

Test Report

As per

FCC Part 96 SAS requirements (CBRS Test Plan)



Add value.
Inspire trust.

on the

Ericsson Remote Radio Air 6488 B48 KRD901160

(3550-3700MHz)

FCC ID(s): TA8AKRD901160

TA8BKRD901160

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, appearing to read "Scott Drysdale", written over a horizontal line.

Glen Westwell
Report Reviewer

A handwritten signature in black ink, appearing to read "Glen Westwell", written over a horizontal line.



Testing Laboratory
Certificate #2955.19

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

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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.

Client	Ericsson	
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Summary

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

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


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

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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

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					installationParam change. <ul style="list-style-type: none"> Record time at which transmission stops. Time must be within 60 seconds of the installationParam change taking effect. 	
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

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					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"> Transmission does not start until time of first 	N/A

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					<p>heartbeat response or after.</p> <ul style="list-style-type: none"> After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh) 	
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"> Transmission does not start until time of first heartbeat response or after. After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh) 	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"> CBSD stops transmission within 60 seconds of the heartbeatResponse which contains 	P

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					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"> CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501 	p
6.4.4.2.5	X	X	WINNF.FT.C.H BT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAMETER)	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502 	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"> CBSD1: will continue to transmit to end of test 	P

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					<p>(this is not a pass/fail criteria, but check)</p> <ul style="list-style-type: none"> CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500 	
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"> CBSD must stop transmission within transmitExpirationTime+60 seconds, where transmitExpirationTime is from last successful heartbeatResponse message 	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

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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"> • CBSD stops transmission at any time prior to sending the relinquishmentRequest message. 	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"> • CBSD stops transmission at any time prior to sending the relinquishmentRequest message. 	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"> • CBSD stops transmission at any time prior to sending the relinquishmentRequest message or deregistrationRequest message (whichever is sent first) 	N/A

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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 relinquishmentRequest message or deregistrationRequest 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

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					(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.	
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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.

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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.

Additional testing for power spectral density (PSD) requirements were evaluated as the original EUT firmware was changed to allow for higher conducted power with different antenna gains. All other parameters were deemed to not be affected as there was no other changes.

Logs are kept on file.

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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


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Document Revision Status

7169006619 000: September 16, 2019 First release

7169006619 001: September 17, 2019 Minor typo fixes as per client request.

7169007158 000: December 20, 2019 Added appendix C for additional testing performed, changed FCC ID. See justifications for further details.

Client	Ericsson	
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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	Ericsson	
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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	Ericsson	
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Testing Environmental Conditions and Dates

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

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
Sept 3 – 5, 2019	All	SD	20-23	40-55	96.106
Dec 18, 2019	PSD retesting	SD	20-23	40-55	96.106

Client	Ericsson	
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Detailed Test Results Section

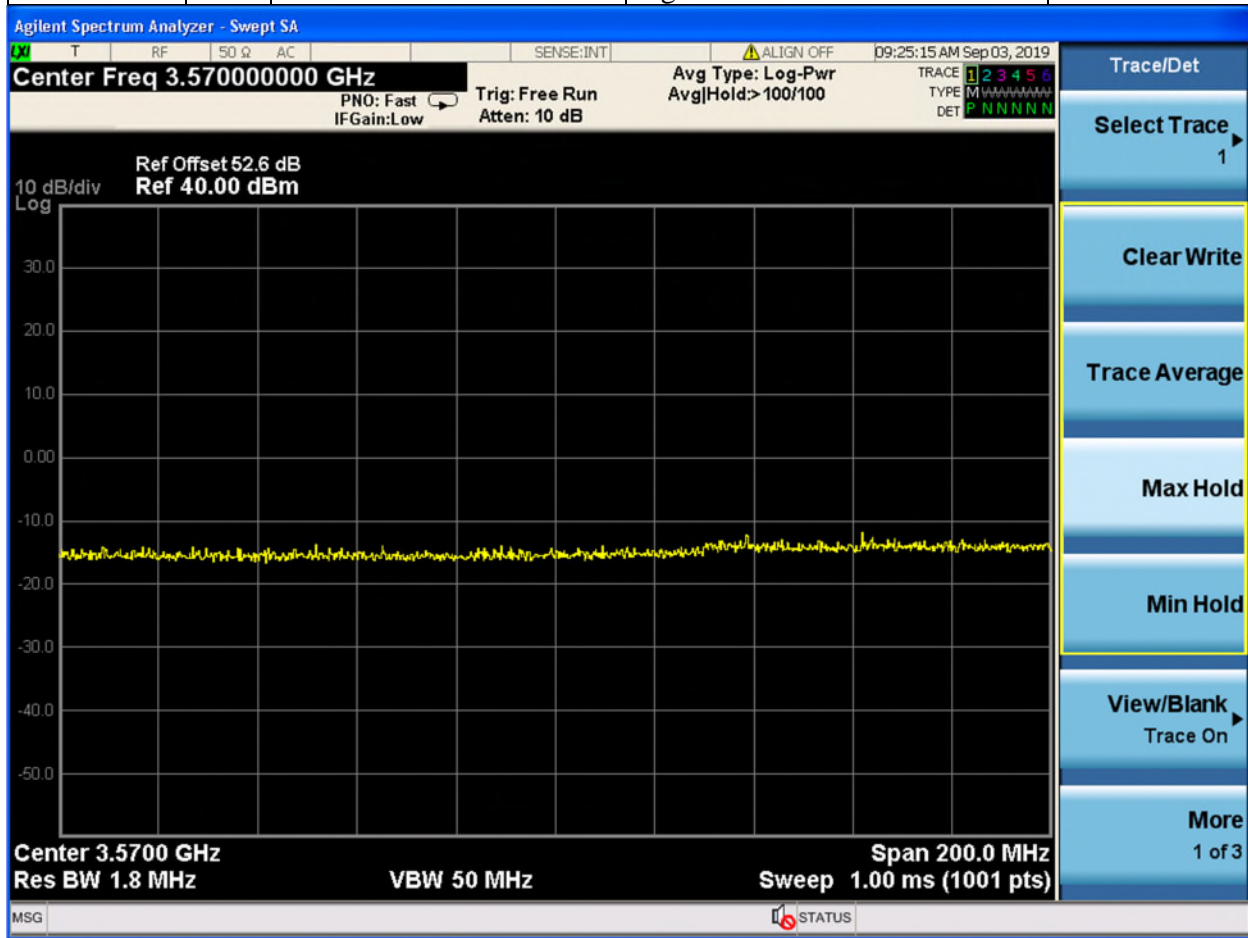
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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Authorization transmit after it receives authorization from a SAS.

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

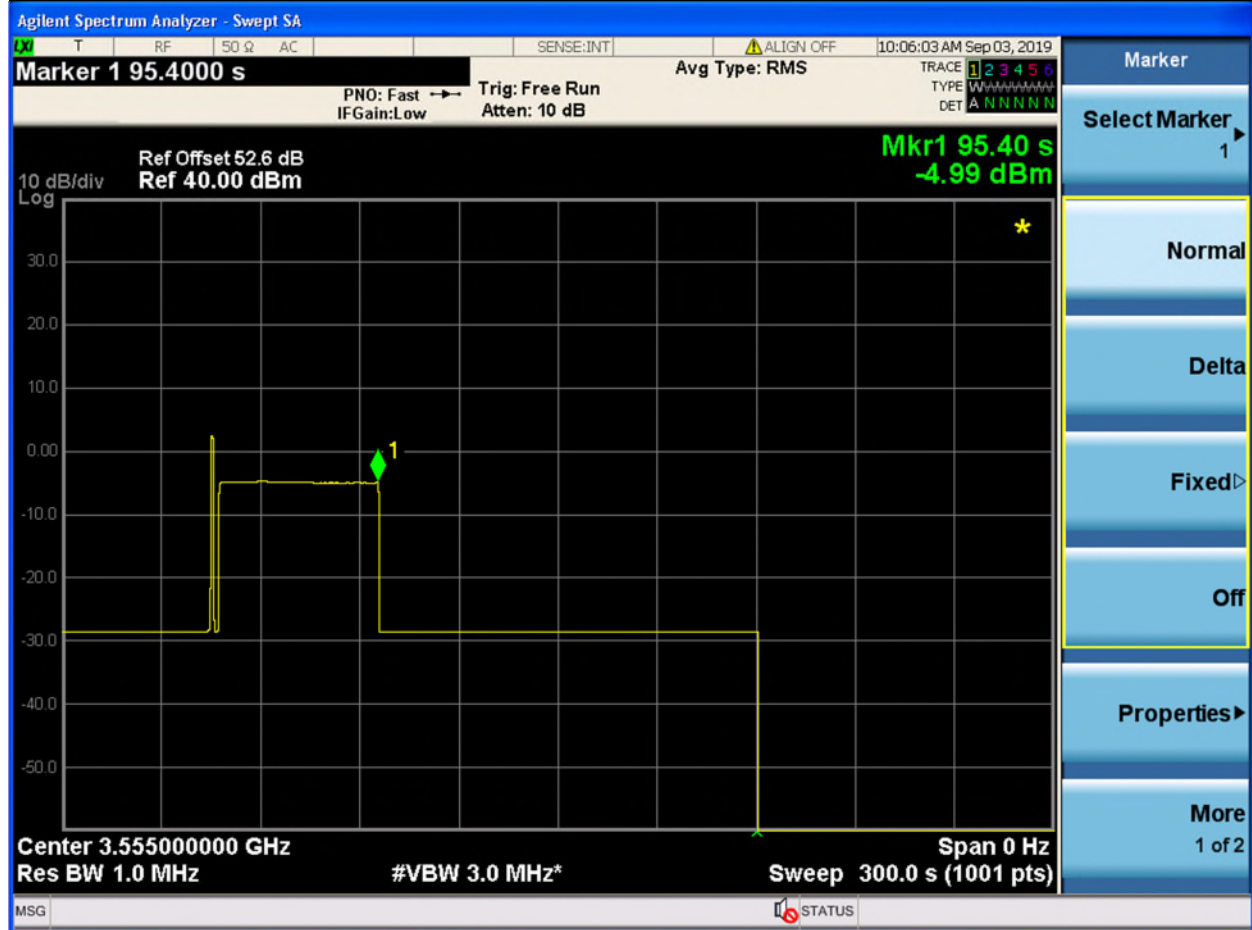
Client	Ericsson	
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6.1.4.1.6	X	WINNF.TT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	P
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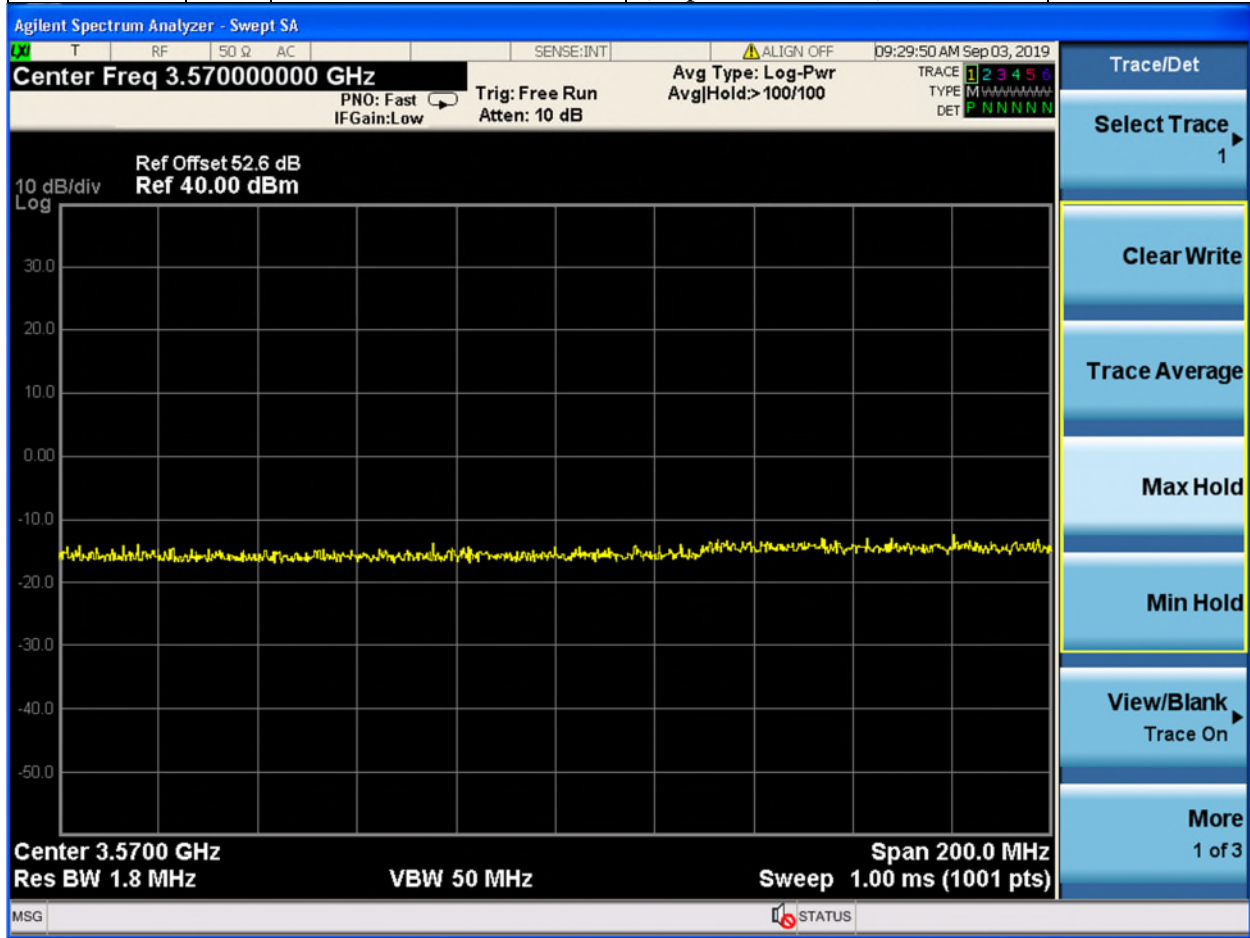
6.1.4.1.7	X	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	P
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Test Harness logs and timing on graph was verified, the EUT passed the requirement.

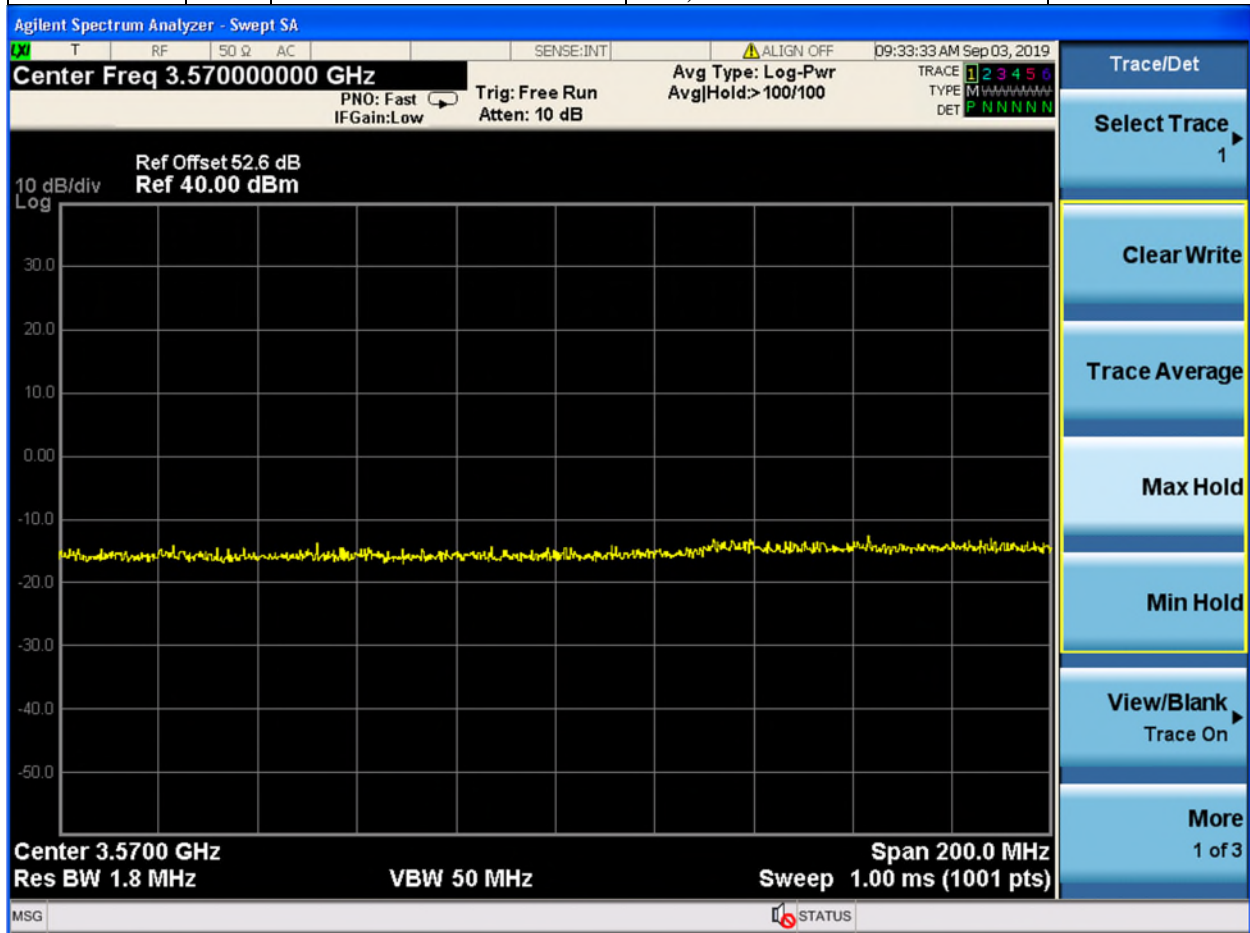
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6.1.4.2.2	X	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	P
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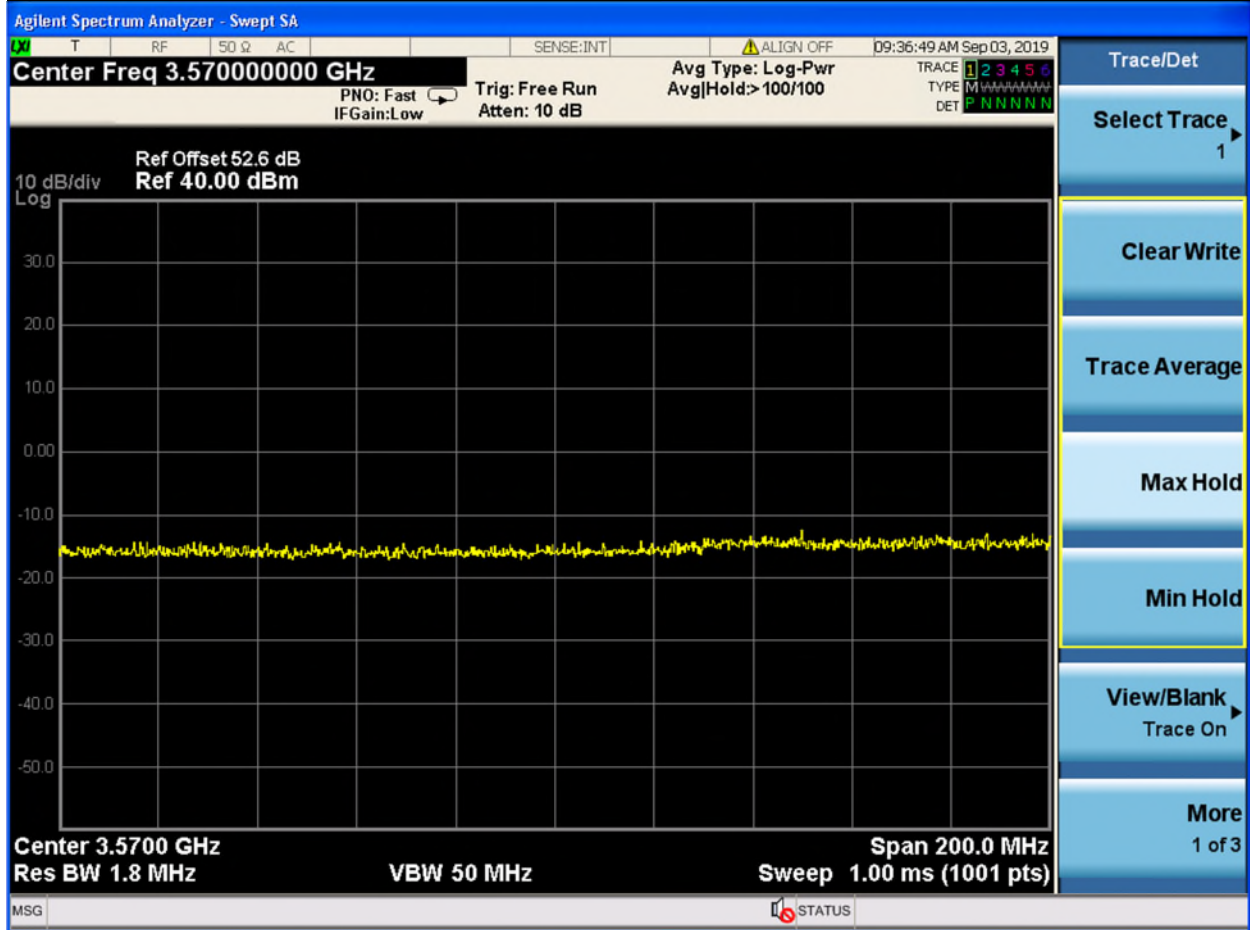
Client	Ericsson	
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6.1.4.2.4	X	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	P
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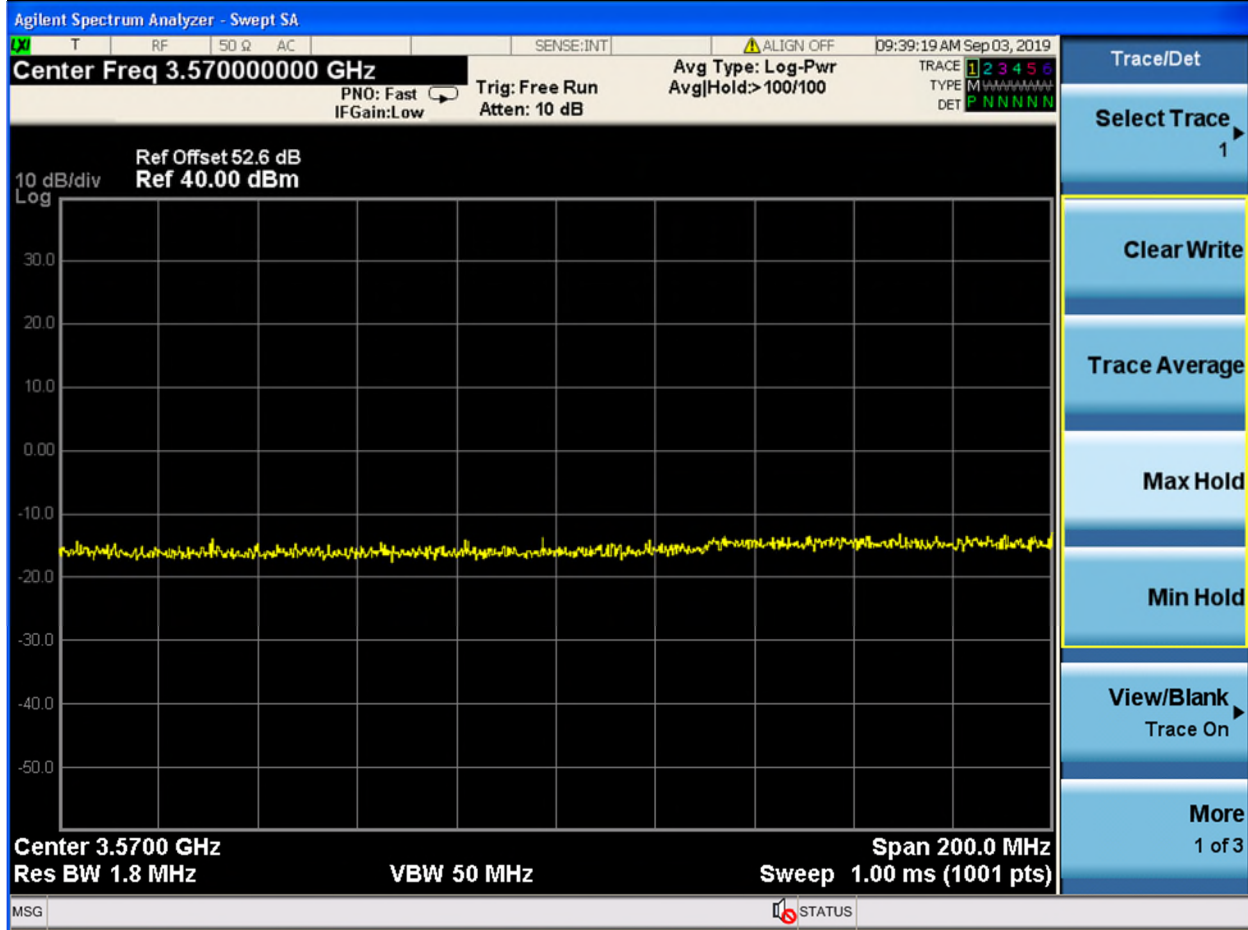
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6.1.4.2.6	X	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	P
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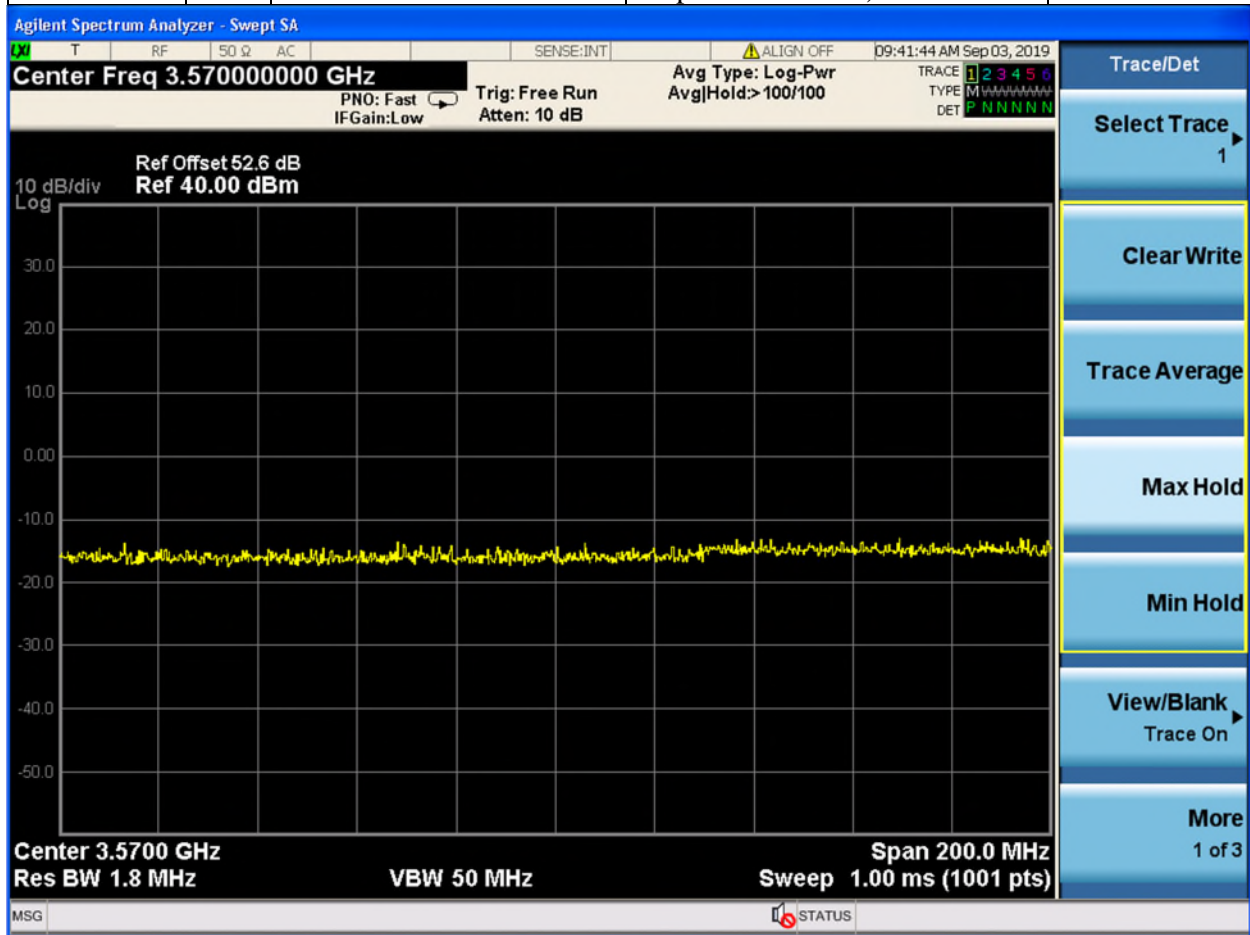
Client	Ericsson	
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Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.8	X	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	P
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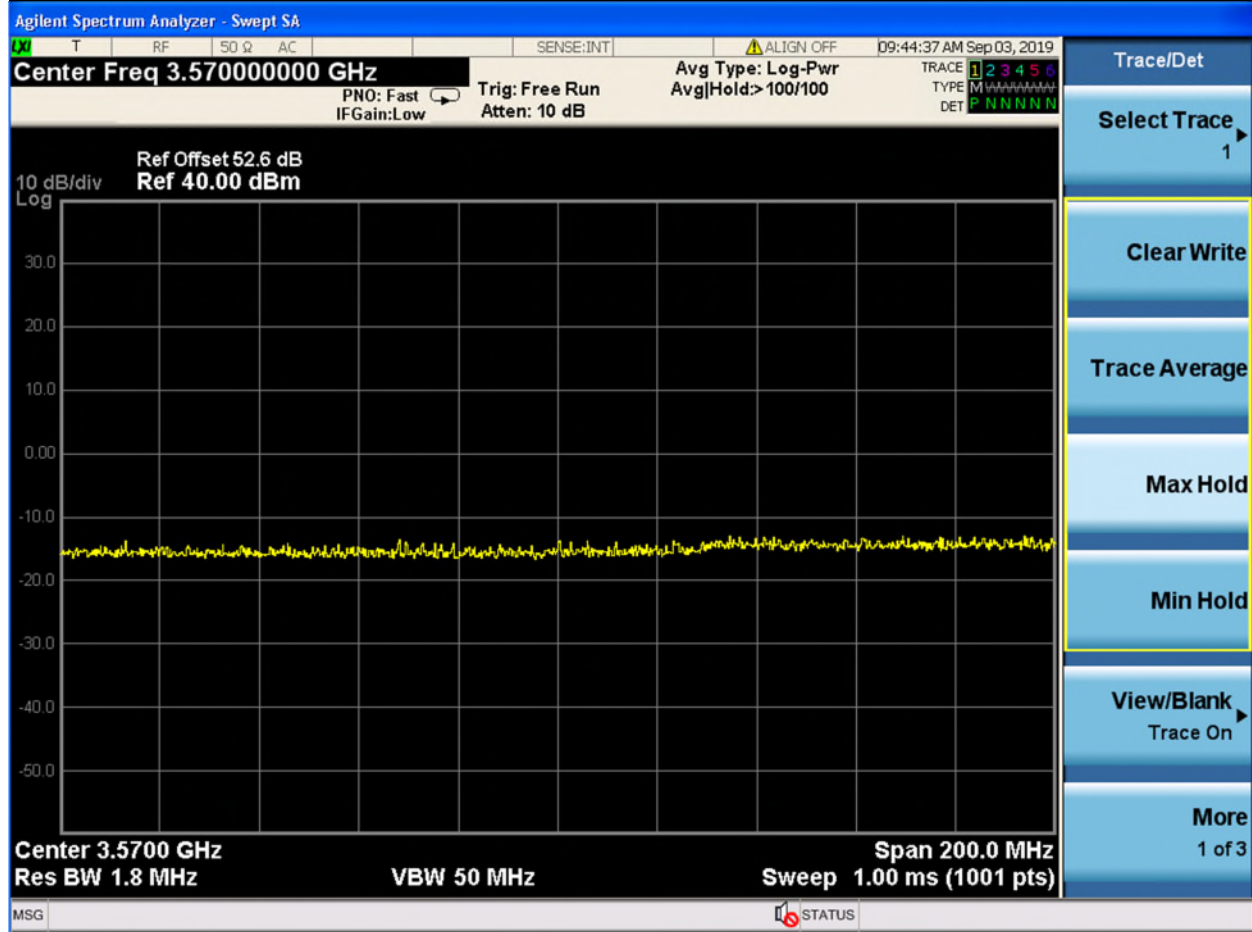
Client	Ericsson	
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Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.1.4.2.10	X	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	P
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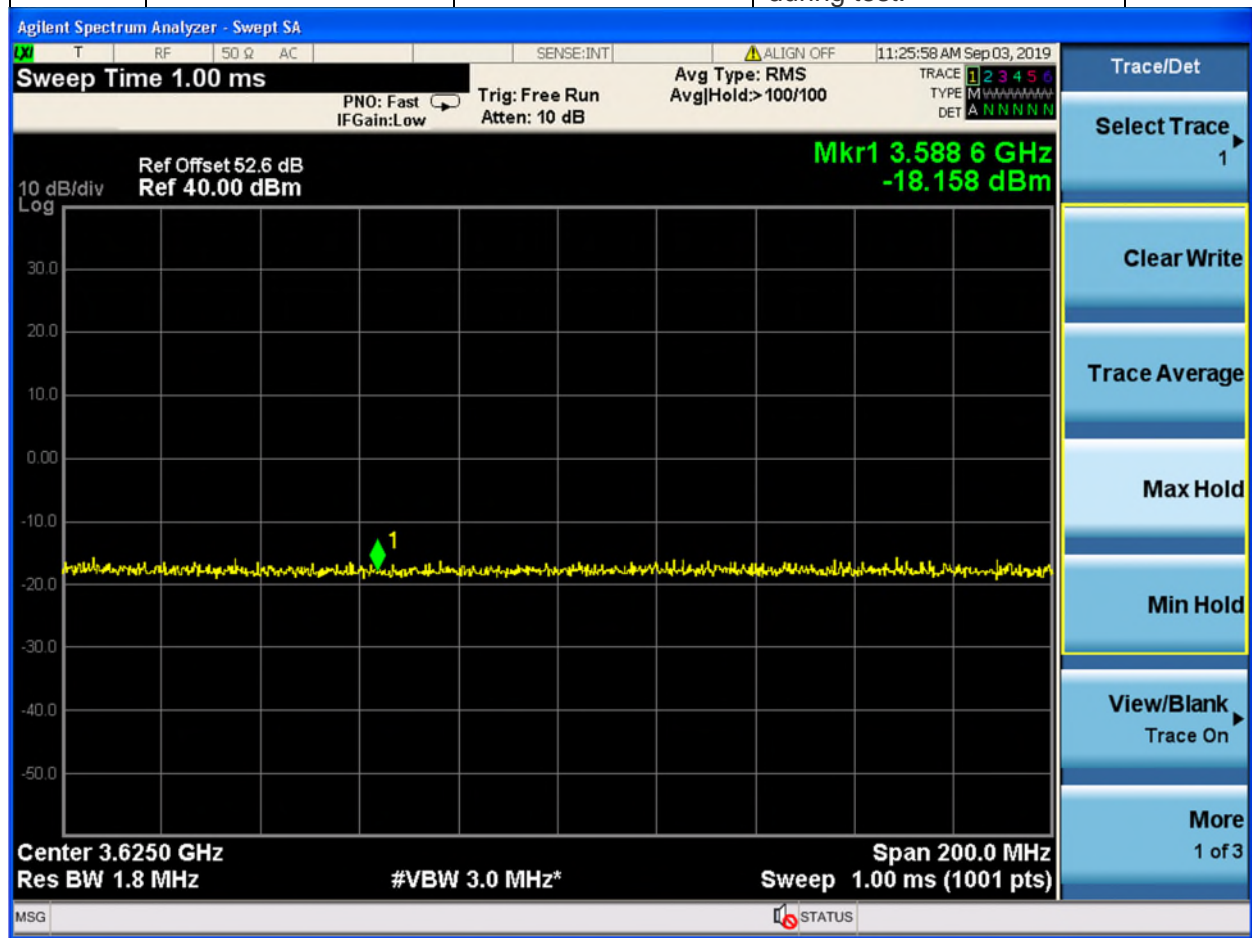
6.1.4.2.12	X	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	P
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Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

***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)	

6.4.4.1.2	WINNF.TT.D.HBT.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"> • Transmission does not start until time of first heartbeat response or after. • After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh) 	P
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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)	

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



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

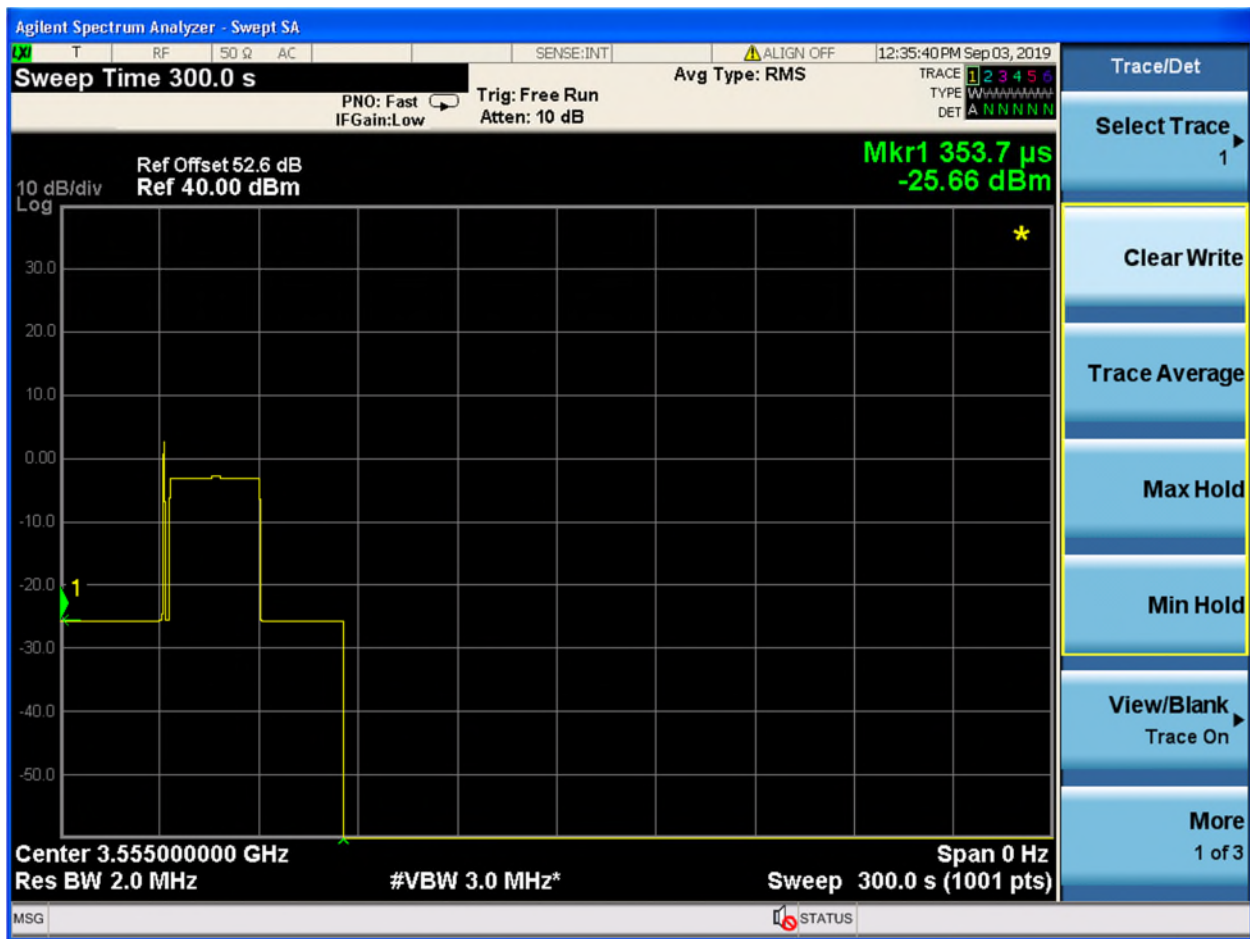
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

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

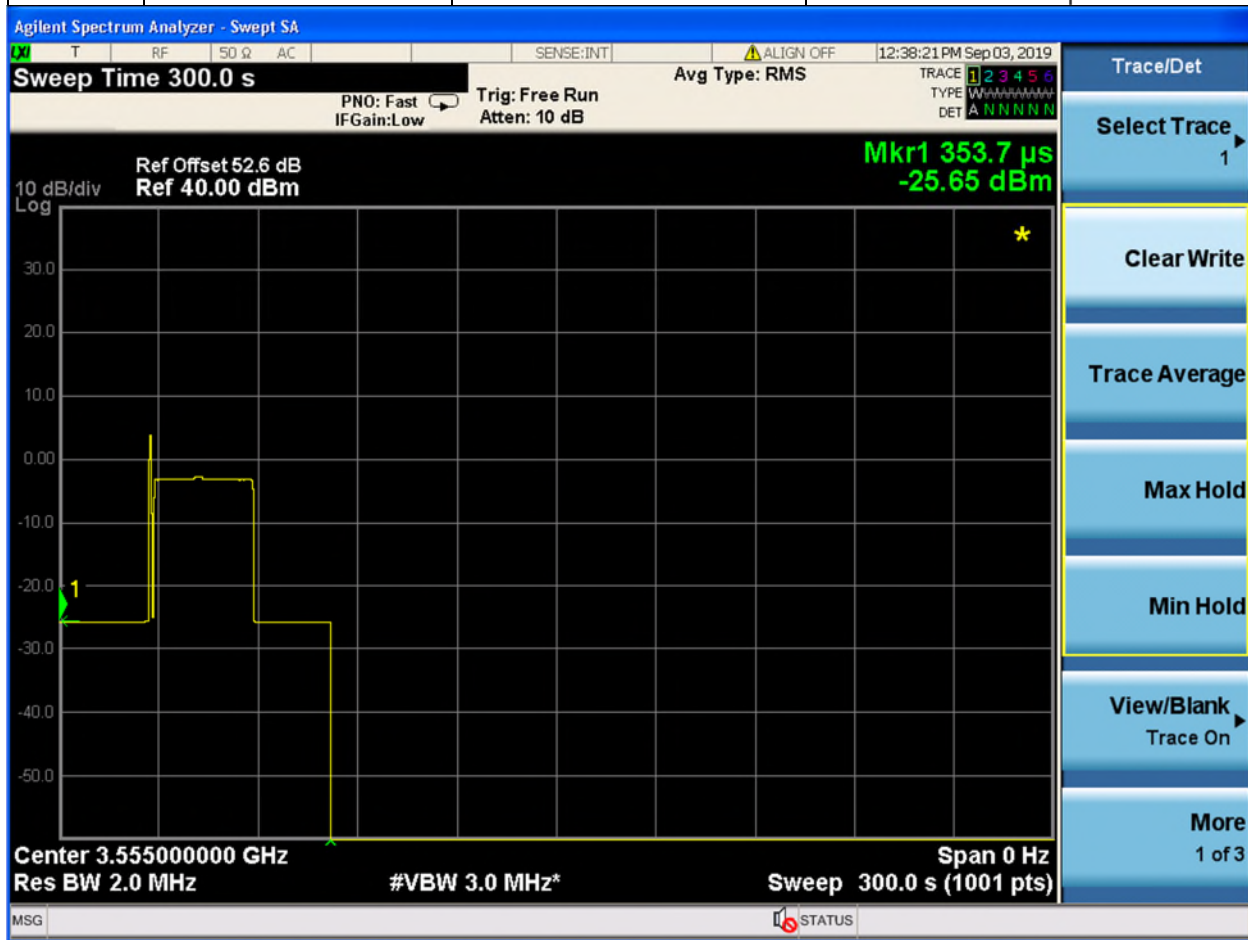
6.4.4.2.4	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501 	p
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Test 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"> CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502 	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)	

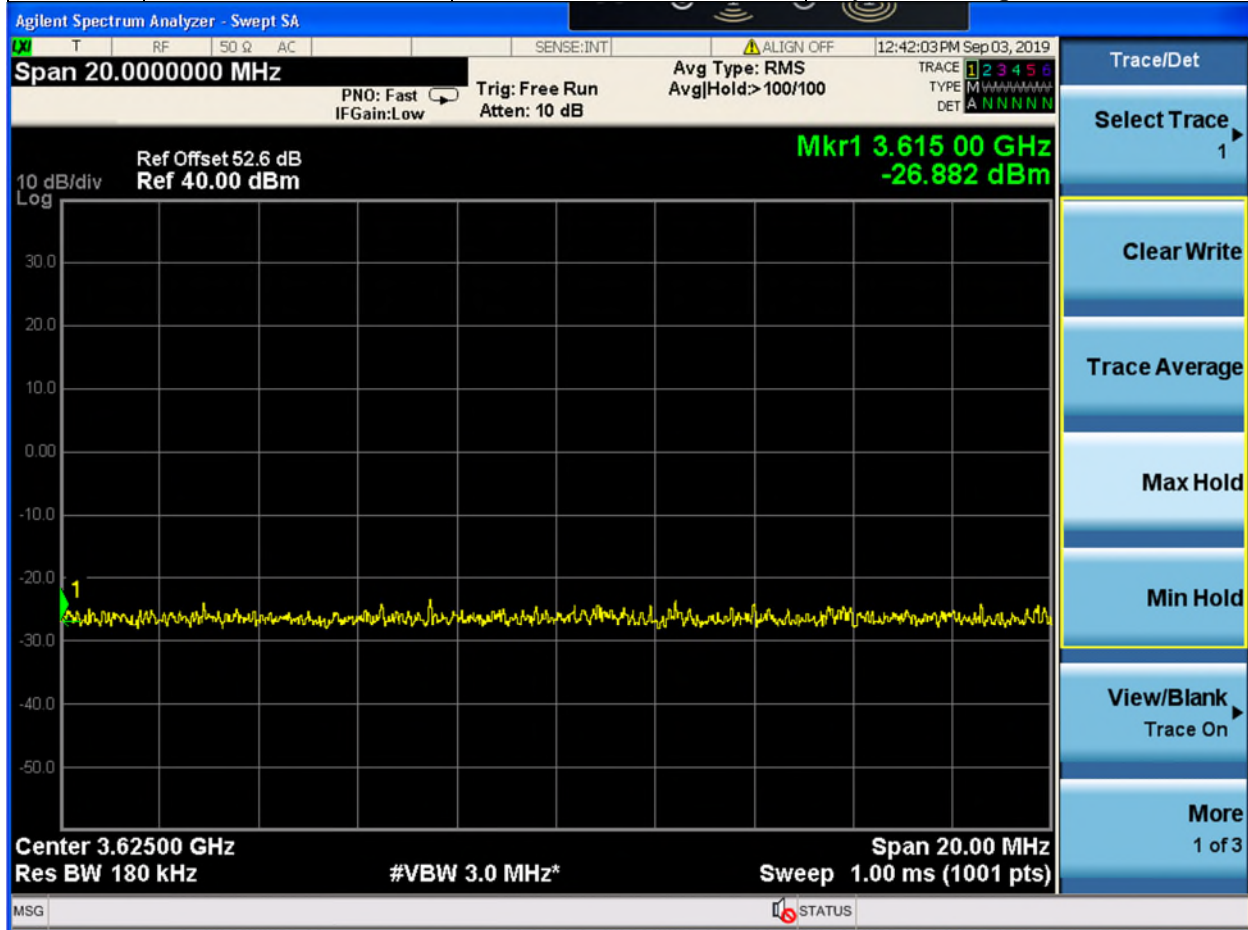
6.4.4.2.6	--	X	WINNF.FT.D.H BT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GR ANT)	Monitor RF transmission. CBSDs will have different behavior: <ul style="list-style-type: none"> CBSD1: will continue to transmit to end of test (this is not a pass/fail criteria, but check) CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500 	P
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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
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Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

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

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

6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	No RF monitoring	P
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Pass. “measreportconfig” in logs. All other requirements verified.

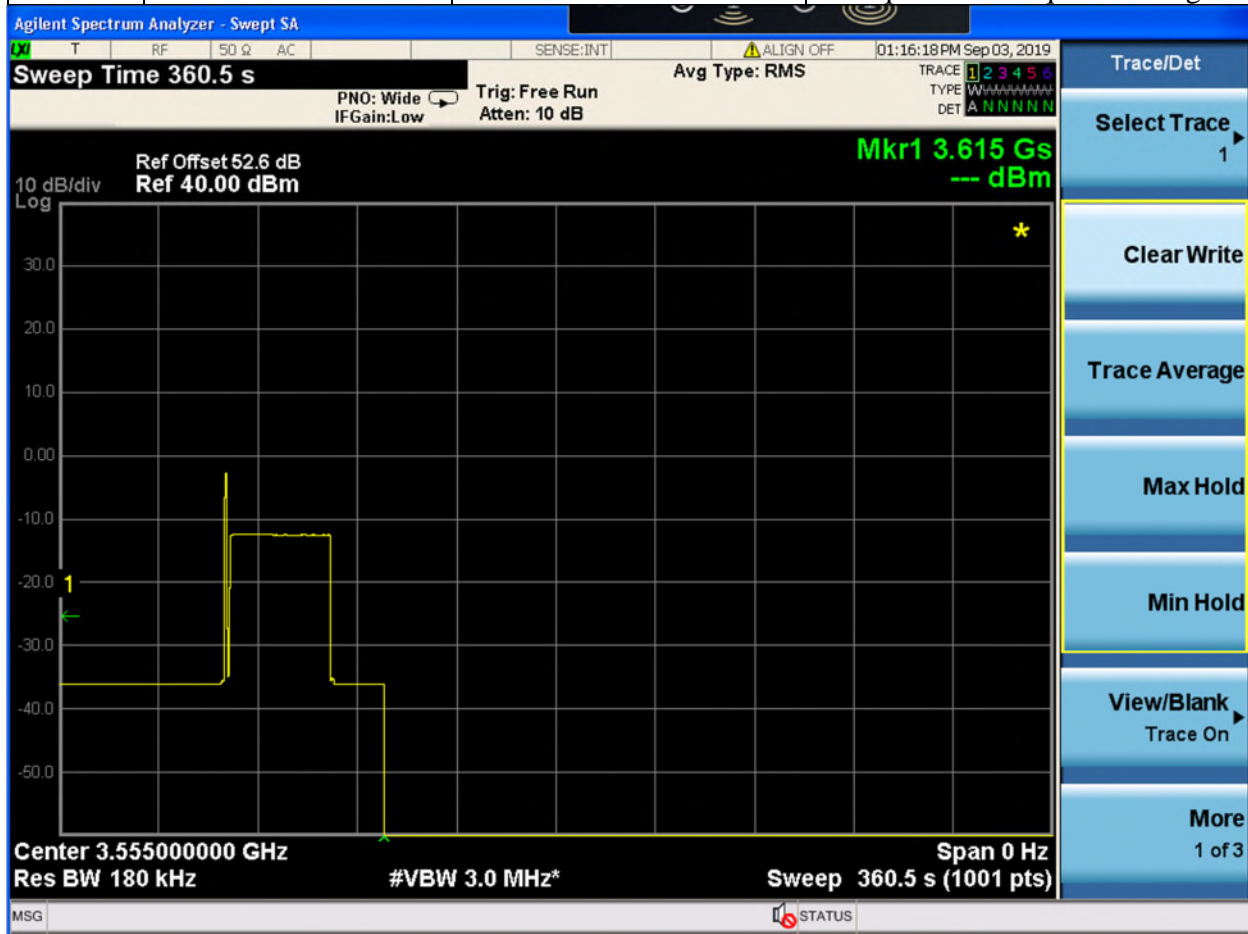
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.5.4.2.5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	No RF monitoring	P
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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"> • CBSD stops transmission at any time prior to sending the relinquishmentRequest message. 	P
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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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

6.7.4.1.2	WINNF.TT.D.DRG.2	Domain Proxy Successful Deregistration	Monitor RF transmission. Ensure: <ul style="list-style-type: none"> • CBSD stops transmission at any time prior to sending the relinquishmentRequest message or deregistrationRequest message (whichever is sent first) 	P
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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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	<p>Power Spectral Density test case.</p> <p>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>	P
-----------	---	---	-----------------	-----------------------------------	---	---

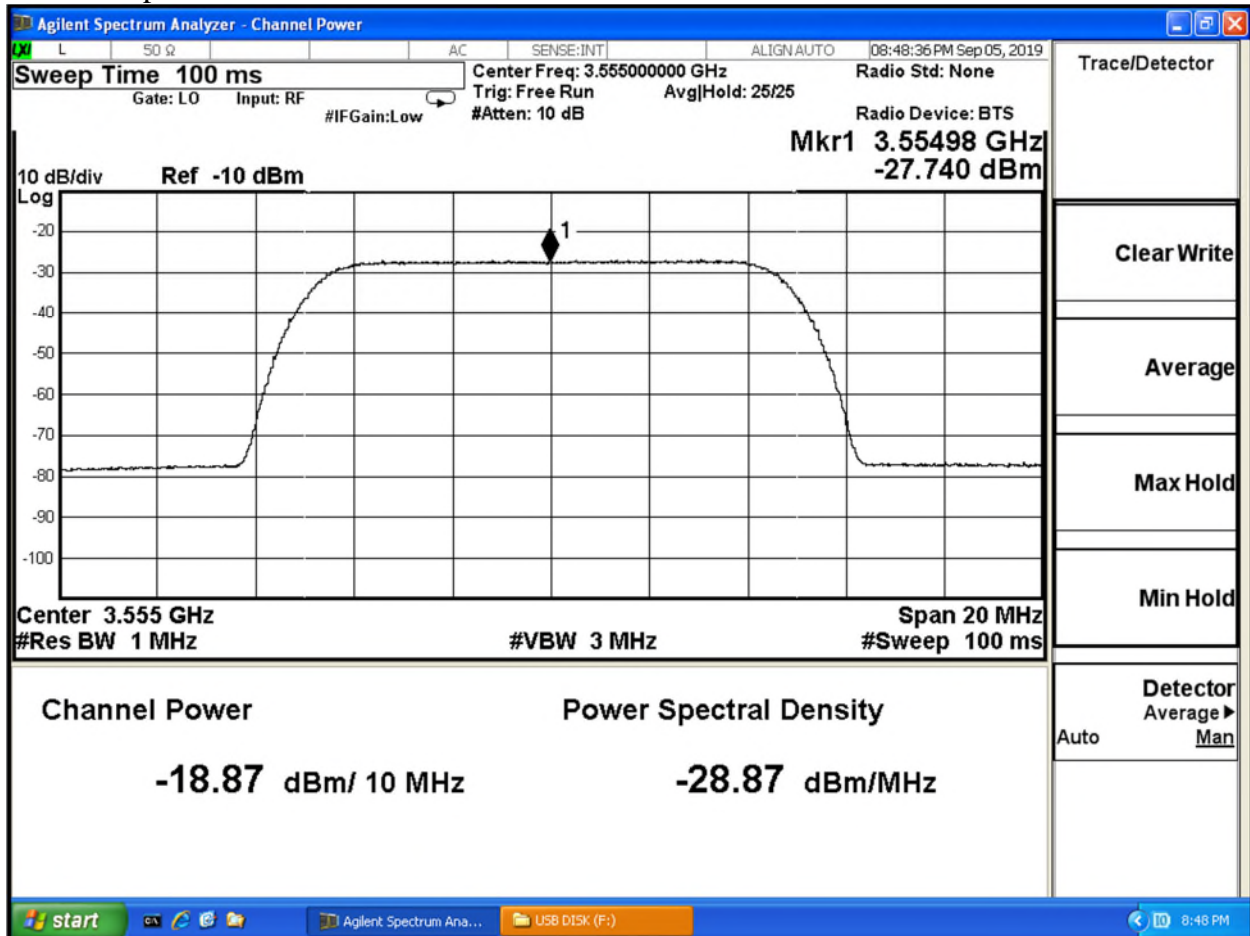
Test Table

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.

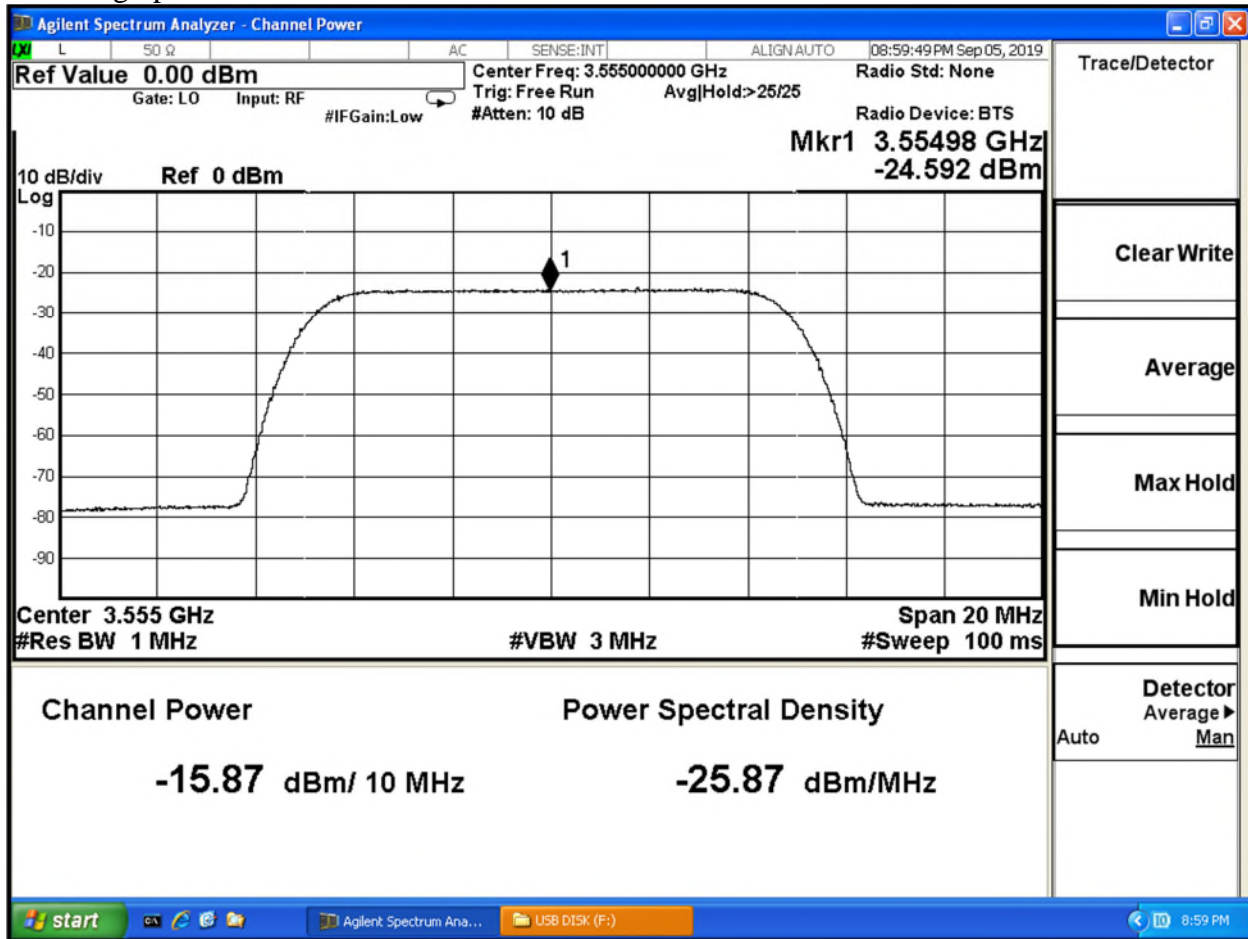
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555 low power



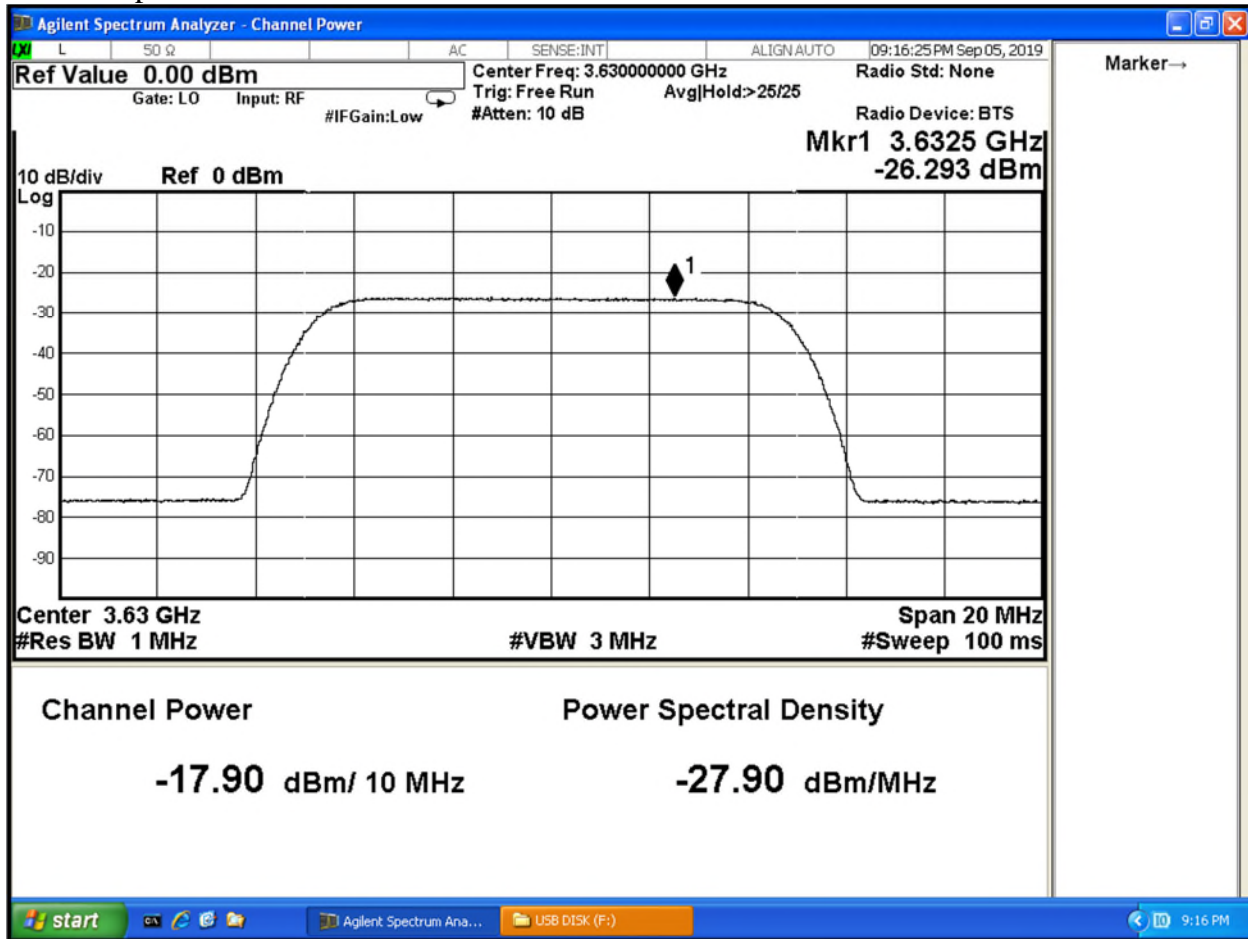
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555-High power



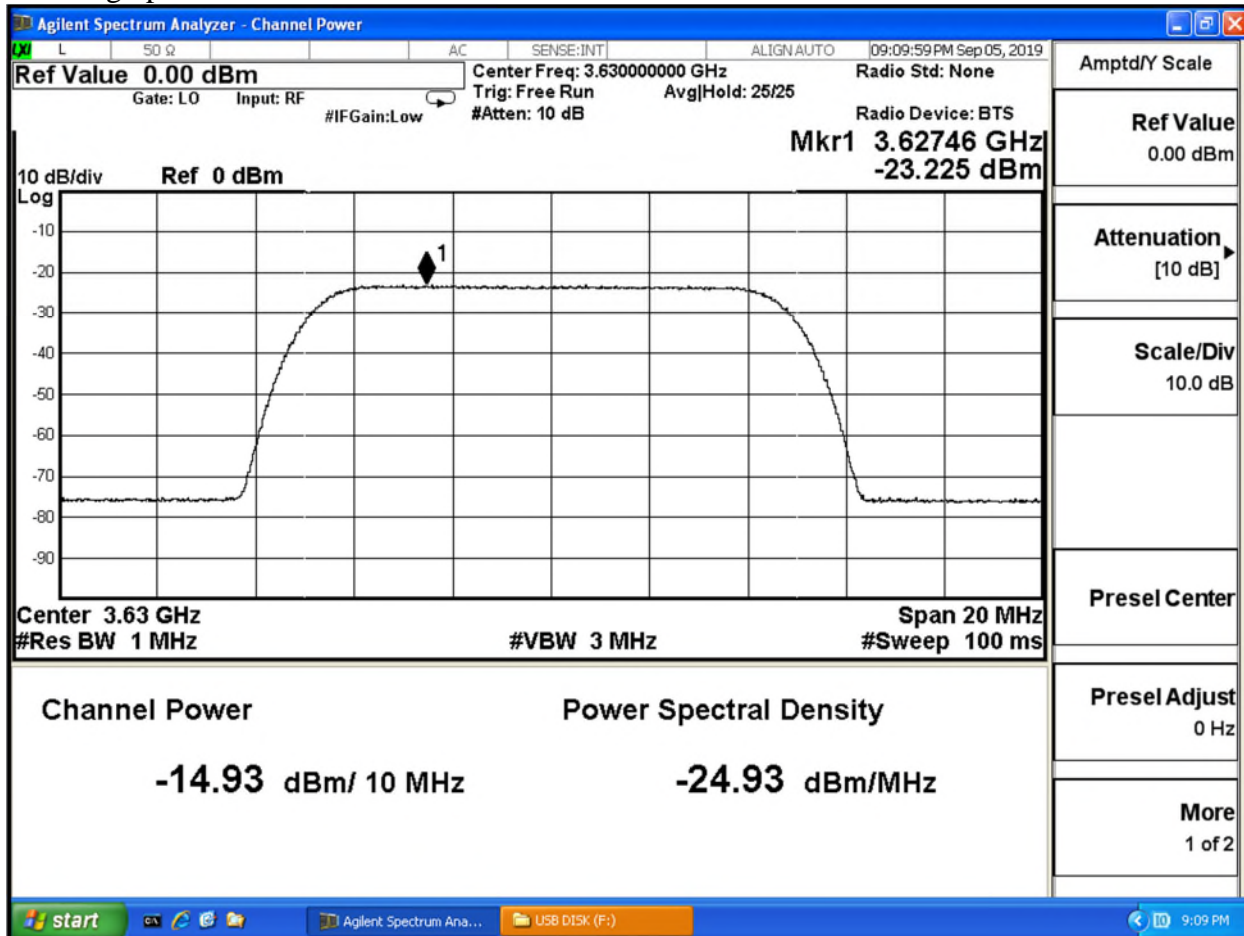
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630 low power



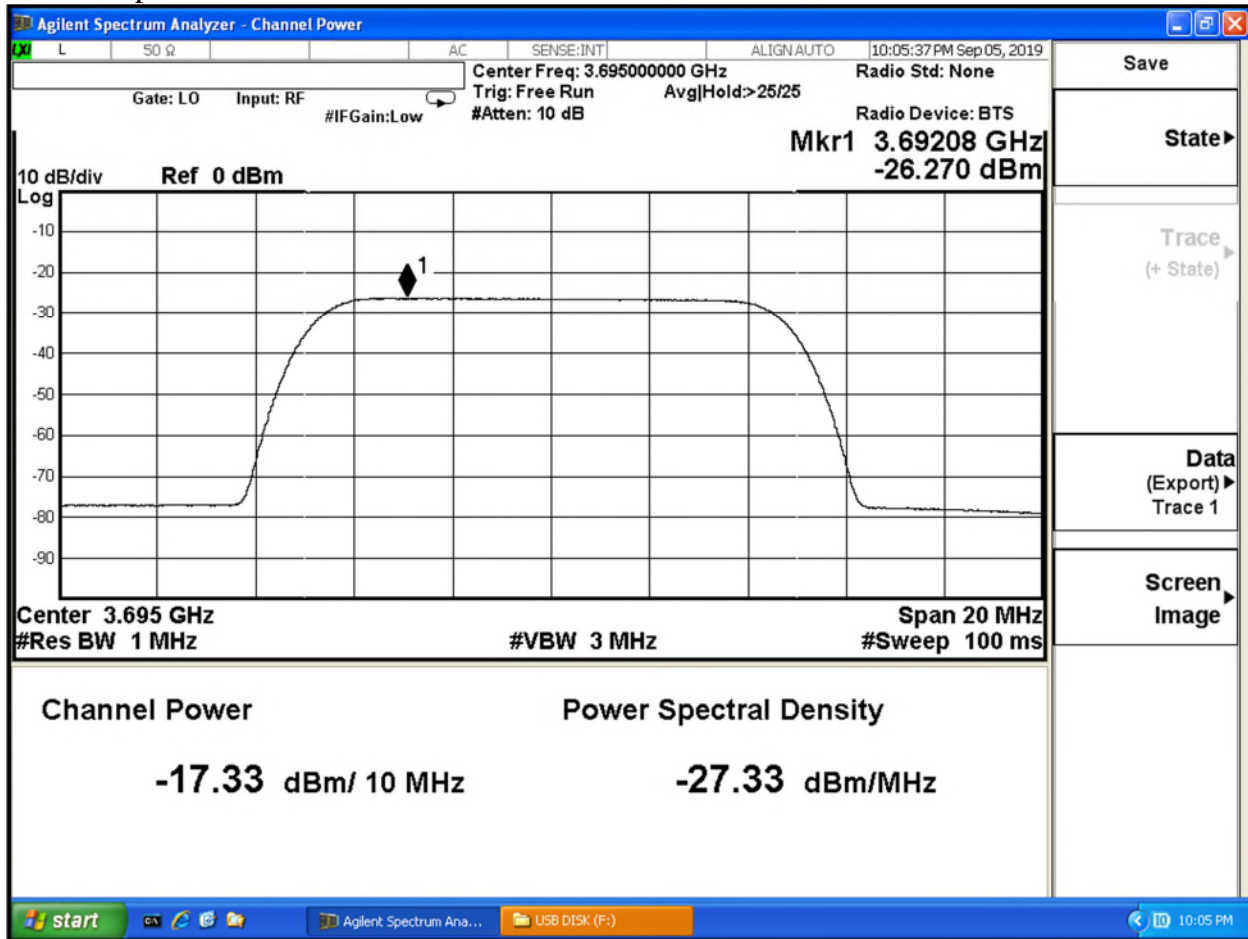
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630-high power



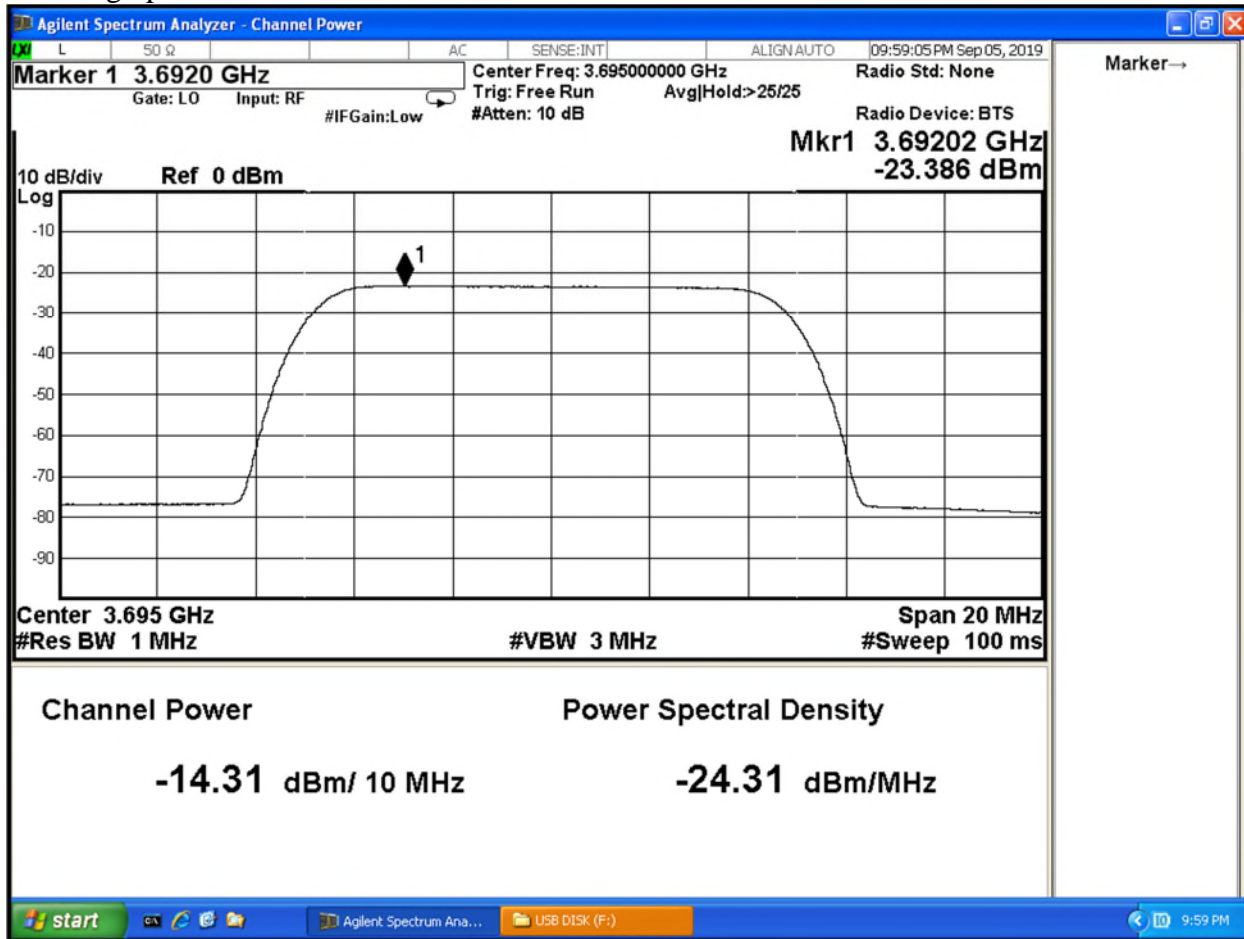
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

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)	

WINNF test requirements:

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

2	<ul style="list-style-type: none"> • Make sure that Mutual authentication happens between UUT and the SAS Test Harness. • Make sure that UUT uses TLS v1.2 • Make sure that cipher suites from one of the following is selected, <ul style="list-style-type: none"> • TLS_RSA_WITH_AES_128_GCM_SHA256 • TLS_RSA_WITH_AES_256_GCM_SHA384 • TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 • TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 	PASS
---	--	------

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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: 5368d21d2529427538588c5ccba4c4e6f3b96641
            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: Id: 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: 5368d21d2529427538588c5ccba4c4e6f3b96641
                issuerKeyHash: 5b63d7bb6e95ca42c49450451b47e5cd6eefdb4
                serialNumber: 18240749012425898463
              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: 906f60430a1260eb9d7e21c1f2049042f94c7f6ee489ad67...
          certs: 1 item
            certificate (id-at-commonName=SAS.OCSP.EXAMPLE,id-at-organizationalUnitName=WiInnForum SAS OCSP Responder Certi,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
  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)

```

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)	

```

> 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)

```

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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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)

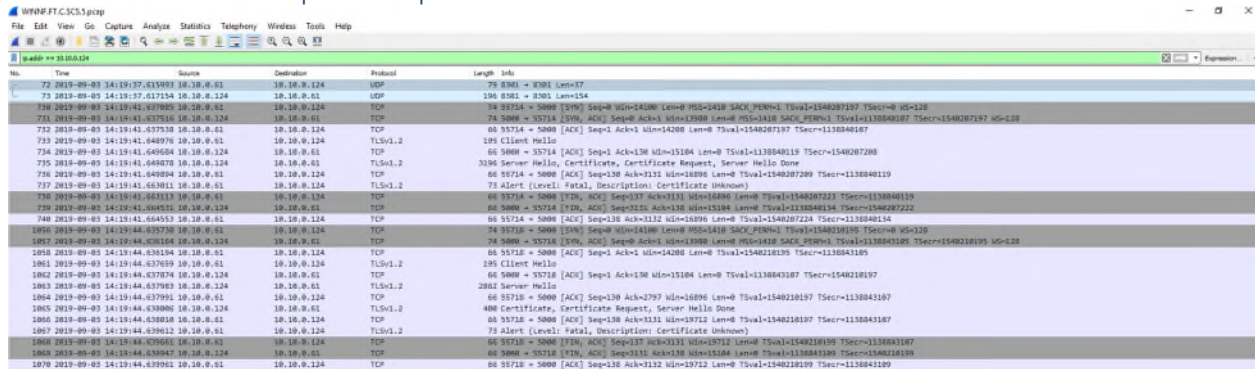
```

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

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

WINNF.FT.C.SCS.5

Packet Capture Sequence



WINNF Test Requirements:

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

2	<ul style="list-style-type: none"> Make sure that UUT uses TLS v1.2 for security establishment. Make sure UUT selects the correct cipher suite. UUT shall use CRL or OCSP to verify the validity of the server certificate. Make sure that Mutual authentication does not happen between UUT and the SAS Test Harness. 	PASS
---	--	------

Analysis of WINNF Test Requirements

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

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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)

```

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

Appendix A – EUT & Client Provided Details

Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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


Note: For the testing performed in Dec 2019, the following EUT details were additionally recorded:

Node HW:

AAS-1 fru_2048 AIR6488B48 1 OFF ON OFF N/A KRD901160/2 R1A
D829153166 20190628 4 (OK) 62.0 0.08

ENM/DC Version:


ENM 19.12 (ISO Version: 1.79.131) AOM 901 151 R1CX/2

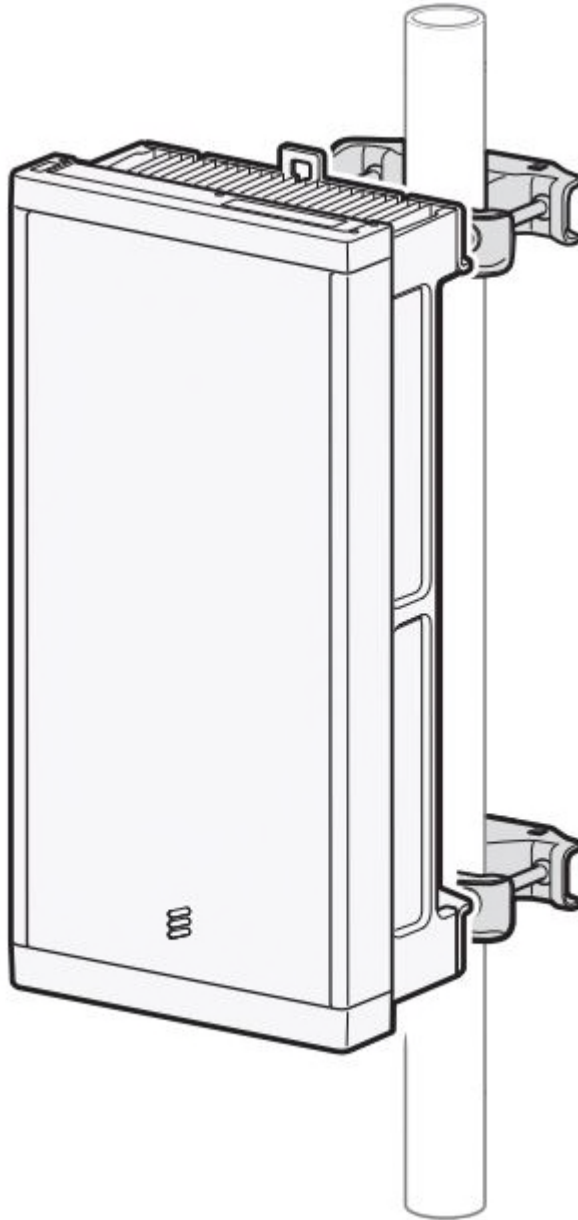
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

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

Appendix B – EUT, Peripherals, and Test Setup Photos

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

Test setup

<Photos kept on file>

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

Appendix C – Additional Test Information


Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
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.

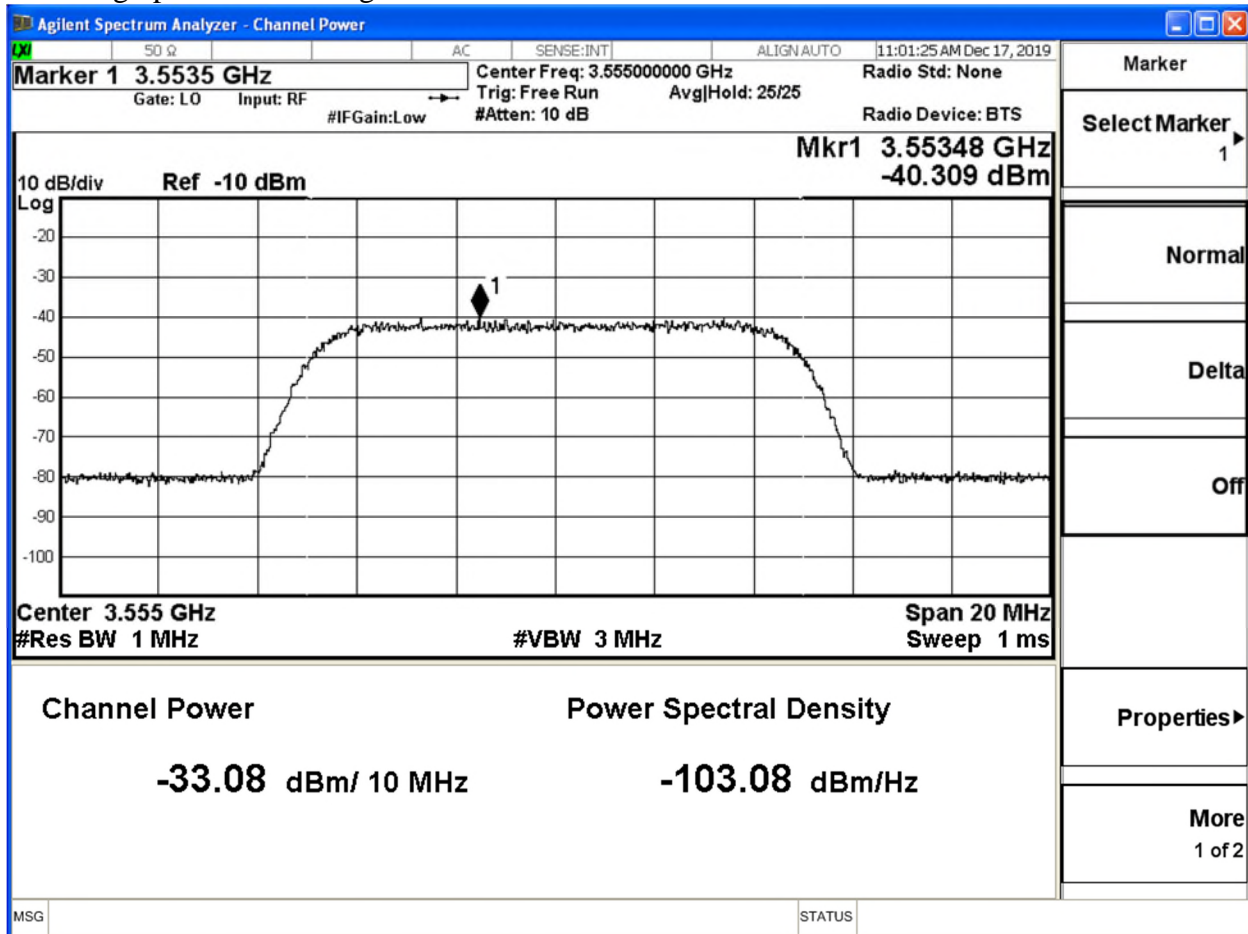
7.1.4.1.1	X	X	WINNF.PT.C.H BT	UUT RF Transmit Power Measurement	<p>Power Spectral Density test case.</p> <p>Assume we use 1 carrier bandwidth (say, 5 or 10 MHz), one frequency (say middle channel in band) for test. Measure at max transmit power, and reduce in steps of 3 dB to minimum declared transmit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

Test Table

		Raw	Raw	External	Conduct				EIRP 1MHz	EIRP 10 MHz	margin
Freq	1MHz EIRP limit (target) dBm	10 MHz	1MHz	Losses (dB)	dBm/M Hz	antenna gain dBi	ports	port gain (dB)	dBm/M Hz	dBm	dB
3555-High	37	-33.08	-40.31	41.93	1.62	17.00	64	18.06	36.68	43.91	0.32
3630-high	37	-33.01	-41.85	42.26	0.41	17.00	64	18.06	35.47	44.31	1.53
3695-high	37	-32.74	-40.82	42.33	1.51	17.00	64	18.06	36.57	44.65	0.43
3555-High	37	-27.94	-35.54	41.93	6.39	11.00	64	18.06	35.45	43.05	1.55
3630-high	37	-27.11	-34.76	42.26	7.50	11.00	64	18.06	36.56	44.21	0.44
3695-high	37	-27.48	-35.93	42.33	6.40	11.00	64	18.06	35.46	43.91	1.54

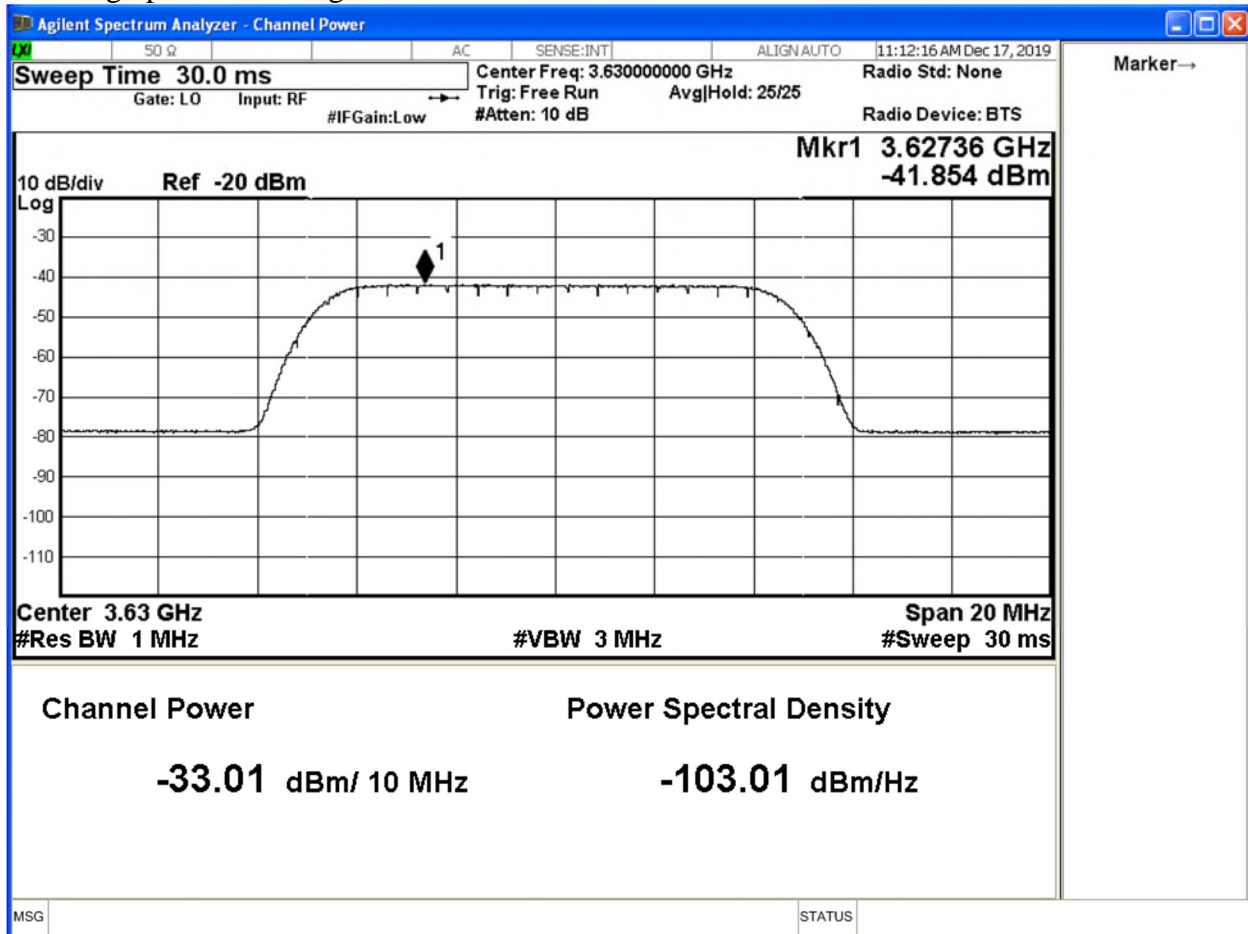
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555-High power – 17 dBi gain



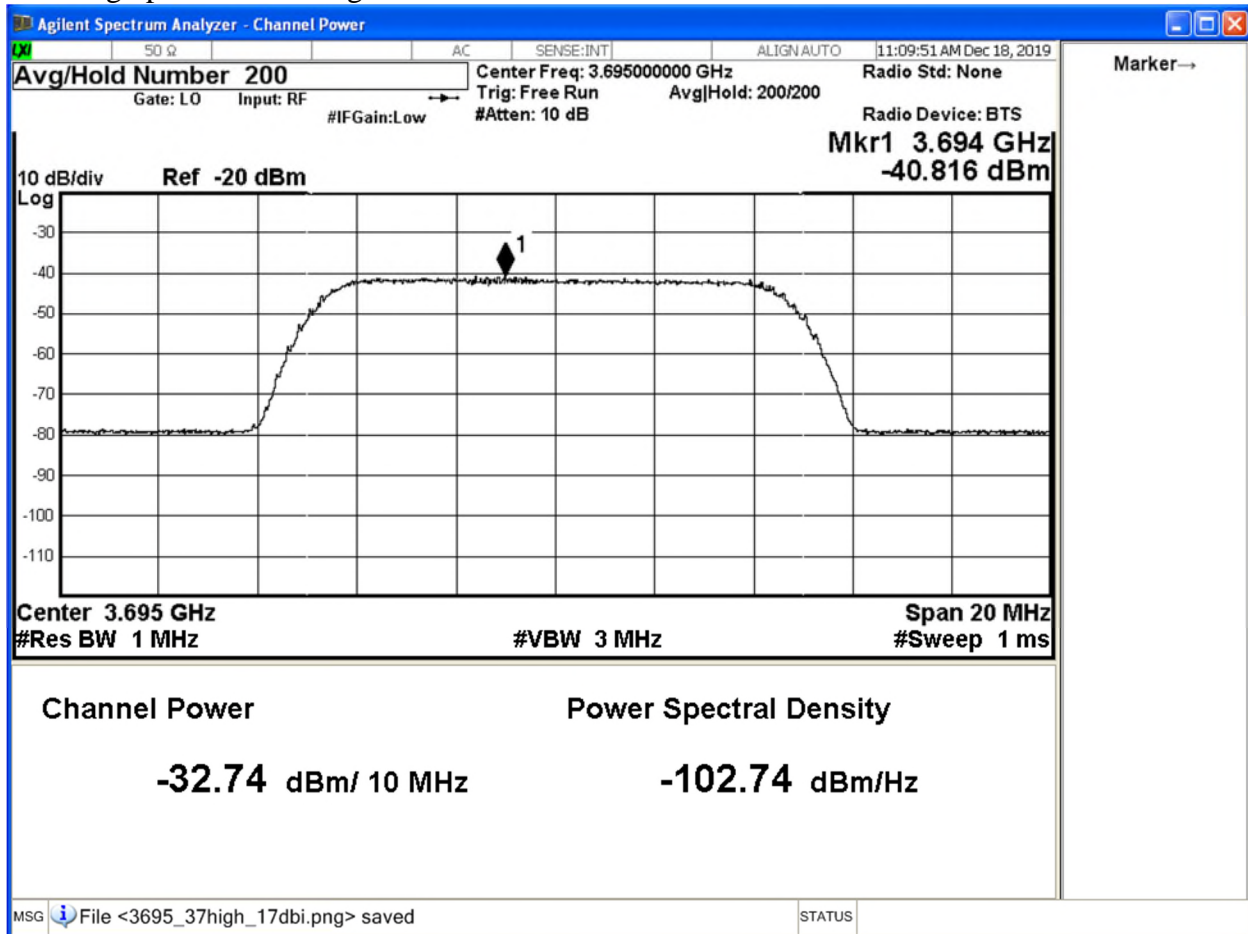
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630-high power 17 dBi gain



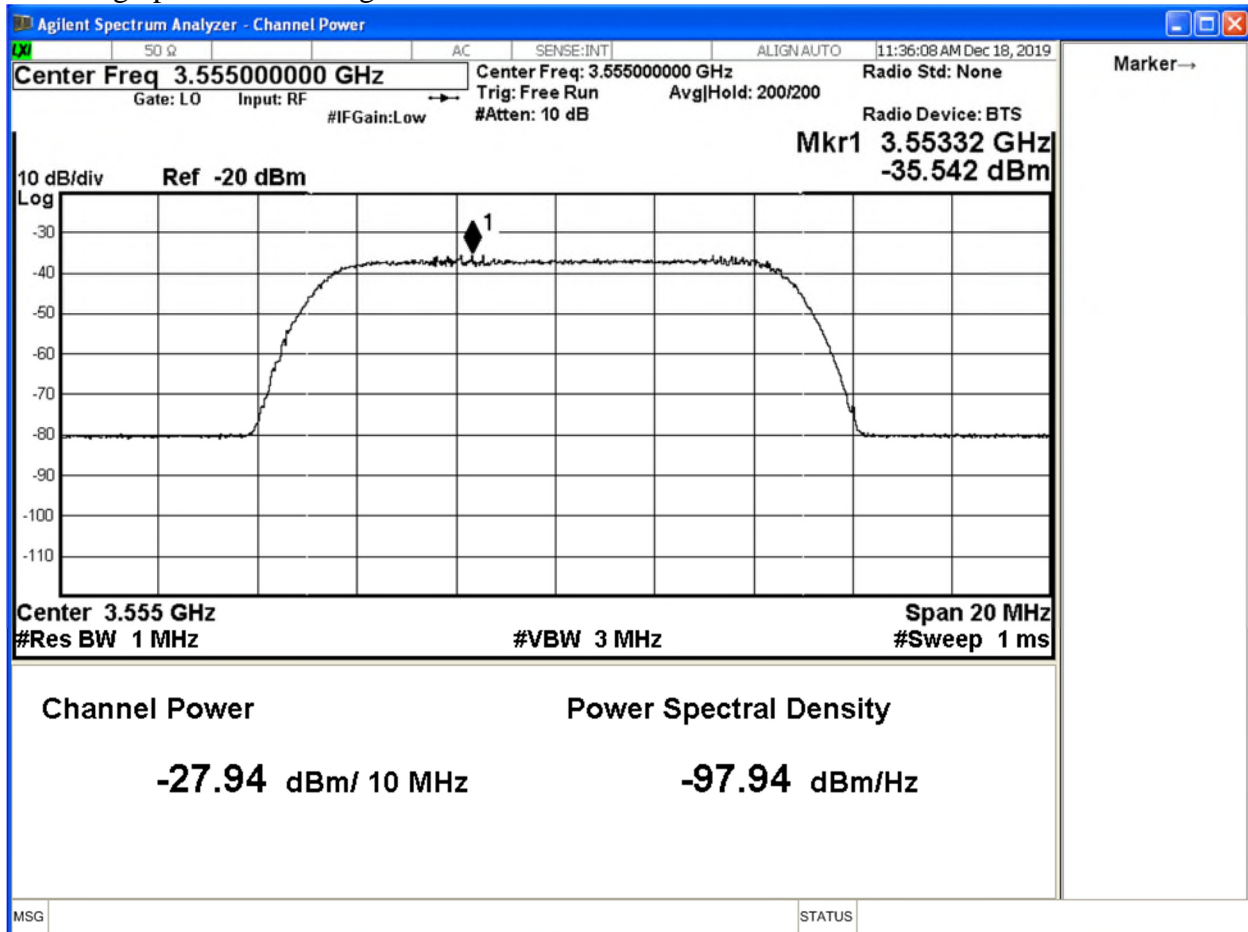
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3695-high power – 17 dbi gain



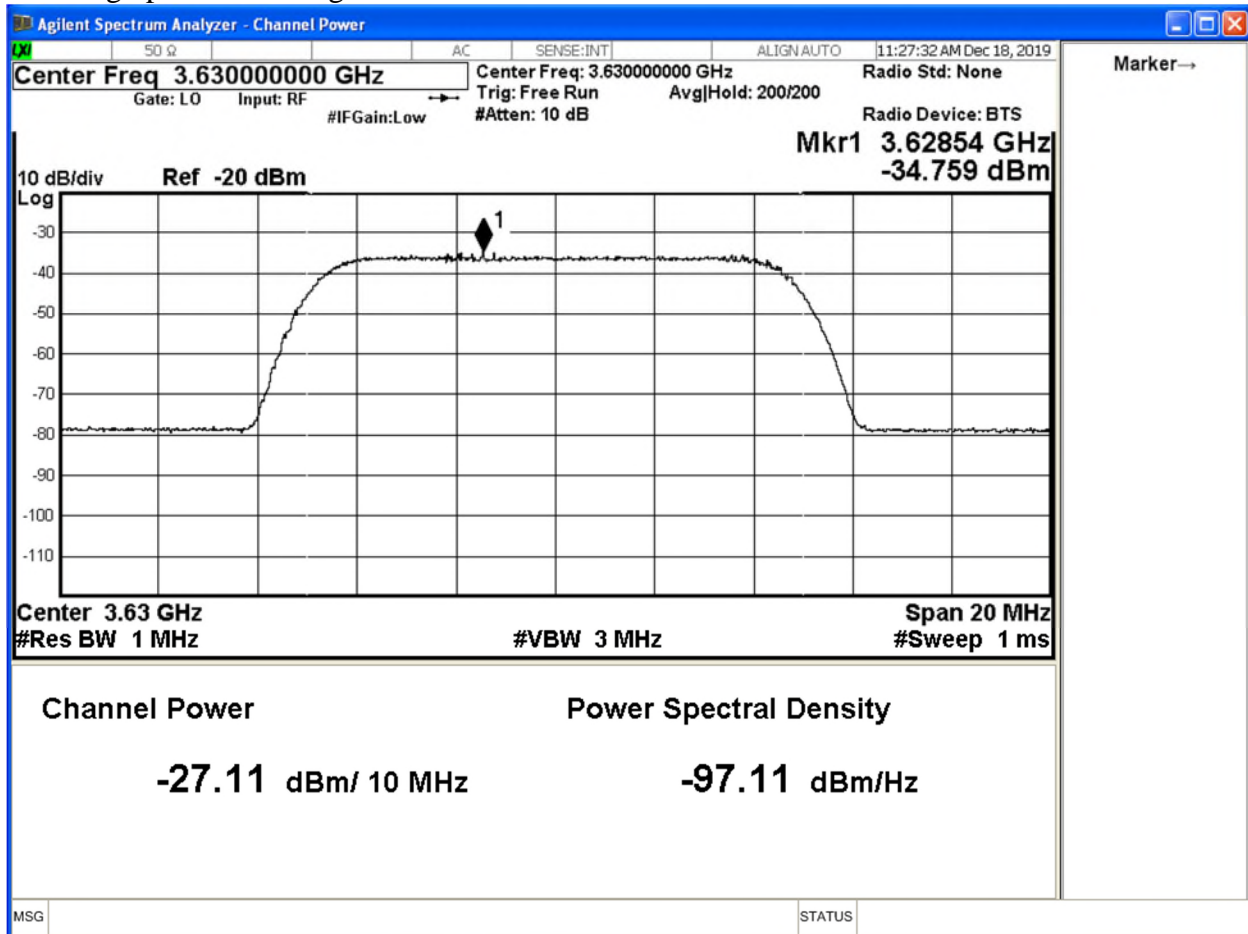
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3555-High power – 11 dBi gain



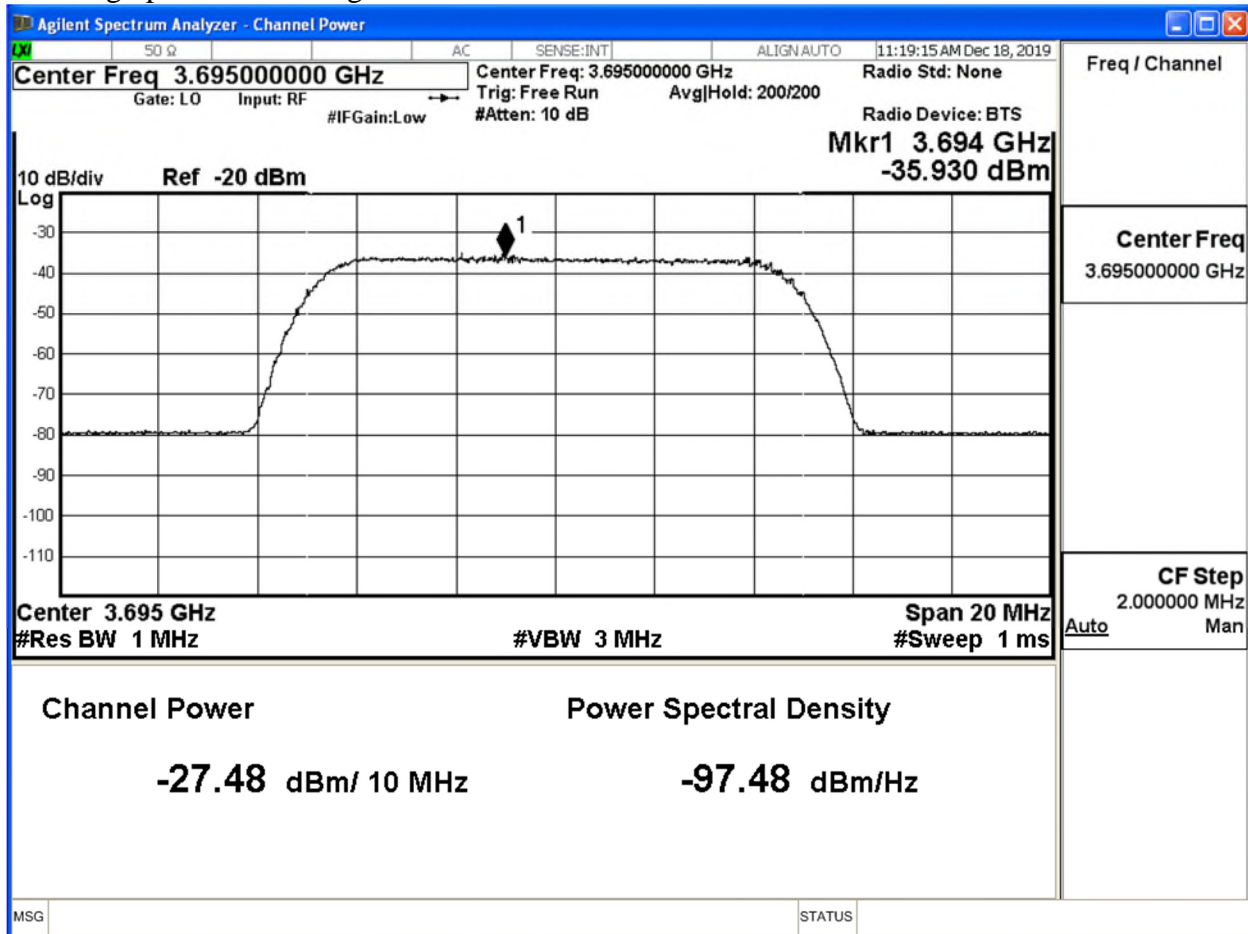
Client	Ericsson	
Product	Ericsson Remote Radio Air 6488 B48 KRD 901160	
Standard(s)	FCC Part 96 SAS requirements (CBRS Test Plan)	

3630-high power 11 dBi gain



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

3695-high power – 11 dbi gain



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

Test equipment used for Dec 2019 testing

Instrument	Manufacturer	Type No.	Serial No	Calibration Period (months)	Calibration Due
THG	Fluke	77 IV	34770264	12	18-Apr-2020
DVM	VWR	61161-378	170120564	24	17-Feb-2021
Power Supply	Xantrex	XKW 60-50	E00109863	O/P Mon	-
Spectrum Analyser	Keysight	N9020A	MY49100827	24	27-Dec-2021
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	-