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TEST REPORT
CBSD-SAS Interoperability

Applicant Name:
EUCAST Co., Ltd.
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Hqansauel-ro Bundang-Gu, Seongnam-si
Greonggi-do, South Korea

Date of Testing:
3/20/2025 – 5/19/2025
Test Report Issue Date:
5/19/2025
Test Site/Location:
Element lab. Columbia, MD, USA
Test Report Serial No.:
1M2503100025-01.2AXTR

FCC ID:	**2AXTR-ENS2278-3823**
APPLICANT:	**EUCAST Co., Ltd**

Application Type:	Certification
Model:	ENS2278-3823
EUT Type:	NR Access Point
Frequency Range:	3550 – 3700 MHz
FCC Classification:	Citizens Band Category A and B Devices (CBD)
FCC Rule Part(s):	Part 96
Test Procedure(s):	KDB 940660 D01 v03, KDB 940660 D02 v02 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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TABLE OF CONTENTS

1.0 INTRODUCTION 3
1.1 Scope 3
1.2 Element Test Location 3
1.3 Test Facility / Accreditations 3
2.0 PRODUCT INFORMATION 4
2.1 Equipment Description 4
2.2 Device Capabilities 4
2.3 Test Configuration 4
2.4 Modifications 4
3.0 TEST EQUIPMENT CALIBRATION DATA 5
4.0 ENVIRONMENTAL CONDITIONS 6
5.0 EVALUATION PROCEDURE 7
6.0 TEST Summary 8
6.1 Summary 8
7.0 CONCLUSION 10
APPENDIX A – TEST RESULT AND DATA 11
A1 [WINNF.FT.C.REG.1] MULTI-STEP REGISTRATION 11
A3 [WINNF.FT.C.REG.3] SINGLE-STEP REGISTRATION FOR CATEGORY A CBSD 13
A4 [WINNF.FT.C.REG.5] SINGLE-STEP REGISTRATION FOR CBSD WITH CPI SIGNED DATA 15
A5 [WINNF.FT.C.REG.8] MISSING REQUIRED PARAMETERS (RESPONSECODE 102) 17
A6 [WINNF.FT.C.REG.10] PENDING REGISTRATION (RESPONSECODE 200) 18
A7 [WINNF.FT.C.REG.12] INVALID PARAMETER (RESPONSECODE 103) 19
A8 [WINNF.FT.C.REG.14] BLACKLISTED CBSD (RESPONSECODE 101) 20
A9 [WINNF.FT.C.REG.16] UNSUPPORTED SAS PROTOCOL VERSION (RESPONSECODE 100) 21
A10 [WINNF.FT.C.REG.18] GROUP ERROR (RESPONSECODE 201) 22
A11 [WINNT.FT.C.REG.20] 23
A12 WINNF.FT.C.GRA.1] UNSUCCESSFUL GRANT RESPONSECODE=400 (INTERFERENCE) 24
A13 [WINNF.FT.C.GRA.2] UNSUCCESSFUL GRANT RESPONSECODE=401 (GRANT_CONFLICT) 25
A14 [WINNF.FT.C.HBT.1] HEARTBEAT SUCCESS CASE (FIRST HEARTBEAT RESPONSE) 26
A15 [WINNF.FT.C.HBT.3] HEARTBEAT RESPONSECODE=105 (DEREGISTER) 29
A16 [WINNF.FT.C.HBT.4] HEARTBEAT RESPONSECODE=500 (TERMINATED_GRANT) 31
A17 [WINNF.FT.C.HBT.5] HEARTBEAT RESPONSECODE=501 (SUSPENDED_GRANT) IN FIRST HEARTBEAT RESPONSE 33
A18 [WINNF.FT.C.HBT.6] HEARTBEAT RESPONSECODE=501 (SUSPENDED_GRANT) IN SUBSEQUENT HEARTBEAT RESPONSE 35
A19 [WINNF.FT.C.HBT.7] HEARTBEAT RESPONSECODE=502 (UNSYNC_OP_PARAM) 37
A20 [WINNF.FT.C.HBT.9] HEARTBEAT RESPONSE ABSENT (FIRST HEARTBEAT) 39
A21 [WINNF.FT.C.HBT.10] HEARTBEAT RESPONSE ABSENT (SUBSEQUENT HEARTBEAT) 41
A22 [WINNF.FT.C.RLQ.1] SUCCESSFUL RELINQUISHMENT 43
A23 [WINNF.FT.C.MES.3] REGISTRATION RESPONSE CONTAINS MEASREPORTCONFIG 45
A24 [WINNF.FT.C.MES.4] HEARTBEAT RESPONSE CONTAINS MEASREPORTCONFIG 47
A25 [WINNF.FT.C.DRG.1] SUCCESSFUL DEREGISTRATION 49
A26 [WINNF.FT.C.SCS.1] SUCCESSFUL TLS CONNECTION BETWEEN UUT AND SAS TEST HARNESS 51
A27 [WINNF.FT.C.SCS.2] TLS FAILURE DUE TO REVOKED CERTIFICATE 53
A28 [WINNF.FT.C.SCS.3] TLS FAILURE DUE TO EXPIRED SERVER CERTIFICATE 55
A29 [WINNF.FT.C.SCS.4] TLS FAILURE WHEN SAS TEST HARNESS CERTIFICATE IS ISSUED BY AN UNKNOWN CA 57
A30 [WINNF.FT.C.SCS.5] TLS FAILURE WHEN CERTIFICATE AT THE SAS TEST HARNESS IS CORRUPTED 59
A31 [WINNF.PT.C.HBT.1] UUT RF TRANSMIT POWER MEASUREMENT 61
APPENDIX B – TEST LOGS 66
APPENDIX C – TEST SETUP 67

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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 **FCC ID: 2AXTR-ENS2278-3823.** The test data contained in this report pertains only to CBSD-SAS interoperability. The EUT can operate as a Category A CBSD. The EUT is not a domain proxy.

Test Device Serial Number(s): NE002501200000195
Test Device Hardware Version: NMB V1.1, MRB V1.0
Test Device Software Version: V2.52

2.2 Device Capabilities

This device contains the following capabilities:

NR n48

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
Keysight Technologies	N9020A	PXA Signal Analyzer	10/16/2024	Annual	10/16/2025	MY48430494
Dell	Latitude 5580	Test Harness Laptop	N/A	N/A	N/A	N/A

Table 3-1 Annual Test Equipment Calibration Schedule

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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: EUCAST Co., Ltd.

FCC ID: 2AXTR-ENS2278-3823

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.3 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.	WINNF.FT.C.REG.20	Pass
96.39 (c)	11	Confirm that the device is capable of reporting the signal level (measurement data) and frequency to SAS.	WINNF.FT.C.MES.3 WINNF.FT.C.MES.4	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€	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.

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7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **, FCC ID:** 2AXTR-ENS2278-3823 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: • UUT shall not transmit RF	☒	☐

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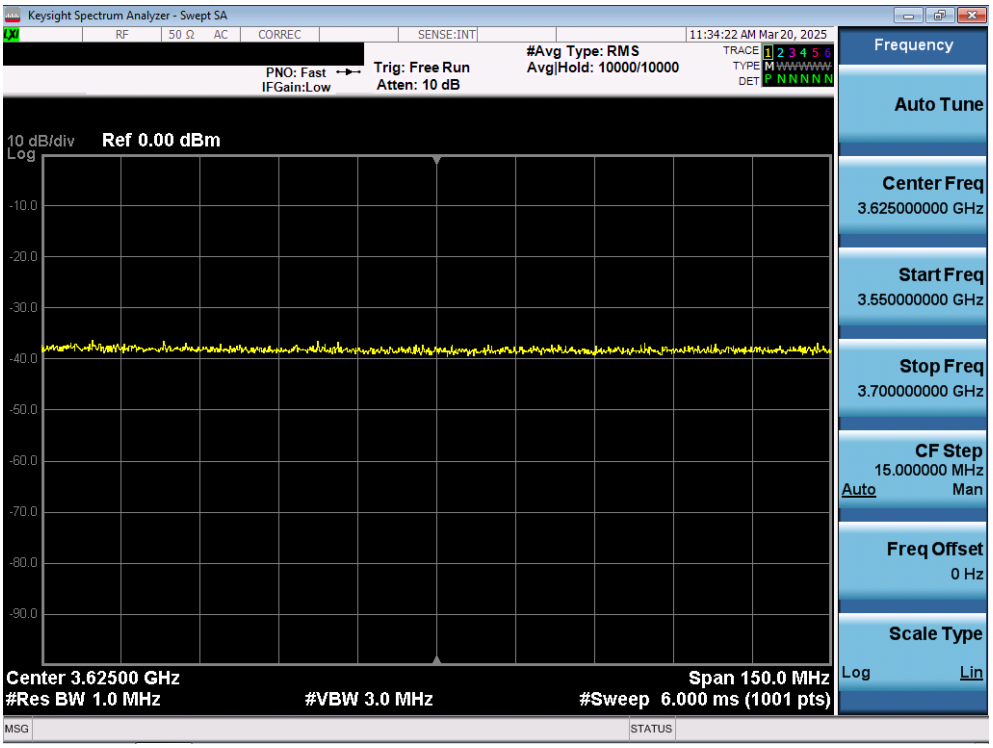
Test Plots:



Plot 1. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.1)

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A3 [WINNF.FT.C.REG.3] Single-Step registration for Category A CBSD

	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 Registration request to SAS Test Harness: all required and REG-Conditional parameter included (userId, fccId, cbsdSerialNumber, cbsdCategory, airInterface, installationParam, measCapability) for a Category A CBSD. • The required userId, fccId and cbsdSerialNumber and REG-Conditional cbsdCategory, airInterface, installationParam, and measCapability 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: • UUT shall not transmit RF	☒	☐

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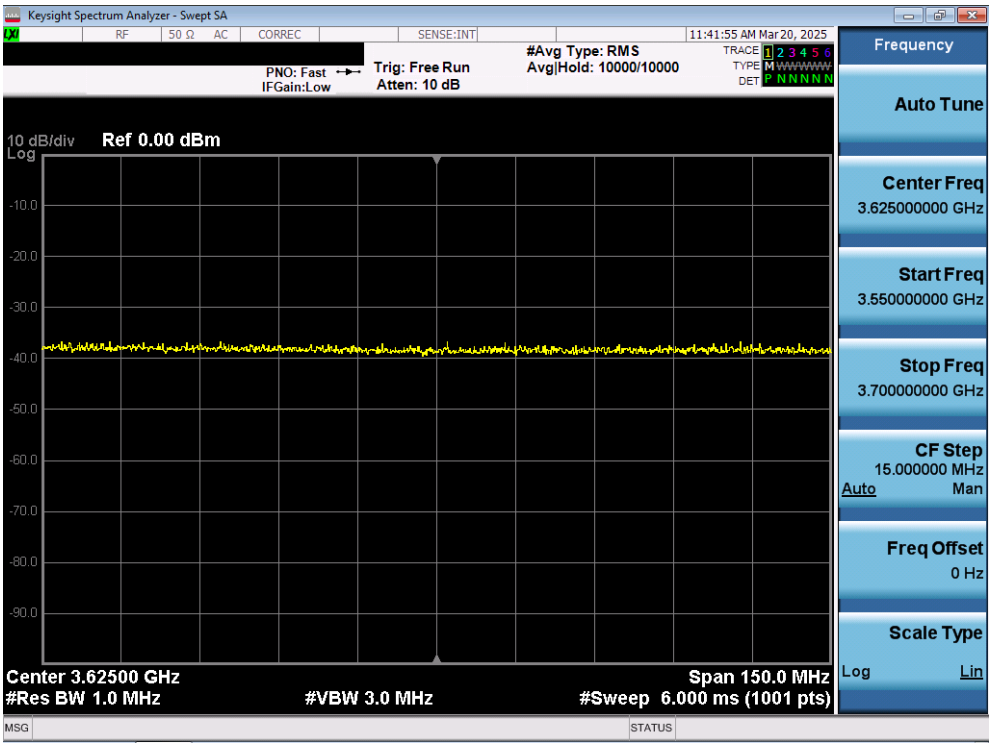

Plot 2. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.3)

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A4 [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: • UUT shall not transmit RF	☒	☐

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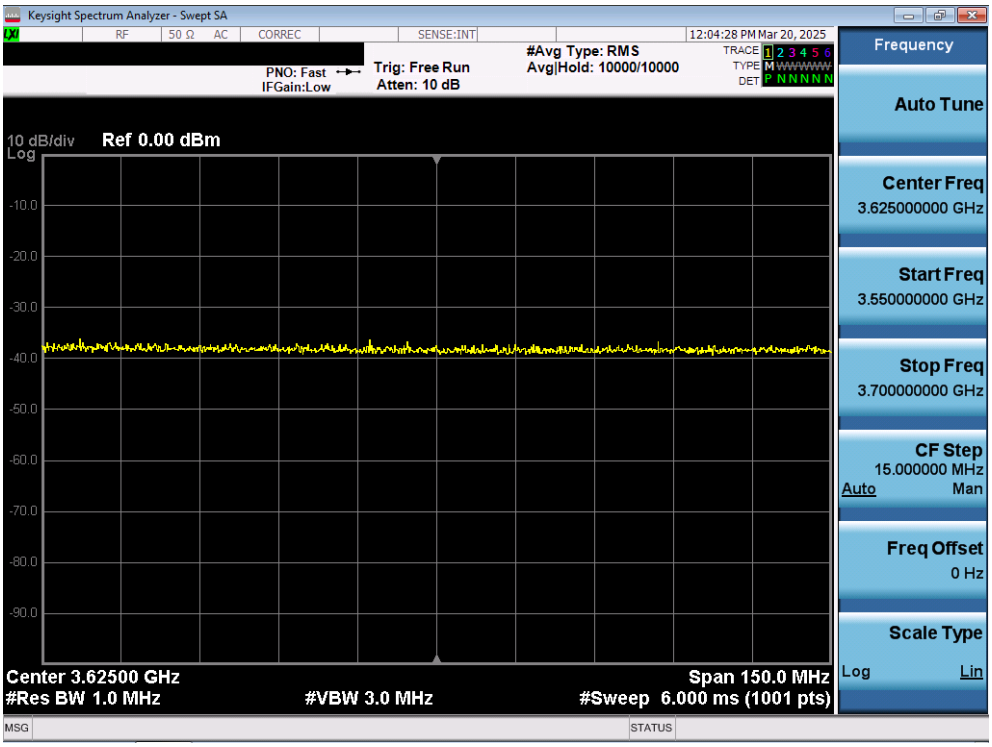

Plot 3. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.5)

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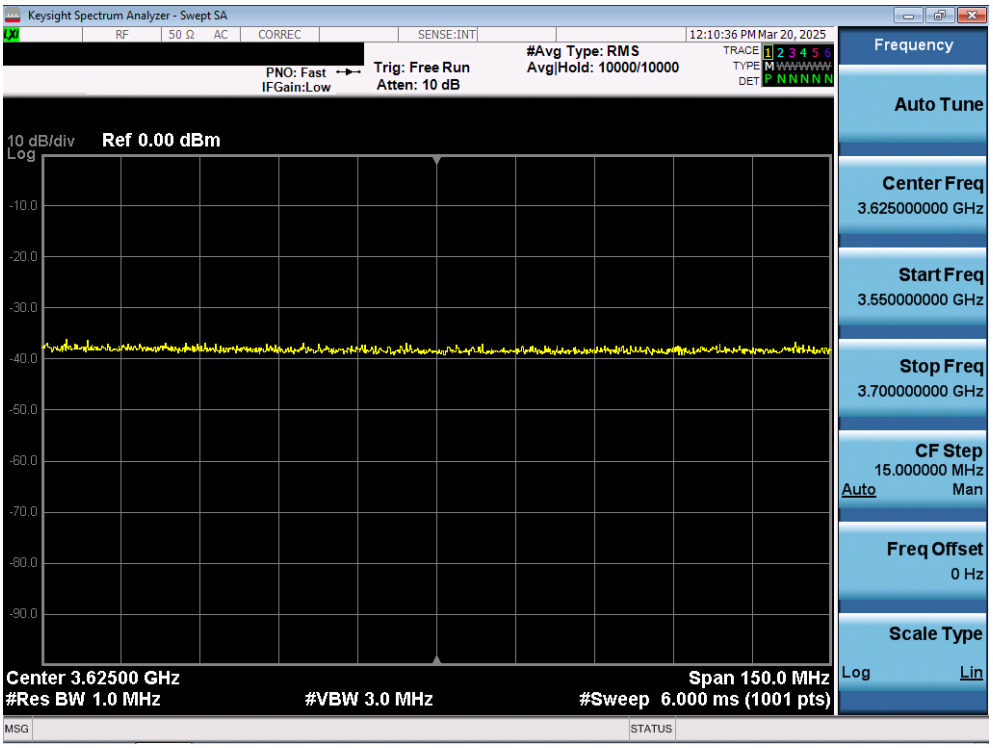
A5 [WINNF.FT.C.REG.8] Missing Required parameters (responseCode 102)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 4. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.8)

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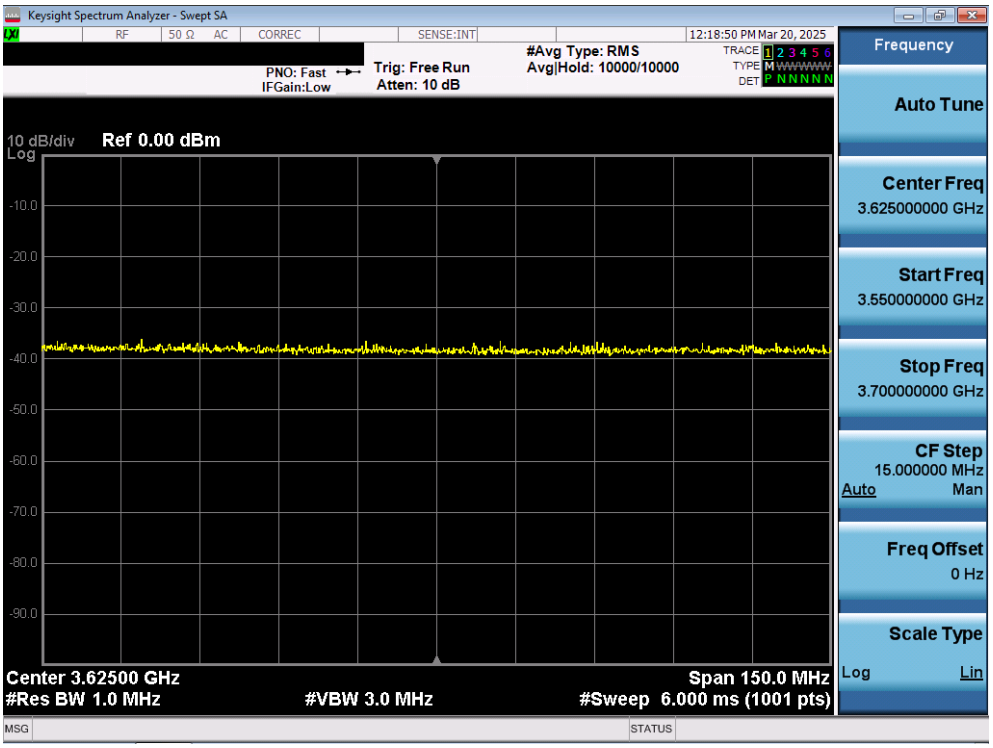
A6 [WINNF.FT.C.REG.10] Pending registration (responseCode 200)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 5. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.10)

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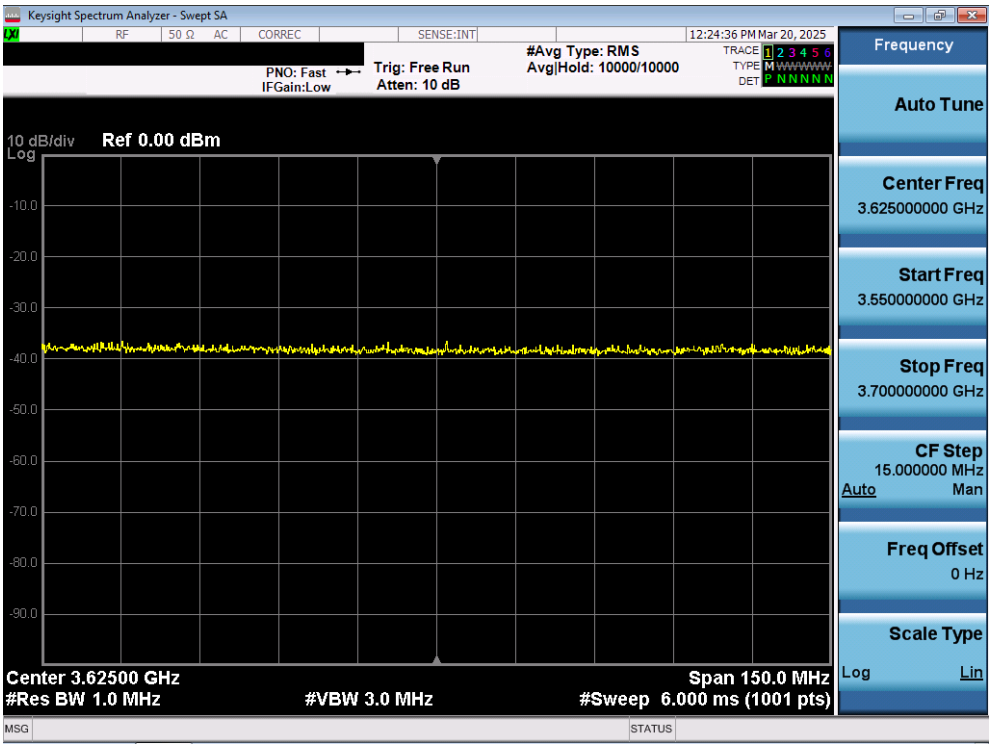
A7 [WINNF.FT.C.REG.12] Invalid parameter (responseCode 103)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 6. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.12)

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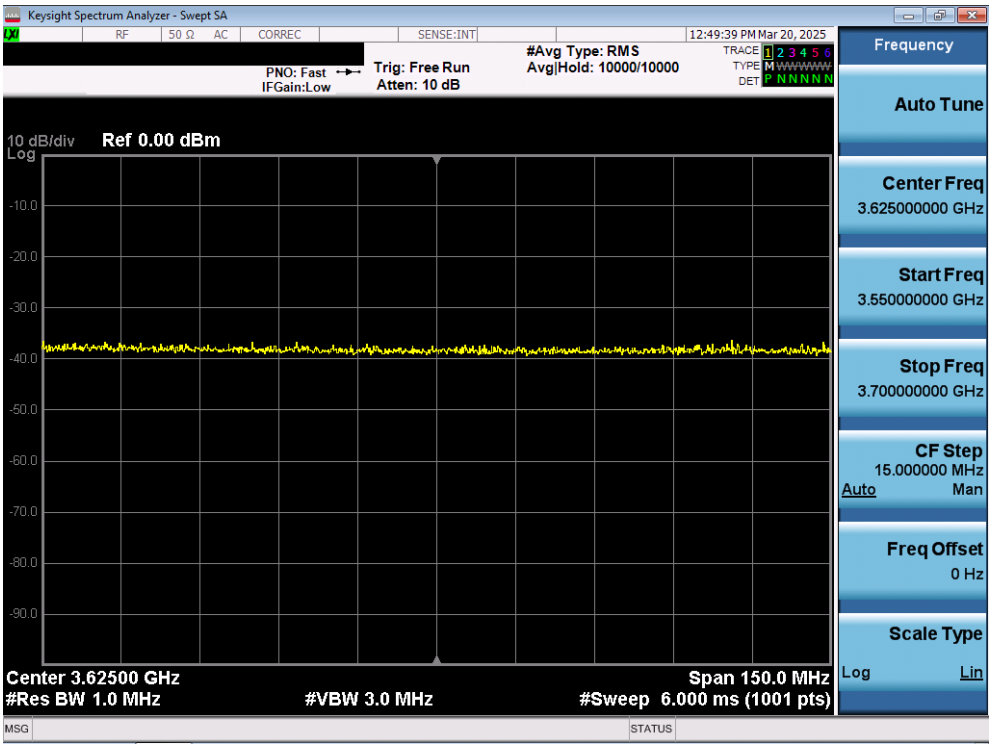
A8 [WINNF.FT.C.REG.14] Blacklisted CBSD (responseCode 101)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 7. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.14)

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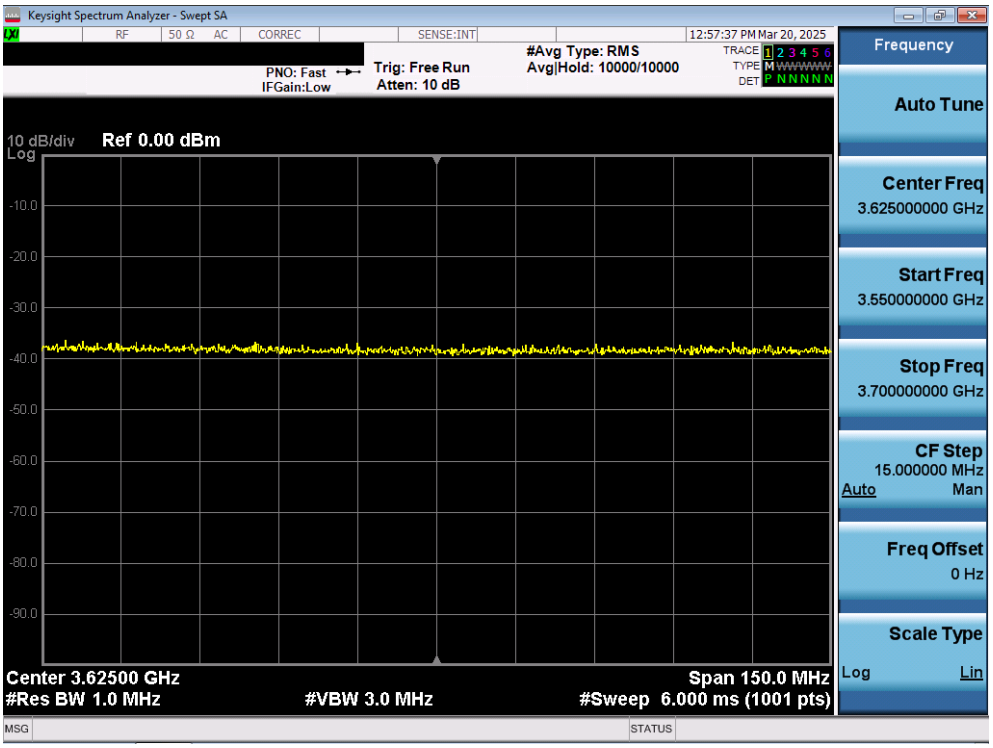
A9 [WINNF.FT.C.REG.16] Unsupported SAS protocol version (responseCode 100)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 8. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.16)

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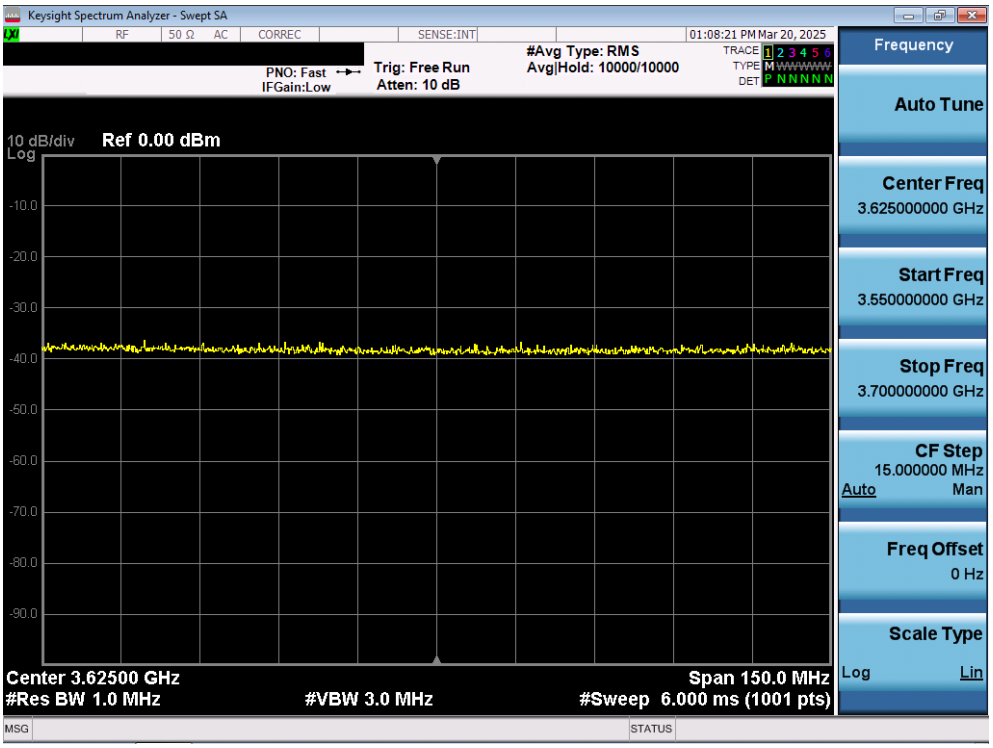
A10 [WINNF.FT.C.REG.18] Group Error (responseCode 201)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 9. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.18)

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A11 [WINNT.FT.C.REG.20] Category A CBSD Location Update

A non-professionally installed Category A CBSD must report to the SAS any location change exceeding adistance of 50m horizontally or 3m vertically within a 60 second window.

```
Timer Timer_CBSD_System_Monitor_Check(9) reached endCount 50 and expired

Event occured: Check GPS & RSSI values from Sysrepo
Idx: 1  (raw: 1)
RSSI_dBFS[1]: -447  (raw: -447)
rxGain_dB[1]: -470  (raw: -470)
Idx: 2  (raw: 2)
RSSI_dBFS[2]: -420  (raw: -420)
rxGain_dB[2]: -464  (raw: -464)
successfully obtained RSSI value from sysrepo (RSSI: -71.28)
Lock: 2  (raw: GPS_LOCK)
Latitude: 39.173500   (raw: 39.1735)
Longitude: -76.825500  (raw: -76.8255)
Altitude: 92  (raw: 92)
successfully obtained GPS Location values from sysrepo (lat:39.173500, lon:-76.825500, alt:92)
>>> GPS Location changed 8 meters horizontally, 70 meters vertically <<<
GPS Location change exceeded the limit.
Do relinquishment & Deregistration to re-register GPS Location Info in SAS
```

Plot 10. Devices deregisters and reregisters upon location change

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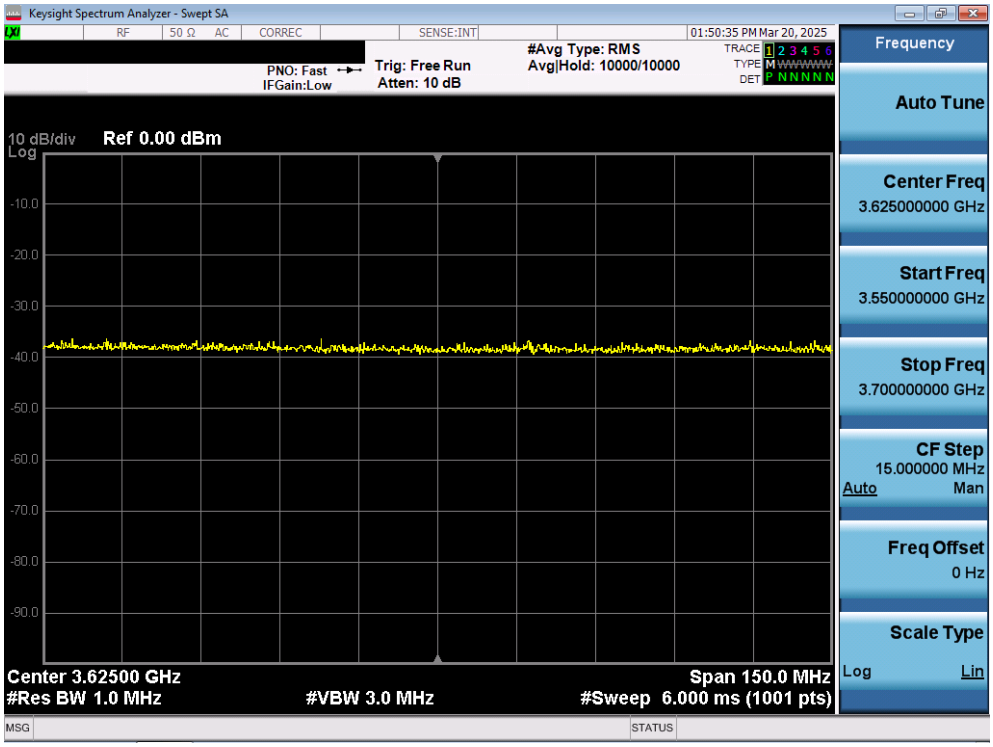
A12 WINNF.FT.C.GRA.1] Unsuccessful Grant responseCode=400 (INTERFERENCE)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 11. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.1)

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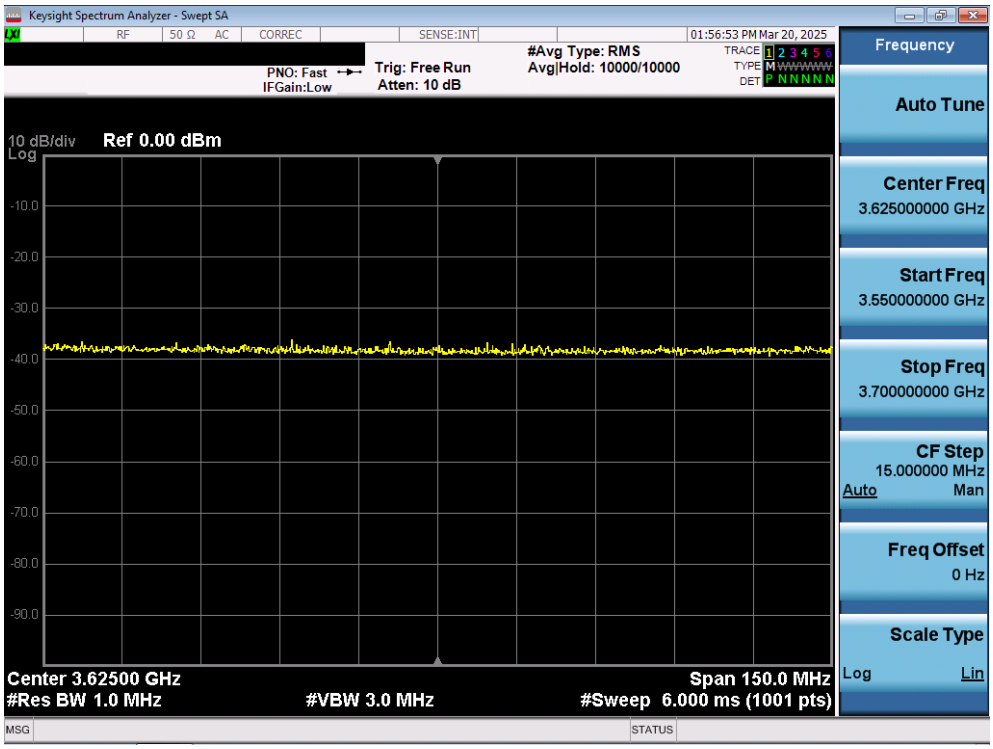
A13 [WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 12. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.2)

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A14 [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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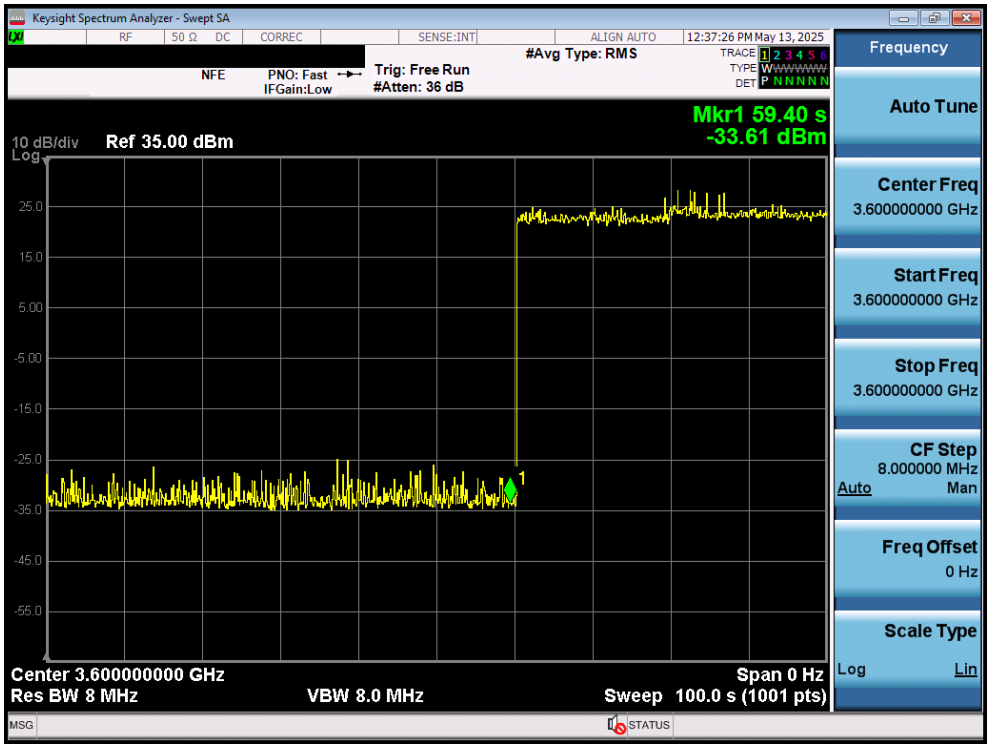
	• grantId = G • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0		
10	Monitor the RF output of the UUT from start of test until UUT transmission commences. Verify: • UUT does not transmit at any time prior to completion of the first heartbeat response • UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F	☒	☐

Test Plots:



Plot 13.Conducted Measurement - RF transmission after SAS heartbeat response (WINNF.FT.C.HBT.1)

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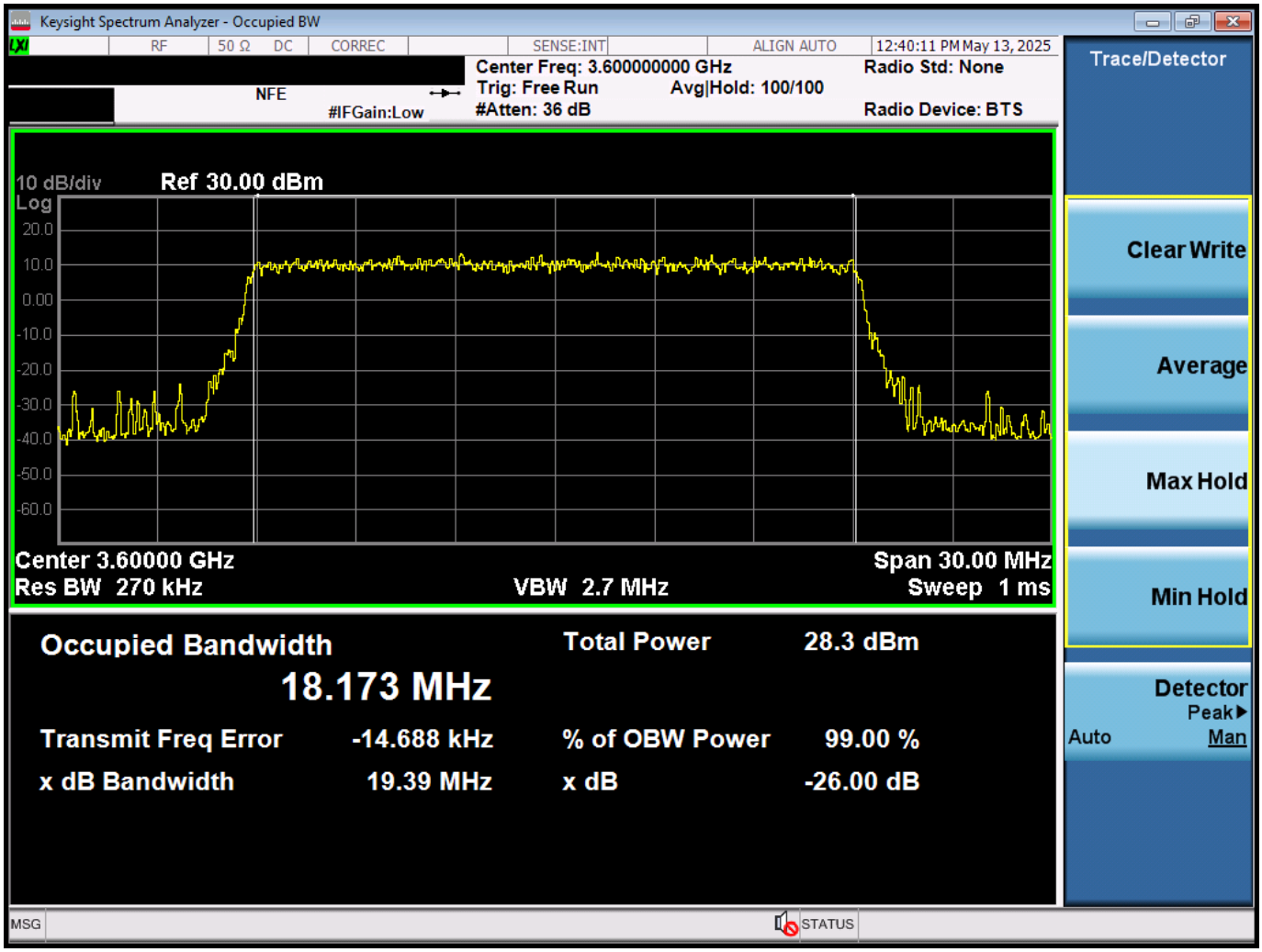

Plot 11. Conducted Measurement Occupied Bandwidth for 20MHz (WINNF.FT.C.HBT.1) – NR

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A15 [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.	--	--
5	Monitor the RF output of the UUT. Verify: • UUT shall stop transmission within (T + 60 seconds) of completion of step 3	☒	☐

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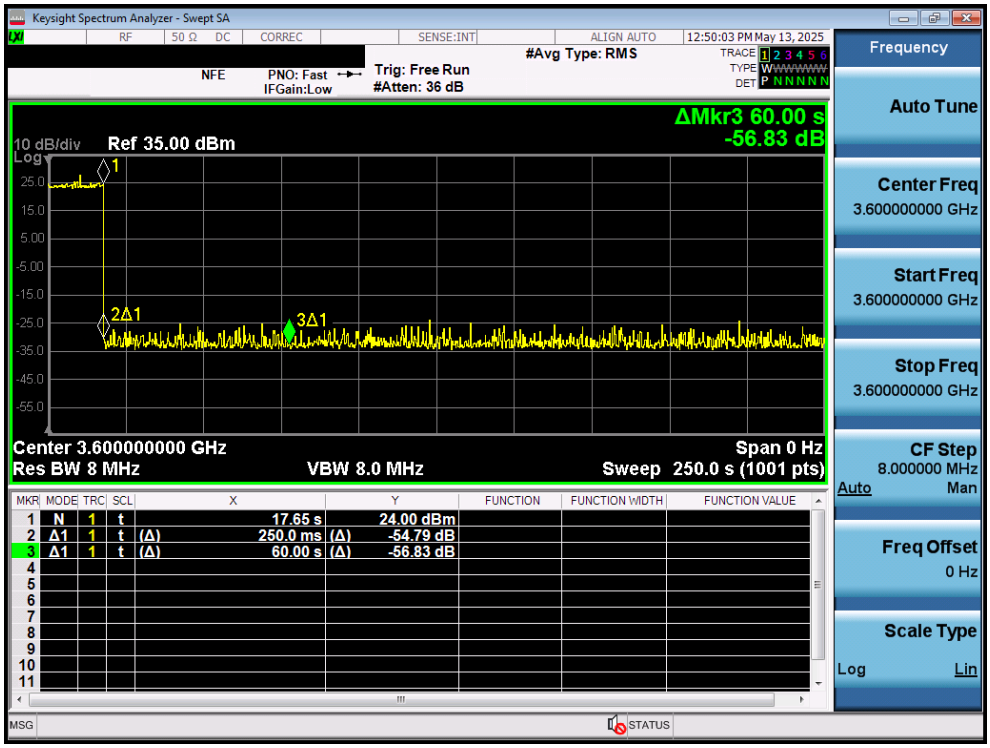
Test Plots:



Plot 14. Conducted Measurement – RF transmission ceases with 60s of SAS heartbeat response (WINNF.FT.C.HBT.3)

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A16 [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.	--	--
5	Monitor the RF output of the UUT. Verify: • UUT shall stop transmission within (T + 60 seconds) of completion of step 3	☒	☐

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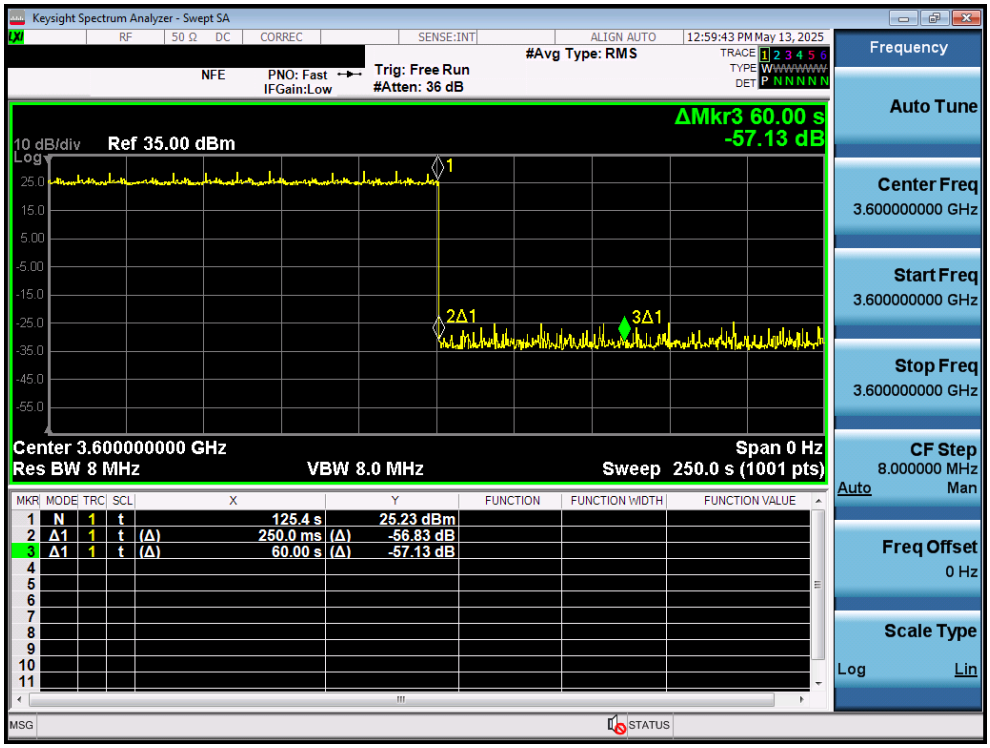
Test Plots:



Plot 15.Conducted Measurement – RF transmission ceases with 60s of SAS heartbeat response (WINNF.FT.C.HBT.4)

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A17 [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: • UUT does not transmit at any time	☒	☐

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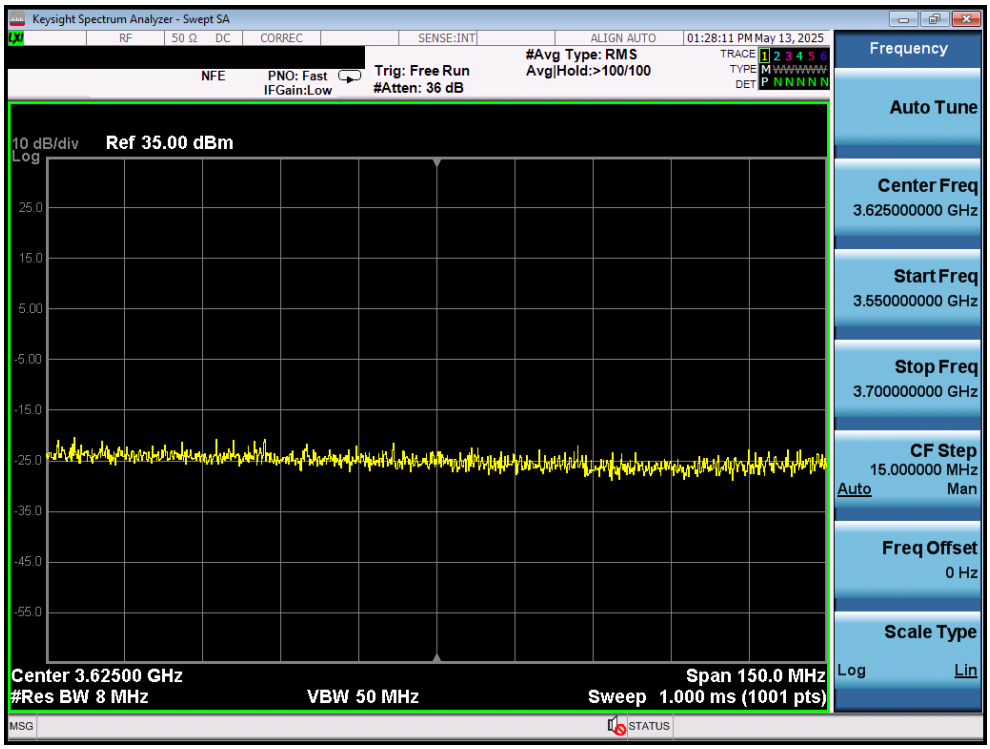
Test Plots:



Plot 16.Conducted Measurement – No RF transmission in entire band at any time (WINNF.FT.C.HBT.5)

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A18 [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 Monitor the RF output of the UUT. Verify: • UUT shall stop transmission within (T + 60 seconds) of completion of step 3	☒	☐

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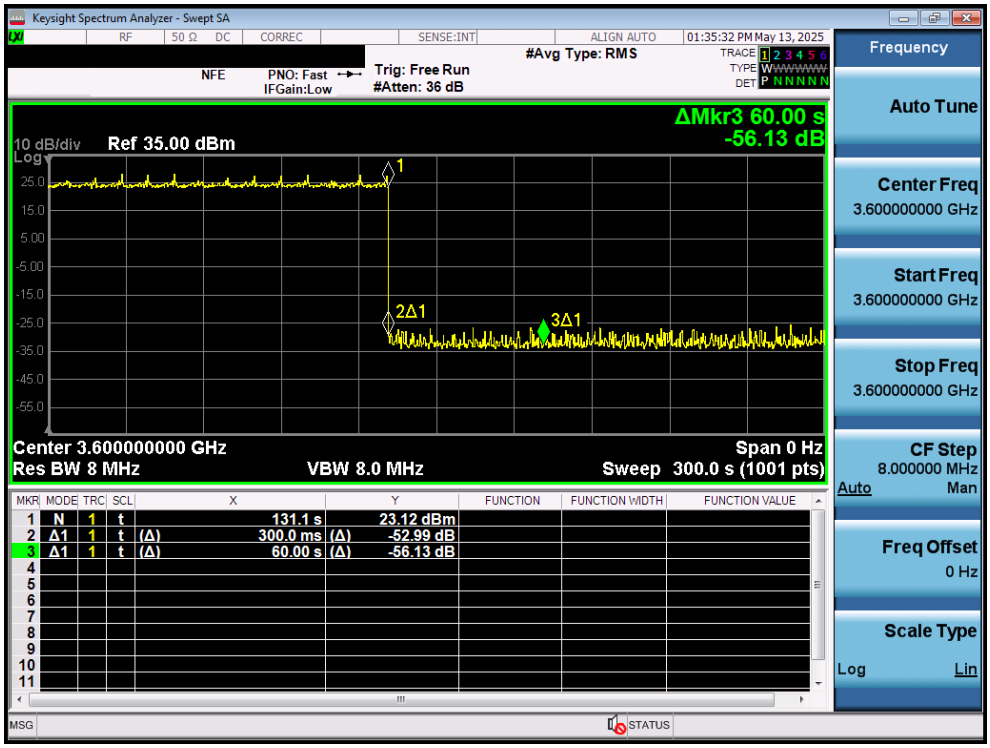
Test Plots:



Plot 17. Conducted Measurement – RF transmission ceases with 60s of SAS heartbeat response (WINNF.FT.C.HBT.6)

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A19 [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 Monitor the RF output of the UUT. Verify: • UUT shall stop transmission within (T+60) seconds of completion of step 3.	☒	☐

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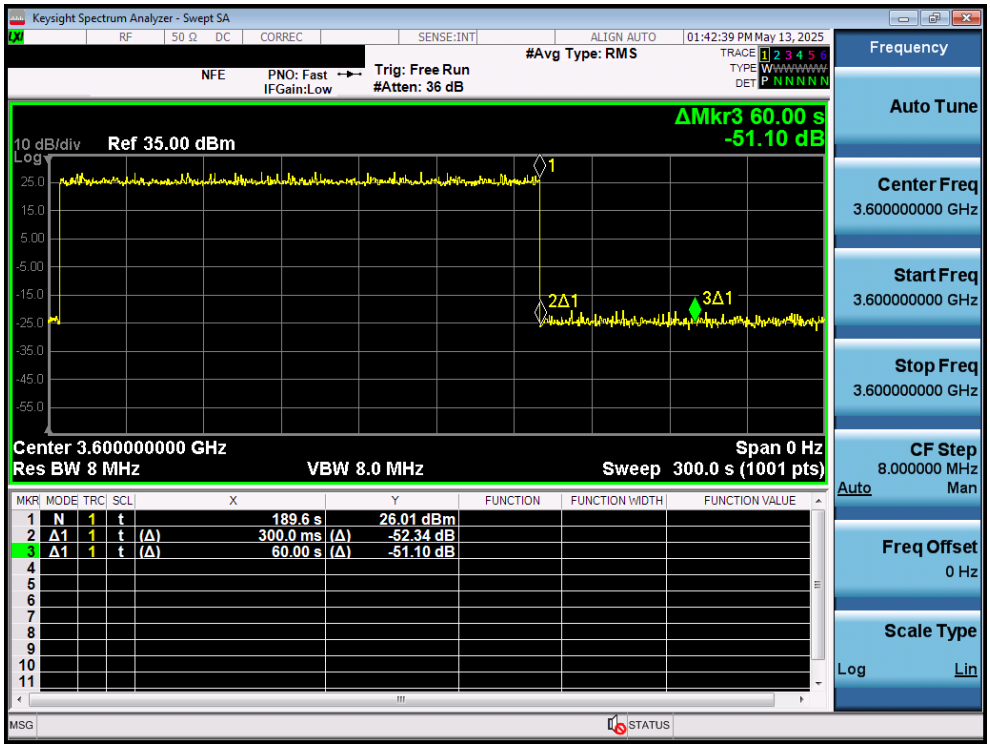
Test Plots:



Plot 18. Conducted Measurement – RF transmission ceases with 60s of SAS heartbeat response (WINNF.FT.C.HBT.7)

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A20 [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: • At any time during the test, UUT shall not transmit on RF interface	☒	☐

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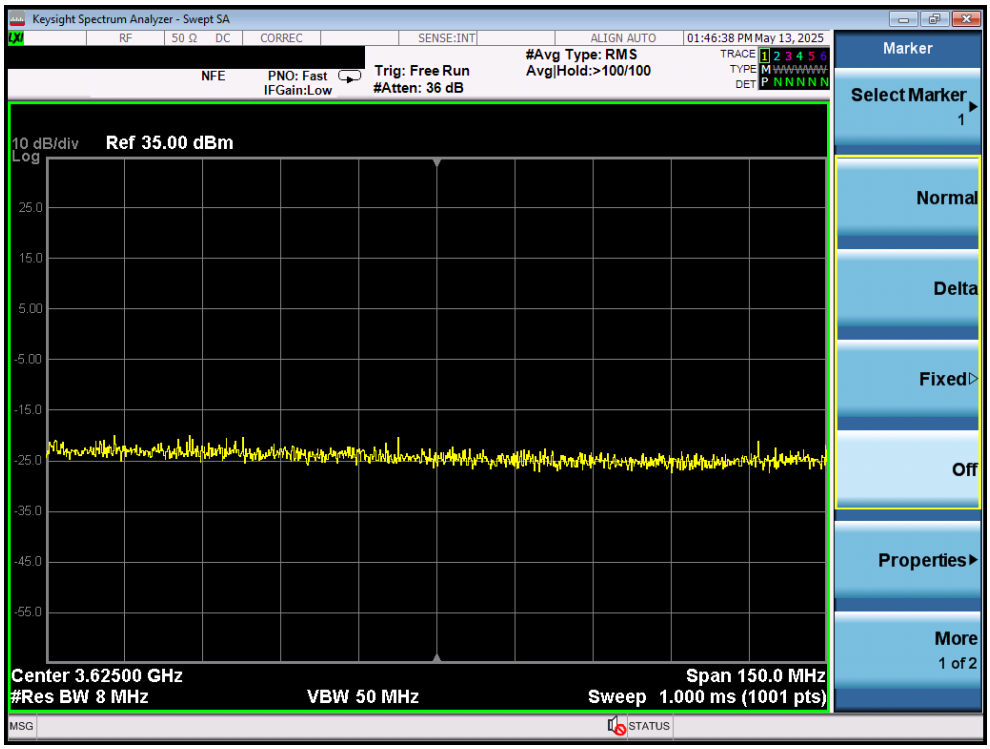
Test Plots:



Plot 19.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.HBT.9)

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A21 [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	--	--
5	Monitor the RF output of the UUT. Verify: • UUT shall stop all transmission on RF interface within (transmitExpireTime + 60 seconds), using the transmitExpireTime sent in Step 3.	☒	☐

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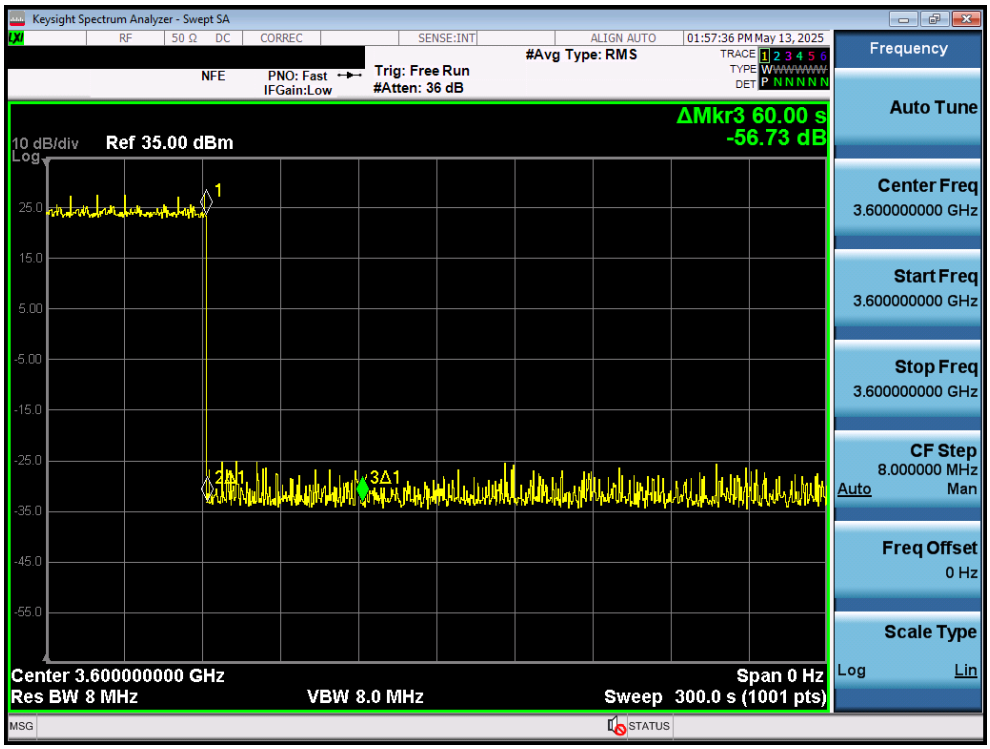
Test Plots:



Plot 20.Conducted Measurement - RF transmission ceases with 60s of SAS heartbeat response (WINNF.FT.C.HBT.10)

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A22 [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.	--	--
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: • UUT shall stop RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request	☒	☐

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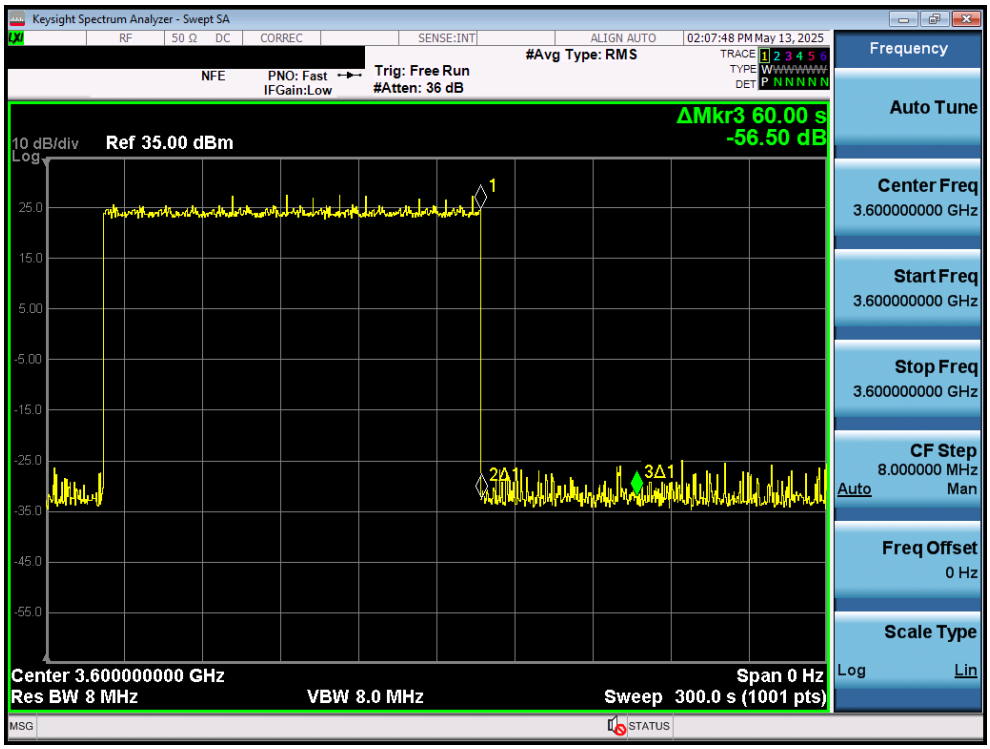
Test Plots:



Plot 21. Conducted Measurement – RF Transmission stops within 60s of relinquishment response (WINNF.FT.C.RLQ.1)

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A23 [WINNF.FT.C.MES.3] 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 • UUT has successfully registered with SAS Test Harness, with cbsdId=C and measCapability="RECEIVED_POWER_WITH_GRANT"	--	--
2	SAS Test Harness sends a Grant Request message, with the following parameters: • cbsdId = C = valid cbsdId for this UUT • operationParam is present and format is valid	☒	--
3	SAS Test Harness sends a Grant Response message, with the following parameters • cbsdId = C • grantId = G = valid grant ID • grantExpireTime = UTC time in the future • heartbeatInterval = 60 seconds • measReportConfig= "RECEIVED_POWER_WITH_GRANT" • channelType = "GAA" • responseCode = 0	--	--
4	UUT sends a Heartbeat Request message. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G	☒	☐

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```
2025-04-21T14:30:08.138Z - INFO - Response message contains measReportConfig
2025-04-21T14:30:08.138Z - INFO - engine sent successfully, the response to CBRS  : {
    "grantResponse": [
        {
            "cbsdId": "2AXTR-ENS2278-3823Mock-SASNE002501200000195",
            "channelType": "GAA",
            "grantExpireTime": "2025-04-28T14:30:08Z",
            "grantId": "209865011",
            "heartbeatInterval": 60,
            "measReportConfig": [
                "RECEIVED_POWER_WITH_GRANT"
            ],
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2025-04-21T14:30:09.232Z - INFO - heartbeat request from CBRS  : {
    "heartbeatRequest": [
        {
            "cbsdId": "2AXTR-ENS2278-3823Mock-SASNE002501200000195",
            "grantId": "209865011",
            "measReport": {
                "rcvdPowerMeasReports": [
                    {
                        "measBandwidth": 10000000,
                        "measFrequency": 3550000000,
                        "measRcvdPower": -100.0
                    }
                ]
            },
            "operationState": "GRANTED"
        }
    ]
}
2025-04-21T14:30:09.232Z - INFO - measReport received in heartbeat message
```


Plot 19. Measurement Report in Grant Response (WINNF.FT.C.MES.3)

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A24 [WINNF.FT.C.MES.4] Heartbeat 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 • UUT has successfully registered with SAS Test Harness, with cbsdId=C and measCapability = "RECEIVED_POWER_WITH_GRANT" • 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. • Grant has heartbeatInterval = 60 seconds	--	--
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message contains all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G • operationState = "AUTHORIZED"	☒	☐
3	SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G • measReportConfig= "RECEIVED_POWER_WITH_GRANT" • responseCode = 0	--	--
4	UUT sends a Heartbeat Request message. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G • operationState = "AUTHORIZED"	☒	☐
5	If Heartbeat Request message (step 4) contains measReport object, then: • verify measReport is properly formatted as object rcvdPowerMeasReport • end test, with PASS result else, if Heartbeat Request message (step 4) does not contain measReport object, then: • If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then stop test with result of FAIL	☒	☐
6	SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G • responseCode = 0 Go to Step 4, above	--	--

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```
2025-04-21T15:07:46.134Z - INFO - Response message contains measReportConfig
2025-04-21T15:07:46.134Z - INFO - engine sent successfully, the response to CBRS  : {
    "heartbeatResponse": [
        {
            "cbsdId": "2AXTR-ENS2278-3823Mock-SASNE002501200000195",
            "grantId": "778895071",
            "measReportConfig": [
                "RECEIVED_POWER_WITH_GRANT"
            ],
            "response": {
                "responseCode": 0
            },
            "transmitExpireTime": "2025-04-21T15:11:06Z"
        }
    ]
}
2025-04-21T15:08:47.605Z - INFO - heartbeat request from CBRS  : {
    "heartbeatRequest": [
        {
            "cbsdId": "2AXTR-ENS2278-3823Mock-SASNE002501200000195",
            "grantId": "778895071",
            "measReport": {
                "rcvdPowerMeasReports": [
                    {
                        "measBandwidth": 10000000,
                        "measFrequency": 3550000000,
                        "measRcvdPower": -71.34
                    }
                ]
            },
            "operationState": "AUTHORIZED"
        }
    ]
}
```


Plot 19. Measurement Report in Heartbeat Response (WINNF.FT.C.MES.4)

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A25 [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: • UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: A. UUT sending a Registration Request message, as this is not mandatory B. UUT sending a Deregistration Request message	☒	☐

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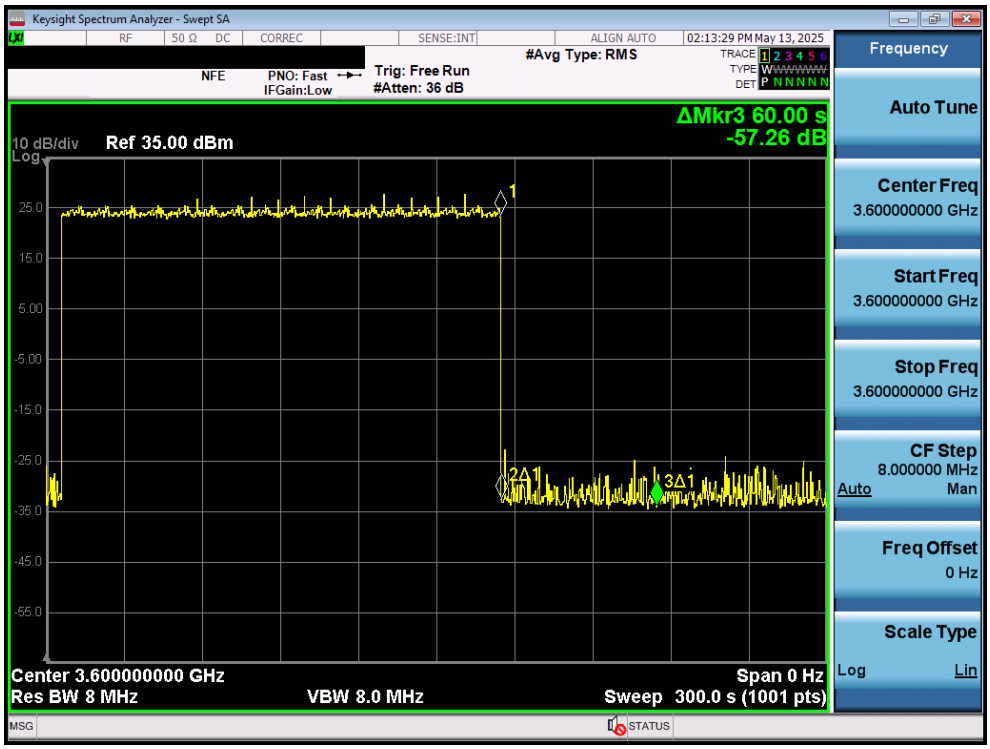
Test Plots:



Plot 22. Conducted Measurement – No RF Transmission stops with 60s of deregistration response (WINNF.FT.C.DRG.1)

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A26 [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: • UUT shall not transmit RF	☒	☐

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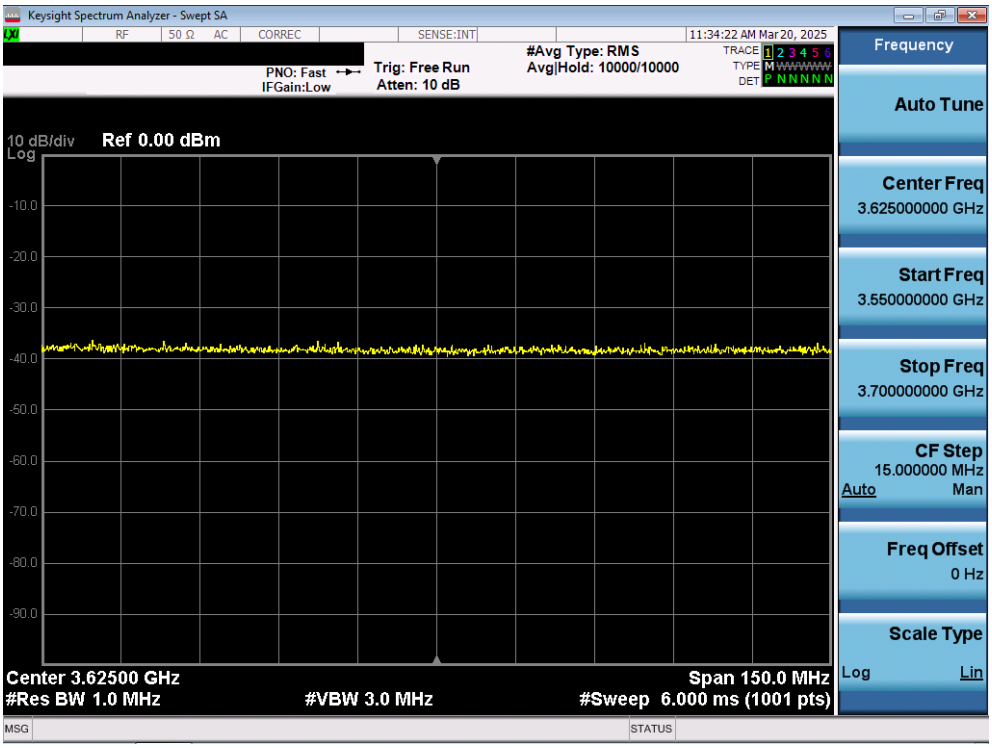
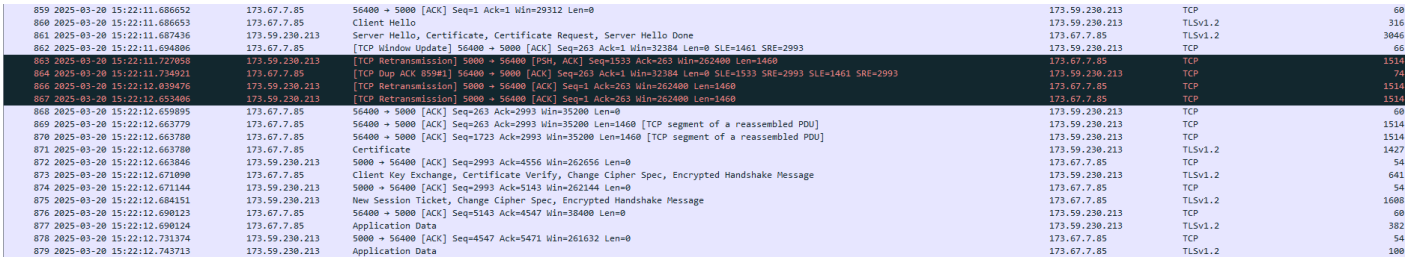
Test Plots:



Plot 23.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)



859 2025-03-20 15:22:11.686652	173.67.7.85	56400 → 5000 [ACK] Seq=1 Ack=1 Win=29312 Len=0	173.59.230.213	TCP	60
860 2025-03-20 15:22:11.686653	173.67.7.85	Client Hello	173.59.230.213	TLSv1.2	316
861 2025-03-20 15:22:11.687436	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.67.7.85	TLSv1.2	3046
862 2025-03-20 15:22:11.694806	173.67.7.85	[TCP Window Update] 56400 → 5000 [ACK] Seq=263 Ack=1 Win=32384 Len=0 SLE=1461 SRE=2993	173.59.230.213	TCP	66
863 2025-03-20 15:22:11.727058	173.59.230.213	[TCP Retransmission] 5000 → 56400 [PSH, ACK] Seq=1533 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
864 2025-03-20 15:22:11.734921	173.67.7.85	[TCP Dup ACK 859#1] 56400 → 5000 [ACK] Seq=263 Ack=1 Win=32384 Len=0 SLE=1533 SRE=2993 SLE=1461 SRE=2993	173.59.230.213	TCP	74
866 2025-03-20 15:22:12.039476	173.59.230.213	[TCP Retransmission] 5000 → 56400 [ACK] Seq=1 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
867 2025-03-20 15:22:12.653406	173.59.230.213	[TCP Retransmission] 5000 → 56400 [ACK] Seq=1 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
868 2025-03-20 15:22:12.659895	173.67.7.85	56400 → 5000 [ACK] Seq=263 Ack=2993 Win=35200 Len=0	173.59.230.213	TCP	60
869 2025-03-20 15:22:12.663779	173.67.7.85	56400 → 5000 [ACK] Seq=263 Ack=2993 Win=35200 Len=1460 [TCP segment of a reassembled PDU]	173.59.230.213	TCP	1514
870 2025-03-20 15:22:12.663780	173.67.7.85	56400 → 5000 [ACK] Seq=1723 Ack=2993 Win=35200 Len=1460 [TCP segment of a reassembled PDU]	173.59.230.213	TCP	1514
871 2025-03-20 15:22:12.663780	173.67.7.85	Certificate	173.59.230.213	TLSv1.2	1427
872 2025-03-20 15:22:12.663846	173.59.230.213	5000 → 56400 [ACK] Seq=2993 Ack=4556 Win=262656 Len=0	173.67.7.85	TCP	54
873 2025-03-20 15:22:12.671090	173.67.7.85	Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message	173.59.230.213	TLSv1.2	641
874 2025-03-20 15:22:12.671144	173.59.230.213	5000 → 56400 [ACK] Seq=2993 Ack=5143 Win=262144 Len=0	173.67.7.85	TCP	54
875 2025-03-20 15:22:12.684151	173.59.230.213	New Session Ticket, Change Cipher Spec, Encrypted Handshake Message	173.67.7.85	TLSv1.2	1608
876 2025-03-20 15:22:12.690123	173.67.7.85	56400 → 5000 [ACK] Seq=5143 Ack=4547 Win=38400 Len=0	173.59.230.213	TCP	60
877 2025-03-20 15:22:12.690124	173.67.7.85	Application Data	173.59.230.213	TLSv1.2	382
878 2025-03-20 15:22:12.731374	173.59.230.213	5000 → 56400 [ACK] Seq=4547 Ack=5471 Win=261632 Len=0	173.67.7.85	TCP	54
879 2025-03-20 15:22:12.743713	173.59.230.213	Application Data	173.67.7.85	TLSv1.2	100

Plot 24.WireShark Screenshot – Successful Handshake (WINNF.FT.C.SCS.1)

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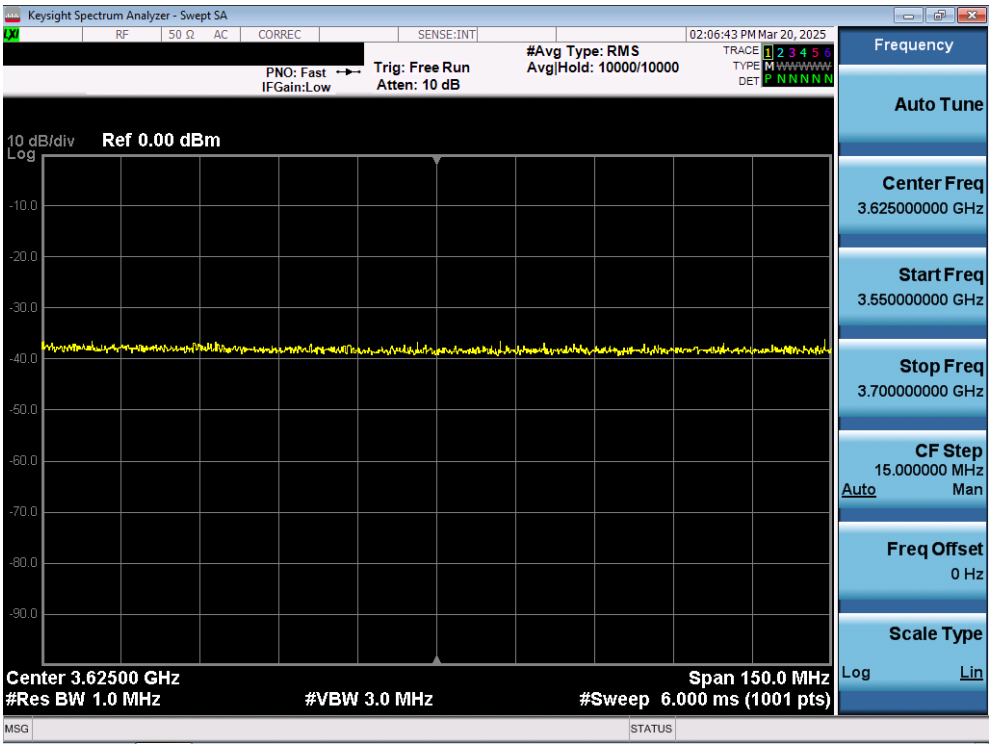
A27 [WINNF.FT.C.SCS.2] TLS failure due to revoked certificate

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 25. 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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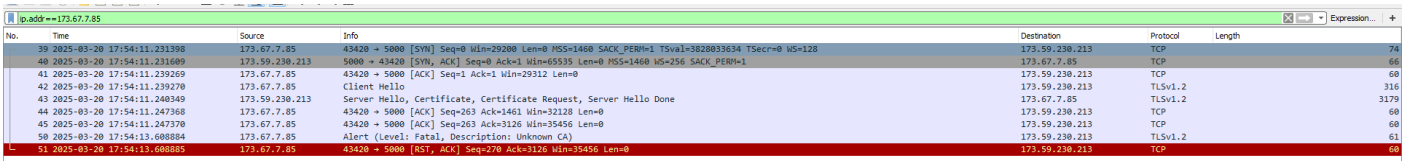

Plot 26. WireShark Screenshot 1 - Failed Handshake (WINNF.FT.C.SCS.2)

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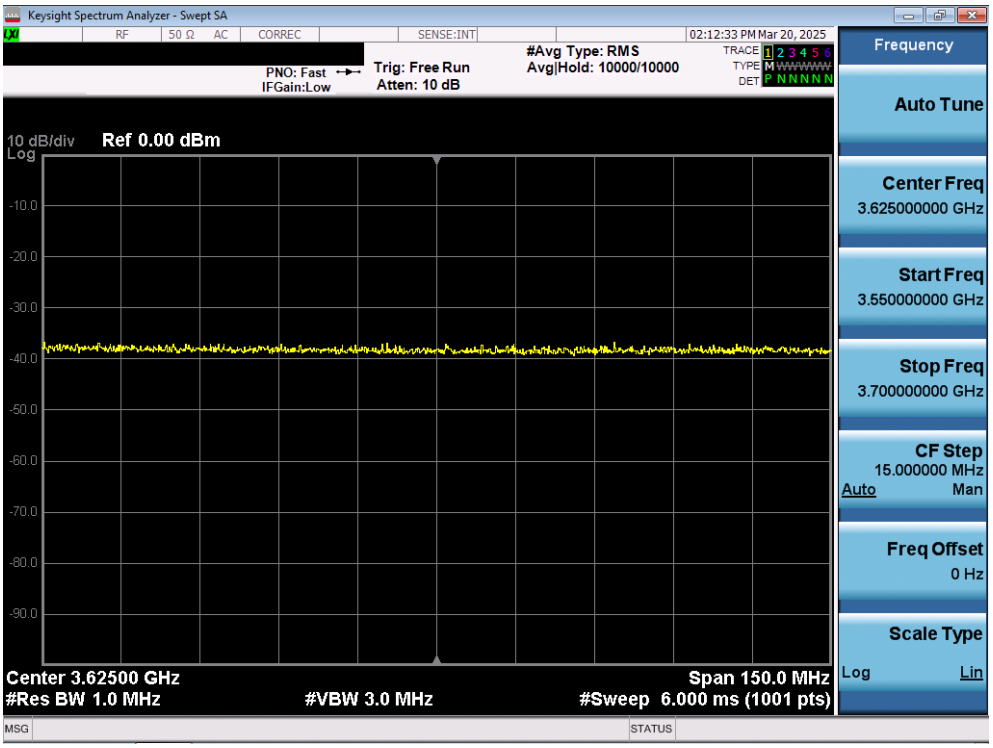
A28 [WINNF.FT.C.SCS.3] TLS failure due to expired server certificate

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 27.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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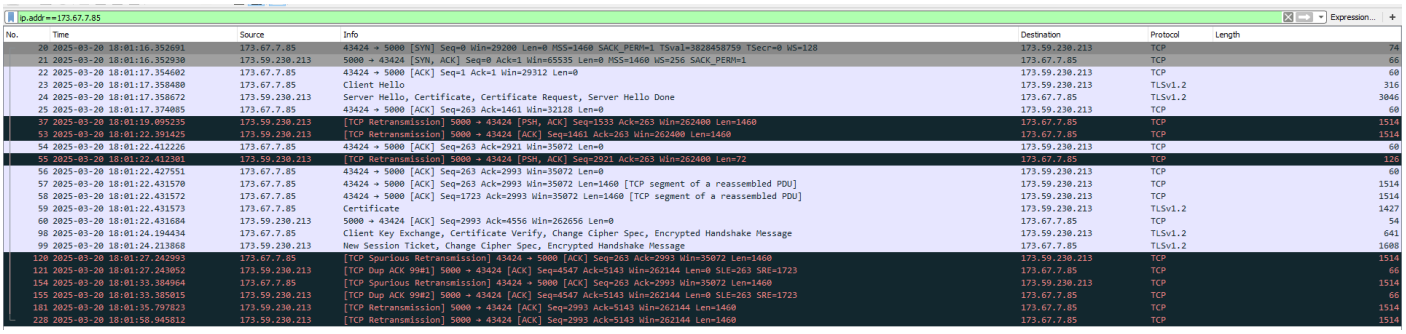

ip.addr==173.67.7.85

No.	Time	Source	Info	Destination	Protocol	Length
20	2025-03-20 18:01:16.352691	173.67.7.85	43424 → 5000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=3828458759 TSecr=0 WS=128	173.59.230.213	TCP	74
21	2025-03-20 18:01:16.352930	173.59.230.213	5000 → 43424 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.67.7.85	TCP	66
22	2025-03-20 18:01:17.354602	173.67.7.85	43424 → 5000 [ACK] Seq=1 Ack=1 Win=29312 Len=0	173.59.230.213	TCP	60
23	2025-03-20 18:01:17.358480	173.67.7.85	Client Hello	173.59.230.213	TLSv1.2	316
24	2025-03-20 18:01:17.358672	173.59.230.213	Server Hello, Certificate, Certificate Request, Server Hello Done	173.67.7.85	TLSv1.2	3046
25	2025-03-20 18:01:17.374085	173.67.7.85	43424 → 5000 [ACK] Seq=263 Ack=1461 Win=32128 Len=0	173.59.230.213	TCP	60
37	2025-03-20 18:01:19.095235	173.59.230.213	[TCP Retransmission] 5000 → 43424 [PSH, ACK] Seq=1533 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
53	2025-03-20 18:01:22.391425	173.59.230.213	[TCP Retransmission] 5000 → 43424 [ACK] Seq=1461 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
54	2025-03-20 18:01:22.412226	173.67.7.85	43424 → 5000 [ACK] Seq=263 Ack=2921 Win=35072 Len=0	173.59.230.213	TCP	60
55	2025-03-20 18:01:22.412301	173.59.230.213	[TCP Retransmission] 5000 → 43424 [PSH, ACK] Seq=2921 Ack=263 Win=262400 Len=72	173.67.7.85	TCP	126
56	2025-03-20 18:01:22.427551	173.67.7.85	43424 → 5000 [ACK] Seq=263 Ack=2993 Win=35072 Len=0	173.59.230.213	TCP	60
57	2025-03-20 18:01:22.431570	173.67.7.85	43424 → 5000 [ACK] Seq=263 Ack=2993 Win=35072 Len=1460 [TCP segment of a reassembled PDU]	173.59.230.213	TCP	1514
58	2025-03-20 18:01:22.431572	173.67.7.85	43424 → 5000 [ACK] Seq=1723 Ack=2993 Win=35072 Len=1460 [TCP segment of a reassembled PDU]	173.59.230.213	TCP	1514
59	2025-03-20 18:01:22.431573	173.67.7.85	Certificate	173.59.230.213	TLSv1.2	1427
60	2025-03-20 18:01:22.431684	173.59.230.213	5000 → 43424 [ACK] Seq=2993 Ack=4556 Win=262656 Len=0	173.67.7.85	TCP	54
98	2025-03-20 18:01:24.194434	173.67.7.85	Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message	173.59.230.213	TLSv1.2	641
99	2025-03-20 18:01:24.213868	173.59.230.213	New Session Ticket, Change Cipher Spec, Encrypted Handshake Message	173.67.7.85	TLSv1.2	1608
120	2025-03-20 18:01:27.242993	173.67.7.85	[TCP Spurious Retransmission] 43424 → 5000 [ACK] Seq=263 Ack=2993 Win=35072 Len=1460	173.59.230.213	TCP	1514
121	2025-03-20 18:01:27.243052	173.59.230.213	[TCP Dup ACK 99#1] 5000 → 43424 [ACK] Seq=4547 Ack=5143 Win=262144 Len=0 SLE=263 SRE=1723	173.67.7.85	TCP	66
154	2025-03-20 18:01:33.384964	173.67.7.85	[TCP Spurious Retransmission] 43424 → 5000 [ACK] Seq=263 Ack=2993 Win=35072 Len=1460	173.59.230.213	TCP	1514
155	2025-03-20 18:01:33.385015	173.59.230.213	[TCP Dup ACK 99#2] 5000 → 43424 [ACK] Seq=4547 Ack=5143 Win=262144 Len=0 SLE=263 SRE=1723	173.67.7.85	TCP	66
181	2025-03-20 18:01:35.797823	173.59.230.213	[TCP Retransmission] 5000 → 43424 [ACK] Seq=2993 Ack=5143 Win=262144 Len=1460	173.67.7.85	TCP	1514
228	2025-03-20 18:01:58.945812	173.59.230.213	[TCP Retransmission] 5000 → 43424 [ACK] Seq=2993 Ack=5143 Win=262144 Len=1460	173.67.7.85	TCP	1514

Plot 28.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.3)

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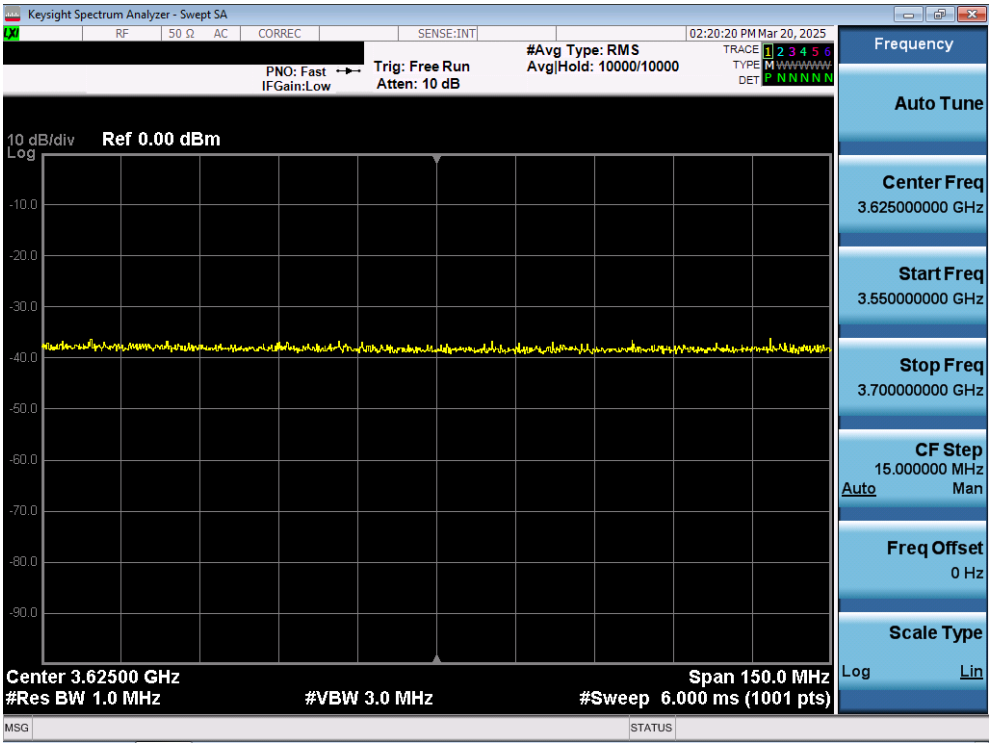
A29 [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 29.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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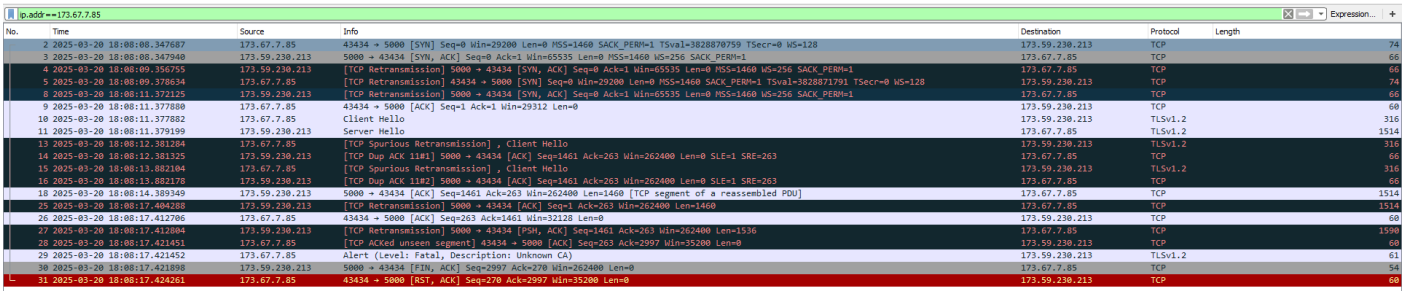

No.	Time	Source	Info	Destination	Protocol	Length
2	2025-03-20 18:08:08.347687	173.67.7.85	43434 → 5000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=3828870759 TSecr=0 WS=128	173.59.230.213	TCP	74
3	2025-03-20 18:08:08.347940	173.59.230.213	5000 → 43434 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.67.7.85	TCP	66
4	2025-03-20 18:08:09.356755	173.59.230.213	[TCP Retransmission] 5000 → 43434 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.67.7.85	TCP	66
5	2025-03-20 18:08:09.378634	173.67.7.85	[TCP Retransmission] 43434 → 5000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=3828871791 TSecr=0 WS=128	173.59.230.213	TCP	74
8	2025-03-20 18:08:11.372125	173.59.230.213	[TCP Retransmission] 5000 → 43434 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1	173.67.7.85	TCP	66
9	2025-03-20 18:08:11.377880	173.67.7.85	43434 → 5000 [ACK] Seq=1 Ack=1 Win=29312 Len=0	173.59.230.213	TCP	60
10	2025-03-20 18:08:11.377882	173.67.7.85	Client Hello	173.59.230.213	TLSv1.2	316
11	2025-03-20 18:08:11.379199	173.59.230.213	Server Hello	173.67.7.85	TLSv1.2	1514
13	2025-03-20 18:08:12.381284	173.67.7.85	[TCP Spurious Retransmission] , Client Hello	173.59.230.213	TLSv1.2	316
14	2025-03-20 18:08:12.381325	173.59.230.213	[TCP Dup ACK 11#1] 5000 → 43434 [ACK] Seq=1461 Ack=263 Win=262400 Len=0 SLE=1 SRE=263	173.67.7.85	TCP	66
15	2025-03-20 18:08:13.882104	173.67.7.85	[TCP Spurious Retransmission] , Client Hello	173.59.230.213	TLSv1.2	316
16	2025-03-20 18:08:13.882178	173.59.230.213	[TCP Dup ACK 11#2] 5000 → 43434 [ACK] Seq=1461 Ack=263 Win=262400 Len=0 SLE=1 SRE=263	173.67.7.85	TCP	66
18	2025-03-20 18:08:14.389349	173.59.230.213	5000 → 43434 [ACK] Seq=1461 Ack=263 Win=262400 Len=1460 [TCP segment of a reassembled PDU]	173.67.7.85	TCP	1514
25	2025-03-20 18:08:17.404288	173.59.230.213	[TCP Retransmission] 5000 → 43434 [ACK] Seq=1 Ack=263 Win=262400 Len=1460	173.67.7.85	TCP	1514
26	2025-03-20 18:08:17.412706	173.67.7.85	43434 → 5000 [ACK] Seq=263 Ack=1461 Win=32128 Len=0	173.59.230.213	TCP	60
27	2025-03-20 18:08:17.412804	173.59.230.213	[TCP Retransmission] 5000 → 43434 [PSH, ACK] Seq=1461 Ack=263 Win=262400 Len=1536	173.67.7.85	TCP	1590
28	2025-03-20 18:08:17.421451	173.67.7.85	[TCP ACKed unseen segment] 43434 → 5000 [ACK] Seq=263 Ack=2997 Win=35200 Len=0	173.59.230.213	TCP	60
29	2025-03-20 18:08:17.421452	173.67.7.85	Alert (Level: Fatal, Description: Unknown CA)	173.59.230.213	TLSv1.2	61
30	2025-03-20 18:08:17.421898	173.59.230.213	5000 → 43434 [FIN, ACK] Seq=2997 Ack=270 Win=262400 Len=0	173.67.7.85	TCP	54
31	2025-03-20 18:08:17.424261	173.67.7.85	43434 → 5000 [RST, ACK] Seq=270 Ack=2997 Win=35200 Len=0	173.59.230.213	TCP	60

Plot 30.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.4)

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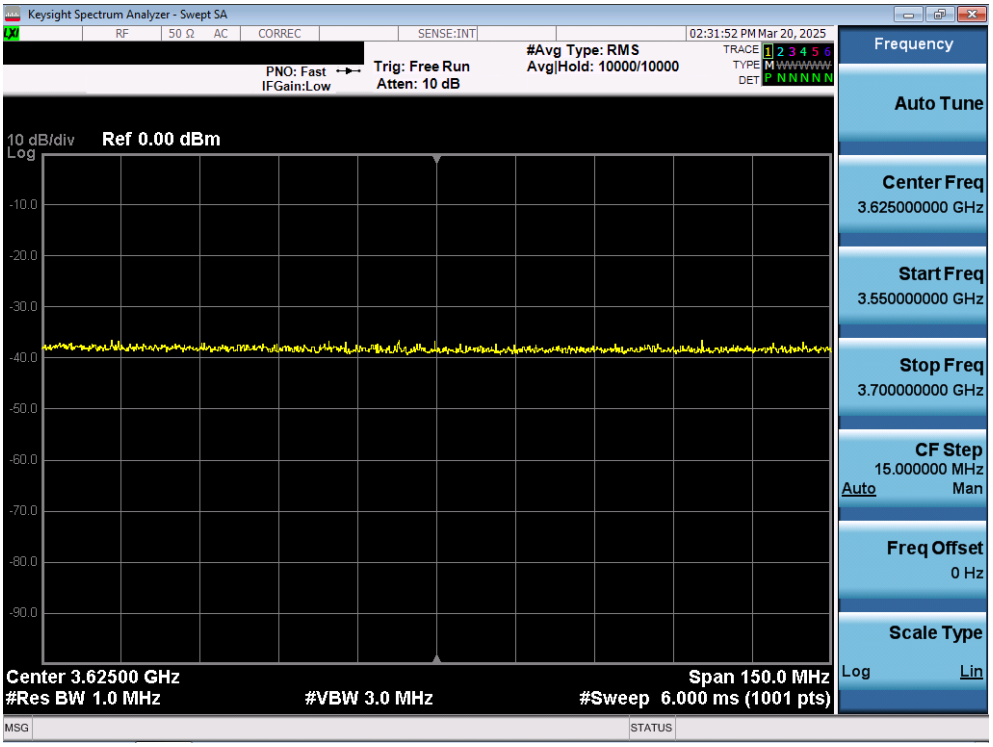
A30 [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

	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: • UUT shall not transmit RF	☒	☐

Test Plots:



Plot 31. 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)

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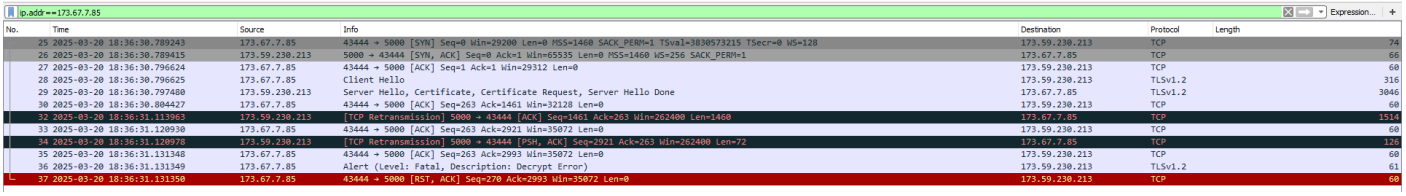

Plot 32.WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.5)

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A31 [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 29dBm/MHz to 19dBm/MHz for 20MHz Bandwidth.

The device transmits into two correlated antennas with ANT1 Gain = 9.3dBi and ANT2 Gain = 9.6dBi. Using the formula: Directional gain = 10 log[(10G1/20 + 10G2/20 + … + 10GN/20)2 /NANT], directional gain is found to be 12.46. EIRP PSD is found by adding the directional gain to the summed conducted PSD level.

SAS EIRP Grant [dBm/MHz]	ANT1 Conducted PSD [dBm/MHz]	ANT2 Conducted PSD [dBm/MHz]	MIMO Conducted PSD [dBm/MHz]	Directional Antenna Gain [dBi]	MIMO EIRP PSD [dBm/MHz]	Margin [dB]
29	12.69	11.18	15.01	12.46	27.47	-1.53
19	3.62	2.55	6.12	12.46	18.58	-0.42
9	-6.42	-7.09	-3.73	12.46	8.73	-0.27

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

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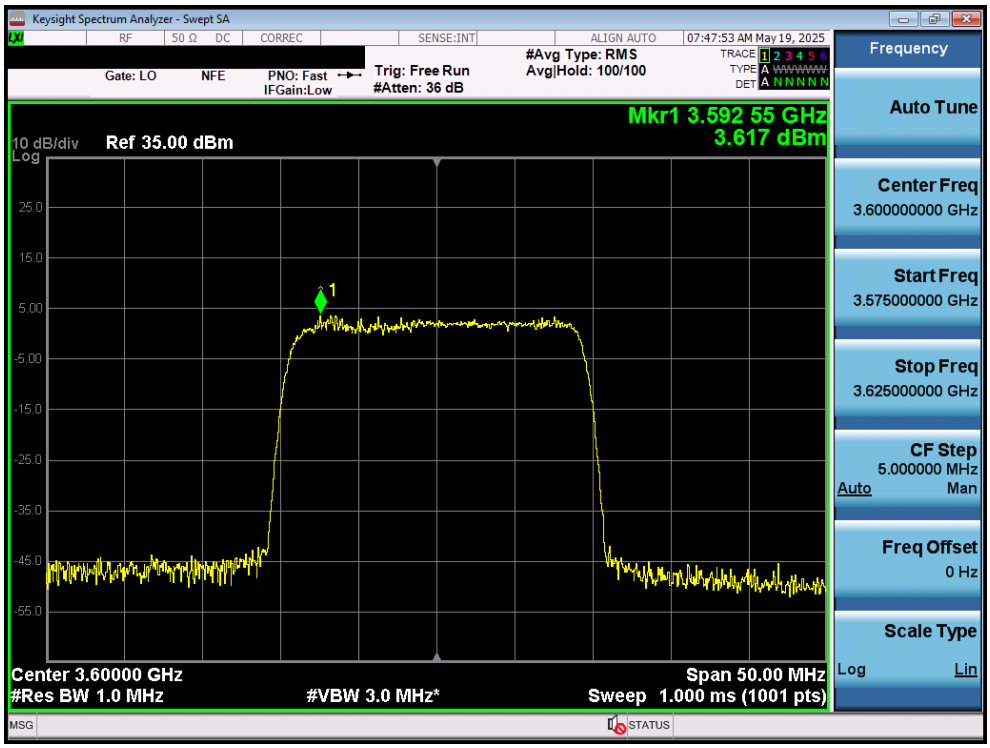
Test Plots:

Plot 33. Conducted PSD, SAS Granted maxEIRP 29 – ANT1



Plot 34. Conducted PSD, SAS Granted maxEIRP 19 – ANT1

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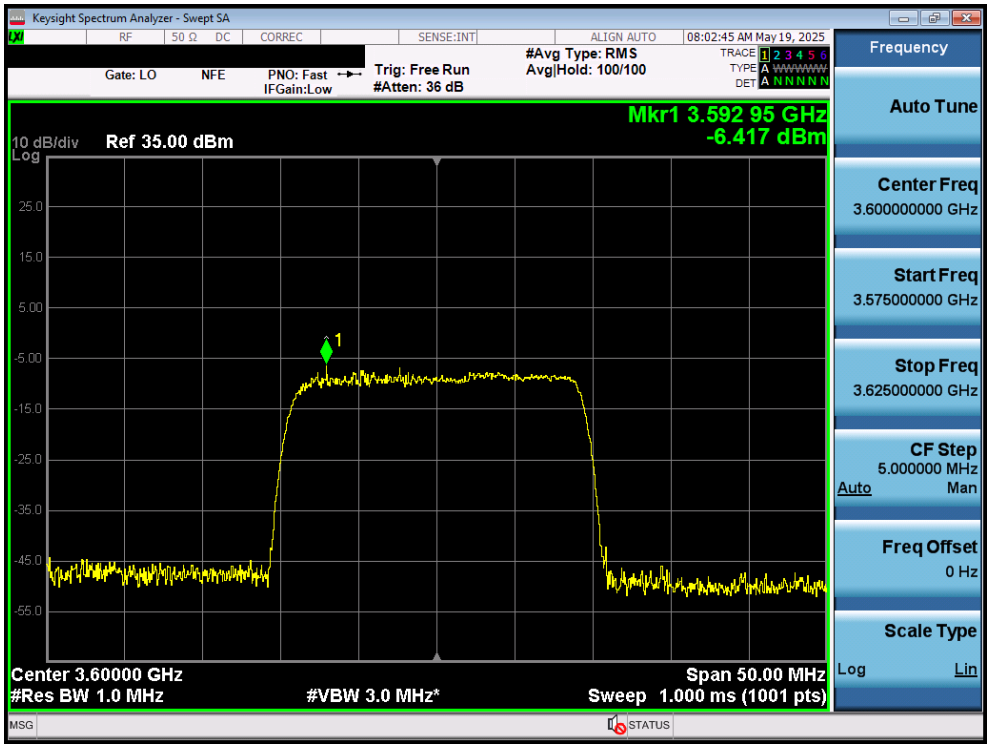
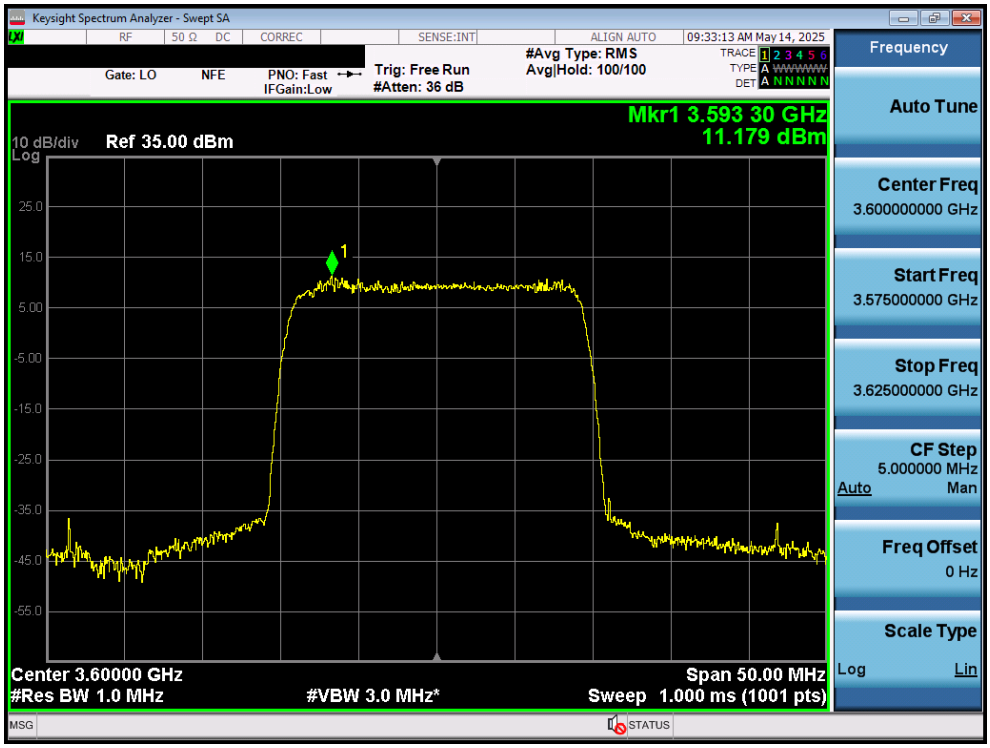


Plot 35. Conducted PSD, SAS Granted maxEIRP 9 – ANT1



Plot 36. Conducted PSD, SAS Granted maxEIRP 29 – ANT2

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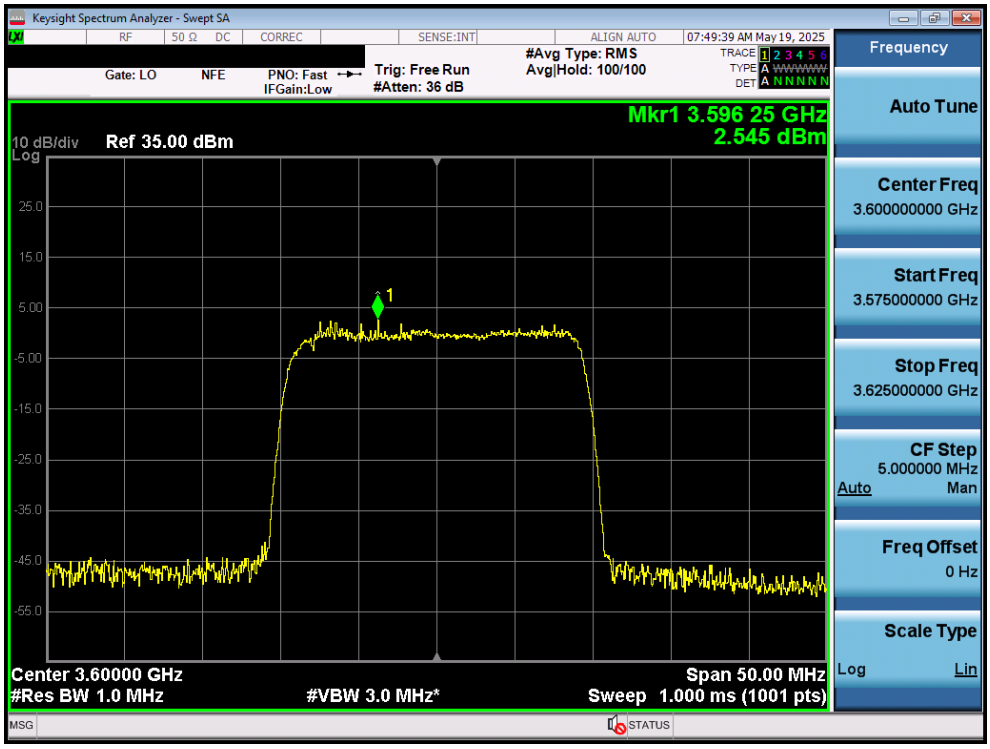
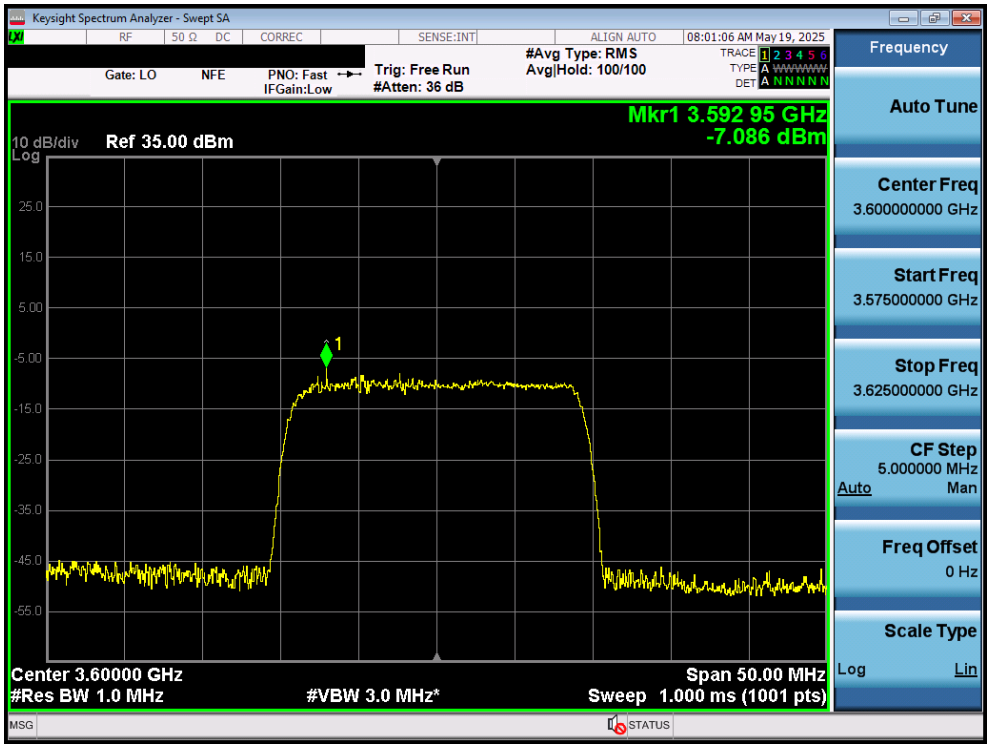


Plot 37. Conducted PSD, SAS Granted maxEIRP 19 – ANT2



Plot 38. Conducted PSD, SAS Granted maxEIRP 9 – ANT2

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APPENDIX B – TEST LOGS

Logs are available upon request

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