ELEMENT WASHINGTON DC LLC
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# TEST REPORT
## CBSD-SAS Interoperability

**Applicant Name:**
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

**Date of Testing:**
6/22/2022 – 7/22/2022
**Test Site/Location:**
Element Lab. Columbia, MD, USA
**Test Report Serial No.:**
1M2205100060-01.A3L

| | |
|---|---|
| **FCC ID:** | **A3LRT2203-48A** |
| **APPLICANT:** | **Samsung Electronics Co., Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | RT2203-48A |
| **EUT Type:** | Cat. B LTE/NR Access Point |
| **Frequency Range:** | 3550 – 3700 MHz |
| **FCC Classification:** | Citizens Band Category A and B Devices (CBD) |
| **FCC Rule Part(s):** | Part 96 |
| **Test Procedure(s):** | KDB 940660 D01 v03, KDB 940660 D02 v01, WINNF-TS-0122-V1.0.2, CBRSA-TS-9001 V.1.0.0 |

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in the test procedures listed above. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**RJ Ortanez**
**Executive Vice President**

Authorized Test Lab

ACCREDITED
CERT #2041.01



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# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of compliance with the technical rules and regulations of the Federal Communications Commission.

## 1.2 Element Test Location

These measurement tests were conducted at the Element laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046.

## 1.3 Test Facility / Accreditations

**Measurements were performed at Element lab located in Columbia, MD 21046, U.S.A.**

- Element is a CBRS Alliance (OnGo) Approved Test Lab
- Element is a WInnForum Approved Test Lab
- Element is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for CBRS Alliance Certification Test Plan and WInnForum Conformance and Performance Test Technical Standard.
- Element is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element facility is a registered (2451B) test laboratory with the site description on file with ISED.




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# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Electronics Co., Ltd., Cat B LTE/NR Access Point FCC ID: A3LRT2203-48A.** The test data contained in this report pertains only to CBSD-SAS interoperability. The EUT is a CBSD.

**Test Device Serial Number(s):** 72300121600061
**Test Device Hardware Version:** PCS00
**Test Device Software Version:** 22A

## 2.2 Device Capabilities

This device contains the following capabilities:

LTE Band 48, NR n48

This device supports the following conditional features:

| | Conditional Test Case Definitions | Supported |
|---|---|---|
| C1 | Mandatory for UUT which supports multi-step registration message | ☒ |
| C2 | Mandatory for UUT which supports single-step registration with no CPI-signed data in the registration message. By definition, this is a subset of Category A devices which determine all registration information, including location, without CPI intervention. | ☐ |
| C3 | Mandatory for UUT which supports single-step registration containing CPI-signed data in the registration message. | ☐ |
| C4 | Mandatory for UUT which supports RECEIVED_POWER_WITHOUT_GRANT measurement report type. | ☒ |
| C5 | Mandatory for UUT which supports RECEIVED_POWER_WITH_GRANT measurement report type. | ☐ |
| C6 | Mandatory for UUT which supports parameter change being made at the UUT and prior to sending a deregistration | ☐ |

**Table 2-1. Conditional Features**

## 2.3 Test Configuration

The EUT was connected to the SAS Test Harness developed by WINNF WG4-CBSD. The latest version of the SAS Test Harness (V1.0.0.2) provided by CBRS Alliance was used. The SAS Test Harness is synchronized to UTC time.

## 2.4 Modifications

No modifications were made to EUT during testing.



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# 3.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| Agilent | N9020A | MXA Signal Analyzer | 3/4/2022 | Annual | 3/4/2023 | US46470561 |
| Dell | Latitude 5580 | Test Harness Laptop | N/A | N/A | N/A | N/A |

**Table 3-1 Annual Test Equipment Calibration Schedule**



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# 4.0 ENVIRONMENTAL CONDITIONS

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).



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# 5.0 EVALUATION PROCEDURE

The measurement procedure described in KDB940660 D01 V03 and WINNF-TS-0122V1.0.2 were used in the measurement of the EUT**.**

**Deviation from measurement procedure…….....None**



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# 6.0 TEST SUMMARY

## 6.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LRT2203-48A

**Table 6-1. Summary of Test Results**

| FCC Part Section(s) | KDB940660 D01 Section 3.3 a) | Test Case Description | WInnForum Test Case | Test Result |
|---|---|---|---|---|
| 96.39 (c) | 1 | Confirm that the device will only transmit after it receives authorization from a SAS | WINNF.FT.C.REG.1<br>WINNF.FT.C.REG.8<br>WINNF.FT.C.REG.10<br>WINNF.FT.C.REG.12<br>WINNF.FT.C.REG.14<br>WINNF.FT.C.REG.16<br>WINNF.FT.C.REG.18<br>WINNF.FT.C.GRA.1<br>WINNF.FT.C.GRA.2<br>WINNF.FT.C.HBT.5 | Pass |
| 96.39 (c) | 2 | Check the device registration and authorization with the SAS – determine if the device behaves appropriately for successful and unsuccessful registrations. The device should not be transmitting without authorization from the SAS. | WINNF.FT.C.REG.1<br>WINNF.FT.C.REG.8<br>WINNF.FT.C.REG.10<br>WINNF.FT.C.REG.12<br>WINNF.FT.C.REG.14<br>WINNF.FT.C.REG.16<br>WINNF.FT.C.REG.18 | Pass |
| 96.39(c)(1) | 3 | Confirm that the device changes its operating power and/or channel in response to a command from the SAS. | WINNF.FT.C.HBT.1 | Pass |
| 96.39 | 4 | Confirm that the device correctly configures based on the different license classes | N/A | Pass |
| 96.39(c)(1) | 5 | Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS. | WINNF.PT.C.HBT | Pass |
| 96.39(b)(c) | 6 | Confirm that the device transmits with a bandwidth less than or equal to the SAS specified bandwidth. | WINNF.FT.C.HBT.1 | Pass |
| 96.39(c)(2) | 7 | Confirm that the device transmits on the SAS specified frequency. | WINNF.FT.C.HBT.1 | Pass |
| 96.39(c)(2) | 8 | Confirm that the device stops transmission in response to a command from the SAS, within a period as required by Part 96. | WINNF.FT.C.HBT.3<br>WINNF.FT.C.HBT.4<br>WINNF.FT.C.HBT.6<br>WINNF.FT.D.HBT.7<br>WINNF.FT.C.HBT.10<br>WINNF.FT.C.RLQ.1<br>WINNF.FT.C.DRG.1 | Pass |

**Table 6-2. Summary of Test Results (continued)**



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| | | | | |
|---|---|---|---|---|
| 96.39 (c) | 9 | Confirm that the device sends measurements data in response to the command from the SAS. | WINNF.FT.C.MES.1 | Pass |
| 96.39(a) | 10 | For devices with geo-location, confirm that it notifies the SAS of a new location when it is beyond the required distance parameter (±50 m) within the required time frame. | N/A | N/A |
| 96.39 (c) | 11 | Confirm that the device is capable of reporting the signal level (measurement data) and frequency to SAS. | WINNF.FT.C.MES.1 | Pass |
| | 12 | For a device that operates as a Category A CBSD and then desires to operate as a Category B CBSD (or vice versa), confirm that it re-registers with the SAS for the updated authorization status. | N/A | Pass |
| 96 E | 13 | When CBSDs communicate through a management system, confirm compliance with all requirements. | N/A | Pass |
| 96.39 | 14 | When communication between the CBSD and SAS is lost:<br>i) Describe how the CBSD would react if the communications between the device and the SAS is lost. Confirm that the CBSD stops transmission once it loses the link to the SAS.<br>ii) Describe the process for re-establishment of the communications and confirm that the CBSD acts accordingly.<br>iii) Confirm power-on restart process for registration (re-registration) occurs as expected.<br>iv) Confirm the process for de-registration occurs as expected. | WINNF.FT.C.HBT.9<br>WINNF.FT.C.HBT.10 | Pass |
| 96.39(f) | KDB940660 D01 Section 4 | SAS and Device Security Requirements | WINNF.FT.C.SCS.1<br>WINNF.FT.C.SCS.2<br>WINNF.FT.C.SCS.3<br>WINNF.FT.C.SCS.4<br>WINNF.FT.C.SCS.5 | Pass |

**Notes:**

- Test cases denoted as “N/A” in the table above are not applicable to the EUT and are either Optional or Conditional per Section 6 of WINNF-TS-0122.
- Please see Appendices for test data.



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# 7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Electronics Co., Ltd., Cat B LTE/NR Router FCC ID: A3LRT2203-48A** has been tested to show compliance with Part 96 and WinnForum TS-0122.




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# APPENDIX A – TEST RESULT AND DATA

## A1 [WINNF.FT.C.REG.1] Multi-Step registration

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness<br>• UUT is in the Unregistered state<br>CBSD sends correct Registration request information, as specified in [n.5], to the SAS Test Harness: | -- | -- |
| 2 | • The required userId, fccId and cbsdSerialNumber registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges.<br>• 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.<br>Note: It is outside the scope of this document to test the Registration information that is supplied via another means. | ☒ | ☐ |
| 3 | • SAS Test Harness sends a CBSD Registration Response as follows:<br>- cbsdId = Ci<br>- measReportConfig shall not be included<br>- responseCode = 0 | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |



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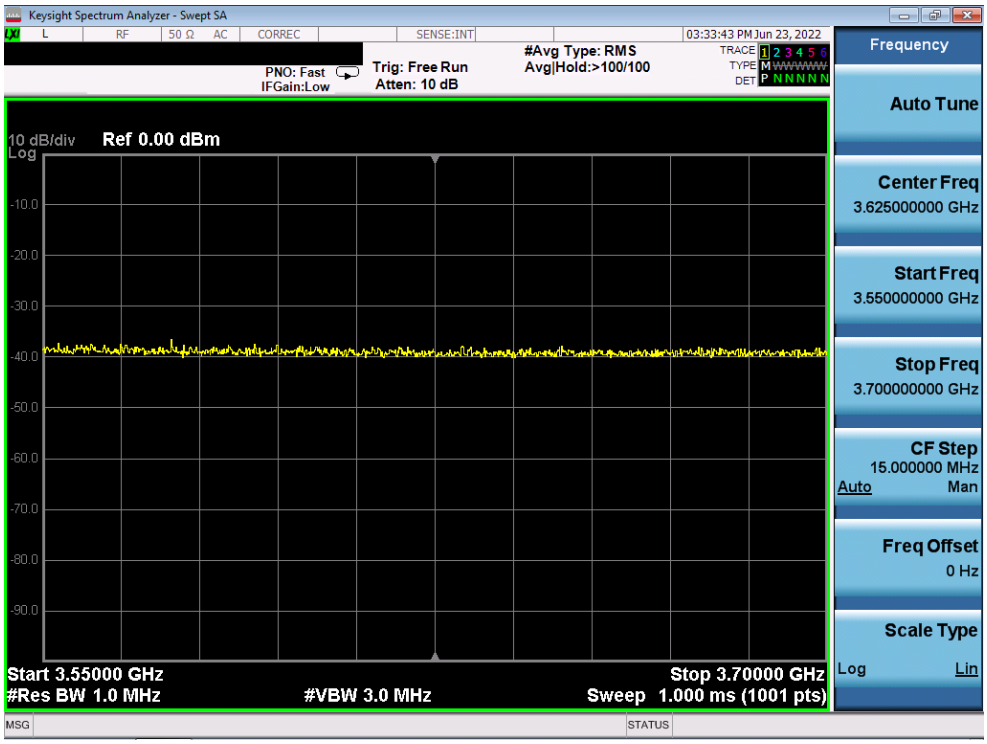
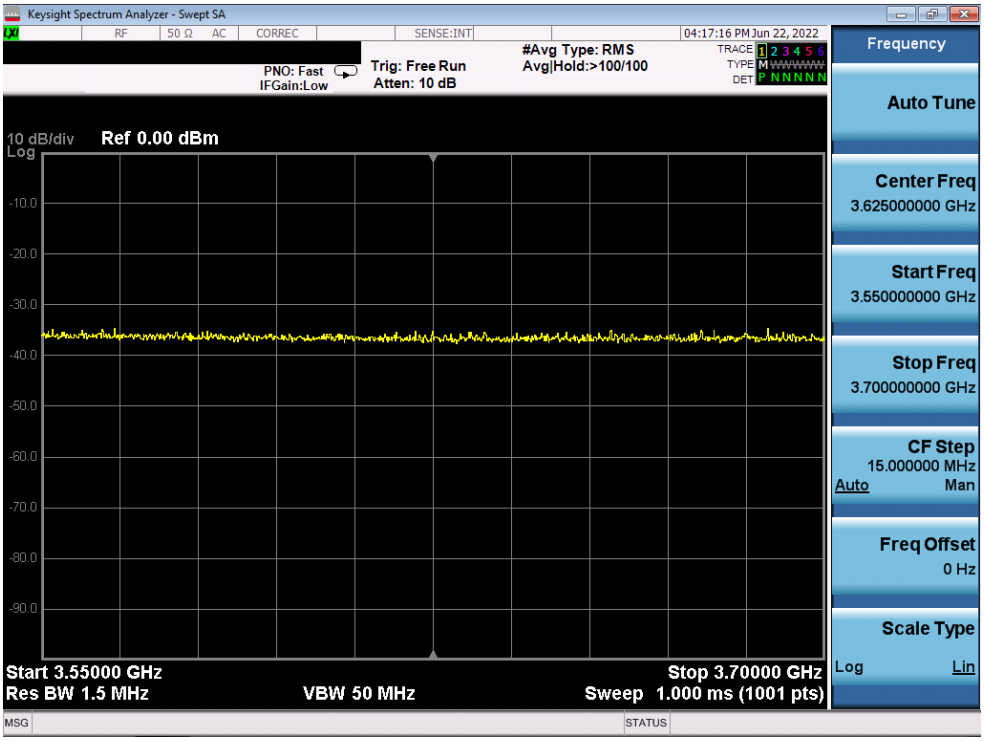
## Test Plots:




**Plot 1. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.1) - LTE**




**Plot 2. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.1) - NR**

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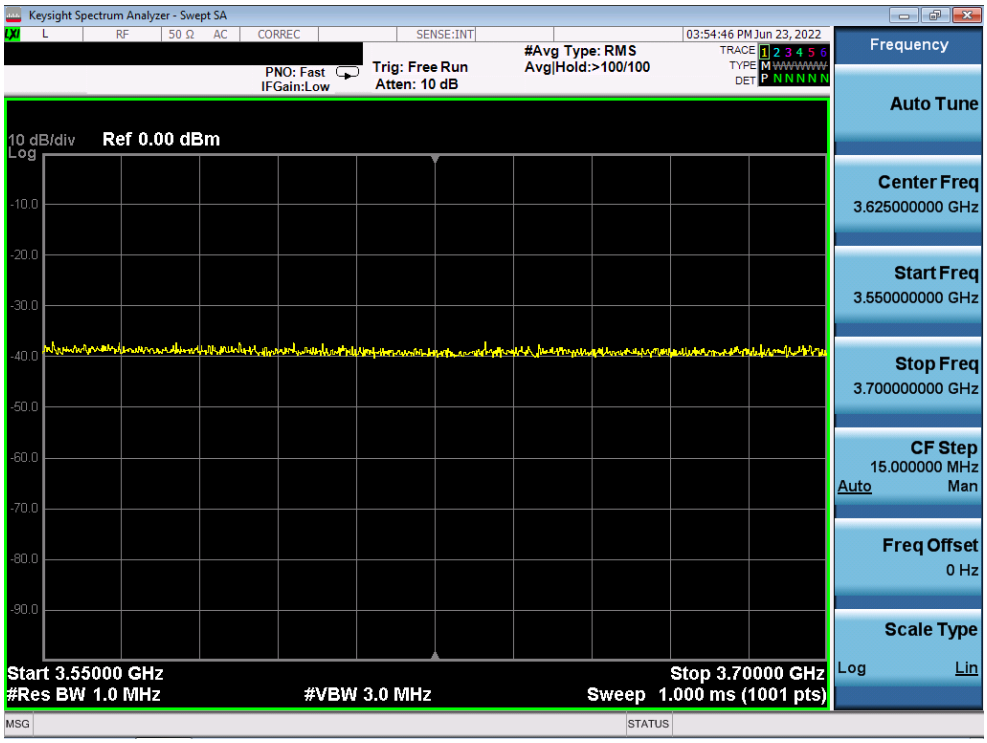
## A2 [WINNF.FT.C.REG.8] Missing Required parameters (responseCode 102)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 3. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.8) – LTE**

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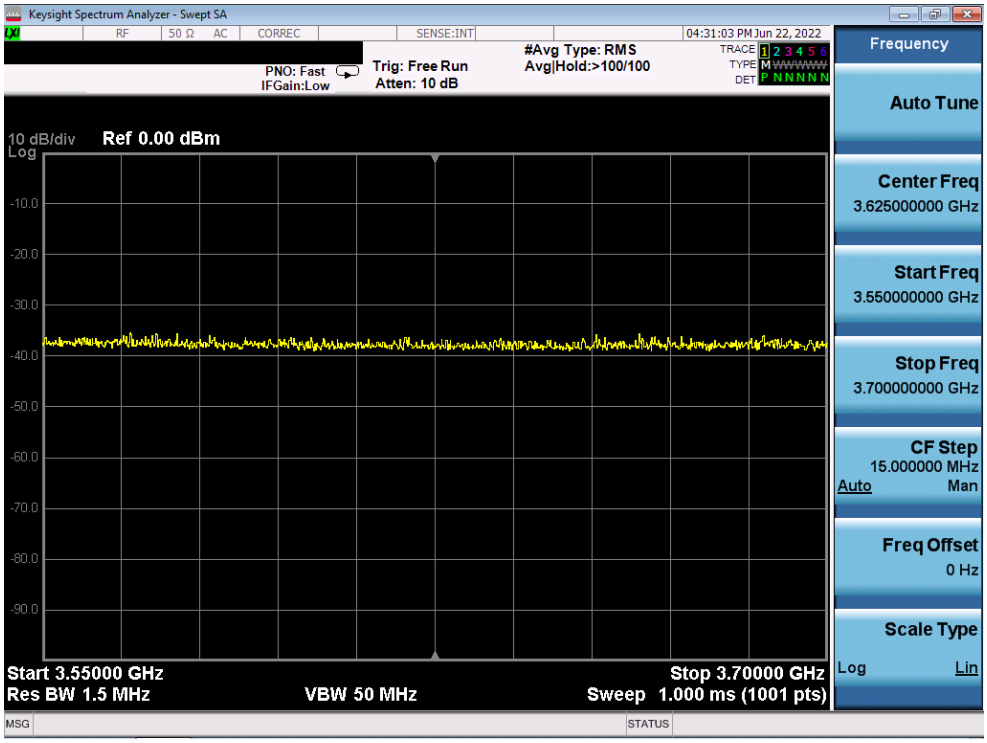


**Plot 4. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.8) – NR**




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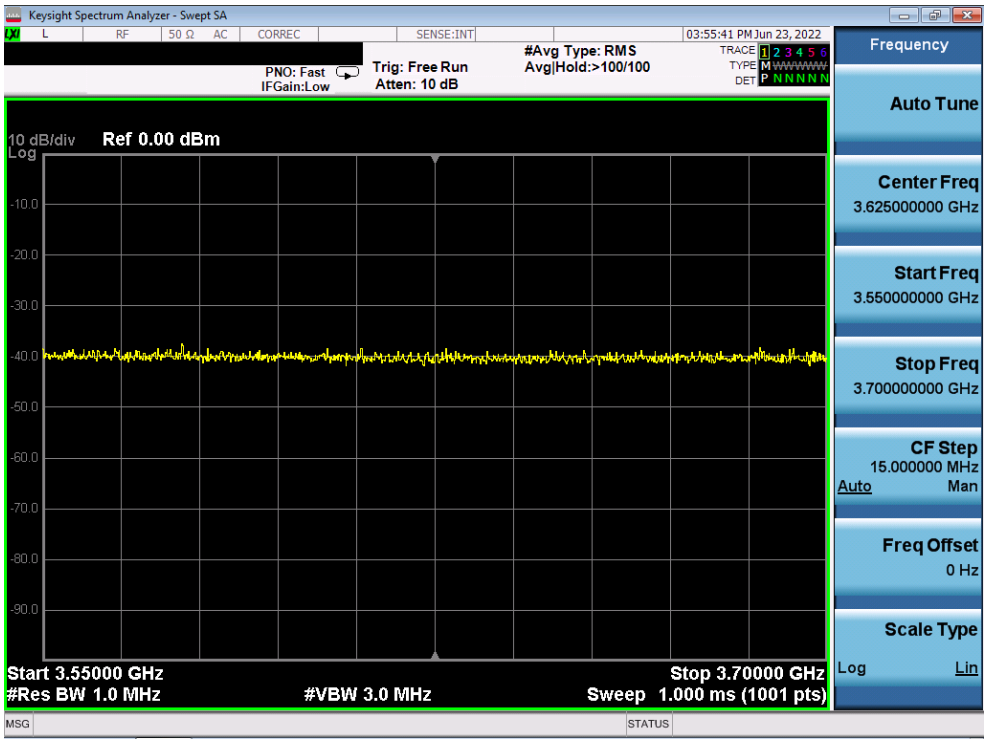
## A3 [WINNF.FT.C.REG.10] Pending registration (responseCode 200)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 5. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.10) – LTE**

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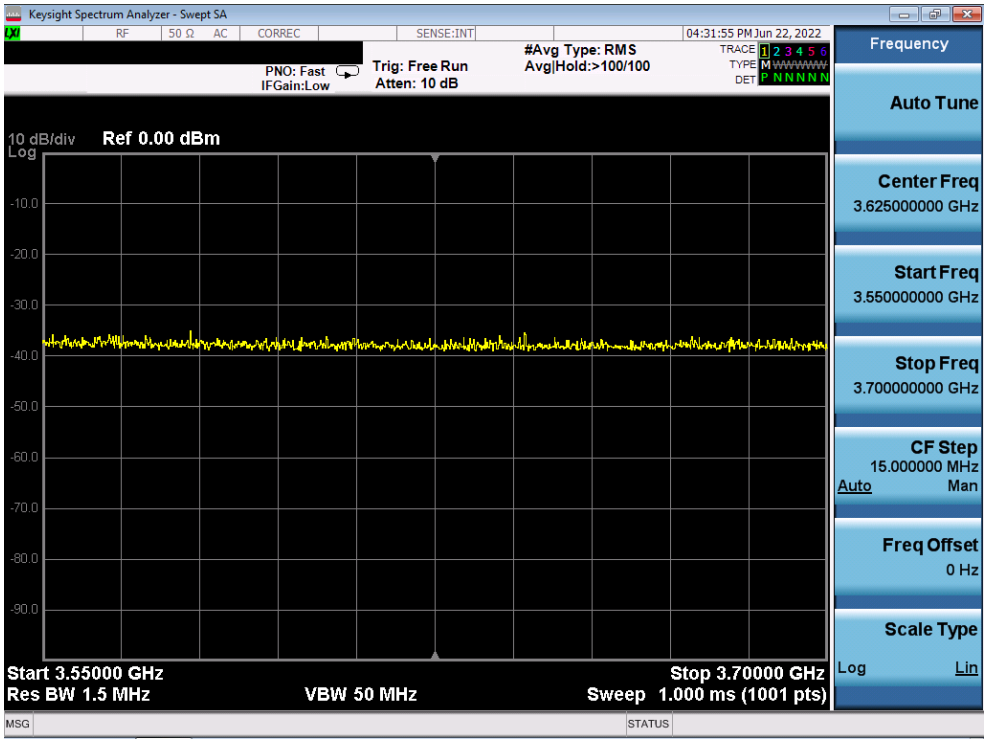


**Plot 6. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.10) – NR**




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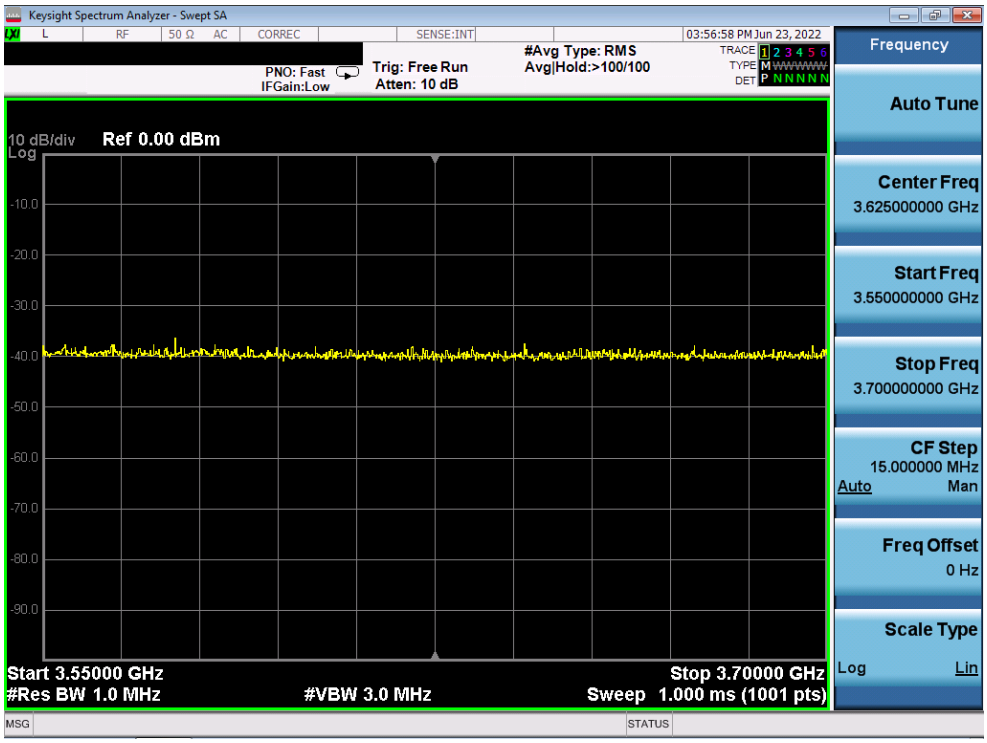
## A4 [WINNF.FT.C.REG.12] Invalid parameter (responseCode 103)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 7. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.12) – LTE**

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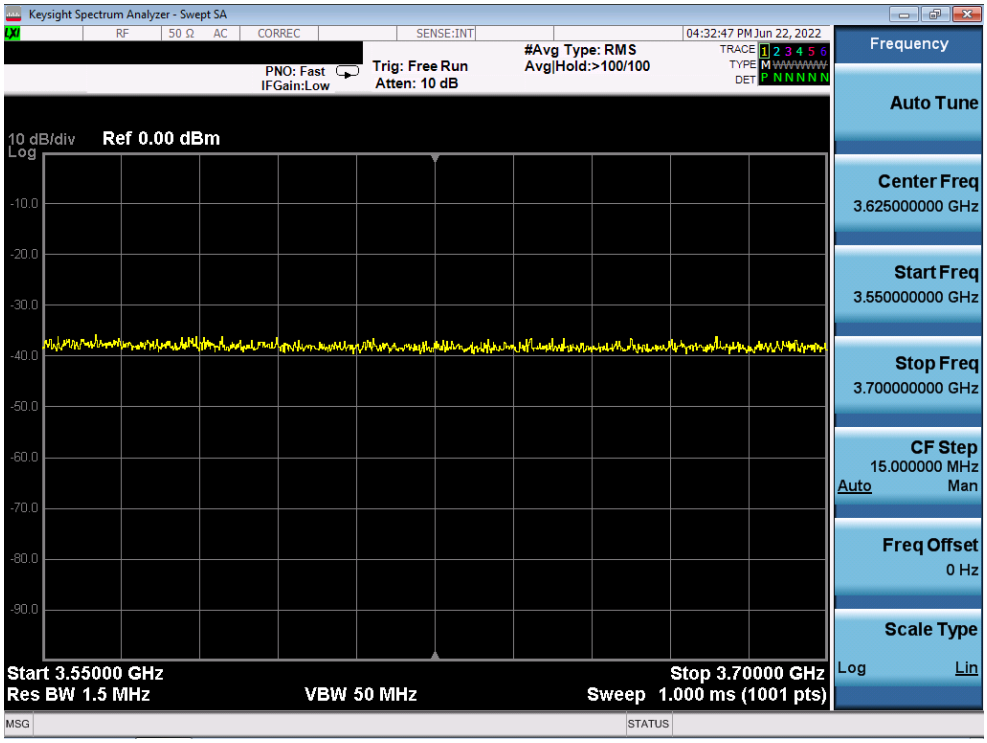


**Plot 8. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.12) – NR**




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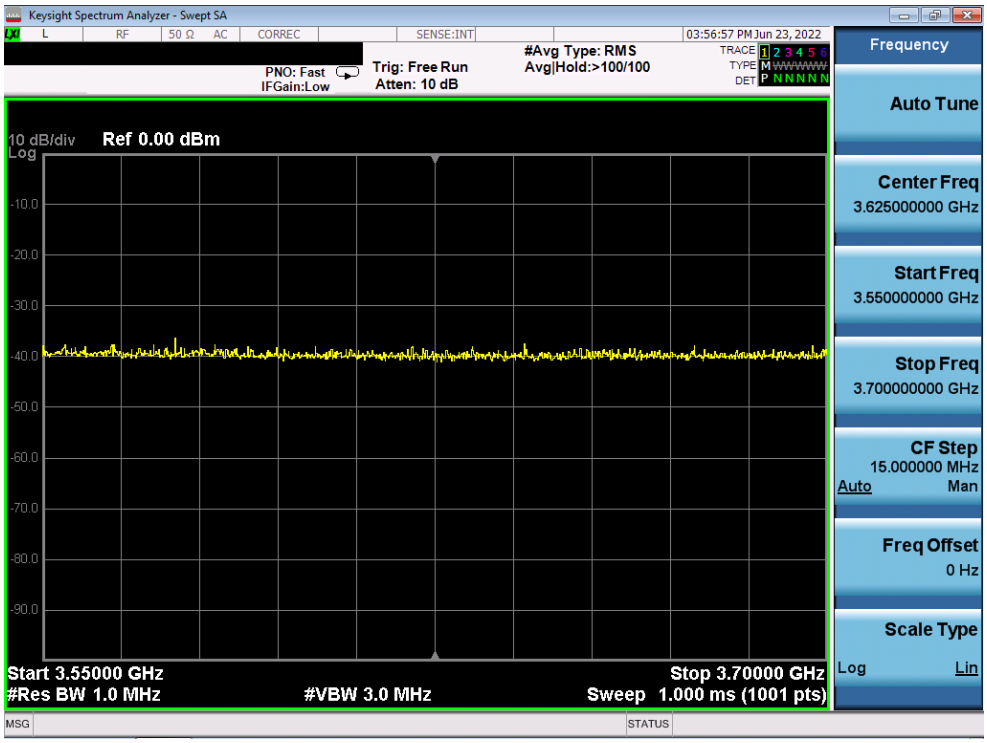
## A5 [WINNF.FT.C.REG.14] Blacklisted CBSD (responseCode 101)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 9. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.14) – LTE**

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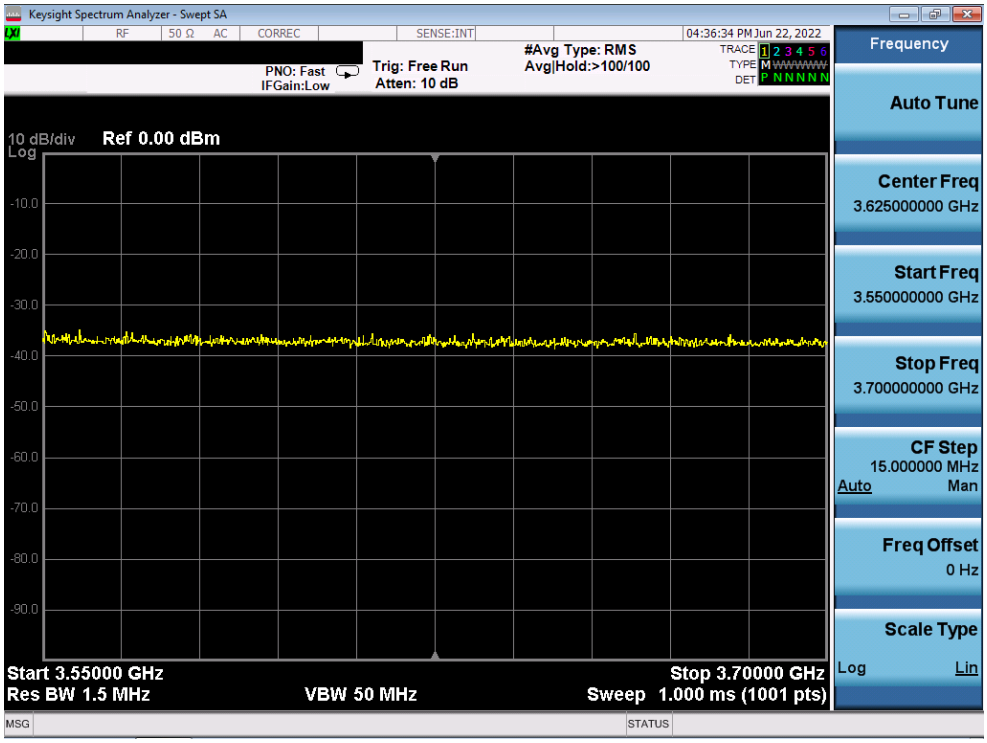


**Plot 10. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.14) – NR**




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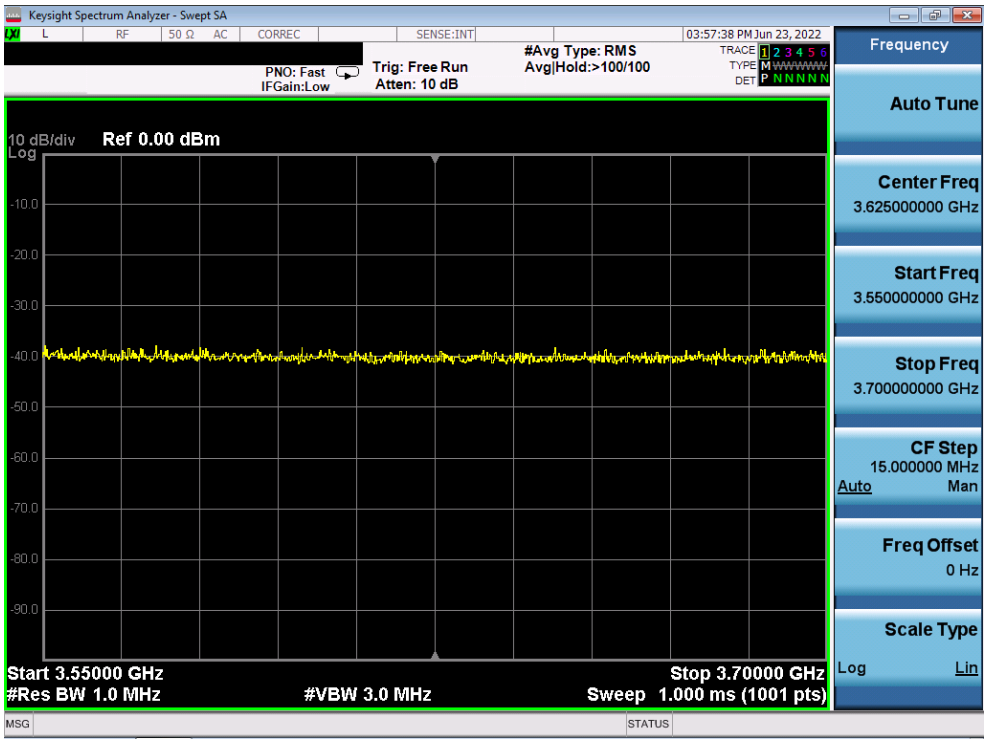
## A6 [WINNF.FT.C.REG.16] Unsupported SAS protocol version (responseCode 100)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 11. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.16) – LTE**

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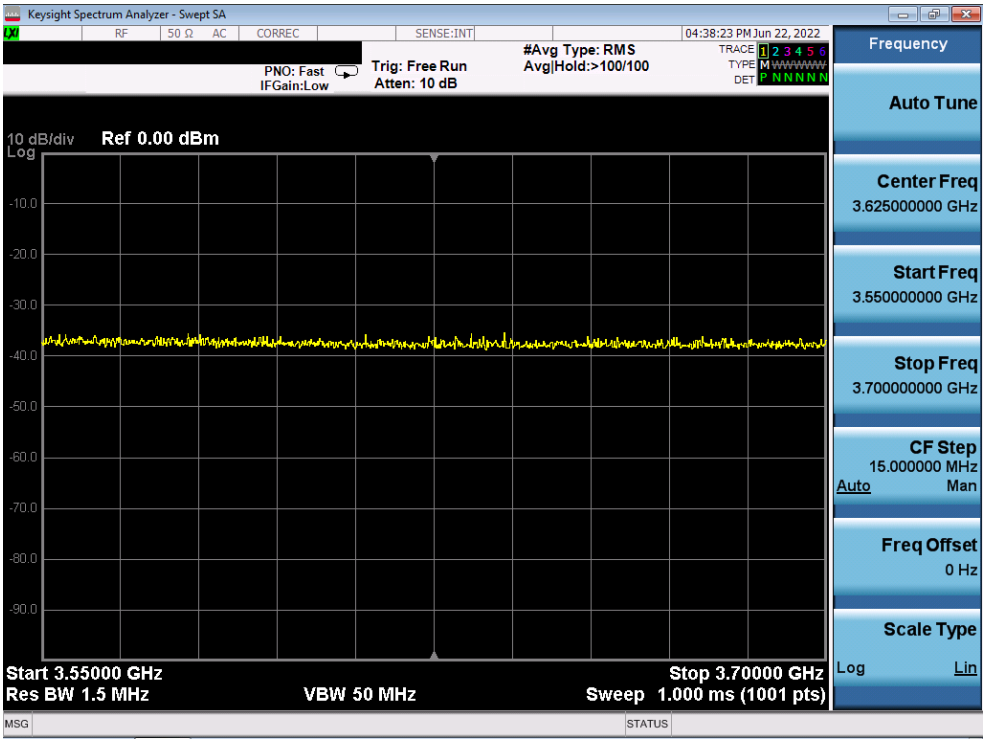


**Plot 12. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.16) – NR**




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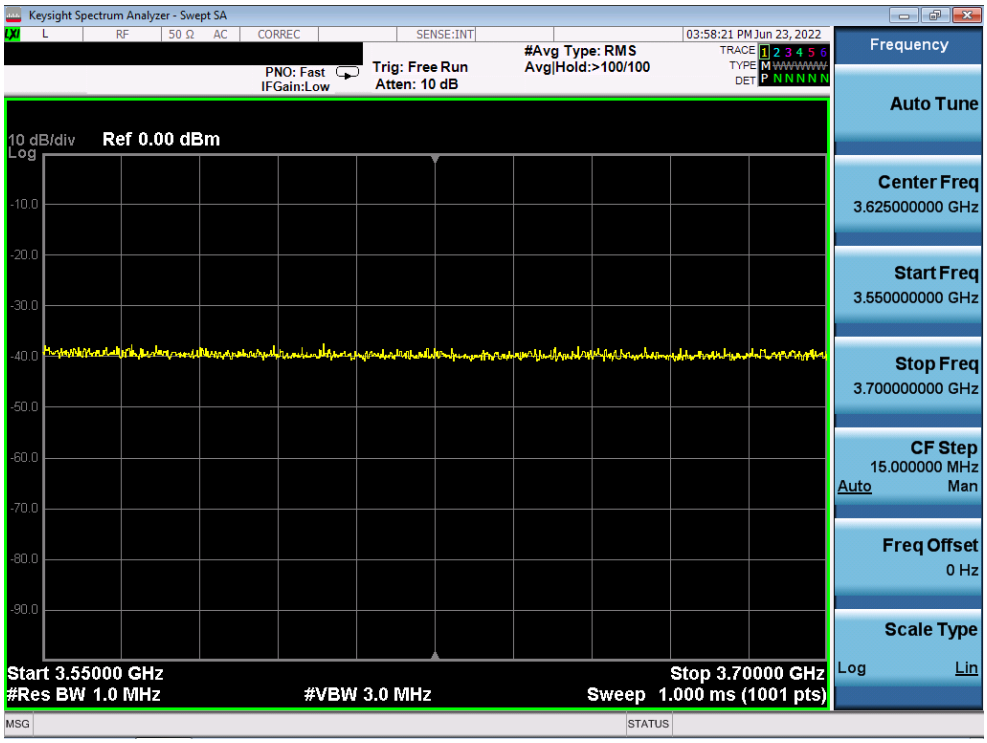
## A7 [WINNF.FT.C.REG.18] Group Error (responseCode 201)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• 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:<br>- SAS response does not include cbsdId<br>- responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 13. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.18) – LTE**

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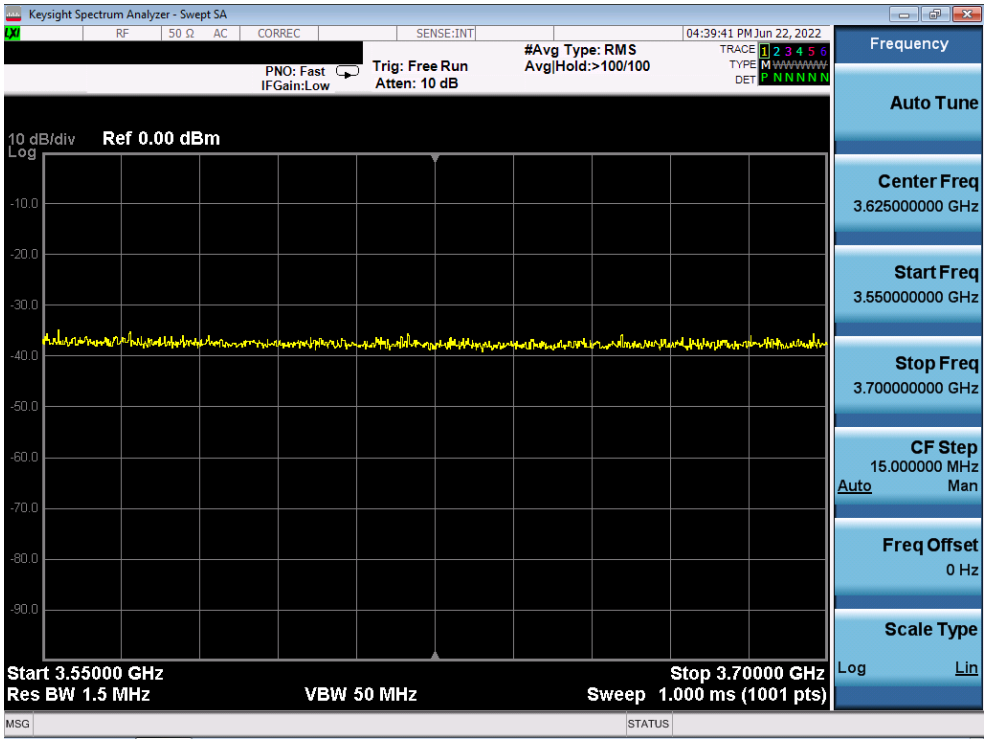


**Plot 14. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.REG.18) – NR**




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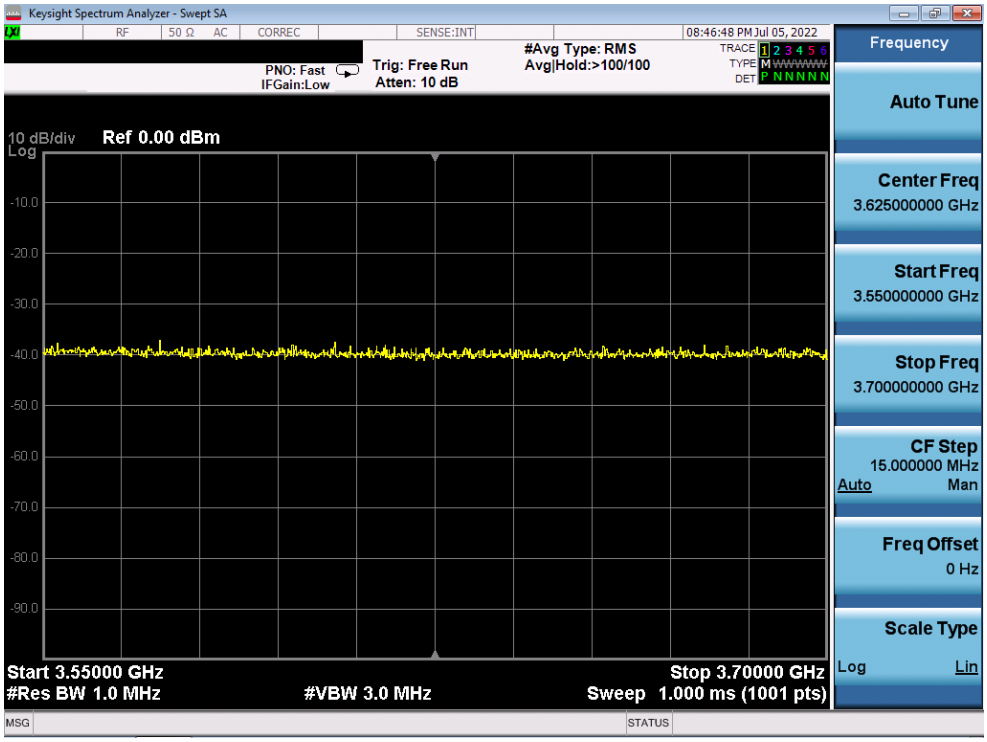
## A8 [WINNF.FT.C.GRA.1] Unsuccessful Grant responseCode=400 (INTERFERENCE)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• 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<br>• cbsdId=C<br>• responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 15. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.1) – LTE**

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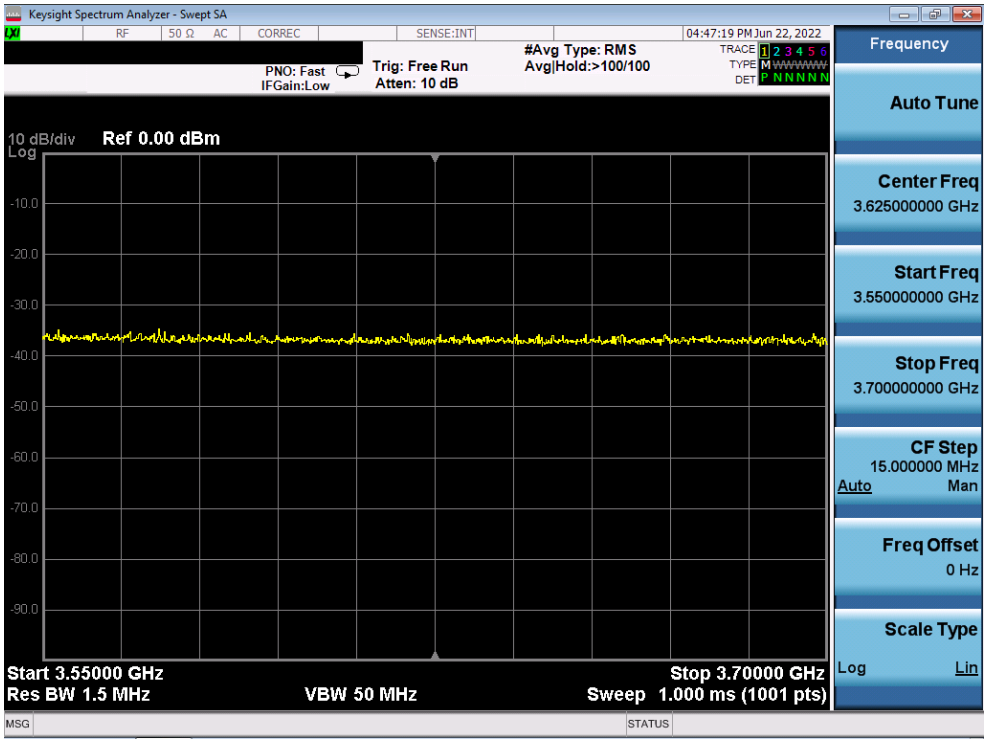


**Plot 16. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.1) – NR**




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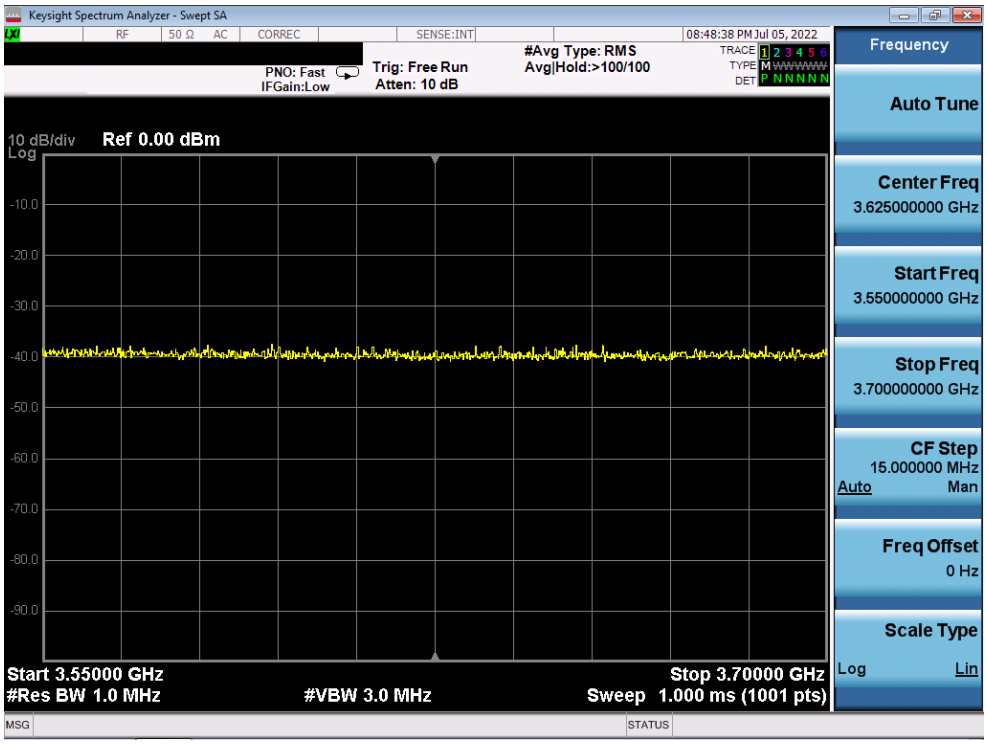
## A9 [WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• 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<br>• cbsdId=C<br>• responseCode = R | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 17. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.2) – LTE**

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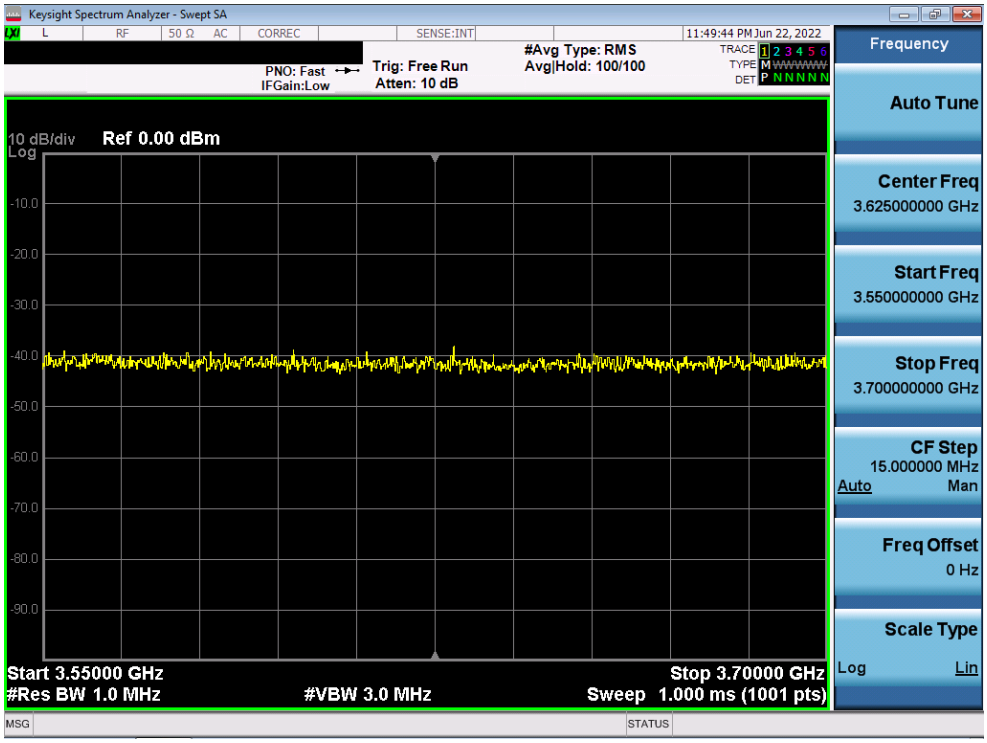


**Plot 18. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.2) – NR**




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## A10 [WINNF.FT.C.HBT.1] Heartbeat Success Case (first Heartbeat Response)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness, with cbsdId = C | -- | -- |
| 2 | UUT sends a message:<br>• If message is type Spectrum Inquiry Request, go to step 3, or<br>• If message is type Grant Request, go to step 5 | -- | -- |
| 3 | UUT sends Spectrum Inquiry Request. Validate:<br>• cbsdId = C<br>• List of frequencyRange objects sent by UUT are within the CBRS frequency range | ☒ | ☐ |
| 4 | SAS Test Harness sends a Spectrum Inquiry Response message, including the following parameters:<br>• cbsdId = C<br>• availableChannel is an array of availableChannel objects<br>• responseCode = 0 | -- | -- |
| 5 | UUT sends Grant Request message. Validate:<br>• cbsdId = C<br>• maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96<br>• operationFrequencyRange, F, sent by UUT is a valid range within the CBRS band | ☒ | ☐ |
| 6 | SAS Test Harness sends a Grant Response message, including the parameters:<br>• cbsdId = C<br>• grantId = G = a valid grant ID<br>• grantExpireTime = UTC time greater than duration of the test<br>• responseCode = 0 | -- | -- |
| 7 | UUT sends a first Heartbeat Request message.<br>Verify Heartbeat Request message is formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “GRANTED” | ☒ | ☐ |
| 8 | SAS Test Harness sends a Heartbeat Response message, with the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = current UTC time + 200 seconds<br>• responseCode = 0 | -- | -- |
| 9 | For further Heartbeat Request messages sent from UUT after completion of step 8, validate message is sent within latest specified heartbeatInterval, and:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED”<br>and SAS Test Harness responds with a Heartbeat Response message including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = current UTC time + 200 seconds<br>• responseCode = 0 | ☒ | ☐ |



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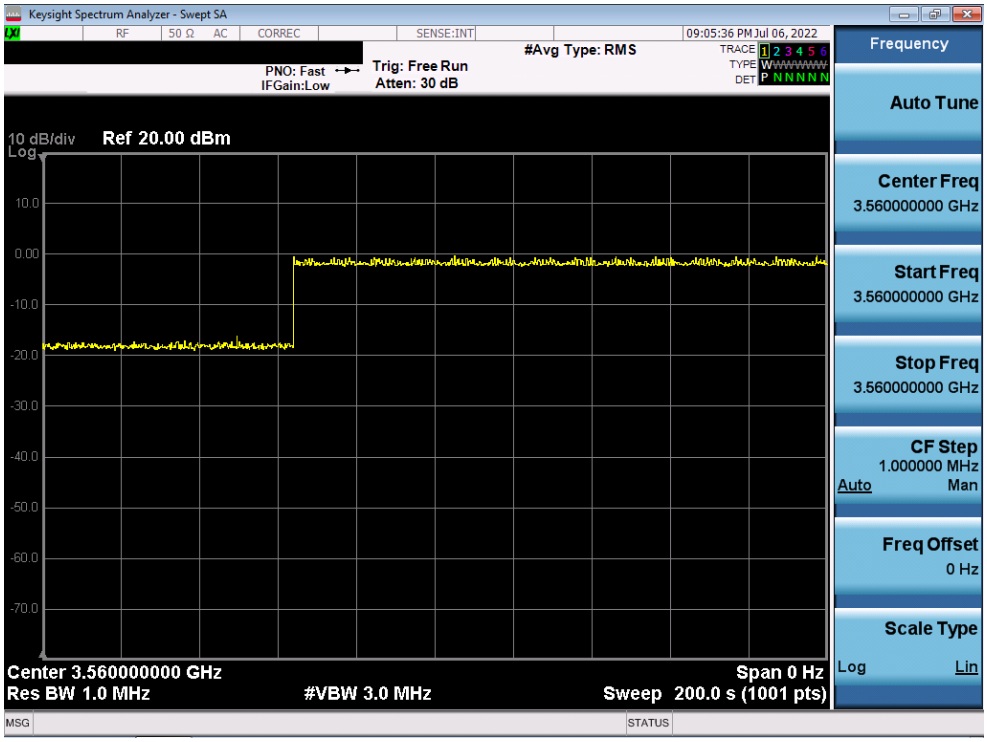
| | | | |
|---|---|---|---|
| 10 | Monitor the RF output of the UUT from start of test until UUT transmission commences. Verify:<br>• UUT does not transmit at any time prior to completion of the first heartbeat response<br>• UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F | ☒ | ☐ |

## Test Plots:




**Plot 19.Conducted Measurement - RF transmission after SAS heartbeat response (WINNF.FT.C.HBT.1) – LTE**

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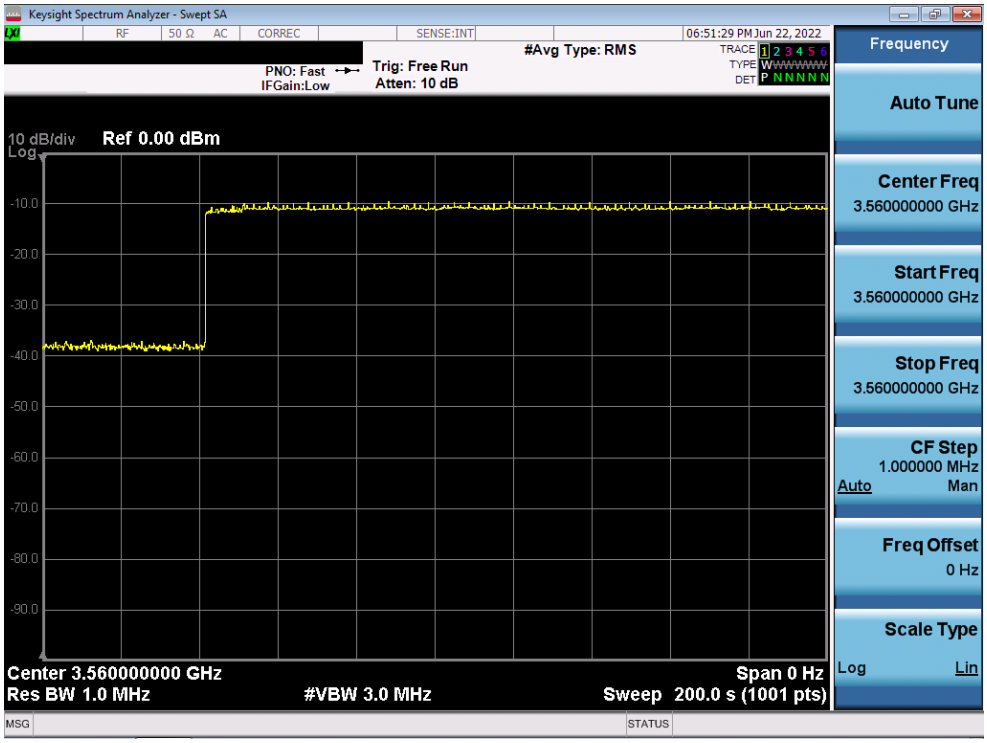
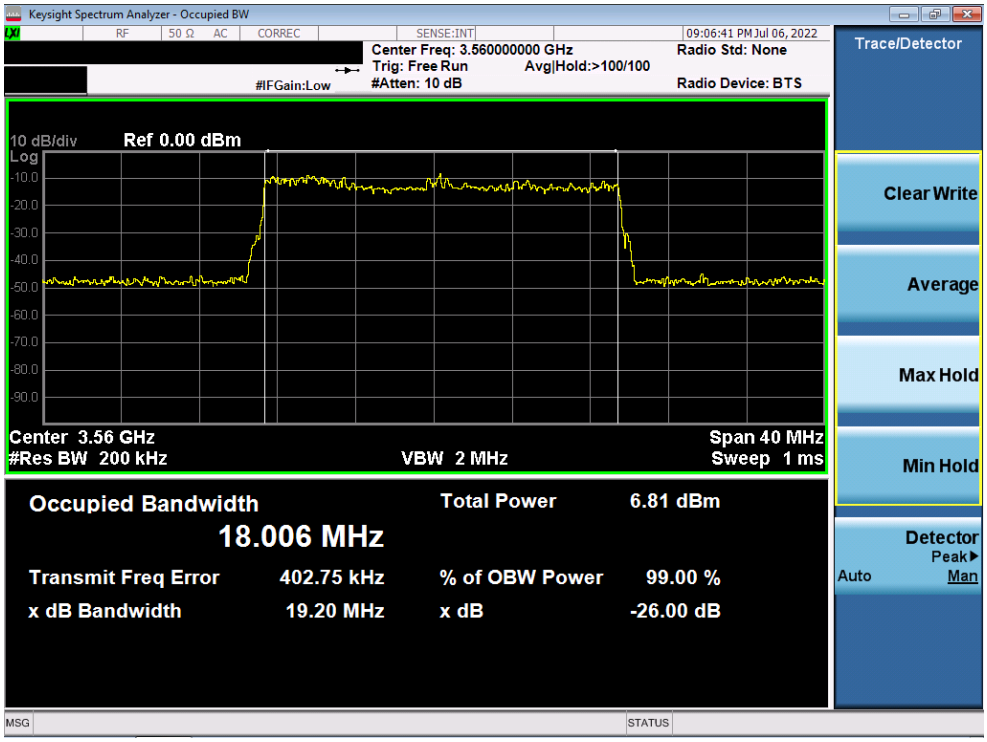



**Plot 20. Conducted Measurement - RF transmission after SAS heartbeat response (WINNF.FT.C.HBT.1) – NR**




**Plot 21. Conducted Measurement Occupied Bandwidth for 20MHz (WINNF.FT.C.HBT.1) – LTE**

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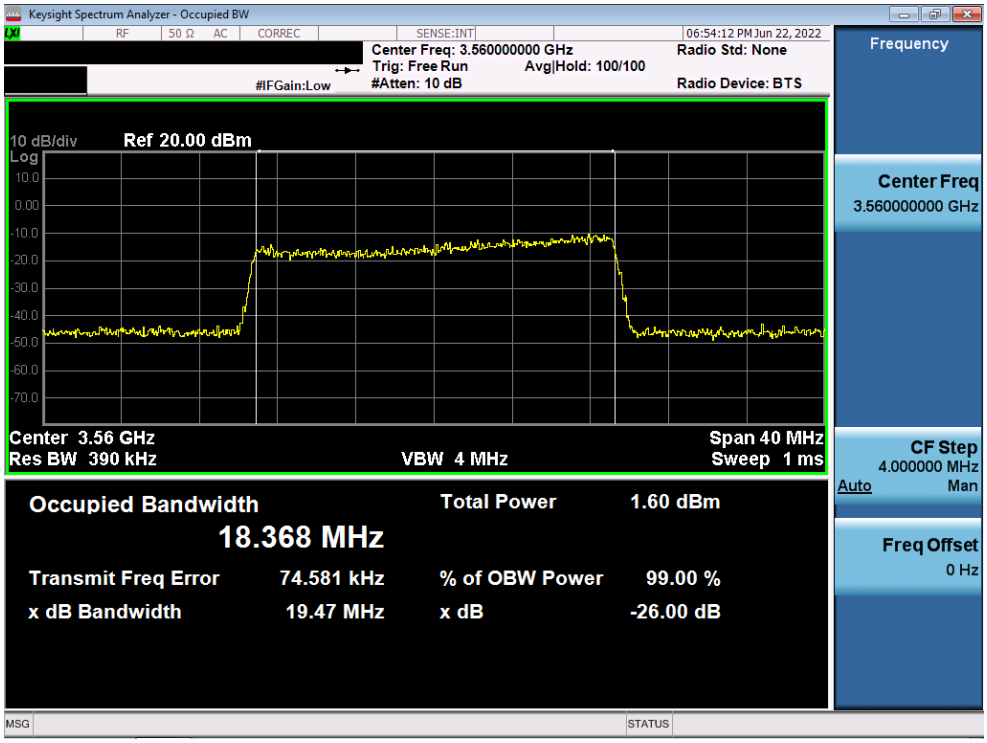


**Plot 22.Conducted Measurement Occupied Bandwidth for 20MHz (WINNF.FT.C.HBT.1) – NR**




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## A11 [WINNF.FT.C.HBT.3] Heartbeat responseCode=105 (DEREGISTER)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = T = Current UTC time<br>• 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:<br>• UUT shall stop transmission within (T + 60 seconds) of completion of step 3 | ☒ | ☐ |



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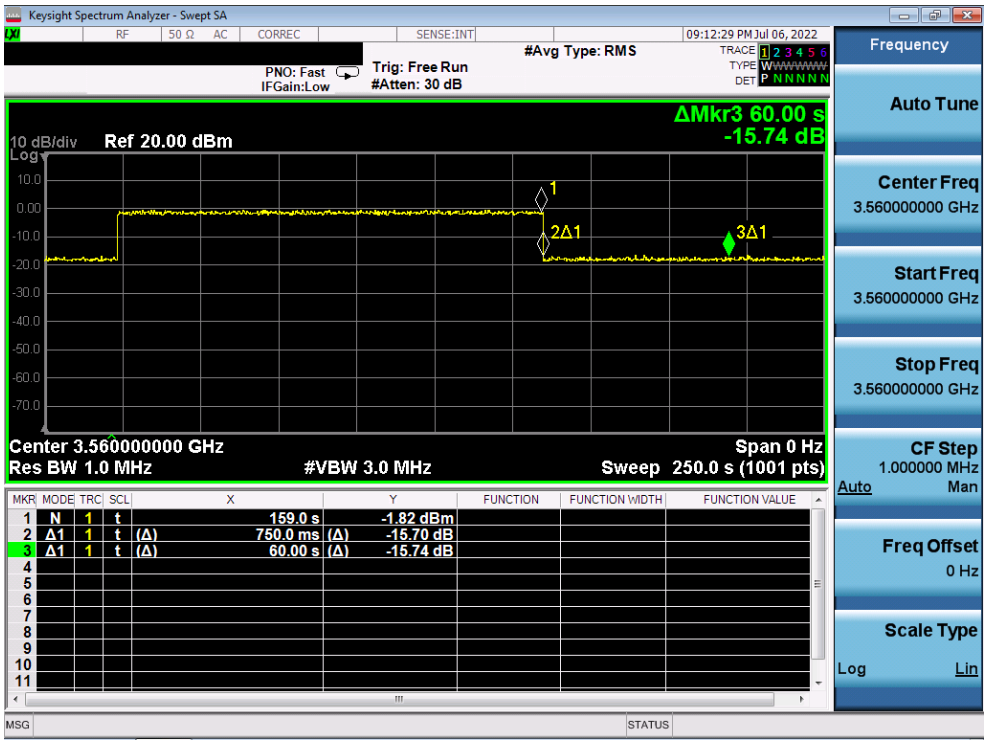
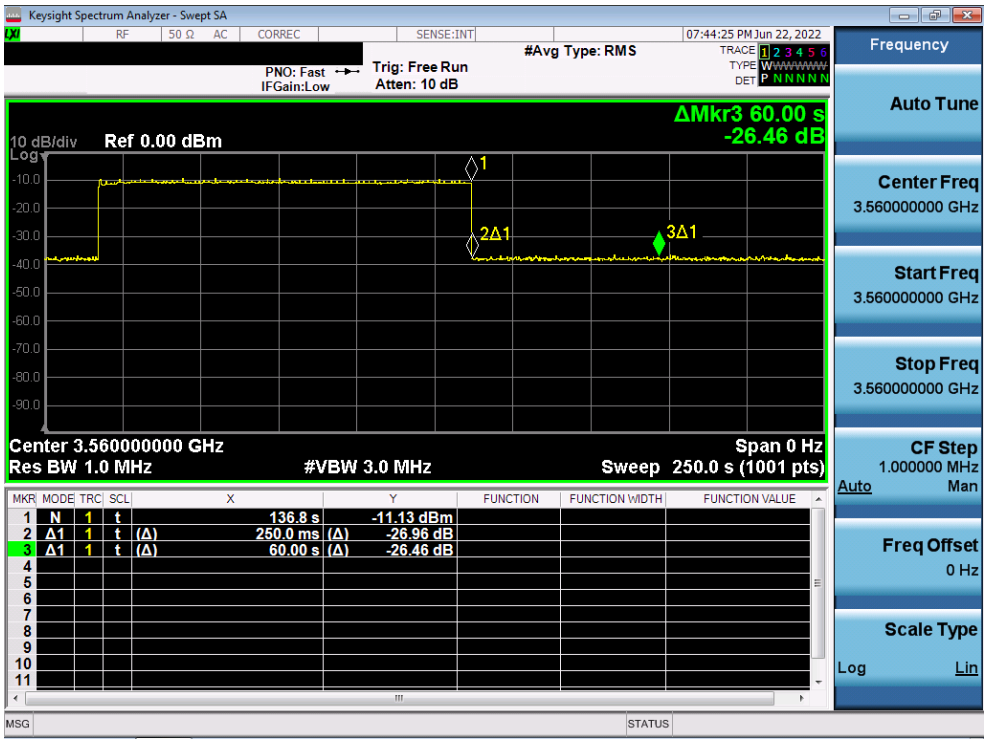
## Test Plots:




**Plot 23. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (WINNF.FT.C.HBT.3) – LTE**




**Plot 24. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (WINNF.FT.C.HBT.3) – NR**

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## A12 [WINNF.FT.C.HBT.4] Heartbeat responseCode=500 (TERMINATED_GRANT)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = T = Current UTC time<br>• responseCode = 500 (TERMINATED_GRANT) | -- | -- |
| 4 | After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT. Verify:<br>• UUT shall stop transmission within (T + 60 seconds) of completion of step 3 | ☒ | ☐ |



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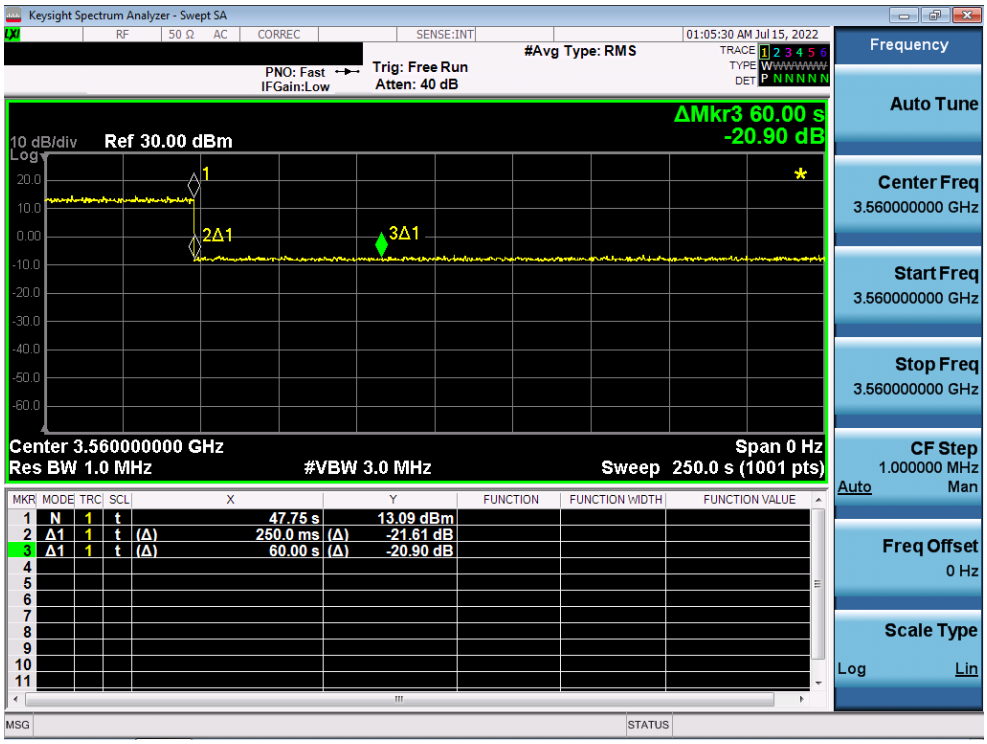
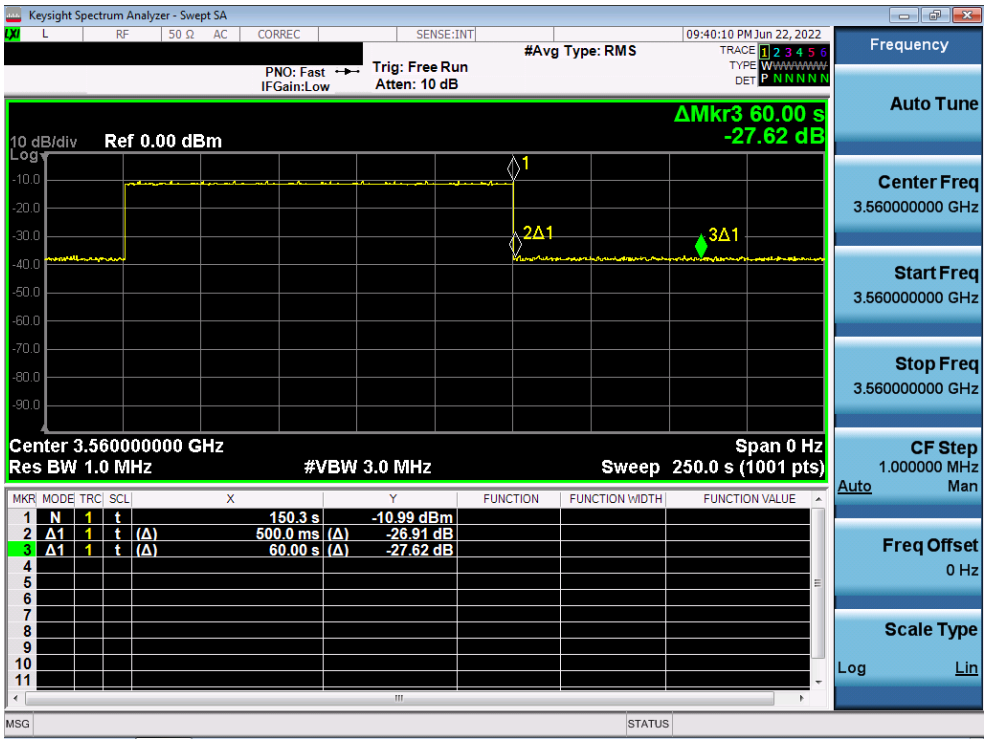
## Test Plots:




**Plot 25. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.4) – LTE**




**Plot 26. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.4) – NR**

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## A13 [WINNF.FT.C.HBT.5] Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “GRANTED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = T = Current UTC time<br>• responseCode = 501 (SUSPENDED_GRANT) | -- | -- |
| 4 | After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. | -- | -- |
| 5 | Monitor the SAS-CBSD interface. Verify either A OR B occurs:<br>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “GRANTED”<br>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:<br>• cbdsId = C<br>• grantId = G<br>Monitor the RF output of the UUT. Verify:<br>• UUT does not transmit at any time | ☒ | ☐ |



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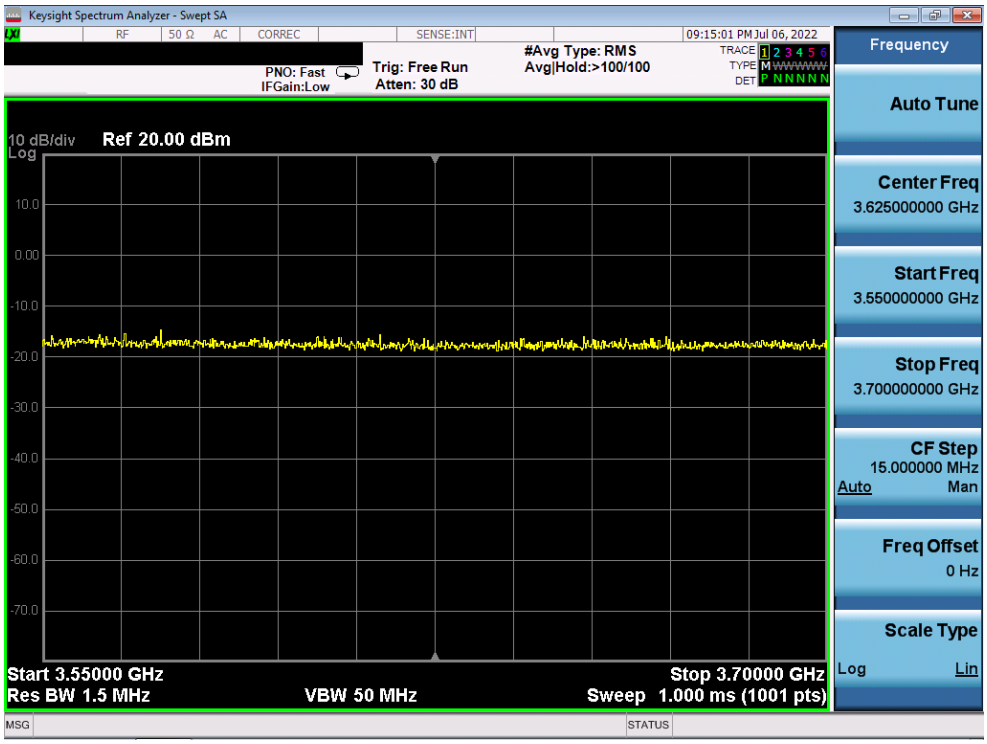
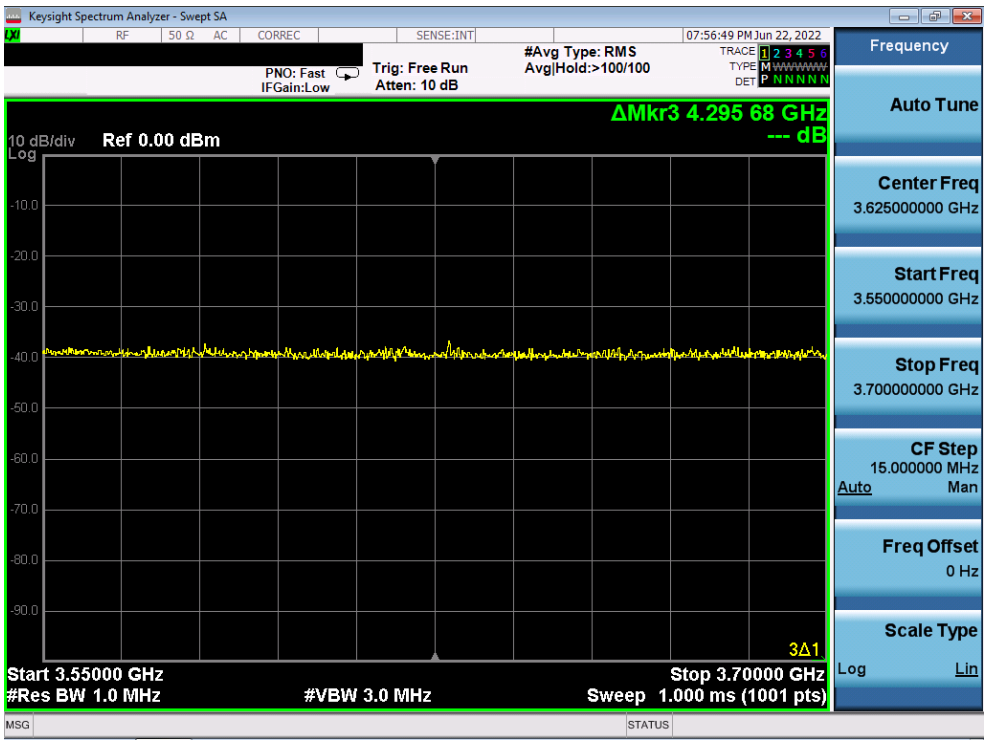
## Test Plots:




**Plot 27. Conducted Measurement – No RF transmission in entire band (WINNF.FT.C.HBT.5) – LTE**




**Plot 28. Conducted Measurement – No RF transmission in entire band (WINNF.FT.C.HBT.5) – NR**

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## A14 [WINNF.FT.C.HBT.6] Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = T = Current UTC time<br>• responseCode = 501 (SUSPENDED_GRANT) | -- | -- |
| 4 | After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. | -- | -- |
| 5 | Monitor the SAS-CBSD interface. Verify either A OR B occurs:<br>A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “GRANTED”<br>B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters:<br>• cbdsId = C<br>• grantId = G<br>Monitor the RF output of the UUT. Verify:<br>• UUT shall stop transmission within (T + 60 seconds) of completion of step 3 | ☒ | ☐ |



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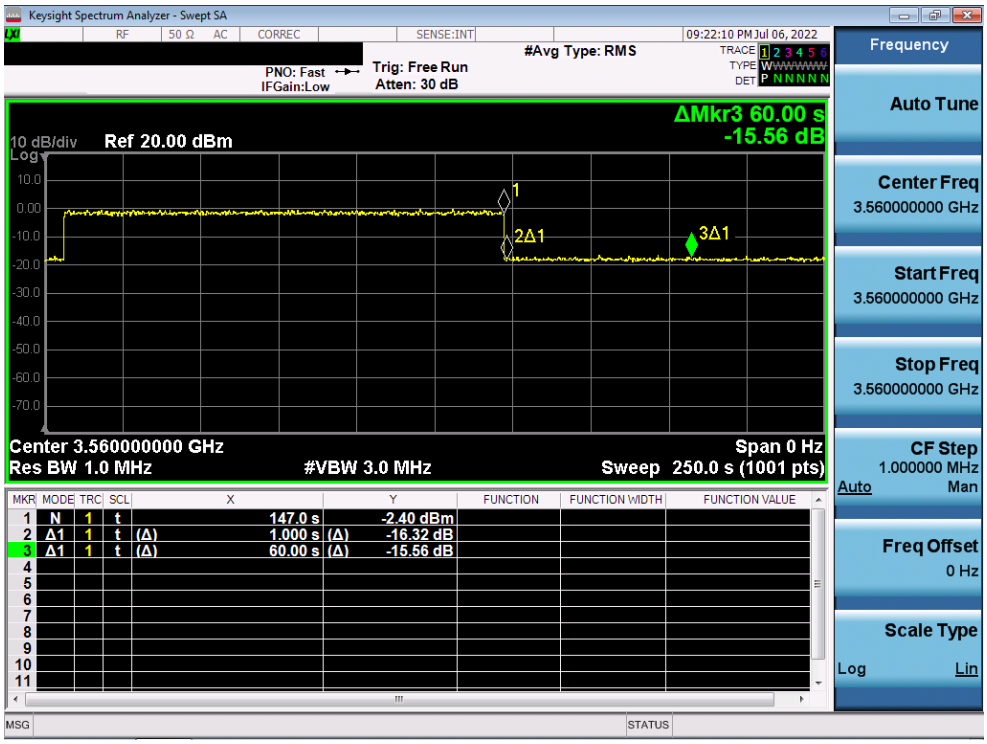
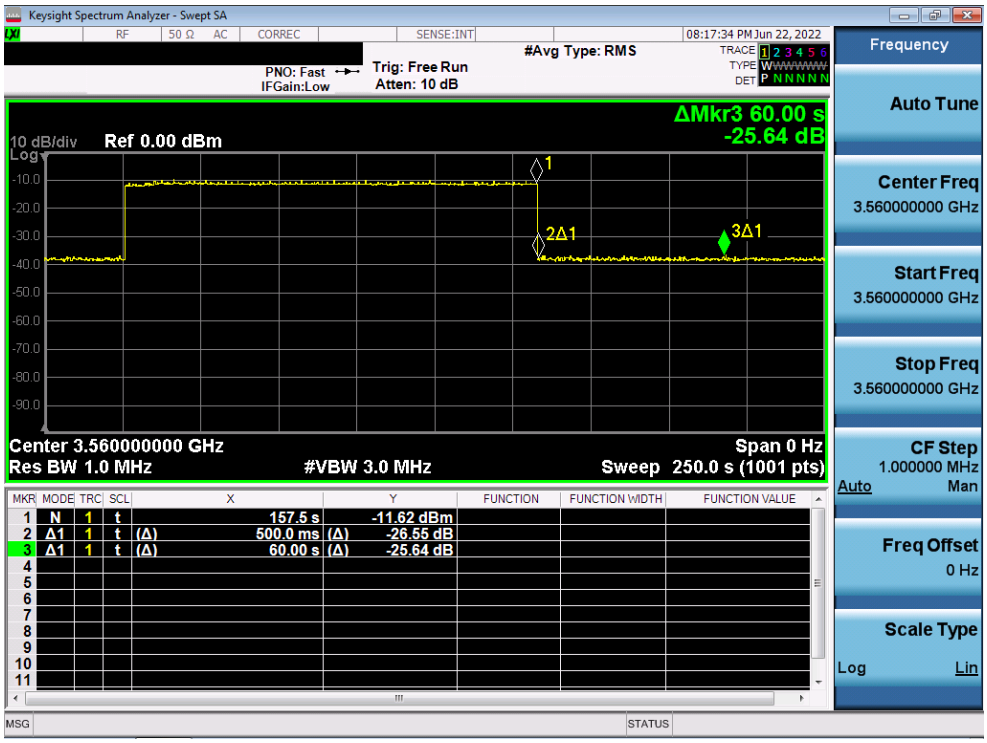
## Test Plots:




**Plot 29. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.6) – LTE**




**Plot 30. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.6) – NR**

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## A15 [WINNF.FT.C.HBT.7] Heartbeat responseCode=502 (UNSYNC_OP_PARAM)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = T = Current UTC time<br>• responseCode = 502 (UNSYNC_OP_PARAM) | -- | -- |
| 4 | After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. | -- | -- |
| 5 | Monitor the SAS-CBSD interface. Verify:<br>• UUT sends a Grant Relinquishment Request message. Verify message is correctly formatted with parameters:<br>o cbdsId = C<br>o grantId = G<br>Monitor the RF output of the UUT. Verify:<br>• UUT shall stop transmission within (T+60) seconds of completion of step 3. | ☒ | ☐ |



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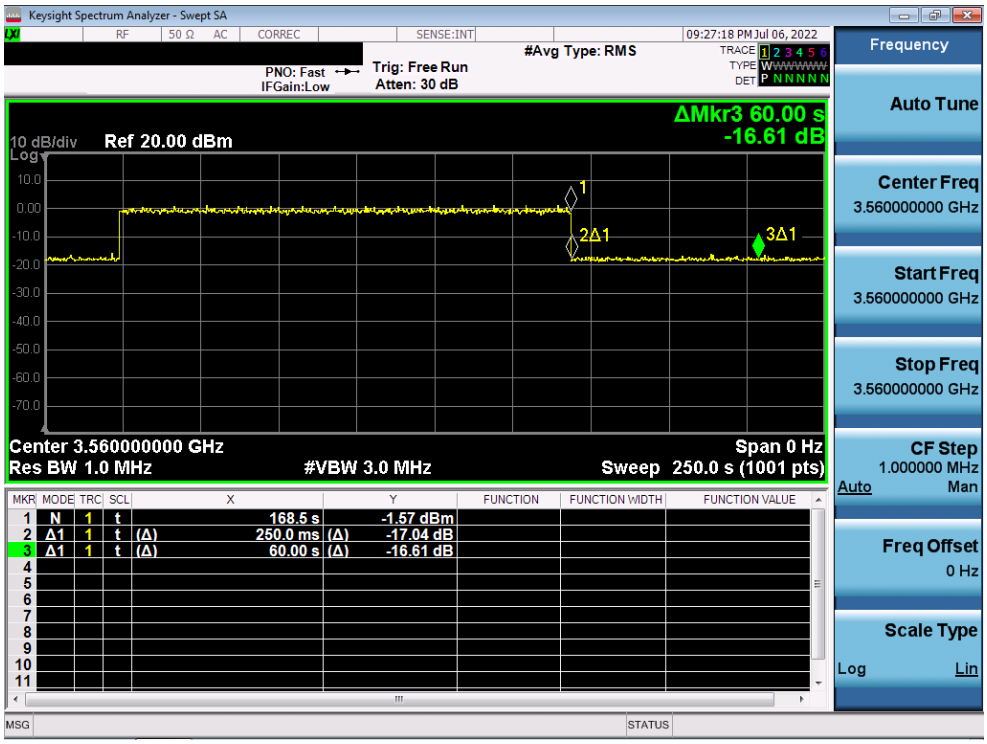
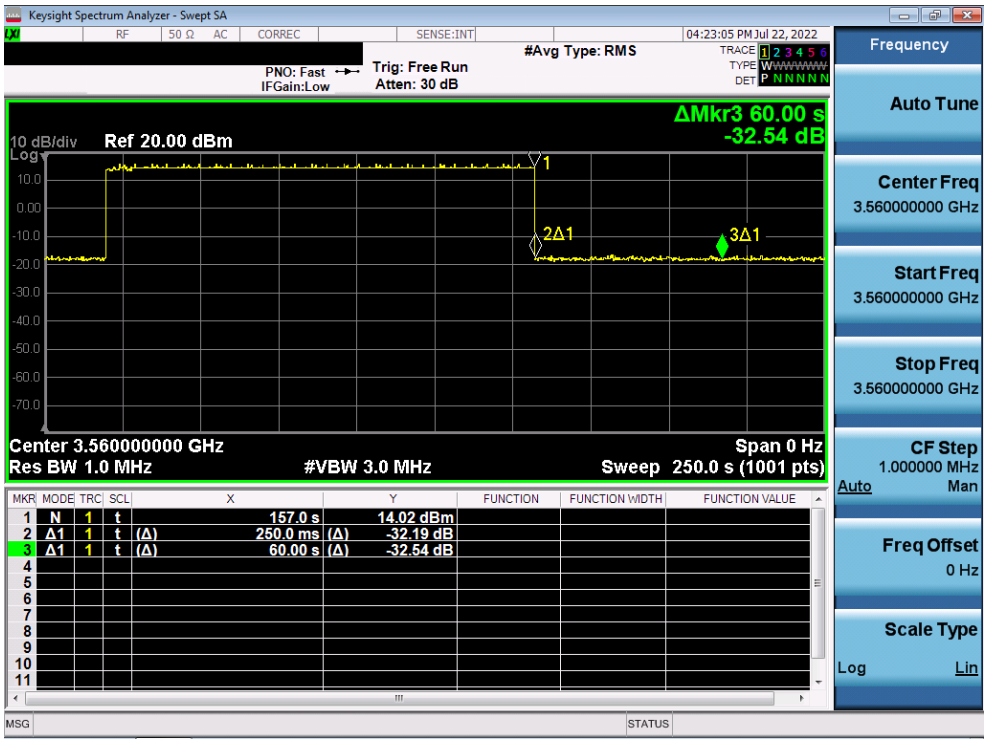
## Test Plots:




**Plot 31. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.7) – LTE**




**Plot 32. Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.7) – NR**

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## A16 [WINNF.FT.C.HBT.9] Heartbeat Response Absent (First Heartbeat)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request) | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “GRANTED” | ☒ | ☐ |
| 3 | After completion of Step 2, SAS Test Harness does not respond to any further messages from UUT to simulate loss of network connection | -- | -- |
| 4 | Monitor the RF output of the UUT from start of test to 60 seconds after step 3. Verify:<br>• At any time during the test, UUT shall not transmit on RF interface | ☒ | ☐ |



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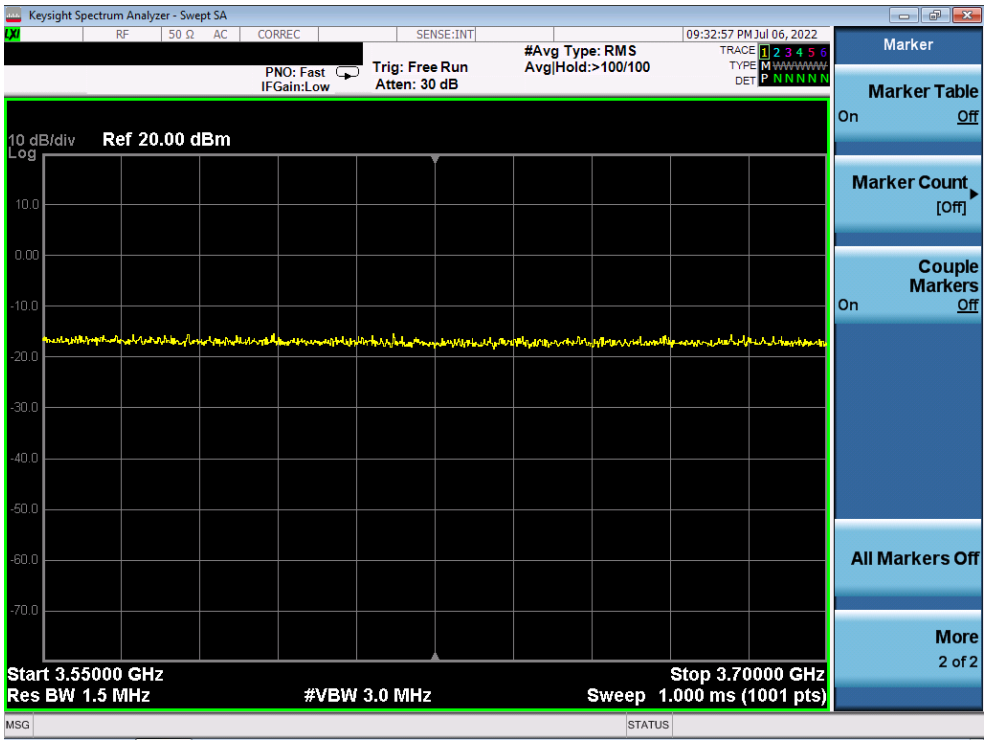
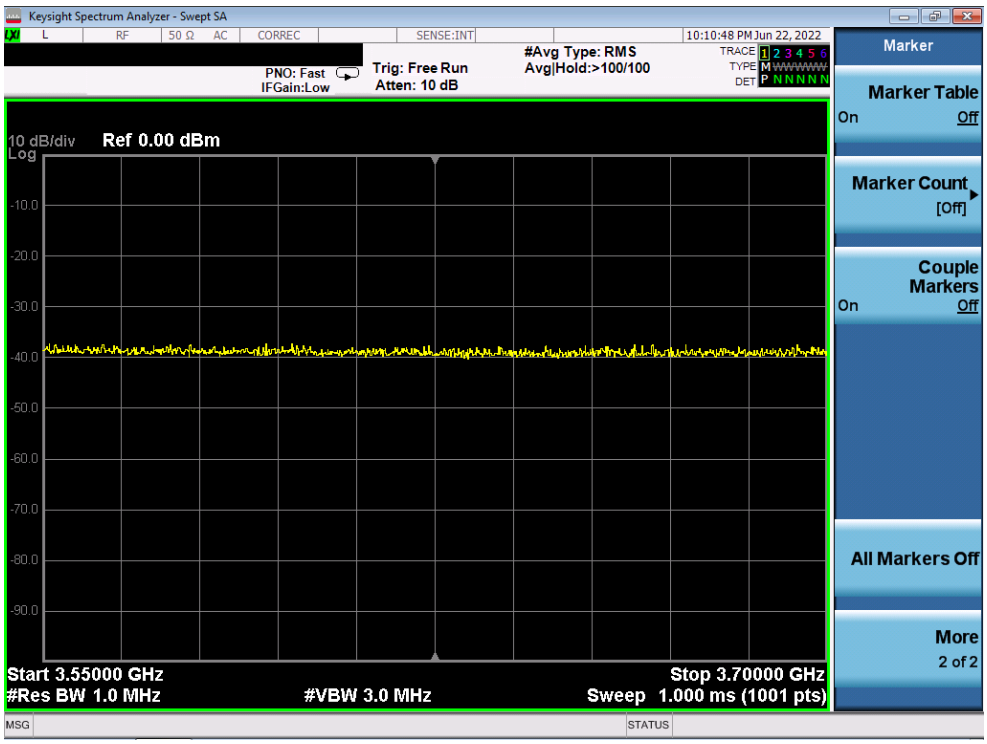
## Test Plots:




**Plot 33. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.HBT.9) – LTE**




**Plot 34. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.HBT.9) – NR**

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## A17 [WINNF.FT.C.HBT.10] Heartbeat Response Absent (Subsequent Heartbeat)

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has registered successfully with SAS Test Harness<br>• UUT has a valid single grant as follows:<br>o valid cbsdId = C<br>o valid grantId = G<br>o grant is for frequency range F, power P<br>o grantExpireTime = UTC time greater than duration of the test<br>• UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface | -- | -- |
| 2 | UUT sends a Heartbeat Request message.<br>Verify Heartbeat Request message issent within the latest specified heartbeatInterval, and is formatted correctly, including:<br>• cbsdId = C<br>• grantId = G<br>• operationState = “AUTHORIZED” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Heartbeat Response message, including the following parameters:<br>• cbsdId = C<br>• grantId = G<br>• transmitExpireTime = current UTC time + 200 seconds<br>• responseCode = 0 | -- | -- |
| 4 | After completion of Step 3, SAS Test Harness does not respond to any further messages from UUT | -- | -- |
| 5 | Monitor the RF output of the UUT. Verify:<br>• UUT shall stop all transmission on RF interface within (transmitExpireTime + 60 seconds), using the transmitExpireTime sent in Step 3. | ☒ | ☐ |



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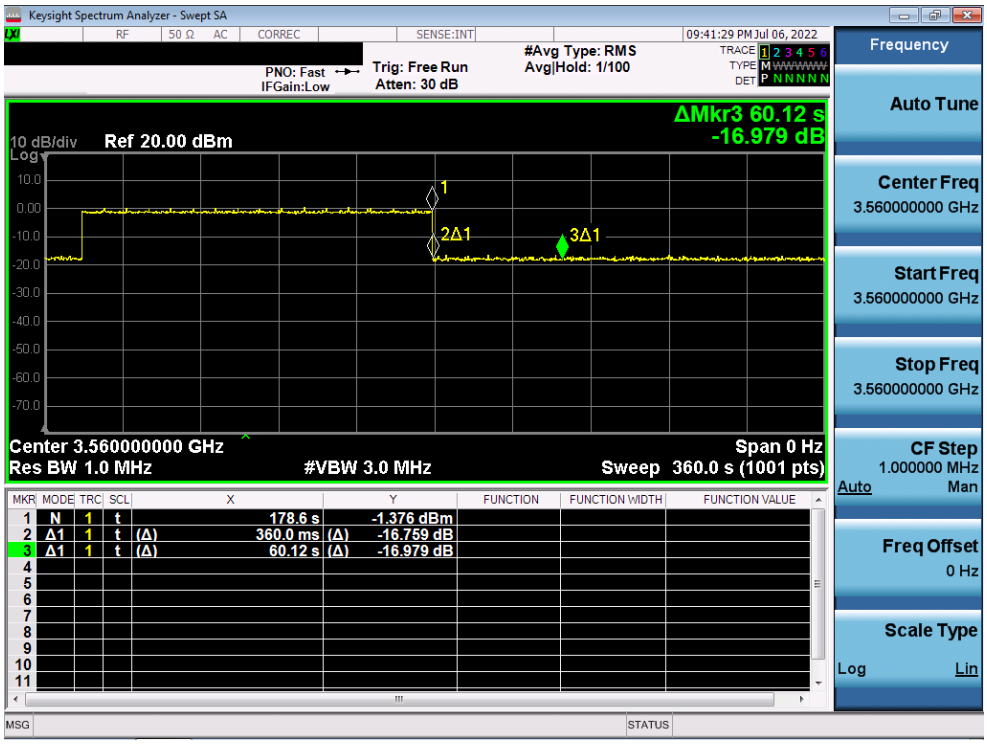
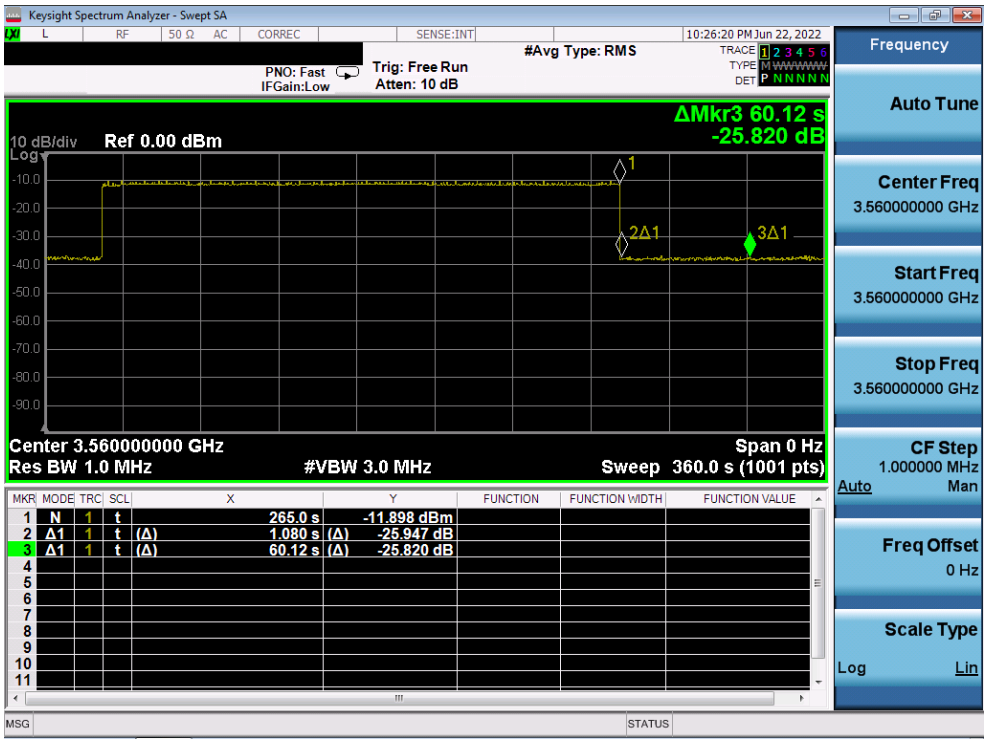
## Test Plots:




**Plot 35. Conducted Measurement - RF transmission stops within transmitExpireTime + 60s. The last SAS heartbeat message is indicated by Marker 1 (X) (WINNF.FT.C.HBT.10) – LTE**




**Plot 36. Conducted Measurement - RF transmission stops within transmitExpireTime + 60s. The last SAS heartbeat message is indicated by Marker 1 (X) (WINNF.FT.C.HBT.10) – NR**

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## A18 [WINNF.FT.C.MES.1] Registration Response contains measReportConfig

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness | -- | -- |
| 2 | UUT sends a Registration Request message.<br>Validate the Registration Request message is formatted correctly, including:<br>• userId is present and correct<br>• fccId is present and correct<br>• cbsdSerialNumber is present and correct<br>• measCapability = “RECEIVED_POWER_WITHOUT_GRANT” | ☒ | ☐ |
| 3 | SAS Test Harness sends a Registration Response message, with the following parameters:<br>• cbsdId = C = valid cbsdId for this UUT<br>• measReportConfig= “RECEIVED_POWER_WITHOUT_GRANT”<br>• responseCode = 0 | -- | -- |
| 4 | UUT sends a message:<br>• If message is type Spectrum Inquiry Request, go to step 5, or<br>• If message is type Grant Request, go to step 7 | -- | -- |
| 5 | UUT sends message type Spectrum Inquiry Request. Verify message contains all required parameters properly formatted, and specifically:<br>• cbsdId = C<br>• measReport is present, and is a properly formatted rcvdPowerMeasReport. | ☒ | ☐ |
| 6 | SAS Test Harness sends a Spectrum Inquiry Response, with the following parameters:<br>• cbsdId = C<br>• availableChannel is an array of availableChannel objects<br>• responseCode = 0 | -- | -- |
| 7 | UUT sends message type Grant Request message. Verify message contains all required parameters properly formatted, and specifically:<br>• cbsdId = C<br>• measReport is present, and is a properly formatted rcvdPowerMeasReport. | ☒ | ☐ |



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## A19 [WINNF.FT.C.RLQ.1] Successful Relinquishment

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• UUT has successfully registered with SAS Test Harness, with cbsdId=C<br>• UUT has received a valid grant with grantId = G<br>• UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant.<br>Invoke trigger to relinquish UUT Grant from the SAS Test Harness | -- | -- |
| 2 | UUT sends a Relinquishment Request message. Verify message contains all required parameters properly formatted, and specifically:<br>• cbsdId = C<br>• grantId = G | ☒ | ☐ |
| 3 | SAS Test Harness shall approve the request with a Relinquishment Response message with parameters:<br>• cbsdId = C<br>• grantId = G<br>• responseCode = 0 | -- | -- |
| 4 | After completion of step 3, SAS Test Harness will not provide any additional positive response (responseCode=0) to further request messages from the UUT. | -- | -- |
| 5 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall stop RF transmission at any time between triggering the relinquishment and UUT sending the relinquishment request | ☒ | ☐ |



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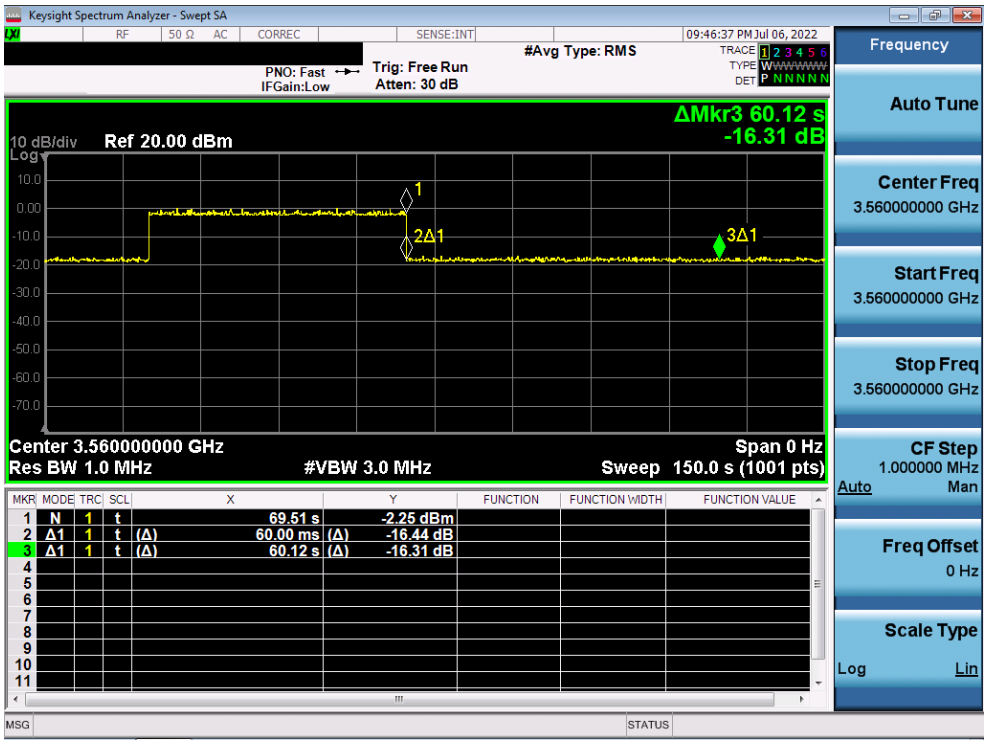
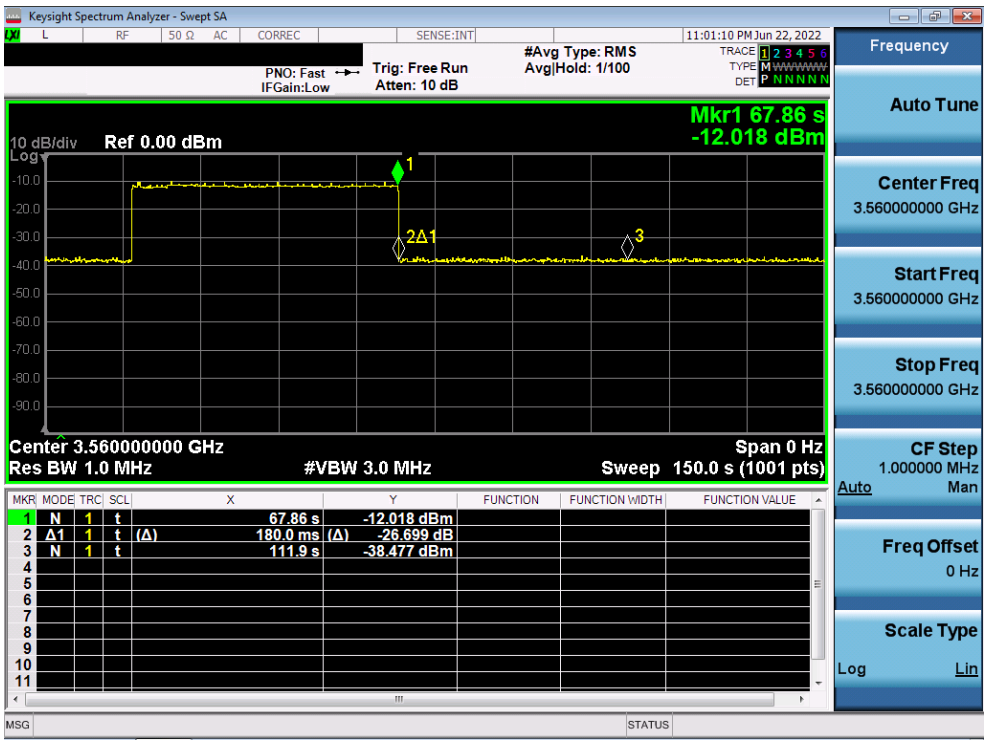
## Test Plots:




**Plot 37.Conducted Measurement - RF transmission stops (WINNF.FT.C.RLQ.1) – LTE**




**Plot 38.Conducted Measurement - RF transmission stops (WINNF.FT.C.RLQ.1) – NR**

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## A20 [WINNF.FT.C.DRG.1] Successful Deregistration

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness<br>• UUT has successfully registered with SAS Test Harness, with cbsdId=C<br>• UUT has received a valid grant with grantId = G<br>• UUT is in Grant State AUTHORIZED and is actively transmitting within the bounds of its grant.<br>Invoke trigger to deregister UUT from the SAS Test Harness | -- | -- |
| 2 | UUT sends a Relinquishment request and receives Relinquishment response with responseCode=0 | -- | -- |
| 3 | UUT sends Deregistration Request to SAS Test Harness with cbsdId = C. | ☒ | ☐ |
| 4 | SAS Test Harness shall approve the request with a Deregistration Response message with parameters:<br>• cbsdId = C<br>• responseCode = 0 | -- | -- |
| 5 | After completion of step 3, SAS Test Harness will not provide any additional positive response (responseCode=0) to further request messages from the UUT | -- | -- |
| 6 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 4 is complete. This is the end of the test. Verify:<br>• UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs:<br>A. UUT sending a Registration Request message, as this is not mandatory<br>B. UUT sending a Deregistration Request message | ☒ | ☐ |



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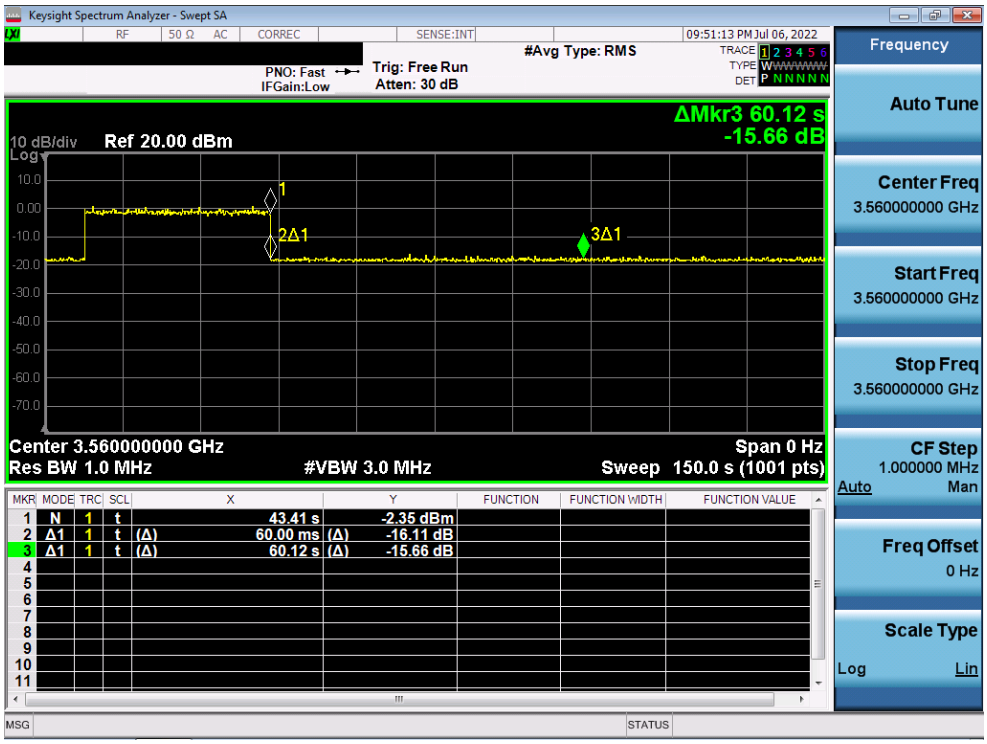
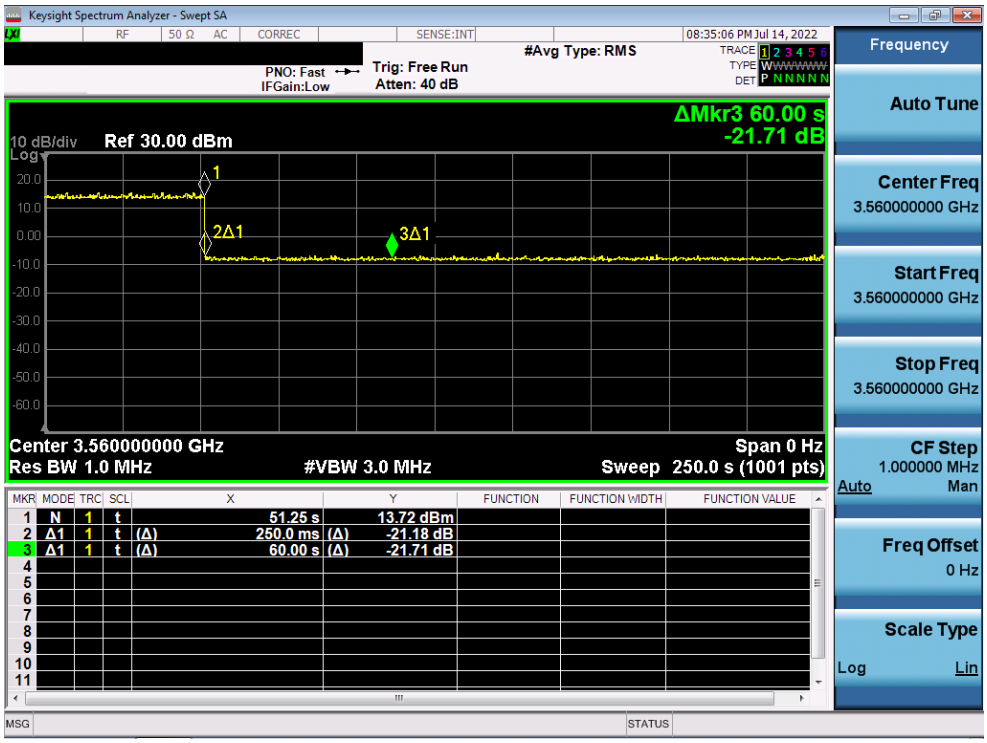
## Test Plots:




**Plot 39.Conducted Measurement - RF transmission stops within 60s. The SAS message is indicated by Marker 1 (X) (WINNF.FT.C.DRG.1) – LTE**




**Plot 40.Conducted Measurement - RF transmission stops within 60s. The SAS message is indicated by Marker 1 (X) (WINNF.FT.C.DRG.1) – NR**

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## A21 [WINNF.FT.C.SCS.1] Successful TLS connection between UUT and SAS Test Harness

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | • UUT shall start CBSD-SAS communication with the security procedure<br>• The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate.<br>• Configure the SAS Test Harness to accept the security procedure and establish the connection | ☒ | ☐ |
| 2 | • Make sure that Mutual authentication happens between UUT and the SAS Test Harness.<br>• Make sure that UUT uses TLS v1.2<br>• Make sure that cipher suites from one of the following is selected,<br>• TLS_RSA_WITH_AES_128_GCM_SHA256<br>• TLS_RSA_WITH_AES_256_GCM_SHA384<br>• TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256<br>• TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384<br>• TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 | ☒ | ☐ |
| 3 | A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability.<br>• UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with responseCode = 0 and cbsdId. | ☒ | ☐ |
| 4 | Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:<br>• UUT shall not transmit RF | ☒ | ☐ |



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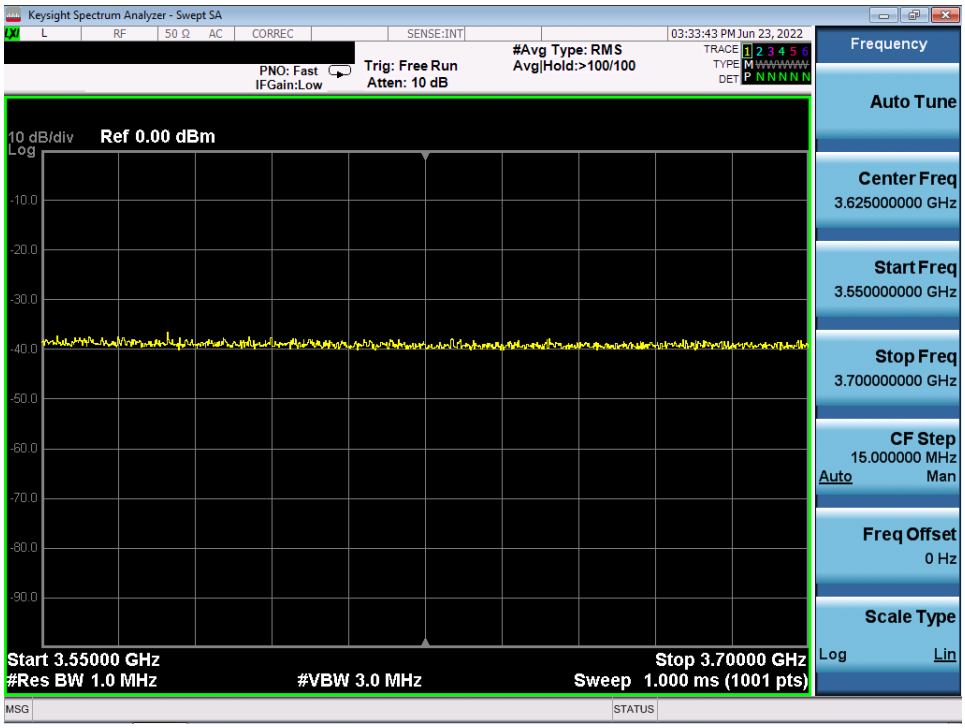
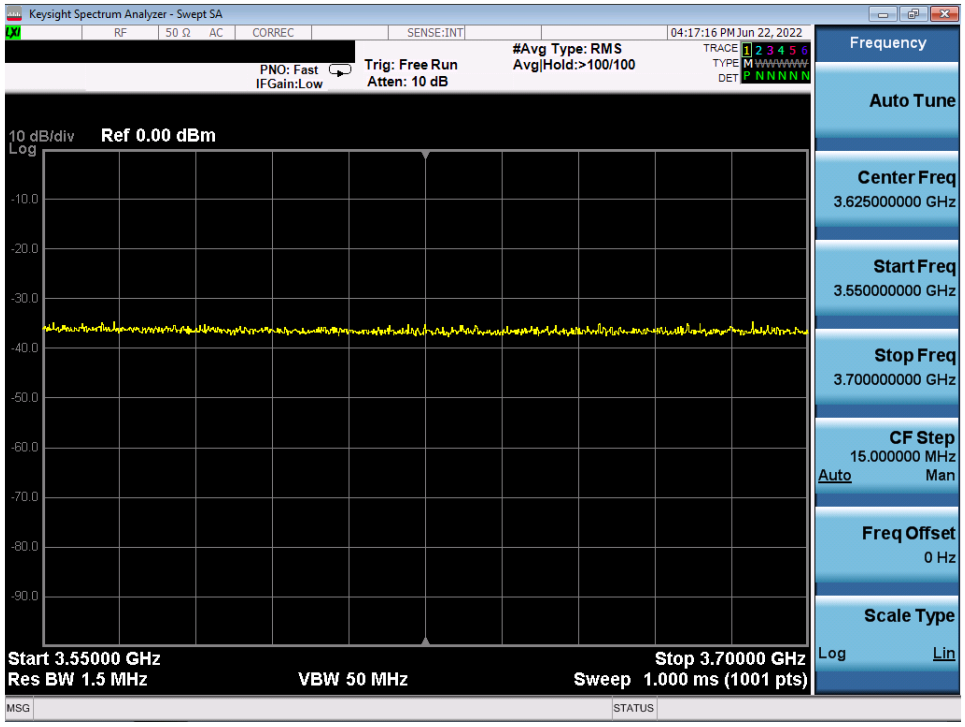
## Test Plots:




**Plot 41. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.1) – LTE**




**Plot 42. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.1) – NR**

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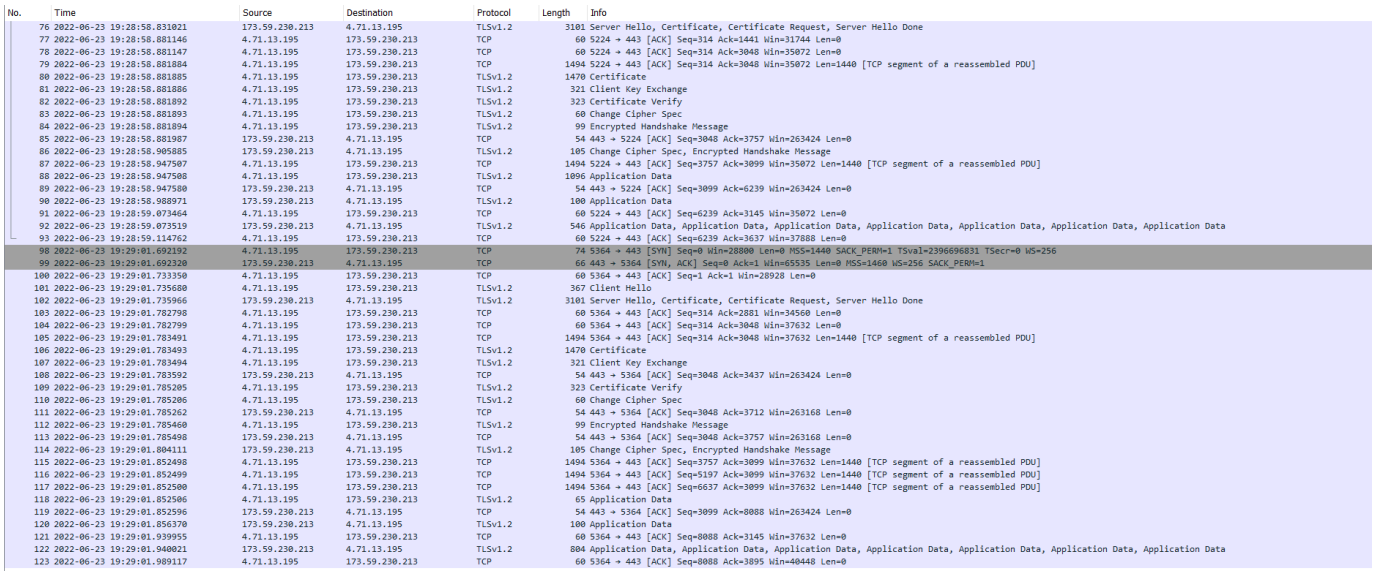
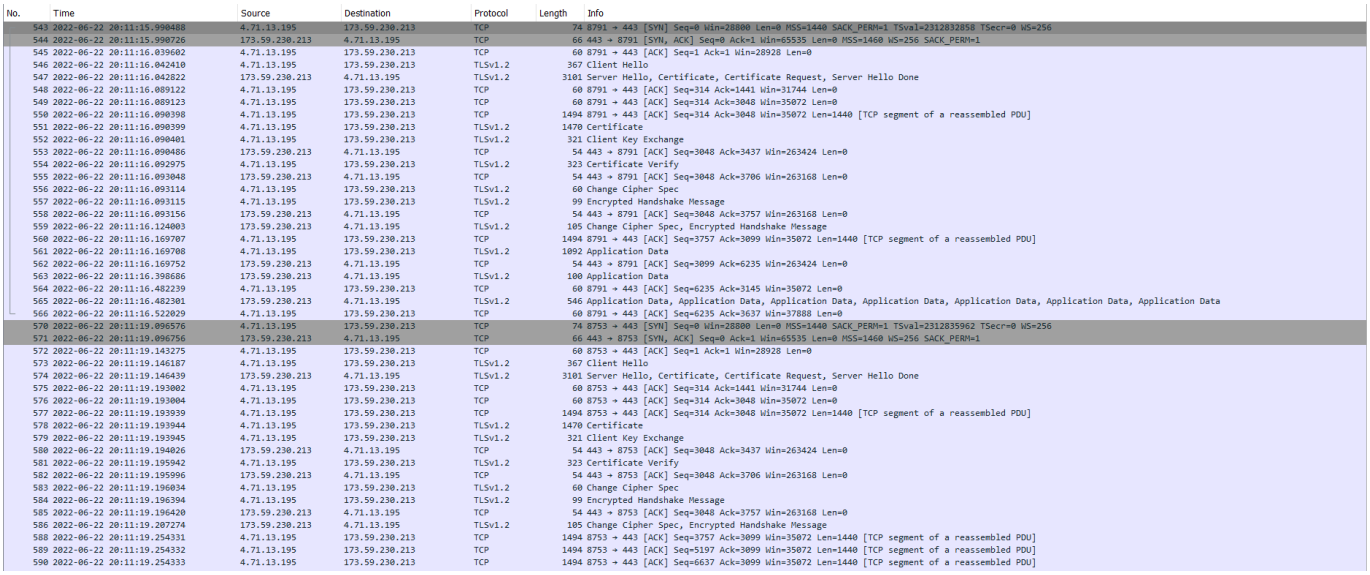


| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 76 | 2022-06-23 19:28:58.831021 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3101 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 77 | 2022-06-23 19:28:58.881146 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 78 | 2022-06-23 19:28:58.881147 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=0 |
| 79 | 2022-06-23 19:28:58.881884 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5224 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 80 | 2022-06-23 19:28:58.881885 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1470 | Certificate |
| 81 | 2022-06-23 19:28:58.881886 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 321 | Client Key Exchange |
| 82 | 2022-06-23 19:28:58.881892 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 323 | Certificate Verify |
| 83 | 2022-06-23 19:28:58.881893 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 60 | Change Cipher Spec |
| 84 | 2022-06-23 19:28:58.881894 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 99 | Encrypted Handshake Message |
| 85 | 2022-06-23 19:28:58.881987 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5224 [ACK] Seq=3048 Ack=3757 Win=263424 Len=0 |
| 86 | 2022-06-23 19:28:58.905885 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 105 | Change Cipher Spec, Encrypted Handshake Message |
| 87 | 2022-06-23 19:28:58.947507 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5224 → 443 [ACK] Seq=3757 Ack=3099 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 88 | 2022-06-23 19:28:58.947508 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1096 | Application Data |
| 89 | 2022-06-23 19:28:58.947580 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5224 [ACK] Seq=3099 Ack=6239 Win=263424 Len=0 |
| 90 | 2022-06-23 19:28:58.988971 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 100 | Application Data |
| 91 | 2022-06-23 19:28:59.073464 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=6239 Ack=3145 Win=35072 Len=0 |
| 92 | 2022-06-23 19:28:59.073519 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 546 | Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data |
| 93 | 2022-06-23 19:28:59.114762 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=6239 Ack=3637 Win=37888 Len=0 |
| 98 | 2022-06-23 19:29:01.692192 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 5364 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2396696831 TSecr=0 WS=256 |
| 99 | 2022-06-23 19:29:01.692320 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 5364 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 100 | 2022-06-23 19:29:01.733350 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5364 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 101 | 2022-06-23 19:29:01.735680 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 102 | 2022-06-23 19:29:01.735966 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3101 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 103 | 2022-06-23 19:29:01.782798 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5364 → 443 [ACK] Seq=314 Ack=2881 Win=34560 Len=0 |
| 104 | 2022-06-23 19:29:01.782799 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5364 → 443 [ACK] Seq=314 Ack=3048 Win=37632 Len=0 |
| 105 | 2022-06-23 19:29:01.783491 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5364 → 443 [ACK] Seq=314 Ack=3048 Win=37632 Len=1440 [TCP segment of a reassembled PDU] |
| 106 | 2022-06-23 19:29:01.783493 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1470 | Certificate |
| 107 | 2022-06-23 19:29:01.783494 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 321 | Client Key Exchange |
| 108 | 2022-06-23 19:29:01.783592 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5364 [ACK] Seq=3048 Ack=3437 Win=263424 Len=0 |
| 109 | 2022-06-23 19:29:01.785205 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 323 | Certificate Verify |
| 110 | 2022-06-23 19:29:01.785206 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 60 | Change Cipher Spec |
| 111 | 2022-06-23 19:29:01.785262 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5364 [ACK] Seq=3048 Ack=3712 Win=263168 Len=0 |
| 112 | 2022-06-23 19:29:01.785460 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 99 | Encrypted Handshake Message |
| 113 | 2022-06-23 19:29:01.785498 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5364 [ACK] Seq=3048 Ack=3757 Win=263168 Len=0 |
| 114 | 2022-06-23 19:29:01.804111 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 105 | Change Cipher Spec, Encrypted Handshake Message |
| 115 | 2022-06-23 19:29:01.852498 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5364 → 443 [ACK] Seq=3757 Ack=3099 Win=37632 Len=1440 [TCP segment of a reassembled PDU] |
| 116 | 2022-06-23 19:29:01.852499 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5364 → 443 [ACK] Seq=5197 Ack=3099 Win=37632 Len=1440 [TCP segment of a reassembled PDU] |
| 117 | 2022-06-23 19:29:01.852500 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 5364 → 443 [ACK] Seq=6637 Ack=3099 Win=37632 Len=1440 [TCP segment of a reassembled PDU] |
| 118 | 2022-06-23 19:29:01.852506 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 65 | Application Data |
| 119 | 2022-06-23 19:29:01.852596 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 5364 [ACK] Seq=3099 Ack=8088 Win=263424 Len=0 |
| 120 | 2022-06-23 19:29:01.856370 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 100 | Application Data |
| 121 | 2022-06-23 19:29:01.939955 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5364 → 443 [ACK] Seq=8088 Ack=3145 Win=37632 Len=0 |
| 122 | 2022-06-23 19:29:01.940021 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 804 | Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data |
| 123 | 2022-06-23 19:29:01.989117 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5364 → 443 [ACK] Seq=8088 Ack=3895 Win=40448 Len=0 |

**Plot 43.WireShark Screenshot – Successful Handshake (WINNF.FT.C.SCS.1) – LTE**



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 543 | 2022-06-22 20:11:15.990488 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 8791 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2312832858 TSecr=0 WS=256 |
| 544 | 2022-06-22 20:11:15.990726 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 8791 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 545 | 2022-06-22 20:11:16.039602 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8791 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 546 | 2022-06-22 20:11:16.042410 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 547 | 2022-06-22 20:11:16.042822 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3101 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 548 | 2022-06-22 20:11:16.089122 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8791 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 549 | 2022-06-22 20:11:16.089123 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8791 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=0 |
| 550 | 2022-06-22 20:11:16.090398 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8791 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 551 | 2022-06-22 20:11:16.090399 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1470 | Certificate |
| 552 | 2022-06-22 20:11:16.090401 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 321 | Client Key Exchange |
| 553 | 2022-06-22 20:11:16.090486 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8791 [ACK] Seq=3048 Ack=3437 Win=263424 Len=0 |
| 554 | 2022-06-22 20:11:16.092975 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 323 | Certificate Verify |
| 555 | 2022-06-22 20:11:16.093048 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8791 [ACK] Seq=3048 Ack=3706 Win=263168 Len=0 |
| 556 | 2022-06-22 20:11:16.093114 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 60 | Change Cipher Spec |
| 557 | 2022-06-22 20:11:16.093115 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 99 | Encrypted Handshake Message |
| 558 | 2022-06-22 20:11:16.093156 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8791 [ACK] Seq=3048 Ack=3757 Win=263168 Len=0 |
| 559 | 2022-06-22 20:11:16.124003 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 105 | Change Cipher Spec, Encrypted Handshake Message |
| 560 | 2022-06-22 20:11:16.169707 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8791 → 443 [ACK] Seq=3757 Ack=3099 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 561 | 2022-06-22 20:11:16.169708 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1092 | Application Data |
| 562 | 2022-06-22 20:11:16.169752 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8791 [ACK] Seq=3099 Ack=6235 Win=263424 Len=0 |
| 563 | 2022-06-22 20:11:16.398686 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 100 | Application Data |
| 564 | 2022-06-22 20:11:16.482239 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8791 → 443 [ACK] Seq=6235 Ack=3145 Win=35072 Len=0 |
| 565 | 2022-06-22 20:11:16.482301 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 546 | Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data |
| 566 | 2022-06-22 20:11:16.522029 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8791 → 443 [ACK] Seq=6235 Ack=3637 Win=37888 Len=0 |
| 570 | 2022-06-22 20:11:19.096576 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 8753 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2312835962 TSecr=0 WS=256 |
| 571 | 2022-06-22 20:11:19.096756 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 8753 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 572 | 2022-06-22 20:11:19.143275 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8753 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 573 | 2022-06-22 20:11:19.146187 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 574 | 2022-06-22 20:11:19.146439 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3101 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 575 | 2022-06-22 20:11:19.193002 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8753 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 576 | 2022-06-22 20:11:19.193004 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8753 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=0 |
| 577 | 2022-06-22 20:11:19.193939 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8753 → 443 [ACK] Seq=314 Ack=3048 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 578 | 2022-06-22 20:11:19.193944 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 1470 | Certificate |
| 579 | 2022-06-22 20:11:19.193945 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 321 | Client Key Exchange |
| 580 | 2022-06-22 20:11:19.194026 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8753 [ACK] Seq=3048 Ack=3437 Win=263424 Len=0 |
| 581 | 2022-06-22 20:11:19.195942 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 323 | Certificate Verify |
| 582 | 2022-06-22 20:11:19.195996 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8753 [ACK] Seq=3048 Ack=3706 Win=263168 Len=0 |
| 583 | 2022-06-22 20:11:19.196034 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 60 | Change Cipher Spec |
| 584 | 2022-06-22 20:11:19.196394 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 99 | Encrypted Handshake Message |
| 585 | 2022-06-22 20:11:19.196420 | 173.59.230.213 | 4.71.13.195 | TCP | 54 | 443 → 8753 [ACK] Seq=3048 Ack=3757 Win=263168 Len=0 |
| 586 | 2022-06-22 20:11:19.207274 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 105 | Change Cipher Spec, Encrypted Handshake Message |
| 588 | 2022-06-22 20:11:19.254331 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8753 → 443 [ACK] Seq=3757 Ack=3099 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 589 | 2022-06-22 20:11:19.254332 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8753 → 443 [ACK] Seq=5197 Ack=3099 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |
| 590 | 2022-06-22 20:11:19.254333 | 4.71.13.195 | 173.59.230.213 | TCP | 1494 | 8753 → 443 [ACK] Seq=6637 Ack=3099 Win=35072 Len=1440 [TCP segment of a reassembled PDU] |

**Plot 44.WireShark Screenshot – Successful Handshake (WINNF.FT.C.SCS.1) – NR**

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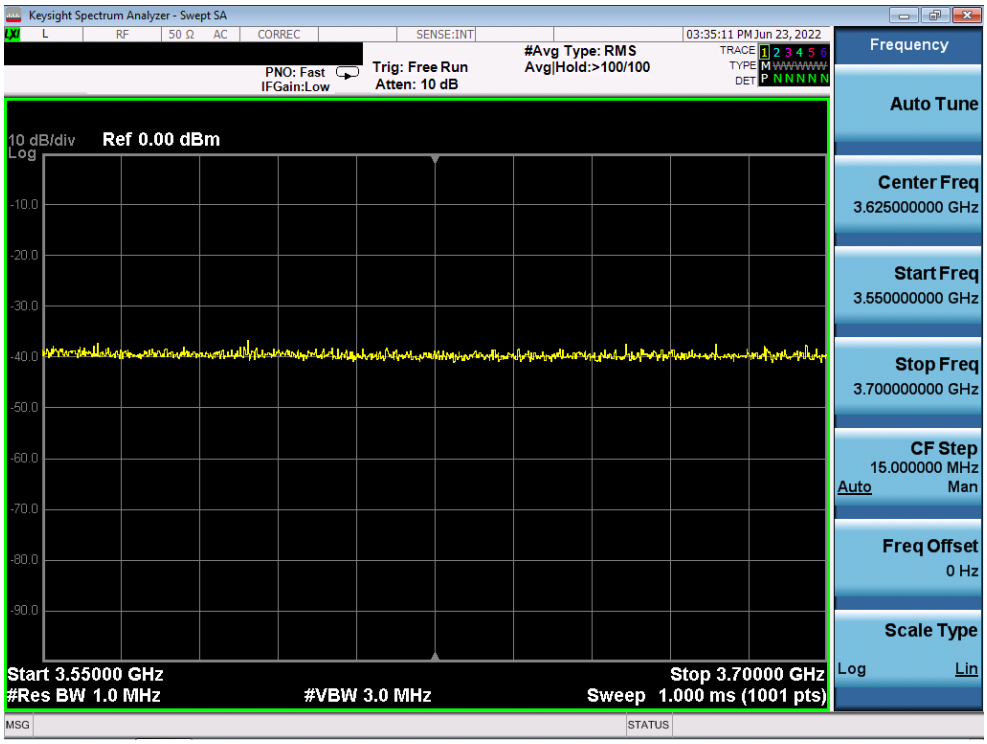
## A22 [WINNF.FT.C.SCS.2] TLS failure due to revoked certificate

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | • UUT shall start CBSD-SAS communication with the security procedure | ☒ | ☐ |
| 2 | • Make sure that UUT uses TLS v1.2 for security establishment.<br>• Make sure UUT selects the correct cipher suite.<br>• UUT shall use CRL or OCSP to verify the validity of the server certificate.<br>• Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness | ☒ | ☐ |
| 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. | -- | -- |
| 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:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 45.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.2) – LTE**

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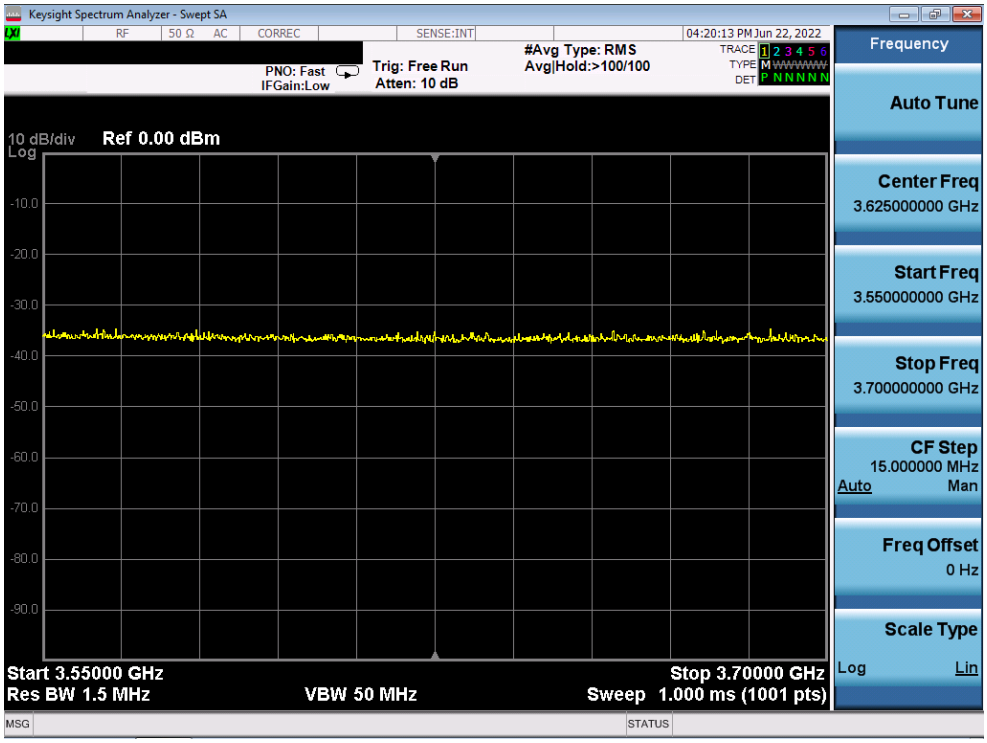
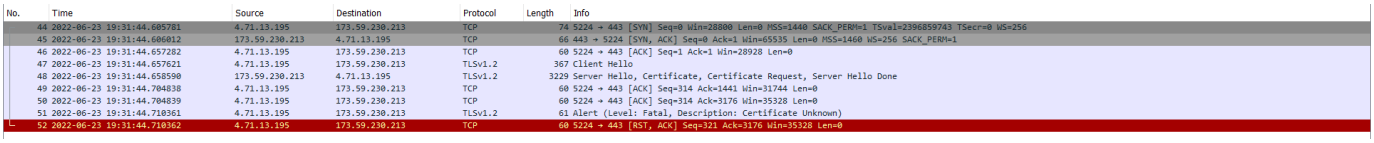
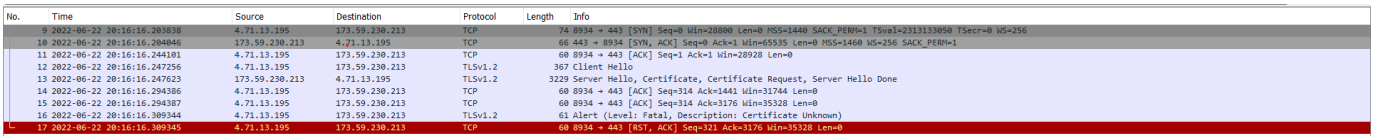



**Plot 46. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.2) – NR**



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 44 | 2022-06-23 19:31:44.605781 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 5224 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2396859743 TSecr=0 WS=256 |
| 45 | 2022-06-23 19:31:44.606012 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 5224 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 46 | 2022-06-23 19:31:44.657282 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 47 | 2022-06-23 19:31:44.657621 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 48 | 2022-06-23 19:31:44.658590 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3229 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 49 | 2022-06-23 19:31:44.704838 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 50 | 2022-06-23 19:31:44.704839 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [ACK] Seq=314 Ack=3176 Win=35328 Len=0 |
| 51 | 2022-06-23 19:31:44.710361 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 61 | Alert (Level: Fatal, Description: Certificate Unknown) |
| 52 | 2022-06-23 19:31:44.710362 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5224 → 443 [RST, ACK] Seq=321 Ack=3176 Win=35328 Len=0 |

**Plot 47. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.2) – LTE**



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 9 | 2022-06-22 20:16:16.203838 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 8934 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2313133050 TSecr=0 WS=256 |
| 10 | 2022-06-22 20:16:16.204046 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 8934 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 11 | 2022-06-22 20:16:16.244101 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8934 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 12 | 2022-06-22 20:16:16.247256 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 13 | 2022-06-22 20:16:16.247623 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3229 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 14 | 2022-06-22 20:16:16.294386 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8934 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 15 | 2022-06-22 20:16:16.294387 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8934 → 443 [ACK] Seq=314 Ack=3176 Win=35328 Len=0 |
| 16 | 2022-06-22 20:16:16.309344 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 61 | Alert (Level: Fatal, Description: Certificate Unknown) |
| 17 | 2022-06-22 20:16:16.309345 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 8934 → 443 [RST, ACK] Seq=321 Ack=3176 Win=35328 Len=0 |

**Plot 48. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.2) – NR**

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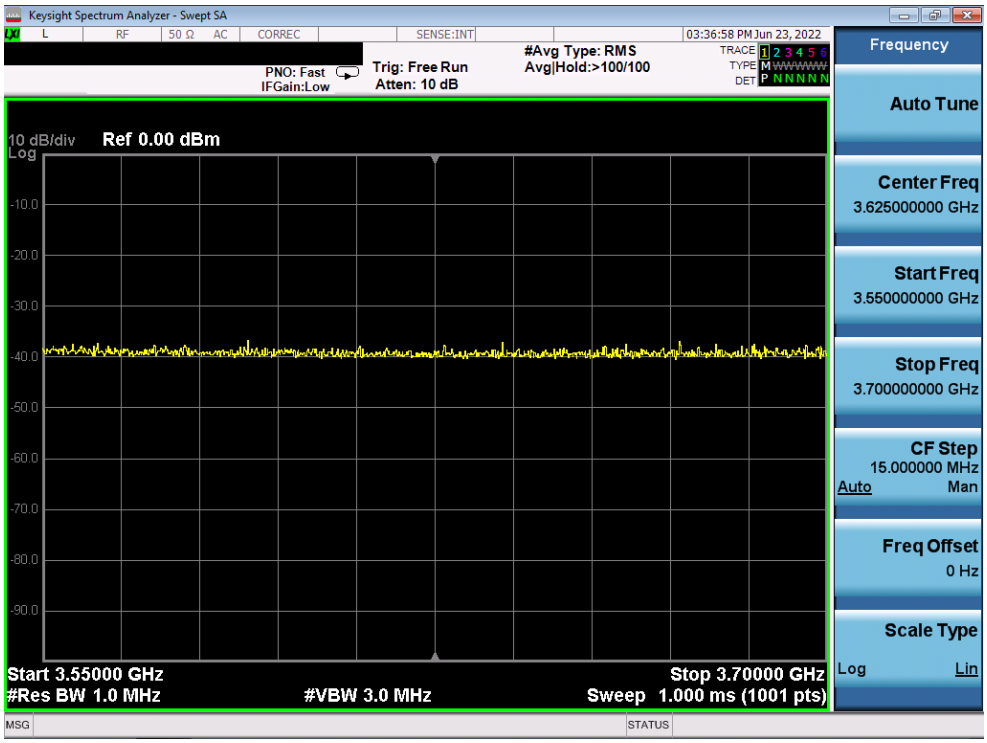
## A23 [WINNF.FT.C.SCS.3] TLS failure due to expired server certificate

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | • UUT shall start CBSD-SAS communication with the security procedure | ☒ | ☐ |
| 2 | • Make sure that UUT uses TLS v1.2 for security establishment.<br>• Make sure UUT selects the correct cipher suite.<br>• UUT shall use CRL or OCSP to verify the validity of the server certificate.<br>• Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness. | ☒ | ☐ |
| 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. | -- | -- |
| 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:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 49.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.3) – LTE**

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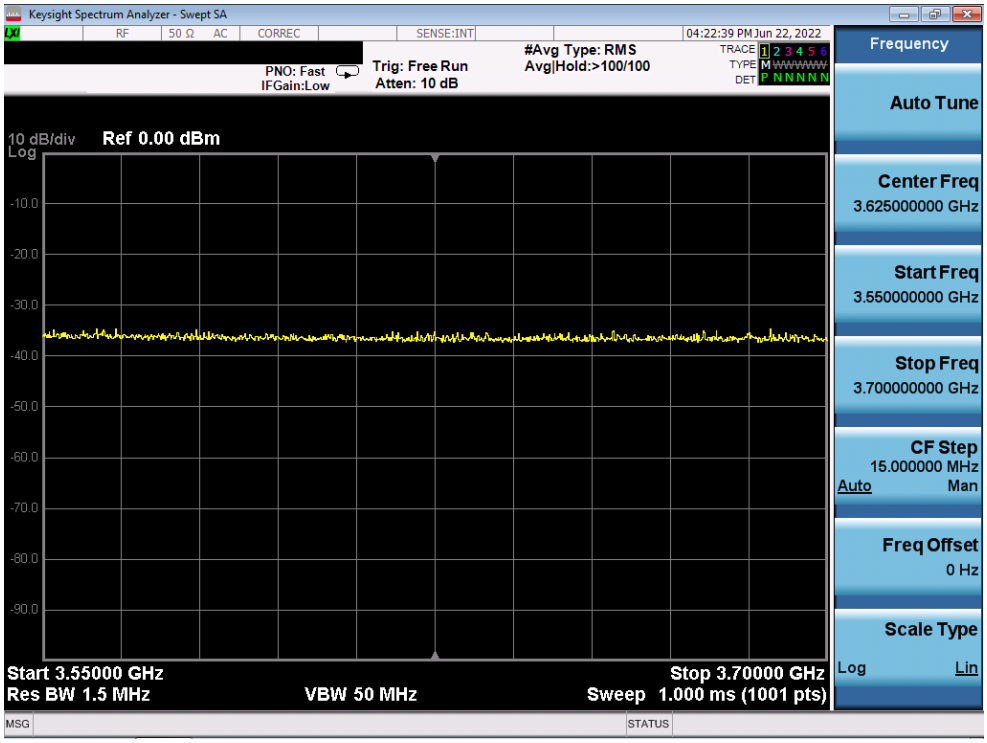
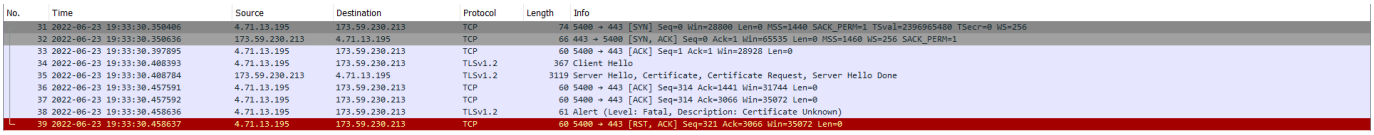
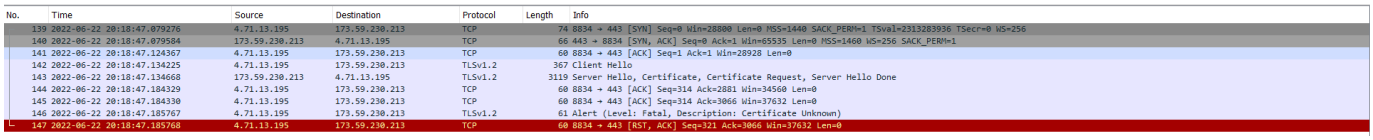



**Plot 50. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.3) – NR**




**Plot 51. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.3) – LTE**




**Plot 52. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.3) – NR**

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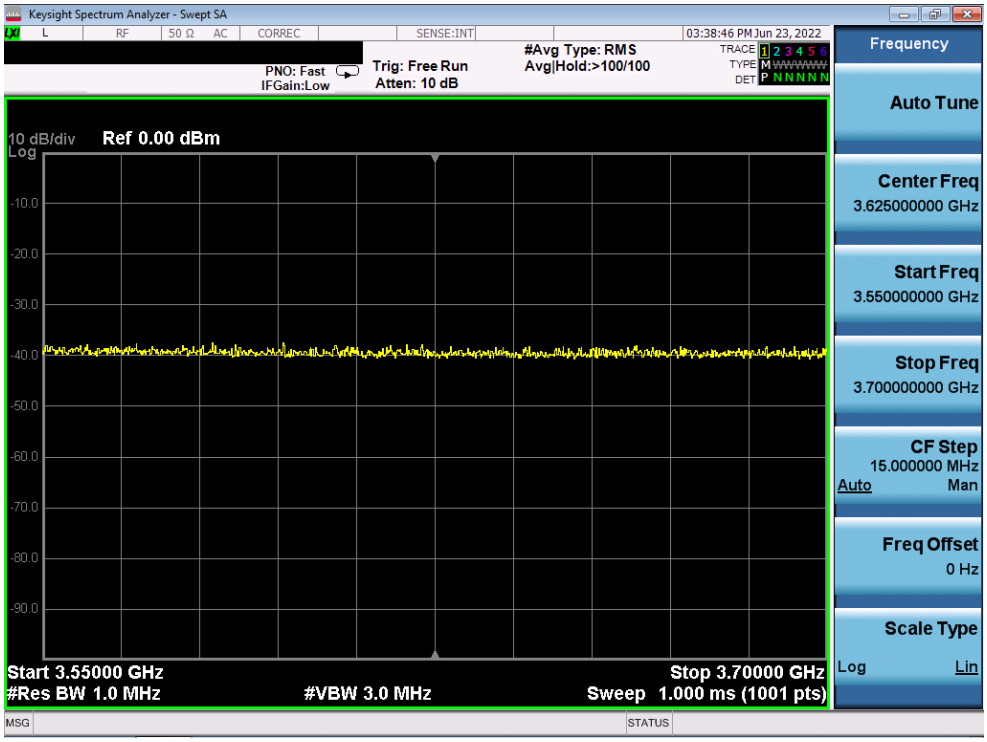
## A24 [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | • UUT shall start CBSD-SAS communication with the security procedure | ☒ | ☐ |
| 2 | • Make sure that UUT uses TLS v1.2 for security establishment.<br>• Make sure UUT selects the correct cipher suite.<br>• UUT shall use CRL or OCSP to verify the validity of the server certificate.<br>• Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness. | ☒ | ☐ |
| 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. | -- | -- |
| 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:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 53. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.4) – LTE**

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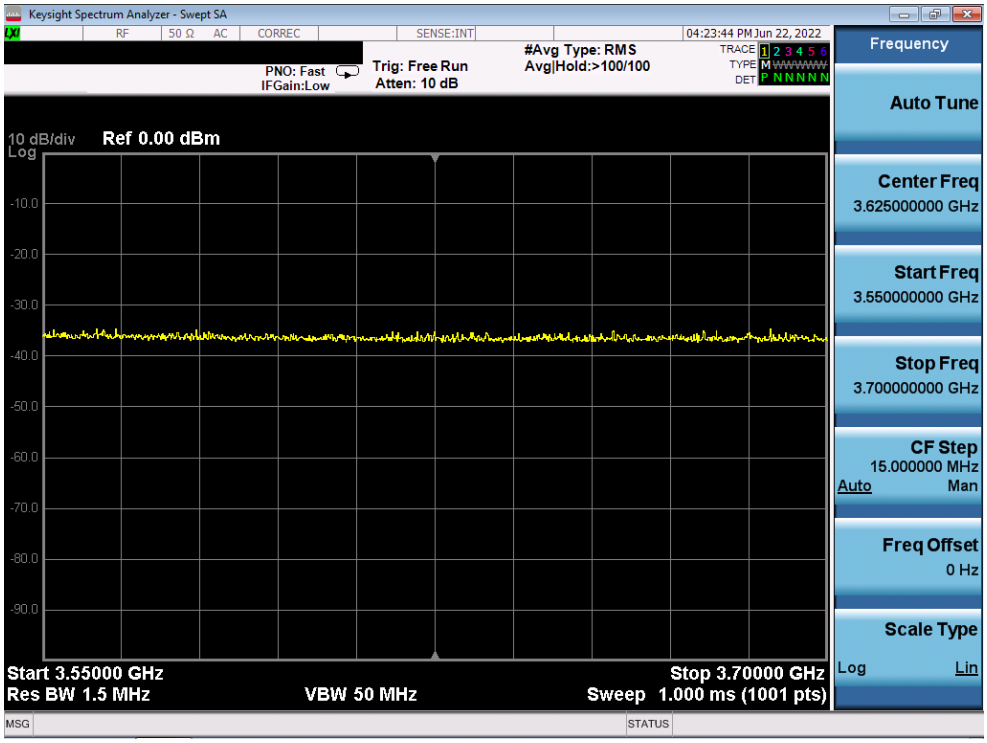


**Plot 54. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.4) – NR**

| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 61 | 2022-06-23 19:35:11.883999 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 5227 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2397067014 TSecr=0 WS=256 |
| 62 | 2022-06-23 19:35:11.884058 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 5227 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 63 | 2022-06-23 19:35:11.928796 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5227 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 64 | 2022-06-23 19:35:11.931584 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 65 | 2022-06-23 19:35:11.931941 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3119 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 66 | 2022-06-23 19:35:11.978047 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5227 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 67 | 2022-06-23 19:35:11.978048 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5227 → 443 [ACK] Seq=314 Ack=3066 Win=35072 Len=0 |
| 68 | 2022-06-23 19:35:11.978387 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 61 | Alert (Level: Fatal, Description: Certificate Unknown) |
| 69 | 2022-06-23 19:35:11.978388 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 5227 → 443 [RST, ACK] Seq=321 Ack=3066 Win=35072 Len=0 |

**Plot 55. WireShark Screenshot – Failed Handshake (WINNF.FT.C.SCS.4) – LTE**

| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 21 | 2022-06-22 20:20:22.798313 | 4.71.13.195 | 173.59.230.213 | TCP | 74 | 6929 → 443 [SYN] Seq=0 Win=28800 Len=0 MSS=1440 SACK_PERM=1 TSval=2313379657 TSecr=0 WS=256 |
| 22 | 2022-06-22 20:20:22.798569 | 173.59.230.213 | 4.71.13.195 | TCP | 66 | 443 → 6929 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 23 | 2022-06-22 20:20:22.843595 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 6929 → 443 [ACK] Seq=1 Ack=1 Win=28928 Len=0 |
| 24 | 2022-06-22 20:20:22.846365 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 367 | Client Hello |
| 25 | 2022-06-22 20:20:22.846782 | 173.59.230.213 | 4.71.13.195 | TLSv1.2 | 3121 | Server Hello, Certificate, Certificate Request, Server Hello Done |
| 27 | 2022-06-22 20:20:22.893502 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 6929 → 443 [ACK] Seq=314 Ack=1441 Win=31744 Len=0 |
| 28 | 2022-06-22 20:20:22.893503 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 6929 → 443 [ACK] Seq=314 Ack=3068 Win=35072 Len=0 |
| 29 | 2022-06-22 20:20:22.895720 | 4.71.13.195 | 173.59.230.213 | TLSv1.2 | 61 | Alert (Level: Fatal, Description: Certificate Unknown) |
| 30 | 2022-06-22 20:20:22.895721 | 4.71.13.195 | 173.59.230.213 | TCP | 60 | 6929 → 443 [RST, ACK] Seq=321 Ack=3068 Win=35072 Len=0 |

**Plot 56. WireShark Screenshot – Failed Handshake (WINNF.FT.C.SCS.4) – NR**




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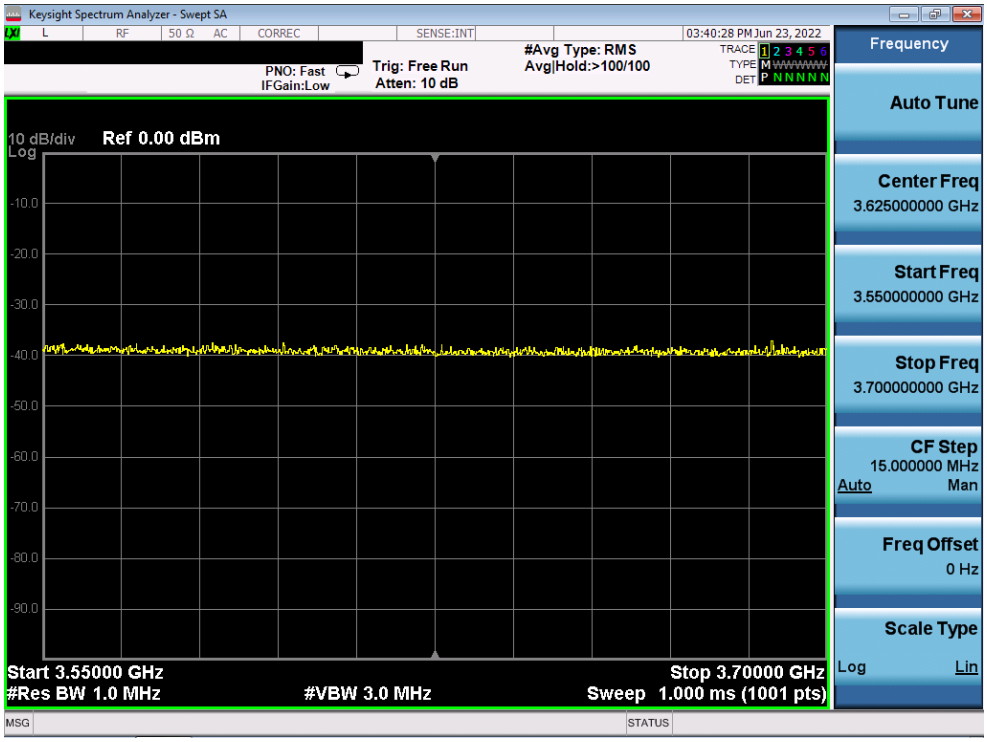
## A25 [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | • UUT shall start CBSD-SAS communication with the security procedure | ☒ | ☐ |
| 2 | • Make sure that UUT uses TLS v1.2 for security establishment.<br>• Make sure UUT selects the correct cipher suite.<br>• UUT shall use CRL or OCSP to verify the validity of the server certificate.<br>• Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness. | ☒ | ☐ |
| 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. | -- | -- |
| 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:<br>• UUT shall not transmit RF | ☒ | ☐ |

## Test Plots:




**Plot 57.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.5) – LTE**

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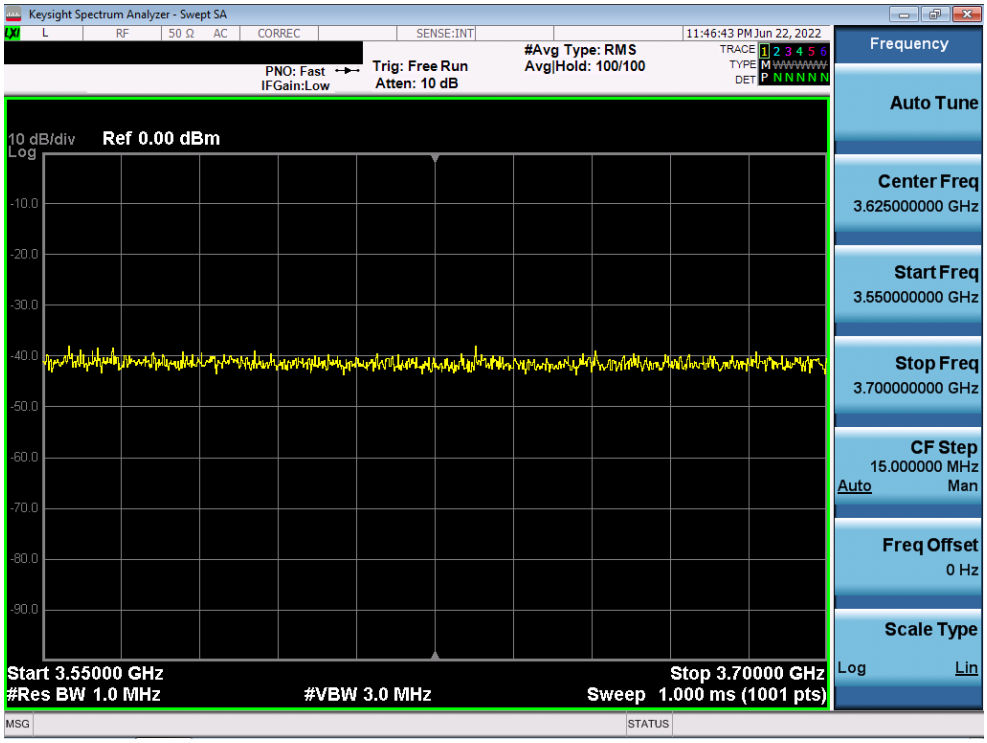
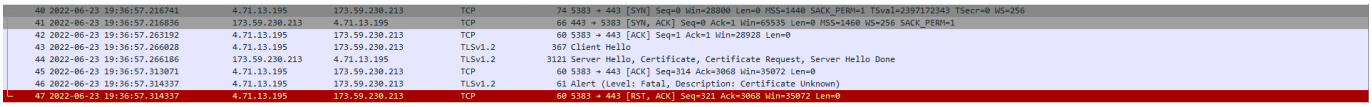
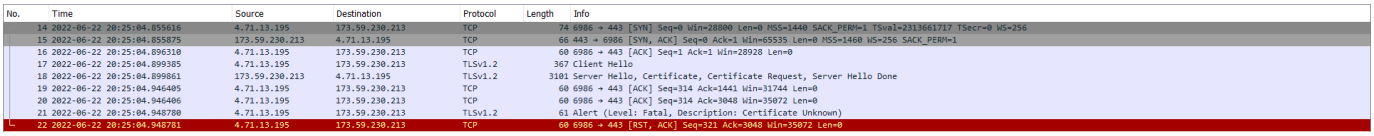



**Plot 58. Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.5) – NR**




**Plot 59. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.5) – LTE**




**Plot 60. WireShark Screenshot - Failed Handshake (WINNF.FT.C.SCS.5) – NR**



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## A26 [WINNF.PT.C.HBT] UUT RF Transmit Power Measurement

| | Test Execution Steps | PASS | FAIL |
|---|---|---|---|
| 1 | Ensure the following conditions are met for test entry:<br>• UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness<br>• UUT has registered with the SAS, with CBSD ID = C<br>• 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<br>*Note: in order for the UUT to request a grant with the parameters {lowFrequency, highFrequency, maxEirp), the SAS Test Harness may need to provide appropriate guidance in the availableChannel object of the spectrumInquiry response message, and the operationParam object of the grant response message. Alternately, the UUT vendor may provide the ability to set those parameters on the UUT so that the UUT will request a grant with those parameters.* | -- | -- |
| 2 | UUT and SAS Test Harness perform a series of Heartbeat Request/Response cycles, which continues until the other test steps are complete. Messaging for each cycle is as follows:<br>• UUT sends Heartbeat Request, including:<br>o cbsdId = C<br>o grantId = G<br>• SAS Test Harness responds with Heartbeat Response, including:<br>o cbsdId = C<br>o grantId = G<br>o transmitExpireTime = current UTC time + 200 seconds<br>o responseCode = 0 | -- | -- |
| 3 | Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfil the requirements of the power measurement method.<br>*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.* | ☒ | ☐ |



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## RF Power Measurements:

Testing is performed per KDB 971168 D01 and across the transmit dynamic range of 20dBm/MHz to 3dBm/MHz for 20MHz Bandwidth. Per the manufacturer, Tx1 and Tx2 produce correlated signals per KDB 662911 D01. The PSD of each transmitter was measured and summed in linear terms and then the directional antenna gain was added to yield the max EIRP.

| Freq [MHz] | SAS Granted maxEIRP [dBm/MHz] | Tx1 Conducted PSD [dBm/MHz] | Tx2 Conducted PSD [dBm/MHz] | Summed Conducted PSD [dBm/MHz] | Dir.Ant Gain [dBi] | maxEIRP [dBm/MHz] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 3560 | 20 | 8.10 | 7.69 | 10.91 | 8.5 | 19.41 | -0.59 |
| 3560 | 10 | -1.74 | -1.51 | 1.38 | 8.5 | 9.88 | -0.12 |
| 3560 | 3 | -8.14 | -9.04 | -5.56 | 8.5 | 2.94 | -0.06 |

**Table 7-1 RF Output Power Measurements (WINNF.PT.C.HBT.1 – LTE)**

| Freq [MHz] | SAS Granted maxEIRP [dBm/MHz] | Tx1 Conducted PSD [dBm/MHz] | Tx2 Conducted PSD [dBm/MHz] | Summed Conducted PSD [dBm/MHz] | Dir.Ant Gain [dBi] | maxEIRP [dBm/MHz] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 3560 | 20 | 8.31 | 7.95 | 11.14 | 8.5 | 19.64 | -0.36 |
| 3560 | 10 | -1.81 | -1.86 | 1.18 | 8.5 | 9.68 | -0.32 |
| 3560 | 3 | -8.55 | -9.04 | -5.78 | 8.5 | 2.72 | -0.28 |

**Table 7-1 RF Output Power Measurements (WINNF.PT.C.HBT.1 – NR)**

Directional Gain Calculation:

Ant1 gain = Ant2 gain = 5.5dBi

Correlated Directional Gain = 10*log(((Ant1 + Ant2)^n)/n) = 10*log(((5.5+5.5)^2)/2) = 8.5 dBi



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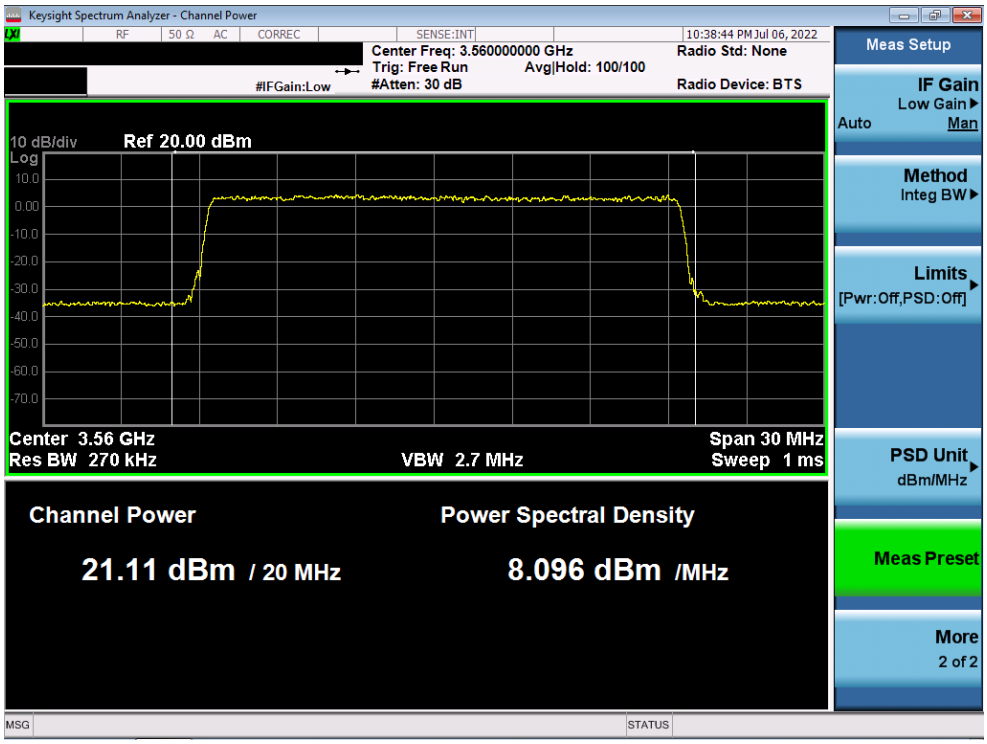
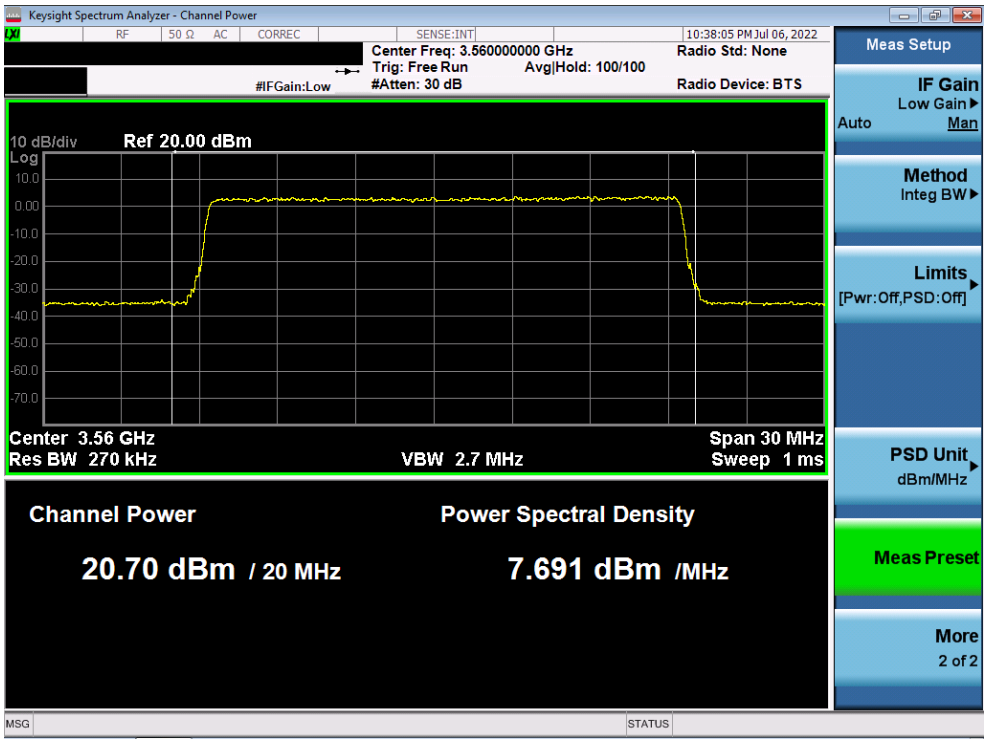
## Test Plots:




**Plot 61. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 20dBm/MHz (LTE)**




**Plot 62. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 20dBm/MHz (LTE)**

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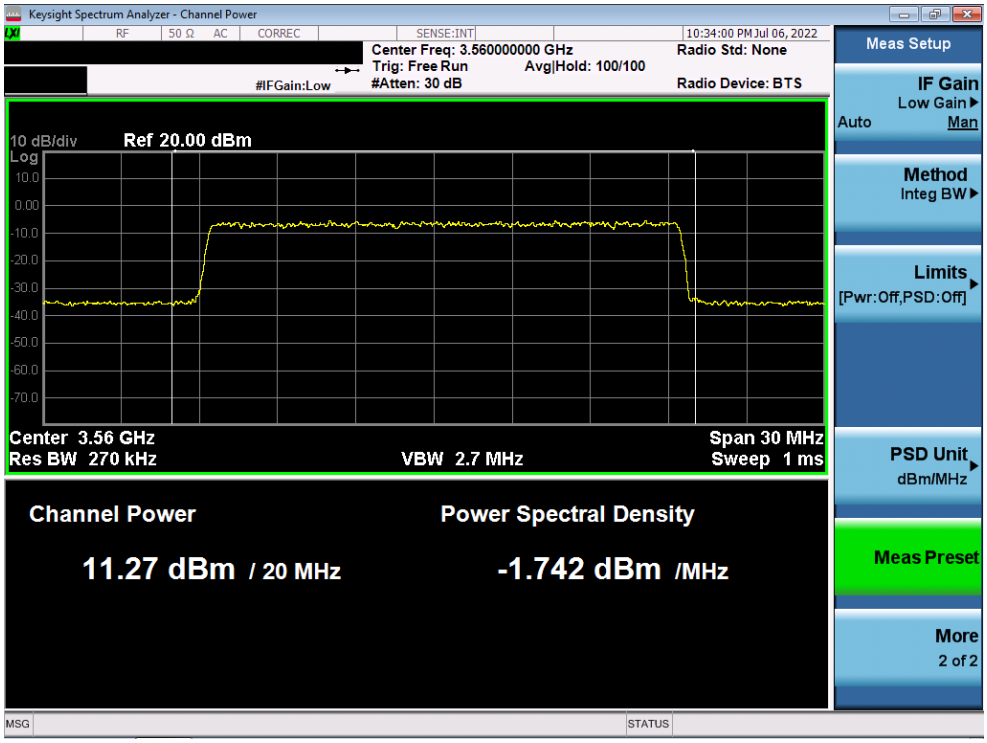
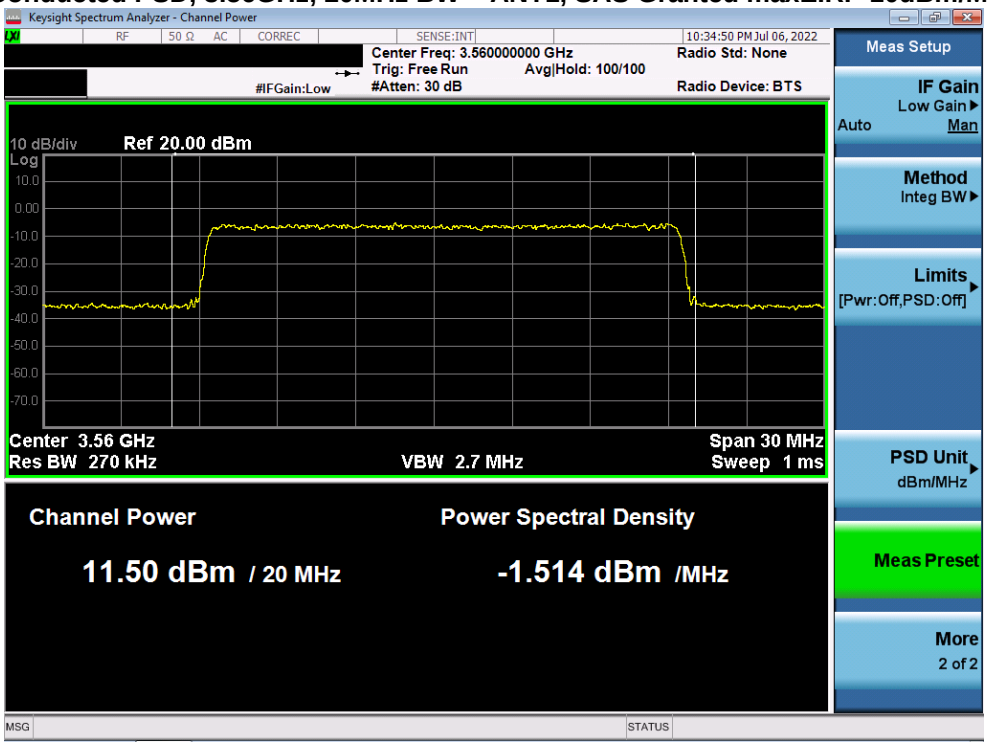



**Plot 63. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 10dBm/MHz (LTE)**




**Plot 64. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 10dBm/MHz (LTE)**

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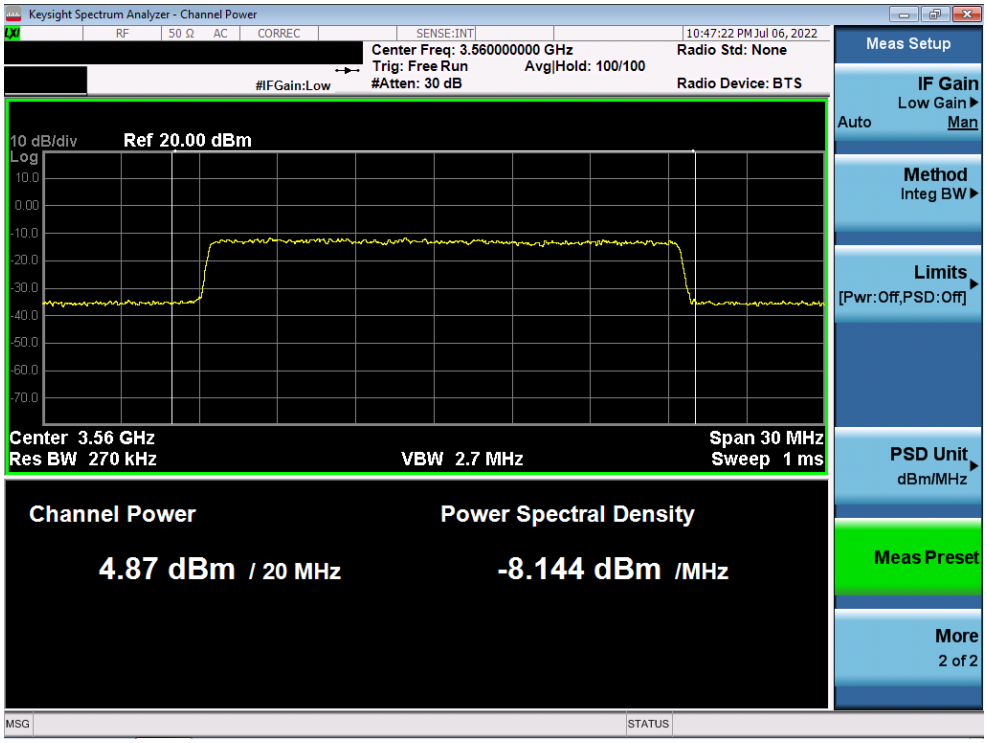
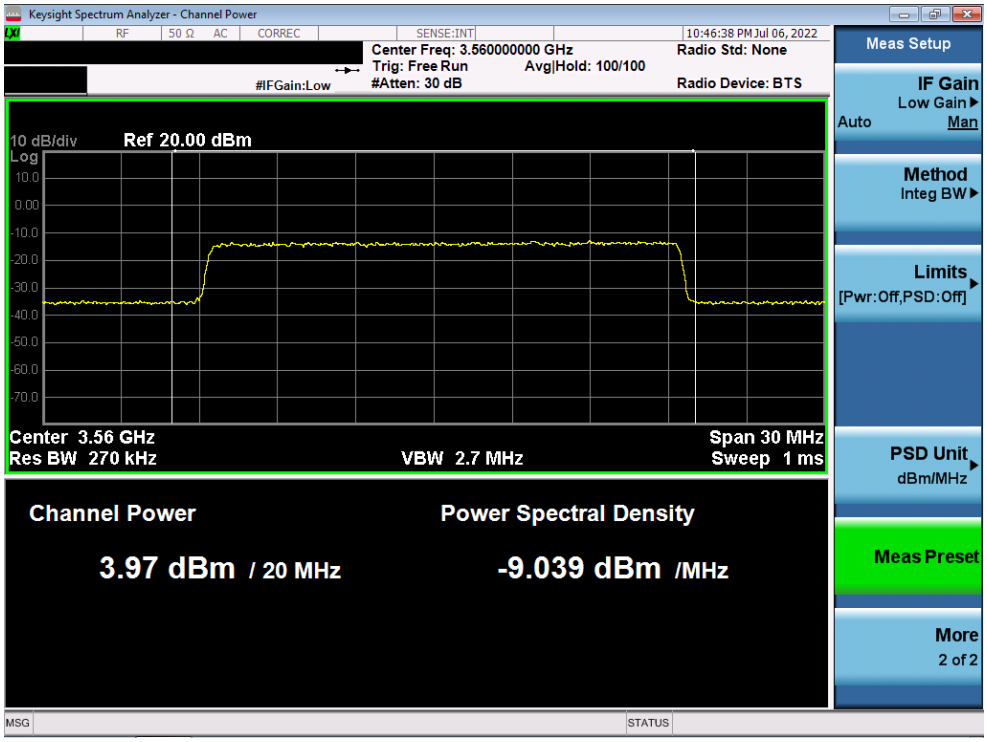



**Plot 65. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 3dBm/MHz (LTE)**




**Plot 66. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 3dBm/MHz (LTE)**

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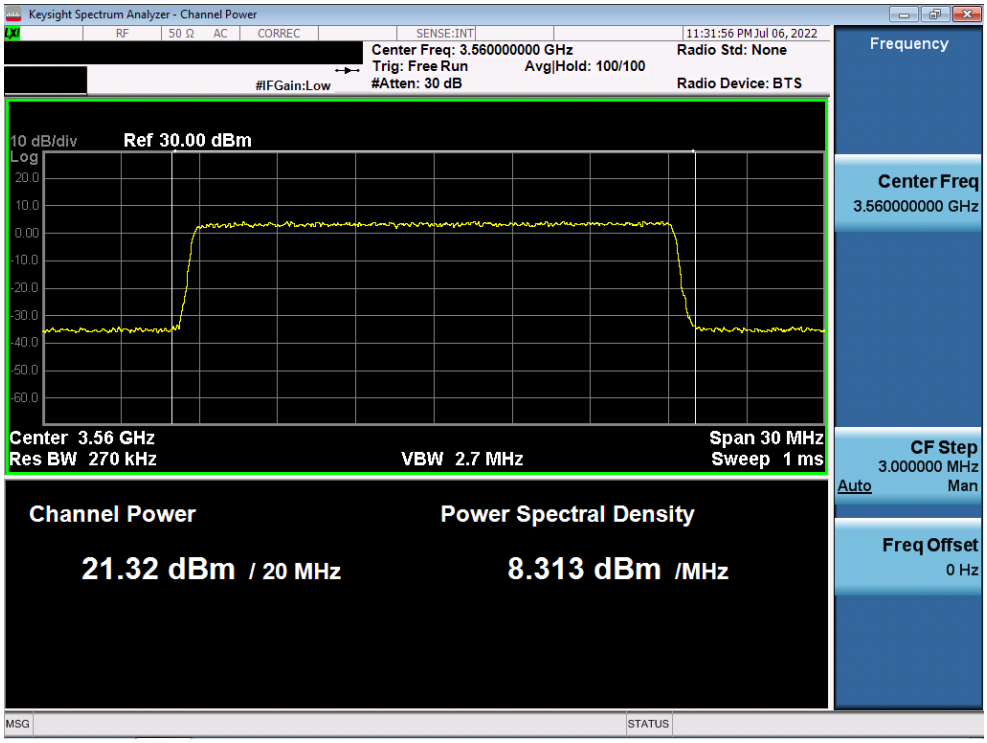
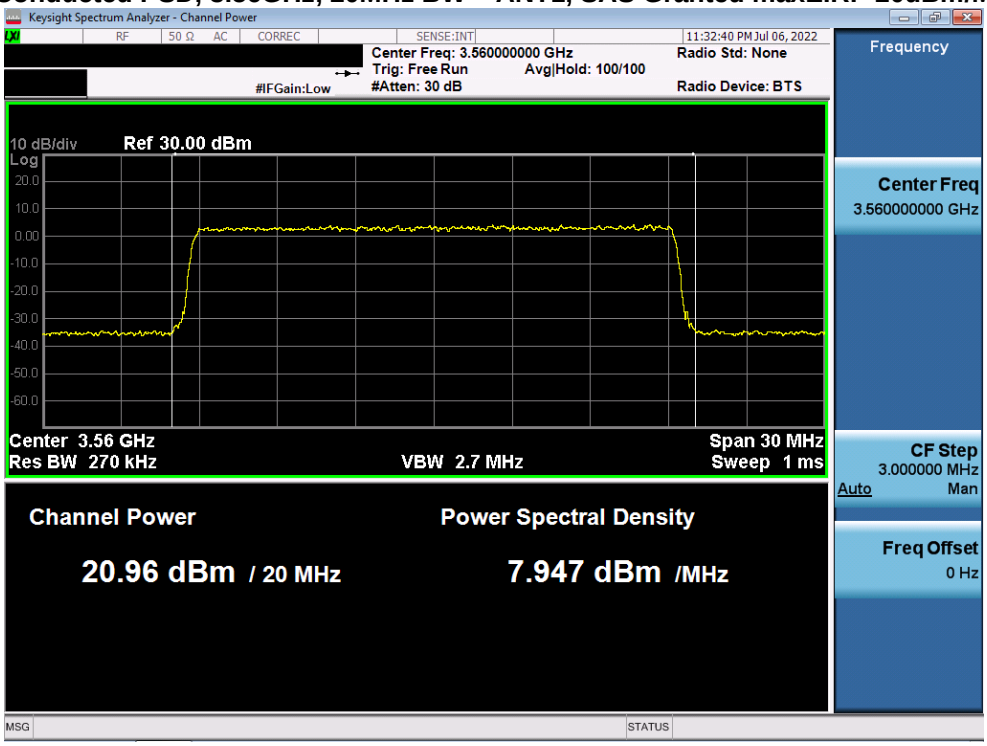



**Plot 67. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 20dBm/MHz (NR)**




**Plot 68. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 20dBm/MHz (NR)**

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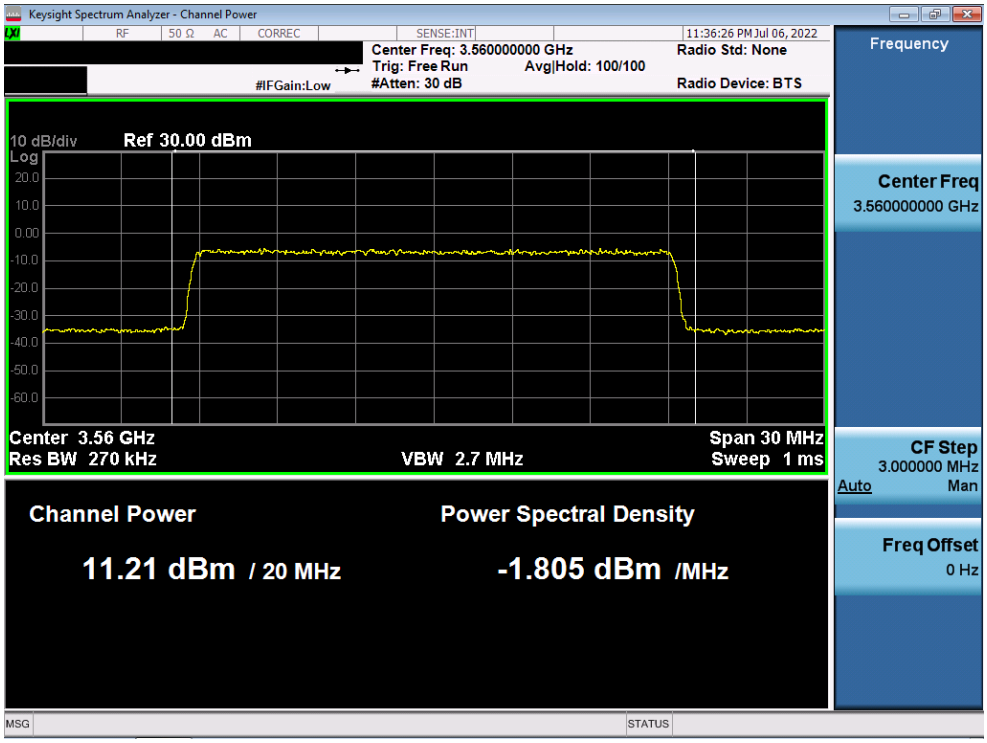
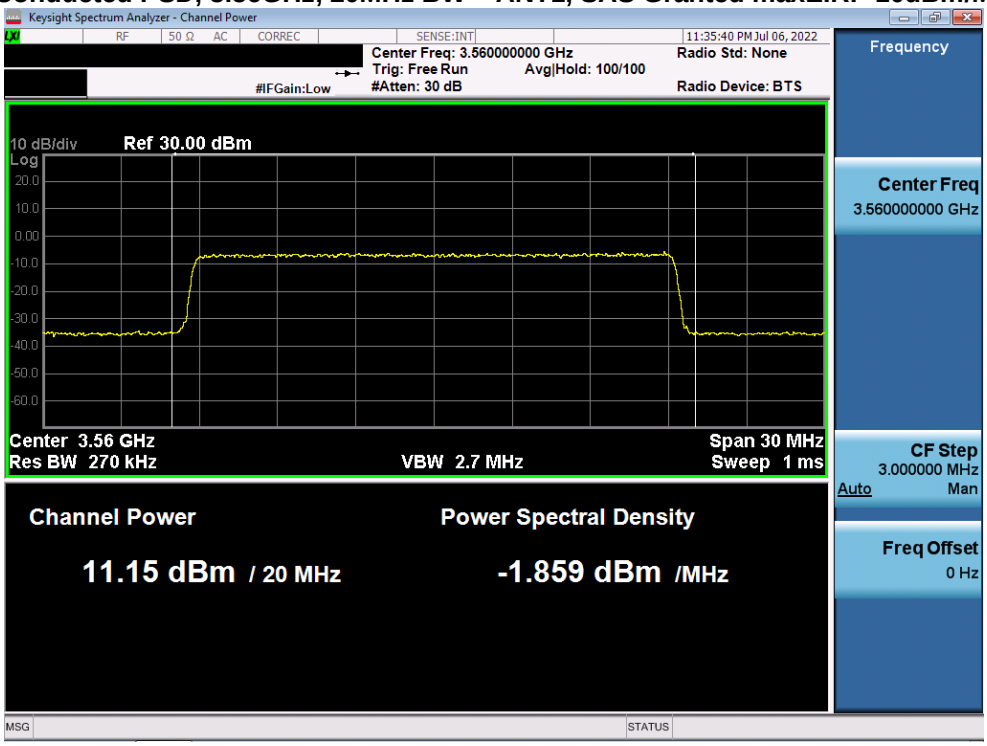



**Plot 69. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 10dBm/MHz (NR)**




**Plot 70. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 10dBm/MHz (NR)**

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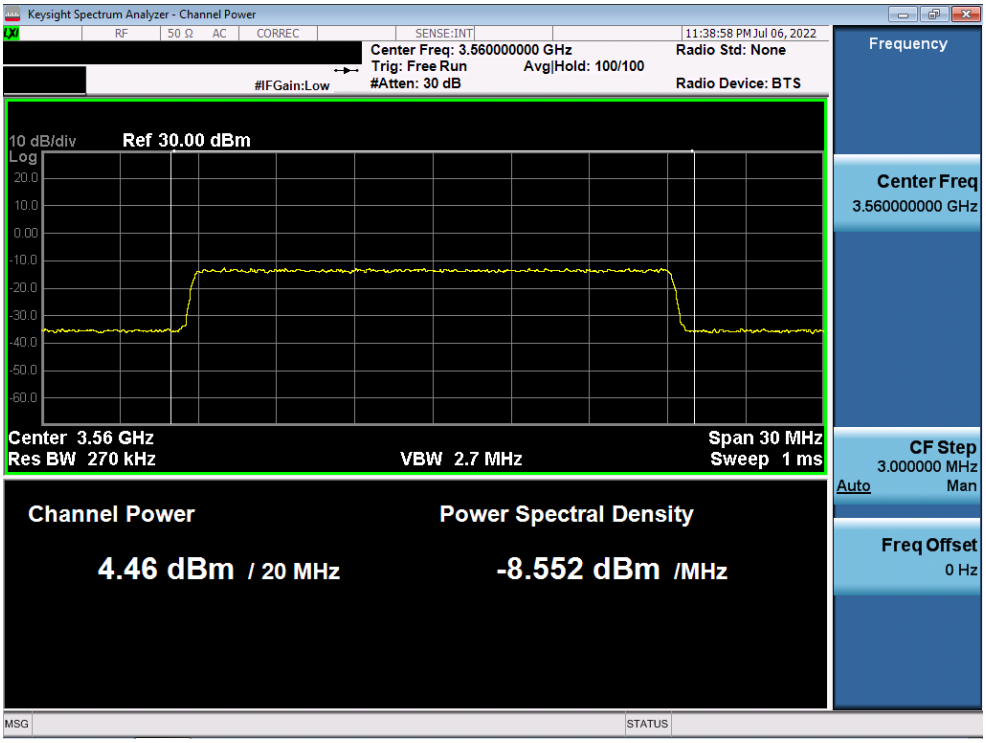
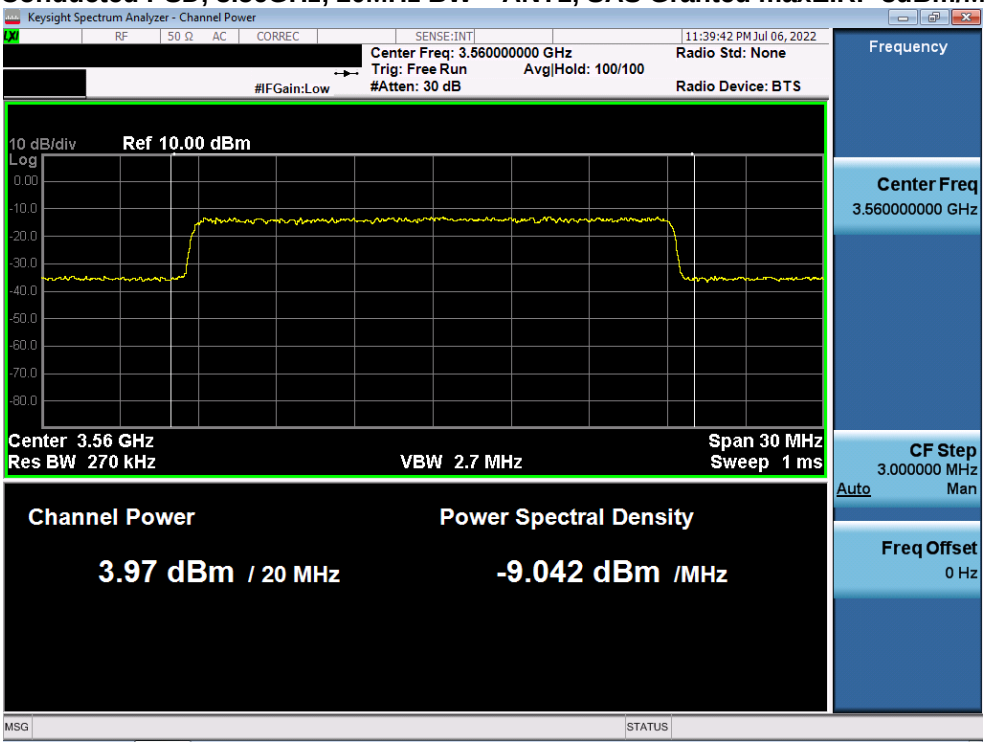



**Plot 71. Conducted PSD, 3.56GHz, 20MHz BW – ANT1, SAS Granted maxEIRP 3dBm/MHz (NR)**




**Plot 72. Conducted PSD, 3.56GHz, 20MHz BW – ANT2, SAS Granted maxEIRP 3dBm/MHz (NR)**

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# APPENDIX B – TEST LOGS

Logs are available upon request

PowerMeasTest_2022-07-07T02.05.06Z
PowerMeasTest_2022-07-07T02.33.01Z
PowerMeasTest_2022-07-07T02.44.47Z
WINNF.FT.C.DRG.1_2022-07-07T01.48.34Z
WINNF.FT.C.GRA.1_2022-07-06T00.42.50Z
WINNF.FT.C.GRA.2_2022-07-06T00.44.48Z
WINNF.FT.C.HBT.1_2022-07-07T00.58.37Z
WINNF.FT.C.HBT.3_2022-07-07T01.04.43Z
WINNF.FT.C.HBT.4_2022-07-15T04.52.38Z
WINNF.FT.C.HBT.5_2022-07-07T01.10.24Z
WINNF.FT.C.HBT.6_2022-07-07T01.13.02Z
WINNF.FT.C.HBT.7_2022-07-07T01.19.33Z
WINNF.FT.C.HBT.9_2022-07-07T01.25.09Z
WINNF.FT.C.HBT.10_2022-07-07T01.30.48Z
WINNF.FT.C.MES.1_2022-07-07T01.39.01Z
WINNF.FT.C.REG.1_2022-06-23T19.27.55Z
WINNF.FT.C.REG.8_2022-06-23T19.51.12Z
WINNF.FT.C.REG.10_2022-06-23T19.52.21Z
WINNF.FT.C.REG.12_2022-06-23T19.53.06Z
WINNF.FT.C.REG.14_2022-06-23T19.53.50Z
WINNF.FT.C.REG.16_2022-06-23T19.54.26Z
WINNF.FT.C.REG.18_2022-06-23T19.55.13Z
WINNF.FT.C.RLQ.1_2022-07-07T01.40.46Z
PowerMeasTest_2022-07-07T03.24.10Z
PowerMeasTest_2022-07-07T03.30.58Z
PowerMeasTest_2022-07-07T03.34.43Z
WINNF.FT.C.DRG.1_2022-06-23T03.04.24Z
WINNF.FT.C.GRA.1_2022-06-22T20.40.00Z
WINNF.FT.C.GRA.2_2022-06-22T20.51.23Z
WINNF.FT.C.HBT.1_2022-06-22T22.44.25Z
WINNF.FT.C.HBT.3_2022-06-22T23.34.40Z
WINNF.FT.C.HBT.4_2022-06-22T23.42.15Z
WINNF.FT.C.HBT.5_2022-06-22T23.52.23Z
WINNF.FT.C.HBT.6_2022-06-23T00.09.19Z
WINNF.FT.C.HBT.7_2022-07-22T20.05.22Z
WINNF.FT.C.HBT.9_2022-06-23T02.02.24Z
WINNF.FT.C.HBT.10_2022-06-23T02.16.35Z
WINNF.FT.C.MES.1_2022-06-23T02.48.05Z
WINNF.FT.C.REG.1_2022-06-22T20.10.54Z
WINNF.FT.C.REG.8_2022-06-22T20.26.34Z
WINNF.FT.C.REG.10_2022-06-22T20.28.29Z
WINNF.FT.C.REG.12_2022-06-22T20.29.23Z
WINNF.FT.C.REG.14_2022-06-22T20.30.21Z
WINNF.FT.C.REG.16_2022-06-22T20.34.19Z
WINNF.FT.C.REG.18_2022-06-22T20.35.54Z
WINNF.FT.C.RLQ.1_2022-06-23T02.55.28Z




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# APPENDIX C – TEST SETUP

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