TEST REPORT

Report Number: 12820744-E1V1

Applicant	:	ERICSSON AB
FCC ID	:	TA8AKRY901385-1
EUT Description	:	RADIO DOT SYSTEM WITH INDUSTRY CONNECT DOMAIN PROXY
Test Standard(s)	:	Wireless Innovation Forum Test and Certification for CBRS (WINN-TS-0122)

Date Of Issue:

June 18, 2019

Prepared by:

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NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	6/18/2019	Initial Issue	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	ERICSSON AB TORSHAMNSGATAN 23, SE-164 80 STOCKHOLM, SWEDEN
EUT DESCRIPTION:	RADIO DOT SYSTEM WITH INDUSTRY CONNECT DOMAIN PROXY
MODEL:	KRY 901 385/1
SERIAL NUMBER:	TD3T465174, TD3T465182
DATE TESTED:	5/13/2019 to 5/17/2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
Wireless Innovation Forum Test and Certification for CBRS (WINN-TS-0122)	PASS

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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UL VERIFICATION SERVICES INC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with WINNF-TS-0122 (v1.0.0) and the WInnForum SAS Test Harness for CBSD UUT Tutorial (v1.0.0.1), and KDB 940660 D01.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd.
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☐ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

4. EQUIPMENT UNDER TEST

4.1. DESCRIPTION OF EUT

The EUT is a RADIO DOT SYSTEM WITH INDUSTRY CONNECT DOMAIN PROXY.

4.2. SOFTWARE AND HARDWARE

Manufacturer: Ericsson

Address: Torshamnsgatan 23, SE-16480, Stockholm, Sweden

Product Name: RD 4442 B48

Product Number: KRY 901 385/1

Software Version: CXP 901 3268/14: R70AK

Hardware Version R1C

Domain Proxy Software

Version: IC_domainproxy_CXP1050455 1.0

4.3. DESCRIPTION OF TEST SETUP

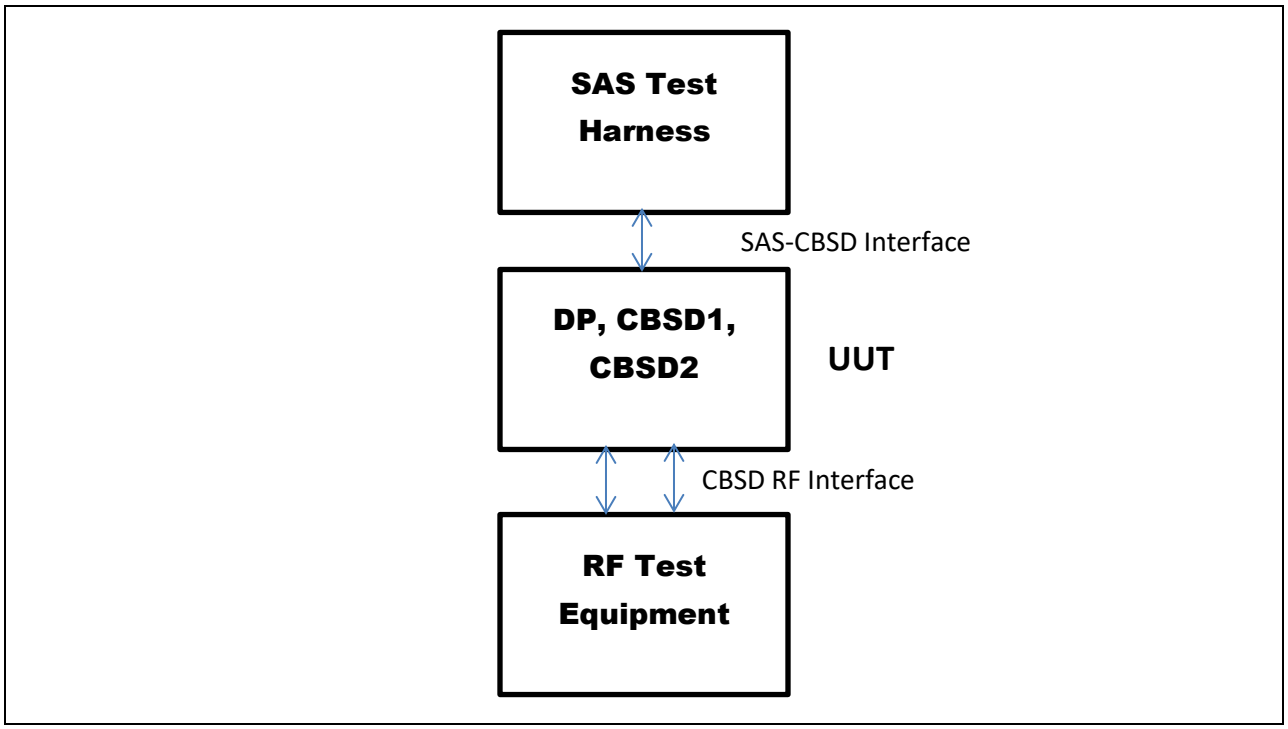
I/O CABLES sss

I/O Cable List						
Cable No	**Port**	**# of Identical ports**	**Connector Type**	**Serial Type**	**Cable Length (m)**	**Remarks**
1	RJ-45	2	RJ-45	Unshielded	1m	NA
2	AC	1	2 Prong	Shielded	1m	NA
3	RF Out	1	Spectrum Analyzer	Shielded	0.5m	NA

TEST SETUP

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)

Domain Proxy with two CBSD



Notes:

- **SAS Test Harness** – UL test laptop with SAS Test Harness software
- **UUT** – CBSD and DP
- **DP** – Domain Proxy
- **RF Test Equipment** – Spectrum Analyzer used to monitor RF transmissions during testing

5. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**T Number**	**Cal Date**	**Cal Due**
Spectrum Analyzer, PSA 3Hz to 44GHz	Keysight	N9030A	200	01/28/19	01/28/20
10 dB Attenuator	Pasternack	PE7087-10	PRE0189653	03/20/19	03/20/20
RF Cable	Mini-Circuits	CBL-3FT-SMNM+		N/A	N/A

Test Software			
Description	**Manufacturer**	**Model**	**Version Number**
Laptop (SAS Test Harness)	Lenovo	T420	2.0

6. TEST CASE LIST

Test Case ID Notes:

{*TestRequirement*}.{*TestCategory*}.{*UnitUnderTest*}.{*TestFunction*}.{*SubTestNumber*}

Test Case ID Descriptions	
Test Requirement	***Description***
FCC	FCC requirement
WINNF	Wireless Innovation Forum requirement
Test Category	***Description***
FT	Functional Test
PT	Performance Test
Unit Under Test	***Description***
C	CBSD
D	Domain Proxy (with CBSD(s))
Test Category	***Description***
REG	CBSD Registration procedure
SIQ	CBSD Spectrum inquiry procedure
GRA	CBSD Grant procedure
HBT	CBSD Heartbeat procedure
MES	CBSD Measurement report
RLQ	CBSD Grant Relinquishment procedure
DRG	CBSD Deregistration procedure
SCS	SAS-CBSD Security validation
Subtest Number	***Description***
1-X	Number of test cases

Test Case Classifcation

Requirement ID	Description
M	Mandatory for certification
O	Optional. Not required for certification
C	Conditional. Mandatory if CBSD supports relevant functionality. See Table below for definition of conditional notation.

Conditional Test Case Definitions

Requirement ID	Description
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

6.1. CBSD REGISTRATION PROCESS TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.1.4.1.1	X	--	C1	WINNF.FT.C.REG.1	Multi-Step registration	N/A
6.1.4.1.2	--	X	C1	WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	N/A
6.1.4.1.3	X	--	C2	WINNF.FT.C.REG.3	Single-Step registration for Category A CBSD	N/A
6.1.4.1.4	--	X	C2	WINNF.FT.D.REG.4	Domain Proxy Single-Step registration for Cat A CBSD	N/A
6.1.4.1.5	X	--	C3	WINNF.FT.C.REG.5	Single-Step registration for CBSD with CPI signed data	N/A
6.1.4.1.6	--	X	C3	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	PASS
6.1.4.1.7	X	X	C6	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	N/A
6.1.4.2.1	X	--	M	WINNF.FT.C.REG.8	Missing Required parameters (responseCode 102)	N/A
6.1.4.2.2	--	X	M	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	PASS
6.1.4.2.3	X	--	M	WINNF.FT.C.REG.10	Pending registration (responseCode 200)	N/A

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.1.4.2.4	--	X	M	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	PASS
6.1.4.2.5	X	--	M	WINNF.FT.C.REG.12	Invalid parameter (responseCode	N/A
6.1.4.2.6	--	X	M	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	PASS
6.1.4.2.7	X	--	M	WINNF.FT.C.REG.14	Blacklisted CBSD (responseCode 101)	N/A
6.1.4.2.8	--	X	M	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	PASS
6.1.4.2.9	X	--	M	WINNF.FT.C.REG.16	Unsupported SAS protocol version (responseCode 100)	N/A
6.1.4.2.10	--	X	M	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	PASS
6.1.4.2.11	X	--	M	WINNF.FT.C.REG.18	Group Error (responseCode 201)	N/A
6.1.4.2.12	--	X	M	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	PASS
6.1.4.3.1	X	X	C2	WINNF.FT.C.REG.20	Category A CBSD location update	N/A

6.2. CBSD SPECTRUM GRANT PROCESS TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.3.4.2.1	X	X	M	WINNF.FT.D.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	PASS
6.3.4.2.2	X	X	M	WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	PASS

6.3. CBSD HEARTBEAT RESPONSE TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.4.4.1.1	X	--	M	WINNF.FT.C.HBT.1	Heartbeat Success Case (first Heartbeat Response)	N/A
6.4.4.1.2	--	X	M	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	PASS
6.4.4.2.1	X	X	M	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	PASS
6.4.4.2.2	X	--	M	WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	N/A
6.4.4.2.3	X	X	M	WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	PASS
6.4.4.2.4	X	X	M	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	PASS
6.4.4.2.5	X	X	M	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	PASS
6.4.4.2.6	--	X	M	WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT)	PASS
6.4.4.3.1	X	X	M	WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	PASS
6.4.4.3.2	X	X	M	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	PASS
6.4.4.4.1	X	X	O	WINNF.FT.C.HBT.11	Successful Grant Renewal in Heartbeat Test Case	PASS

6.4. CBSD MEASUREMENT REPORT TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.5.4.2.1	X	--	C4	WINNF.FT.C.MES.1	Registration Response contains measReportConfig	N/A
6.5.4.2.2	--	X	C4	WINNF.FT.D.MES.2	Domain Proxy Registration Response contains measReportConfig	PASS
6.5.4.2.3	X	X	C5	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	PASS
6.5.4.2.4	X	--	C5	WINNF.FT.C.MES.4	Heartbeat Response contains measReportConfig	N/A
6.5.4.2.5	--	X	C5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	PASS

6.5. CBSD RELINQUISHMENT PROCESS TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.6.4.1.1	X	--	M	WINNF.FT.C.RLQ.1	Successful Relinquishment	N/A
6.6.4.1.2	--	X	M	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	PASS
6.6.4.2.1	X	--	O	WINNF.FT.C.RLQ.3	Unsuccessful Relinquishment, responseCode=102	N/A
6.6.4.2.2	--	X	O	WINNF.FT.D.RLQ.4	Domain Proxy Unsuccessful Relinquishment, responseCode=102	N/A
6.6.4.3.1	X	--	O	WINNF.FT.C.RLQ.5	Unsuccessful Relinquishment, responseCode=103	N/A
6.6.4.3.2	--	X	O	WINNF.FT.D.RLQ.6	Domain Proxy Unsuccessful Relinquishment, responseCode=103	N/A

6.6. CBSD DEREGISTRATION PROCESS TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.7.4.1.1	X	--	M	WINNF.FT.C.DRG.1	Successful Deregistration	N/A
6.7.4.1.2	--	X	M	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	PASS
6.7.4.2.1	X	--	O	WINNF.FT.C.DRG.3	Deregistration responseCode=102	N/A
6.7.4.2.2	--	X	O	WINNF.FT.D.DRG.4	Domain Proxy Deregistration responseCode=102	N/A
6.7.4.3.1	X	X	O	WINNF.FT.C.DRG.5	Deregistration responseCode=103	N/A

6.7. CBSD SECURITY VALIDATION TEST CASES

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
6.8.4.1.1	X	X	M	WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	PASS
6.8.4.2.1	X	X	M	WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	PASS
6.8.4.2.2	X	X	M	WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	PASS
6.8.4.2.3	X	X	M	WINNF.FT.C.SCS.4	TLS failure when SAS Test Harness certificate is issue by unknown CA	PASS
6.8.4.2.4	X	X	M	WINNF.FT.C.SCS.5	TLS failure when certificate at the SAS Test Harness is corrupted	PASS

6.8. SAS-CBSD/DP PERFORMANCE (POWER MEASUREMENT) TEST CASE

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID	Test Case Title	PASS/FAIL
7.1.4.1.1	X	X	M	WINNF.PT.C.HBT	UUT RF Transmit	PASS

7. TEST CASE RESULTS

7.1. Registration Process Test Cases for Domain Proxy UUT

7.1.1. Domain Proxy Multi-Step Registration for CBSD with CPI signed data

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.1.6	-	X	C3	WINNF.FT.D.REG.6
Purpose	Validates that each of the required and REG-Conditional parameters appear within the registration request message. This test is for devices where the CPI enters data into the CBSD and this information along with the CPI signature are sent in the request message..			

Procedures:

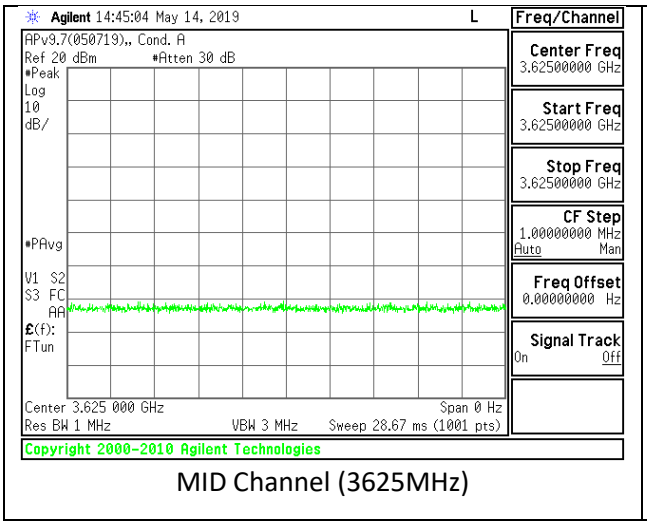
1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in Unregistered state
    c. All of the required and REG-Conditional paramters shall be configured and CPI signature provided
2. DP with two CBSD sends correct Registration request information to the SAS Test Harness:
    a. 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.
    b. Mark PASS or FAIL for RESULTS.
3. SAS Test Harness sends a CBSD Registration Response as follows:
    a. cbsdId=Ci
    b. measReportConfig for each CBSD shall not be included
    c. responseCode = 0 for each CBSD
4. 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.
6. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

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

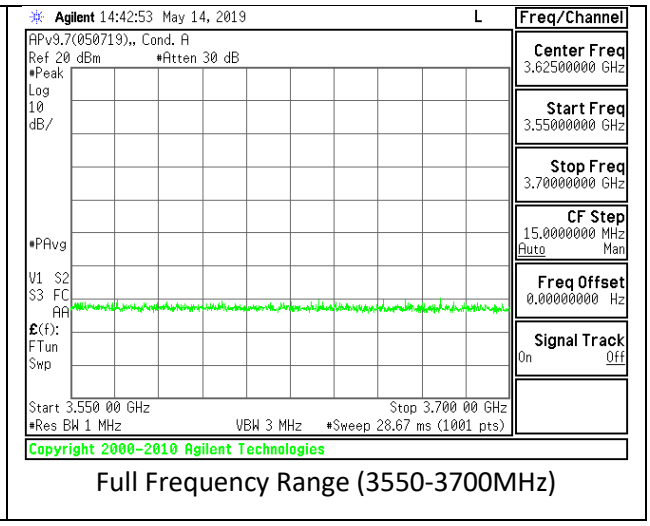
Results:

Criteria	Results	
CBSDs sends correct Registration request information to the SAS Test Harness:	☒ PASS	☐ FAIL
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz)



Full Frequency Range (3550-3700MHz)

7.1.2. Domain Proxy Missing Required Parameters (responseCode 102)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.2	--	X	M	WINNF.FT.D.REG.9
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

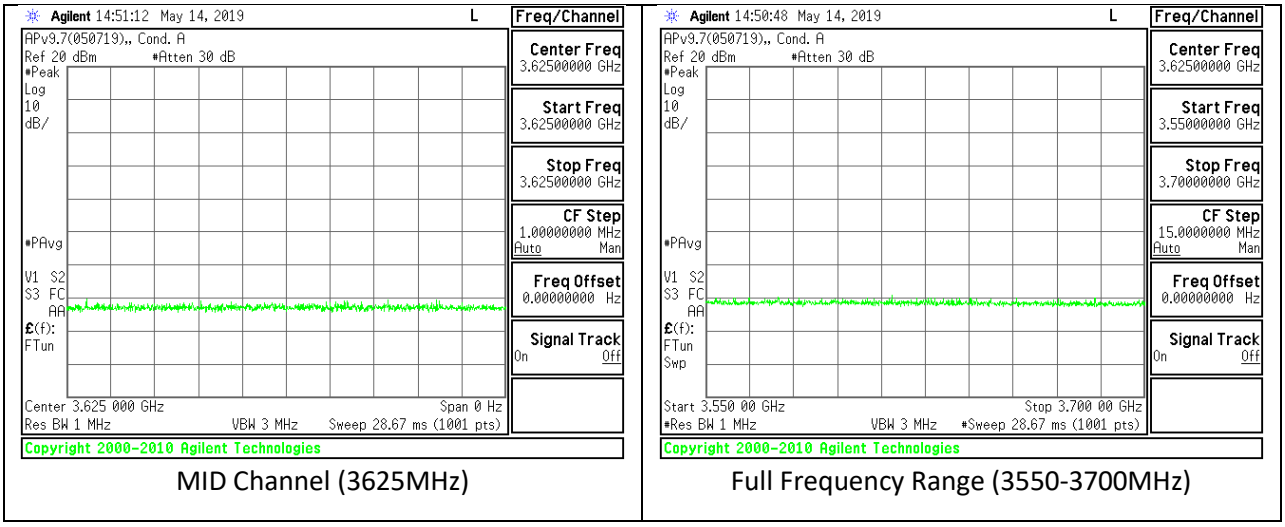
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = Ri for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz)

Full Frequency Range (3550-3700MHz)

7.1.3. Domain Proxy Pending Registration (responseCode 200)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.4	--	X	M	WINNF.FT.D.REG.11
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

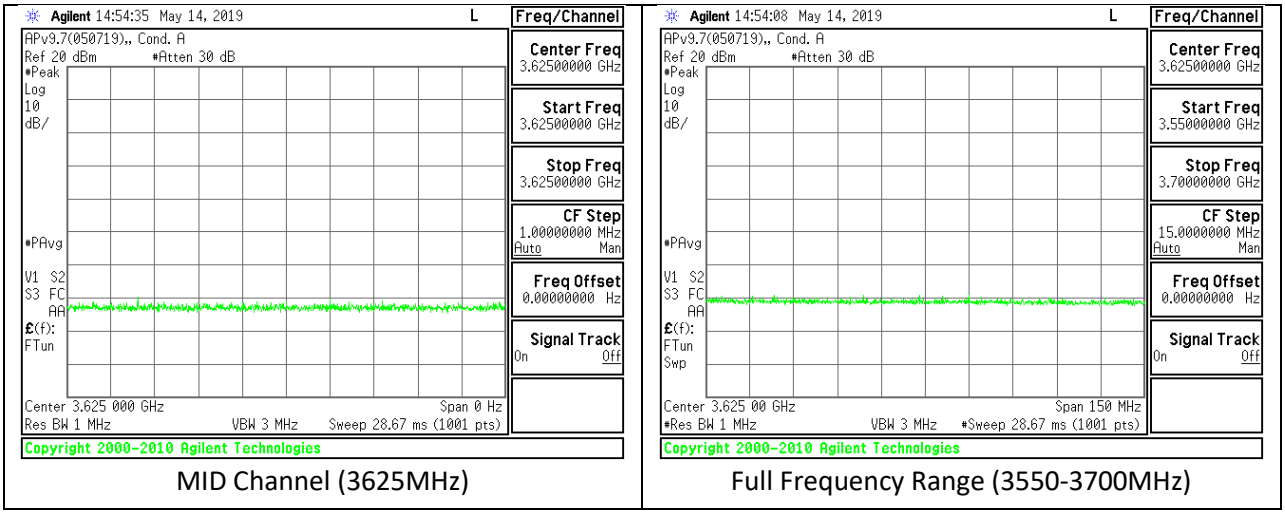
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = 200 for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



7.1.4. Domain Proxy Invalid Parameters (responseCode 103)

Section			CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.6			--	X	M	WINNF.FT.D.REG.13
Purpose			Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

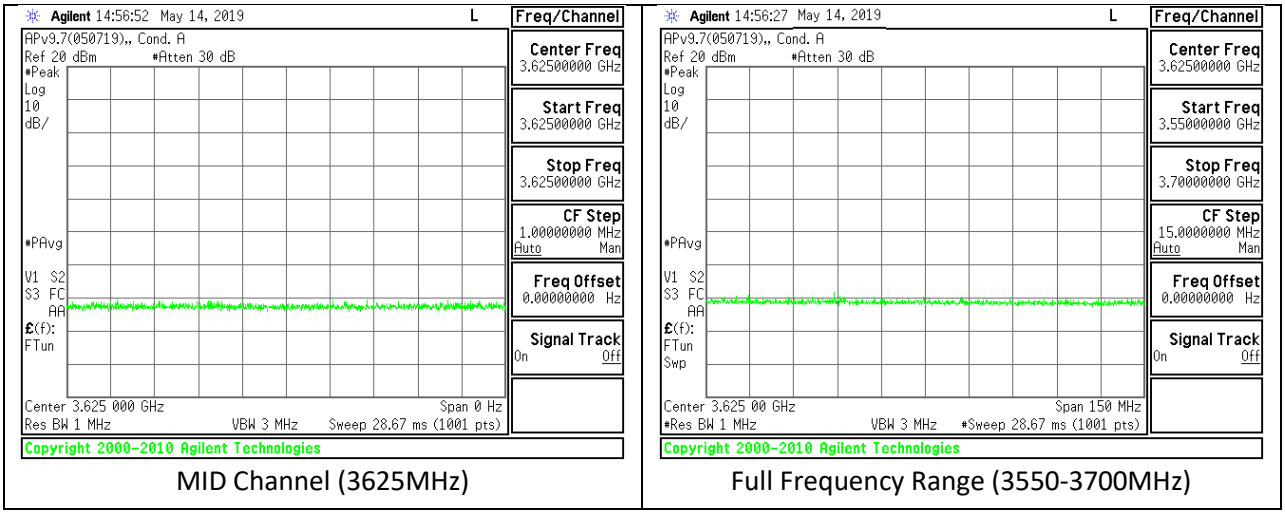
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = 103 for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz) | Full Frequency Range (3550-3700MHz)

7.1.5. Domain Proxy Blacklisted CBSD (responseCode 101)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.8	--	X	M	WINNF.FT.C.REG.15
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

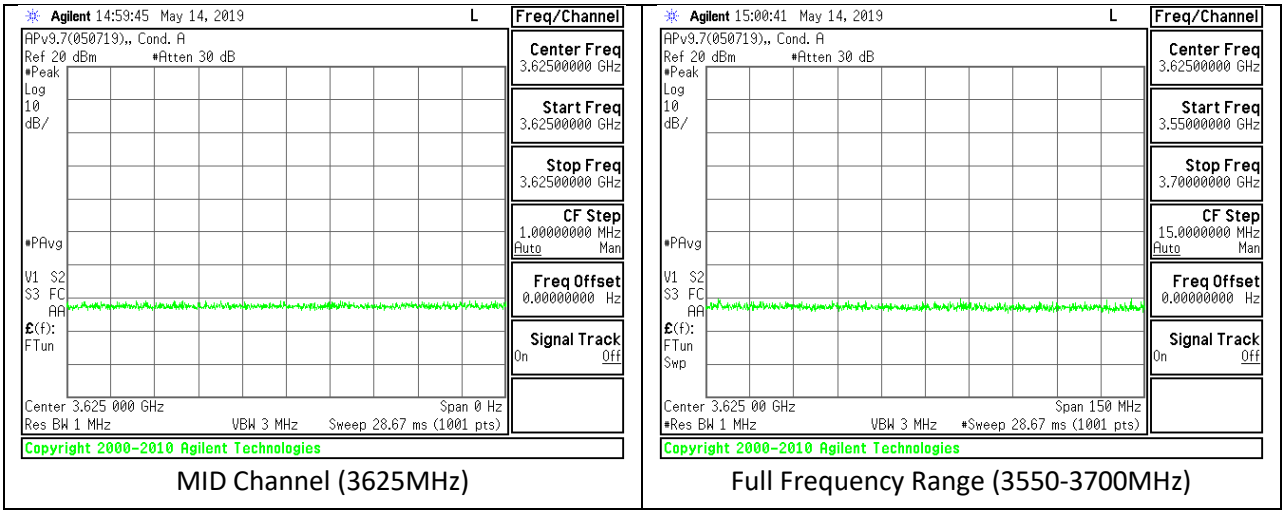
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = 101 for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz) | Full Frequency Range (3550-3700MHz)

7.1.6. Domain Proxy Unsupported SAS protocol version (responseCode 100)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.10	--	X	M	WINNF.FT.C.REG.17
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

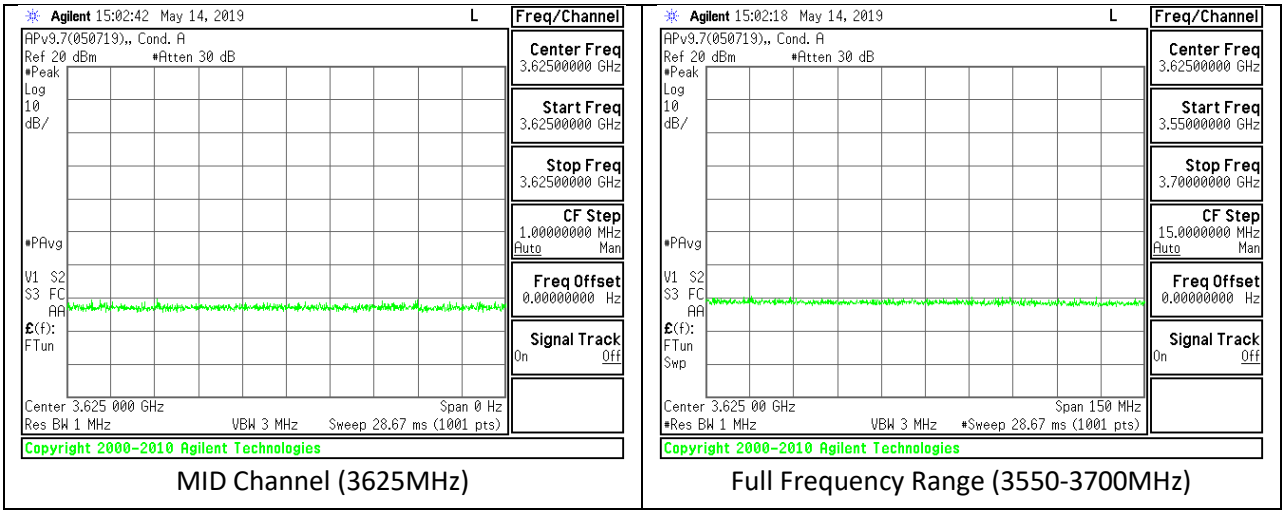
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = 200 for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz)

Full Frequency Range (3550-3700MHz)

7.1.7. Domain Proxy Group Error (responseCode 201)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.1.4.2.12	--	X	M	WINNF.FT.C.REG.19
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

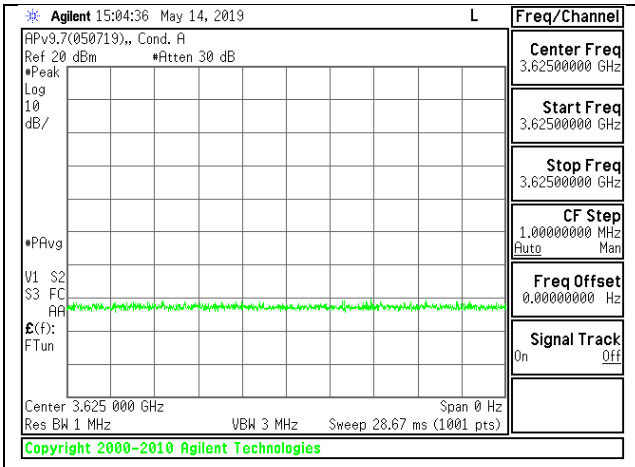
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT is in the Unregistered state
2. CBSD sends a Registration request to SAS Test Harness
3. Change an installation parameters at the UUT (time T)
    a. SAS Test Harness rejects the request by sending a CBSD Registration Response:
        i. SAS response does not include cbsdId
        ii. responseCode = 201 for CBSD1 and CBSD2
4. SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT
5. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

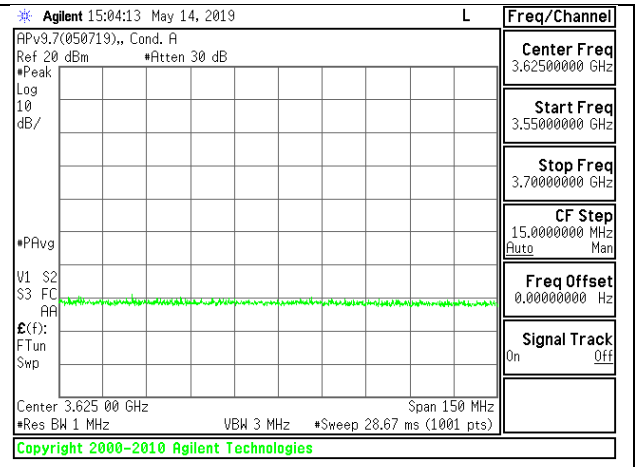
Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



MID Channel (3625MHz)



Full Frequency Range (3550-3700MHz)

7.2. CBSD Spectrum Inquiry Process Test Case

Definition

These test cases demonstrate the conformance of the CBSD to the CBSD Spectrum Inquiry Procedure

Initial Conditions / Test Pre-conditions

- CBSD has gone through SAS discovery process and can authenticate with the SAS.
- CBSD has already registered with SAS and has obtained a valid cbsdId

7.2.1. Successful spectrum Inquiry response from the SAS

This test case is incorporated into **WINNF.FT.C.HBT.1**, which validates successful Spectrum Inquiry messaging, if it is used by the UUT, as part of that test case.

7.2.2. Successful spectrum Inquiry response from SAS for all requests – Domain Proxy

This test case is incorporated into **WINNF.FT.D.HBT.2**, which validates successful Spectrum Inquiry messaging, if it is used by the UUT, as part of that test case

7.3. CBSD Spectrum Grant Process(CBSD and DP)

Definition

- These test cases demonstrate the conformance of the CBSD to the CBSD Spectrum Grant Process.

Initial Conditions / Test Pre-conditions

- CBSD has gone through SAS discovery process and can authenticate with the SAS.
- CBSD has already registered with SAS and has obtained a valid cbsdId

7.3.1. Successful Grant Response

This test case is incorporated into WINNF.FT.C.HBT.1, which validates successful Grant messaging as part of that test case.

7.3.2. Domain Proxy Successful Grant Response

This test case is incorporated into WINNF.FT.D.HBT.2, which validates successful Grant messaging as part of that test case.

7.3.3. Unsuccessful Responses from the SAS Test Harness

The test cases in this section are for verifying the handling of CBSD for various responseCodes in response from the-SAS Test Harness. The actions taken in response of any responseCode are beyond the scope of this document unless mentioned in the test procedure.

7.3.4. Unsuccessful Grant responseCode=400 (INTERFERENCE)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.3.4.2.1	X	X	M	WINNF.FT.C.GRA.1
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

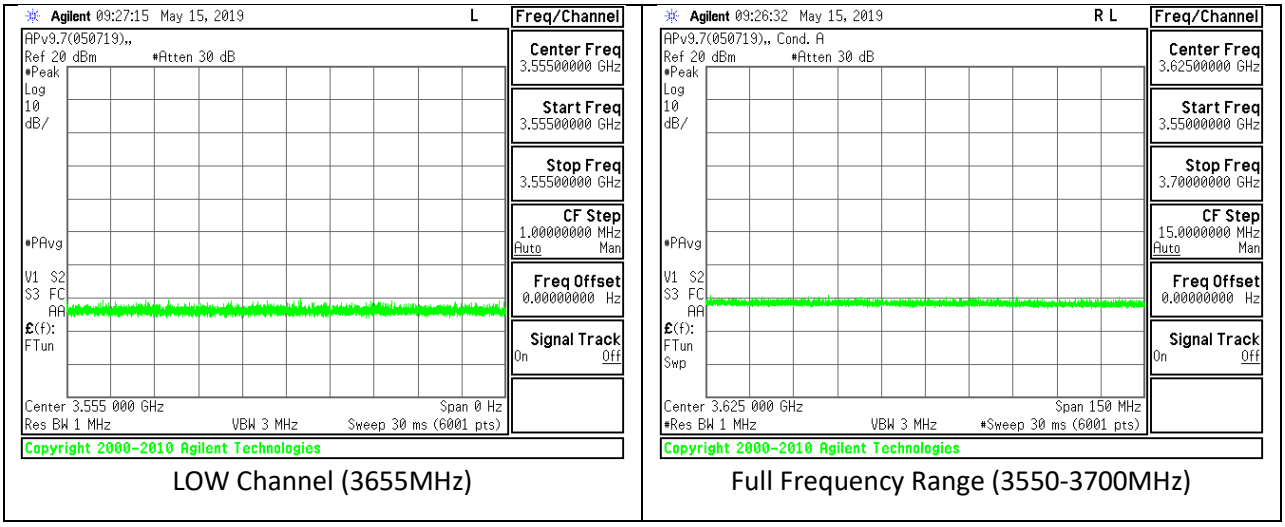
Procedures:

1. 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:
    a. cbsdId=C
    b. responseCode = R
4. 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
6. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3655MHz)

Full Frequency Range (3550-3700MHz)

7.3.5. Unsuccessful Grant responseCode=401 (INTERFERENCE)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.3.4.2.2	X	X	M	WINNF.FT.D.GRA.2
Purpose	Verify the CBSD does not transmit a responseCode other than 0 other than 0 is received.			

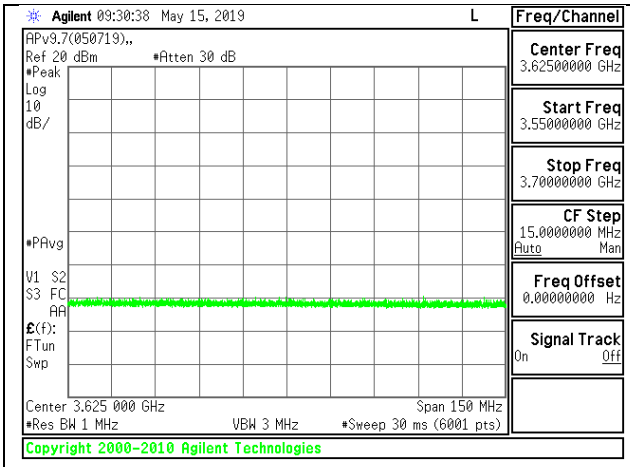
Procedures:

1. 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:
    a. cbsdId=C
    b. responseCode = 401
4. 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
6. Verify UUT does not transmit RF
    a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
Verify UUT does not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



Full Frequency Range (3550-3700MHz)

7.4. CBSD Heart Beat Process (CBSD and DP)

Definition

- These test cases demonstrate the conformance of the CBSD to the CBSD Heart Beat Process.

Initial Conditions / Test Pre-conditions

- CBSD has gone through SAS discovery process and can authenticate with the SAS.
- CBSD has already registered with SAS Test Harness

7.4.1. Heartbeat responseCode =105 (DEREGISTER)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.2.1	X	X	M	WINNF.FT.C.HBT.3
Purpose	UUT conforms with not allowing any new Grant Request from the UUT when non-zero responseCode is sent.			

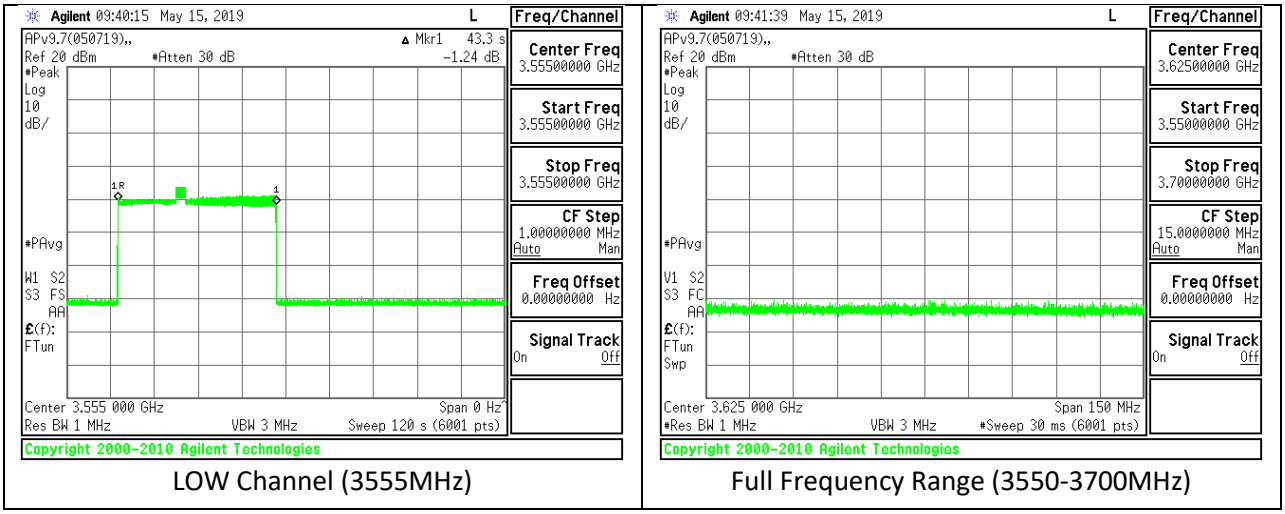
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has registered successfully with SAS Test Harness
    b. UUT has a valid single grant as follows
        i. Valid cbsdId = C
        ii. Valid grantId = G
        iii. Grant is for frequency range F, power P
        iv. grantExpireTime = UTC time greater than duration of the test
    c. 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:
    a. cbsdId = C
    b. grantId = G
    c. operationState = "AUTHORIZED"
    d. **Mark PASS or FAIL for RESULTS**
3. SAS Test Harness sends a Heartbeat Response message:
    a. cbsdId = C
    b. grantId = G
    c. transmitExpiretime = T = Current UTC time
    d. responseCode = 105 (DEREGISTER)
4. After completion of step 3, SAS Test Harness does not allow further grants to the UUT
5. Monitor RF output of the UUT
    a. UUT stops transmission within (T+60 seconds of completion of step 3)
    b. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT stops transmission	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) | Full Frequency Range (3550-3700MHz)

7.4.2. Heartbeat responseCode =501 (SUSPENDED_GRANT) in First Heartbeat Response

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.2.3	X	X	M	WINNF.FT.C.HBT.5
Purpose	UUT conforms with not allowing any new Grant Request from the UUT when non-zero responseCode is sent.			

Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has registered successfully with SAS Test Harness
    b. UUT has a valid single grant as follows
        i. Valid cbsdId = C
        ii. Valid grantId = G
        iii. Grant is for frequency range F, power P
        iv. grantExpireTime = UTC time greater than duration of the test
    c. 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:
    a. cbsdId = C
    b. grantId = G
    c. operationState = “AUTHORIZED”
    d. **Mark PASS or FAIL for RESULTS**
3. SAS Test Harness sends a Heartbeat Response message:
    a. cbsdId = C
    b. grantId = G
    c. transmitExpiretime = T = Current UTC time
    d. responseCode = 501 (SUSPENDED_GRANT)
4. After completion of step 3, SAS Test Harness does not allow further grants to the UUT
5. Monitor the SAS-CBSD interface. Verify either of the following:
    a. UUT sends a Heartbeat response message and the message is correctly formatted with parameters:
        i. cbsdId = C
        ii. grantId = G
        iii. operationState = “GRANTED”
    b. UUT sends a Relinquishment request message and the message is correctly formatted with parameters:
        i. cbsdID =C
        ii. grantId = G

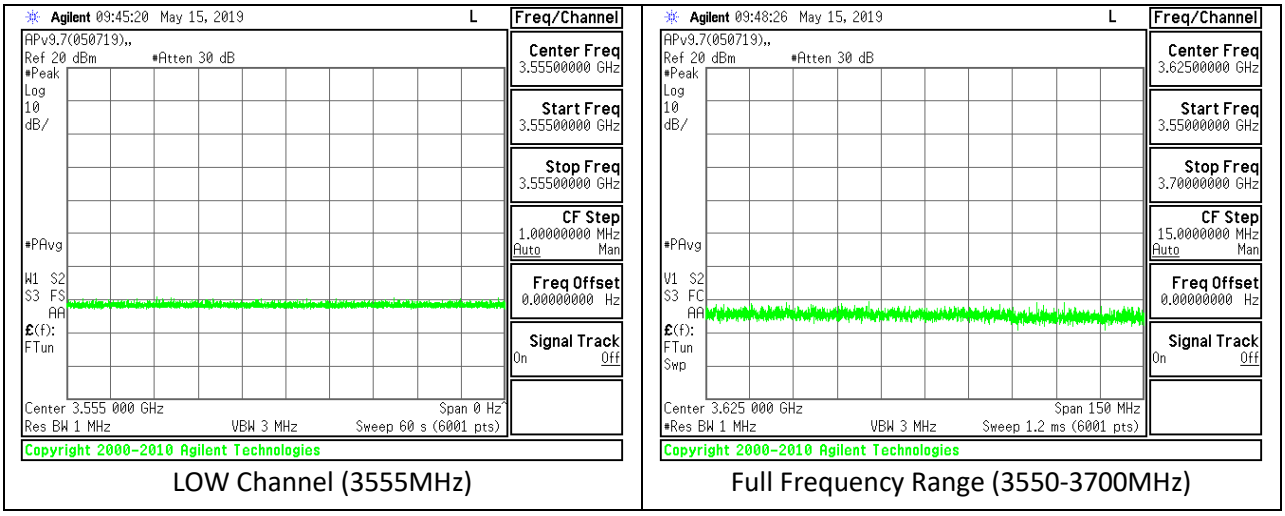
c. Monitor RF output that UUT does not transmit at any time.

d. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT does not transmit at any time	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) | Full Frequency Range (3550-3700MHz)

7.4.3. Heartbeat responseCode =501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.2.4	X	X	M	WINNF.FT.C.HBT.6
Purpose	UUT conforms with not allowing any new Grant Request from the UUT when non-zero responseCode is sent.			

Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has registered successfully with SAS Test Harness
    b. UUT has a valid single grant as follows
        i. Valid cbsdId = C
        ii. Valid grantId = G
        iii. Grant is for frequency range F, power P
        iv. grantExpireTime = UTC time greater than duration of the test
    c. 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:
    a. cbsdId = C
    b. grantId = G
    c. operationState = “AUTHORIZED”
    d. **Mark PASS or FAIL for RESULTS**
3. SAS Test Harness sends a Heartbeat Response message:
    a. cbsdId = C
    b. grantId = G
    c. transmitExpiretime = T = Current UTC time
    d. responseCode = 501 (SUSPENDED_GRANT)
4. After completion of step 3, SAS Test Harness does not allow further grants to the UUT
5. Monitor the SAS-CBSD interface. Verify either of the following:
    a. UUT sends a Heartbeat response message and the message is correctly formatted with parameters:
        i. cbsdId = C
        ii. grantId = G
        iii. operationState = “GRANTED”
    b. UUT sends a Relinquishment request message and the message is correctly formatted with parameters:
        i. cbsdID =C
        ii. grantId = G

c. Monitor RF output that UUT does not transmit at any time.

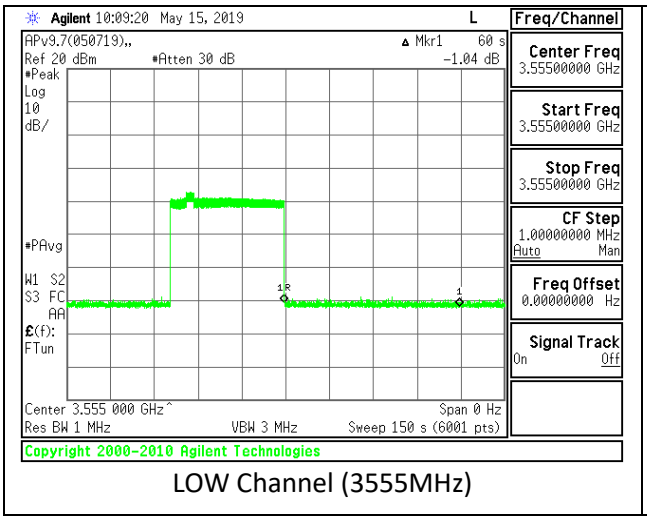
i. UUT shall stop transmission within (*T* + 60 seconds) of completion of step 3.

d. <u>Mark PASS or FAIL for RESULTS.</u>

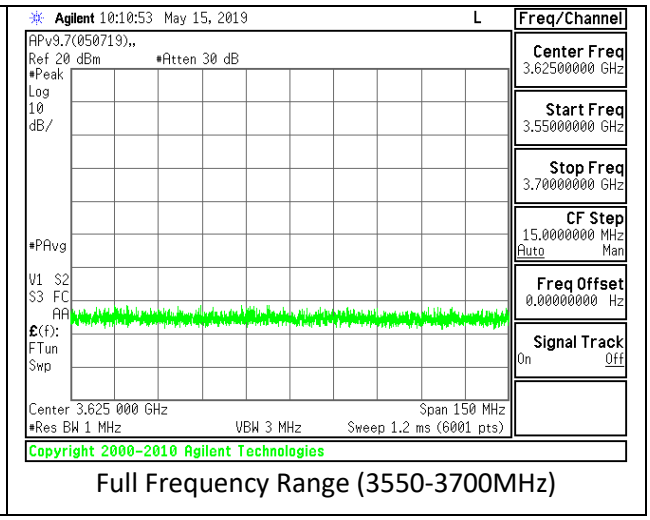
<u>Results:</u>

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT does not transmit at any time	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)



Full Frequency Range (3550-3700MHz)

7.4.4. Heartbeat responseCode =502 (UNSYNC_OP_PARAM)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.2.5	X	X	M	WINNF.FT.C.HBT.7
Purpose	UUT conforms with not allowing any new Grant Request from the UUT when non-zero responseCode is sent.			

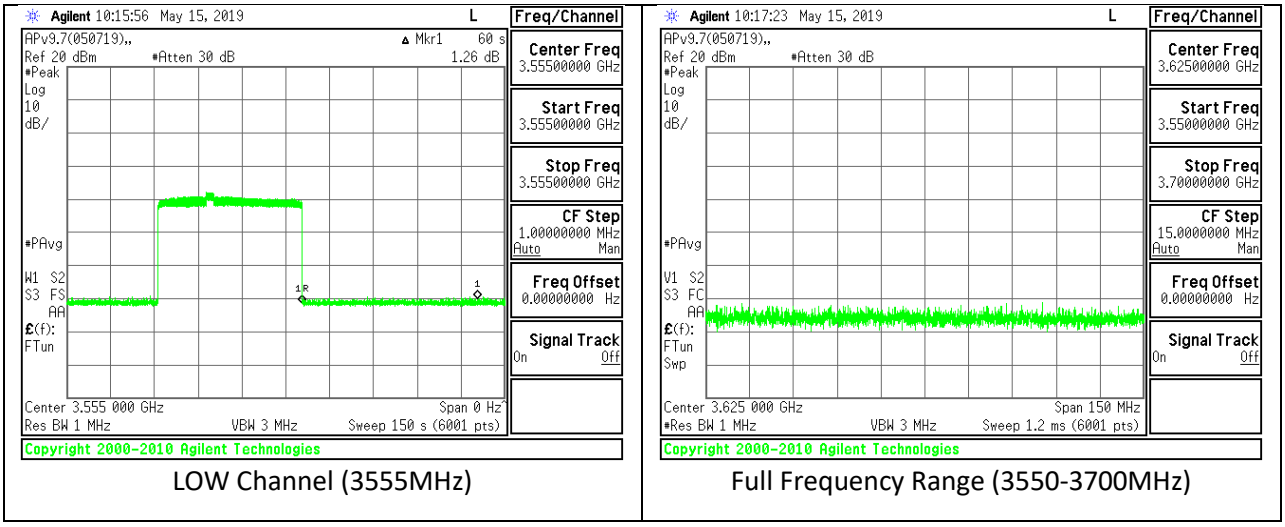
Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has registered successfully with SAS Test Harness
    b. UUT has a valid single grant as follows
        i. Valid cbsdId = C
        ii. Valid grantId = G
        iii. Grant is for frequency range F, power P
        iv. grantExpireTime = UTC time greater than duration of the test
    c. 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:
    a. cbsdId = C
    b. grantId = G
    c. operationState = "AUTHORIZED"
    d. **Mark PASS or FAIL for RESULTS**
3. SAS Test Harness sends a Heartbeat Response message:
    a. cbsdId = C
    b. grantId = G
    c. transmitExpiretime = T = Current UTC time
    d. responseCode = 502 (UNSYNC_OP_PARAM)
4. After completion of step 3, SAS Test Harness does not allow further grants to the UUT
5. Monitor RF output that UUT does not transmit at any time.
        i. UUT shall stop transmission within (*T* + 60 seconds) of completion of step 3.
    b. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT stops transmission	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) Full Frequency Range (3550-3700MHz)

7.4.5. Heartbeat Response Absent (First Heartbeat)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.3.1	X	X	M	WINNF.FT.C.HBT.9
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

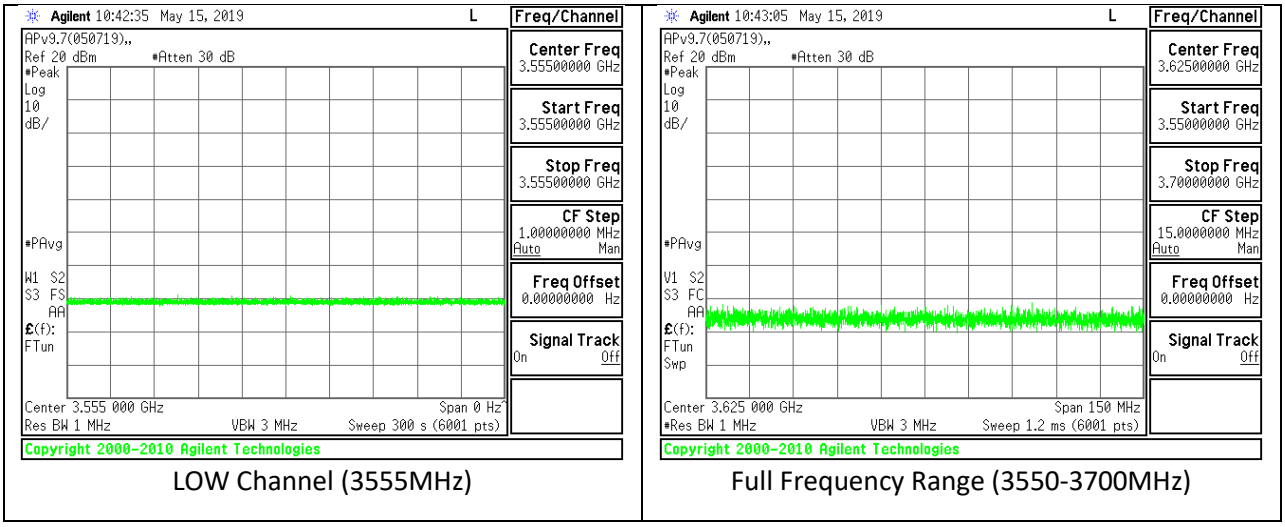
Procedures:

1. Ensure following conditions are met for test entry:
   a. UUT has registered successfully with SAS Test Harness
   b. UUT has a valid single grant as follows
      i. Valid cbsdId = C
      ii. Valid grantId = G
      iii. Grant is for frequency range F, power P
      iv. grantExpireTime = UTC time greater than duration of the test
   c. 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:
   a. cbsdId = C
   b. grantId = G
   c. operationState = "GRANTED"
   d. **Mark PASS or FAIL for RESULTS**
3. After completion of step 3, SAS Test Harness does not allow further grants to the UUT. If CBSD sends further Heartbeat Reuest messages for CBSD1, SAS Test Harness shall respond with a Heartbeat message with parameters:
   a. cbsdId = C
   b. grantId = G
   c. transmitExpireTime = current UTC time + 200 seconds
   d. responseCode = 0
   e.
4. After completion of step 2, SAS Test Harness does not allow respond to any further messages from UUT to simulate loss of network connection
5. Monitor RF output of the UUT from start of test to 60 seconds after step 3 to verify that UUT does not transmit.
   a. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT does not transmission	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) | Full Frequency Range (3550-3700MHz)

7.4.6. Heartbeat Response Absent (Subsequent Heartbeat)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.3.2	X	X	M	WINNF.FT.C.HBT.10
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

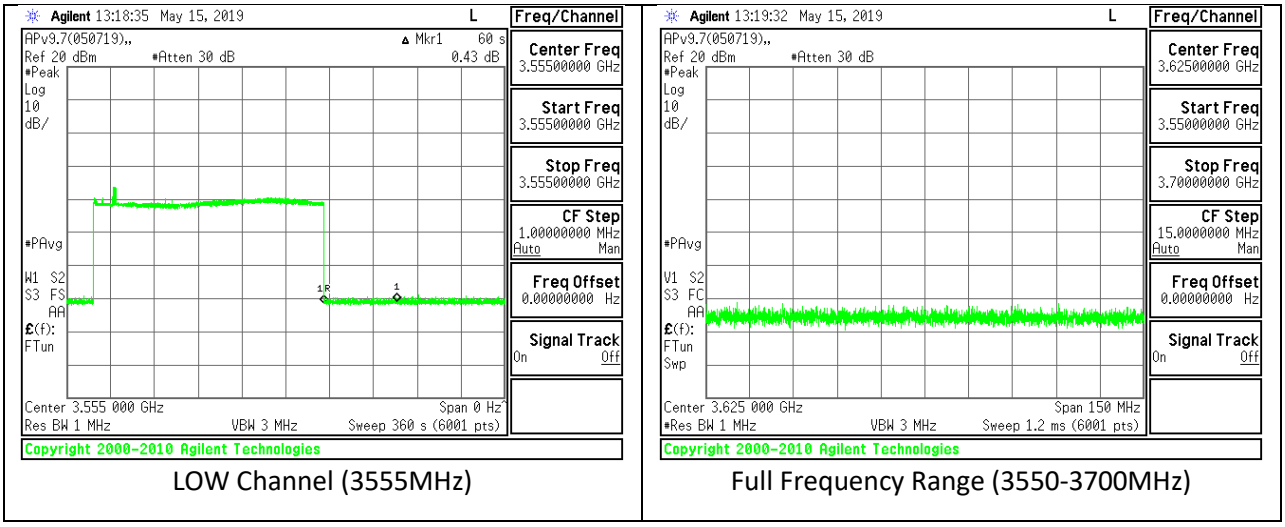
Procedures:

1. Ensure following conditions are met for test entry:
   a. UUT has registered successfully with SAS Test Harness
   b. UUT has a valid single grant as follows
      i. Valid cbsdId = C
      ii. Valid grantId = G
      iii. Grant is for frequency range F, power P
      iv. grantExpireTime = UTC time greater than duration of the test
   c. 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:
   a. cbsdId = C
   b. grantId = G
   c. operationState = "AUTHORIZED"
   d. **Mark PASS or FAIL for RESULTS**
3. SAS Test Harness shall respond with a Heartbeat message with parameters:
   a. cbsdId = C
   b. grantId = G
   c. transmitExpireTime = current UTC time + 200 seconds
   d. responseCode = 0
4. After completion of Step 3, SAS Test Harness does not respond to any further messages from UUT
5. Monitor RF output of the UUT from start of test to 60 seconds after step 3 to verify that UUT does not transmit.
   a. Mark PASS or FAIL for RESULTS.

Results:

Criteria	Results	
UUT sends Heartbeat Request message	☒ PASS	☐ FAIL
UUT stops transmission	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) | Full Frequency Range (3550-3700MHz)

7.4.7. Successful Grant Renewal in Heartbeat Test Case

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.4.4.4.1	X	X	O	WINNF.FT.C.HBT.11
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

Procedures:

1. Ensure following conditions are met for test entry:
    a. UUT has registered successfully with SAS Test Harness
    b. UUT has a valid single grant as follows
        i. Valid cbsdId = C
        ii. Valid grantId = G
        iii. Grant is for frequency range F, power P
    c. UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface
    d. Grant has the following parameters at the start of the test:
        i. grantExpireTime = UTC time equal to time at start of test + 300 seconds = Tgrant_expire
        ii. transmitExpireTime = UTC time equal to time at start of test + 200 seconds
        iii. heartbeatInterval = 60 seconds
2. UUT sends a Heartbeat Request message. If message contains grantRenew = True, go to step 6, if not go to step 3
3. Verify Heartbeat Request message is sent within the latest specified heartbeatInterval with this format:
    a. cbsdId = C
    b. grantId = G
    c. operationState = “AUTHORIZED”
    d. **Mark PASS or FAIL for RESULTS**
4. SAS Test Harness shall respond with a Heartbeat message with parameters:
    a. cbsdId = C
    b. grantId = G
    c. transmitExpireTime = current UTC time + 200 seconds
    d. gramtExpireTime = same as step 1
    e. responseCode = 0
5. Go to Step 2
6. Verify Heartbeat Request message is sent within the latest specified heartbeatInterval with this format:
    a. cbsdId = C
    b. grantId = G
    c. operationState = “AUTHORIZED”

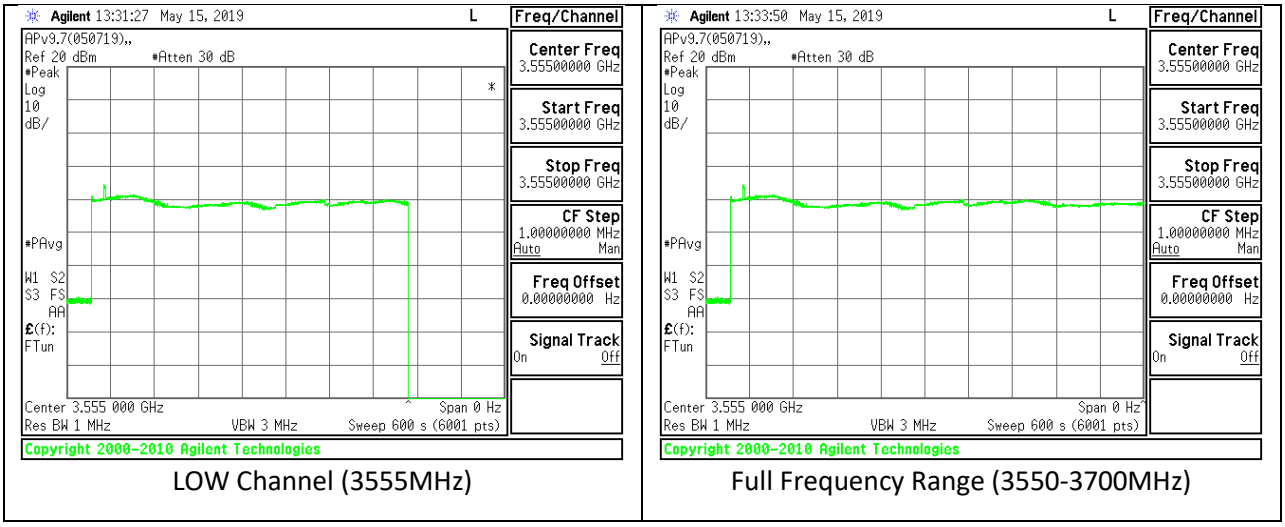
d. grantRenew = TRUE
e. **Mark PASS or FAIL for RESULTS.**

7. SAS Test Harness shall respond with a Heartbeat message with parameters:
   a. cbsdId = C
   b. grantId = G
   c. transmitExpireTime = current UTC time + 200 seconds
   d. gramtExpireTime = UTC time set far in the future
   e. responseCode = 0
8. Continue to respond to any subsequentHeartbeat Request from CBSD with Heartbeat Response with the following parameters:
   a. cbsdId = C
   b. grantId = G
   c. transmitExpireTime = same as step 7
   d. responseCode = 0
9. Monitor RF transmission of UUT from start of test until Tgrant_expire + 60 seconds and ensure UUT continues to transmit throughout the time period
   a. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
Verify Heartbeat Request message is sent within the latest specified heartbeatInterval with correct format	☒ PASS	☐ FAIL
Verify Heartbeat Request message is sent within the latest specified heartbeatInterval with correct format	☒ PASS	☐ FAIL
UUT continues to transmit throughout the time period	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz) Full Frequency Range (3550-3700MHz)

7.5. CBSD Measurement Report

Definition

- These test cases demonstrate the conformance of the CBSD behavior for Measurement Reports

Initial Conditions / Test Pre-conditions

- Test harness SAS Discovery and Authentication by CBSD is complete

7.5.1. Domain Proxy Registration Response contains measReportConfig

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.5.4.2.2	--	X	C4	WINNF.FT.D.MES.2
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

Procedures:

1. Ensure following conditions are met for test entry:
    a. DP has completed SAS Discovery and Authentication with SAS Test Harness
2. UUT sends a Registration Request message. Validate the message is formatted correctly:
    i. userId is present and correct
    ii. fccId is present and correct
    iii. cbsdSerialNumber is present and correct
    iv. measCapability = "RECEIVED_POWER_WITHOUT GRANT"
    v. **Mark PASS or FAIL for RESULTS.**
3. SAS Test Harness sends a Registration Response message, with the following parameters:
    a. cbsdId = C = valid cbsdID for this UUT
    b. measReportConfig = "RECEIVED_POWER_WITHOUT_GRANT"
    c. responseCode = 0
4. UUT sends a message:
    a. If message is type Spectrum Inquiry Request, go to step 5, or
    b. 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:
    a. cbsdId = Ci
    b. measReport is present and formatted rcvdPowerMeasReport
    c. **Mark PASS or FAIL for RESULTS.**
6. SAS Test Harness Sends a Spectrum Inquiry Response with parameters:
    a. cbsdId = Ci
    b. availableChannel is an array of availableChannel objects
    c. responseCode = 0
7. UUT sends message type Grant Request message. Verify message contains all required parameters properly formatted:
    a. cbsdID = Ci
    b. measReport is present and formatted rcvdPowerMeasReport
    c. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
UUT sends a Registration Request message with correct format	☒ PASS	☐ FAIL
UUT sends message type Spectrum Inquiry Request with correct format	☒ PASS	☐ FAIL
UUT sends message type Grant Request message with correct format	☒ PASS	☐ FAIL

7.5.2. Grant Response contains measReportConfig

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.5.4.2.3	X	X	C5	WINNF.FT.C.MES.3
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

Procedures:

1. Ensure following conditions are met for test entry:
   a. UUT has completed SAS Discovery and Authentication with SAS Test Harness
   b. UUT has successfully registered with SAS Test Harness, with cbsdId = C and measCapability = "RECEVIED_POWER_WITH_GRANT"
2. UUT sends a Registration Request message. Validate the message is formatted correctly:
   a. cbsdID = C
   b. operationParam is present and format is valid
   c. **Mark PASS or FAIL for RESULTS.**
3. SAS Test Harness sends a Grant Response message with parameters:
   a. cbsdId = C
   b. grantId = G = valid grand ID
   c. grantExpiretTime = UTC time in the future
   d. heartbeatInterval = 60 seconds
   e. measReportConfig = "RECEIVED_POWER_ WIT GRANT"
   f. operationParam is set to valid operating parameters
   g. channelType = "GAA"
   h. responseCode = 0
4. UUT sends a Heartbeat Request message. Verify these parameters are properly formatted:
   a. cbsdId = C
   b. grantId = G
   c. operationState = "GRANTED"
   d. **Mark PASS or FAIL for RESULTS.**

5. If Heartbeat Request message (step 4) contains *measReport* object, then:
   a. verify *measReport* is properly formatted as object *rcvdPowerMeasReport*
   b. end test, with PASS result
   c. else, if Heartbeat Request message (step 4) does not contain measReport object, then:
      i. If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then stop test with result of FAIL
   d. **Mark PASS or FAIL for RESULTS.**

6. SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically:
   a. cbsdId = C
   b. grantId = G

c. transmitExpireTime = current UTC time + 200 seconds
d. responseCode = 0

7. Go to Step 4, above

Results:

Criteria	Results	
UUT sends a Registration Request message with correct format	☒ PASS	☐ FAIL
UUT sends a Heartbeat Request message with correct format	☒ PASS	☐ FAIL
UUT sends message Heartbeat Request message with *measReport* is properly formatted as object *rcvdPowerMeasReport*	☒ PASS	☐ FAIL

7.5.3. Domain Proxy Hearbeat Response contains measReportConfig

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.5.4.2.5	--	X	C5	WINNF.FT.D.MES.5
Purpose	Test cases determine UUT conforms when communication is lost between UUT and the SAS during the Heartbeat Process			

Procedures:

1. Ensure following conditions are met for test entry:
   a. DP has completed SAS Discovery and Authentication with SAS Test Harness
   b. DP has successfully registered with SAS Test Harness, with cbsdId = Ci and measCapability = "RECEVIED_POWER_WITH_GRANT"
   c. DP received a valid grant with grantId = Gi
   d. Both CBSD is in grant state AUTHORIZED and is actively transmitting withn the bounds of its grant
   e. Grant has heartbeatInterval = 60 seconds
2. DP sends Heartbeat Request message. Validate the message is formatted correctly:
   a. cbsdID = Ci
   b. grantId = Gi
   c. operationState = "AUTHORIZED"
   d. **Mark PASS or FAIL for RESULTS.**
3. SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically:
   a. cbsdId = Ci
   b. grantId = Gi
   c. measReportConfig = "RECEIVED_POWER_WITH_GRANT"
   d. responseCode = 0
4. UUT sends Heartbeat Request message. Validate the message is formatted correctly:
   a. cbsdID = Ci
   b. grantId = Gi
   c. operationState = "AUTHORIZED"
   d. **Mark PASS or FAIL for RESULTS.**
5. If Heartbeat Request(step 4) message contains measReport object,
   a. Verify measReport is properly formatted as object rcvdPowerMeasReport
   b. End test with PASS result
   c. If Heartbeat Request (step 4) does not contain measReport object,
      i. If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then sop test with FAIL result.
   d. **Mark PASS or FAIL for RESULTS.**
6. SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically:

a. cbsdId = Ci
b. grantId = Gi
c. responseCode = 0

Results:

Criteria	Results	
DP sends a Registration Request message with correct format	☒ PASS	☐ FAIL
DP sends a Heartbeat Request message with correct format	☒ PASS	☐ FAIL
UUT sends message Heartbeat Request message with *measReport* is properly formatted as object *rcvdPowerMeasReport*	☒ PASS	☐ FAIL

7.6. CBSD Relinquishment Process

Definition

- These test cases demonstrate the conformance of the CBSD Relinquishment Procedure

Initial Conditions / Test Pre-conditions

- Test Harness SAS Discovery and Authentication by CBSD is complete.
- CBSD has registered with SAS Test Harness and obtained a valid cbsdId C.
- CBSD has received a successful grant, grantId G.

7.6.1. Domain Proxy Successful Relinquishment Request (responseCode 0)

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.6.4.1.2	--	X	M	WINNF.FT.D.RLQ.2
Purpose	Test cases determine UUT conforms in Relinquishment Process			

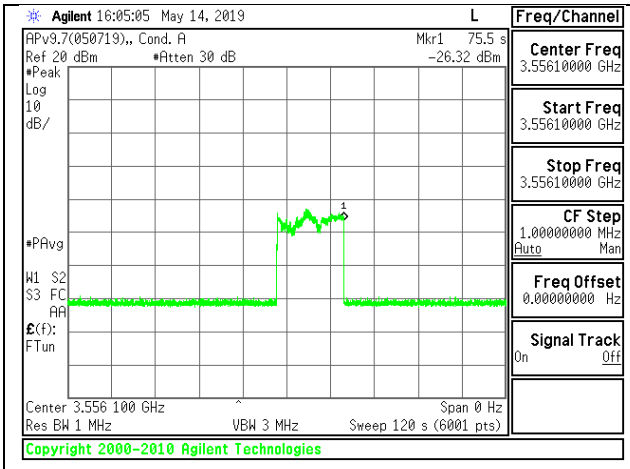
Procedures:

1. Ensure following conditions are met for test entry:
   a. DP has successfully completed SAS Discovery and Authentication with SAS Test Harness
   b. DP has successfully registered with SAS Test Harness, with cbsdId = Ci
   c. DP has received a valid grant with grandId = Gi
   d. DP is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant
   e. Invoke trigger to relinquish UUT Grant from the SAS Test Harness.
2. DP sends a Relinquishment Request message and verify message contains these parameters:
   a. cbsdId=Ci
   b. grantId = Gi
   c. **Mark PASS or FAIL for RESULTS.**
3. SAS Test Harness shall approve the request with a Relinquishment Response message with parameters:
   a. cbsdId = Ci
   b. grantId = Gi
   c. response = 0
4. After completion of step 3, SAS Test Harness will not provide responseCode = 0
5. Monitor the RF output of UUT from start of test until 60 seconds after step 3 is complete. Verify:
   a. UUT stops RF transmission any time between triggering relinquishment and UUT sending the relinquishment.
   b. **Mark PASS or FAIL for RESULTS.**

Results:

Criteria	Results	
DP sends a Relinquishment Request message with correct format	☒ PASS	☐ FAIL
Monitor RF output of UUT from start of test until 60 seconds and verify UUT stops RF transmission any time between triggering relinquishment and UUT sending the relinquishment.	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)

7.7. CBSD Degistration Process

Definition

- These test cases demonstrate the conformance of the CBSD Deregistration Request

Initial Conditions / Test Pre-conditions

- CBSD has registered with SAS Test Harness and obtained a valid cbsdId C.
- CBSD has received a successful grant, grantId G.
- CBSD UUT must provide functionality to trigger a deregistration.
- CBSD should send a Relinquishment Request object for each Grant priot to sending DeregistrationRequest object.

7.7.1. Domain Proxy Successful Deregistration

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.7.4.1.2	--	X	M	WINNF.FT.D.DRG.2
Purpose	Test cases determine UUT conforms in Deregistration Process			

Procedures

1. Ensure the following conditions for test entry
   a. Each UUT has successfully SAS Discovery and Authentication with SAS Test Harness
   b. Each UUT has successfully registered with SAS Test Harness, with cbsdId = C
   c. Each UUT is authorized state
   d. DP has received a valid grant with grandId = G
   e. Both CBSD are in Grant State AUTHORIZED and is actively transmitting within the bounds of their grants
   f. Invoke trigger to relinquish UUT Grant from the SAS Test Harness
2. UUT sends a Relinquishment request and receives a responseCode = 0
3. DP sends Deregistration Request to SAS Test Harness with cbsdId = C
   a. MARK as PASS OR FAIL for RESULTS
4. SAS Test Harness shall approve the request with a Deregistration Response message with parameters:
   a. cbsdId = Ci
   b. responseCode =0
5. After completion of step 3, SAS Test Harness will not provide responseCode = 0
6. Monitor RF output of each UUT from start of test until 60 seconds after Step 4 is complete. Verify :
   a. UUT stopped RF transmission at any time between triggering deregistration AND either A OR B occurs:
      i. UUT sending Registration Request message
      ii. UUT sending a Deregistration Request message
   b. MARK as PASS OR FAIL for RESULTS

Results:

Criteria	Results	
DP sends Deregistration Request to SAS Test Harness with cbsdID = C	☒ PASS	☐ FAIL
Monitor RF output of UUT from start of test until 60 seconds and verify UUT stops RF transmission any time between triggering deregistration and when UUT sending Registration Request message or UUT sending a Deregistration Request message	☒ PASS	☐ FAIL

7.8. CBSD Security Validation

Definition

- These test cases demonstrate the conformance of the CBSD Security Establishment Procedure

Initial Conditions / Test Pre-conditions

- CBSD has gone through SAS discovery process.
- Test certificates are loaded on CBSD as well as on the SAS Test Harness

7.8.1. Successful TLS Connection Between UUT and SAS Test Harness

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.8.4.1.1	X	X	M	WINNF.FT.C.SCS.1
Purpose	Test cases determine UUT conforms in TLS connection between SAS Test Harness and CBSD			

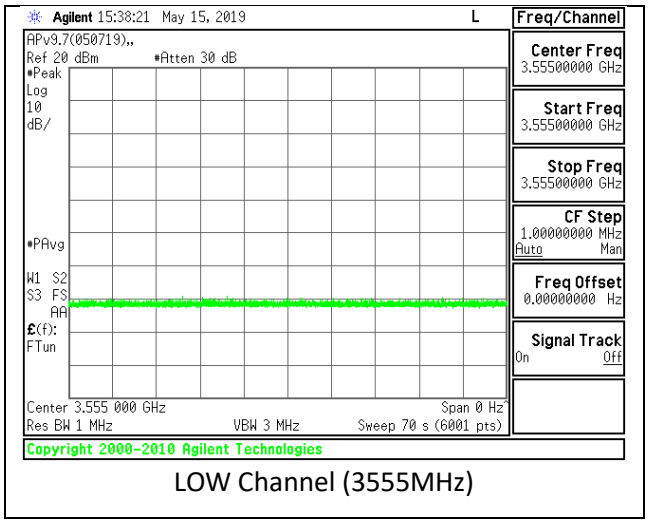
Procedures

1. UUT shall start CBSD-SAS communication with the security procedure
    a. The UUT shall establish a TLS handshake with the SAS Test Harness using the configured certificate
    b. Configure SAS Test Harness to accept the security procedure and establish the connection.
    c. **MARK as PASS OR FAIL for RESULTS**
2. Make sure Mutual authentication happens between UUT and the SAS Test Harness
    a. Make sure that UUT uses TLS v1.2
    b. Make sure that cipher suits from one of the following is selected:
        i. TLS_RSA_WITH_AES_128_GCM_SHA256
        ii. TLS_RSA_WITH_AES_256_GCM_SHA384
        iii. TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
        iv. TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
        v. TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
    c. **MARK as PASS OR FAIL for RESULTS**
3. Successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability
    a. UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with responseCode = 0 and cbsdId
    b. **MARK as PASS OR FAIL for RESULTS**
    c. Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF
    d. **MARK as PASS OR FAIL for RESULTS**

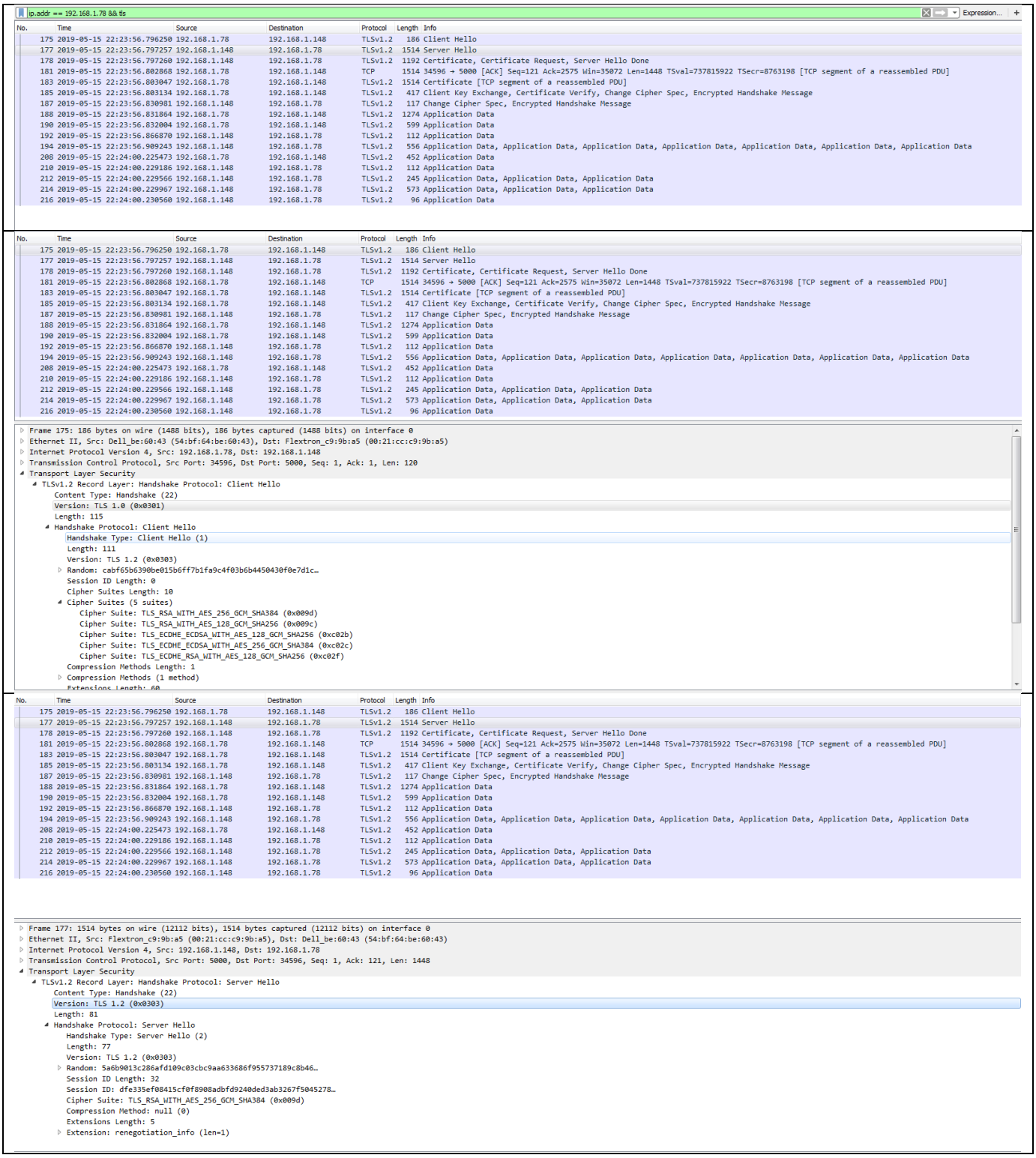
Results:

Criteria	Results	
Configure SAS Test Harness to accept the security procedure and establish the connection	☒ PASS	☐ FAIL
Make sure Mutual authentication happens between UUT and the SAS Test Harness. UUT uses TLS v1.2 and has one of the cipher suites from Step 2 selected.	☒ PASS	☐ FAIL
UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with responseCode = 0 and cbsdId	☒ PASS	☐ FAIL
Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)



7.8.2. TLS Failure Due to Revoke Certificate

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.8.4.2.1	X	X	M	WINNF.FT.C.SCS.2
Purpose	Test cases determine UUT conforms in TLS connection between SAS Test Harness and CBSD			

Pre-requisite: Certificate at the SAS Test Harness shall be marked as revoked

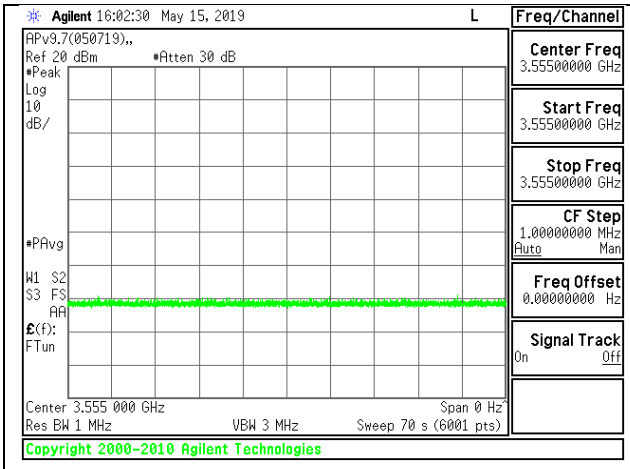
Procedures

1. UUT shall start CBSD-SAS communication with the security procedure
    a. **MARK as PASS OR FAIL for RESULTS**
2. Make sure UUT uses TLS v1.2 for security establishment
    a. Make sure UUT selects correct cipher suite
    b. UUT shall use CRL or OCSP to verify the validity of the server certificate.
    c. Make sure that Mutual authentication does NOT happens between UUT and the SAS Test Harness
    d. **MARK as PASS OR FAIL for RESULTS**
3. UUT may retry for the security procedure which shall fail
    a. **MARK as PASS OR FAIL for RESULTS**
4. SAS Test Harness shall not receive any Registration request
5. Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF
    a. MARK as PASS OR FAIL for RESULTS

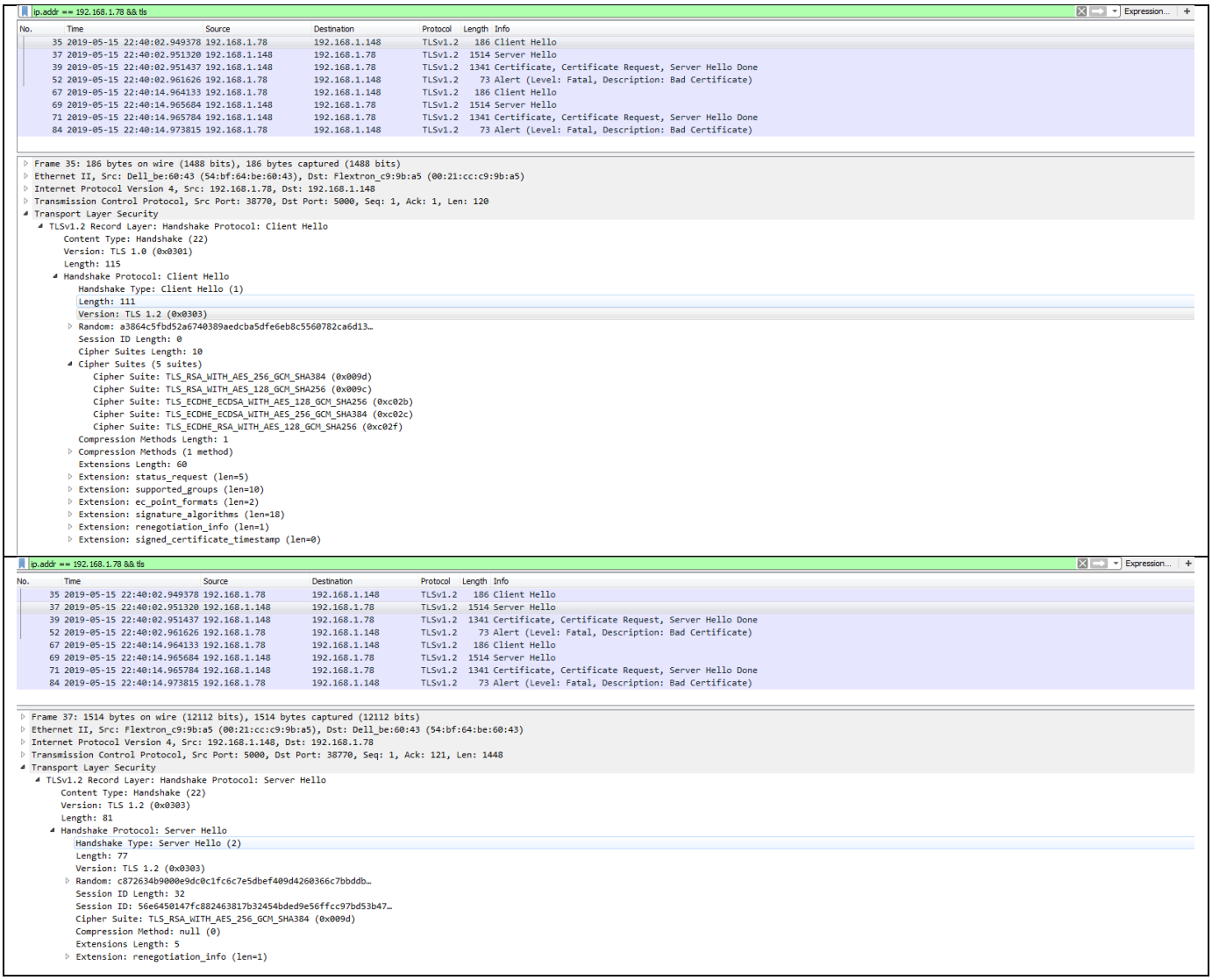
Results:

Criteria	Results	
Configure SAS Test Harness to accept the security procedure and establish the connection	☒ PASS	☐ FAIL
Make sure Mutual authentication happens between UUT and the SAS Test Harness. UUT uses TLS v1.2 and has correct cipher suites selected.	☒ PASS	☐ FAIL
UUT retry for security procedure which shall fail	☒ PASS	☐ FAIL
Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)



ocsp || tls

No.	Time	Source	Destination	Protocol	Length	Info
35	2019-05-15 22:40:02.949378	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
37	2019-05-15 22:40:02.951320	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
39	2019-05-15 22:40:02.951437	192.168.1.148	192.168.1.78	TLSv1.2	1341	Certificate, Certificate Request, Server Hello Done
44	2019-05-15 22:40:02.954176	192.168.1.78	192.168.1.184	OCSP	346	Request
48	2019-05-15 22:40:02.960738	192.168.1.184	192.168.1.78	OCSP	1756	Response
52	2019-05-15 22:40:02.961626	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
67	2019-05-15 22:40:14.964133	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
69	2019-05-15 22:40:14.965684	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
71	2019-05-15 22:40:14.965784	192.168.1.148	192.168.1.78	TLSv1.2	1341	Certificate, Certificate Request, Server Hello Done
76	2019-05-15 22:40:14.968208	192.168.1.78	192.168.1.184	OCSP	346	Request
80	2019-05-15 22:40:14.972934	192.168.1.184	192.168.1.78	OCSP	1756	Response
84	2019-05-15 22:40:14.973815	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 48: 1756 bytes on wire (14048 bits), 1756 bytes captured (14048 bits)
▷ Ethernet II, Src: PcsCompu_7f:96:1a (08:00:27:7f:96:1a), Dst: Dell_be:60:43 (54:bf:64:be:60:43)
▷ Internet Protocol Version 4, Src: 192.168.1.184, Dst: 192.168.1.78
▷ Transmission Control Protocol, Src Port: 80, Dst Port: 55308, Seq: 1449, Ack: 281, Len: 1690
▷ [2 Reassembled TCP Segments (3138 bytes): #46(1448), #48(1690)]
▷ Hypertext Transfer Protocol
◢ Online Certificate Status Protocol
    responseStatus: successful (0)
  ◢ responseBytes
      ResponseType Id: 1.3.6.1.5.5.7.48.1.1 (id-pkix-ocsp-basic)
    ◢ BasicOCSPResponse
      ◢ tbsResponseData
        ▷ responderID: byName (1)
          producedAt: 2019-05-15 22:40:14 (UTC)
        ◢ responses: 1 item
          ◢ SingleResponse
            ▷ certID
            ◢ certStatus: revoked (1)
              ◢ revoked
                  revocationTime: 2019-05-15 17:30:00 (UTC)
                thisUpdate: 2019-05-15 17:31:18 (UTC)
                nextUpdate: 2019-05-15 22:45:14 (UTC)
      ▷ signatureAlgorithm (sha1WithRSAEncryption)
        Padding: 0
        signature: a7587c43c29ad62341b173ee73f568ad7e606de358484205…
      ▷ certs: 2 items
```

ocsp || tls

No.	Time	Source	Destination	Protocol	Length	Info
35	2019-05-15 22:40:02.949378	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
37	2019-05-15 22:40:02.951320	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
39	2019-05-15 22:40:02.951437	192.168.1.148	192.168.1.78	TLSv1.2	1341	Certificate, Certificate Request, Server Hello Done
44	2019-05-15 22:40:02.954176	192.168.1.78	192.168.1.184	OCSP	346	Request
48	2019-05-15 22:40:02.960738	192.168.1.184	192.168.1.78	OCSP	1756	Response
52	2019-05-15 22:40:02.961626	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
67	2019-05-15 22:40:14.964133	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
69	2019-05-15 22:40:14.965684	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
71	2019-05-15 22:40:14.965784	192.168.1.148	192.168.1.78	TLSv1.2	1341	Certificate, Certificate Request, Server Hello Done
76	2019-05-15 22:40:14.968208	192.168.1.78	192.168.1.184	OCSP	346	Request
80	2019-05-15 22:40:14.972934	192.168.1.184	192.168.1.78	OCSP	1756	Response
84	2019-05-15 22:40:14.973815	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 52: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
▷ Ethernet II, Src: Dell_be:60:43 (54:bf:64:be:60:43), Dst: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5)
▷ Internet Protocol Version 4, Src: 192.168.1.78, Dst: 192.168.1.148
▷ Transmission Control Protocol, Src Port: 38770, Dst Port: 5000, Seq: 121, Ack: 2724, Len: 7
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Bad Certificate)
      Content Type: Alert (21)
      Version: TLS 1.2 (0x0303)
      Length: 2
    ◢ Alert Message
        Level: Fatal (2)
        Description: Bad Certificate (42)
```

7.8.3. TLS Failure Due to Expired Server Certificate

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.8.4.2.2	X	X	M	WINNF.FT.C.SCS.3
Purpose	Test cases determine UUT conforms in TLS connection between SAS Test Harness and CBSD			

Pre-requisite: Configure SAS Test Harness such that server certificate is valid but expired

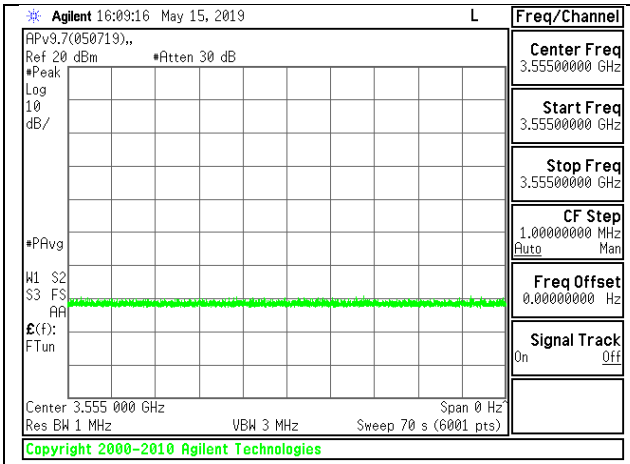
Procedures

1. UUT shall start CBSD-SAS communication with the security procedure
    a. **MARK as PASS OR FAIL for RESULTS**
2. Make sure UUT uses TLS v1.2 for security establishment
    a. Make sure UUT selects correct cipher suite
    b. UUT shall use CRL or OCSP to verify the validity of the server certificate.
    c. Make sure that Mutual authentication does NOT happens between UUT and the SAS Test Harness
    d. **MARK as PASS OR FAIL for RESULTS**
3. UUT may retry for the security procedure which shall fail
    a. **MARK as PASS OR FAIL for RESULTS**
4. SAS Test Harness shall not receive any Registration request
5. Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF
    a. MARK as PASS OR FAIL for RESULTS

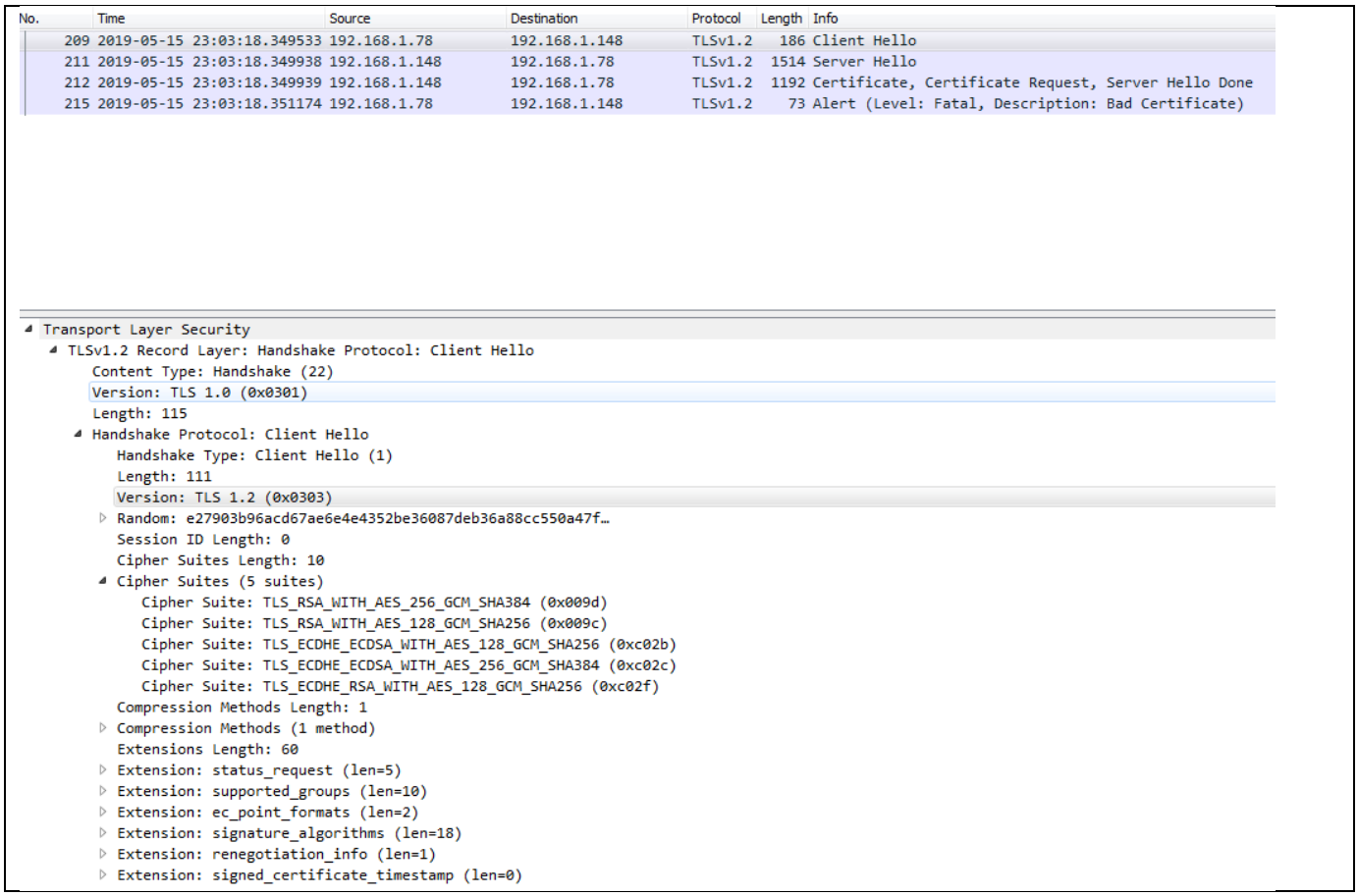
Results:

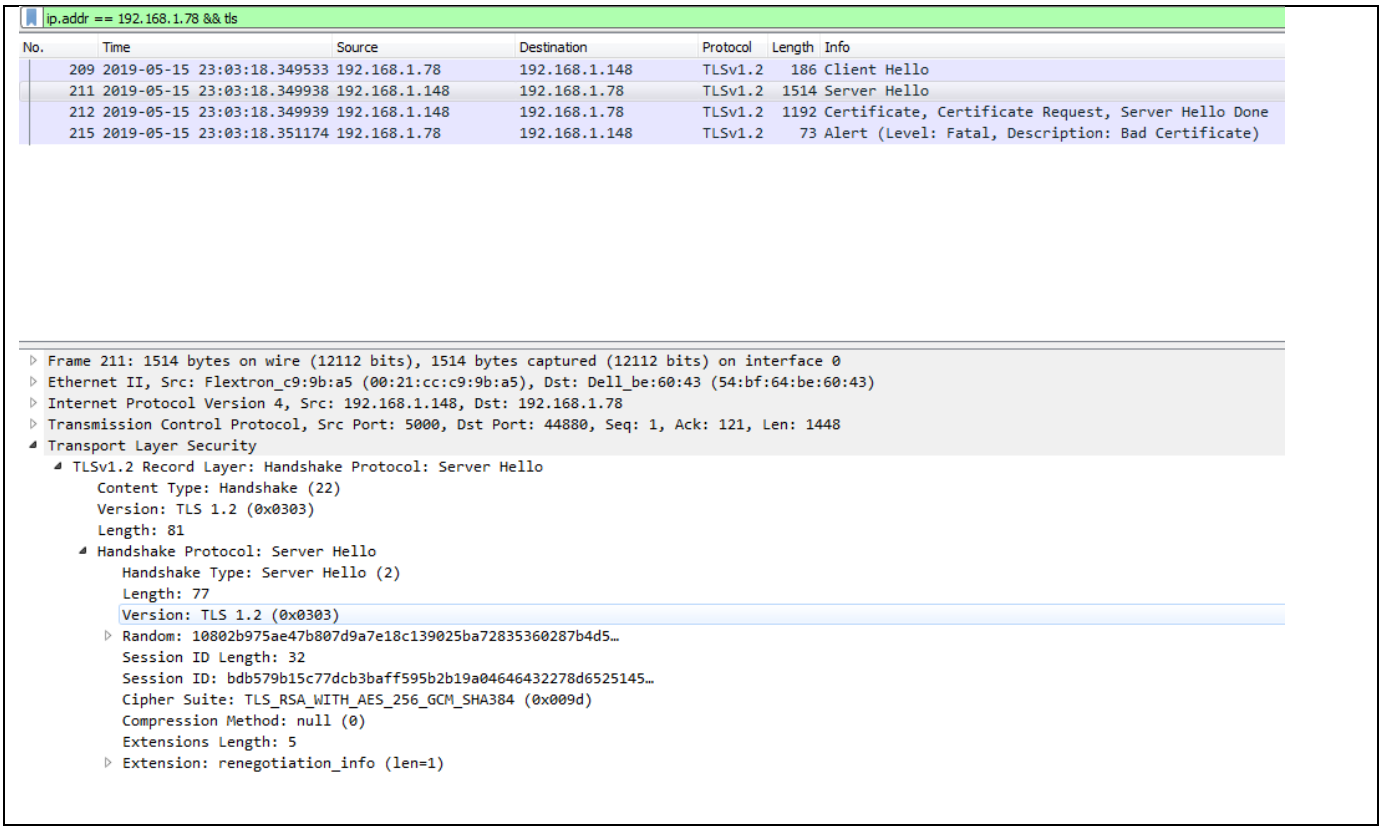
Criteria	Results	
Configure SAS Test Harness to accept the security procedure and establish the connection	☒ PASS	☐ FAIL
Make sure Mutual authentication happens between UUT and the SAS Test Harness. UUT uses TLS v1.2 and has correct cipher suites selected.	☒ PASS	☐ FAIL
UUT retry for security procedure which shall fail	☒ PASS	☐ FAIL
Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF	☒ PASS	☐ FAIL

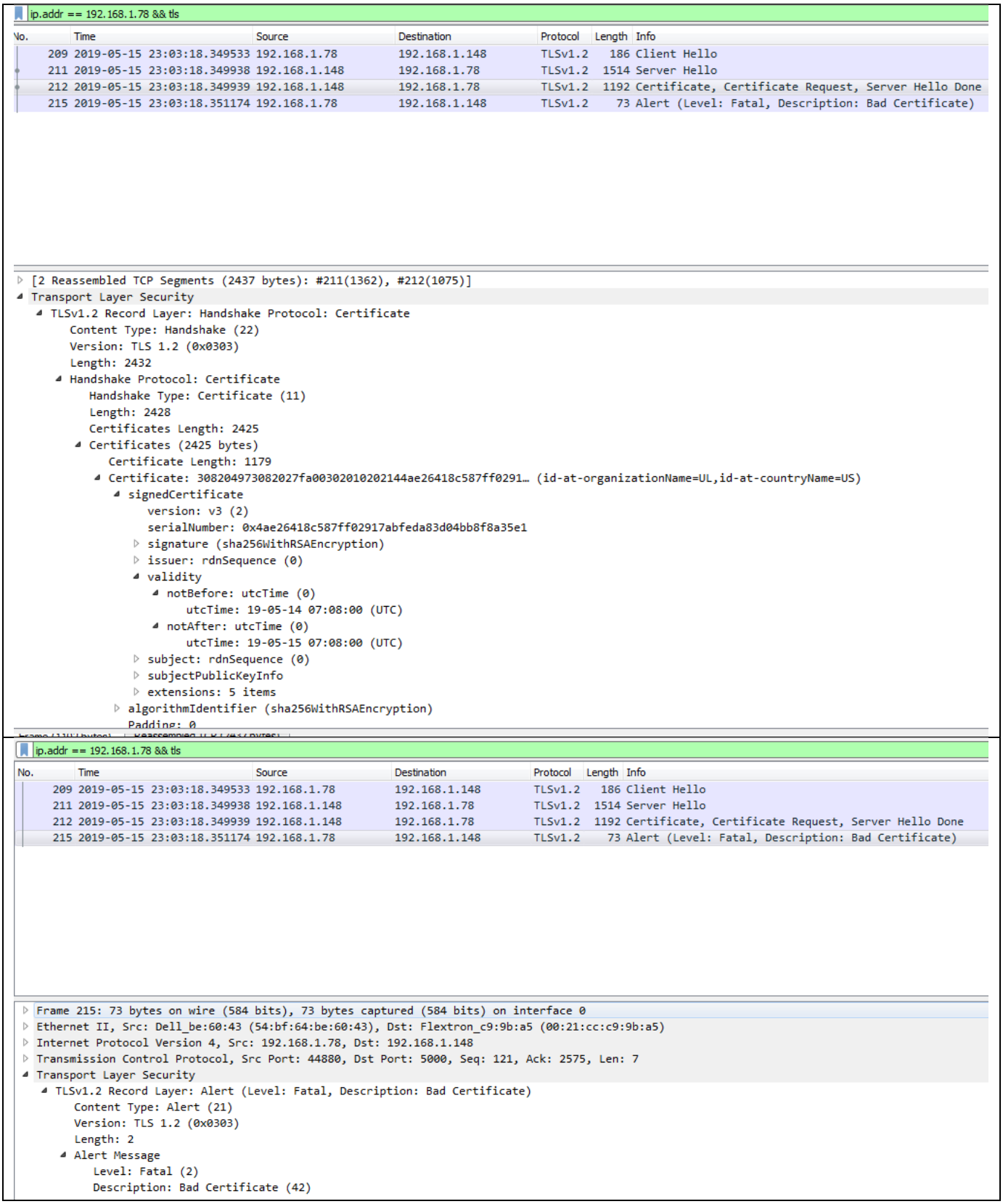
RF plot for test case



LOW Channel (3555MHz)







7.8.4. TLS Failure When SAS Test Harness Cerficate is issued by an unknown CA

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.8.4.2.3	X	X	M	WINNF.FT.C.SCS.4
Purpose	Test cases determine UUT conforms in TLS connection between SAS Test Harness and CBSD			

Pre-requisite: Equip the SAS Test Harness with certificate signed by an unknown CA to the CBSD.

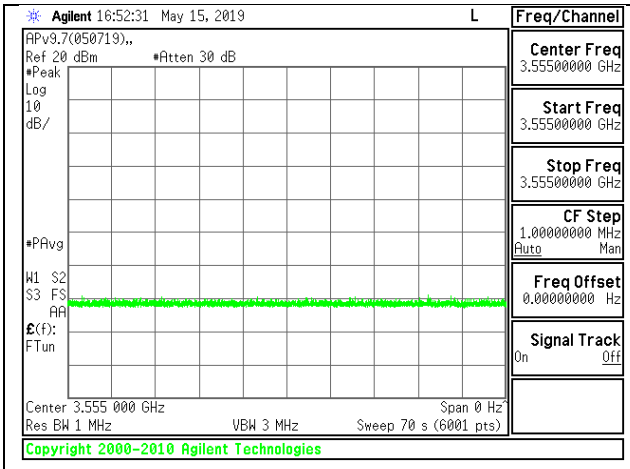
Procedures

1. UUT shall start CBSD-SAS communication with the security procedure
   a. **MARK as PASS OR FAIL for RESULTS**
2. Make sure UUT uses TLS v1.2 for security establishment
   a. Make sure UUT selects correct cipher suite
   b. UUT shall use CRL or OCSP to verify the validity of the server certificate.
   c. Make sure that Mutual authentication does NOT happens between UUT and the SAS Test Harness
   d. **MARK as PASS OR FAIL for RESULTS**
3. UUT may retry for the security procedure which shall fail
   a. **MARK as PASS OR FAIL for RESULTS**
4. SAS Test Harness shall not receive any Registration request
5. Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF
   a. MARK as PASS OR FAIL for RESULTS

Results:

Criteria	Results	
Configure SAS Test Harness to accept the security procedure and establish the connection	☒ PASS	☐ FAIL
Make sure Mutual authentication happens between UUT and the SAS Test Harness. UUT uses TLS v1.2 and has correct cipher suites selected. UUT shall use CRL or OCSP to verify the validity of the server certificate. Mutual authentification does NOT happen between UUT and SAS Test Harness	☒ PASS	☐ FAIL
UUT retry for security procedure which shall fail	☒ PASS	☐ FAIL
Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
49	2019-05-15 23:43:25.657974	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
51	2019-05-15 23:43:25.659811	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
53	2019-05-15 23:43:25.659928	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
55	2019-05-15 23:43:25.660256	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
57	2019-05-15 23:43:25.660422	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
94	2019-05-15 23:43:37.662872	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
96	2019-05-15 23:43:37.664349	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
98	2019-05-15 23:43:37.664495	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
100	2019-05-15 23:43:37.664700	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
102	2019-05-15 23:43:37.664985	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
123	2019-05-15 23:43:49.667710	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
125	2019-05-15 23:43:49.669331	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
127	2019-05-15 23:43:49.669449	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]

```
▷ Frame 49: 186 bytes on wire (1488 bits), 186 bytes captured (1488 bits)
▷ Ethernet II, Src: Dell_be:60:43 (54:bf:64:be:60:43), Dst: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5)
▷ Internet Protocol Version 4, Src: 192.168.1.78, Dst: 192.168.1.148
▷ Transmission Control Protocol, Src Port: 55444, Dst Port: 5000, Seq: 1, Ack: 1, Len: 120
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
      Content Type: Handshake (22)
      Version: TLS 1.0 (0x0301)
      Length: 115
    ◢ Handshake Protocol: Client Hello
        Handshake Type: Client Hello (1)
        Length: 111
        Version: TLS 1.2 (0x0303)
      ▷ Random: 04980a4c628f2ca0b1774189741a1060ab3f84fe63b4e056…
        Session ID Length: 0
        Cipher Suites Length: 10
      ◢ Cipher Suites (5 suites)
          Cipher Suite: TLS_RSA_WITH_AES_256_GCM_SHA384 (0x009d)
          Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
          Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
          Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (0xc02c)
          Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
        Compression Methods Length: 1
```

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
49	2019-05-15 23:43:25.657974	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
51	2019-05-15 23:43:25.659811	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
53	2019-05-15 23:43:25.659928	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
55	2019-05-15 23:43:25.660256	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
57	2019-05-15 23:43:25.660422	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
94	2019-05-15 23:43:37.662872	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
96	2019-05-15 23:43:37.664349	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
98	2019-05-15 23:43:37.664495	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
100	2019-05-15 23:43:37.664700	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
102	2019-05-15 23:43:37.664985	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
123	2019-05-15 23:43:49.667710	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
125	2019-05-15 23:43:49.669331	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
127	2019-05-15 23:43:49.669449	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]

```
▷ Frame 51: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
▷ Ethernet II, Src: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5), Dst: Dell_be:60:43 (54:bf:64:be:60:43)
▷ Internet Protocol Version 4, Src: 192.168.1.148, Dst: 192.168.1.78
▷ Transmission Control Protocol, Src Port: 5000, Dst Port: 55444, Seq: 1, Ack: 121, Len: 1448
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 81
    ◢ Handshake Protocol: Server Hello
        Handshake Type: Server Hello (2)
        Length: 77
        Version: TLS 1.2 (0x0303)
      ▷ Random: f43f383a81fed3d939800339c29cde600b9bafc584785fc6…
        Session ID Length: 32
        Session ID: 72a4f600c0bd0ed6518d651d545957c476dd96dbd79b3d35…
        Cipher Suite: TLS_RSA_WITH_AES_256_GCM_SHA384 (0x009d)
        Compression Method: null (0)
        Extensions Length: 5
      ▷ Extension: renegotiation_info (len=1)
```

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
49	2019-05-15 23:43:25.657974	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
51	2019-05-15 23:43:25.659811	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
53	2019-05-15 23:43:25.659928	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
55	2019-05-15 23:43:25.660256	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
57	2019-05-15 23:43:25.660422	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
94	2019-05-15 23:43:37.662872	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
96	2019-05-15 23:43:37.664349	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
98	2019-05-15 23:43:37.664495	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
100	2019-05-15 23:43:37.664700	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
102	2019-05-15 23:43:37.664985	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
123	2019-05-15 23:43:49.667710	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
125	2019-05-15 23:43:49.669331	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
127	2019-05-15 23:43:49.669449	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]

```
Frame 55: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
Ethernet II, Src: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5), Dst: Dell_be:60:43 (54:bf:64:be:60:43)
Internet Protocol Version 4, Src: 192.168.1.148, Dst: 192.168.1.78
Transmission Control Protocol, Src Port: 5000, Dst Port: 55444, Seq: 2897, Ack: 121, Len: 7
[2 Reassembled TCP Segments (51 bytes): #53(44), #55(7)]
Transport Layer Security
  TLSv1.2 Record Layer: Handshake Protocol: Multiple Handshake Messages
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 46
    Handshake Protocol: Certificate Request
        Handshake Type: Certificate Request (13)
        Length: 38
        Certificate types count: 3
      Certificate types (3 types)
        Signature Hash Algorithms Length: 30
      Signature Hash Algorithms (15 algorithms)
        Distinguished Names Length: 0
    Handshake Protocol: Server Hello Done
        Handshake Type: Server Hello Done (14)
        Length: 0
```

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
49	2019-05-15 23:43:25.657974	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
51	2019-05-15 23:43:25.659811	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
53	2019-05-15 23:43:25.659928	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
55	2019-05-15 23:43:25.660256	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
57	2019-05-15 23:43:25.660422	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
94	2019-05-15 23:43:37.662872	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
96	2019-05-15 23:43:37.664349	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
98	2019-05-15 23:43:37.664495	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]
100	2019-05-15 23:43:37.664700	192.168.1.148	192.168.1.78	TLSv1.2	73	Certificate Request, Server Hello Done
102	2019-05-15 23:43:37.664985	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)
123	2019-05-15 23:43:49.667710	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
125	2019-05-15 23:43:49.669331	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
127	2019-05-15 23:43:49.669449	192.168.1.148	192.168.1.78	TLSv1.2	1514	Certificate [TCP segment of a reassembled PDU]

```
Frame 57: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
Ethernet II, Src: Dell_be:60:43 (54:bf:64:be:60:43), Dst: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5)
Internet Protocol Version 4, Src: 192.168.1.78, Dst: 192.168.1.148
Transmission Control Protocol, Src Port: 55444, Dst Port: 5000, Seq: 121, Ack: 2904, Len: 7
Transport Layer Security
  TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Bad Certificate)
      Content Type: Alert (21)
      Version: TLS 1.2 (0x0303)
      Length: 2
    Alert Message
        Level: Fatal (2)
        Description: Bad Certificate (42)
```

7.8.5. TLS Failure When SAS Test Harness Cerficate is corrupted

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
6.8.4.2.4	X	X	M	WINNF.FT.C.SCS.5
Purpose	Test cases determine UUT conforms in TLS connection between SAS Test Harness and CBSD			

Pre-requisite: The end-entity certificate at the SAS Test Harness shall be corrupted.

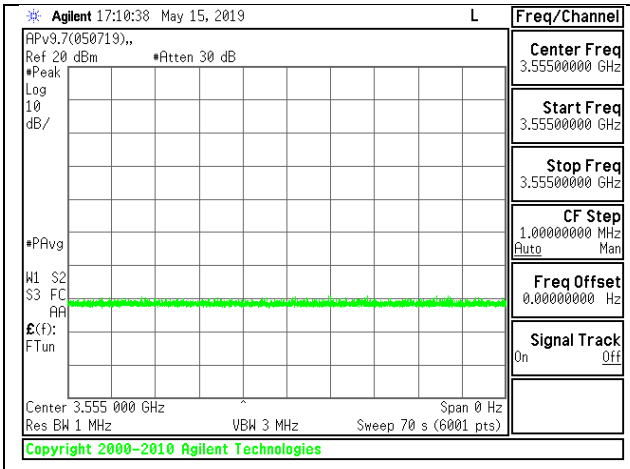
Procedures

1. UUT shall start CBSD-SAS communication with the security procedure
    a. **MARK as PASS OR FAIL for RESULTS**
2. Make sure UUT uses TLS v1.2 for security establishment
    a. Make sure UUT selects correct cipher suite
    b. UUT shall use CRL or OCSP to verify the validity of the server certificate.
    c. Makesure that Mutual authentication does NOT happens between UUT and the SAS Test Harness
    d. **MARK as PASS OR FAIL for RESULTS**
3. UUT may retry for the security procedure which shall fail
    a. **MARK as PASS OR FAIL for RESULTS**
4. SAS Test Harness shall not receive any Registration request
5. Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF
    a. MARK as PASS OR FAIL for RESULTS

Results:

Criteria	Results	
Configure SAS Test Harness to accept the security procedure and establish the connection	☒ PASS	☐ FAIL
Make sure Mutual authentication happens between UUT and the SAS Test Harness. UUT uses TLS v1.2 and has correct cipher suites selected. UUT shall use CRL or OCSP to verify the validity of the server certificate. Mutual authentification does NOT happen between UUT and SAS Test Harness	☒ PASS	☐ FAIL
UUT retry for security procedure which shall fail	☒ PASS	☐ FAIL
Monitor the RF output of the UUT from start of test until 60seconds after Step 3 is complete. Verify that UUT shall not transmit RF	☒ PASS	☐ FAIL

RF plot for test case



LOW Channel (3555MHz)

ip.addr == 192.168.1.78 && tls

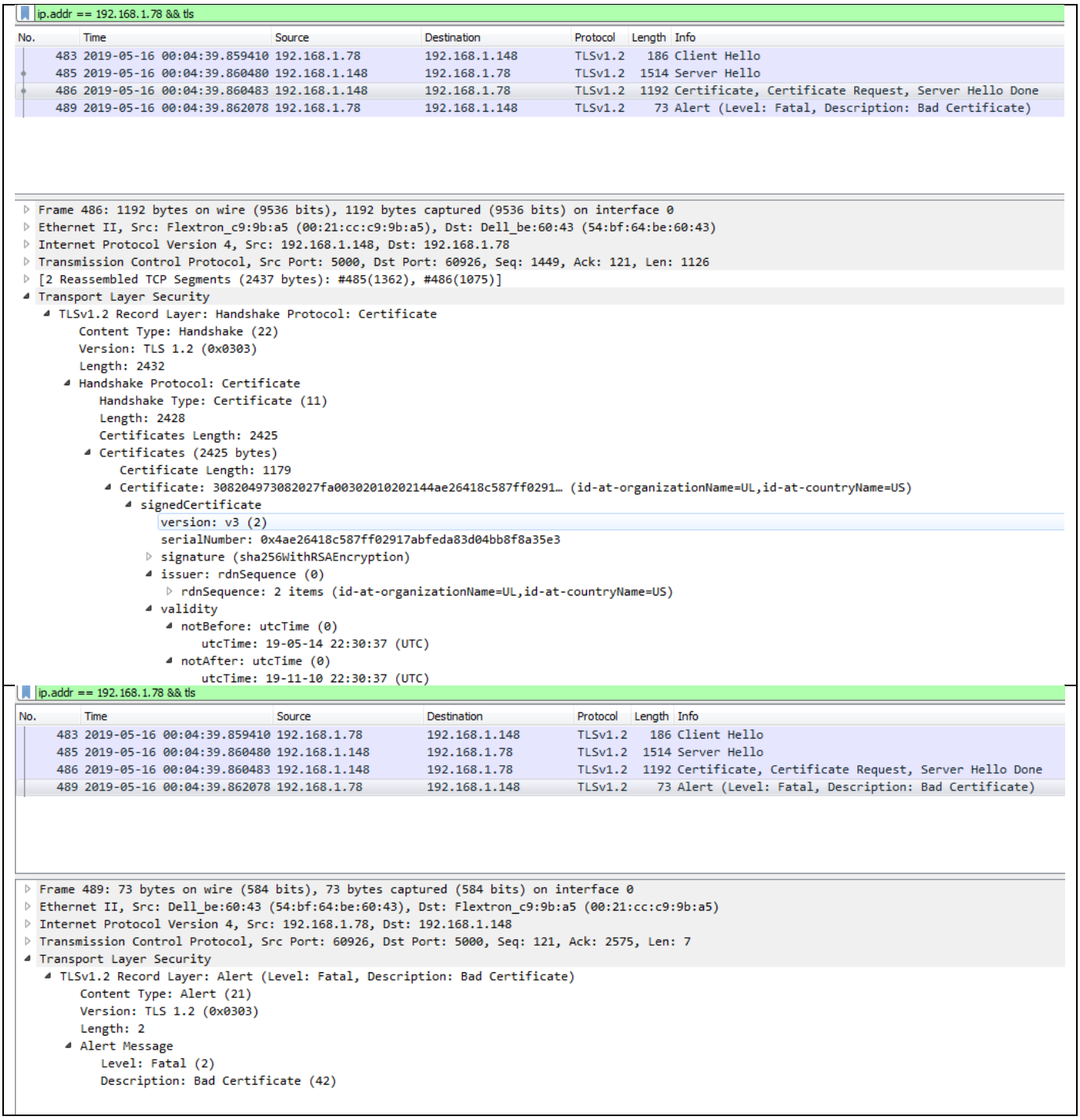
No.	Time	Source	Destination	Protocol	Length	Info
483	2019-05-16 00:04:39.859410	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
485	2019-05-16 00:04:39.860480	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
486	2019-05-16 00:04:39.860483	192.168.1.148	192.168.1.78	TLSv1.2	1192	Certificate, Certificate Request, Server Hello Done
489	2019-05-16 00:04:39.862078	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 483: 186 bytes on wire (1488 bits), 186 bytes captured (1488 bits) on interface 0
▷ Ethernet II, Src: Dell_be:60:43 (54:bf:64:be:60:43), Dst: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5)
▷ Internet Protocol Version 4, Src: 192.168.1.78, Dst: 192.168.1.148
▷ Transmission Control Protocol, Src Port: 60926, Dst Port: 5000, Seq: 1, Ack: 1, Len: 120
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
      Content Type: Handshake (22)
      Version: TLS 1.0 (0x0301)
      Length: 115
    ◢ Handshake Protocol: Client Hello
        Handshake Type: Client Hello (1)
        Length: 111
        Version: TLS 1.2 (0x0303)
      ▷ Random: 9d93db96a029c6c1ff7e0d058a7a77d3123127e593eba8be…
        Session ID Length: 0
        Cipher Suites Length: 10
      ◢ Cipher Suites (5 suites)
          Cipher Suite: TLS_RSA_WITH_AES_256_GCM_SHA384 (0x009d)
          Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
          Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
          Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (0xc02c)
          Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
        Compression Methods Length: 1
      ▷ Compression Methods (1 method)
        Extensions Length: 60
      ▷ Extension: status_request (len=5)
      ▷ Extension: supported_groups (len=10)
```

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
483	2019-05-16 00:04:39.859410	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
485	2019-05-16 00:04:39.860480	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
486	2019-05-16 00:04:39.860483	192.168.1.148	192.168.1.78	TLSv1.2	1192	Certificate, Certificate Request, Server Hello Done
489	2019-05-16 00:04:39.862078	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 485: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface 0
▷ Ethernet II, Src: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5), Dst: Dell_be:60:43 (54:bf:64:be:60:43)
▷ Internet Protocol Version 4, Src: 192.168.1.148, Dst: 192.168.1.78
▷ Transmission Control Protocol, Src Port: 5000, Dst Port: 60926, Seq: 1, Ack: 121, Len: 1448
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 81
    ◢ Handshake Protocol: Server Hello
        Handshake Type: Server Hello (2)
        Length: 77
        Version: TLS 1.2 (0x0303)
      ▷ Random: 4edb6c84e16a09af74d10919a5fb02addac86ef922ef18e8…
        Session ID Length: 32
        Session ID: 5012821e26f17cfce7a6cc41ddb53140984bc608292291a8…
        Cipher Suite: TLS_RSA_WITH_AES_256_GCM_SHA384 (0x009d)
        Compression Method: null (0)
        Extensions Length: 5
      ▷ Extension: renegotiation_info (len=1)
```



ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
483	2019-05-16 00:04:39.859410	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
485	2019-05-16 00:04:39.860480	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
486	2019-05-16 00:04:39.860483	192.168.1.148	192.168.1.78	TLSv1.2	1192	Certificate, Certificate Request, Server Hello Done
489	2019-05-16 00:04:39.862078	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 486: 1192 bytes on wire (9536 bits), 1192 bytes captured (9536 bits) on interface 0
▷ Ethernet II, Src: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5), Dst: Dell_be:60:43 (54:bf:64:be:60:43)
▷ Internet Protocol Version 4, Src: 192.168.1.148, Dst: 192.168.1.78
▷ Transmission Control Protocol, Src Port: 5000, Dst Port: 60926, Seq: 1449, Ack: 121, Len: 1126
▷ [2 Reassembled TCP Segments (2437 bytes): #485(1362), #486(1075)]
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Handshake Protocol: Certificate
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 2432
    ◢ Handshake Protocol: Certificate
        Handshake Type: Certificate (11)
        Length: 2428
        Certificates Length: 2425
      ◢ Certificates (2425 bytes)
          Certificate Length: 1179
        ◢ Certificate: 308204973082027fa00302010202144ae26418c587ff0291… (id-at-organizationName=UL,id-at-countryName=US)
          ◢ signedCertificate
              version: v3 (2)
              serialNumber: 0x4ae26418c587ff02917abfeda83d04bb8f8a35e3
            ▷ signature (sha256WithRSAEncryption)
            ◢ issuer: rdnSequence (0)
              ▷ rdnSequence: 2 items (id-at-organizationName=UL,id-at-countryName=US)
            ◢ validity
              ◢ notBefore: utcTime (0)
                    utcTime: 19-05-14 22:30:37 (UTC)
              ◢ notAfter: utcTime (0)
                    utcTime: 19-11-10 22:30:37 (UTC)
```

ip.addr == 192.168.1.78 && tls

No.	Time	Source	Destination	Protocol	Length	Info
483	2019-05-16 00:04:39.859410	192.168.1.78	192.168.1.148	TLSv1.2	186	Client Hello
485	2019-05-16 00:04:39.860480	192.168.1.148	192.168.1.78	TLSv1.2	1514	Server Hello
486	2019-05-16 00:04:39.860483	192.168.1.148	192.168.1.78	TLSv1.2	1192	Certificate, Certificate Request, Server Hello Done
489	2019-05-16 00:04:39.862078	192.168.1.78	192.168.1.148	TLSv1.2	73	Alert (Level: Fatal, Description: Bad Certificate)

```
▷ Frame 489: 73 bytes on wire (584 bits), 73 bytes captured (584 bits) on interface 0
▷ Ethernet II, Src: Dell_be:60:43 (54:bf:64:be:60:43), Dst: Flextron_c9:9b:a5 (00:21:cc:c9:9b:a5)
▷ Internet Protocol Version 4, Src: 192.168.1.78, Dst: 192.168.1.148
▷ Transmission Control Protocol, Src Port: 60926, Dst Port: 5000, Seq: 121, Ack: 2575, Len: 7
◢ Transport Layer Security
  ◢ TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Bad Certificate)
      Content Type: Alert (21)
      Version: TLS 1.2 (0x0303)
      Length: 2
    ◢ Alert Message
        Level: Fatal (2)
        Description: Bad Certificate (42)
```

7.9. CBSD RF Power Measurement

Definition

- These test cases demonstrate the conformance of the CBSD due to limitations on transmit power.

Initial Conditions / Test Pre-conditions

- CBSD has gone through SAS discovery process and can authenticate with the SAS Test Harness.

7.9.1. UUT RF Transmit Power Measurement

Section	CBSD	Domain Proxy (DP)	Required for Cert.	Test Case ID
7.1.4.1.1	X	X	M	WINNF.PT.C.HBT
Purpose	Test cases determine UUT conforms with limitations set for transmit power.			

Procedures

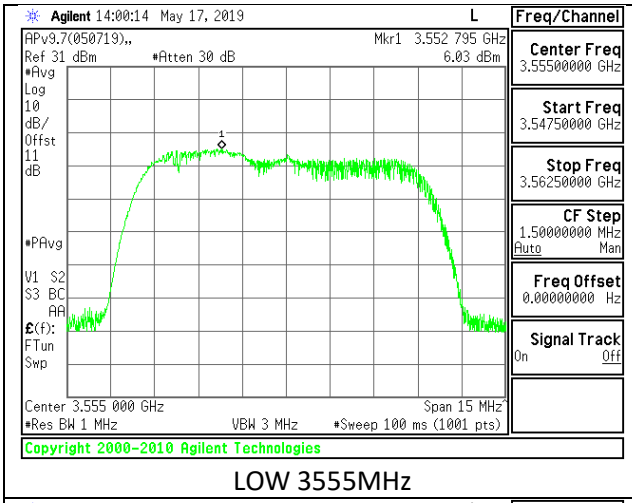
1. Ensure the following conditions are met:
    a. UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness
    b. UUT has registered with SAS, with CBSD ID = C
    c. UUT has a single valid grant G with parameters {lowFrequency = FL, highFrequency = FH, maxEirp = Pi}, with grant in AUTHORIZED state, and grantExpireTime set to a value far past the duration of this test case.
2. UUT and SAS Test Harness perform a seres of Heartbeat Request/Response cycles, which continues until the other test steps are complete. Messaging for each cycle is as follows:
    a. UUT sends Heartbeat Request
        i. cbsdId = C
        ii. grantId = G
    b. SAS Test Harness responds with Heartbeat Response including:
        i. cbsdId = C
        ii. grantId = G
        iii. transmitExpireTime = current UTC time + 200 seconds
        iv. responseCode = 0
3. Measure power on of the UUT and verify it complies with maxEirp setting.
    a. MARK as PASS OR FAIL for RESULTS

Results:

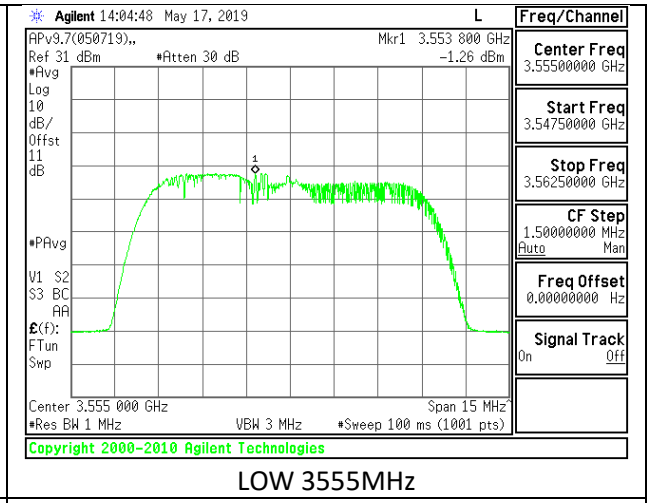
Criteria	Results	
Power of UUT complies with maxEirp setting	☒ PASS	☐ FAIL

BW	Power Test Case	Frequency (Mhz)	Single Port PSD dBm/MHz	Total PSD EIRP (dBm/MHz)	Declared Max/Min EIRP (dBm/MHz)	Margin
10	High P	3555	6.03	15.15	16	-0.85
	Low P	3555	-1.26	7.86	10	-2.14
	High P	3625	6.18	15.30	16	-0.70
	Low P	3625	-1.28	7.84	10	-2.16
	High P	3695	6.13	15.25	16	-0.75
	Low P	3695	-1.16	7.96	10	-2.04

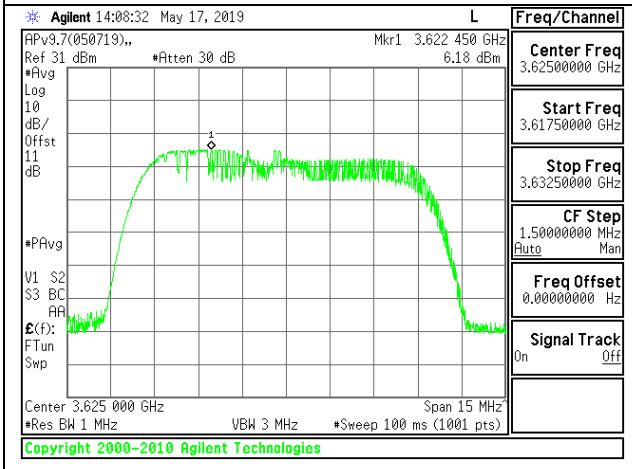
RF plot for test case



LOW 3555MHz

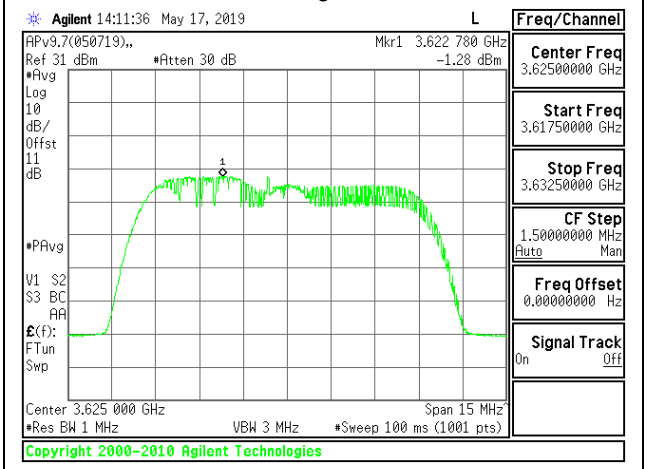


LOW 3555MHz

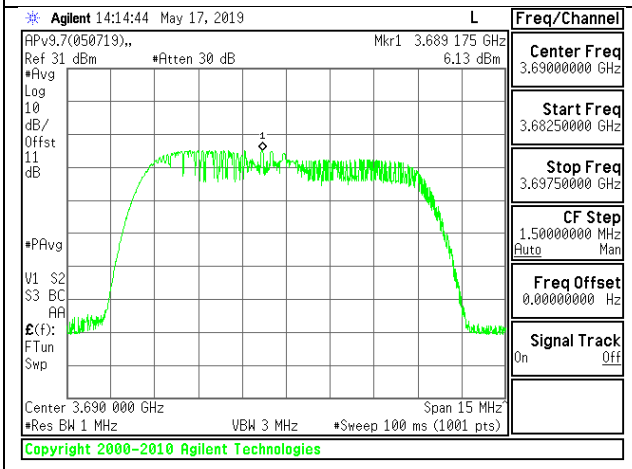


MID 3625MHz

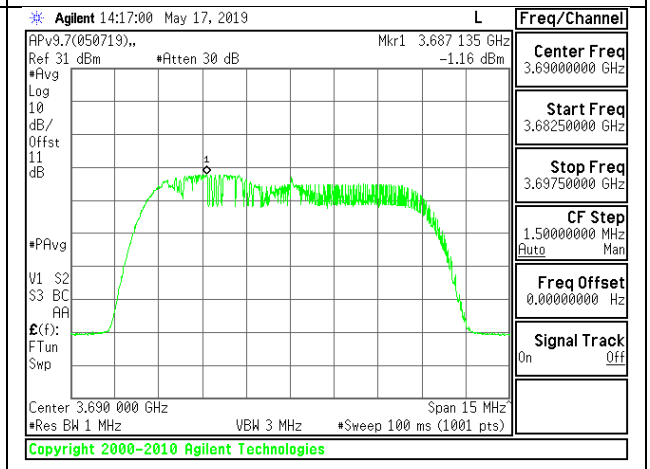
S



MID 3625MHz



HIGH 3690MHz



HIGH 3690MHz