

## PCTEST

7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. 410.290.6652 / Fax 410.290.6654 http://www.pctest.com

### TEST REPORT DP/CBSD-SAS Interoperability

#### **Applicant Name:**

Mercury Wireless 1100 Walnut St, Suite 2050 Kansas City, Missouri 64106 USA

#### Date of Testing:

6/23/2020 – 7/22/2020 Test Site/Location: PCTEST Lab. Columbia, MD, USA Test Report Serial No.: 3M2006240049

## FCC ID:

#### XN3-QUANTUM6636

APPLICANT:

# Mercury Wireless

Application Type: Model: EUT Type: Frequency Range: FCC Classification: FCC Rule Part(s): Test Procedure(s): Certification QUANTUM 6636 Base Station 3550 – 3700 MHz Citizens Band Category A and B Devices (CBD) Part 96 KDB 940660 D01 v01, WINNF-TS-0122-V1.0.0, 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.

Randy Ortanez President



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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 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046.

#### **1.3** Test Facility / Accreditations Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is a CBRS Alliance (OnGo) Approved Test Lab
- PCTEST is a WInnForum Approved Test Lab
- PCTEST is an ISO 17025-2005 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.
- PCTEST is an ISO 17025-2005 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.
- PCTEST 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).
- PCTEST 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 **Mercury Base Station FCC ID: XN3-QUANTUM6636.** The test data contained in this report pertains only to DP/CBSD-SAS interoperability. The EUT is a Domain Proxy.

Test Device Serial Number(s): 164899400032, T-F0103

### 2.2 Device Capabilities

This device contains the following capabilities:

IEEE 802.16e Mobile WiMAX

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.	$\boxtimes$
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.	$\boxtimes$
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

Two base stations (EUT) were connected to the Domain Proxy which 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	4/20/2019	Annual	8/20/2020	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 15°C to 35°C. 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 KDB 940660 D01 v01 and WINNF-TS-0122-V1.0.0 was 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:	Mercury Wireless
FCC ID:	XN3-QUANTUM6636

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

FCC Part	KDB940660 D01 Section	Test Case Description	WinnForum	Test
Section(s)	3.3 a)		Test Case	Result
			WINNF.FT.D.REG.6 WINNF.FT.D.REG.9	
96.39 (c) 1	Confirm that the device will only transmit after it receives authorization from a SAS	WINNF.FT.D.REG.11 WINNF.FT.D.REG.13 WINNF.FT.D.REG.15	Pass	
			WINNF.FT.D.REG.17 WINNF.FT.D.REG.19 WINNF.FT.C.GRA.1	
			WINNF.FT.C.GRA.2 WINNF.FT.D.REG.6	
96.39 (c)	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	WINNF.FT.D.REG.9 WINNF.FT.D.REG.11 WINNF.FT.D.REG.13	Pass
		transmitting without authorization from the SAS.	WINNF.FT.D.REG.15 WINNF.FT.D.REG.17 WINNF.FT.D.REG.19	
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.D.HBT.2	Pass
96.39	4	Confirm that the device correctly configures based on the different license classes	N/A	N/A
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.D.HBT.2	Pass
96.39(c)(2)	7	Confirm that the device transmits on the SAS specified frequency.	WINNF.FT.D.HBT.2	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 WINNF.FT.C.HBT.5 WINNF.FT.C.HBT.6 WINNF.FT.C.HBT.7 WINNF.FT.D.HBT.8 WINNF.FT.C.HBT.9 WINNF.FT.C.HBT.10 WINNF.FT.D.RLQ.2 WINNF.FT.C.DRG.1 WINNF.FT.D.RG.2	Pass

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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.3 WINNF.FT.D.MES.5	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.3 WINNF.FT.D.MES.5	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	N/A
96 E	13	When CBSDs communicate through a management system, confirm compliance with all requirements.	N/A	N/A
96.39	14	When communication between the CBSD and SAS is lost: 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. ii) Describe the process for re-establishment of the communications and confirm that the CBSD acts accordingly. iii) Confirm power-on restart process for registration (re- registration) occurs as expected. iv) Confirm the process for de-registration occurs as expected.	WINNF.FT.C.HBT.9 WINNF.FT.C.HBT.10	Pass
96.39(f)	KDB940660 D01 Section 4	SAS and Device Security Requirements	WINNF.FT.C.SCS.1 WINNF.FT.C.SCS.2 WINNF.FT.C.SCS.3 WINNF.FT.C.SCS.4 WINNF.FT.C.SCS.5	Pass

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

#### 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 Appendix for test data.

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## 7.0 RF POWER MEASUREMENTS

Testing is performed per KDB 971168 D01 and across the transmit dynamic range of 37dBm/MHz to 16dBm/MHz for 10MHz Bandwidth.

The UUT was configured such that all ports were transmitting at the same output power level. The 6 ports of the UUT are the same design and pretesting showed that the power levels between the sampling of the various ports is the same. As all 6 ports are identical in design and equivalent power levels, the PSD was sampled on 1 port. The EIRP was calculated by adding the conducted power, antenna gain, and duty cycle correction factor. Please see appendix for plot data.

Freq [MHz]	SAS Granted maxEIRP [dBm/MHz]	Conducted PSD on Antenna Port 1 [dBm/MHz]	Ant Gain [dBi]	DCCF [dB]	maxEIRP [dBm/MHz]	Margin [dB]
3625	37	18.52	17	1.427	36.947	-0.053
3625	26	7.47	17	1.427	25.897	-0.103
3625	16	-2.533	17	1.427	15.894	-0.106

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

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## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Mercury Base Station FCC ID: XN3-QUANTUM6636** has been tested to show compliance with Part 96 and KDB 940660 D01 v01.

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# APPENDIX A - TEST RESULT AND DATA

# A1 [WINNF.FT.D.REG.6] Domain Proxy Single-Step registration for CBSD with CPI signed data

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	<ul> <li>DP with two CBSD sends correct Registration request information, as specified in [n.5], in the form of one 2-element Array or as individual messages to the SAS Test Harness:</li> <li>The required userId, fccId and cbsdSerialNumber registration parameters shall be sent for each CBSD and conform to proper format and acceptable ranges.</li> <li>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.</li> <li>Note: It is outside the scope of this document to test the Registration information that is supplied via another means.</li> </ul>	X	
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or individual messages as follows:</li> <li>- cbsdld = Ci</li> <li>- measReportConfig shall not be included</li> <li>- responseCode = 0 for each CBSD</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

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RF         50 Ω         AC           Center Freq 3.625000000		#Avg Typ Run Avg Hold:	e: RMS TRAC	1 Jun 22, 2020 E 1 2 3 4 5 6 E M WWWWW	Frequency
10 dB/div Ref 30.00 dBm	IFGain:Low Atten: 30			T P NNNNN	Auto Tune
20.0					Center Freq 3.625000000 GHz
0.00					<b>Start Freq</b> 3.550000000 GHz
-10.0	randonamorikan.com/haris/black/	<sup>เ</sup> กางกับเสริ] <sub>ท</sub> ายหุ <sub>้</sub> นเสราะ <sub>ห</sub> ล่ะไม่สระบ	hermoniaminalismum	พ.ศ.แ	<b>Stop Freq</b> 3.700000000 GHz
-30.0					<b>CF Step</b> 15.000000 MHz <u>Auto</u> Man
-40.0					<b>Freq Offse</b> 0 Hz
-60.0					Scale Type
Center 3.62500 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz		Span 1 Sweep 1.000 ms (	50.0 IVII 12	
MSG			STATUS		

Plot 1. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.6)

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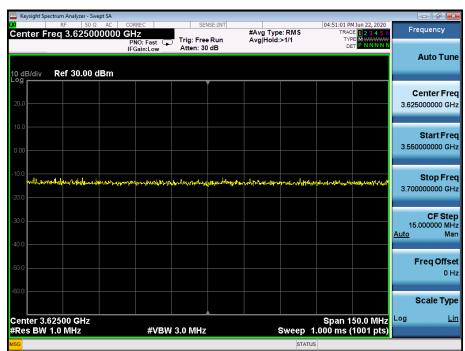
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# A2 [WINNF.FT.D.REG.9] Domain Proxy Missing Required parameters (responseCode 102)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 2. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.9)

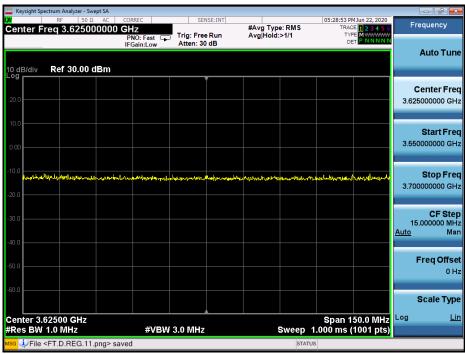
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## A3 [WINNF.FT.D.REG.11] Domain Proxy Pending registration (responseCode 200)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	X	

### **Test Plots:**



Plot 3. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.11)

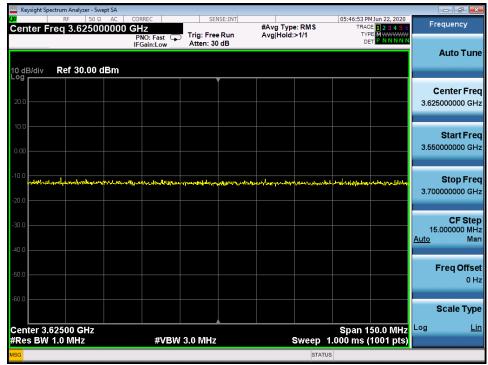
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## A4 [WINNF.FT.D.REG.13] Domain Proxy Invalid parameters (responseCode 103)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	X	

### **Test Plots:**



Plot 4. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.13)

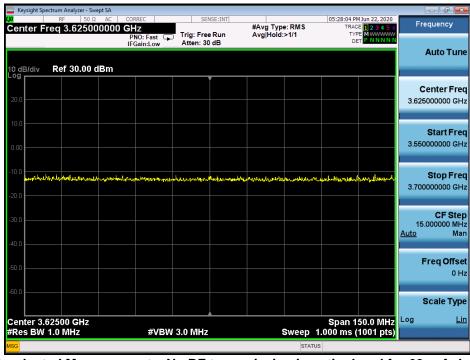
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## A5 [WINNF.FT.D.REG.15] Domain Proxy Blacklisted CBSD (responseCode 101)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>	-	
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 5. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.15)

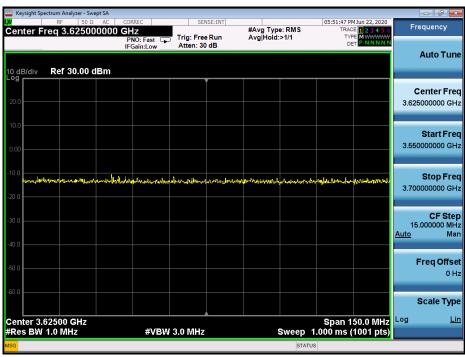
FCC ID: XN3-QUANTUM6636	Pout to be part of the element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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### A6 [WINNF.FT.D.REG.17] Domain Proxy Unsupported SAS protocol version (responseCode 100)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 6. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.17)

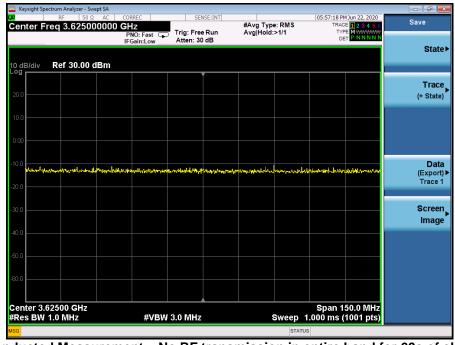
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## A7 [WINNF.FT.D.REG.19] Domain Proxy Group Error (responseCode 201)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT is in the Unregistered state</li> </ul>		
2	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.		
3	<ul> <li>SAS Test Harness sends a CBSD Registration Response in the form of one 2-element</li> <li>Array or as individual messages as follows:</li> <li>SAS response does not include a cbsdld.</li> <li>responseCode = Ri for CBSD1 and CBSD2</li> </ul>		
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 7. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.D.REG.19)

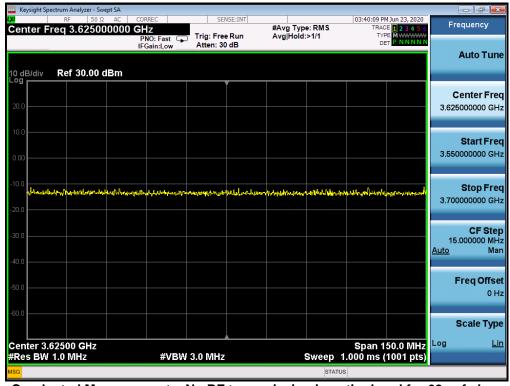
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## A8 [WINNF.FT.C.GRA.1] Unsuccessful Grant responseCode=400 (INTERFERENCE)

	Test Execution Steps	PASS	FAIL
1	Ensure the following conditions are met for test entry: • UUT has registered successfully with SAS Test Harness, with cbsdId = C		
2	UUT sends valid Grant Request.		
3	<ul> <li>SAS Test Harness sends a Grant Response message, including</li> <li>cbsdld=C</li> <li>responseCode = R</li> </ul>		
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.		
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 8. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.1)

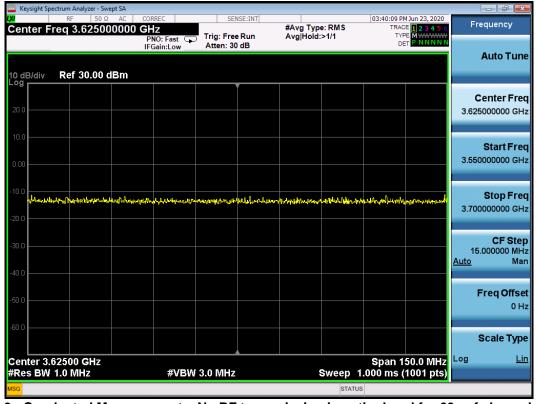
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# A9 [WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT\_CONFLICT)

	Test Execution Steps	PASS	FAIL
1	<ul><li>Ensure the following conditions are met for test entry:</li><li>UUT has registered successfully with SAS Test Harness, with cbsdld = C</li></ul>		
2	UUT sends valid Grant Request.		
3	<ul> <li>SAS Test Harness sends a Grant Response message, including</li> <li>cbsdld=C</li> <li>responseCode = R</li> </ul>		
4	After completion of step 3, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.		
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	$\boxtimes$	

### **Test Plots:**



Plot 9. Conducted Measurement – No RF transmission in entire band for 60s of elapsed time (WINNF.FT.C.GRA.2)

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# A10 [WINNF.FT.D.HBT.2] Domain Proxy Heartbeat Success Case (first Heartbeat Response)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>DP has two CBSD registered successfully with SAS Test Harness, with cbsdId = Ci, i={1,2}</li> </ul>		
2	DP sends a message: • If message is a Spectrum Inquiry Request, go to step 3 • If message is a Grant Request, go to step 5		
3	<ul> <li>DP sends a Spectrum Inquiry Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</li> <li>Verify Spectrum Inquiry Request message is formatted correctly for each CBSD, including for CBSDi, i={1,2}:</li> <li>cbsdld = Ci</li> <li>List of frequencyRange objects sent by DP are within the CBRS frequency range</li> </ul>	X	
4	If a separate Spectrum Inquiry Request message was sent for each CBSD, the SAS Test Harness shall respond to each Spectrum Inquiry Request message with a separate Spectrum Inquiry Response message. If a single Spectrum Inquiry Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Spectrum Inquiry Response message containing a 2-object array. Verify parameters for each CBSD within the Spectrum Inquiry Response message are as follows, for CBSDi, i={1,2}: • cbsdld = Ci • availableChannel is an array of availableChannel objects • responseCode = 0		
5	DP sends a Grant Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Grant Request message is formatted correctly for each CBSD, including for CBSDi, i={1,2}: • cbsdld = C • maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 • operationFrequencyRange, Fi, sent by UUT is a valid range within the CBRS band		

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6	If a separate Grant Request message was sent for each CBSD, the SAS Test Harness shall respond to each Grant Request message with a separate Grant Response message. If a single Grant Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Grant Response message containing a 2-object array. Verify parameters for each CBSD within the Grant Response message are as follows, for CBSDi, i={1,2}: • cbsdld = Ci • grantId = Gi = a valid grant ID • grantExpireTime = UTC time greater than duration of the test • responseCode = 0		
7	<ul> <li>Ensure DP sends first Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</li> <li>Verify Heartbeat Request message is formatted correctly for each CBSD, including, for CBSDi i={1,2}:</li> <li>cbsdld = Ci, i={1,2}</li> <li>grantId = Gi, i={1,2}</li> <li>operationState = "GRANTED"</li> </ul>	X	
8	If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Verify parameters for each CBSD within the Heartbeat Response message are as follows, for CBSDi: • cbsdld = Ci • grantId = Gi • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0		
9	<ul> <li>For further Heartbeat Request messages sent from DP after completion of step 8, validate message is sent within latest specified heartbeatInterval for CBSDi:</li> <li>cbsdld = Ci, • grantId = Gi</li> <li>operationState = "AUTHORIZED"</li> <li>and SAS Test Harness responds with a Heartbeat Response message including the following parameters, for CBSDi</li> <li>cbsdld = Ci, • grantId = Gi</li> <li>transmitExpireTime = current UTC time + 200 seconds</li> <li>responseCode = 0</li> </ul>	X	

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

Keysight Spectrum Analyzer - Swept SA				
arker 1 3.656650000000 (		#Avg Type: RMS Run Avg Hold:>1/1	01:19:25 PM Jun 23, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW	Marker
	IFGain:Low Atten: 30			Select Marker
dB/div Ref 30.00 dBm			r1 3.656 65 GHz 1.497 dBm	1
		Pur wy		Norma
0.0				Norma
0.0		1		
.00				Delt
0.0				
hand here the second and the second here	how -alter alter physical conclusions and	ntermeter and the property of the	Weilmontalemoniklenkedysissedikt	Fixed
0.0				
0.0				O
0.0				
0.0				Properties
0.0				Mor
enter 3.62500 GHz			Span 150.0 MHz 1.000 ms (1001 pts)	1 of
Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep		

Plot 10.Conducted Measurement - RF transmission after SAS heartbeat response and Occupied Bandwidth for 10MHz (WINNF.FT.D.HBT.2)

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

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has registered successfully with SAS Test Harness</li> <li>UUT has a valid single grant as follows: <ul> <li>valid cbsdld = C</li> <li>valid grantId = G</li> <li>grant is for frequency range F, power P</li> <li>grantExpireTime = UTC time greater than duration of the test</li> </ul> </li> <li>UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface</li> </ul>		
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within Heartbeat Interval specified in the latest Heartbeat Response, and formatted correctly, including: • cbsdld = C • grantId = G • operationState = "AUTHORIZED"	X	
3	<ul> <li>SAS Test Harness sends a Heartbeat Response message, including the following parameters:</li> <li>cbsdld = C</li> <li>grantld = G</li> <li>transmitExpireTime = T = Current UTC time</li> <li>responseCode = 105 (DEREGISTER)</li> </ul>		
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.		
5	Monitor the RF output of the UUT. Verify: • UUT shall stop transmission within (T + 60 seconds) of completion of step 3	X	

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Keysight Spectrum Analyzer - Swept SA					
RF         50 Ω         AC           Center Freq 3.660000000         Center Freq 3.660000000         Center Freq 3.6600000000	CORREC GHZ PNO: Fast	SENSE:INT	#Avg Type: RM Avg Hold: 1/1	12:49:07 PM Jun 30, 2020 S TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Frequency
Ref Offset 13.5 dB 10 dB/div Ref 43.50 dBm Logy	IFGain:Low	Atten: 30 dB		ΔMkr3 60.00 s -38.569 dB	Auto Tune
					Center Freq 3.66000000 GHz
3.50 -6.50 -16.5 <b>2∆1</b> -16.5	<b>3</b> ∆1			nijeter et - servezet, strake stranovjest, strake	<b>Start Freq</b> 3.660000000 GHz
-26.5					<b>Stop Freq</b> 3.66000000 GHz
Center 3.660000000 GHz Res BW 1.0 MHz	#VBW	3.0 MHz		Span 0 Hz eep 250.0 s (1001 pts)	<b>CF Step</b> 1.000000 MHz <u>Auto</u> Man
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	11.75 s 1.000 s (Δ) 60.00 s (Δ)	20.008 dBm -39.144 dB -38.569 dB			Freq Offset 0 Hz
7 8 9 10					Scale Type
11 <		III		* 4	
MSG				STATUS	

Plot 11.Conducted Measurement - RF transmission stops within 60s of SAS message indicated by Marker 1 (X) (WINNF.FT.C.HBT.3)

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### A12 [WINNF.FT.C.HBT.5] Heartbeat responseCode=501 (SUSPENDED\_GRANT) in First Heartbeat Response

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

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Keysight Spectrum Analyzer - Swept SA				
x RF 50 Ω AC Center Freq 3.625000000	CORREC SENSE:1	#Avg Type: RMS	12:52:35 PM Jun 30, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
Ref Offset 13.5 dB 10 dB/div Ref 43.50 dBm	PNO: Fast Free Ru IFGain:Low Atten: 30 dB		DET P NNNNN	Auto Tune
33.5				Center Freq 3.625000000 GHz
13.5				Start Freq 3.550000000 GHz
-6.50				<b>Stop Freq</b> 3.700000000 GHz
-16.5	ne ve how why replace and a set the stranger	-14hours-4hourseurshitestation	ulfrensioninglementer	CF Step 15.000000 MH: <u>Auto</u> Mar
-36.5				Freq Offse 0 Hz
-46.5				Scale Type
Center 3.62500 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep	Span 150.0 MHz 1.000 ms (1001 pts)	Log <u>Lin</u>
MSG		STAT	US	

Plot 12.Conducted Measurement – No RF transmission in entire band (WINNF.FT.C.HBT.5)

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# A13 [WINNF.FT.C.HBT.6] Heartbeat responseCode=501 (SUSPENDED\_GRANT) in Subsequent Heartbeat Response

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

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Center Freq 3.660050000 GH P IFG 10 dB/div Ref 0ffset 13.5 dB 10 dB/div Ref 43.50 dBm	RREC Z NO: Fast ↔→ Gain:Low	SENSE:I Trig: Free Ru Atten: 30 dB	#Avg	Type: RMS old: 1/1	TRAC			quency
Ref Offset 13.5 dB 10 dB/div Ref 43.50 dBm 33.5	Gain:Low	Atten: 30 dB						
33.5					-39.	60.00 s 565 dB		Auto Tune
23.5		1 ]						<b>enter Freq</b> 050000 GHz
-6.50		201	• • • • • • • • • • • • • • • • • • •	3Δ1 	felente de ballert Ju-red	(é Lingues, population)		<b>Start Freq</b> 050000 GHz
-26.5								<b>Stop Freq</b> 050000 GHz
Center 3.660050000 GHz Res BW 1.0 MHz	#VBW 3	.0 MHz	FUNCTION	Sweep	250.0 s (	pan 0 Hz 1001 pts)	1.0 <u>Auto</u>	<b>CF Step</b> 000000 MHz Man
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	02.5 s 1.000 s (Δ) i0.00 s (Δ)	20.444 dBm -39.223 dB -39.565 dB				=	F	r <b>eq Offset</b> 0 Hz
7							S	cale Type
11MSG		III		STATUS				

Plot 13.Conducted Measurement - RF transmission stops within 60s of SAS message. The SAS message is indicated by Marker 1 (WINNF.FT.C.HBT.6)

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# A15 [WINNF.FT.C.HBT.7] Heartbeat responseCode=502 (UNSYNC\_OP\_PARAM)

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

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Plot 14.Conducted Measurement - RF transmission stops within 60s of SAS message. The SAS message is indicated by Marker 1 (WINNF.FT.C.HBT.7)

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# A16 [WINNF.FT.D.HBT.8] Domain Proxy Heartbeat responseCode=500 (TERMINATED\_GRANT)

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>DP has two CBSD registered successfully with SAS Test Harness</li> <li>Each CBSD {1,2} has a valid single grant as follows: <ul> <li>valid cbsdld = Ci, i={1,2}</li> <li>valid grantId = Gi, i={1,2}</li> <li>o grant is for frequency range Fi, power Pi</li> <li>o grantExpireTime = UTC time greater than duration of the test</li> </ul> </li> <li>Both CBSD are in AUTHORIZED state and transmitting within their granted bandwidth on RF interface</li> </ul>		
2	DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of size 2. Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly for each CBSD, including, for CBSDi i={1,2}: • cbsdld = Ci, i = {1,2} • grantId = Gi, i = {1,2} • operationState = "AUTHORIZED"	×	
3	If separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Parameters for each CBSD within the Heartbeat Response message should be as follows, for CBSDi: • cbsdld = Ci • grantId = Gi • For CBSD1: • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0 • For CBSD2: • transmitExpireTime = T = current UTC time		

	FCC ID: XN3-QUANTUM6636	Poul to be part of the element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager	
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4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. If CBSD sends further Heartbeat Request messages for CBSD1, SAS Test Harness shall respond with a Heartbeat Response message with parameters: • cbsdld = C1 • grantId = G1 • transmitExpireTime = current UTC time + 200 seconds • responseCode = 0 • Heartbeat Request message is within heartbeatInterval of previous Heartbeat Request message		
5	<ul> <li>Monitor the RF output of CBSD2. Verify:</li> <li>CBSD2 shall stop transmission within bandwidth F2 within (T + 60 seconds) of completion of step 3</li> </ul>	X	

	ectrum Analyzer - S											ð X
<mark>xı</mark> Center Fı	<sub>R</sub> ⊧ 50 req 3.6600		CORREC GHZ PNO: Fast IFGain:Lov		Trig: Free F Atten: 30 c	Run		y Type: RMS Hold: 1/1	TRA TY	M Jun 30, 2020 CE <b>1 2 3 4 5</b> 6 PE M WWWWW ET P N N N N N	Freque	ncy
10 dB/div	Ref Offset 1 Ref 43.50									60.00 s .839 dB	Auto	o Tun
33.5 23.5 13.5					<u>22</u> 41			<b>3</b> ∆1	- Inc		Cente 3.6600500	
3.50 -6.50 -16.5											<b>Sta</b> 3.6600500	rt Fre 100 GH
-26.5 -36.5 -46.5											<b>Sto</b> 3.6600500	<b>p Fre</b> 100 G⊦
Center 3.0 Res BW 1		GHz	#V	/BW	3.0 MHz	FIII	NCTION	Sweep	250.0 s (	Span 0 Hz (1001 pts)	<b>C</b> 1.0000 <u>Auto</u>	F Ste 00 M⊦ Ma
1 N 1 2 A1 1 3 A1 1 4 5 6	t t (Δ)		115.5 s 1.000 s 60.00 s	<u>(Δ)</u>	23.737 dBr -3.819 d -3.839 d	n B				=	Freq	Offso 0 ⊦
7 8 9 10											Scal	е Тур <u>Li</u>
11					III			1		•		
SG								STATU	5			

# Plot 15.Conducted Measurement - RF transmission stops within 60s of SAS message. The SAS message is indicated by Marker 1 (WINNF.FT.D.HBT.8)

**Note:** Plot above shows CBSD2 stopping transmission, while CBSD1 continues to transmit.

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# A17 [WINNF.FT.C.HBT.9] Heartbeat Response Absent (First Heartbeat)

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

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- Key	sight Spectro	um Analyzer - S	•									
Cent	ter Fre	RF 50 9 q 3.6265		CORREC GHz PNO: Fast	Trig: Fre		#Avg Typ Avg Hold	e: RMS :>1/1	TRAC	MJul 02, 2020 E 1 2 3 4 5 6 E M WWWW	Fre	equency
10 dE	3/div	Ref 30.00	dBm	IFGain:Low	Atten: 30	0 dB			Di			Auto Tune
Log 20.0 -												enter Freq 500000 GHz
10.0 · 0.00 ·											3.551	Start Freq 500000 GHz
-10.0 - -20.0 -	La rathaly Martin	K <b>B</b> ∥JNAnatakijatna		ntradit of the state of the sta	riverty/nLaurenyverso	-Latharryphilerad	mhathradimina	mulernylereve	rectorestability	hyph.c.f.jph/4.sey.tab	3.701	Stop Freq 500000 GHz
-30.0 ×											15 <u>Auto</u>	<b>CF Step</b> .000000 MHz Man
-50.0 -											F	F <b>req Offset</b> 0 Hz
-60.0												Scale Type
	ter 3.62 s BW 1.	650 GHz 0 MHz		#VE	3W 3.0 MHz			Sweep	Span 1 1.000 ms (	50.0 MHz 1001 pts)	Log	Lin
MSG								STATU	JS			

Plot 16.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.HBT.9)

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# A18 [WINNF.FT.C.HBT.10] Heartbeat Response Absent (Subsequent Heartbeat)

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

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Keysight Spe	ectrum Analyzer - Swept SA								
Center F	RF 50 Ω AC req 3.6600000		SENSE	#Av	g Type: RMS	TRAC	1 Jun 30, 2020 E <b>1 2 3 4 5</b> 6	Fr	equency
		PNO: Fast ++ IFGain:Low	Trig: Free R Atten: 30 d		Hold: 1/1	TYP DE			
10 dB/div	Ref Offset 13.5 dl Ref 43.50 dBn					Mkr2 20.4	85.00 s 52 dBm		Auto Tune
23.5 13.5	1 	2							Center Freq 0000000 GHz
3.50 -6.50 -16.5		3Δ1			Republic of the production of the	on yte At south at a state		3.66	Start Freq 0000000 GHz
-26.5 -36.5 -46.5								3.66	<b>Stop Freq</b> 0000000 GHz
Center 3. Res BW 1			N 3.0 MHz	FUNCTION	Sweep	250.0 s (′	pan 0 Hz 1001 pts)	1 <u>Auto</u>	CF Step .000000 MHz Man
1 N 1 2 N 1 3 Δ1 1 4 5 6	t t	25.50 s 85.00 s 60.00 s (Δ)	20.496 dBm 20.452 dBm	n n			=		F <b>req Offset</b> 0 Hz
7 8 9 10									Scale Type
11								Log	<u>Lin</u>
MSG					STATU	5			

Plot 17.Conducted Measurement - RF transmission stops within transmitExpireTime + 60s. The last SAS heartbeat message is indicated by Marker 1 (WINNF.FT.C.HBT.10)

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### A19 [WINNF.FT.C.MES.3] Grant Response contains measReportConfig

A19	[WINNF.FI.C.MES.3] Grant Response contains measReportConfig Test Execution Steps	PASS	FAIL
	Ensure the following conditions are met for test entry:		
1	<ul> <li>UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>UUT has successfully registered with SAS Test Harness, with cbsdld=C and measCapability = "RECEIVED_POWER_WITH_GRANT"</li> </ul>		
	UUT sends a Grant Request message.		
2	<ul> <li>Verify Grant Request message contains all required parameters properly formatted, and specifically:</li> <li>cbsdld = C</li> <li>operationParam is present and format is valid</li> </ul>		
3	<ul> <li>SAS Test Harness sends a Grant Response message, with the following parameters:</li> <li>cbsdld = C</li> <li>grantId = G = valid grant ID</li> <li>grantExpireTime = UTC time in the future</li> <li>heartbeatInterval = 60 seconds</li> <li>measReportConfig= "RECEIVED_POWER_WITH_GRANT"</li> <li>operationParam is set to valid operating parameters</li> <li>channelType = "GAA"</li> <li>responseCode = 0</li> </ul>		
4	UUT sends a Heartbeat Request message. Verify message contains all required parameters properly formatted, and specifically: • cbsdId = C • grantId = G • operationState = "GRANTED"	X	
5	If Heartbeat Request message (step 4) contains measReport object, then: • verify measReport is properly formatted as object rcvdPowerMeasReport • end test, with PASS result else, if Heartbeat Request message (step 4) does not contain measReport object, then: If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then stop test with result of FAIL	×	
6	<ul> <li>SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically:</li> <li>cbsdld = C, • grantId = G</li> <li>transmitExpireTime = current UTC time + 200 seconds</li> <li>responseCode = 0</li> <li>Go to Step 4, above</li> </ul>		

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# A20 [WINNF.FT.D.MES.5] Domain Proxy Heartbeat Response contains measReportConfig

	Test Execution Steps	PASS	FAIL
	Ensure the following conditions are met for test entry:		
	<ul> <li>DP has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> </ul>		
1	<ul> <li>DP has successfully registered 2 CBSD with SAS Test Harness, each with cbsdId=Ci, i={1,2} and measCapability = "RECEIVED_POWER_WITH_GRANT"</li> </ul>		
	<ul> <li>DP has received a valid grant with grantId = Gi, i={1,2} for each CBSD</li> </ul>		
	<ul> <li>Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</li> </ul>		
	<ul> <li>Grants have heartbeatInterval =60 seconds</li> </ul>		
	Verify DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.		
2	Verify Heartbeat Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:	$\boxtimes$	
	• cbsdld = Ci		
	• grantId = Gi		
	• operationState = "AUTHORIZED"		
	If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message.		
	If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array.		
3	Parameters for each CBSD within the Heartbeat Response message containing all required parameters properly formatted, and specifically:		
	• cbsdld = Ci		
	• grantId = Gi		
	<ul> <li>measReportConfig= "RECEIVED_POWER_WITH_GRANT"</li> <li>responseCode = 0</li> </ul>		
	Verify DP sends a Heartbeat Request message for each CBSD. This may occur in a		
	separate message per CBSD, or together in a single message with array of 2.		
	Verify Heartbeat Request message contains all required parameters properly		
4	formatted for each CBSD, and specifically, for CBSDi, $i = \{1,2\}$ :	$\boxtimes$	
	• cbsdld = Ci		
	• grantId = Gi		
	• operationState = "AUTHORIZED"		

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	• Check whether measReport is present, and if present, ensure it is a properly formatted rcvdPowerMeasReport object, and record its reception for each CBSDi, i = {1,2}.	
5	<ul> <li>If Heartbeat Request message (step 4) contains measReport object, then:</li> <li>Verify measReport is properly formatted as object rcvdPowerMeasReport</li> <li>record which CBSD have successfully sent a measReport object</li> <li>If all CBSDi, i = {1,2} have successfully sent a measReport object, then</li> <li>end test, with PASS result</li> <li>else, if the number of Heartbeat Requests sent per CBSD is 5 or more, then stop test with result of FAIL</li> </ul>	
6	If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Parameters for each CBSD within the Heartbeat Response message containing all required parameters properly formatted, and specifically: • cbsdld = Ci • grantId = Gi • responseCode = 0 Go to Step 4, above.	 

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# A21 [WINNF.FT.D.RLQ.2] Domain Proxy Successful Relinquishment

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>DP has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>DP has successfully registered 2 CBSD with SAS Test Harness, each with cbsdld=Ci, i={1,2}</li> <li>DP has received a valid grant with grantId = Gi, i={1,2} for each CBSD</li> <li>Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</li> <li>Invoke trigger to relinquish each UUT Grant from the SAS Test Harness</li> </ul>		
2	<ul> <li>Verify DP sends a Relinquishment Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2.</li> <li>Verify Relinquishment Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi:</li> <li>cbsdld = Ci</li> <li>grantld = Gi</li> </ul>		
3	If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message. If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array. Parameters for each CBSD within the Relinquishment Response shall be as follows: • cbsdld = Ci • grantId = Gi • 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	<ul> <li>Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify:</li> <li>UUT shall stop RF transmission at any time between triggering the relinquishments and UUT sending the relinquishment requests for each CBSD.</li> </ul>	X	

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Keysight Spectrum Analyzer - Swept SA						
ເ₩ RF 50 Ω AC Center Freq 3.660000000	CORREC GHz	SENSE:IN	#Avg	Type: RMS lold: 1/1	05:32:18 PM Jun 23, 2020 TRACE 1 2 3 4 5	6 Frequency
	PNO: Fast +++ IFGain:Low	#Atten: 30 dB		1010: 1/1	TYPE A WWW DET A NNNN	
Ref Offset 13.5 dB 10 dB/div Ref 33.50 dBm					Mkr1 4.750 s 27.119 dBn	Auto Tune
23.5 X1						Center Freq 3.66000000 GHz
-6.50 22 <u>1</u> -16.5 -26.5	<u>}3∆1</u>					<b>Start Freq</b> 3.660000000 GHz
-36.5 -46.5 -56.5						<b>Stop Freq</b> 3.660000000 GHz
Center 3.660000000 GHz Res BW 1.0 MHz	#VBW	3.0 MHz*			Span 0 Hz 250.0 s (1001 pts	CF Step 1.000000 MHz Auto Man
MKR         MODE         TRC         SCL         X           1         F         1         t         4         4         4         4         4         5         5         6         6         4 <td< td=""><td>4.750 s 14.75 s (Δ) 60.00 s (Δ)</td><td>Y 27.119 dBm -37.239 dB -37.232 dB</td><td>FUNCTION</td><td>FUNCTION WIDTH</td><td>FUNCTION VALUE</td><td>Freq Offset 0 Hz</td></td<>	4.750 s 14.75 s (Δ) 60.00 s (Δ)	Y 27.119 dBm -37.239 dB -37.232 dB	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Freq Offset 0 Hz
7 8 9 10 11						Scale Type
J≮ L		III		STATU	5	

Plot 18.Conducted Measurement - RF transmission stops (WINNF.FT.D.RLQ.2)

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# A22 [WINNF.FT.C.DRG.1] Successful Deregistration

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

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Keysight Spe	ectrum Analyzer - Swept										
💢 Center Fi	RF 50 Ω req 3.660000	0000 GI	RREC Z	<b>.</b>	SE:INT		Type: RMS	TRAC	M Jun 23, 2020 E 1 2 3 4 5 6 E A WWWW	F	requency
			NO: Fast ↔ Gain:Low	Trig: Free #Atten: 30		AvgiH	lold: 1/1				
10 dB/div	Ref Offset 13.5 Ref 33.50 di							Mkr1 25.0	49.75 s 16 dBm		Auto Tune
23.5		1									Center Freq
13.5 3.50										3.66	6000000 GHz
-6.50		2∆1		<mark>3∆1</mark>							Start Fred
-16.5										3.66	50000000 GHz
-26.5											
-46.5										3.66	Stop Freq 50000000 GHz
-56.5											
Center 3.0 Res BW 1	660000000 GH I.0 MHz	łz	#VB۱	₩ 3.0 MHz*			Sweep	S 250.0 s (	pan 0 Hz 1001 pts)		CF Step 1.000000 MHz
MKR MODE TF	RC  SCL	Х	49.75 s	۲ 25.016 dB			FUNCTION WIDTH	FUNCTIO	ON VALUE	<u>Auto</u>	Mar
2 <u>A</u> 1 1	t (Δ) t (Δ)		3.000 s (Δ) 60.00 s (Δ)	-35.144 (	IB						Freq Offset
4 5									=		0 Hz
6 7 8											Scale Type
9 10										Log	Lir
11				III						LUg	<u></u>
MSG							STATUS				

Plot 19.Conducted Measurement - RF transmission stops within 60s. The SAS message is indicated by Marker 1 (WINNF.FT.C.DRG.1)

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# A23 [WINNF.FT.D.DRG.2] Domain Proxy Successful Deregistration

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>Each UUT has successfully registered with SAS Test Harness</li> <li>Each UUT is in the authorized state</li> <li>DP has successfully completed SAS Discovery and Authentication with SAS Test Harness</li> <li>DP has successfully registered 2 CBSD with SAS Test Harness, each with cbsdld=Ci, i={1,2}</li> <li>DP has received a valid grant with grantId = Gi, i={1,2} for each CBSD</li> <li>Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants.</li> <li>Invoke trigger to deregister each UUT from the SAS Test Harness</li> </ul>		
2	UUT sends a Relinquishment request and receives Relinquishment response with responseCode=0		
3	Verify DP sends a Deregistration Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Deregistration Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi: • cbsdld = Ci	X	
4	If a separate Deregistration Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message. If a single Deregistration Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array. Parameters for each CBSD within the Deregistration Response shall be as follows: • cbsdld = Ci • responseCode = 0		
5	After completion of step 4, SAS Test Harness will not provide any positive response (responseCode=0) to further request messages from the UUT.		
6	<ul> <li>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:</li> <li>UUT stopped RF transmission at any time between triggering the deregistration and either A OR B occurs: <ul> <li>A. UUT sending a Registration Request message, as this is not mandatory</li> <li>B. UUT sending a Deregistration Request message</li> </ul> </li> </ul>		

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Keysight Spec	trum Analyzer - Swept										
Contor Fr	RF 50 Ω eq 3.660000		ORREC	SI	ENSE:INT	#Ava	Type: RMS		M Jun 23, 2020 CE 1 2 3 4 5 6	Fre	quency
	eq 3.860000		PNO: Fast + FGain:Low	Trig: Fre #Atten:			fold:/1	TY			
10 dB/div	Ref Offset 13.5 Ref 33.50 dB							ΔMkr3 -37	60.00 s .510 dB		Auto Tune
23.5 13.5 3.50	- X1	<b>⊘2∆1</b>									<b>enter Freq</b> 000000 GHz
-6.50 -16.5 -26.5				3Δ1							<b>Start Freq</b> 000000 GHz
-36.5 -46.5 -56.5										3.660	<b>Stop Freq</b> 000000 GHz
Center 3.6 Res BW 1.	60000000 GH 0 MHz	z	#VB	W 3.0 MH:	Z*		Sweep	250.0 s (		1. Auto	CF Step 000000 MHz Man
MKR MODE TRO 1 F 1 2 A1 1 3 A1 1 4 5 6 6	t (Δ) t (Δ) t (Δ)		31.75 s 26.50 s (A 60.00 s (A	Y 27.391 c () -3.068 () -37.510	Bm dB	NCTION	FUNCTION WIDTH	H FUNCTI	ON VALUE		req Offset 0 Hz
7 8 9 10 11										s Log	Scale Type Lin
. ↓				III			STATU	JS	4		

Plot 20.Conducted Measurement - RF transmission stops within 60s. The SAS message is indicated by Marker 1 (X) (WINNF.FT.D.DRG.2)

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## A24 [WINNF.FT.C.SCS.1] Successful TLS connection between UUT and SAS Test Harness

	Test Execution Steps	PASS	FAIL
1	<ul> <li>UUT shall start CBSD-SAS communication with the security procedure</li> <li>The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate.</li> <li>Configure the SAS Test Harness to accept the security procedure and establish the connection</li> </ul>	$\boxtimes$	
2	<ul> <li>Make sure that Mutual authentication happens between UUT and the SAS Test Harness.</li> <li>Make sure that UUT uses TLS v1.2</li> <li>Make sure that cipher suites from one of the following is selected,</li> <li>TLS_RSA_WITH_AES_128_GCM_SHA256</li> <li>TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256</li> <li>TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384</li> <li>TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384</li> <li>TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA384</li> <li>TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA384</li> <li>TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA384</li> </ul>	$\boxtimes$	
3	<ul> <li>A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability.</li> <li>UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with responseCode = 0 and cbsdld.</li> </ul>	X	
4	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	X	

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Keysight Spectrum Ana					1	
R⊧ Center Freq 3.0	625000000	PNO: Fast	SENSE:INT	#Avg Type: RM Avg Hold:>1/1	TYPE	1 01,2020 1 2 3 4 5 6 M
0 dB/div Ref 3	0.00 dBm	IFGain:Low	Atten: 30 dB		DET	Auto Tun
20.0						Center Fre 3.625000000 GH
0.00						Start Fre 3.550000000 GH
10.0 <mark>milaninininininininininininininininininin</mark>	tilwanlangeosserhelatja	onghynyndigellanykayu	and the second second	the market all a second states and	provident and provident and an alter	<del>ໜ້າງານໄປພູທີ່</del> 3.700000000 GH
0.0						CF Ste 15.000000 Mi <u>Auto</u> Mi
0.0						Freq Offs 01
enter 3.62500 (		#\/B\M	3.0 MHz	Swee	Span 150 ep 1.000 ms (10	Scale Typ
G			5.0 10112	GWC	STATUS	(or pts)

Plot 21.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.1)

	1 V 坐 💶 🔲 🔍 🔍	C 10			
==192.168.1.230 &&.ssi					🛆 🔀 📑 💌 Express
Time	Source	Destination	Protocol	Length Info	
2020-06-24 18:54:22.565911	192.168.1.251	192.168.1.230	TLSv1.2	571 Client Hello	
2020-06-24 18:54:22.591166	192.168.1.230	192.168.1.251	TLSv1.2	3494 Server Hello, Certificate, Server Key Exchange, Certificate Request, Server Hello Done	
2020-06-24 18:54:22.602596	192.168.1.251	192.168.1.230	TCP	1514 53829 → 443 [PSH, ACK] Seq=518 Ack=3441 Win=131328 Len=1460 [TCP segment of a reassembled PDU]	
2020-06-24 18:54:22.602597	192.168.1.251	192.168.1.230	TLSv1.2	1514 Certificate [TCP segment of a reassembled PDU]	
2020-06-24 18:54:22.602600	192.168.1.251	192.168.1.230	TLSv1.2	417 Client Key Exchange, Certificate Verify, Change Cipher Spec, Encrypted Handshake Message	
2020-06-24 18:54:22.607359	192.168.1.230	192.168.1.251	TLSv1.2	105 Change Cipher Spec, Encrypted Handshake Message	
2020-06-24 18:54:22.610025	192.168.1.251	192.168.1.230	TLSv1.2	254 Application Data	
2020-06-24 18:54:22.610349	192.168.1.230	192.168.1.251	TLSv1.2	108 Application Data	
2020-06-24 18:54:22.612543	192.168.1.251	192.168.1.230	TCP	1514 53829 + 443 [P5H, ACK] Seq=4001 Ack=3546 Win=131072 Len=1460 [TCP segment of a reassembled PDU]	
2020-06-24 18:54:22.612544 2020-06-24 18:54:22.720524	192.168.1.251 192.168.1.230	192.168.1.230 192.168.1.251	TLSv1.2 TLSv1.2	198 Application Data 100 Application Data	
2020-06-24 18:54:22.720524	192.168.1.230	192.168.1.251	TLSv1.2	ию Аррикатион Data 541 Application Data, Application Data, Application Data, Application Data, Application Data, Application Data,	
2020-06-24 18:54:22.762599	192.168.1.250	192.168.1.230	TLSv1.2 TLSv1.2	341 Application bata, Application bata, Application bata, Application bata, Application bata, Application bata 85 Encrypted Alert	
Content Type: Handshake (22)					
Version: TLS 1.2 (0x0303) Length: 89 Handshake Protocol: Server Hello Length: 85 Version: TLS 1.2 (0x0303) > Random: c0073dic6d6a761151bai Session ID: 8b0694f4d095a741	(2) 2e29089943ca2677a29ce7b 1de98bedb8d5a22b372920d	8dc77b215			
Version: TLS 1.2 (0x0303) Length: 89 Handshake Protocol: Server Hello Handshake Type: Server Hello Length: 85 Version: TLS 1.2 (0x0303) > Random: c0073dLc6d6a761151ba Session 10 Length: 32	<pre>(2) 2e29080943ca2677a29ce7b 1de90Bedb8d5a22b372020d wITH_AES_1228_6CM_SH4256 b (len=1) (len=4) otocol: Certificate otocol: Server Key Exch</pre>	8dc77b215 (0xc02f)			
Version: TLS 1.2 (0x808) Length: 89 Handshake Protocol: Server Hell Handshake Protocol: Server Hell Handshake Protocol: Server Hell Werston: TLS 1.2 (0x808) Bandom: (00794)Cd6474(31534) Session TLS Bookerf84(d)5474 Cohere Suite: TLS COME SAI Compression Protoch State Extension Length: 13 Market Second Server: Handshake Privil.2 Record Layer: Record Layer: Handshake Privil.2 Record Layer: Hands	<pre>(2) 2e29089943ca2677e29ce7b 1de98bedb8d5e22b3729204 ATH_AES_128_GCM_SMA256 0 (len=1) (len=4) otocol: Certificate otocol: Server Key Exch otocol: Multiple Handsh</pre>	8dc77b215 (0xc02f) ange ake Messages			

#### Plot 22.WireShark Screenshot (WINNF.FT.C.SCS.1)

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### A25 [WINNF.FT.C.SCS.2] TLS failure due to revoked certificate

	Test Execution Steps	PASS	FAIL
1	<ul> <li>UUT shall start CBSD-SAS communication with the security procedure</li> </ul>	X	
2	<ul> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> <li>Make sure UUT selects the correct cipher suite.</li> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate.</li> <li>Make sure that Mutual authentication does not happen between UUT and the SAS</li> </ul>	X	
	Test Harness		
3	UUT may retry for the security procedure which shall fail	X	
4	SAS Test-Harness shall not receive any Registration request or any application data.		
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	X	

#### **Test Plots:**

🔤 Keysight Sp	oectrum Analyzer - Swe									_	-   #
Center F	RF 50 Ω req 3.62500		z		ISE:INT	#Avg Typ		TRAC	M Jul 09, 2020 E <b>1 2 3 4 5</b> 6	Free	quency
		PI IFC	IO: Fast 🖵 Gain:Low	Trig: Free Atten: 30		Avg Hold	:>1/1	DI			
	Ref Offset 13.									<i>,</i>	uto Tune
10 dB/div	Ref 43.50 d	Bm		,							
33.5											enter Freq
33.5										3.6250	00000 GHz
23.5											Start Freq
13.5											000000 GHz
10.0											
3.50										;	Stop Freq
-6.50										3.7000	00000 GHz
0.00											05.04++
-16.5	No. March Margare Arrigan	nd alla	مد بيه او		يد ياب در						CF Step 00000 MHz
-26.5	ana shafafadhahan sharar	-Hulling of the second s	an na an a	relation of the second second	eeliva afalykia	and and a cost	and and a later of	yayaho dalam dala	WAAADAMAAAAAAA	<u>Auto</u>	Man
										E	req Offset
-36.5											0 Hz
-46.5											
										S	cale Type
	.62500 GHz						1	Span 1	30.0 WIT12	Log	Lin
#Res BW	1.0 MHz		#VBW	3.0 MHz				1.000 ms (	1001 pts)		
MSG							STATI	JS			

Plot 23.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.2)

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(rel	PCTEST
	Proud to be part of element

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ile	Edit	View	Go	Capture	Analyze	Statistic	s Telepho	ny Wireless	Tools Help										
( I		•	010	🗙 🔁	۹ 👄 ه	⇒ ≌ 👔	· 🕹 🧮	. ⊕, ⊖,	Q. II										
(ip	.addr =:	= 173.59	.230.2	30 && ssl)	Idns http													Expression	
D.		me		····,			Source		Destination		P	otocol	Length	Info					
			-09	2:16:02	.080689			.230.228	173.59.2			LSv1.2	-	Client He	110				
					.101564			.230.230	173.59.2			LSv1.2		Server Hel		ficate.	Server	Kev Exc	hang
					.111807			.230.228	173.59.2			LSv1.2		2 Certificat					
	122 2	020-07	-09 2	22:16:02	.111917		173.59	.230.230	173.59.2	30.228	т	LSv1.2	61	Alert (Lev	vel: Fatal	, Descri	iption:	Handsha	ke Fa
	127 2	020-07	-09 2	22:16:02	.146882		173.59	.230.228	173.59.2	230.230	H	ттр	209	GET /crlse	erver.crl	HTTP/1.1	1		
	130 2	020-07	-09 2	22:16:02	.643905		173.59	.230.230	173.59.2	230.228	P	KIX-CRL	1339	) Certificat	te Revocat	ion List	t		
٢																			
> Ef	thernet iternet ransmis	t II, S t Proto ssion (	orc: ocol	Fortine Version	t_7c:ef: 4, Src:	e2 (08: 173.59	5b:0e:7c:0 .230.228,	ef:e2), Dst Dst: 173.5	d (2776 bits) t: Dell_d6:ba 59.230.230 43, Seq: 1, A	e:6d (d4:81	1:d7:d6:b	⊇:6d)							
300	d4 8	1 d7 d	6 be	6d 08	5b 0e 7	c ef e2	08 00 45	00	m·[ · ····E·										

Plot 24.WireShark Screenshot 1 (WINNF.FT.C.SCS.2)

# A26 [WINNF.FT.C.SCS.3] TLS failure due to expired server certificate

	Test Execution Steps	PASS	FAIL
1	<ul> <li>UUT shall start CBSD-SAS communication with the security procedure</li> </ul>	$\boxtimes$	
	<ul> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> </ul>		
	<ul> <li>Make sure UUT selects the correct cipher suite.</li> </ul>		
2	<ul> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate.</li> </ul>	$\boxtimes$	
	• 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	$\boxtimes$	
4	SAS Test-Harness shall not receive any Registration request or any application data.		
	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is		_
5	complete. This is the end of the test. Verify:	$\mathbf{X}$	
	• UUT shall not transmit RF		

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Keysight Spectrum Analyzer - Swept SA         RF       50 Ω         AC         Center Freq 3.625000000	PNO: East Trig:	Free Run Avg	g Type: RMS Hold:>1/1	06:31:32 PM Jul 01, 2020 TRACE 1 2 3 4 5 TYPE M	*
0 dB/div Ref 30.00 dBm	IFGain:Low Atten	: 30 dB		DET	Auto Tur
og					Center Fre 3.625000000 Gi
0.00					<b>Start Fr</b> 3.550000000 G
0.0					
www.annews.and.hulugen.anne	water intraction of the sector	anadalan matakan kana kana kana kana kana kana kan	an an Arrich Baralana	allowers and international termined	
00 00 00	evaler julivarir, proto pipperte	n Aser Lingung Alamanya	المانىيەل يالارلىكى مەنىيەل يالارلىكى	ikke-ran <sub>a</sub> si w <sup>i</sup> niterirasinin	3.70000000 G CF St 15.000000 M
					Stop Fr           3.70000000 G           CF Sto           15.00000 M <u>Auto</u> Freq Offs           0

Plot 25.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.3)

*Ethernet						- 🗆
File Edit View Go Capture Analyze Statisti						
🕻 🔳 🖉 🐵 📙 🛅 🗙 🖬 🍳 🗢 🗢 🕾	F 🕹 📃 🗏 Q Q	२, 🎹				
ip.addr==192.168.1.230&&ssl						🛆 🛛 🖃 💌 Expression
o. Time	Source	Destination	Protocol	Length Info		
7 2020-07-01 22:29:27.063772	192.168.1.251	192.168.1.230	TLSv1.2	571 Client Hello		
8 2020-07-01 22:29:27.080993	192.168.1.230	192.168.1.251 192.168.1.230	TLSv1.2		Certificate, Server Key Exchange, Cer	
10 2020-07-01 22:29:27.088132	192.168.1.251	192.168.1.230	TLSv1.2	bi Alert (Level:	Fatal, Description: Certificate Expir	ea)
Frame 7: 571 bytes on wire (4568 bits),	571 bytes cantured (	4568 hits) on interface 0				
Ethernet II, Src: Luxshare 44:cf:20 (3c			d6:be:6d)			
Internet Protocol Version 4, Src: 192.10			· · · ·			
Transmission Control Protocol, Src Port	: 50178, Dst Port: 44	3, Seq: 1, Ack: 1, Len: 51	.7			
Transport Layer Security						
✓ TLSv1.2 Record Layer: Handshake Prote	ocol: Client Hello					
Content Type: Handshake (22)						
Version: TLS 1.0 (0x0301)						
Length: 512						
<ul> <li>Handshake Protocol: Client Hello</li> </ul>						
Handshake Type: Client Hello (1	.)					
Length: 508 Version: TLS 1.2 (0x0303)						
Version: ILS 1.2 (0x0303) > Pandom: 1740fa0d0804d1aa15f4006	o7h52dhoh80546dqdqfd	Bded				
0000 d4 81 d7 d6 be 6d 3c 18 a0 44 cf 20						
wireshark Ethernet 20200701182911 a12220.pd					Packets: 19 · Displayed: 3 (15.8%)	Profile: Defa

#### Plot 26.WireShark Screenshot (WINNF.FT.C.SCS.3)

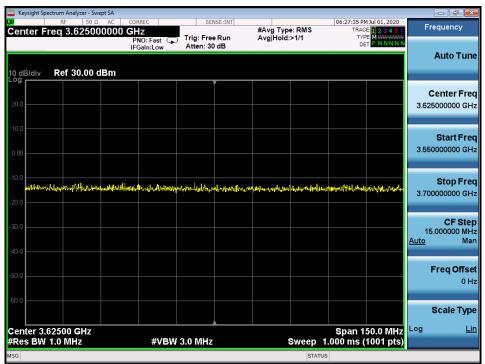
FCC ID: XN3-QUANTUM6636	Pout to be part of the element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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# A27 [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

	Test Execution Steps	PASS	FAIL
1	<ul> <li>UUT shall start CBSD-SAS communication with the security procedure</li> </ul>	$\boxtimes$	
	<ul> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> </ul>		
	<ul> <li>Make sure UUT selects the correct cipher suite.</li> </ul>		
2	<ul> <li>UUT shall use CRL or OCSP to verify the validity of the server certificate.</li> </ul>	$\boxtimes$	
	• 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	$\boxtimes$	
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:	$\boxtimes$	
5	• UUT shall not transmit RF		

#### **Test Plots:**



Plot 27.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.4)

FCC ID: XN3-QUANTUM6636	Poul to be part of @diment	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager				
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Capturing from Ethernet							-		×
File Edit View Go Capture Analyze Statistics	Telephony Wireless	Tools Help							
	2 = 444								
ip.addr==192.168.1.230&&ssl								<ul> <li>Expression</li> </ul>	n   +
No. Time	Source	Destination	Protocol	Length	Info				
35 2020-07-01 22:27:03.212309	192.168.1.251	192.168.1.230	TLSv1.2		1 Client H				
37 2020-07-01 22:27:03.279428	192.168.1.230	192.168.1.251	TLSv1.2			Hello, Certificate, Server Key Exchange, Certifica		, Server	Hello
39 2020-07-01 22:27:03.282485	192.168.1.251	192.168.1.230	TLSv1.2	6	1 Alert (L	Level: Fatal, Description: Unsupported Certificate	)		
<									
> Frame 35: 571 bytes on wire (4568 bits), > Ethernet IL, Src: LuxShare_44:cf:20 (3c:i > Internet Protocol Version 4, Src: 192.166 > Transmission Control Protocol, Src Port: > Transport Layer Security > TLSU1.2 Record Layer: Handshake Protoc Content Type: Handshake (22) Version: TLS 1.0 (0x0301) Length: 512	8:a0:44:cf:20), Dst: 0.1.251, Dst: 192.168. 50025, Dst Port: 443,	Dell_d6:be:6d (d4:81:d7:d6 1.230	6:be:6d)						
Length: 512 Handshake Protocol: Client Hello Handshake Type: Client Hello (1) Length: 508 Version: TLS 1.2 (0x0303) Dandom: 0h56664abc34d6604680007	aba6a78b11ad4fb8b65b6;	<u>المهم المعامة المعامة</u>							
0000 d4 81 d7 d6 be 6d 3c 18 a0 44 cf 20	08 00 45 00 ····m<	· · D · · · E ·							;
Ethernet: <live capture="" in="" progress=""></live>						Packets: 99 · Displayed: 3 (3.0%)		Profile: De	

Plot 28.WireShark Screenshot (WINNF.FT.C.SCS.4)

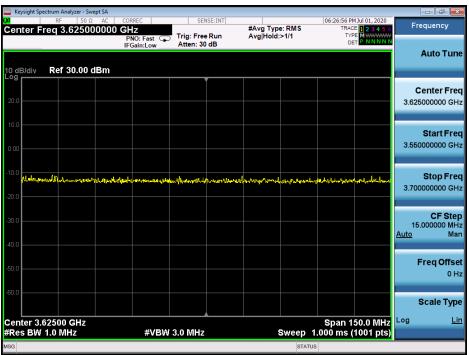
FCC ID: XN3-QUANTUM6636	PCTEST Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N:	Test Dates:	EUT Type:	Page 54 of 60
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# A28 [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

	Test Execution Steps	PASS	FAIL
1	<ul> <li>UUT shall start CBSD-SAS communication with the security procedure</li> </ul>	X	
	<ul> <li>Make sure that UUT uses TLS v1.2 for security establishment.</li> </ul>		
	<ul> <li>Make sure UUT selects the correct cipher suite.</li> </ul>		
2	• UUT shall use CRL or OCSP to verify the validity of the server certificate.	$\boxtimes$	
	• 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	X	
4	SAS Test-Harness shall not receive any Registration request or any application data.		
	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is		
5	complete. This is the end of the test. Verify:	$\boxtimes$	
	UUT shall not transmit RF		

#### **Test Plots:**



Plot 29.Conducted Measurement – No RF transmission in entire band at anytime (WINNF.FT.C.SCS.5)

FCC ID: XN3-QUANTUM6636	Poud to be part of @ vieweet	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager				
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Capturing from Ethernet						· · · · · · · · · · ·	- 0	×
ile Edit View Go Capture Analyze Statis	stics Telephony Wireless To	ols Help						
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ip.addr == 192.168.1.2308.8ssl						A	Express	sion
o. Time	Source	Destination	Protocol	Length	Info			
52 2020-07-01 22:24:18.327918	192.168.1.251	192.168.1.230	TLSv1.2	57	1 Client Hello	0		
53 2020-07-01 22:24:18.349227	192.168.1.230	192.168.1.251	TLSv1.2	349	4 Server Hello	o, Certificate, Server Key Exchange, Certificate	Request, Serve	er Hell
55 2020-07-01 22:24:18.426875	192.168.1.251	192.168.1.230	TLSv1.2	e	1 Alert (Leve	1: Fatal, Description: Decrypt Error)		
P Frame 52: 571 bytes on wire (4568 bits					_			
Ethernet II, Src: Luxshare_44:cf:20 (3			6:be:6d)					
Internet Protocol Version 4, Src: 192.								
Transmission Control Protocol, Src Por Transport Layer Security	t: 49052, UST PORT: 443,	Sey: 1, ACK: 1, Len: 51/						
V TLSUL2 Record Layer: Handshake Pro Content Type: Handshake (22) Version: TLS 1.0 (0x0301) Length: 512 Y Handshake Protocol: Client Hello Handshake Type: Client Hello Length: 588								
Version: TLS 1.2 (0x0303)								
Pandom: 42af70b4c3aded81b61det 0000 44.04 47 46 4 40 40 40 40 40 40 40 40 40 40 40 40 4								
000 d4 81 d7 d6 be 6d 3c 18 a0 44 cf 3	20 08 00 45 00 ·····m<·	·D· ··E·						
Ethernet: <li>Ethernet: <li>Et</li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li></li>						Packets: 62 · Displayed: 3 (4.8%)	Profile:	Default

#### Plot 30.WireShark Screenshot (WINNF.FT.C.SCS.5)

FCC ID: XN3-QUANTUM6636	PCTEST* Proud to be part of @ element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Y Quality Manager
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# A29 [WINNF.PT.C.HBT.1] UUT RF Transmit Power Measurement

	Test Execution Steps	PASS	FAIL
1	<ul> <li>Ensure the following conditions are met for test entry:</li> <li>UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness</li> <li>UUT has registered with the SAS, with CBSD ID = C</li> <li>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</li> </ul>		
	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	<ul> <li>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:</li> <li>UUT sends Heartbeat Request, including: <ul> <li>o cbsdld = C</li> <li>o grantld = G</li> </ul> </li> <li>SAS Test Harness responds with Heartbeat Response, including: <ul> <li>o cbsdld = C</li> <li>o grantld = G</li> <li>o transmitExpireTime = current UTC time + 200 seconds</li> <li>o responseCode = 0</li> </ul> </li> </ul>		
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. <i>Note: it may be required for the vendor to provide a method or configuration to bring</i> <i>the UUT to a mode which is required by the measurement methodology. Any such</i> <i>mode is vendor-specific and depends upon UUT behavior and the measurement</i> <i>methodology.</i>	$\boxtimes$	

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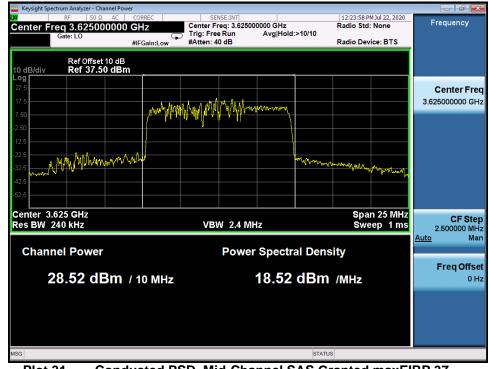
#### **RF Power Measurements:**

Testing is performed per KDB 971168 D01 and across the transmit dynamic range of 37dBm/MHz to 16dBm/MHz for 10MHz Bandwidth.

The UUT was configured such that all ports were transmitting at the same output power level. The 6 ports of the UUT are the same design and pretesting showed that the power levels between the sampling of the various ports is the same. As all 6 ports are identical in design and equivalent power levels, the PSD was sampled on 1 port. The EIRP was calculated by adding the conducted power, antenna gain, and duty cycle correction factor.

Freq [MHz]	SAS Granted maxEIRP [dBm/MHz]	Conducted PSD on Antenna Port 1 [dBm/MHz]	Ant Gain [dBi]	DCCF [dB]	maxEIRP [dBm/MHz]	Margin [dB]
3625	37	18.52	17	1.427	36.947	-0.053
3625	26	7.47	17	1.427	25.897	-0.103
3625	16	-2.533	17	1.427	15.894	-0.106

#### Table 7-1 RF Output Power Measurements (WINNF.PT.C.HBT)

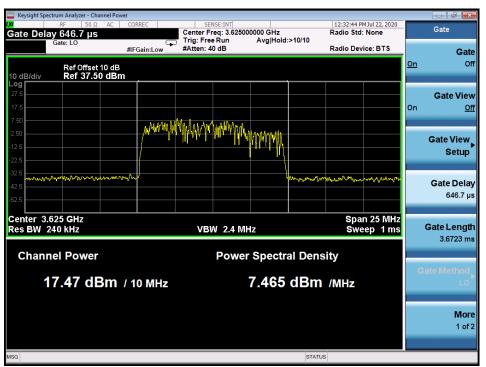


#### Test Plots:

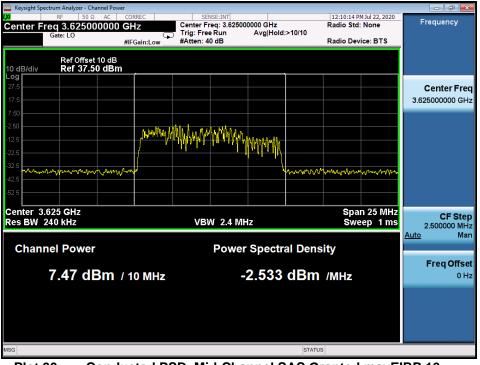
Plot 31. Conducted PSD, Mid-Channel SAS Granted maxEIRP 37

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Plot 32. Conducted PSD, Mid-Channel SAS Granted maxEIRP 26



Plot 33. Conducted PSD, Mid-Channel SAS Granted maxEIRP 16

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# APPENDIX B - TEST LOGS

#### Logs are available upon request



WINNF.FT.C.DRG.1\_2020-06-23T21. 41.11Z Text Document

WINNF.FT.C.HBT.3\_2020-06-30T16.3 9.44Z Text Document

WINNF.FT.C.HBT.10\_2020-06-30T22. 30.10Z Text Document



WINNF.FT.C.REG.1\_SCS3\_2020-07-0 1T22.29.22Z Text Document

WINNF.FT.D.DRG.2\_2020-06-23T21. 33.06Z Text Document

WINNF.FT.D.MES	.5_2020-06-30T21.
41.04Z	
Text Document	

WINNF.FT.D.REG.9\_2020-06-22T20. 48.22Z Text Document

WINNF.FT.D.REG.15\_2020-06-22T21 .23.22Z

Text Document

WINNF.FT.D.RLQ.2\_2020-06-23T21. 25.10Z Text Document WINNF.FT.C.GRA.1\_2020-06-23T19. 37.20Z Text Document

WINNF.FT.C.HBT.5\_2020-06-30T16.5 0.01Z Text Document

WINNF.FT.C.MES.3\_2020-06-30T21. 32.52Z Text Document

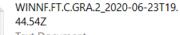
WINNF.FT.C.REG.1\_SCS4\_2020-07-0 1T22.26.29Z Text Document

WINNF.FT.D.HBT.2\_2020-06-23T17. 02.36Z Text Document

WINNF.FT.D.REG.6\_2020-06-22T20. 41.41Z Text Document

WINNF.FT.D.REG.11\_2020-06-22T20 .52.22Z Text Document

WINNF.FT.D.REG.17\_2020-06-22T21 .48.41Z Text Document



Text Document

WINNF.FT.C.HBT.9\_2020-07-02T19.4 3.58Z Text Document

WINNF.FT.C.REG.1\_SCS1\_2020-06-2 4T19.00.03Z Text Document

WINNF.FT.C.REG.1\_SCS5\_2020-07-0 1T22.24.11Z Text Document

WINNF.FT.D.HBT.8\_2020-06-30T20. 58.30Z Text Document

WINNF.FT.D.REG.6\_SCS2\_2020-07-0 9T22.15.56Z Text Document

WINNF.FT.D.REG.13\_2020-06-22T21 .40.12Z Text Document

WINNF.FT.D.REG.19\_2020-06-22T21 .51.50Z Text Document

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