

# Test Report

As per

## FCC Part 96 SAS requirements (CBRS Test Plan)

on the

**Ericsson Remote Radio Air 6488 B48 KRD901160  
(3550-3700MHz)**



Canada

**Choose certainty.  
Add value.**

Issued by:  
**TÜV SÜD Canada  
Inc.**  
1280 Teron Rd,  
Ottawa, ON K2K  
2C1  
Canada

Testing produced  
for

Ericsson Canada

See Appendix A for  
full client & EUT  
details.

Scott Drysdale.  
Test Personnel

A handwritten signature in black ink that reads 'Scott Drysdale'.

Sivaratnam,  
Kasinathan  
Technical Reviewer

A handwritten signature in blue ink that reads 'S. M.'.



Testing Laboratory  
Certificate #2955.19

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Table of Contents

Table of Contents .....	2
Report Scope .....	3
Summary .....	4
Test Results Summary .....	5
Notes, Justifications, or Deviations .....	14
Applicable Standards, Specifications and Methods .....	15
Document Revision Status .....	16
Definitions and Acronyms .....	17
Testing Facility .....	18
Calibrations and Accreditations .....	18
Testing Environmental Conditions and Dates .....	19
Detailed Test Results Section .....	20
Authorization transmit after it receives authorization from a SAS .....	21
Check the device registration and authorization with the SAS .....	30
Confirm that the device changes its operating power and/or channel in response to a command from the SAS and Confirm that the device correctly configures based on the different license classes. ....	30
Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS .....	45
WINNF Security Test Case Analysis .....	52
WINNF.FT.C.SCS.1 .....	52
WINNF.FT.C.SCS.2 .....	56
WINNF.FT.C.SCS.3 .....	60
WINNF.FT.C.SCS.4 .....	f63
WINNF.FT.C.SCS.5 .....	66
Appendix A – EUT & Client Provided Details .....	70
Technical Description .....	72
Appendix B – EUT, Peripherals, and Test Setup Photos .....	74

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Report Scope

This report addresses the EMC verification testing and test results of the **Ericsson Remote Radio Air 6488 B48 KRD 901160 (3550-3700 MHz)** herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

FCC Part 96 SAS requirements (CBRS Test Plan)

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

For a more detailed list of the standards and the revision used, see the "Applicable Standards, Specifications and Methods" section of this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc, unless otherwise stated.

© TÜV SÜD Canada Inc. This test report shall not be reproduced except in full, without written approval of TÜV SÜD Canada Inc.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Summary

The results contained in this report relate only to the item(s) tested.

Equipment Under Test (EUT)	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160 (3550-3700 MHz)</b>
EUT passed all tests performed	Yes
Tests conducted by	Scott Drysdale

For testing dates, see 'Testing Environmental Conditions and Dates'.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Test Results Summary

Section as per Working Document WINNF-TS-0122

Section	CBS D	D P	Test Case ID	Test Case Title	RF Measurement Requirement	Pass / Fail
6.1.4.1.1	X	--	WINNF.FT.C.R EG.1	Multi-Step registration	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.1.2	--	X	WINNF.FT.D.R EG.2	Domain Proxy Multi-Step registration	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.1.3	X	--	WINNF.FT.C.R EG.3	Single-Step registration for Category A CBSD	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.1.4	--	X	WINNF.FT.D.R EG.4	Domain Proxy Single-Step registration for Cat A CBSD (Note: Mandatory for without CPI, if EUT will always have signed CPI – asked for email waiver)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.1.5	X	--	WINNF.FT.C.R EG.5	Single-Step registration for CBSD with CPI signed data	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.1.6	--	X	WINNF.FT.D.R EG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.1.7	X	X	WINNF.FT.C.R EG.7	Registration due to change of an installation parameter	Test waits until transmission starts, then trigger an	P

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					installationParam change. <ul style="list-style-type: none"> <li>Record time at which transmission stops. Time must be within 60 seconds of the installationParam change taking effect.</li> </ul>	
6.1.4.2.1	X	--	WINNF.FT.C.R EG.8	Missing Required parameters (responseCode 102)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.2.2	--	X	WINNF.FT.D.R EG.9	Domain Proxy Missing Required parameters (responseCode 102)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.2.3	X	--	WINNF.FT.C.R EG.10	Pending registration (responseCode 200)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.2.4	--	X	WINNF.FT.D.R EG.11	Domain Proxy Pending registration (responseCode 200)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.2.5	X	--	WINNF.FT.C.R EG.12	Invalid parameter (responseCode 103)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.2.6	--	X	WINNF.FT.D.R EG.13	Domain Proxy Invalid parameters (responseCode 103)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.2.7	X	--	WINNF.FT.C.R EG.14	Blacklisted CBSD (responseCode 101)	Monitor for 60 seconds after REG message sent. No	N/A

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					transmission during test.	
6.1.4.2.8	--	X	WINNF.FT.D.R EG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.2.9	X	--	WINNF.FT.C.R EG.16	Unsupported SAS protocol version (responseCode 100)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.2.10	--	X	WINNF.FT.D.R EG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.2.11	X	--	WINNF.FT.C.R EG.18	Group Error (responseCode 201)	Monitor for 60 seconds after REG message sent. No transmission during test.	N/A
6.1.4.2.12	--	X	WINNF.FT.D.R EG.19	Domain Proxy Group Error (responseCode 201)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.1.4.3.1	X	X	WINNF.FT.C.R EG.20	Category A CBSD location update		N/A
6.3.4.2.1	X	X	WINNF.FT.C.G RA.1 (TYPO FIXED D TO C)	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.3.4.2.2	X	X	WINNF.FT.C.G RA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
6.4.4.1.1	X	--	WINNF.FT.C.H BT.1	Heartbeat Success Case (first Heartbeat Response)	Monitor RF from start of test. Ensure that: <ul style="list-style-type: none"> <li>Transmission does not start until time of first</li> </ul>	N/A

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					<p>heartbeat response or after.</p> <ul style="list-style-type: none"> <li>• After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh)</li> </ul>	
6.4.4.1.2	--	X	WINNF.FT.D.H BT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	<p>Monitor RF from start of test. Ensure that:</p> <ul style="list-style-type: none"> <li>• Transmission does not start until time of first heartbeat response or after.</li> <li>• After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh)</li> </ul>	P
6.4.4.2.1	X	X	WINNF.FT.C.H BT.3	Heartbeat responseCode=105 (DEREGISTER)	<p>Monitor RF transmission. Ensure that:</p> <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of the heartbeatResponse which contains</li> </ul>	P



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					responseCode = 105	
6.4.4.2.2	X	--	WINNF.FT.C.H BT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)		N/A
6.4.4.2.3	X	X	WINNF.FT.C.H BT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	Monitor RF transmission from start of test. Ensure there is no transmission during the test	p
6.4.4.2.4	X	X	WINNF.FT.C.H BT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501</li> </ul>	p
6.4.4.2.5	X	X	WINNF.FT.C.H BT.7	Heartbeat responseCode=502 (UNSYNC_OPERATION)	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502</li> </ul>	p
6.4.4.2.6	--	X	WINNF.FT.D.H BT.8	Domain Proxy Heartbeat responseCode=500 (TERMINATED_GRANT)	Monitor RF transmission. CBSDs will have different behavior: <ul style="list-style-type: none"> <li>• CBSD1: will continue to transmit to end of test</li> </ul>	P

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					<p>(this is not a pass/fail criteria, but check)</p> <ul style="list-style-type: none"> <li>• CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500</li> </ul>	
6.4.4.3.1	X	X	WINNF.FT.C.H BT.9	Heartbeat Response Absent (First Heartbeat)	Monitor RF from start of test to 60 seconds after last heartbeatResponse message was sent. CBSD should not transmit at any time during test	P
6.4.4.3.2	X	X	WINNF.FT.C.H BT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Monitor RF transmission. Verify: <ul style="list-style-type: none"> <li>• CBSD must stop transmission within transmitExpirationTime+60 seconds, where transmitExpirationTime is from last successful heartbeatResponse message</li> </ul>	P
6.5.4.2.1	X	--	WINNF.FT.C.M ES.1	Registration Response contains measReportConfig	No RF monitoring	N/A
6.5.4.2.2	--	X	WINNF.FT.D.M ES.2	Domain Proxy Registration Response contains measReportConfig	No RF monitoring	P

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.5.4.2.3	X	X	WINNF.FT.C.M ES.3	Grant Response contains measReportConfig	No RF monitoring	P
6.5.4.2.4	X	--	WINNF.FT.C.M ES.4	Heartbeat Response contains measReportConfig	No RF monitoring	N/A
6.5.4.2.5	--	X	WINNF.FT.D.M ES.5	Domain Proxy Heartbeat Response contains measReportConfig	No RF monitoring	P
6.6.4.1.1	X	--	WINNF.FT.C.R LQ.1	Successful Relinquishment	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission at any time prior to sending the relinquishmentRequest message.</li> </ul>	N/A
6.6.4.1.2	--	X	WINNF.FT.D.R LQ.2	Domain Proxy Successful Relinquishment	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission at any time prior to sending the relinquishmentRequest message.</li> </ul>	P
6.7.4.1.1	X	--	WINNF.FT.C.D RG.1	Successful Deregistration	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission at any time prior to sending the relinquishmentRequest message or deregistrationRequest message (whichever is sent first)</li> </ul>	N/A

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.7.4.1.2	--	X	WINNF.FT.D.D RG.2	Domain Proxy Successful Deregistration	Monitor RF transmission. Ensure : • CBSD stops transmission at any time prior to sending the relinquishmentReque st message or deregistrationReques t message (whichever is sent first)	P
6.8.4.1.1	X	X	WINNF.FT.C.SC S.1	Successful TLS connection between UUT and SAS Test Harness	No RF transmission during test Check the tcpdump for the TLS information	P
6.8.4.2.1	X	X	WINNF.FT.C.SC S.2	TLS failure due to revoked certificate	No RF transmission during test Check the tcpdump for the TLS information	P
6.8.4.2.2	X	X	WINNF.FT.C.SC S.3	TLS failure due to expired server certificate	No RF transmission during test Check the tcpdump for the TLS information	P
6.8.4.2.3	X	X	WINNF.FT.C.SC S.4	TLS failure when SAS Test Harness certificate is issue by unknown CA	No RF transmission during test Check the tcpdump for the TLS information	P
6.8.4.2.4	X	X	WINNF.FT.C.SC S.5	TLS failure when certificate at the SAS Test Harness is corrupted	No RF transmission during test Check the tcpdump for the TLS information	P
7.1.4.1.1	X	X	WINNF.PT.C.H BT	UUT RF Transmit Power Measurement	Power Spectral Density test case.  Assume we use 1 carrier bandwidth	P

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

					(say, 5 or 10 MHz), one frequency (say middle channel in band) for test. Measure at max transmit power, and reduce in steps of 3 dB to minimum declared transmit power.	
--	--	--	--	--	---	--

If the product as tested complies with the specification, the EUT is deemed to comply with the standard and is deemed a 'PASS' or 'P' grade. If not 'FAIL' grade is issued. Where 'N/A' is stated this means the test case is not applicable, and see Notes, Justifications or Deviations Section for details.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

### **Notes, Justifications, or Deviations**

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

A later revision of the standard may have been substituted in place of the previous dated referenced revision. The year of the specification used is listed under applicable standards. Using the later revision accomplishes the goal of ensuring compliance to the intent of the previous specification, while allowing the laboratory to incorporate the extensions and clarifications made available by a later revision.

Test results were obtained using the KRD 901 160/2 model, the client attests the test results are representative or worst case of all models as listed in appendix A

For the N/A test cases, the following justifications apply:

- a. EUT is a CBSD with Domain Proxy
- b. EUT supports the following Conditional functionality from WINNF-TS-0122-V1.0.0, Table 6-2:
  - i. C1 – Multi-step registration (WINNF.FT.D.REG.2)
  - ii. C3 – Single step registration containing CPI-signed data in the registration message (WINNF.FT.D.REG.6)
  - iii. C4 – RECEIVED\_POWER\_WITHOUT\_GRANT measurement report (WINNF.FT.D.MES.2)
  - iv. C5 – RECEIVED\_POWER\_WITH\_GRANT measurement report (WINNF.FT.D.MES.3, WINNF.FT.D.MES.5)
  - v. C6 – UUT supports installation parameter change (WINNF.FT.C.REG.7)
- c. Optional test cases were not performed

The device does not use single-step registration (as defined in condition C2 in WINNF-TS-0122-V1.0.0, Table 6-2), therefore test cases 6.1.4.1.4, and 6.1.4.3.1 are not applicable as per WINNF-TS-0122-V1.0.0, Table 6-3 and therefore not required or performed.

Note, where graph sweeps are incomplete, this was used to set the time stamp of when the events occurred. This can be accomplished by determining the time at which the graph was captured and subtracting the remaining time. For example if there was a 30 second sweep, and 9 out of 10 is complete, that means the end occurred at the 27 second mark. If the time on the graph was 12:03:35, this means the graph started at 12:03:08. This allows us to co-ordinate graph with timing provided in the logs.

Logs are kept on file.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Applicable Standards, Specifications and Methods

- ANSI C63.4:2014 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- CFR47 FCC Part 96 Code of Federal Regulations – Citizens Broadband Radio Service
- WINNF-TS-0122 Conformance and Performance Test Technical Specification;  
Version V1.0.0 CBSD/DP as Unit Under Test (UUT)  
19 December 2017 Working Document
- ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Document Revision Status

Revision 000:    September 16, 2019    First release

Revision 001:    September 17, 2019    Minor typo fixes as per client request.



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Definitions and Acronyms

The following definitions and acronyms are applicable in this report.  
See also ANSI C63.14.

**AE** – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

**AM** – Amplitude Modulation

**Class A device** – A device that is marketed for use in a commercial, industrial or business environment. A 'Class A' device should not be marketed for use by the general public and the instructions for use accompanying the product shall contain the following text:

**Caution:** This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

**Class B device** – A device that is marketed for use in a residential environment and may also be used in a commercial, business or industrial environments.

**EMC** – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

**EMI** – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

**Enclosure Port** – Physical boundary of equipment through which electromagnetic fields may radiate or impinge.

**EUT** – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

**LISN** – Line Impedance Stabilization Network

**NCR** – No Calibration Required

**NSA** – Normalized Site Attenuation

**RF** – Radio Frequency

**EMC Test Plan** – An EMC test plan established prior to testing. See 'Appendix A – EUT & Client Provided Details'.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Testing Facility

Testing for EMC on the EUT was carried out at customer location as described in Appendix A.

### ***Calibrations and Accreditations***

TÜV SÜD Canada Inc is accredited to ISO/IEC 17025 by A2LA with Testing Certificate #2955.19. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

### ***Testing Environmental Conditions and Dates***

Following environmental conditions were recorded in the facility during time of testing

<b>Date</b>	<b>Test</b>	<b>Initials</b>	<b>Temperature (°C)</b>	<b>Humidity (%)</b>	<b>Pressure (kPa)</b>
Sept 3 – 5, 2019	All	SD	20-23	40-55	96.106

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

**Detailed Test Results Section**

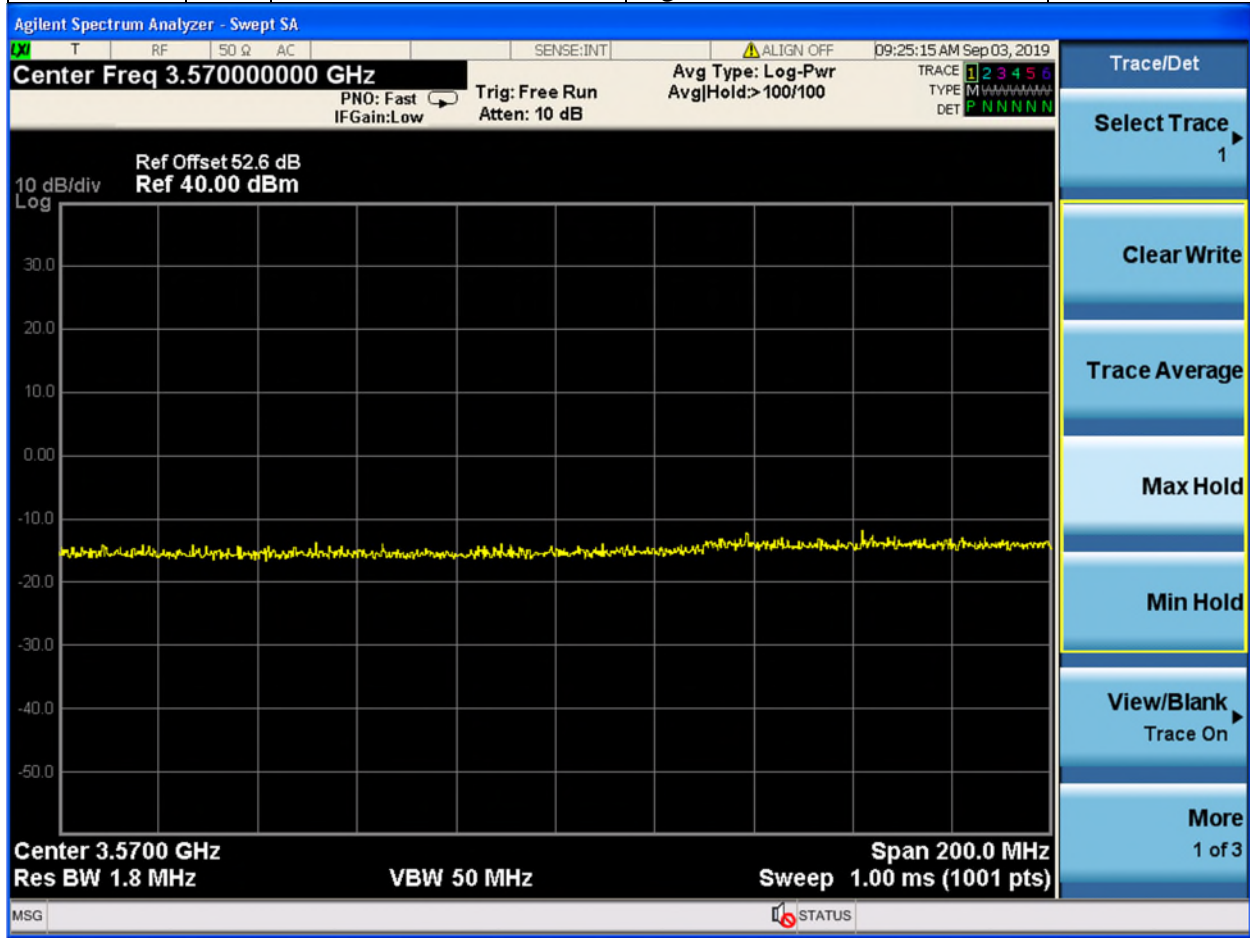
Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

***Authorization transmit after it receives authorization from a SAS.***

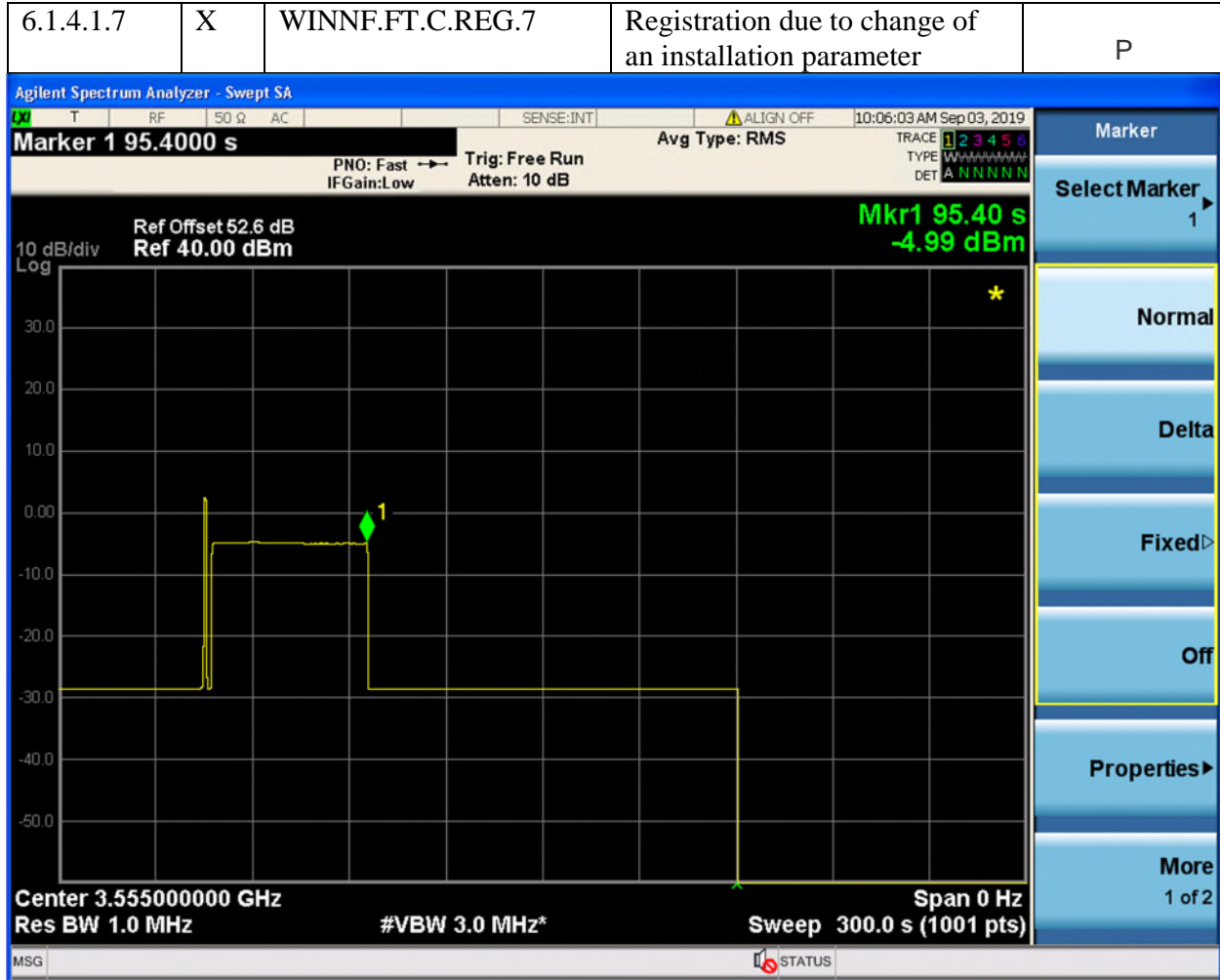
Section	DP	Test Case ID	Test Case Title	Pass / Fail
6.1.4.1.2	X	WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	P

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.1.6	X	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	P
-----------	---	------------------	---	---



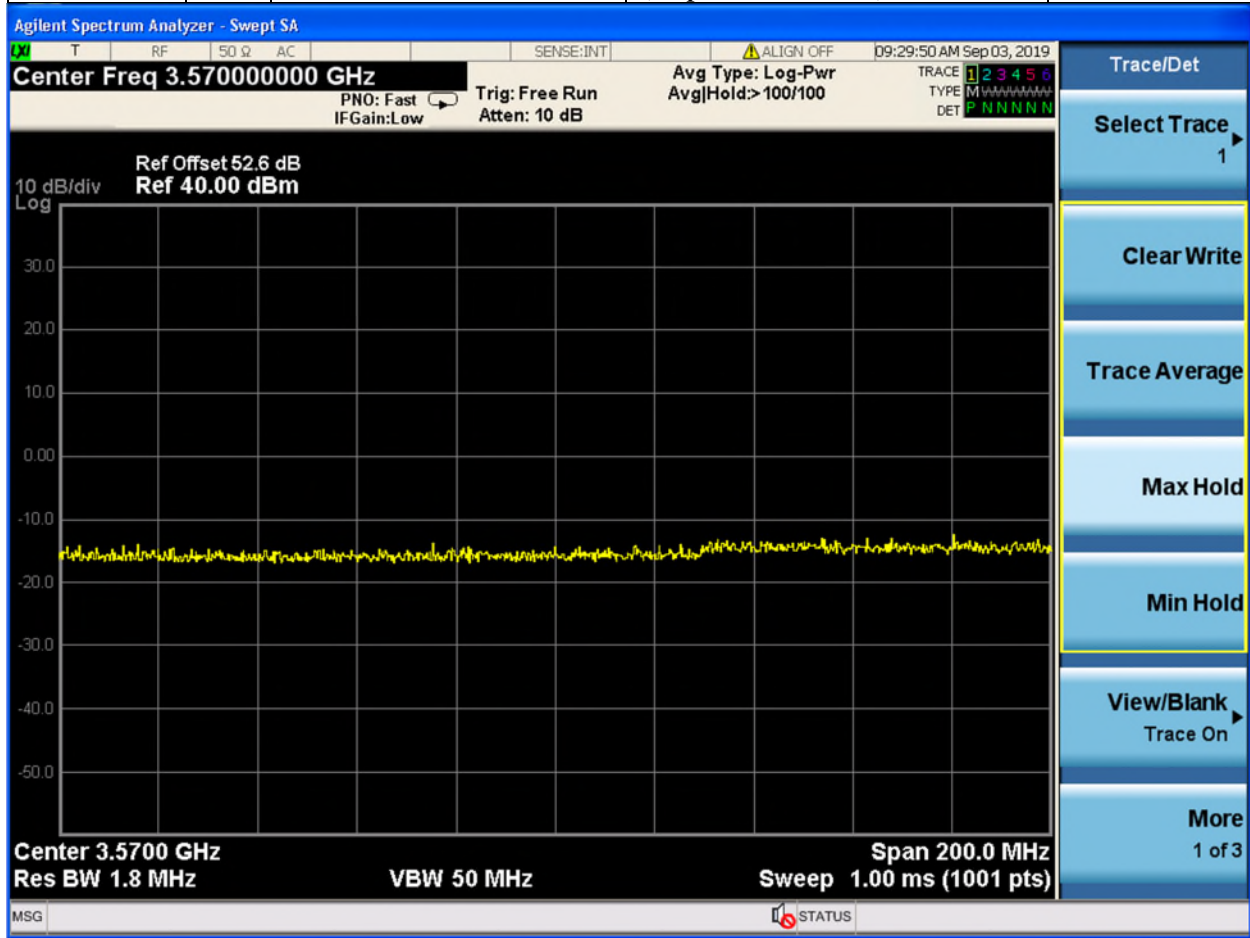
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

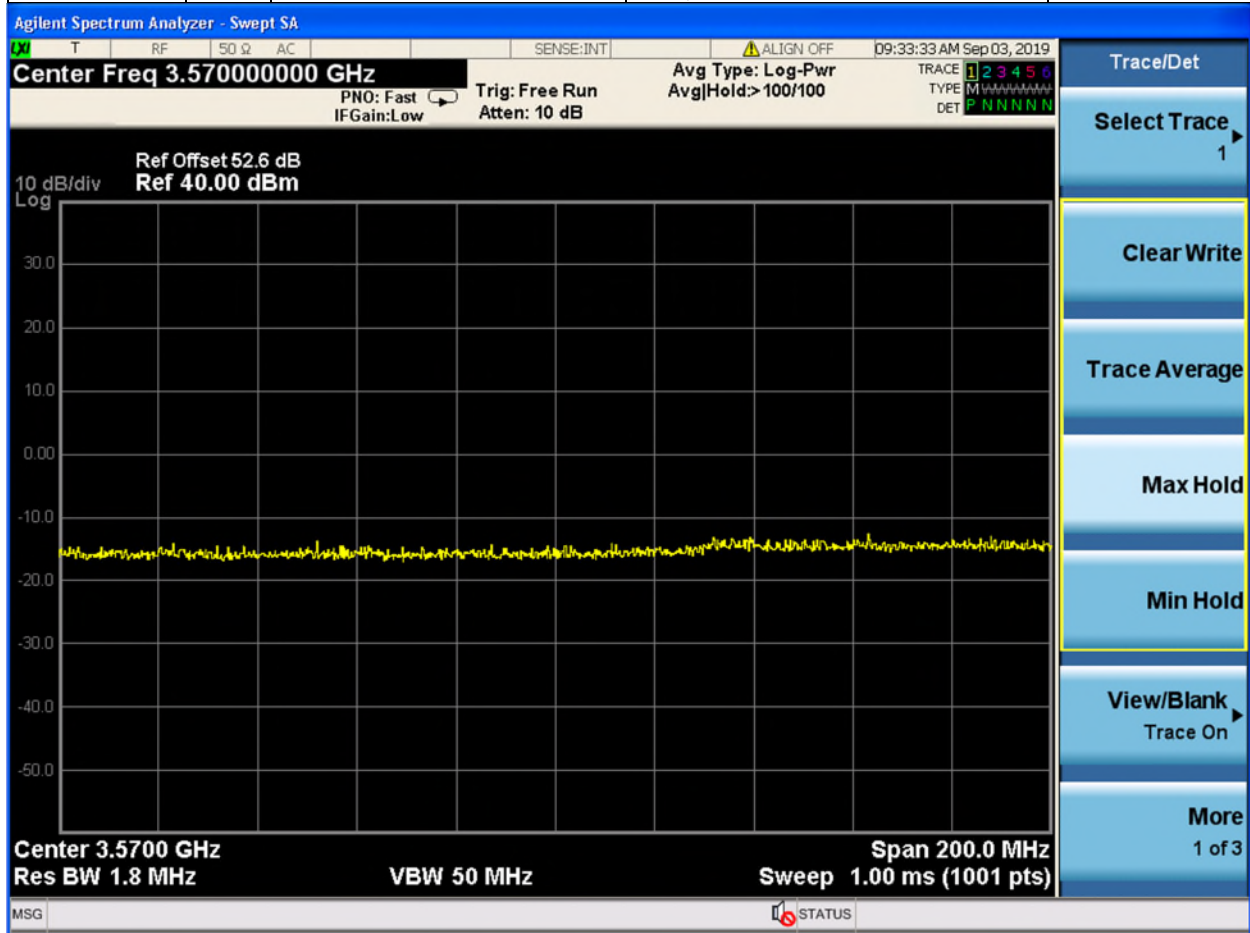
6.1.4.2.2	X	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	P
-----------	---	------------------	---	---





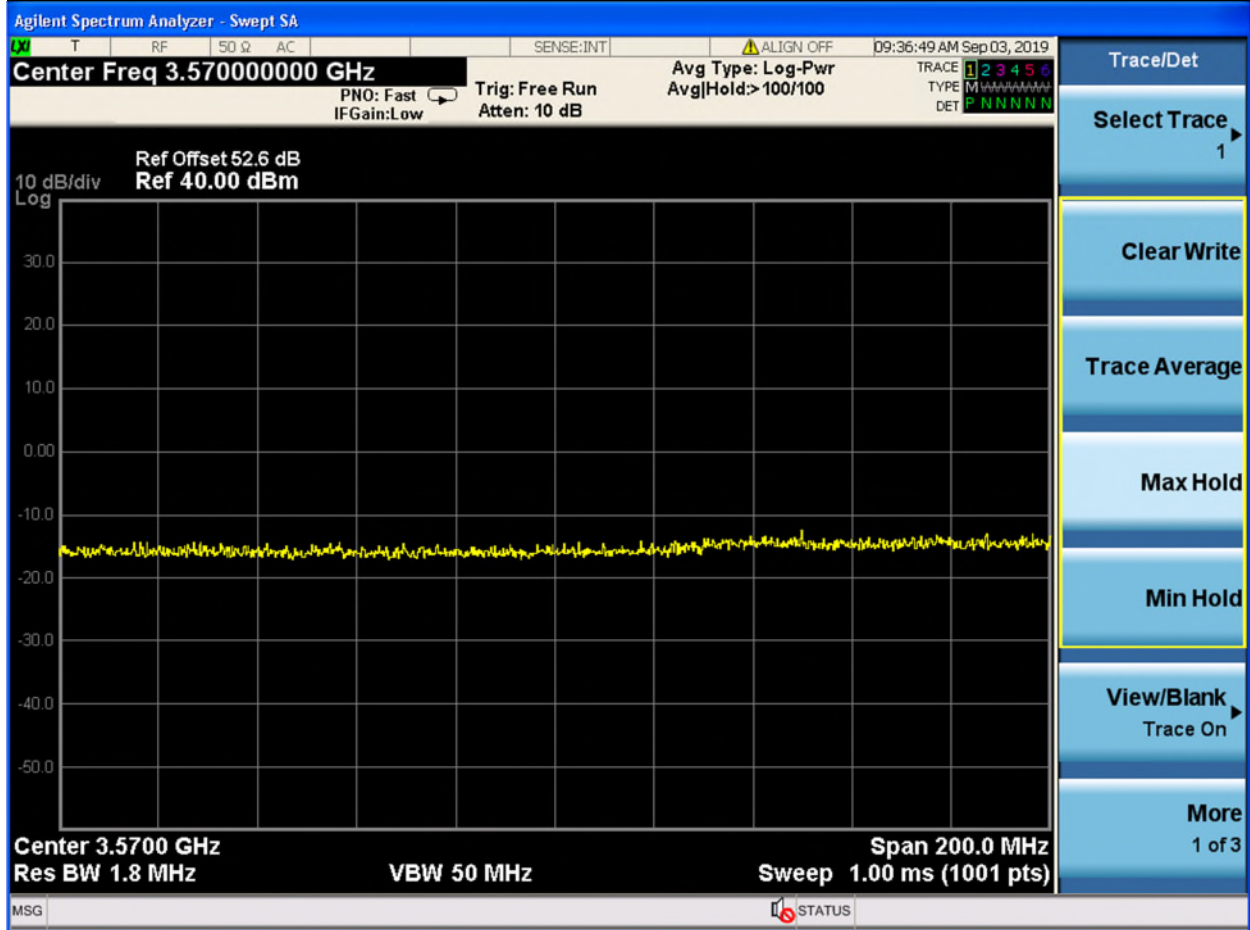
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.4	X	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	P
-----------	---	-------------------	--	---



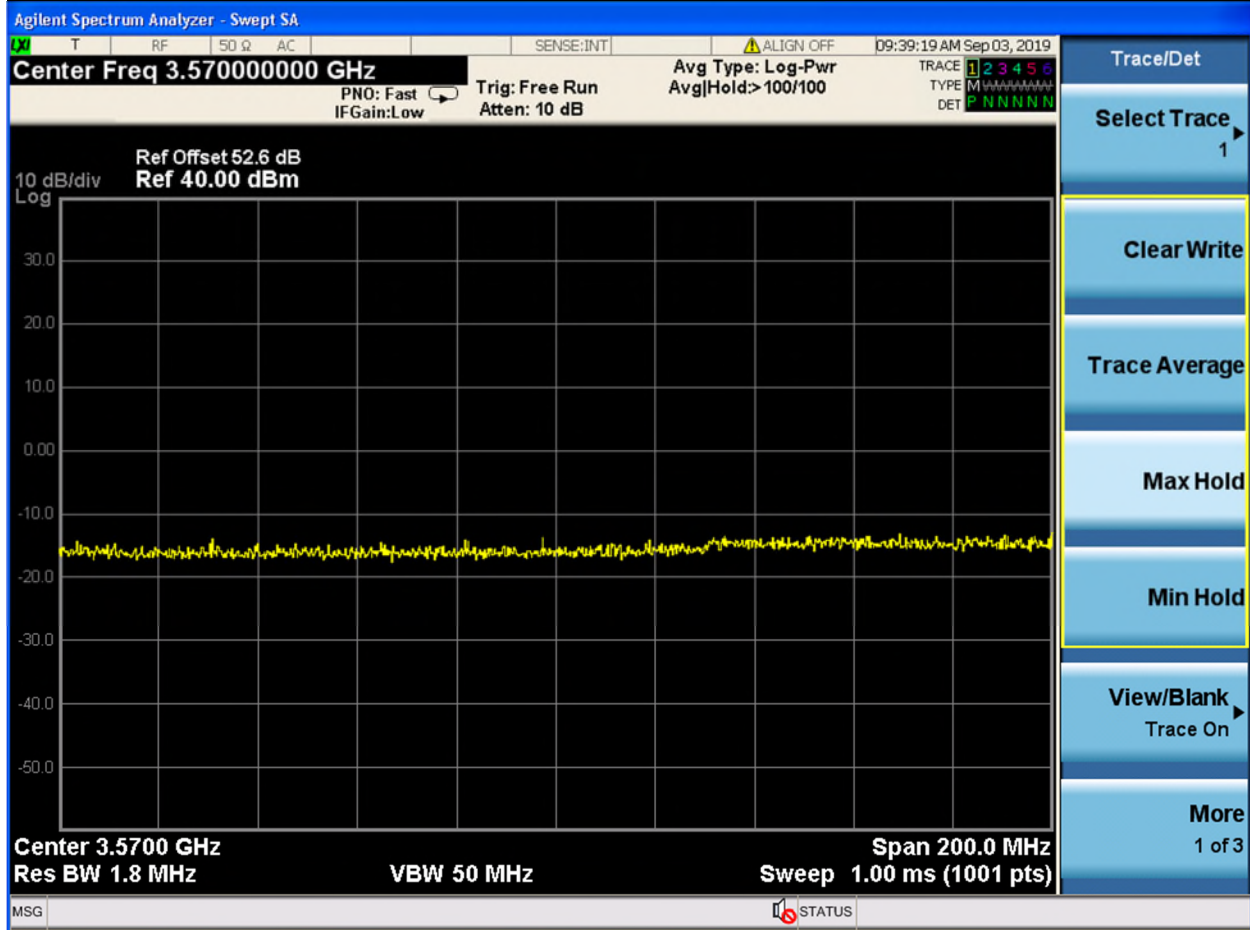
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.6	X	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	P
-----------	---	-------------------	--	---



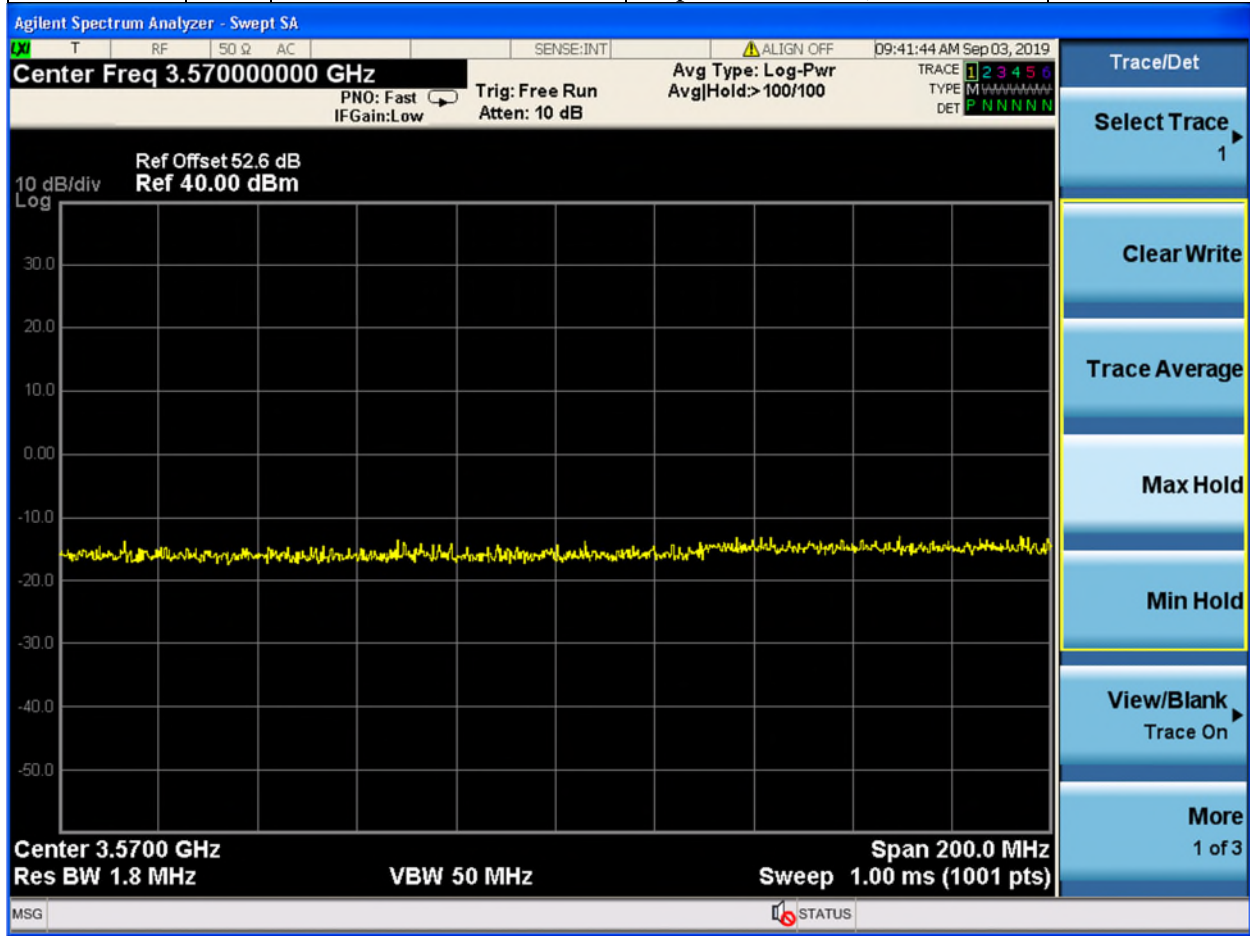
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.8	X	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	P
-----------	---	-------------------	---	---



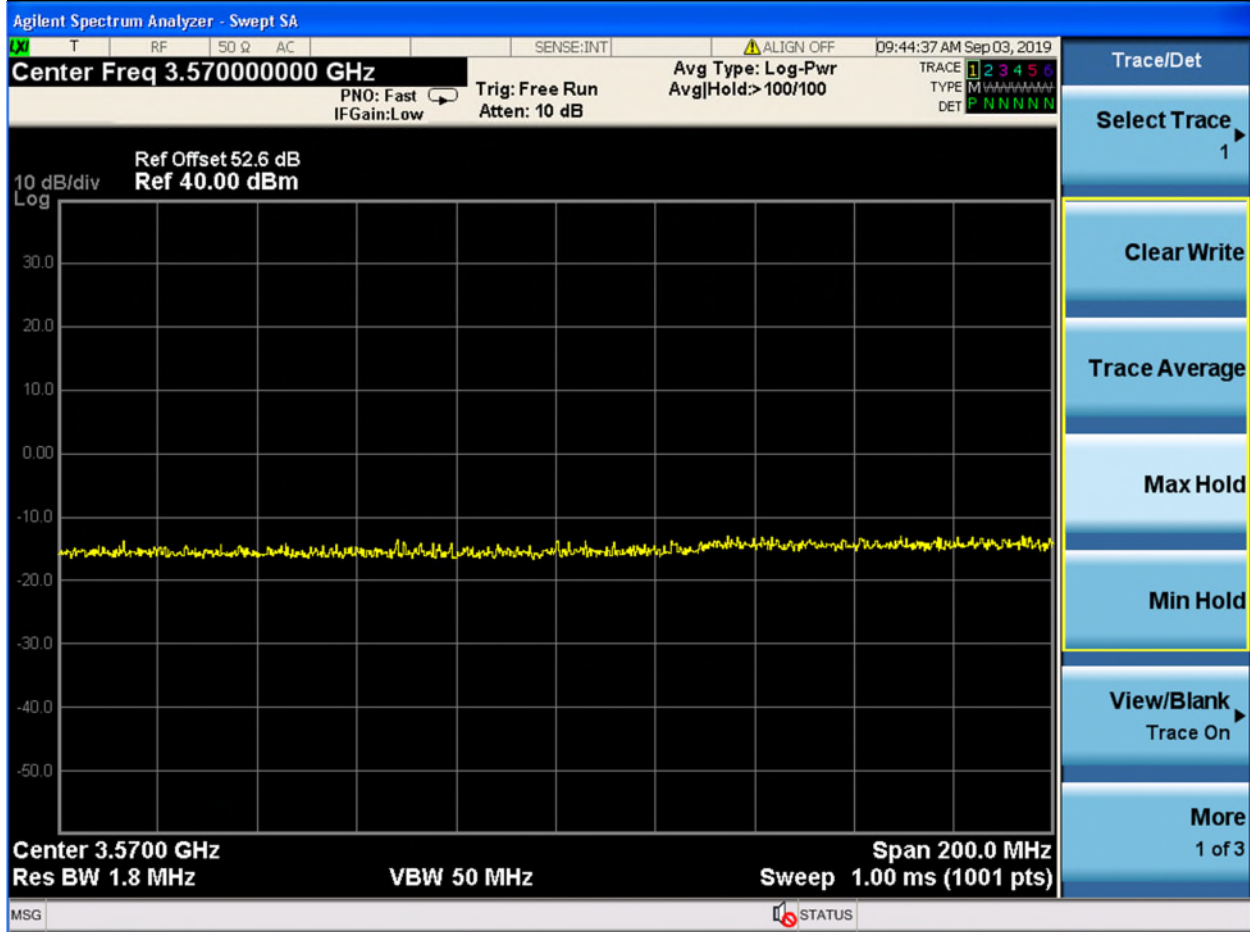
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.10	X	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	P
------------	---	-------------------	---	---



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

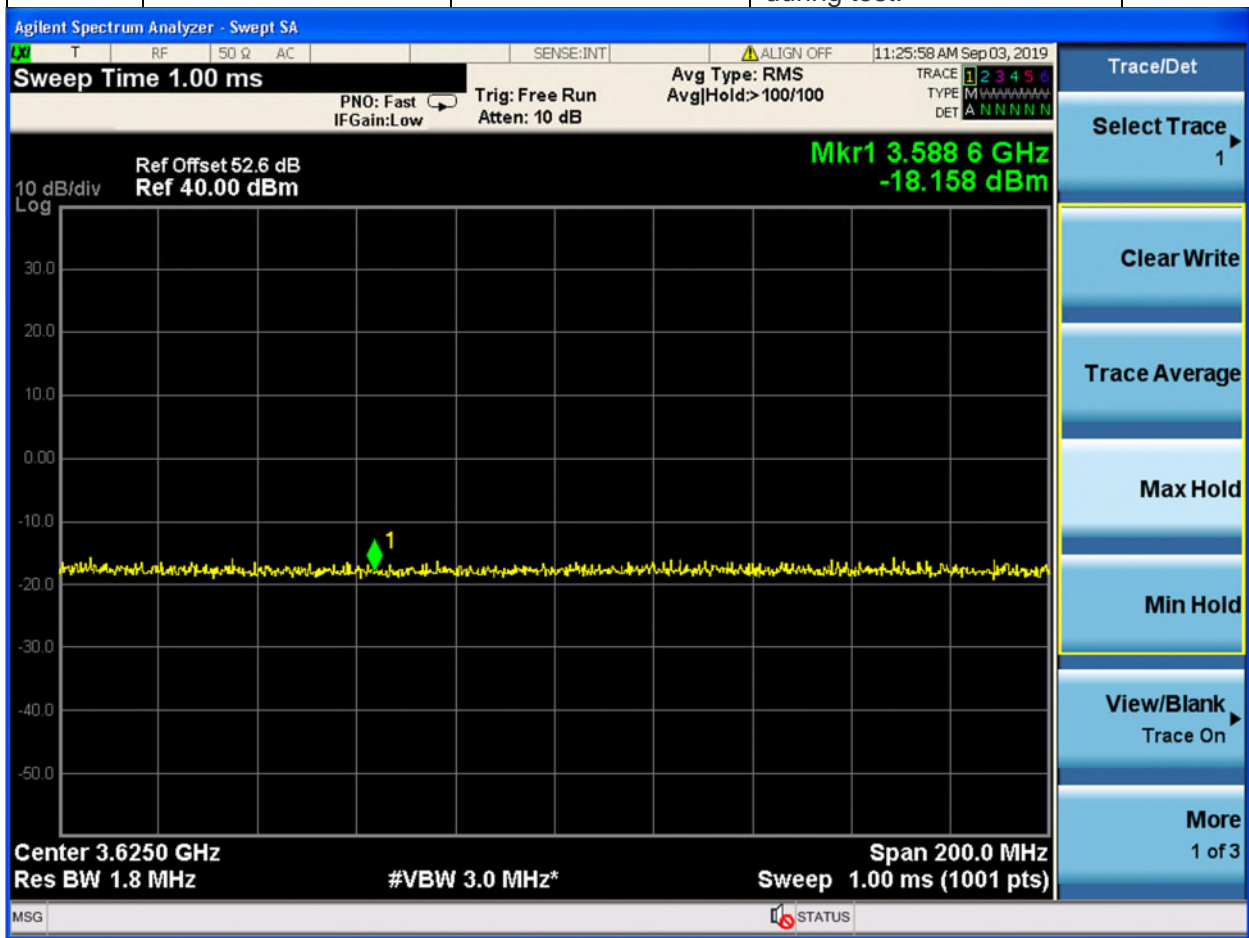
6.1.4.2.12	X	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	P
------------	---	-------------------	--	---



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

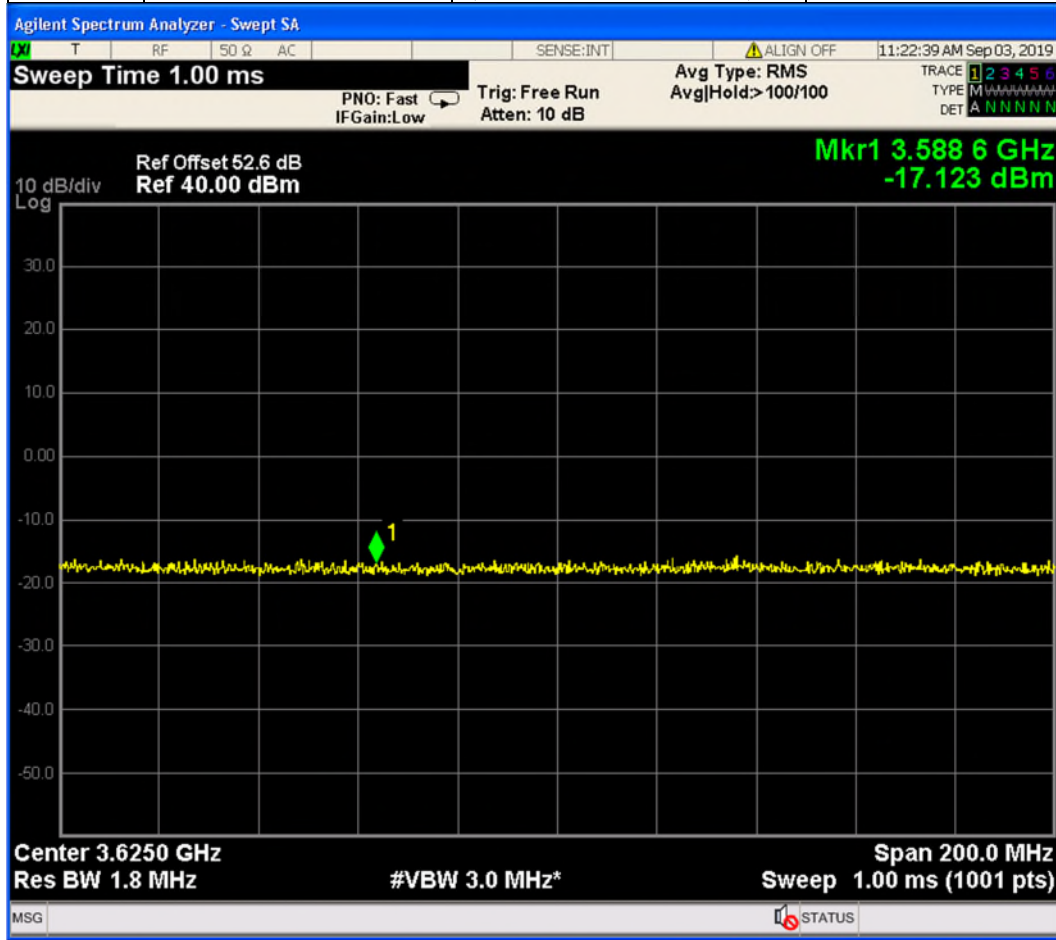
**Check the device registration and authorization with the SAS, Confirm that the device changes its operating power and/or channel in response to a command from the SAS and Confirm that the device correctly configures based on the different license classes.**

6.3.4.2.1	WINNF.FT.C.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
-----------	------------------	--	---	---



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.3.4.2.2	WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	Monitor for 60 seconds after REG message sent. No transmission during test.	P
-----------	------------------	--	---	---



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.4.4.1.2	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	Monitor RF from start of test. Ensure that: <ul style="list-style-type: none"> <li>• Transmission does not start until time of first heartbeat response or after.</li> <li>• After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh)</li> </ul>	P
-----------	------------------	--	--	---

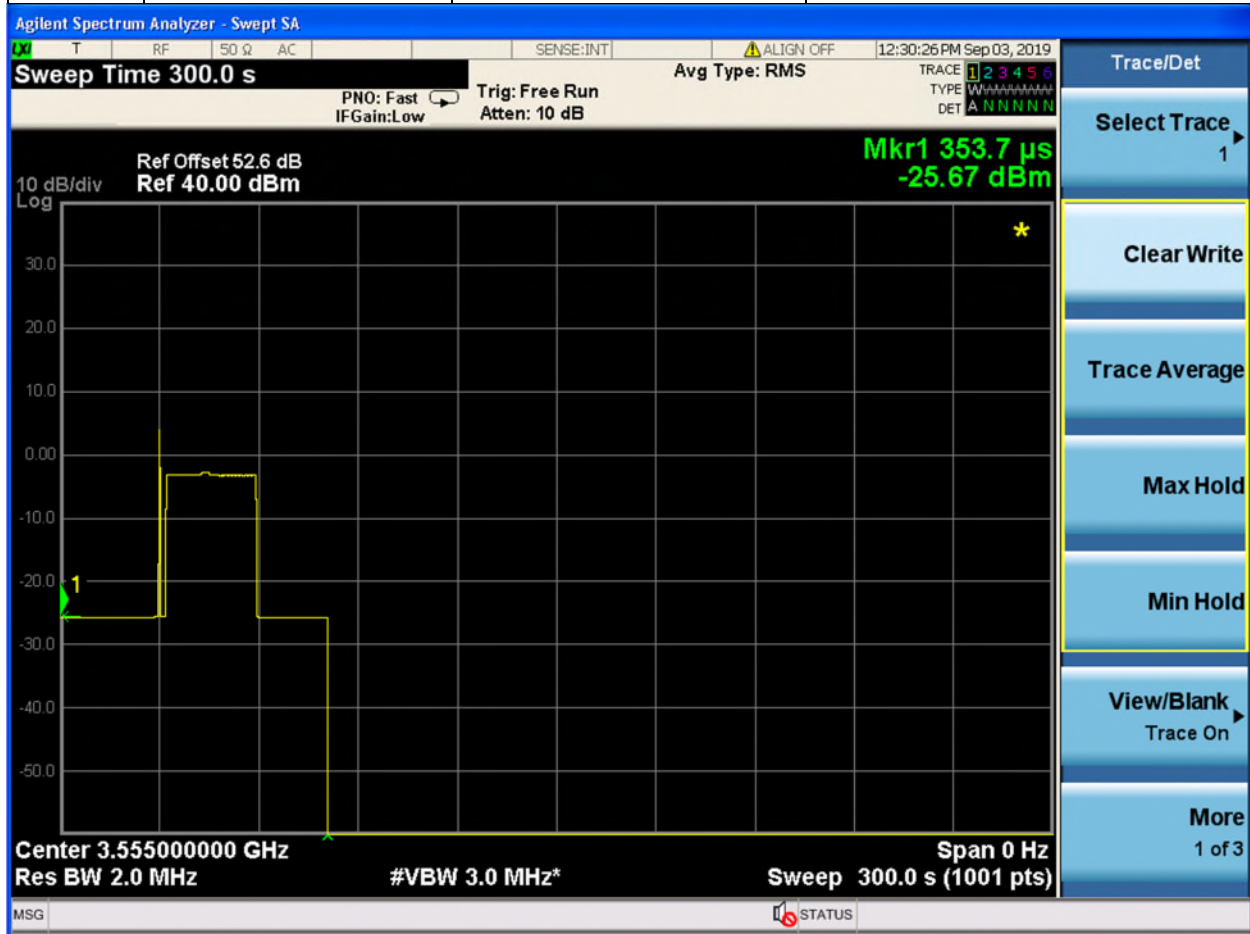


Test Harness logs and timing on graph was verified, the EUT passed the requirement.



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

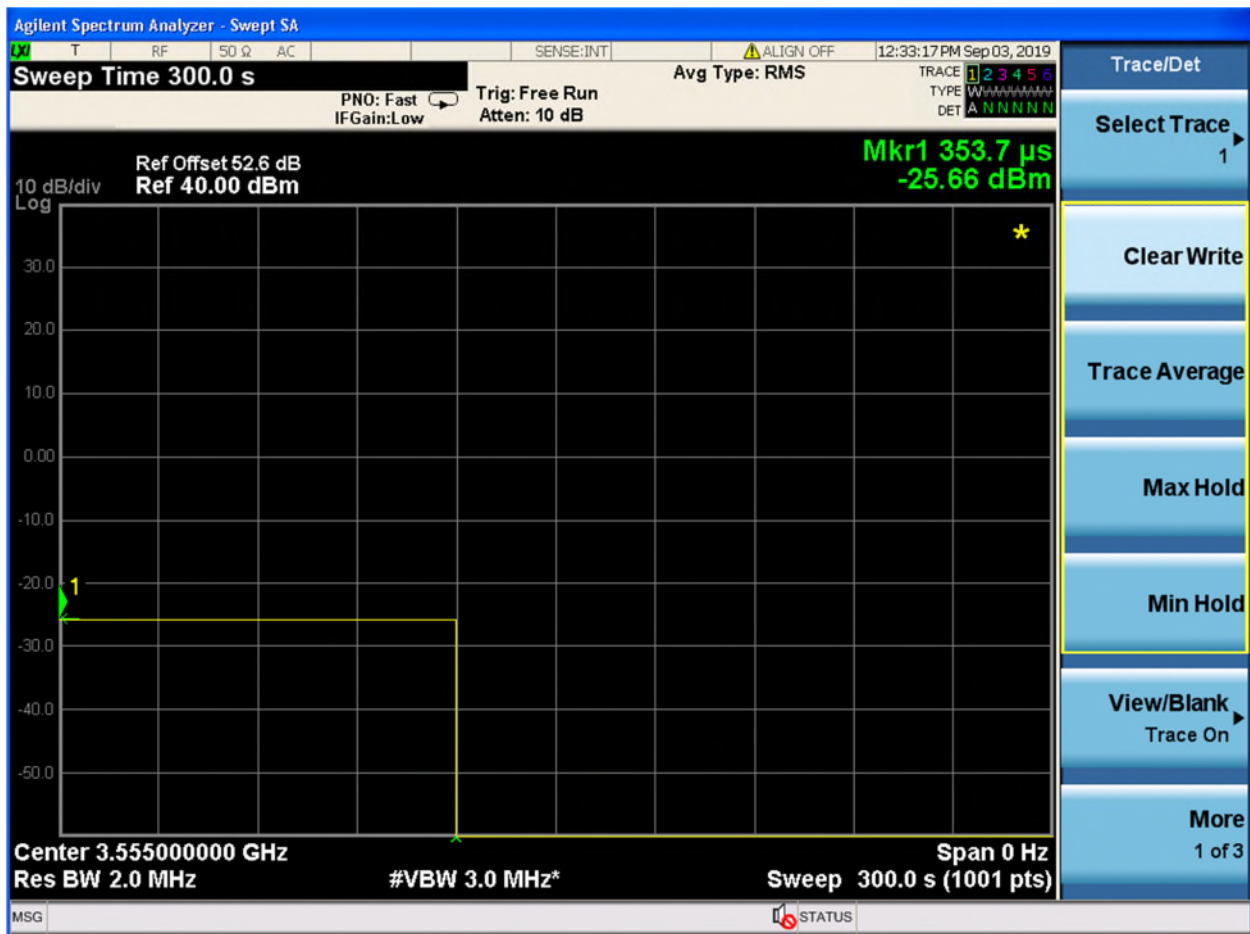
6.4.4.2.1	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	Monitor RF transmission. Ensure that: <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of the heartbeatResponse which contains responseCode = 105</li> </ul>	P
-----------	------------------	---	--	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

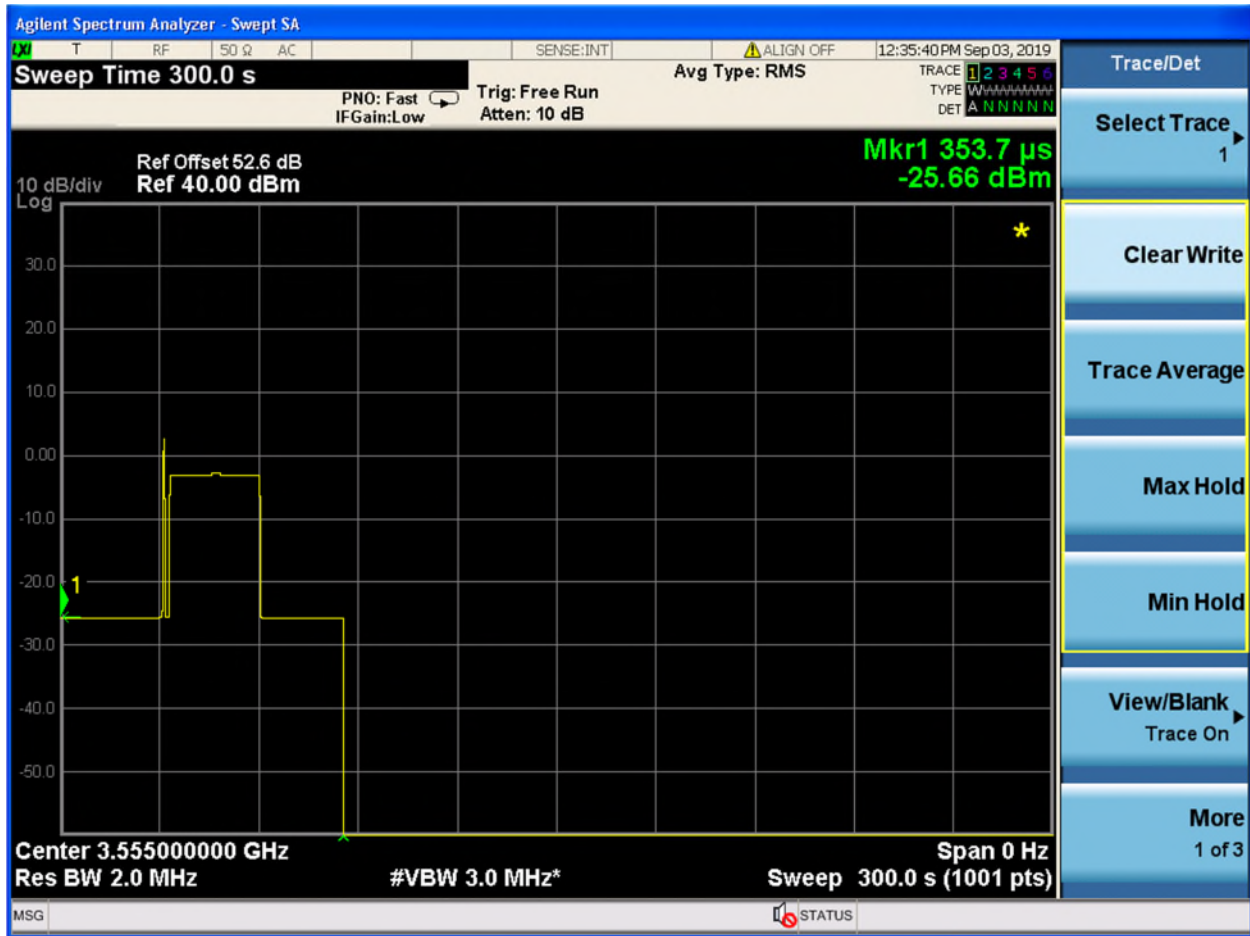
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.4.4.2.3	WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	Monitor RF transmission from start of test. Ensure there is no transmission during the test	p
-----------	------------------	--	---	---



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

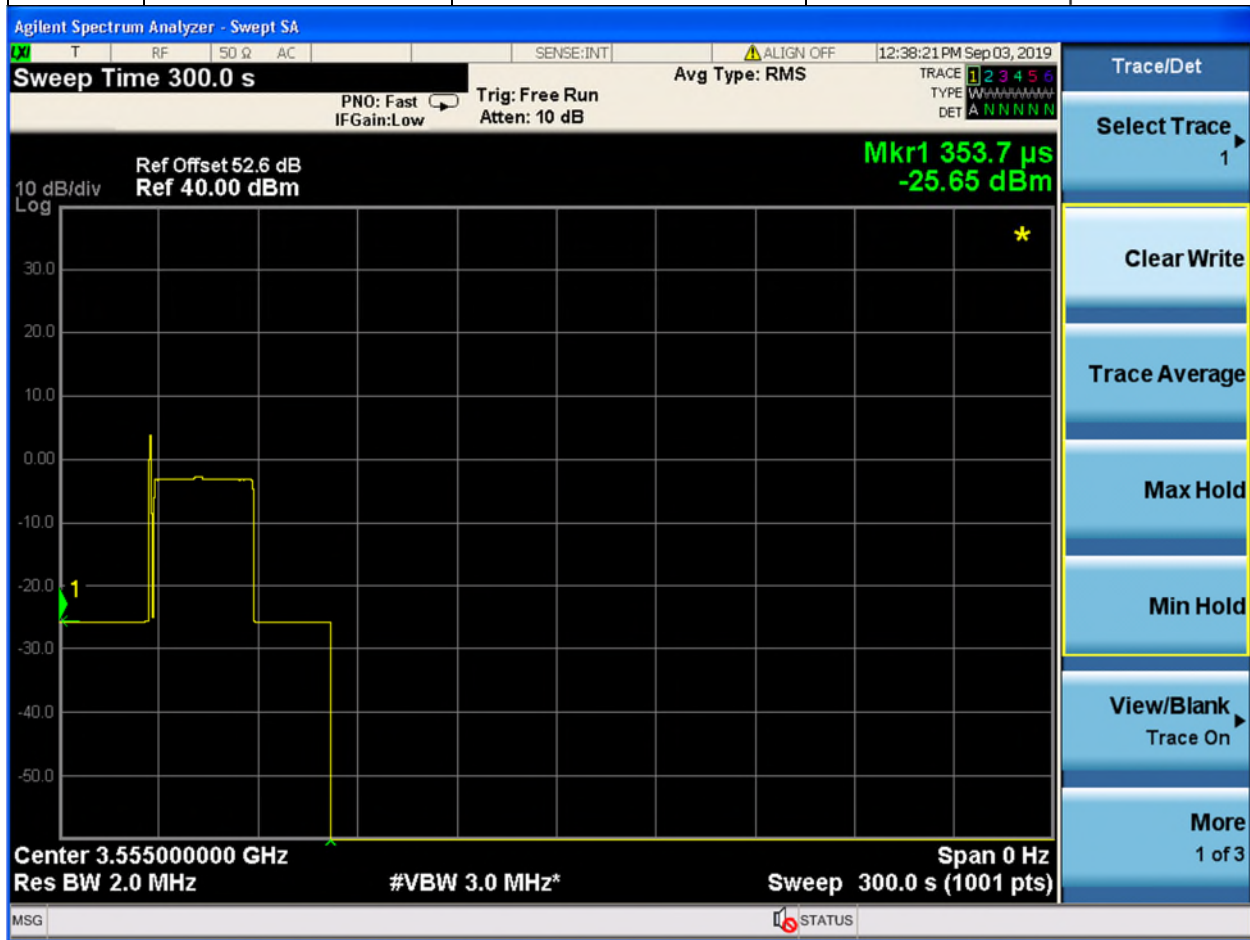
6.4.4.2.4	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501</li> </ul>	p
-----------	------------------	---	---	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

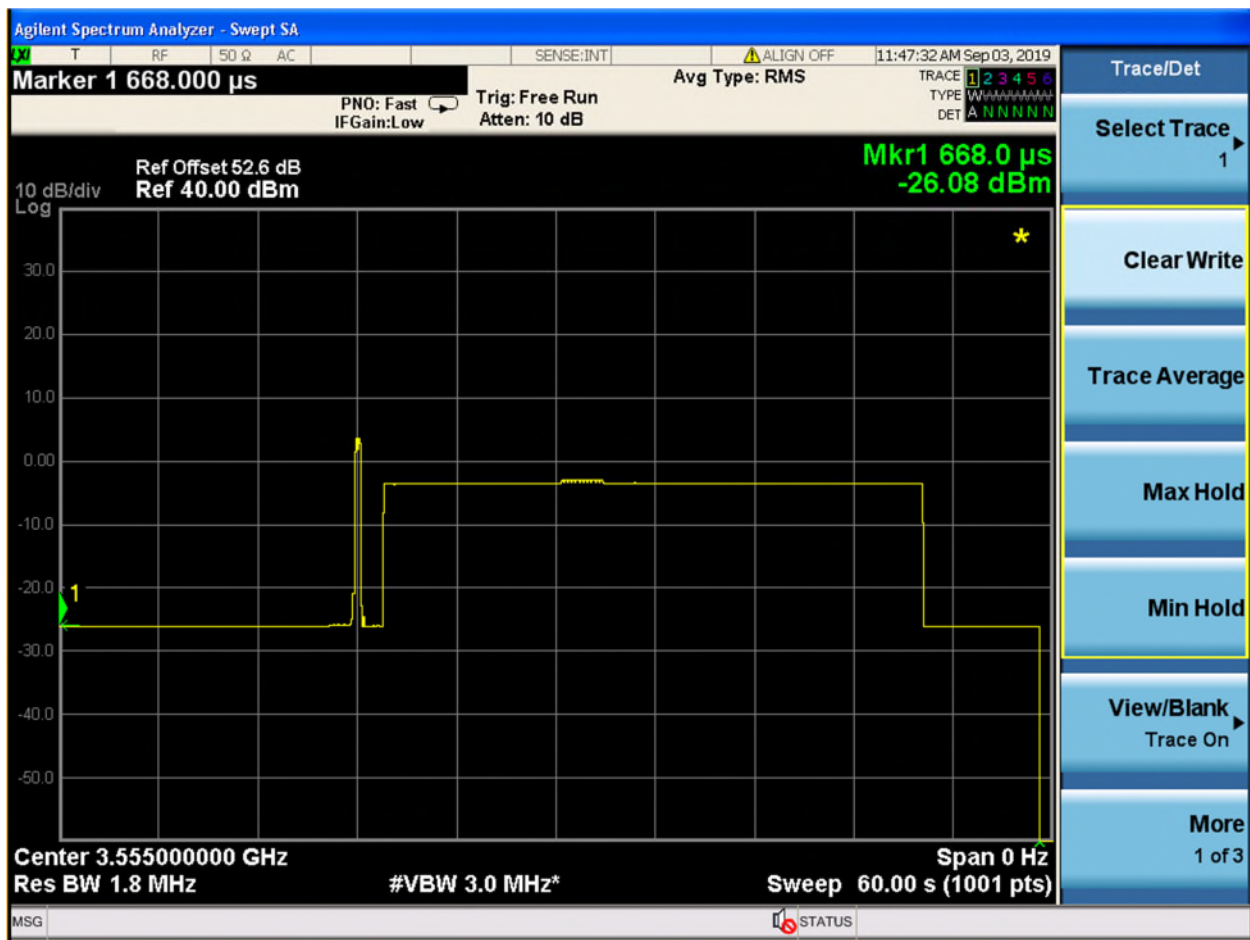
6.4.4.2.5	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM )	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502</li> </ul>	p
-----------	------------------	--	---	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

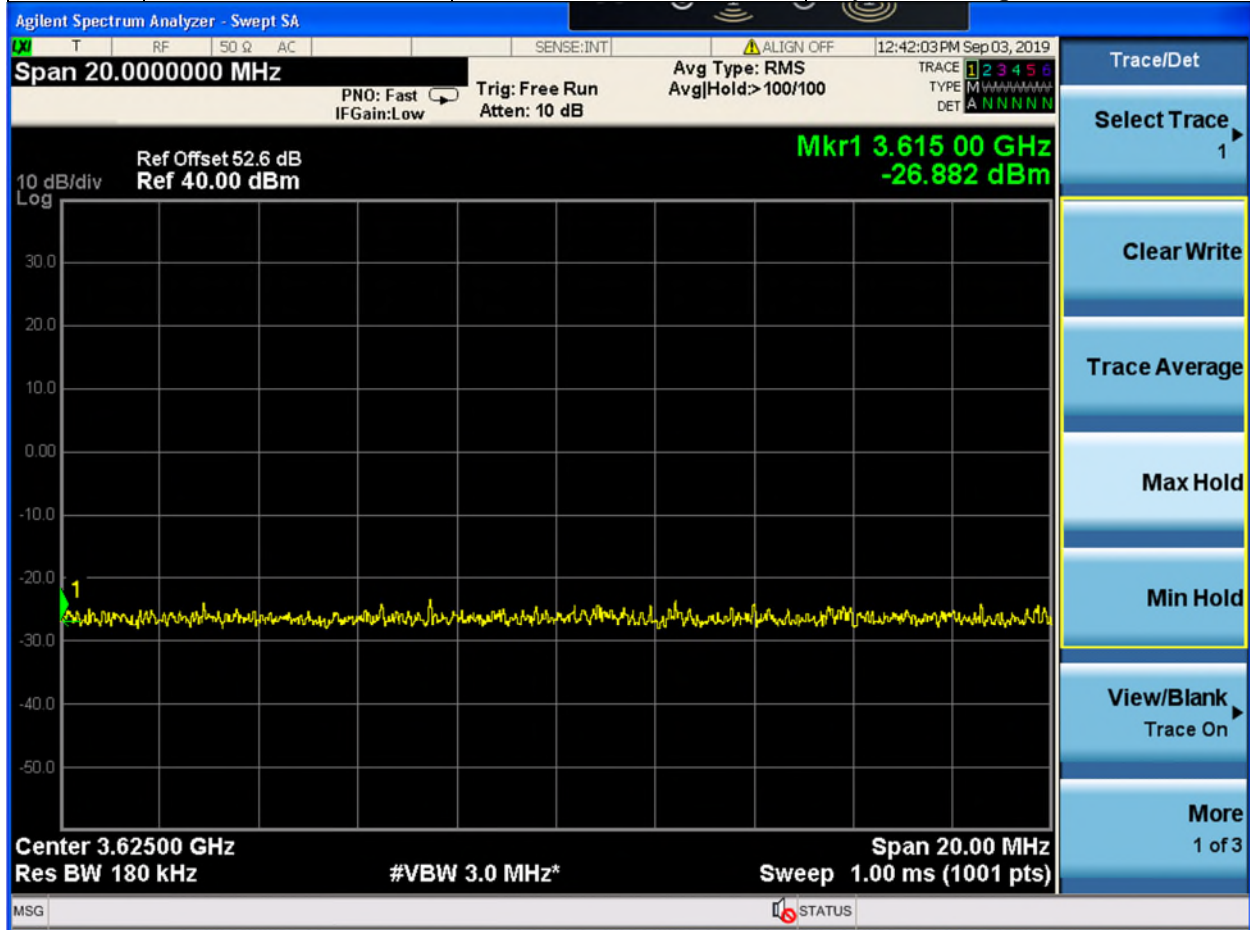
6.4.4.2.6	--	X	WINNF.FT.D.H BT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT)	Monitor RF transmission. CBSDs will have different behavior: <ul style="list-style-type: none"> <li>• CBSD1: will continue to transmit to end of test (this is not a pass/fail criteria, but check)</li> <li>• CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500</li> </ul>	P
-----------	----	---	----------------------	--	---	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.4.4.3.1	WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	Monitor RF from start of test to 60 seconds after last heartbeatResponse message was sent. CBSD should not transmit at any time during test	P
-----------	------------------	---	---	---



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.4.4.3.2	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Monitor RF transmission. Verify: <ul style="list-style-type: none"> <li>• CBSD must stop transmission within transmitExpireTime+60 seconds, where transmitExpireTime is from last successful heartbeatResponse message</li> </ul>	P
-----------	-------------------	--	---	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.5.4.2.2	WINNF.FT.D.MES.2	Domain Proxy Registration Response contains measReportConfig	No RF monitoring	P
-----------	------------------	---	------------------	---

Pass. "measreportconfig" in logs. All other requirements verified.



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	No RF monitoring	P
-----------	------------------	--	------------------	---

Pass. “measreportconfig” in logs. All other requirements verified.

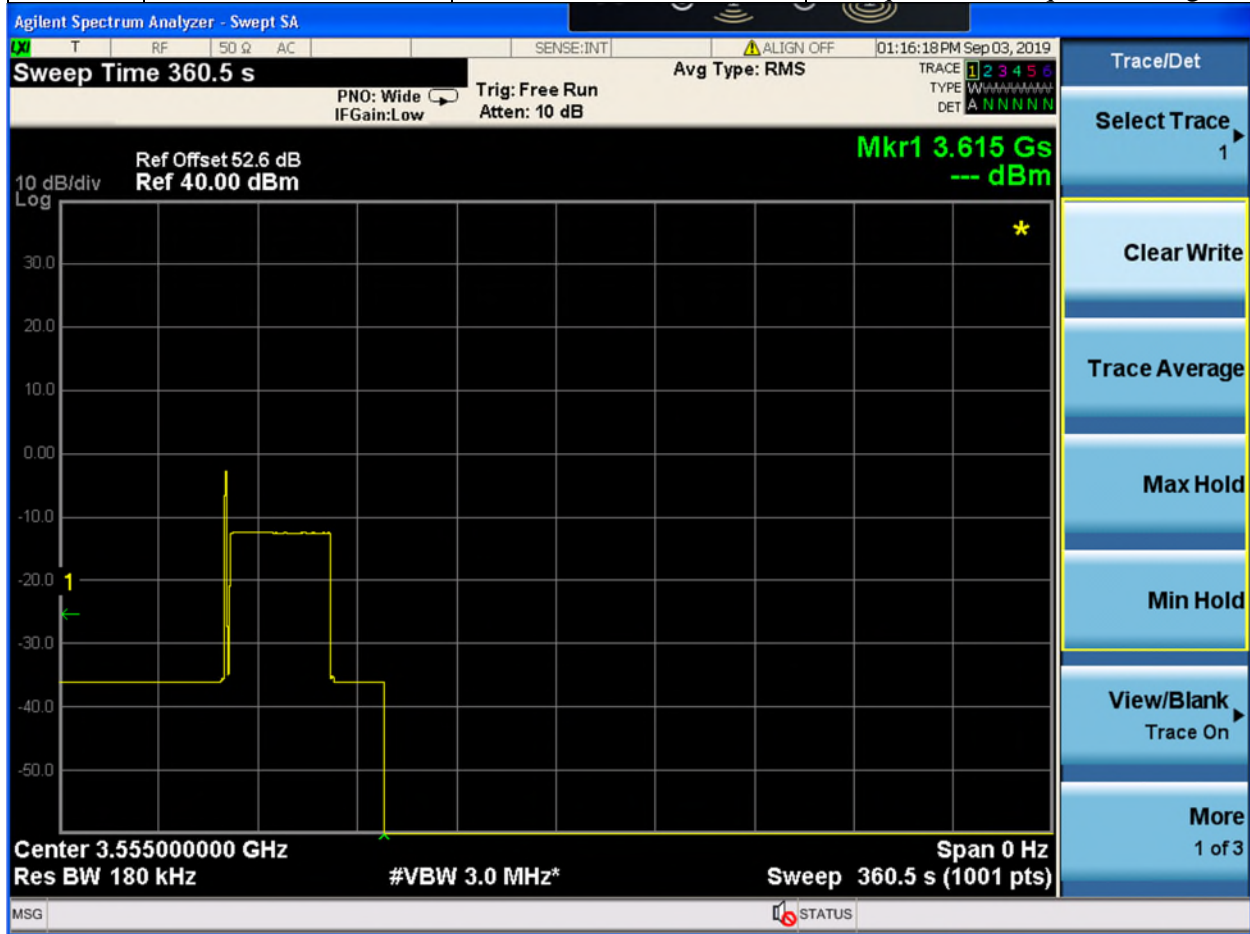
Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.5.4.2.5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	No RF monitoring	P
-----------	------------------	---	------------------	---

Pass. “measreportconfig” in logs. All other requirements verified.

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission at any time prior to sending the relinquishmentRequest message.</li> </ul>	P
-----------	------------------	--	--	---

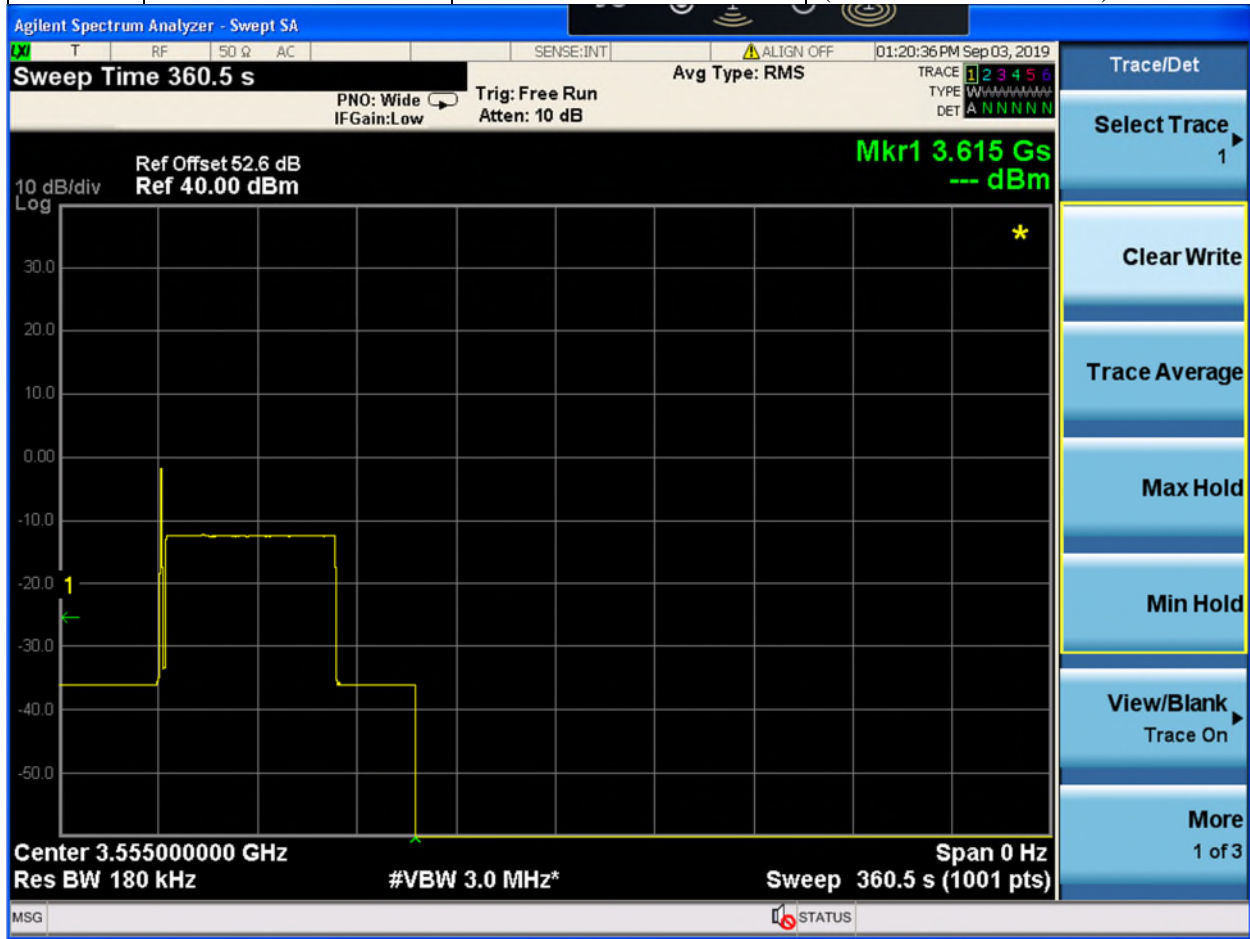


Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Shutdown time taken from Domain Proxy logs, and shutdown confirmed by RF monitoring.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.7.4.1.2	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> <li>• CBSD stops transmission at any time prior to sending the relinquishmentRequest message or deregistrationRequest message (whichever is sent first)</li> </ul>	P
-----------	------------------	--	--	---



Test Harness logs and timing on graph was verified, the EUT passed the requirement.

Shutdown time taken from Domain Proxy logs, and shutdown confirmed by RF monitoring.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

**Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS.**

7.1.4.1.1	X	X	WINNF.PT.C.H BT	UUT RF Transmit Power Measurement	Power Spectral Density test case.  Assume we use 1 carrier bandwidth (say, 5 or 10 MHz), one frequency (say middle channel in band) for test. Measure at max transmit power, and reduce in steps of 3 dB to minimum declared transmit power.	P
-----------	---	---	--------------------	--------------------------------------	--	---

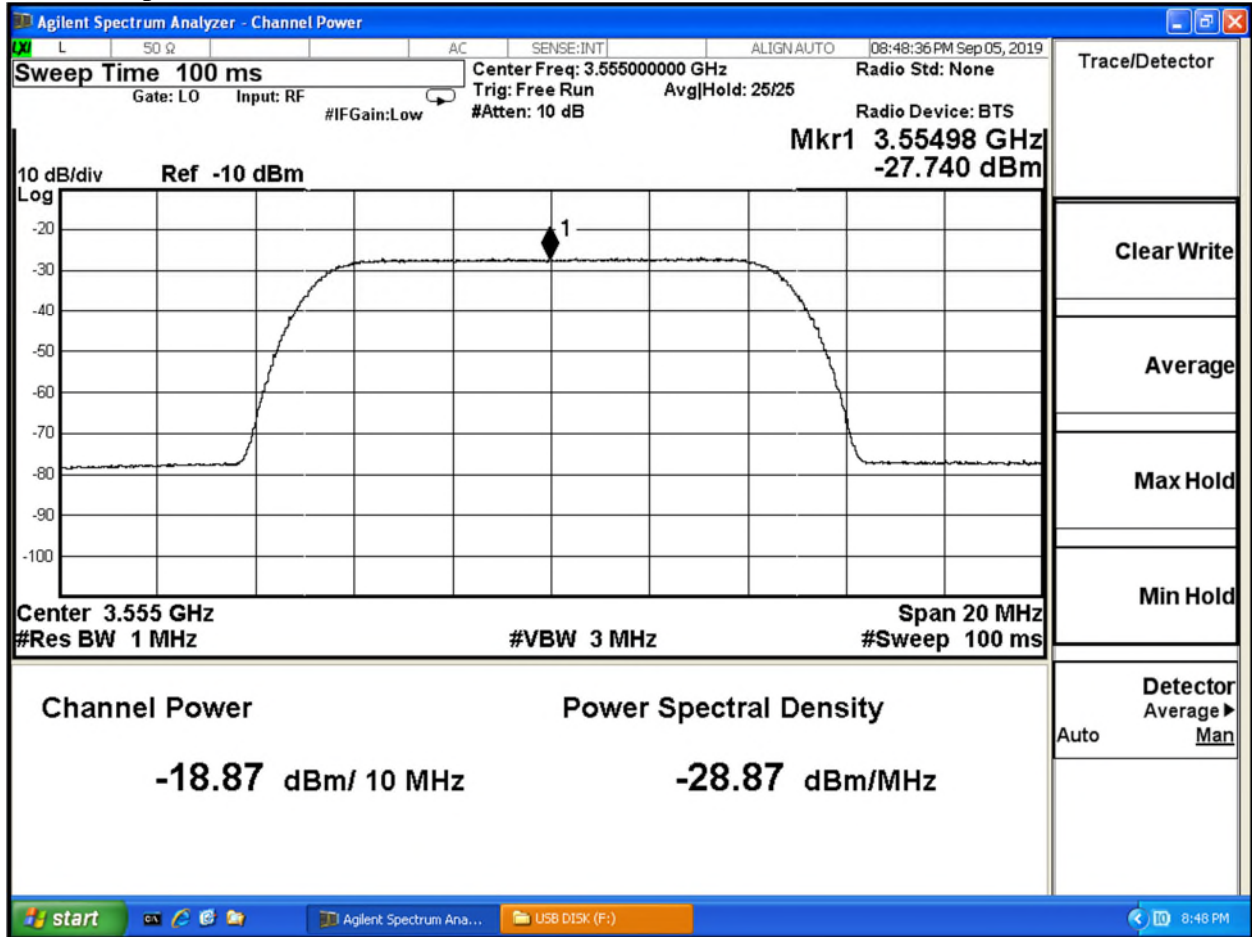
### Test Table

Freq	1MHz EIRP limit (target) dBm	Raw 10 MHz	Raw 1MHz	External Losses (dB)	Raw dBm/MHz	antenna gain dBi	ports	port gain (dB)	EIRP 1MHz dBm/MHz	EIRP 10 MHz dBm	margin dB
3555-Low	34	-18.9	-27.7	19.93	-7.77	22	64	18.0618	32.2918	41.0918	1.7082
3555-High	37	-15.87	-24.6	19.93	-4.67	22	64	18.0618	35.3918	44.1218	1.6082
3630-low	34	-17.91	-26.29	19.93	-6.36	22	64	18.0618	33.7018	42.0818	0.2982
3630-high	37	-14.93	-23.2	19.93	-3.27	22	64	18.0618	36.7918	45.0618	0.2082
3695-low	34	-17.33	-26.27	19.93	-6.34	22	64	18.0618	33.7218	42.6618	0.2782
3695-high	37	-14.31	-24.31	19.93	-4.38	22	64	18.0618	35.6818	45.6818	1.3182

Note: 3555 MHz and 3630 MHz were performed under max hold of average as worst case.

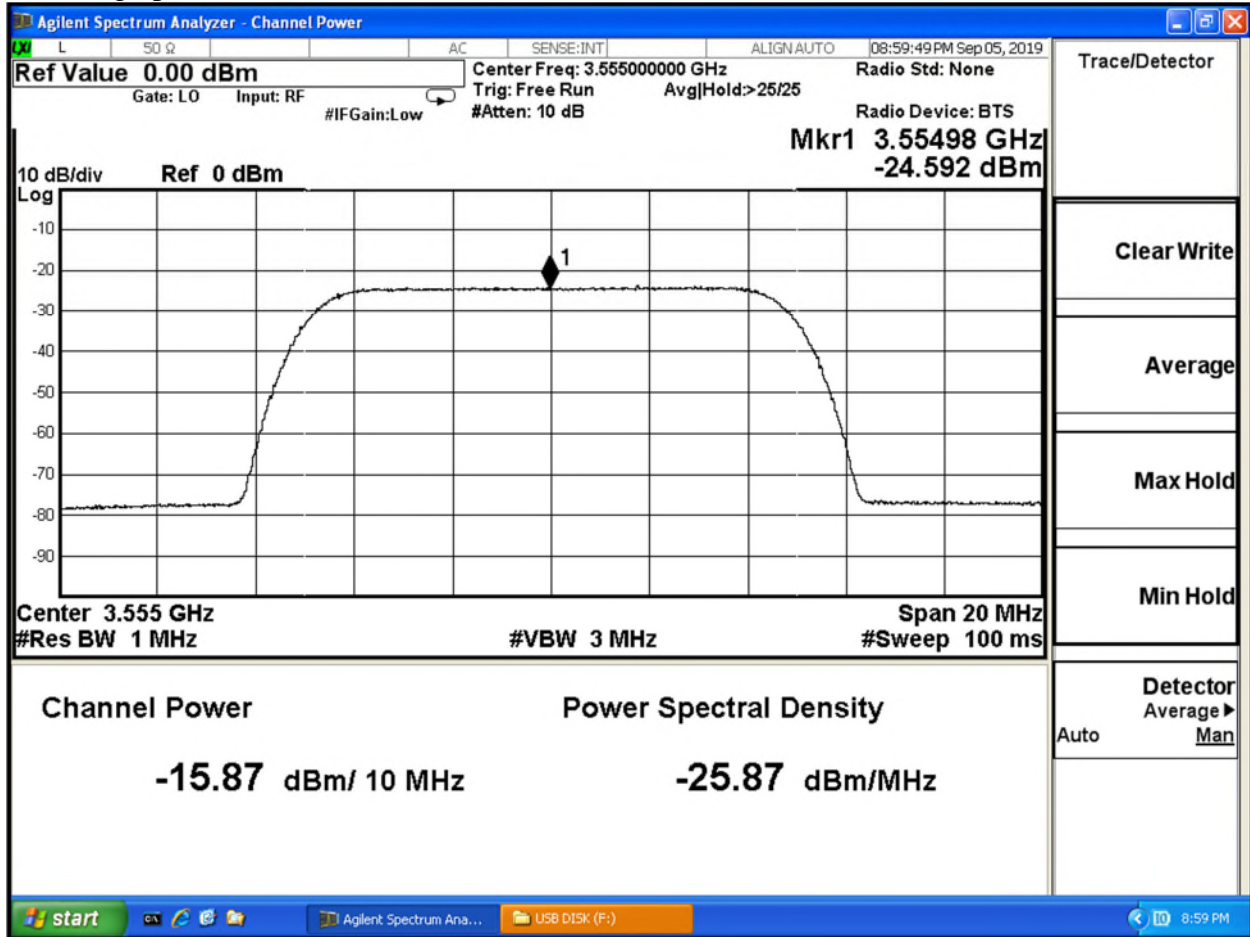
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555 low power



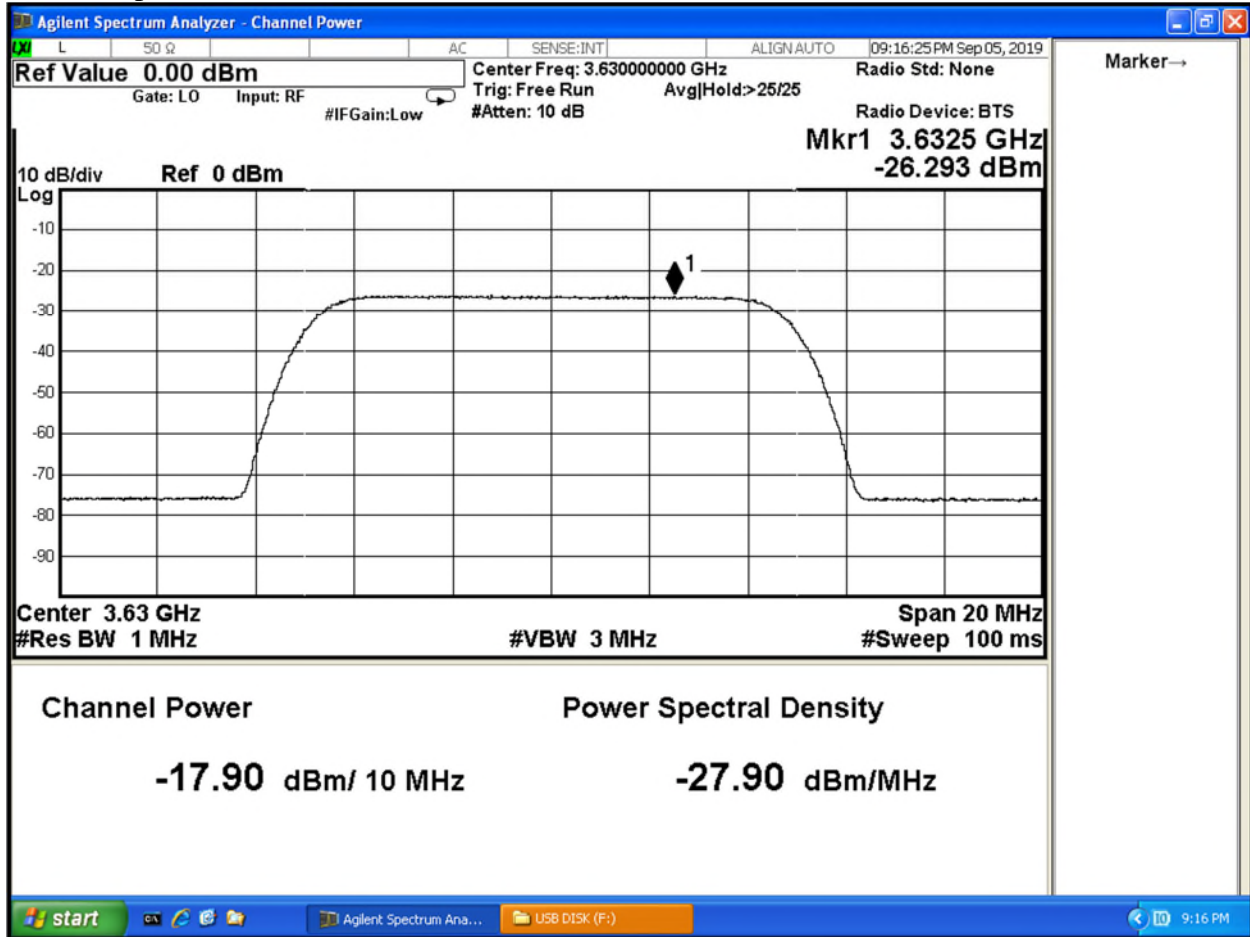
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555-High power



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

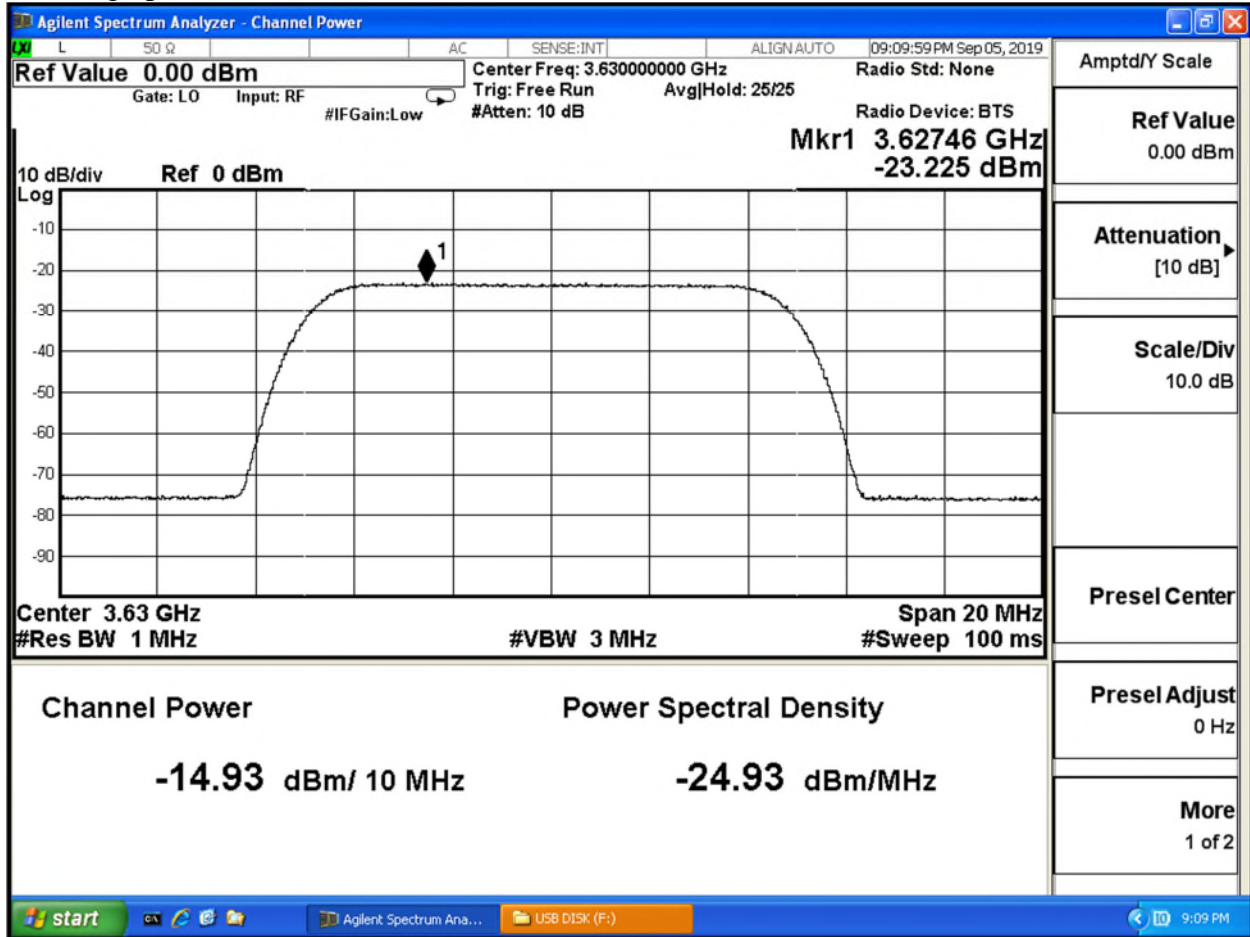
3630 low power





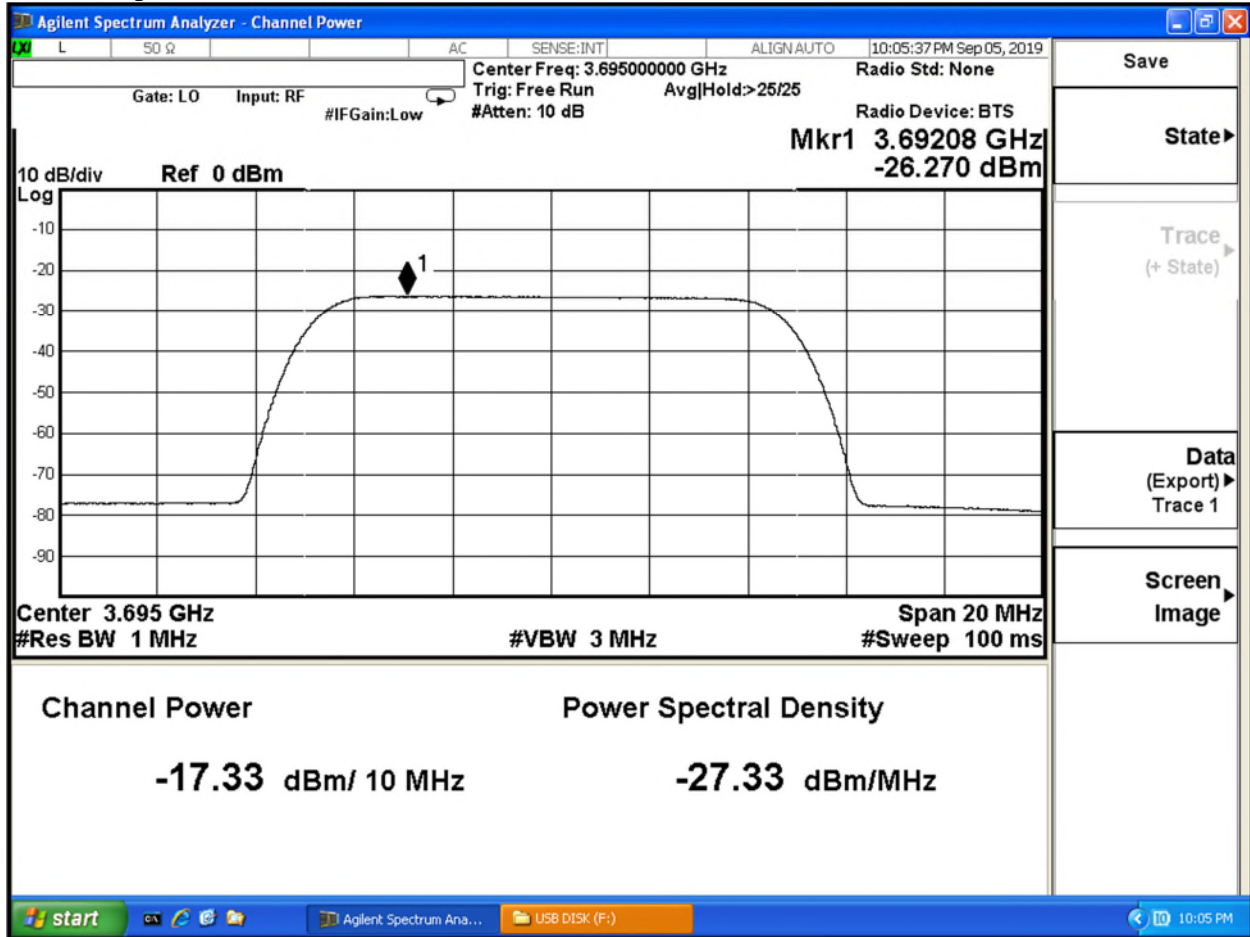
Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630-high power



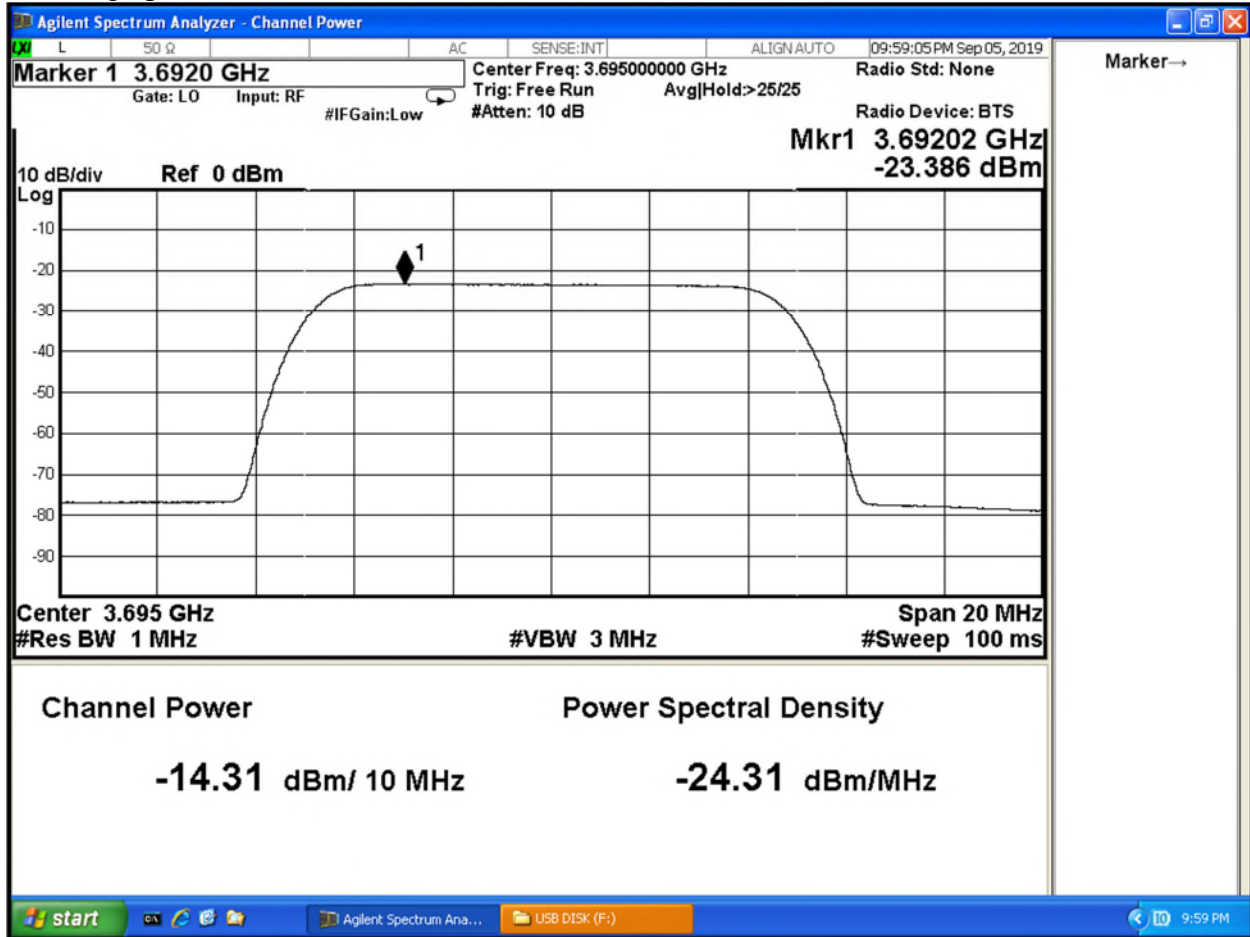
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3695 low power



Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3695-high power



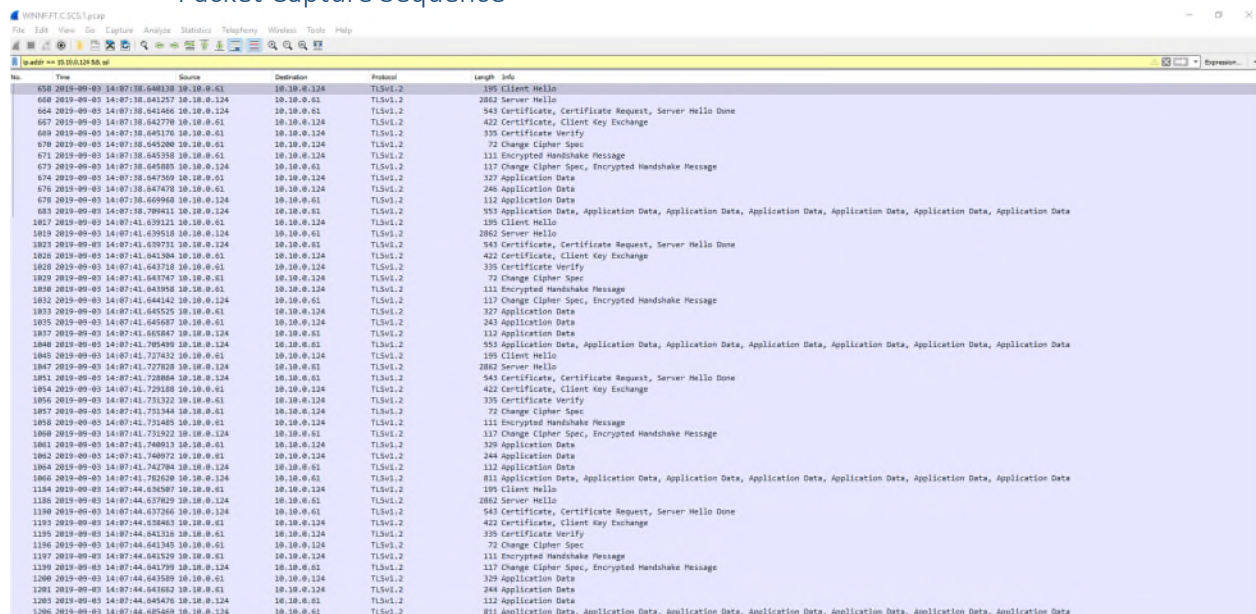
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## DOT CBRS Radio: WINNF / Security Test Case Analysis

### WINNF Security Test Case Analysis

#### WINNF.FT.C.SCS.1

#### Packet Capture Sequence



No.	Time	Source	Destination	Protocol	Length	Info
648	2019-09-03 14:07:38.648136	10.10.0.61	10.10.0.124	TLSv1.2	395	Client Hello
649	2019-09-03 14:07:38.641257	10.10.0.124	10.10.0.61	TLSv1.2	2862	Server Hello
654	2019-09-03 14:07:38.641466	10.10.0.124	10.10.0.61	TLSv1.2	543	Certificate, Certificate Request, Server Hello Done
667	2019-09-03 14:07:38.642776	10.10.0.61	10.10.0.124	TLSv1.2	422	Certificate, Client Key Exchange
669	2019-09-03 14:07:38.643176	10.10.0.61	10.10.0.124	TLSv1.2	339	Certificate Verify
679	2019-09-03 14:07:38.645200	10.10.0.61	10.10.0.124	TLSv1.2	72	Change Cipher Spec
671	2019-09-03 14:07:38.645350	10.10.0.61	10.10.0.124	TLSv1.2	111	Encrypted Handshake Message
673	2019-09-03 14:07:38.645803	10.10.0.124	10.10.0.61	TLSv1.2	117	Change Cipher Spec, Encrypted Handshake Message
674	2019-09-03 14:07:38.647369	10.10.0.61	10.10.0.124	TLSv1.2	327	Application Data
676	2019-09-03 14:07:38.647470	10.10.0.61	10.10.0.124	TLSv1.2	246	Application Data
678	2019-09-03 14:07:38.650990	10.10.0.124	10.10.0.61	TLSv1.2	112	Application Data
683	2019-09-03 14:07:38.789421	10.10.0.124	10.10.0.61	TLSv1.2	553	Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data
1017	2019-09-03 14:07:41.639321	10.10.0.61	10.10.0.124	TLSv1.2	195	Client Hello
1019	2019-09-03 14:07:41.639510	10.10.0.124	10.10.0.61	TLSv1.2	2862	Server Hello
1023	2019-09-03 14:07:41.639710	10.10.0.124	10.10.0.61	TLSv1.2	543	Certificate, Certificate Request, Server Hello Done
1026	2019-09-03 14:07:41.641304	10.10.0.61	10.10.0.124	TLSv1.2	422	Certificate, Client Key Exchange
1028	2019-09-03 14:07:41.641710	10.10.0.61	10.10.0.124	TLSv1.2	339	Certificate Verify
1029	2019-09-03 14:07:41.641740	10.10.0.61	10.10.0.124	TLSv1.2	72	Change Cipher Spec
1030	2019-09-03 14:07:41.641958	10.10.0.61	10.10.0.124	TLSv1.2	111	Encrypted Handshake Message
1032	2019-09-03 14:07:41.644142	10.10.0.124	10.10.0.61	TLSv1.2	117	Change Cipher Spec, Encrypted Handshake Message
1033	2019-09-03 14:07:41.645220	10.10.0.124	10.10.0.61	TLSv1.2	327	Application Data
1035	2019-09-03 14:07:41.645607	10.10.0.61	10.10.0.124	TLSv1.2	243	Application Data
1037	2019-09-03 14:07:41.645847	10.10.0.124	10.10.0.61	TLSv1.2	112	Application Data
1040	2019-09-03 14:07:41.706490	10.10.0.124	10.10.0.61	TLSv1.2	553	Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data
1043	2019-09-03 14:07:41.737432	10.10.0.61	10.10.0.124	TLSv1.2	195	Client Hello
1047	2019-09-03 14:07:41.777028	10.10.0.124	10.10.0.61	TLSv1.2	2862	Server Hello
1051	2019-09-03 14:07:41.778864	10.10.0.124	10.10.0.61	TLSv1.2	543	Certificate, Certificate Request, Server Hello Done
1054	2019-09-03 14:07:41.779160	10.10.0.61	10.10.0.124	TLSv1.2	422	Certificate, Client Key Exchange
1056	2019-09-03 14:07:41.781322	10.10.0.61	10.10.0.124	TLSv1.2	339	Certificate Verify
1057	2019-09-03 14:07:41.791344	10.10.0.61	10.10.0.124	TLSv1.2	72	Change Cipher Spec
1058	2019-09-03 14:07:41.791480	10.10.0.61	10.10.0.124	TLSv1.2	111	Encrypted Handshake Message
1060	2019-09-03 14:07:41.791922	10.10.0.124	10.10.0.61	TLSv1.2	117	Change Cipher Spec, Encrypted Handshake Message
1061	2019-09-03 14:07:41.740913	10.10.0.61	10.10.0.124	TLSv1.2	329	Application Data
1062	2019-09-03 14:07:41.740970	10.10.0.61	10.10.0.124	TLSv1.2	244	Application Data
1064	2019-09-03 14:07:41.742794	10.10.0.124	10.10.0.61	TLSv1.2	112	Application Data
1066	2019-09-03 14:07:41.762626	10.10.0.61	10.10.0.124	TLSv1.2	811	Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data
1184	2019-09-03 14:07:44.636307	10.10.0.61	10.10.0.124	TLSv1.2	195	Client Hello
1186	2019-09-03 14:07:44.637020	10.10.0.124	10.10.0.61	TLSv1.2	2862	Server Hello
1190	2019-09-03 14:07:44.637264	10.10.0.124	10.10.0.61	TLSv1.2	543	Certificate, Certificate Request, Server Hello Done
1193	2019-09-03 14:07:44.638463	10.10.0.61	10.10.0.124	TLSv1.2	422	Certificate, Client Key Exchange
1195	2019-09-03 14:07:44.640330	10.10.0.61	10.10.0.124	TLSv1.2	339	Certificate Verify
1196	2019-09-03 14:07:44.641345	10.10.0.61	10.10.0.124	TLSv1.2	72	Change Cipher Spec
1197	2019-09-03 14:07:44.641520	10.10.0.61	10.10.0.124	TLSv1.2	111	Encrypted Handshake Message
1199	2019-09-03 14:07:44.641790	10.10.0.124	10.10.0.61	TLSv1.2	117	Change Cipher Spec, Encrypted Handshake Message
1200	2019-09-03 14:07:44.643508	10.10.0.61	10.10.0.124	TLSv1.2	329	Application Data
1201	2019-09-03 14:07:44.643882	10.10.0.61	10.10.0.124	TLSv1.2	244	Application Data
1203	2019-09-03 14:07:44.645476	10.10.0.124	10.10.0.61	TLSv1.2	112	Application Data
1206	2019-09-03 14:07:44.646460	10.10.0.124	10.10.0.61	TLSv1.2	811	Application Data, Application Data, Application Data, Application Data, Application Data, Application Data, Application Data

© TÜV SÜD Canada Inc. This test report shall not be reproduced except in full, without written approval of TÜV SÜD Canada Inc.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

WINNF test requirements:

WINNF test requirements from WINNF-TS-0122-V1.0.0 CBRS CBSD Test Specification:

2	<ul style="list-style-type: none"> <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, <ul style="list-style-type: none"> <li>• TLS_RSA_WITH_AES_128_GCM_SHA256</li> <li>• TLS_RSA_WITH_AES_256_GCM_SHA384</li> <li>• TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256</li> <li>• TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384</li> <li>• TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256</li> </ul> </li> </ul>	PASS
---	--	------

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Analysis of WINNF Test Requirements

### 1. From Client Hello: TLS version = TLS 1.2

```

> Frame 658: 195 bytes on wire (1560 bits), 195 bytes captured (1560 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55482, Dst Port: 5000, Seq: 1, Ack: 1, Len: 129
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 124
  ▼ Handshake Protocol: Client Hello
    Handshake Type: Client Hello (1)
    Length: 120
    Version: TLS 1.2 (0x0303)
    > Random: 5d6e73aaa319bed5672f75f9f4ac9b12db5d59130b44f1cc...
    Session ID Length: 0
    Cipher Suites Length: 6
  ▼ Cipher Suites (3 suites)
    Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
    Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
    Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
    Compression Methods Length: 1
  > Compression Methods (1 method)
    Extensions Length: 73
  > Extension: supported_groups (len=22)
  > Extension: ec_point_formats (len=2)
  > Extension: signature_algorithms (len=28)
  > Extension: extended_master_secret (len=0)
  > Extension: renegotiation_info (len=1)

```

### 2. Cipher suite list from Client Hello is from WINNF approved list:

```

TLS_RSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

```

### 3. Cipher suite chosen (from Server Hello):

```

TLS_RSA_WITH_AES_128_GCM_SHA256

```

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 660: 2862 bytes on wire (22896 bits), 2862 bytes captured (22896 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55482, Seq: 1, Ack: 130, Len: 2796
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 81
    ✓ Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 77
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e73b5267853f94c269c3818f0a575ac5d562d15e544eb...
      Session ID Length: 32
      Session ID: 22698059d7a584ee0cd7b1905af413c1fa4241c12a49862c...
      Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
      Compression Method: null (0)
      Extensions Length: 5
      > Extension: renegotiation_info (len=1)

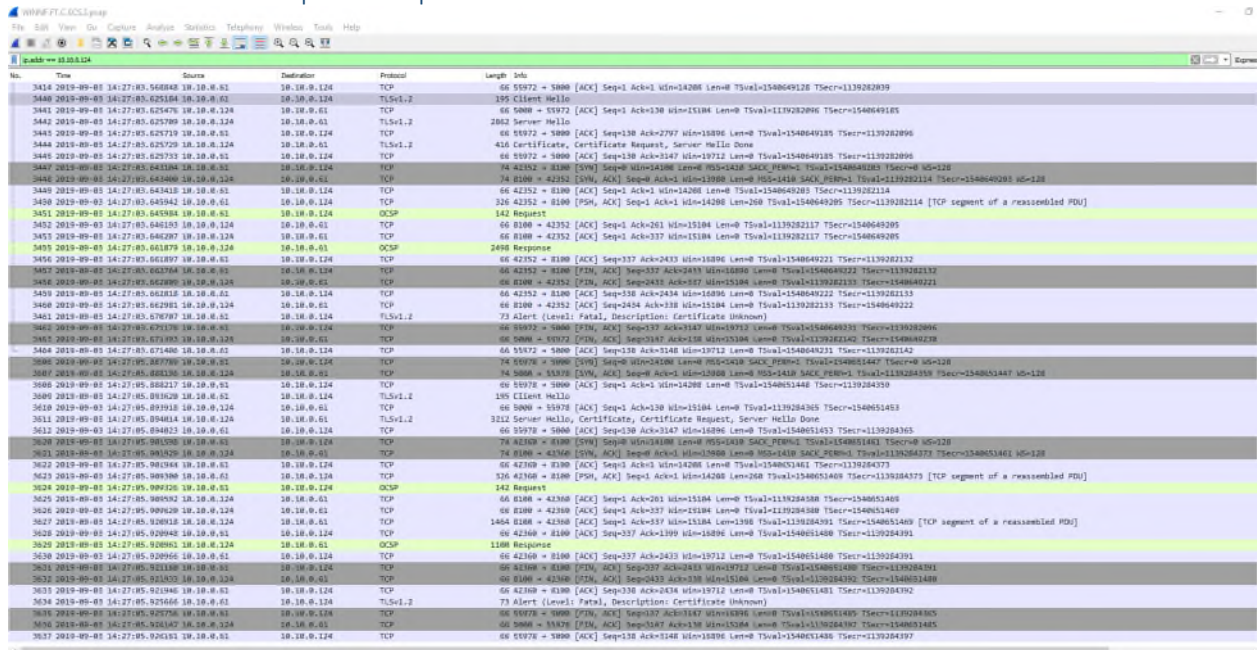
```

4. The Registration request message arrived at the Test Harness, so authentication was completed.

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	<b>FCC Part 96 SAS requirements (CBRS Test Plan)</b>	

## WINNF.FT.C.SCS.2

### Packet Capture Sequence



The screenshot shows a packet capture sequence in Wireshark. The interface includes a menu bar, toolbar, and a packet list pane. The packet list pane shows the following entries:

No.	Time	Source	Destination	Protocol	Length	Info
3414	2019-09-05 14:27:03.568408	192.168.1.124	192.168.1.124	TLSv1.2	66	59372 > 5900 [ACK] Seq=1 Acks=130 Len=0 TSV=1540649128 TSecr=1139282899
3415	2019-09-05 14:27:03.625164	192.168.1.124	192.168.1.124	TLSv1.2	195	Client Hello
3416	2019-09-05 14:27:03.625676	192.168.1.124	192.168.1.124	TCP	66	5900 > 59372 [ACK] Seq=1 Acks=130 Len=0 TSV=1540649128 TSecr=1139282899
3442	2019-09-05 14:27:03.625709	192.168.1.124	192.168.1.124	TLSv1.2	2052	Server Hello
3443	2019-09-05 14:27:03.625719	192.168.1.124	192.168.1.124	TCP	66	59372 > 5900 [ACK] Seq=138 Acks=2797 Len=0 TSV=1540649128 TSecr=1139282899
3444	2019-09-05 14:27:03.625729	192.168.1.124	192.168.1.124	TLSv1.2	416	Certificate, Certificate Request, Server Hello Done
3445	2019-09-05 14:27:03.625733	192.168.1.124	192.168.1.124	TCP	66	59372 > 5900 [ACK] Seq=138 Acks=2797 Len=0 TSV=1540649128 TSecr=1139282899

### WINNF Test Requirements:

WINNF test requirements from WINNF-TS-0122-V1.0.0 CBRS CBDT Test Specification:

2	<ul style="list-style-type: none"> <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 OSCP to verify the validity of the server certificate.</li> <li>• Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness.</li> </ul>	PASS
---	--	------

### Analysis of WINNF Test Requirements

1. From Client Hello can read: TLS version = TLS 1.2



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 3440: 195 bytes on wire (1560 bits), 195 bytes captured (1560 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55972, Dst Port: 5000, Seq: 1, Ack: 1, Len: 129
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 124
    ✓ Handshake Protocol: Client Hello
      Handshake Type: Client Hello (1)
      Length: 120
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e7837c5e3315b08e80a896946254509886b3c5b562820...
      Session ID Length: 0
      Cipher Suites Length: 6
      ✓ Cipher Suites (3 suites)
        Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
        Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
        Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
      Compression Methods Length: 1
      > Compression Methods (1 method)
      Extensions Length: 73
      > Extension: supported_groups (len=22)
      > Extension: ec_point_formats (len=2)
      > Extension: signature_algorithms (len=28)
      > Extension: extended_master_secret (len=0)
      > Extension: renegotiation_info (len=1)

```

- From Client Hello, cipher suite list is from WINNF approved list:

```

TLS_RSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

```

- From Server Hello, cipher suite chosen:  
 TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 3442: 2862 bytes on wire (22896 bits), 2862 bytes captured (22896 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55972, Seq: 1, Ack: 130, Len: 2796
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 81
    ▼ Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 77
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e7842d84d8cbfc7078fe9e913fcf7eb0fe3354f54f192...
      Session ID Length: 32
      Session ID: e50dd1e43d8d5028f12ae61800ad52ffd4fe63dce8630ea5...
      Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
      Compression Method: null (0)
      Extensions Length: 5
      > Extension: renegotiation_info (len=1)

```

#### 4. Read OSCP Request/Response to/from server:

```

> Frame 3451: 142 bytes on wire (1136 bits), 142 bytes captured (1136 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 42352, Dst Port: 8100, Seq: 261, Ack: 1, Len: 76
> [2 Reassembled TCP Segments (336 bytes): #3450(260), #3451(76)]
> Hypertext Transfer Protocol
▼ Online Certificate Status Protocol
  ▼ tbsRequest
    ▼ requestList: 1 item
      ▼ Request
        ▼ reqCert
          ▼ hashAlgorithm (SHA-1)
            Algorithm Id: 1.3.14.3.2.26 (SHA-1)
            issuerNameHash: 5368d21d2529427538588c5ccb4c4e6f3b96641
            issuerKeyHash: 5b63d7bb6e95ca42c49450451b47e5cd6ee1fdb4
            serialNumber: 18248749012425898463

```

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 3455: 2498 bytes on wire (19984 bits), 2498 bytes captured (19984 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 8100, Dst Port: 42352, Seq: 1, Ack: 337, Len: 2432
> Hypertext Transfer Protocol
> Online Certificate Status Protocol
  responseStatus: successful (0)
  responseBytes
    responseType: 1.3.6.1.5.5.7.40.1.1 (id-pkix-ocsp-basic)
    basicOCSPResponse
      tbsResponseData
        responderID: byName (1)
        producedAt: 2019-09-03 14:27:14 (UTC)
        responses: 1 item
          singleResponse
            certID
              hashAlgorithm (SHA-1)
                algorithmId: 1.3.14.3.2.26 (SHA-1)
                issuerNameHash: 5368d21d2529427538588c5c3ba4c4e6f3b96641
                issuerKeyHash: 5b63d7bb6e95ca42c49450451b47e5cd6ee1fdb4
                serialNumber: 18240749012425098463
              certStatus: revoked (1)
                revoked
                  revocationTime: 2019-09-02 13:59:41 (UTC)
                  thisUpdate: 2019-09-03 14:27:14 (UTC)
            signatureAlgorithm (sha1WithRSAEncryption)
              algorithmId: 1.2.840.113549.1.1.5 (sha1WithRSAEncryption)
              padding: 0
              signature: 906f60430a1260eb9d7e21cf2049042f94c7f6ee489ad67...
          certs: 1 item
            certificate (id-at-commonName=SAS.OCSF.EXAMPLE,id-at-organizationalUnitName=WINNForum SAS OCSF Responder Cert1,id-at-organizationName=Test Lab for FCC PART 96,id-at-countryName=US)
              signedCertificate
                algorithmIdentifier (sha256WithRSAEncryption)
                  padding: 0
                  encrypted: 88a547c487789b3ad084c353a8cc7d0ff2c507626c62494b...

```


5. Authentication exchange ends with TLS Alert message (i.e. authentication fails):

```

> Frame 3461: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55972, Dst Port: 5000, Seq: 130, Ack: 3147, Len: 7
> Transport Layer Security
  TLV1.2 Record Layer: Alert (Level: Fatal, Description: Certificate Unknown)
    Content Type: Alert (21)
    Version: TLS 1.2 (0x0303)
    Length: 2
  Alert Message
    Level: Fatal (2)
    Description: Certificate Unknown (46)

```

6. Registration request message is not received at Test Harness (authentication fails)

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## WINNF.FT.C.SCS.3

### Packet Capture Sequence

No.	Time	Source	Destination	Protocol	Length	Info
896	2019-09-03 14:11:24.63524	10.10.0.61	10.10.0.124	TCP	74	55508 → 5000 [SYN] Seq=0 Win=14200 Len=0 MSS=1460 SACK_PERM=1 TSval=1539772195 TSecr=0 Win=128
897	2019-09-03 14:11:24.637957	10.10.0.124	10.10.0.61	TCP	74	5000 → 55508 [RST] Seq=14200 Len=0 MSS=1460 SACK_PERM=1 TSval=1539772195 TSecr=1539772195 Win=128
898	2019-09-03 14:11:24.637957	10.10.0.61	10.10.0.124	TLSv1.2	195	Client Hello
899	2019-09-03 14:11:24.637957	10.10.0.124	10.10.0.61	TCP	66	5000 → 55508 [ACK] Seq=18 Ack=130 Win=15104 Len=0 TSval=1539772195 TSecr=1539772195
900	2019-09-03 14:11:24.637957	10.10.0.61	10.10.0.124	TLSv1.2	323	Server Hello, Certificate, Certificate Request, Server Hello Done
901	2019-09-03 14:11:24.640499	10.10.0.61	10.10.0.124	TLSv1.2	73	Alert (Level: Fatal, Description: Certificate Unknown)
902	2019-09-03 14:11:24.640499	10.10.0.124	10.10.0.61	TCP	66	55508 → 5000 [FIN, ACK] Seq=14200 Ack=130 Win=14200 Len=0 TSval=1539772195 TSecr=1539772195
903	2019-09-03 14:11:24.641061	10.10.0.124	10.10.0.61	TCP	66	5000 → 55508 [FIN, ACK] Seq=14200 Ack=130 Win=14200 Len=0 TSval=1539772195 TSecr=1539772195
904	2019-09-03 14:11:24.641071	10.10.0.61	10.10.0.124	TCP	66	55508 → 5000 [ACK] Seq=138 Ack=149 Win=16896 Len=0 TSval=1539772195 TSecr=1539772195
905	2019-09-03 14:11:24.641130	10.10.0.124	10.10.0.61	TCP	66	5000 → 55508 [ACK] Seq=149 Ack=138 Win=15104 Len=0 TSval=1539772195 TSecr=1539772195
1006	2019-09-03 14:11:24.637957	10.10.0.124	10.10.0.61	TCP	74	55508 → 5000 [SYN] Seq=0 Win=14200 Len=0 MSS=1460 SACK_PERM=1 TSval=1539772195 TSecr=0 Win=128
1095	2019-09-03 14:11:24.634848	10.10.0.124	10.10.0.61	TCP	74	5000 → 55508 [SYN, ACK] Seq=0 Ack=130 Win=15104 Len=0 TSval=1539772195 TSecr=1539772195 Win=128
1097	2019-09-03 14:11:24.634852	10.10.0.61	10.10.0.124	TCP	66	55508 → 5000 [ACK] Seq=149 Ack=138 Win=16896 Len=0 TSval=1539772195 TSecr=1539772195
1098	2019-09-03 14:11:24.635461	10.10.0.61	10.10.0.124	TLSv1.2	195	Client Hello
1099	2019-09-03 14:11:24.635466	10.10.0.124	10.10.0.61	TCP	66	5000 → 55508 [ACK] Seq=18 Ack=130 Win=15104 Len=0 TSval=1539772195 TSecr=1539772195
1100	2019-09-03 14:11:24.635761	10.10.0.124	10.10.0.61	TLSv1.2	323	Server Hello, Certificate, Certificate Request, Server Hello Done
1267	2019-09-03 14:11:29.615865	10.10.0.61	10.10.0.124	TCP	66	55508 → 5000 [ACK] Seq=138 Ack=149 Win=16896 Len=0 TSval=1539772195 TSecr=1539772195
1268	2019-09-03 14:11:29.615941	10.10.0.124	10.10.0.61	UDP	79	8381 → 8381 Len=37
1269	2019-09-03 14:11:29.615941	10.10.0.124	10.10.0.61	UDP	196	8381 → 8381 Len=154

### WINNF Test Requirements:

WINNF test requirements from WINNF-TS-0122-V1.0.0 CBRS CBSD Test Specification:

2	<ul style="list-style-type: none"> <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 Test Harness.</li> </ul>	PASS
---	--	------

### Analysis of WINNF Test Requirements

1. From Client Hello can read: TLS version = TLS 1.2

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 893: 195 bytes on wire (1560 bits), 195 bytes captured (1560 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55560, Dst Port: 5000, Seq: 1, Ack: 1, Len: 129
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 124
    ▼ Handshake Protocol: Client Hello
      Handshake Type: Client Hello (1)
      Length: 120
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e74c8e3b9907c8bf1d8d3b2e41de44ff3d4d88a2df236...
      Session ID Length: 0
      Cipher Suites Length: 6
      ▼ Cipher Suites (3 suites)
        Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
        Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
        Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
      Compression Methods Length: 1
      > Compression Methods (1 method)
      Extensions Length: 73
      > Extension: supported_groups (len=22)
      > Extension: ec_point_formats (len=2)
      > Extension: signature_algorithms (len=28)
      > Extension: extended_master_secret (len=0)
      > Extension: renegotiation_info (len=1)

```

- From Client Hello, cipher suite list is from WINNF approved list:

```

TLS_RSA_WITH_AES_128_GCM_SHA25
TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

```

- From Server Hello, cipher suite chosen:  
 TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 895: 3213 bytes on wire (25704 bits), 3213 bytes captured (25704 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55560, Seq: 1, Ack: 130, Len: 3147
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 81
    ✓ Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 77
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e74d363b38c017e0456ec16e593567a70151d81f72696...
      Session ID Length: 32
      Session ID: 9736c983db797e9cedf3a8d3ff5cde8d50f9f0d983a75c99...
      Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
      Compression Method: null (0)
      Extensions Length: 5
      > Extension: renegotiation_info (len=1)
    > TLSv1.2 Record Layer: Handshake Protocol: Certificate
    > TLSv1.2 Record Layer: Handshake Protocol: Multiple Handshake Messages

```

4. Authentication exchange ends with TLS Alert message (i.e. authentication fails):

```

> Frame 897: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55560, Dst Port: 5000, Seq: 130, Ack: 3148, Len: 7
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Certificate Unknown)
    Content Type: Alert (21)
    Version: TLS 1.2 (0x0303)
    Length: 2
    ✓ Alert Message
      Level: Fatal (2)
      Description: Certificate Unknown (46)

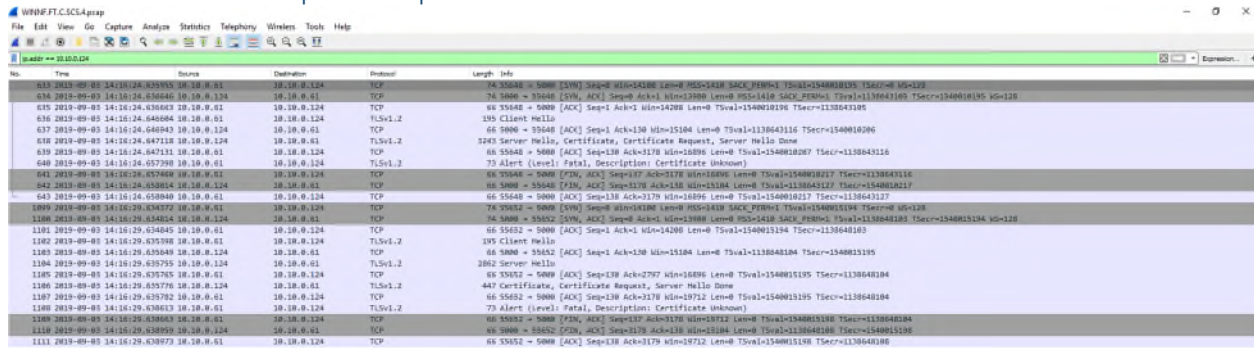
```

5. Registration request message is not received at Test Harness (authentication fails)

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	<b>FCC Part 96 SAS requirements (CBRS Test Plan)</b>	

## WINNF.TC.SCS.4

### Packet Capture Sequence



No.	Time	Source	Destination	Protocol	Length	Info
613	2019-09-03 14:16:24.935953	10.10.0.1	10.10.0.124	TCP	74	55648 → 5000 [SYN] Seq=0 Win=14288 Len=0 MSS=1440 SACK_PERM=1 TSval=154001135 TSecr=0 Win=138
616	2019-09-03 14:16:24.936045	10.10.0.124	10.10.0.1	TCP	74	5000 → 55648 [RST] Seq=0 Win=0 Len=0 RST=138641185 TSval=1138641185 TSecr=154001135 Win=138
615	2019-09-03 14:16:24.936063	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=1 Ack=1 HdrLen=5280 Len=0 TSval=154001135 TSecr=1138641185
616	2019-09-03 14:16:24.940684	10.10.0.1	10.10.0.124	TLSv1.2	195	Client Hello
617	2019-09-03 14:16:24.940943	10.10.0.124	10.10.0.1	TCP	66	5000 → 55648 [ACK] Seq=1 Ack=138 HdrLen=5184 Len=0 TSval=1138641116 TSecr=1540010206
618	2019-09-03 14:16:24.947118	10.10.0.124	10.10.0.1	TLSv1.2	2863	Server Hello, Certificate, Certificate Request, Server Hello Done
619	2019-09-03 14:16:24.947131	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=138 Ack=1378 HdrLen=1896 Len=0 TSval=1540012067 TSecr=1138643116
640	2019-09-03 14:16:24.957390	10.10.0.1	10.10.0.124	TLSv1.2	73	Alert (level: Fatal, Description: Certificate Unknown)
642	2019-09-03 14:16:24.957460	10.10.0.124	10.10.0.124	TCP	66	55648 → 5000 [RST] Seq=0 Win=0 Len=0 RST=138641185 TSval=1138641185 TSecr=154001135 Win=138
642	2019-09-03 14:16:24.958014	10.10.0.124	10.10.0.1	TCP	66	5000 → 55648 [FIN, ACK] Seq=138 Ack=138 HdrLen=5184 Len=0 TSval=1138641127 TSecr=1540012017
643	2019-09-03 14:16:24.958040	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=138 Ack=1378 HdrLen=1896 Len=0 TSval=1540010217 TSecr=1138643127
1009	2019-09-03 14:16:29.938772	10.10.0.1	10.10.0.124	TCP	74	55648 → 5000 [SYN] Seq=0 Win=14288 Len=0 MSS=1440 SACK_PERM=1 TSval=154001134 TSecr=0 Win=138
1100	2019-09-03 14:16:29.938814	10.10.0.124	10.10.0.1	TCP	66	5000 → 55648 [RST] Seq=0 Win=0 Len=0 RST=138641185 TSval=1138641185 TSecr=154001134 Win=138
1101	2019-09-03 14:16:29.938845	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=1 Ack=1 HdrLen=5280 Len=0 TSval=154001134 TSecr=1138641185
1102	2019-09-03 14:16:29.939300	10.10.0.1	10.10.0.124	TLSv1.2	195	Client Hello
1103	2019-09-03 14:16:29.939404	10.10.0.124	10.10.0.1	TCP	66	5000 → 55648 [ACK] Seq=1 Ack=138 HdrLen=5184 Len=0 TSval=1138641184 TSecr=1540011335
1104	2019-09-03 14:16:29.939755	10.10.0.124	10.10.0.1	TLSv1.2	2862	Server Hello
1105	2019-09-03 14:16:29.939765	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=138 Ack=2797 HdrLen=1896 Len=0 TSval=1540011335 TSecr=1138641184
1106	2019-09-03 14:16:29.939776	10.10.0.124	10.10.0.1	TLSv1.2	443	Certificate, Certificate Request, Server Hello Done
1107	2019-09-03 14:16:29.939782	10.10.0.1	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=138 Ack=1378 HdrLen=1912 Len=0 TSval=1540011335 TSecr=1138641184
1108	2019-09-03 14:16:29.939813	10.10.0.1	10.10.0.124	TLSv1.2	73	Alert (level: Fatal, Description: Certificate Unknown)
1109	2019-09-03 14:16:29.939855	10.10.0.124	10.10.0.1	TCP	66	55648 → 5000 [RST] Seq=0 Win=0 Len=0 RST=138641185 TSval=1138641185 TSecr=1540011335 Win=138
1110	2019-09-03 14:16:29.939919	10.10.0.124	10.10.0.1	TCP	66	5000 → 55648 [FIN, ACK] Seq=138 Ack=138 HdrLen=5184 Len=0 TSval=1138641184 TSecr=1540011335
1111	2019-09-03 14:16:29.939973	10.10.0.124	10.10.0.124	TCP	66	55648 → 5000 [ACK] Seq=138 Ack=1378 HdrLen=1872 Len=0 TSval=1540011335 TSecr=1138641184

### WINNF Test Requirements:

WINNF test requirements from WINNF-TS-0122-V1.0.0 CBRS CBSD Test Specification:

2	<ul style="list-style-type: none"> <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 Test Harness.</li> </ul>	PASS
---	---	------

### Analysis of WINNF Test Requirements

- From Client Hello can read: TLS version = TLS 1.2

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 636: 195 bytes on wire (1560 bits), 195 bytes captured (1560 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55648, Dst Port: 5000, Seq: 1, Ack: 1, Len: 129
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 124
    ▼ Handshake Protocol: Client Hello
      Handshake Type: Client Hello (1)
      Length: 120
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e75b8e4794caba494c3d4e26398551122b1995d332a19...
      Session ID Length: 0
      Cipher Suites Length: 6
      ▼ Cipher Suites (3 suites)
        Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
        Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
        Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
      Compression Methods Length: 1
      > Compression Methods (1 method)
      Extensions Length: 73
      > Extension: supported_groups (len=22)
      > Extension: ec_point_formats (len=2)
      > Extension: signature_algorithms (len=28)
      > Extension: extended_master_secret (len=0)
      > Extension: renegotiation_info (len=1)

```

2. From Client Hello, cipher suite list is from WINNF approved list:

```

TLS_RSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

```

3. From Server Hello, cipher suite chosen:  
 TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 638: 3243 bytes on wire (25944 bits), 3243 bytes captured (25944 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55648, Seq: 1, Ack: 130, Len: 3177
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 81
    ✓ Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 77
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e75c348790b56a8a2b2e56c0448af8a18c8b5f0ca8790...
      Session ID Length: 32
      Session ID: 51f334de8b50d6a093491444515eaa5feb9995af54e66e30...
      Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
      Compression Method: null (0)
      Extensions Length: 5
      > Extension: renegotiation_info (len=1)
    > TLSv1.2 Record Layer: Handshake Protocol: Certificate
    > TLSv1.2 Record Layer: Handshake Protocol: Multiple Handshake Messages

```

4. Authentication exchange ends with TLS Alert message (i.e. authentication fails):

```

> Frame 640: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55648, Dst Port: 5000, Seq: 130, Ack: 3178, Len: 7
✓ Transport Layer Security
  ✓ TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Certificate Unknown)
    Content Type: Alert (21)
    Version: TLS 1.2 (0x0303)
    Length: 2
    ✓ Alert Message
      Level: Fatal (2)
      Description: Certificate Unknown (46)

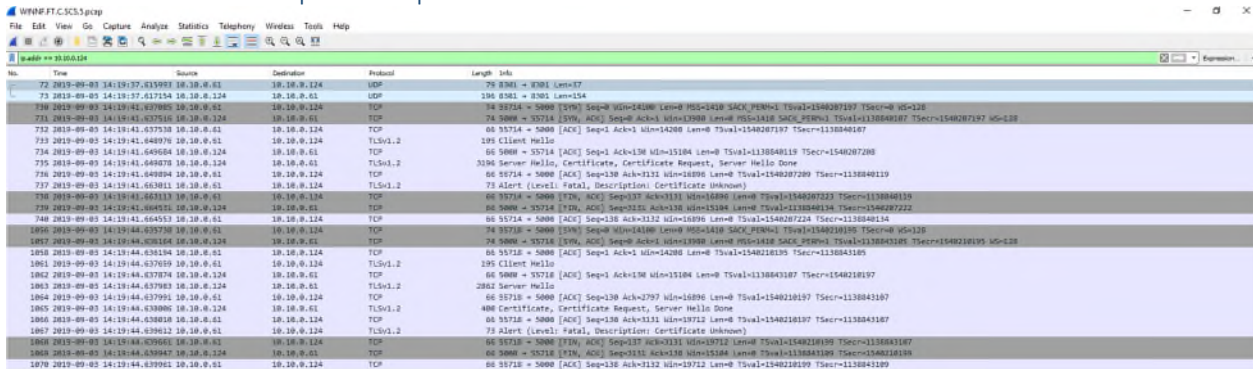
```

5. Registration request message is not received at Test Harness (authentication fails)

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	<b>FCC Part 96 SAS requirements (CBRS Test Plan)</b>	

## WINNF.FT.C.SCS.5

### Packet Capture Sequence



No.	Time	Source	Destination	Protocol	Length	Info
72	2019-09-03 14:19:37.615991	10.10.0.124	10.10.0.124	UDP	78	8301 → 8301 Len=57
73	2019-09-03 14:19:37.61754	10.10.0.124	10.10.0.124	UDP	196	8301 → 8301 Len=154
74	2019-09-03 14:19:37.617965	10.10.0.124	10.10.0.124	TCP	74	83716 → 5000 [RST] Seq=0 Win=14100 Len=0 MSS=1410 SACK_PERM=1 TSval=1540207197 TSecr=0 WS=128
75	2019-09-03 14:19:41.637516	10.10.0.124	10.10.0.124	TCP	74	5000 → 55714 [SYN, ACK] Seq=0 Ack=1 Wlen=0 Len=0 MSS=1410 SACK_PERM=1 TSval=1138841187 TSecr=1540207197 WS=128
76	2019-09-03 14:19:41.637530	10.10.0.124	10.10.0.124	TCP	60	55714 → 5000 [ACK] Seq=1 Ack=1 Wlen=0 Len=0 TSval=1540207200 TSecr=1138841187
77	2019-09-03 14:19:41.640970	10.10.0.124	10.10.0.124	TLSv1.2	295	Client Hello
78	2019-09-03 14:19:41.640970	10.10.0.124	10.10.0.124	TCP	60	5000 → 55714 [ACK] Seq=1 Ack=1 Wlen=0 Len=0 TSval=1540207200 TSecr=1540207200
79	2019-09-03 14:19:41.640970	10.10.0.124	10.10.0.124	TLSv1.2	3394	Server Hello, Certificate, Certificate Request, Server Hello Done
80	2019-09-03 14:19:41.640970	10.10.0.124	10.10.0.124	TCP	60	55714 → 5000 [ACK] Seq=130 Ack=131 Wlen=0 Len=0 TSval=1540207200 TSecr=1540207200
81	2019-09-03 14:19:41.643011	10.10.0.124	10.10.0.124	TLSv1.2	73	Alert (Level: Fatal, Description: Certificate Unknown)
82	2019-09-03 14:19:41.643011	10.10.0.124	10.10.0.124	TCP	60	55714 → 5000 [FIN, ACK] Seq=137 Ack=131 Wlen=0 Len=0 TSval=1540207223 TSecr=1138841119
83	2019-09-03 14:19:41.643011	10.10.0.124	10.10.0.124	TCP	60	5000 → 55714 [FIN, ACK] Seq=130 Ack=130 Wlen=0 Len=0 TSval=1138841199 TSecr=1540207222
84	2019-09-03 14:19:41.644551	10.10.0.124	10.10.0.124	TCP	60	55714 → 5000 [ACK] Seq=130 Ack=132 Wlen=0 Len=0 TSval=1540207223 TSecr=1138841119
85	2019-09-03 14:19:44.637530	10.10.0.124	10.10.0.124	TCP	74	55716 → 5000 [SYN] Seq=0 Win=14100 Len=0 MSS=1410 SACK_PERM=1 TSval=1540210195 TSecr=0 WS=128
86	2019-09-03 14:19:44.637530	10.10.0.124	10.10.0.124	TCP	74	5000 → 55716 [SYN, ACK] Seq=0 Ack=1 Wlen=0 Len=0 MSS=1410 SACK_PERM=1 TSval=1138841199 TSecr=1540210195 WS=128
87	2019-09-03 14:19:44.637530	10.10.0.124	10.10.0.124	TCP	60	55716 → 5000 [ACK] Seq=1 Ack=1 Wlen=0 Len=0 TSval=1540210200 TSecr=1138841199
88	2019-09-03 14:19:44.637619	10.10.0.124	10.10.0.124	TLSv1.2	295	Client Hello
89	2019-09-03 14:19:44.637619	10.10.0.124	10.10.0.124	TCP	60	5000 → 55716 [ACK] Seq=1 Ack=1 Wlen=0 Len=0 TSval=1540210197 TSecr=1540210197
90	2019-09-03 14:19:44.637619	10.10.0.124	10.10.0.124	TLSv1.2	2842	Server Hello
91	2019-09-03 14:19:44.637619	10.10.0.124	10.10.0.124	TCP	60	55716 → 5000 [ACK] Seq=130 Ack=130 Wlen=0 Len=0 TSval=1540210197 TSecr=1138841187
92	2019-09-03 14:19:44.638006	10.10.0.124	10.10.0.124	TLSv1.2	488	Certificate, Certificate Request, Server Hello Done
93	2019-09-03 14:19:44.638006	10.10.0.124	10.10.0.124	TCP	60	55716 → 5000 [ACK] Seq=130 Ack=131 Wlen=0 Len=0 TSval=1540210197 TSecr=1138841187
94	2019-09-03 14:19:44.639612	10.10.0.124	10.10.0.124	TLSv1.2	73	Alert (Level: Fatal, Description: Certificate Unknown)
95	2019-09-03 14:19:44.639612	10.10.0.124	10.10.0.124	TCP	60	55716 → 5000 [FIN, ACK] Seq=137 Ack=131 Wlen=0 Len=0 TSval=1540210199 TSecr=1138841187
96	2019-09-03 14:19:44.639612	10.10.0.124	10.10.0.124	TCP	60	5000 → 55716 [FIN, ACK] Seq=130 Ack=130 Wlen=0 Len=0 TSval=1138841199 TSecr=1540210199
97	2019-09-03 14:19:44.639961	10.10.0.124	10.10.0.124	TCP	60	55716 → 5000 [ACK] Seq=130 Ack=132 Wlen=0 Len=0 TSval=1540210199 TSecr=1138841199

### WINNF Test Requirements:

WINNF test requirements from WINNF-TS-0122-V1.0.0 CBRS CBSD Test Specification:

2	<ul style="list-style-type: none"> <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 Test Harness.</li> </ul>	PASS
---	--	------

### Analysis of WINNF Test Requirements

1. From Client Hello can read: TLS version = TLS 1.2

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 733: 195 bytes on wire (1560 bits), 195 bytes captured (1560 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55714, Dst Port: 5000, Seq: 1, Ack: 1, Len: 129
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Client Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 124
    ▼ Handshake Protocol: Client Hello
      Handshake Type: Client Hello (1)
      Length: 120
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e767d62c21254967019646a3fc8da4d00c8eca5e78cc9...
      Session ID Length: 0
      Cipher Suites Length: 6
      ▼ Cipher Suites (3 suites)
        Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
        Cipher Suite: TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (0xc02b)
        Cipher Suite: TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (0xc02f)
      Compression Methods Length: 1
      > Compression Methods (1 method)
      Extensions Length: 73
      > Extension: supported_groups (len=22)
      > Extension: ec_point_formats (len=2)
      > Extension: signature_algorithms (len=28)
      > Extension: extended_master_secret (len=0)
      > Extension: renegotiation_info (len=1)

```

- From Client Hello, cipher suite list is from WINNF approved list:

TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA25  
 TLS\_ECDHE\_ECDSA\_WITH\_AES\_128\_GCM\_SHA256  
 TLS\_ECDHE\_RSA\_WITH\_AES\_128\_GCM\_SHA256

- From Server Hello, cipher suite chosen:  
 TLS\_RSA\_WITH\_AES\_128\_GCM\_SHA256

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

```

> Frame 735: 3196 bytes on wire (25568 bits), 3196 bytes captured (25568 bits)
> Ethernet II, Src: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b), Dst: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec)
> Internet Protocol Version 4, Src: 10.10.0.124, Dst: 10.10.0.61
> Transmission Control Protocol, Src Port: 5000, Dst Port: 55714, Seq: 1, Ack: 130, Len: 3130
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Handshake Protocol: Server Hello
    Content Type: Handshake (22)
    Version: TLS 1.2 (0x0303)
    Length: 81
    ▼ Handshake Protocol: Server Hello
      Handshake Type: Server Hello (2)
      Length: 77
      Version: TLS 1.2 (0x0303)
      > Random: 5d6e768814d017b54b1c55f0176bf996f1b41c32231ba2fd...
      Session ID Length: 32
      Session ID: fb8025d3eec7ffc9f97f61f574942c6276f822812fac30f4...
      Cipher Suite: TLS_RSA_WITH_AES_128_GCM_SHA256 (0x009c)
      Compression Method: null (0)
      Extensions Length: 5
      > Extension: renegotiation_info (len=1)
    > TLSv1.2 Record Layer: Handshake Protocol: Certificate
    > TLSv1.2 Record Layer: Handshake Protocol: Multiple Handshake Messages

```

4. Authentication exchange ends with TLS Alert message (i.e. authentication fails):

```

> Frame 737: 73 bytes on wire (584 bits), 73 bytes captured (584 bits)
> Ethernet II, Src: fa:16:3e:17:b4:ec (fa:16:3e:17:b4:ec), Dst: fa:16:3e:41:fa:8b (fa:16:3e:41:fa:8b)
> Internet Protocol Version 4, Src: 10.10.0.61, Dst: 10.10.0.124
> Transmission Control Protocol, Src Port: 55714, Dst Port: 5000, Seq: 130, Ack: 3131, Len: 7
▼ Transport Layer Security
  ▼ TLSv1.2 Record Layer: Alert (Level: Fatal, Description: Certificate Unknown)
    Content Type: Alert (21)
    Version: TLS 1.2 (0x0303)
    Length: 2
    ▼ Alert Message
      Level: Fatal (2)
      Description: Certificate Unknown (46)

```

5. Registration request message is not received at Test Harness (authentication fails)

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Test Equipment

Instrument	Manufacturer	Type No.	Serial No	Calibration Period (months)	Calibration Due
Power Supply	Xantrex	XXW 60-50	E00109863	O/P Mon	-
Signal Analyzer	Agilent	MXA	SSG013930	12 months	2020-01-15
Attenuator	Pasternack	PE7004-10	N/S	O/P Mon	-
Switching Control Unit	Hewlett Packard	11713A	3748A060876	O/P Mon	-
RF Switch Unit	Burnsco	RARFSW 4x1	001	O/P Mon	-
Power Supply	Leader	730-3D	9801135	O/P Mon	-

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

## Appendix A – EUT & Client Provided Details

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

### General EUT Description

Manufacturer	Ericsson
Address	Torshamnsgatan 23 Kista SE-16480 Stockholm Sweden
Product Name	Radio 6488 B48
Product Number	KRD 901 160/2 (with un-security software and RDNB board for testing purpose). KRD 901 160/21 (with security software and RDNB board for testing purpose). KRD 901 160/1 (with un-security software and antenna). KRD 901 160/11 (with security software and antenna).
Serial Number(s)	D829153166
Software Version	CXP 901 3268/15_R79GC
Hardware Version	R1A
Test Specification/Issue/Date	FCC CFR 47 Part 96: 2018

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

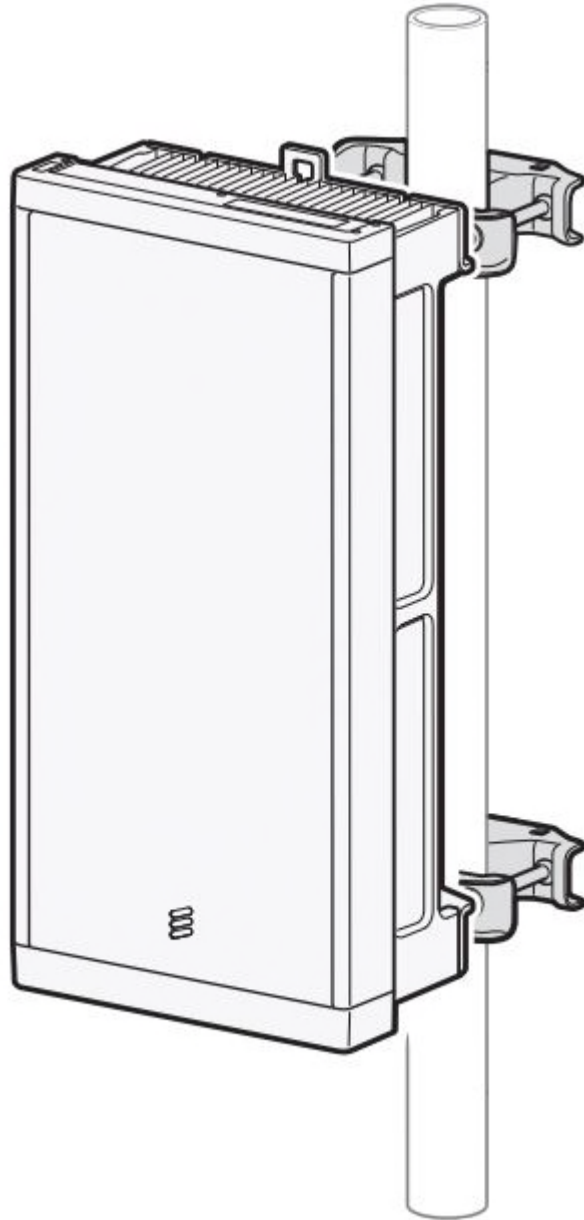
**Technical Description**

The Equipment Under Test (EUT) Radio 6488 B48 KRD 901 160 is an Ericsson AB Radio Unit working in the public mobile service (3550-3700 MHz) band which provides communication connections to 3550-3700 MHz network. The Radio 6488 B48 KRD 901 160 operates from a - 48V DC or a 120V AC power supply.

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturer’s documentation.



Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	



#### EUT Configuration

Please see Appendix B for close up pictures of the unit as configured during testing

- Cables and earthing when applicable were connected as per manufacturer's specification.

Domain Proxy Software Version: = 1.36.1 (ENM version ENM 19.14)

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

**Appendix B – EUT, Peripherals, and Test Setup Photos**

Client	<b>Ericsson</b>	
Product	<b>Ericsson Remote Radio Air 6488 B48 KRD 901160</b>	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

Test setup

