Test Report

As per

FCC Part 96 SAS requirements (CBRS Test Plan)

Canada

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on the

Ericsson Remote Radio Unit LTE KRC 161 711/1
Radio 2208 B48 (3550-3700MHz)

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Testing produced for

Ericcson Canada

See Appendix A for full client & EUT details.

Scott Drysdale.
Test Personnel

Abderrahmane Ferhat
Report Reviewer

Testing Laboratory
Certificate #2955.02

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the **LTE KRC 161 711/1 Radio 2208 B48(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.

Summary

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

Equipment Under Test (EUT)	**LTE KRC 161 711/1 Radio 2208 B48(3550-3700 MHz)**
EUT passed all tests performed	Yes
Tests conducted by	Scott Drysdale

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

Test Results Summary

Section as per Working Document WINNF-TS-0122

Section	CBSD	DP	Test Case ID	Test Case Title	RF Measurement Requirement	Pass / Fail
6.1.4.1.1	X	--	WINNF.FT.C.REG.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.REG.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.REG.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.REG.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.REG.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.REG.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.REG.7	Registration due to change of an installation parameter	Test waits until transmission starts, then trigger an	P

					installationParam change. • 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.REG.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.REG.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.REG.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.REG.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.REG.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.REG.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.REG.14	Blacklisted CBSD (responseCode 101)	Monitor for 60 seconds after REG message sent. No	N/A

					transmission during test.	
6.1.4.2.8	--	X	WINNF.FT.D.REG.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.REG.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.REG.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.REG.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.REG.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.REG.20	Category A CBSD location update		N/A
6.3.4.2.1	X	X	WINNF.FT.C.GRA.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.GRA.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.HBT.1	Heartbeat Success Case (first Heartbeat Response)	Monitor RF from start of test. Ensure that: • Transmission does not start until time of first	N/A

					heartbeat response or after. • After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh)	
6.4.4.1.2	--	X	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	Monitor RF from start of test. Ensure that: • 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.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	Monitor RF transmission. Ensure that: • CBSD stops transmission within 60 seconds of the heartbeatResponse which contains	P

					responseCode = 105	
6.4.4.2.2	X	--	WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)		N/A
6.4.4.2.3	X	X	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
6.4.4.2.4	X	X	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Monitor RF transmission. Ensure: • CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501	p
6.4.4.2.5	X	X	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	Monitor RF transmission. Ensure: • CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502	p
6.4.4.2.6	--	X	WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT)	Monitor RF transmission. CBSDs will have different behavior: • CBSD1: will continue to transmit to end of test	P

					(this is not a pass/fail criteria, but check) • CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500	
6.4.4.3.1	X	X	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
6.4.4.3.2	X	X	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Monitor RF transmission. Verify: • CBSD must stop transmission within transmitExpireTime+60 seconds, where transmitExpireTime is from last successful heartbeatResponse message	P
6.5.4.2.1	X	--	WINNF.FT.C.MES.1	Registration Response contains measReportConfig	No RF monitoring	N/A
6.5.4.2.2	--	X	WINNF.FT.D.MES.2	Domain Proxy Registration Response contains measReportConfig	No RF monitoring	P

6.5.4.2.3	X	X	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	No RF monitoring	P
6.5.4.2.4	X	--	WINNF.FT.C.MES.4	Heartbeat Response contains measReportConfig	No RF monitoring	N/A
6.5.4.2.5	--	X	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	No RF monitoring	P
6.6.4.1.1	X	--	WINNF.FT.C.RLQ.1	Successful Relinquishment	Monitor RF transmission. Ensure: • CBSD stops transmission at any time prior to sending the relinquishmentRequest message.	N/A
6.6.4.1.2	--	X	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	Monitor RF transmission. Ensure: • CBSD stops transmission at any time prior to sending the relinquishmentRequest message.	P
6.7.4.1.1	X	--	WINNF.FT.C.DRG.1	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)	N/A

6.7.4.1.2	--	X	WINNF.FT.D.DRG.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.SCS.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.SCS.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.SCS.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.SCS.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.SCS.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.HBT	UUT RF Transmit Power Measurement	Power Spectral Density test case. Assume we use 1 carrier bandwidth	P

					(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.

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.

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

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 market. 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 UTC in the logs.

Logs are kept on file.

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 Version V1.0.0 19 December 2017	Conformance and Performance Test Technical Specification; CBSD/DP as Unit Under Test (UUT) Working Document
ISO/IEC 17025:2005	General requirements for the competence of testing and calibration laboratories

Document Revision Status

Revision 000: August 13, 2018 First Draft

Revision 001: August 14, 2018 Revisions as per customer request. Kept on file.

Revision 002: August 15, 2018 Revisions as per customer request. Kept on file.

Revision 003: August 16, 208 Changed coloring of text and added revisions to EUT description as per customer request.

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'.

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 #2955.02. 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.

Testing Environmental Conditions and Dates

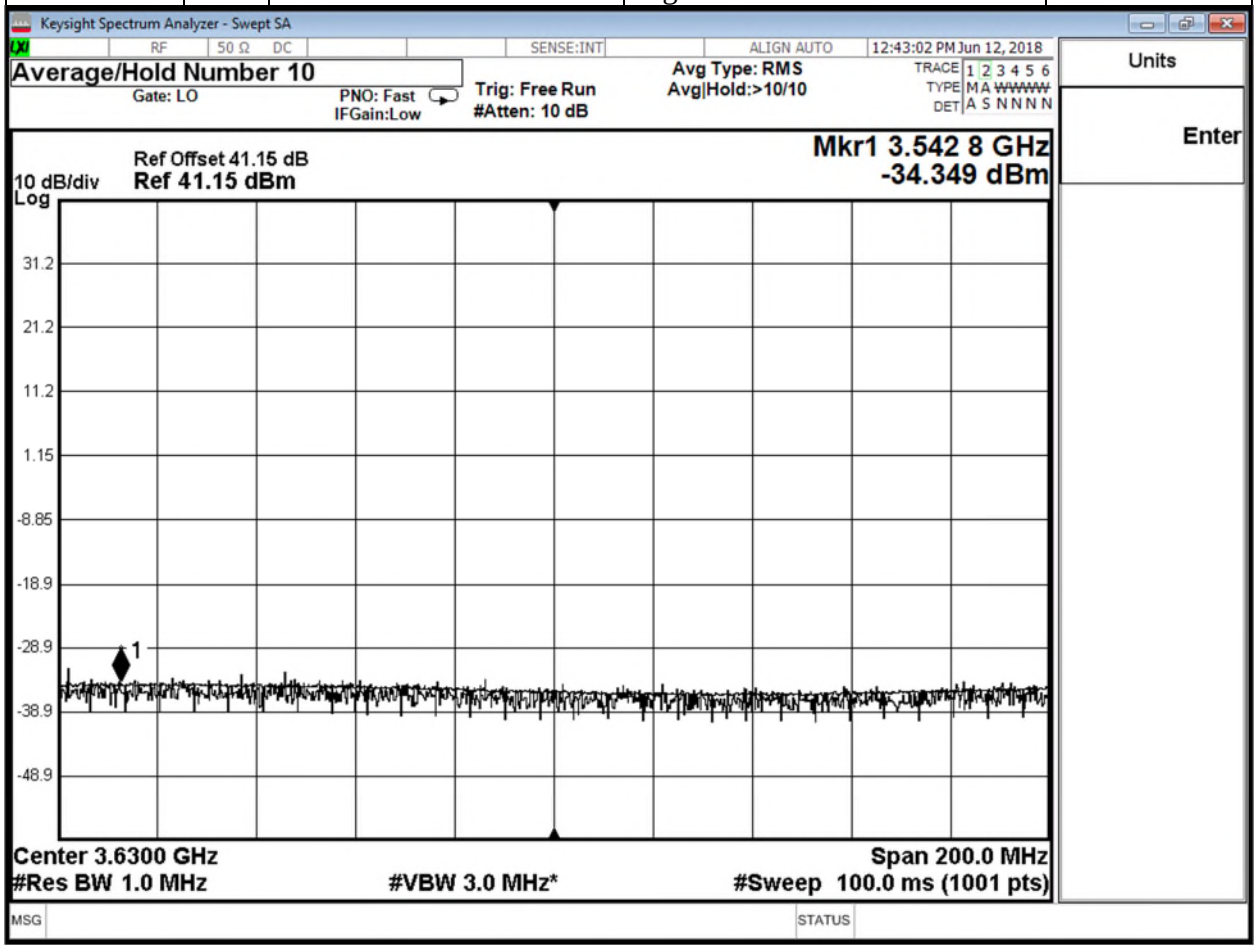
Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
June 12, 2018	All	SD	20-23	40-55	96.106

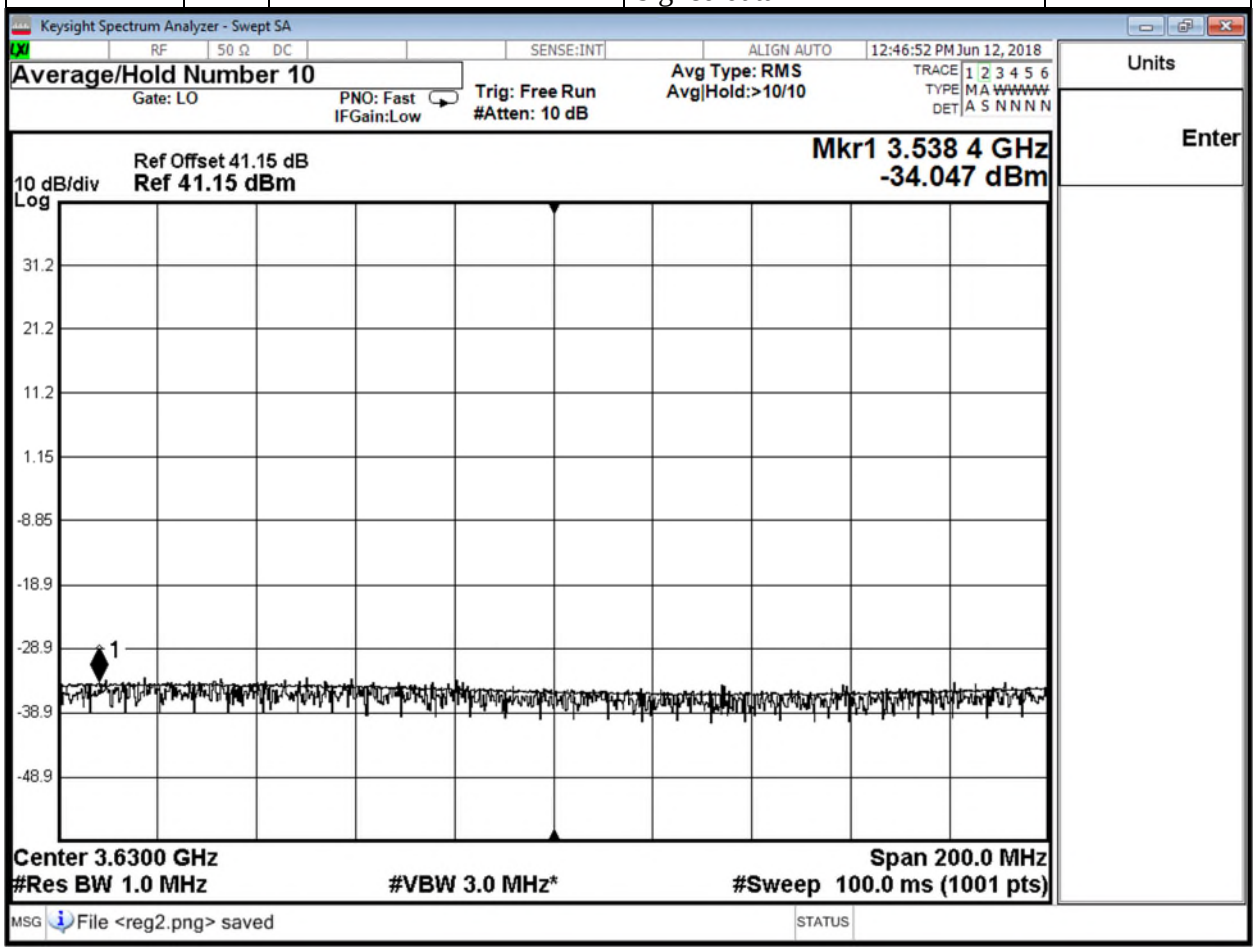
Detailed Test Results Section

Authorization transmit after it receives authorization from a SAS.

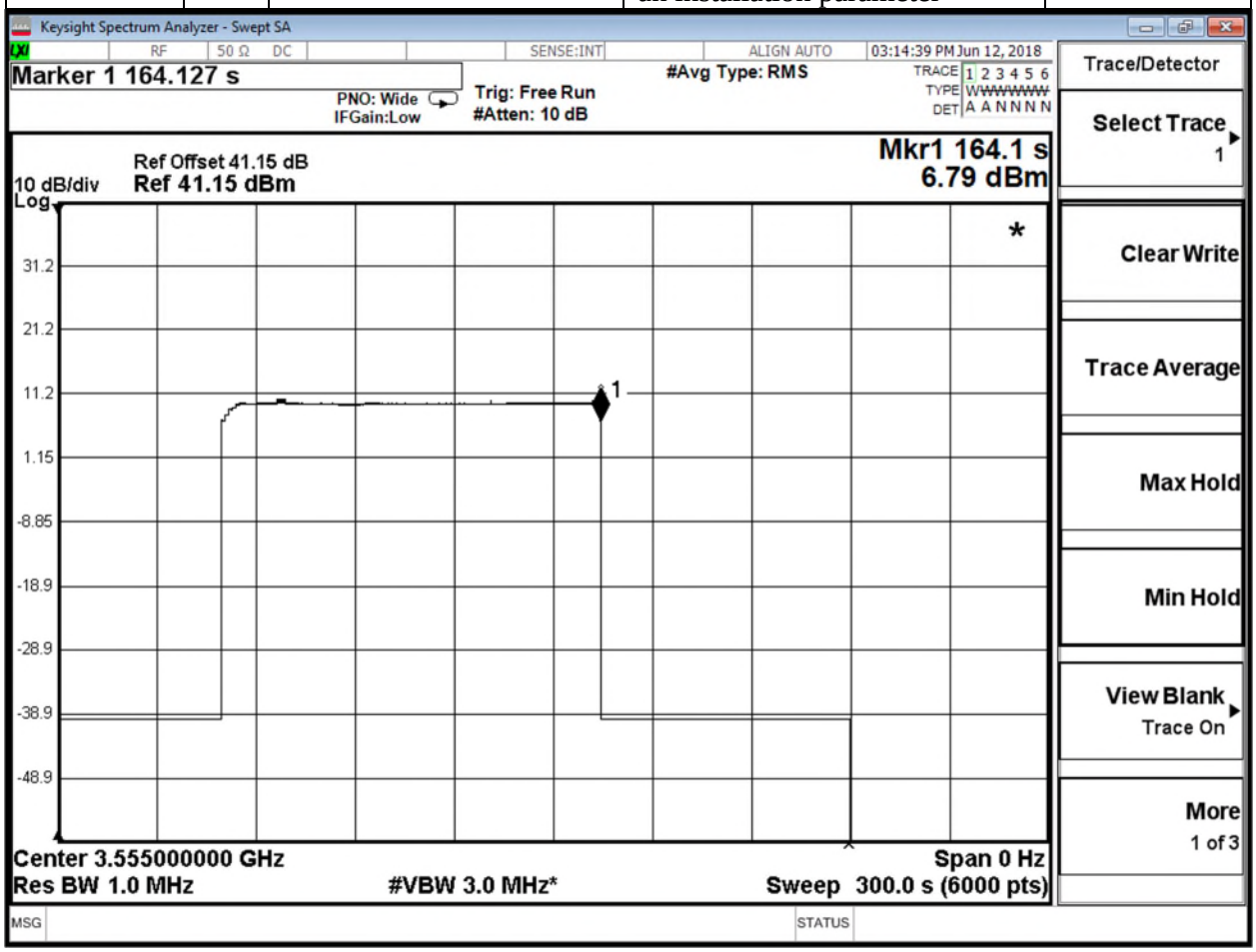
Section	DP	Test Case ID	Test Case Title	Pass / Fail
6.1.4.1.2	X	WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	P



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



6.1.4.1.7	X	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	P

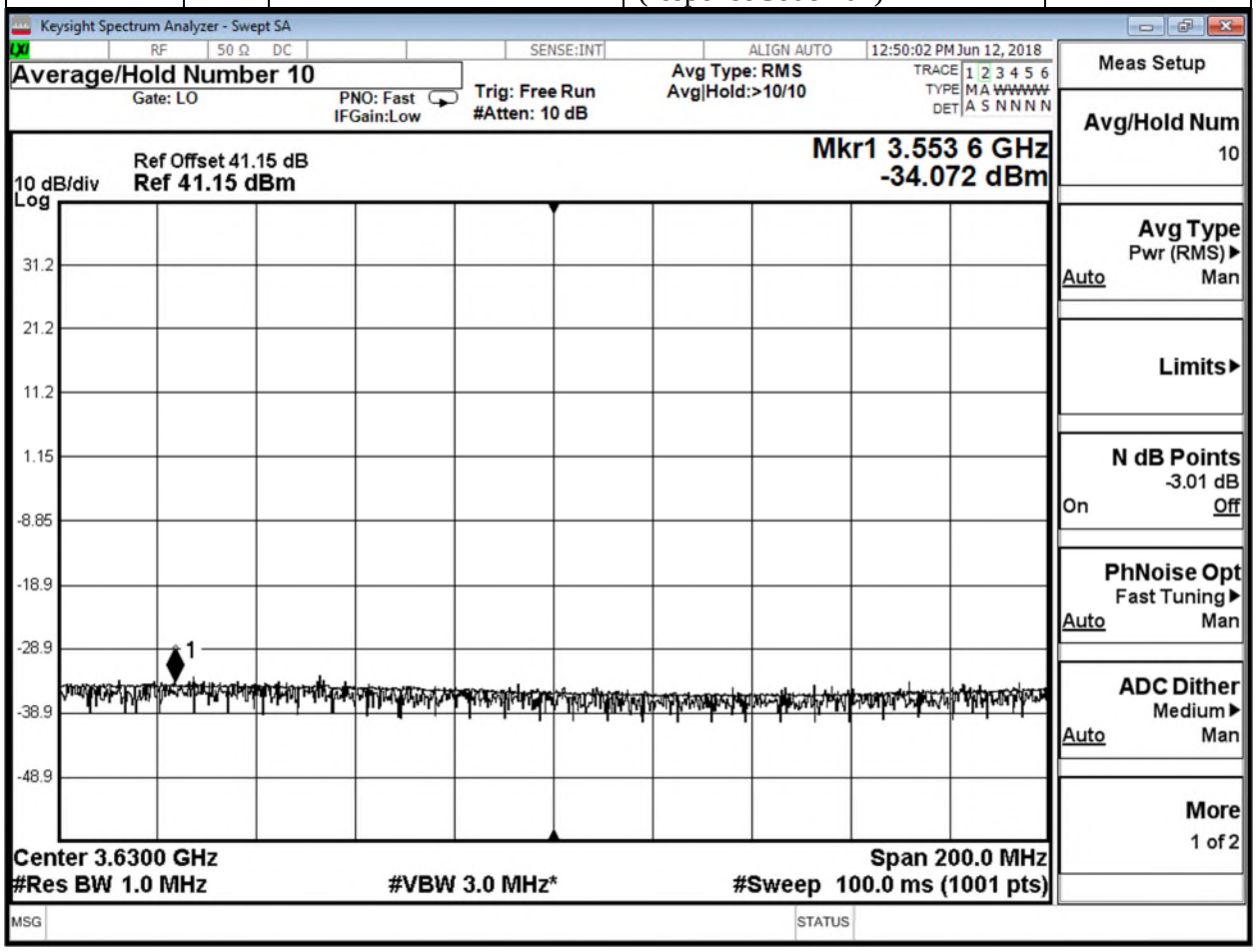


From Test Harness Logs:	
eventTime (from logs)	**Comment**
19:13:30	RLQ.request sent at 2018-06-12T19:13:30.108Z

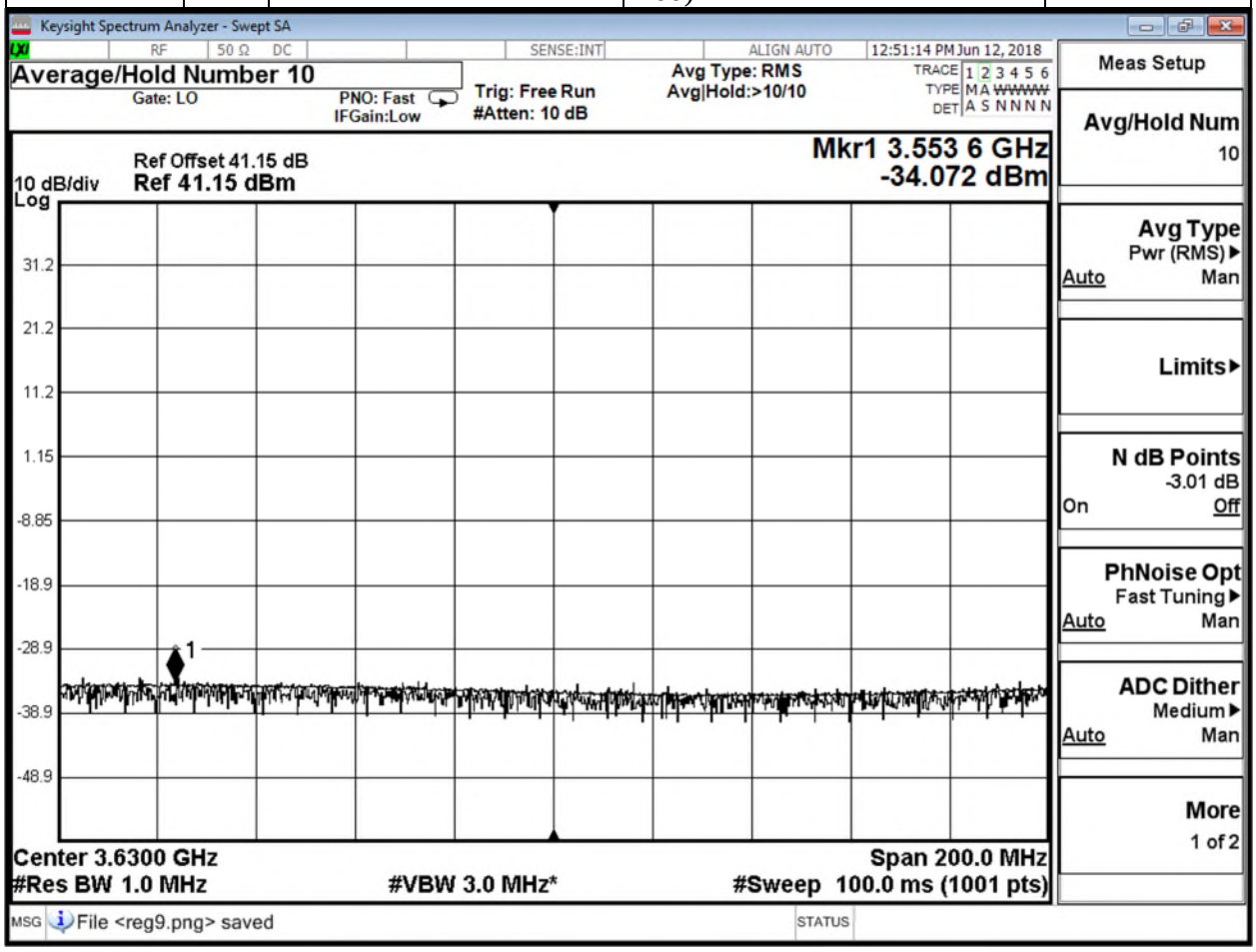
From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
REG.7	15:14:39	240	15:10:39	164	15:13:23	**19:13:23**	ok
			from DP logs (below)			**19:13:25**	ok from DP

Note: DP log 19:13:25,898 INFO [com.ericsson.oss.sas.handler.network.cm.CMHandler] (EJB timerService - 1) Set the CbrsTxExpireTime on the cell: SubNetwork=G2RBS,ManagedElement=OTENB5311,ENodeBFunction=1,EUtranCellTDD=1 to: -1 in DPS. Time taken: 2054

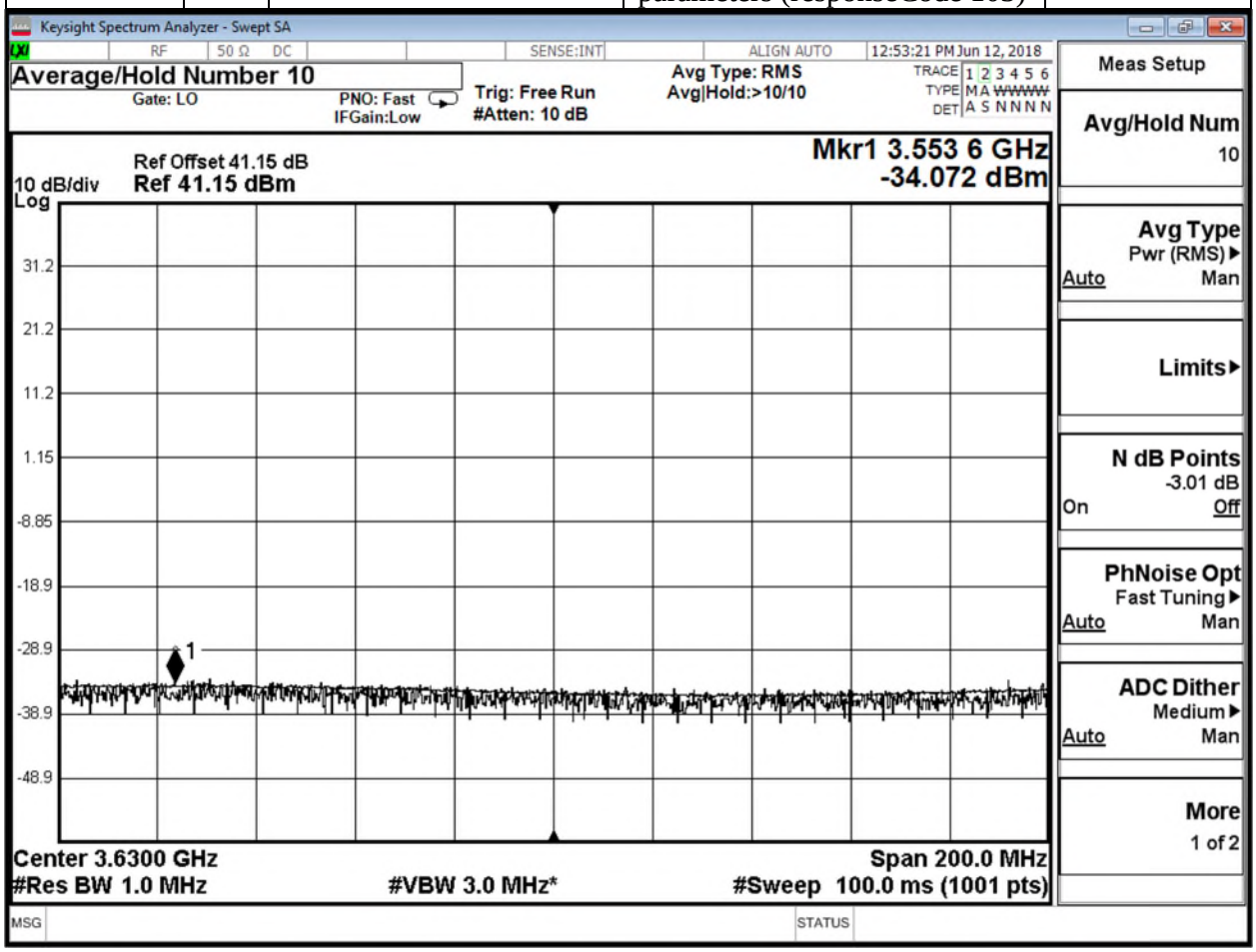
6.1.4.2.2	X	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	P



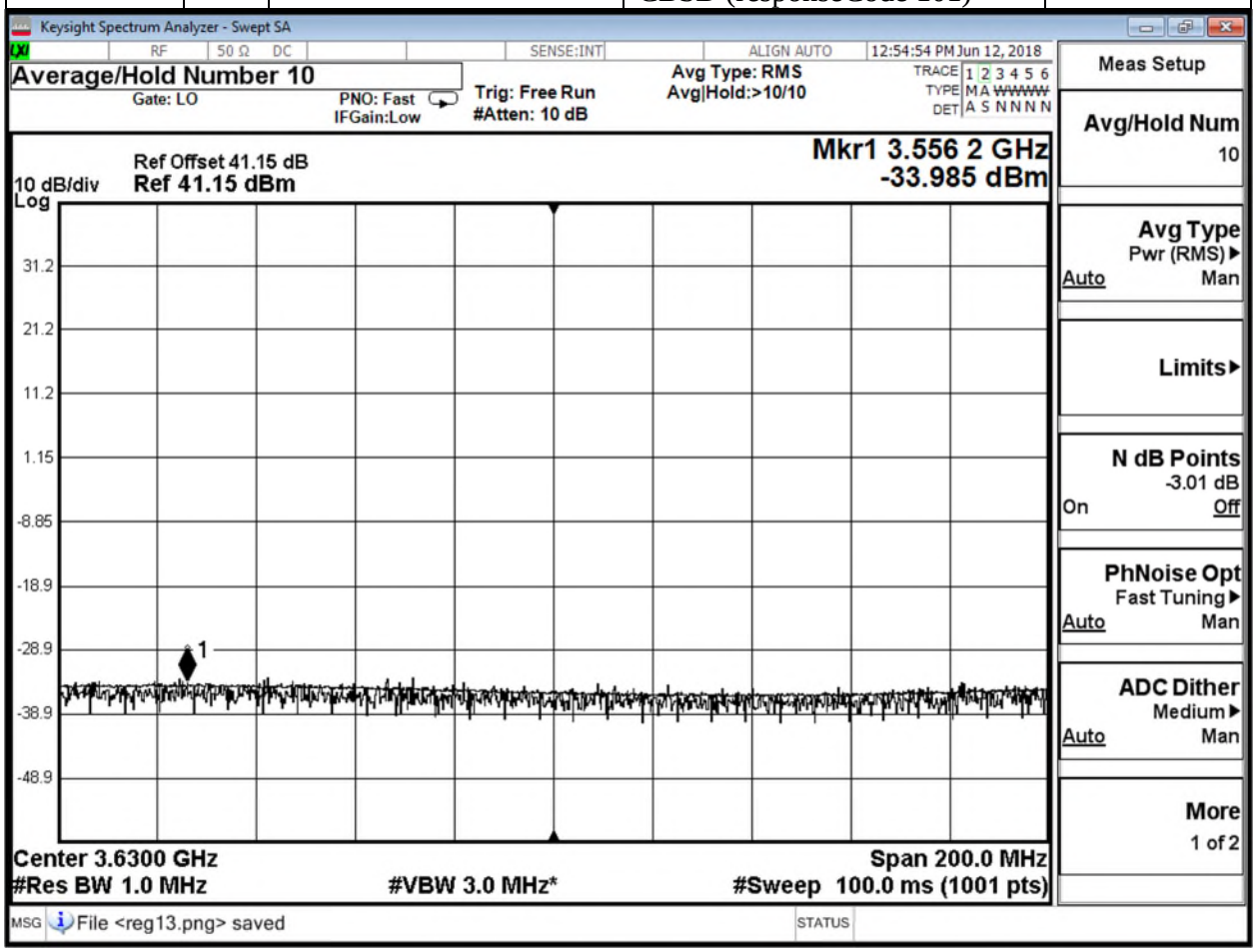
6.1.4.2.4	X	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	P



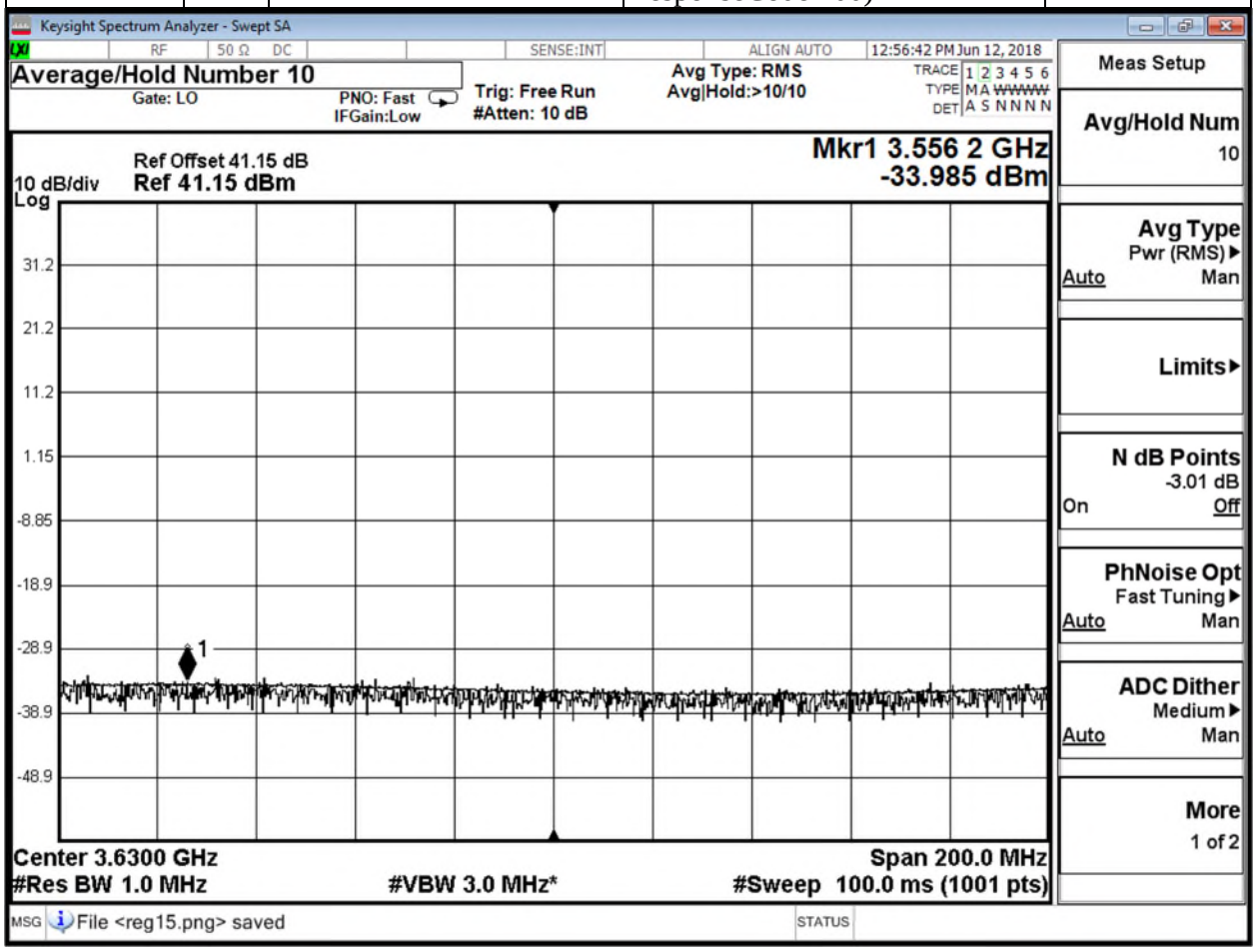
6.1.4.2.6	X	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	P



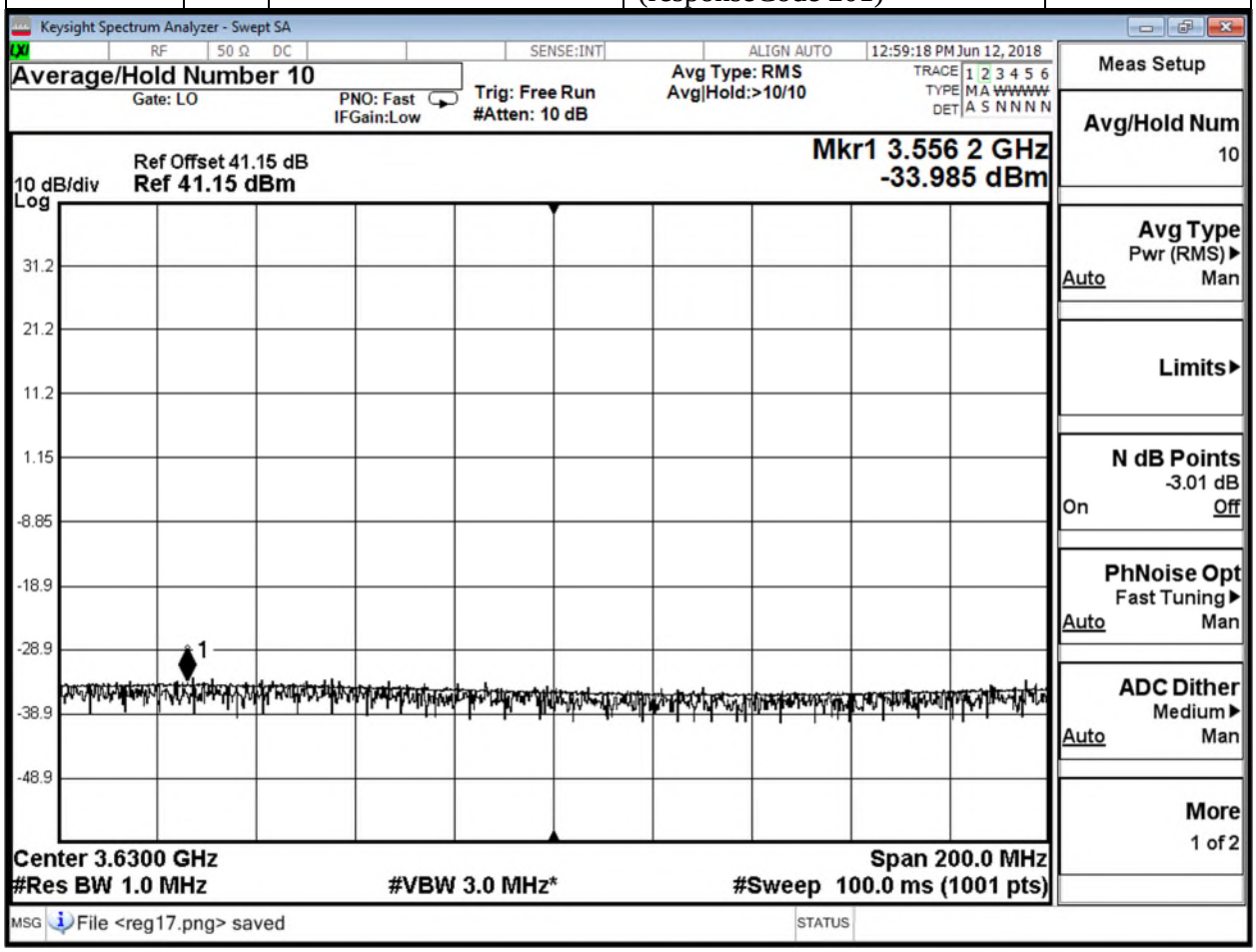
6.1.4.2.8	X	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	P



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

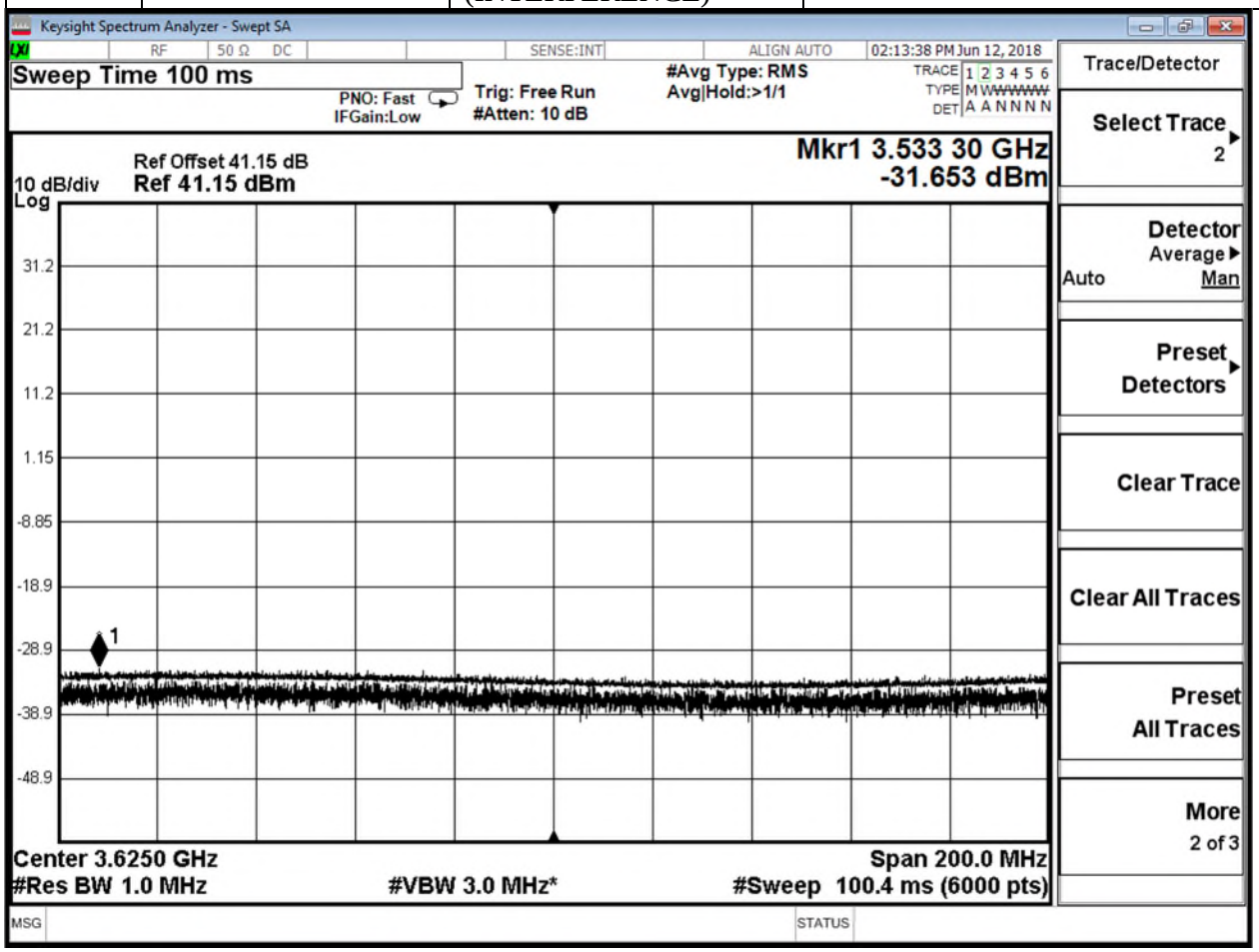


6.1.4.2.12	X	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	P

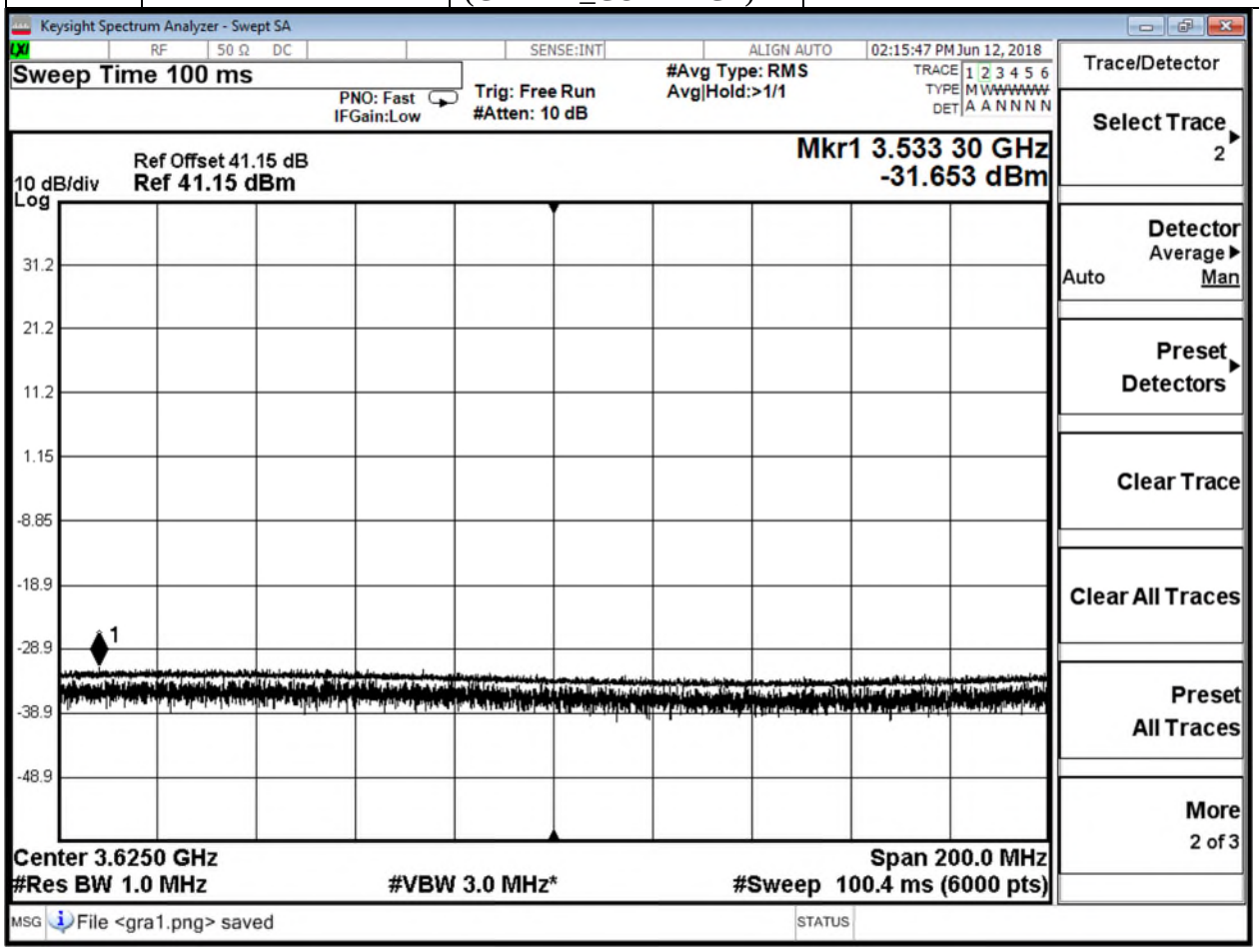


Check the device registration and authorization with the SAS*, *Confirm that the device changes its operating power and/or channel in response to a command from the SAS and Confirm that the device correctly configures based on the different license classes.

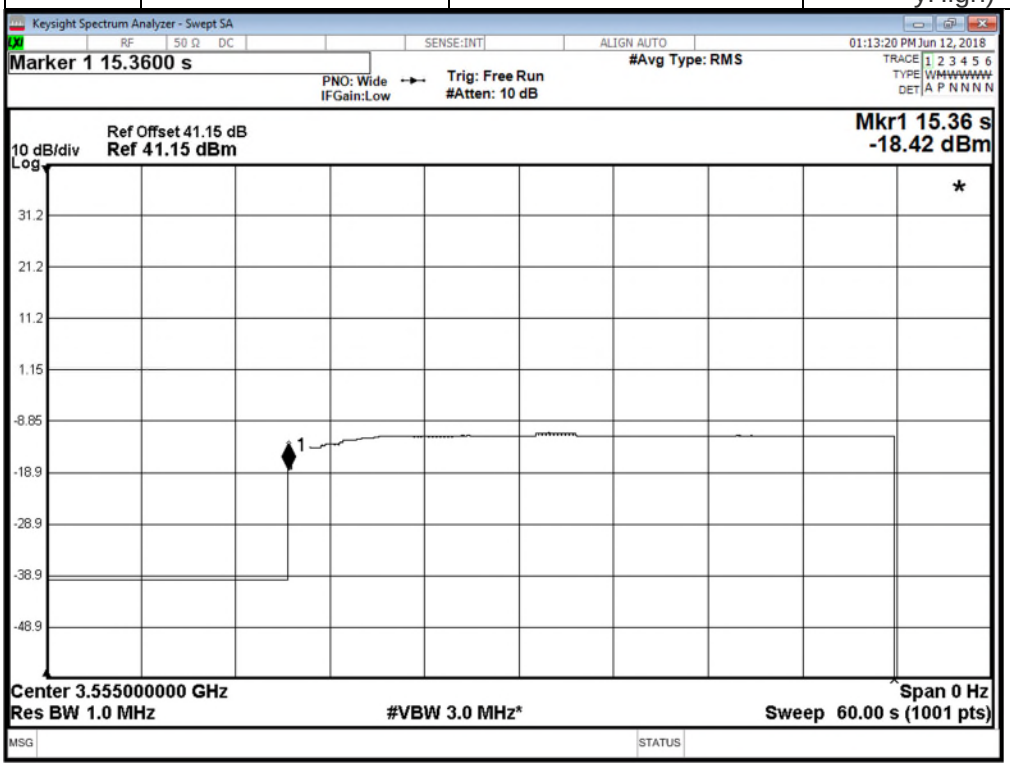
6.3.4.2.1	WINNF.FT.C.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Monitor for 60 seconds after REG message sent. No transmission during test.	P



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



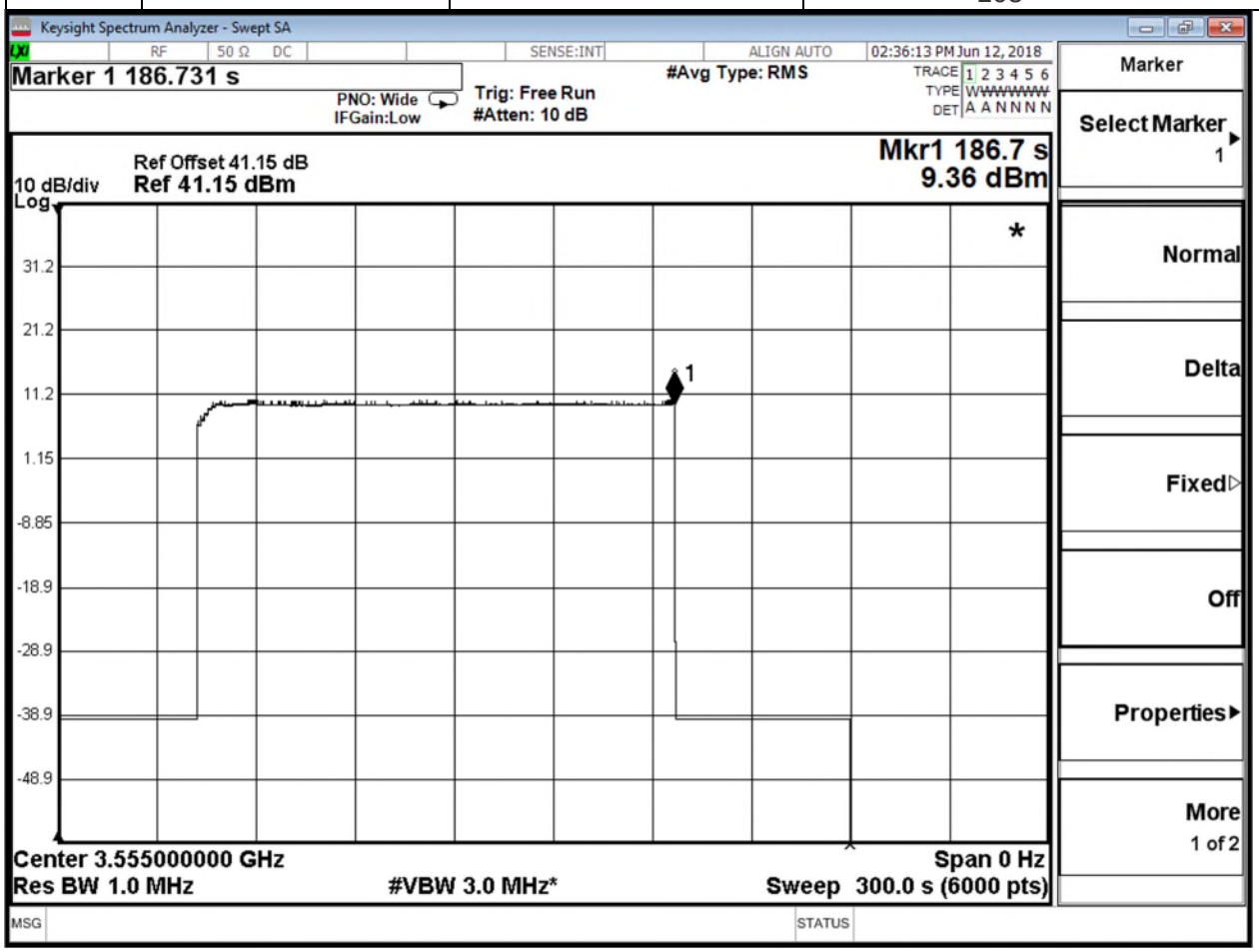
6.4.4.1.2	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	Monitor RF from start of test. Ensure that: • Transmission does not start until time of first heartbeat response or after. • After transmission starts, measure that transmission is within the granted channel (frequencyLow, frequencyHigh)	P



From Test Harness Logs:	
eventTime (from logs)	**Comment**
17:12:38	first HBT.response sent at 2018-06-12T17:12:38.221Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.2	13:13:20	54	13:12:26	15.36	13:12:41	**17:12:41**	ok

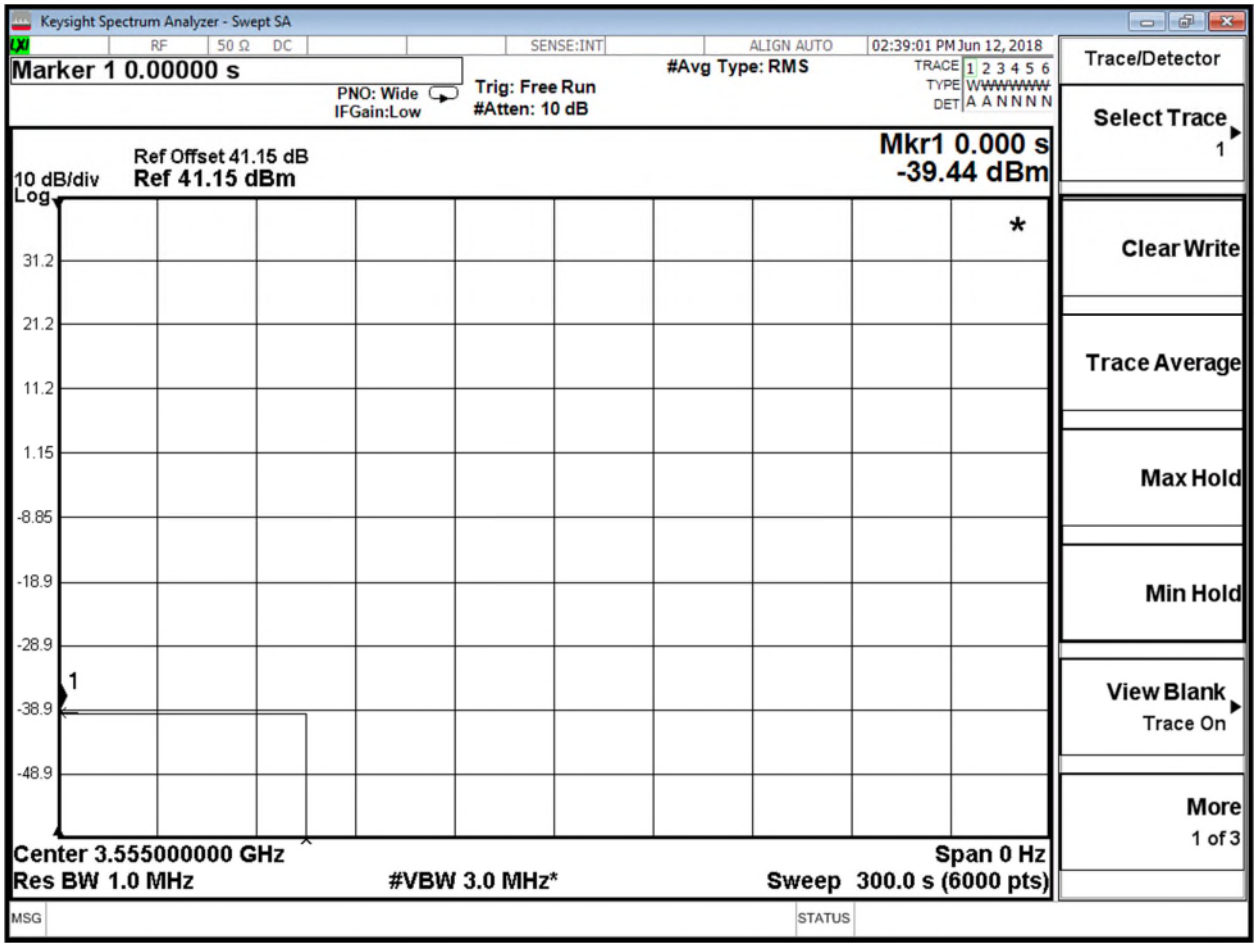
6.4.4.2.1	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	Monitor RF transmission. Ensure that: • CBSD stops transmission within 60 seconds of the heartbeatResponse which contains responseCode = 105	P



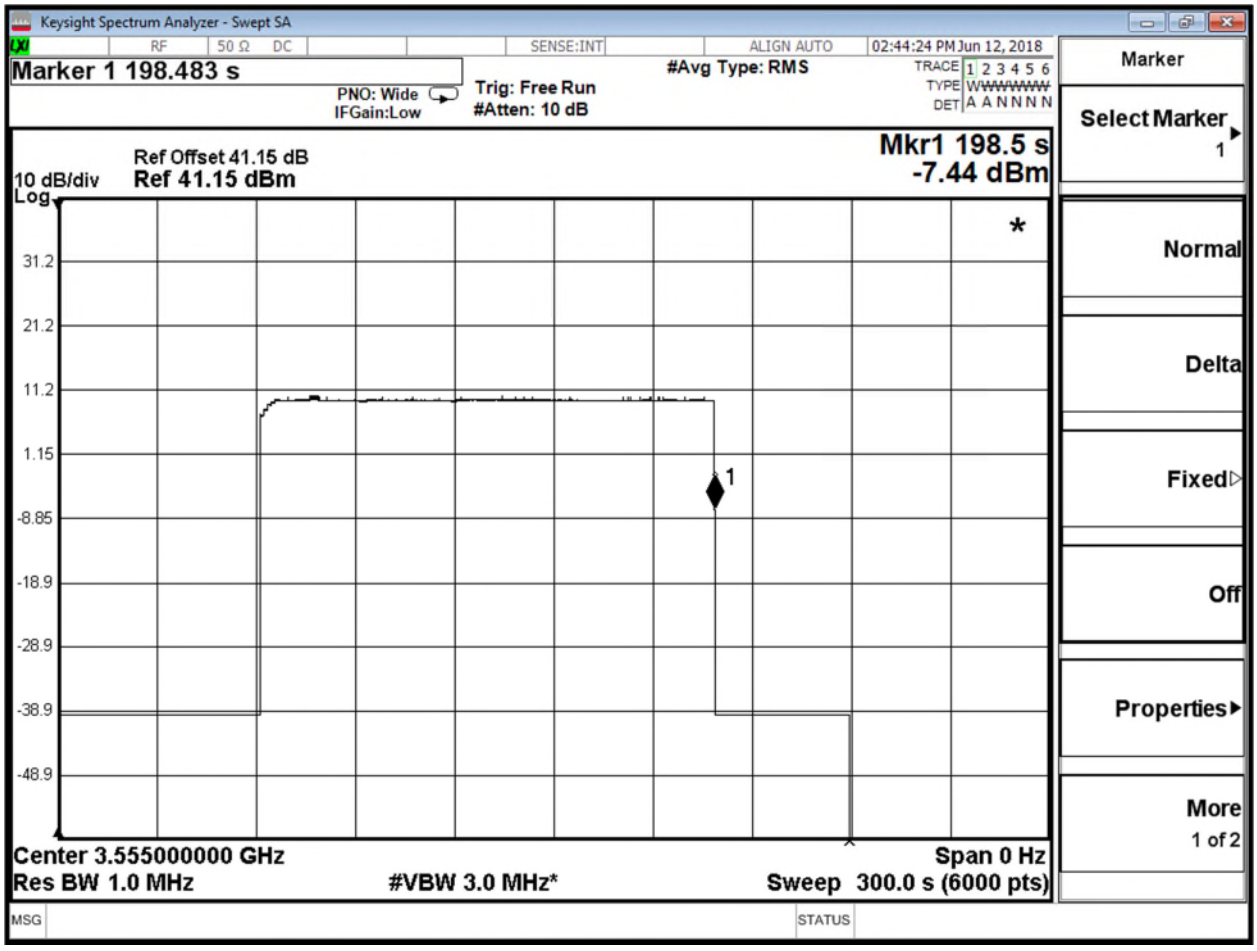
From Test Harness Logs:	
eventTime (from logs)	**Comment**
18:35:19	HBT.response with respCode=105 sent at: 2018-06-12T18:35:19.737Z

From Domain Proxy Logs:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.3	14:36:13	240	14:32:13	186.7	14:35:19	**18:35:19**	ok

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



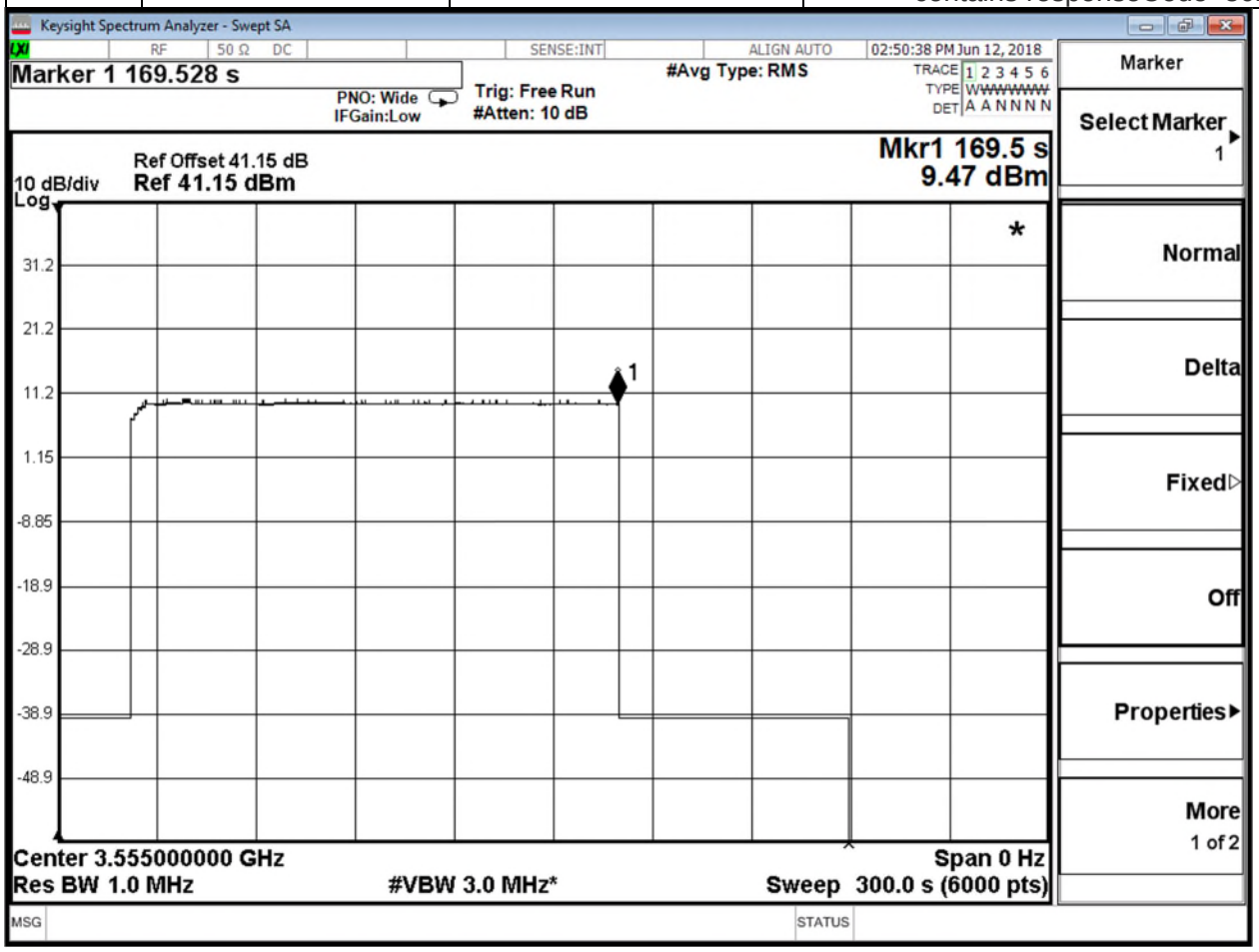
6.4.4.2.4	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Monitor RF transmission. Ensure: • CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=501	p



From Test Harness Logs:	
eventTime (from logs)	**Comment**
18:43:42	HBT.response with respCode=501 sent at: 2018-06-12T18:43:42.239Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.6	14:44:24	240	14:40:24	198.5	14:43:42	**18:43:42**	ok

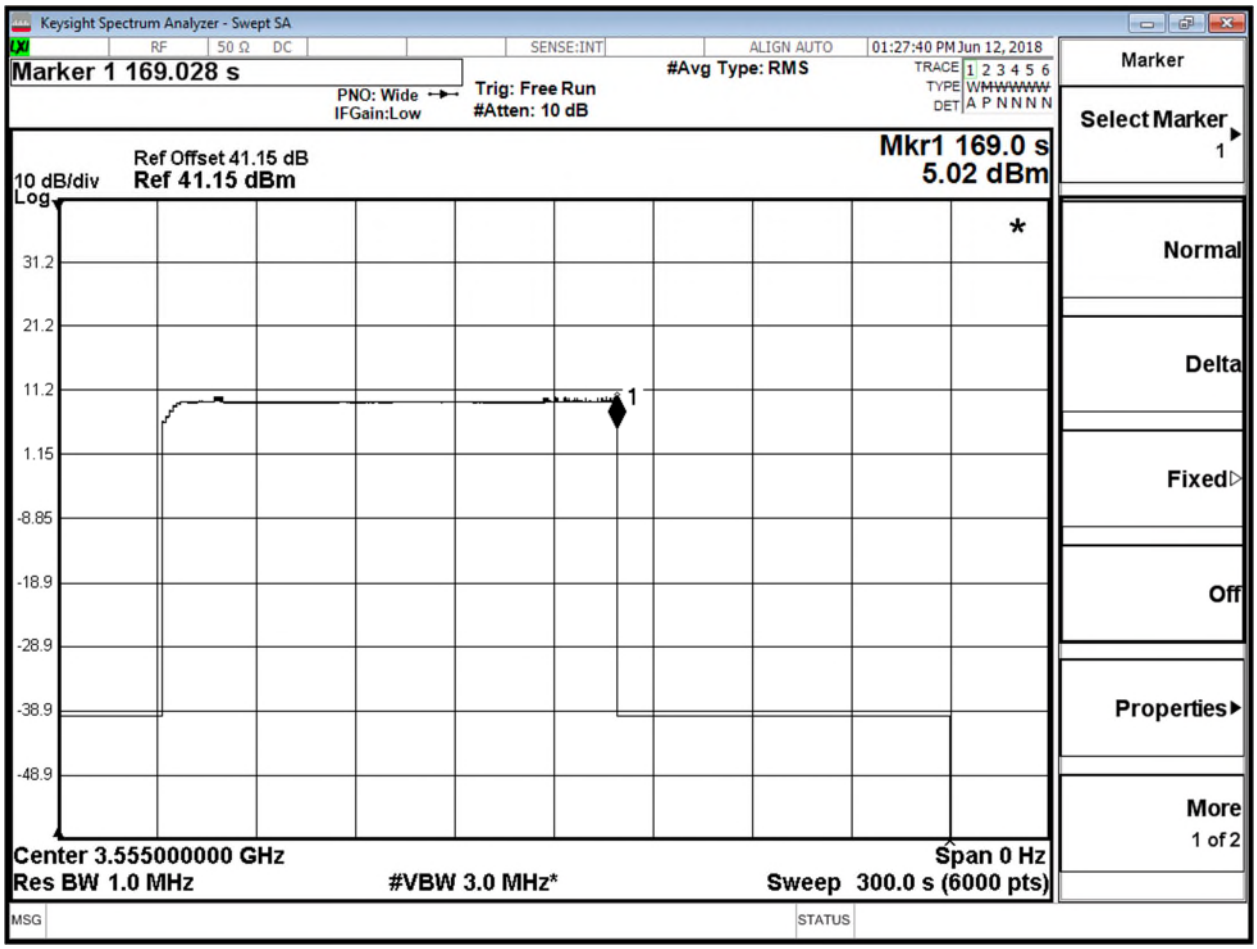
6.4.4.2.5	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	Monitor RF transmission. Ensure: • CBSD stops transmission within 60 seconds of heartbeatResponse which contains responseCode=502	p



From Test Harness Logs:	
eventTime (from logs)	**Comment**
18:49:26	HBT.response with respCode=502 send at: 2018-06-12T18:49:24.686Z, RLQ.request sent at: 2018-06-12T18:49:26.323Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.7	14:50:38	239	14:46:39	169.5	14:49:28	**18:49:28**	ok

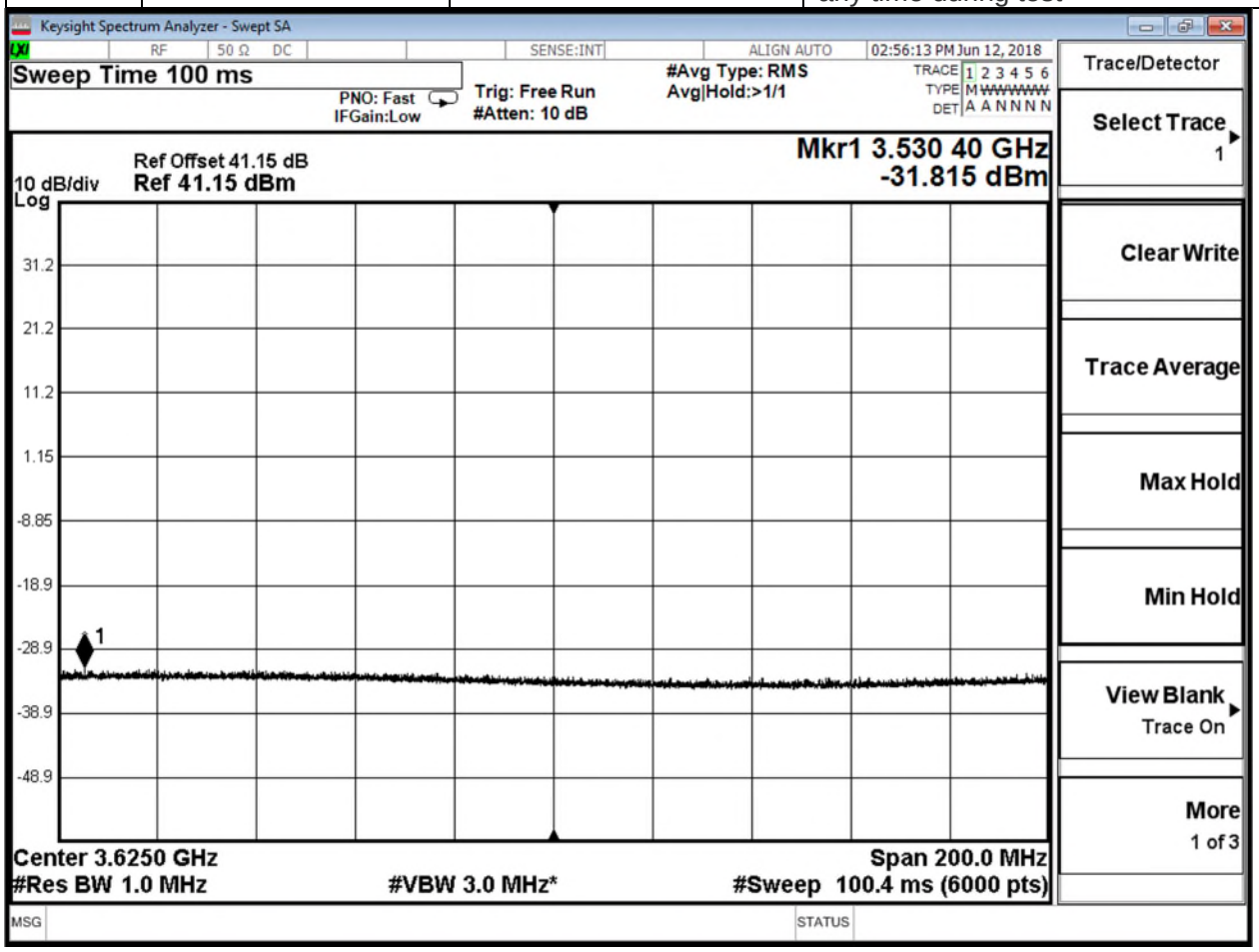
6.4.4.2.6	--	X	WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT)	Monitor RF transmission. CBSDs will have different behavior: • CBSD1: will continue to transmit to end of test (this is not a pass/fail criteria, but check) • CBSD2: must stop transmission within 60 seconds of being sent heartbeatResponse with responseCode = 500	P



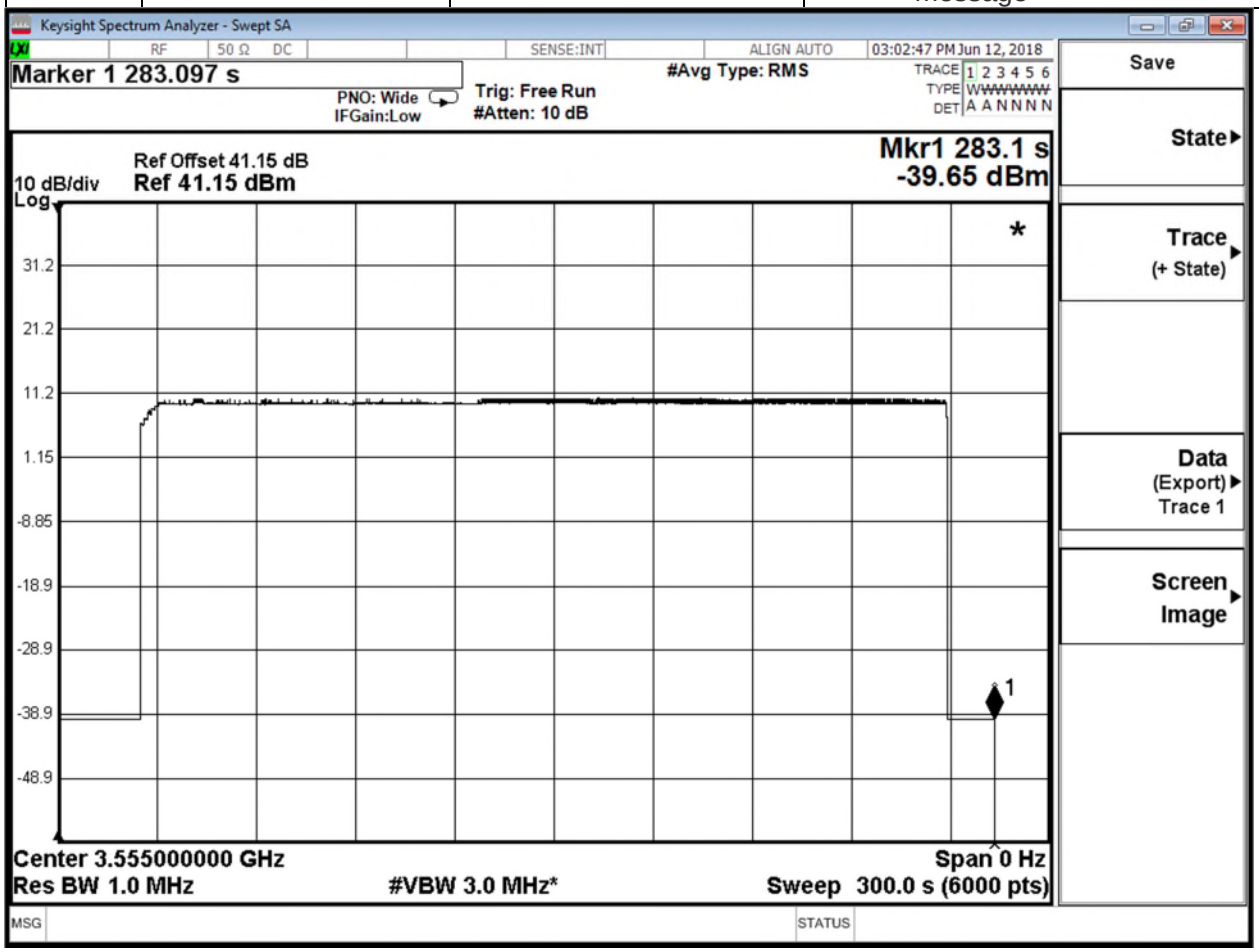
From Test Harness Logs:	
eventTime (from logs)	**Comment**
17:25:57	HBT.response with respCode= 500 sent at: 2018-06-12T17:25:57.004Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.8	13:27:40	270	13:23:10	169	13:25:59	**17:25:59**	ok

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



6.4.4.3.2	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Monitor RF transmission. Verify: • CBSD must stop transmission within transmitExpireTime+60 seconds, where transmitExpireTime is from last successful heartbeatResponse message	P



From Test Harness Logs:	
eventTime (from logs)	**Comment**
19:02:33	Last HBT.response that set TxExpire time @ 2018-06-12T18:59:13.048Z, transmitExpireTime = 2018-06-12T19:02:33Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
HBT.10	15:02:47	283	14:58:04	267	15:02:31	**19:02:31**	ok

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

Pass saw “measreportconfig” in logs

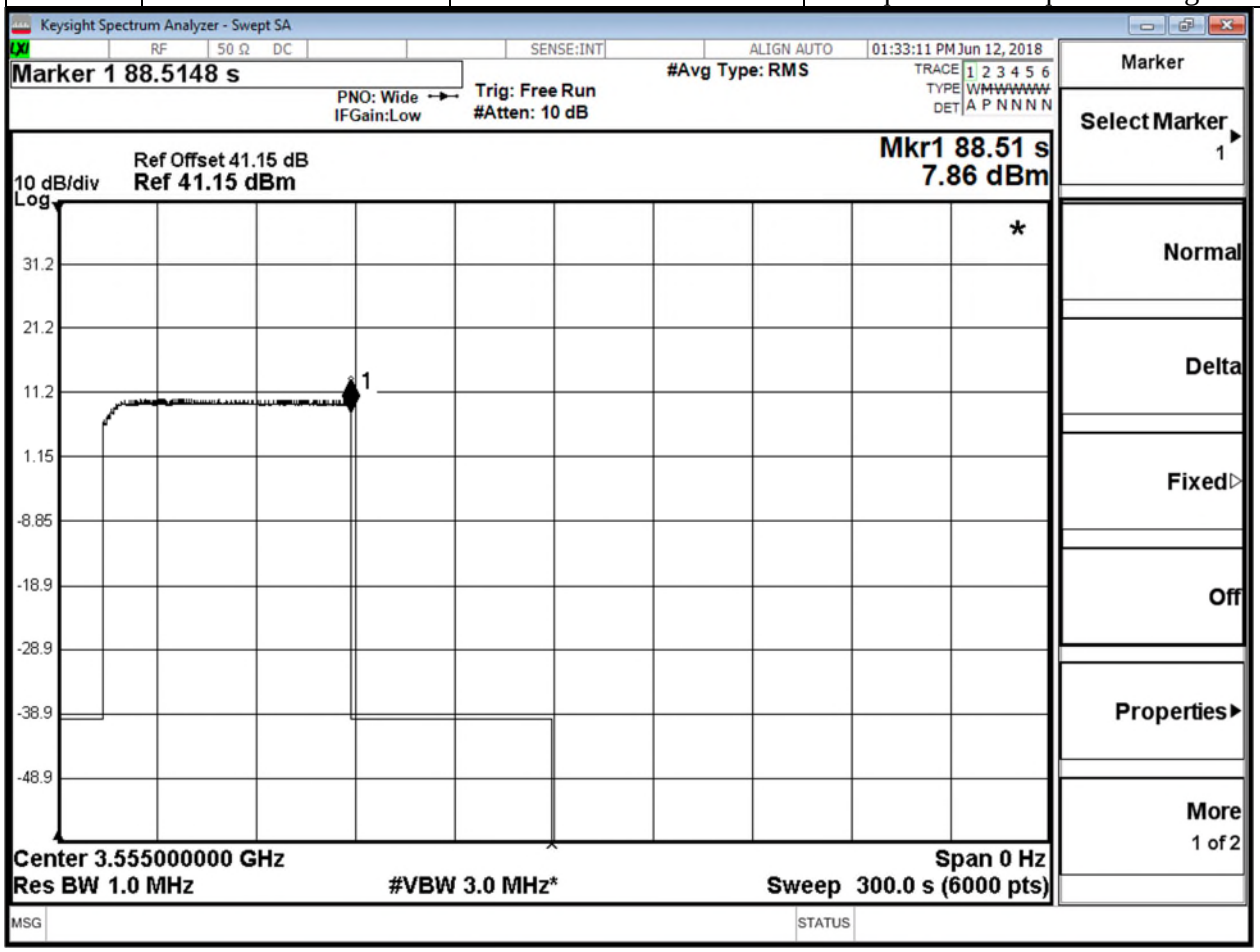
6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	No RF monitoring	P

Pass saw “measreportconfig” in logs

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

Pass saw “measreportconfig” in logs

6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	Monitor RF transmission. Ensure: • CBSD stops transmission at any time prior to sending the relinquishmentRequest message.	P



From Test Harness Logs:	
eventTime (from logs)	**Comment**
17:32:16	RLQ.request sent at: 2018-06-12T17:32:16.822Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
RLQ.2	13:33:11	147	13:30:44	88.51	13:32:12	**17:32:12**	ok
			from DP logs (below)			**17:32:14**	ok from DP logs

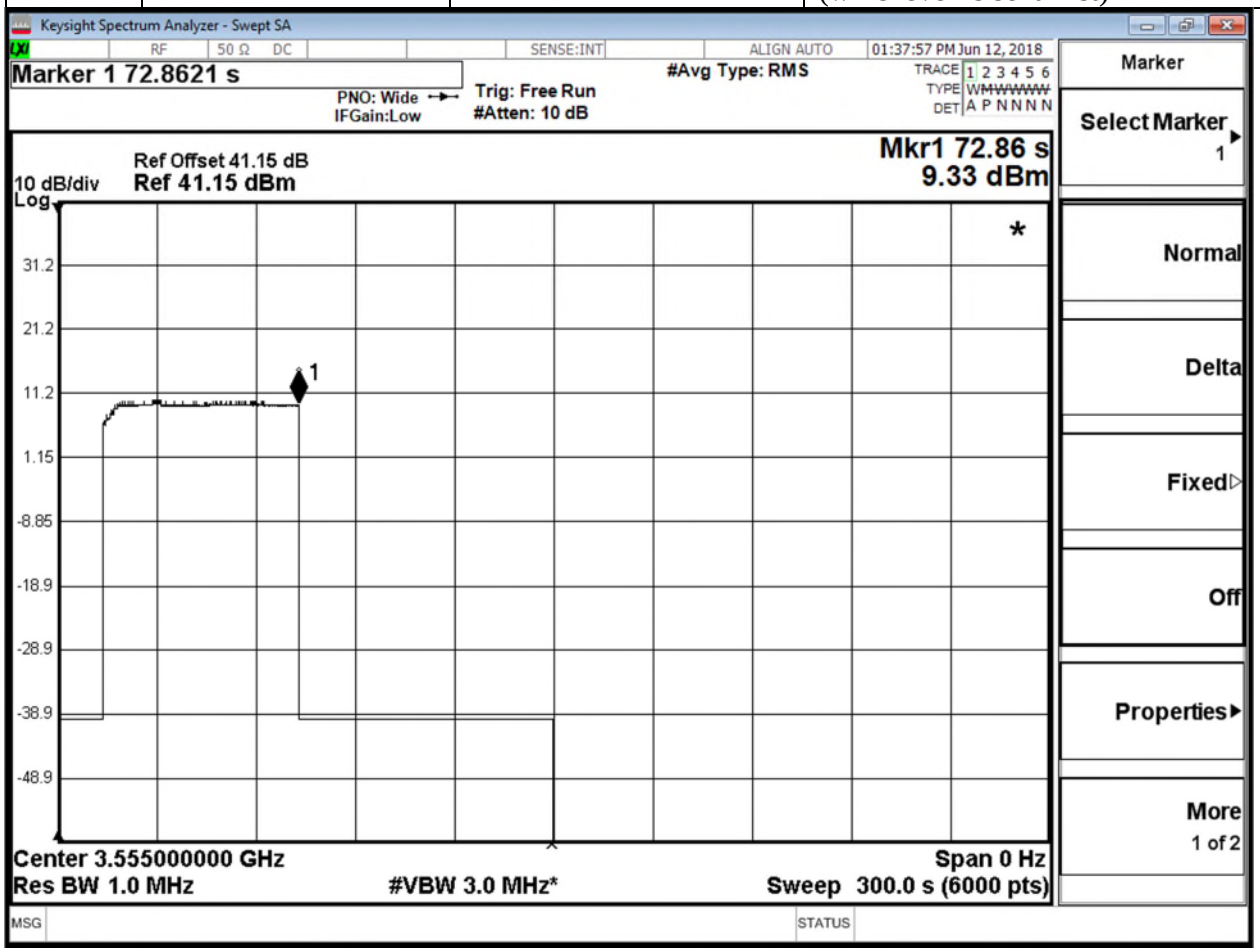
RLQ.2

17:32:12,723 INFO [com.ericsson.oss.sas.handler.network.cm.CMHandler] (EJB timerService - 6) Set the CbrsTxExpireTime on the cell: SubNetwork=G2RBS,ManagedElement=OTENB5311,ENodeBFunction=1,EUtranCellTDD=2 to: -1 in DPS. Time taken: 2030

17:32:14,524 INFO [com.ericsson.oss.sas.handler.network.cm.CMHandler] (EJB timerService - 6) Set the CbrsTxExpireTime on the cell: SubNetwork=G2RBS,ManagedElement=OTENB5311,ENodeBFunction=1,EUtranCellTDD=1 to: -1 in DPS. Time taken: 1781

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

6.7.4.1.2	WINNF.FT.D.DRG.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



From Test Harness Logs:	
eventTime (from logs)	**Comment**
17:36:45	RLQ.request sent at: 2018-06-12T17:36:45.269Z, DRG.request sent at: 2018-06-12T17:36:49.337Z

From Spectrum Analyzer Capture:							
Test	**plot time [h:m:s]**	**sweep [s]**	**plot start time [h:m:s]**	**mrk [s]**	**event time [h:m:s]**	**eventTime UTC**	
DRG.2	13:37:57	150	13:35:27	72.86	13:36:39	**17:36:39**	ok
			from DP logs (below)			**17:36:44**	ok from DP

DRG.2

17:36:42,605 INFO [com.ericsson.oss.sas.handler.network.cm.CMHandler] (EJB timerService - 6) Set the CbrsTxExpireTime on the cell: SubNetwork=G2RBS,ManagedElement=OTENB5311,ENodeBFunction=1,EUtranCellTDD=2 to: -1 in DPS. Time taken: 1912

17:36:44,399 INFO [com.ericsson.oss.sas.handler.network.cm.CMHandler] (EJB timerService - 6) Set the CbrsTxExpireTime on the cell: SubNetwork=G2RBS,ManagedElement=OTENB5311,ENodeBFunction=1,EUtranCellTDD=1 to: -1 in DPS. Time taken: 1773

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

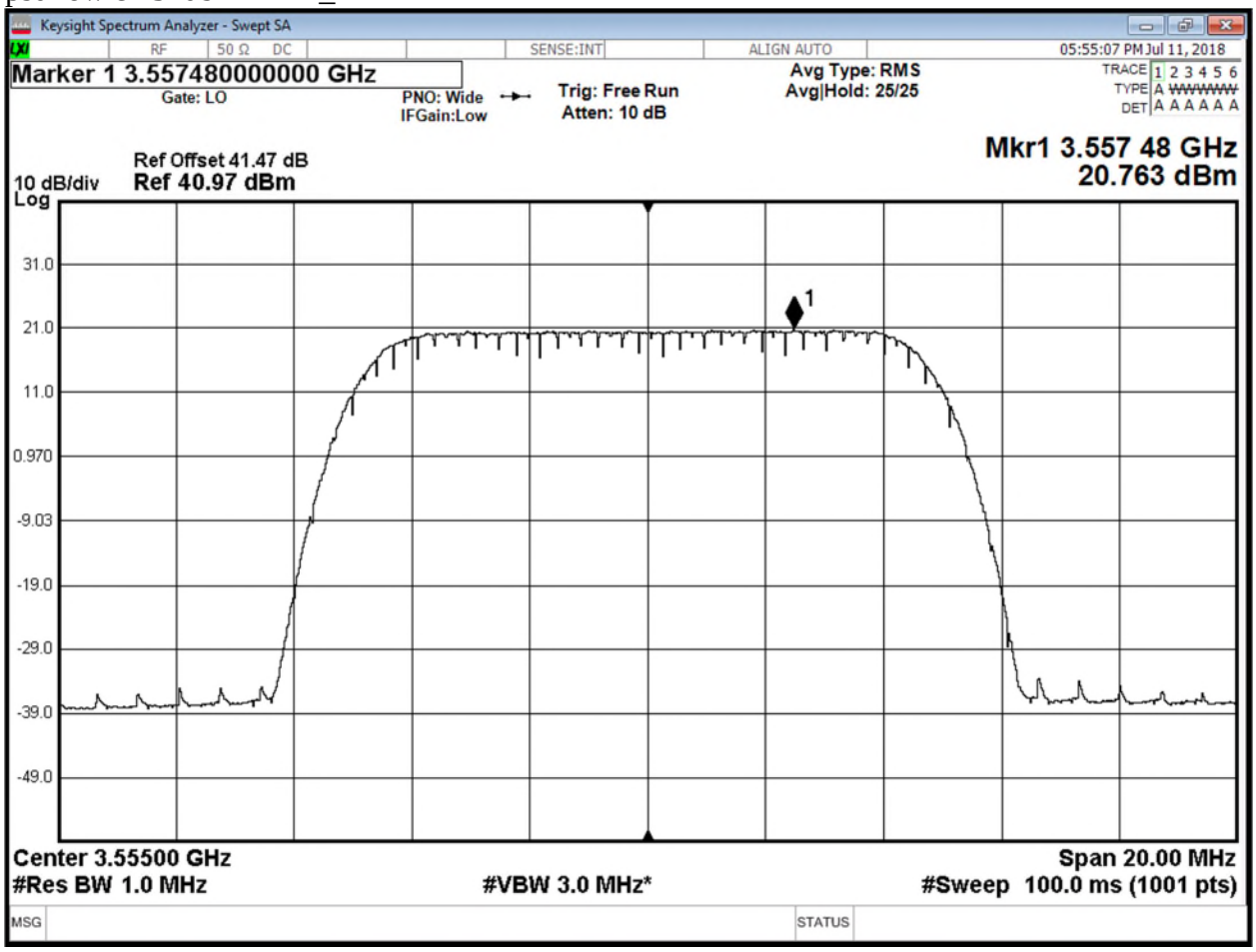
Confirm that the device transmits at a power level less than or equal to the maximum power level approved by the SAS.

7.1.4.1.1	X	X	WINNF.PT.C.HBT	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

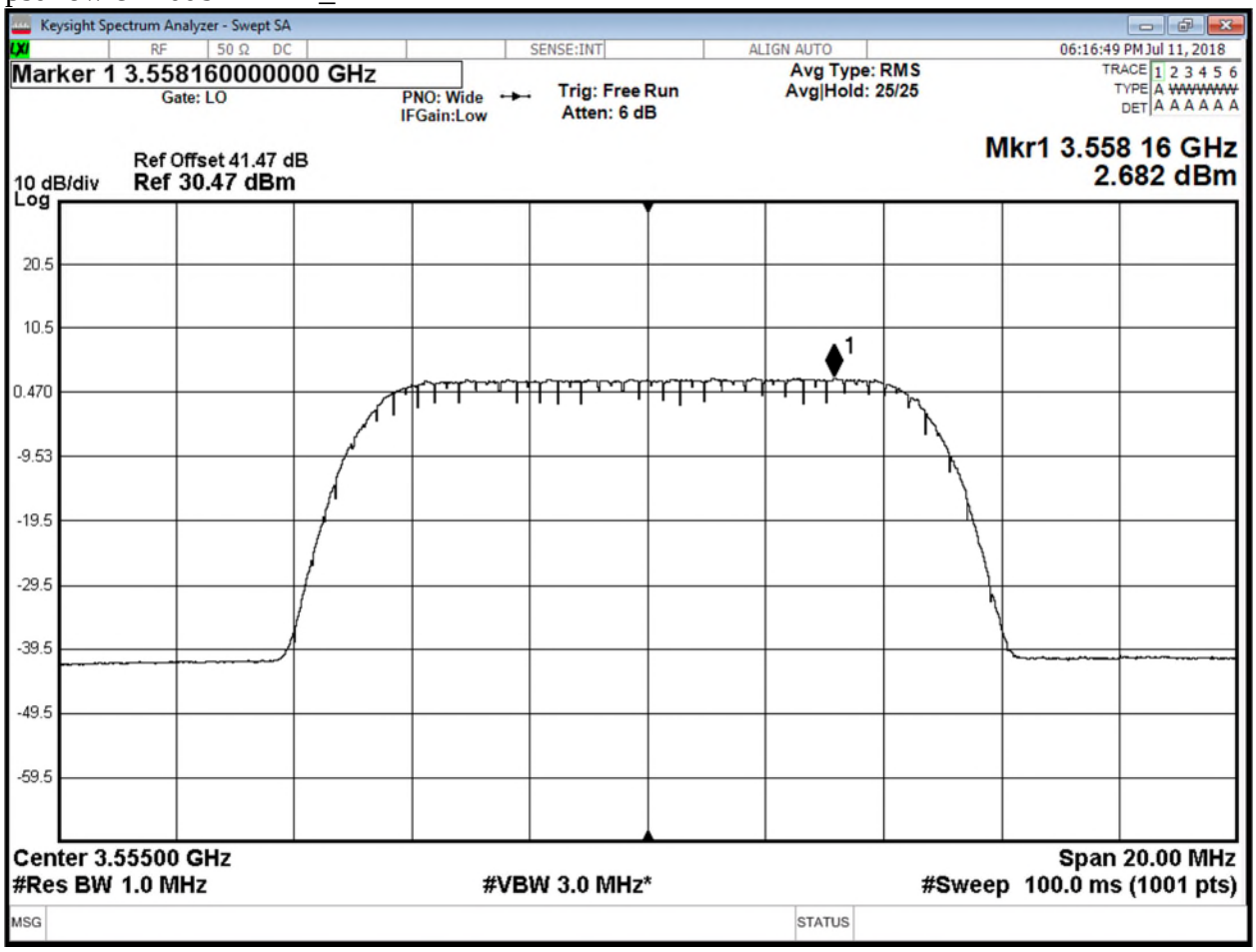
	Information from grantRequest				
Log file name	lowFrequency (MHz)	highFrequency (MHz)	Grant Center Freq (MHz)	maxEirp (dBm/MHz)	
PowerMeasTest_2018-07-11T21.48.50Z	3550	3560	3555	35.55273	
PowerMeasTest_2018-07-11T22.12.42Z	3550	3560	3555	17.47158	
PowerMeasTest_2018-07-11T22.30.50Z	3625	3635	3630	17.47158	
PowerMeasTest_2018-07-11T22.44.08Z	3625	3635	3630	23.49218	
PowerMeasTest_2018-07-11T22.49.19Z	3625	3635	3630	29.28389	
PowerMeasTest_2018-07-11T22.56.45Z	3625	3635	3630	35.55273	
PowerMeasTest_2018-07-11T23.03.41Z	3690	3700	3695	35.55273	
PowerMeasTest_2018-07-11T23.10.19Z	3690	3700	3695	17.47158	

	plot			single port, conducted	Offset used on spectrum analyzer	Actual Calibration Offset from calibration curve	**total PSD EIRP, measured [dBm/MHz]**	**Margin**
plot name	time		Freq [MHz]	PSD [dBm/MHz]	[dB]	[dB]		
psd low ch 37dbm 1mhz_2	5:55:07	9:55:07	3555	20.763	41.47	41.16	35.5	0.1
psd low ch 20dbm 1mhz_2	6:16:49	10:16:49	3555	2.682	41.47	41.16	17.4	0.1
psd mid ch 20dbm 1mhz_2	6:38:47	10:38:47	3630	1.902	41.47	41.2	16.6	0.8
psd mid ch 24.9dbm 1mhz_2	6:46:51	10:46:51	3630	8.073	41.47	41.2	22.8	0.7
psd mid ch 30.9dbm 1mhz_2	6:51:53	10:51:53	3630	13.865	41.47	41.2	28.6	0.7
psd mid ch 37dbm 1mhz_2	6:59:07	10:59:07	3630	19.975	41.47	41.2	34.7	0.8
psd high ch 37dbm 1mhz_2	7:06:54	11:06:54	3695	19.679	41.47	41.47	34.7	0.9
psd high ch 20dbm 1mhz_2	7:16:09	11:16:09	3695	1.787	41.47	41.47	16.8	0.7

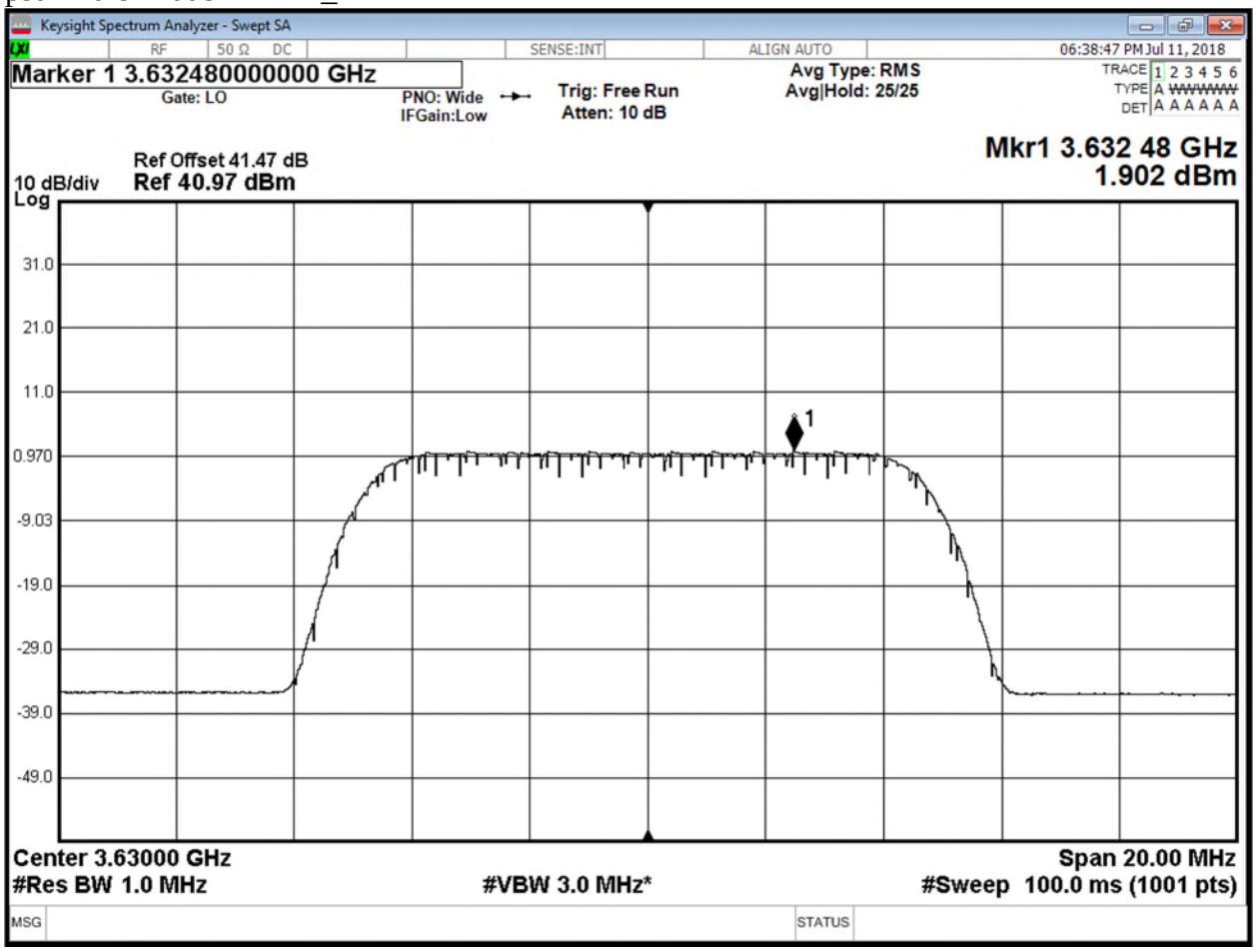
psd low ch 37dbm 1mhz_2



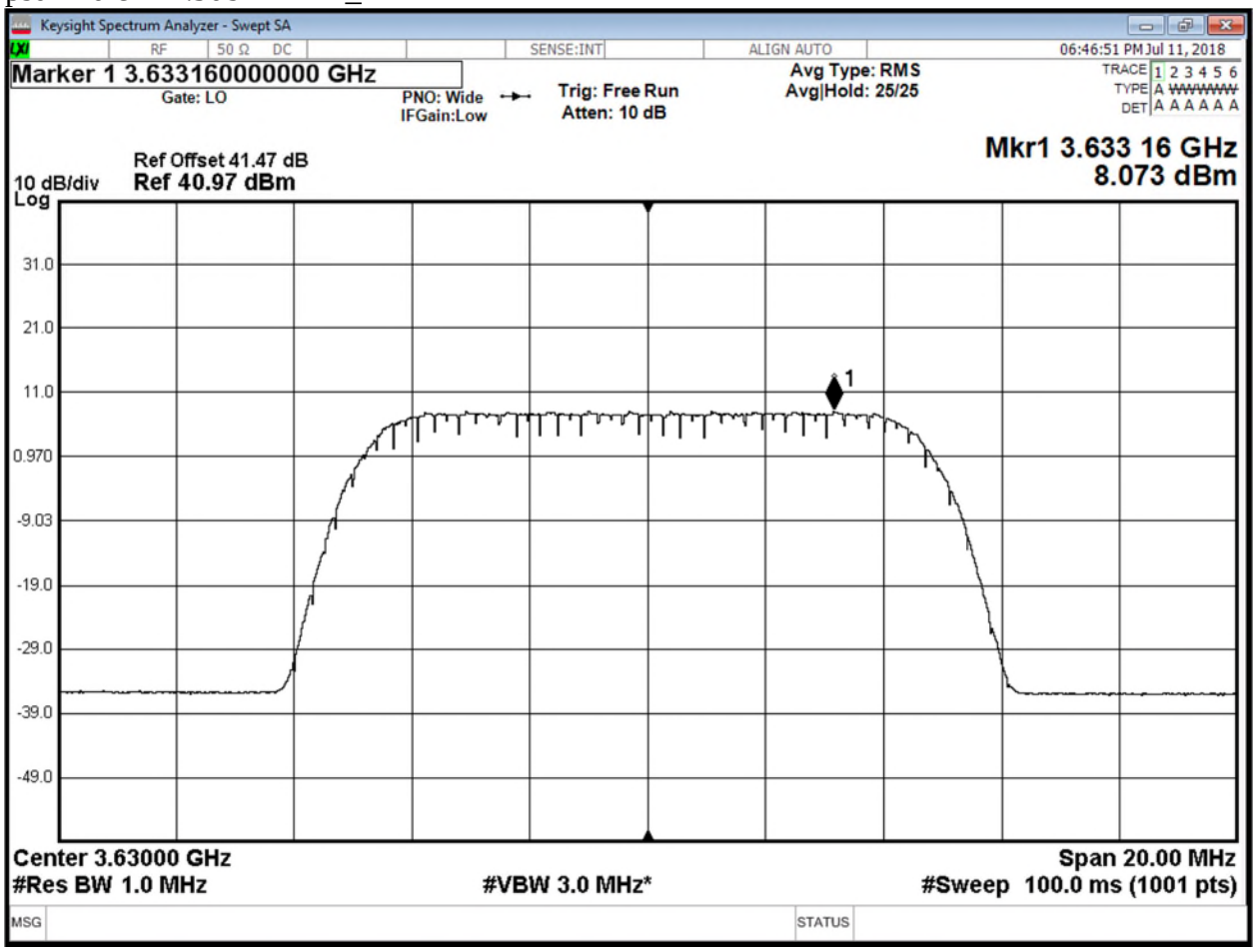
psd low ch 20dbm 1mhz_2



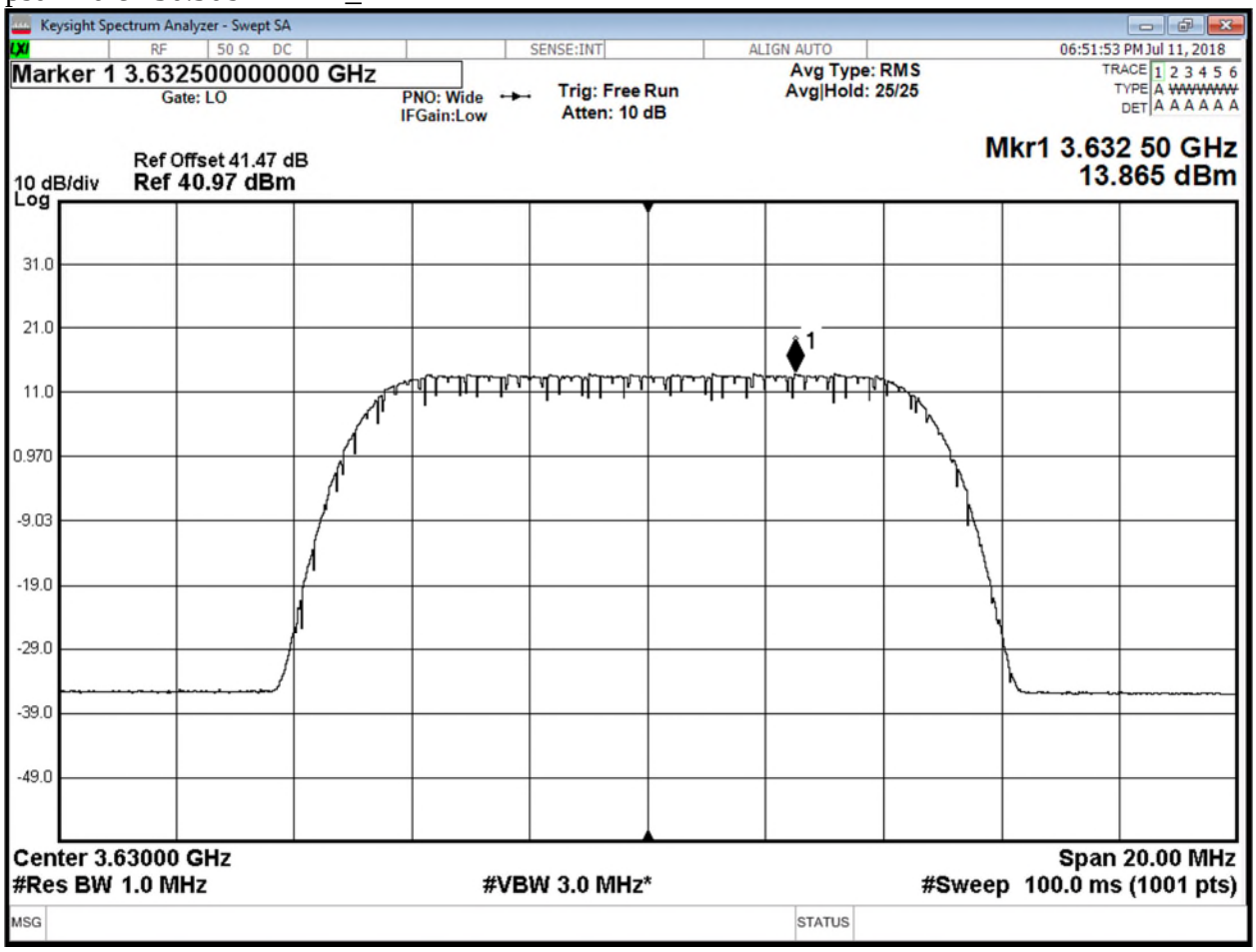
psd mid ch 20dbm 1mhz_2



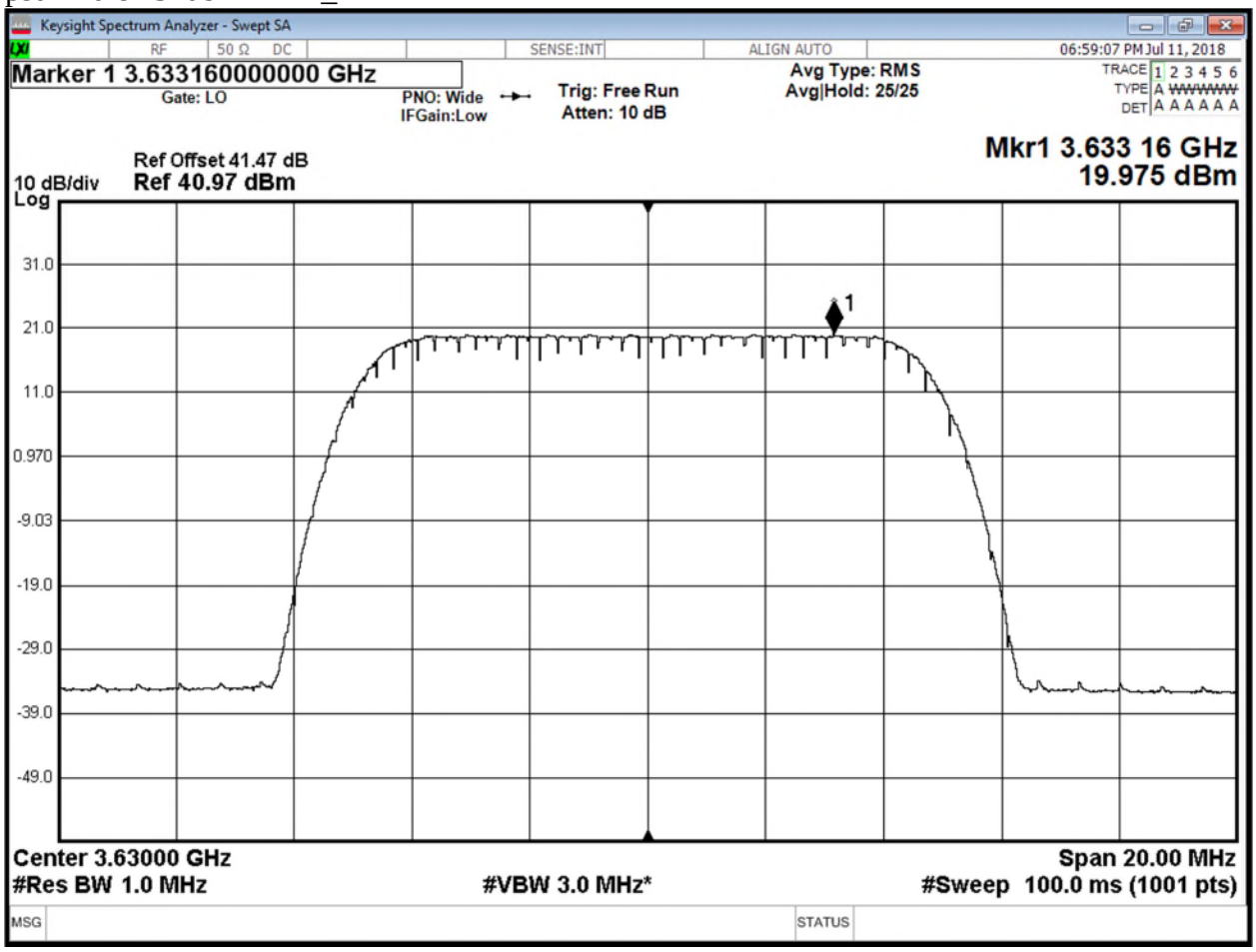
psd mid ch 24.9dbm 1mhz_2



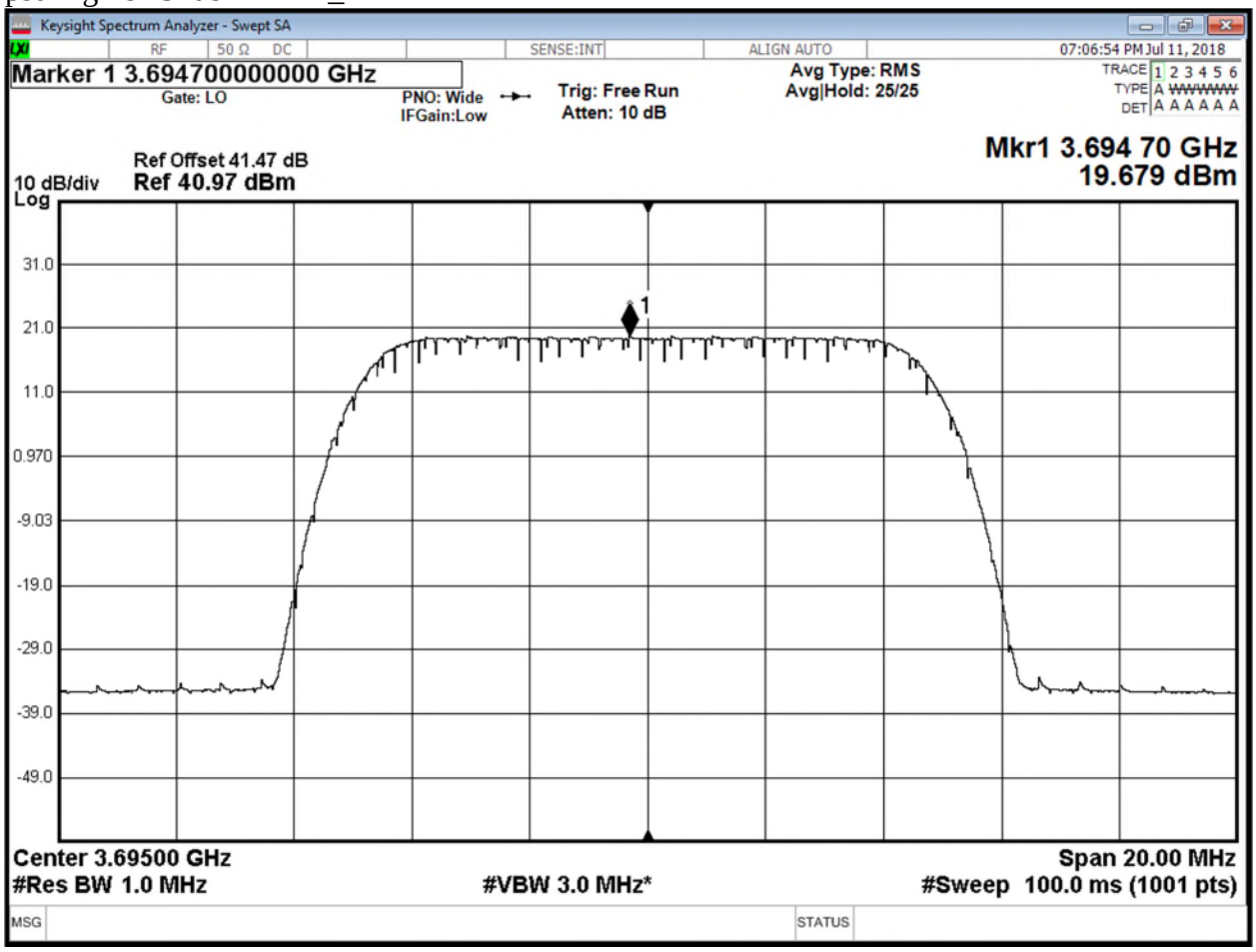
psd mid ch 30.9dbm 1mhz_2



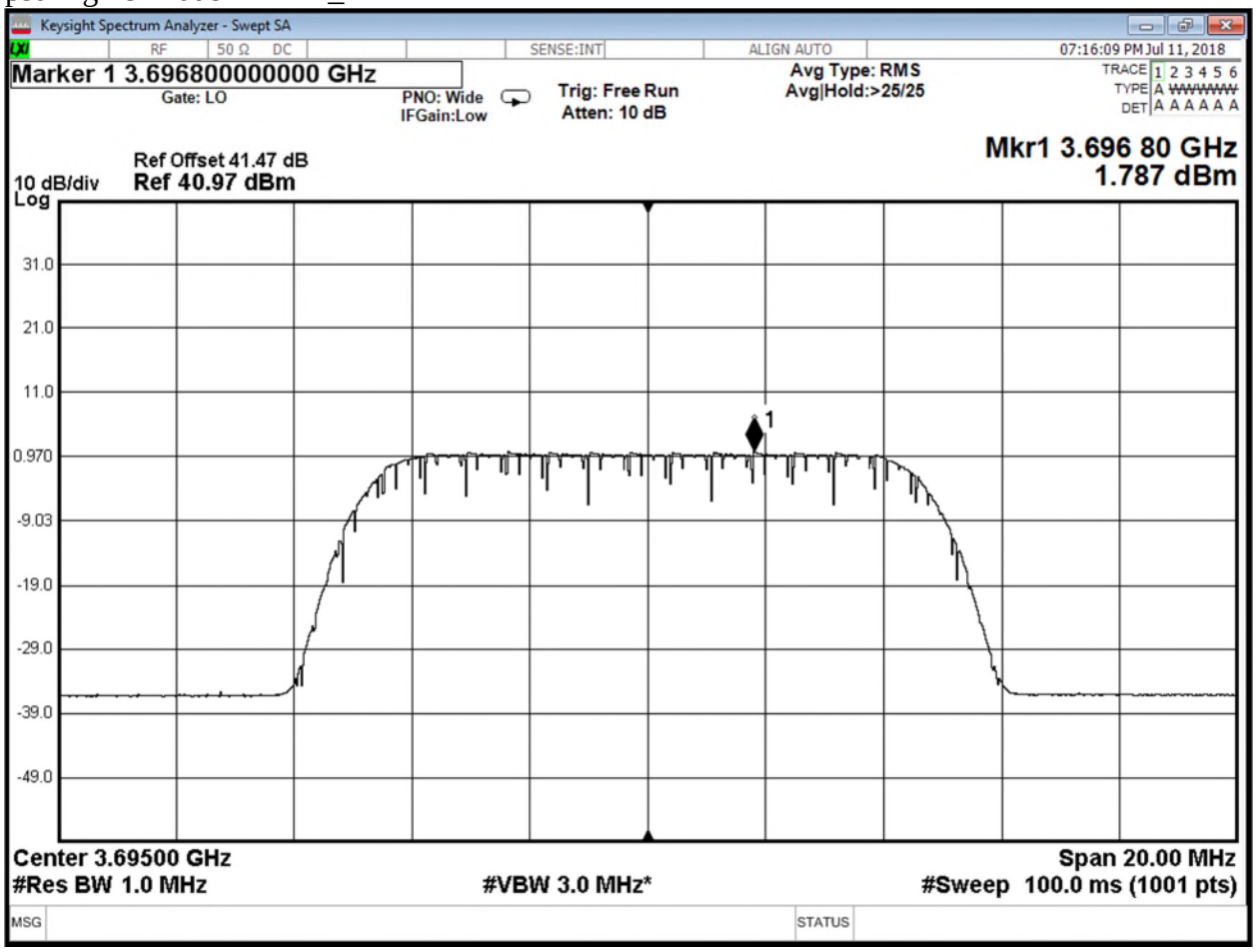
psd mid ch 37dbm 1mhz_2



psd high ch 37dbm 1mhz_2



psd high ch 20dbm 1mhz_2

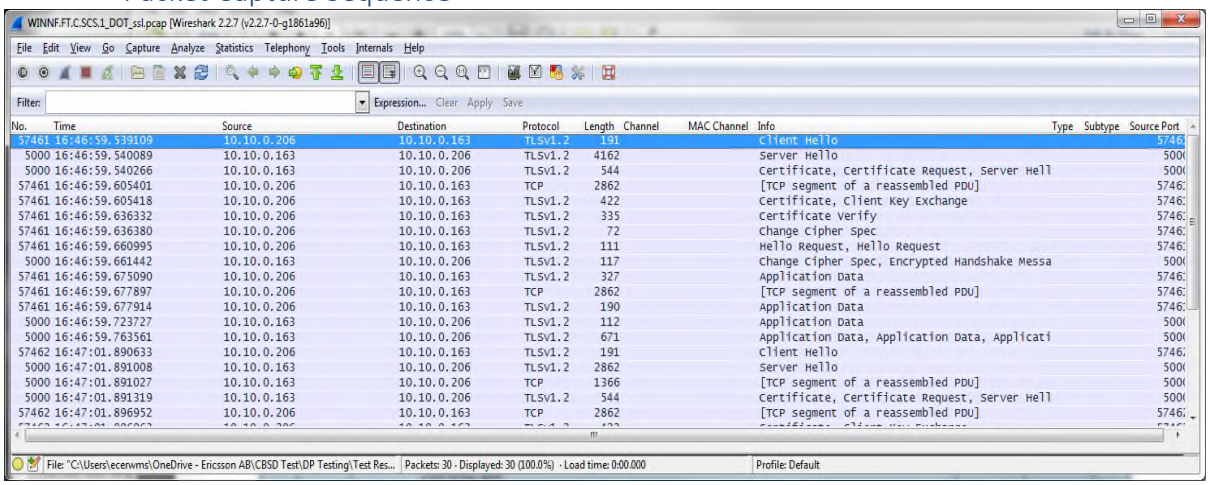


DOT CBRS Radio: WINNF / Security Test Case Analysis

WINNF Security Test Case Analysis

WINNF.FT.C.SCS.1

Packet Capture Sequence



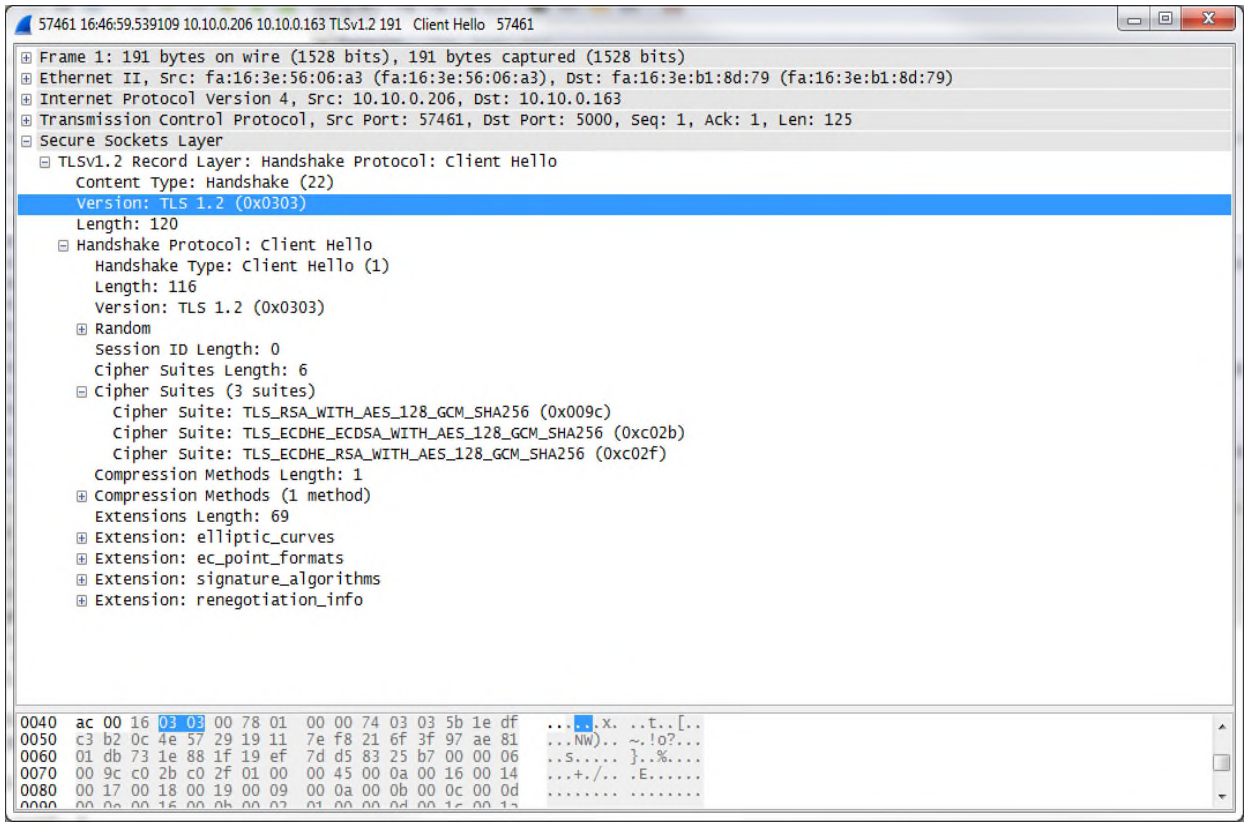
WINNF test requirements:

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

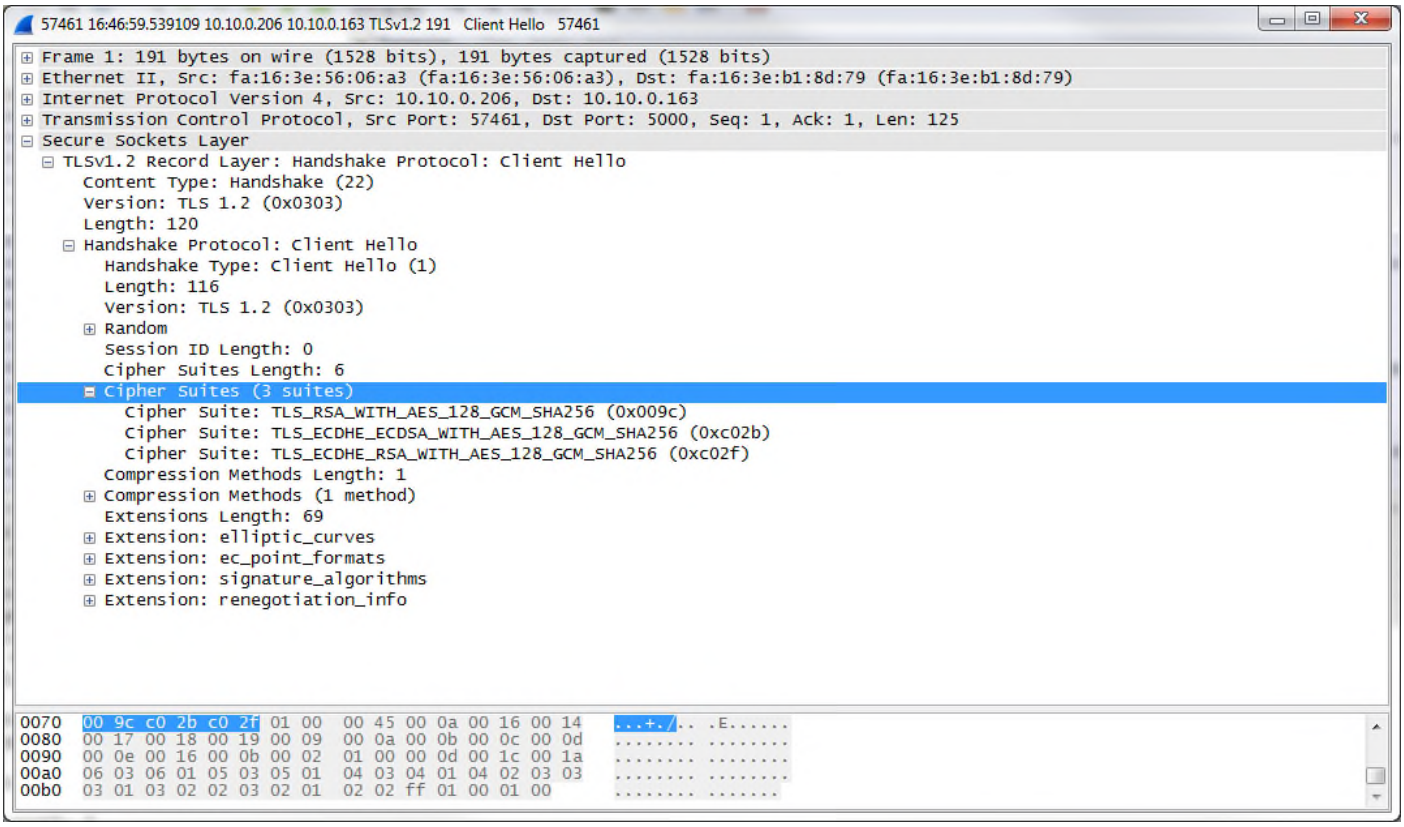
2	• Make sure that Mutual authentication happens between UUT and the SAS Test Harness.
	• Make sure that UUT uses TLS v1.2
	• Make sure that cipher suites from one of the following is selected,
	  • TLS_RSA_WITH_AES_128_GCM_SHA256
	  • TLS_RSA_WITH_AES_256_GCM_SHA384
	  • TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
	  • TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
	  • TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
		PASS	FAIL

Analysis of WINNF Test Requirements

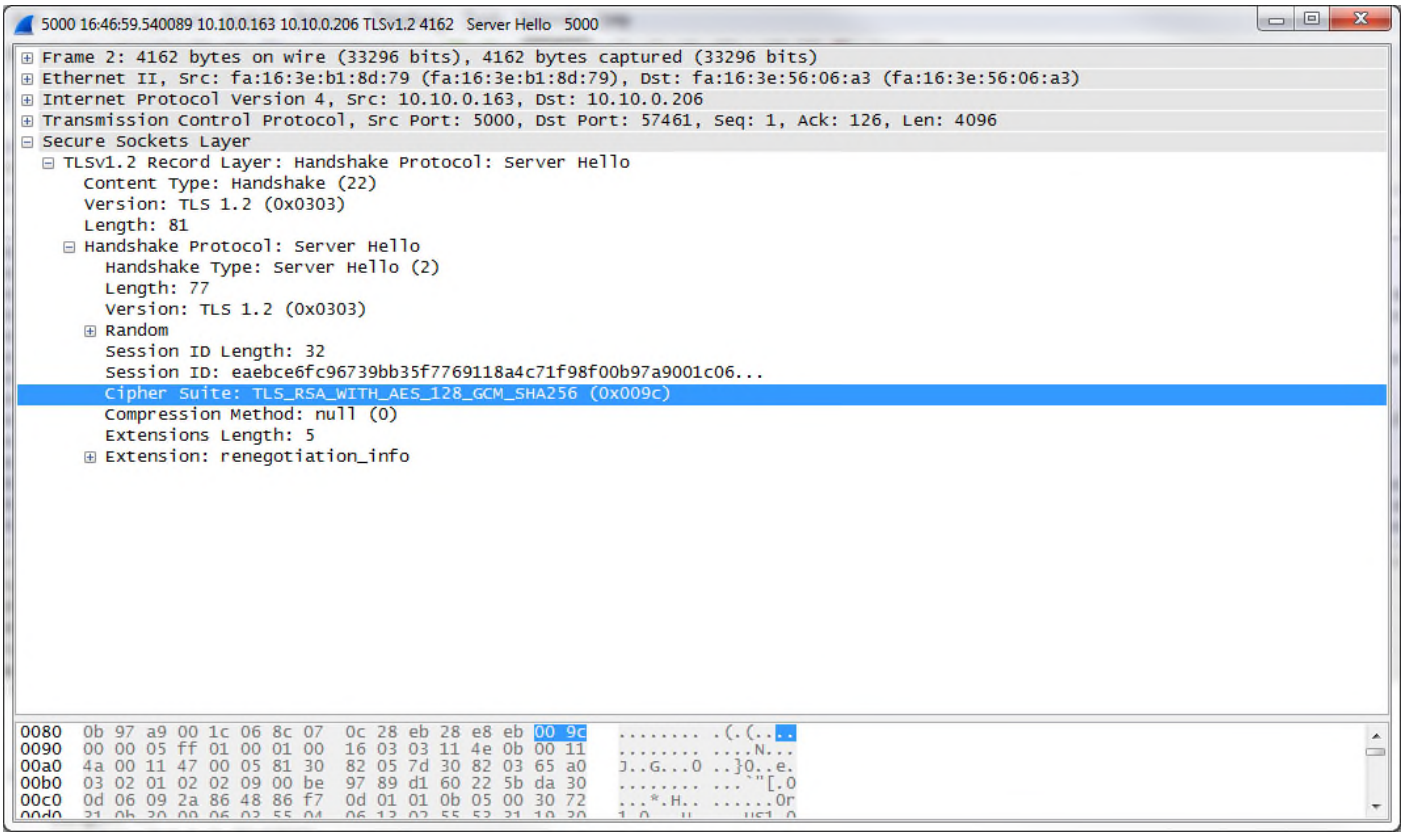
1. From Client Hello: TLS version = TLS 1.2



2. Cipher suite list from Client Hello 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



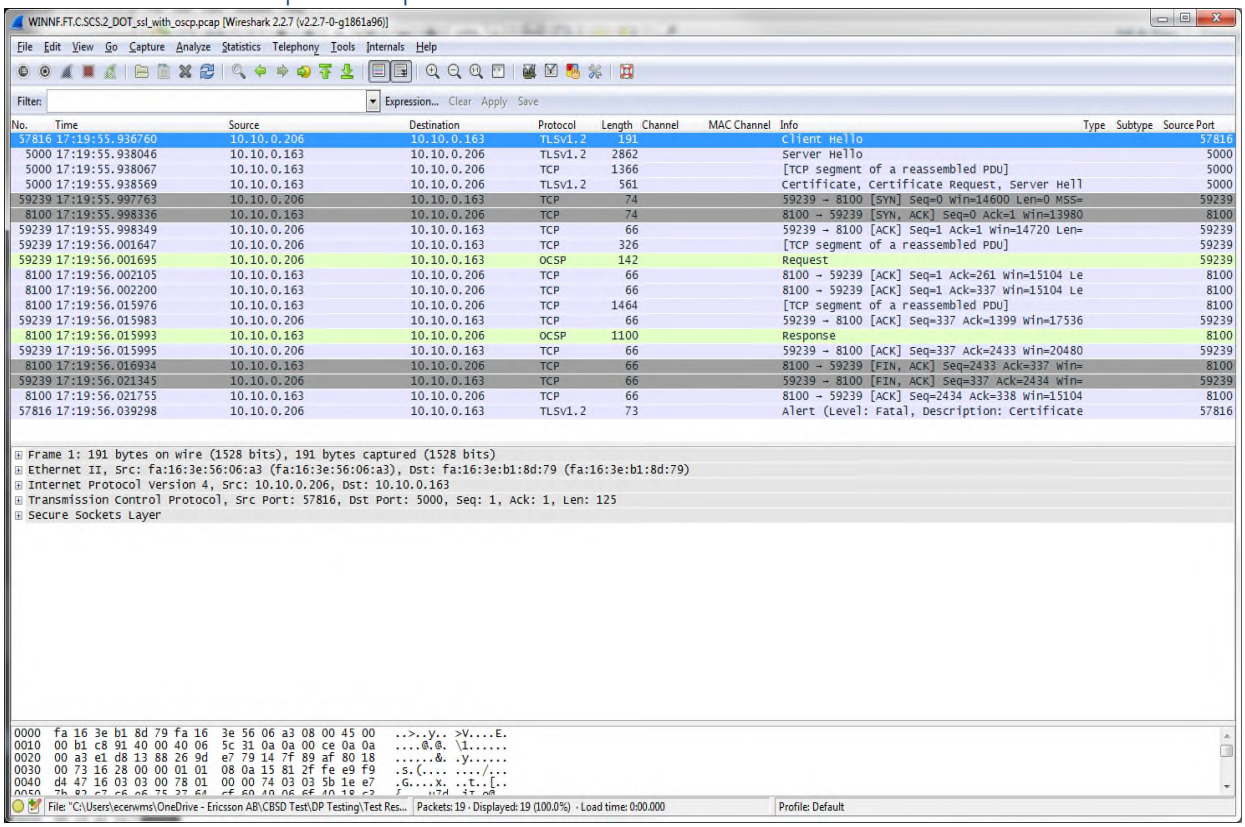
3. Cipher suite chosen (from Server Hello): TLS_RSA_WITH_AES_128_GCM_SHA256



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

WINNF.FT.C.SCS.2

Packet Capture Sequence



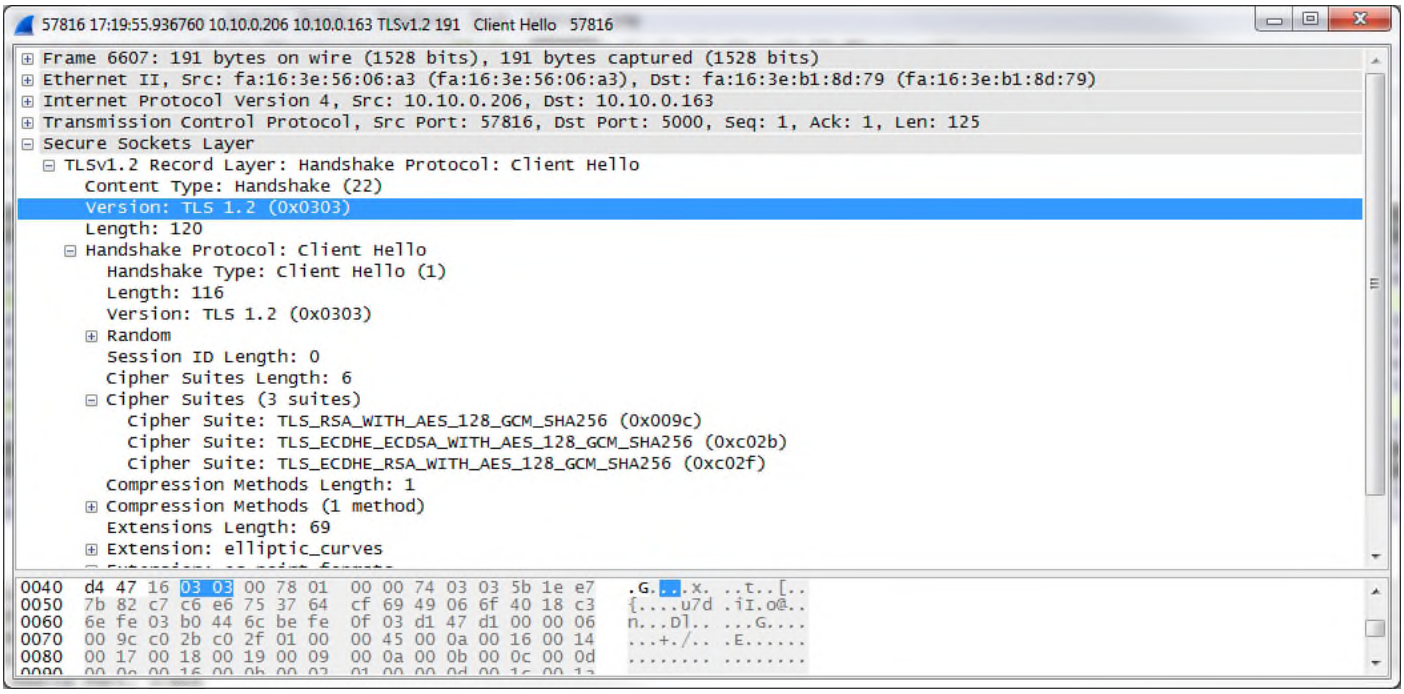
WINNF Test Requirements:

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

2	• 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	FAIL

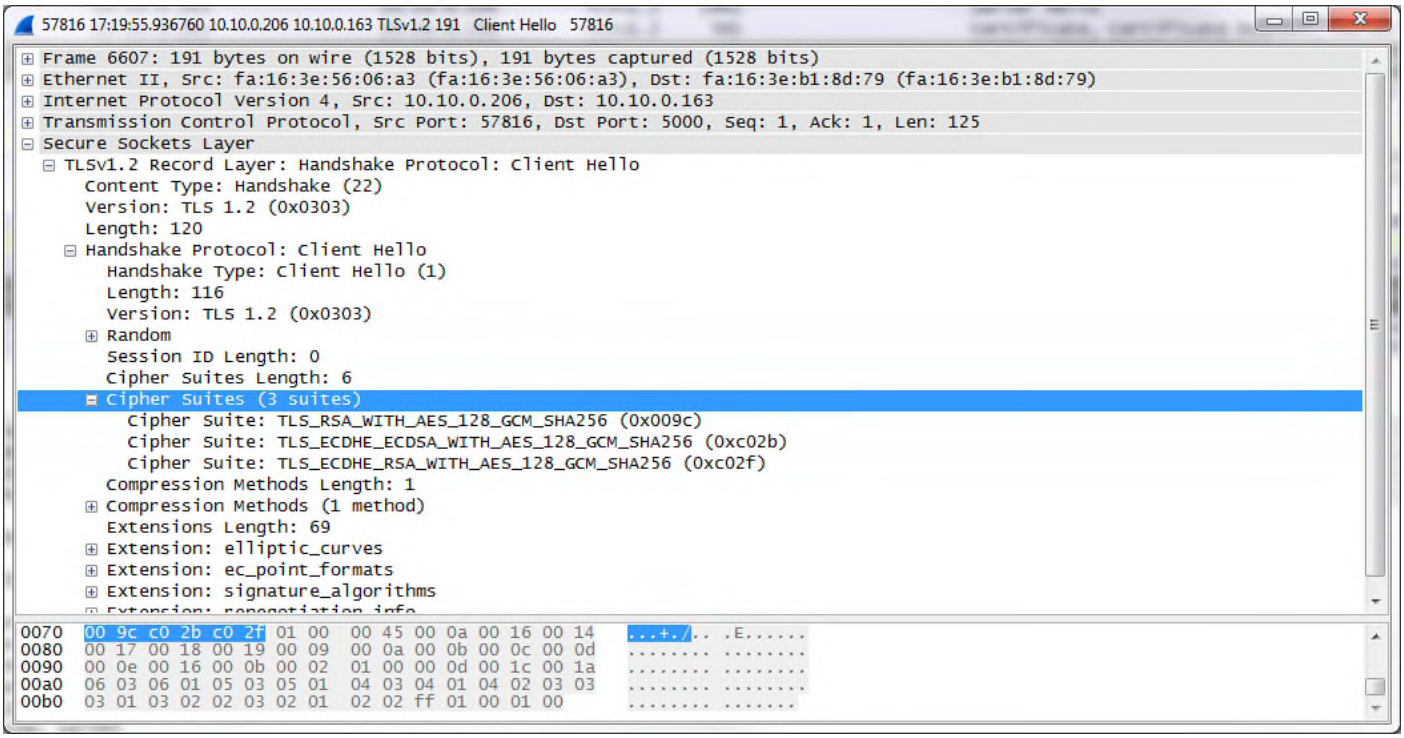
Analysis of WINNF Test Requirements

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

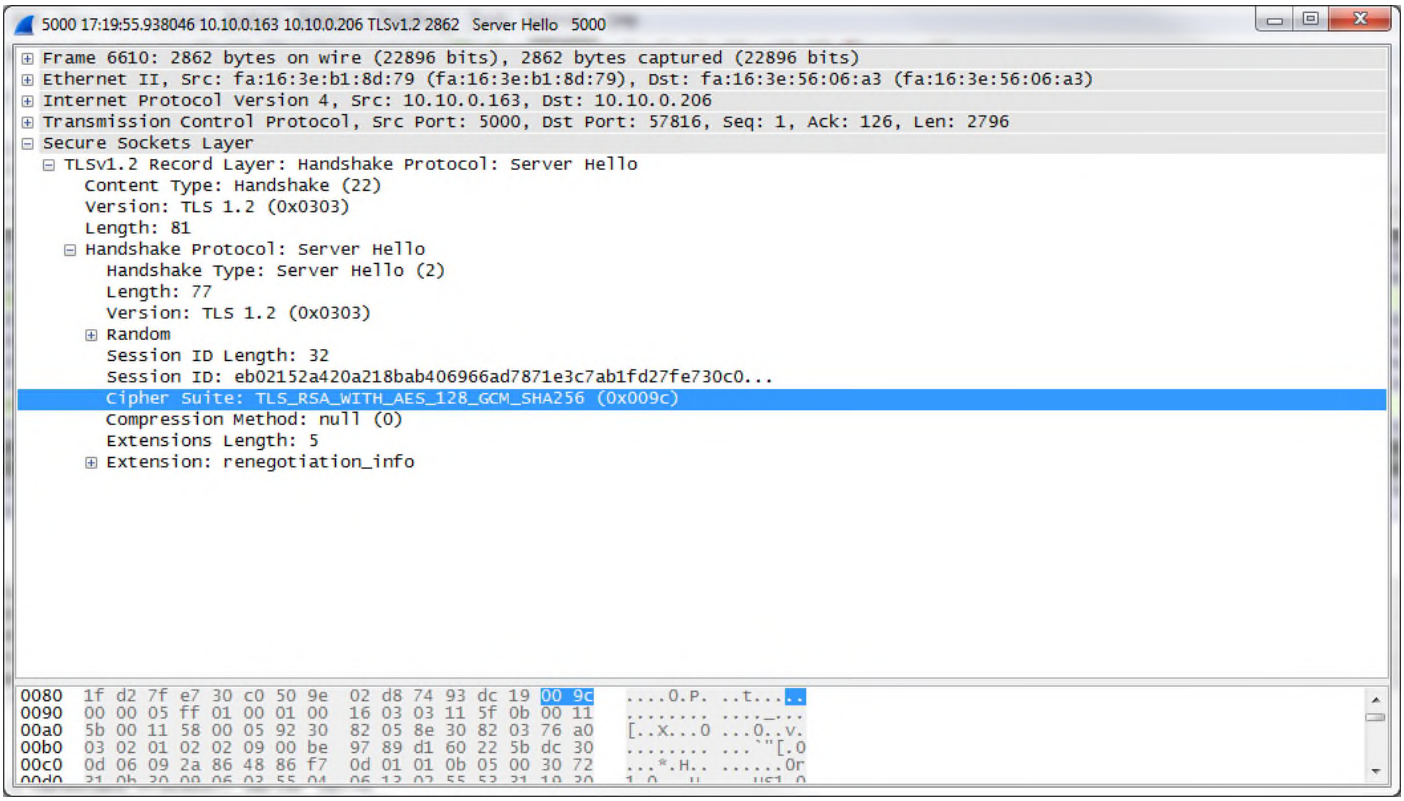


2. From Client Hello, cipher suite list is from WINNF approved list:

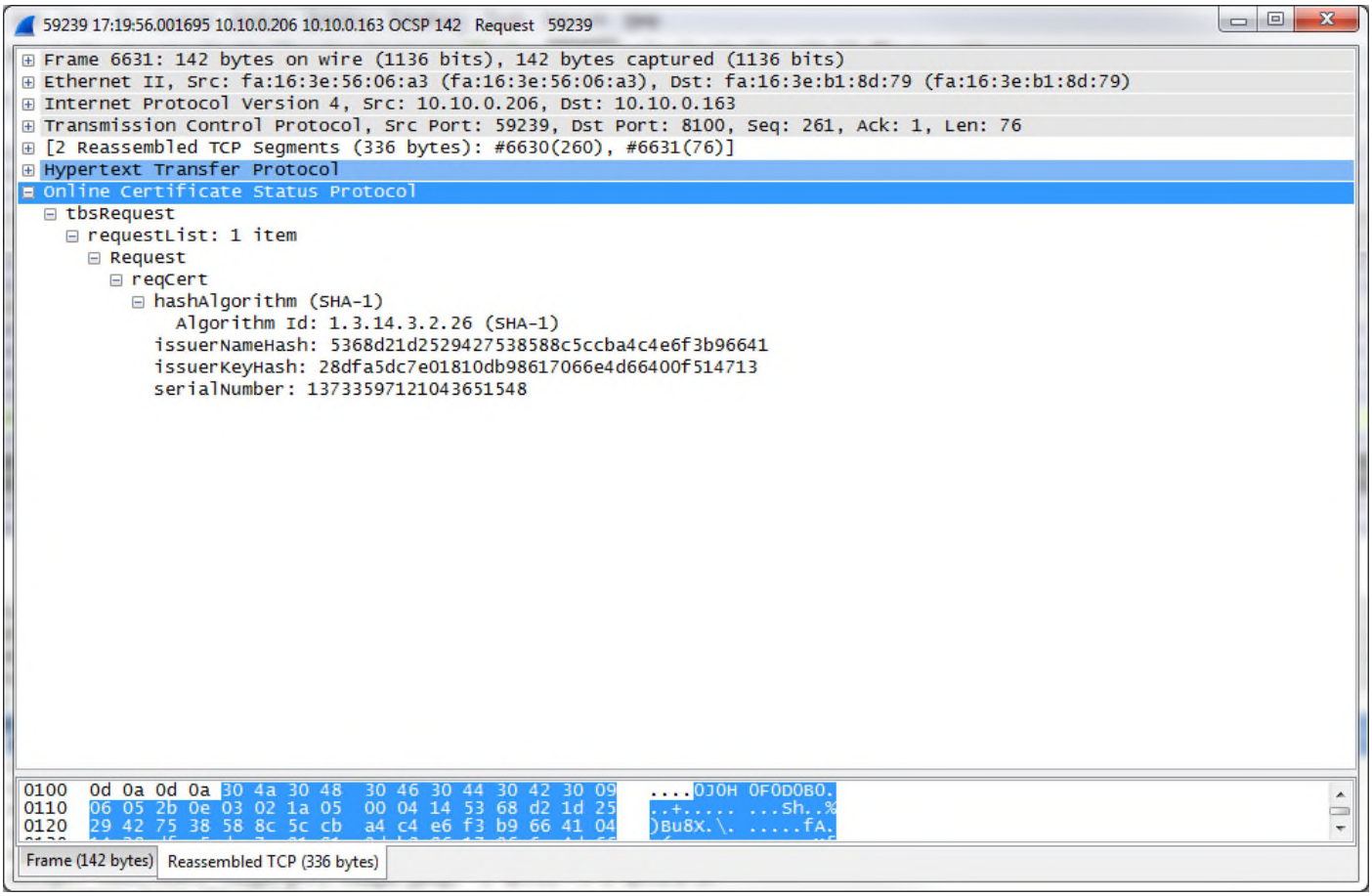
   TLS_RSA_WITH_AES_128_GCM_SHA25
   TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
   TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256

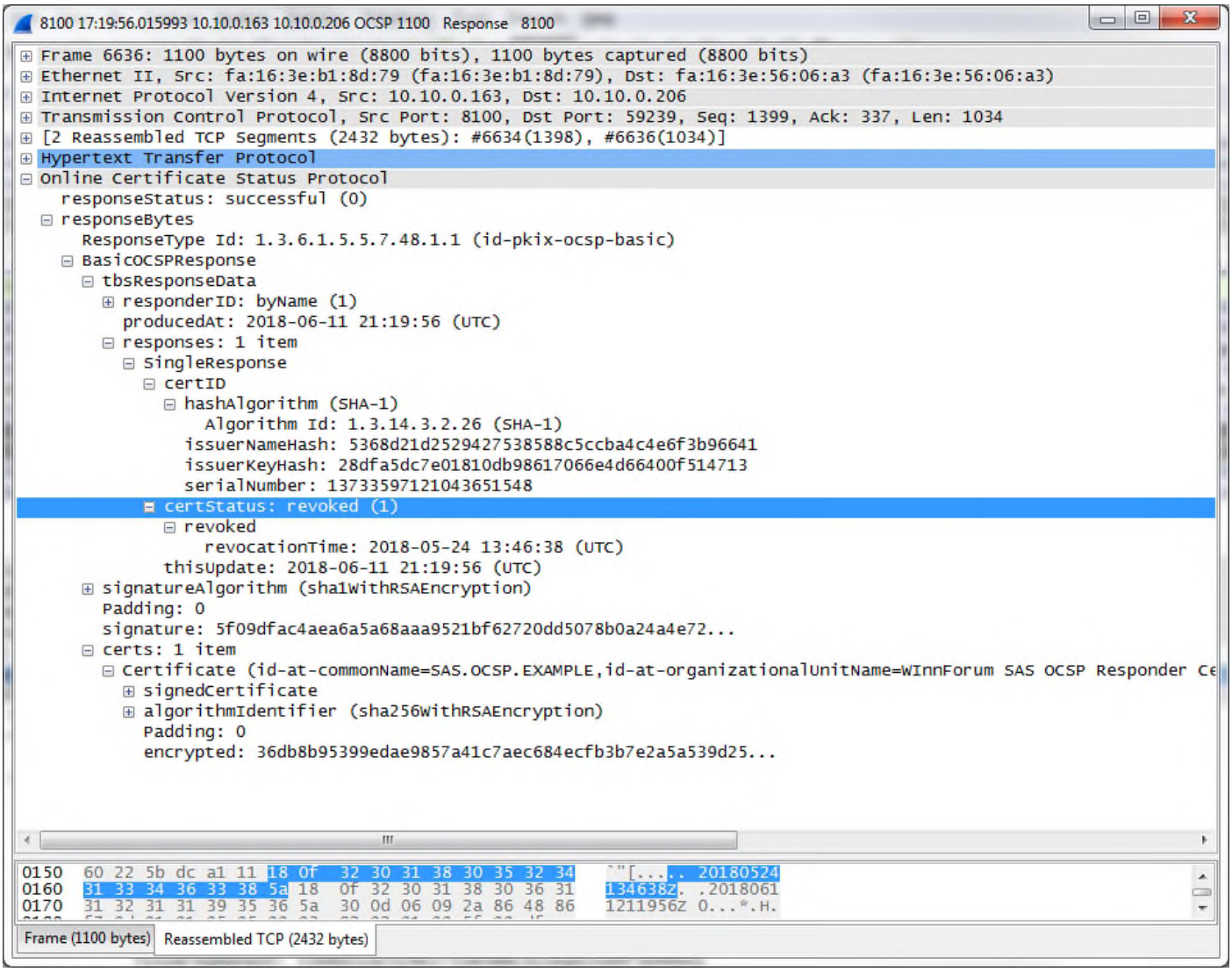


3. From Server Hello, cipher suite chosen: TLS_RSA_WITH_AES_128_GCM_SHA256

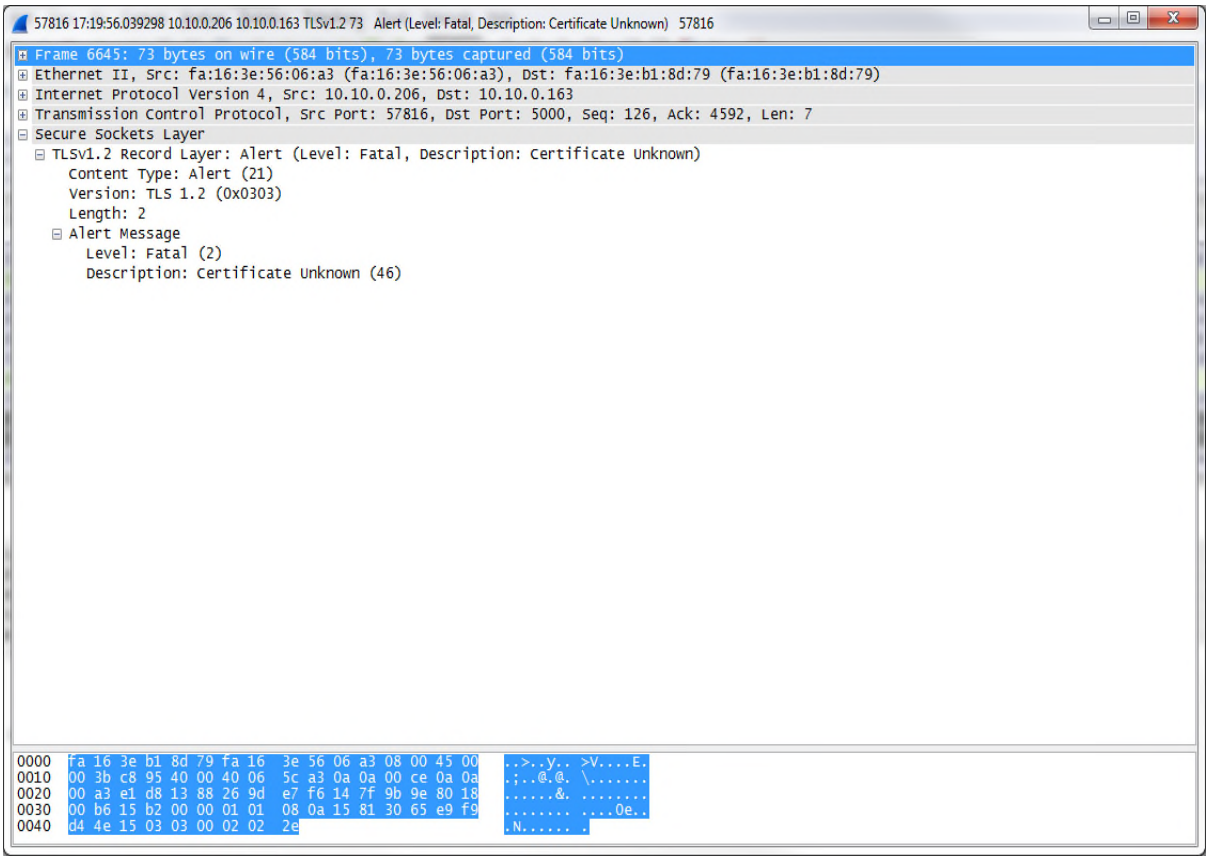


4. Read OSCP Request/Response to/from server:





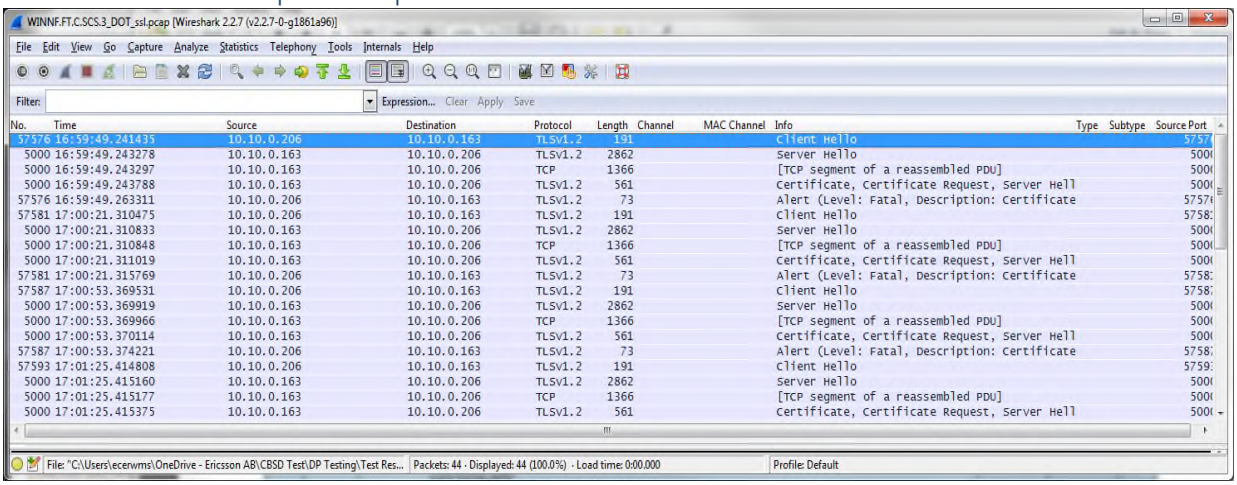
5. Authentication exchange ends with TLS Alert message (i.e. authentication fails):



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

WINNF.FT.C.SCS.3

Packet Capture Sequence



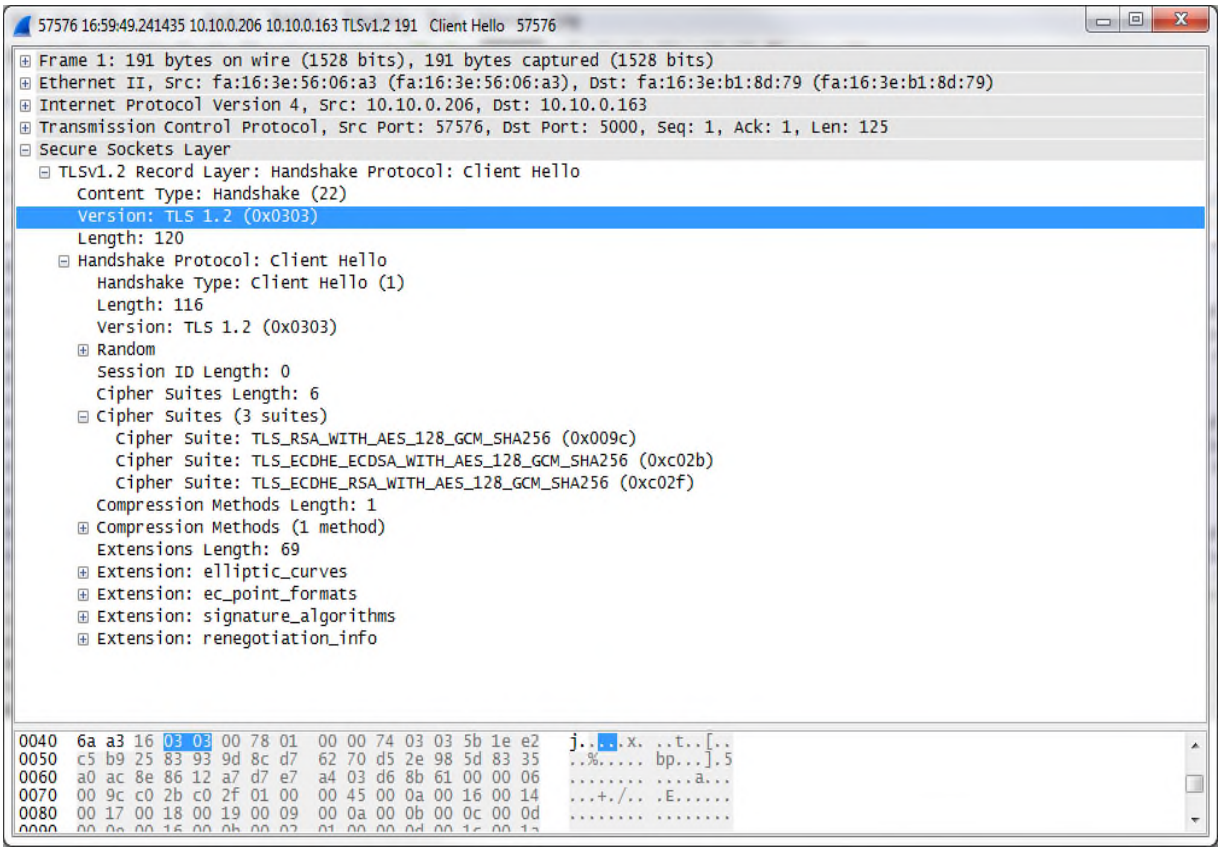
WINNF Test Requirements:

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

2	• 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	FAIL

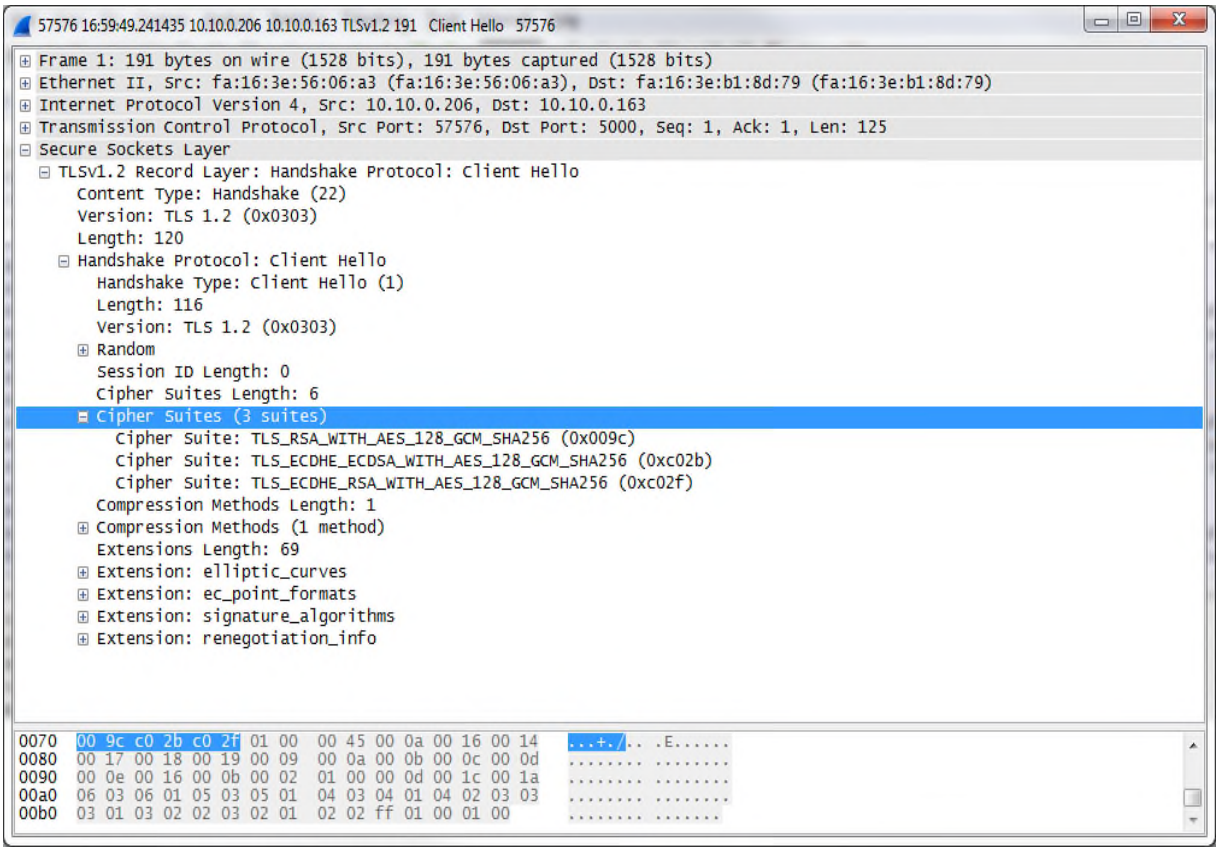
Analysis of WINNF Test Requirements

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

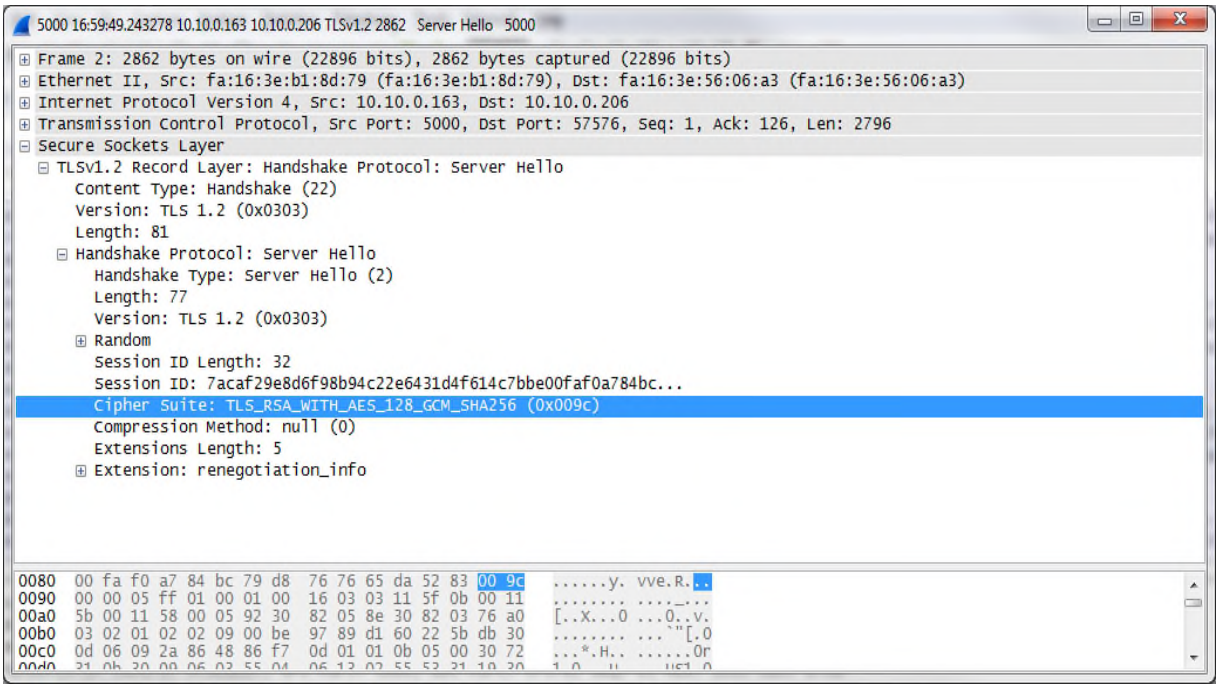


2. From Client Hello, cipher suite list is from WINNF approved list:

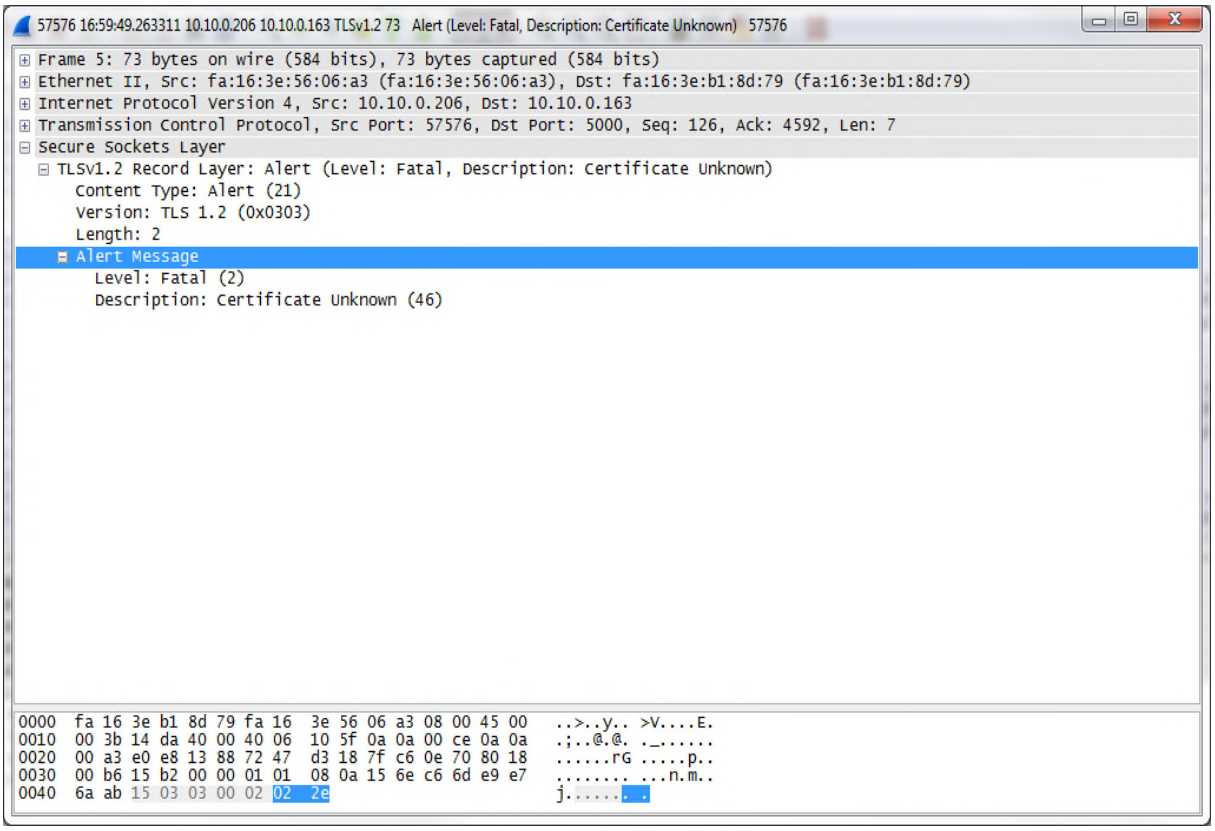
   TLS_RSA_WITH_AES_128_GCM_SHA25
   TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
   TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256



3. From Server Hello, cipher suite chosen: TLS_RSA_WITH_AES_128_GCM_SHA256



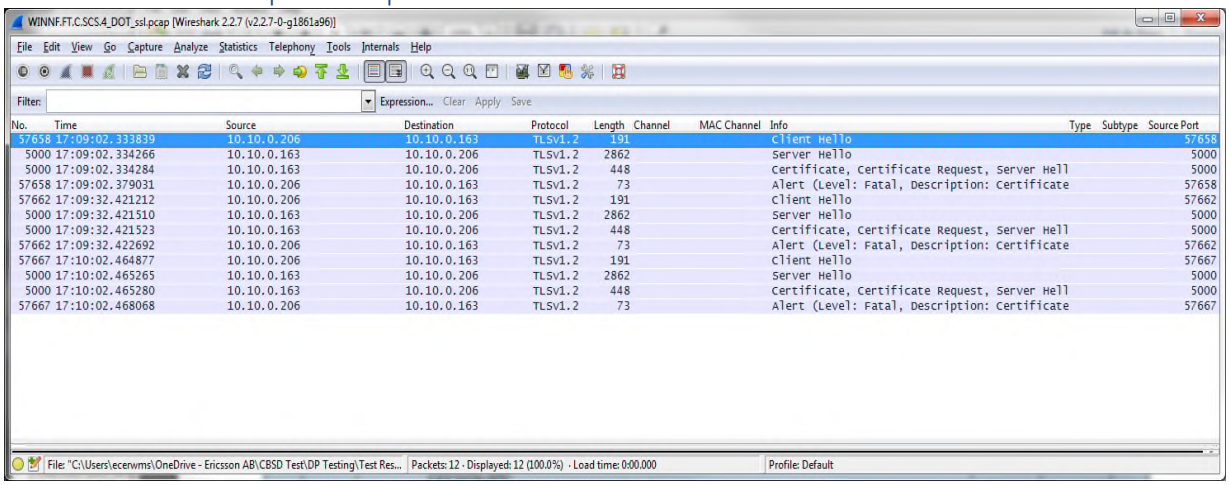
4. Authentication exchange ends with TLS Alert message (i.e. authentication fails):



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

WINNF.FT.C.SCS.4

Packet Capture Sequence



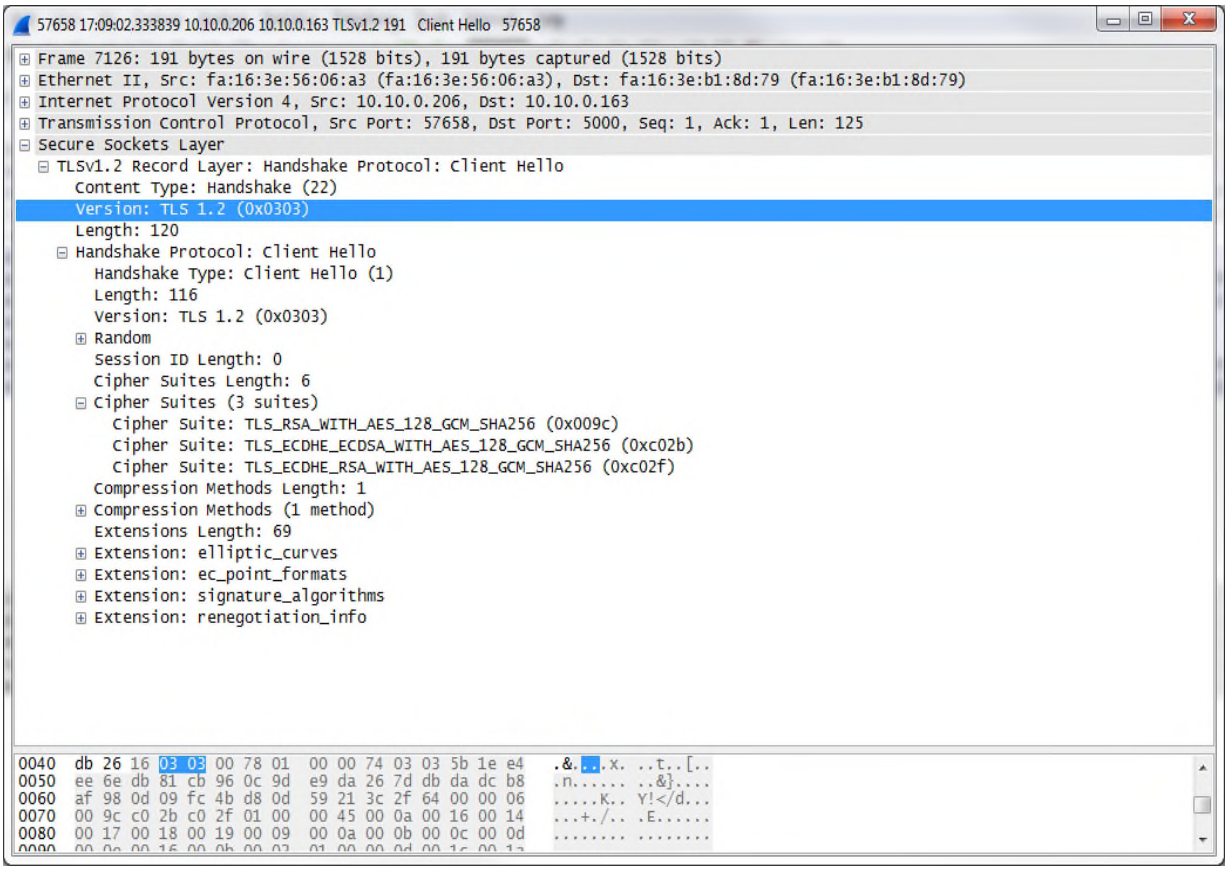
WINNF Test Requirements:

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

2	• 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	FAIL

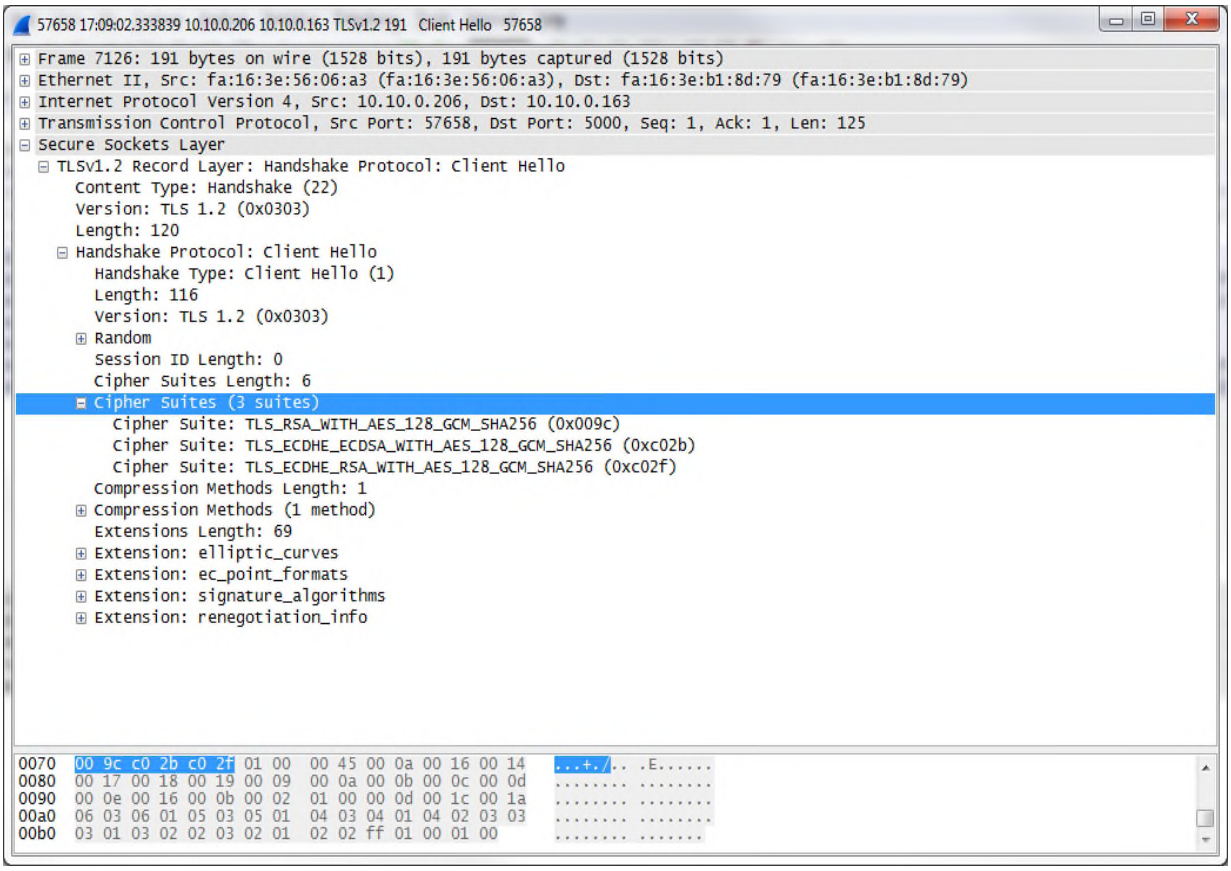
Analysis of WINNF Test Requirements

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

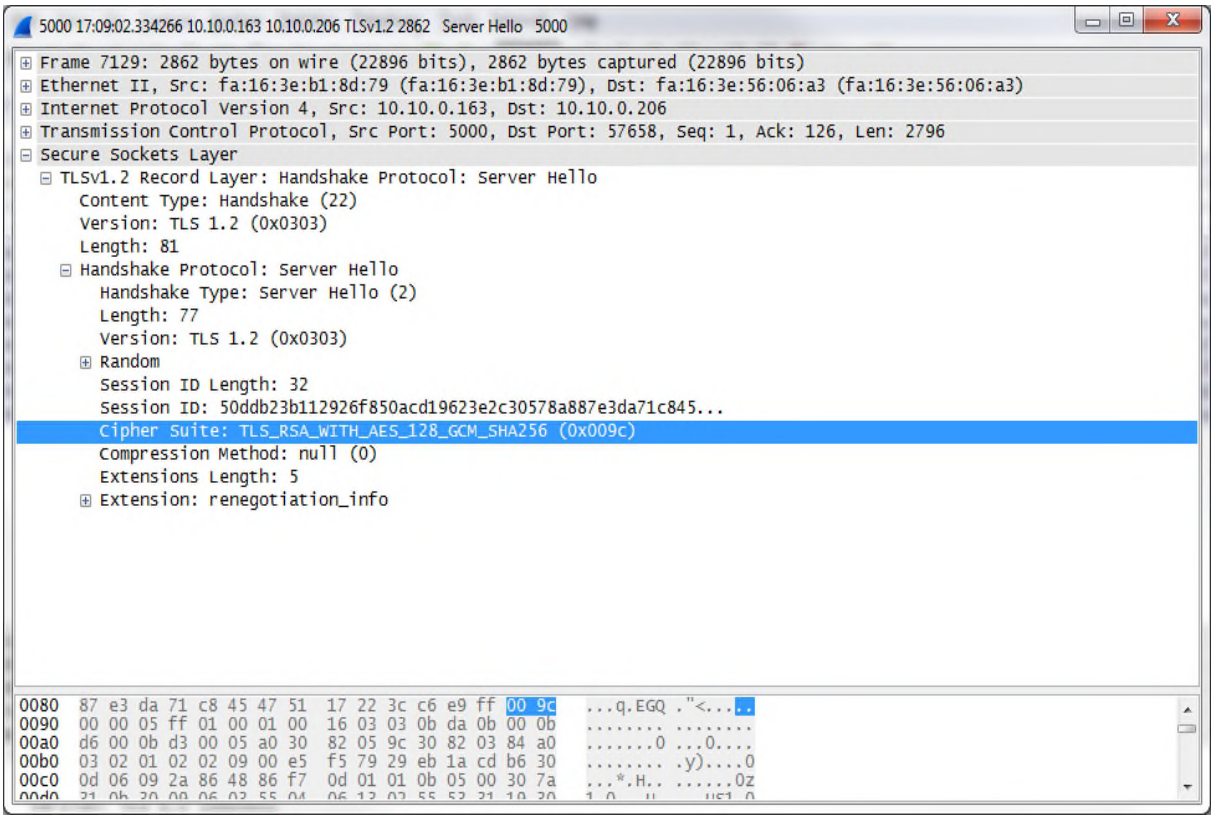


2. From Client Hello, cipher suite list is from WINNF approved list:

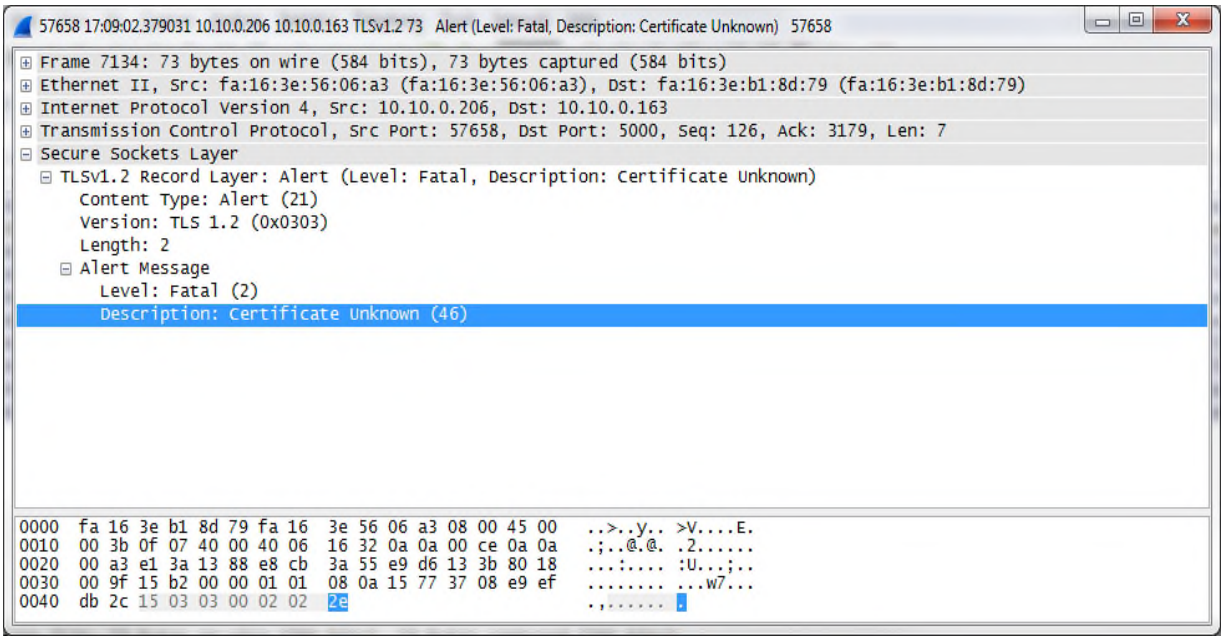
   TLS_RSA_WITH_AES_128_GCM_SHA25
   TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
   TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256



3. From Server Hello, cipher suite chosen: TLS_RSA_WITH_AES_128_GCM_SHA256



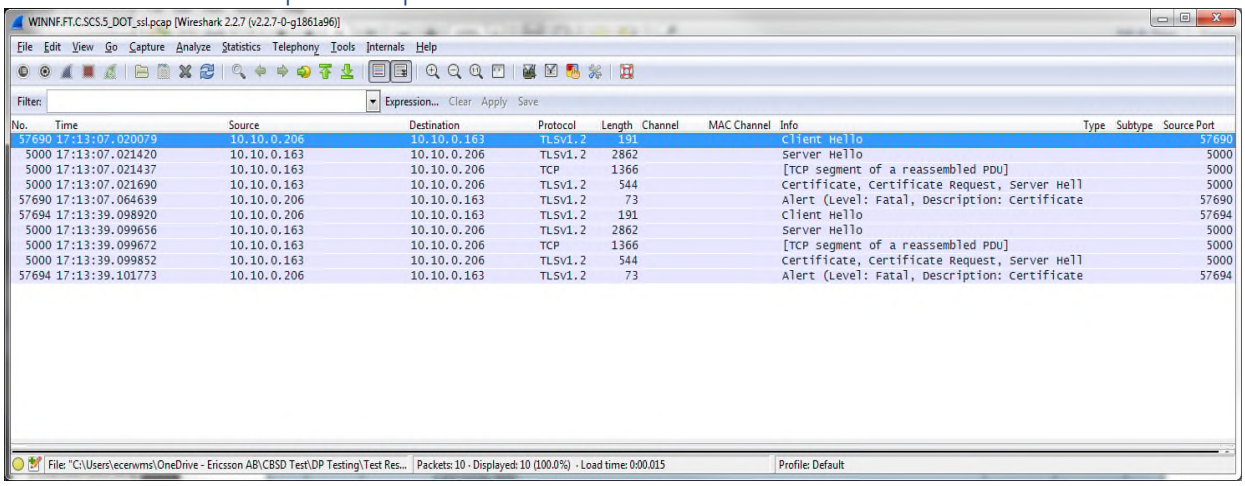
4. Authentication exchange ends with TLS Alert message (i.e. authentication fails):



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

WINNF.FT.C.SCS.5

Packet Capture Sequence



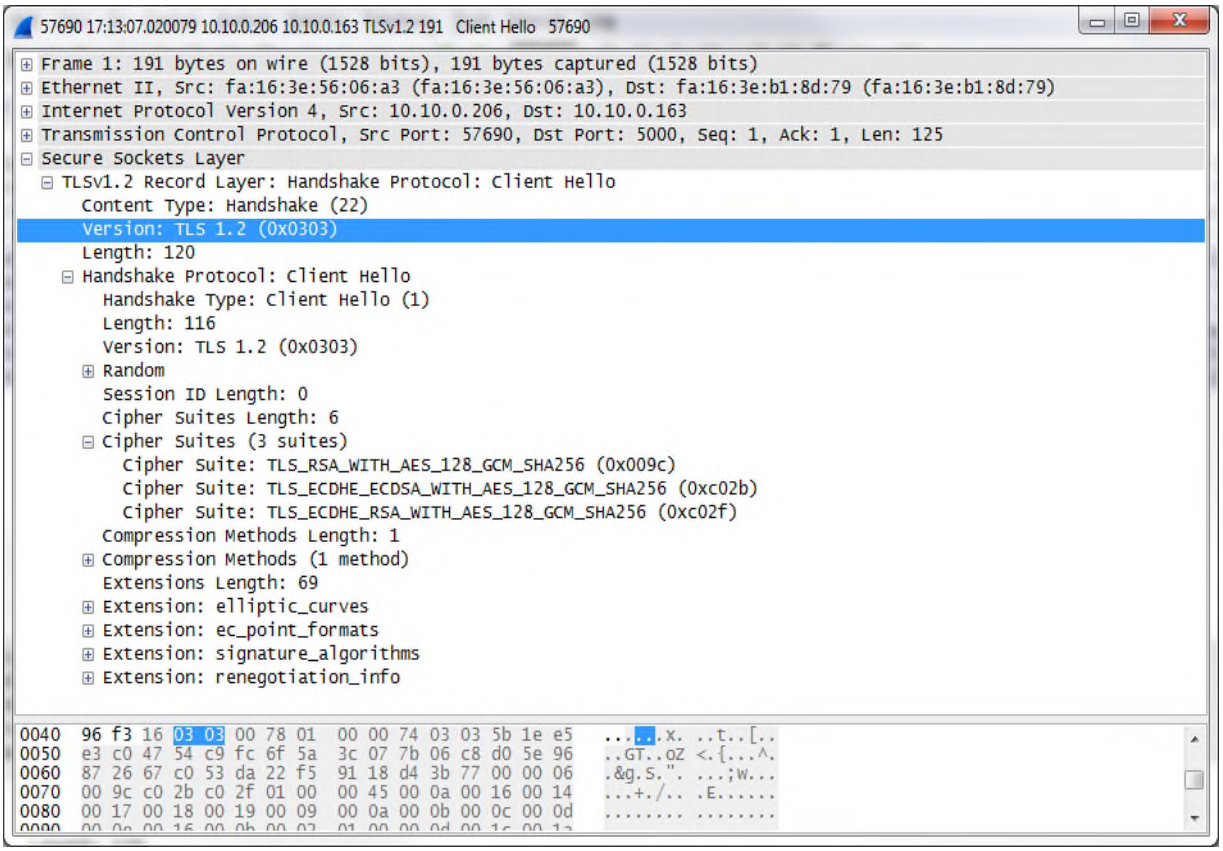
WINNF Test Requirements:

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

2	• 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	FAIL

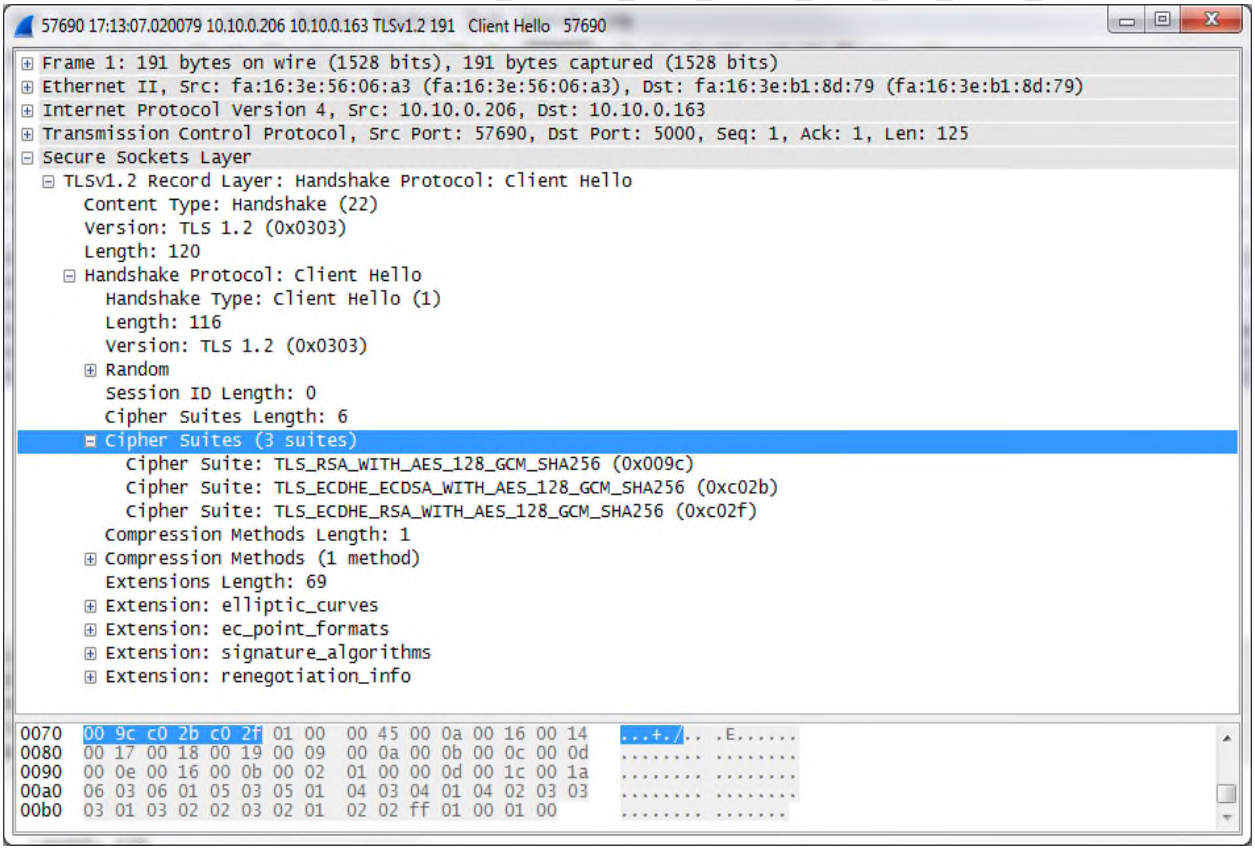
Analysis of WINNF Test Requirements

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

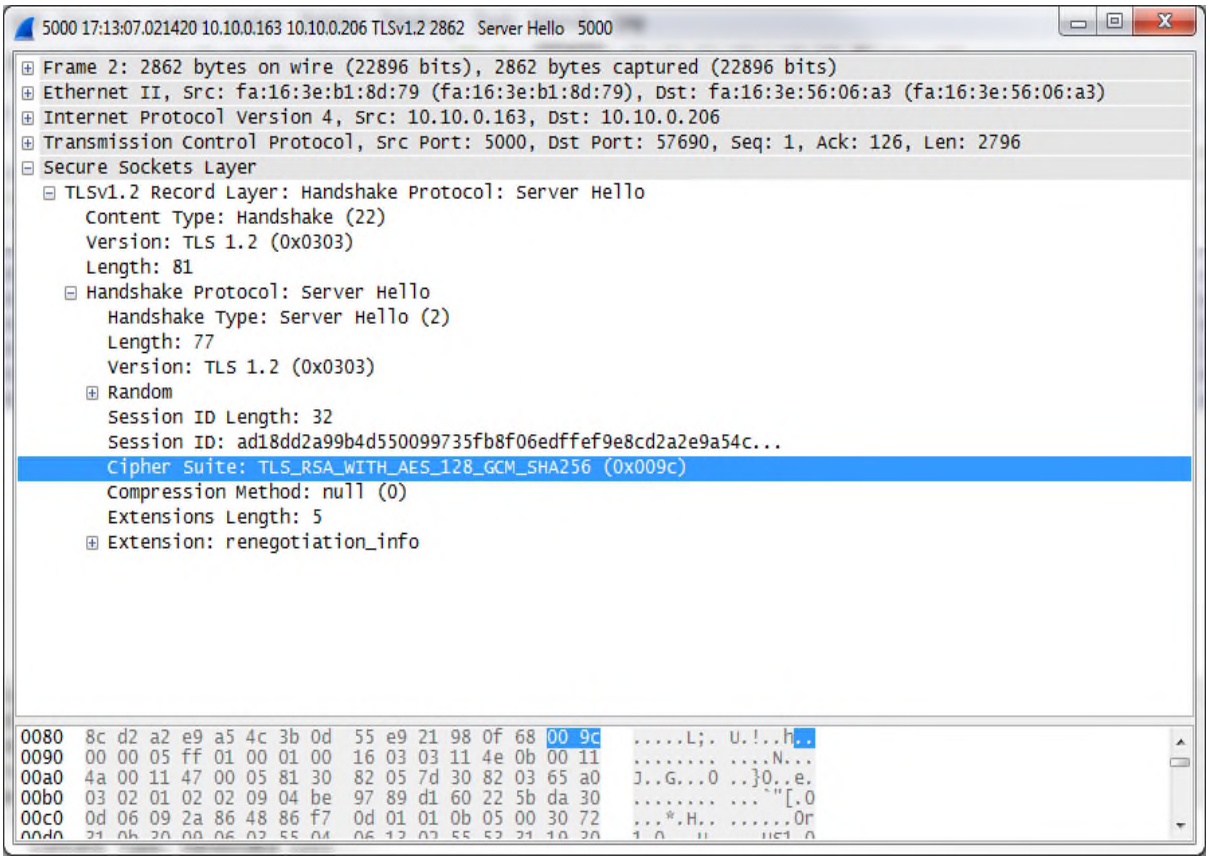


2. From Client Hello, cipher suite list is from WINNF approved list:

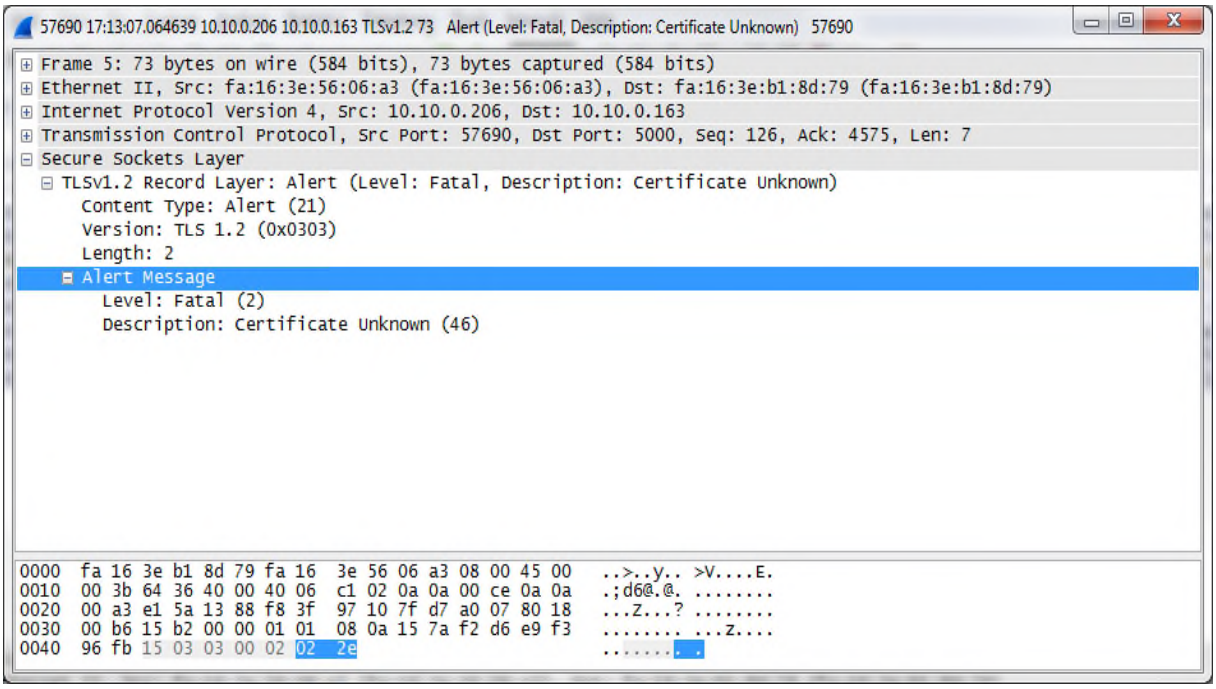
   TLS_RSA_WITH_AES_128_GCM_SHA25
   TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
   TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256



3. From Server Hello, cipher suite chosen:
   TLS_RSA_WITH_AES_128_GCM_SHA256



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



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

Test Equipment

Instrument	Manufacturer	Type No.	Serial No	Calibration Period (months)	Calibration Due
THG	Fluke	77 IV	34770264	12	18-Apr-2019
DVM	VWR	61161-378	170120564	24	17-Feb-2019
Power Supply	Xantrex	XKW 60-50	E00109863	O/P Mon	-
Spectrum Analyser	Keysight	N9030A	MY55410202	12	26-Sep-2019
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	-
Receiver	Rohde & Schwarz	ESU40	1001162	24	20-Apr-2019

Appendix A – EUT & Client Provided Details

General EUT Description

Manufacturer	Ericsson
Address	Torshamnsgatan 23 Kista SE-16480 Stockholm Sweden
Product Name	Radio 2208 B48
Product Number	KRC 161 711/1
Serial Number(s)	D827120515 and D827189029
Software Version	CXP 903 4711/2_R1H04
Hardware Version	R1B
Test Specification/Issue/Date	FCC CFR 47 Part 96: 2017

Technical Description

The Equipment Under Test (EUT) Radio 2208 B48 KRC 161 711/1 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 2208 B48 KRC 161 711/1 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.

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: ERICdomainproxyservice_CXP9035414 1.10.1

Appendix B – EUT, Peripherals, and Test Setup Photos

Test setup