CBSD Test Report

Report No.:	RF200324C03
FCC ID:	2AG32EG7035L96
Test Model:	EG7035L-M11
Series Model:	EG7035L-M2 (refer to item 3.1 for more details)
Received Date:	Mar. 24, 2020
Test Date:	May 29 ~ Jun. 06, 2020
Issued Date:	Jun. 08, 2020
Applicant:	Baicells Technologies Co., Ltd.
Address:	3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN
FCC Registration/ Designation Number:	788550 / TW0003

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Table of Contents

Release Control Record 4

1 Certificate of Conformity 5

2 Summary of Test Results 6

2.1 Measurement Uncertainty 9
2.2 Modification Record 9

3 General Information 10

3.1 General Description of EUT 10
3.2 General Description of Applied Standards and References 10

4 Measurement 11

4.1 CBSD Measurement 11
4.2 CBSD Test Procedure 11
4.3 Duration and Duty Cycle Measurement 11
4.4 Duration and Duty Cycle Test Procedure 11
4.5 Test Environment 11
4.6 Test Equipment 12
4.7 Test Setup 12
4.8 Test Results 13
4.8.1 CBSD Registration Process 13
4.8.1.1 WINNF.FT.C.REG.5 13
4.8.1.2 WINNF.FT.C.REG.8 14
4.8.1.3 WINNF.FT.C.REG.10 15
4.8.1.4 WINNF.FT.C.REG.12 16
4.8.1.5 WINNF.FT.C.REG.14 17
4.8.1.6 WINNF.FT.C.REG.16 18
4.8.1.7 WINNF.FT.C.REG.18 19
4.8.2 CBSD Spectrum Grant Process 20
4.8.2.1 WINNF.FT.C.GRA.1 20
4.8.2.2 WINNF.FT.C.GRA.2 21
4.8.3 CBSD Heart Beat Process 22
4.8.3.1 WINNF.FT.C.HBT.1 22
4.8.3.2 WINNF.FT.C.HBT.3 24
4.8.3.3 WINNF.FT.C.HBT.4 25
4.8.3.4 WINNF.FT.C.HBT.5 26
4.8.3.5 WINNF.FT.C.HBT.6 27
4.8.3.6 WINNF.FT.C.HBT.7 28
4.8.3.7 WINNF.FT.C.HBT.9 29
4.8.3.8 WINNF.FT.C.HBT.10 30
4.8.4 CBSD Relinquishment Process 31
4.8.4.1 WINNF.FT.C.RLQ.1 31
4.8.5 CBSD Deregistration Process 32
4.8.5.1 WINNF.FT.C.DRG.1 32
4.8.6 CBSD Security Validation 33
4.8.6.1 WINNF.FT.C.SCS.1 33
4.8.6.2 WINNF.FT.C.SCS.2 34
4.8.6.3 WINNF.FT.C.SCS.3 35
4.8.6.4 WINNF.FT.C.SCS.4 36
4.8.6.5 WINNF.FT.C.SCS.5 37
4.8.7 CBSD RF Power Measurement 38
4.8.7.1 WINNF.PT.C.HBT.1 38
4.8.8 Duration and Duty Cycle 41
4.8.9 Verify that the device will register with a SAS when operating below 23 dBm 43

5 Pictures of Test Arrangements 44
6 WInnForum Logs 44
Appendix – Information of the Testing Laboratories 45

Release Control Record

Issue No.	Description	Date Issued
RF200324C03	Original release	Jun. 08, 2020

1 Certificate of Conformity

Product:	LTE Outdoor CPE
Brand:	Baicells
Test Model:	EG7035L-M11
Series Model:	EG7035L-M2 (refer to item 3.1 for more details)
Sample Status:	Engineering sample
Applicant:	Baicells Technologies Co., Ltd.
Test Date:	Mar 29 ~ Jun. 06, 2020
Standards:	WINNF-TS-0122 V1.0.1 CBRSA-TS-9001 V1.1.0

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Polly Chien , **Date:** Jun. 08, 2020

Polly Chien / Specialist

Approved by : Bruce Chen , **Date:** Jun. 08, 2020

Bruce Chen / Senior Project Engineer

2 Summary of Test Results

WINNF-TS-0122			
Classes	Test Case Items	Pass Items	Pass Rate (%)
FT(CBSD, DP/CBSD)	24	24	100
PT(CBSD, DP/CBSD)	1	1	100
Total	25	25	100

Note:
1. Functional Test (FT): Test to validate the conformance of the Protocols and functionalities implemented in the CBSD/DP UUT to the requirements developed by WInnForum and supporting FCC/DoD requirements.
2. Field/Performance Test (PT): Test to check the capability of the CBSD/DP UUT to support various traffic models and actual operations in the field.

Duration and Duty Cycle		
Period	Limit	Test Result
10-second	1-second	Pass
300-second	10-second	Pass
3600-second	20-second	Pass

Note: Limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS. This time should not exceed 1 second within any 10-second period, 10seconds within any 300-second period, or 20 seconds within any 3600-second period.

Supported Features in details:

WINNF-TS-0122 Test Case		
Definitions	Test Case ID	Supported
C1	NA	No
C2	NA	No
C3	WINNF.FT.C.REG.5	Yes
C4	NA	No
C5	NA	No
C6	NA	No

WINNF-TS-0122 Test Case			
Section	Test Case ID	Test Case Title	Test Result
6.1.4.1.1	WINNF.FT.C.REG.1	Multi-Step registration	NA
6.1.4.1.2	WINNF.FT.D.REG.2	Domain Proxy Multi-Step registration	NA
6.1.4.1.3	WINNF.FT.C.REG.3	Single-Step registration for Category A CBSD	NA
6.1.4.1.4	WINNF.FT.D.REG.4	Domain Proxy Single-Step registration for Cat A CBSD	NA
6.1.4.1.5	WINNF.FT.C.REG.5	Single-Step registration for CBSD with CPI signed data	Pass
6.1.4.1.6	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	NA
6.1.4.1.7	WINNF.FT.C.REG.7	Registration due to change of an installation parameter	NA
6.1.4.2.1	WINNF.FT.C.REG.8	Missing Required parameters (responseCode 102)	Pass
6.1.4.2.2	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	NA
6.1.4.2.3	WINNF.FT.C.REG.10	Pending registration (responseCode 200)	Pass
6.1.4.2.4	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	NA
6.1.4.2.5	WINNF.FT.C.REG.12	Invalid parameter (responseCode 103)	Pass
6.1.4.2.6	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	NA
6.1.4.2.7	WINNF.FT.C.REG.14	Blacklisted CBSD (responseCode 101)	Pass
6.1.4.2.8	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	NA
6.1.4.2.9	WINNF.FT.C.REG.16	Unsupported SAS protocol version (responseCode 100)	Pass
6.1.4.2.10	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	NA
6.1.4.2.11	WINNF.FT.C.REG.18	Group Error (responseCode 201)	Pass
6.1.4.2.12	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	NA
6.1.4.3.1	WINNF.FT.C.REG.20	Category A CBSD location update	NA

WINNF-TS-0122 Test Case			
Section	Test Case ID	Test Case Title	Test Result
6.3.4.2.1	WINNF.FT.D.GRA.1	Unsuccessful Grant responseCode=400 (INTERFERENCE)	Pass
6.3.4.2.2	WINNF.FT.C.GRA.2	Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)	Pass
6.4.4.1.1	WINNF.FT.C.HBT.1	Heartbeat Success Case (first Heartbeat Response)	Pass
6.4.4.1.2	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	NA
6.4.4.2.1	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	Pass
6.4.4.2.2	WINNF.FT.C.HBT.4	Heartbeat responseCode=500 (TERMINATED_GRANT)	Pass
6.4.4.2.3	WINNF.FT.C.HBT.5	Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response	Pass
6.4.4.2.4	WINNF.FT.C.HBT.6	Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response	Pass
6.4.4.2.5	WINNF.FT.C.HBT.7	Heartbeat responseCode=502 (UNSYNC_OP_PARAM)	Pass
6.4.4.2.6	WINNF.FT.D.HBT.8	Domain Proxy Heartbeat responseCode=500 (TEMINATED_GRANT)	NA
6.4.4.3.1	WINNF.FT.C.HBT.9	Heartbeat Response Absent (First Heartbeat)	Pass
6.4.4.3.2	WINNF.FT.C.HBT.10	Heartbeat Response Absent (Subsequent Heartbeat)	Pass
6.4.4.4.1	WINNF.FT.C.HBT.11	Successful Grant Renewal in Heartbeat Test Case	NA
6.5.4.2.1	WINNF.FT.C.MES.1	Registration Response contains measReportConfig	NA
6.5.4.2.2	WINNF.FT.D.MES.2	Domain Proxy Registration Response contains measReportConfig	NA
6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	NA
6.5.4.2.4	WINNF.FT.C.MES.4	Heartbeat Response contains measReportConfig	NA
6.5.4.2.5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	NA

WINNF-TS-0122 Test Case			
Section	Test Case ID	Test Case Title	Test Result
6.6.4.1.1	WINNF.FT.C.RLQ.1	Successful Relinquishment	Pass
6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	NA
6.6.4.2.1	WINNF.FT.C.RLQ.3	Unsuccessful Relinquishment, responseCode=102	NA
6.6.4.2.2	WINNF.FT.D.RLQ.4	Domain Proxy Unsuccessful Relinquishment, responseCode=102	NA
6.6.4.3.1	WINNF.FT.C.RLQ.5	Unsuccessful Relinquishment, responseCode=103	NA
6.6.4.3.2	WINNF.FT.D.RLQ.6	Domain Proxy Unsuccessful Relinquishment, responseCode=103	NA
6.7.4.1.1	WINNF.FT.C.DRG.1	Successful Deregistration	Pass
6.7.4.1.2	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	NA
6.7.4.2.1	WINNF.FT.C.DRG.3	Deregistration responseCode=102	NA
6.7.4.2.2	WINNF.FT.D.DRG.4	Domain Proxy Deregistration responseCode=102	NA
6.7.4.3.1	WINNF.FT.C.DRG.5	Deregistration responseCode=103	NA
6.8.4.1.1	WINNF.FT.C.SCS.1	Successful TLS connection between UUT and SAS Test Harness	Pass
6.8.4.2.1	WINNF.FT.C.SCS.2	TLS failure due to revoked certificate	Pass
6.8.4.2.2	WINNF.FT.C.SCS.3	TLS failure due to expired server certificate	Pass
6.8.4.2.3	WINNF.FT.C.SCS.4	TLS failure when SAS Test Harness certificate is issue by unknown CA	Pass
6.8.4.2.4	WINNF.FT.C.SCS.5	TLS failure when certificate at the SAS Test Harness is corrupted	Pass
7.1.4.1.1	WINNF.PT.C.HBT	UUT RF Transmit Power Measurement	Pass

Note: Section as per WINNF-TS-0122 If the product as tested complies with the specification, the UUT is deemed to comply with the standard and is deemed a “Pass” grade. If not “Fail” grade is issued. Where “NA” is stated this means the test case is not applicable.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the UUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions above 1 GHz	1GHz ~ 18GHz	1 dB

2.2 Modification Record

Following the FCC KDB 940660 D02 CPE-CBSD Handshake Procedures v01, when running the test cases in WINNF-TS-0122 for CPE-CBSD device type, for the last execution step appearing in WINNF-TS-0122:

1. The Pass/Fail criteria “UUT shall not transmit RF” is replaced by “CPE-CBSD UUT shall not transmit user traffic”.
2. The Pass/Fail criteria “UUT shall stop transmission” is replaced by CPE-CBSD UUT shall stop transmitting user traffic”

3 General Information

3.1 General Description of EUT

Product	LTE Model
Brand	Baicells
Test Model	EG7035L-M11
Series Model	EG7035L-M2
Model Difference	Refer to Note
Power Supply Rating	24Vdc from adapter
Hardware Version	ver.A
Firmware Version	BaiCE_AP_2.2.1_SAS
Status of EUT	Engineering sample
Accessory Device	Adapter
Data Cable Supplied	NA

Note:

1. All models are listed as below. Model EG7035L-M11 is the representative for final test.

Brand	Model	Difference
Baicells	EG7035L-M11	All models are electrically identical, different model names are for marketing purpose.
	EG7035L-M2	

2. The EUT consumes power from the following adapter.

Brand	SHENZHEN GOSPELL DIGITAL TECHNOLOGY CO., LTD.
Model	G0549A-240-050
Input Power	100-240Vac~, 50/60Hz, 0.5A MAX
Output Power	24Vdc, 0.5A

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
WINNF-TS-0122	25deg. C, 65%RH	120Vac, 60Hz	Leona Hu

3.2 General Description of Applied Standards and References

The UUT is a CPE-CBSD product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:
FCC 47 CFR Part 96
WINNF-19-IN-00033 V1.0

All test items have been performed and recorded as per the above standards.

References Test Guidance:
KDB 940660 D01 Part 96 CBRS Eqpt v02
KDB 940660 D02 CPE-CBSD Handshake Procedures v01

All test items have been performed as a reference to the above KDB test guidance.

4 Measurement

4.1 CBSD Measurement

The CBSD shall validate and ensure that the Conformance and Performance Test results from compliance with SAS functional requirements.

4.2 CBSD Test Procedure

a. Connect the UUT to SAS Test Harness system and RF Test instruments via the CBSD interface and RF components. The highest level is set to test configuration.
b. UUT shall be UTC time synchronized
c. The frequency band is granted and set as UUT supported Modulation and Channels, transmitted power of the UUT according to it granted parameters from the SAS Test Harness.
d. Each test case results was recorded and validated by SAS Test Harness system and RF instruments test cases was recorded test results from SAS Test Harness system.

4.3 Duration and Duty Cycle Measurement

The CPE-CBSD shall validate and ensure that limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS.

4.4 Duration and Duty Cycle Test Procedure

a. CPE-CBSD as UUT does not receive any RF signal from its “Compatible BTS-CBSD” (FCC ID: P27P208), so CPE-CBSD as UUT does not transmit. UUT shall be UTC time synchronized.
b. Use the WinnForum SAS Harness #1 for CPE-CBSD as UUT and run test case WINNF.FT.C.GRA.1 for CPE-CBSD as UUT.
c. CPE-CBSD as UUT starts to receive the RF signal from its “Compatible BTS-CBSD”, so CPE-CBSD can start communicating with the WinnForum SAS Harness #1. Make note of the time when RF Test equipment logs the first transmission from CPE-CBSD which is above 23dBm/10MHz – this is the start time of the {X time out of Y time}.
d. When the test case WINNF.FT.C.GRA.1 finishes and the questions appear on the WinnForum SAS Harness #1 console, do NOT answer the questions. Wait until Y time has passed from step #3. During this Y time, the RF test equipment is logging the amount of time CPE-CBSD as UUT transmitted EiRP above 23dBm/10MHz. The amount of time logged for transmitting EiRP above 23dBm/10MHz is the X time.
e. Answer the questions on the WinnForum SAS Harness #1 console so the WinnForum SAS Harness #1 is ready for the next test.

4.5 Test Environment

Test Harness Version	V1.0.0.3
Operating System	Microsoft Windows 10
TLS Version	1.2
Python	2.7.13

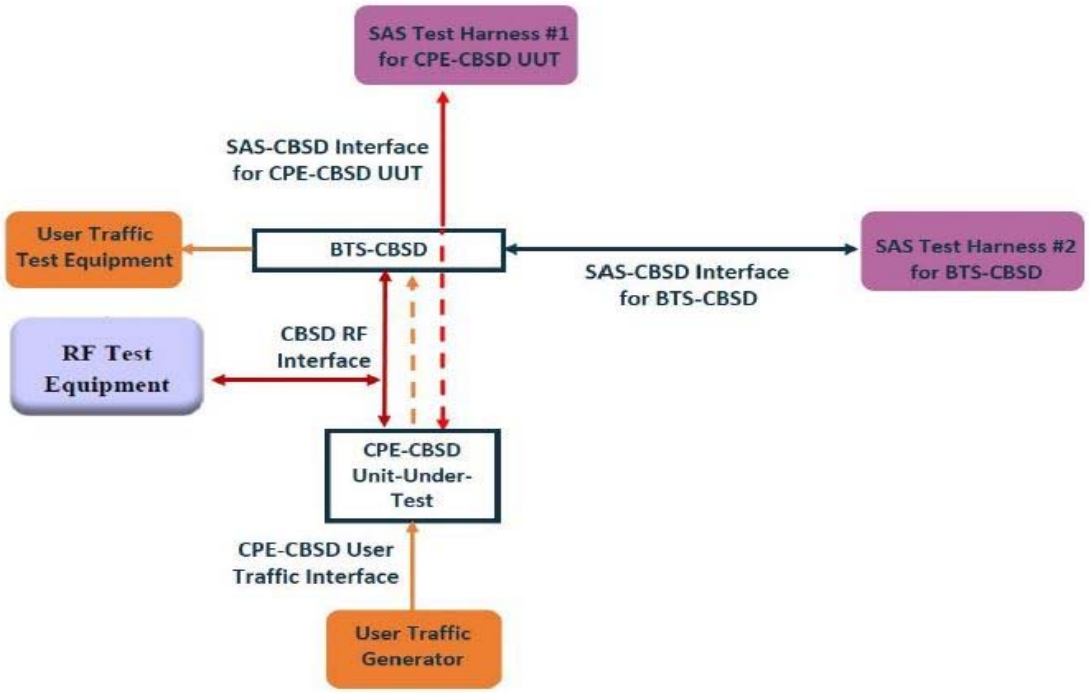
4.6 Test Equipment

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
ROHDE & SCHWARZ Signal Analyzer	FSV	E2-010642	May 28, 2020	May 27, 2021
Temperature & Humidity Chamber TERCHY	ETP-101	Info Sec 1	Jan. 08, 2020	Jan. 07, 2021
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Nov. 25, 2019	Nov. 24, 2020
Laptop Lenovo	L470	PF-11H9B8	NA	NA

Note: 1. The test was performed in InfoSec Test Room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.7 Test Setup

■ Test configuration without Domain Proxy - CPE-CBSD as UUT, BTS-CBSD direct communication



4.8 Test Results

4.8.1 CBSD Registration Process

4.8.1.1 WINNF.FT.C.REG.5

■Test Case ID : WINNF.FT.C.REG.5 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends correct Registration request information, as specified in [n.5], to the SAS Test Harness: ● The required userId, fccId and cbsdSerialNumber registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges. ● Any REG-conditional or optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges. Note: It is outside the scope of this document to test the Registration information that is supplied via another means.	■ Pass	□ Fail
3	● SAS Test Harness sends a CBSD Registration Response as follows: - *cbsdId* = C - *measReportConfig* shall not be included - *responseCode* = 0	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.2 WINNF.FT.C.REG.8

■Test Case ID : WINNF.FT.C.REG.8 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.3 WINNF.FT.C.REG.10

■Test Case ID : WINNF.FT.C.REG.10 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=200) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.4 WINNF.FT.C.REG.12

■Test Case ID : WINNF.FT.C.REG.12 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=103) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.5 WINNF.FT.C.REG.14

■Test Case ID : WINNF.FT.C.REG.14 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=101) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.6 WINNF.FT.C.REG.16

■Test Case ID : WINNF.FT.C.REG.16 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=100) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.1.7 WINNF.FT.C.REG.18

■Test Case ID : WINNF.FT.C.REG.18 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with SAS Test Harness ● UUT is in the Unregistered state	--	--
2	CBSD sends a Registration request to SAS Test Harness.	--	--
3	SAS Test Harness rejects the request by sending a CBSD Registration Response as follows: - SAS response does not include *cbsdId* - *responseCode* = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=201) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.2 CBSD Spectrum Grant Process

4.8.2.1 WINNF.FT.C.GRA.1

■Test Case ID : WINNF.FT.C.GRA.1 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness, with *cbsdId* = C	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including ● *cbsdId*=C ● responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=0) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.2.2 WINNF.FT.C.GRA.2

■Test Case ID : WINNF.FT.C.GRA.2 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness, with *cbsdId* = C	--	--
2	UUT sends valid Grant Request.	--	--
3	SAS Test Harness sends a Grant Response message, including ● *cbsdId*=C ● responseCode = R	--	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=401) to further request messages from the UUT.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

4.8.3 CBSD Heart Beat Process

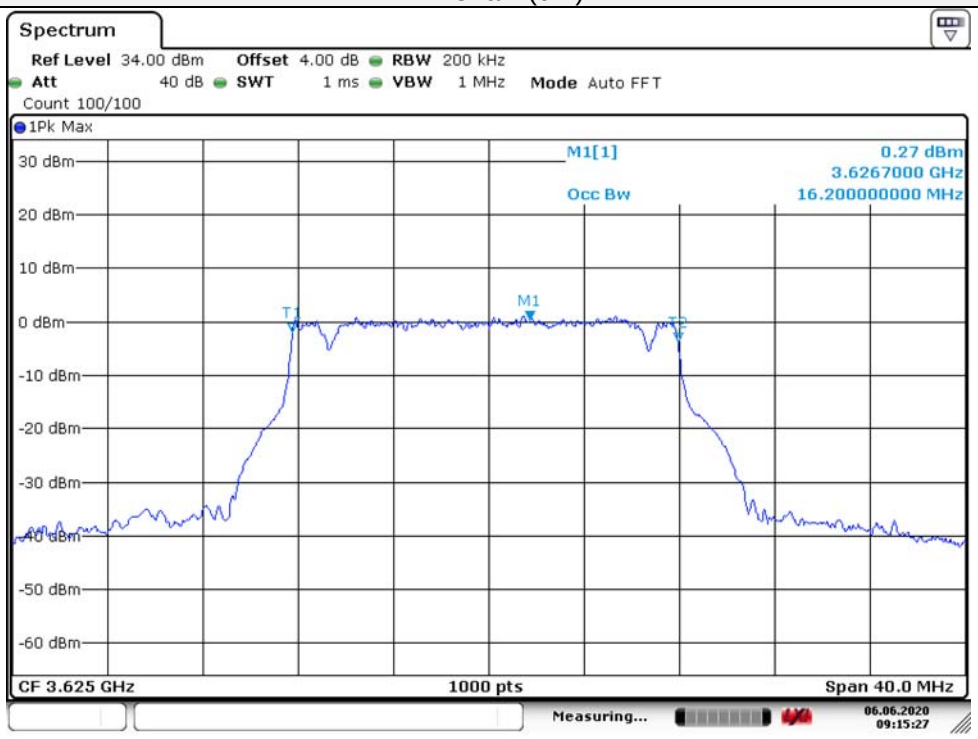
4.8.3.1 WINNF.FT.C.HBT.1

■Test Case ID : WINNF.FT.C.HBT.1 □NA

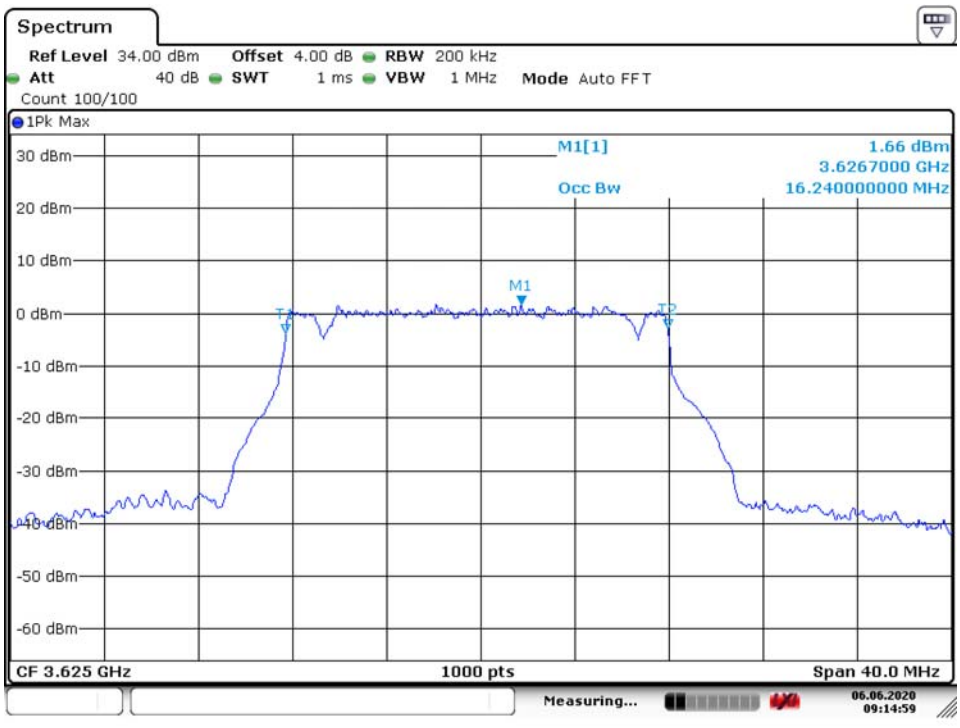
#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness, with *cbsdId* = C	--	--
2	UUT sends a message: ● If message is type Spectrum Inquiry Request, go to step 3, or ● If message is type Grant Request, go to step 5	--	--
3	UUT sends Spectrum Inquiry Request. Validate: ● *cbsdId* = C ● List of frequencyRange objects sent by UUT are within the CBRS frequency range	■ Pass	□ Fail
4	SAS Test Harness sends a Spectrum Inquiry Response message, including the following parameters: ● *cbsdId* = C ● availableChannel is an array of availableChannel objects ● *responseCode* = 0	--	--
5	UUT sends Grant Request message. Validate: ● *cbsdId* = C ● maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 ● operationFrequencyRange, F, sent by UUT is a valid range within the CBRS band	■ Pass	□ Fail
6	SAS Test Harness sends a Grant Response message, including the parameters: ● *cbsdId* = C ● *grantId* = G = a valid grant ID ● grantExpireTime = UTC time greater than duration of the test ● *responseCode* = 0	--	--
7	UUT sends a first Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: ● *cbsdId* = C ● *grantId* = G ● *operationState* = “GRANTED”	■ Pass	□ Fail
8	SAS Test Harness sends a Heartbeat Response message, with the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = current UTC time + 200 seconds ● *responseCode* = 0	--	--
9	For further Heartbeat Request messages sent from UUT after completion of step 8, validate message is sent within latest specified heartbeatInterval, and: ● *cbsdId* = C ● *grantId* = G ● *operationState* = “AUTHORIZED” and SAS Test Harness responds with a Heartbeat Response message including the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = current UTC time + 200 seconds ● *responseCode* = 0	■ Pass	□ Fail
10	Monitor the RF output of the UUT from start of test until UUT transmission commences. Verify: ● UUT does not transmit at any time prior to completion of the first heartbeat response ● UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F.	■ Pass	□ Fail

- UUT transmits after step 8 is complete, and its transmission is limited to within the bandwidth range F.

Channel	Freq. (MHz)	OCP 99 Band Width (MHz)	
		F = 20MHz	
		Chain (0)	Chain (1)
Middle	3625	16.2	16.24
Spectrum Plot			
Chain (0-1)			



Date: 6.JUN.2020 09:15:27



Date: 6.JUN.2020 09:14:59

4.8.3.2 WINNF.FT.C.HBT.3

■Test Case ID : WINNF.FT.C.HBT.3 □NA

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

4.8.3.3 WINNF.FT.C.HBT.4

■Test Case ID : WINNF.FT.C.HBT.4 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness ● UUT has a valid single grant as follows: ○ valid *cbsdId* = C ○ valid *grantId* = G ○ grant is for frequency range F, power P ○ *grantExpireTime* = UTC time greater than duration of the test ● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface	--	--
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: ● *cbsdId* = C ● *grantId* = G ● *operationState* = "AUTHORIZED"	■ Pass	□ Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = T = current UTC time ● *responseCode* = 500 (TERMINATED_GRANT)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the RF output of the UUT. Verify: ● UUT shall stop transmission within (T + 60 seconds) of completion of step 3	■ Pass	□ Fail

4.8.3.4 WINNF.FT.C.HBT.5

■Test Case ID : WINNF.FT.C.HBT.5 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness ● UUT has a valid single grant as follows: ○ valid *cbsdId* = C ○ valid *grantId* = G ○ grant is for frequency range F, power P ○ *grantExpireTime* = UTC time greater than duration of the test ● UUT is in GRANTED, but not AUTHORIZED state (i.e. has not performed its first Heartbeat Request)	--	--
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message is formatted correctly, including: ● *cbsdId* = C ● *grantId* = G ● *operationState* = "GRANTED"	■ Pass	□ Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = T = current UTC time ? *responseCode* = 501 (SUSPENDED_GRANT)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the SAS-CBSD interface. Verify either A OR B occurs: A. UUT sends a Heartbeat Request message. Ensure message is sent within latest specified heartbeatInterval, and is correctly formatted with parameters: ● *cbsdId* = C ● *grantId* = G ● *operationState* = "GRANTED" B. UUT sends a Relinquishment request message. Ensure message is correctly formatted with parameters: ● *cbdsId* = C ● *grantId* = G Monitor the RF output of the UUT. Verify: ● UUT does not transmit at any time	■ Pass	□ Fail

4.8.3.5 WINNF.FT.C.HBT.6

■Test Case ID : WINNF.FT.C.HBT.6 □NA

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

4.8.3.6 WINNF.FT.C.HBT.7

■Test Case ID : WINNF.FT.C.HBT.7 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness ● UUT has a valid single grant as follows: ○ valid *cbsdId* = C ○ valid *grantId* = G ○ grant is for frequency range F, power P ○ *grantExpireTime* = UTC time greater than duration of the test ● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface	--	--
2	UUT sends a Heartbeat Request message. Ensure Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: ● *cbsdId* = C ● *grantId* = G ● *operationState* = "AUTHORIZED"	■ Pass	□ Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = T = current UTC time ● *responseCode* = 502 (UNSYNC_OP_PARAM)	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the SAS-CBSD interface. Verify: ● UUT sends a Grant Relinquishment Request message. Verify message is correctly formatted with parameters: ○ cbsdId = C ○ grantId = G Monitor the RF output of the UUT. Verify: ● UUT shall stop transmission within (T+60) seconds of completion of step 3	■ Pass	□ Fail

4.8.3.7 WINNF.FT.C.HBT.9

■Test Case ID : WINNF.FT.C.HBT.9 □NA

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

4.8.3.8 WINNF.FT.C.HBT.10

■Test Case ID : WINNF.FT.C.HBT.10 □NA

#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has registered successfully with SAS Test Harness ● UUT has a valid single grant as follows: ○ valid *cbsdId* = C ○ valid *grantId* = G ○ grant is for frequency range F, power P ○ *grantExpireTime* = UTC time greater than duration of the test ● UUT is in AUTHORIZED state and is transmitting within the grant bandwidth F on RF interface	--	--
2	UUT sends a Heartbeat Request message. Verify Heartbeat Request message is sent within latest specified heartbeatInterval, and is formatted correctly, including: ● *cbsdId* = C ● *grantId* = G ● *operationState* = "AUTHORIZED"	■ Pass	□ Fail
3	SAS Test Harness sends a Heartbeat Response message, including the following parameters: ● *cbsdId* = C ● *grantId* = G ● *transmitExpireTime* = T = current UTC time + 200 seconds ● *responseCode* = 0	--	--
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT.	--	--
5	Monitor the RF output of the UUT. Verify: ● UUT shall stop all transmission on RF interface within (*transmitExpireTime* + 60 seconds), using the transmitExpireTime sent in Step 3.	■ Pass	□ Fail

4.8.4 CBSD Relinquishment Process

4.8.4.1 WINNF.FT.C.RLQ.1

■Test Case ID : WINNF.FT.C.RLQ.1 □NA

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

4.8.5 CBSD Deregistration Process

4.8.5.1 WINNF.FT.C.DRG.1

■Test Case ID : WINNF.FT.C.DRG.1 □NA

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

4.8.6 CBSD Security Validation

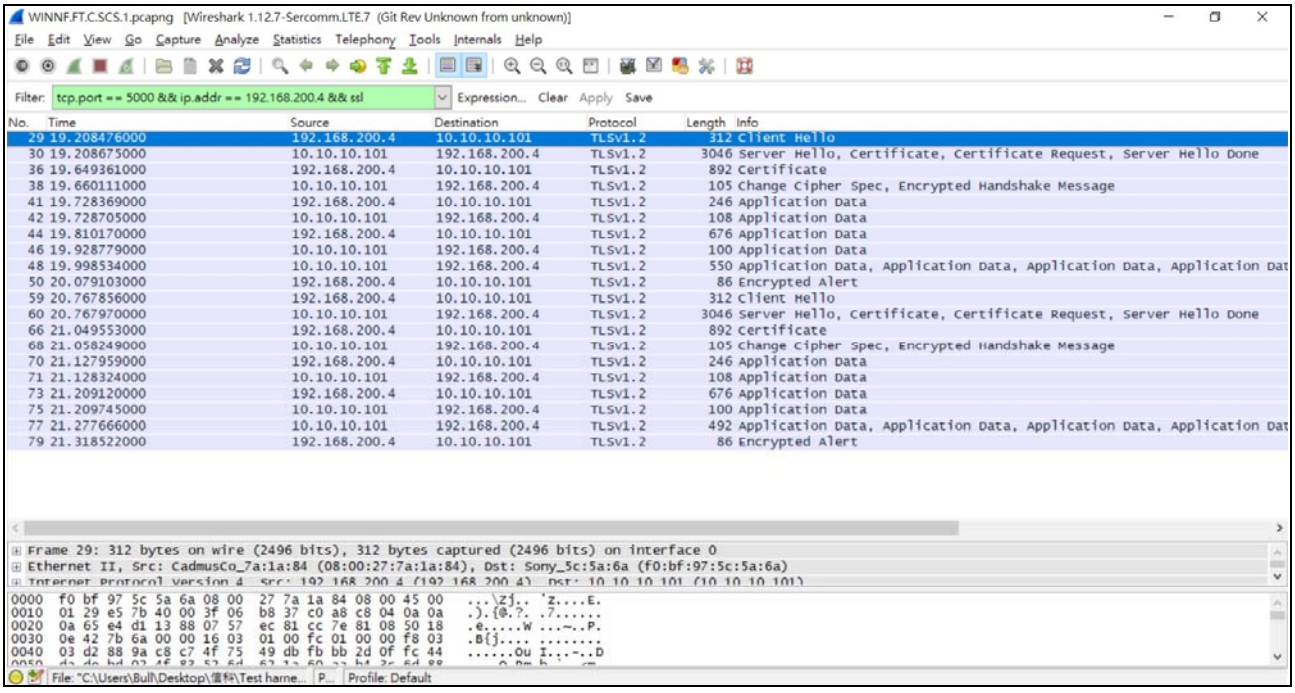
4.8.6.1 WINNF.FT.C.SCS.1

■Test Case ID : WINNF.FT.C.SCS.1 □NA

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedure ● The UUT shall establish a TLS handshake with the SAS Test Harness using configured certificate. ● Configure the SAS Test Harness to accept the security procedure and establish the connection	■ Pass	□ Fail
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
3	A successful registration is accomplished using one of the test cases described in section 6.1.4.1, depending on CBSD capability. ● UUT sends a registration request to the SAS Test Harness and the SAS Test Harness sends a Registration Response with *responseCode* = 0 and *cbsdId*.	■ Pass	□ Fail
4	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

Wireshark Capture Example for Test Case :

● Make sure that UUT uses TLS v1.2



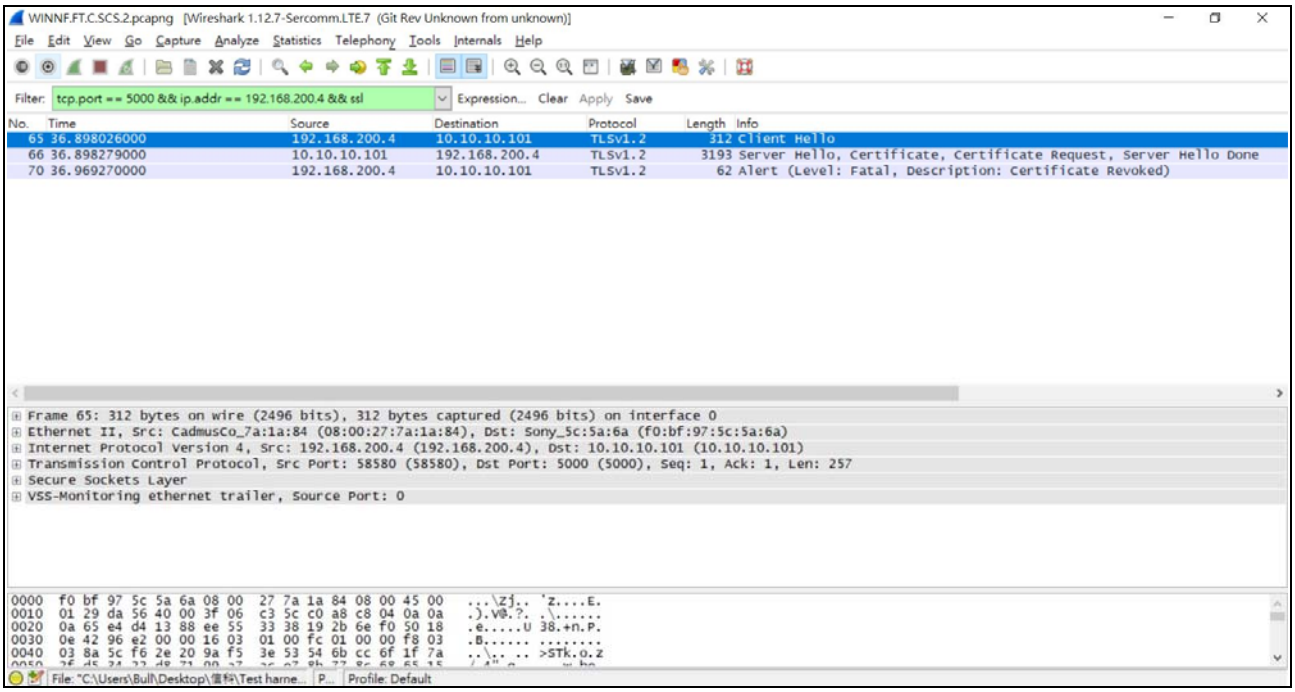
4.8.6.2 WINNF.FT.C.SCS.2

■Test Case ID : WINNF.FT.C.SCS.2 □NA

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	□ Fail
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
3	UUT may retry for the security procedure which shall fail.	■ Pass	□ Fail
4	SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

Wireshark Capture Example for Test Case :

● Make sure that UUT uses TLS v1.2



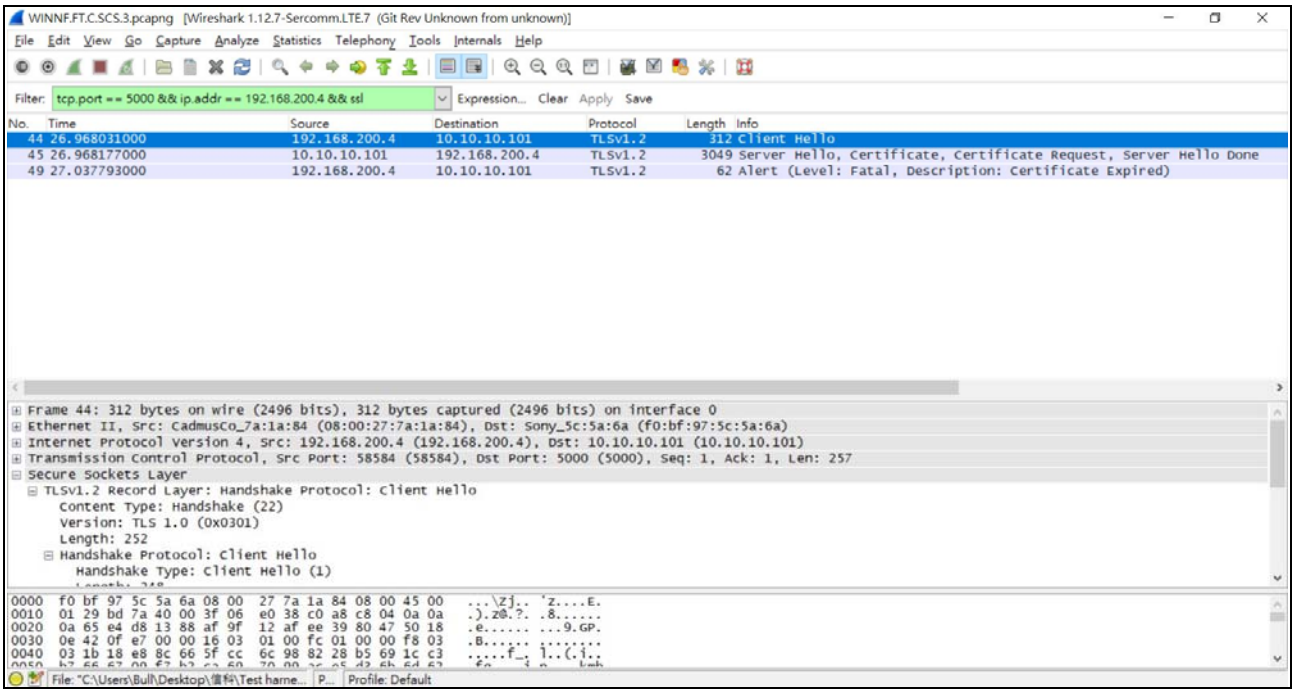
4.8.6.3 WINNF.FT.C.SCS.3

■Test Case ID : WINNF.FT.C.SCS.3 □NA

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	□ Fail
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
3	UUT may retry for the security procedure which shall fail.	■ Pass	□ Fail
4	SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

Wireshark Capture Example for Test Case :

● Make sure that UUT uses TLS v1.2



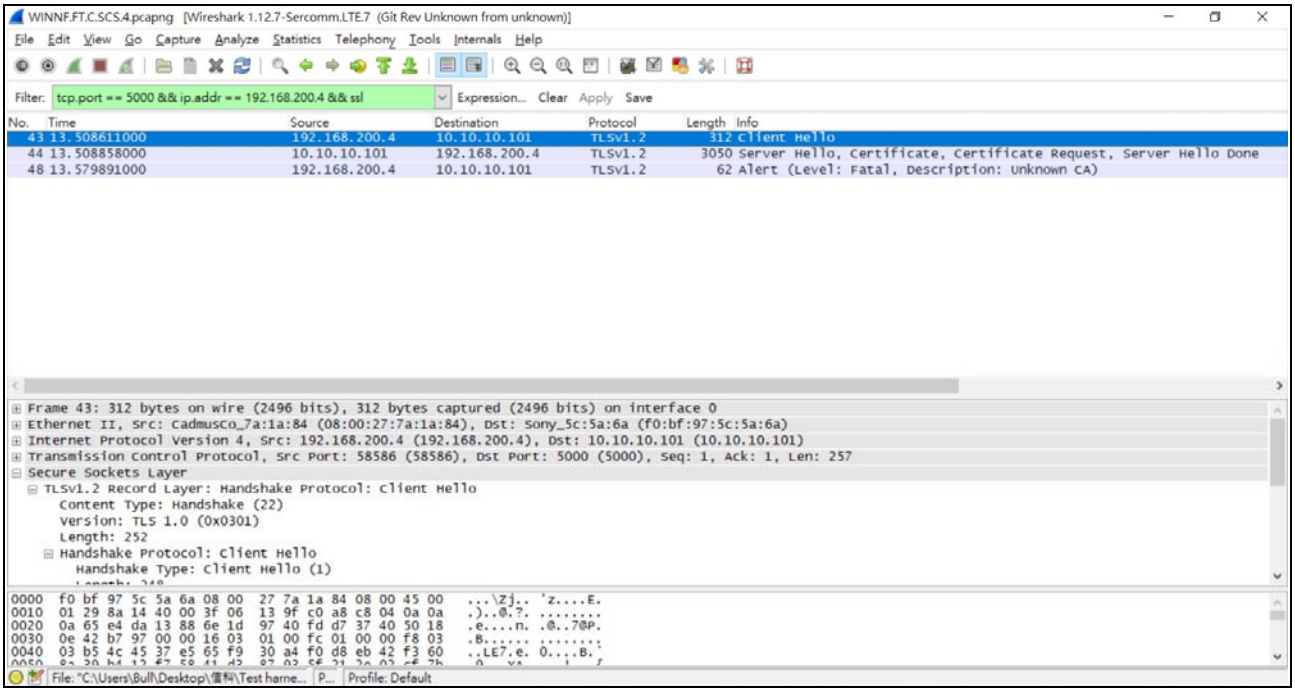
4.8.6.4 WINNF.FT.C.SCS.4

■Test Case ID : WINNF.FT.C.SCS.4 □NA

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	□ Fail
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
3	UUT may retry for the security procedure which shall fail.	■ Pass	□ Fail
4	SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

Wireshark Capture Example for Test Case :

● Make sure that UUT uses TLS v1.2



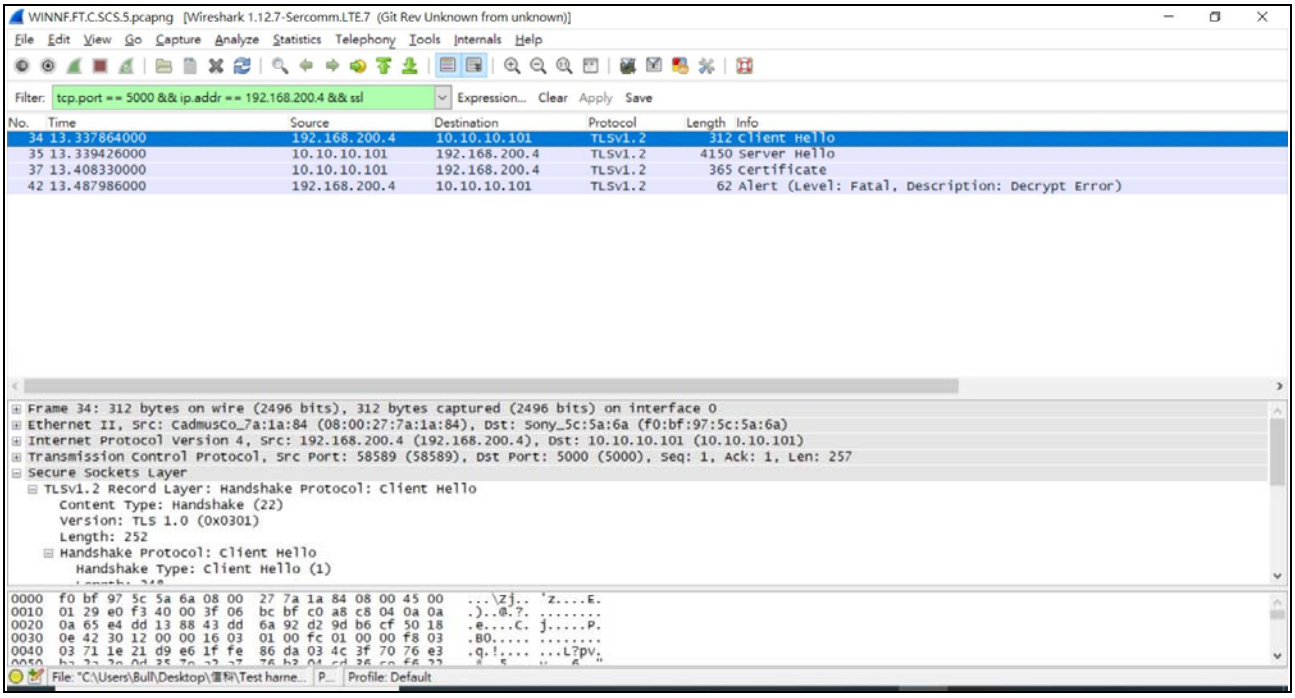
4.8.6.5 WINNF.FT.C.SCS.5

■Test Case ID : WINNF.FT.C.SCS.5 □NA

#	Test Execution Steps	Results	
1	● UUT shall start CBSD-SAS communication with the security procedures	■ Pass	□ Fail
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
3	UUT may retry for the security procedure which shall fail.	■ Pass	□ Fail
4	SAS Test-Harness shall not receive any Registration request or any application data.	--	--
5	Monitor the RF output of the UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: ● UUT shall not transmit RF	■ Pass	□ Fail

Wireshark Capture Example for Test Case :

● Make sure that UUT uses TLS v1.2



4.8.7 CBSD RF Power Measurement

4.8.7.1 WINNF.PT.C.HBT.1

■Test Case ID : WINNF.PT.C.HBT.1 □NA

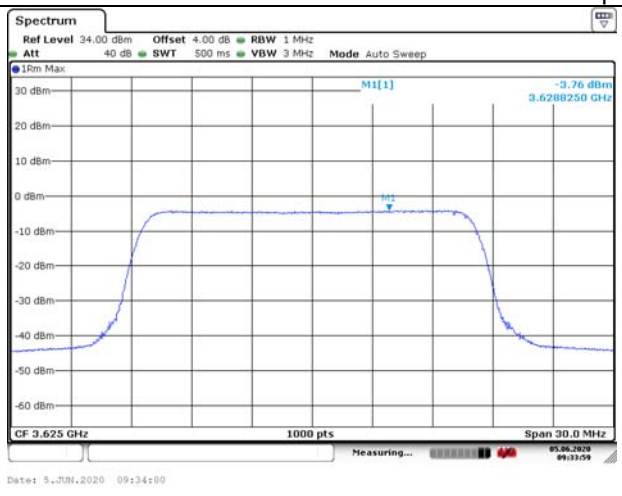
#	Test Execution Steps	Results	
1	Ensure the following conditions are met for test entry: ● UUT has successfully completed SAS Discovery and Authentication with the SAS Test Harness ● UUT has registered with the SAS, with CBSD ID = C ● UUT has a single valid grant G with parameters {lowFrequency = FL, highFrequency = FH, maxEirp = Pi}, with grant in AUTHORIZED state, and grantExpireTime set to a value far past the duration of this test case *Note: in order for the UUT to request a grant with the parameters {lowFrequency, highFrequency, maxEirp), the SAS Test Harness may need to provide appropriate guidance in the availableChannel object of the spectrumInquiry response message, and the operationParam object of the grant response message. Alternately, the UUT vendor may provide the ability to set those parameters on the UUT so that the UUT will request a grant with those parameters*	--	--
2	UUT and SAS Test Harness perform a series of Heartbeat Request/Response cycles, which continues until the other test steps are complete. Messaging for each cycle is as follows: ● UUT sends Heartbeat Request, including: ○ *cbsdId* = C ○ *grantId* = G ● SAS Test Harness responds with Heartbeat Response, including: o *cbsdId* = C ○ grantId = G ○ *transmitExpireTime* = current UTC time + 200 seconds ○ *responseCode* = 0	--	--
3	Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill the requirements of the power measurement method. *Note: it may be required for the vendor to provide a method or configuration to bring the UUT to a mode which is required by the measurement methodology. Any such mode is vendor-specific and depends upon UUT behavior and the measurement methodology.*	■ Pass	□ Fail

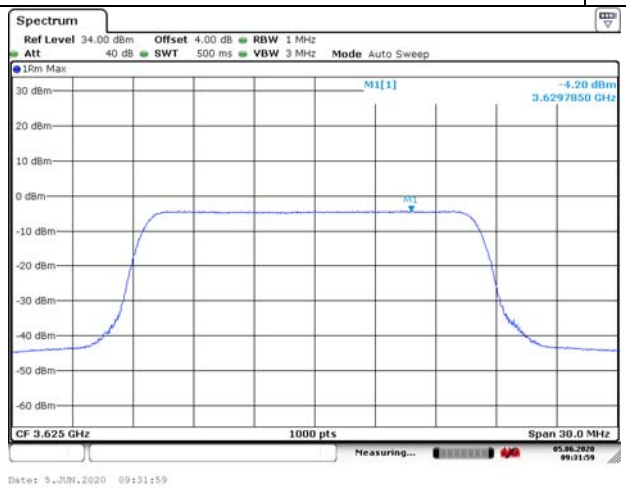
RF measurement plot for Test Case :

- Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, Pi. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfill the requirements of the power measurement method.

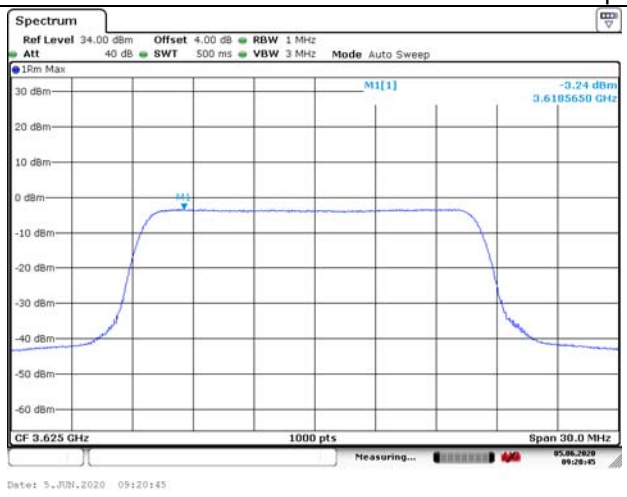
Channel	Freq. (MHz)	20MHz				Limit	Pass / Fail
		Conducted Power Density (dBm/MHz)		Gain(dBi)	14		
		Chain 0	Chain 1	Power Density		maxEirp(dBm)=Pi	
Middle	3625	-3.76	-4.2	-0.96		25.0	Pass
Middle	3625	-3.24	-3.17	-0.19		26.0	Pass
Middle	3625	-2.22	-1.95	0.93		27.0	Pass

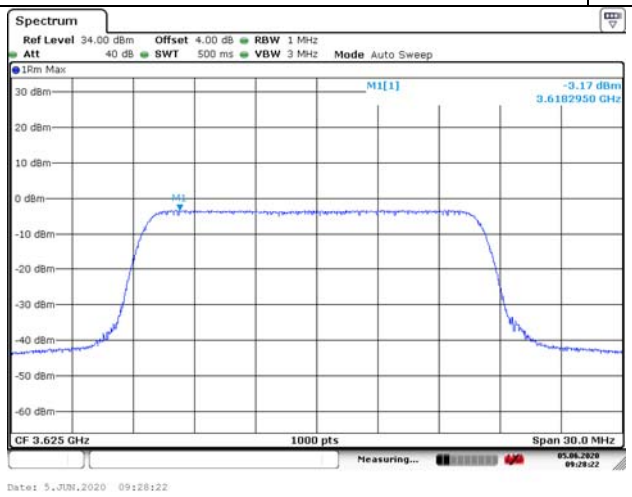
maxEirp = 25 dBm/MHz



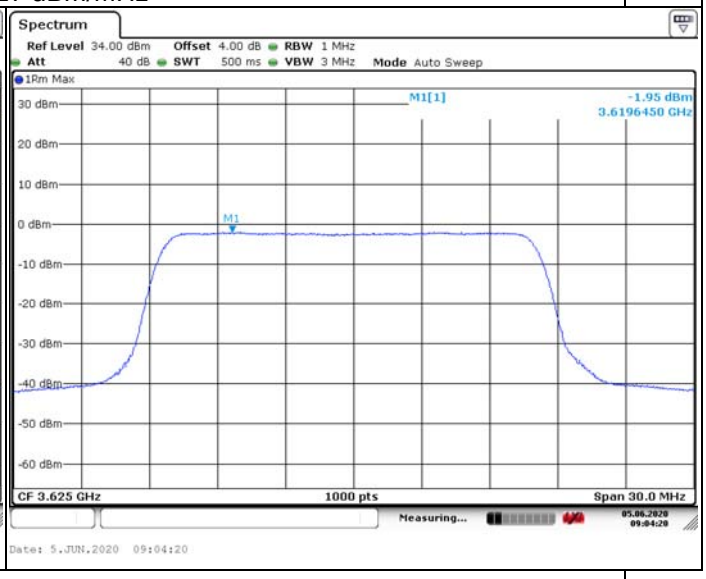


maxEirp = 26 dBm/MHz





maxEirp = 27 dBm/MHz



4.8.8 Duration and Duty Cycle

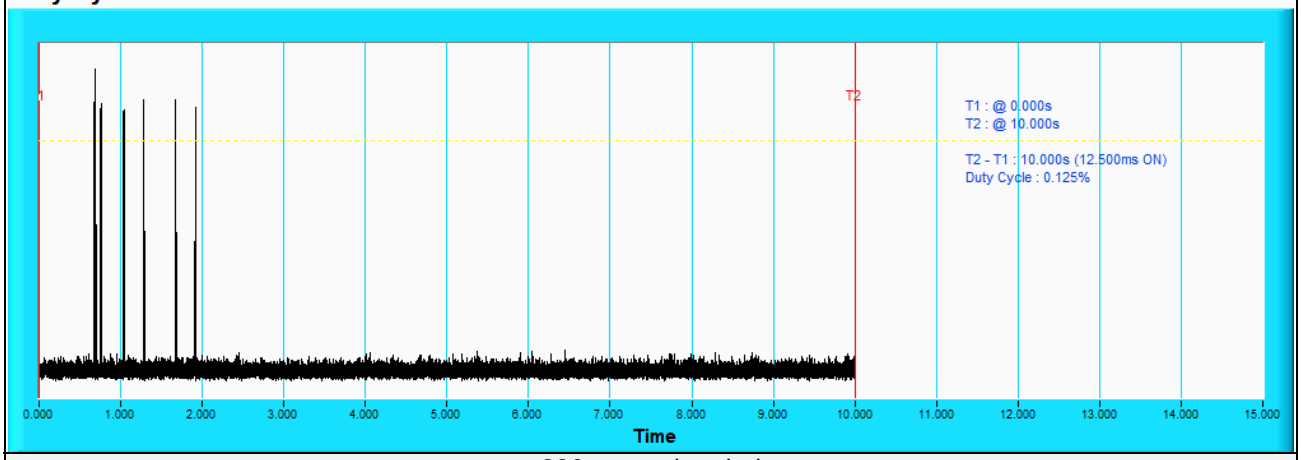
Duration and Duty Cycle			
Period	Minimum Time	Limit	Pass / Fail
10-second	12.5 msec	1-second	Pass
300-second	1.397 sec	10-second	Pass
3600-second	13.275 sec	20-second	Pass

Note:

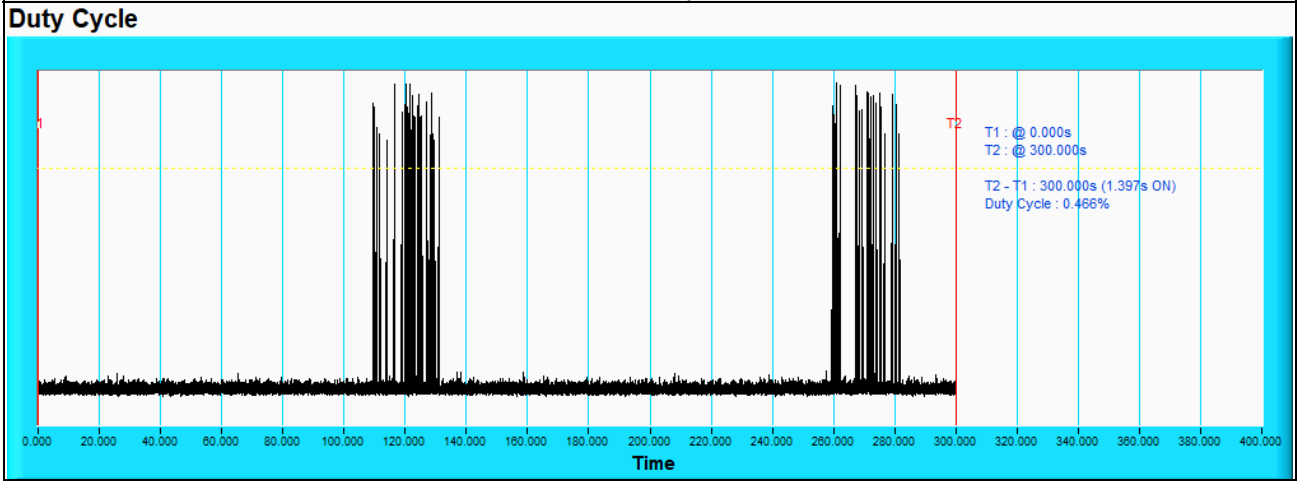
1. Limited in duration and duty cycle to the minimum time necessary to get a grant from the SAS. This time should not exceed 1 second within any 10-second period, 10seconds within any 300-second period, or 20 seconds within any 3600-second period.
2. Pass = Minimum Time < Limit

- Measurement plot for Test Case :

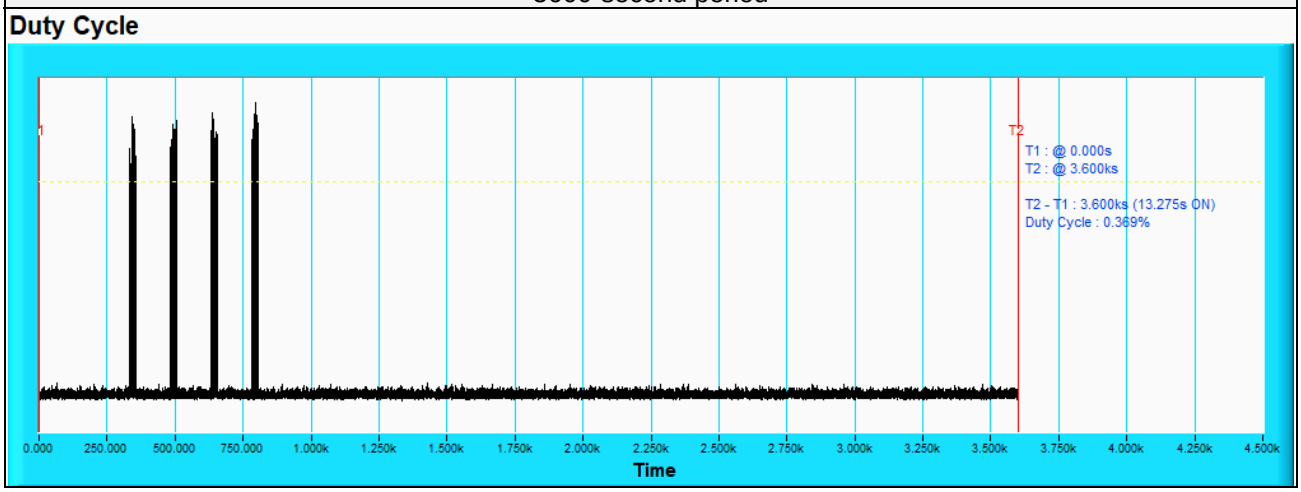
10-second period



300-second period



3600-second period



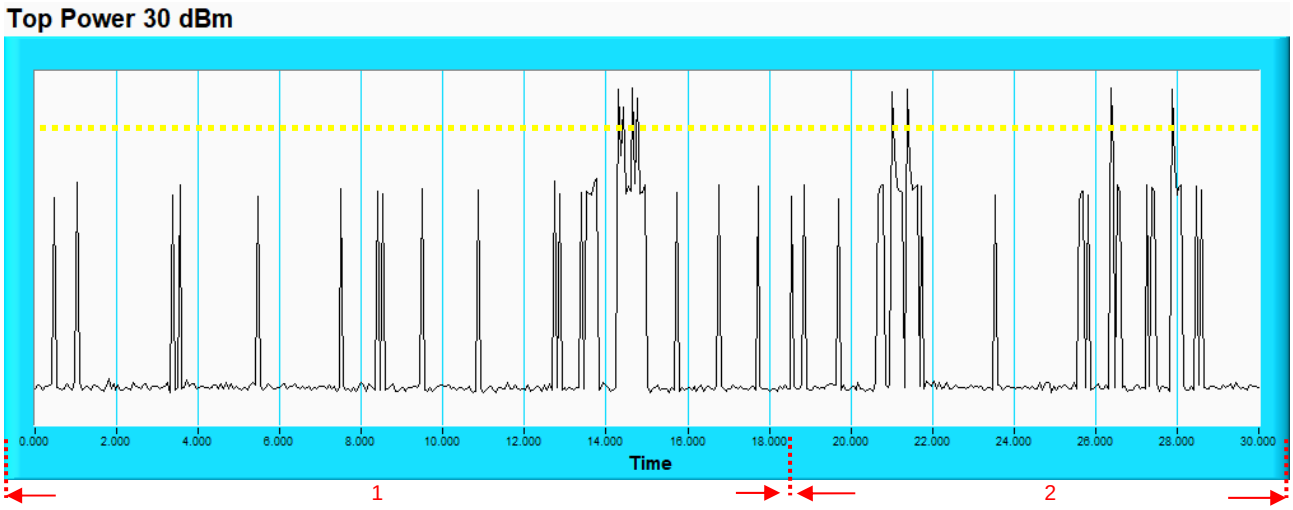
Note: Yellow color line in above plot represent the RF test equipment is logging the amount of time CPE-CBSD as UUT transmitted EIRP above 23 dBm/10MHz

4.8.9 Verify that the device will register with a SAS when operating below 23 dBm

Answer: Verified in test case WINNF.PT.C.HBT.1

Yes, the CPE-CBSD as UUT default EIRP is under 23 dBm and can register success with SAS.
After granted, the CPE-CBSD UUT will adjust the EIRP by maxEirp.

UUT will register with the SAS



Note :

1. Yellow color line in above plot represent the 23 dBm.
2. Marker 1 : The CPE-CBSD as UUT will register with SAS and adjust the EIRP by maxEirp < 23 dBm.
3. Marker 2 : After granted, the CPE-CBSD as UUT will adjust the EIRP by maxEirp > 23 dBm.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

6 WInnForum Logs

Please refer to the attached file (Test Logs).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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