

TEST REPORT

Application No.: SZCR2212004131AT
Applicant: Shenzhen RAKwireless Technology Co.,Ltd.
Address of Applicant: Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, China
Manufacturer: Shenzhen RAKwireless Technology Co.,Ltd.
Address of Manufacturer: Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, China

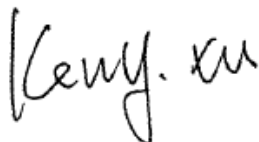
Equipment Under Test (EUT):

EUT Name: All-in-One. 5G
Model No.: M320
Trade Mark: RAK, MNTD
FCC ID: 2AF6B-M320
Standard(s) : CBRSA-TS-9001-V1.0.0
WINNF-TS-0122-V1.0.2
FCC 47 CFR Part 96
KDB 940660 D01 V03

Date of Receipt: 2023-03-23
Date of Test: 2023-03-23 to 2023-04-04
Date of Issue: 2023-05-10

| | |
|---------------------|--------------|
| Test Result: | Pass* |
|---------------------|--------------|



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



Keny Xu
EMC Laboratory Manager



| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 01 | | 2023-05-10 | | Original |
| | | | | |
| | | | | |

| | | | |
|---------------------------------|--|--|--|
| Authorized for issue by: | | | |
| | |  | |
| | | Benson Wang/Project Engineer | |
| | |  | |
| | | Eric Fu/Reviewer | |



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2 Test Summary

| Item | Standard | Test Case ID | Result |
|---|----------------------|-------------------|--------|
| Domain Proxy Multi-Step registration | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.2 | Pass |
| Domain Proxy Single-Step registration for Cat A CBSD | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.4 | Pass |
| Registration due to change of an installation parameter | WINNF-TS-0122-V1.0.2 | WINNF.FT.C.REG.7 | Pass |
| Domain Proxy Missing Required parameters (responseCode 102) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.9 | Pass |
| Domain Proxy Pending registration (responseCode 200) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.11 | Pass |
| Domain Proxy Invalid parameters (responseCode 103) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.13 | Pass |
| Domain Proxy Blacklisted CBSD (responseCode 101) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.15 | Pass |
| Domain Proxy Unsupported SAS protocol version responseCode 100) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.17 | Pass |
| Domain Proxy Group Error (responseCode 201) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.REG.19 | Pass |
| Category A CBSD location update | WINNF-TS-0122-V1.0.2 | WINNF.FT.C.REG.20 | Pass |
| Unsuccessful Grant responseCode=400 (INTERFERENCE) | WINNF-TS-0122-V1.0.2 | WINNF.FT.C.GRA.1 | Pass |
| Unsuccessful Grant responseCode=401 (GRANT_CONFLICT) | WINNF-TS-0122-V1.0.2 | WINNF.FT.C.GRA.2 | Pass |
| Domain Proxy Heartbeat Success Case (first Heartbeat Response) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.HBT.2 | Pass |
| Heartbeat responseCode=105 (DEREGISTER) | WINNF-TS-0122-V1.0.2 | WINNF.FT.C.HBT.3 | 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 |
| Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT) | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.HBT.8 | Pass |



| Item | Standard | Test Case ID | Result |
|--|----------------------|-------------------|--------|
| 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 |
| Domain Proxy Successful Relinquishment | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.RLQ.2 | Pass |
| Domain Proxy Successful Deregistration | WINNF-TS-0122-V1.0.2 | WINNF.FT.D.DRG.2 | Pass |
| 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.1 | Pass |
| SAS Version: 1.0.0.3 | | | |

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

Test standards:

CBRSA-TS-9001-V1.0.0

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)

KDB 940660 D01 Part 96 CBRS Eqpt v03



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4 General Information

4.1 Details of E.U.T.

| | |
|------------------------------|---|
| Product Information: | This base station consists of C BU and RU |
| Power supply: | Powered by POE adapter: Adapter model: RP026-5601080YE Input: AC 100-240V 50/60Hz Output: DC 56.0V 1.08A |
| Sample Type: | Fixed device |
| CBSD Class: | A |
| Transmitter Frequency Band: | LTE Band 48; 5G NR n48 |
| Transmitter Frequency Range: | 3550~3700MHz |
| Hardware Version: | RAKBS_M320_1.0.0 |
| Software Version: | BaiBBU_QSS_1.1.8.a |
| Test sample: | SN1: 918100TAE4030100008 SN2: 918100TAE4030100009 |
| Antenna Gain: | 5.5dBi |
| MIMO supported | 2*2 UL |
| Antenna Type: | Integral Antenna |

Note: This is a BTS-CBSD communication with Domain Proxy. Domain Proxy information show as below:

Name of Domain Proxy: RAK CloudNMS

Software Version of Domain Proxy: V1.8.0



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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. | Y |
| C3 | Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message. | N |
| 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. | Y |

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) | 27 | 27 | 100 |
| PT (CBSD, DP/CBSD) | 1 | 1 | 100 |
| Total | 28 | 28 | 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 | $\pm 7.25 \times 10^{-8}$ |
| 2 | RF conducted power | $\pm 0.75\text{dB}$ |
| 3 | Temperature test | $\pm 1^\circ\text{C}$ |
| 4 | Humidity test | $\pm 3\%$ |
| 5 | Supply voltages | $\pm 1.5\%$ |
| 6 | Time | $\pm 3\%$ |

4.5 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|-------------|--------------|------------|---------------|
| CPE | SMAWAVE | USB Dongle | / |
| Mobile | OSOM | OV1 | / |
| Router | TP-LINK | TL-R860+ | 1175379002425 |



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4.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

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

No tests were sub-contracted.



5 Equipment List

| Test Equipment | Manufacturer | Model No. | Inventory No. | Cal Date | Cal Due Date |
|-----------------------------------|--|--------------|--------------------|------------|--------------|
| Laptop (With SAS Test harness) | Samsung | 930XCJ | REF. No.SEA1900 | / | / |
| Spectrum Analyzer | Keysight | N9020B | SEM004-28 | 2022-09-20 | 2023-09-19 |
| Shield Room | SAEMC | MSR433 | SEM001-11 | 2021-03-13 | 2024-03-12 |
| Coaxial Cable | SGS | N/A | SEM031-01 | 2022-07-11 | 2023-07-10 |
| 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 | 2022-09-27 | 2023-09-26 |



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

6.2 CBSD Test Procedure

- a. Connect the UUT to SAS Test Harness system and RF Test instruments via the DP 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 TestHarness.
- 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.



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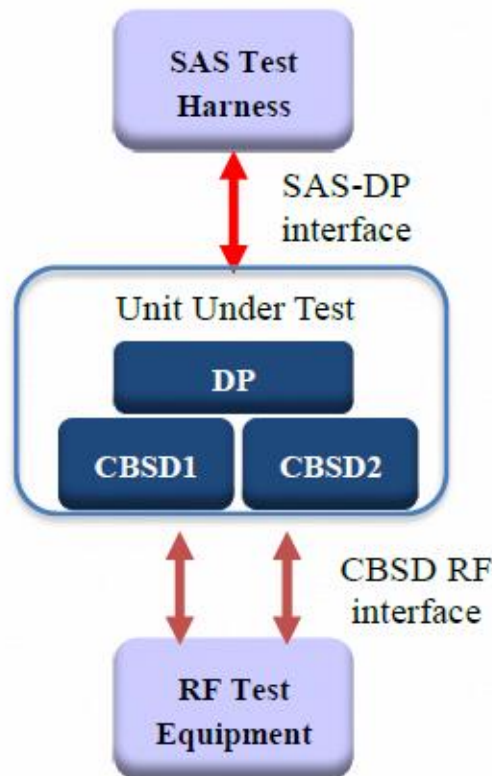
6.3 Test Environment

| | |
|---------------------------|----------------------|
| 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 |

6.4 Test Setup

1) DP is deployed on the network management, and the registration of DP to SAS is to register with SAS according to the granularity of CBSID ID;

2) The DP and the network element communicate messages according to the cell granularity, and each CBSIDID corresponds to a cell of an RRU which belongs to a base station.



DP/CBSD as UUT, BTS-CBSD communication with Domain Proxy



7 Test Data

7.1 CBSD Registration Process

7.1.1 WINNF.FT.D.REG.2

| # | 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>DP with two CBSD sends correct Registration request information, as specified in [n.5], in the form of one 2-element Array or as individual messages to the SAS Test Harness:</p> <ul style="list-style-type: none"> ● The required userId, fcId and cbsdSerialNumber registration parameters shall be sent for each 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> | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> ● SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or individual messages as follows: <ul style="list-style-type: none"> - cbsdId = Ci - measReportConfig shall not be included - responseCode = 0 for each CBSD | -- | -- |
| 4 | <p>After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=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 not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.1.2 WINNF.FT.D.REG.4

| # | 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 the SAS Test Harness ● UUT is in the Unregistered state | -- | -- |
| 2 | The DP with two CBSDs sends Registration requests in the form of one 2-element Array or as individual messages to SAS Test Harness. <ul style="list-style-type: none"> ● The required userId, fcId and cbsdSerialNumber and REG-Conditional cbsdCategory, airInterface, installationParam, and measCapability registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges. ● Any optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> ● SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or individual messages as follows: <ul style="list-style-type: none"> - cbsdId = Ci - measReportConfig for each CBSD shall not be included - responseCode = 0 for each CBSD | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.1.3 WINNF.FT.C.REG.7

| # | 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 | -- | -- |
| 2 | UUT has successfully registered with SAS Test Harness | -- | -- |
| 3 | Change an installation parameters at the UUT (time T) <ul style="list-style-type: none"> - Tester needs to record the current time at which the parameter change is executed. | -- | -- |
| 4 | Monitor the SAS-CBSD interface. UUT sends a deregistrationRequest to the SAS Test Harness The deregistration request shall be sent within (T + 60 seconds) from step 3. | ■ Pass | □ Fail |



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7.1.4 WINNF.FT.D.REG.9

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 102 for CBSD1 and CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | ■ Pass | □ Fail |

7.1.5 WINNF.FT.D.REG.11

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 200 for CBSD1 and CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | ■ Pass | □ Fail |



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7.1.6 WINNF.FT.D.REG.13

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 0 for CBSD1 - responseCode = 103 for CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |

7.1.7 WINNF.FT.D.REG.15

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 0 for CBSD1 - responseCode = 101 for CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.1.8 WINNF.FT.D.REG.17

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 100 for CBSD1 and CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |

7.1.9 WINNF.FT.D.REG.19

| # | 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 | The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness. | -- | -- |
| 3 | SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: <ul style="list-style-type: none"> - SAS response does not include a cbsdId. - responseCode = 0 for CBSD1 - responseCode = 201 for CBSD2 | -- | -- |
| 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: <ul style="list-style-type: none"> ● UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> 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. | -- | -- |
| 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> 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. | -- | -- |
| 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3 CBSD HeartBeat Process

7.3.1 WINNF.FT.D.HBT.2

| # | Test Execution Steps | Results | |
|---|---|--|-------------------------------|
| 1 | <p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> ● DP has two CBSD registered successfully with SAS Test Harness, with $cbsdId = Ci, i=\{1,2\}$ | -- | -- |
| 2 | <p>DP sends a message:</p> <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 | <p>DP sends a Spectrum Inquiry Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Spectrum Inquiry Request message is formatted correctly for each CBSD, including for $CBSDi, i=\{1,2\}$:</p> <ul style="list-style-type: none"> ● $cbsdId = Ci$ ● List of frequencyRange objects sent by DP are within the CBRS frequency range | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <p>If a separate Spectrum Inquiry Request message was sent for each CBSD, the SAS Test Harness shall respond to each Spectrum Inquiry Request message with a separate Spectrum Inquiry Response message. If a single Spectrum Inquiry Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Spectrum Inquiry Response message containing a 2-object array. Verify parameters for each CBSD within the Spectrum Inquiry Response message are as follows, for $CBSDi, i=\{1,2\}$:</p> <ul style="list-style-type: none"> ● $cbsdId = Ci$ ● availableChannel is an array of availableChannel objects ● responseCode = 0 | -- | -- |
| 5 | <p>DP sends a Grant Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Grant Request message is formatted correctly for each CBSD, including for $CBSDi, i=\{1,2\}$:</p> <ul style="list-style-type: none"> ● $cbsdId = C$ ● maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 ● operationFrequencyRange, Fi, sent by UUT is a valid range within the CBRS band | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 6 | <p>If a separate Grant Request message was sent for each CBSD, the SAS Test Harness shall respond to each Grant Request message with a separate Grant Response message. If a single Grant Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Grant Response message containing a 2-object array. Verify parameters for each CBSD within the Grant Response message are as follows, for $CBSDi, i=\{1,2\}$:</p> | -- | -- |



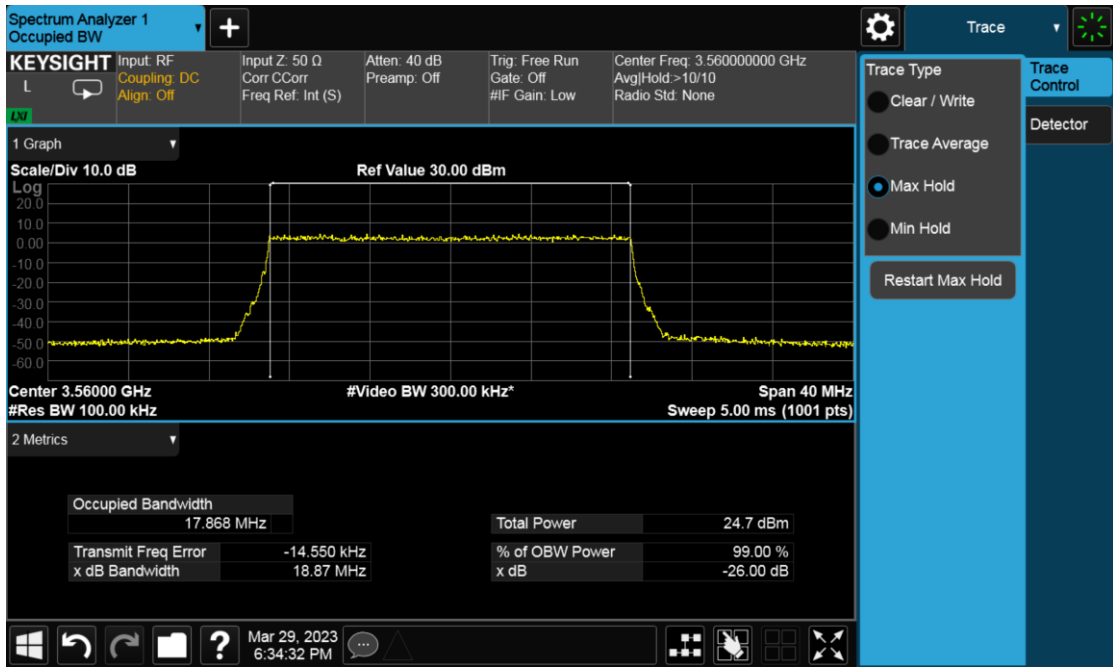
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| | | | |
|----|---|--|-------------------------------|
| | <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi = a valid grant ID ● grantExpireTime = UTC time greater than duration of the test ● responseCode = 0 | | |
| 7 | <p>Ensure DP sends first Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Heartbeat Request message is formatted correctly for each CBSD, including, for CBSDi i={1,2}:</p> <ul style="list-style-type: none"> ● cbsdId = Ci, i={1,2} ● grantId = Gi, i={1,2} ● operationState = "GRANTED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 8 | <p>If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Verify parameters for each CBSD within the Heartbeat Response message are as follows, for CBSDi:</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi ● transmitExpireTime = current UTC time + 200 seconds ● responseCode = 0 | -- | -- |
| 9 | <p>For further Heartbeat Request messages sent from DP after completion of step 8, validate message is sent within latest specified heartbeatInterval for CBSDi:</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi ● operationState = "AUTHORIZED" <p>and SAS Test Harness responds with a Heartbeat Response message including the following parameters, for CBSDi</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi ● transmitExpireTime = current UTC time + 200 seconds ● responseCode = 0 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 10 | <p>Monitor the RF output of the UUT from start of test until UUT transmission commences. Monitor the RF output of the UUT from start of test until RF 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 Fi. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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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: <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 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: <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "AUTHORIZED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● UUT shall stop transmission within (T + 60 seconds) of completion of step 3 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3.3 WINNF.FT.C.HBT.5

| # | 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 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 | <p>UUT sends a Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "GRANTED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● transmitExpireTime = T = current UTC time ● responseCode = 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"> ● cbsdId = C ● grantId = G ● operationState = "GRANTED" <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G <p>Monitor the RF output of the UUT. Verify:</p> <ul style="list-style-type: none"> ● UUT does not transmit at any time | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3.4 WINNF.FT.C.HBT.6

| # | 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 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 | <p>UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "AUTHORIZED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● transmitExpireTime = T = current UTC time ● responseCode = 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"> ● cbsdId = C ● grantId = G ● operationState = "GRANTED" <p>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3.5 WINNF.FT.C.HBT.7

| # | 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 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 | <p>UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "AUTHORIZED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● transmitExpireTime = T = current UTC time ● responseCode = 502 (UNSYNC_OP_PARAM) | -- | -- |
| 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:</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"> ○ cbsdId = C ○ grantId = 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3.6 WINNF.FT.D.HBT.8

| # | Test Execution Steps | Results | |
|---|--|--|-------------------------------|
| 1 | <p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> ● DP has two CBSD registered successfully with SAS Test Harness ● Each CBSD {1,2} has a valid single grant as follows <ul style="list-style-type: none"> ○ valid cbsdId = Ci, i={1,2} ○ valid grantId = Gi, i={1,2} ○ grant is for frequency range Fi, power Pi ○ grantExpireTime = UTC time greater than duration of the test ● Both CBSD are in AUTHORIZED state and transmitting within their granted bandwidth on RF interface | -- | -- |
| 2 | <p>DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of size 2. Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly for each CBSD, including, for CBSDi i={1,2}:</p> <ul style="list-style-type: none"> ● cbsdId = Ci, i = {1,2} ● grantId = Gi, i = {1,2} ● operationState = "AUTHORIZED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>If separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Parameters for each CBSD within the Heartbeat Response message should be as follows, for CBSDi:</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi ● For CBSD1: <ul style="list-style-type: none"> ○ transmitExpireTime = current UTC time + 200 seconds ○ responseCode = 0 ● For CBSD2: <ul style="list-style-type: none"> ○ transmitExpireTime = T = current UTC time ○ responseCode = 500 (TERMINATED_GRANT) | -- | -- |
| 4 | <p>After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. If CBSD sends further Heartbeat Request messages for CBSD1, SAS Test Harness shall respond with a Heartbeat Response message with parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C1 ● grantId = G1 ● transmitExpireTime = current UTC time + 200 seconds ● responseCode = 0 ● Heartbeat Request message is within heartbeatInterval of previous Heartbeat Request message | -- | -- |



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| | | | |
|---|--|--|-------------------------------|
| 5 | <p>Monitor the RF output of CBSD2. Verify:</p> <ul style="list-style-type: none"> ● CBSD2 shall stop transmission within bandwidth F2 within (T + 60 seconds) of completion of step 3 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
|---|--|--|-------------------------------|



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7.3.7 WINNF.FT.C.HBT.9

| # | 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 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 | <p>UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "GRANTED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>After completion of step 2, SAS Test Harness does not respond to any further</p> <ul style="list-style-type: none"> ● 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. Verify:</p> <ul style="list-style-type: none"> ● At any time during the test, UUT shall not transmit on RF interface | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.3.8 WINNF.FT.C.HBT.10

| # | 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 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 | <p>UUT sends a Heartbeat Request message. Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● operationState = "AUTHORIZED" | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</p> <ul style="list-style-type: none"> ● cbsdId = C ● grantId = G ● transmitExpireTime = T = current UTC time + 200 seconds ● responseCode = 0 | -- | -- |
| 4 | <p>After completion of step 3, SAS Test Harness shall not allow any further grants to the 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 (transmitExpireTime + 60 seconds), using the transmitExpireTime sent in Step 3. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.4 CBSD Relinquishment Process

7.4.1 WINNF.FT.D.RLQ.2

| # | Test Execution Steps | Results | |
|---|--|--|-------------------------------|
| 1 | <p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> ● DP has successfully completed SAS Discovery and Authentication with SAS Test Harness ● DP has successfully registered 2 CBSD with SAS Test Harness, each with cbsdId=Ci, i={1,2} ● DP has received a valid grant with grantId = Gi, i={1,2} for each CBSD ● Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger to relinquish UUT Grant from the SAS Test Harness</p> | -- | -- |
| 2 | <p>Verify DP sends a Relinquishment Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify Relinquishment Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <p>If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Relinquishment Response shall be as follows:</p> <ul style="list-style-type: none"> ● cbsdId = Ci ● grantId = Gi ● responseCode = 0 | -- | -- |
| 4 | <p>After completion of step 3, SAS Test Harness will not provide any additional positive response (responseCode=0) to further request messages from the UUT.</p> | -- | -- |
| 5 | <p>Monitor the RF output of each 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 relinquishments and UUT sending the relinquishment requests for each CBSD. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.5 CBSD Deregistration Process

7.5.1 WINNF.FT.D.DRG.2

| # | Test Execution Steps | Results | |
|---|---|--|-------------------------------|
| 1 | <p>Ensure the following conditions are met for test entry:</p> <ul style="list-style-type: none"> ● Each UUT has successfully registered with SAS Test Harness ● Each UUT is in the authorized state ● DP has successfully completed SAS Discovery and Authentication with SAS Test Harness ● DP has successfully registered 2 CBSD with SAS Test Harness, each with $cbsdId=C_i, i=\{1,2\}$ ● DP has received a valid grant with $grantId = G_i, i=\{1,2\}$ for each CBSD ● Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. <p>Invoke trigger to relinquish UUT Grant from the SAS Test Harness</p> | -- | -- |
| 2 | UUT sends a Relinquishment request and receives Relinquishment response with $responseCode=0$ | -- | -- |
| 3 | <p>Verify DP sends a Deregistration Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</p> <p>Verify Deregistration Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</p> <ul style="list-style-type: none"> ● $cbsdId = C_i$ | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <p>If a separate Deregistration Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message.</p> <p>If a single Deregistration Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array.</p> <p>Parameters for each CBSD within the Deregistration Response shall be as follows:</p> <ul style="list-style-type: none"> ● $cbsdId = C_i$ ● $responseCode = 0$ | -- | -- |
| 5 | After completion of step 4, SAS Test Harness will not provide any positive response ($responseCode=0$) to further request messages from the UUT. | -- | -- |
| 6 | <p>Monitor the RF output of each 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: <p>A. UUT sending a Registration Request message, as this is not mandatory</p> <p>B. UUT sending a Deregistration Request message</p> | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.6 CBSD Security Validation

7.6.1 WINNF.FT.C.SCS.1

| # | 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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 responseCode = 0 and cbsdId. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |

7.6.2 WINNF.FT.C.SCS.2

| # | Test Execution Steps | Results | |
|---|--|--|-------------------------------|
| 1 | <ul style="list-style-type: none"> UUT shall start CBSD-SAS communication with the security procedures | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> UUT may retry for the security procedure which shall fail. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <ul style="list-style-type: none"> SAS Test-Harness shall not receive any Registration request or any application data. | -- | -- |
| 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 | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.6.3 WINNF.FT.C.SCS.3

| # | Test Execution Steps | Results | |
|---|--|---|----------------------------------|
| 1 | <ul style="list-style-type: none"> UUT shall start CBSD-SAS communication with the security procedures | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> UUT may retry for the security procedure which shall fail. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |

7.6.4 WINNF.FT.C.SCS.4

| # | Test Execution Steps | Results | |
|---|---|---|----------------------------------|
| 1 | <ul style="list-style-type: none"> UUT shall start CBSD-SAS communication with the security procedures | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> UUT may retry for the security procedure which shall fail. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.6.5 WINNF.FT.C.SCS.5

| # | Test Execution Steps | Results | |
|---|---|---|----------------------------------|
| 1 | <ul style="list-style-type: none"> UUT shall start CBSD-SAS communication with the security procedures | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 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. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 3 | <ul style="list-style-type: none"> UUT may retry for the security procedure which shall fail. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| 4 | <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> UUT shall not transmit RF | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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7.7 CBSD RF Power Measurement

7.7.1 WINNF.PT.C.HBT.1

| # | 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 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 | <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"> cbstdId = C grantId = G SAS Test Harness responds with Heartbeat Response, including: <ul style="list-style-type: none"> cbstdId = C grantId = G transmitExpireTime = current UTC time + 200 seconds responseCode = 0 | -- | -- |
| 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 fulfill the requirements of the power measurement method.</p> <ul style="list-style-type: none"> 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. | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |



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RF measurement plot for Test Case:

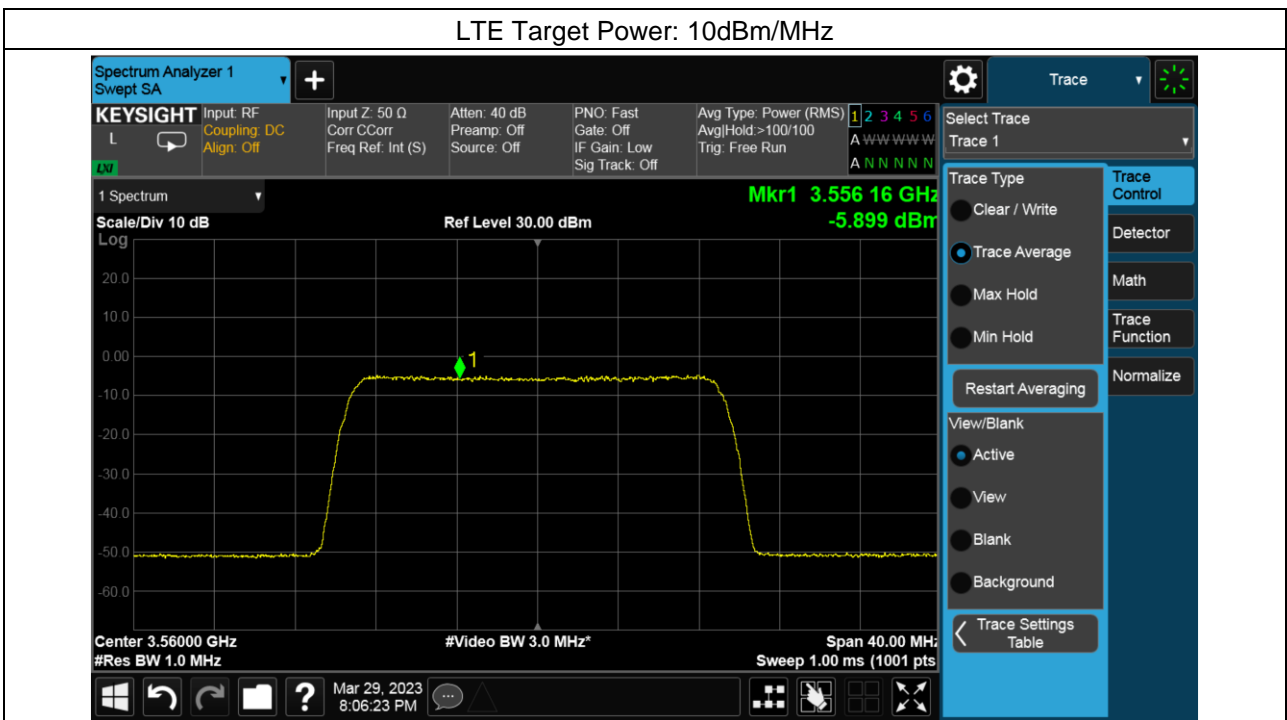
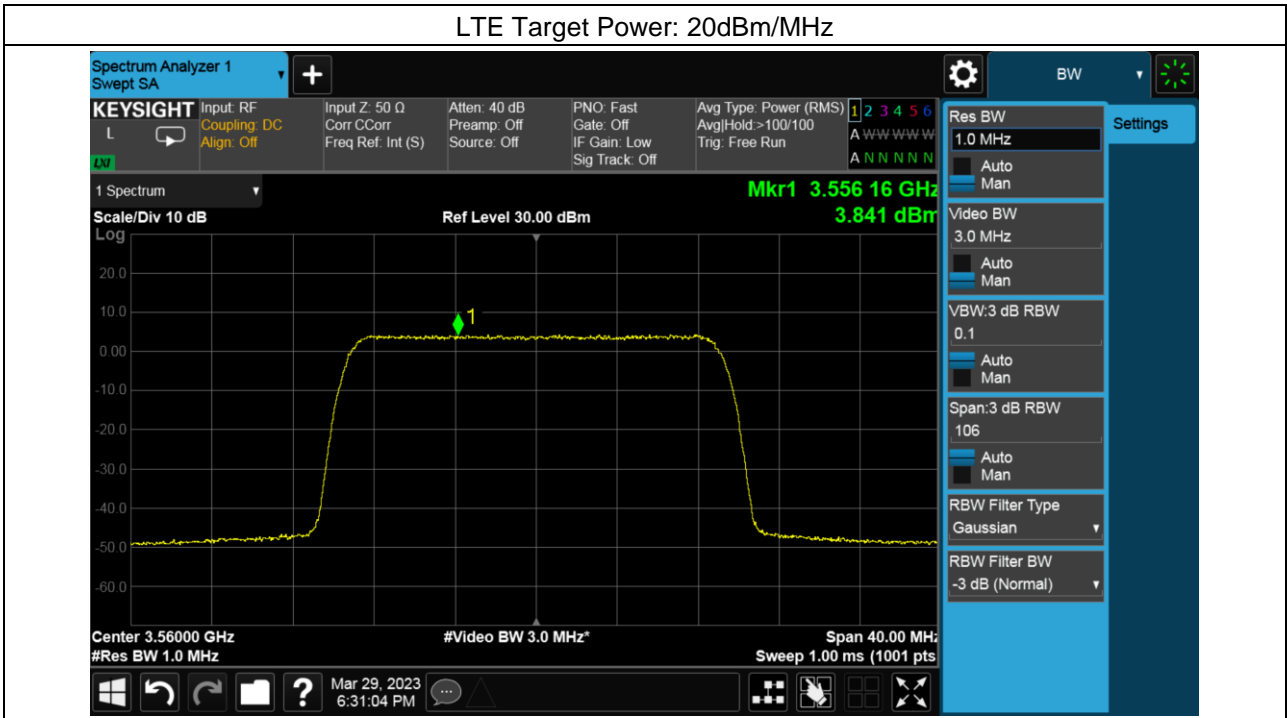
- Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill the requirements of the power measurement method.

| LTE | | | | | | | |
|--|-------------------------|----------------|--------------------|-----------------|--------------------|-----------------|---------|
| Freq. (MHz) | Conducted PSD (dBm/MHz) | Path Loss (dB) | Antenna Gain (dBi) | Array Gain (dB) | EIRP PSD (dBm/MHz) | Limit (dBm/MHz) | Verdict |
| 3560 | 3.841 | 5 | 5.5 | 3.01 | 17.351 | 20 | Pass |
| 3560 | -5.899 | 5 | 5.5 | 3.01 | 7.611 | 10 | Pass |
| Note: | | | | | | | |
| 1. Array Gain=10log(n), n is the antenna number, for this test the n=2 | | | | | | | |
| 2. EIRP PSD= Conducted PSD+ Path Loss+ Antenna Gain+ Array Gain | | | | | | | |

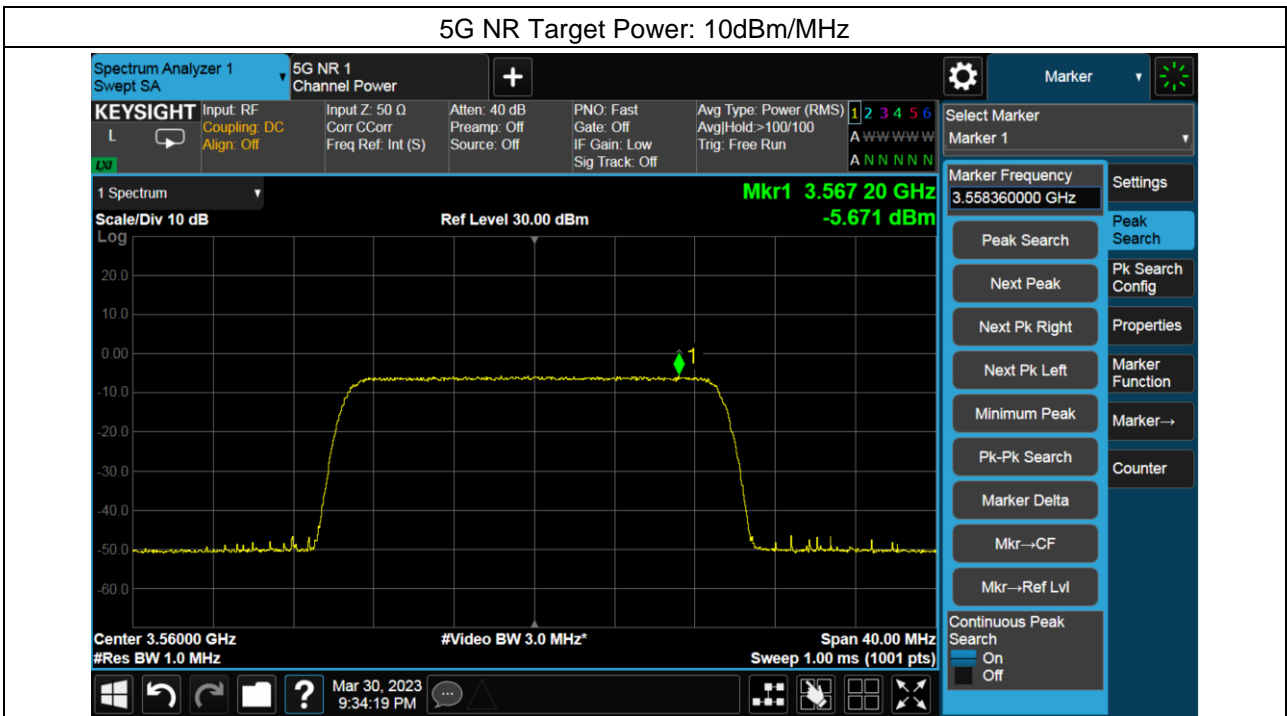
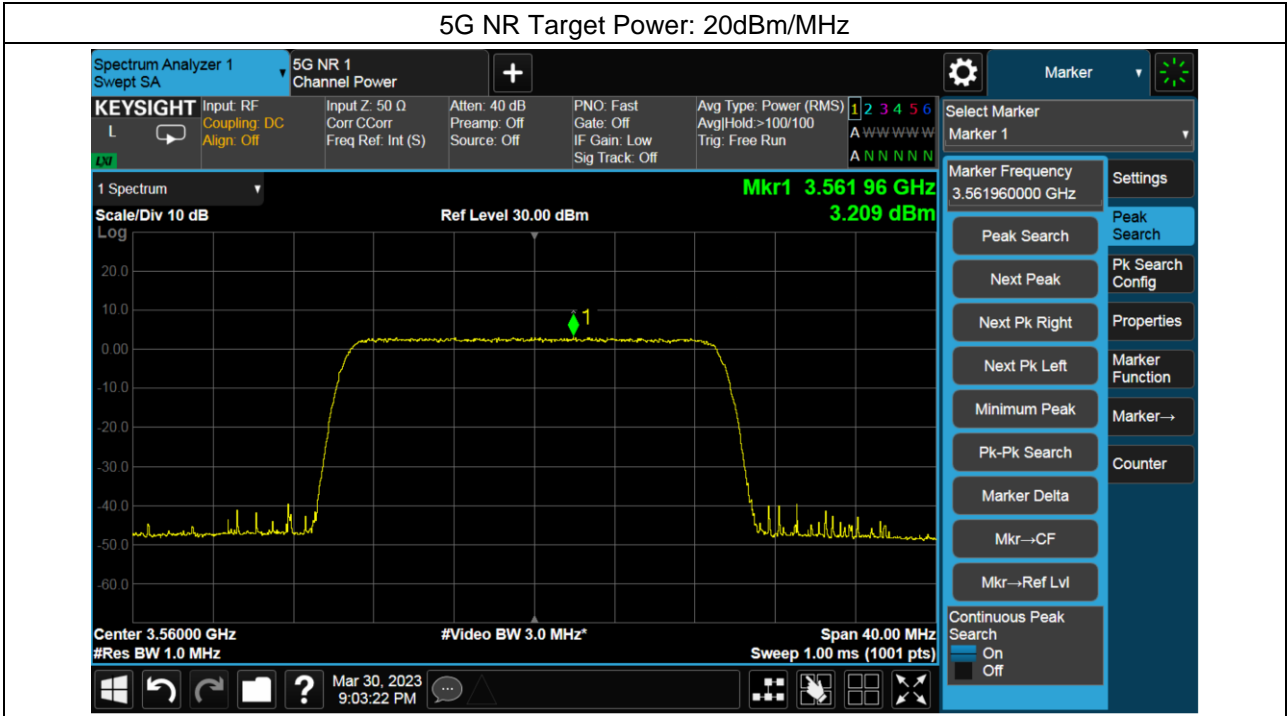
| 5G NR | | | | | | | |
|--|-------------------------|----------------|--------------------|-----------------|--------------------|-----------------|---------|
| Freq. (MHz) | Conducted PSD (dBm/MHz) | Path Loss (dB) | Antenna Gain (dBi) | Array Gain (dB) | EIRP PSD (dBm/MHz) | Limit (dBm/MHz) | Verdict |
| 3560 | 3.209 | 5 | 5.5 | 3.01 | 16.719 | 20 | Pass |
| 3560 | -5.671 | 5 | 5.5 | 3.01 | 7.839 | 10 | Pass |
| Note: | | | | | | | |
| 3. Array Gain=10log(n), n is the antenna number, for this test the n=2 | | | | | | | |
| 4. EIRP PSD= Conducted PSD+ Path Loss+ Antenna Gain+ Array Gain | | | | | | | |



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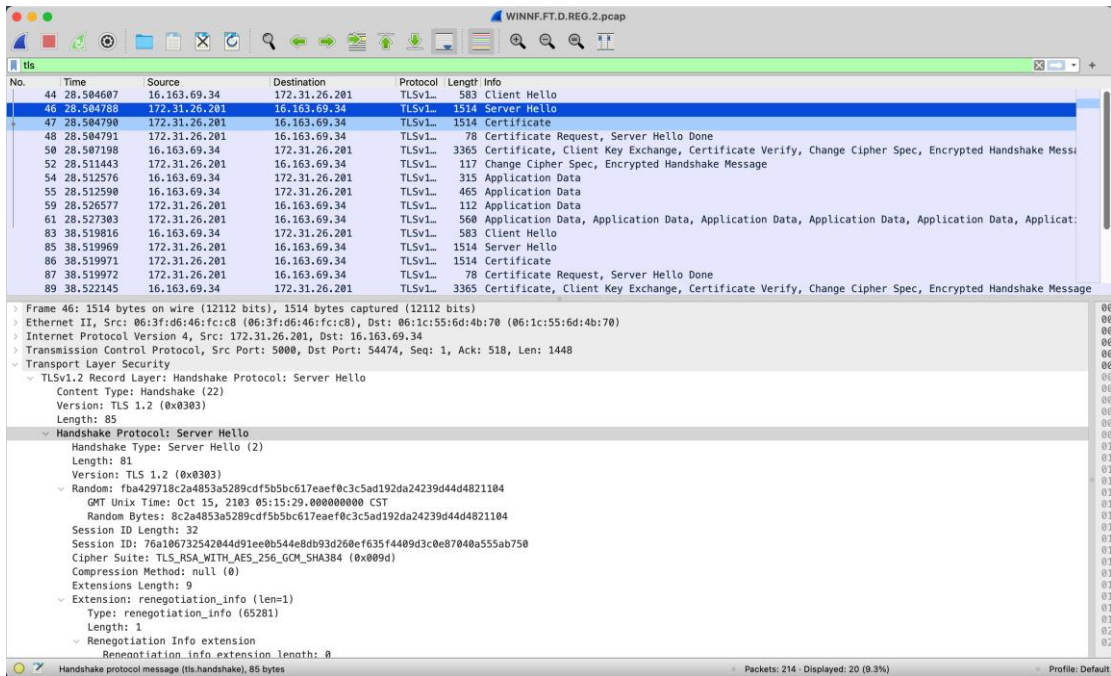
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8 Test Data Log

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

8.1 WINNF.FT.C.SCS.1



| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------|--------|--|
| 44 | 28.504607 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 583 | Client Hello |
| 45 | 28.504753 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 1514 | Server Hello |
| 47 | 28.504790 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 1514 | Certificate |
| 48 | 28.504791 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 78 | Certificate Request, Server Hello Done |
| 50 | 28.507198 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 3365 | Certificate, Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message |
| 52 | 28.511443 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 117 | Change Cipher Spec, Encrypted Handshake Message |
| 54 | 28.512576 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 315 | Application Data |
| 55 | 28.512590 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 465 | Application Data |
| 59 | 28.526577 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 112 | Application Data |
| 61 | 28.527303 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 560 | Application Data, Application Data, Application Data, Application Data, Application Data, Application Data |
| 83 | 38.519816 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 583 | Client Hello |
| 85 | 38.519969 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 1514 | Server Hello |
| 86 | 38.519971 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 1514 | Certificate |
| 87 | 38.519972 | 172.31.26.201 | 16.163.69.34 | TLSv1 | 78 | Certificate Request, Server Hello Done |
| 89 | 38.522145 | 16.163.69.34 | 172.31.26.201 | TLSv1 | 3365 | Certificate, Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message |



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SZEMC-TRF-01 Rev. A/0 Aug01,2022

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8.2 WINNF.FT.C.SCS.2

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|--------------|---------------|---------------|----------|--------|-----------------------------|
| 348 | 9.947579498 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 352 | 9.948427125 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 628 | 15.970841318 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 624 | 15.974813431 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 749 | 30.809553124 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 753 | 30.810385988 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 879 | 40.842836954 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 883 | 40.842838813 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 1989 | 50.802254215 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 1913 | 50.878345732 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 4329 | 60.897978692 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 4333 | 60.898041555 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 6235 | 70.131443756 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 6239 | 70.132152525 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |
| 7825 | 80.161185366 | 16.163.69.34 | 172.31.26.201 | HTTP | 243 | GET /criserver.crt HTTP/1.1 |
| 7829 | 80.161881349 | 172.31.26.201 | 16.163.69.34 | PKIX~ | 1130 | Certificate Revocation List |

```

Frame 348: 243 bytes on wire (1944 bits), 243 bytes captured (1944 bits) on interface ens5, id 0
Ethernet II, Src: 86:3f:06:46:fc:8b (86:3f:06:46:fc:8b), Dst: 86:3f:06:46:fc:8b (86:3f:06:46:fc:8b)
Internet Protocol Version 4, Src: 16.163.69.34, Dst: 172.31.26.201
Transmission Control Protocol, Src Port: 26644, Dst Port: 80, Seq: 1, Ack: 1, Len: 177
Hypertext Transfer Protocol
GET /criserver.crt HTTP/1.1\r\n
Host: ec2-18-163-59-186.ap-east-1.compute.amazonaws.com\r\n
User-Agent: Mget/1.2.1\r\n
Accept: */*\r\n
Accept-Encoding: identity\r\n
Connection: Keep-Alive\r\n
\r\n
[Full request URI: http://ec2-18-163-59-186.ap-east-1.compute.amazonaws.com/criserver.crt]
[HTTP request 1/1]
[Response in frame: 352]

```

Hypertext Transfer Protocol

```

Frame 362: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface ens5, id 0
Ethernet II, Src: 86:3f:06:46:fc:8b (86:3f:06:46:fc:8b), Dst: 86:3f:06:46:fc:8b (86:3f:06:46:fc:8b)
Internet Protocol Version 4, Src: 172.31.26.201, Dst: 16.163.69.34
Transmission Control Protocol, Src Port: 5088, Dst Port: 48465, Seq: 1, Ack: 352, Len: 1448
Transport Layer Security
  TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 57
    Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 53
      Version: TLS 1.2 (0x0303)
      Random: 8673a027870381015dbd2279f44128e509bdc066d16412131e046c2ee0b67d
      Session ID Length: 0
      Cipher Suite: TLS_RSA_WITH_AES_256_GCM_SHA384 (0x009d)
      Compression Method: null (0)
      Extension Length: 13
      Extension: renegotiation_info (len=1)
        Type: renegotiation_info (65281)
        Length: 1
      Renegotiation Info extension
      Extension: session_ticket (len=8)
        Type: session_ticket (135)
        Length: 8
        Data (8 bytes)

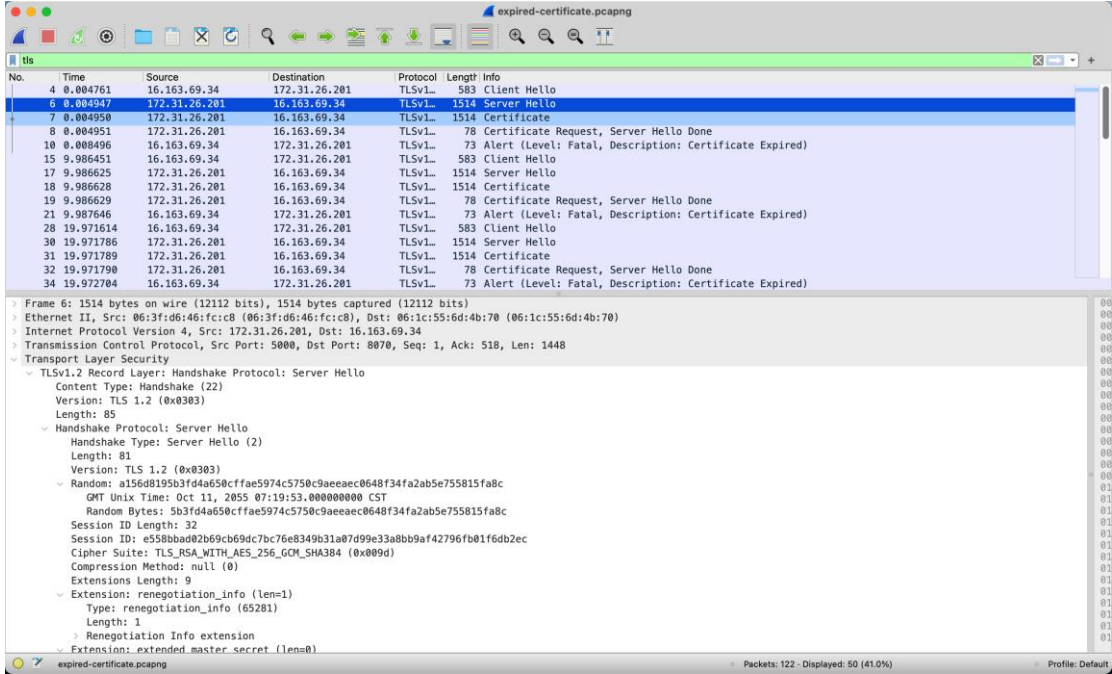
```



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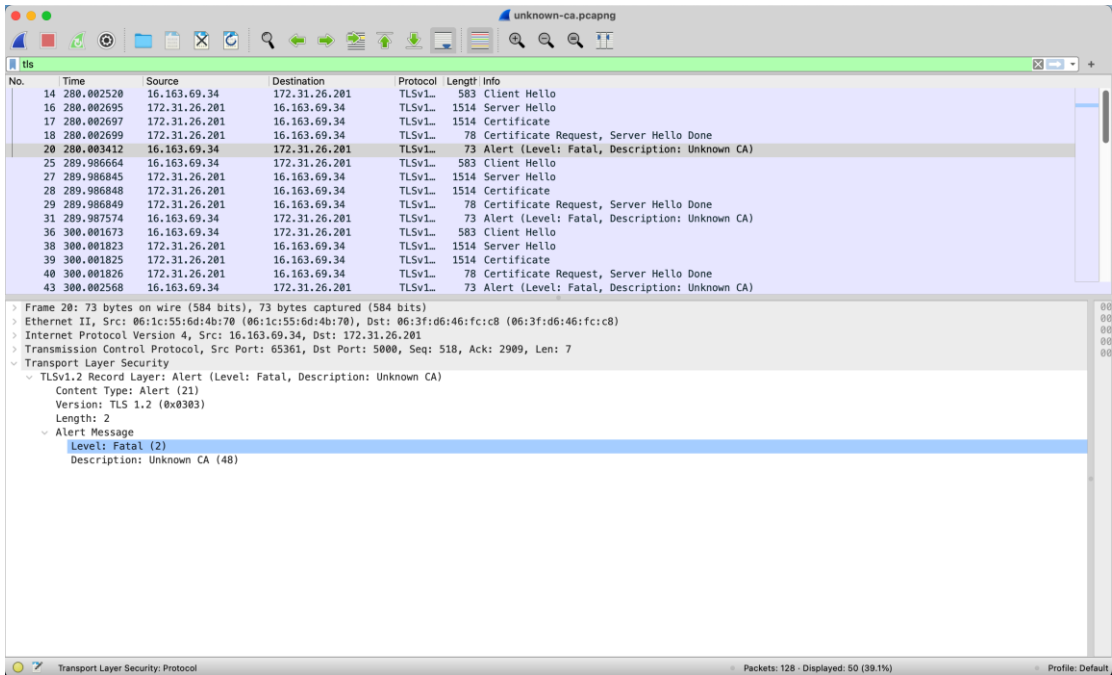
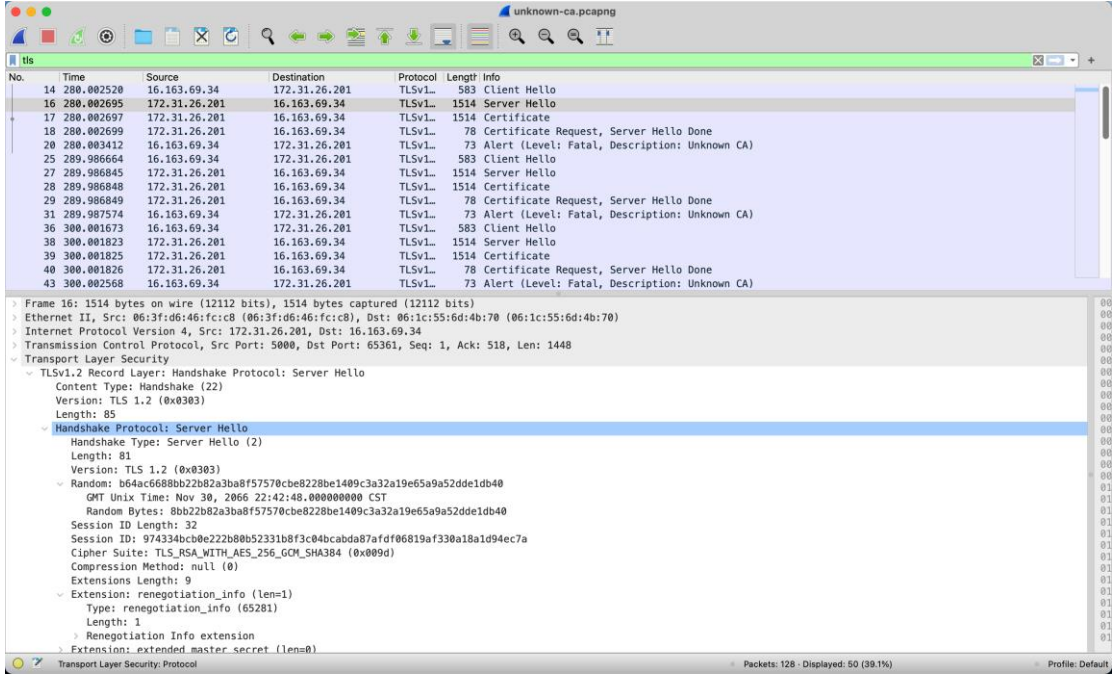
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8.3 WINNF.FT.C.SCS.3



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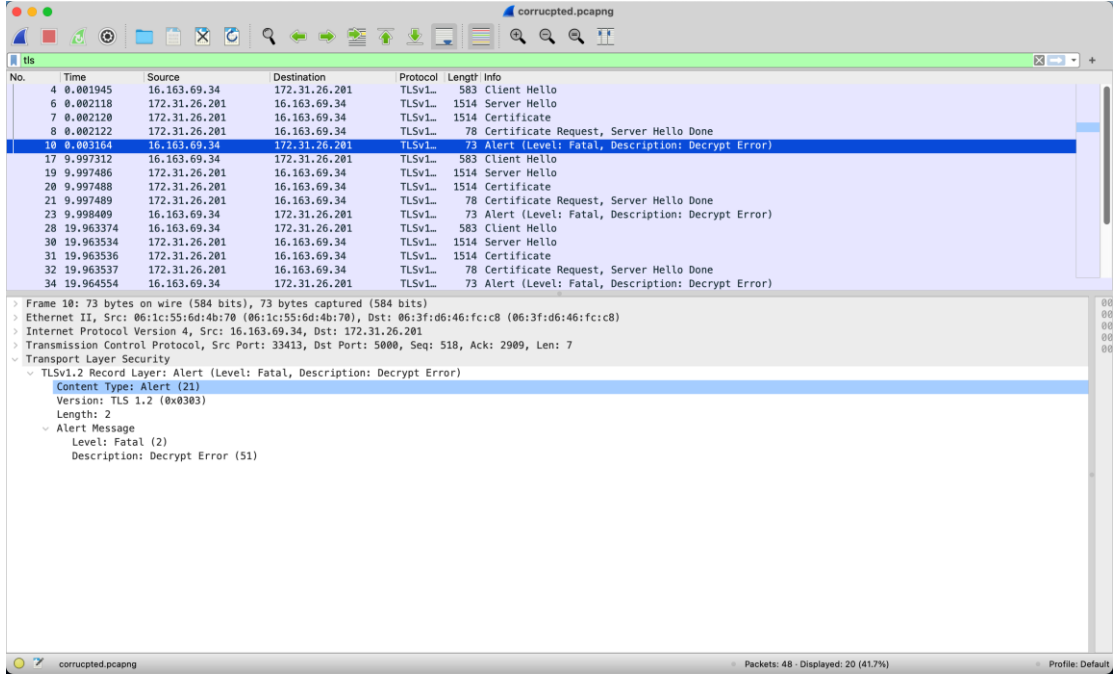
8.4 WINNF.FT.C.SCS.4



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8.5 WINNF.FT.C.SCS.5



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9 Photographs

9.1 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for details.

- End of the Report -

