WINNF-TS-0122 Test Report

Applicant	**Tarana Wireless**
Equipment	**Base Node (BN)**
Brand Name	**Tarana**
Model Name	**G1-BN3ASI001**
Marketing Name	**G1**
FCC ID	**2ABOF-G1-BN3ASI001**
Reference	**WINNF-TS-0122 Version V1.0.2**

The product was received on Apr. 30, 2021 and testing was started from May 03, 2021 and completed on May 04, 2021. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in WINNF-TS-0122 Version V1.0.2 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Neil Kao

Approved by: Neil Kao

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Appendix A. RF measurement plots

Appendix B. Setup Plot

Revision History

Report No.	Version	Description	Issued Date
FG210405002-01	01	Initial issue of report	Jul. 22, 2021

1. Administration Data

1.1 Testing Laboratory

Test Site	SPORTON INTERNATIONAL (USA) INC.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL: (408) 904-3300
Test Engineer	Janssen Wongso
Temperature	20 ~ 24 ℃
Relative Humidity	41 ~ 49 %

1.2 Applicant

Company Name	Tarana Wireless
Address	590 Alder Drive, Milpitas, CA 95035

1.3 Manufacturer

Company Name	Tarana Wireless
Address	590 Alder Drive, Milpitas, CA 95035

2. General Information

2.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Base Node (BN)
Brand Name	Tarana
Model Name	G1-BN3ASI001
FCC ID	2ABOF-G1-BN3ASI001
Professional Installation	☒ Yes ☐ No
Unit Under Test Category	☐ Category A ☒ Category B
Domain Proxy support	☒ UUT with Domain Proxy ☐ UUT without Domain Proxy
CBSD Antenna Gain	13 dBi
CBSD HW Version	30-0147-001.1.0
CBSD FW Version	SYS.A3.B10.XXX.0.950.22.00
CBSD SW Version	20210503-Id51844-devel
CBSD Serial Number	S147T1211600143 S147T1211700151
Domain Proxy HW Version	Not Applicable (DP runs in the cloud on any hardware)
Domain Proxy SW Version	20210503-Id95880-devel

2.2 Protocol Test Summary

Section	Test Case ID	Test Case Title	Test Result
6.1.4.1.6	WINNF.FT.D.REG.6	Domain Proxy Single-Step registration for CBSD with CPI signed data	PASS
6.1.4.2.2	WINNF.FT.D.REG.9	Domain Proxy Missing Required parameters (responseCode 102)	PASS
6.1.4.2.4	WINNF.FT.D.REG.11	Domain Proxy Pending registration (responseCode 200)	PASS
6.1.4.2.6	WINNF.FT.D.REG.13	Domain Proxy Invalid parameters (responseCode 103)	PASS
6.1.4.2.8	WINNF.FT.D.REG.15	Domain Proxy Blacklisted CBSD (responseCode 101)	PASS
6.1.4.2.10	WINNF.FT.D.REG.17	Domain Proxy Unsupported SAS protocol version responseCode 100)	PASS
6.1.4.2.12	WINNF.FT.D.REG.19	Domain Proxy Group Error (responseCode 201)	PASS
6.3.4.2.1	WINNF.FT.C.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
6.4.4.1.2	WINNF.FT.D.HBT.2	Domain Proxy Heartbeat Success Case (first Heartbeat Response)	PASS
6.4.4.2.1	WINNF.FT.C.HBT.3	Heartbeat responseCode=105 (DEREGISTER)	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)	PASS
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
6.5.4.2.3	WINNF.FT.C.MES.3	Grant Response contains measReportConfig	PASS
6.5.4.2.5	WINNF.FT.D.MES.5	Domain Proxy Heartbeat Response contains measReportConfig	PASS
6.6.4.1.2	WINNF.FT.D.RLQ.2	Domain Proxy Successful Relinquishment	PASS
6.7.4.1.2	WINNF.FT.D.DRG.2	Domain Proxy Successful Deregistration	PASS

Section	Test Case ID	Test Case Title	Test Result
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

2.3 Support Equipment

Name	Item Name	Manufacturer	Model Number	HW Version	SW Version	Serial Number
Residential Node	RN	Tarana	NA	NA	NA	S148T1211600145
Laptop	Dell Laptop	Dell	Latitude E5450	Windows	Windows	GL8CQF2
Switch	Switch	Netgear	GS108	NA	NA	3TX271788480F
WiFi Router	Access point	Netgear	Nighthawk AC1900	NA	NA	3LG4447KA7BD0
Power Supply for BN	Power Supply	MeanWell	HEP-480-54A	NA	NA	HB95B32412
Power Supply for BN	Power Supply	MeanWell	HEP-480-54A	NA	NA	HB90C64727
Power Supply for RN	Power Supply	ShenZhen Gospel Digital Technology CO.,LTD	G0566-500-120	NA	NA	2050
Laptop	Acer Laptop	Acer	Altos PS548	NA	NA	830000431033

2.4 Test Equipment List

Name	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101559	2020-06-17	2021-06-16

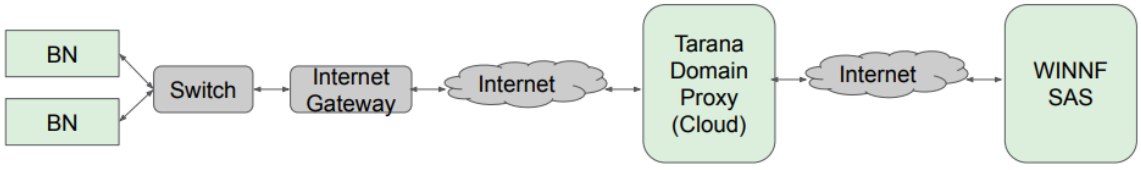
3. Measurement Environment

Measurement Environment Information	
SAS Test Harness version	1.0.0.3
Operating System	Windows 10
TLS version	V 1.2
Python version	V 2.7

Conditional Test Case		
Support (Yes / No)	**Condition**	**Definition**
No	**C1**	Mandatory for UUT which supports multi-step registration message
No	**C2**	Mandatory for UUT which supports single-step registration with no CPI-signed data in the registration message. By definition, this is a subset of Category A devices which determine all registration information, including location, without CPI intervention.
Yes	**C3**	Mandatory for UUT which supports single-step registration containing CPIsigned data in the registration message.
No	**C4**	Mandatory for UUT which supports RECEIVED_POWER_WITHOUT_GRANT measurement report type
Yes	**C5**	Mandatory for UUT which supports RECEIVED_POWER_WITH_GRANT measurement report type.
No	**C6**	Mandatory for UUT which supports parameter change being made at the UUT and prior to sending a deregistration.

3.1 Test configuration with Domain Proxy

Certification Setup diagram:



3.2 Standards

[n.1]. WINNF-TS-0122 Version 1.0.2, “Conformance and Performance Test Technical Specification; CBSD/DP as Unit Under Test (UUT)”, 25 November 2020

[n.2]. WINNF-TS-0016 Version 1.2.6, “SAS to CBSD Technical Specification”, 25 November 2020

4. Protocol Test Results

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

#	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 • All of the required and REG-Conditional parameters shall be configured and CPI signature provided	--
2	The DP with two CBSDs sends Registration requests in the form of one 2-element Array or as individual messages to the SAS Test Harness: • The required userId, fccId and cbsdSerialNumber and REG-Conditional cbsdCategory, airInterface, measCapability and cpiSignatureData registration parameters shall be sent from the CBSD and conform to proper format and acceptable ranges. • Any optional registration parameters that may be included in the message shall be verified that they conform to proper format and are within acceptable ranges.	PASS
3	• SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – *cbsdId* = Ci – *measReportConfig* for each CBSD shall not be included. – *responseCode* = 0 for each CBSD	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=0) to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	PASS

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

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode*=0) to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • • UUT shall not transmit RF	PASS

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

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
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 each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • • UUT shall not transmit RF	PASS

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

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode* R1 = 0 for CBSD1 and R2 = 103 for CBSD2) to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • • UUT shall not transmit RF	PASS

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

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode* R1 = 0 for CBSD1 and R2 = 101 for CBSD2) to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	PASS

4.6 [WINNF.FT.D.REG.17] Domain Proxy Unsupported SAS protocol version (responseCode 100)

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode (Ri) = 100 for each CBSD)* to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	PASS

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

#	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	The DP with two CBSDs sends a Registration request in the form of one 2-element Array or as individual messages to SAS Test Harness.	--
3	SAS Test Harness sends a CBSD Registration Response in the form of one 2-element Array or as individual messages as follows: – SAS response does not include a *cbsdId*. – *responseCode* = Ri for CBSD1 and CBSD2	--
4	After completion of step 3, SAS Test Harness will not provide any positive response (*responseCode* R1 = 0 for CBSD1 and R2 = 201 for CBSD2) to further request messages from the UUT.	--
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall not transmit RF	PASS

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

#	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

4.9 [WINNF.FT.C.GRA.2] Unsuccessful Grant responseCode=401 (GRANT_CONFLICT)

#	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

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: • DP has two CBSD registered successfully with SAS Test Harness, with *cbsdId* = Ci, i={1,2}	--
2	DP sends a message: • If message is a Spectrum Inquiry Request, go to step 3 • If message is a Grant Request, go to step 5	--
3	DP sends a Spectrum Inquiry Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Spectrum Inquiry Request message is formatted correctly for each CBSD, including for CBSDi, i={1,2}: • *cbsdId* = Ci • List of frequencyRange objects sent by DP are within the CBRS frequency range	PASS
4	If a separate Spectrum Inquiry Request message was sent for each CBSD, the SAS Test Harness shall respond to each Spectrum Inquiry Request message with a separate Spectrum Inquiry Response message. If a single Spectrum Inquiry Request message was sent containing a 2- object array (one per CBSD), the SAS Test Harness shall respond with a single Spectrum Inquiry Response message containing a 2-object array. Verify parameters for each CBSD within the Spectrum Inquiry Response message are as follows, for CBSDi, i={1,2}: • *cbsdId* = Ci • availableChannel is an array of availableChannel objects • *responseCode* = 0	--

#	Test Execution Steps	Results
5	DP sends a Grant Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Grant Request message is formatted correctly for each CBSD, including for CBSDi, i={1,2}: • *cbsdId* = C • maxEIRP is at or below the limit appropriate for CBSD category as defined by Part 96 • operationFrequencyRange, Fi, sent by UUT is a valid range within the CBRS band	PASS
6	If a separate Grant Request message was sent for each CBSD, the SAS Test Harness shall respond to each Grant Request message with a separate Grant Response message. If a single Grant Request message was sent containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Grant Response message containing a 2-object array. Verify parameters for each CBSD within the Grant Response message are as follows, for CBSDi, i={1,2}: • *cbsdId* = Ci • *grantId* = Gi = a valid grant ID • *grantExpireTime* = UTC time greater than duration of the test • *responseCode* = 0	--
7	Ensure DP sends first Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Heartbeat Request message is formatted correctly for each CBSD, including, for CBSDi i={1,2}: • *cbsdId* = Ci, i={1,2} • *grantId* = Gi, i={1,2} • *operationState* = “GRANTED”	PASS

#	Test Execution Steps	Results
8	If a separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Verify parameters for each CBSD within the Heartbeat Response message are as follows, for CBSDi: • *cbsdId* = Ci • *grantId* = Gi • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0	--
9	For further Heartbeat Request messages sent from DP after completion of step 8, validate message is sent within latest specified heartbeatInterval for CBSDi: • *cbsdId* = Ci • *grantId* = Gi • *operationState* = “AUTHORIZED” and SAS Test Harness responds with a Heartbeat Response message including the following parameters, for CBSDi • *cbsdId* = Ci • *grantId* = Gi • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0	PASS
10	Monitor the RF output of the UUT from start of test until UUT transmission commences. Monitor the RF output of the UUT from start of test until RF transmission commences. Verify: • 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 Fi.	PASS

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

#	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"	PASS
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

4.12 [WINNF.FT.C.HBT.5] Heartbeat responseCode=501 (SUSPENDED_GRANT) in First Heartbeat Response

#	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
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

4.13 [WINNF.FT.C.HBT.6] Heartbeat responseCode=501 (SUSPENDED_GRANT) in Subsequent Heartbeat Response

#	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
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.	--

#	Test Execution Steps	Results
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

4.14 [WINNF.FT.C.HBT.7] Heartbeat responseCode=502 (UNSYNC_OP_PARAM)

#	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
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: ○ *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

4.15 [WINNF.FT.D.HBT.8] Domain Proxy Heartbeat responseCode=500 (TERMINATED_GRANT)

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: • DP has two CBSD registered successfully with SAS Test Harness • Each CBSD {1,2} has a valid single grant as follows: o valid *cbsdId* = Ci, i={1,2} o valid *grantId* = Gi, i={1,2} o grant is for frequency range Fi, power Pi o *grantExpireTime* = UTC time greater than duration of the test • Both CBSD are in AUTHORIZED state and transmitting within their granted bandwidth on RF interface	--
2	DP sends a Heartbeat Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of size 2. Verify Heartbeat Request message is sent within latest specified *heartbeatInterval*, and is formatted correctly for each CBSD, including, for CBSDi i={1,2}: • *cbsdId* = Ci, i = {1,2} • *grantId* = Gi, i = {1,2} • *operationState* = "AUTHORIZED"	PASS
3	If separate Heartbeat Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each Heartbeat Request message with a separate Heartbeat Response message. If a single Heartbeat Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Heartbeat Response message containing a 2-object array. Parameters for each CBSD within the Heartbeat Response message should be as follows, for CBSDi: • *cbsdId* = Ci • *grantId* = Gi • For CBSD1: o *transmitExpireTime* = current UTC time + 200 seconds o *responseCode* = 0 • For CBSD2: o *transmitExpireTime* = T = current UTC time o *responseCode* = 500 (TERMINATED_GRANT)	--

#	Test Execution Steps	Results
4	After completion of step 3, SAS Test Harness shall not allow any further grants to the UUT. If CBSD sends further Heartbeat Request messages for CBSD1, SAS Test Harness shall respond with a Heartbeat Response message with parameters: • *cbsdId* = C1 • *grantId* = G1 • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0 • Heartbeat Request message is within *heartbeatInterval* of previous Heartbeat Request message	--
5	Monitor the RF output of CBSD2. Verify: • CBSD2 shall stop transmission within bandwidth F2 within (T + 60 seconds) of completion of step 3	PASS

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

#	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
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

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

#	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 issent within the latest specified *heartbeatInterval*, and is formatted correctly, including: • *cbsdId* = C • *grantId* = G • *operationState* = “AUTHORIZED”	PASS
3	SAS Test Harness sends a Heartbeat Response message, with the following parameters: • *cbsdId* = C • *grantId* = G • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0	--
4	After completion of Step 3, SAS Test Harness does not respond to any further messages from UUT	--
5	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

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

#	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 and *measCapability* = "RECEIVED_POWER_WITH_GRANT"	--
2	UUT sends a Grant Request message. Verify Grant Request message contains all required parameters properly formatted, and specifically: • *cbsdId* = C • *operationParam* is present and format is valid	PASS
3	SAS Test Harness sends a Grant Response message, with the following parameters: • *cbsdId* = C • *grantId* = G = valid grant ID • *grantExpireTime* = UTC time in the future • *heartbeatInterval* = 60 seconds • *measReportConfig*= "RECEIVED_POWER_WITH_GRANT" • *operationParam* is set to valid operating parameters • *channelType* = "GAA" • *responseCode* = 0	--
4	UUT sends a Heartbeat Request message. Verify message contains all required parameters properly formatted, and specifically: • *cbsdId* = C • *grantId* = G • *operationState* = "GRANTED"	PASS

#	Test Execution Steps	Results
5	If Heartbeat Request message (step 4) contains *measReport* object, then: • verify *measReport* is properly formatted as object *rcvdPowerMeasReport* • end test, with PASS result else, if Heartbeat Request message (step 4) does not contain measReport object, then: If number of Heartbeat Requests sent by UUT after Step 3 is = 5, then stop test with result of FAIL	PASS
6	SAS Test Harness sends a Heartbeat Response message, containing all required parameters properly formatted, and specifically: • *cbsdId* = C • *grantId* = *G* • *transmitExpireTime* = current UTC time + 200 seconds • *responseCode* = 0 Go to Step 4, above	--

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

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

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

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

#	Test Execution Steps	Results
1	Ensure the following conditions are met for test entry: • DP has successfully completed SAS Discovery and Authentication with SAS Test Harness • DP has successfully registered 2 CBSD with SAS Test Harness, each with *cbsdId*=Ci, i={1,2} • DP has received a valid grant with *grantId* = Gi, i={1,2} for each CBSD • Both CBSD are in Grant State AUTHORIZED and actively transmitting within the bounds of their grants. Invoke trigger to relinquish each UUT Grant from the SAS Test Harness	--
2	Verify DP sends a Relinquishment Request message for each CBSD. This may occur in a separate message per CBSD, or together in a single message with array of 2. Verify Relinquishment Request message contains all required parameters properly formatted for each CBSD, specifically, for CBSDi: • *cbsdId* = Ci • *grantId* = Gi	PASS
3	If a separate Relinquishment Request message was sent for each CBSD by the DP, the SAS Test Harness shall respond to each request message with a separate response message. If a single Relinquishment Request message was sent by the DP containing a 2-object array (one per CBSD), the SAS Test Harness shall respond with a single Response message containing a 2-object array. Parameters for each CBSD within the Relinquishment Response shall be as follows: • *cbsdId* = Ci • *grantId* = Gi • *responseCode* = 0	--
4	After completion of step 3, SAS Test Harness will not provide any additional positive response (*responseCode*=0) to further request messages from the UUT.	--

#	Test Execution Steps	Results
5	Monitor the RF output of each UUT from start of test until 60 seconds after Step 3 is complete. This is the end of the test. Verify: • UUT shall stop RF transmission at any time between triggering the relinquishments and UUT sending the relinquishment requests for each CBSD.	PASS

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

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

#	Test Execution Steps	Results
6	Monitor the RF output of each 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

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

#	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

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_SHA2 56
	  • TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA3 84
	  • TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
		PASS

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
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

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

#	Test Execution Steps	Results
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS
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
3	UUT may retry for the security procedure which shall fail	PASS
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

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

#	Test Execution Steps	Results
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS
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
3	UUT may retry for the security procedure which shall fail.	PASS
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

4.25 [WINNF.FT.C.SCS.4] TLS failure when SAS Test Harness certificate is issued by an unknown CA

#	Test Execution Steps	Results
1	• UUT shall start CBSD-SAS communication with the security procedures	PASS
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
3	UUT may retry for the security procedure which shall fail.	PASS
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

4.26 [WINNF.FT.C.SCS.5] TLS failure when certificate at the SAS Test Harness is corrupted

#	Test Execution Steps	Results
1	• UUT shall start CBSD-SAS communication withthe security procedures	PASS
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
3	UUT may retry for the security procedure which shall fail.	PASS
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

4.27 [WINNF.PT.C.HBT] UUT RF Transmit Power Measurement

#	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 = F_L, highFrequency = F_H, maxEirp = P_i}, 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:
	  ○ *cbsdId* = C
	  ○ *grantId* = G
	  ○ *transmitExpireTime* = current UTC time + 200 seconds
	  ○ *responseCode* = 0
		--

#	Test Execution Steps	Results
3	Tester performs power measurement on RF interface(s) of UUT, and verifies it complies with the maxEirp setting, P_i. The RF measurement method is out of scope of this document, but may include additional configuration of the UUT, as required, to fulfil the requirements of the power measurement method. *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

Note: For test 4.27, pleaes find the Appendix B for RF measurement plots.

Appendix A. RF measurement plots

Appendix A.1 [WINNF.PT.C.HBT] UUT RF Transmit Power Measurement

Report Clause 4.27 [WINNF.PT.C.HBT] UUT RF Transmit Power Measurement

Center Frequency [MHz]	Bandwidth [MHz]	Granted maxEIRP [dBm/MHz]	Conducted PSD [dBm/MHz]		Antenna Gain [dBi]	UUT total MaxEIRP [dBm/MHz]
			TX 0	TX 1		
3590	80	37	18.56	20.42	13	35.60
3605		30	11.63	14.54		29.34
3625		26	6.94	9.35		24.32
3645		34	17.31	18.18		33.78
3660		23	6.31	7.4		22.90

Note: The total offset 56.2 dB includes the antenna gain 13 dBi and cable path loss 43.2 dB.

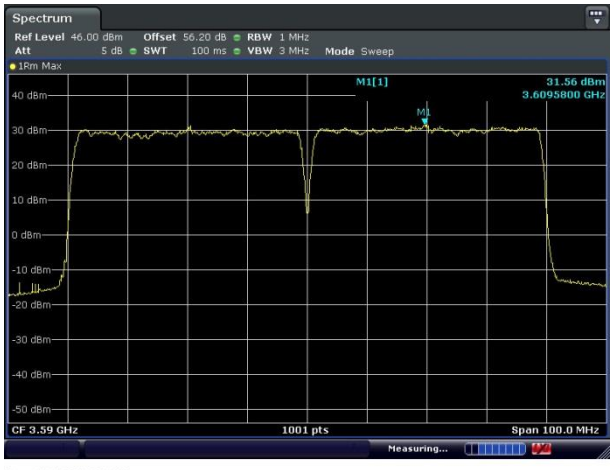
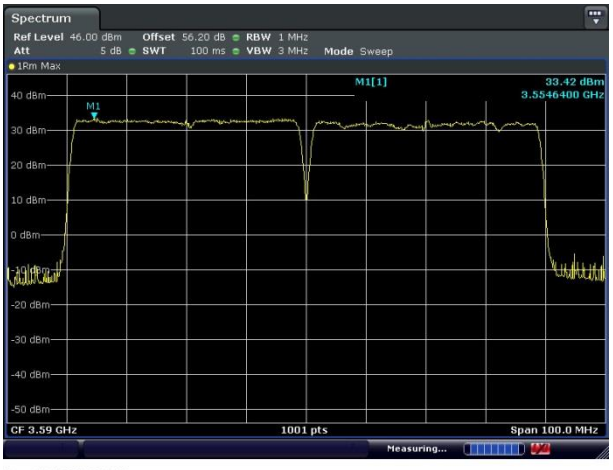
Appendix A.1.1 Test Procedure

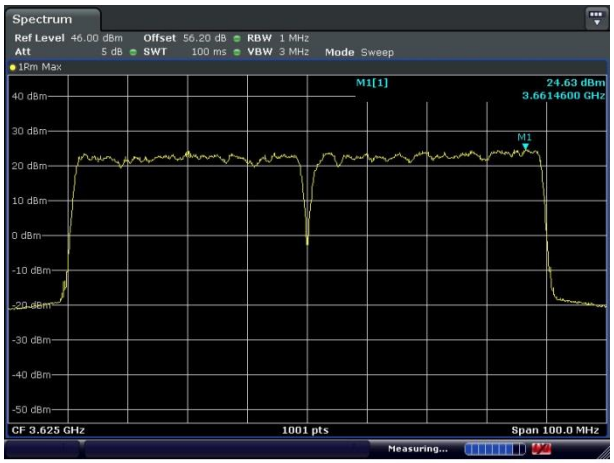
[WINNF.PT.C.HBT] UUT RF Transmit Power Measurement defined in clause 4.27 of this test report.

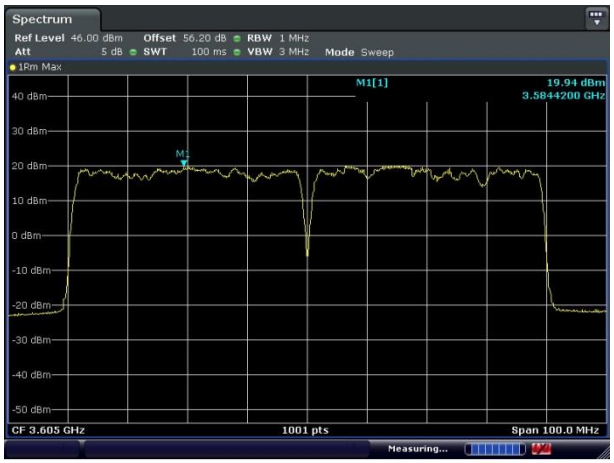
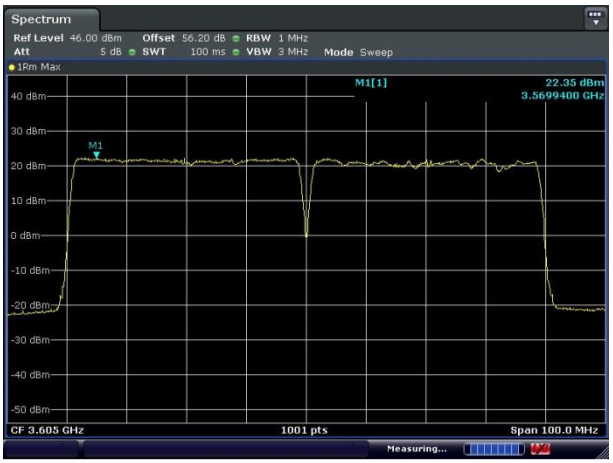
Appendix A.1.2 Test Result

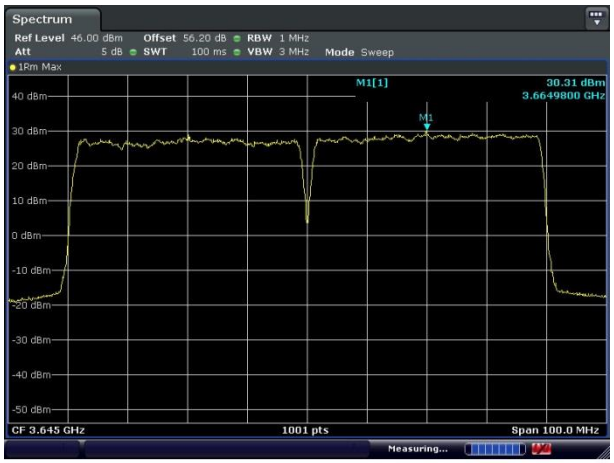
SAS Granted MaxEIRP 37 [dBm/MHz]

UUT total MaxEIRP 35.60 [dBm/MHz]

TX 0	TX 1
	

SAS Granted MaxEIRP 30 [dBm/MHz] UUT total MaxEIRP 29.34 [dBm/MHz]	
TX 0	**TX 1**
	

SAS Granted MaxEIRP 26 [dBm/MHz] UUT total MaxEIRP 24.32 [dBm/MHz]	
TX 0	**TX 1**
	

SAS Granted MaxEIRP 34 [dBm/MHz] UUT total MaxEIRP 33.78 [dBm/MHz]	
TX 0	**TX 1**
	

SAS Granted MaxEIRP 23 [dBm/MHz] UUT total MaxEIRP 22.90 [dBm/MHz]	
TX 0	**TX 1**