FCC Test Report

Report No.: AGC02762230702FE05

FCC ID	:	2AVM4-NTRIP-X
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	GNSS RTK Base Station
BRAND NAME	:	GNS-Electronics
MODEL NAME	:	NTRIP-X
APPLICANT	:	GNS-Electronics GmbH
DATE OF ISSUE	:	Jul. 13, 2023
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul. 13, 2023	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	GNS-Electronics GmbH
Address	Adenauerstr. 18, 52146 Wuerselen, Germany
manufacturer	GNS-Electronics GmbH
Address	Adenauerstr. 18, 52146 Wuerselen, Germany
Factory	GNS-Electronics GmbH
Address	Adenauerstr. 18, 52146 Wuerselen, Germany
Product Designation	GNSS RTK Base Station
Brand Name	GNS-Electronics
Test Model	NTRIP-X
Date of receipt of test item	Jul. 04, 2023
Date of test	Jul. 04, 2023 to Jul. 13, 2023
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BGN/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Prepared By	Bibo Zhang (Project Engineer)	Jul. 13, 2023
Reviewed By	Calvin Liu (Reviewer)	Jul. 13, 2023
Approved By	Max Zhang (Authorized Officer)	Jul. 13, 2023

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “GNSS RTK Base Station”. It is designed by way of utilizing the DSSS and OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

Equipment Type	WLAN 2.4G
Frequency Band	2400MHz ~ 2483.5MHz
Operation Frequency	2412MHz ~ 2462MHz
Output Power (Average)	IEEE 802.11b:13.62dBm; IEEE 802.11g:13.24dBm; IEEE 802.11n(HT20):13.30dBm; IEEE 802.11n(HT40):12.44dBm
Output Power (Peak)	IEEE 802.11b:16.03dBm; IEEE 802.11g:20.63dBm; IEEE 802.11n(HT20):20.87dBm; IEEE 802.11n(HT40):19.85dBm
Modulation	802.11b:DQPSK, DBPSK, CCK 802.11g/n: 64-QAM, 16-QAM, QPSK, BPSK
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps
Number of channels	11
Hardware Version	3.0
Software Version	0.8.2
Antenna Designation	Rod Antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	1.23dBi
Power Supply	DC 5V

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2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11. For 40MHZ bandwidth system use Channel 3 to Channel 9

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2.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps) 800nsGI	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

2.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AVM4-NTRIP-X** filing to comply with the FCC Part 15 requirements.

2.5. TEST METHODOLOGY

KDB 558074 D01 15.247 Meas Guidance v05: Guidance for compliance measurements on Digital transmissio n system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules
ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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2.8. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	U_c = ±3.1 dB
Uncertainty of Radiated Emission below 1GHz	U_c = ±4.0 dB
Uncertainty of Radiated Emission above 1GHz	U_c = ±4.8 dB
Uncertainty of total RF power, conducted	U_c = ±0.8 dB
Uncertainty of RF power density, conducted	U_c = ±2.6 dB
Uncertainty of spurious emissions, conducted	U_c = ±2.7 %
Uncertainty of Occupied Channel Bandwidth	U_c = ±2 %

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4. DESCRIPTION OF TEST MODES

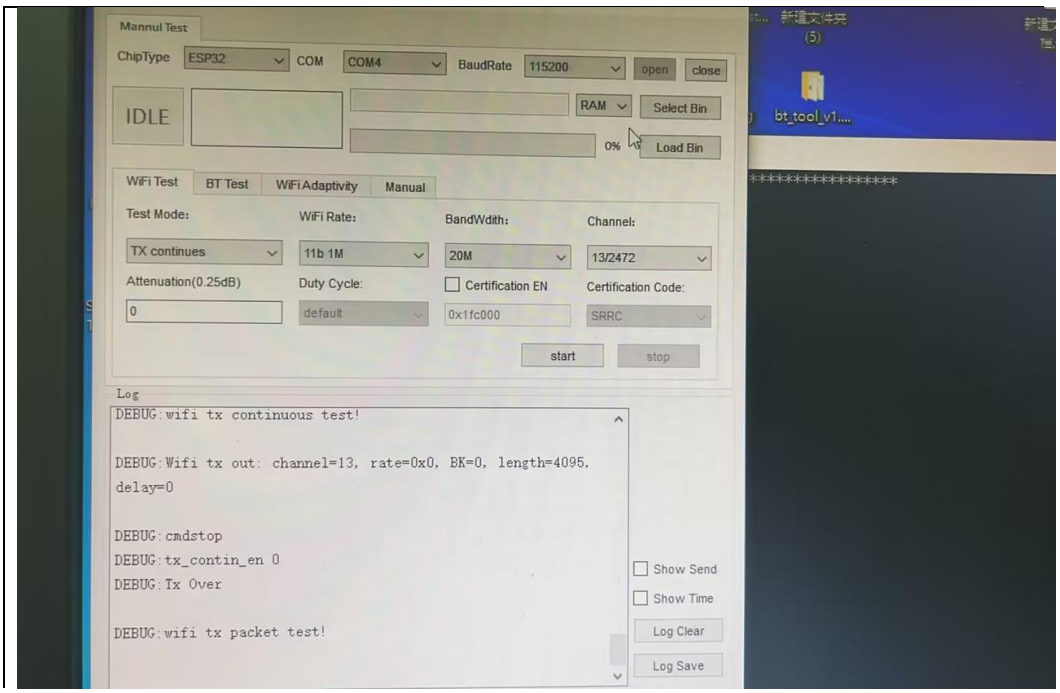
NO.	TEST MODE DESCRIPTION
1	Low channel transmitting (TX)
2	Middle channel transmitting (TX)
3	High channel transmitting (TX)

Note:
Transmit by 802.11b with Date rate (1/2/5.5/11)
Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)
Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)
Transmit by 802.11n (40MHz) with Date rate (13.5/27/40.5/54/81/108/121.5/135)
The test channel for 20MHZ bandwidth system is channel 1, 6 and 11.
The test channel for 40MHZ bandwidth system is channel 3, 6 and 9.

Note:

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the EUT is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.

Test software



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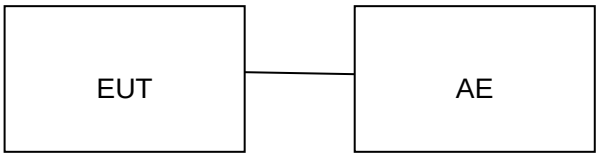
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	GNSS RTK Base Station	NTRIP-X	2AVM4-NTRIP-X	EUT
2	Huawei adapter	HW-200325CP0	N/A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247(b)(3)	Output Power	Compliant
§15.247(a)(2)	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247(e)	Maximum Conducted Output Power Spectral Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247(d)	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Aug. 04, 2022	Aug. 03, 2023
LISN	R&S	ESH2-Z5	100086	Jun. 03, 2023	Jun. 02, 2024
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Feb. 18, 2023	Feb. 17, 2024
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Aug. 04, 2022	Aug. 03, 2023
USB Wideband Power Sensor	Aglient	U2021XA	MY541100B	Feb. 18, 2023	Feb. 17, 2024
2.4GHz Fliter	EM Electronics	N/A	N/A	Mar. 18, 2022	Mar. 19, 2024
Attenuator	ZHINAN	E-002	N/A	Aug. 04, 2022	Aug. 03, 2024
Horn antenna	SCHWARZBEC	BBHA9170	768	Oct. 31, 2021	Oct. 30, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2024
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2023	Apr. 22, 2024
Double-Ridged Waveguide Horn	ETS	3117	00154520	Sep. 06, 2021	Sep. 05, 2023
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 01, 2022	Sep. 02, 2024
ANTENNA	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 05, 2023	Jan. 04, 2025
Test software	FARA	EZ-EMC (Ver RA-03A)	N/A	N/A	N/A

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7. OUTPUT POWER

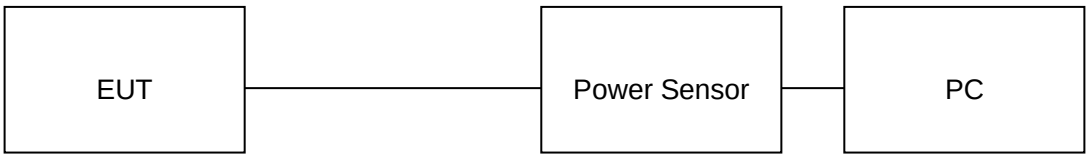
7.1. MEASUREMENT PROCEDURE

For average power test:

1. Connect EUT RF output port to power sensor through an RF attenuator.
2. Connect the power sensor to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

Note：The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11b	2412	13.62	16.03	≤30	Pass
	2437	13.52	15.89	≤30	Pass
	2462	12.92	15.35	≤30	Pass
802.11g	2412	13.24	20.56	≤30	Pass
	2437	13.18	20.63	≤30	Pass
	2462	12.76	20.14	≤30	Pass
802.11n20	2412	12.81	20.27	≤30	Pass
	2437	13.30	20.87	≤30	Pass
	2462	12.42	19.87	≤30	Pass
802.11n40	2422	12.44	19.85	≤30	Pass
	2437	12.15	19.67	≤30	Pass
	2452	11.85	19.36	≤30	Pass

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8. BANDWIDTH

8.1. MEASUREMENT PROCEDURE

6dB bandwidth:

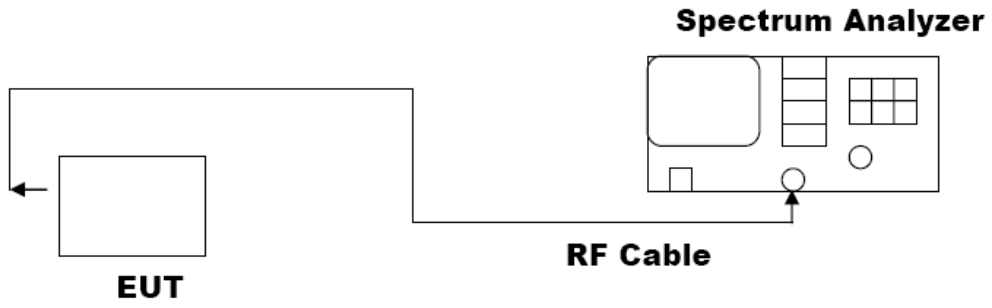
1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Occupied bandwidth:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
   The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and DTS Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
802.11b	2412	12.817	8.091	≥0.5	Pass
	2437	13.210	8.106	≥0.5	Pass
	2462	12.621	8.066	≥0.5	Pass
802.11g	2412	16.443	15.112	≥0.5	Pass
	2437	16.622	15.326	≥0.5	Pass
	2462	16.360	15.087	≥0.5	Pass
802.11n20	2412	17.489	15.113	≥0.5	Pass
	2437	17.641	16.503	≥0.5	Pass
	2462	17.414	15.086	≥0.5	Pass
802.11n40	2422	35.660	31.275	≥0.5	Pass
	2437	36.252	35.359	≥0.5	Pass
	2452	35.786	33.767	≥0.5	Pass

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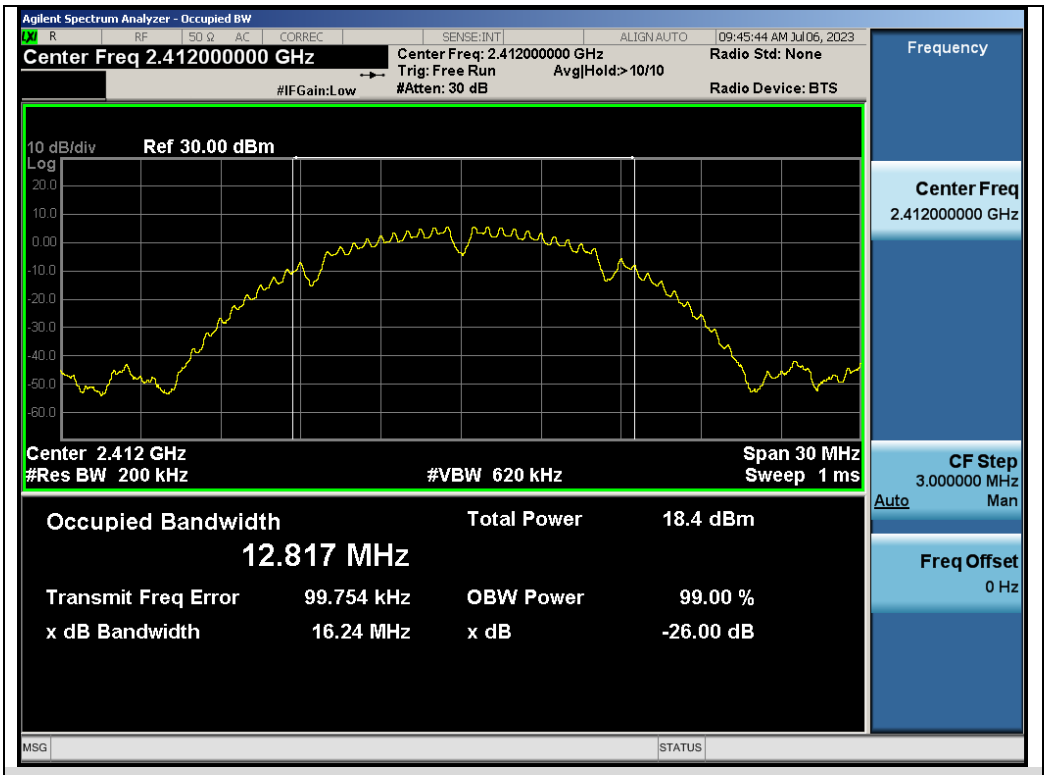
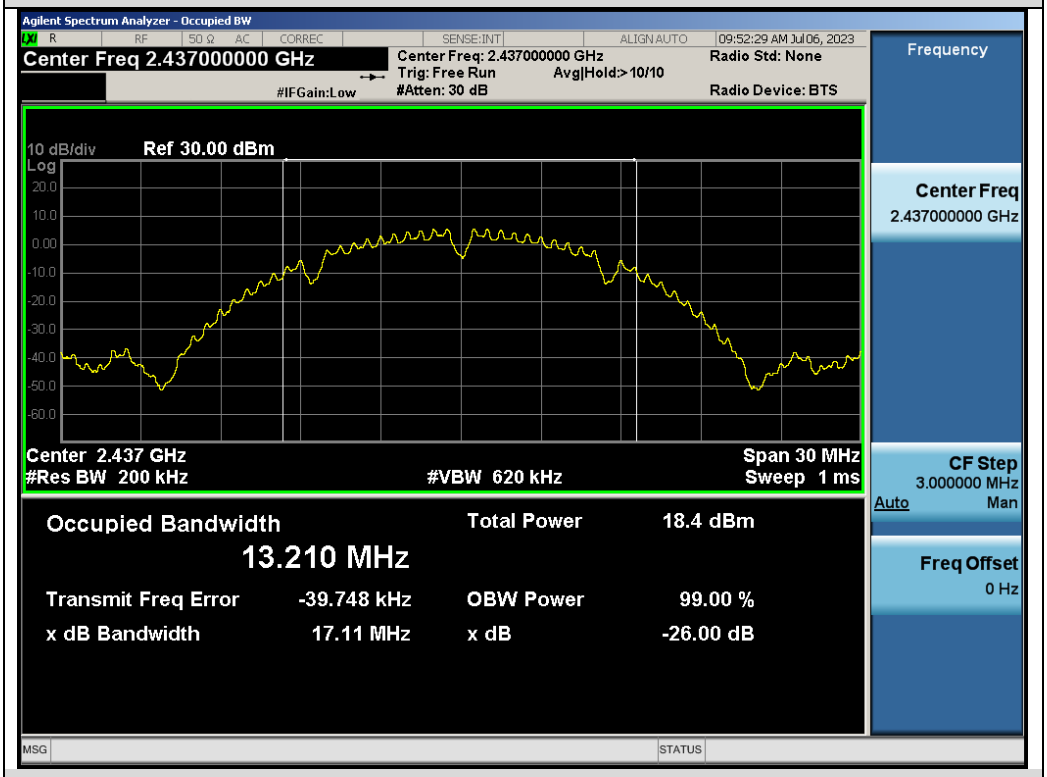
Test Graphs of Occupied Bandwidth



Test_Graph_802.11b_ANT1_2412_1Mbps_OBW



Test_Graph_802.11b_ANT1_2437_1Mbps_OBW

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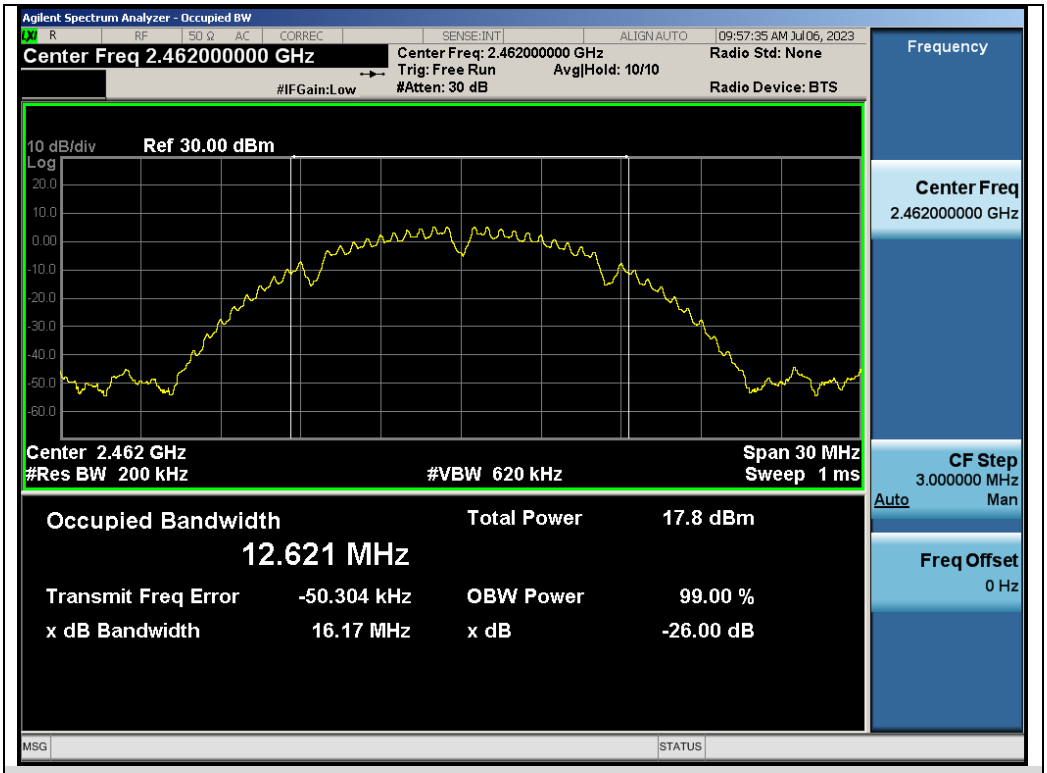
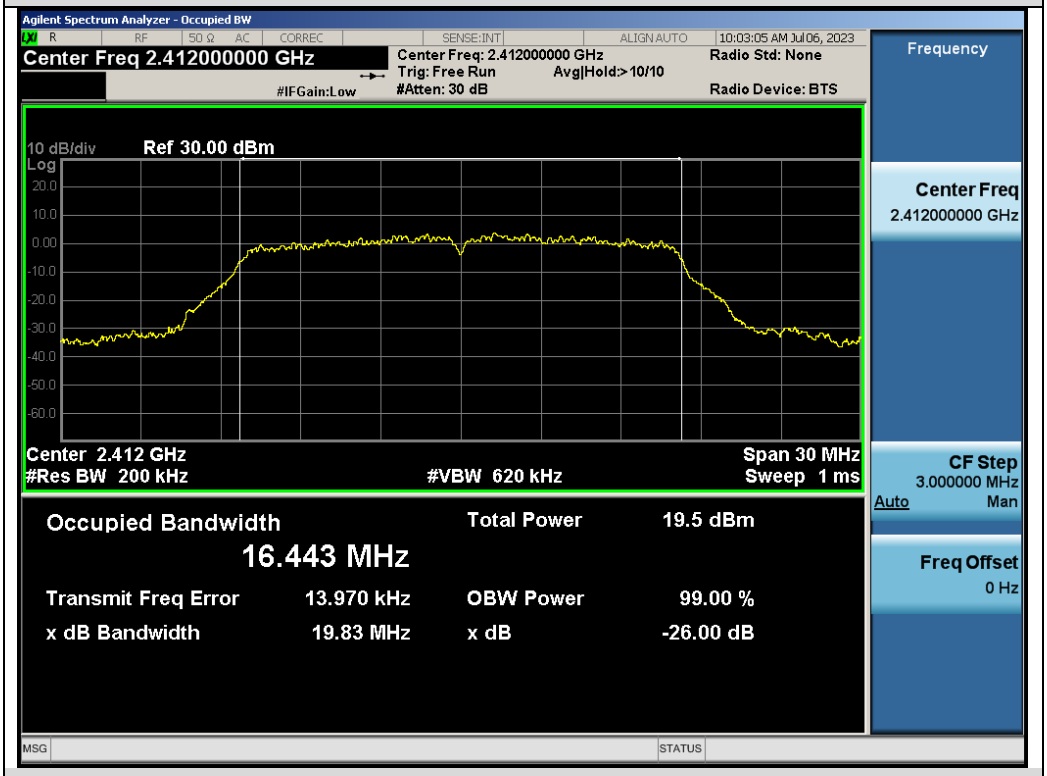


Test_Graph_802.11b_ANT1_2462_1Mbps_OBW



Test_Graph_802.11g_ANT1_2412_6Mbps_OBW

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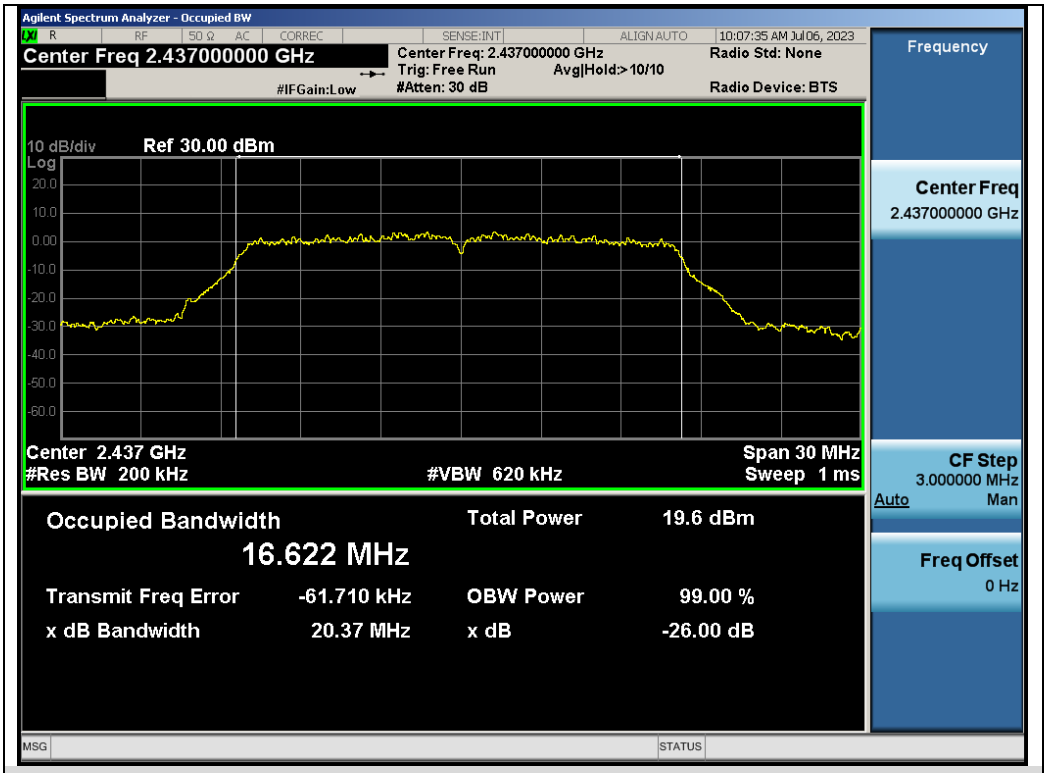
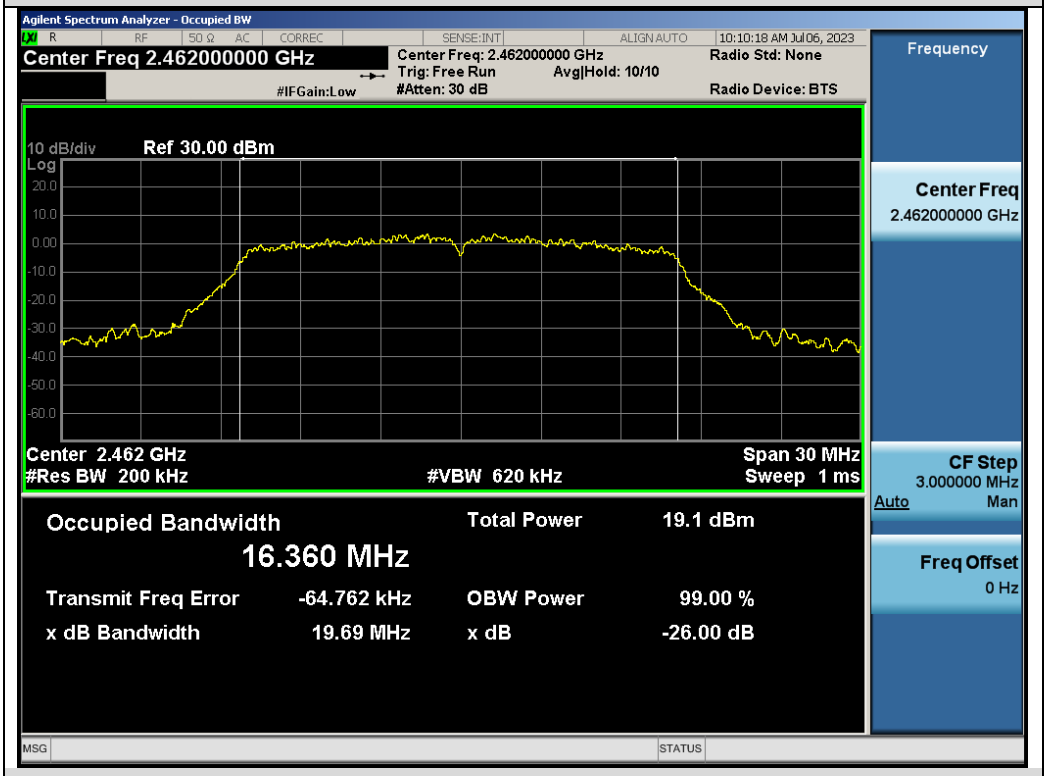


Test_Graph_802.11g_ANT1_2437_6Mbps_OBW



Test_Graph_802.11g_ANT1_2462_6Mbps_OBW

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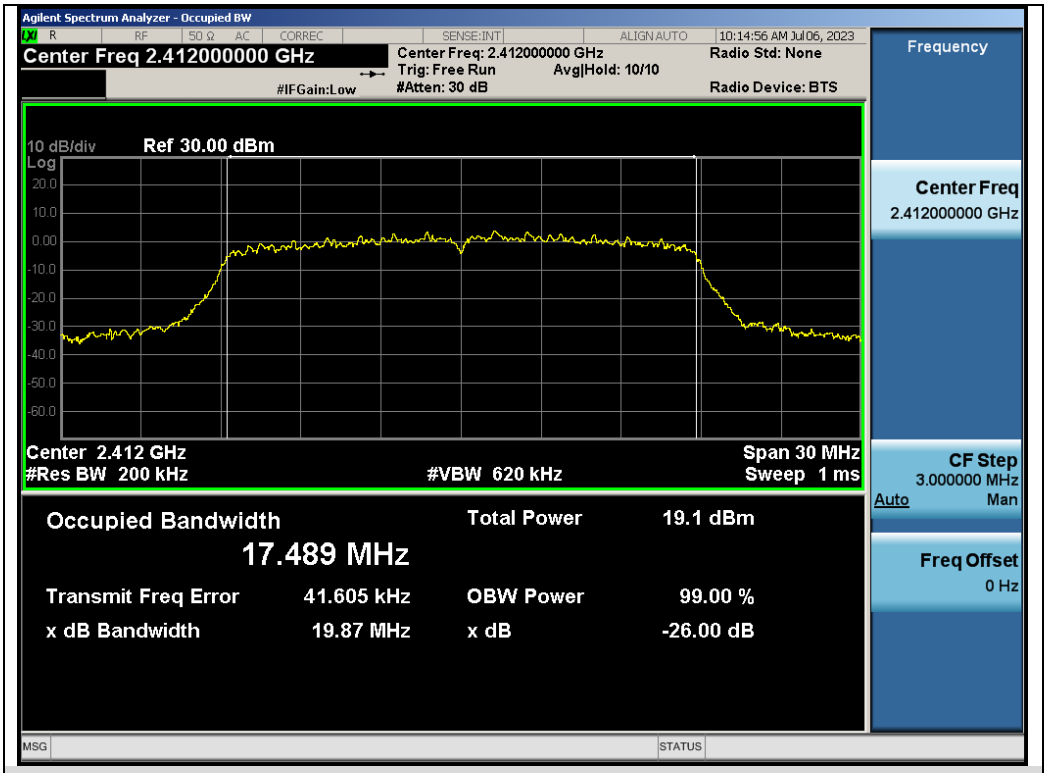
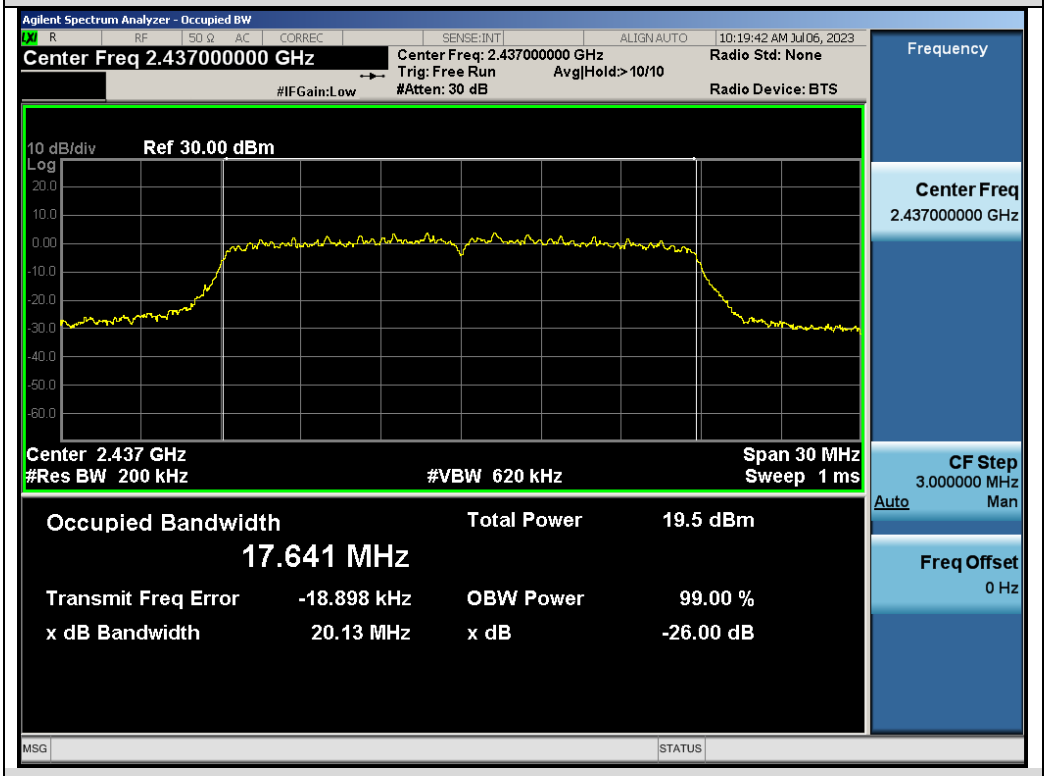


Test_Graph_802.11n20_ANT1_2412_MCS0_OBW



Test_Graph_802.11n20_ANT1_2437_MCS0_OBW

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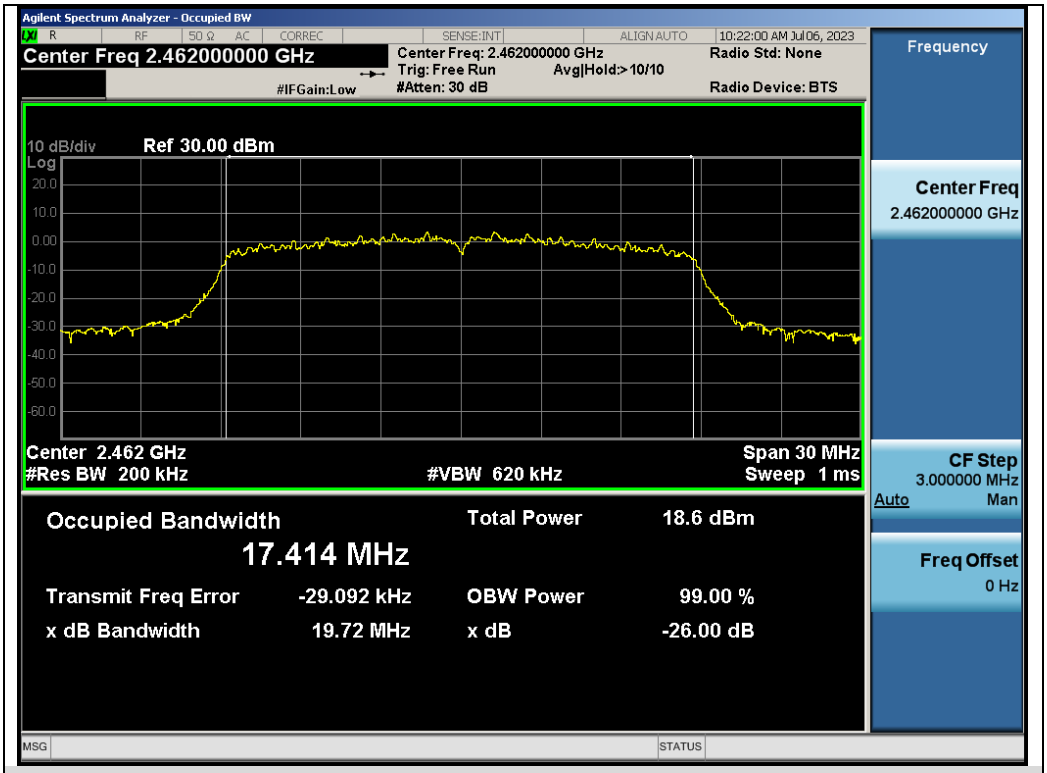
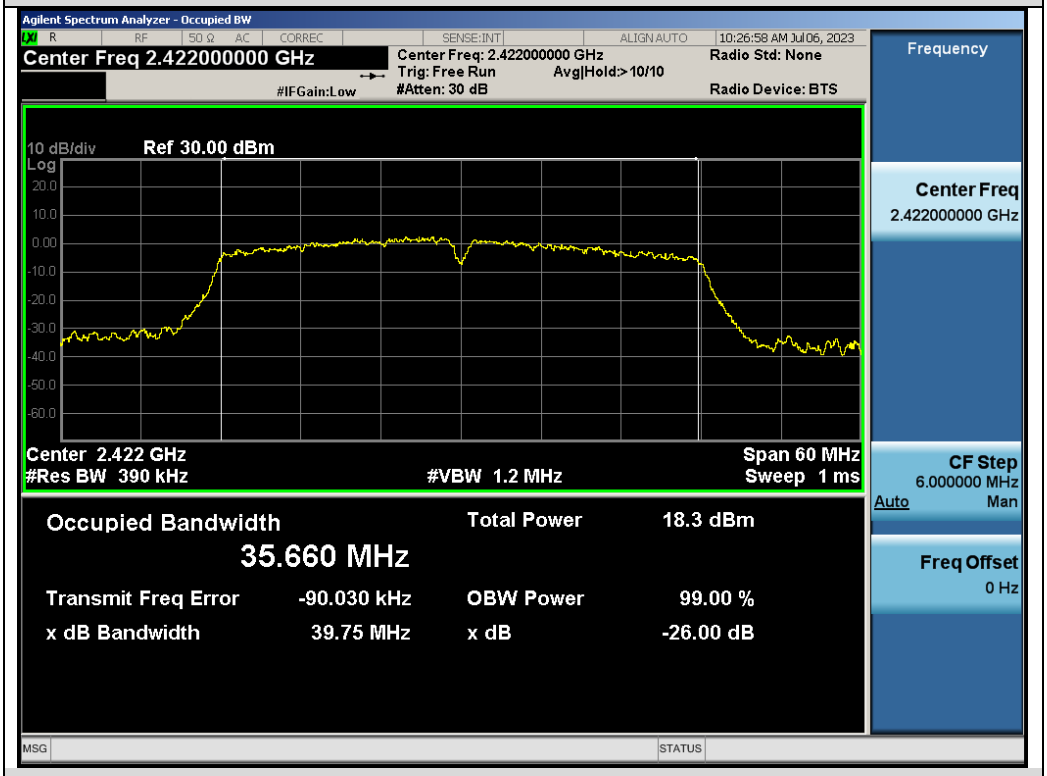


Test_Graph_802.11n20_ANT1_2462_MCS0_OBW



Test_Graph_802.11n40_ANT1_2422_MCS0_OBW

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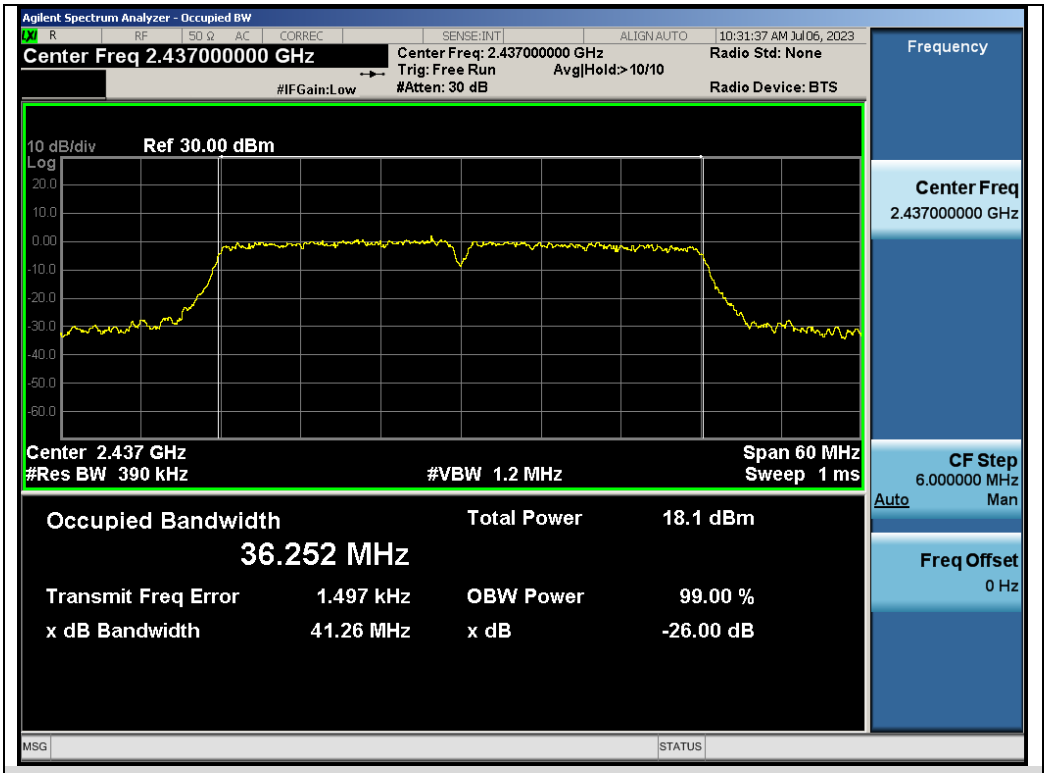
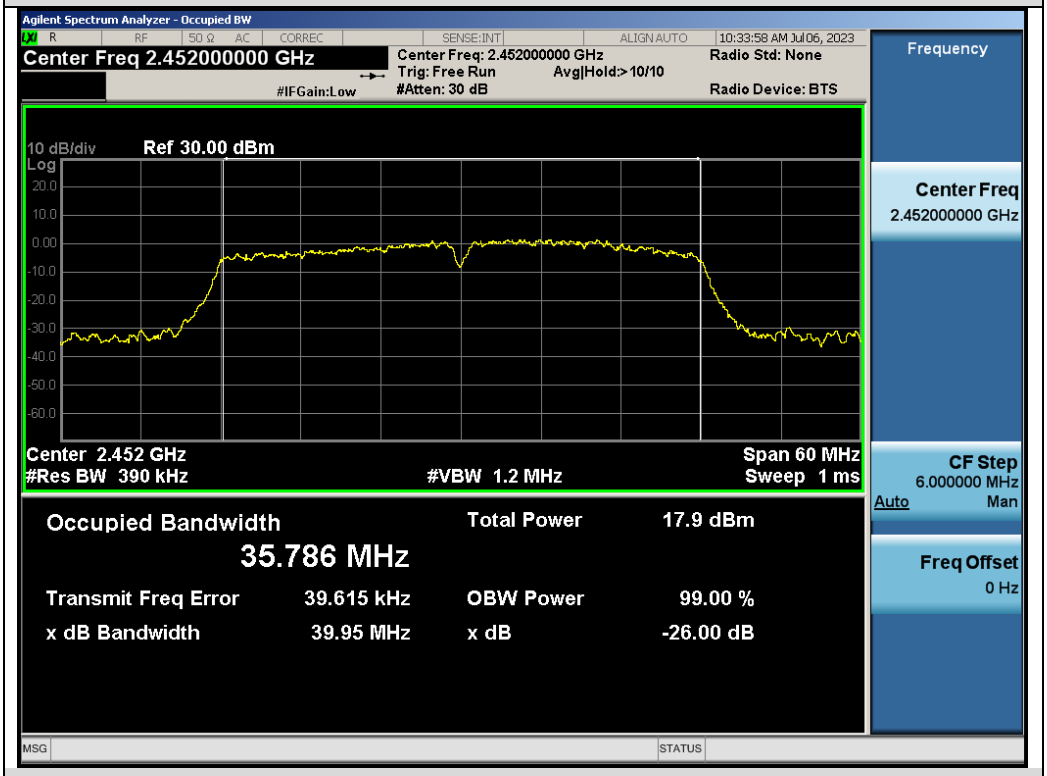


Test_Graph_802.11n40_ANT1_2437_MCS0_OBW



Test_Graph_802.11n40_ANT1_2452_MCS0_OBW

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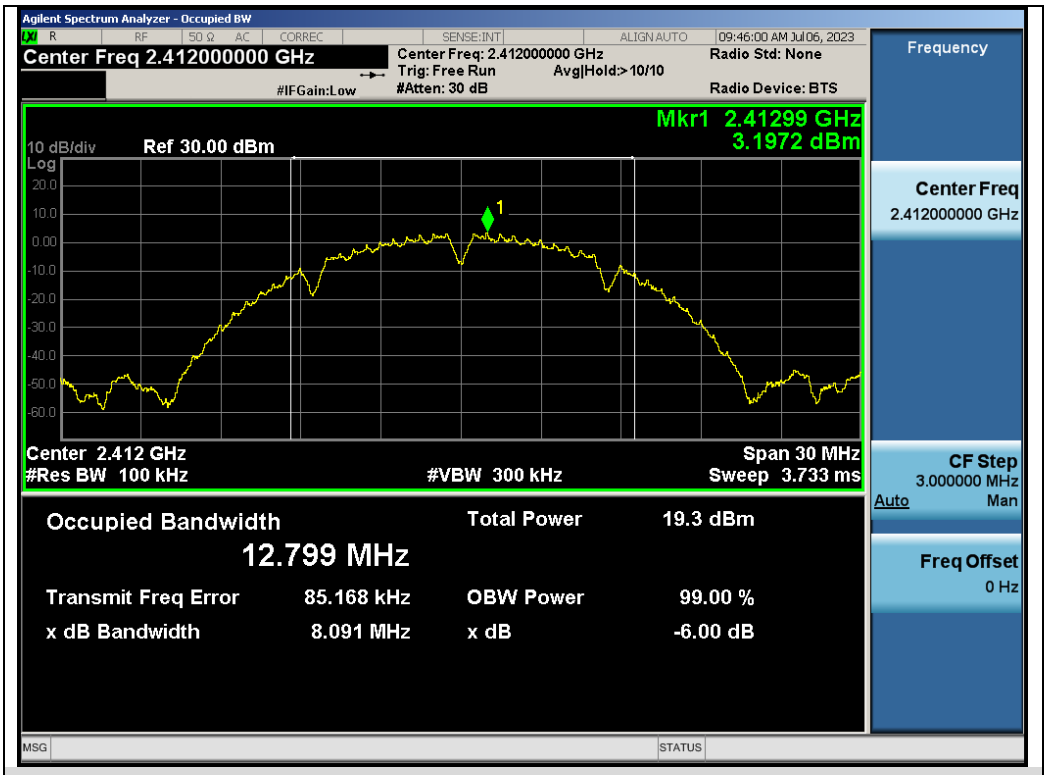
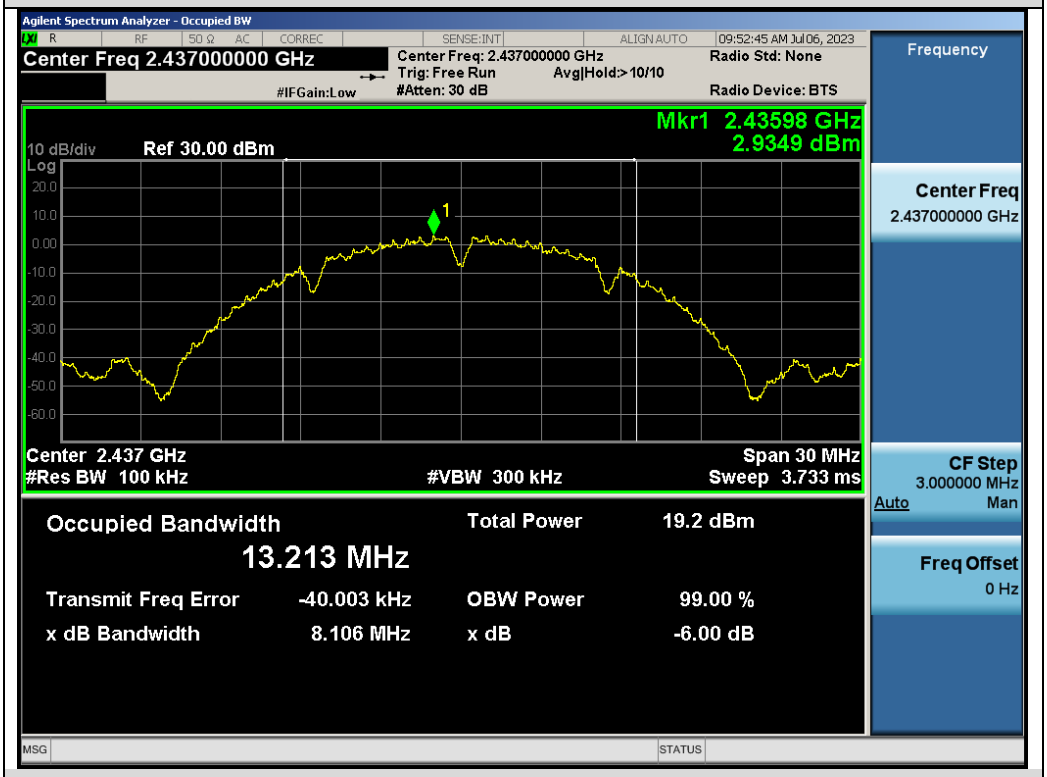
Test Graphs of DTS Bandwidth



Test_Graph_802.11b_ANT1_2412_1Mbps_DTSBW



Test_Graph_802.11b_ANT1_2437_1Mbps_DTSBW

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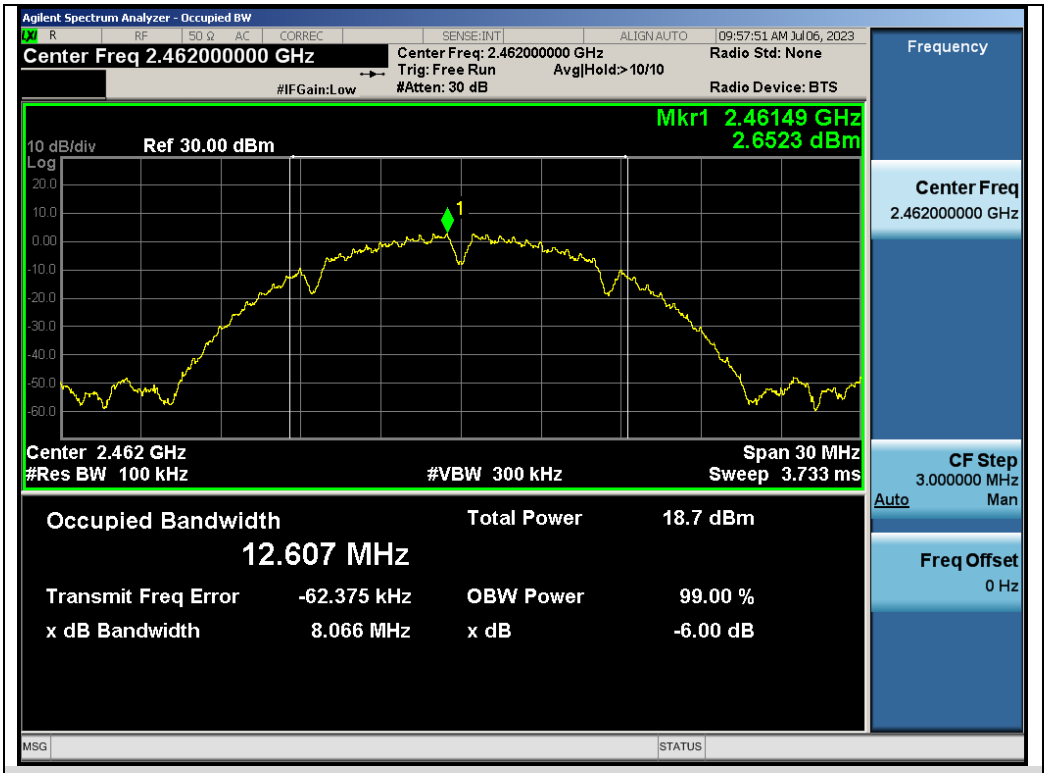
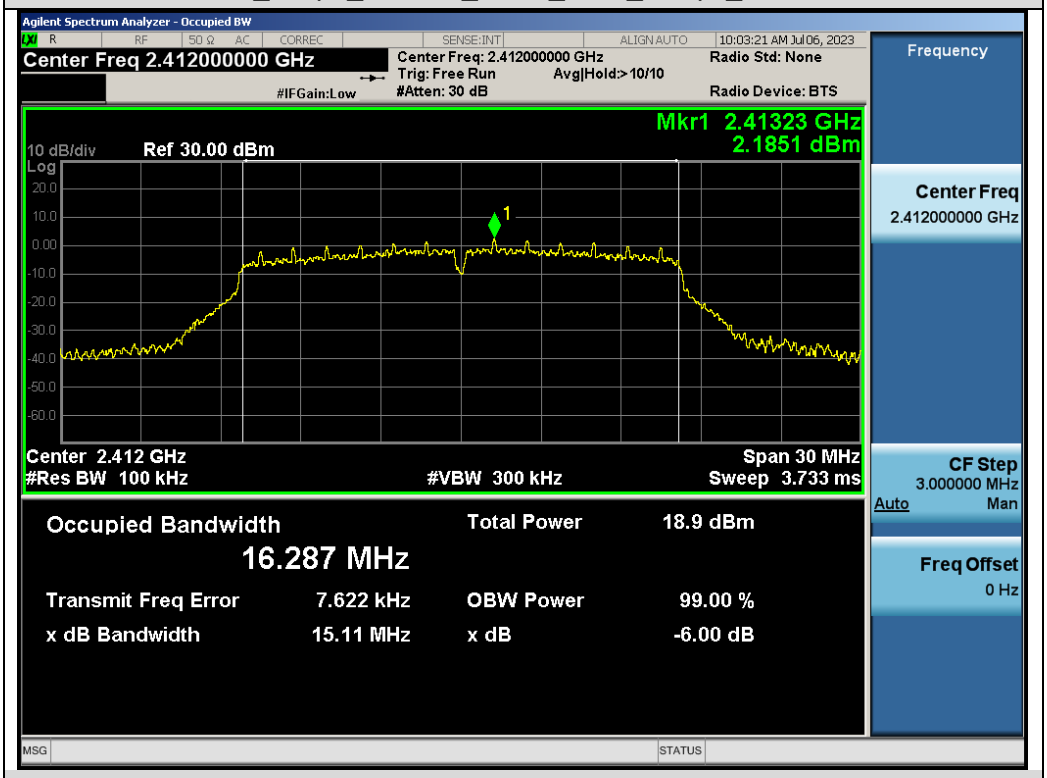


Test_Graph_802.11b_ANT1_2462_1Mbps_DTSBW



Test_Graph_802.11g_ANT1_2412_6Mbps_DTSBW

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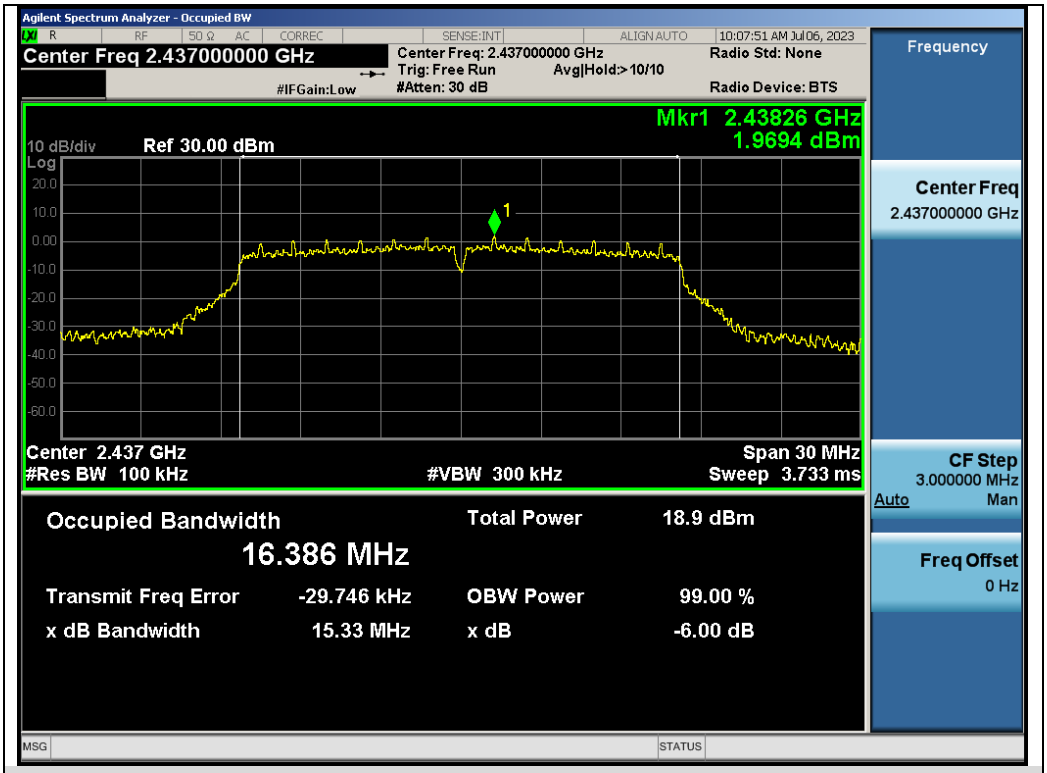
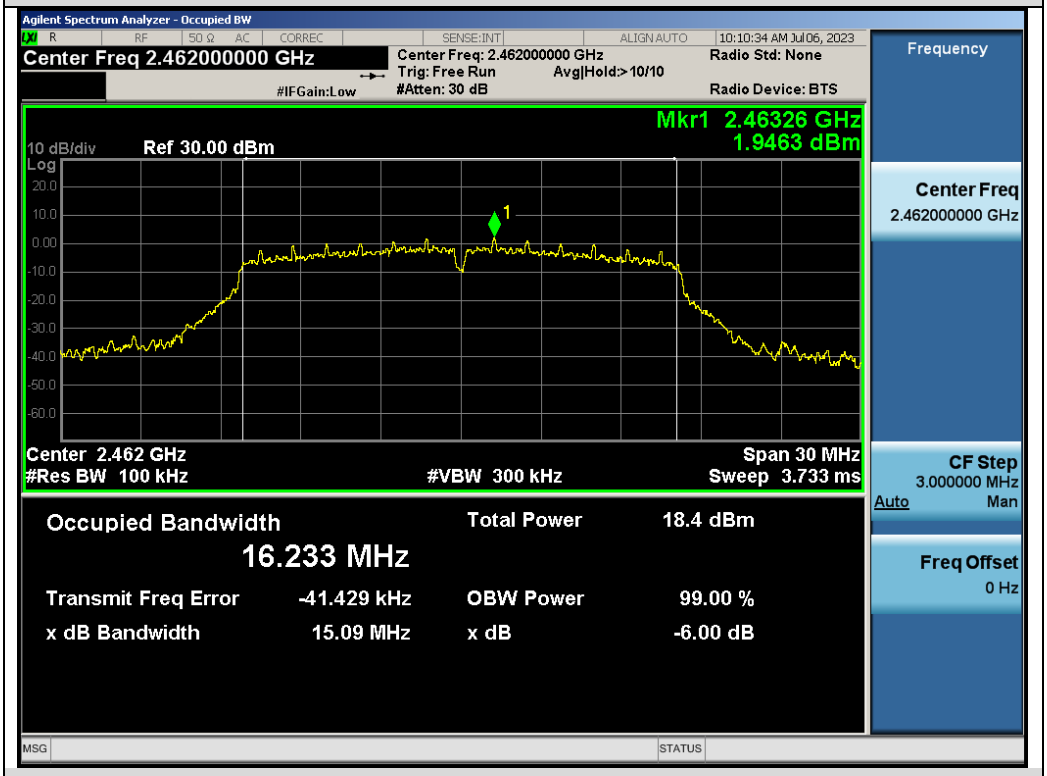


Test_Graph_802.11g_ANT1_2437_6Mbps_DTSBW



Test_Graph_802.11g_ANT1_2462_6Mbps_DTSBW

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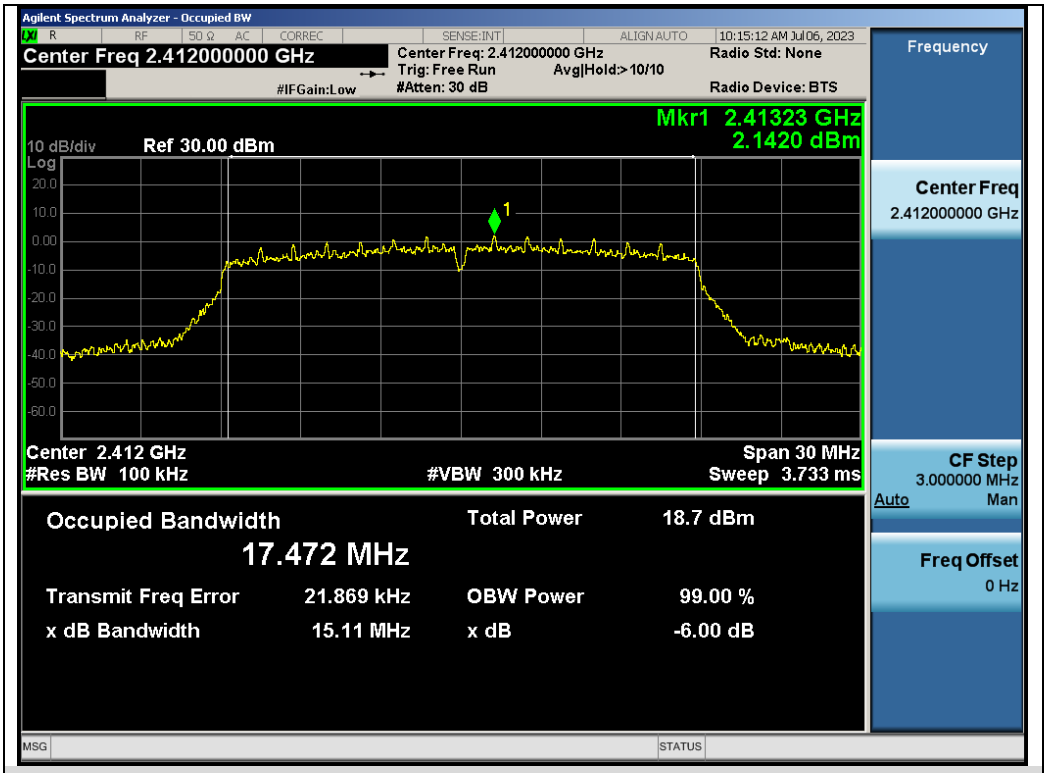
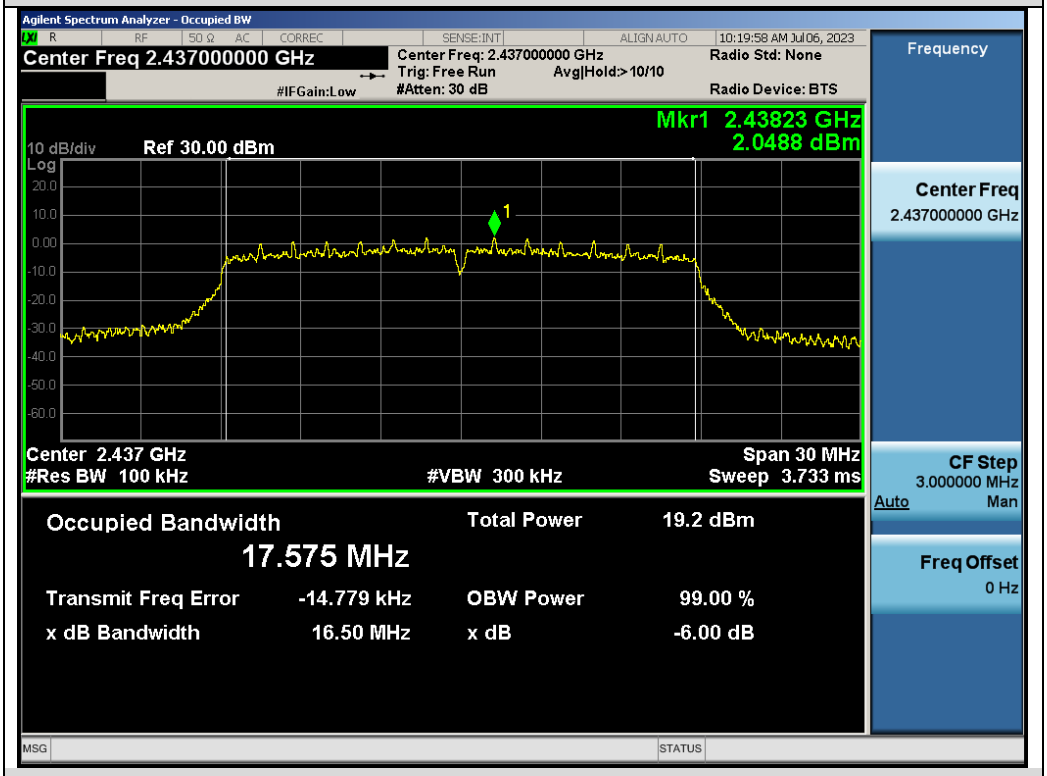


Test_Graph_802.11n20_ANT1_2412_MCS0_DTSBW



Test_Graph_802.11n20_ANT1_2437_MCS0_DTSBW

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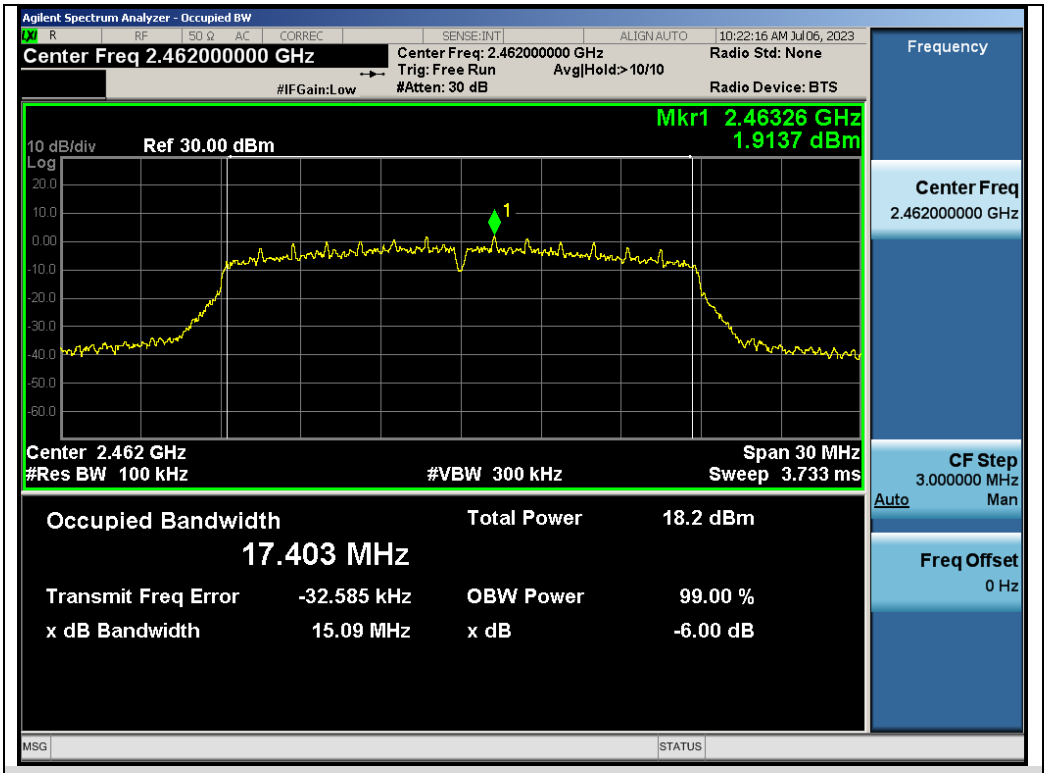
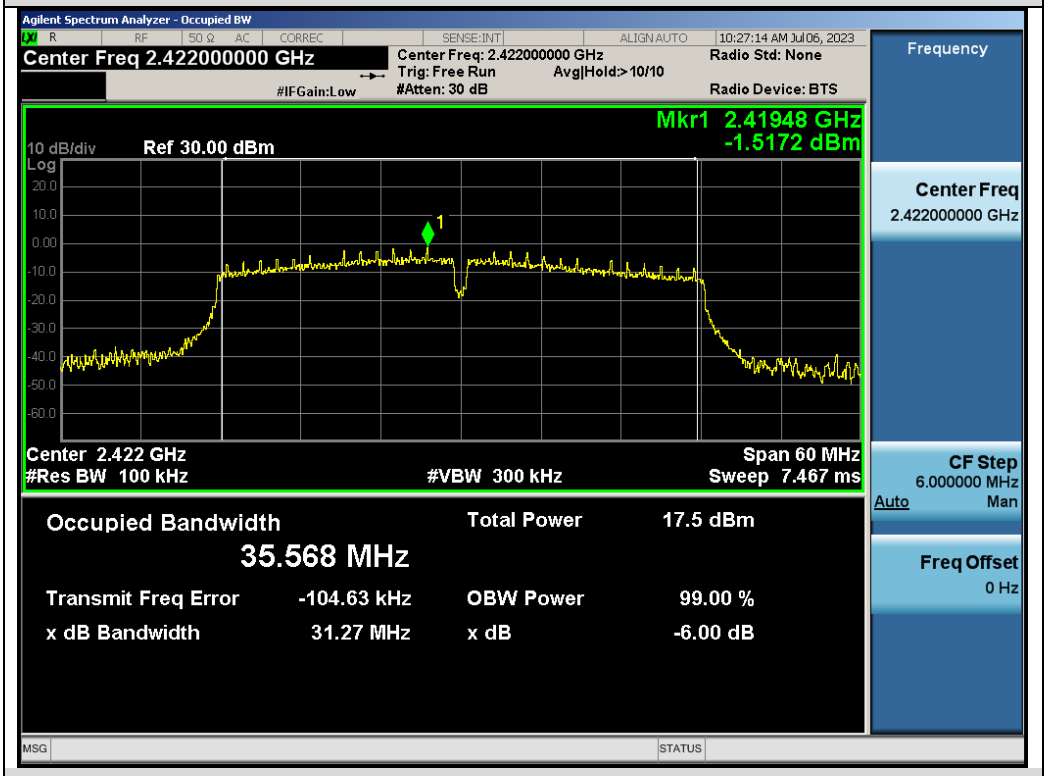


Test_Graph_802.11n20_ANT1_2462_MCS0_DTSBW



Test_Graph_802.11n40_ANT1_2422_MCS0_DTSBW

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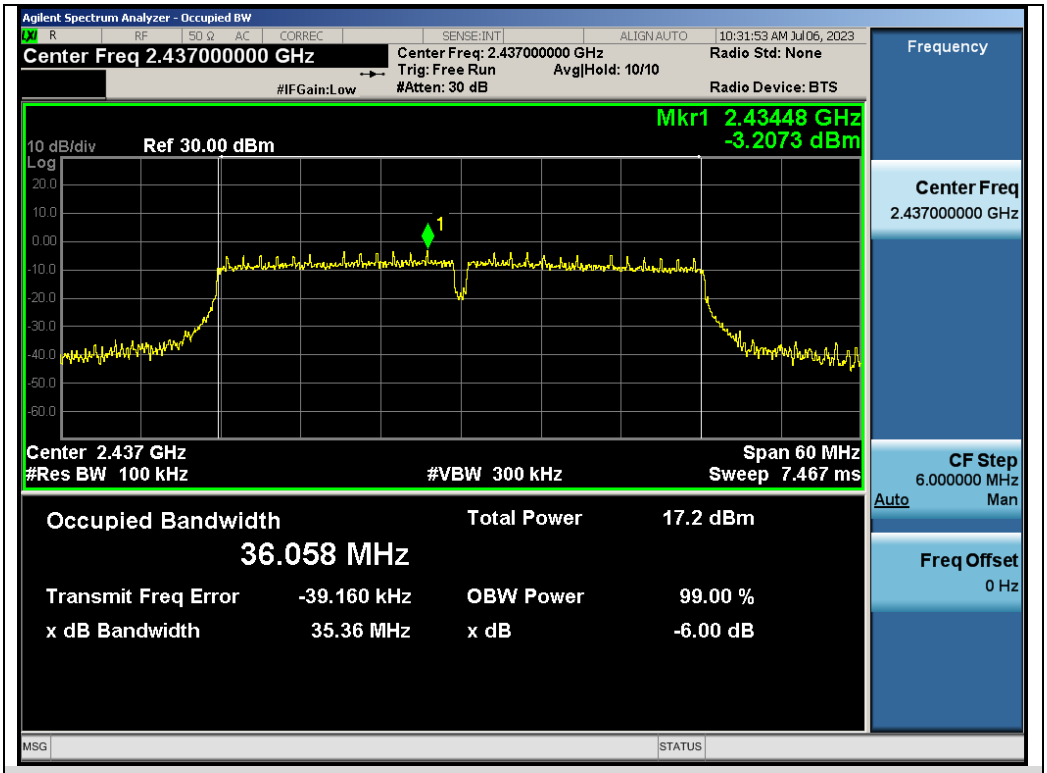
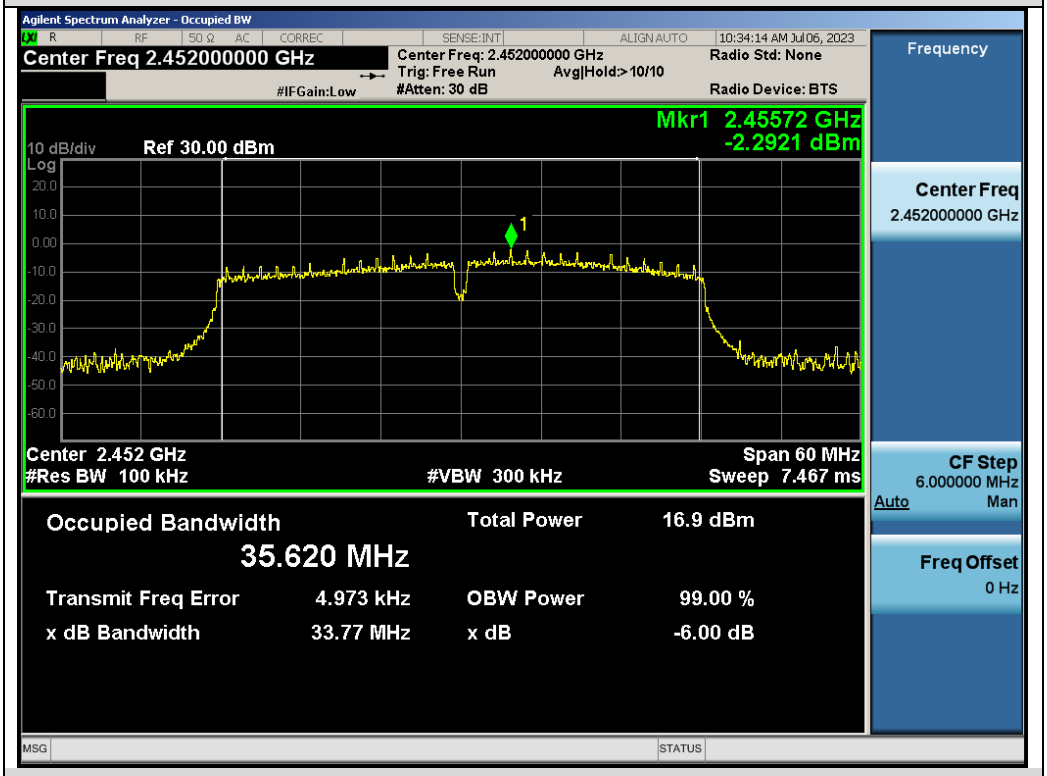


Test_Graph_802.11n40_ANT1_2437_MCS0_DTSBW



Test_Graph_802.11n40_ANT1_2452_MCS0_DTSBW

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9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW > RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW > RBW) are conform to the requirement.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

9.3. MEASUREMENT EQUIPMENT USEDJN

The same as described in section 6.

9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

Note: The limits reference level is according to the test plot of -6dB bandwidth.

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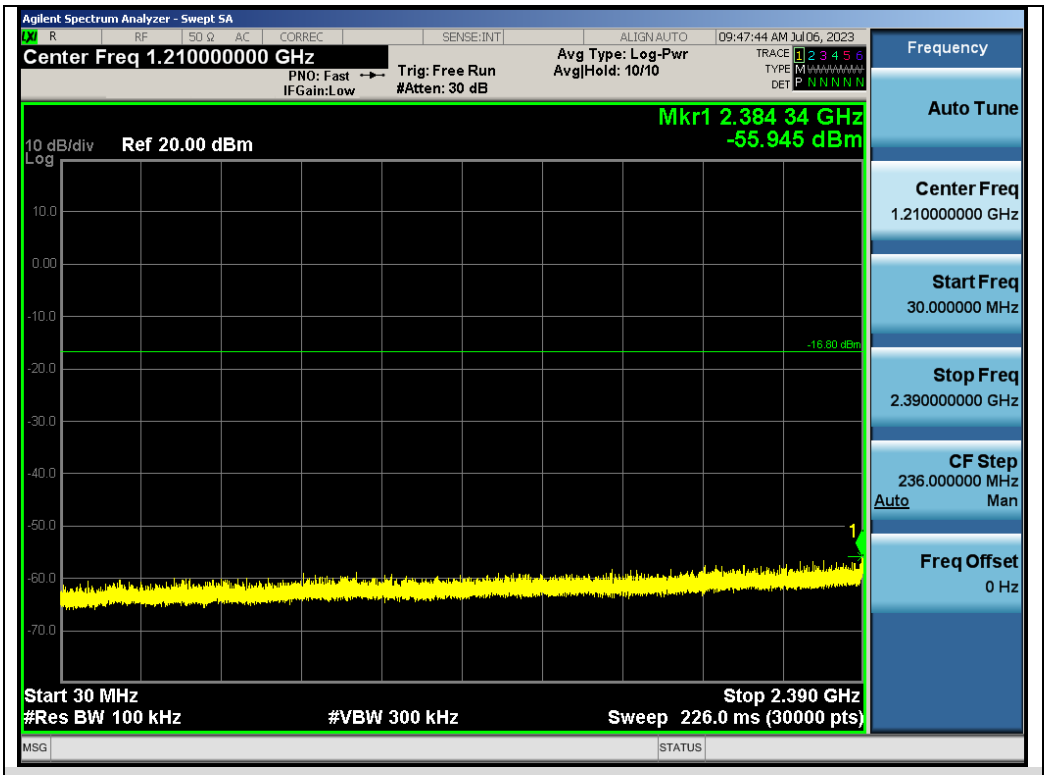
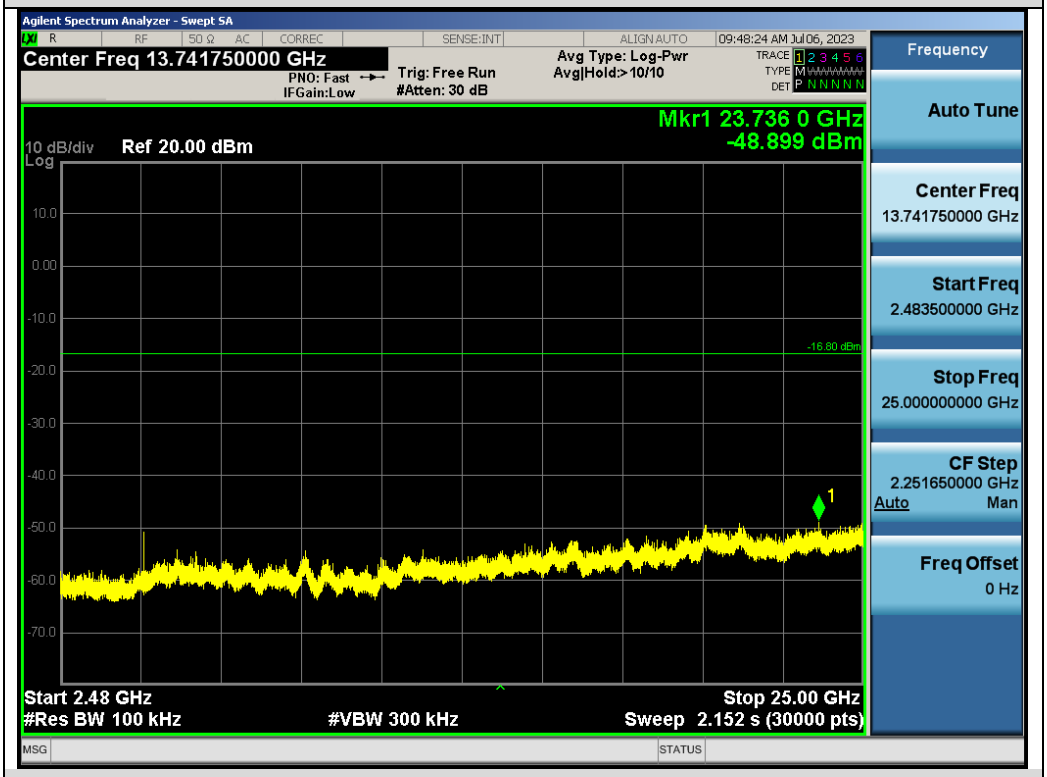
Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Test_Graph_802.11b_ANT1_2412_1Mbps_Lower Band Emissions



Test_Graph_802.11b_ANT1_2412_1Mbps_Higher Band Emissions

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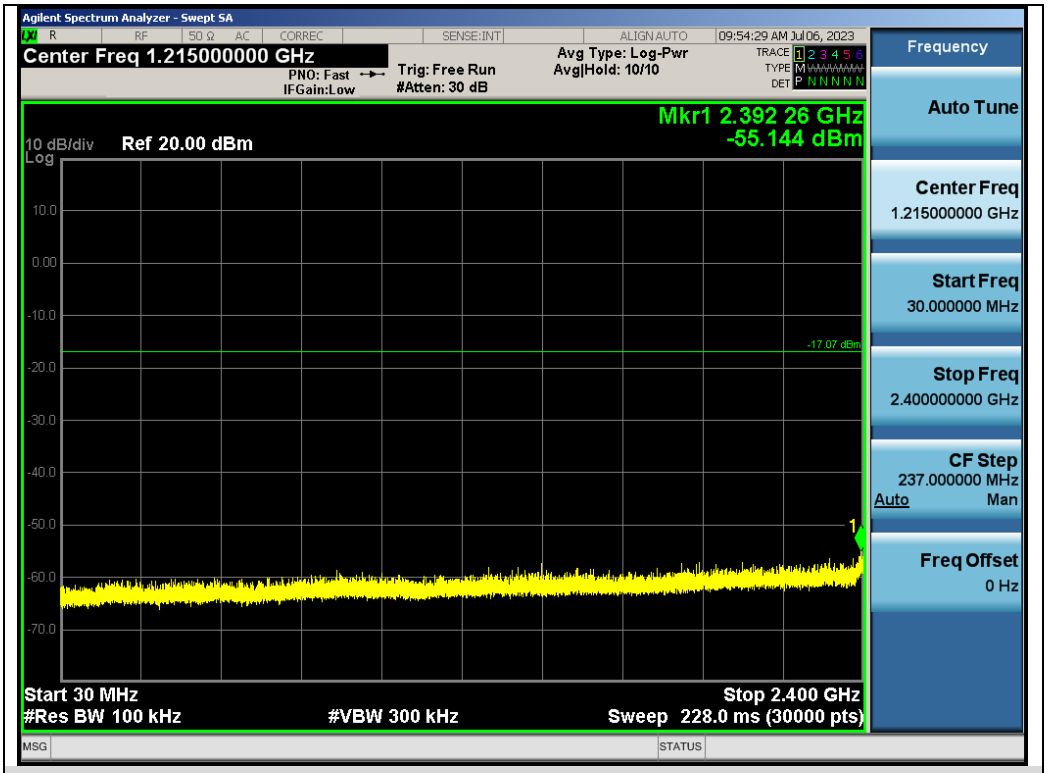
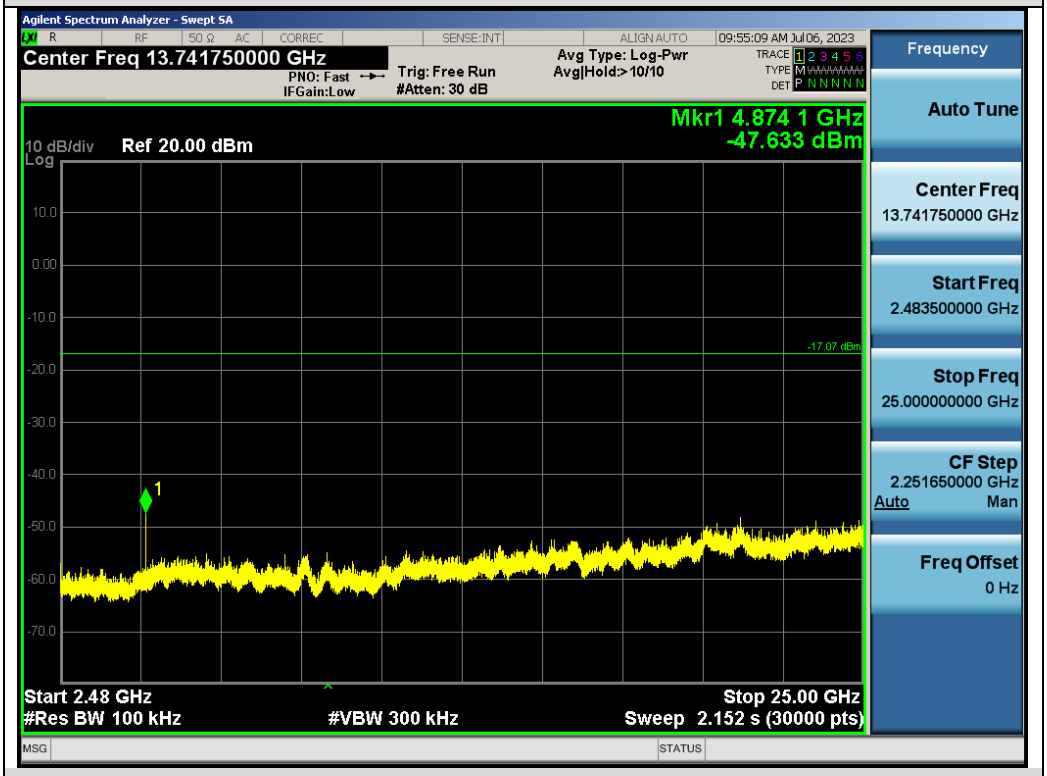


Test_Graph_802.11b_ANT1_2437_1Mbps_Lower Band Emissions



Test_Graph_802.11b_ANT1_2437_1Mbps_Higher Band Emissions

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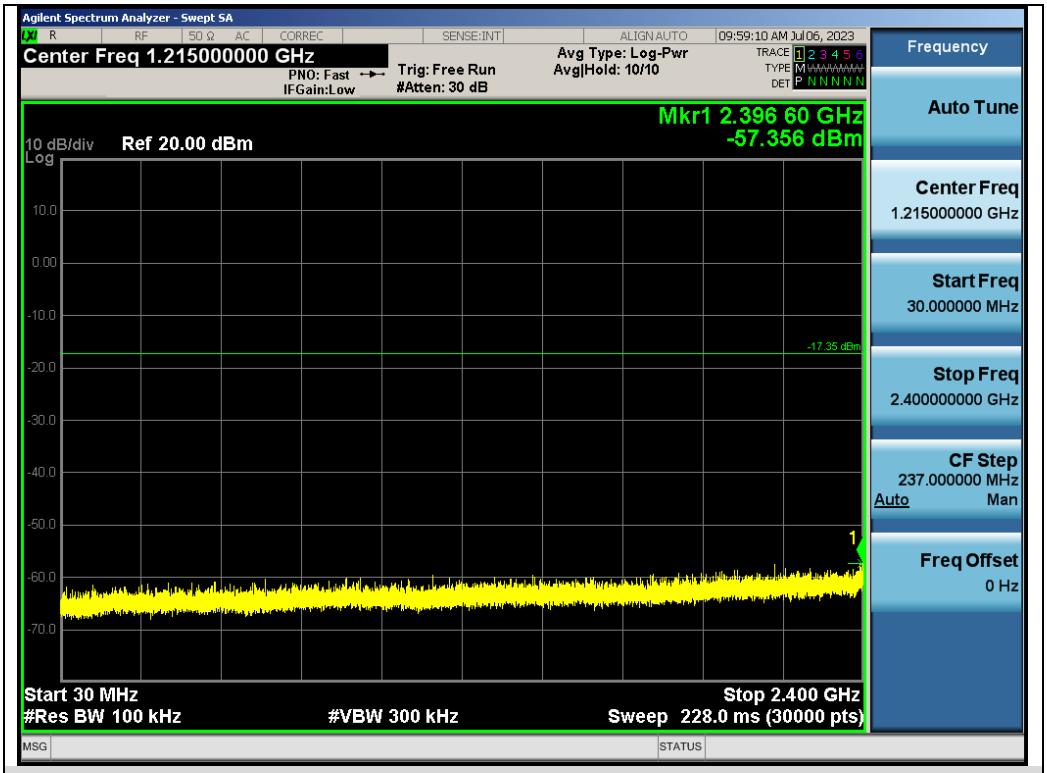
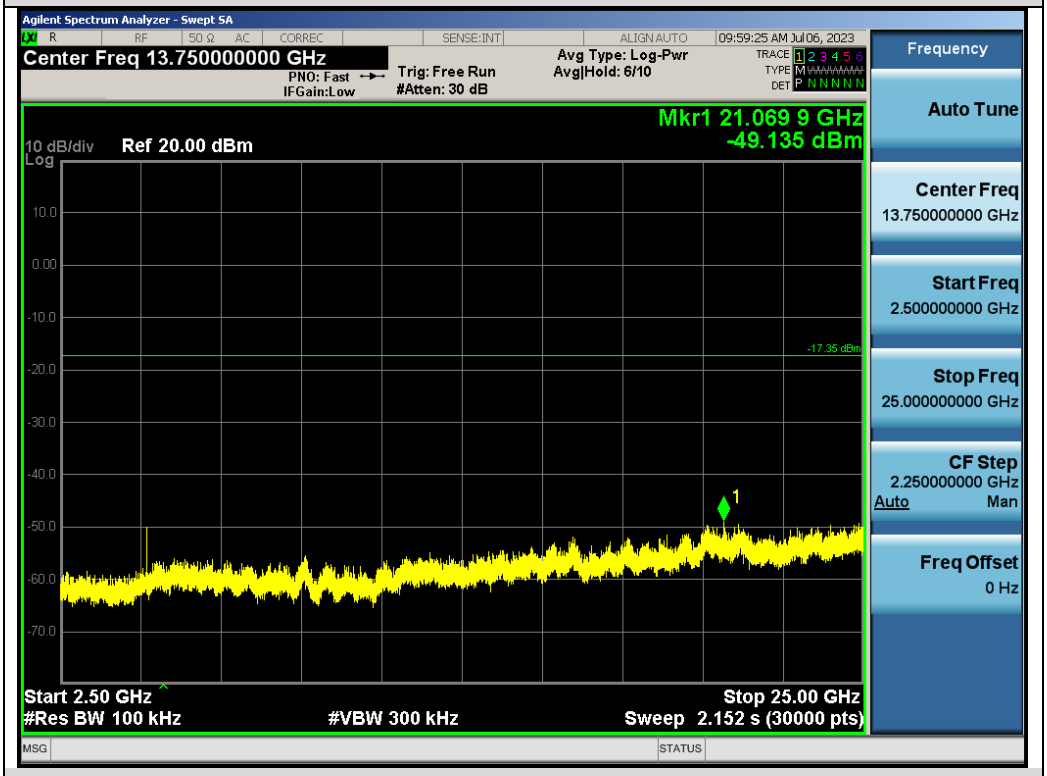


Test_Graph_802.11b_ANT1_2462_1Mbps_Lower Band Emissions



Test_Graph_802.11b_ANT1_2462_1Mbps_Higher Band Emissions

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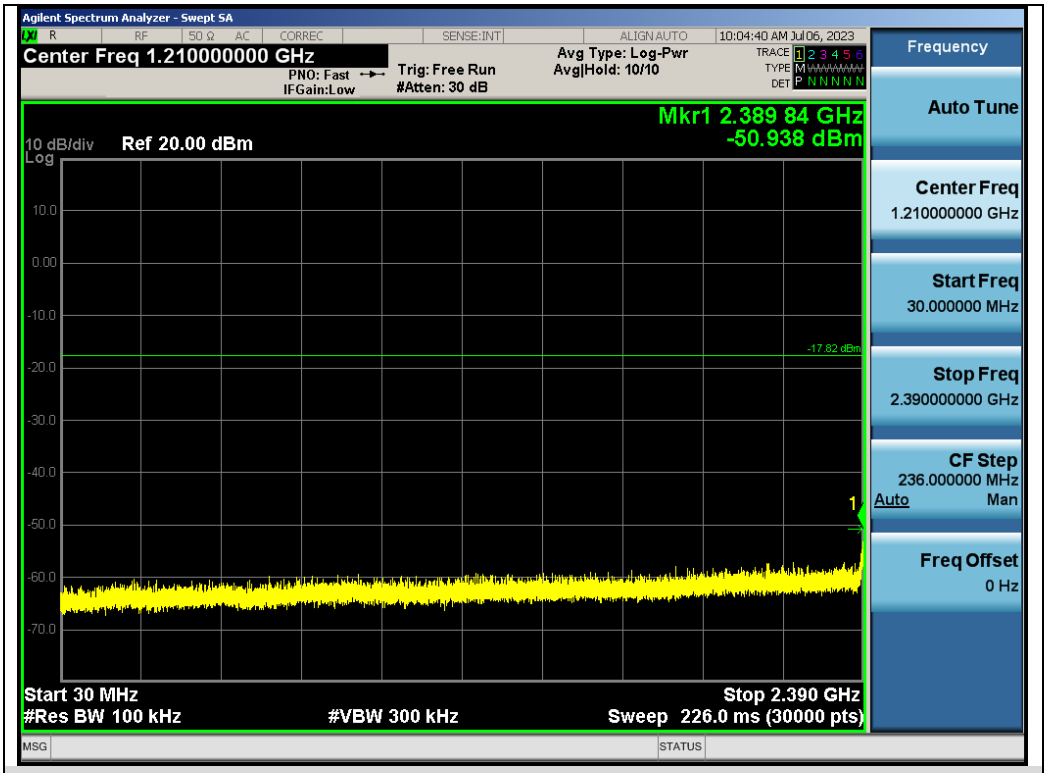
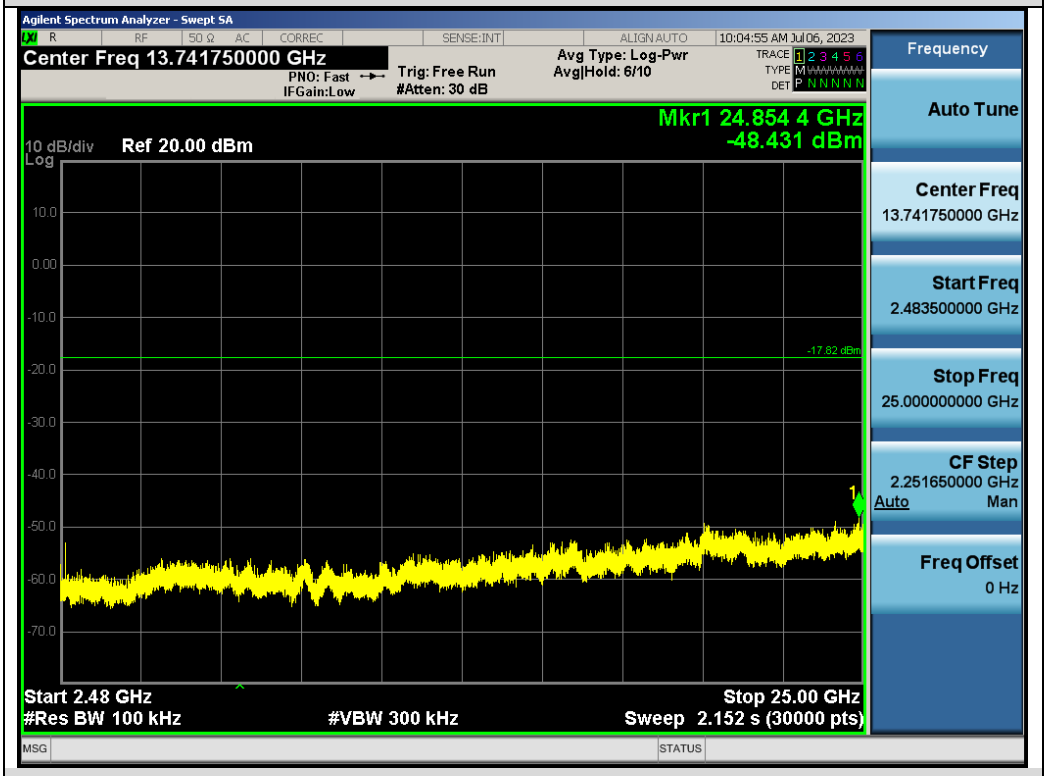


Test_Graph_802.11g_ANT1_2412_6Mbps_Lower Band Emissions



Test_Graph_802.11g_ANT1_2412_6Mbps_Higher Band Emissions

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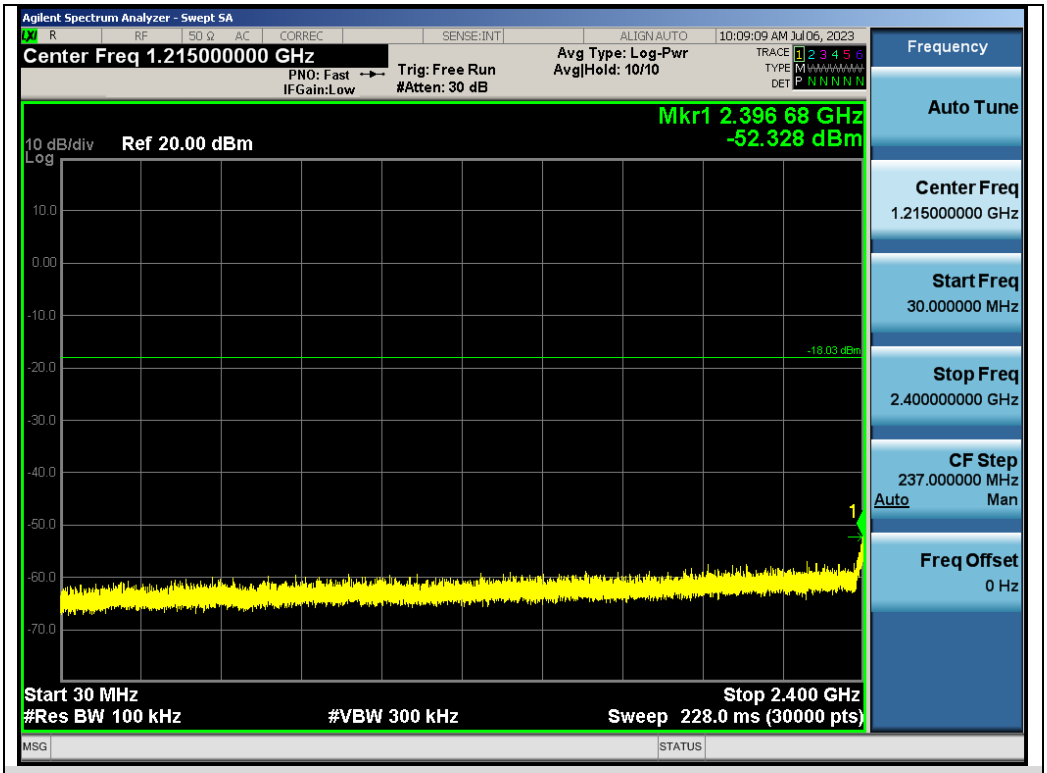
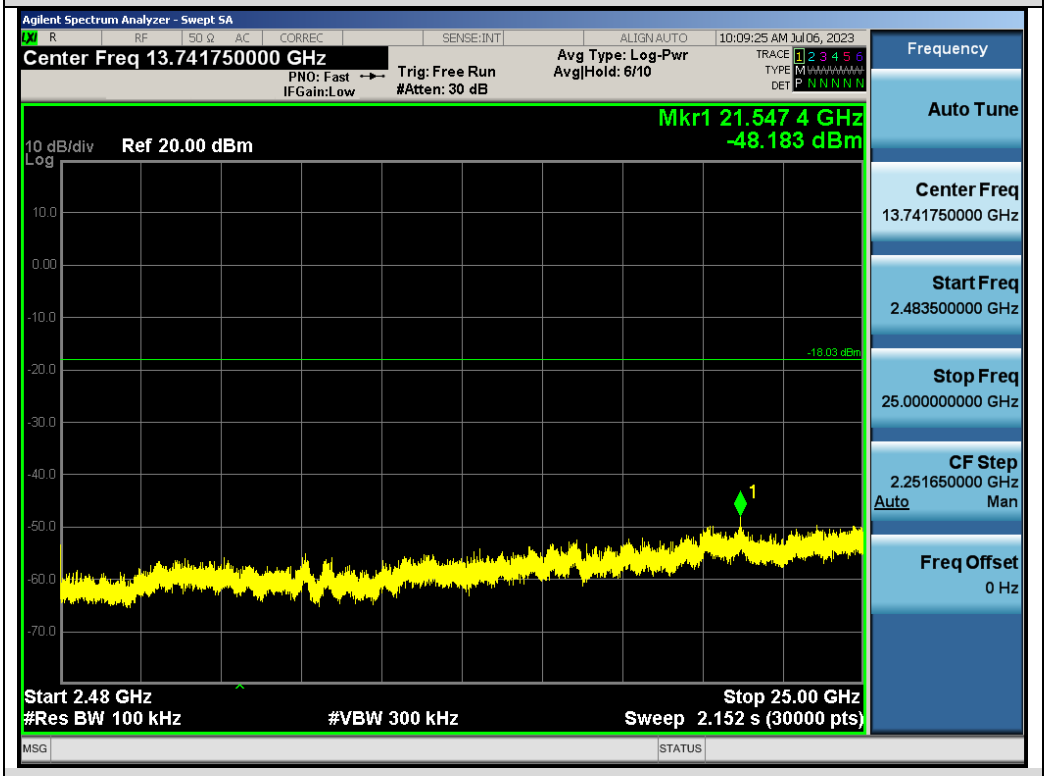


Test_Graph_802.11g_ANT1_2437_6Mbps_Lower Band Emissions



Test_Graph_802.11g_ANT1_2437_6Mbps_Higher Band Emissions

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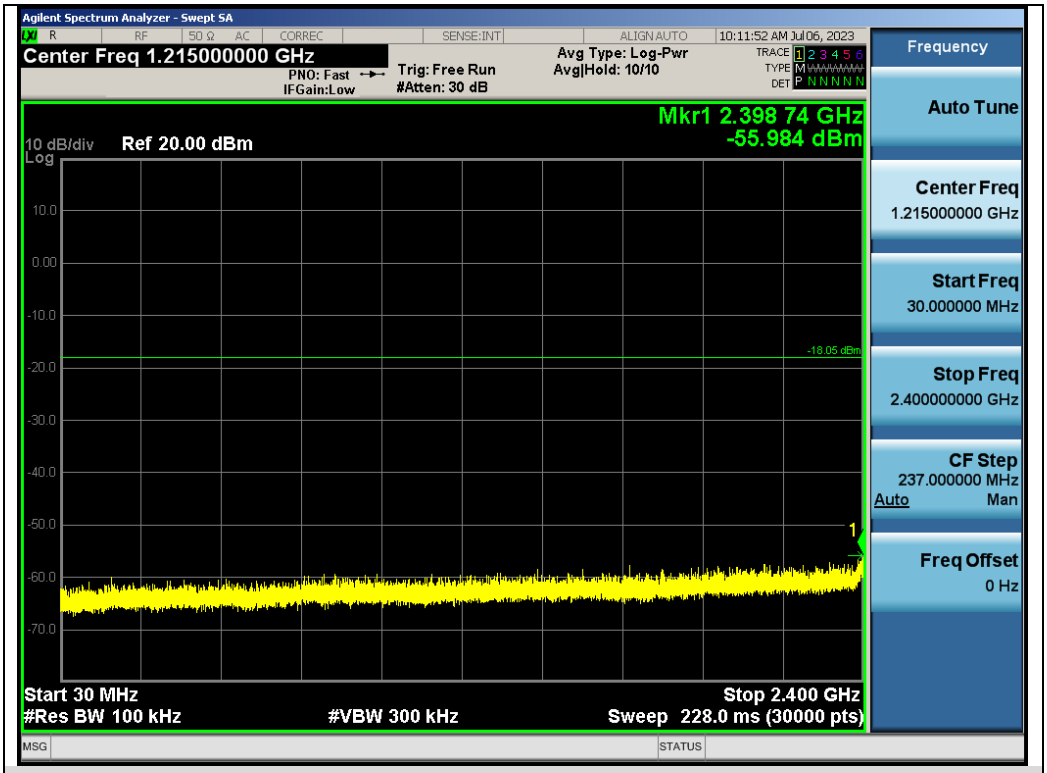
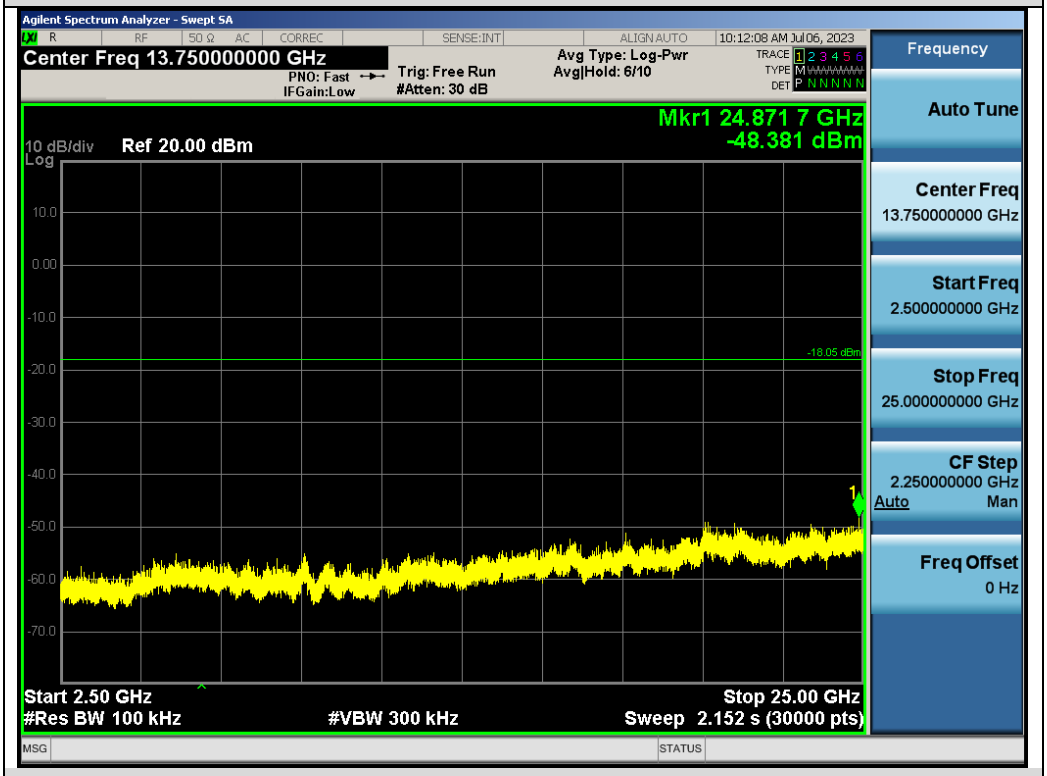


Test_Graph_802.11g_ANT1_2462_6Mbps_Lower Band Emissions



Test_Graph_802.11g_ANT1_2462_6Mbps_Higher Band Emissions

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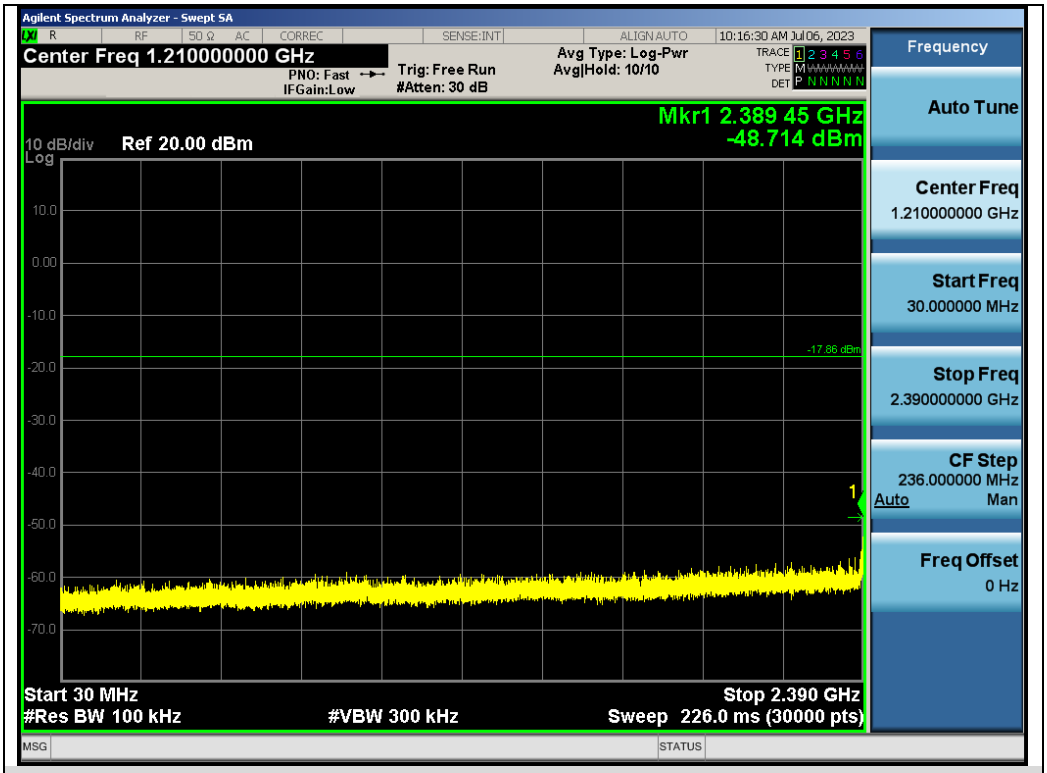
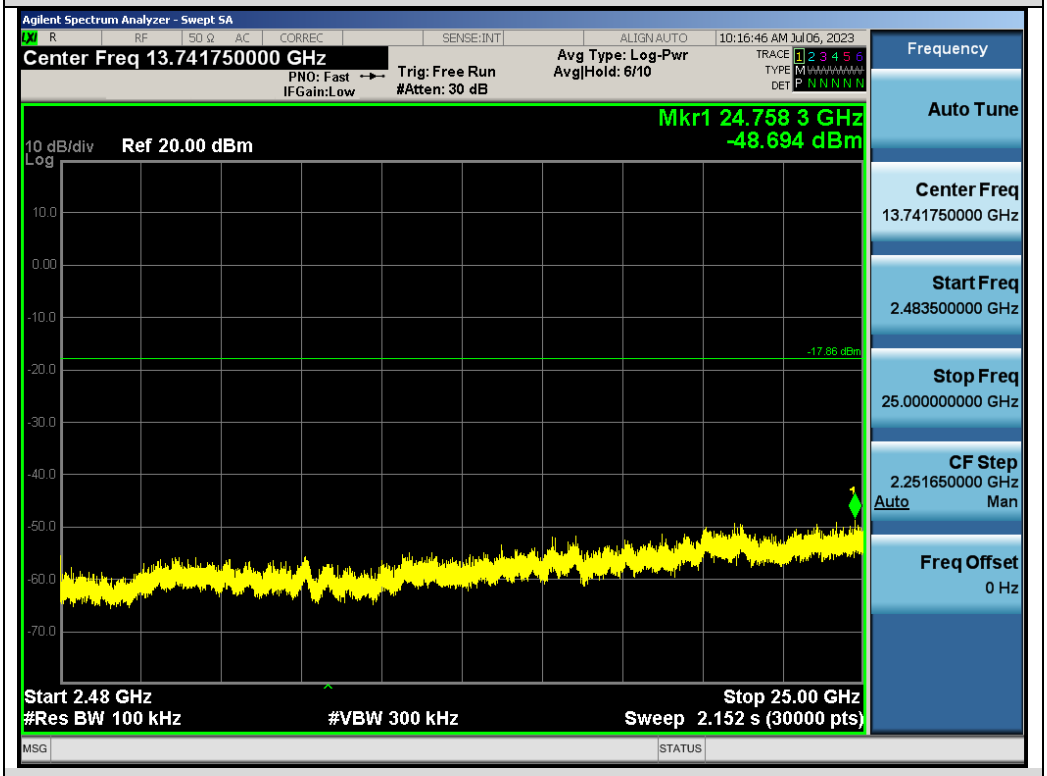


Test_Graph_802.11n20_ANT1_2412_MCS0_Lower Band Emissions



Test_Graph_802.11n20_ANT1_2412_MCS0_Higher Band Emissions

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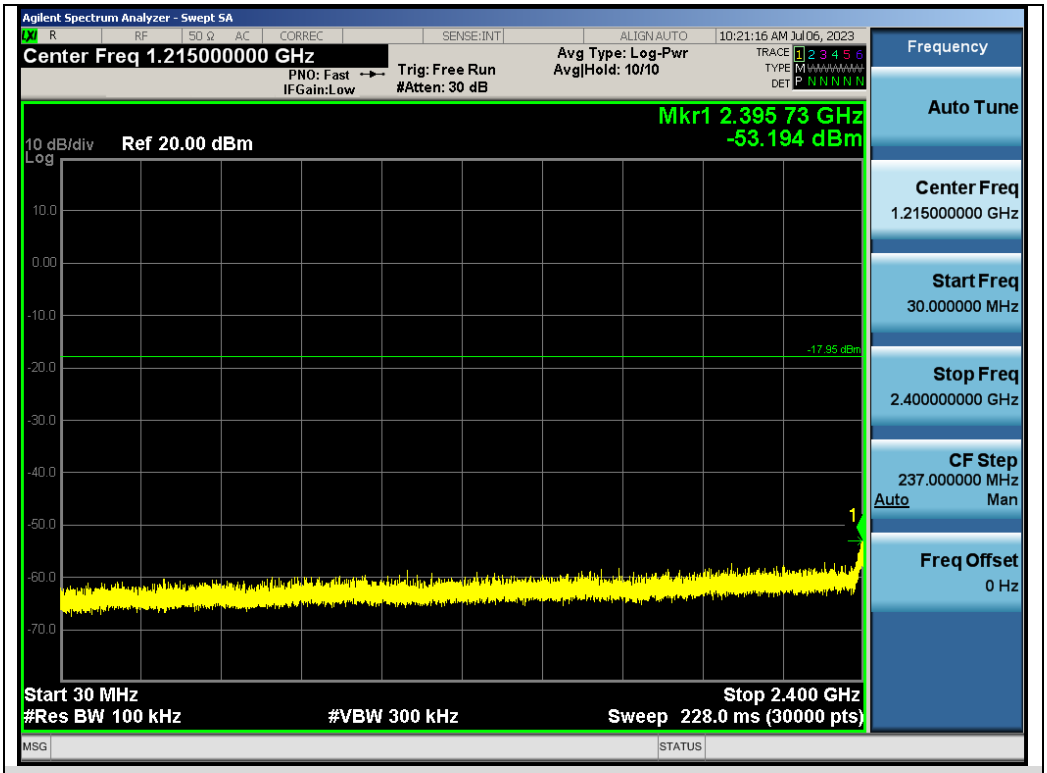
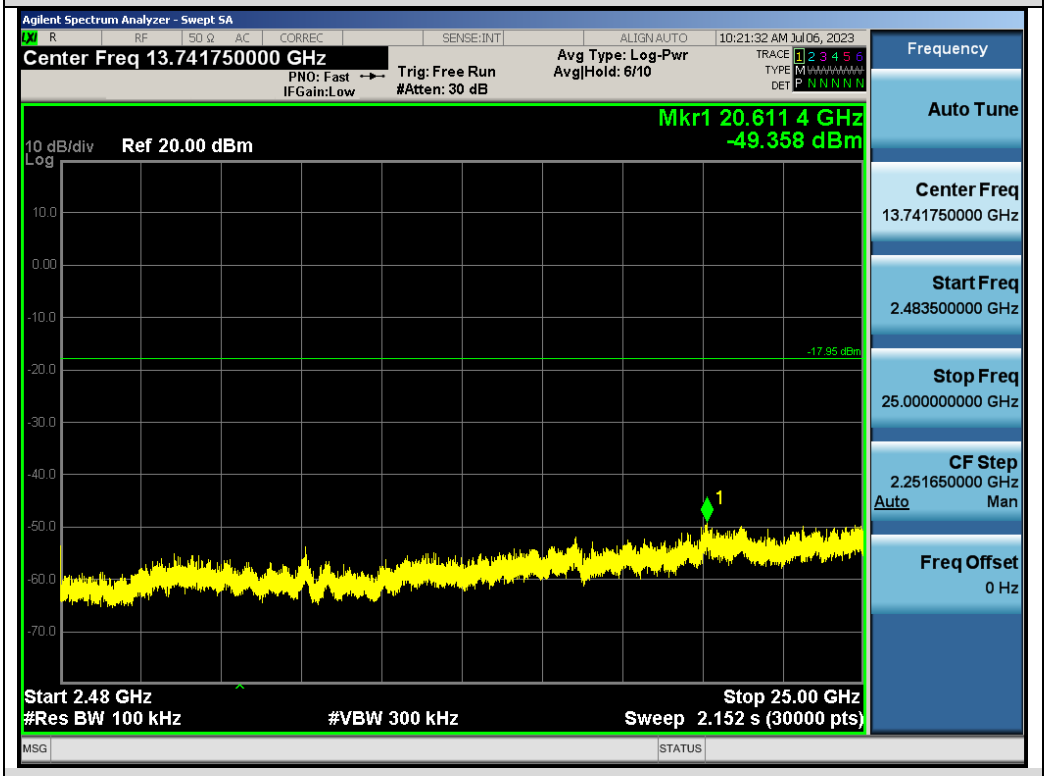


Test_Graph_802.11n20_ANT1_2437_MCS0_Lower Band Emissions



Test_Graph_802.11n20_ANT1_2437_MCS0_Higher Band Emissions

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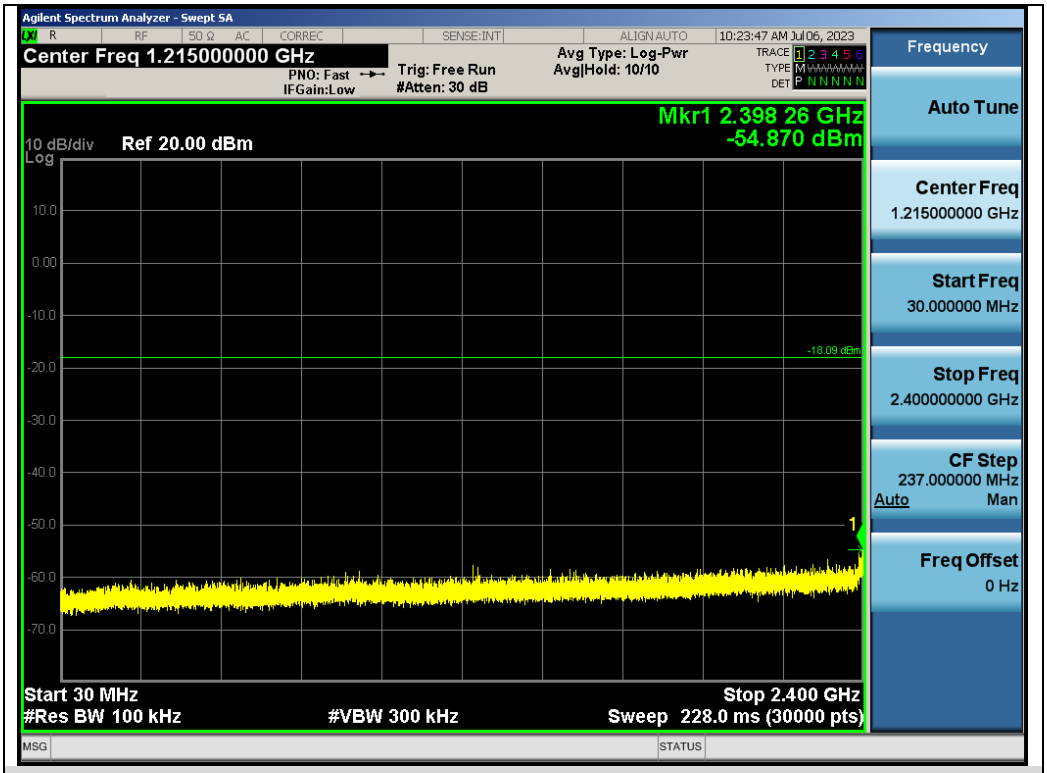
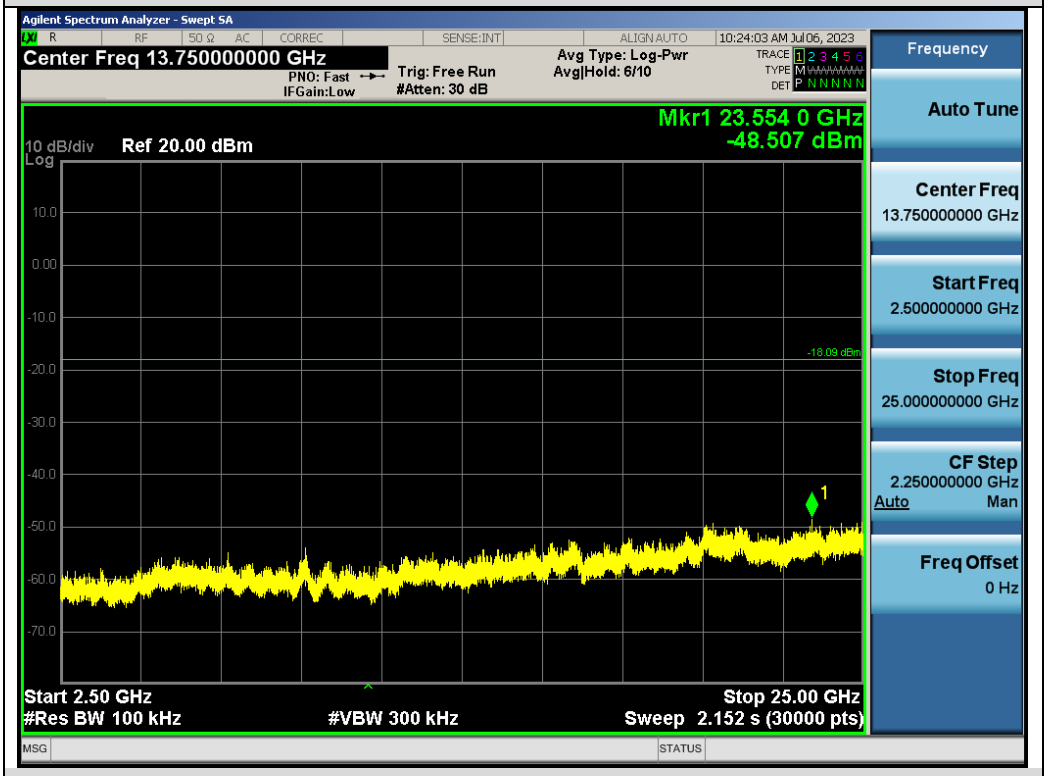


Test_Graph_802.11n20_ANT1_2462_MCS0_Lower Band Emissions



Test_Graph_802.11n20_ANT1_2462_MCS0_Higher Band Emissions

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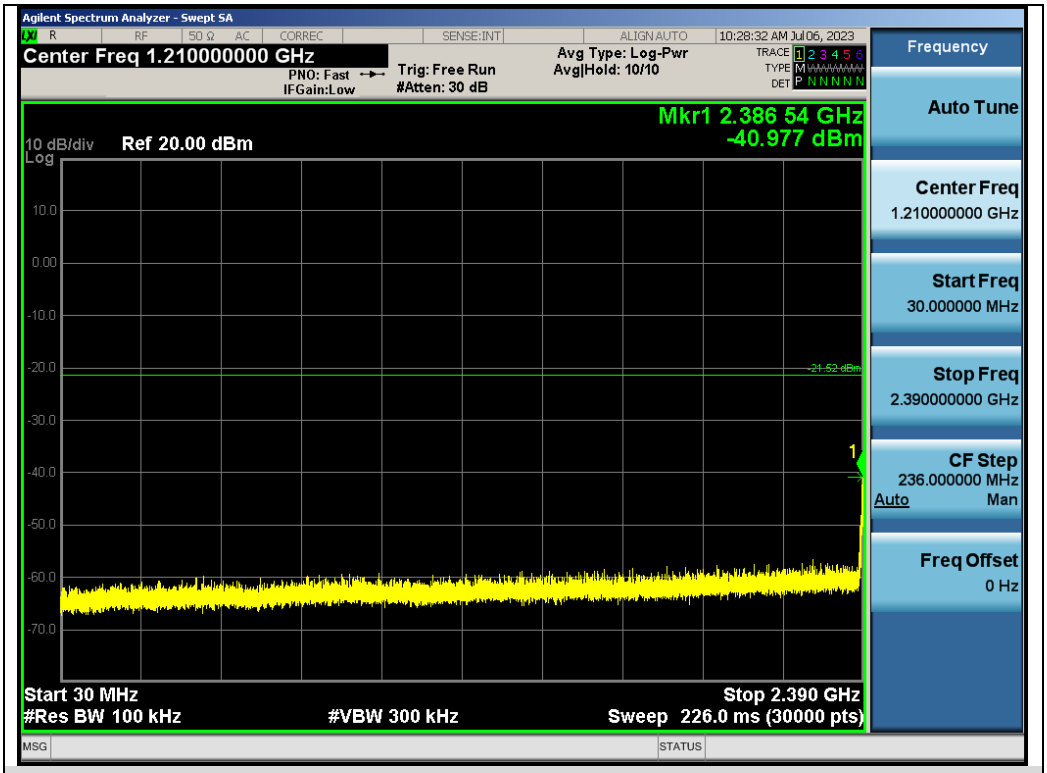
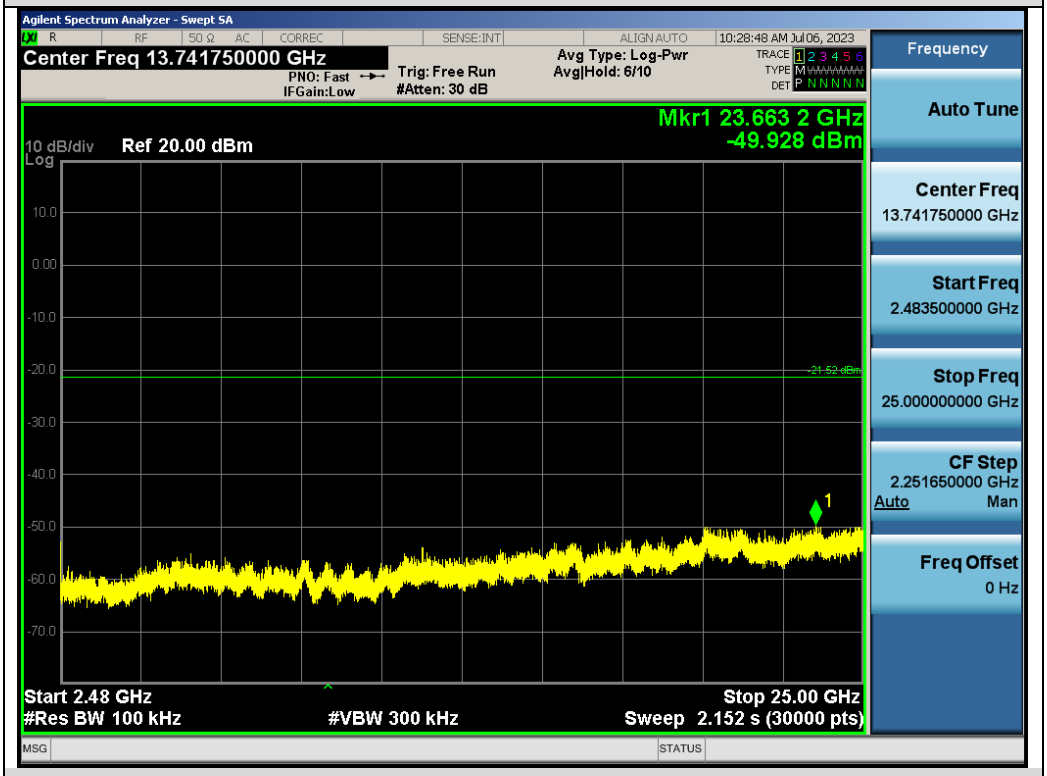


Test_Graph_802.11n40_ANT1_2422_MCS0_Lower Band Emissions



Test_Graph_802.11n40_ANT1_2422_MCS0_Higher Band Emissions

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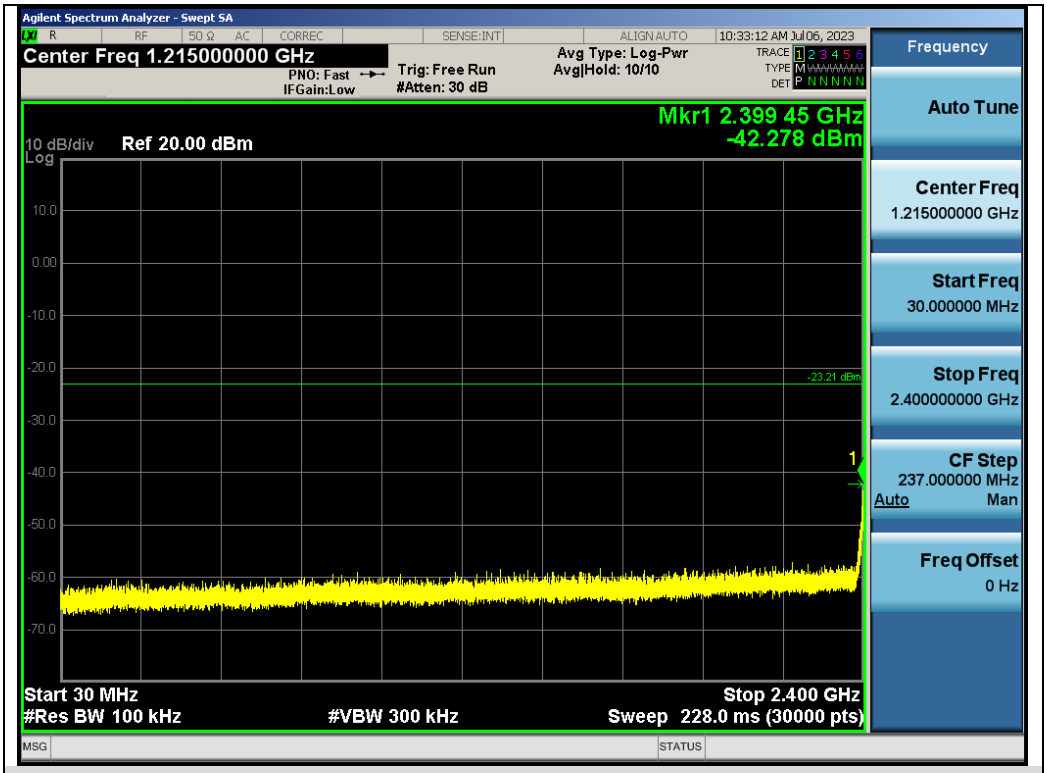
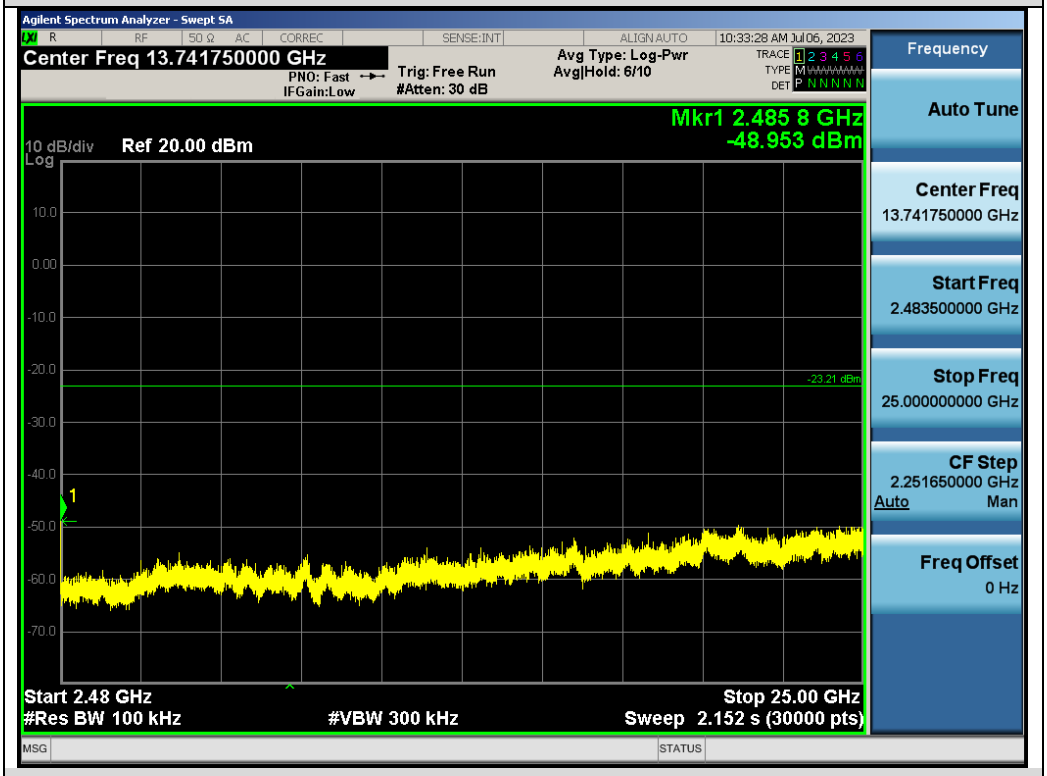


Test_Graph_802.11n40_ANT1_2437_MCS0_Lower Band Emissions



Test_Graph_802.11n40_ANT1_2437_MCS0_Higher Band Emissions

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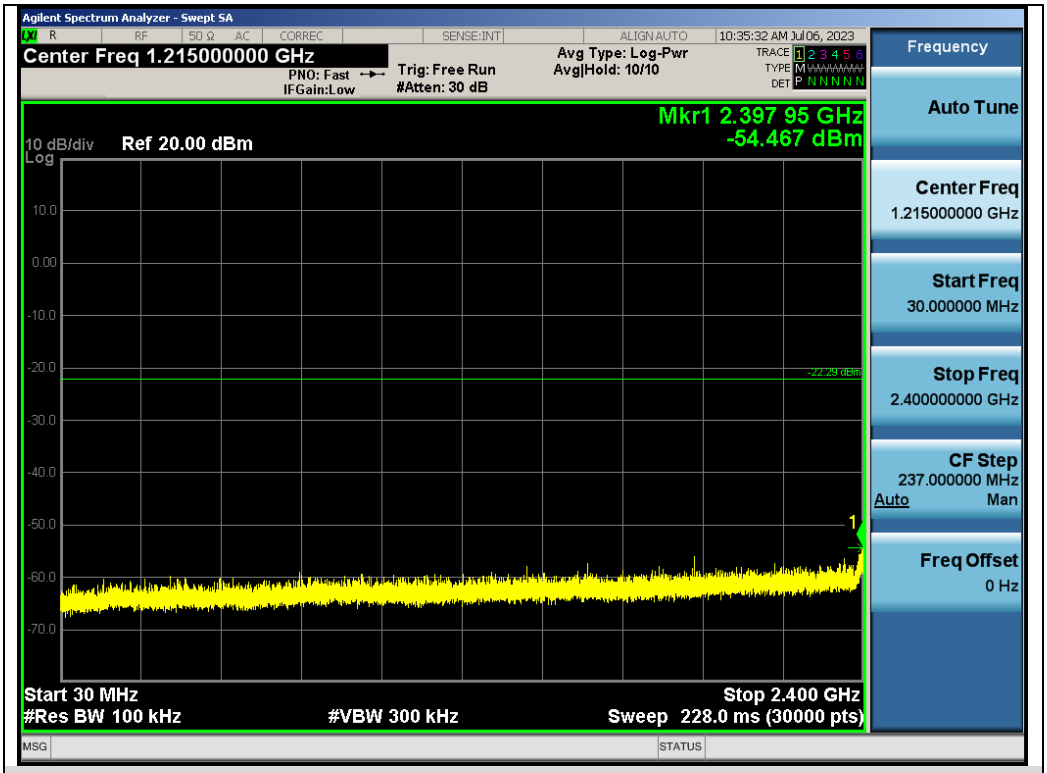
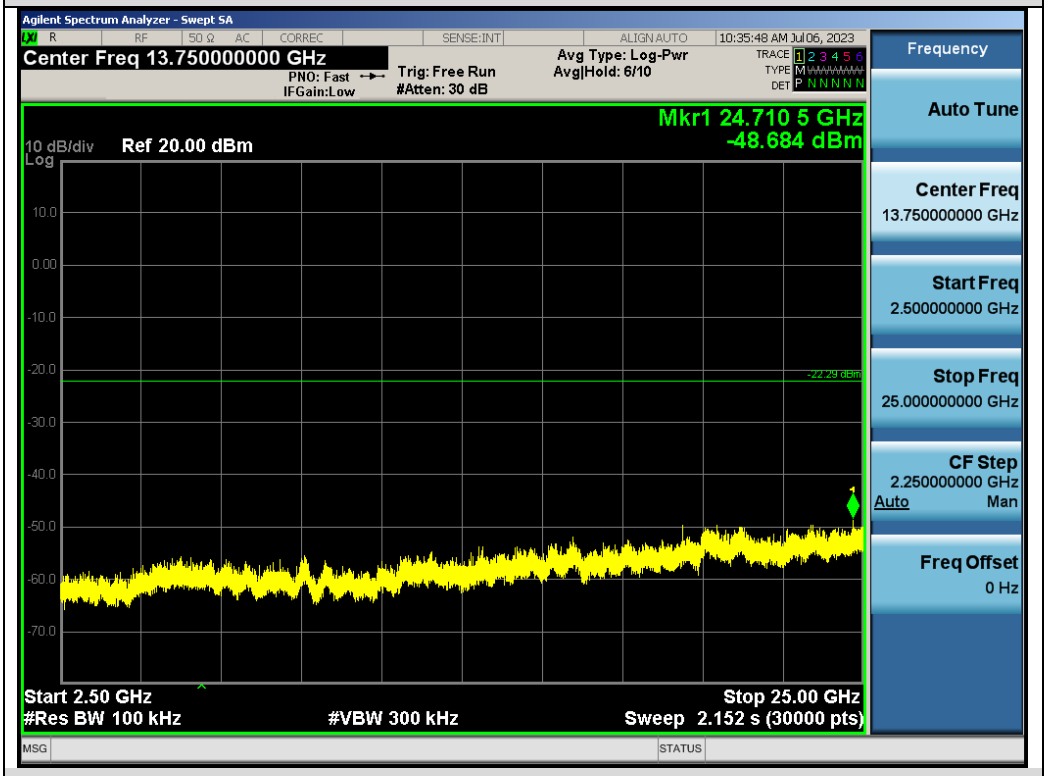


Test_Graph_802.11n40_ANT1_2452_MCS0_Lower Band Emissions



Test_Graph_802.11n40_ANT1_2452_MCS0_Higher Band Emissions

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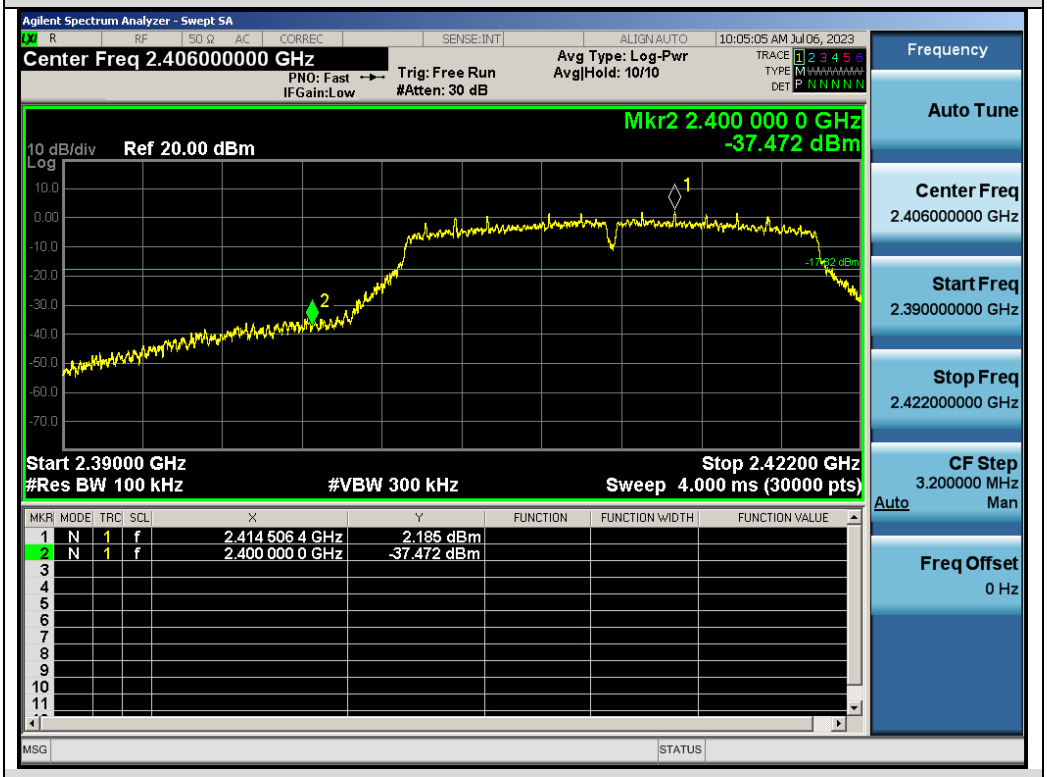
Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands

Test_Graph_802.11b_ANT1_2412_1Mbps_Lower Band Edge Emissions



Test_Graph_802.11g_ANT1_2412_6Mbps_Lower Band Edge Emissions

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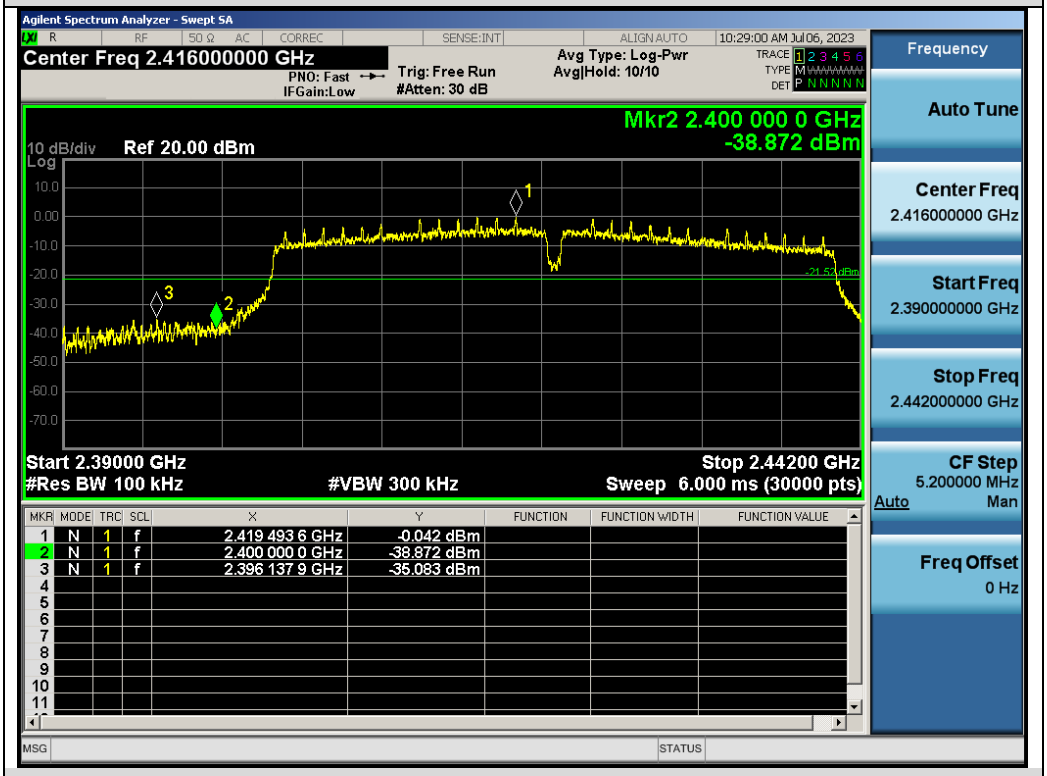
Test_Graph_802.11n20_ANT1_2412_MCS0_Lower Band Edge Emissions



Test_Graph_802.11n40_ANT1_2422_MCS0_Lower Band Edge Emissions

Note: Emissions from 2483.5-2500MHz which fall in the restricted bands had been considered with the radiated emission limits specified.

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10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

10.1 MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
(3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the ANSI C63.10 (2013) item 11.10 was used in this testing.

10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer to Section 8.2.

10.3 MEASUREMENT EQUIPMENT USED

Refer to Section 6.

10.4 LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power Spectral Density					
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11b	2412	-1.735	-9.974	≤8	Pass
	2437	-2.324	-10.563	≤8	Pass
	2462	-2.138	-10.377	≤8	Pass
802.11g	2412	-3.718	-11.957	≤8	Pass
	2437	-2.597	-10.836	≤8	Pass
	2462	-4.445	-12.684	≤8	Pass
802.11n20	2412	-3.529	-11.768	≤8	Pass
	2437	-3.121	-11.36	≤8	Pass
	2462	-3.706	-11.945	≤8	Pass
802.11n40	2422	-7.195	-15.434	≤8	Pass
	2437	-8.680	-16.919	≤8	Pass
	2452	-7.530	-15.769	≤8	Pass

Note: Power density(dBm/3kHz) = Power density(dBm/20kHz) – 10*log(20/3).

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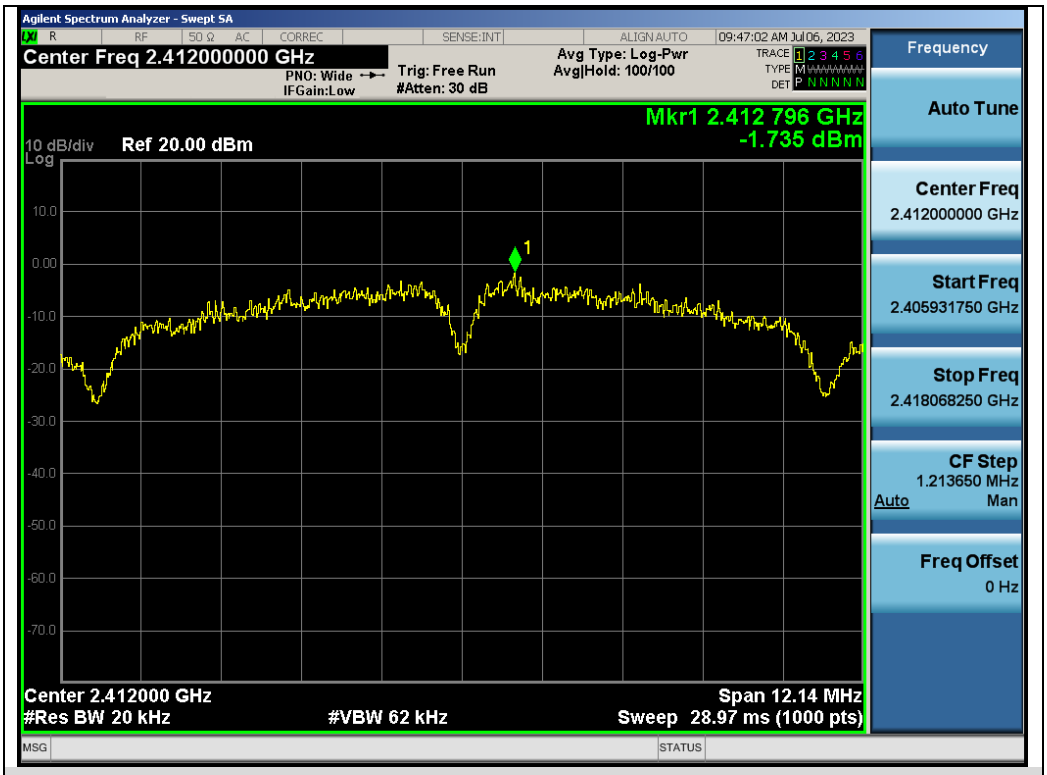
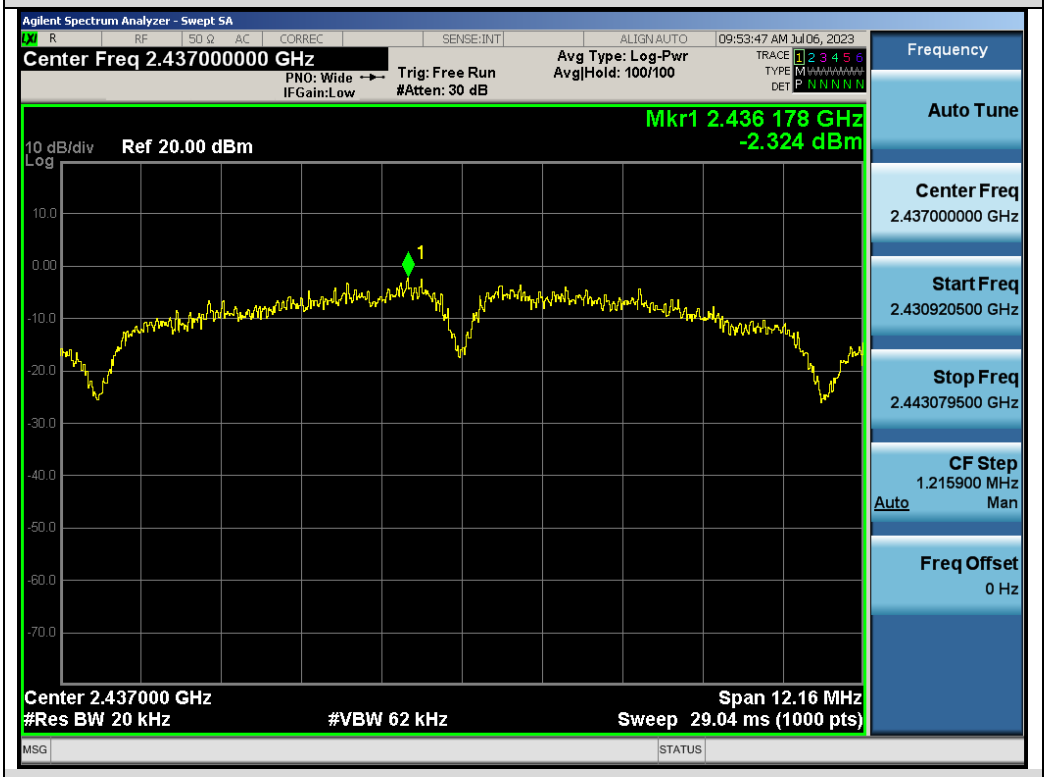
Test Graphs of Conducted Output Power Spectral Density



Test_Graph_802.11b_ANT1_2412_1Mbps_PSD



Test_Graph_802.11b_ANT1_2437_1Mbps_PSD

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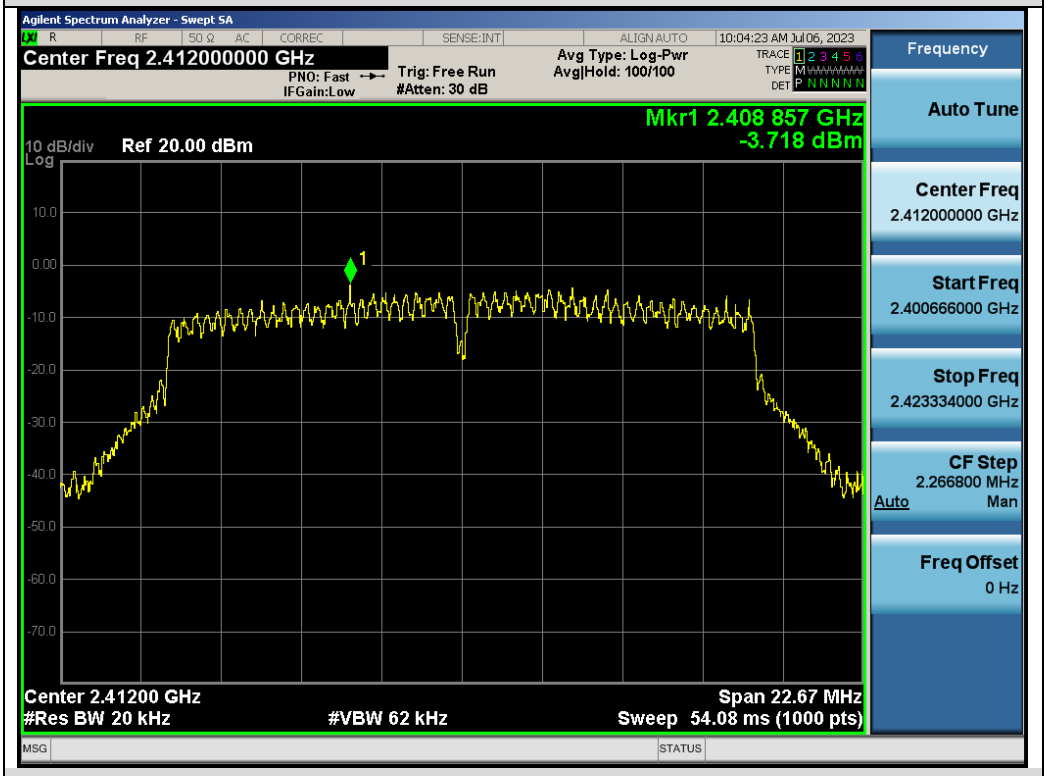
Test_Graph_802.11b_ANT1_2462_1Mbps_PSD



Test_Graph_802.11g_ANT1_2412_6Mbps_PSD

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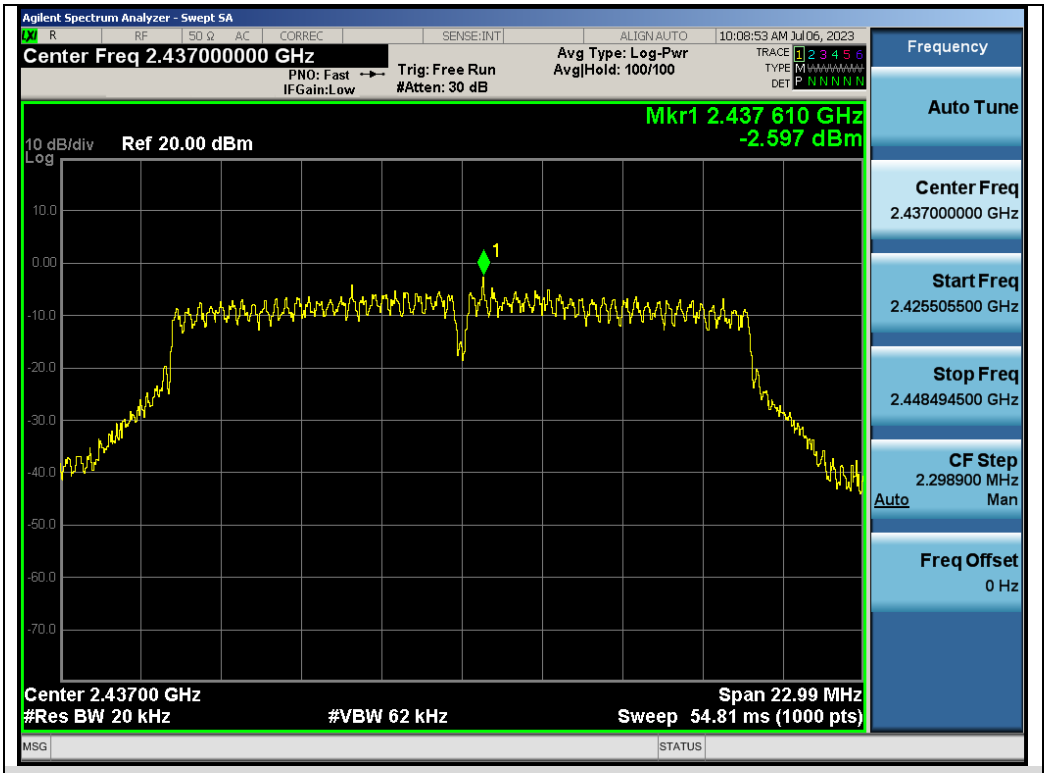
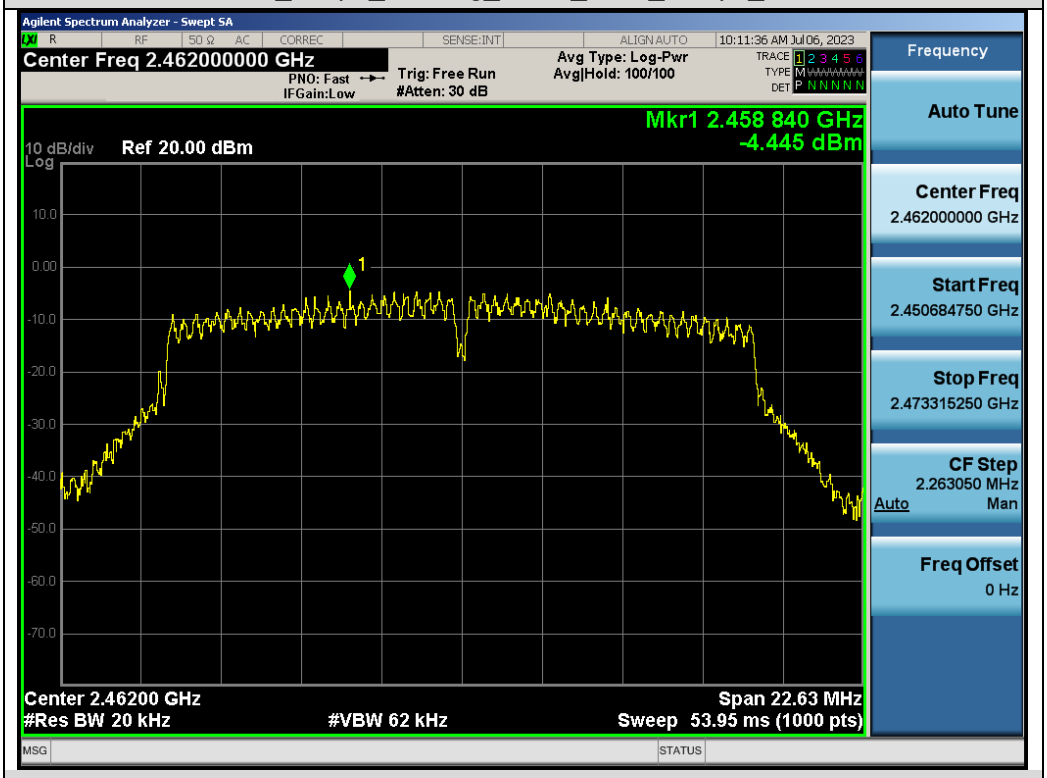


Test_Graph_802.11g_ANT1_2437_6Mbps_PSD



Test_Graph_802.11g_ANT1_2462_6Mbps_PSD

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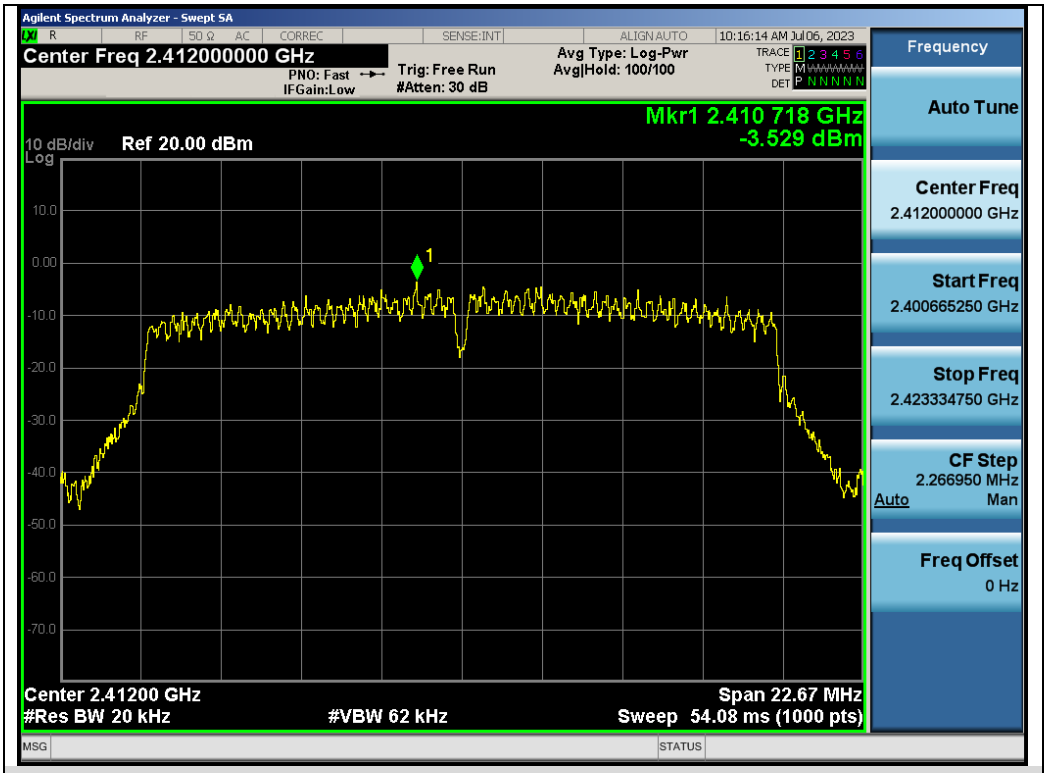
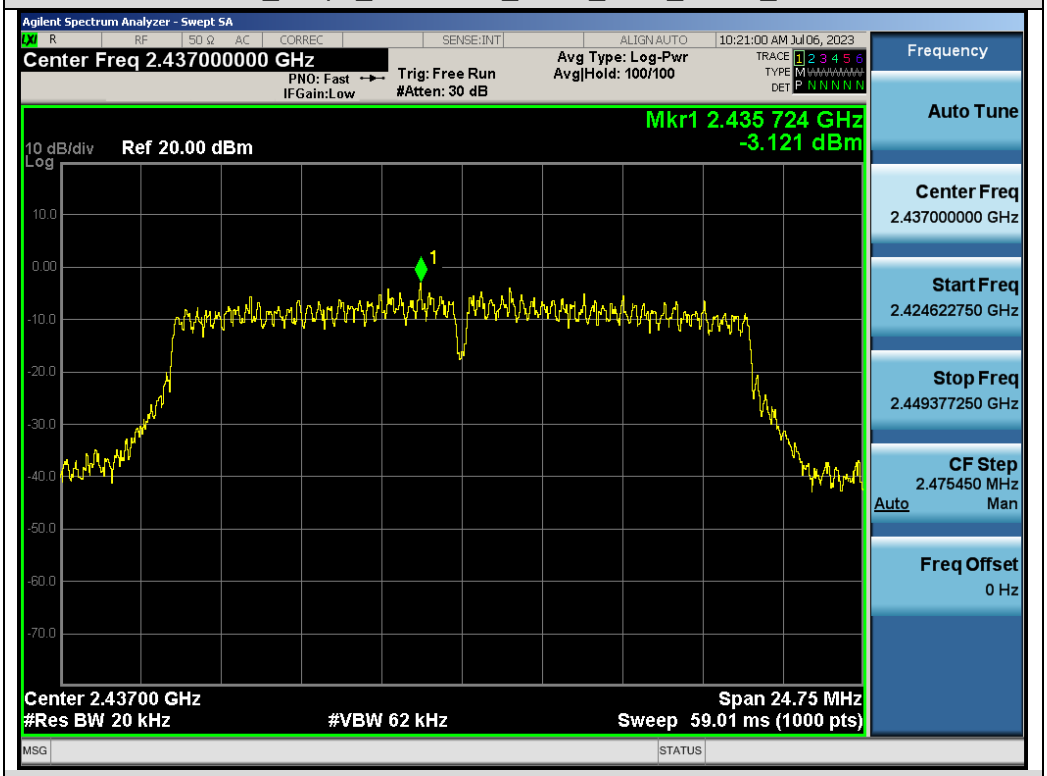


Test_Graph_802.11n20_ANT1_2412_MCS0_PSD



Test_Graph_802.11n20_ANT1_2437_MCS0_PSD

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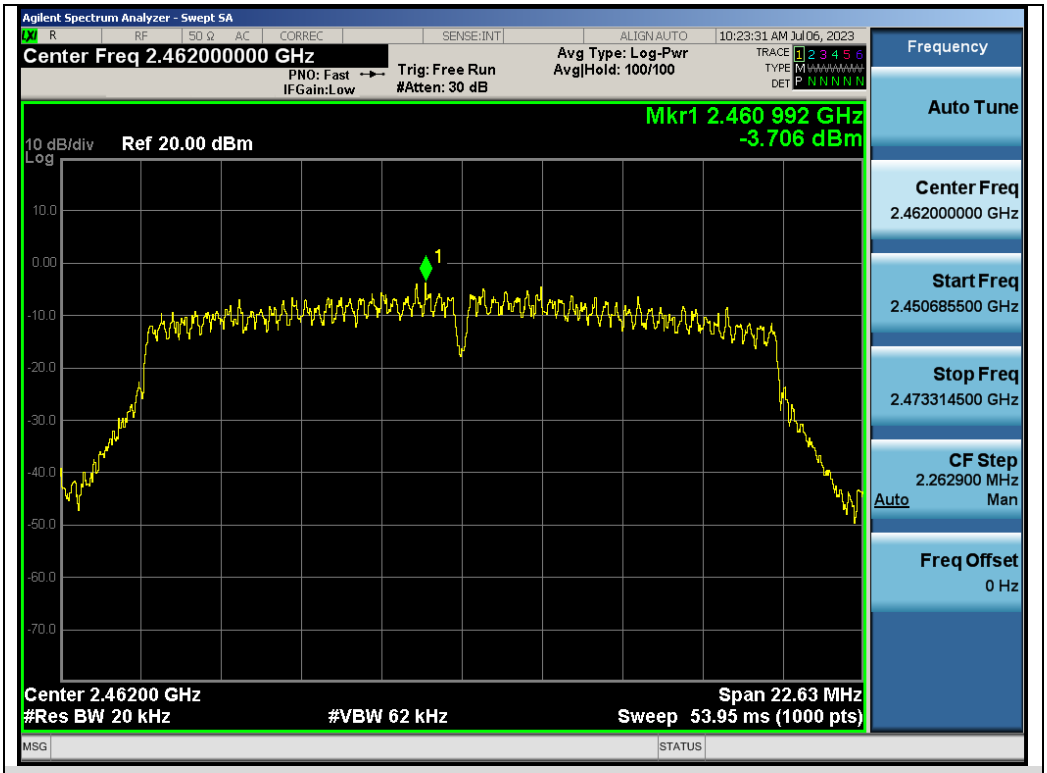

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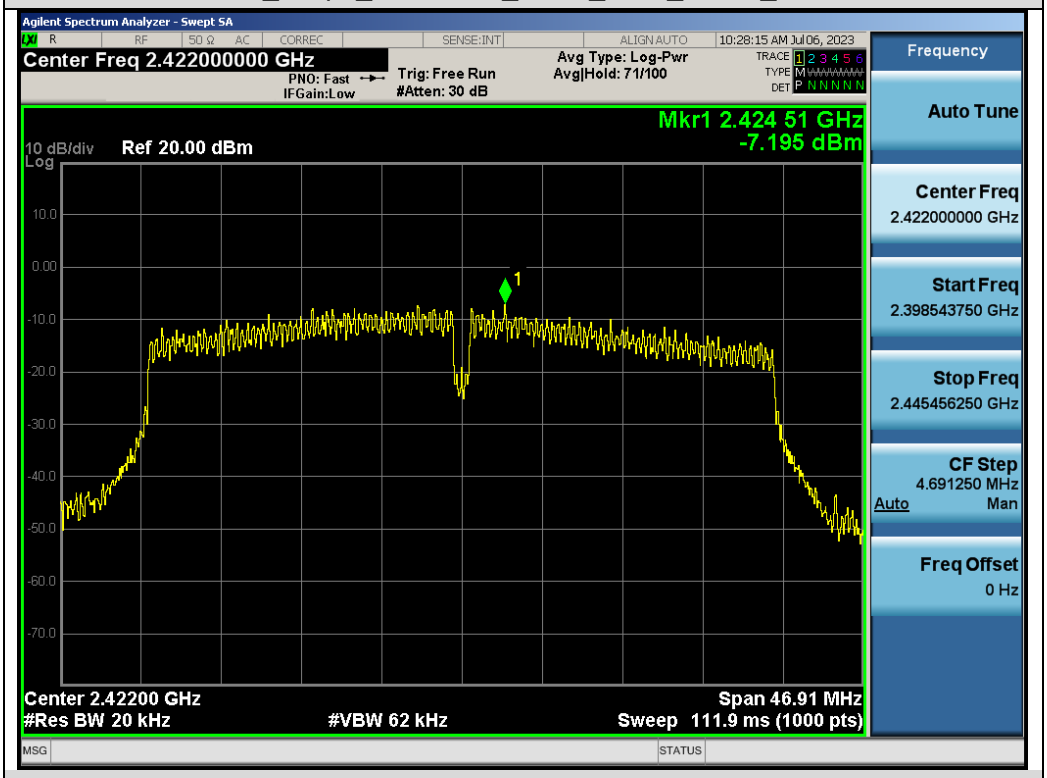

Test_Graph_802.11n40_ANT1_2422_MCS0_PSD

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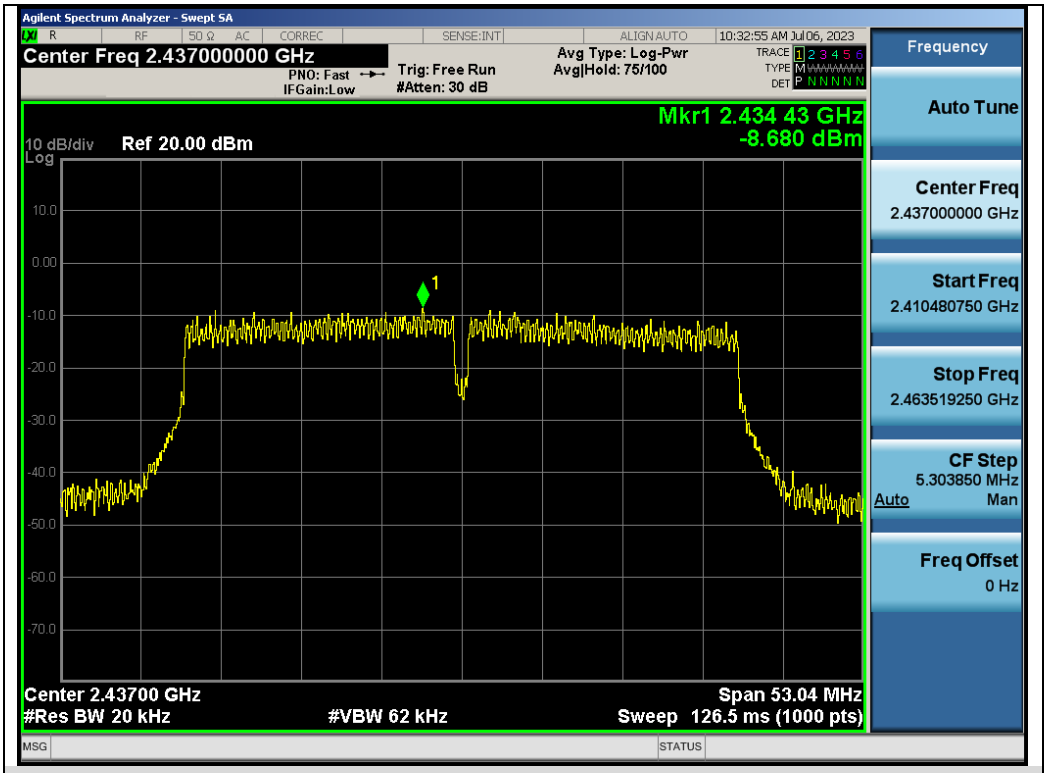
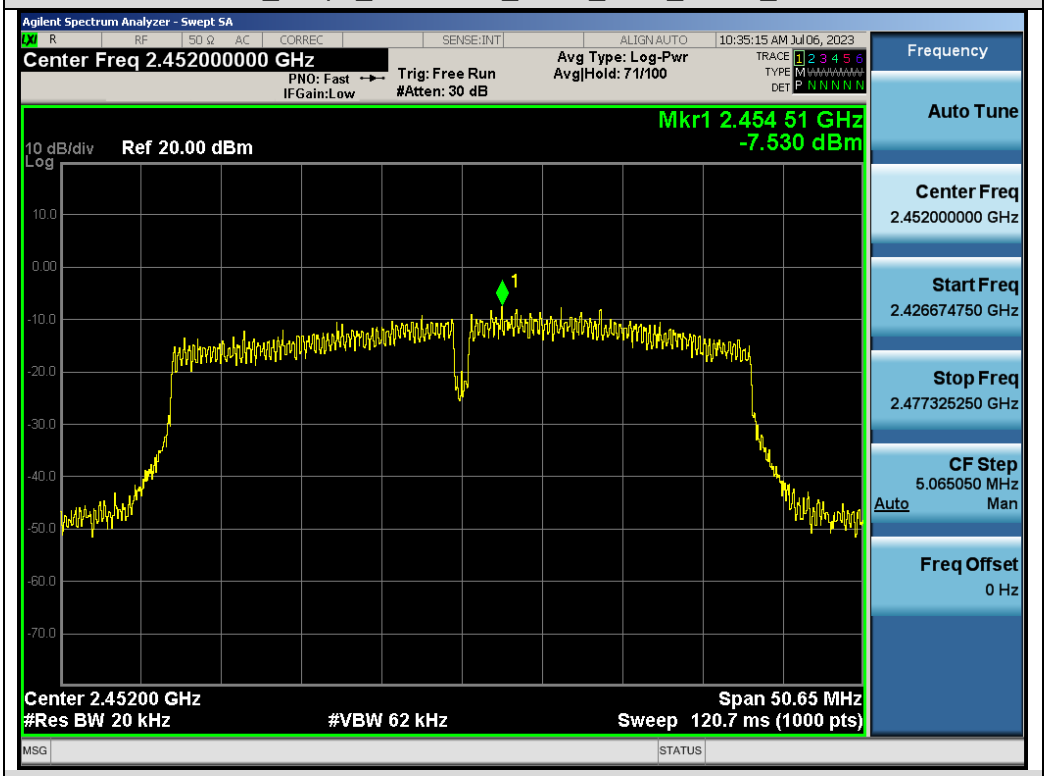


Test_Graph_802.11n40_ANT1_2437_MCS0_PSD



Test_Graph_802.11n40_ANT1_2452_MCS0_PSD

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11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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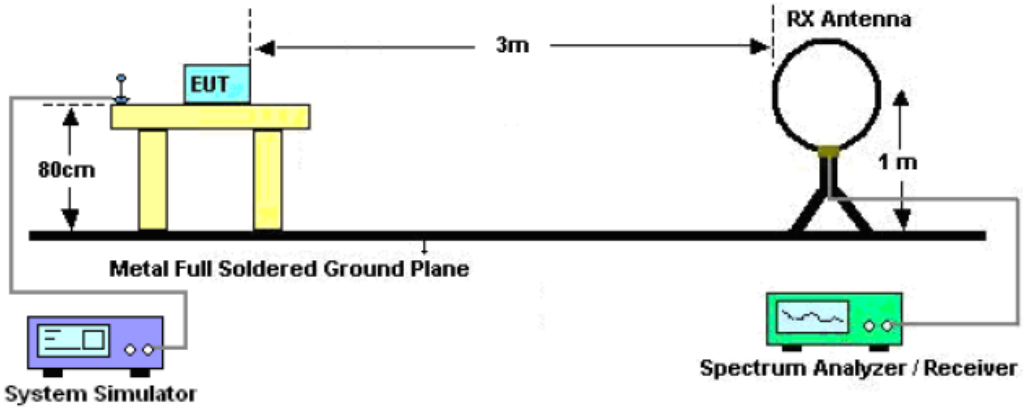
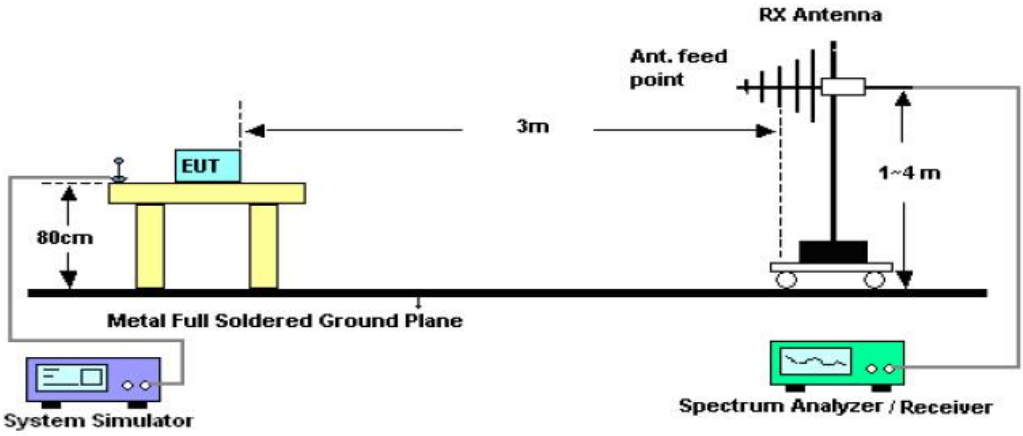
11.2. TEST SETUP

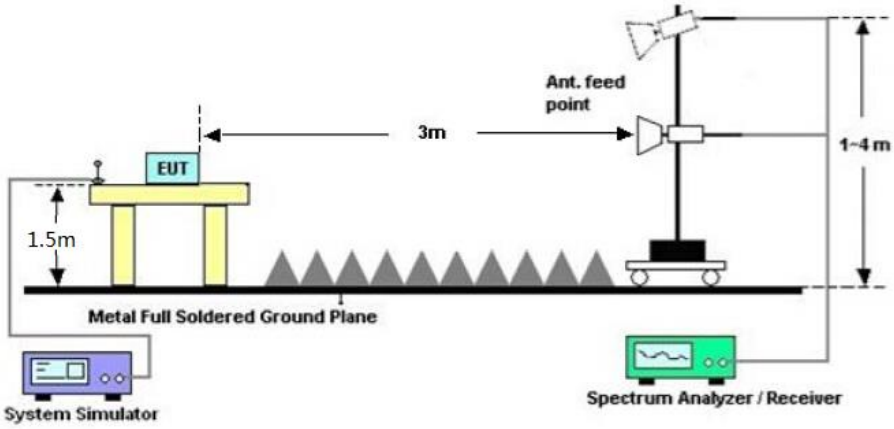
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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11.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested for restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

11.4. TEST RESULT

Radiated emission below 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

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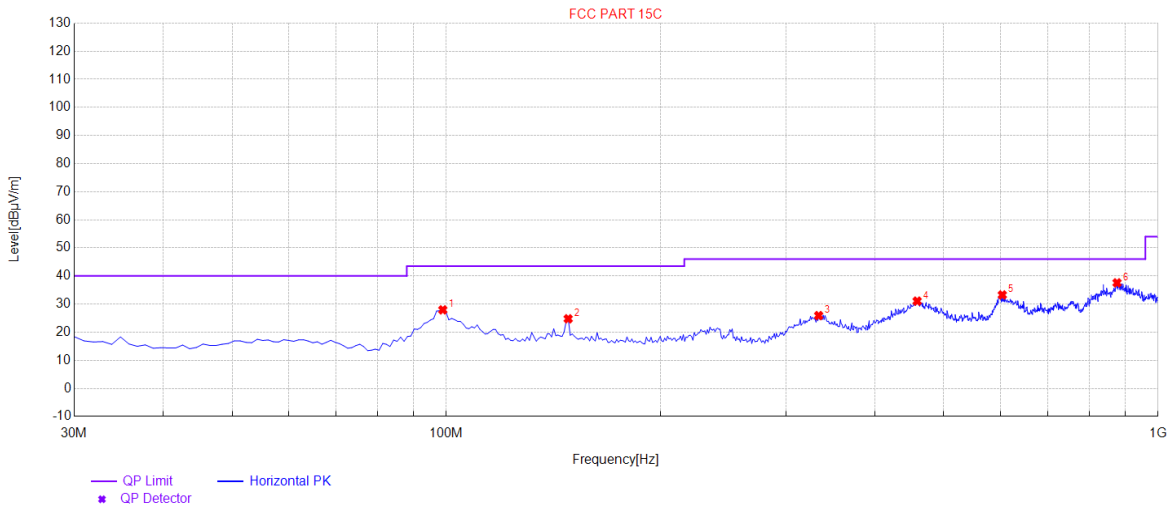
Radiated emission from 30MHz to 1000MHz

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	98.87	27.93	20.81	43.50	15.57	100	160	Horizontal
2	148.34	24.76	14.46	43.50	18.74	100	80	Horizontal
3	333.61	25.90	21.02	46.00	20.10	100	50	Horizontal
4	458.74	31.05	27.45	46.00	14.95	100	50	Horizontal
5	604.24	33.25	28.57	46.00	12.75	100	80	Horizontal
6	875.84	37.56	32.60	46.00	8.44	100	80	Horizontal

RESULT: PASS

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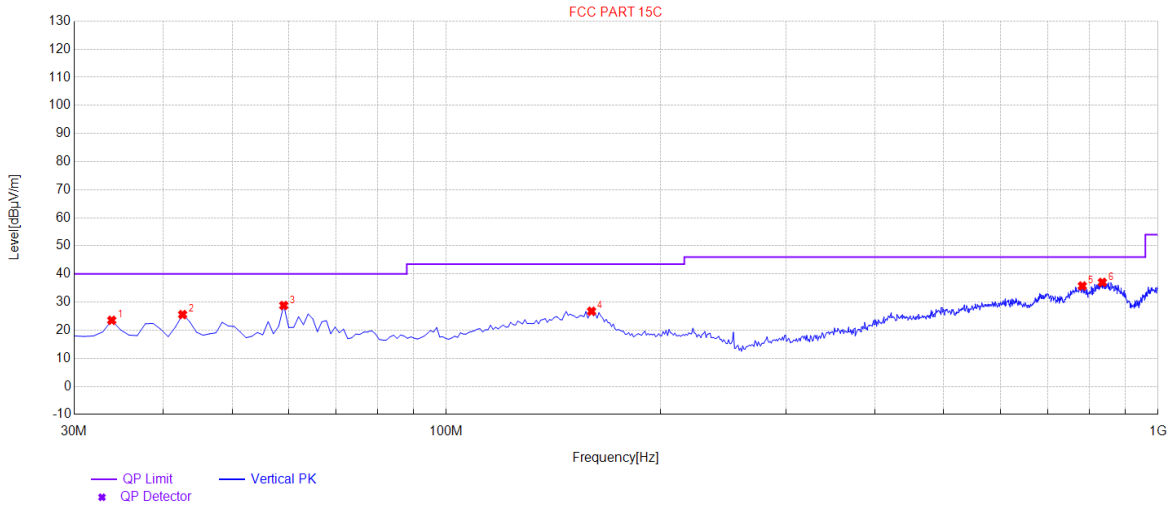
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.88	23.51	10.57	40.00	16.49	100	320	Vertical
2	42.61	25.55	12.15	40.00	14.45	100	300	Vertical
3	59.1	28.78	14.77	40.00	11.22	100	270	Vertical
4	159.98	26.73	21.94	43.50	16.77	100	160	Vertical
5	782.72	35.73	30.77	46.00	10.27	100	120	Vertical
6	835.1	37.02	32.30	46.00	8.98	100	270	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

3. All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.

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Radiated emission above 1GHz

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	55.36	0.08	55.44	74	-18.56	peak
4824.000	46.31	0.08	46.39	54	-7.61	AVG
7236.000	49.57	2.21	51.78	74	-22.22	peak
7236.000	41.05	2.21	43.26	54	-10.74	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	55.94	0.08	56.02	74	-17.98	peak
4824.000	46.34	0.08	46.42	54	-7.58	AVG
7236.000	51.08	2.21	53.29	74	-20.71	peak
7236.000	42.15	2.21	44.36	54	-9.64	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	56.37	0.14	56.51	74	-17.49	peak
4874.000	46.25	0.14	46.39	54	-7.61	AVG
7311.000	51.34	2.36	53.7	74	-20.3	peak
7311.000	41.26	2.36	43.62	54	-10.38	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	55.19	0.14	55.33	74	-18.67	peak
4874.000	46.37	0.14	46.51	54	-7.49	AVG
7311.000	51.02	2.36	53.38	74	-20.62	peak
7311.000	40.35	2.36	42.71	54	-11.29	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	55.19	0.22	55.41	74	-18.59	peak
4924.000	46.34	0.22	46.56	54	-7.44	AVG
7386.000	49.61	2.64	52.25	74	-21.75	peak
7386.000	30.58	2.64	33.22	54	-20.78	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	57.46	0.22	57.68	74	-16.32	peak
4924.000	46.34	0.22	46.56	54	-7.44	AVG
7386.000	51.08	2.64	53.72	74	-20.28	peak
7386.000	42.18	2.64	44.82	54	-9.18	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

All test modes had been pre-tested. The 802.11b mode is the worst case and recorded in the report.

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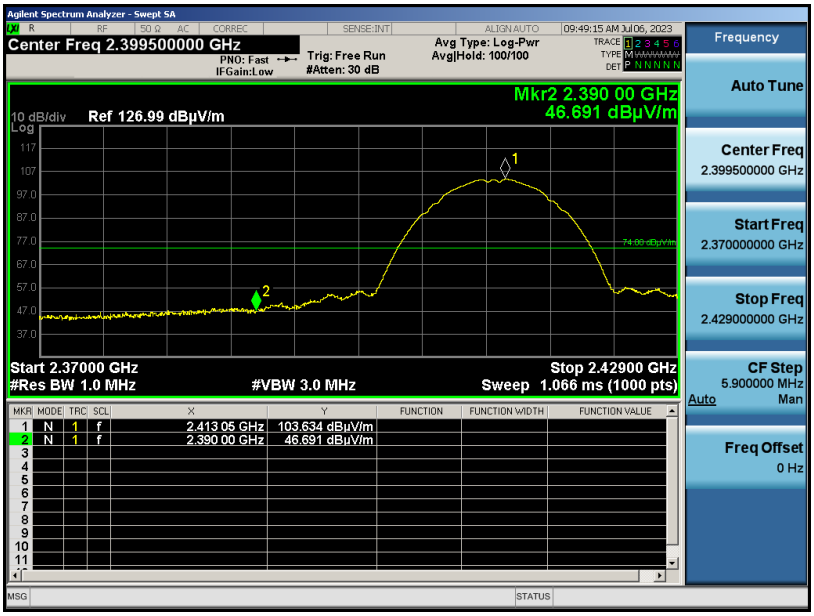
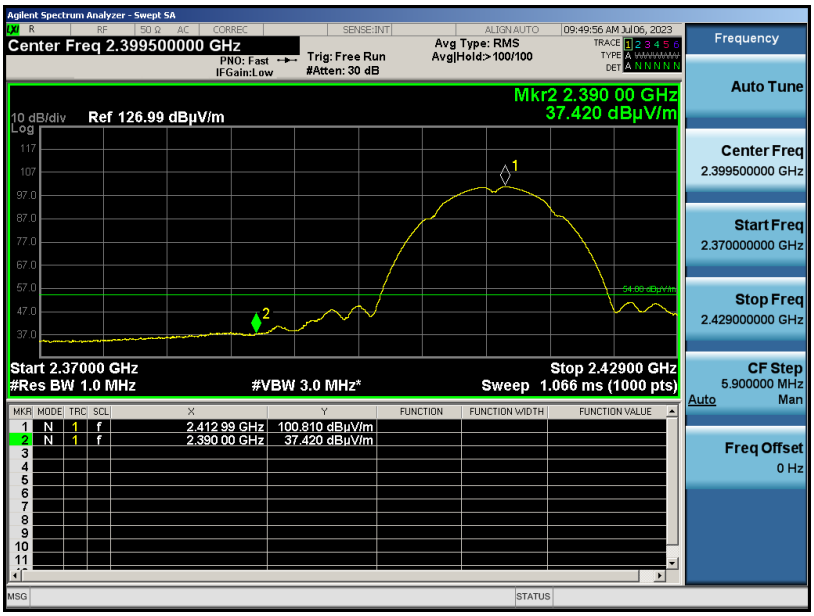
Test result for band edge emission at restricted bands

EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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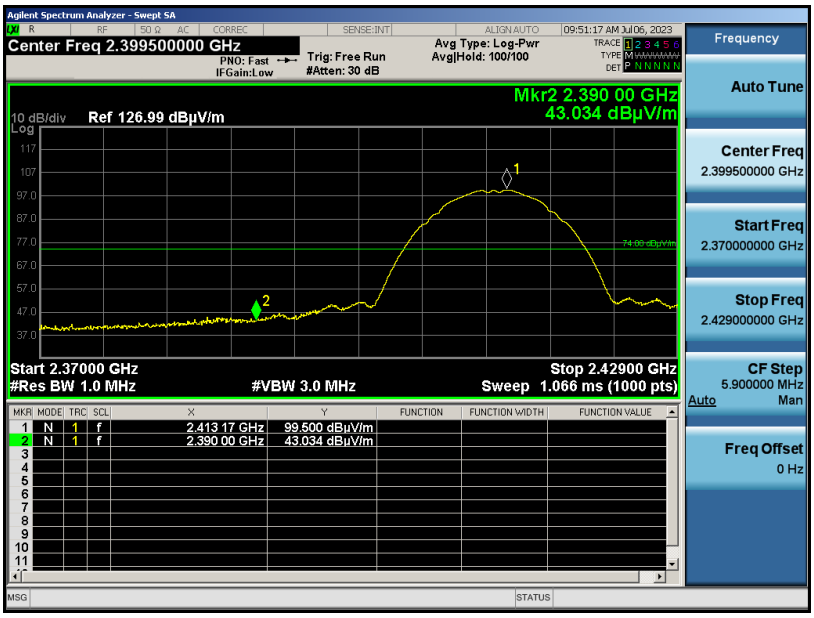
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement

RESULT: PASS

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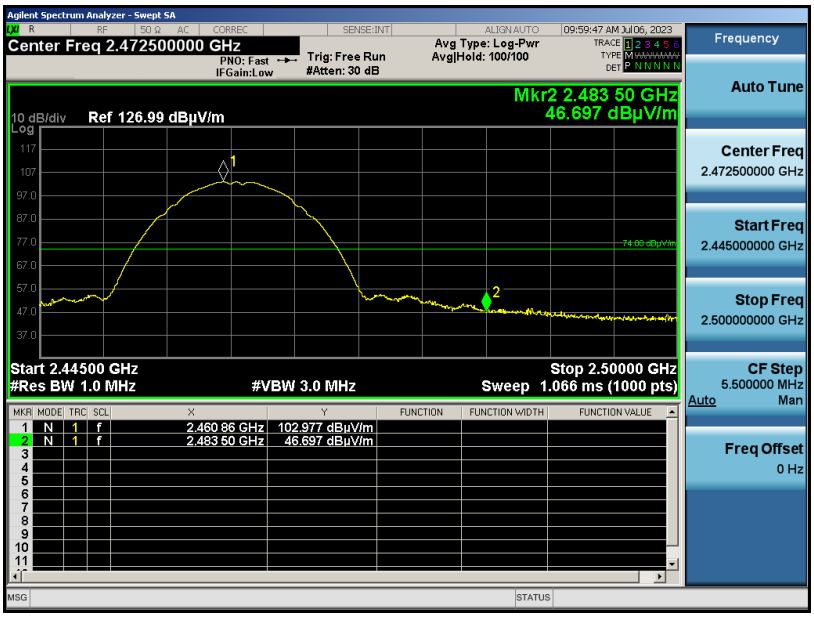
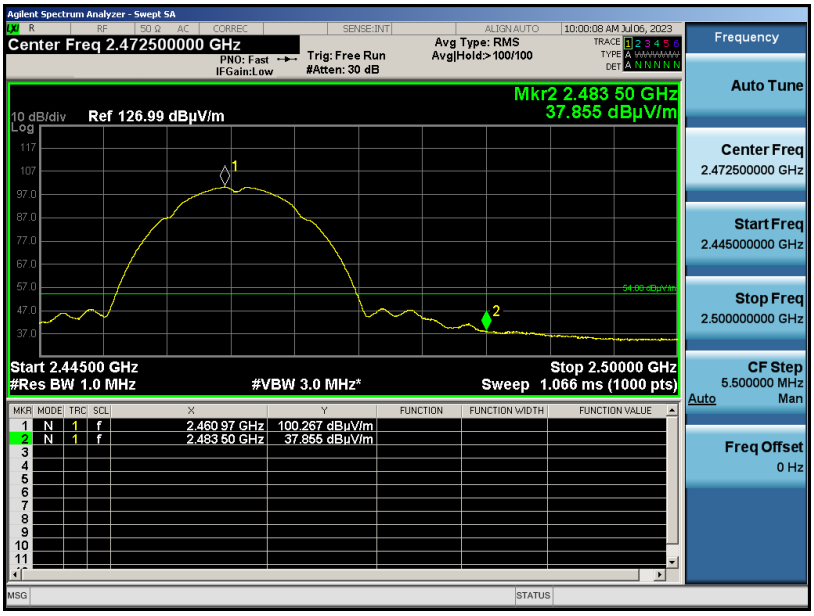
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



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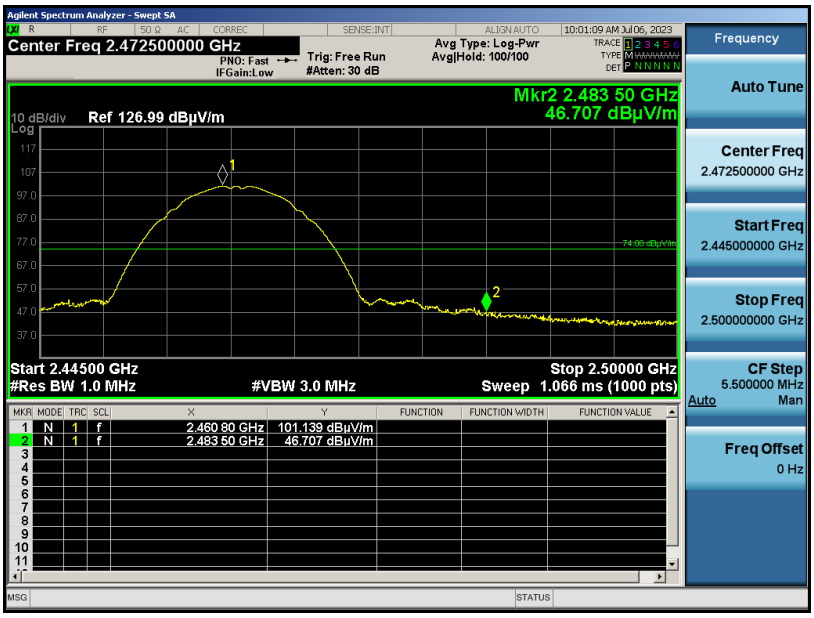
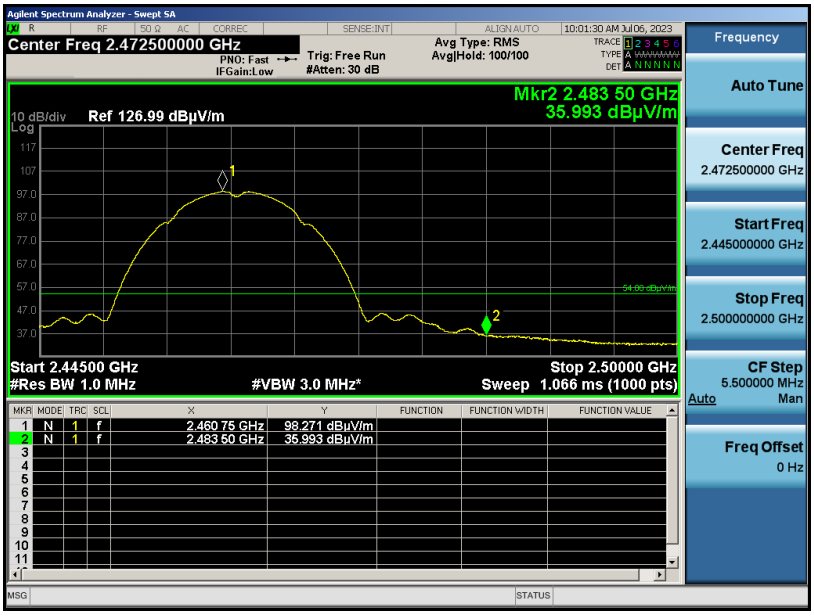
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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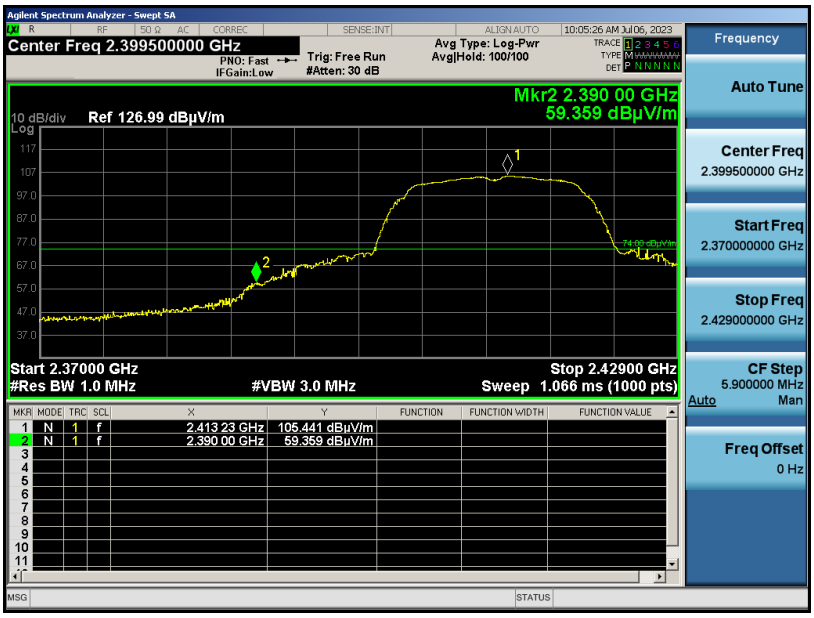
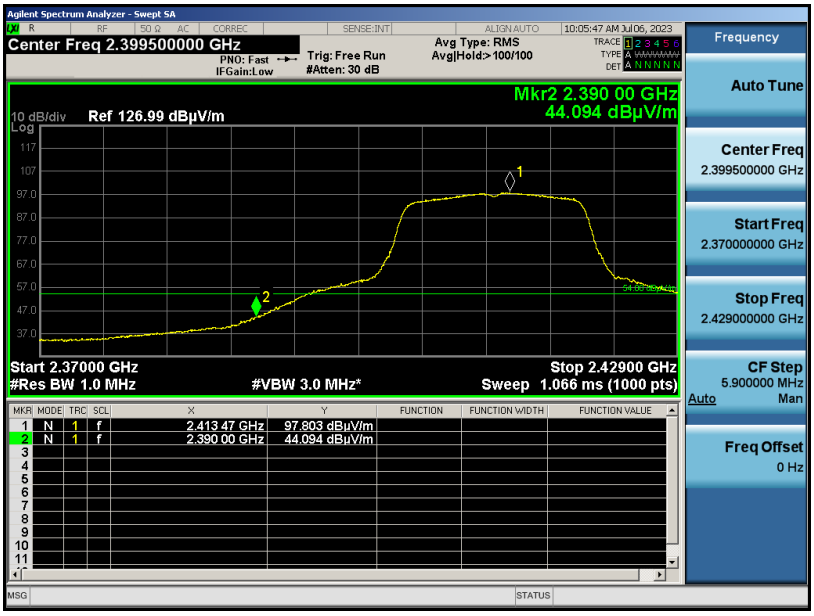
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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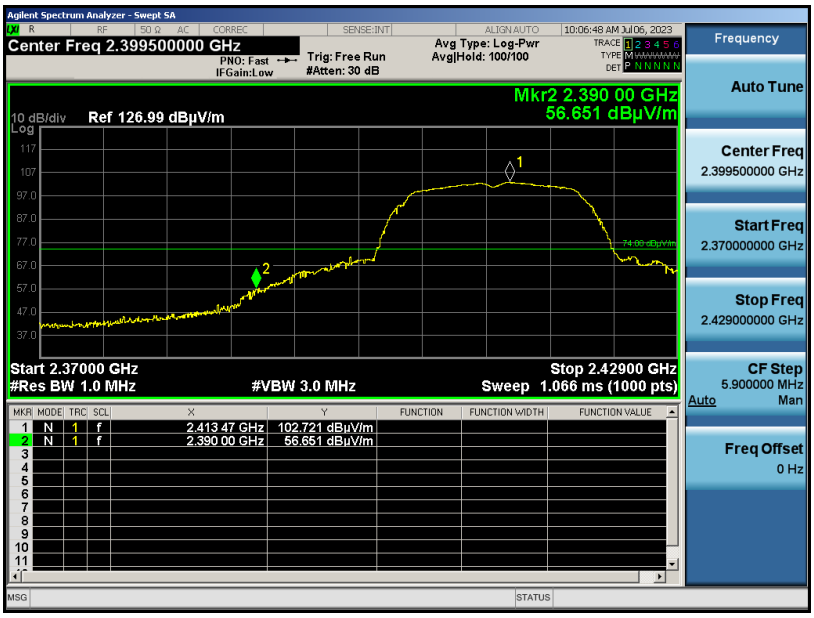
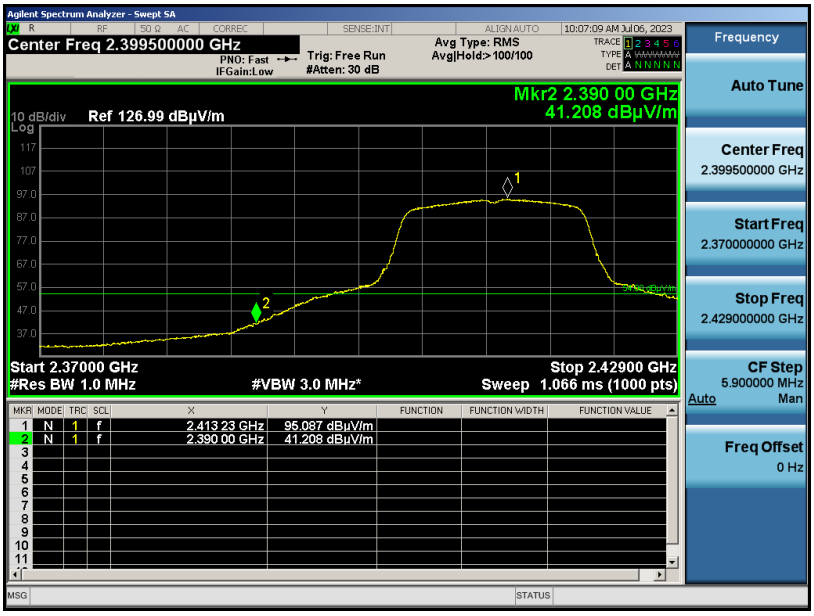
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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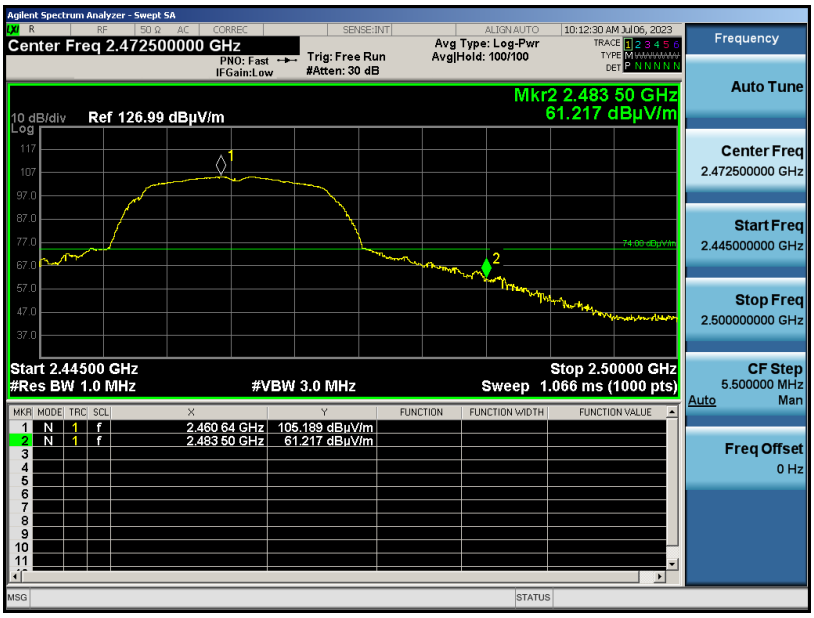
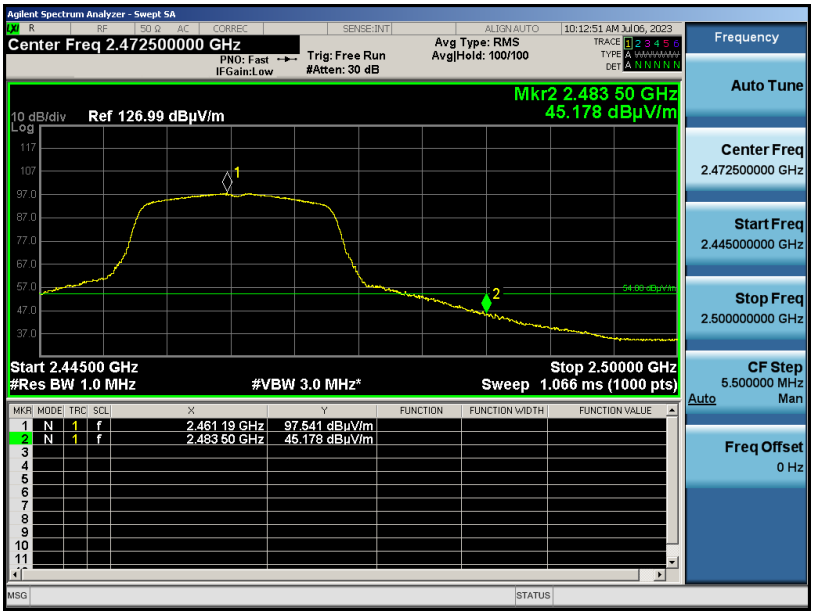
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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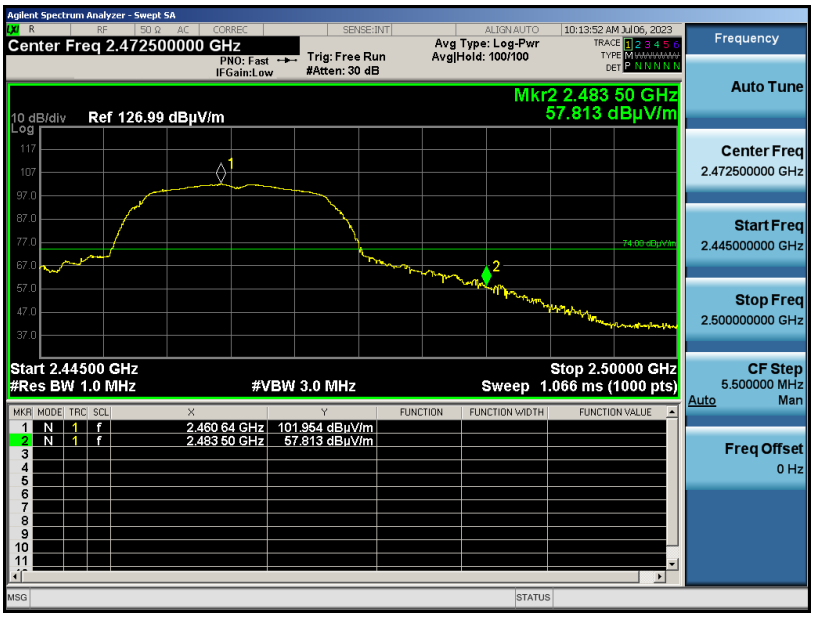
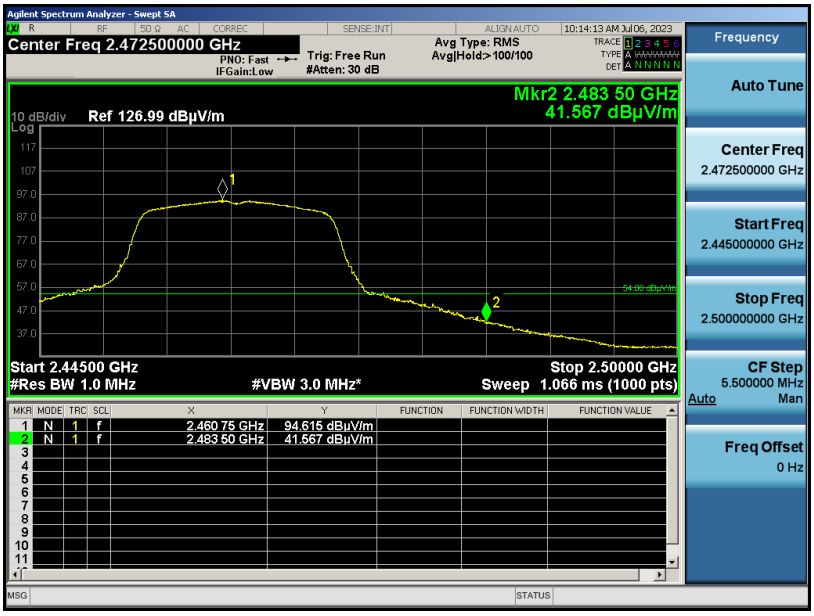
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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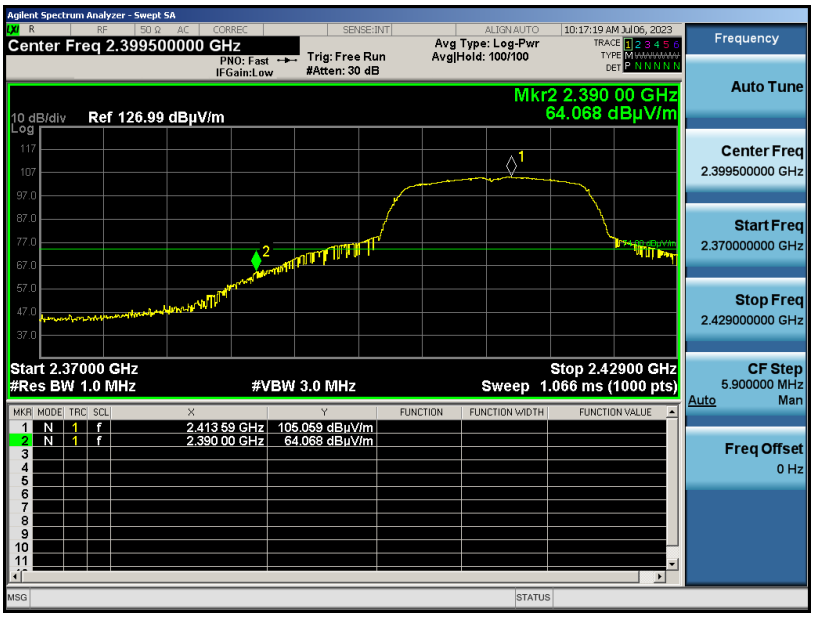
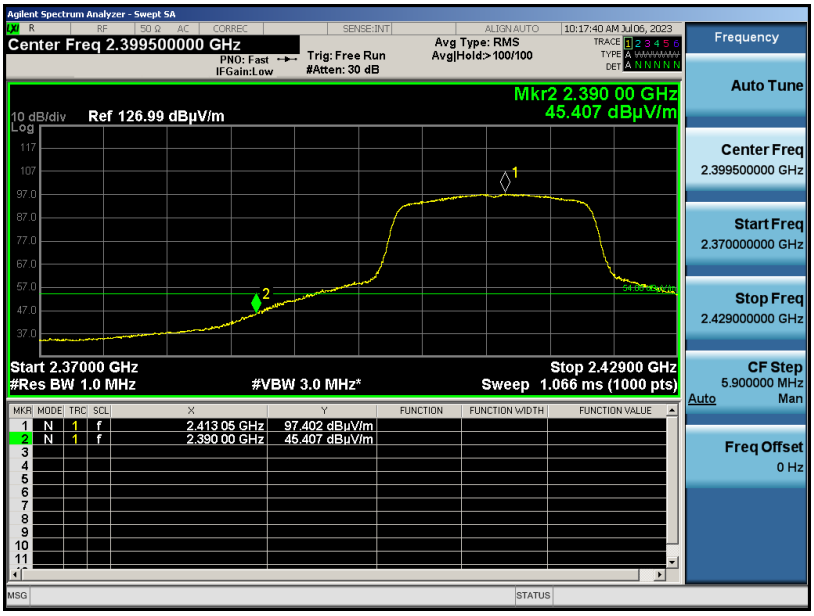
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n20 with data rate 6.5 2412MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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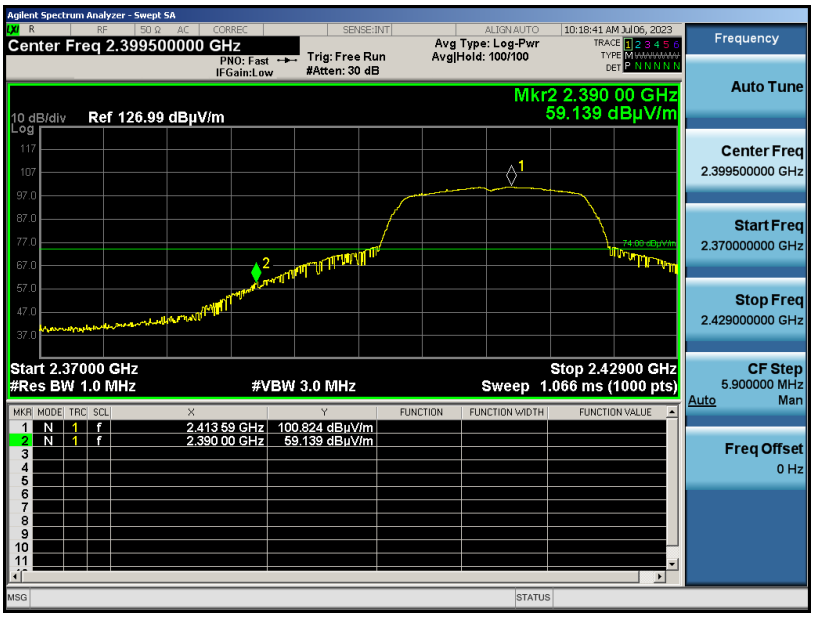
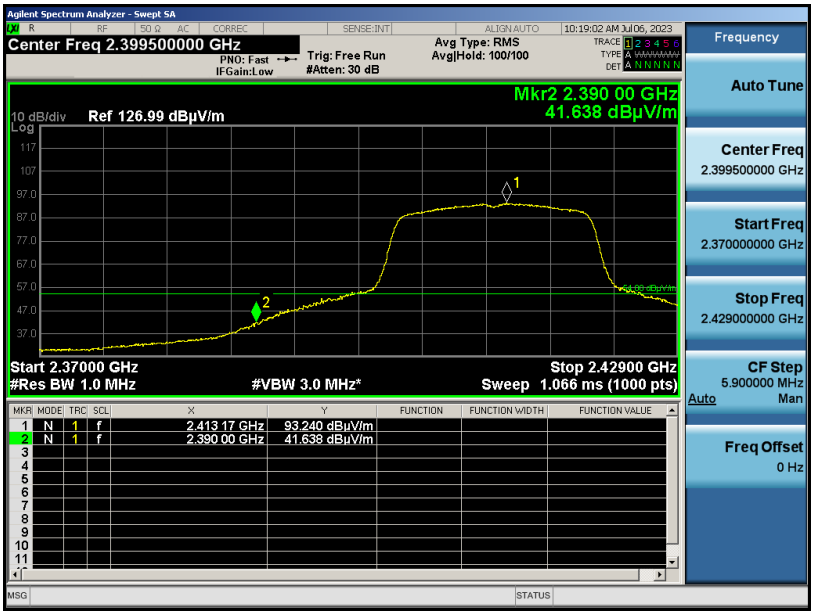
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n20 with data rate 6.5 2412MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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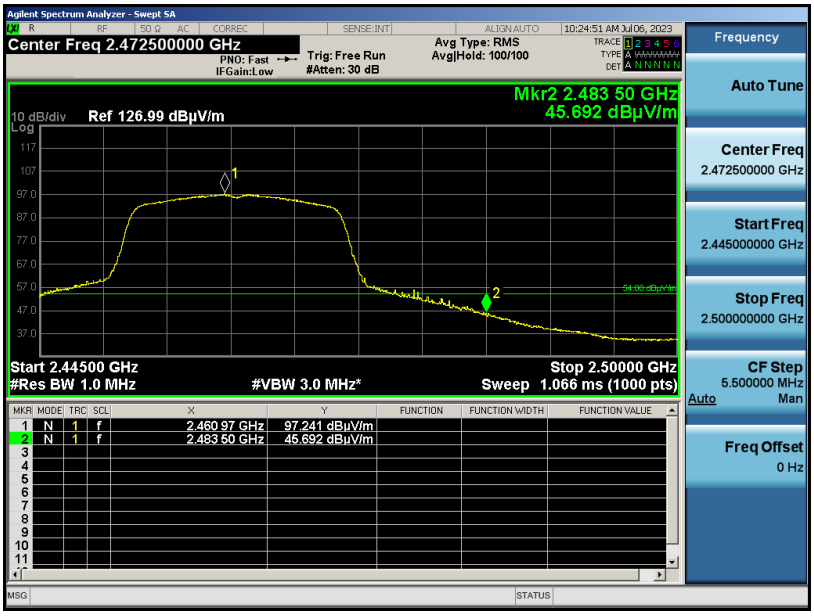
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n20 with data rate 6.5 2462MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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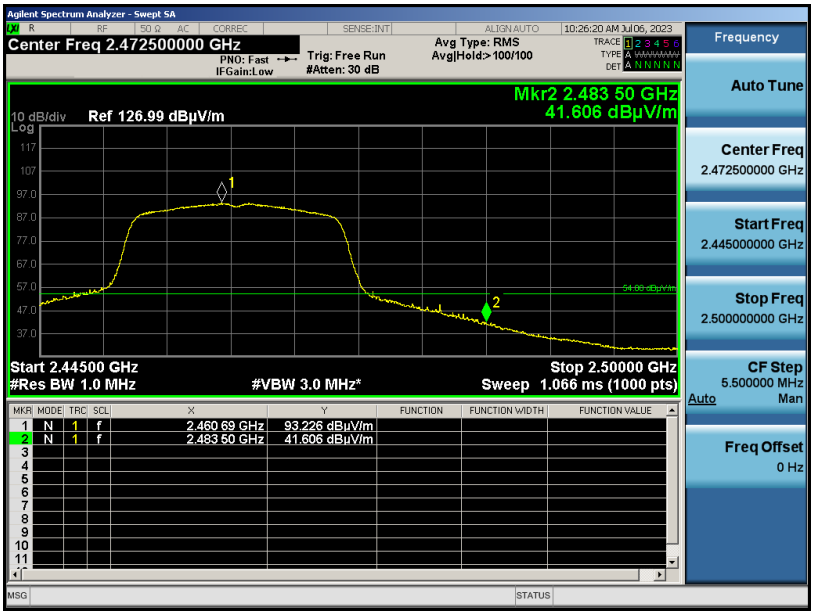
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n20 with data rate 6.5 2462MHz	**Antenna**	Vertical

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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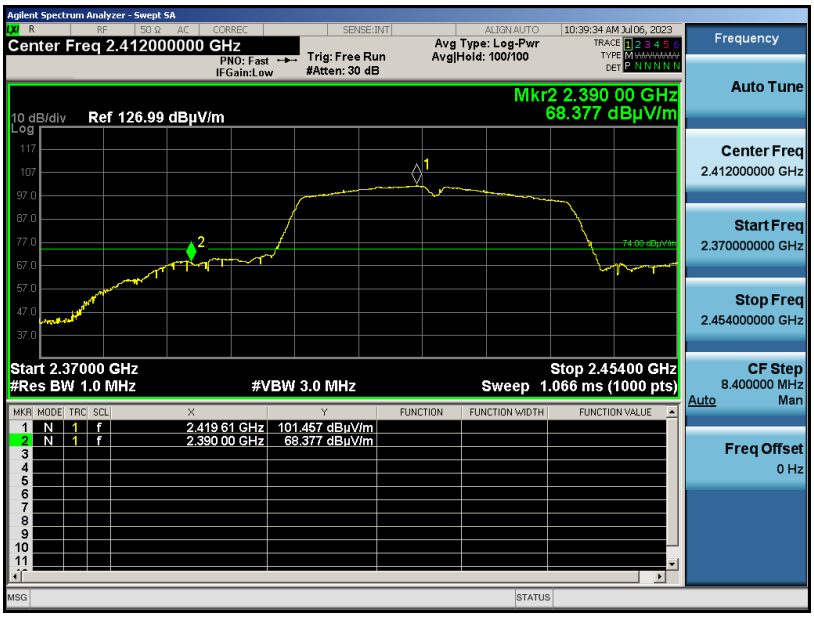
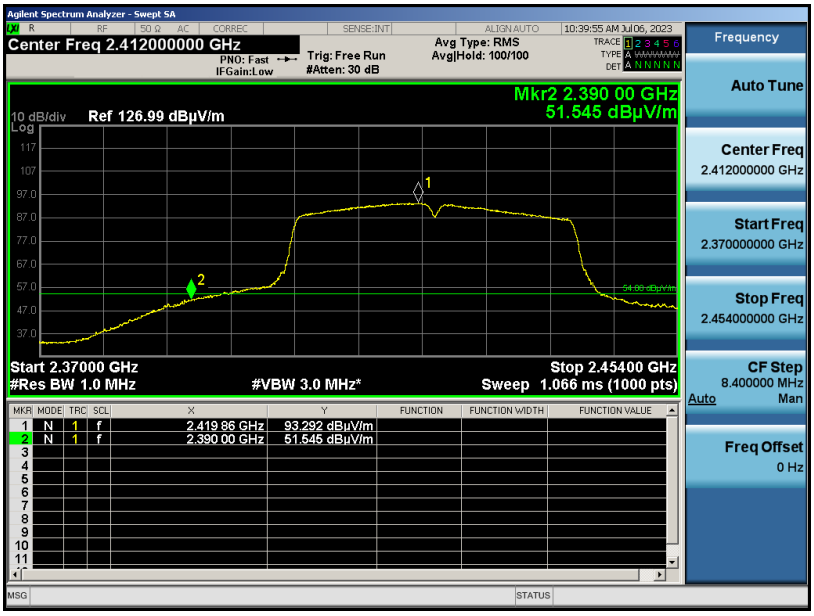
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n40 with data rate 13.5 2422MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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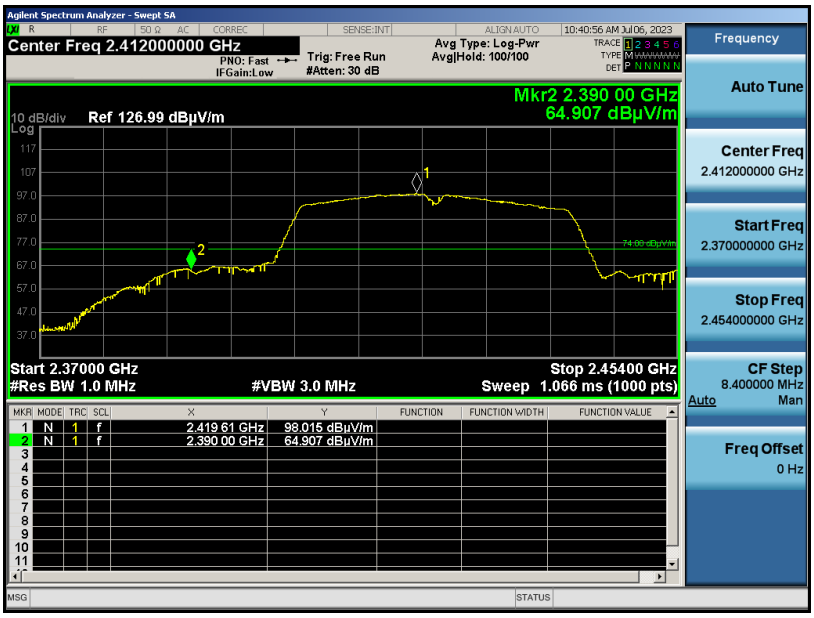
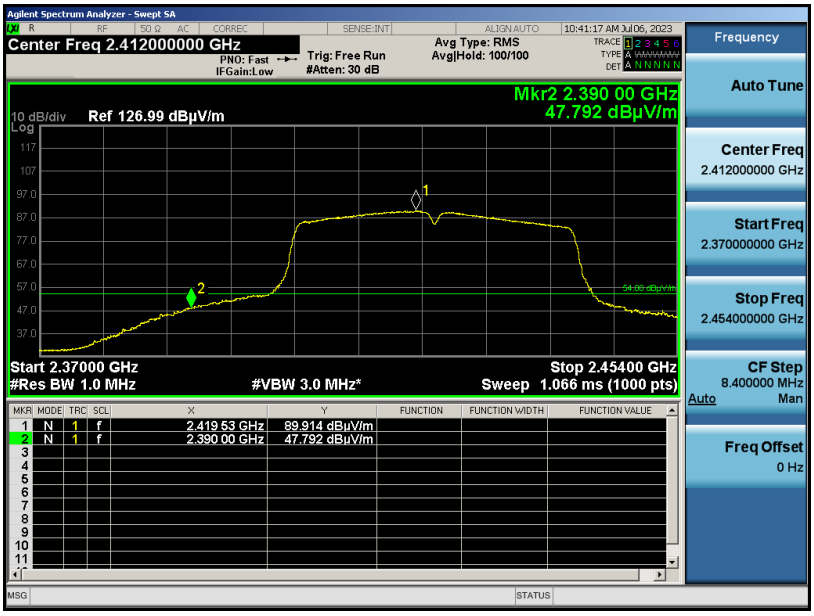
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n40 with data rate 13.5 2422MHz	**Antenna**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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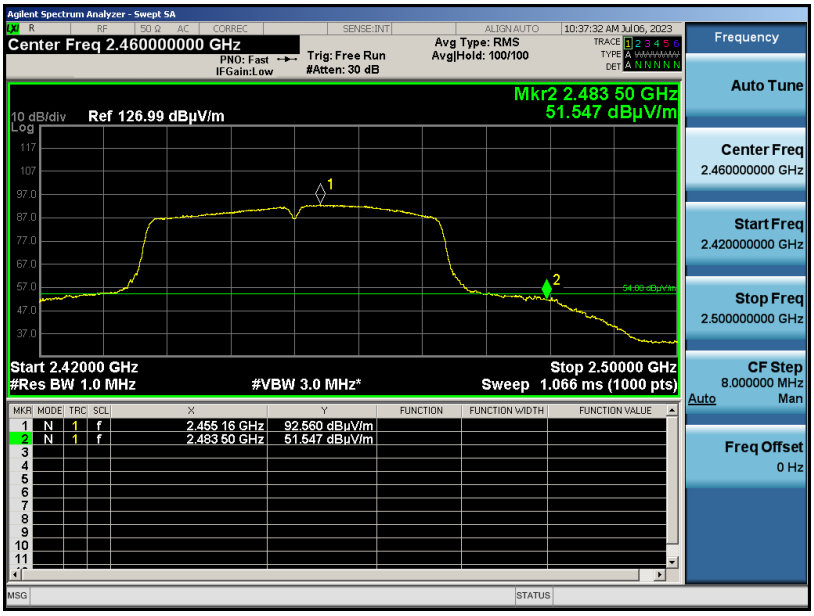
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n40 with data rate 13.5 2452MHz	**Antenna**	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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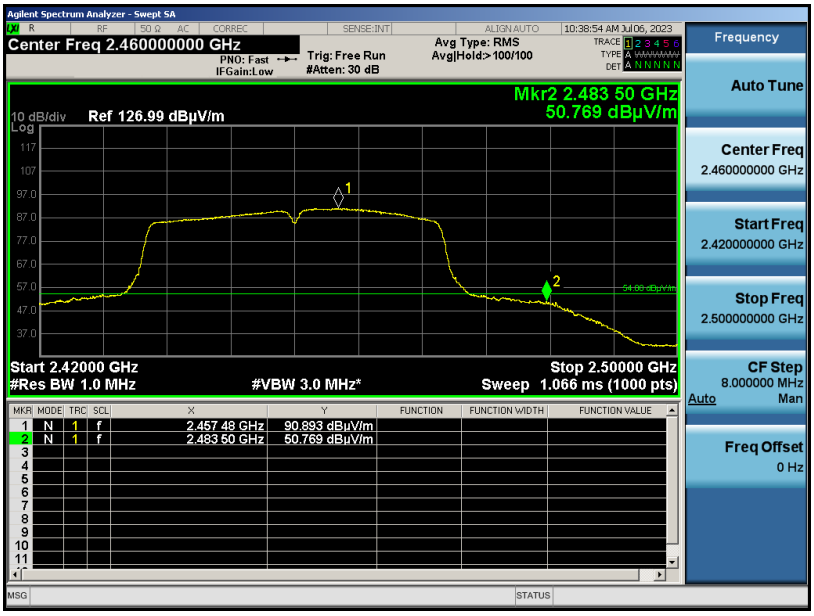
EUT	GNSS RTK Base Station	**Model Name**	NTRIP-X
Temperature	25°C	**Relative Humidity**	60%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n40 with data rate 13.5 2452MHz	**Antenna**	Vertical

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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12. LINE CONDUCTED EMISSION TEST

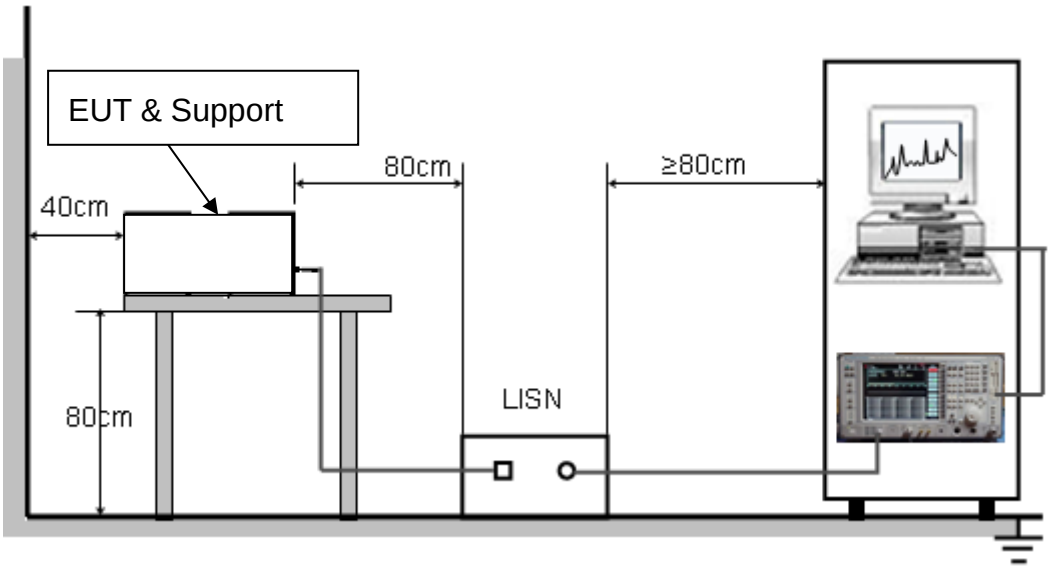
12.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P (dBμV)	Average (dBμV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



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12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 5V power from adapter which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 Ohm load; the second scan had Line 1 connected to a 50 Ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case was reported on the Summary Data page.

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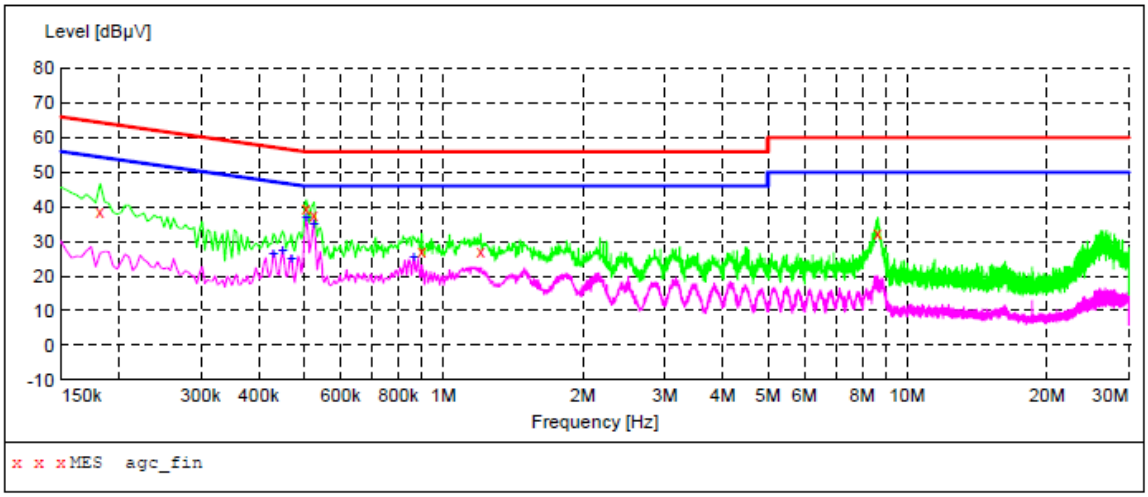
12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



MEASUREMENT RESULT: "agc_fin"

2023/7/7 17:24

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.182000	38.70	6.1	64	25.7	QP	L1
0.506000	39.30	6.1	56	16.7	QP	L1
0.526000	37.80	6.1	56	18.2	QP	L1
0.898000	27.00	6.2	56	29.0	QP	L1
1.202000	26.90	6.2	56	29.1	QP	L1
8.626000	32.40	6.6	60	27.6	QP	L1

MEASUREMENT RESULT: "agc_fin2"

2023/7/7 17:24

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.430000	26.80	6.1	47	20.5	AV	L1
0.450000	27.40	6.1	47	19.5	AV	L1
0.470000	25.10	6.1	47	21.4	AV	L1
0.506000	36.90	6.1	46	9.1	AV	L1
0.526000	35.10	6.1	46	10.9	AV	L1
0.862000	25.50	6.2	46	20.5	AV	L1

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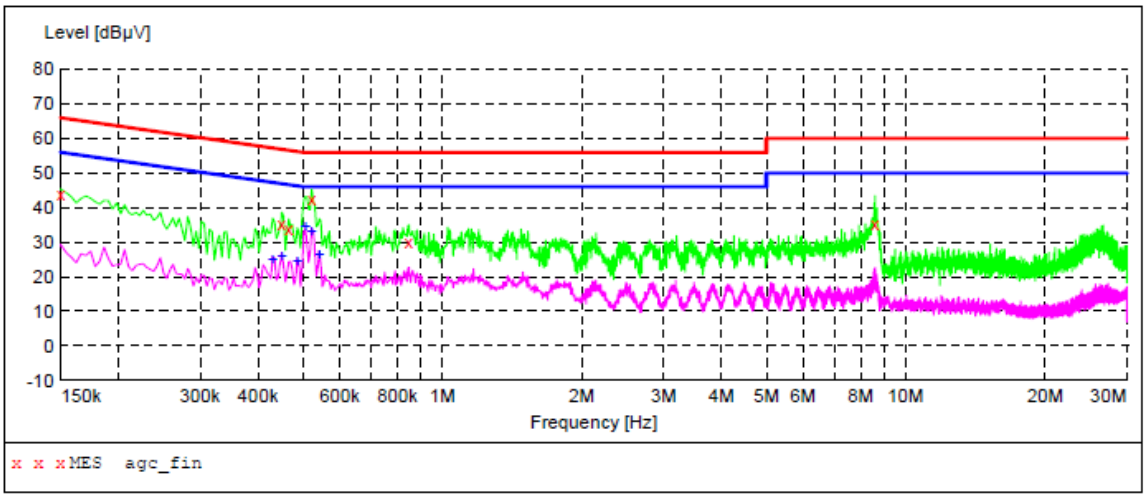
Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "agc_fin"

2023/7/7 17:29

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.150000	43.70	6.1	66	22.3	QP	N
0.450000	35.30	6.1	57	21.6	QP	N
0.466000	33.80	6.1	57	22.8	QP	N
0.522000	42.50	6.1	56	13.5	QP	N
0.846000	30.20	6.2	56	25.8	QP	N
8.586000	35.30	6.6	60	24.7	QP	N

MEASUREMENT RESULT: "agc_fin2"

2023/7/7 17:29

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.430000	25.40	6.1	47	21.9	AV	N
0.450000	26.30	6.1	47	20.6	AV	N
0.486000	24.50	6.1	46	21.7	AV	N
0.506000	34.50	6.1	46	11.5	AV	N
0.522000	33.50	6.1	46	12.5	AV	N
0.542000	26.40	6.1	46	19.6	AV	N

RESULT: PASS

Note: All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.

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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Refer to the Report No.: AGC02762230702AP02

APPENDIX B: PHOTOGRAPHS OF EUT

Refer to the Report No.: AGC02762230702AP03

----END OF REPORT----

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Conditions of Issuance of Test Reports

1. All samples and goods are accepted by the Attestation of Global Compliance (Shenzhen) Co., Ltd (the "Company") solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the company and any person, firm or company requesting its services (the "Clients").

2. Any report issued by Company as a result of this application for testing services (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3.The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

5. Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

6. The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

7.Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

8. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.

9. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.