001 [ACK] Seq=145 Ack=2986 Win=62720 Len=0	173.59.230.213	TCP	60
22	2023-12-01 17:05:31.764761	173.59.230.214	Alert (Level: Fatal, Description: Certificate Expired)	173.59.230.213	TLSv1.2	61
23	2023-12-01 17:05:31.764762	173.59.230.214	42522 → 5001 [RST, ACK] Seq=152 Ack=2986 Win=64128 Len=0	173.59.230.213	TCP	60
24	2023-12-01 17:05:31.766226	173.59.230.214	42518 → 5001 [RST, ACK] Seq=152 Ack=2987 Win=64128 Len=0	173.59.230.213	TCP	60

Plot 27.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.3)

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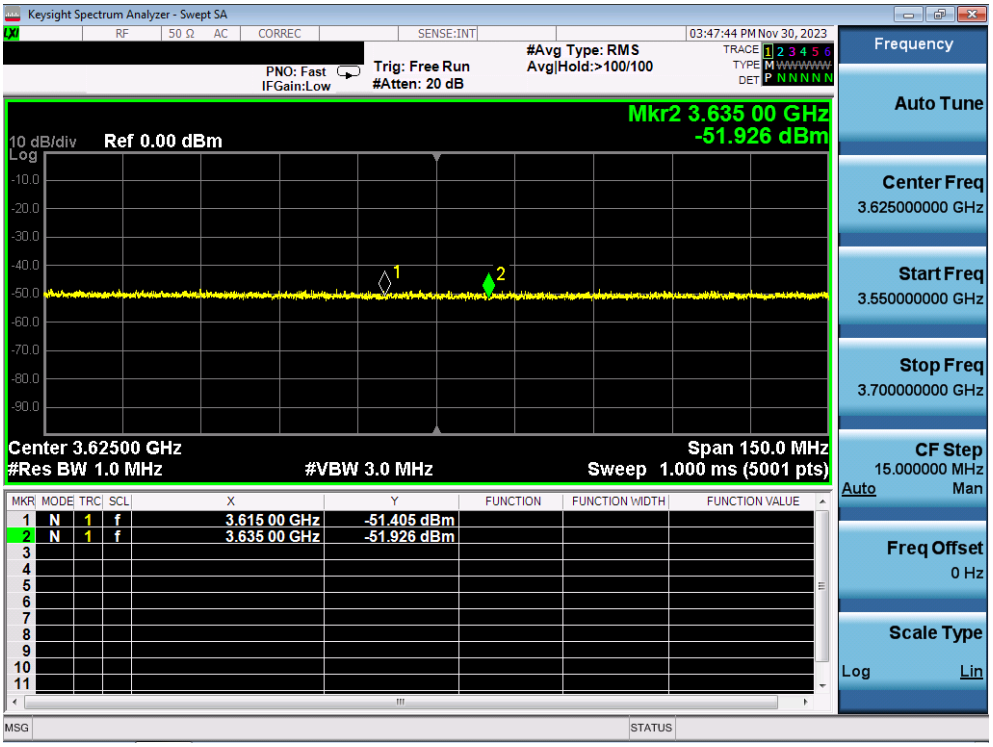
A26 [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

	Test Execution Steps	PASS	FAIL
1	• UUT shall start CBSD-SAS communication with the security procedure	☒	☐
2	• 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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time	☒	☐

Test Plots:



Plot 28.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.SCS.4)

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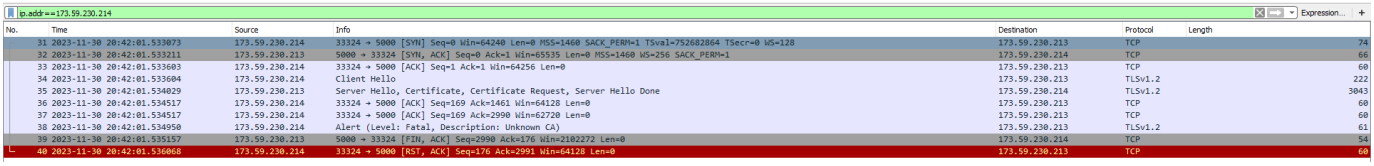

No.	Time	Source	Info	Destination	Protocol	Length
31	2023-11-30 20:42:01.533073	173.59.230.214	33324 → 5000 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 TSval=752682864 TSecr=0 WS=128	173.59.230.213	TCP	74
32	2023-11-30 20:42:01.533211	173.59.230.213	5000 → 33324 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.59.230.214	TCP	66
33	2023-11-30 20:42:01.533603	173.59.230.214	33324 → 5000 [ACK] Seq=1 Ack=1 Win=64256 Len=0	173.59.230.213	TCP	60
34	2023-11-30 20:42:01.533604	173.59.230.214	Client Hello	173.59.230.213	TLSv1.2	222
35	2023-11-30 20:42:01.534029	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.59.230.214	TLSv1.2	3043
36	2023-11-30 20:42:01.534517	173.59.230.214	33324 → 5000 [ACK] Seq=169 Ack=1461 Win=64128 Len=0	173.59.230.213	TCP	60
37	2023-11-30 20:42:01.534517	173.59.230.214	33324 → 5000 [ACK] Seq=169 Ack=2990 Win=62720 Len=0	173.59.230.213	TCP	60
38	2023-11-30 20:42:01.534950	173.59.230.214	Alert (Level: Fatal, Description: Unknown CA)	173.59.230.213	TLSv1.2	61
39	2023-11-30 20:42:01.535157	173.59.230.213	5000 → 33324 [FIN, ACK] Seq=2990 Ack=176 Win=2102272 Len=0	173.59.230.214	TCP	54
40	2023-11-30 20:42:01.536068	173.59.230.214	33324 → 5000 [RST, ACK] Seq=176 Ack=2991 Win=64128 Len=0	173.59.230.213	TCP	60

Plot 29.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.4)

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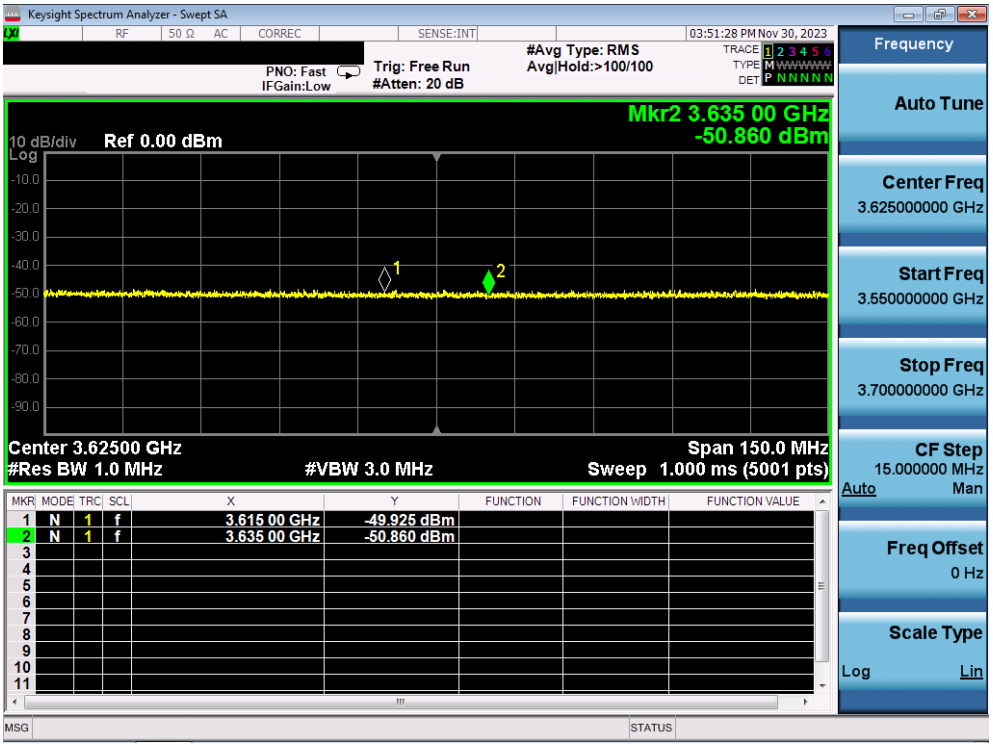
A27 [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

	Test Execution Steps	PASS	FAIL
1	• UUT shall start CBSD-SAS communication with the security procedure	☒	☐
2	• 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: • CPE UUT shall not transmit RF outside the authorized grant of the associated BTS-CBSD at any time prior	☒	☐

Test Plots:



Plot 30.Conducted Measurement – UUT RF transmission range and bandwidths are less or equal to frequency range and bandwidth of compatible BTS-CBSD (WINNF.FT.C.SCS.5)

Plot 31.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.5)

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A28 [WINNF.PT.C.HBT.1] UUT RF Transmit Power Measurement

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness • UUT has registered with the SAS, with CBSD ID = C • 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 *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.*	--	--
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: • UUT sends Heartbeat Request, including: o cbsdId = C o grantId = G • SAS Test Harness responds with Heartbeat Response, including: o cbsdId = C o grantId = G o transmitExpireTime = current UTC time + 200 seconds o responseCode = 0	--	--
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 fulfil the requirements of the power measurement method. *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.*	☒	☐

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RF Power Measurements:

Testing is performed per KDB 971168 D01 and across the transmit dynamic range of 37dBm/MHz to 27dBm/MHz for 20MHz Bandwidth.

EIRP PSD is found by adding directional antenna gain to the conducted PSD level.

Frequency [MHz]	Antenna 1 Conducted PSD [dBm/Mhz]	Antenna 2 Conducted PSD [dBm/MHz]	MIMO Conducted PSD [dBm/MHz]	Directional Antenna Gain [dBi]	EIRP Density [dBm/MHz]	SAS Granted EIRP [dBm/MHz]	Margin [dB]
3625	12.82	11.52	15.23	13.00	28.23	37.00	-8.77
	9.02	6.77	11.05	13.00	24.05	32.00	-7.95
	3.79	3.20	6.51	13.00	19.51	27.00	-7.49

Table 7-1 RF Output Power Measurements (WINNF.PT.C.HBT.1)

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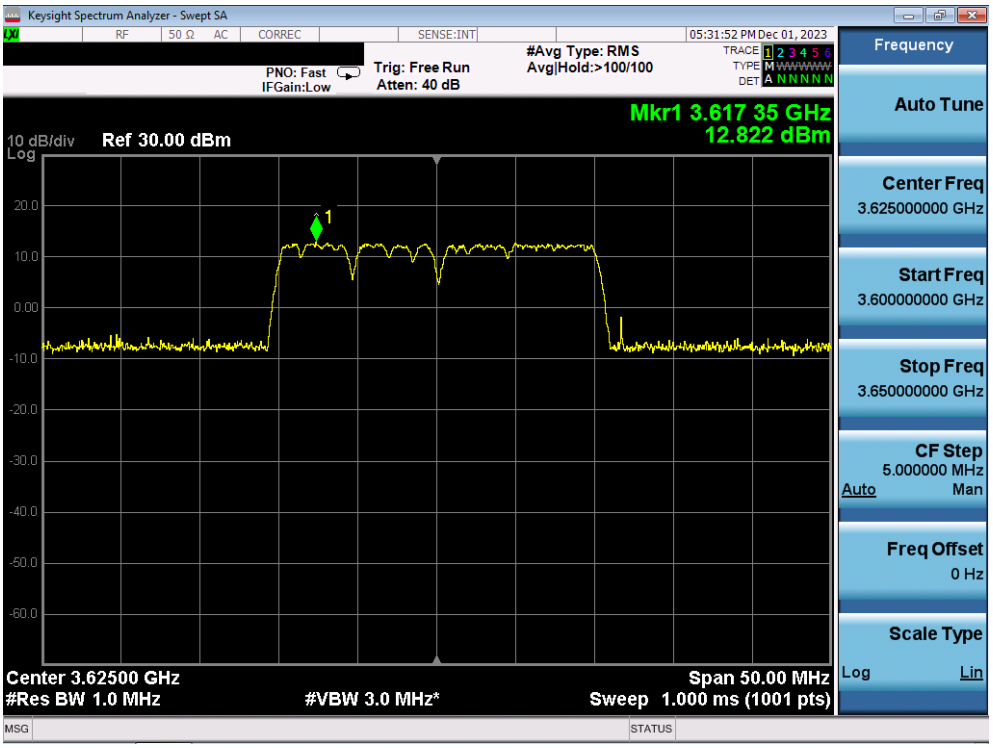
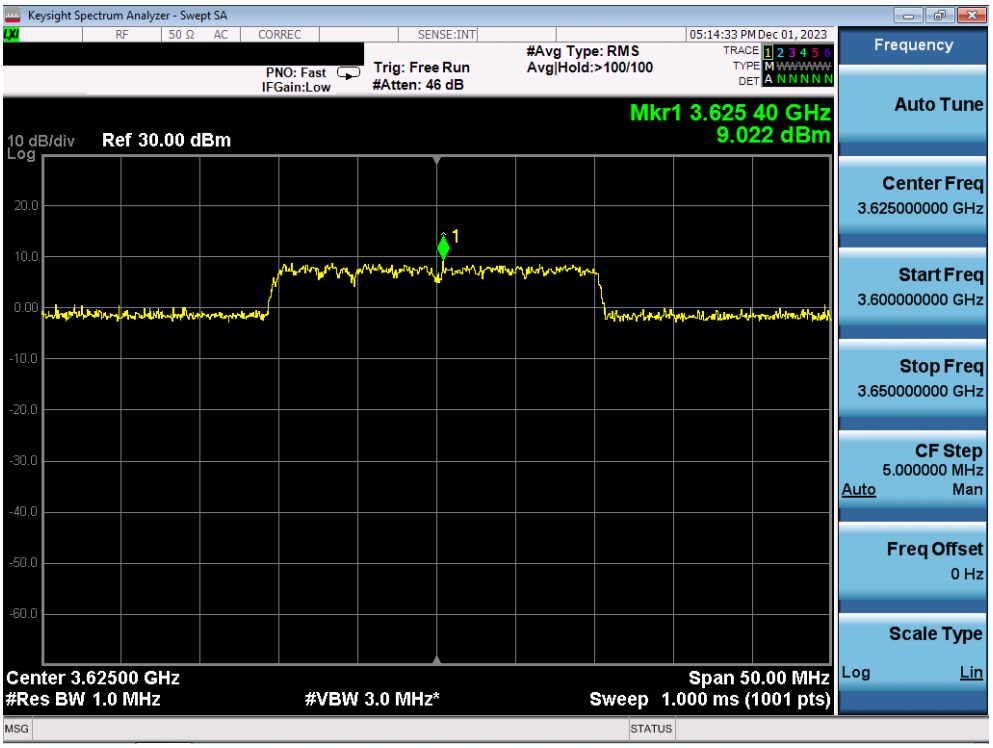
Test Plots:



Plot 32. Conducted PSD, SAS Granted maxEIRP 37 – ANT1



Plot 33. Conducted PSD, SAS Granted maxEIRP 32 – ANT1

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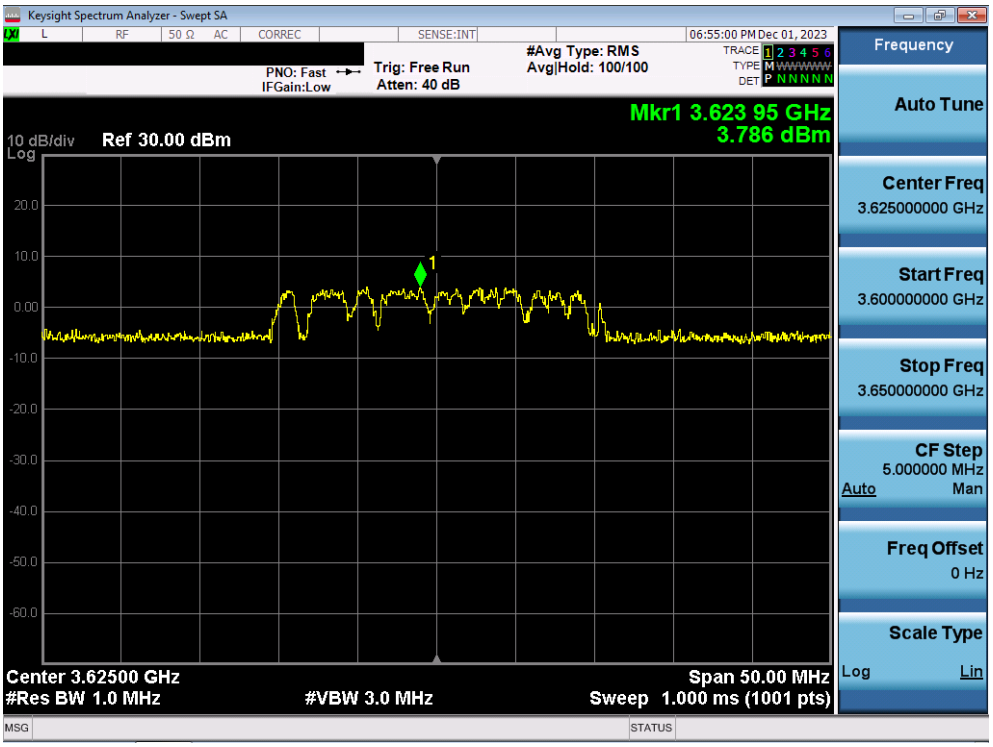
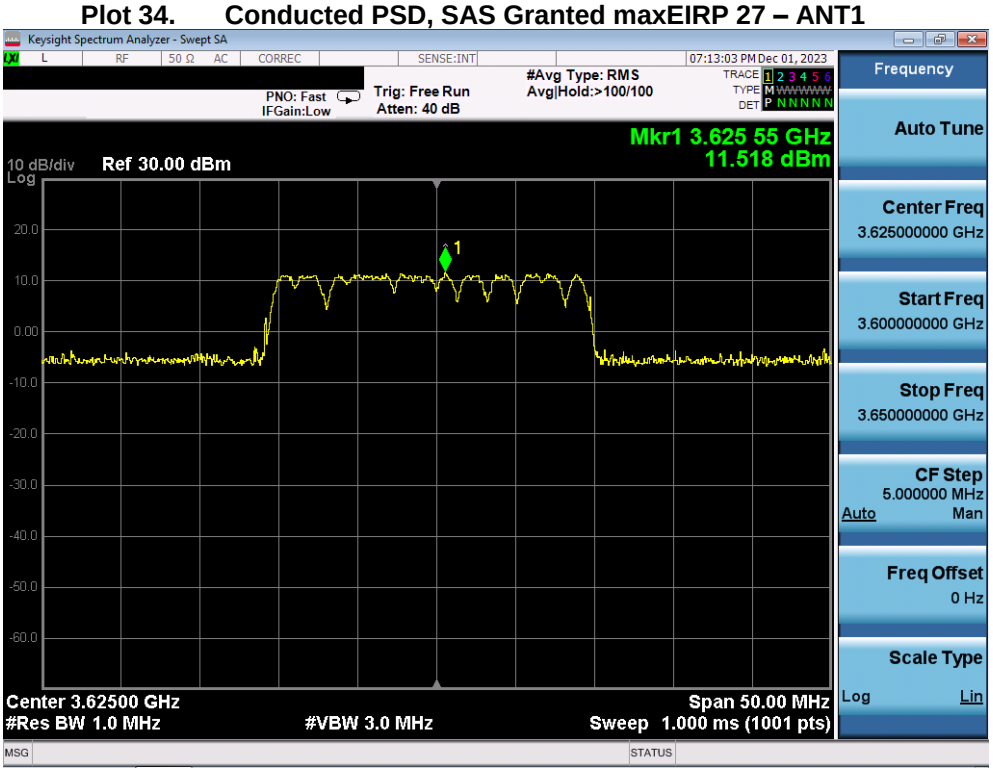


Plot 34. Conducted PSD, SAS Granted maxEIRP 27 – ANT1



Plot 35. Conducted PSD, SAS Granted maxEIRP 37 – ANT2

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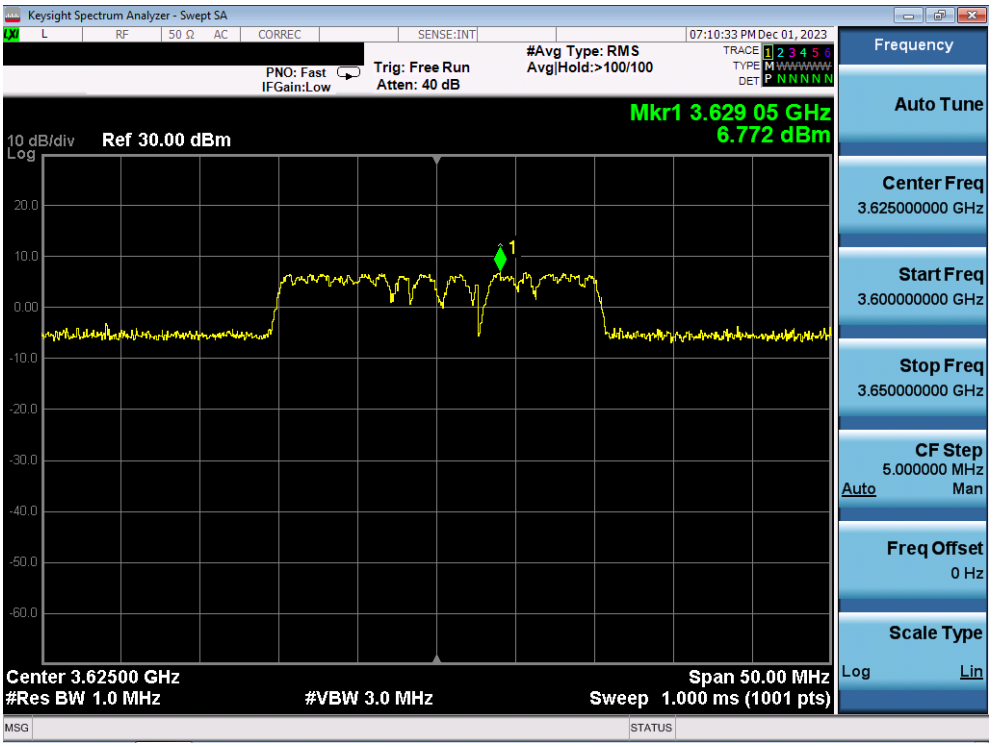
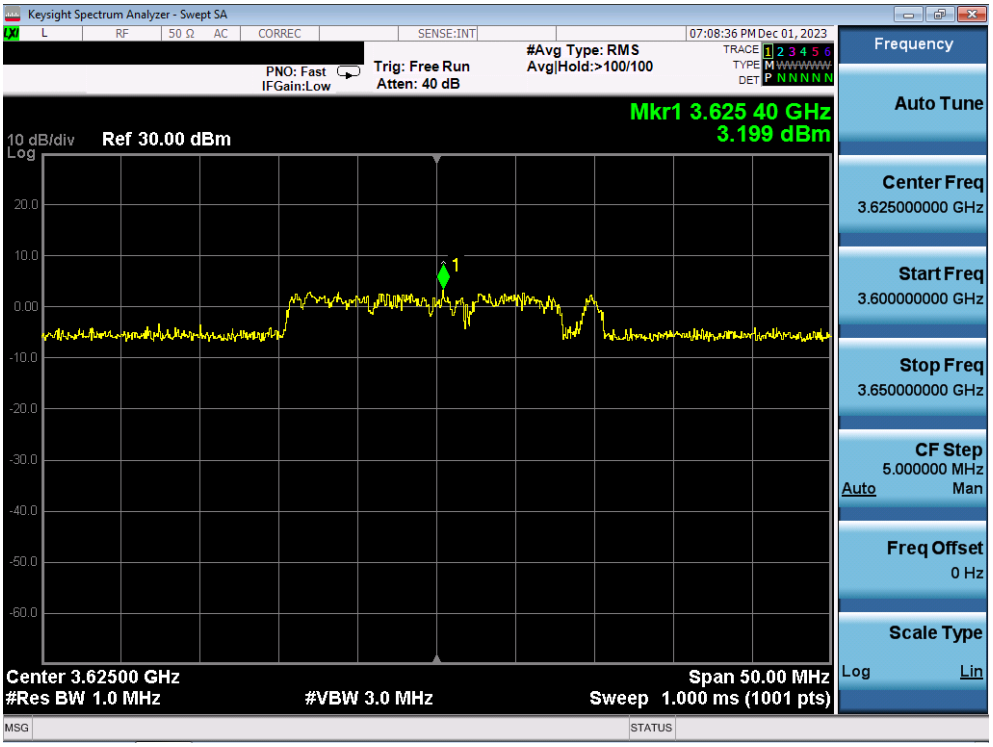


Plot 36. Conducted PSD, SAS Granted maxEIRP 32 – ANT2



Plot 37. Conducted PSD, SAS Granted maxEIRP 27 – ANT2

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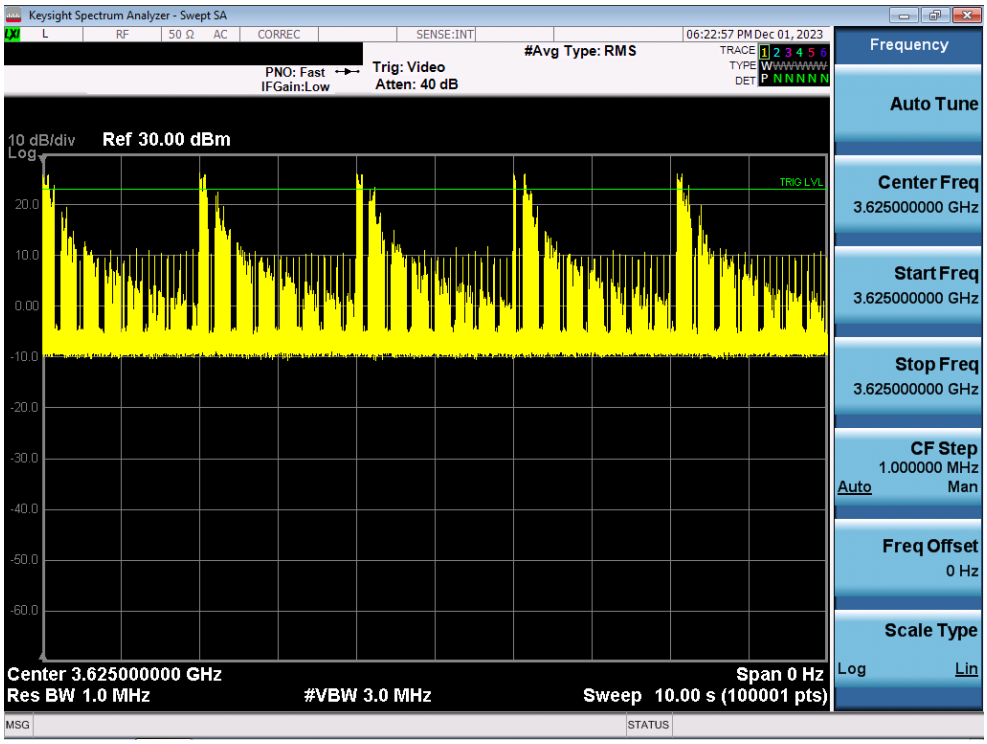
A29 CPE-CBSD Initial SAS Communications Duty Cycle (X of Y)

Testing is performed per WINNF-19-IN-00033 CBRS CPE CBSD as UUT Test Guidelines. Using a spectrum analyzer, time domain sweeps were performed at each time duration: 10s, 300s, and 3600s.

Due to limitations in the measurement equipment's available number of sweep points, observing the 3600s period with a single sweep overestimates the true value for time over 23dBm, as one sweep point is notably longer than the portion of the time the transmission is over 23dBm. A 3600s sweep was performed to determine the maximum number of connection attempts in 3600s, and a zoomed in 100s sweep was performed to more accurately represent the amount of time over 23dBm in one connection attempt.

Time allowed per KDB	Aggregate amount of time >23dB,
1s of 10s period	0.013s
10s of 300s period	3.153s
20s of 3600s period	10.500s



Plot 38. 10s Time Domain Sweep

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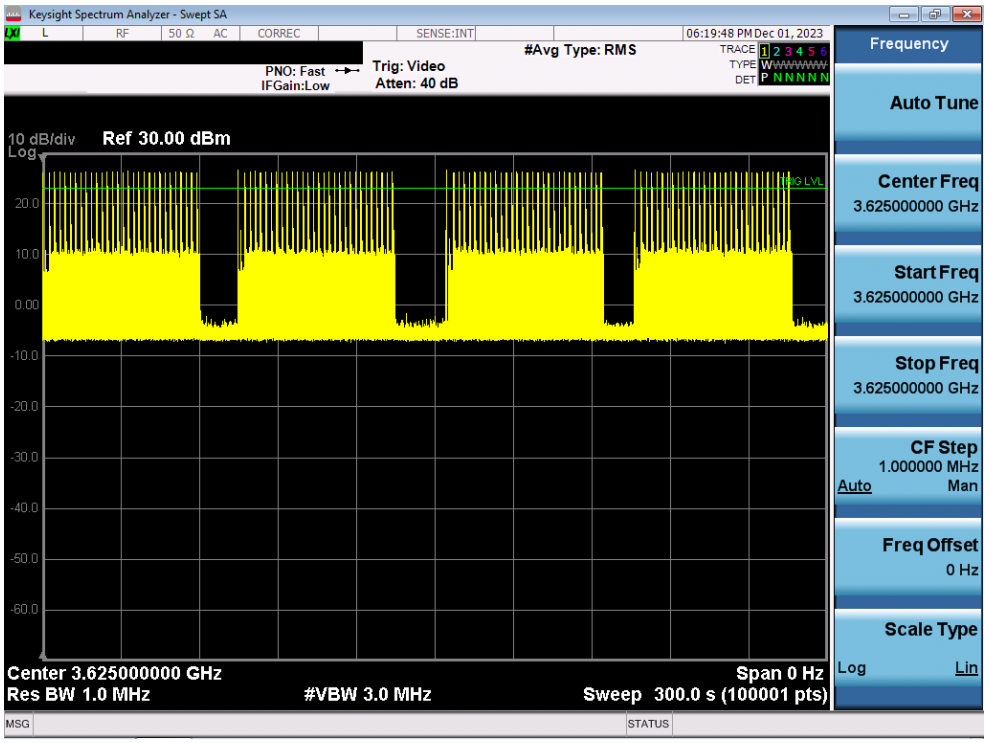
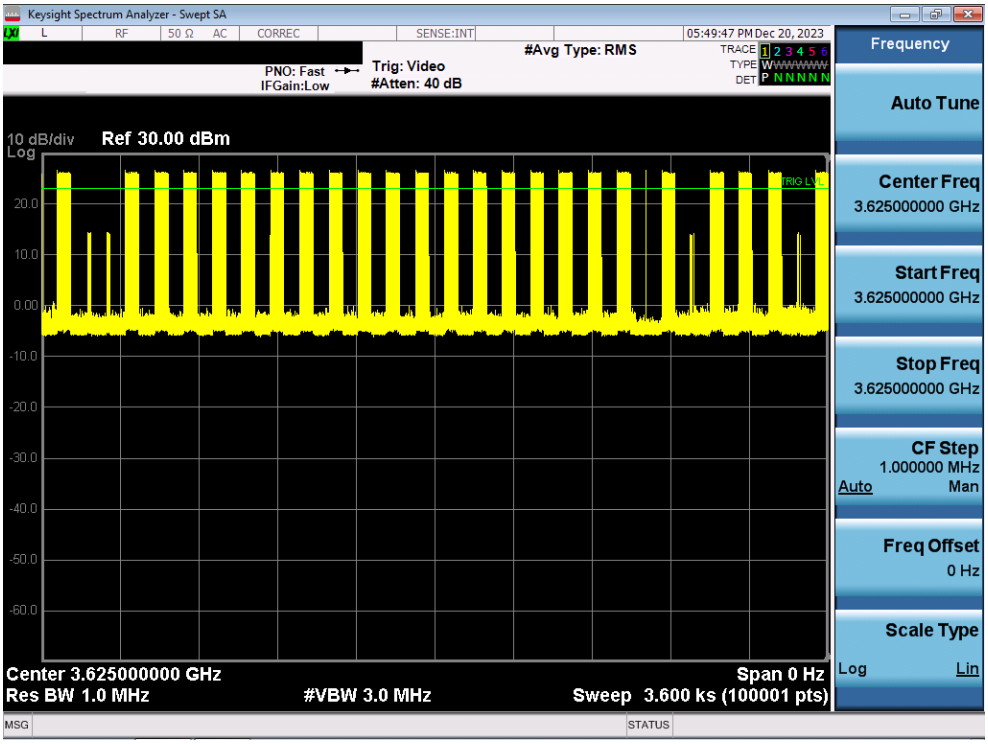


Plot 39. 300s Time Domain Sweep



Plot 40. 3600s Time Domain Sweep

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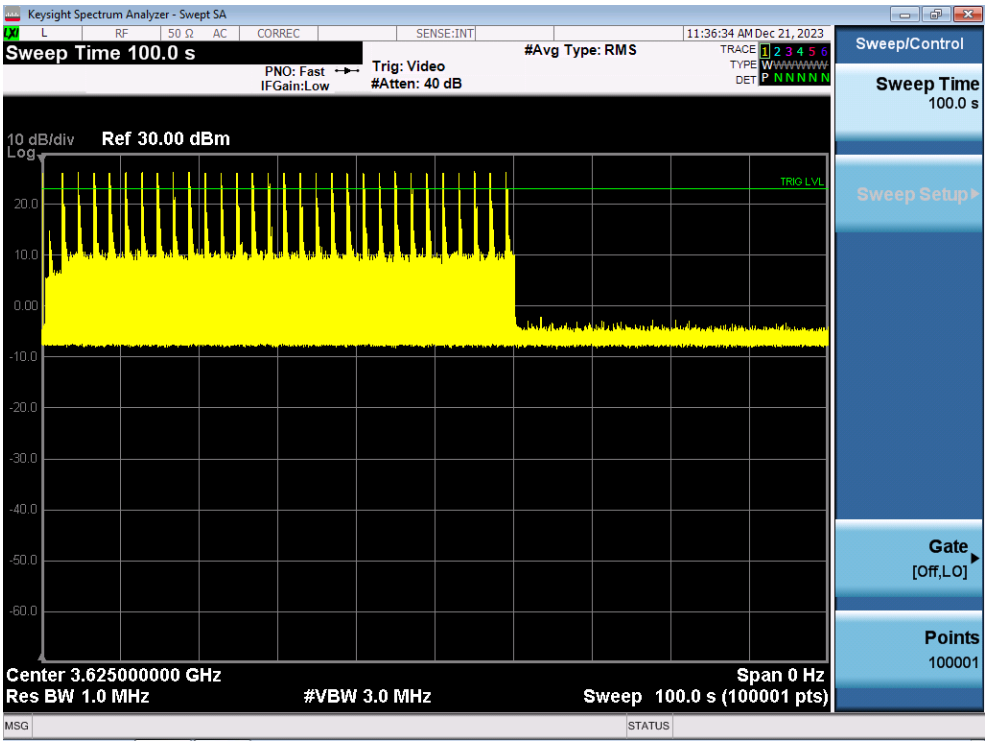

Plot 41. 100s Time Domain Sweep

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APPENDIX B – TEST LOGS

Logs are available upon request

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