WINNF-TS-0122 TEST REPORT

FCC ID	:	2AG87RM-3625
Equipment	:	Smart Radio - CBRS
Model Name	:	RM-3625
Applicant	:	Doodle Labs (SG) Pte Ltd 150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324,
Manufacturer	:	Doodle Labs (SG) Pte Ltd 150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324,
Standard	:	WINNF-TS-0122 Version V1.0.2

The product was received on Sep. 09, 2021, and testing was started from May 17, 2022 and completed on Jun. 30, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in WINNF-TS-0122 Version V1.0.2 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
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History of this test report

Report No.	Version	Description	Issued Date
FG183131AA	01	Initial issue of report	Jul. 18, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	CBSD	DP	Required for Cert.	Test Case ID	Test Case Title	Result (PASS/FAIL)	Remark
-	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	-
3.1	6.1.4.1.3	X	-	C2	WINNF.FT.C.REG.3. waiver	Single-Step registration for Category A CBSD (Waiver)	PASS	Note 3
-	6.1.4.1.4	-	X	C2	WINNF.FT.D.REG.4	Domain Proxy Single-Step registration for Cat A CBSD	N/A	-
3.2	6.1.4.1.5	X	-	C3	WINNF.FT.C.REG.5. waiver	Single-Step registration for CBSD with CPI signed Data (Waiver)	PASS	Note 3
-	6.1.4.1.6	-	X	C3	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	N/A	-
-	6.1.4.1.7	X	X	C6	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	N/A	-
3.3	6.1.4.2.1	X	-	M	WINNF.FT.C.REG.8	Missing Required parameters (responseCode 102)	PASS	-
-	6.1.4.2.2	-	X	M	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	N/A	-
3.4	6.1.4.2.3	X	-	M	WINNF.FT.C.REG.10	Pending registration (responseCode 200)	PASS	-
-	6.1.4.2.4	-	X	M	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	N/A	-
3.5	6.1.4.2.5	X	-	M	WINNF.FT.C.REG.12	Invalid parameter (responseCode 103)	PASS	-
-	6.1.4.2.6	-	X	M	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	N/A	-
3.6	6.1.4.2.7	X	-	M	WINNF.FT.C.REG.14	Blacklisted CBSD (responseCode 101)	PASS	-
-	6.1.4.2.8	-	X	M	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	N/A	-
3.7	6.1.4.2.9	X	-	M	WINNF.FT.C.REG.16	Unsupported SAS protocol version (responseCode 100)	PASS	-
-	6.1.4.2.10	-	X	M	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	N/A	-
3.8	6.1.4.2.11	X	-	M	WINNF.FT.C.REG.18	Group Error (responseCode 201)	PASS	-
-	6.1.4.2.12	-	X	M	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	N/A	-

3.9	6.1.4.3.1	X	X	C2	WINNF.FT.C.REG.20	Category A CBSD location Update	PASS	-
3.10	6.3.4.2.1	X	X	M	WINNF.FT.C.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	PASS	-
3.11	6.3.4.2.2	X	X	M	WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	PASS	-
3.12	6.4.4.1.1	X	-	M	WINNF.FT.C.HBT.1	Heartbeat Success Case (first Heartbeat Response)	PASS	-
-	6.4.4.1.2	-	X	M	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	N/A	-
3.13	6.4.4.2.1	X	X	M	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	PASS	-
3.14	6.4.4.2.2	X	-	M	WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	PASS	-
3.15	6.4.4.2.3	X	X	M	WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	PASS	-
3.16	6.4.4.2.4	X	X	M	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	PASS	-
3.17	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)	N/A	-
3.18	6.4.4.3.1	X	X	M	WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	PASS	-
3.19	6.4.4.3.2	X	X	M	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	PASS	-
3.20	6.4.4.4.1	X	X	O	WINNF.FT.C.HBT.11	SuccessfulGrantRenewalin HeartbeatTestCase	PASS	-
-	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	N/A	-
-	6.5.4.2.3	X	X	C5	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	N/A	-
-	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	N/A	-
3.21	6.6.4.1.1	X	-	M	WINNF.FT.C.RLQ.1	Successful Relinquishment	PASS	-
-	6.6.4.1.2	-	X	M	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	N/A	-

3.22	6.6.4.2.1	X	-	O	WINNF.FT.C.RLQ.3	Unsuccessful Relinquishment, responseCode=102	PASS	-
-	6.6.4.2.2	-	X	O	WINNF.FT.D.RLQ.4	Domain Proxy Unsuccessful Relinquishment, responseCode=102	N/A	-
3.23	6.6.4.3.1	X	-	O	WINNF.FT.C.RLQ.5	Unsuccessful Relinquishment, responseCode=103	PASS	-
-	6.6.4.3.2	-	X	O	WINNF.FT.D.RLQ.6	Domain Proxy Unsuccessful Relinquishment, responseCode=103	N/A	-
3.24	6.7.4.1.1	X	-	M	WINNF.FT.C.DRG.1	Successful Deregistration	PASS	-
-	6.7.4.1.2	-	X	M	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	N/A	-
3.25	6.7.4.2.1	X	-	O	WINNF.FT.C.DRG.3	Deregistration responseCode=102	PASS	-
-	6.7.4.2.2	-	X	O	WINNF.FT.D.DRG.4	Domain Proxy Deregistration responseCode=102	N/A	-
3.26	6.7.4.3.1	X	X	O	WINNF.FT.C.DRG.5	Deregistration responseCode=103	PASS	-
3.27	6.8.4.1.1	X	X	M	WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	PASS	-
3.28	6.8.4.2.1	X	X	M	WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	PASS	-
3.29	6.8.4.2.2	X	X	M	WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	PASS	-
3.30	6.8.4.2.3	X	X	M	WINNF.FT.C.SCS.4	TLSfailurewhenSASTestHarness certificateisissue by unknown CA	PASS	-
3.31	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	-
3.32	7.1.4.1.1	X	X	M	WINNF.PT.C.HBT.1	UUT RF Transmit Power Measurement	PASS	-

Note1:
♦ M: Mandatory for certification
♦ O: Optional. Not required for certification.
♦ C: Conditional. Mandatory if CBSD supports relevant functionality.
Note2: The unit under test type is CBSD without Domain Proxy and Conditional Test Case Definitions are C2 and C3.
Note3: DUT does not support sensing capabilities.

Declaration of Conformity:
1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Measurement Uncertainty".
Comments and Explanations:
1. The test configuration, test mode and test software were written in this test report are declared by the manufacturer. 2. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. 3. Only 10MHz bandwidth was selected for testing by manufacturer requirement.

Reviewed by: Sam Chen

Report Producer: Wendy Pan

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature of Equipment Under Test	
EUT Type	CBSD
Power Type	From Internal Power Supply
Category of EUT	☒ Category A ☒ Category B
Professional Installation	☒ Yes for Category A and Category B ☒ No for Category A
EUT in Test ID	☐ EUT with Domain Proxy ☒ EUT without Domain Proxy
CBSD Firmware Version	Doodle Labs firmware-2022-04.1-cbrs r11306-c4a6851c72 / LuCI 2022-04-25_disable_meshmap_when_alfred_not_running branch (git-22.069.40492-e136d65)
CBSD Software Version	N/A
CBSD Hardware Version	N/A

Note: The above information was declared by manufacturer.

1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Cable Loss		True Gain (dBi)	Remark
						Short	Long		
1	MARS	MA-WO36-10N	Dipole	N Type	9.5	0.63	2.08	6.79	CBSD-A
2	Laird	SJS330065-17-001	Dipole	N Type	18	0.63	2.08	15.29	CBSD-B
3	Doodle	ANT-3625-3-O-RP	Dipole	RP-SMA	3	0.63	-	2.37	EUD

Note: The above information was declared by manufacturer.

The EUT support 2TX, 2RX function.

1.3 Support Equipment

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	WLAN AP	Netgear	R7500	PY314300288
B	Switch	Panasonic	Switch-S9GPWR	N/A
C	Notebook	Lenovo	X1 Carbon	N/A
D	Notebook	DELL	E4300	N/A
E	EUD	N/A	RM-3625	2AG87-RM3625
F	Notebook	DELL	E4300	N/A

1.4 Testing Location

Testing Location Information
Test Lab.：Sporton International Inc. Hsinchu Laboratory Hsinchu (TAF: 3787) ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) TEL: 886-3-656-9065 FAX: 886-3-656-9085 Test site Designation No. TW3787 with FCC. Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH01-CB	Jeff Wu	20.6~21.8 / 66~68	May 17, 2022~ Jun. 30, 2022

2 Measurement Environment

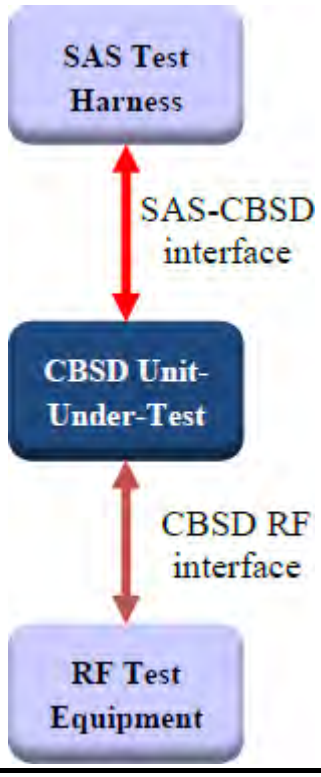
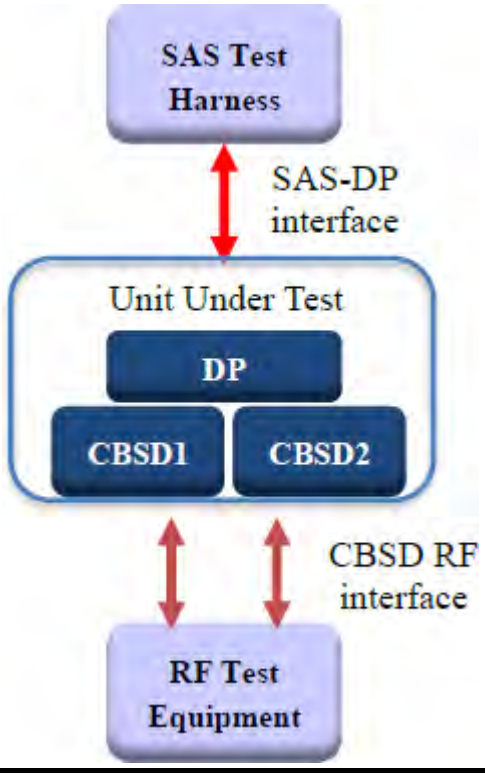
Measurement Environment Information	
Test Harness version	1.0.0.3
Operating System	Microsoft Windows 7 and Windows 10
TLS version	1.2
Python	2.7.18

2.1 Conditional Test Case

☐	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.

Note: The above information was declared by manufacturer.

2.2 Test Configuration

Test configuration without Domain Proxy	Test configuration with Domain Proxy
	

3 Protocol Test Results

3.1 WINNF.FT.C.REG.3 - Single-Step registration for Category A CBSD

#	Test Execution Steps	Results	
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.	PASS	--
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 does 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	PASS	--

3.2 WINNF.FT.C.REG.5 - Single-Step registration for CBSD-B with CPI signed data

#	Test Execution Steps	Results	
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.	PASS	--
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 does 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	PASS	--

3.3 WINNF.FT.C.REG.8 - Missing Required parameters (responseCode 102)

#	Test Execution Steps	Results	
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 does 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	PASS	--

3.4 WINNF.FT.C.REG.10 - Pending registration (responseCode 200)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=200) 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	PASS	--

3.5 WINNF.FT.C.REG.12 - Invalid parameter (responseCode 103)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=103) 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	PASS	--

3.6 WINNF.FT.C.REG.14 - Blacklisted CBSD (responseCode 101)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=101) 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	PASS	--

3.7 WINNF.FT.C.REG.16 - Unsupported SAS protocol version (responseCode 100)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=100) 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	PASS	--

3.8 WINNF.FT.C.REG.18 - Group Error (responseCode 201)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=201) 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	PASS	--

3.9 WINNF.FT.C.REG.20 - Category A CBSD location update

This section is specific to Category A CBSDs that do not require professional installation. The requirement is for the Category A (non-professionally installed) to report to the SAS any location change exceeding a distance of 50m horizontally or 3m vertically within a 60 second window.

#	Test Execution	Results	
1	Report to the SAS any location change exceeding a distance of 50m horizontally within a 60 second window	PASS	--
2	Report to the SAS any location change exceeding a distance of 3m vertically within a 60 second window	PASS	--

3.10 WINNF.FT.C.GRA.1 - Unsuccessful Grant responseCode=400 (INTERFERENCE)

#	Test Execution Steps	Results	
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 does 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	PASS	--

3.11 WINNF.FT.C.GRA.2 - Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

#	Test Execution Steps	Results	
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 does not provide any positive response (*responseCode*=401) 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	PASS	--

3.12 WINNF.FT.C.HBT.1 - Heartbeat Success Case (first Heartbeat Response)

#	Test Execution Steps	Results	
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	PASS	--
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	PASS	--
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 HeartbeatRequest message is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "GRANTED"	PASS	--
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 • *grantId* = G • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0	PASS	--
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.	PASS	--

3.13 WINNF.FT.C.HBT.3 - Heartbeat responseCode=105 (DEREGISTER)

#	Test Execution Steps	Results	
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"	PASS	--
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	PASS	--

3.14 WINNF.FT.C.HBT.4 - Heartbeat responseCode=500 (TERMINATED_GRANT)

#	Test Execution Steps	Results	
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 latest specified heartbeatInterval, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED"	PASS	--
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	PASS	--

3.15 WINNF.FT.C.HBT.5 - Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response

#	Test Execution Steps	Results	
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. Verify Heartbeat Request message is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "GRANTED"	PASS	--
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	PASS	--

3.16 WINNF.FT.C.HBT.6 - Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

#	Test Execution Steps	Results	
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 is sent within latest specified heartbeatInterval, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED"	PASS	--
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	PASS	--

3.17 WINNF.FT.C.HBT.7 - Heartbeat responseCode=502 (UNSYNC_OP_PARAM)

#	Test Execution Steps	Results	
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 is sent within latest specified *heartbeatInterval*, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED"	PASS	--
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.	PASS	--

3.18 WINNF.FT.C.HBT.9 - Heartbeat Response Absent (First Heartbeat)

#	Test Execution Steps	Results	
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"	PASS	--
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	PASS	--

3.19 WINNF.FT.C.HBT.10 - Heartbeat Response Absent (Subsequent Heartbeat)

#	Test Execution Steps	Results	
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 HeartbeatRequest message is sent within the latest specified *heartbeatInterval*, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED"	PASS	--
3	SAS Test Harness sends a Heartbeat Response message, with 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.	PASS	--

3.20 WINNF.FT.C.HBT.11 - Successful Grant Renewal in Heartbeat Test Case

#	Test Execution Steps	Results	
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 • UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface. • Grant has the following parameters at the start of the test: o *grantExpireTime* = UTC time equal to time at start of test + 300 seconds = Tgrant_expire o *transmitExpireTime* = UTC time equal to time at start of test + 200 seconds o *heartbeatInterval* = 60 seconds	--	--
2	UUT sends a Heartbeat Request message. If Heartbeat Request message contains grantRenew = TRUE, go to Step 6, else go to Step 3.	--	--
3	Verify Heartbeat Request message is sent within the latest specified *heartbeatInterval*, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED"	PASS	--
4	SAS Test Harness sends a Heartbeat Response message, with the following parameters: • *cbsdId* = C • *grantId* = G • *transmitExpireTime* = current UTC + 200 seconds • *grantExpireTime* = same as Step 1 • *responseCode* = 0	--	--
5	Go to Step 2	--	--
6	Verify Heartbeat Request message is sent within the latest specified heartbeatInterval, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = "AUTHORIZED" • *grantRenew* = TRUE	PASS	--

7	SAS Test Harness sends a Heartbeat Response message, with the following parameters: • *cbsdId* = C • *grantId* = G • *grantExpireTime* = UTC time set far in the future • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0	--	--
8	Continue to respond to any subsquent Heartbeat Request from CBSD with Heartbeat Response with the following parameters: • *cbsdId* = C • *grantId* = G • *transmitExpireTime* = same as Step 7 • *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.	PASS	--

3.21 WINNF.FT.C.RLQ.1 - Successful Relinquishment

#	Test Execution Steps	Results	
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	PASS	--
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	PASS	--

3.22 WINNF.FT.C.RLQ.3 - Unsuccessful Relinquishment, responseCode=102

#	Test Execution Steps	Results	
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 send a Relinquishment Response message with parameters: • *cbsdId* = C • No *grantId* • *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 stopped RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request	PASS	--

3.23 WINNF.FT.C.RLQ.5 - Unsuccessful Relinquishment, responseCode=103

#	Test Execution Steps	Results	
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 send a Relinquishment Response message with parameters: • *cbsdId* = C • No *grantId* • *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=103) 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 stopped RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request	PASS	--

3.24 WINNF.FT.C.DRG.1 - Successful Deregistration

#	Test Execution Steps	Results	
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.	PASS	--
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	PASS	--

3.25 WINNF.FT.C.DRG.3 - Deregistration responseCode=102

#	Test Execution Steps	Results	
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	The SAS Test Harness sends the Deregistration Response Message to UUT with: • No *cbsdId* • *responseCode* = 102	--	--
5	After completion of step 3, SAS Test Harness will not provide any 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	PASS	--

3.26 WINNF.FT.C.DRG.5 - Deregistration responseCode=103

#	Test Execution Steps	Results	
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	The SAS Test Harness sends the Deregistration Response Message to UUT with: • No *cbsdId* • *responseCode* = 103	--	--
5	After completion of step 3, SAS Test Harness will not provide any 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	PASS	--

3.27 WINNF.FT.C.SCS.1 - Successful TLS connection between UUT and SAS Test Harness

#	Test Execution Steps	Results	
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	PASS	--

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
		PASS	--

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*.	PASS	--
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	PASS	--

3.28 WINNF.FT.C.SCS.2 - TLS failure due to revoked certificate

#	Test Execution Steps	Results	
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS	--
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.	PASS	--
3	UUT may retry for the security procedure which shall fail	PASS	--
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	PASS	--

3.29 WINNF.FT.C.SCS.3 - TLS failure due to expired server certificate

#	Test Execution Steps	Results	
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS	--
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.	PASS	--
3	UUT may retry for the security procedure which shall fail.	PASS	--
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	PASS	--

3.30 WINNF.FT.C.SCS.4 - TLS failure when SAS Test Harness certificate is issued by an unknown CA

#	Test Execution Steps	Results	
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS	--
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.	PASS	--
3	UUT may retry for the security procedure which shall fail.	PASS	--
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	PASS	--

3.31 WINNF.FT.C.SCS.5 - TLS failure when certificate at the SAS Test Harness is corrupted

#	Test Execution Steps	Results	
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS	--
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.	PASS	--
3	UUT may retry for the security procedure which shall fail.	PASS	--
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	PASS	--

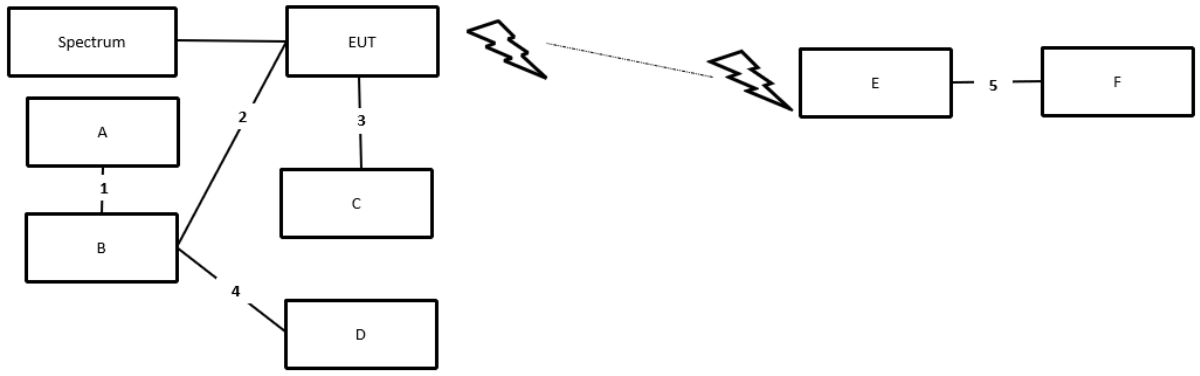
3.32 WINNF.PT.C.HBT.1 - UUT RF Transmit Power Measurement

For Category A:

Items	Parameters
Maximum rated power (EIRP, dBm/MHz)	15
Transmit dynamic range (EIRP, dBm/MHz)	1dB increments from 12 dBm/MHz to 15 dBm/MHz (4 steps)
Occupied bandwidth (OBW)	10MHz
maxEirp values	15

For Category B:

Items	Parameters
Maximum rated power (EIRP, dBm/MHz)	23
Transmit dynamic range (EIRP, dBm/MHz)	1dB increments from 20 dBm/MHz to 23 dBm/MHz (4 steps)
Occupied bandwidth (OBW)	10MHz
maxEirp values	23



Item	Connection	Shielded	Length
1	RJ-45 cable	No	1.5m
2	RJ-45 cable	No	1.5m
3	RJ-45 cable	No	1.5m
4	RJ-45 cable	No	1.5m
5	RJ-45 cable	No	1.5m

Note: To ensure EUT transmits with full power across the Bandwidth during the on duration of duty cycle, EUT is running maximum traffic during the test.

For Category A:

Spectrum Analyzer Setting	Parameters
Center Frequency	3555MHz
Frequency Span	20MHz
RBW / VBW	1 MHz / 3MHz
Channel Power Meas Bandwidth	10MHz
Sweep Time	1ms

For Category B:

Spectrum Analyzer Setting	Parameters
Center Frequency	3555MHz
Frequency Span	20MHz
RBW / VBW	1 MHz / 3MHz
Channel Power Meas Bandwidth	10MHz
Sweep Time	1ms

#	Test Execution Steps	Results	
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 = F_L, highFrequency = F_H, maxEirp = P_i}, 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, P_i. 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.*	PASS	--

For Category A:

Frequency (MHz)	Bandwidth	Antenna Gain	Conducted PSD		maxEirp	Grant maxEirp	Result
			PORT ANT 0	PORT ANT 1			
	(MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dBm/MHz)	(dBm/MHz)	
3555	10	9.5	-1.493	-2.05	10.75	12	PASS
3555	10	9.5	-0.2618	-0.39	12.18	13	PASS
3555	10	9.5	2.39	1.357	14.41	15	PASS

For Category B:

Frequency (MHz)	Bandwidth	Antenna Gain	Conducted PSD		maxEirp	Grant maxEirp	Result
			PORT ANT 0	PORT ANT 1			
	(MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dBm/MHz)	(dBm/MHz)	
3555	10	18	-3.039	-2.413	18.30	20	PASS
3555	10	18	-1.92	-1.617	19.24	21	PASS
3555	10	18	-0.3743	0.6517	21.18	23	PASS

4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Signal analyzer	Agilent	N9010A	MY52220519	10kHz~44GHz	Mar. 18, 2022	Mar. 17, 2023	Conducted (TH01-CB)
Signal analyzer	Keysight	N9020A	MY55400138	10 Hz up to 26.5 GHz	Jan. 25, 2022	Jan. 24, 2023	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-30	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
Cable	Woken	RG402	low Cable-30	9 kHz –1 GHz	Mar. 04, 2022	Mar. 03, 2023	Conducted (TH01-CB)
RF Power Divider	Woken	4 Way	TH01-DV-01	1GHz ~ 6GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Power Divider	STI	2 Way	DV-2way-01	1GHz ~ 8GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

5 Measurement Uncertainty

Before Jun. 01, 2022

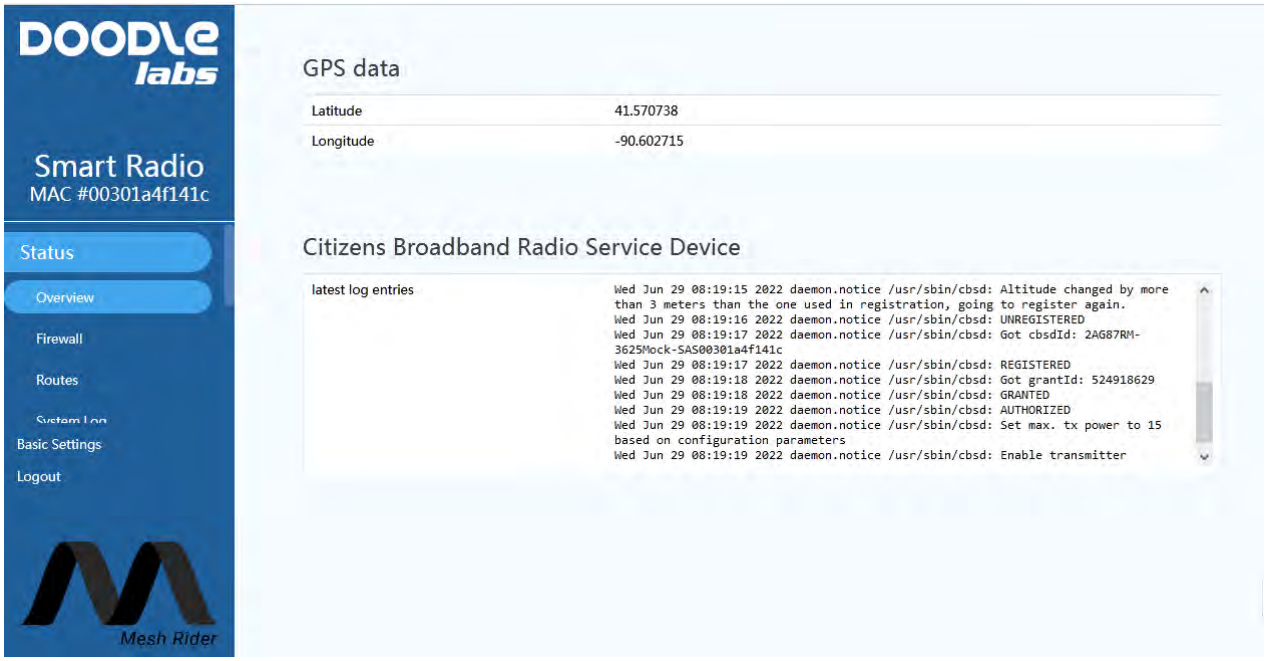
Test Items	Uncertainty	Remark
Conducted Emission	2.5 dB	Confidence levels of 95%

After May 31, 2022

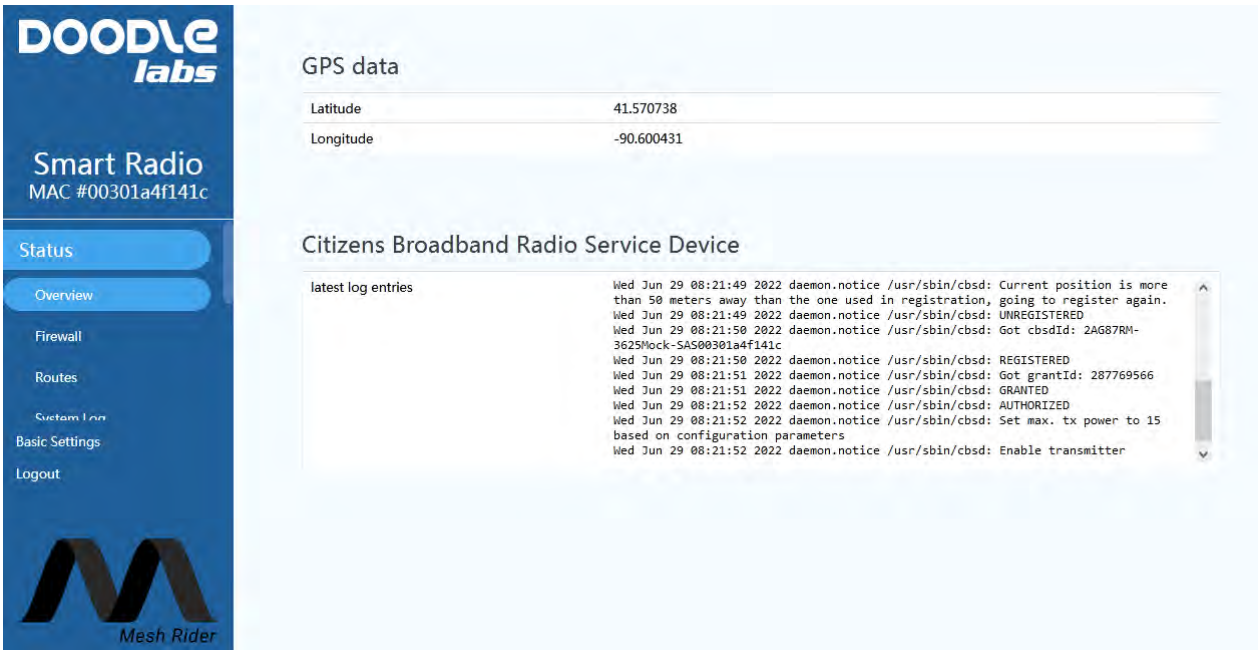
Test Items	Uncertainty	Remark
Conducted Emission	3.2 dB	Confidence levels of 95%

For Category A:

Category A CBSD location update plot for WINNF.FT.C.REG.20 Test Case ID
Vertical Change



Horizontal Change



Test Log for WINNF.FT.C.REG.20 Test Case ID

2022-06-29T08:17:51.039Z - INFO - registration request from CBRS : {


```
"registrationRequest": [
    {
        "airInterface": {
            "radioTechnology": "DOODLE_CBRS"
        },
        "cbsdCategory": "A",
        "cbsdSerialNumber": "00301a4f141c",
        "fccId": "2AG87RM-3625",
        "installationParam": {
            "antennaGain": 10,
            "height": 212,
            "heightType": "AMSL",
            "indoorDeployment": false,
            "latitude": 41.570738,
            "longitude": -90.602715
        },
        "userId": "7U5MDL"
    }
]
}
```


2022-06-29T08:17:51.082Z - INFO - engine sent successfully, the response to CBRS : {


```
"registrationResponse": [
    {
        "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
        "response": {
            "responseCode": 0
        }
    }
]
}
```


2022-06-29T08:17:52.148Z - INFO - grant request from CBRS : {


```
"grantRequest": [
    {
        "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
        "operationParam": {
            "maxEirp": 12,
            "operationFrequencyRange": {
                "highFrequency": 3610000000,
                "lowFrequency": 3600000000
            }
        }
    }
]
}
```


2022-06-29T08:17:52.154Z - INFO - engine sent successfully, the response to CBRS : {


```
"grantResponse": [
    {
        "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
        "channelType": "GAA",
```

```
                "grantExpireTime": "2022-07-06T08:17:52Z",
                "grantId": "263463150",
                "heartbeatInterval": 60,
                "response": {
                    "responseCode": 0
                }
            }
        ]
    }
    2022-06-29T08:17:53.167Z - INFO - heartbeat request from CBRS    : {
        "heartbeatRequest": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "263463150",
                "operationState": "GRANTED"
            }
        ]
    }
    2022-06-29T08:17:53.180Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "263463150",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:21:13Z"
            }
        ]
    }
    2022-06-29T08:18:58.328Z - INFO - heartbeat request from CBRS    : {
        "heartbeatRequest": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "263463150",
                "operationState": "AUTHORIZED"
            }
        ]
    }
    2022-06-29T08:18:58.335Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "263463150",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:22:18Z"
            }
        ]
    }
```

```
2022-06-29T08:19:16.450Z - INFO - relinquishment request from CBRS    : {
    "relinquishmentRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "grantId": "263463150"
        }
    ]
}
2022-06-29T08:19:16.456Z - INFO - engine sent successfully, the response to CBRS    : {
    "relinquishmentResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "grantId": "263463150",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:19:16.467Z - INFO - deregistration request from CBRS    : {
    "deregistrationRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c"
        }
    ]
}
2022-06-29T08:19:16.476Z - INFO - engine sent successfully, the response to CBRS    : {
    "deregistrationResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:19:17.530Z - INFO - registration request from CBRS    : {
    "registrationRequest": [
        {
            "airInterface": {
                "radioTechnology": "DOODLE_CBRS"
            },
            "cbsdCategory": "A",
            "cbsdSerialNumber": "00301a4f141c",
            "fccId": "2AG87RM-3625",
            "installationParam": {
                "antennaGain": 10,
                "height": 216,
                "heightType": "AMSL",
                "indoorDeployment": false,
                "latitude": 41.570738,
```

```
                "longitude": -90.602715
            },
            "userId": "7U5MDL"
        }
    ]
}
2022-06-29T08:19:17.569Z - INFO - engine sent successfully, the response to CBRS    : {
    "registrationResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:19:18.584Z - INFO - grant request from CBRS    : {
    "grantRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "operationParam": {
                "maxEirp": 12,
                "operationFrequencyRange": {
                    "highFrequency": 3610000000,
                    "lowFrequency": 3600000000
                }
            }
        }
    ]
}
2022-06-29T08:19:18.591Z - INFO - engine sent successfully, the response to CBRS    : {
    "grantResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "channelType": "GAA",
            "grantExpireTime": "2022-07-06T08:19:18Z",
            "grantId": "524918629",
            "heartbeatInterval": 60,
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:19:19.602Z - INFO - heartbeat request from CBRS    : {
    "heartbeatRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "grantId": "524918629",
            "operationState": "GRANTED"
        }
```

```
        ]
    }
    2022-06-29T08:19:19.611Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "524918629",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:22:39Z"
            }
        ]
    }
    2022-06-29T08:20:24.144Z - INFO - heartbeat request from CBRS    : {
        "heartbeatRequest": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "524918629",
                "operationState": "AUTHORIZED"
            }
        ]
    }
    2022-06-29T08:20:24.151Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "524918629",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:23:44Z"
            }
        ]
    }
    2022-06-29T08:21:16.237Z - INFO - heartbeat request from CBRS    : {
        "heartbeatRequest": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "524918629",
                "operationState": "AUTHORIZED"
            }
        ]
    }
    2022-06-29T08:21:16.246Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "524918629",
                "response": {
                    "responseCode": 0
```

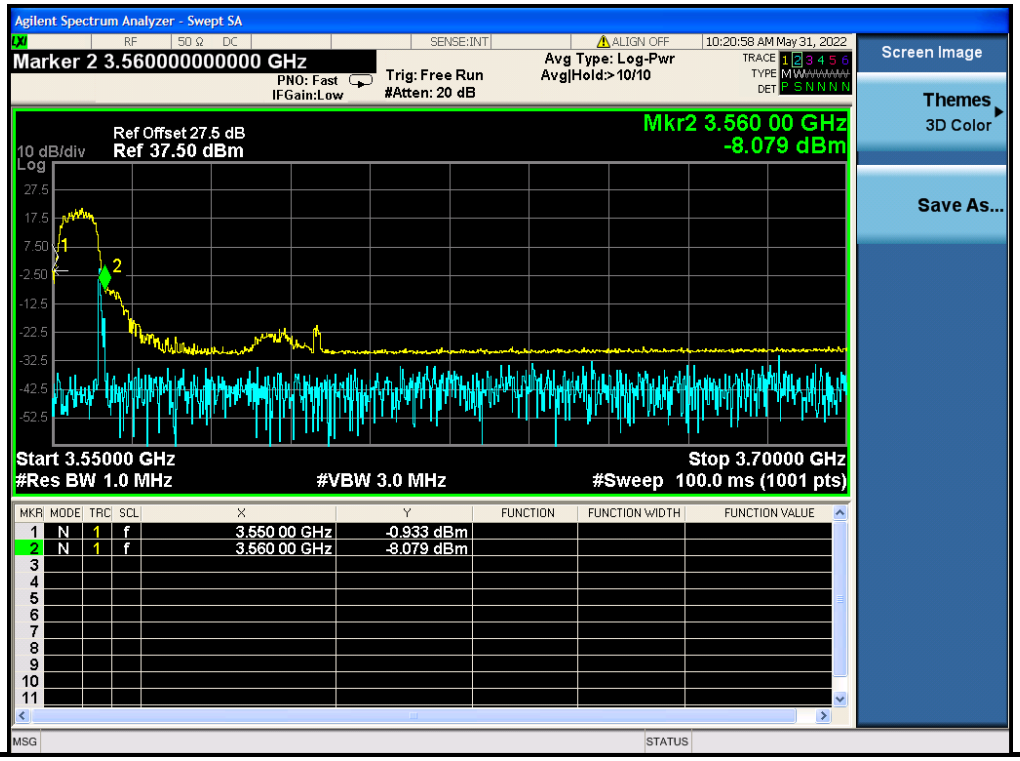
```
            },
            "transmitExpireTime": "2022-06-29T08:24:36Z"
        }
    ]
}
2022-06-29T08:21:49.996Z - INFO - relinquishment request from CBRS    : {
    "relinquishmentRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "grantId": "524918629"
        }
    ]
}
2022-06-29T08:21:50.003Z - INFO - engine sent successfully, the response to CBRS    : {
    "relinquishmentResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "grantId": "524918629",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:21:50.015Z - INFO - deregistration request from CBRS    : {
    "deregistrationRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c"
        }
    ]
}
2022-06-29T08:21:50.019Z - INFO - engine sent successfully, the response to CBRS    : {
    "deregistrationResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:21:51.075Z - INFO - registration request from CBRS    : {
    "registrationRequest": [
        {
            "airInterface": {
                "radioTechnology": "DOODLE_CBRS"
            },
            "cbsdCategory": "A",
            "cbsdSerialNumber": "00301a4f141c",
            "fccId": "2AG87RM-3625",
            "installationParam": {
```

```
                "antennaGain": 10,
                "height": 216,
                "heightType": "AMSL",
                "indoorDeployment": false,
                "latitude": 41.570738,
                "longitude": -90.600431
            },
            "userId": "7U5MDL"
        }
    ]
}
2022-06-29T08:21:51.115Z - INFO - engine sent successfully, the response to CBRS    : {
    "registrationResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:21:52.127Z - INFO - grant request from CBRS    : {
    "grantRequest": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "operationParam": {
                "maxEirp": 12,
                "operationFrequencyRange": {
                    "highFrequency": 3610000000,
                    "lowFrequency": 3600000000
                }
            }
        }
    ]
}
2022-06-29T08:21:52.138Z - INFO - engine sent successfully, the response to CBRS    : {
    "grantResponse": [
        {
            "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
            "channelType": "GAA",
            "grantExpireTime": "2022-07-06T08:21:52Z",
            "grantId": "287769566",
            "heartbeatInterval": 60,
            "response": {
                "responseCode": 0
            }
        }
    ]
}
2022-06-29T08:21:53.148Z - INFO - heartbeat request from CBRS    : {
    "heartbeatRequest": [
```

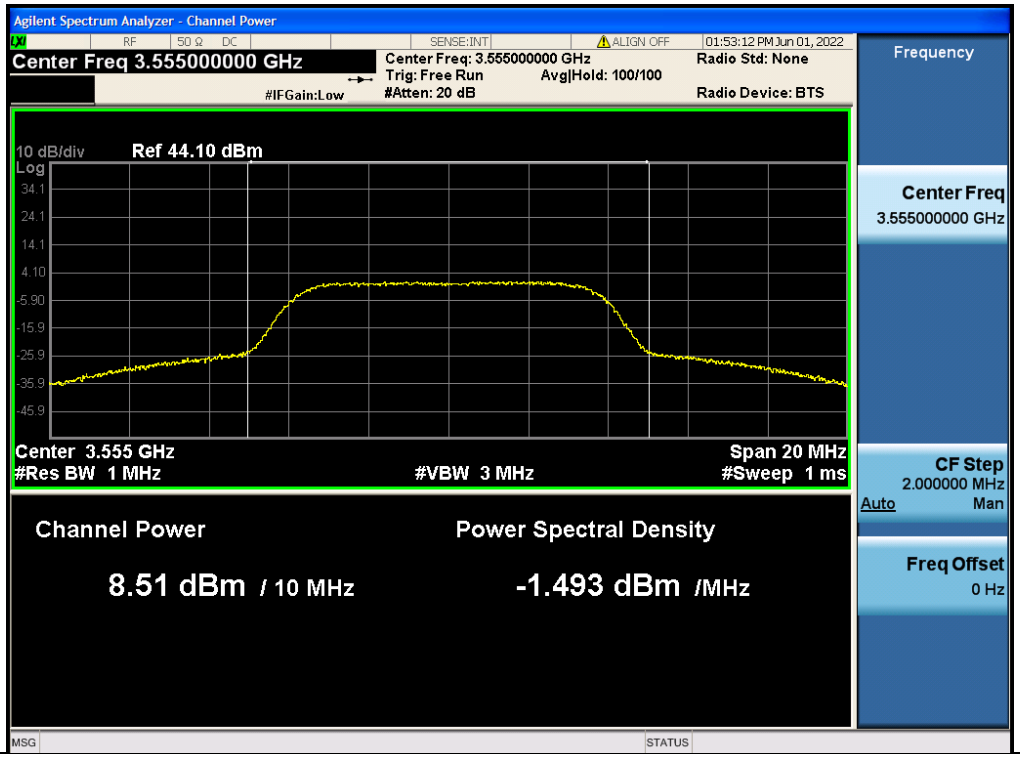
```
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "287769566",
                "operationState": "GRANTED"
            }
        ]
    }
    2022-06-29T08:21:53.154Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "287769566",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:25:13Z"
            }
        ]
    }
    2022-06-29T08:22:56.137Z - INFO - heartbeat request from CBRS    : {
        "heartbeatRequest": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "287769566",
                "operationState": "AUTHORIZED"
            }
        ]
    }
    2022-06-29T08:22:56.144Z - INFO - engine sent successfully, the response to CBRS    : {
        "heartbeatResponse": [
            {
                "cbsdId": "2AG87RM-3625Mock-SAS00301a4f141c",
                "grantId": "287769566",
                "response": {
                    "responseCode": 0
                },
                "transmitExpireTime": "2022-06-29T08:26:16Z"
            }
        ]
    }
```

For Category A:

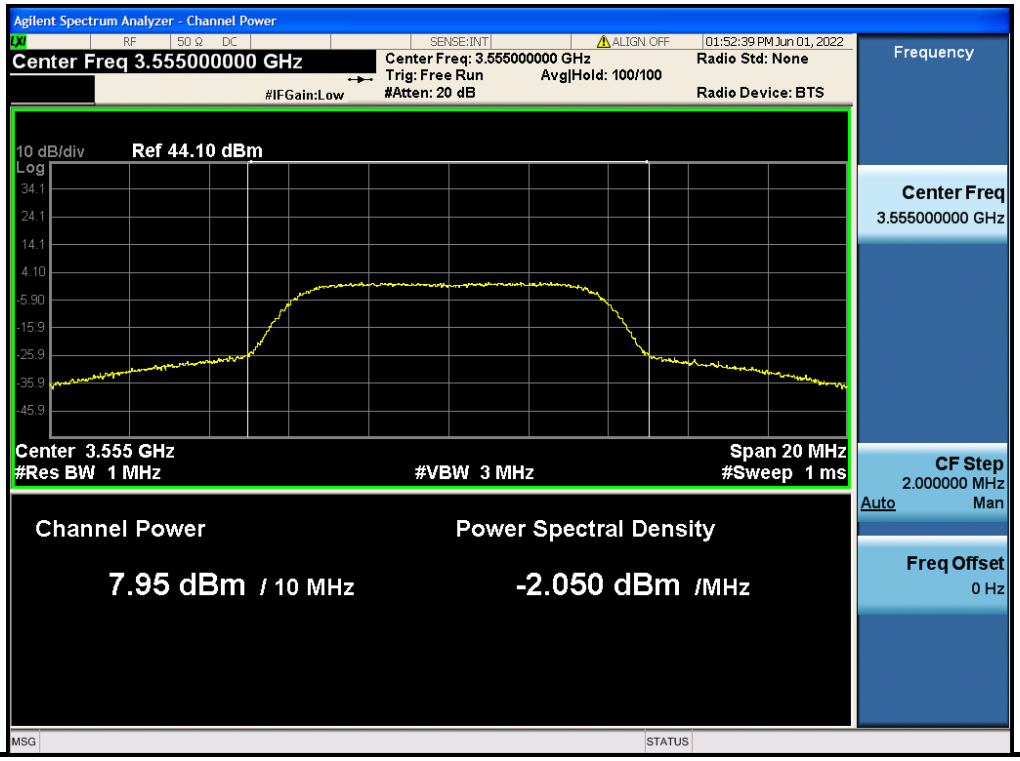
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID



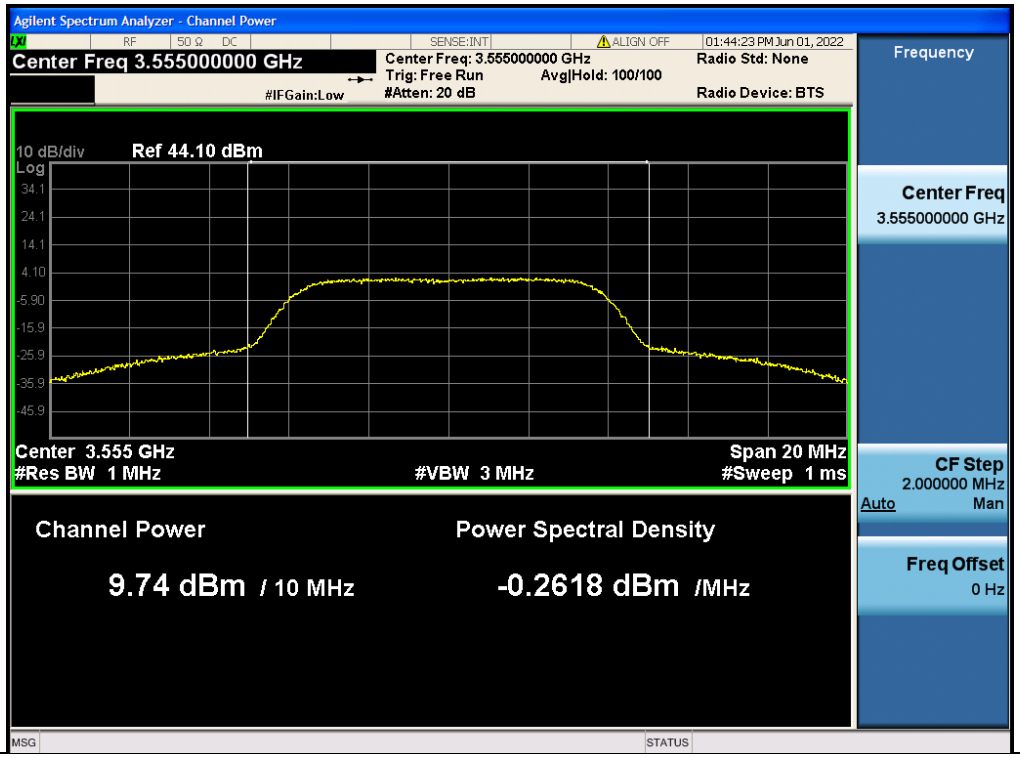
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 12_Ant.1



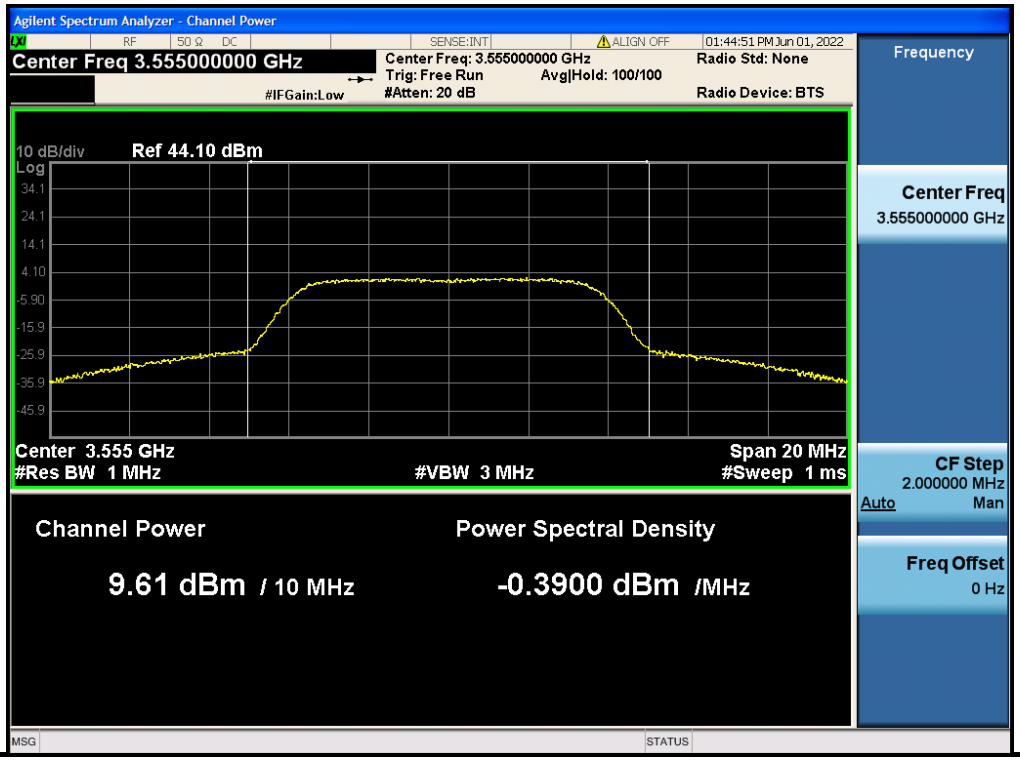
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 12_Ant.2



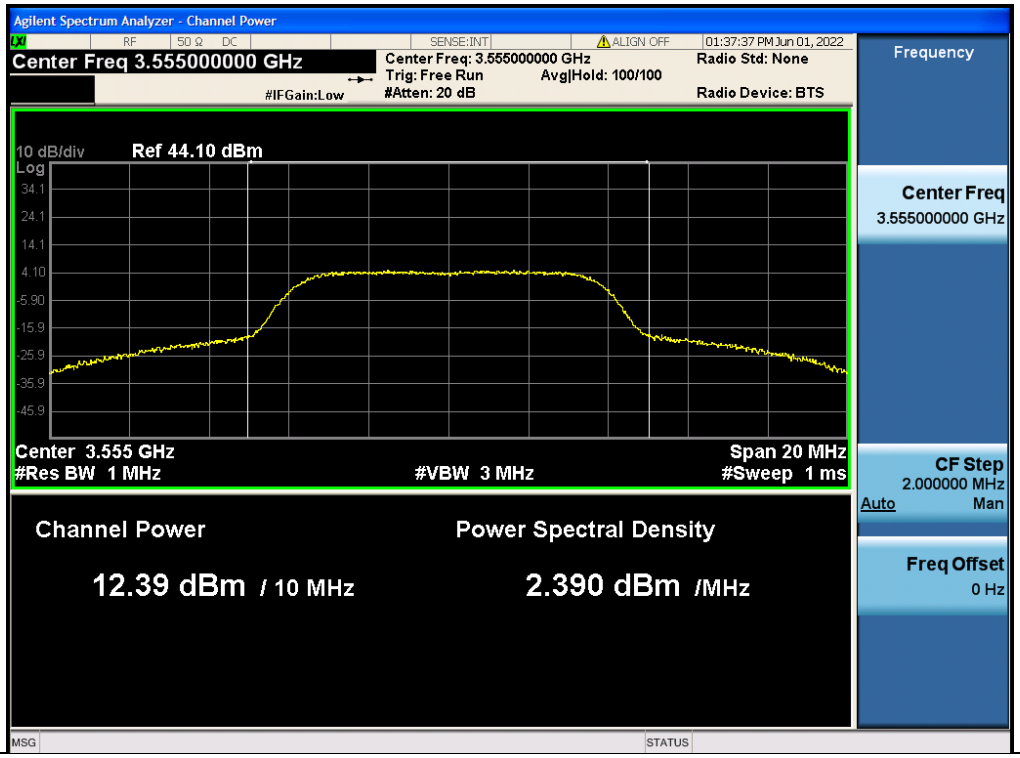
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 13_Ant.1



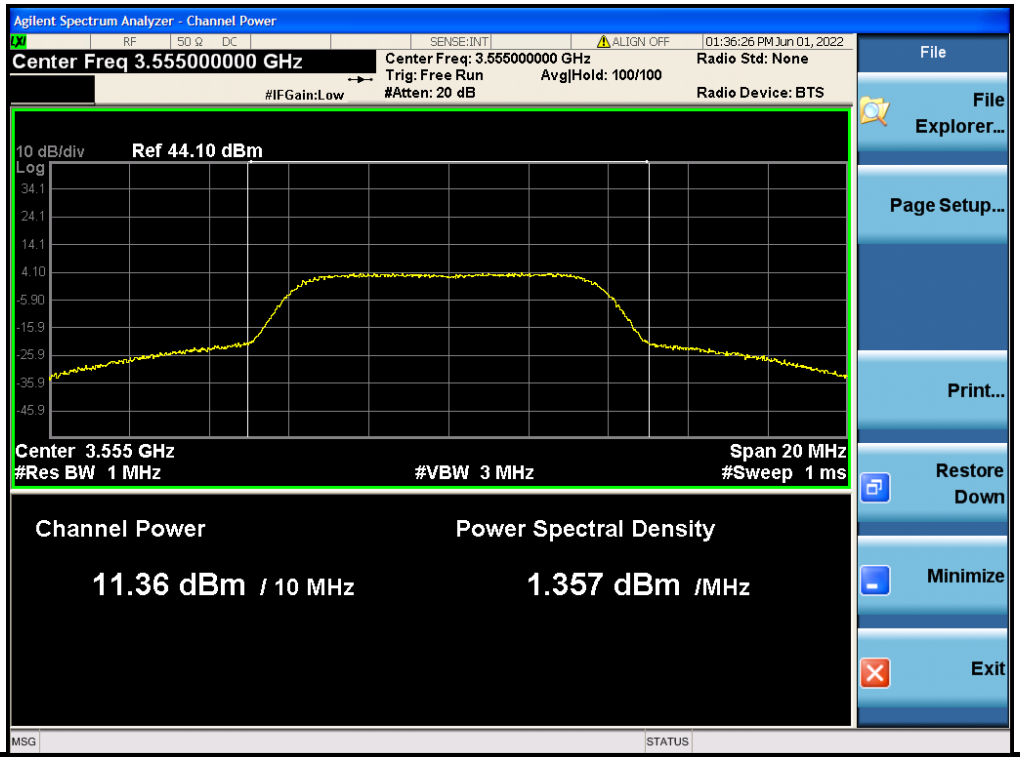
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 13_Ant.2



RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 15_Ant.1

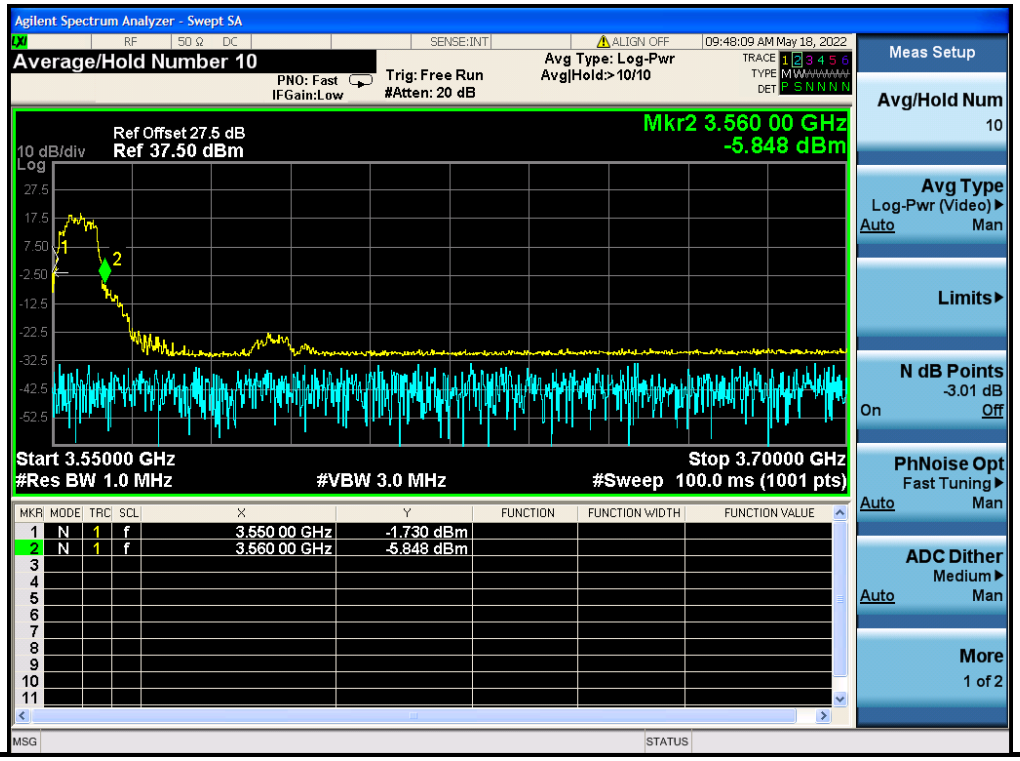


RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 15_Ant.2

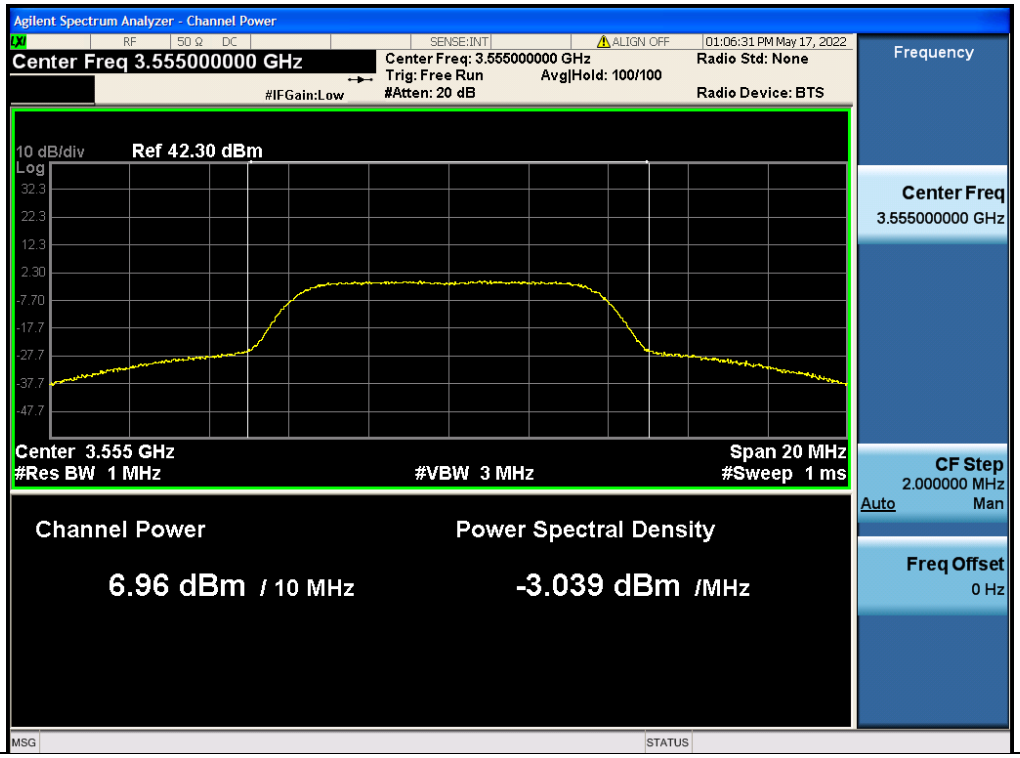


For Category B:

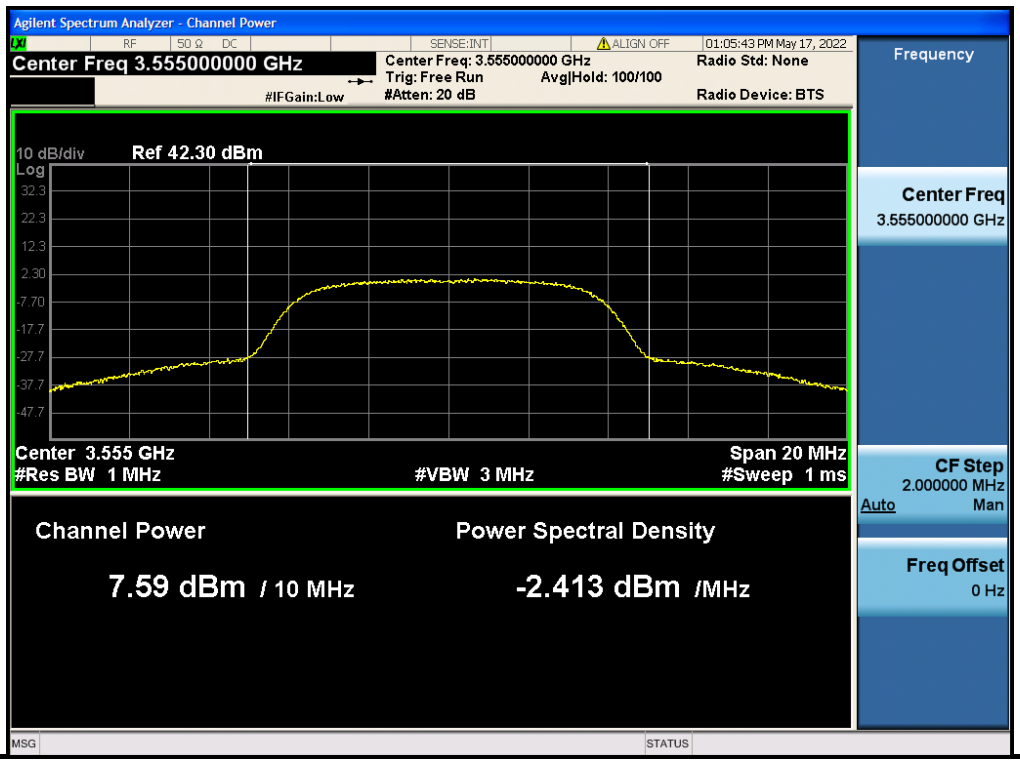
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID



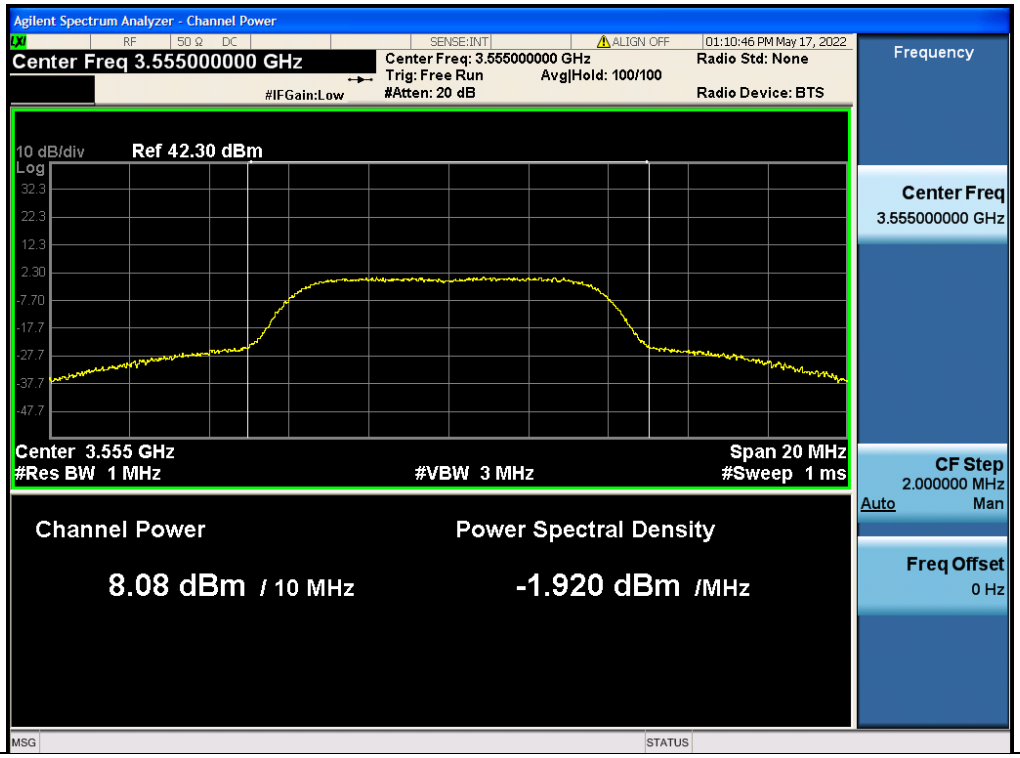
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 20_Ant.1



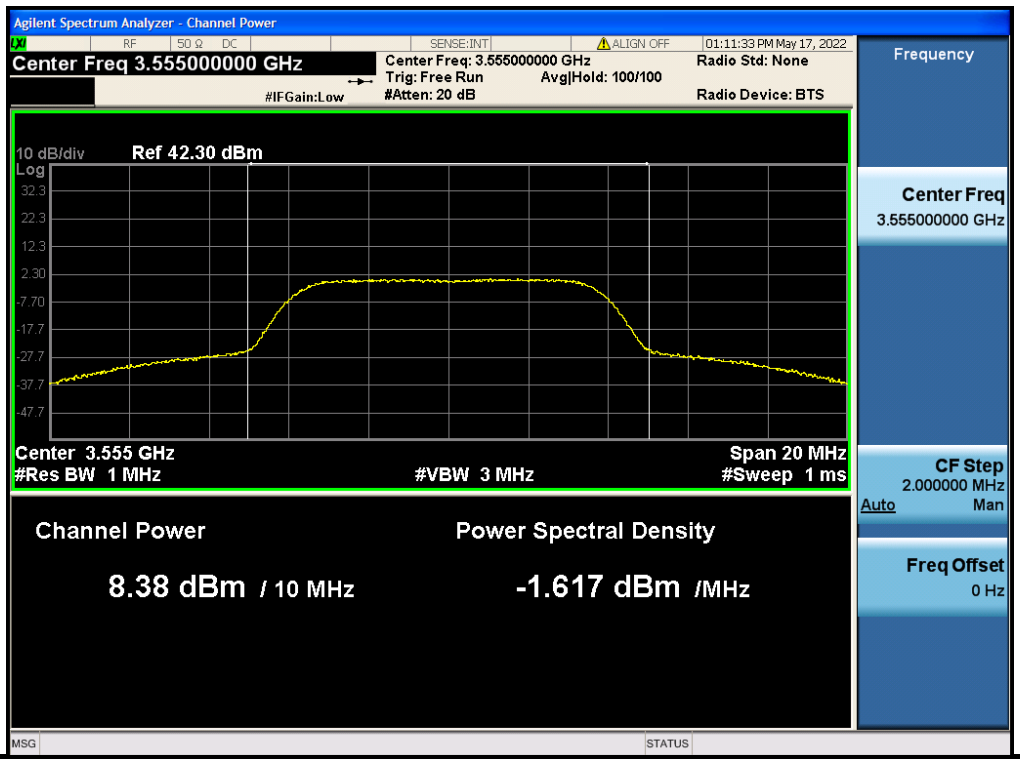
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 20_Ant.2



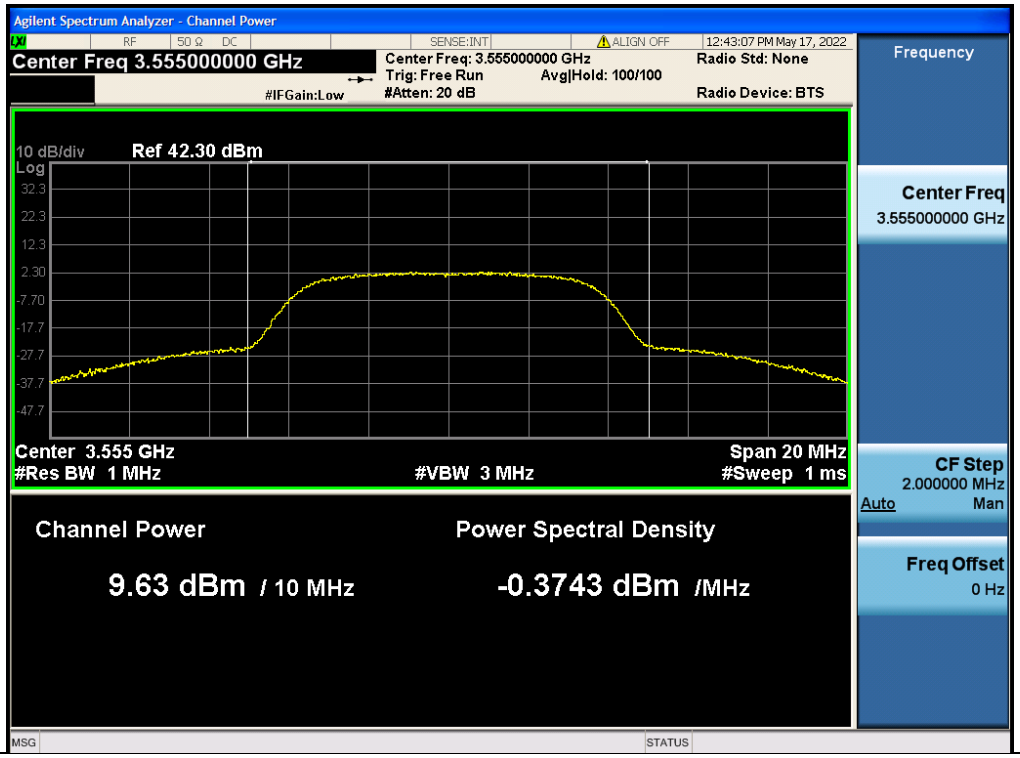
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 21_Ant.1



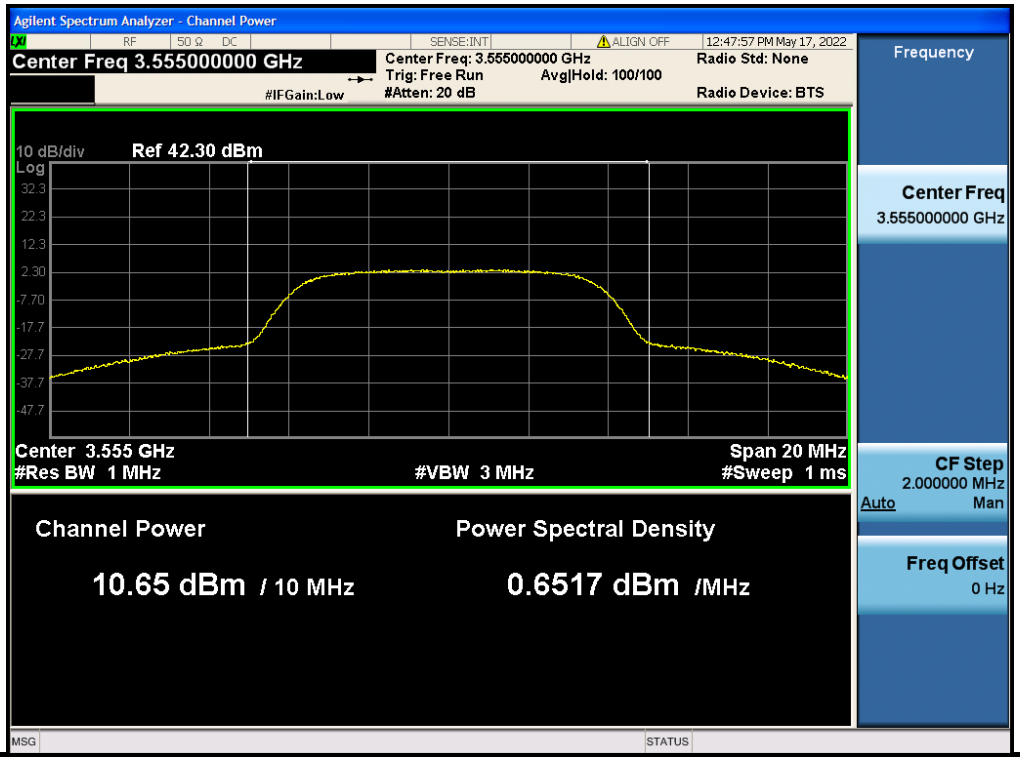
RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 21_Ant.2



RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 23_Ant.1

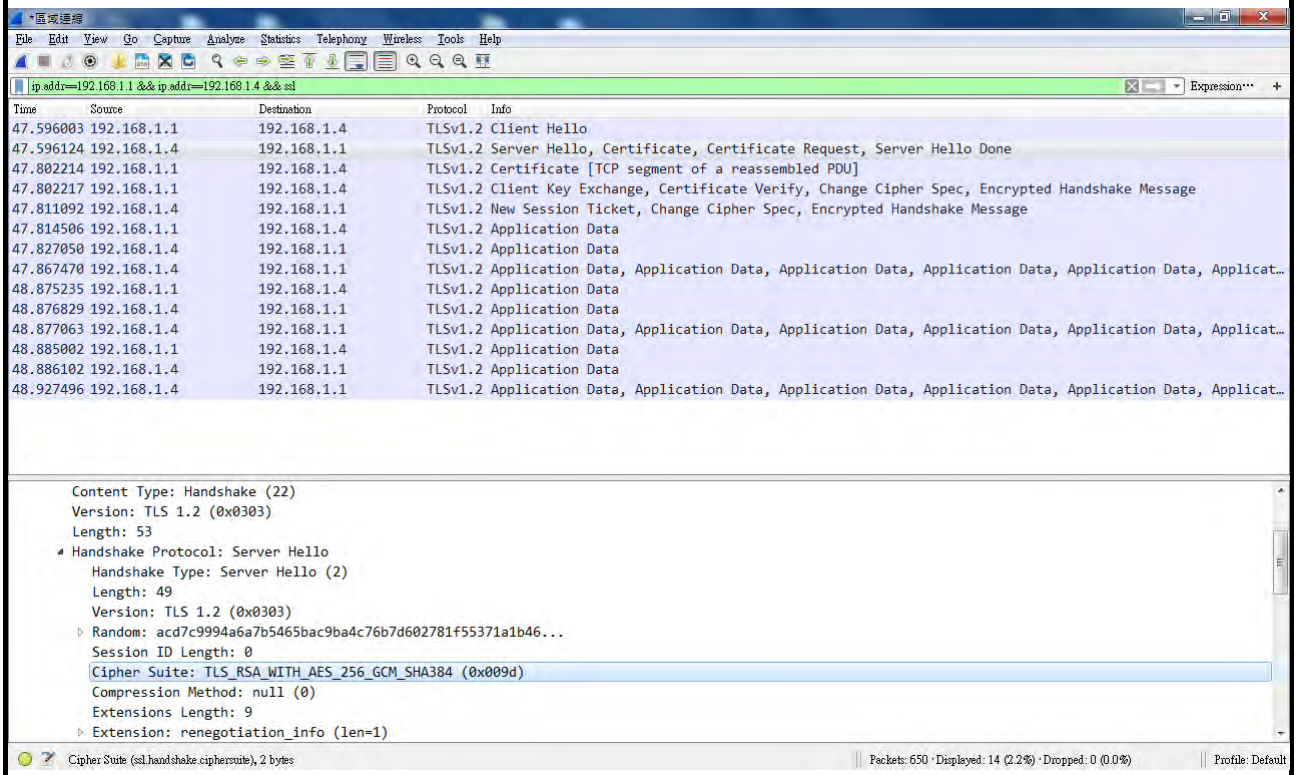


RF measurement plot for WINNF.PT.C.HBT.1 Test Case ID_BW10M_Grant maxEirp 23_Ant.2

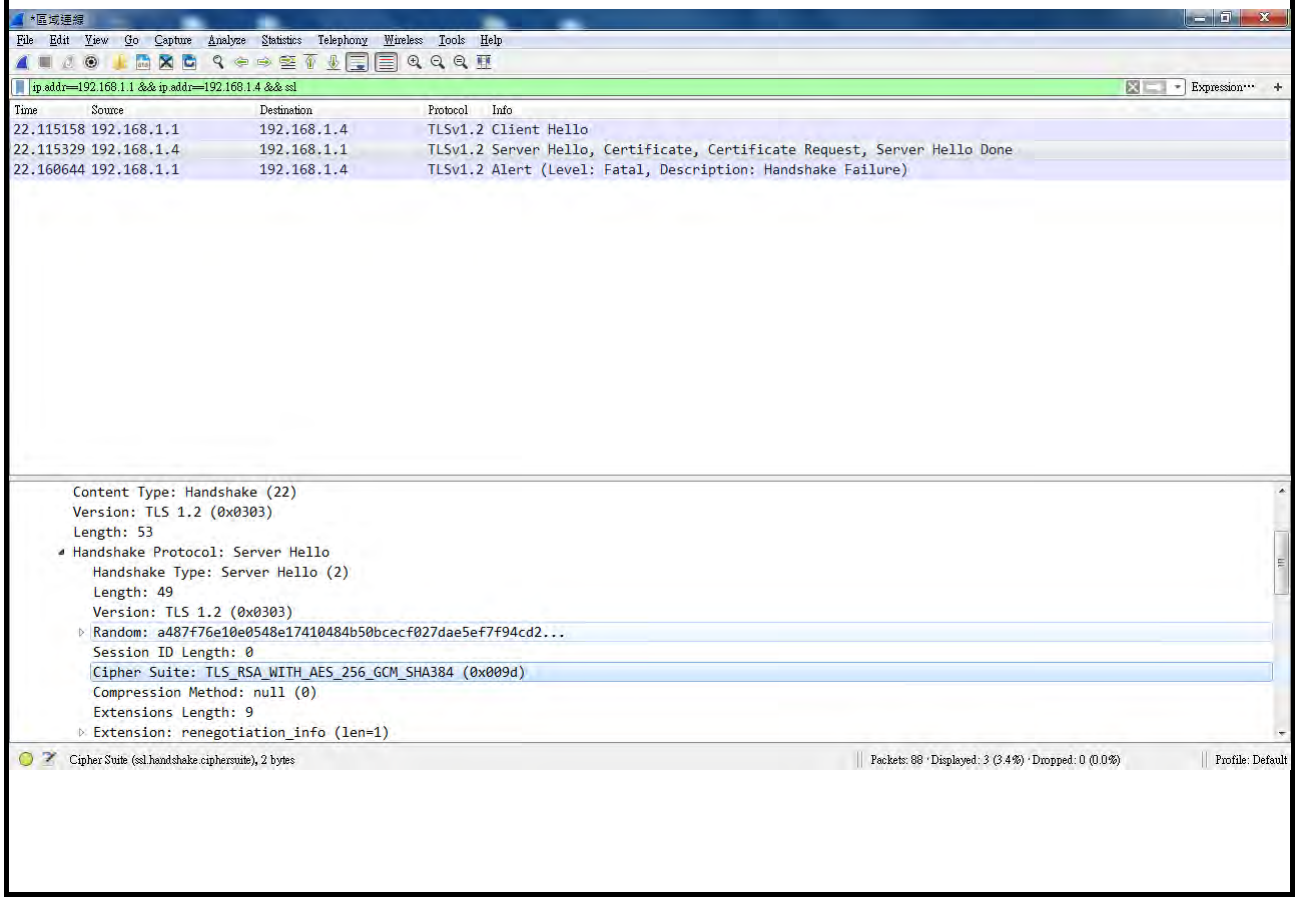


For Category A:

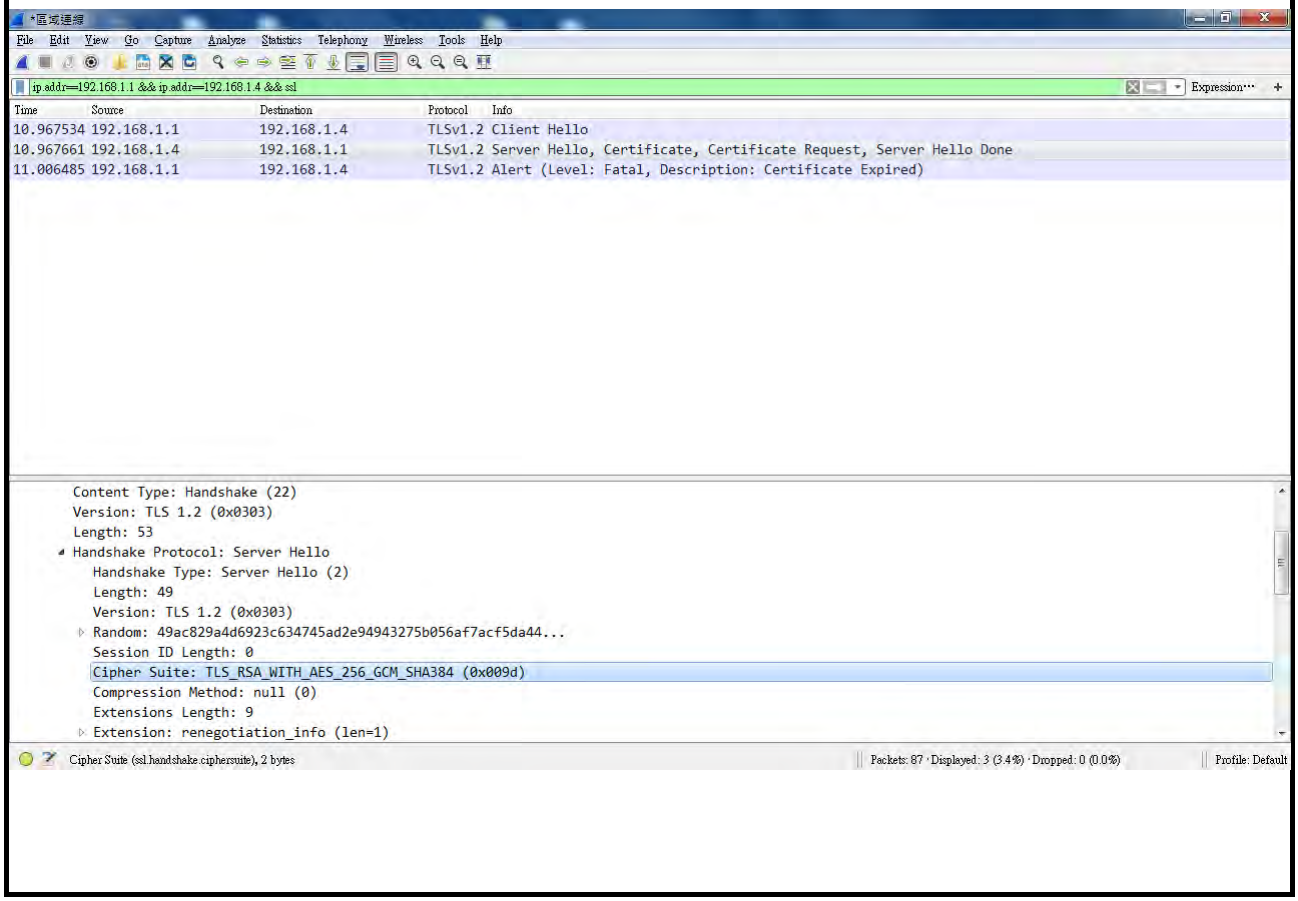
Wireshark Plots for WINNF.FT.C.SCS.1 Test Case ID



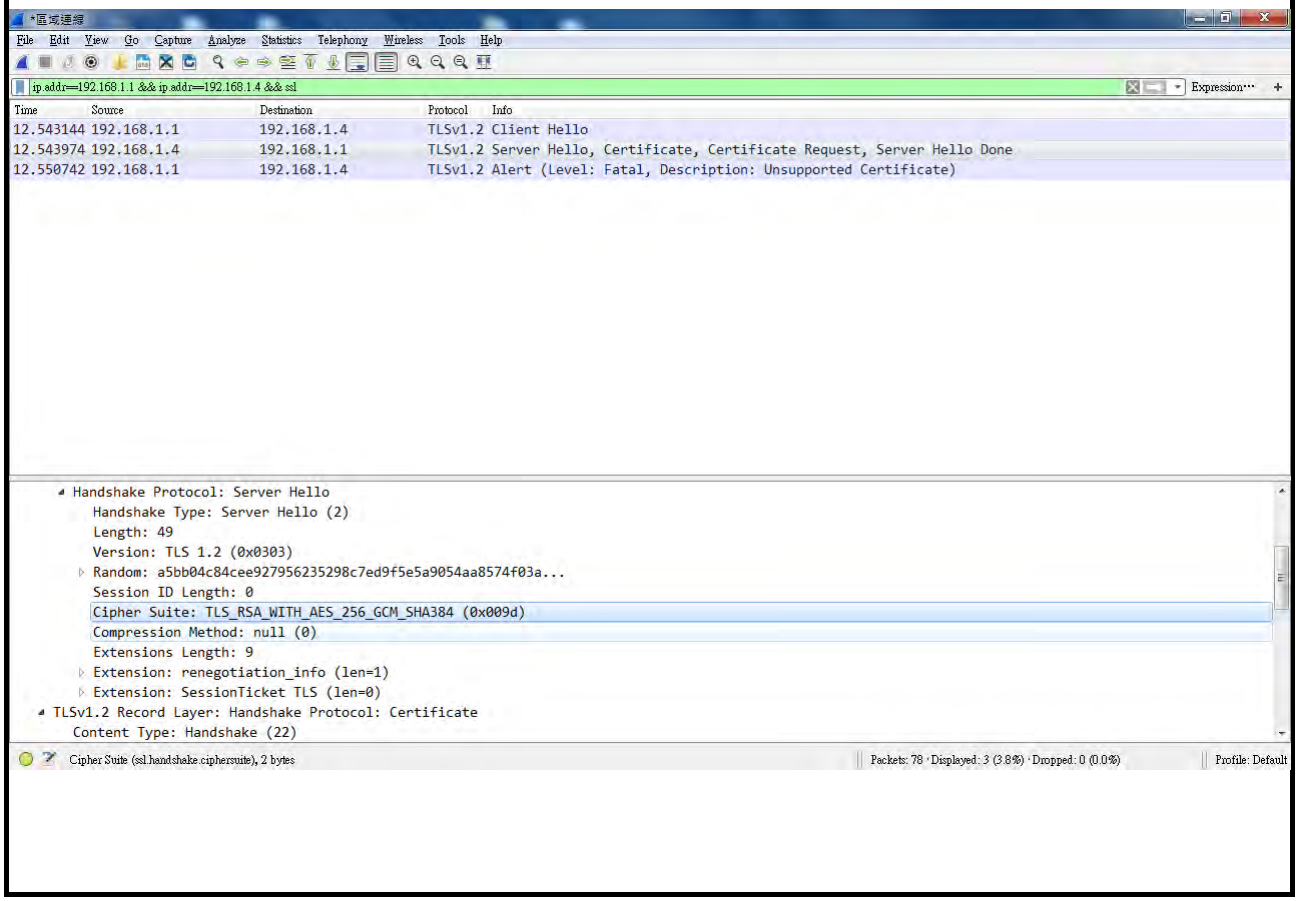
Wireshark Plots for WINNF.FT.C.SCS.2 Test Case ID



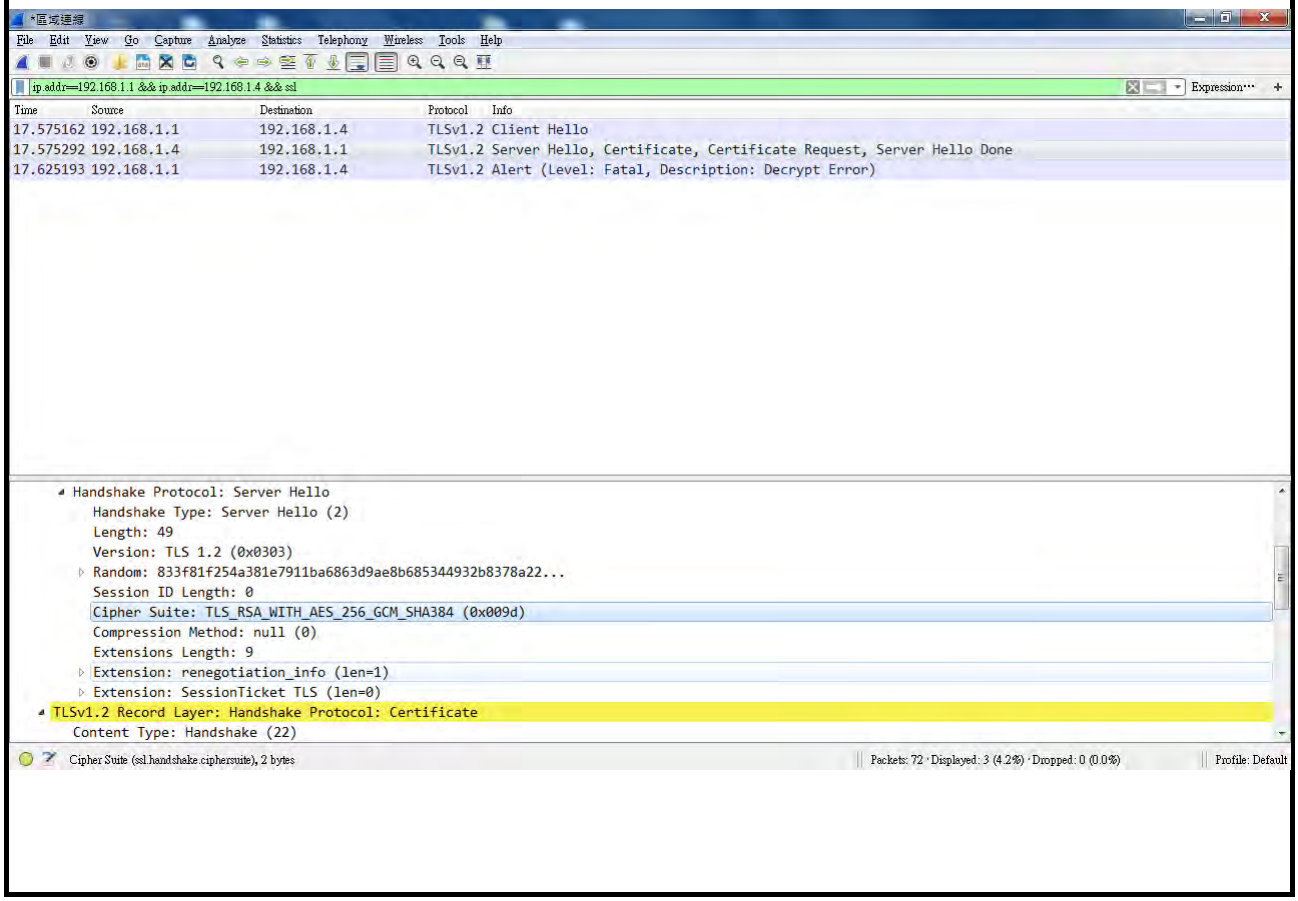
Wireshark Plots for WINNF.FT.C.SCS.3 Test Case ID



Wireshark Plots for WINNF.FT.C.SCS.4 Test Case ID

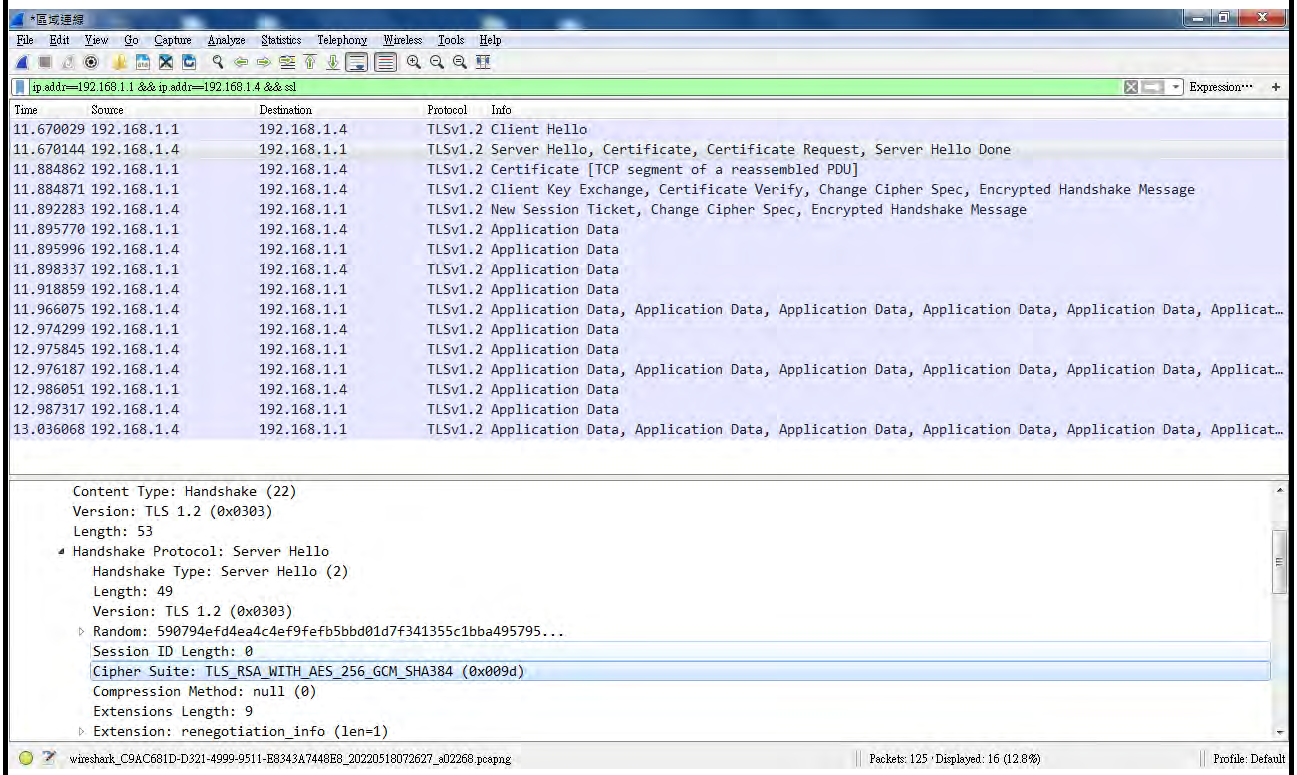


Wireshark Plots for WINNF.FT.C.SCS.5 Test Case ID

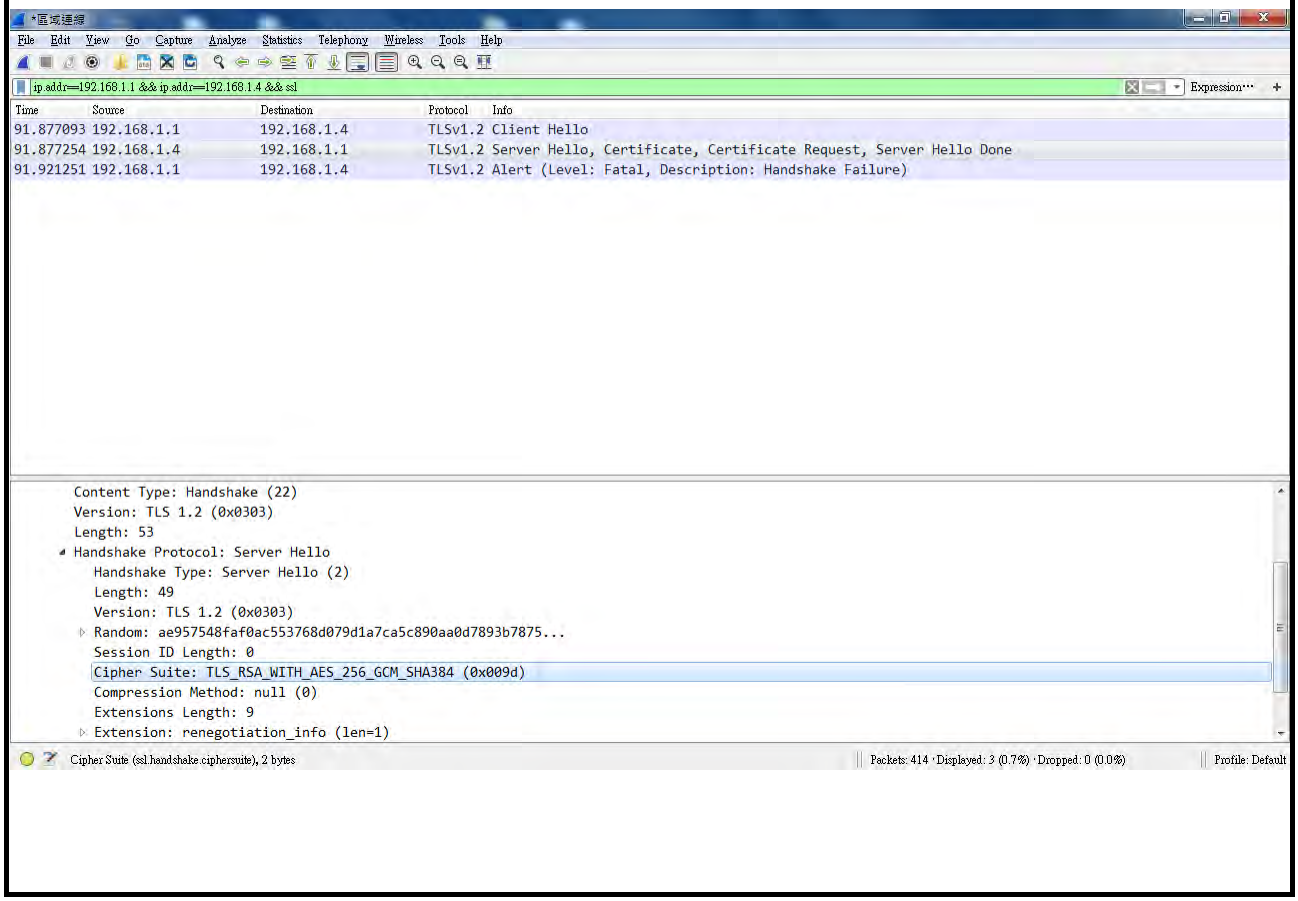


For Category B:

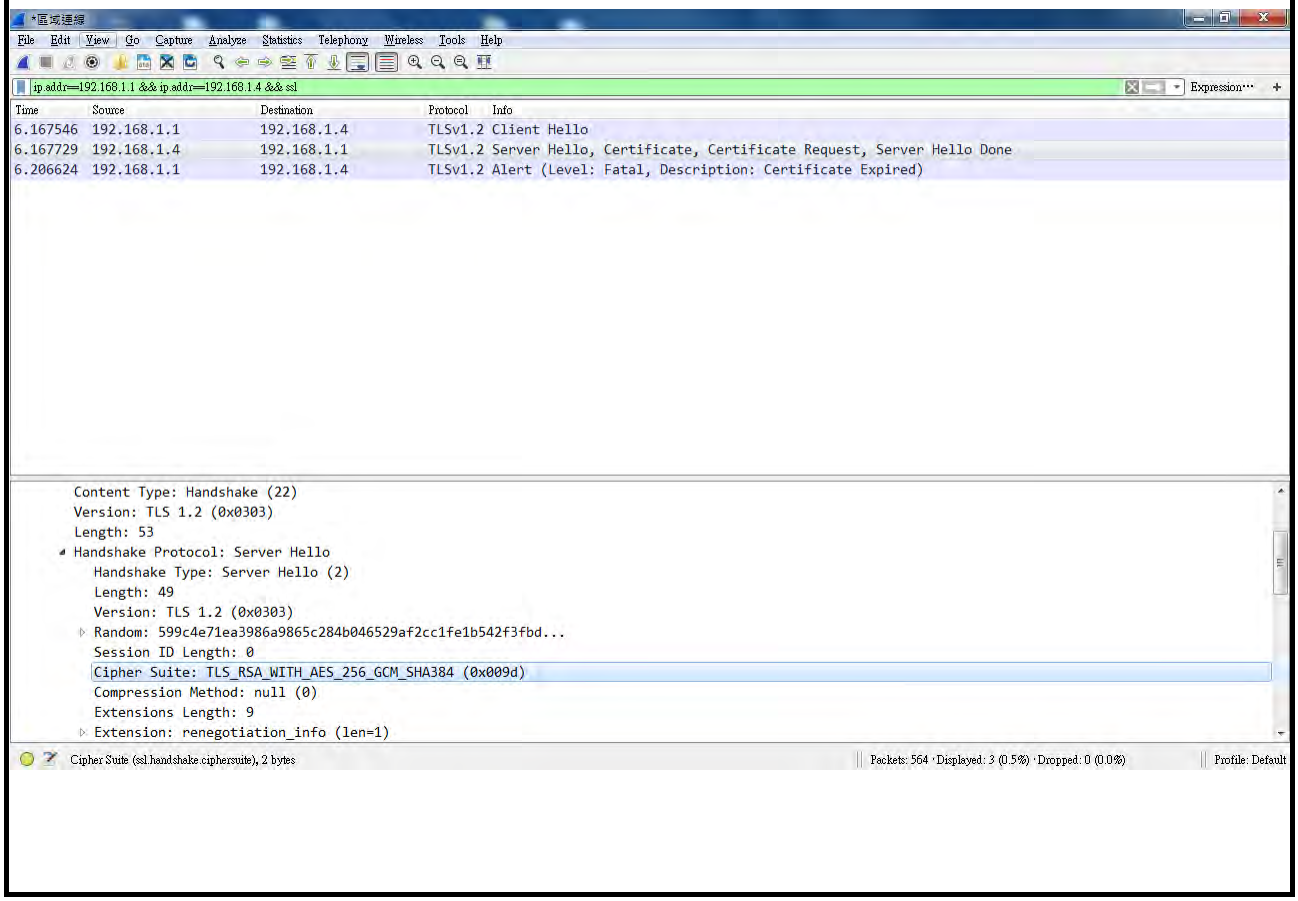
Wireshark Plots for WINNF.FT.C.SCS.1 Test Case ID



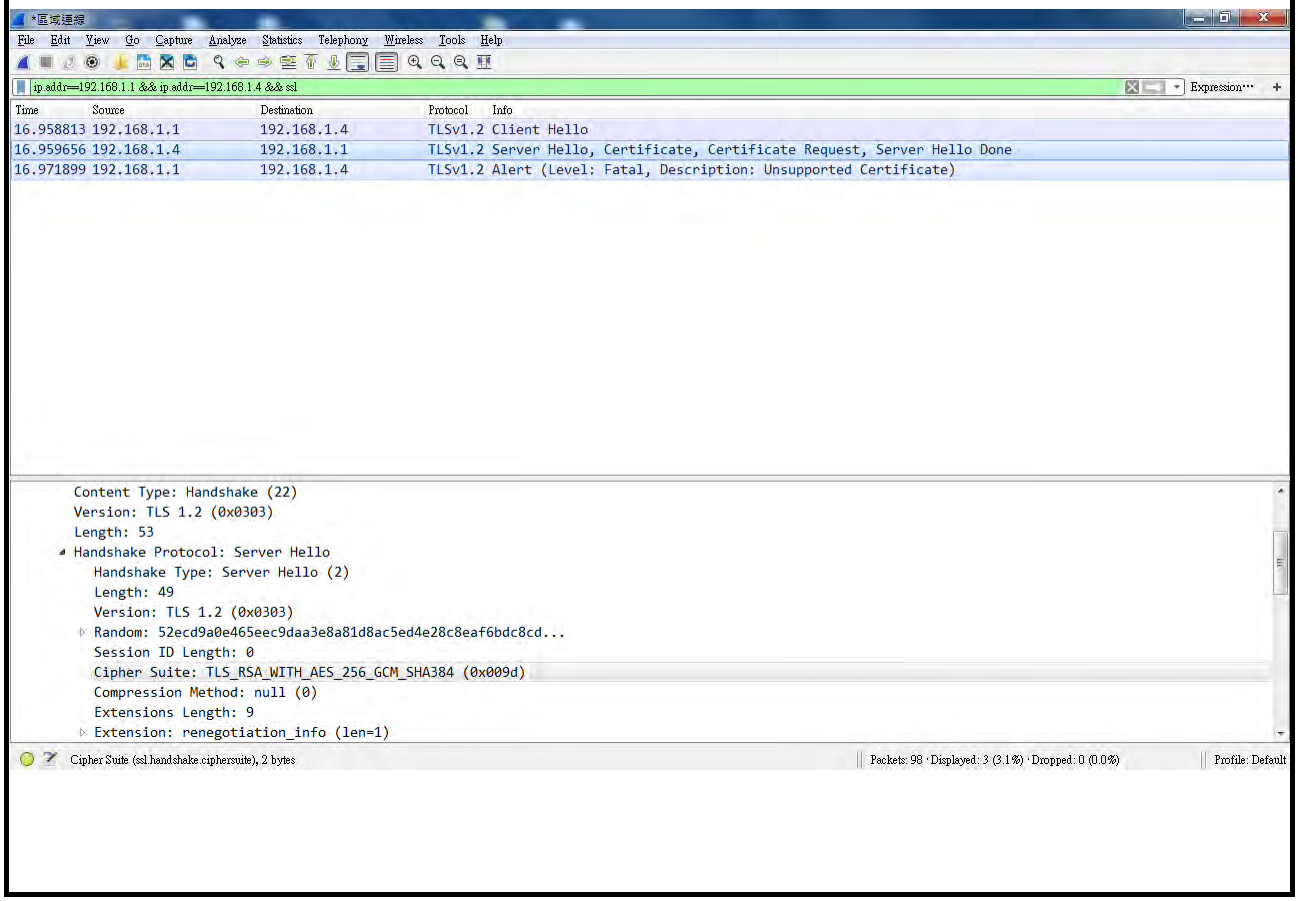
Wireshark Plots for WINNF.FT.C.SCS.2 Test Case ID



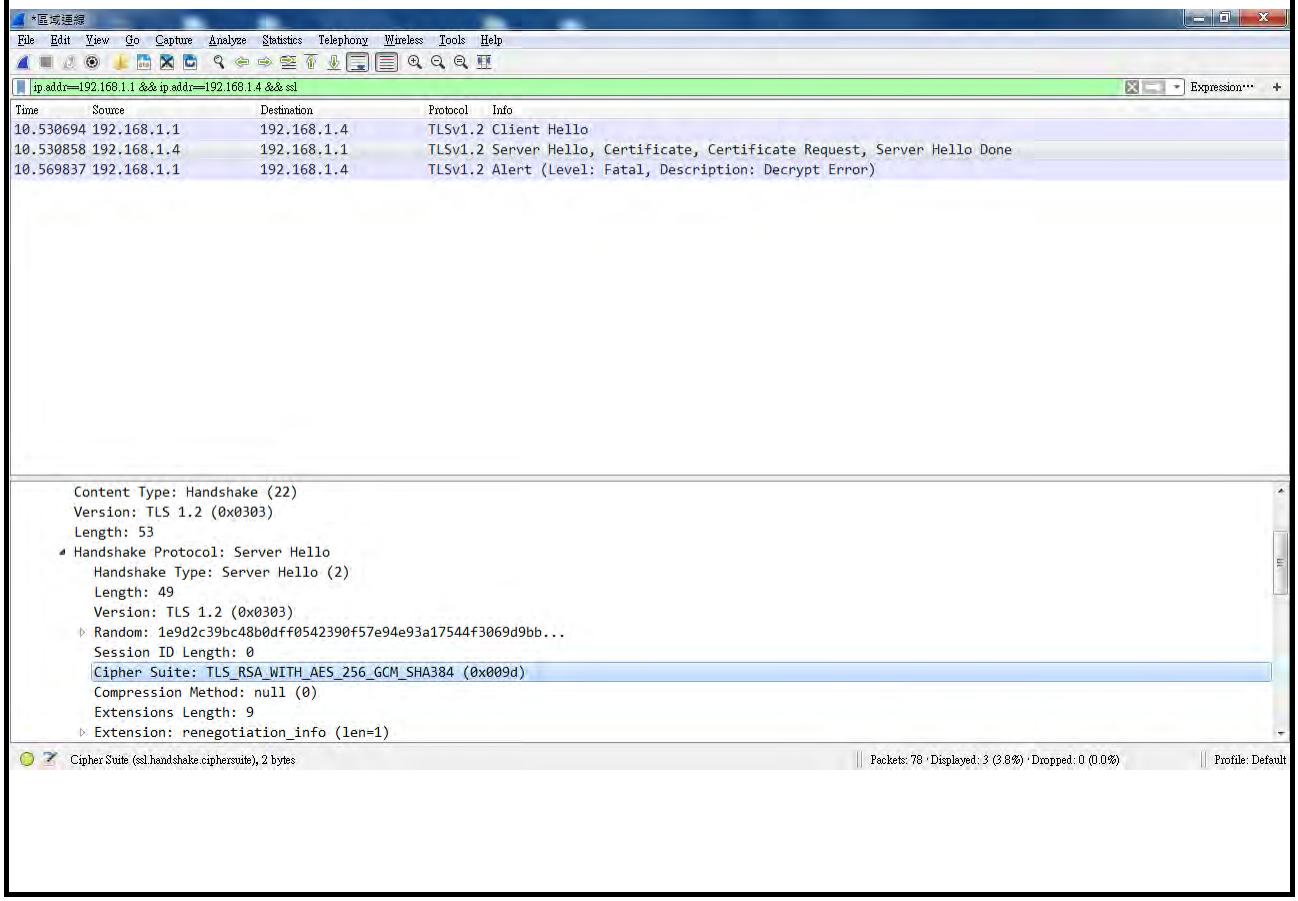
Wireshark Plots for WINNF.FT.C.SCS.3 Test Case ID



Wireshark Plots for WINNF.FT.C.SCS.4 Test Case ID

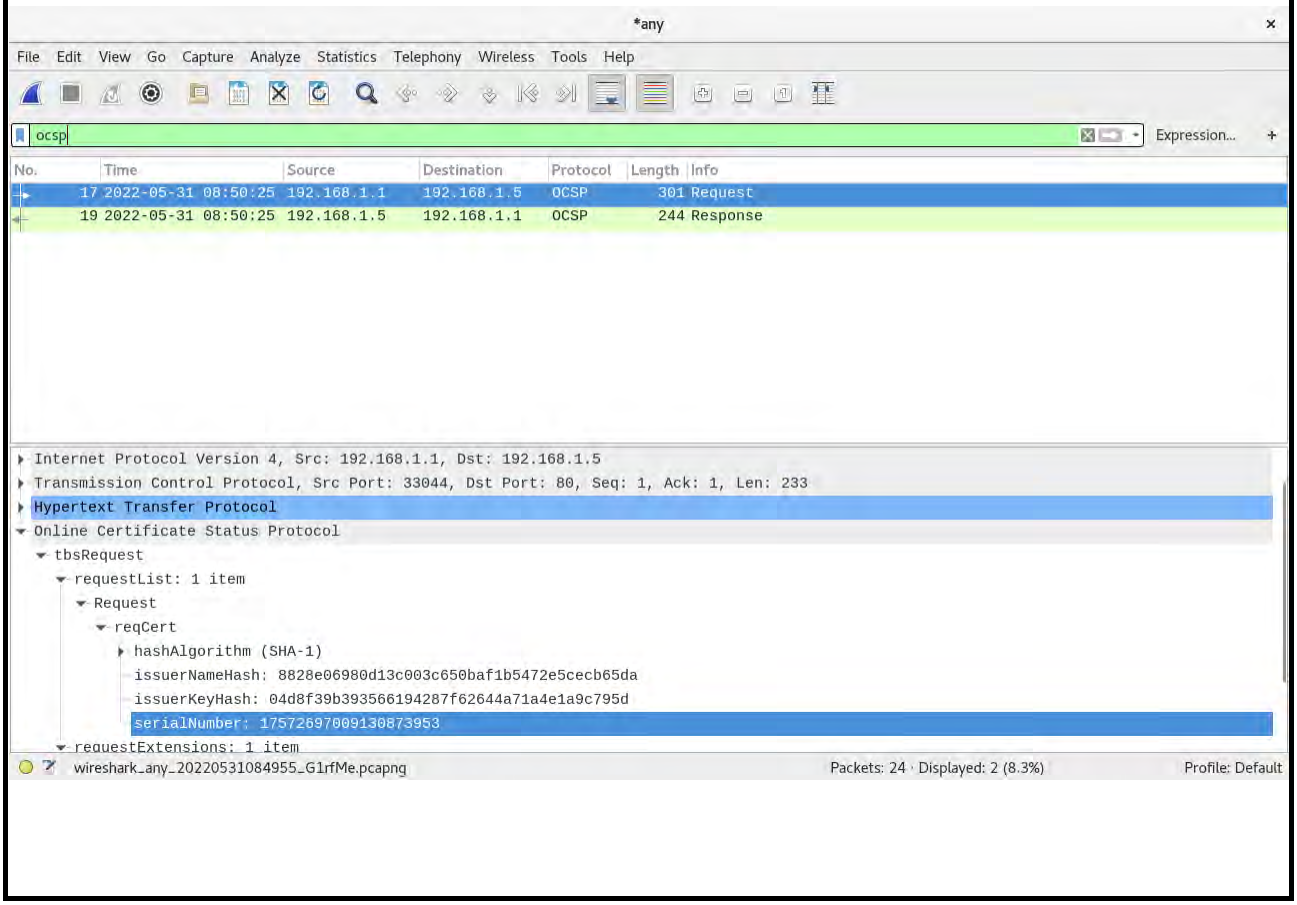


Wireshark Plots for WINNF.FT.C.SCS.5 Test Case ID



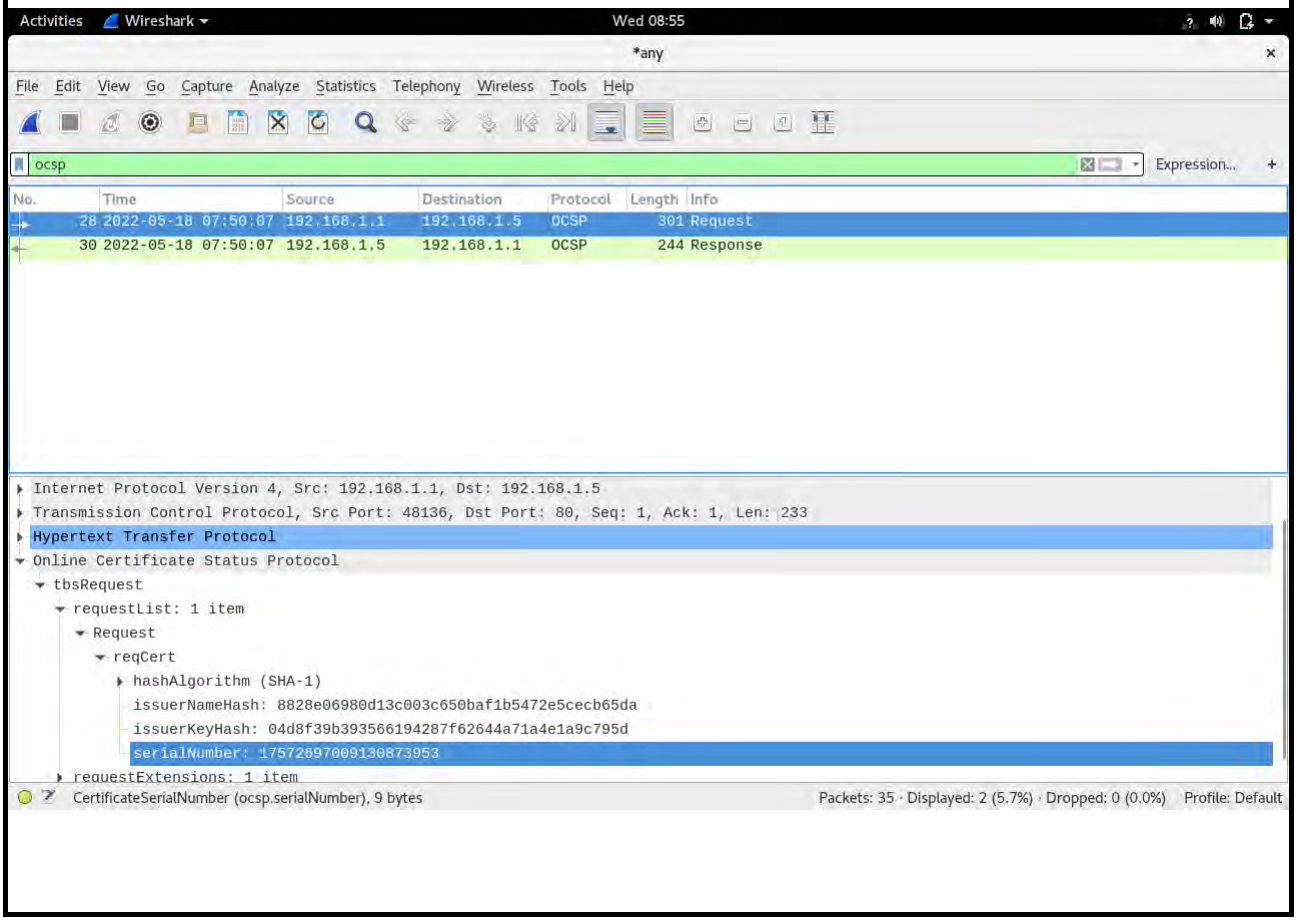
For Category A:

CRL and OCSP Verify Plots for WINNF.FT.C.SCS.2 Test Case ID

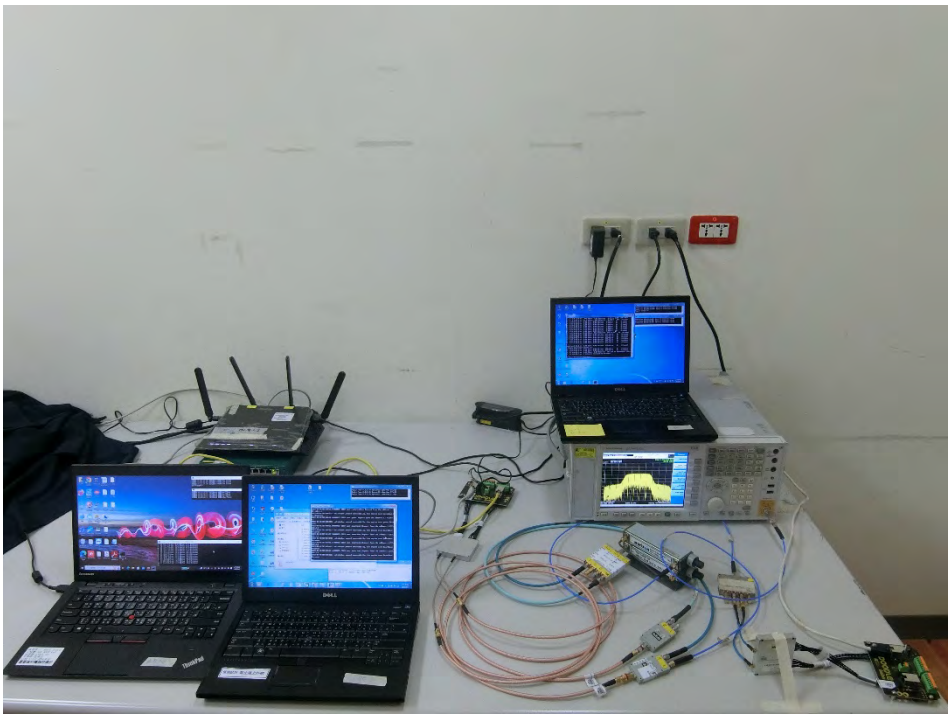


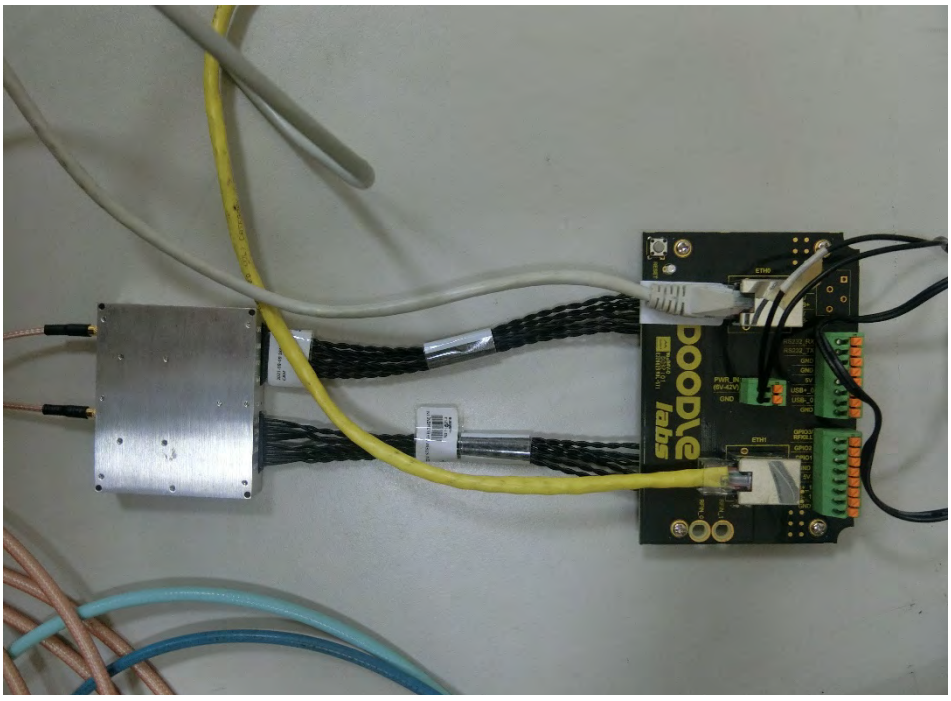
For Category B:

CRL and OCSP Verify Plots for WINNF.FT.C.SCS.2 Test Case ID



1. Photographs of Test Configuration





———THE END———