TEST REPORT

Application No.:	SZCR2310003424AT
Applicant:	Baicells Technologies Co., Ltd.
Address of Applicant:	9-10F,1stBldg.,No.81BeiqingRoad,Haidian District,Beijing,China
Manufacturer:	Baicells Technologies Co., Ltd.
Address of Manufacturer:	9-10F,1stBldg.,No.81BeiqingRoad,Haidian District,Beijing,China
Equipment Under Test (EUT):	
EUT Name:	5G Indoor CPE
Model No.:	EG3661M-NR6
Trade Mark:	Baicells
FCC ID:	2AG32EG3661MNR6
Standard(s) :	FCC 47 CFR Part 96
	CBRSA-TS-9001-V1.2.1
	WINNF-19-IN-00033 V1.0
	KDB 940660 D01 Part 96 CBRS Eqpt v03
	KDB 940660 D02 CPE-CBSD Handshake Procedures v02
	WINNF-TS-0122-V1.0.2 CBRS CBSD Test Specification
Date of Receipt:	2023-10-25
Date of Test:	2023-12-27 to 2024-01-16
Date of Issue:	2024-01-18
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2024-01-18		Original

Authorized for issue by:				
		Frank Chen **Frank Chen /Project Engineer**		
		Eric Fu **Eric Fu/Reviewer**		

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2 Test Summary

Test Summary for Standalone CBSD			
Item	**Standard**	**Test Case ID**	**Result**
Multi-Step registration	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.1	Pass
Single-Step registration for CBSD with CPI signed data	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.5	Pass
Missing Required parameters (responseCode 102)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.8	Pass
Pending registration (responseCode 200)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.10	Pass
Invalid parameter (responseCode 103)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.12	Pass
Blacklisted CBSD (responseCode 101)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.14	Pass
Unsupported SAS protocol version (responseCode 100)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.16	Pass
Group Error (responseCode 201)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.REG.18	Pass
Unsuccessful Grant responseCode=400 (INTERFERENCE)	WINNF-TS-0122-V1.0.2	WINNF.FT.D.GRA.1	Pass
Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.GRA.2	Pass
Heartbeat Success Case (first Heartbeat Response)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.1	Pass
Heartbeat responseCode=105 (DEREGISTER)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.3	Pass
Heartbeat responseCode=500 (TERMINATED_GRANT)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.4	Pass
Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.5	Pass
Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.6	Pass
Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.7	Pass
Heartbeat Response Absent (First Heartbeat)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.9	Pass
Heartbeat Response Absent (Subsequent Heartbeat)	WINNF-TS-0122-V1.0.2	WINNF.FT.C.HBT.10	Pass
Successful Relinquishment	WINNF-TS-0122-V1.0.2	WINNF.FT.C.RLQ.1	Pass
Successful Deregistration	WINNF-TS-0122-V1.0.2	WINNF.FT.C.DRG.1	Pass

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Test Summary for Standalone CBSD			
Item	**Standard**	**Test Case ID**	**Result**
Successful TLS connection between UUT and SAS Test Harness	WINNF-TS-0122-V1.0.2	WINNF.FT.C.SCS.1	Pass
TLS failure due to revoked certificate	WINNF-TS-0122-V1.0.2	WINNF.FT.C.SCS.2	Pass
TLS failure due to expired server certificate	WINNF-TS-0122-V1.0.2	WINNF.FT.C.SCS.3	Pass
TLS failure when SAS Test Harness certificate is issue by unknown CA	WINNF-TS-0122-V1.0.2	WINNF.FT.C.SCS.4	Pass
TLS failure when certificate at the SAS Test Harness is corrupted	WINNF-TS-0122-V1.0.2	WINNF.FT.C.SCS.5	Pass
UUT RF Transmit Power Measurement	WINNF-TS-0122-V1.0.2	WINNF.PT.C.HBT	Pass
SAS Version: 1.0.0.3			

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

Test standards:

CBRSA-TS-9001-V1.2.1

CBRS Alliance Certification Test Plan

WINNF-TS-0122-V1.0.2

Test and Certification for Citizens Broadband Radio Service (CBRS); Conformance and Performance Test Technical Specification; CBSD/DP as Unit Under Test (UUT)

WINNF-19-IN-00033 V1.0

CBRS CPE-CBSD as UUT Test Guidelines

KDB 940660 D01 Part 96 CBRS Eqpt v03

KDB 940660 D02 CPE-CBSD Handshake Procedures v02

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4 General Information

4.1 Details of E.U.T.

Power supply:	AC/DC ADAPTOR Model: DCT36W120300US-A2 Input Power: AC 100-240V~, 50/60Hz 1.0A MAX; DC Output: 12V 3A
Sample Type:	Mobile device
CBSD Class:	A
Transmitter Frequency Band:	LTE: Band 48; 5G NR: n48
Transmitter Frequency Range:	3550~3700MHz
Hardware Version:	VER.B
Software Version:	BaiCE_BQ6_2.0.5.3_NA
Test sample:	12323432435434222222
Antenna Gain:	4.23dBi
MIMO supported	2*2
Antenna Type:	Integrated Antenna

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4.2 Description of CBSD/DP Support Features

Condition	Feature Description	Supported
C1	Mandatory for UUT which supports multi-step registration message.	Y
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.	N
C3	Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message.	Y
C4	Mandatory for UUT which supports RECEIVED_POWER_WITHOUT_GRANT measurement report type.	N
C5	Mandatory for UUT which supports RECEIVED_POWER_WITH_GRANT measurement report type.	N
C6	Mandatory for UUT which supports parameter change being made at the UUT and prior to sending a deregistration.	N

Y: Supported

N: Not supported

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4.3 Summary of Test Results

WINNF-TS-0122			
Classes	Test Case Items	Pass Items	Pass Rate (%)
FT (CBSD, DP/CBSD)	25	25	100
PT (CBSD, DP/CBSD)	1	1	100
Total	26	26	100

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

4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	± 7.25 x 10^{-8}
2	RF conducted power	± 0.75dB
3	Temperature test	± 1°C
4	Humidity test	± 3%
5	Supply voltages	± 1.5%
6	Time	± 3%

4.5 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
EPC	Lanner Electronics Inc.	LICA-1513A	LR202002004052
Router	TP-LINK	TL-R860+	1175379002425
LTE Base station	Baicells	mBS1105 (FCC ID: 2AG32MBS110596N)	120200007219BSP0001
5G NR Base station	Baicells	BSC7048A243 (FCC ID: 2AG32BSC7048A243)	1202000577233VB0002

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4.6 Test Location

All tests were performed at:

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Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

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5 Equipment List

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Laptop (With SAS Test hamess)	Lenovo	T14	/	/	/
Spectrum Analyzer	Keysight	N9020A	SEM004-21	2023-03-20	2024-03-19
Shield Room	SAEMC	MSR433	SEM001-11	2021-03-13	2024-03-12
Coaxial Cable	SGS	N/A	SEM031-01	2023-07-11	2024-07-10
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Splitter	MACOM	2090-6214-00	N/A	N/A	N/A
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2023-09-27	2024-09-26

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6 Test Method and Environment

6.1 CBSD/DP Conformance and Performance

Test Requirement:	CBRS CBSD Test Specification WINNF-TS-0122-V1.0.2
Test Method:	WINNF-IN-0156_WInnForum_SAS_Test_Harness_CBSD_UUT_Tutorial_v1_0_0_1

6.2 CPE-CBSD Handshake Procedures

Test Requirement:	KDB 940660 D02 CPE-CBSD Handshake Procedures v02
Test Method:	WINNF-19-IN-00033 V1.0 KDB 940660 D02 CPE-CBSD Handshake Procedures v02

6.3 CBSD Test Procedure

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

6.4 Duration and Duty Cycle Measurement

The CPE-CBSD shall validate and ensure that limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS.

6.5 Duration and Duty Cycle Test Procedure

a. CPE-CBSD as UUT does not receive any RF signal from its “Compatible BTS-CBSD” (FCC ID: 2AG32BSC7048A243), so CPE-CBSD as UUT does not transmit. UUT shall be UTC time synchronized.
b. Use the WinnForum SAS Harness #1 for CPE-CBSD as UUT and run test case WINNF.FT.C.GRA.1 for CPE-CBSD as UUT.
c. CPE-CBSD as UUT starts to receive the RF signal from its “Compatible BTS-CBSD”, so CPE-CBSD can start communicating with the WinnForum SAS Harness #1. Make note of the time when RF Test equipment logs the first transmission from CPE-CBSD which is above 23dBm/10MHz – this is the start time of the {X time out of Y time}.
d. When the test case WINNF.FT.C.GRA.1 finishes and the questions appear on the WinnForum SAS Harness #1 console, do NOT answer the questions. Wait until Y time has passed from step #3. During this Y time, the RF test equipment is logging the amount of time CPE-CBSD as UUT transmitted EiRP above 23dBm/10MHz. The amount of time logged for transmitting EIRP above 23dBm/10MHz is the X time.
e. Answer the questions on the WinnForum SAS Harness #1 console so the WinnForum SAS

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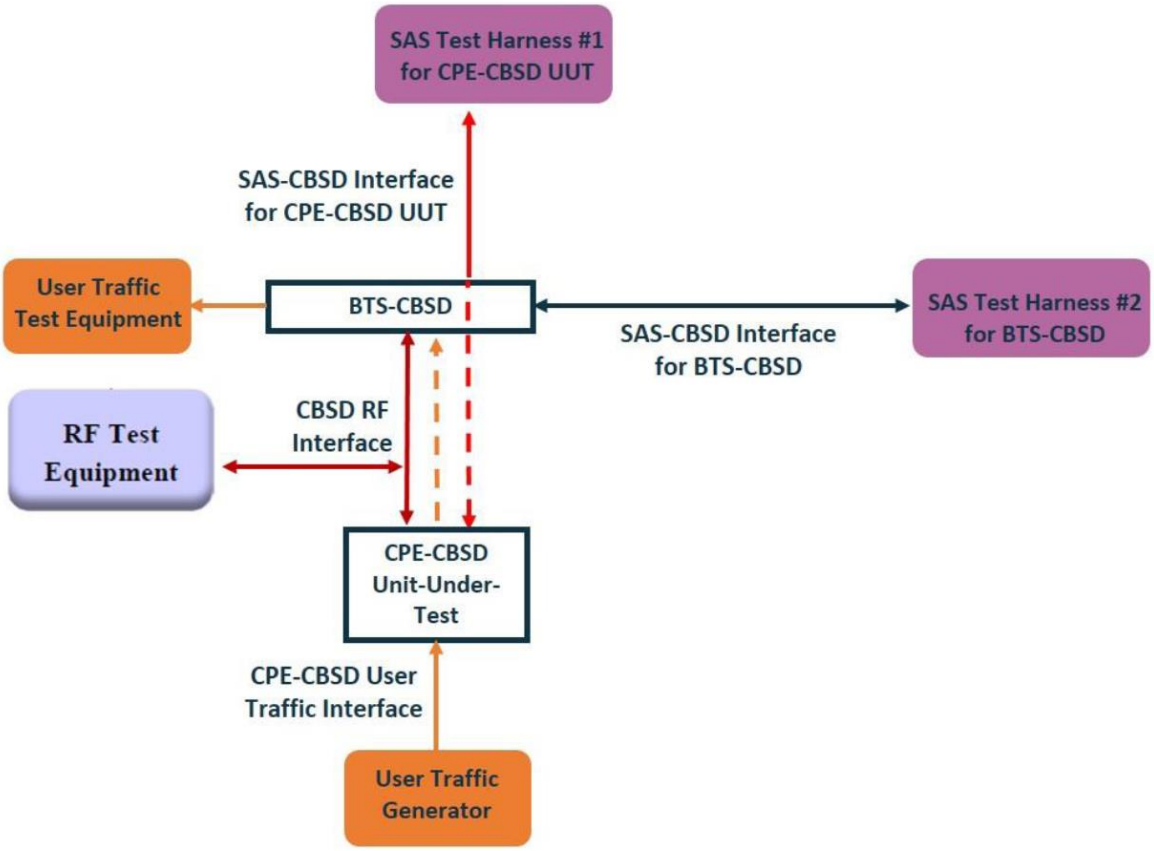
Harness #1 is ready for the next test.

6.6 Test Environment

Test Harness Version:	V1.0.0.3
Operating System:	Microsoft Windows 10
TLS Version:	1.2
Python Version:	2.7.13
Environmental Conditions:	25deg. C, 65%RH
Input Power:	120Vac, 60Hz

6.7 Test Setup



CPE-CBSD as UUT, BTS-CBSD direct communication without Domain Proxy

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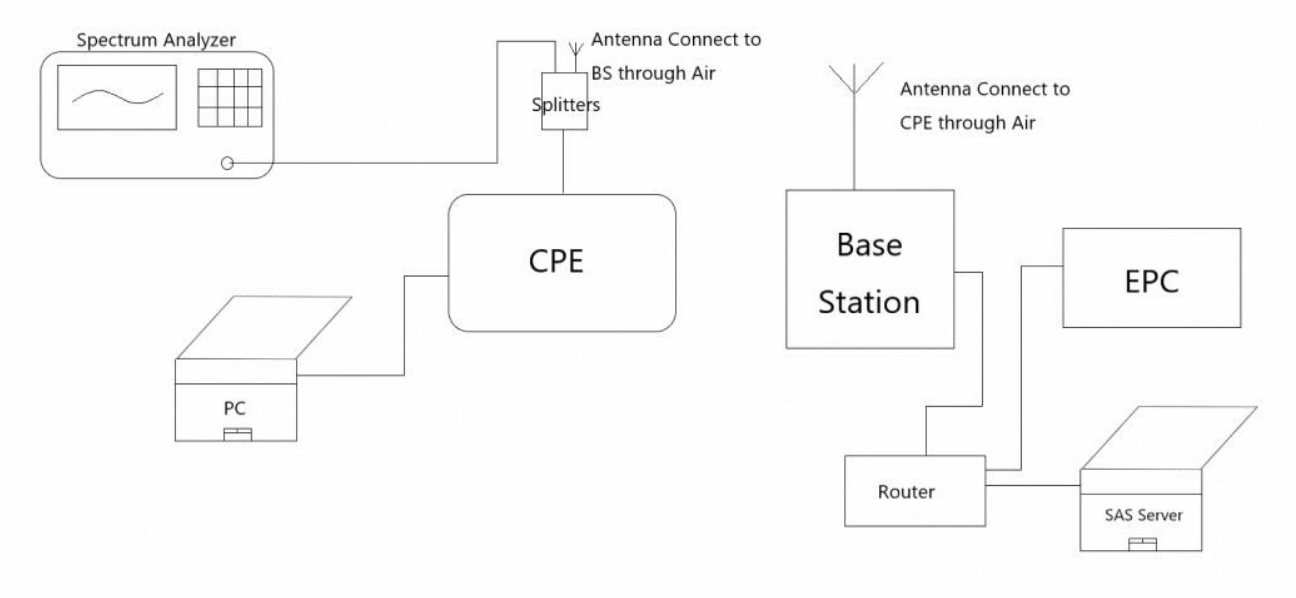

Test setup diagram for WINNF.PT.C.HBT Test case

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7 Test Data

7.1 CBSD Registration Process

7.1.1 WINNF.FT.C.REG.1

#	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 is in the Unregistered state	--	--
2	CBSD sends correct Registration request information, as specified in [n.5], to the SAS Test Harness: ● The required userId, fccId and cbsdSerialNumber registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges. ● Any REG-conditional or optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges. Note: It is outside the scope of this document to test the Registration information that is supplied via another means.	■ Pass	☐ Fail
3	SAS Test Harness sends a CBSD Registration Response as follows: - cbsdId = C - measReportConfig shall not be included - responseCode = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.1.2 WINNF.FT.C.REG.5

#	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	☐ Fail
3	SAS Test Harness sends a CBSD Registration Response as follows: - cbsdId = C - measReportConfig shall not be included. - responseCode = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.1.3 WINNF.FT.C.REG.8

#	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 = 102	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.1.4 WINNF.FT.C.REG.10

#	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 = 200	--	--
4	After completion of step 3, SAS Test Harness will 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	☐ Fail

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7.1.5 WINNF.FT.C.REG.12

#	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 = 103	--	--
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 shall not transmit RF	■ Pass	☐ Fail

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7.1.6 WINNF.FT.C.REG.14

#	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 = 101	--	--
4	After completion of step 3, SAS Test Harness will 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	☐ Fail

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7.1.7 WINNF.FT.C.REG.16

#	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 = 100	--	--
4	After completion of step 3, SAS Test Harness will 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	☐ Fail

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7.1.8 WINNF.FT.C.REG.18

#	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 = 201	--	--
4	After completion of step 3, SAS Test Harness will 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	☐ Fail

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7.2 CBSD Spectrum Grant Process

7.2.1 WINNF.FT.C.GRA.1

#	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.	■ Pass	☐ Fail
3	SAS Test Harness sends a Grant Response message, including ● cbsdId=C - responseCode = 400	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

7.2.2 WINNF.FT.C.GRA.2

#	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.	■ Pass	☐ Fail
3	SAS Test Harness sends a Grant Response message, including - cbsdId=C - responseCode = 401	--	--
4	After completion of step 3, SAS Test Harness will 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	☐ Fail

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7.3 CBSD HeartBeat Process

7.3.1 WINNF.FT.C.HBT.1

#	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	☐ Fail
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	☐ Fail
6	SAS Test Harness sends a Grant Response message, including the parameters: ● cbsdId = C ● grantId = G = a valid grant ID ● grantExpireTime = UTC time greater than duration of the test ● responseCode = 0	--	--
7	UUT sends a first Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: ● cbsdId = C ● grantId = G ● operationState = “GRANTED”	■ Pass	☐ Fail
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	--	--

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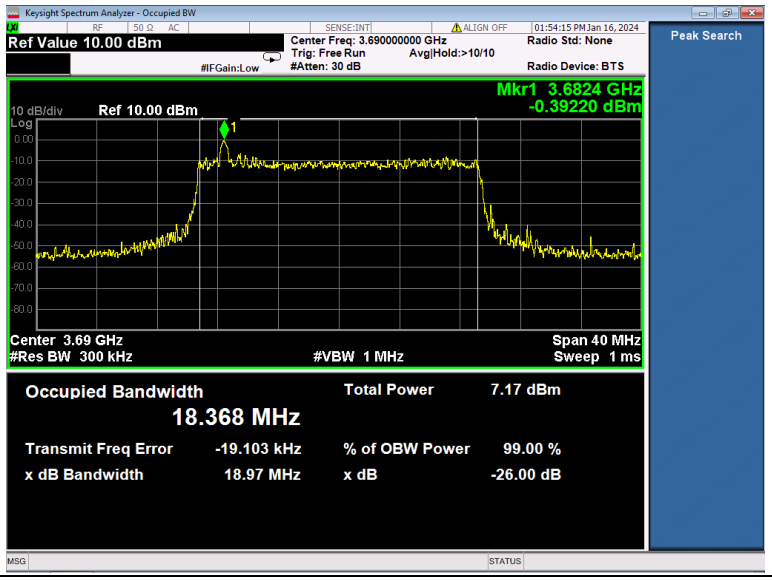
9	For further Heartbeat Request messages sent from UUT after completion of step 8, validate message is sent within latest specified heartbeatInterval, and: ● cbsdId = C ● grantId = G ● operationState = “AUTHORIZED” and SAS Test Harness responds with a Heartbeat Response message including the following parameters: ● cbsdId = C ● grantId = G ● transmitExpireTime = current UTC time + 200 seconds ● responseCode = 0	■ Pass	☐ Fail
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	☐ Fail

Spectrum Plot



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7.3.2 WINNF.FT.C.HBT.3

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ grantExpireTime = UTC time greater than duration of the test ● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface	--	--
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including: ● cbsdId = C ● grantId = G ● operationState = “AUTHORIZED”	--	--
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: ● cbsdId = C ● grantId = G ● transmitExpireTime = T = Current UTC time ● responseCode = 105 (DEREGISTER)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the RF output of the UUT. Verify: ● UUT shall stop transmission within (T + 60 seconds) of completion of step 3	■ Pass	☐ Fail

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7.3.3 WINNF.FT.C.HBT.4

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
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	☐ Fail

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7.3.4 WINNF.FT.C.HBT.5

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
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	☐ Fail

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7.3.5 WINNF.FT.C.HBT.6

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
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	☐ Fail

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7.3.6 WINNF.FT.C.HBT.7

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
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: ○ cbsdId = 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	☐ Fail

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7.3.7 WINNF.FT.C.HBT.9

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
3	After completion of step 2, SAS Test Harness does not respond to any further ● messages from UUT to simulate loss of network connection	--	--
4	Monitor the RF output of the UUT from start of test to 60 seconds after step 3. Verify: At any time during the test, UUT shall not transmit on RF interface	■ Pass	☐ Fail

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7.3.8 WINNF.FT.C.HBT.10

#	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: ○ valid cbsdId = C ○ valid grantId = G ○ grant is for frequency range F, power P ○ 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	☐ Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: cbsdId = C grantId = G transmitExpireTime = T = current UTC time + 200 seconds ● responseCode = 0	--	--
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 all transmission on RF interface within (transmitExpireTime + 60 seconds), using the transmitExpireTime sent in Step 3.	■ Pass	☐ Fail

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7.4 CBSD Relinquishment Process

7.4.1 WINNF.FT.C.RLQ.1

#	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	☐ Fail
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	☐ Fail

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7.5 CBSD Deregistration Process

7.5.1 WINNF.FT.C.DRG.1

#	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	□ Fail
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	□ Fail

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7.6 CBSD Security Validation

7.6.1 WINNF.FT.C.SCS.1

#	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	☐ Fail
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	☐ Fail
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	☐ Fail
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	☐ Fail

7.6.2 WINNF.FT.C.SCS.2

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	☐ Fail
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	☐ Fail
3	● UUT may retry for the security procedure which shall fail.	■ Pass	☐ Fail
4	● SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.6.3 WINNF.FT.C.SCS.3

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	☐ Fail
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	☐ Fail
3	● UUT may retry for the security procedure which shall fail.	■ Pass	☐ Fail
4	● SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

7.6.4 WINNF.FT.C.SCS.4

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	☐ Fail
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	☐ Fail
3	● UUT may retry for the security procedure which shall fail.	■ Pass	☐ Fail
4	● SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.6.5 WINNF.FT.C.SCS.5

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	☐ Fail
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	☐ Fail
3	● UUT may retry for the security procedure which shall fail.	■ Pass	☐ Fail
4	● SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	☐ Fail

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7.7 CBSD RF Power Measurement

7.7.1 WINNF.PT.C.HBT

#	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 = FL, highFrequency = FH, maxEirp = Pi}, with grant in AUTHORIZED state, and grantExpireTime set to a value far past the duration of this test case ● Note: in order for the UUT to request a grant with the parameters {lowFrequency, highFrequency, maxEirp), the SAS Test Harness may need to provide appropriate guidance in the availableChannel object of the spectrumInquiry response message, and the operationParam object of the grant response message. Alternately, the UUT vendor may provide the ability to set those parameters on the UUT so that the UUT will request a grant with those parameters	--	--
2	UUT and SAS Test Harness perform a series of Heartbeat Request/Response cycles, which continues until the other test steps are complete. Messaging for each cycle is as follows: ● UUT sends Heartbeat Request, including: ○ cbsdId = C ○ grantId = G ● SAS Test Harness responds with Heartbeat Response, including: o cbsdId = C ○ grantId = G ○ transmitExpireTime = current UTC time + 200 seconds ● responseCode = 0	--	--
3	Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill 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	☐ Fail

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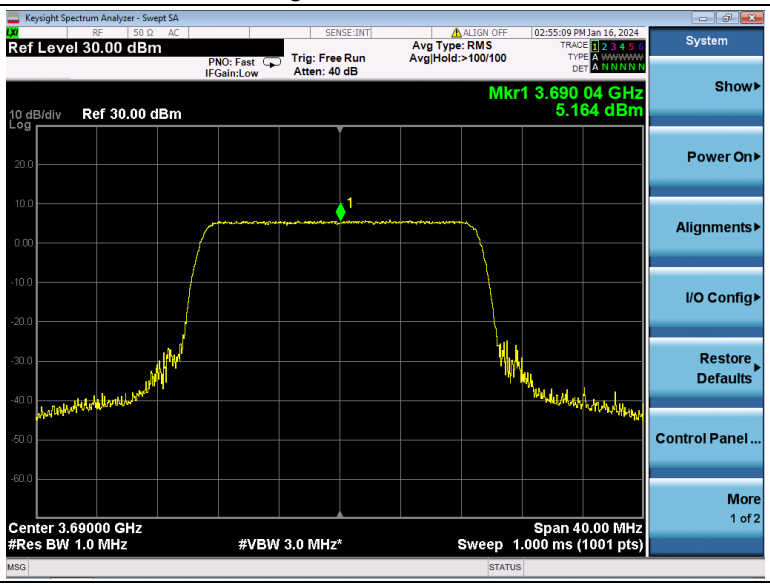
RF measurement plot for Test Case:

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

Freq. (MHz)	Conducted PSD (dBm/MHz)	Antenna Gain (dBi)	Loss (dB)	Array Gain (dB)	EIRP PSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
LTE							
3690	5.164	4.23	8	3.01	20.404	23	Pass
3690	-5.032	4.23	8	3.01	10.208	11	Pass
5G NR							
3690	5.502	4.23	8	3.01	20.742	23	Pass
3690	-5.786	4.23	8	3.01	9.454	10	Pass

Note:
1. Array Gain=10log(n), n is the antenna number, for this test the n=2
2. EIRP PSD= Conducted PSD+ Antenna Gain+ Array Gain
3. Loss includes cable loss and loss of attenuator

LTE Target Power: 23 dBm/MHz



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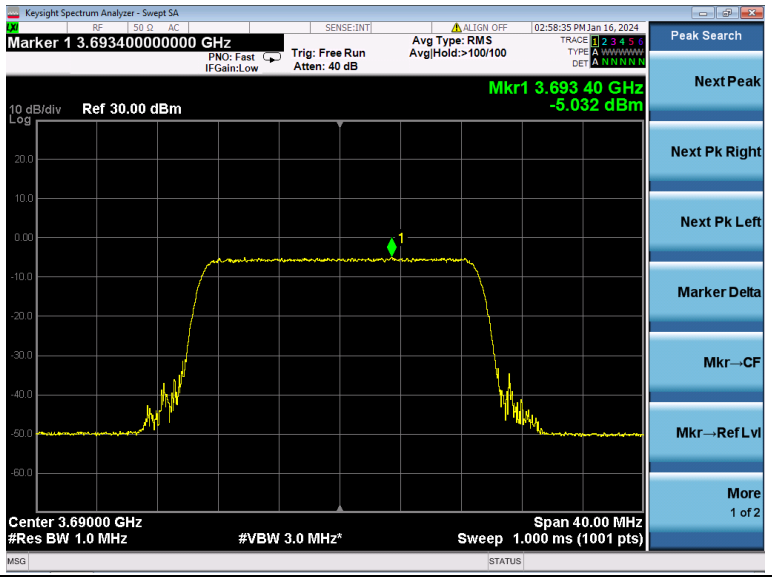
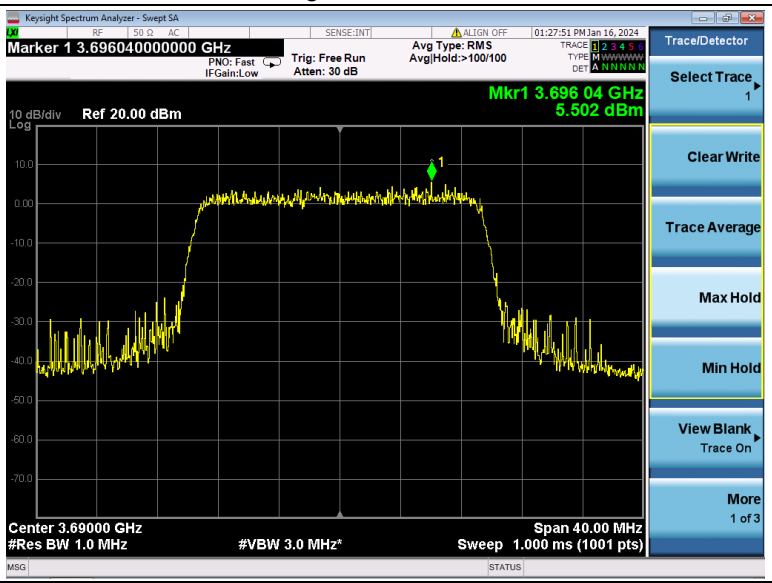
LTE Target Power: 10 dBm/MHz



5G NR Target Power: 23 dBm/MHz



5G NR Target Power: 10 dBm/MHz

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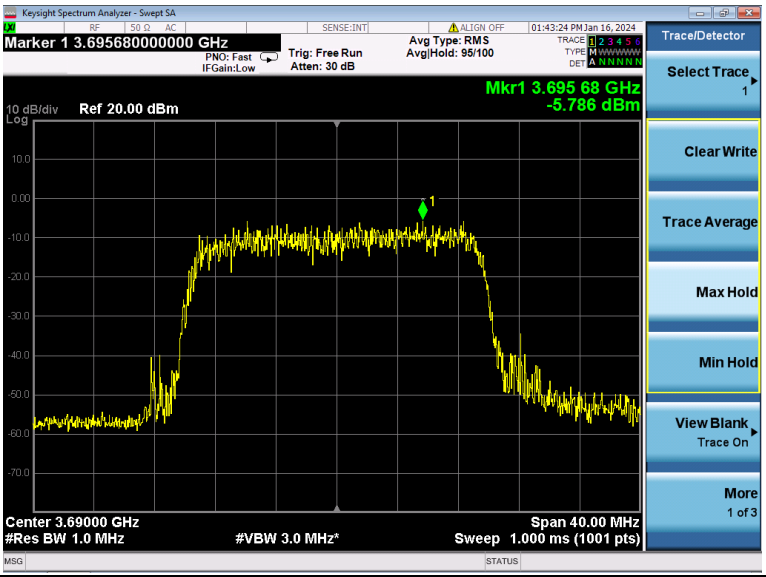

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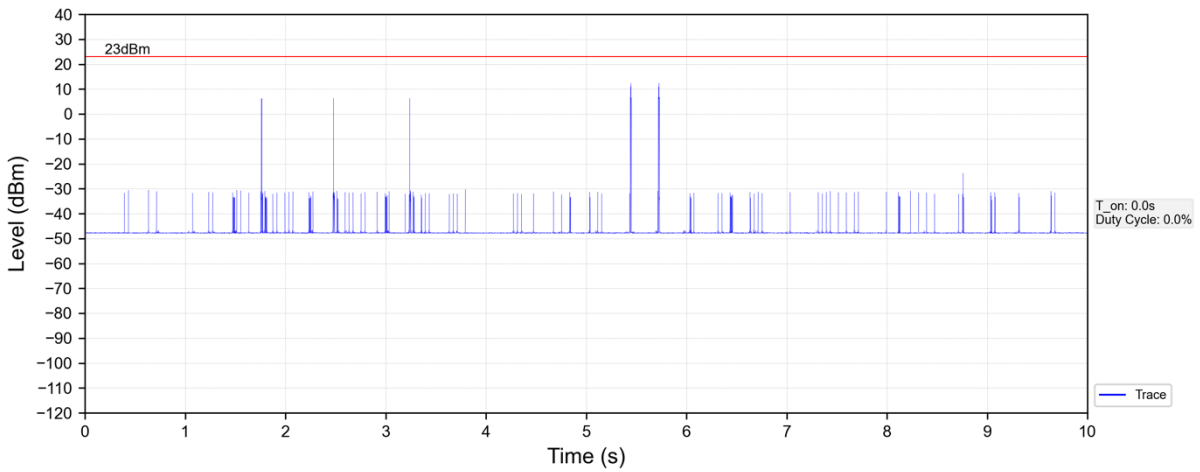
7.8 Duration and Duty Cycle

Duration and Duty Cycle			
Period	Minimum Time (s)	Limit (s)	Pass / Fail
10-second	0.0	1-second	Pass
300-second	0.0	10-second	Pass
3600-second	0.0	20-second	Pass

Note:

1. Limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS. This time should not exceed 1 second within any 10-second period, 10seconds within any 300-second period, or 20 seconds within any 3600-second period.
2. Pass = Minimum Time < Limit

10s Period Test data



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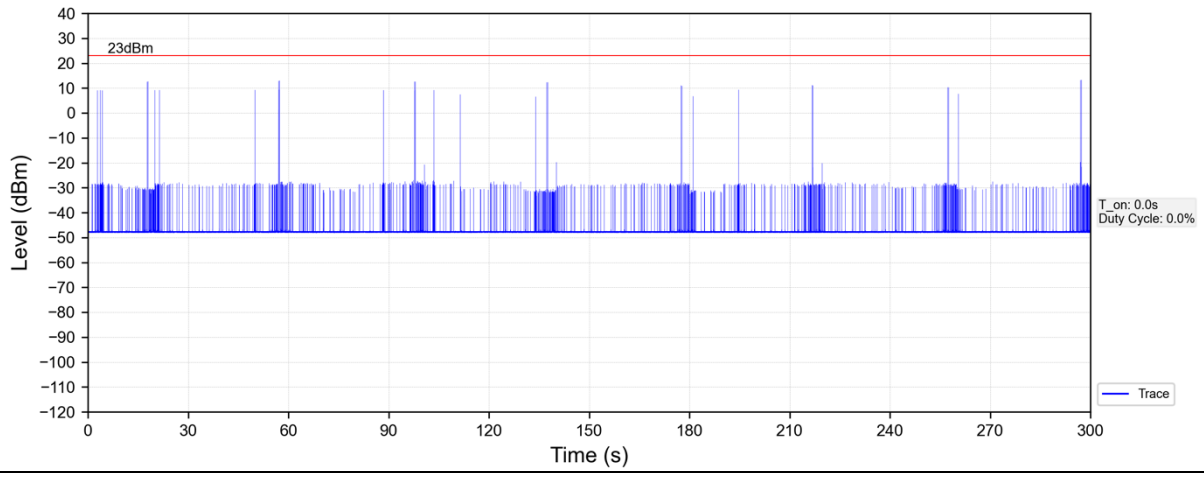
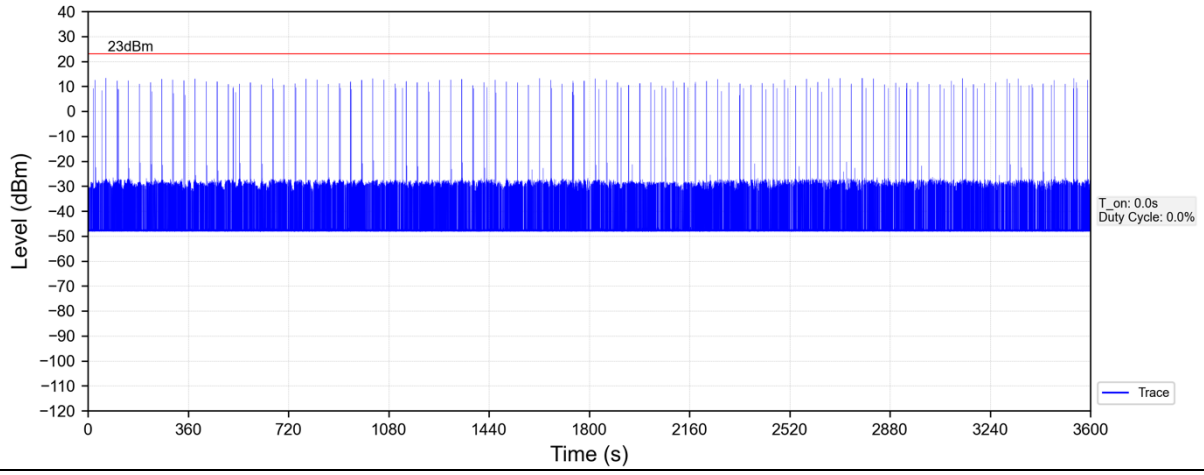
300s Period Test data



3600s Period Test data



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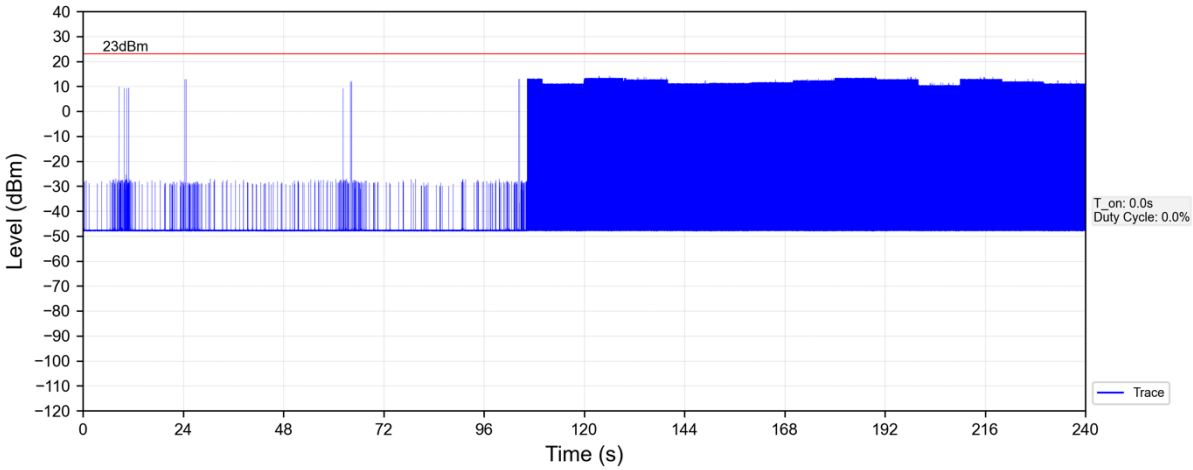
7.9 Verify that the device will register with a SAS when operating below 23 dBm

Verified in test case WINNF.PT.C.HBT.1, the CPE-CBSD as UUT default EIRP is under 23 dBm and can register success with SAS. After granted, the CPE-CBSD UUT will adjust the EIRP by maxEirp.



Note:

1. Red color line in above plot represents the 23 dBm.
2. When Granted the product will transmit at power level above 23dBm.
3. Only when the product sends packets the product will work at max EIRP.

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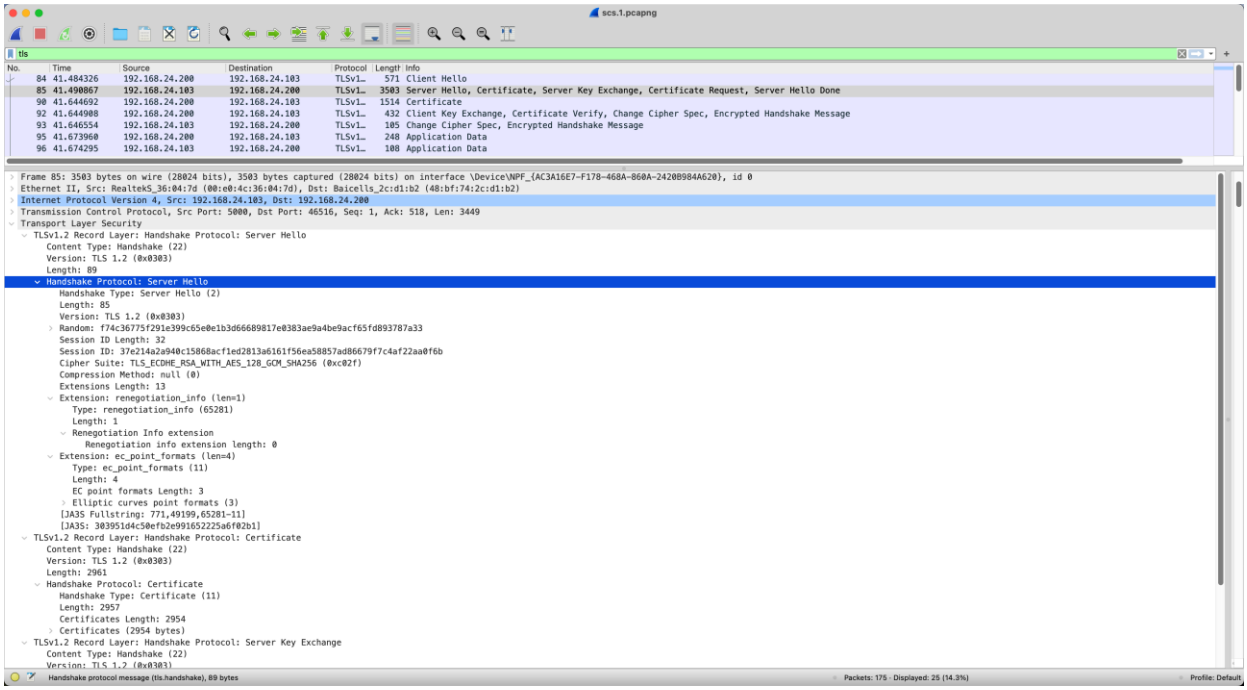
8 Test Data Log For Standalone CBSD

Test data log refer to log files (Log files appendix) except for securitytest cases which shows below.

8.1 WINNF.FT.C.SCS.1



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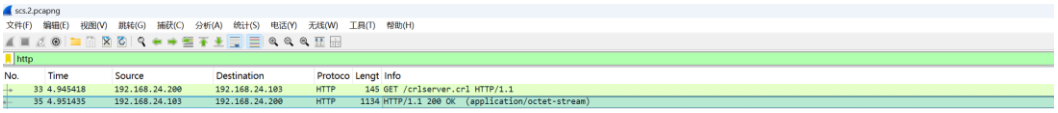
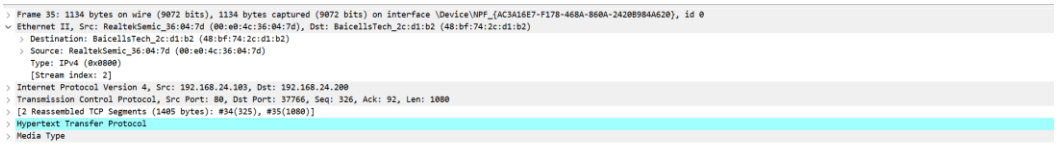
8.2 WINNF.FT.C.SCS.2



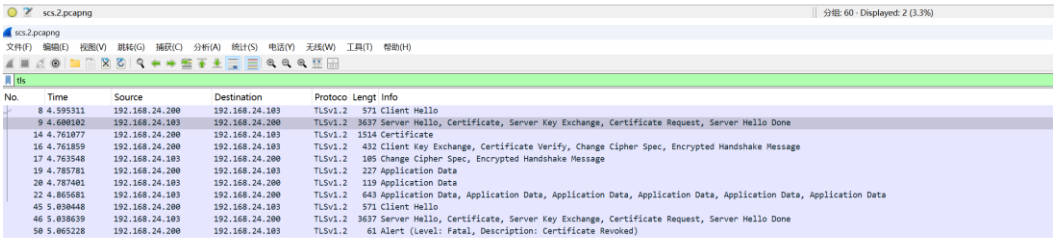
scs.2.pcapng

http

No.	Time	Source	Destination	Protoco	Lengt	Info
33	4.945418	192.168.24.200	192.168.24.103	HTTP	145	GET /crlserver.crl HTTP/1.1
35	4.951435	192.168.24.103	192.168.24.200	HTTP	1134	HTTP/1.1 200 OK (application/octet-stream)



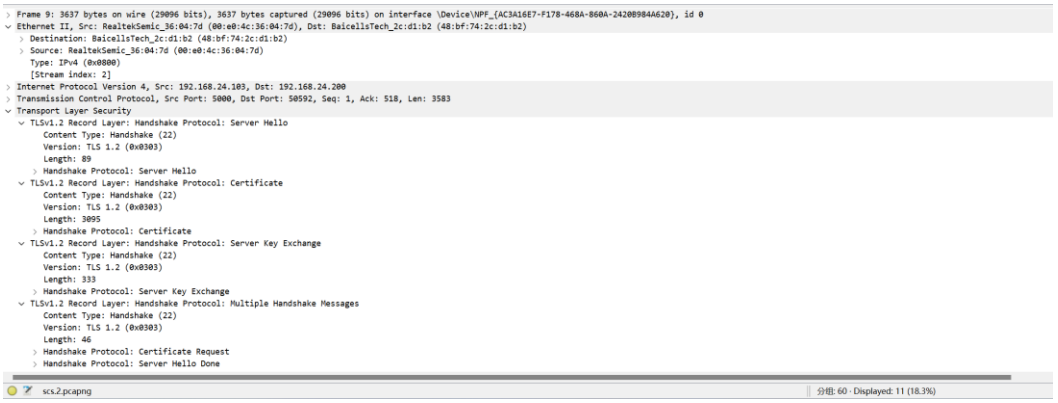
```
> Frame 35: 1134 bytes on wire (9072 bits), 1134 bytes captured (9072 bits) on interface \Device\NPF_{AC3A16E7-F178-468A-860A-2420B984A620}, id 0
v Ethernet II, Src: RealtekSemic_36:04:7d (00:e0:4c:36:04:7d), Dst: BaicellsTech_2c:d1:b2 (48:bf:74:2c:d1:b2)
  > Destination: BaicellsTech_2c:d1:b2 (48:bf:74:2c:d1:b2)
  > Source: RealtekSemic_36:04:7d (00:e0:4c:36:04:7d)
    Type: IPv4 (0x0800)
    [Stream index: 2]
> Internet Protocol Version 4, Src: 192.168.24.103, Dst: 192.168.24.200
> Transmission Control Protocol, Src Port: 80, Dst Port: 37766, Seq: 326, Ack: 92, Len: 1080
> [2 Reassembled TCP Segments (1405 bytes): #34(325), #35(1080)]
> Hypertext Transfer Protocol
> Media Type
```



scs.2.pcapng 分组: 60 · Displayed: 2 (3.3%)

tls

No.	Time	Source	Destination	Protoco	Lengt	Info
8	4.595311	192.168.24.200	192.168.24.103	TLSv1.2	571	Client Hello
9	4.600102	192.168.24.103	192.168.24.200	TLSv1.2	3637	Server Hello, Certificate, Server Key Exchange, Certificate Request, Server Hello Done
14	4.761077	192.168.24.200	192.168.24.103	TLSv1.2	1514	Certificate
16	4.761859	192.168.24.200	192.168.24.103	TLSv1.2	432	Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message
17	4.763548	192.168.24.103	192.168.24.200	TLSv1.2	105	Change Cipher Spec, Encrypted Handshake Message
19	4.785781	192.168.24.200	192.168.24.103	TLSv1.2	227	Application Data
20	4.787401	192.168.24.103	192.168.24.200	TLSv1.2	119	Application Data
22	4.865681	192.168.24.103	192.168.24.200	TLSv1.2	643	Application Data, Application Data, Application Data, Application Data, Application Data, Application Data
45	5.030448	192.168.24.200	192.168.24.103	TLSv1.2	571	Client Hello
46	5.038639	192.168.24.103	192.168.24.200	TLSv1.2	3637	Server Hello, Certificate, Server Key Exchange, Certificate Request, Server Hello Done
50	5.065228	192.168.24.200	192.168.24.103	TLSv1.2	61	Alert (Level: Fatal, Description: Certificate Revoked)



```
> Frame 9: 3637 bytes on wire (29096 bits), 3637 bytes captured (29096 bits) on interface \Device\NPF_{AC3A16E7-F178-468A-860A-2420B984A620}, id 0
v Ethernet II, Src: RealtekSemic_36:04:7d (00:e0:4c:36:04:7d), Dst: BaicellsTech_2c:d1:b2 (48:bf:74:2c:d1:b2)
  > Destination: BaicellsTech_2c:d1:b2 (48:bf:74:2c:d1:b2)
  > Source: RealtekSemic_36:04:7d (00:e0:4c:36:04:7d)
    Type: IPv4 (0x0800)
    [Stream index: 2]
> Internet Protocol Version 4, Src: 192.168.24.103, Dst: 192.168.24.200
> Transmission Control Protocol, Src Port: 5000, Dst Port: 50592, Seq: 1, Ack: 518, Len: 3583
v Transport Layer Security
  v TLSv1.2 Record Layer: Handshake Protocol: Server Hello
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 89
    > Handshake Protocol: Server Hello
  v TLSv1.2 Record Layer: Handshake Protocol: Certificate
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 3095
    > Handshake Protocol: Certificate
  v TLSv1.2 Record Layer: Handshake Protocol: Server Key Exchange
      Content Type: Handshake (22)
      Version: TLS 1.2 (0x0303)
      Length: 333
    > Handshake Protocol: Server Key Exchange
  v 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 Protocol: Server Hello Done
```

scs.2.pcapng 分组: 60 · Displayed: 11 (18.3%)

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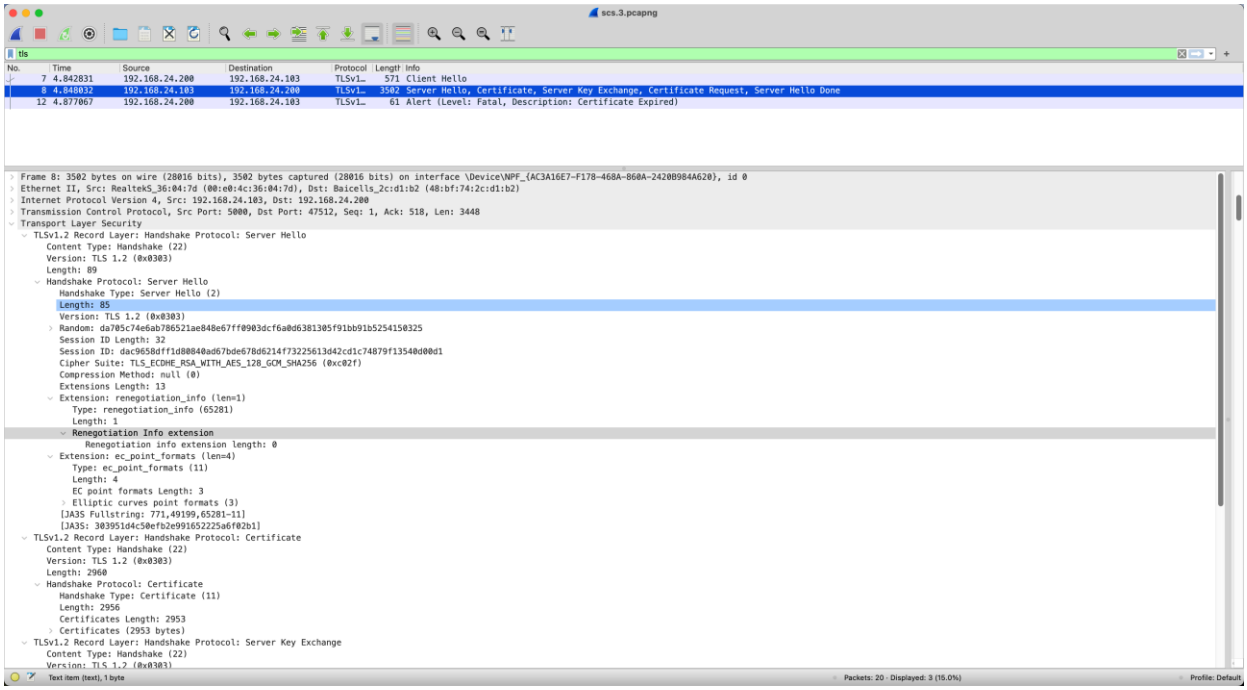
8.3 WINNF.FT.C.SCS.3



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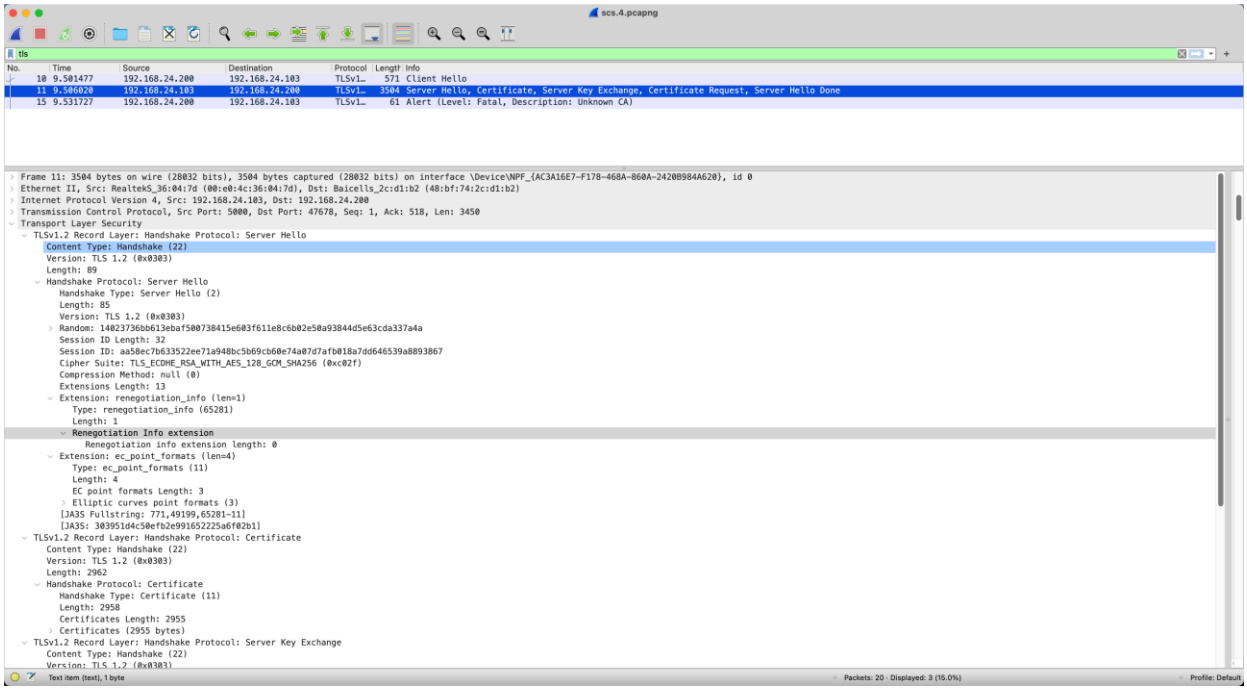

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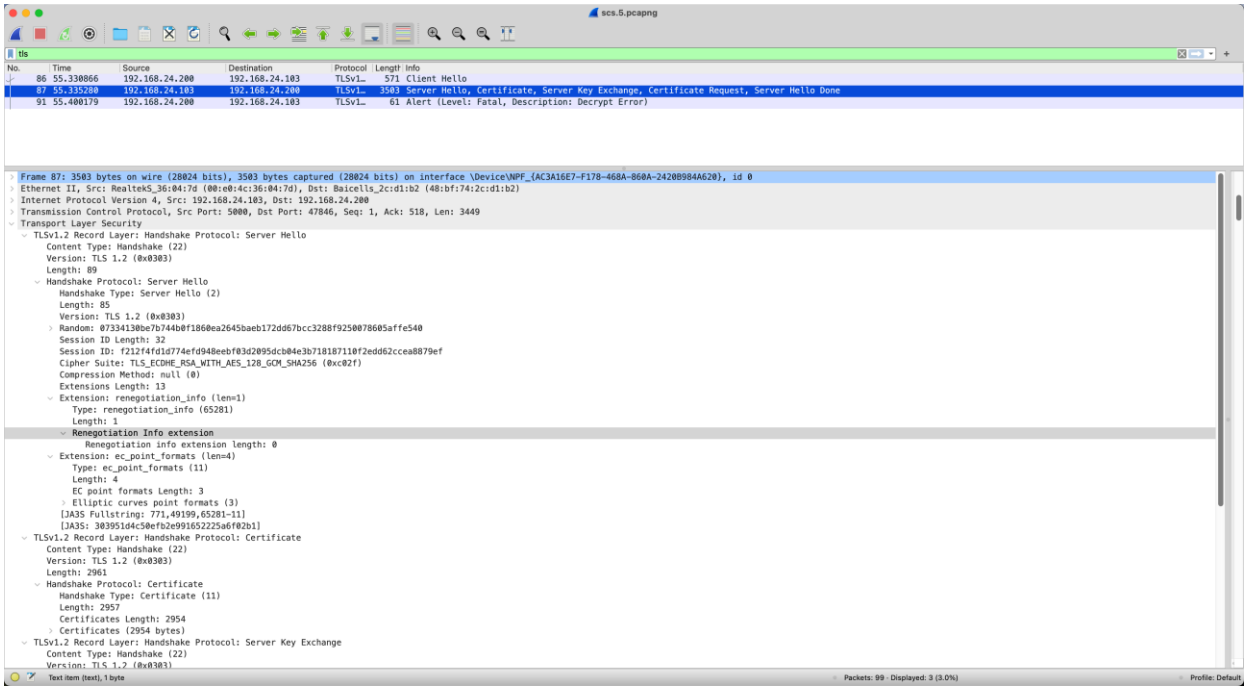

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9 Photographs

9.1 EUT Constructional Details (EUT Photos)

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