



TEST REPORT

No. 25T04Z100627-002

for

Japan Radio Co., Ltd.

Product Name: CBRS eNodeB

Model Name: JRL-1411

FCC ID: CKEJRL-1411

with

Hardware Version: JRL-1411

Software Version: JR_1.1.1

Issued Date: 2025-07-02

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
25T04Z100627-002	Rev.0	1 st edition	2025-07-02

Note: the latest revision of the test report supersedes all previous version.

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1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA website.

1.2. Testing Location

Location 1: CTTL(Huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China
100191.

1.3. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

1.4. Project data

Testing Start Date: 2025-04-30

Testing End Date: 2025-05-30

1.5. Signature



Dong Yuan

(Prepared this test report)



Zhou Yu

(Reviewed this test report)



Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name: Japan Radio Co., Ltd.
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2.2. Manufacturer Information

Company Name: Japan Radio Co., Ltd.
Address: 3000 Scott Blvd, Suite 212, Santa Clara, California 95054, United States
Contact: Yuji Kinoshita
Email: kinoshita.yuji@jrc.co.jp
Tel.: +81-49-257-6468
Fax: +81-49-257-6214

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT(*)

Description	CBRS eNodeB Base Station
Model Name	JRL-1411
CBSD Category	Category A
Antenna Gain	3dBi
Supported Channel bandwidth	LTE:10/20MHz
Maximum Output Power	conducted 24dBm per port for 20MHz bandwidth, 21dbm per port for 10MHz bandwidth
Number of Antenna ports	4
Frequency range	LTE B48 3550MHz-3700MHz
Type of modulation	QPSK, 16QAM, 64QAM, 256QAM
Extreme Temperature	-30/+50°C
Normal Voltage	12V DC
EUT in Test	CBSD

(*): Declared by applicant.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
UT01a	1202000466241RB0004	JRL-1411	JR_1.1.1	2025-04-08

*EUT ID: is used to identify the test sample in the lab internally.

4. Reference Documents

4.1. Documents supplied by applicant

Supported features, referring to Annex A for detailed information, are supplied by the client or manufacturer, which is the basis of testing. CAICT is not responsible for the accuracy of customer supplied technical information that may affect the test results (for example, antenna gain and loss of customer supplied cable).

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
WINNF-TS-0122	Test and Certification for Citizens Broadband Radio Service (CBRS); Conformance and Performance Test Technical Specification; CBSD/DP as Unit Under Test (UUT)	V1.0.2
ONGO-TS-9001	OnGo Release 1 Certification Test Plan	V1.2.1
FCC 47 CFR Part 96	Citizens Broadband Radio Service	10-1-23 Edition
KDB 940660 D01	Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96	v03 October 29, 2020

5. Test Results

5.1. Summary of Test Results

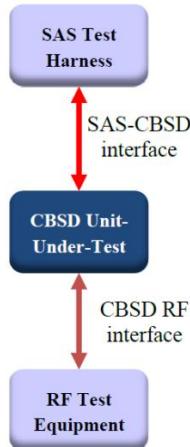
Test Case Name	Description	Verdict
WINNF.FT.C.REG.1	Multi-Step registration	Pass
WINNF.FT.C.REG.5	Single-Step registration for CBSD with CPI signed data	Pass
WINNF.FT.C.REG.8	Missing Required parameters (responseCode 102)	Pass
WINNF.FT.C.REG.10	Pending registration (responseCode 200)	Pass
WINNF.FT.C.REG.12	Invalid parameter (responseCode 103)	Pass
WINNF.FT.C.REG.14	Blacklisted CBSD (responseCode 101)	Pass
WINNF.FT.C.REG.16	Unsupported SAS protocol version (responseCode 100)	Pass
WINNF.FT.C.REG.18	Group Error (responseCode 201)	Pass
WINNF.FT.C.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Pass
WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	Pass
WINNF.FT.C.HBT.1	Heartbeat Success Case (first Heartbeat Response)	Pass
WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DREGISTER)	Pass
WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	Pass
WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	Pass
WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Pass
WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	Pass
WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	Pass
WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Pass
WINNF.FT.C.RLQ.1	Successful Relinquishment	Pass
WINNF.FT.C.DRG.1	Successful Dereistration	Pass
WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	Pass
WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	Pass
WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	Pass
WINNF.FT.C.SCS.4	TLS failure when SAS Test Harness certificate is issued by unknown CA	Pass
WINNF.FT.C.SCS.5	TLS failure when certificate at the SAS Test Harness is corrupted	Pass
WINNF.PT.C.HBT.1	UUT RF Transmit Power Measurement	Pass

Note: please refer to Annex B in this test report for the detailed test results.

The following terms are used in the above table.

Pass	Amount of testcases with pass results in the given frequency band.
Fail	Amount of testcases with fail results in the given frequency band.
Inc	Amount of testcases with ambiguous results in the given frequency band.
Declare	Amount of testcases with conformity declaration from the client in the given frequency band.

5.2. Test Setup Diagram



5.3. Statements

4G LTE Base Station, Model JRL-1411, manufactured by Japan Radio Co., Ltd.. is an initial model for the test. The CBSD and the Laptop with SAS test harness were connected directly. The RF antenna port on UUT was connected to spectrum analyzer with RF cable. UUT and the SAS Test Harnesses were time synchronized. The WInnForum Test Harness Test Harness (V1.0.0.3) was used. The RF measurement was performed by conducted method.

6. Test Equipment Utilized

Test Equipment List

Description	Type	Series Number	Manufacture	Cal Due Date	Calibration Interval
PXA Signal Analyzer	N9030B	MY57142378	Keysight	2026-02-20	1 year

Description of Support Units

Description	Model No.	Series Number	Manufacture
Laptop(with SAS Test Harness)	Thinkpad E480	PF-136YPF	Lenovo

7. Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Discipline	Measurement Uncertainty
Conducted RF power	0.68dB

ANNEX A: Supported 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

ANNEX B: Detailed Test Results

Annex B.1 Terms used in Results column

Pass	This testcase has been tested, and EUT is conformant to the applied standards in the given frequency band.
Fail	This testcase has been tested, but EUT is not conformant to the applied standards in the given frequency band.
n/a	This test case is either not required/not applicable in the specified band or is not applicable according to the specific PICS/PIXIT for the EUT.
Inc	Test case result is ambiguous in the given frequency band.
Decl	Declaration is received from the client to demonstrate the conformity to the relevant specification in the given frequency band.
BR	This testcase is not tested in the given frequency band, but this testcase was tested with pass result for the initial model in the given frequency band.

Annex B.2 Testcases Results

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness • UUT is in the Unregistered state 	--
2	<p>CBSD sends correct Registration request information, as specified in [n.5], to the SAS Test Harness:</p> <ul style="list-style-type: none"> • The required userId, fcld 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. <p>Note: It is outside the scope of this document to test the Registration information that is supplied via another means.</p>	PASS
3	<ul style="list-style-type: none"> • SAS Test Harness sends a CBSD Registration Response as follows: <ul style="list-style-type: none"> – <i>cbsdId</i> = C – <i>measReportConfig</i> shall not be included – <i>responseCode</i> = 0 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.	--
5	<p>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:</p> <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • 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	<p>CBSD sends Registration request to the SAS Test Harness:</p> <ul style="list-style-type: none"> • The required userId, fcId and cbsdSerialNumber and REGConditional 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	<ul style="list-style-type: none"> • SAS Test Harness sends a CBSD Registration Response as follows: <ul style="list-style-type: none"> – <i>cbsdId</i> = C – <i>measReportConfig</i> shall not be included. – <i>responseCode</i> = 0 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =0) to further request messages from the UUT.	--
5	<p>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:</p> <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 102 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 200 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 103 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 101 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

[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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 100 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> – SAS response does not include <i>cbsdId</i> – <i>responseCode</i> = 201 	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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: <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS

[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 <i>cbsdId</i> = C	--
2	UUT sends valid Grant Request.	--
3	SAS Test Harness sends a Grant Response message, including • <i>cbsdId</i> =C • <i>responseCode</i> = 400	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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

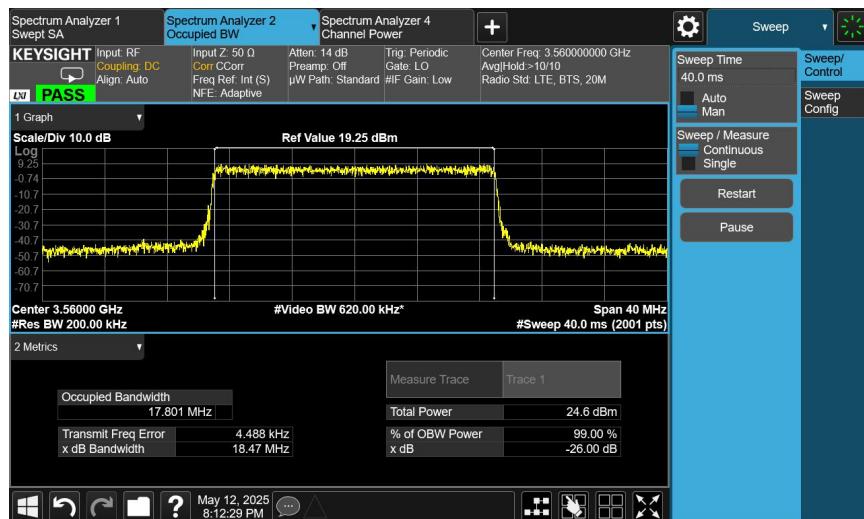
[WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness, with <i>cbsdId</i> = C	--
2	UUT sends valid Grant Request.	--
3	SAS Test Harness sends a Grant Response message, including • <i>cbsdId</i> =C • <i>responseCode</i> = 401	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (<i>responseCode</i> =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

[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: <ul style="list-style-type: none">• UUT has registered successfully with SAS Test Harness, with <i>cbsdId</i> = C	--
2	UUT sends a message: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• <i>cbsdId</i> = 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: <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>availableChannel</i> is an array of <i>availableChannel</i> objects• <i>responseCode</i> = 0	--
5	UUT sends Grant Request message. Validate: <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>maxEIRP</i> is at or below the limit appropriate for CBSD category as defined by Part 96• <i>operationFrequencyRange</i>, 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: <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>grantId</i> = G = a valid grant ID• <i>grantExpireTime</i> = UTC time greater than duration of the test• <i>responseCode</i> = 0	--
7	UUT sends a first Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>grantId</i> = G• <i>operationState</i> = "GRANTED"	PASS
8	SAS Test Harness sends a Heartbeat Response message, with the following parameters: <ul style="list-style-type: none">• <i>cbsdId</i> = C• <i>grantId</i> = G• <i>transmitExpireTime</i> = current UTC time + 200 seconds• <i>responseCode</i> = 0	--

9	<p>For further Heartbeat Request messages sent from UUT after completion of step 8, validate message is sent within latest specified heartbeatInterval, and:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = “AUTHORIZED” and SAS Test Harness responds with a Heartbeat Response message including the following parameters: <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0 	PASS
10	<p>Monitor the RF output of the UUT from start of test until UUT transmission commences. Verify:</p> <ul style="list-style-type: none"> • 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



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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ◦ valid <i>cbsId</i> = C ◦ valid <i>grantId</i> = G ◦ grant is for frequency range F, power P ◦ <i>grantExpireTime</i> = 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	<p>UUT sends a Heartbeat Request message.</p> <p>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = <i>T</i> = Current UTC time • <i>responseCode</i> = 105 (DEREGISTER) 	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--
5	<p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop transmission within (<i>T</i> + 60 seconds) of completion of step 3 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ◦ valid <i>cbsId</i> = C ◦ valid <i>grantId</i> = G ◦ grant is for frequency range F, power P ◦ <i>grantExpireTime</i> = 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	<p>UUT sends a Heartbeat Request message.</p> <p>Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = current UTC time • <i>responseCode</i> = 500 (TERMINATED_GRANT) 	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--
5	<p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop transmission within (T + 60 seconds) of completion of step 3 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • <p>UUT has a valid single grant as follows:</p> <ul style="list-style-type: none"> ○ valid <i>cbsdId</i> = C ○ valid <i>grantId</i> = G ○ grant is for frequency range F, power P ○ <i>grantExpireTime</i> = UTC time greater than duration of the test <ul style="list-style-type: none"> • UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request) 	--
2	<p>UUT sends a Heartbeat Request message.</p> <p>Verify Heartbeat Request message is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = current UTC time • <i>responseCode</i> = 501 (SUSPENDED_GRANT) 	--
4	<p>After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.</p>	--
5	<p>Monitor the SAS-CBSD interface. Verify either A OR B occurs:</p> <p>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED" <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbdsId</i> = C • <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT does not transmit at any time 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ◦ valid <i>cbsId</i> = C ◦ valid <i>grantId</i> = G ◦ grant is for frequency range F, power P ◦ <i>grantExpireTime</i> = 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	<p>UUT sends a Heartbeat Request message.</p> <p>Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = current UTC time • <i>responseCode</i> = 501 (SUSPENDED_GRANT) 	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--
5	<p>Monitor the SAS-CBSD interface. Verify either A OR B occurs:</p> <p>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "GRANTED" <p>B. UUT sends a Relinquishment Request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> • <i>cbdsId</i> = C • <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop transmission within (T + 60 seconds) of 	PASS

	completion of step 3	
--	----------------------	--

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> o valid <i>cbsId</i> = C o valid <i>grantId</i> = G o grant is for frequency range F, power P o <i>grantExpireTime</i> = 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	<p>UUT sends a Heartbeat Request message.</p> <p>Verify Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i>, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = T = Current UTC Time • <i>responseCode</i> = 502 (UNSYNC_OP_PARAM) 	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--
5	<p>Monitor the SAS-CBSD interface. Verify:</p> <ul style="list-style-type: none"> • UUT sends a Grant Relinquishment Request message. Verify message is correctly formatted with parameters: <ul style="list-style-type: none"> o <i>cbdsId</i> = C o <i>grantId</i> = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop transmission within (T+60) seconds of completion of step 3. 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • UUT has a valid single grant as follows: <ul style="list-style-type: none"> ◦ valid <i>cbsId</i> = C ◦ valid <i>grantId</i> = G ◦ grant is for frequency range F, power P ◦ <i>grantExpireTime</i> = 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	<p>UUT sends a Heartbeat Request message.</p> <p>Ensure Heartbeat Request message is sent within latest specified <i>heartbeatInterval</i>, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "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	<p>Monitor the RF output of the UUT from start of test to 60 seconds after step 3.</p> <p>Verify:</p> <ul style="list-style-type: none"> • At any time during the test, UUT shall not transmit on RF interface 	PASS

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has registered successfully with SAS Test Harness • <p>UUT has a valid single grant as follows:</p> <ul style="list-style-type: none"> ◦ valid <i>cbsId</i> = C ◦ valid <i>grantId</i> = G ◦ grant is for frequency range F, power P ◦ <i>grantExpireTime</i> = UTC time greater than duration of the test <ul style="list-style-type: none"> • UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface 	--
2	<p>UUT sends a Heartbeat Request message.</p> <p>Verify Heartbeat Request message is sent within the latest specified <i>heartbeatInterval</i>, and is formatted correctly, including:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>operationState</i> = "AUTHORIZED" 	PASS
3	<p>SAS Test Harness sends a Heartbeat Response message, with the following parameters:</p> <ul style="list-style-type: none"> • <i>cbsId</i> = C • <i>grantId</i> = G • <i>transmitExpireTime</i> = current UTC time + 200 seconds • <i>responseCode</i> = 0 	--
4	<p>After completion of Step 3, SAS Test Harness does not respond to any further messages from UUT</p>	--
5	<p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> • UUT shall stop all transmission on RF interface within (<i>transmitExpireTime</i> + 60 seconds), using the <i>transmitExpireTime</i> sent in Step 3. 	PASS

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

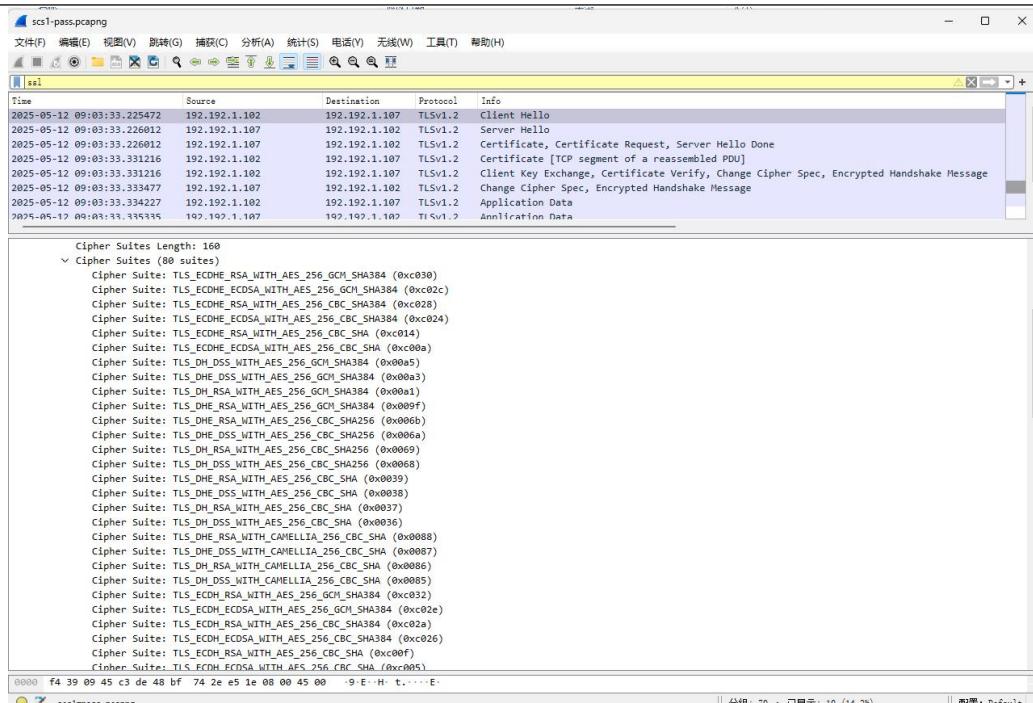
#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT has successfully registered with SAS Test Harness, with <i>cbsdId</i>=C • UUT has received a valid grant with <i>grantId</i> = G • UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant. <p>Invoke trigger to relinquish UUT Grant from the SAS Test Harness</p>	--
2	<p>UUT sends a Relinquishment Request message. Verify message contains all required parameters properly formatted, and specifically:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>grantId</i> = G 	PASS
3	<p>SAS Test Harness shall approve the request with a Relinquishment Response message with parameters:</p> <ul style="list-style-type: none"> – <i>cbsdId</i> = C – <i>grantId</i> = G – <i>responseCode</i> = 0 	--
4	<p>After completion of step 3, SAS Test Harness will not provide any additional positive response (<i>responseCode</i>=0) to further request messages from the UUT.</p>	--
5	<p>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:</p> <ul style="list-style-type: none"> • UUT shall stop RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request 	PASS

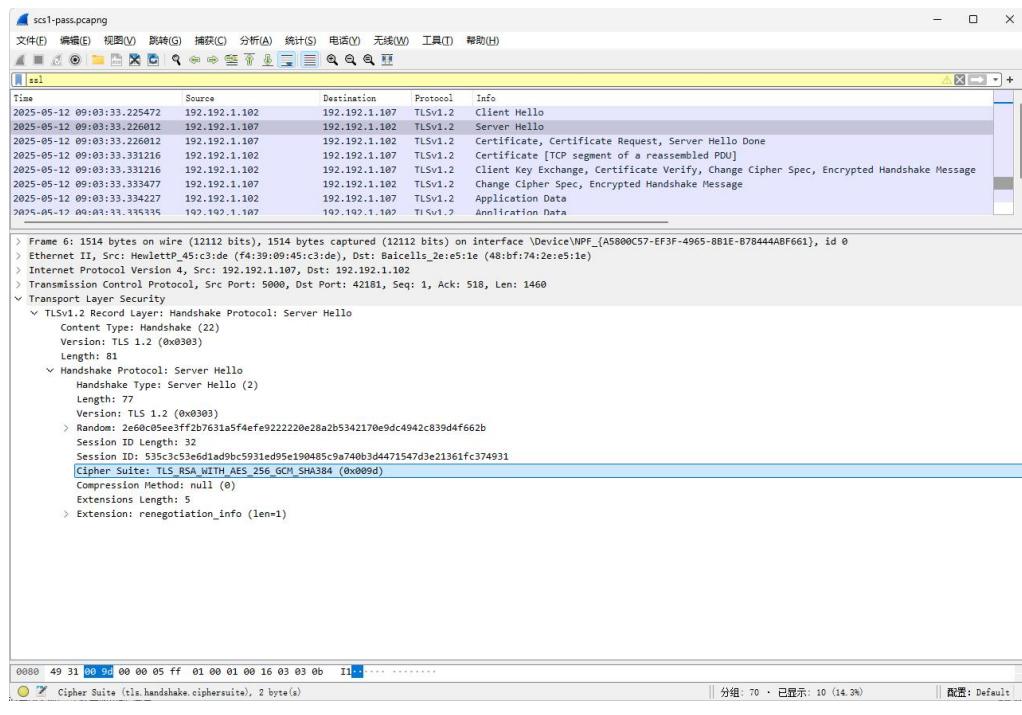
[WINNF.FT.C.DRG.1] Successful Deregistration

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness • UUT has successfully registered with SAS Test Harness, with <i>cbsdId</i>=C • UUT has received a valid grant with <i>grantId</i> = G • UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant. <p>Invoke trigger to deregister UUT from the SAS Test Harness</p>	--
2	UUT may send a Relinquishment request and receives Relinquishment response with <i>responseCode</i> =0	--
3	UUT sends Deregistration Request to SAS Test Harness with <i>cbsdId</i> = C.	PASS
4	<p>SAS Test Harness shall approve the request with a Deregistration Response message with parameters:</p> <ul style="list-style-type: none"> • <i>cbsdId</i> = C • <i>responseCode</i> = 0 	--
5	After completion of step 3, SAS Test Harness will not provide any additional positive response (<i>responseCode</i> =0) to further request messages from the UUT.	--
6	<p>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:</p> <ul style="list-style-type: none"> • UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: <ul style="list-style-type: none"> A. UUT sending a Registration Request message, as this is not mandatory B. UUT sending a Deregistration Request message 	PASS

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

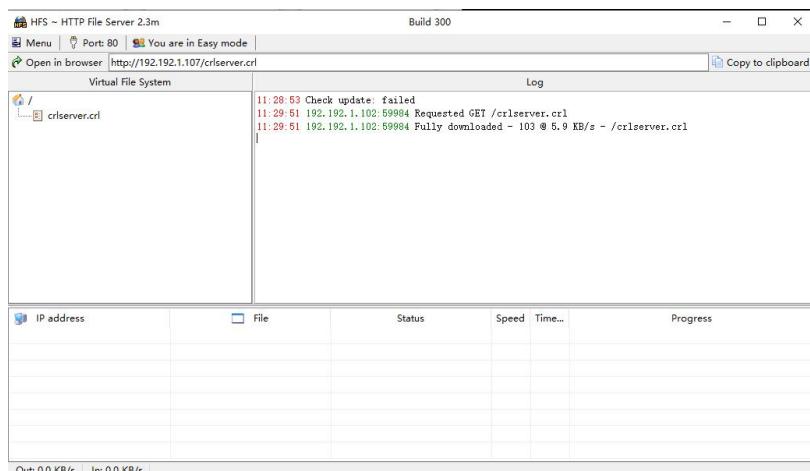
#	Test Execution Steps	Results
1	<ul style="list-style-type: none"> • UUT shall start CBSD-SAS communication with the security procedure • The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate. • Configure the SAS Test Harness to accept the security procedure and establish the connection 	PASS
2	<ul style="list-style-type: none"> • 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, <ul style="list-style-type: none"> • 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	<p>A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability.</p> <ul style="list-style-type: none"> • UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with <i>responseCode</i> = 0 and <i>cbsdId</i>. 	PASS
4	<p>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:</p> <ul style="list-style-type: none"> • UUT shall not transmit RF 	PASS



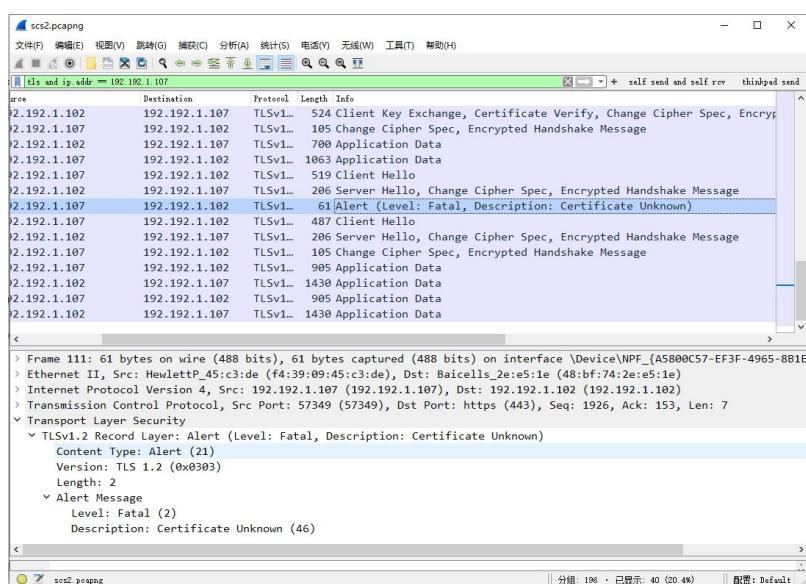


[WINNF.FT.C.SCS.2] TLS failure due to revoked certificate Test prerequisite:

#	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	/
4	SAS Test-Harness shall not receive any Registration request or any application data.	PASS
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



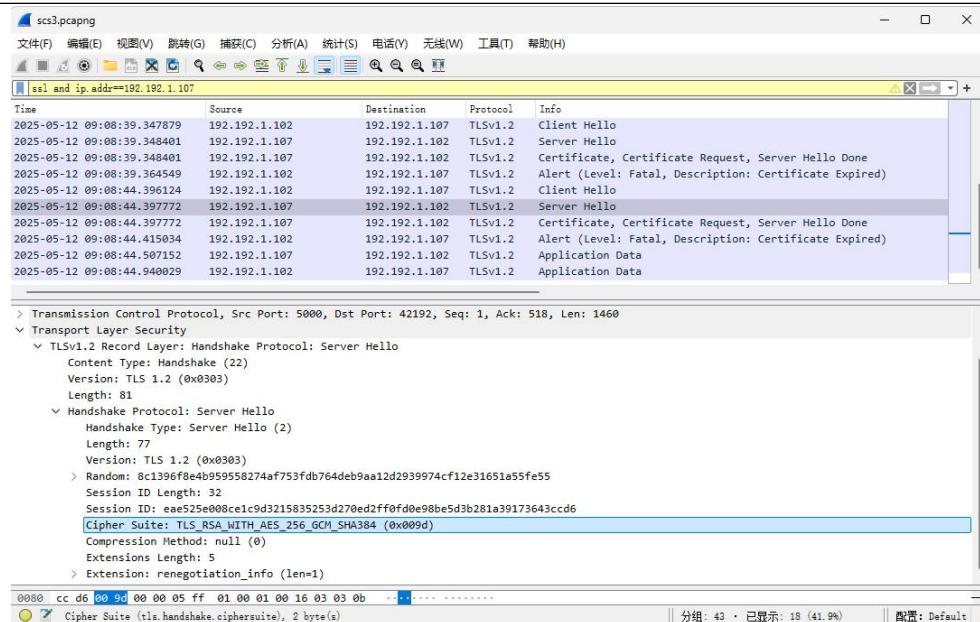
UUT CRL file download

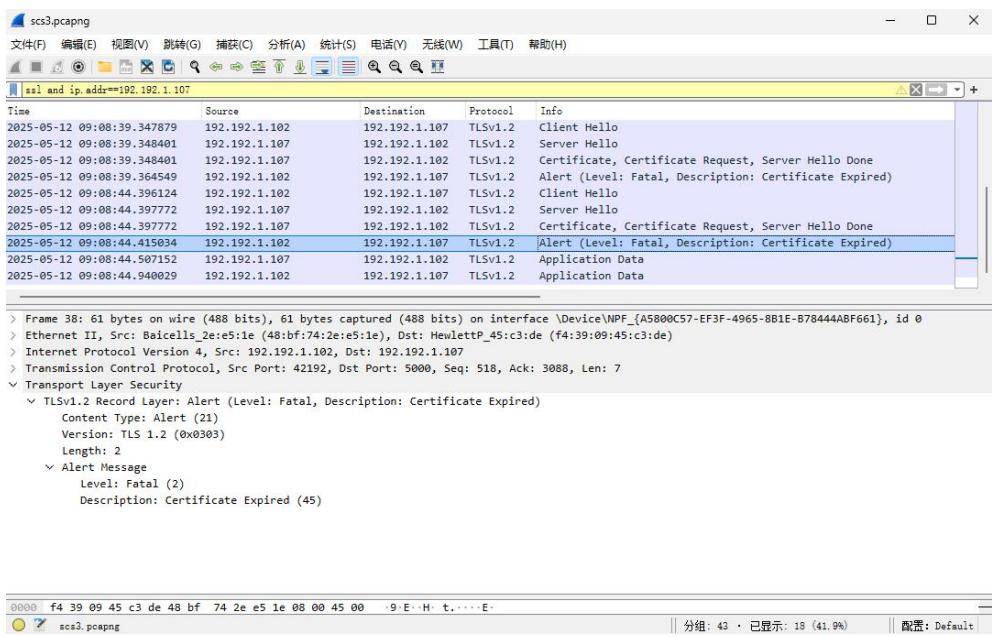


Packet capture sequence

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

#	Test Execution Steps	Results
1	<ul style="list-style-type: none">• UUT shall start CBSD-SAS communication with the security procedures	PASS
2	<ul style="list-style-type: none">• 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	/
4	SAS Test-Harness shall not receive any Registration request or any application data.	PASS
5	<p>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:</p> <ul style="list-style-type: none">• UUT shall not transmit RF	PASS

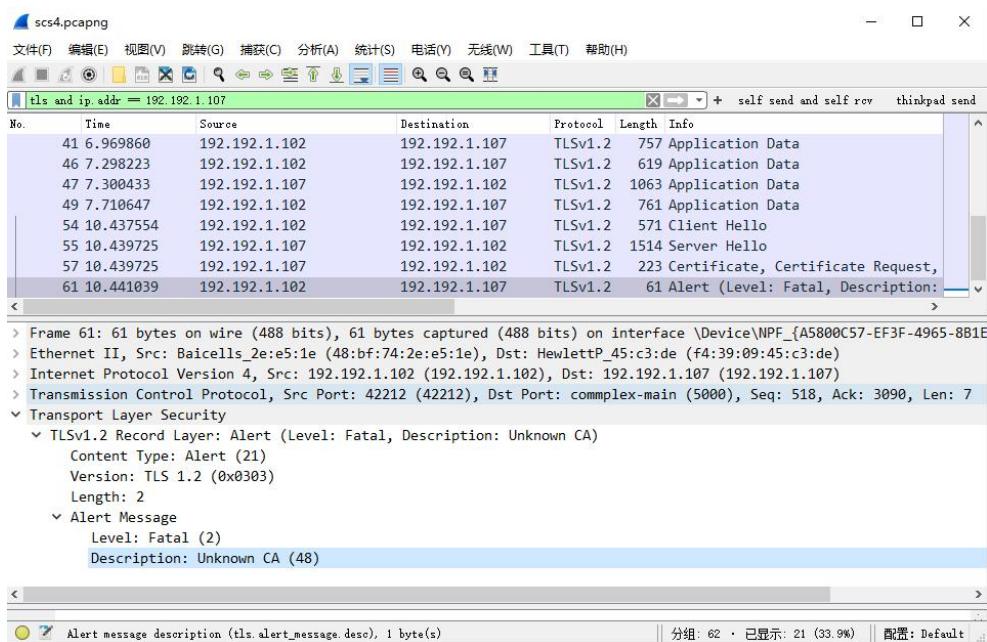




Packet capture sequence

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

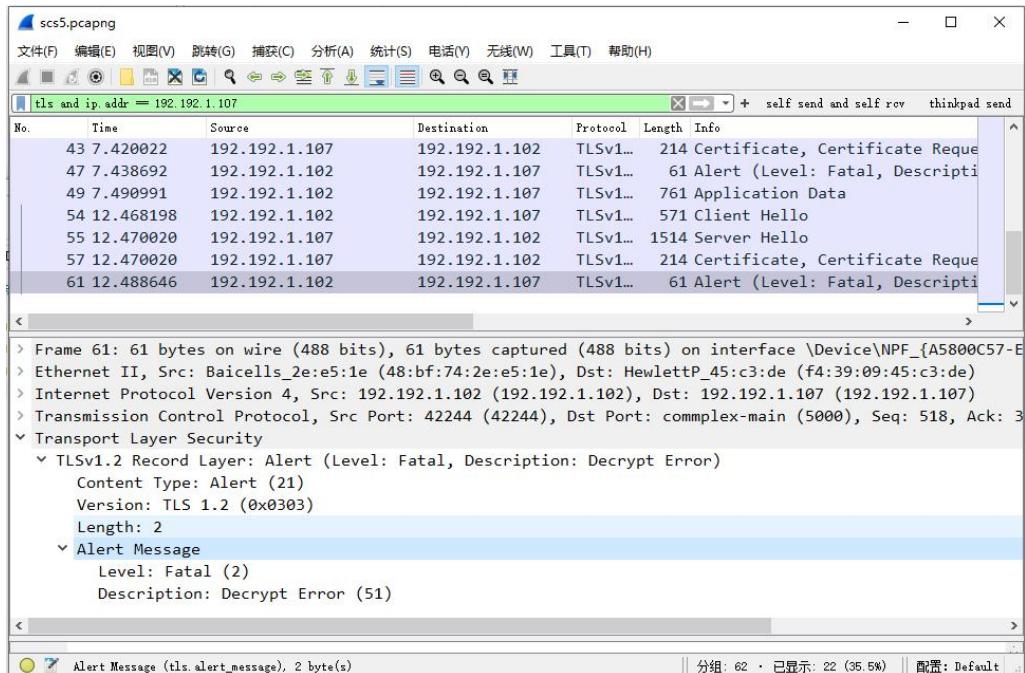
#	Test Execution Steps	Results
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS
2	• Make sure that UUT uses TLS v1.2 for security establishment. • Make sure UUT selects the correct cipher suite. • UUT shall use CRL or OCSP to verify the validity of the server certificate. • 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	/
4	SAS Test-Harness shall not receive any Registration request or any application data.	PASS
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



Packet capture sequence

[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	/
4	SAS Test-Harness shall not receive any Registration request or any application data.	PASS
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



Packet capture sequence

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

#	Test Execution Steps	Results
1	<p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> • UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness • UUT has registered with the SAS, with CBSID 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 <p><i>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.</i></p>	PASS
2	<p>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:</p> <ul style="list-style-type: none"> • UUT sends Heartbeat Request, including: <ul style="list-style-type: none"> o <i>cbsId = C</i> o <i>grantId = G</i> • SAS Test Harness responds with Heartbeat Response, including: <ul style="list-style-type: none"> o <i>cbsId = C</i> o <i>grantId = G</i> o <i>transmitExpireTime = current UTC time + 200 seconds</i> o <i>responseCode = 0</i> 	PASS
3	<p>Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfil the requirements of the power measurement method.</p> <p><i>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.</i></p>	PASS

Frequency [MHz]	Bandwidth [MHz]	Granted maxEIRP [dBm/MHz]	Tx1 Conducted PSD [dBm/MHz]	Array Gain [dB]	Antenna Gain [dBi]	maxEIRP PSD [dBm/MHz]	verdict
3555	10	20	13.55	3.01	3	19.56	PASS
3555	10	17	10.86	3.01	3	16.87	PASS

Note:

1. Array Gain=10log(n), n is the antenna number, for this CBSD the n=2
2. From output power pretest results, the Tx3 is the maximum output power antenna port.
3. maxEIRP PSD = worst port Tx3 Conducted PSD + Array Gain + Antenna Gain
4. The conducted PSD test results include a correction factor for cable loss. The antenna gain is provided by the customer.



Annex C: Accreditation Certificate



Accredited Laboratory

A2LA has accredited

TELECOMMUNICATION TECHNOLOGY LABS, CAICT

Beijing, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 23rd day of July 2024.



Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 7049.01
Valid to July 31, 2026

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

*****END OF REPORT*****