FCC TEST REPORT

FCC ID: 2BCZA-OB16

Product	:	sweeping robot
Model Name	:	OB16
Additional model	:	OB16Pro
Brand	:	bowAI
Report No.	:	PTC23070700702E-FC01

Prepared for

Guangdong obao Intelligent Electric Appliance Co., LTD

Chenghai District, Shantou City, Chenghua Street, New Jia Dongyuan Road, 9 fifth, sixth floor

Prepared by

Precise Testing & Certification Co., Ltd

Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	Guangdong obao Intelligent Electric Appliance Co., LTD
Address	:	Chenghai District, Shantou City, Chenghua Street, New Jia Dongyuan Road, 9 fifth, sixth floor
Manufacture's name	:	Guangdong obao Intelligent Electric Appliance Co., LTD
Address	:	Chenghai District, Shantou City, Chenghua Street, New Jia Dongyuan Road, 9 fifth, sixth floor
Product name	:	sweeping robot
Model name	:	OB16, OB16Pro
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	Sep. 27, 2023 to Oct. 09, 2023
Date of Issue	:	Oct. 19, 2023
Test Result	:	Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Tested By:

Jack Zhou / Engineer

Technical Manager:

Simon Pu / Manager

Contents

Page

1 TEST RESULT CERTIFICATION **2**

2 TEST SUMMARY **5**

3 GENERAL INFORMATION **6**

3.1 GENERAL DESCRIPTION OF E.U.T. 6

3.2 CHANNEL LIST 7

3.3 TEST SITE 12

4 EQUIPMENT DURING TEST **13**

4.1 EQUIPMENTS LIST 13

4.2 MEASUREMENT UNCERTAINTY 15

4.3 DESCRIPTION OF SUPPORT UNITS 16

5 CONDUCTED EMISSION **17**

5.1 E.U.T. OPERATION 17

5.2 EUT SETUP 17

5.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 18

5.4 MEASUREMENT PROCEDURE 18

5.5 CONDUCTED EMISSION LIMIT 18

5.6 MEASUREMENT DESCRIPTION 18

5.7 CONDUCTED EMISSION TEST RESULT 18

6 RADIATED SPURIOUS EMISSIONS **21**

6.1 EUT OPERATION 21

6.2 TEST SETUP 22

6.3 SPECTRUM ANALYZER SETUP 23

6.4 TEST PROCEDURE 24

6.5 SUMMARY OF TEST RESULTS 25

7 CONDUCTED SPURIOUS EMISSION **39**

7.1 TEST PROCEDURE 39

7.2 TEST SETUP 39

7.3 TEST RESULT 39

8 BAND EDGE MEASUREMENT **55**

8.1 TEST PROCEDURE 55
8.2 TEST SETUP 55
8.3 TEST RESULT 56
9 6DB BANDWIDTH MEASUREMENT 60
9.1 TEST PROCEDURE 60
9.2 TEST SETUP 60
9.3 TEST RESULT 60
10 MAXIMUM PEAK OUTPUT POWER 66
10.1 TEST PROCEDURE 66
10.2 TEST SETUP 66
10.3 TEST RESULT 66
11 POWER SPECTRAL DENSITY 67
11.1 TEST PROCEDURE 67
11.2 TEST SETUP 67
11.3 TEST RESULT 67
12 ANTENNA APPLICATION 73
12.1 ANTENNA REQUIREMENT 73
12.2 RESULT 73
13 TEST SETUP 74
14 EUT PHOTOS 76

2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious Emission	15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3)	PASS
Power Spectral Density	15.247(e)	PASS
Antenna Requirement	15.203	PASS
Remark: N/A: Not Applicable		

3 General Information

3.1 General Description of E.U.T.

Product Name	:	sweeping robot
Model Name	:	OB16
Additional model	:	OB16Pro
Model difference	:	Only the size and parameters are different.
Specification	:	802.11b/g/n HT20
Operating frequency	:	2412-2462MHz for 802.11b/g/ n(HT20)
Numbers of Channel	:	11 channels
Antenna Type	:	PCB Antenna
Antenna Gain	:	2.54 dBi
Type of Modulation	:	DSSS with DBPSK/DQPSK/CCK for 802.11b; OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n;
Power supply	:	Input: DC 19V, 500mA Output: DC 14.4V,1500mA
Hardware Version/HMN	:	V3.0
Software Version/FVIN	:	1.4.6
Test Sample No.	:	PTC23070700702E-1/2, PTC23070700702E-2/2

3.2 Channel List

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20): MCS0;) were used for all test.

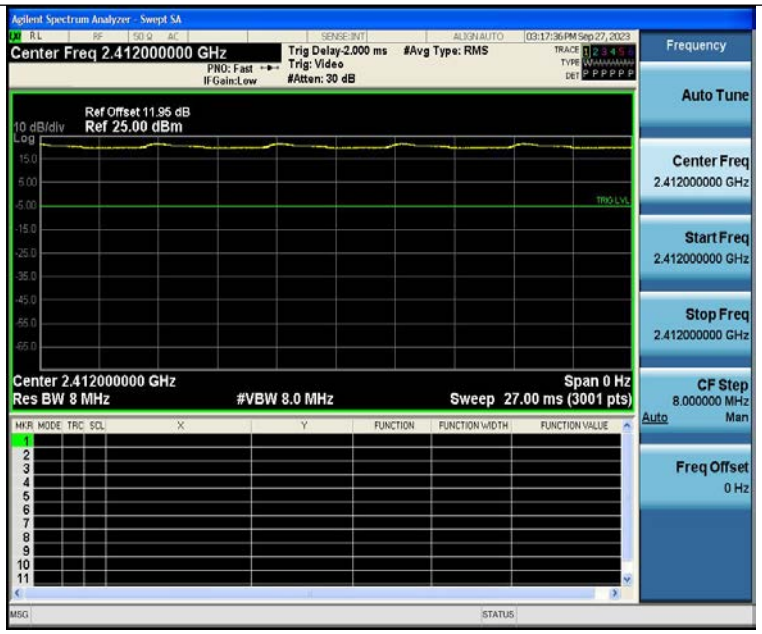
Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for 802.11 b/g/n (HT20)

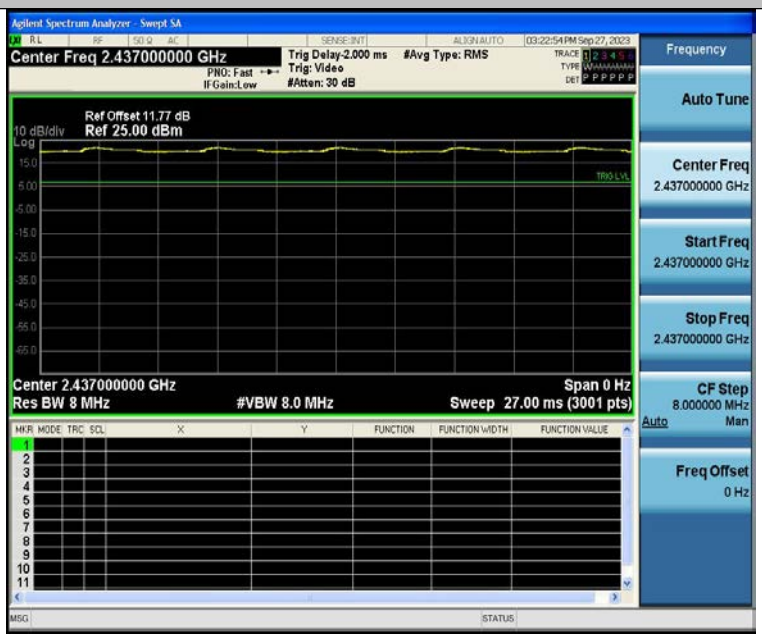
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2427	8	2447		

The maximum duty cycle as following table:

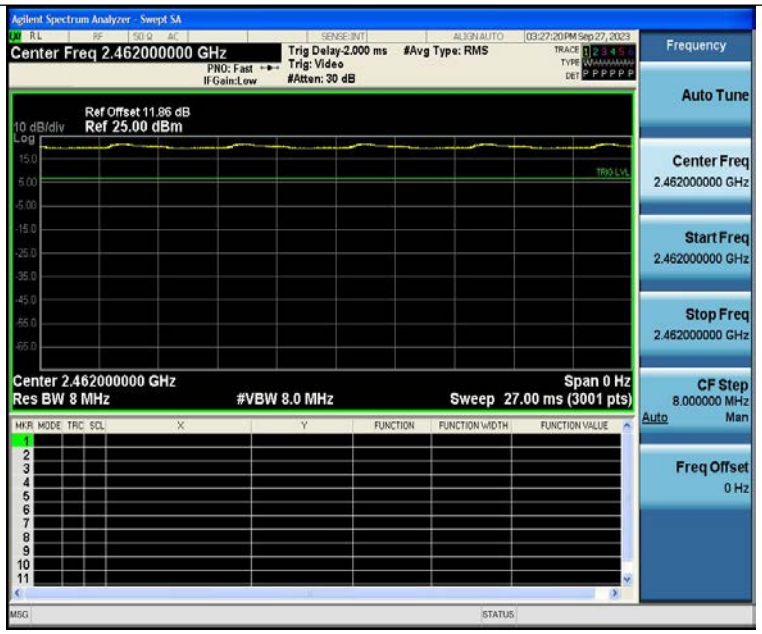
Test Mode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Factor
11B	Ant1	2412	27.00	27.00	100.00	0.00
11B	Ant1	2437	27.00	27.00	100.00	0.00
11B	Ant1	2462	27.00	27.00	100.00	0.00
11G	Ant1	2412	27.00	27.00	100.00	0.00
11G	Ant1	2437	27.00	27.00	100.00	0.00
11G	Ant1	2462	27.00	27.00	100.00	0.00
11N20SISO	Ant1	2412	27.00	27.00	100.00	0.00
11N20SISO	Ant1	2437	27.00	27.00	100.00	0.00
11N20SISO	Ant1	2462	27.00	27.00	100.00	0.00



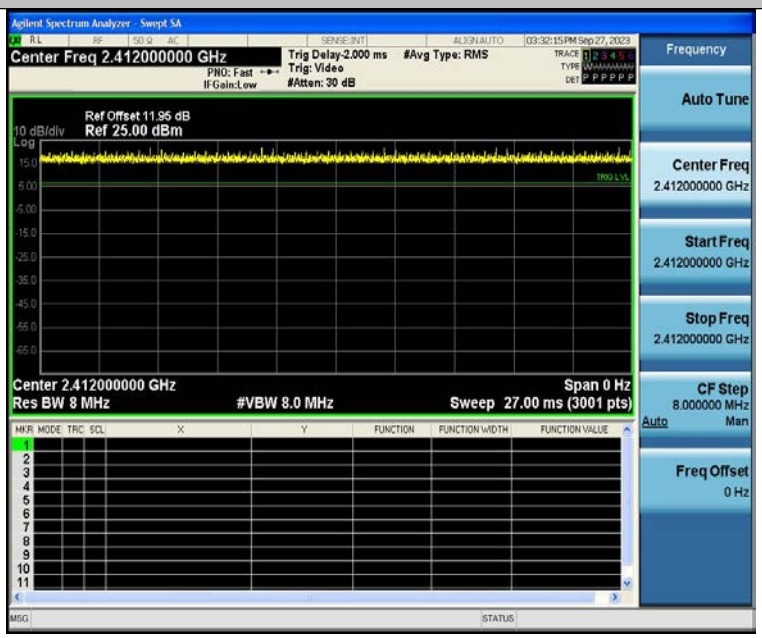
NTNV-11B-Ant1-2412



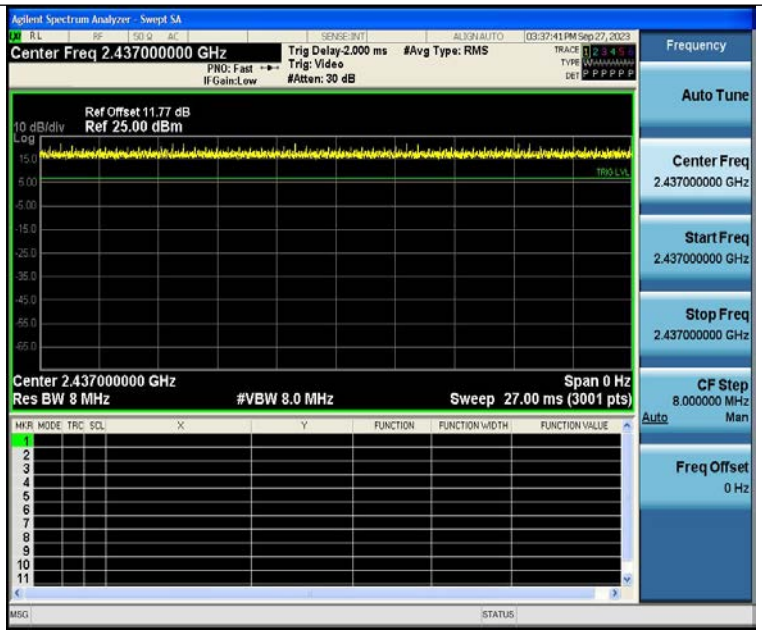
NTNV-11B-Ant1-2437



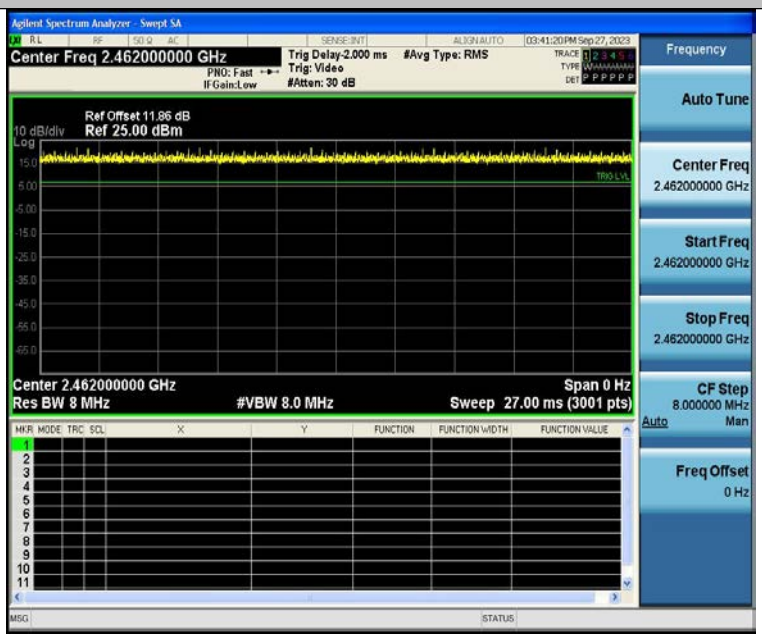
NTNV-11B-Ant1-2462



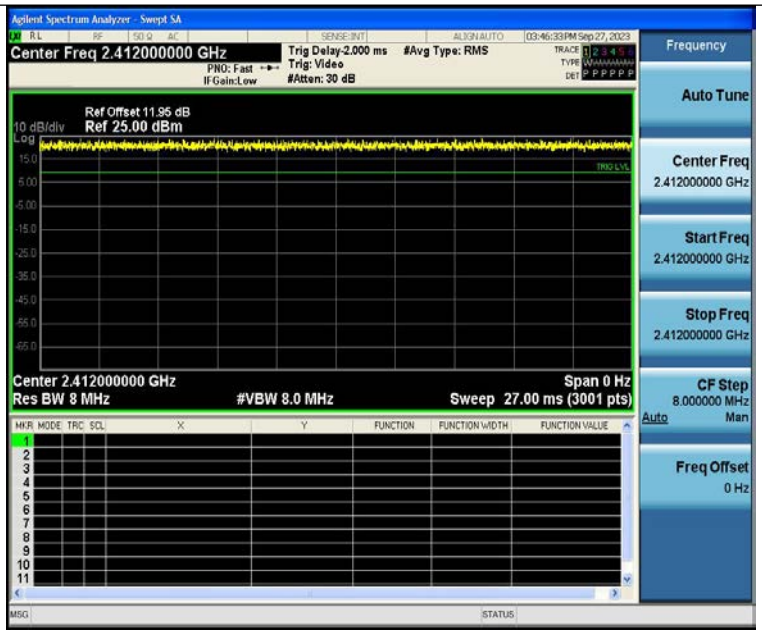
NTNV-11G-Ant1-2412



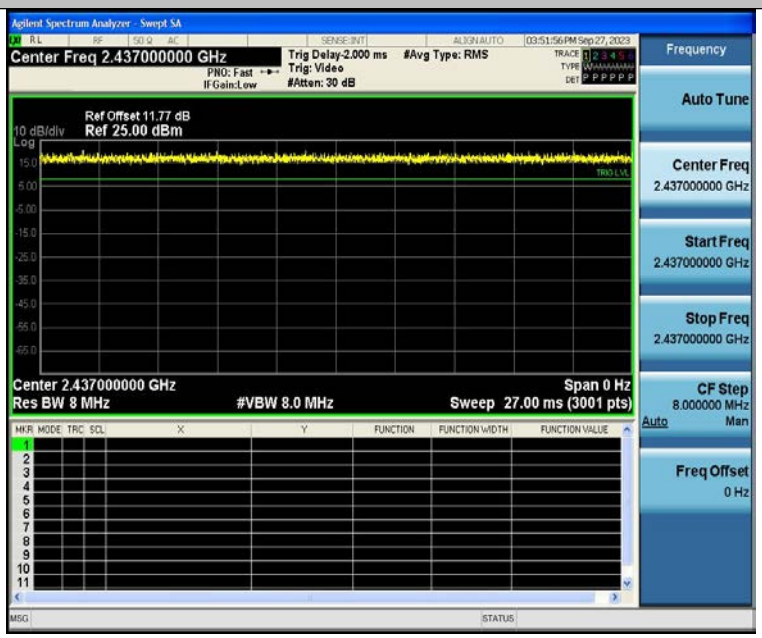
NTNV-11G-Ant1-2437



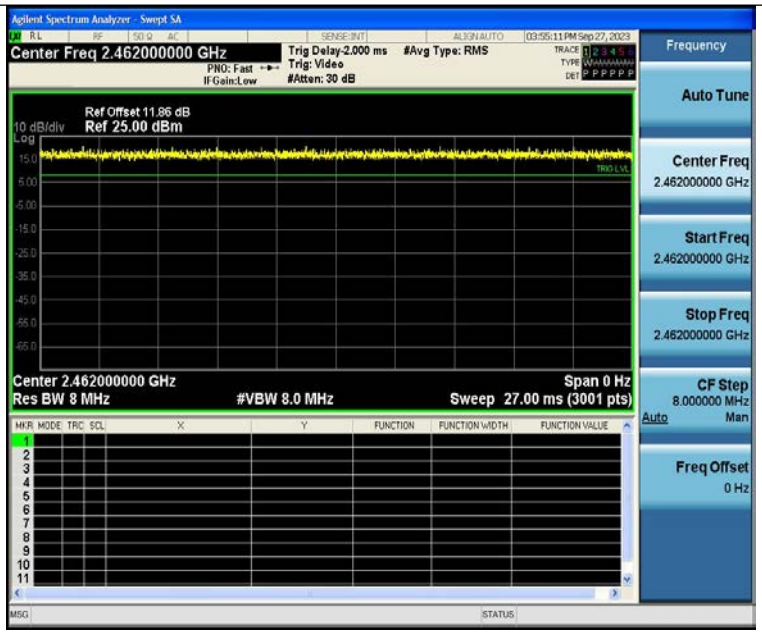
NTNV-11G-Ant1-2462



NTNV-11N20SISO-Ant1-2412



NTNV-11N20SISO-Ant1-2437



NTNV-11N20SISO-Ant1-2462

3.3 Test Site

Precise Testing & Certification Co., Ltd.

Address: Building 1, No.6 Tongxin Road, Dongcheng Street, Dongguan,China

FCC Registration Number: 790290

Designation Number: CN1219

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

CAB identifier: CN0080

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
MXG Signal Analyzer	Agilent	N9020A	MY56070279	10Hz-30GHz	Aug 21,2024	1 year
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Aug 21,2024	1 year
Antenna Connector	Florida RF Labs	N/A	RF01#	N/A	Aug 21,2024	1 year
Scope	Tektronix	TDS3032B	B014131	300MHz BW; 2 way scope	Aug 21,2024	1 year
DC power	eTOMENS	eTM-1560	--	15V 60A	Aug 21,2024	1 year
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Aug 21,2024	1 year
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Aug 21,2024	1 year

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug 21,2024	1 year
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Aug 21,2024	1 year
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug 21,2024	1 year
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Aug 21,2024	1 year
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Aug 21,2024	1 year
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-26.5GHz	Aug 21,2024	1 year
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug 21,2024	1 year
High NOISE AMPLIFIER	ZHINAN	ZN3380C	15002	10KHz-18GHz	Aug 21,2024	1 year

Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Aug 21,2024	1 year
Spectrum Analyzer	Rohde&Schwarz	FSVR40	101003	10Hz-40GHz	Aug 21,2024	1 year
Horn Antenna	SCHWARZBECK	BBHA9170	01066	15GHZ-40GHZ	Aug 21,2024	1 year
Preamplifier	SCHWARZBECK	BBV-9721	81	18GHZ-40GHZ	Aug 21,2024	1 year
Test S/W	Tonscend	JS32-RE/4.0.0.0				

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug 21,2024	1 year
Artificial Mains Network	Rohde&Schwarz	BS ENV216	102453	9KHz-300MHz	Aug 21,2024	1 year
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	9KHz-300MHz	Aug 21,2024	1 year
Test S/W	Tonscend	JS32-CE/4.0.0.3				

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Radiated Emission(25GHz-40GHz)	±4.14dB
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

4.3 Description of Support Units

Equipment	Model No.	Series No.
N/A	N/A	N/A

5 Conducted Emission

Test Requirement:	:	FCC CFR 47 Part 15 Section 15.207
Test Method	:	ANSI C63.10: 2013
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

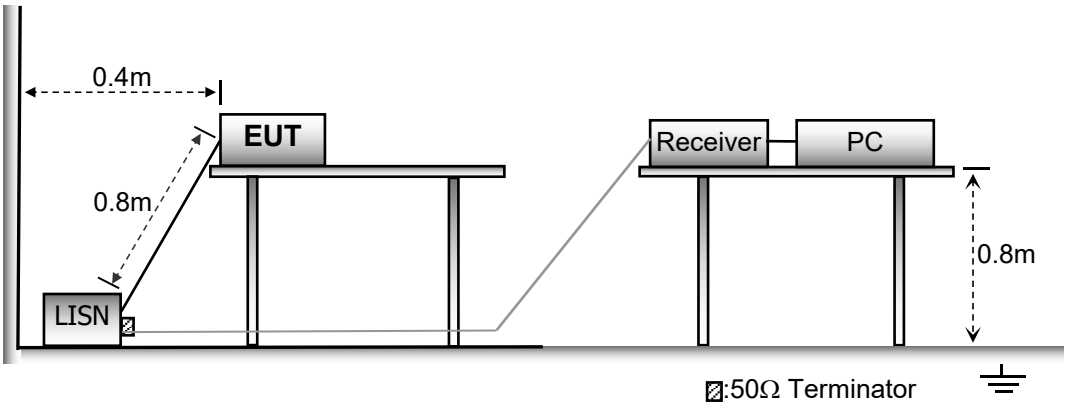
5.1 E.U.T. Operation

Operating Environment :

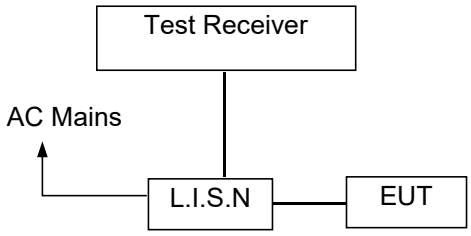
Temperature	:	23.9 °C
Humidity	:	51.4 % RH
Atmospheric Pressure	:	101.21kPa

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

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

5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

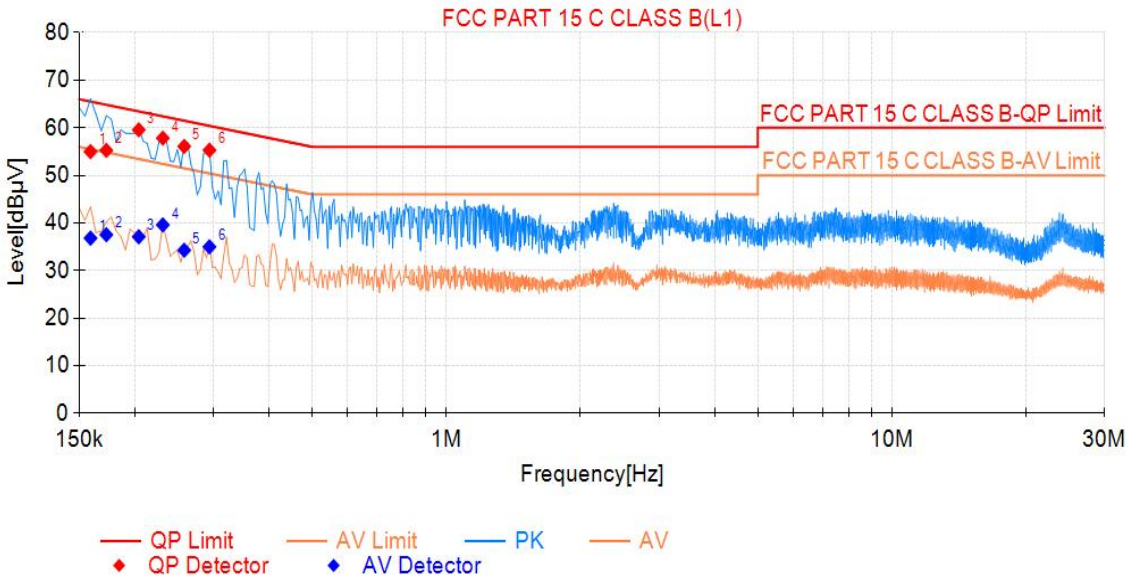
5.7 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

No futher quasi-peak or average measurements were performed since no peak emissions were detected within 10Db line below the average limit.

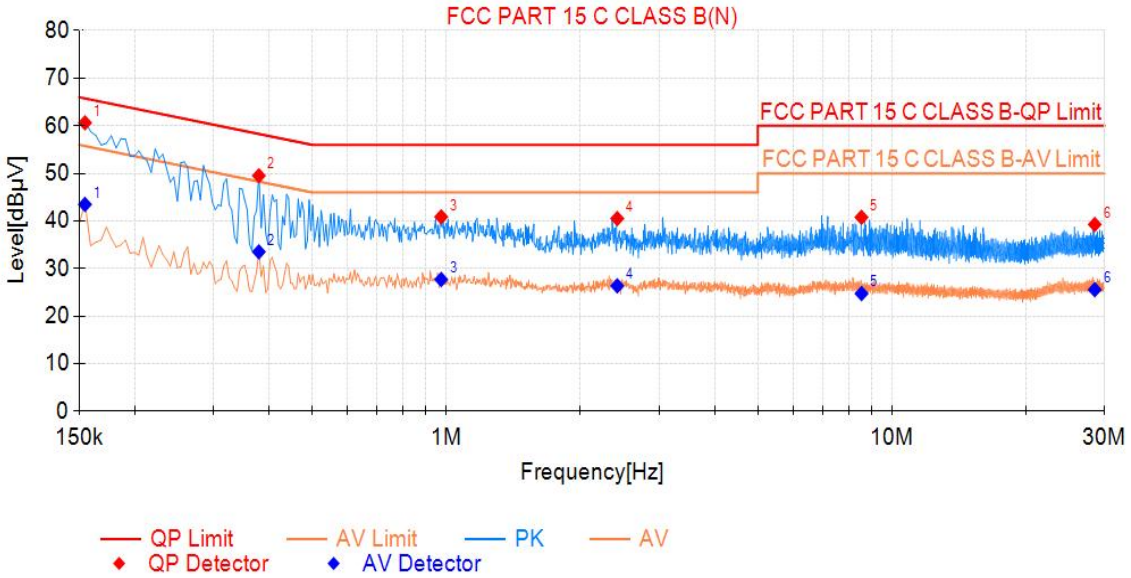
Please refer to the following peak scan graph for reference.

Test Phase: Line,



Final Data List								
NO.	Freq. [MHz]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Verdict
1	0.159	55.00	65.52	10.52	36.81	55.52	18.71	PASS
2	0.173	55.27	64.84	9.57	37.54	54.84	17.30	PASS
3	0.204	59.58	63.45	3.87	37.11	53.45	16.34	PASS
4	0.231	57.83	62.41	4.58	39.60	52.41	12.81	PASS
5	0.258	56.10	61.50	5.40	34.28	51.50	17.22	PASS
6	0.294	55.31	60.41	5.10	34.99	50.41	15.42	PASS

Test Phase:Neutral



Final Data List

NO.	Freq. [MHz]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Verdict
1	0.155	60.63	65.75	5.12	43.48	55.75	12.27	PASS
2	0.380	49.53	58.29	8.76	33.52	48.29	14.77	PASS
3	0.974	40.87	56.00	15.13	27.71	46.00	18.29	PASS
4	2.418	40.51	56.00	15.49	26.37	46.00	19.63	PASS
5	8.543	40.78	60.00	19.22	24.76	50.00	25.24	PASS
6	28.523	39.28	60.00	20.72	25.57	50.00	24.43	PASS

6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

6.1 EUT Operation

Operating Environment :

Temperature: : 24.5 °C

Humidity: : 52 % RH

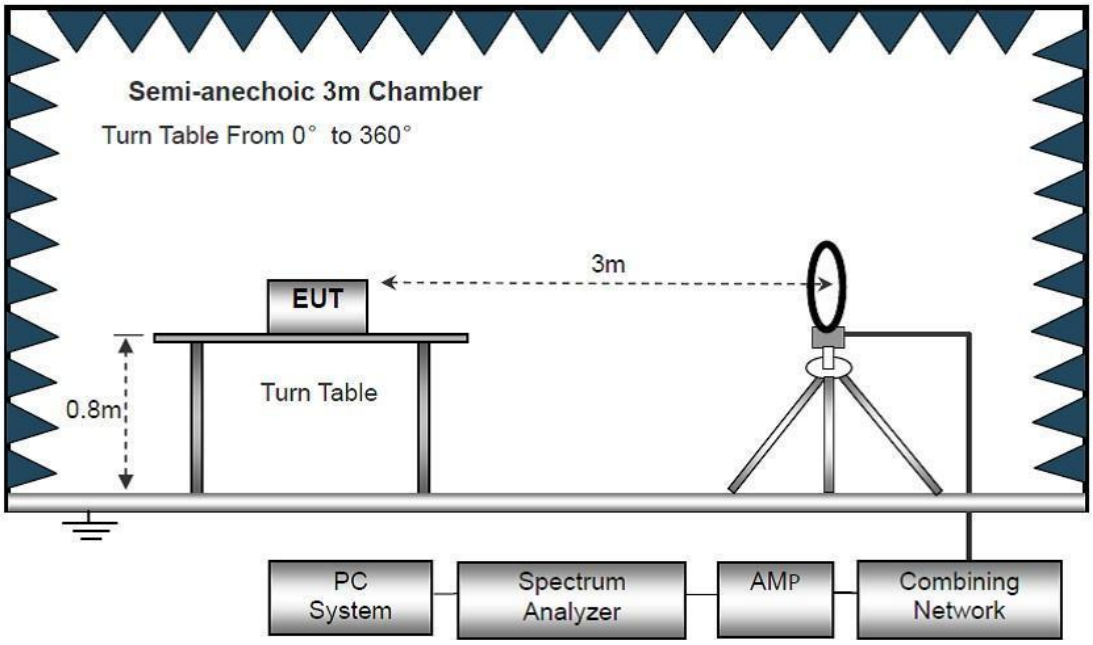
Atmospheric Pressure: : 101.3kPa

Test Voltage : DC 5V

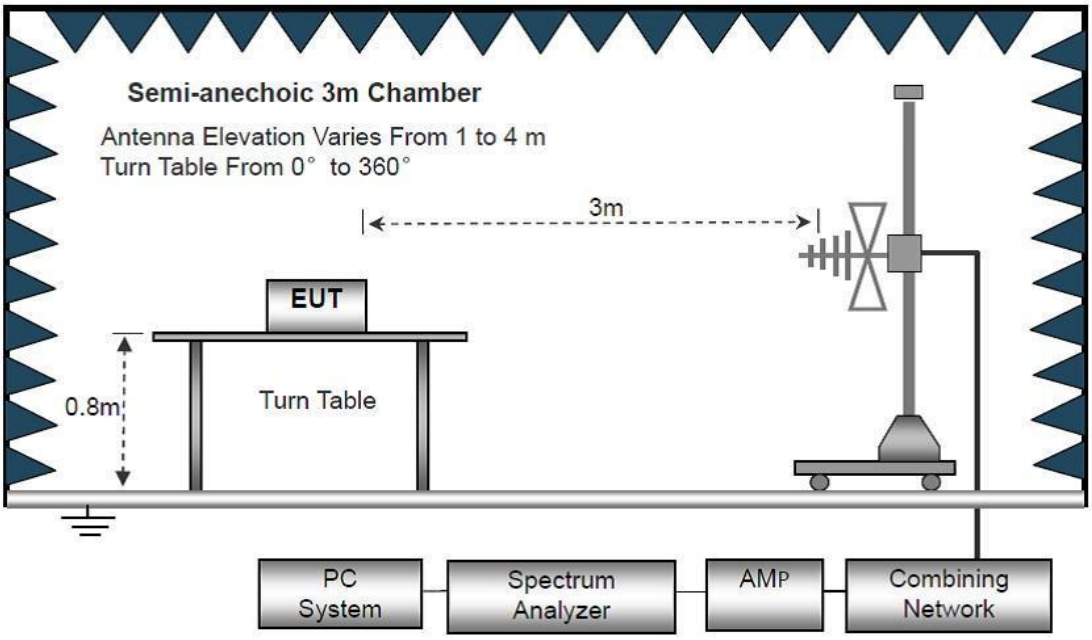
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

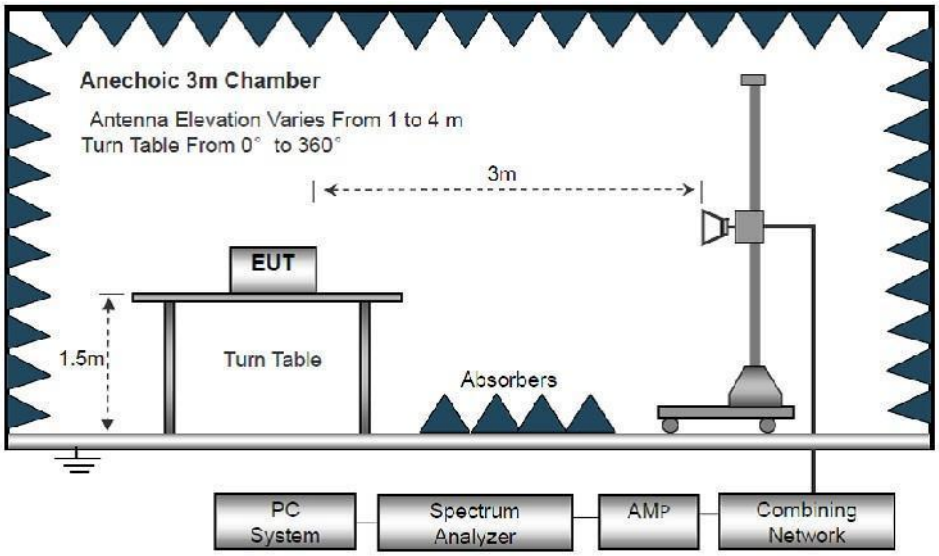
The test setup for emission measurement below 30MHz



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz



6.3 Spectrum Analyzer Setup

	Frequency	Detector	RBW	VBW	Remark
Receiver Setup	Below 30MHz	--	10kHz	10kHz	--
	30MHz ~ 1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

6.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room

6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

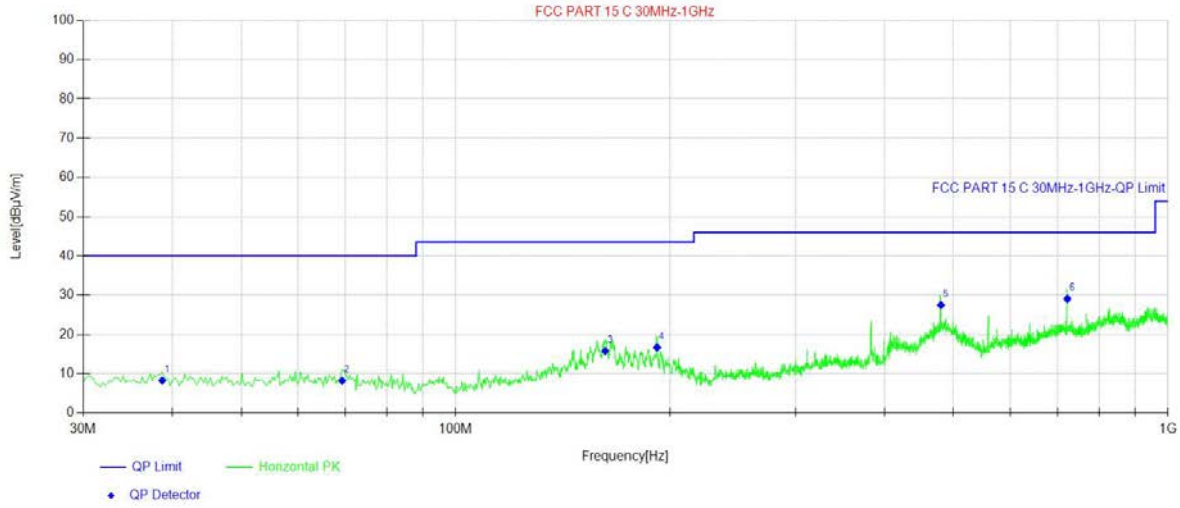
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

All the modulation modes were tested the data of the worst mode (TX 802.11b Low Channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

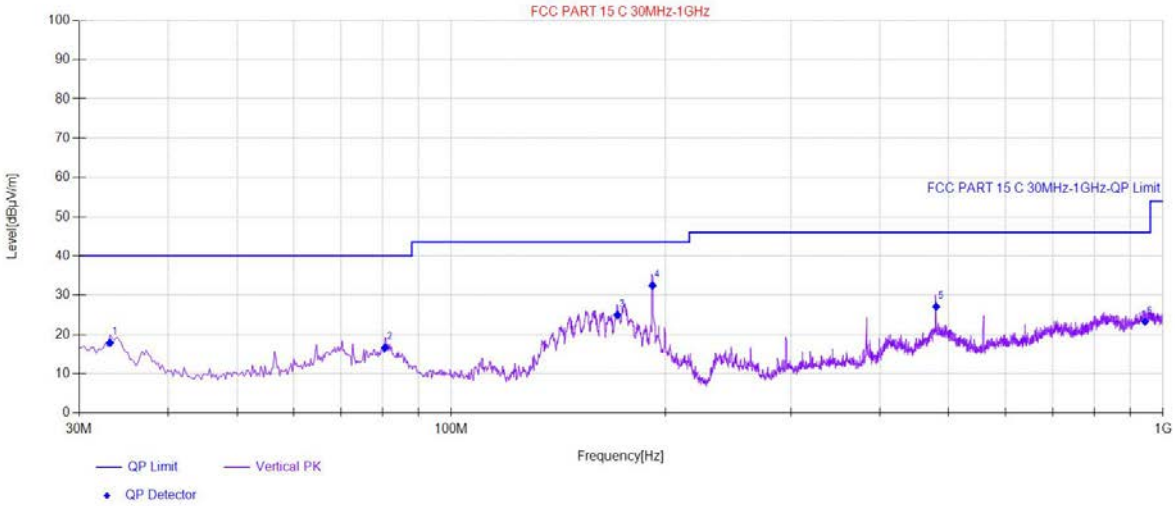
Antenna Polarization: Horizontal



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity	Verdict
1	38.73	25.89	-17.59	8.30	40.00	31.70	Horizontal	PASS
2	69.29	27.11	-18.86	8.25	40.00	31.75	Horizontal	PASS
3	162.16	32.33	-16.54	15.79	43.50	27.71	Horizontal	PASS
4	191.75	34.99	-18.25	16.74	43.50	26.76	Horizontal	PASS
5	480.08	38.06	-10.55	27.51	46.00	18.49	Horizontal	PASS
6	722.34	34.37	-5.29	29.08	46.00	16.92	Horizontal	PASS

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical



Final Data List[QP]								
NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity	Verdict
1	33.15	35.99	-18.10	17.89	40.00	22.11	Vertical	PASS
2	80.68	37.56	-20.91	16.65	40.00	23.35	Vertical	PASS
3	171.14	41.62	-16.68	24.94	43.50	18.56	Vertical	PASS
4	191.75	50.73	-18.25	32.48	43.50	11.02	Vertical	PASS
5	480.08	37.64	-10.55	27.09	46.00	18.91	Vertical	PASS
6	943.26	25.37	-2.12	23.25	46.00	22.75	Vertical	PASS

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test Frequency: From 1GHz to 25GHz

Worst case 802.11b

Test Mode: 2412					Test channel: Lowest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4824	48.93	30.16	6.58	34.09	51.58	74	-22.42	V
7236	43.27	37.11	7.73	34.50	53.61	74	-20.39	V
9648	36.35	39.31	9.23	34.79	50.10	74	-23.90	V
4824	44.80	34.04	6.58	34.09	51.33	74	-22.67	H
7236	40.32	37.11	7.73	34.50	50.66	74	-23.34	H
9648	35.82	39.31	9.23	34.79	49.57	74	-24.43	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4824	32.77	34.38	6.69	34.09	39.75	54	-14.25	V
7236	31.00	37.22	7.78	34.53	41.47	54	-12.53	V
9648	24.52	39.46	9.35	34.80	38.53	54	-15.47	V
4824	32.49	34.38	6.69	34.09	39.47	54	-14.53	H
7236	26.10	37.22	7.78	34.53	36.57	54	-17.43	H
9648	26.16	39.46	9.35	34.80	40.17	54	-13.83	H

Worst case 802.11b

Test Mode: 2437					Test channel: Middle			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4874	46.99	32.35	4.12	28.44	55.02	74	-18.98	V
7311	38.76	36.08	6.30	27.74	53.40	74	-20.60	V
9748	35.24	38.25	7.91	24.65	56.75	74	-17.25	V
4874	43.58	32.35	4.12	28.44	51.61	74	-22.39	H
7311	39.11	36.08	6.30	27.74	53.75	74	-20.25	H
9748	35.62	38.25	7.91	24.65	57.13	74	-16.87	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4874	32.26	32.35	4.12	28.44	40.29	54	-13.71	V
7311	25.22	36.08	6.30	27.74	39.86	54	-14.14	V
9748	21.07	38.25	7.91	24.65	42.58	54	-11.42	V
4874	30.83	32.35	4.12	28.44	38.86	54	-15.14	H
7311	25.63	36.08	6.30	27.74	40.27	54	-13.73	H
9748	20.44	38.25	7.91	24.65	41.95	54	-12.05	H

Worst case 802.11b

Test Mode: 2462					Test channel: High			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4924	46.85	32.41	4.14	28.42	54.98	74	-19.02	V
7386	39.21	36.15	6.36	27.68	54.04	74	-19.96	V
9848	35.20	38.35	7.97	24.33	57.19	74	-16.81	V
4924	45.05	32.41	4.14	28.42	53.18	74	-20.82	H
7386	38.43	36.15	6.36	27.68	53.26	74	-20.74	H
9848	35.34	38.35	7.97	24.33	57.33	74	-16.67	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4924	32.26	32.41	4.14	28.42	40.39	54	-13.61	V
7386	25.34	36.15	6.36	27.68	40.17	54	-13.83	V
9848	19.93	38.35	7.97	24.33	41.92	54	-12.08	V
4924	30.44	32.41	4.14	28.42	38.57	54	-15.43	H
7386	26.85	36.15	6.36	27.68	41.68	54	-12.32	H
9848	19.67	38.35	7.97	24.33	41.66	54	-12.34	H

Note:

1. The testing has been conformed to 10*2462MHz=24620MHz.
2. All other emissions more than 30dB below the limit.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor
   Margin=Emission Level-Limit
4. X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz
2.4G WiFi (802.11b/g/n)mode have been tested, and the worst result(802.11g) was report as below

Test Mode: Worst case 802.11g Low Channel 2412MHz

Test Mode: 802.11g Low Channel 2412MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2390	48.96	27.39	2.77	34.01	45.11	74	-28.89	H	Peak
2400	60.24	27.42	2.78	34.01	56.43	74	-17.57	H	
2390	48.57	27.39	2.77	34.01	44.72	74	-29.28	V	
2400	55.32	27.42	2.78	34.01	51.51	74	-22.49	V	
2390	40.41	27.39	2.77	34.01	36.56	54	-17.44	H	Average
2400	43.56	27.42	2.78	34.01	39.75	54	-14.25	H	
2390	39.96	27.39	2.77	34.01	36.11	54	-17.89	V	
2400	44.82	27.42	2.78	34.01	41.01	54	-12.99	V	

Test Mode: Worst case 802.11g High Channel 2462MHz

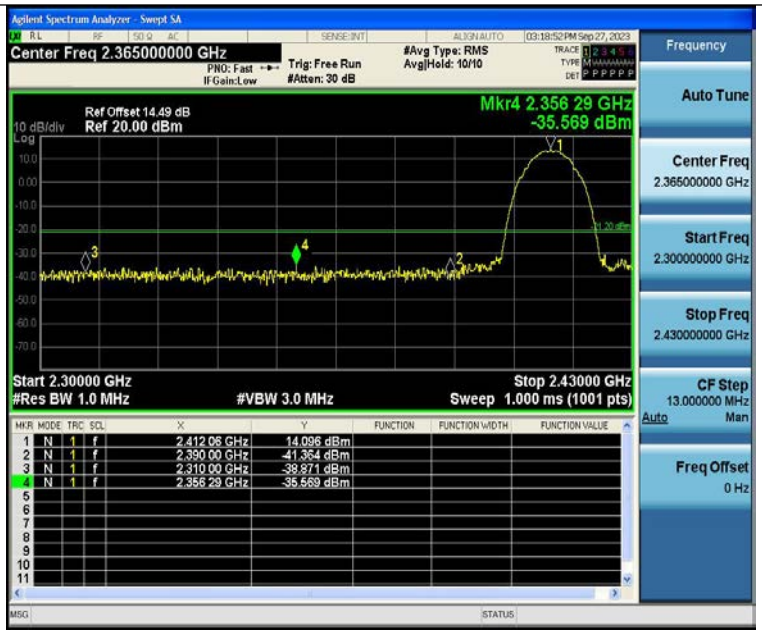
Test Mode: 802.11g High Channel 2462MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2483.5	60.27	27.7	2.84	34.03	56.78	74	-17.22	H	Peak
2500	48.93	27.75	2.86	34.03	45.51	74	-28.49	H	
2483.5	60.05	27.7	2.84	34.03	56.56	74	-17.44	V	
2500	47.78	27.75	2.86	34.03	44.36	74	-29.64	V	
2483.5	42.56	27.7	2.84	34.03	39.07	54	-14.93	H	Average
2500	39.83	27.75	2.86	34.03	36.41	54	-17.59	H	
2483.5	43.63	27.7	2.84	34.03	40.14	54	-13.86	V	
2500	40.07	27.75	2.86	34.03	36.65	54	-17.35	V	

Spurious Emission in Restricted Bands

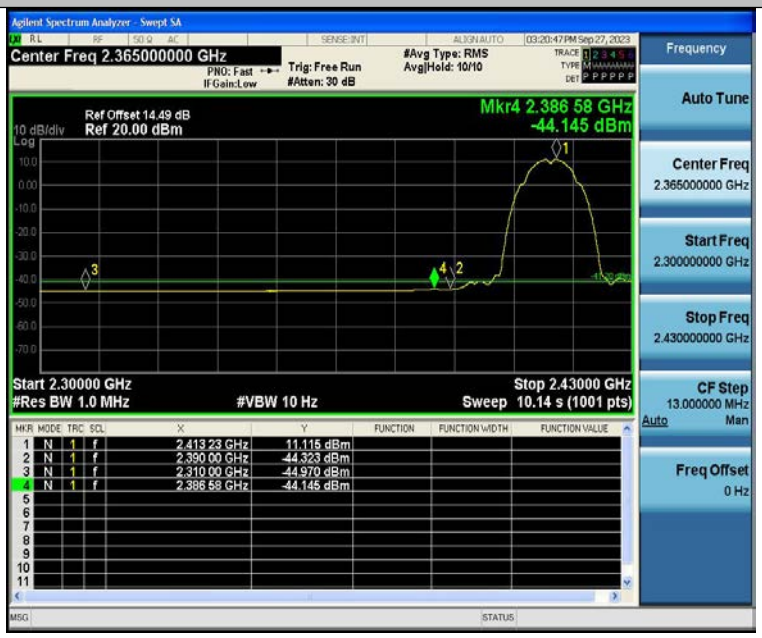
Test Mode	Antenna	ChName	Frequency[MHz]	Detector	Freq [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/m]	Limit [dBuV/m]	Verdict
11B	Ant1	Low	2412	Peak	2390.000	-41.36	≤-21.20	53.84	≤74	PASS
11B	Ant1	Low	2412	Peak	2310.000	-38.87	≤-21.20	56.33	≤74	PASS
11B	Ant1	Low	2412	Peak	2356.290	-35.57	≤-21.20	59.63	≤74	PASS
11B	Ant1	Low	2412	AV	2390.000	-44.32	≤-41.20	50.88	≤54	PASS
11B	Ant1	Low	2412	AV	2310.000	-44.97	≤-41.20	50.23	≤54	PASS
11B	Ant1	Low	2412	AV	2386.580	-44.15	≤-41.20	51.05	≤54	PASS
11B	Ant1	High	2462	Peak	2483.500	-40.19	≤-21.20	55.01	≤74	PASS
11B	Ant1	High	2462	Peak	2500.000	-40.13	≤-21.20	55.07	≤74	PASS
11B	Ant1	High	2462	Peak	2486.420	-34.94	≤-21.20	60.26	≤74	PASS
11B	Ant1	High	2462	AV	2483.500	-44.01	≤-41.20	51.19	≤54	PASS
11B	Ant1	High	2462	AV	2500.000	-44.25	≤-41.20	50.95	≤54	PASS
11B	Ant1	High	2462	AV	2487.300	-43.88	≤-41.20	51.32	≤54	PASS
11G	Ant1	Low	2412	Peak	2390.000	-39.36	≤-21.20	55.84	≤74	PASS
11G	Ant1	Low	2412	Peak	2310.000	-40.56	≤-21.20	54.64	≤74	PASS
11G	Ant1	Low	2412	Peak	2372.280	-35.25	≤-21.20	59.95	≤74	PASS
11G	Ant1	Low	2412	AV	2390.000	-43.8	≤-41.20	51.40	≤54	PASS
11G	Ant1	Low	2412	AV	2310.000	-45.07	≤-41.20	50.13	≤54	PASS
11G	Ant1	Low	2412	AV	2389.960	-43.8	≤-41.20	51.40	≤54	PASS
11G	Ant1	High	2462	Peak	2483.500	-35.93	≤-21.20	59.27	≤74	PASS
11G	Ant1	High	2462	Peak	2500.000	-41.28	≤-21.20	53.92	≤74	PASS
11G	Ant1	High	2462	Peak	2489.610	-34.33	≤-21.20	60.87	≤74	PASS
11G	Ant1	High	2462	AV	2483.500	-43.33	≤-41.20	51.87	≤54	PASS
11G	Ant1	High	2462	AV	2500.000	-44.34	≤-41.20	50.86	≤54	PASS
11G	Ant1	High	2462	AV	2483.560	-43.35	≤-41.20	51.85	≤54	PASS
11N20SISO	Ant1	Low	2412	Peak	2390.000	-32.8	≤-21.20	62.40	≤74	PASS
11N20SISO	Ant1	Low	2412	Peak	2310.000	-36.67	≤-21.20	58.53	≤74	PASS
11N20SISO	Ant1	Low	2412	Peak	2388.790	-32.41	≤-21.20	62.79	≤74	PASS
11N20SISO	Ant1	Low	2412	AV	2390.000	-41.4	≤-41.20	53.80	≤54	PASS
11N20SISO	Ant1	Low	2412	AV	2310.000	-44.95	≤-41.20	50.25	≤54	PASS
11N20SISO	Ant1	Low	2412	AV	2389.960	-41.4	≤-41.20	53.80	≤54	PASS
11N20SISO	Ant1	High	2462	Peak	2483.500	-38.74	≤-21.20	56.46	≤74	PASS
11N20SISO	Ant1	High	2462	Peak	2500.000	-39.27	≤-21.20	55.93	≤74	PASS
11N20SISO	Ant1	High	2462	Peak	2484.550	-34.06	≤-21.20	61.14	≤74	PASS
11N20SISO	Ant1	High	2462	AV	2483.500	-43.03	≤-41.20	52.17	≤54	PASS
11N20SISO	Ant1	High	2462	AV	2500.000	-44.34	≤-41.20	50.86	≤54	PASS
11N20SISO	Ant1	High	2462	AV	2483.560	-43.05	≤-41.20	52.15	≤54	PASS

Note：

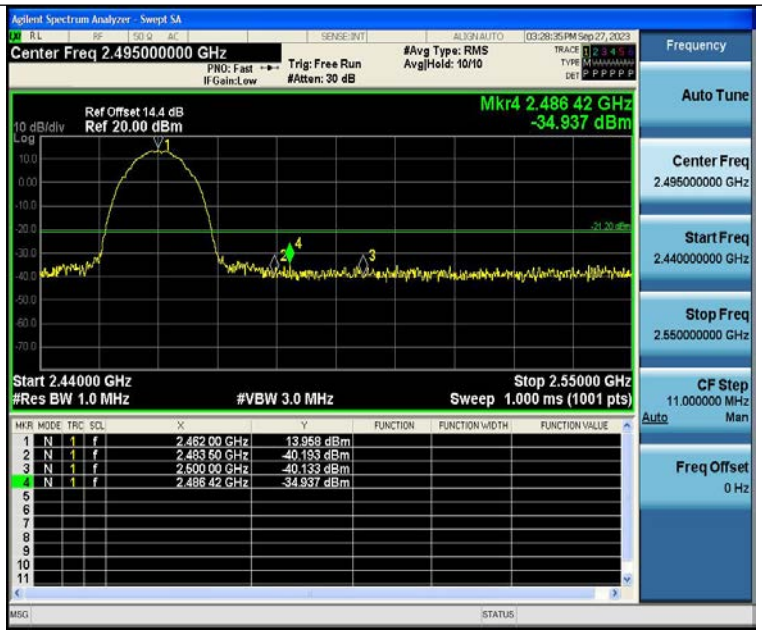
1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.



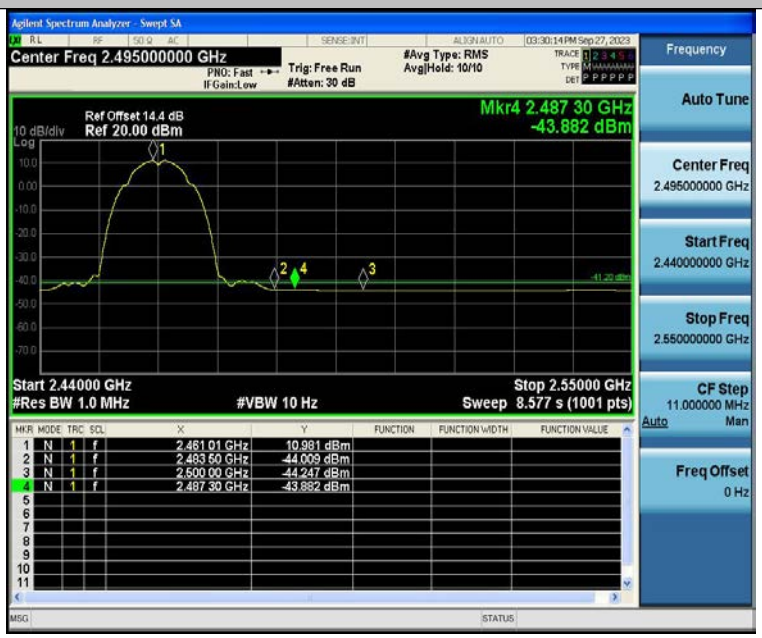
11B-Ant1-2412-PASS



11B-Ant1-2412-PASS

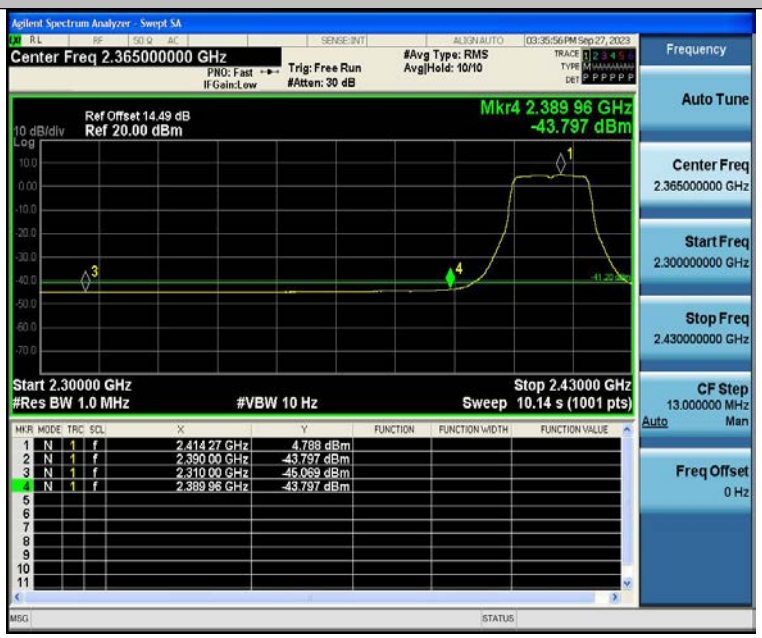


11B-Ant1-2462-PASS

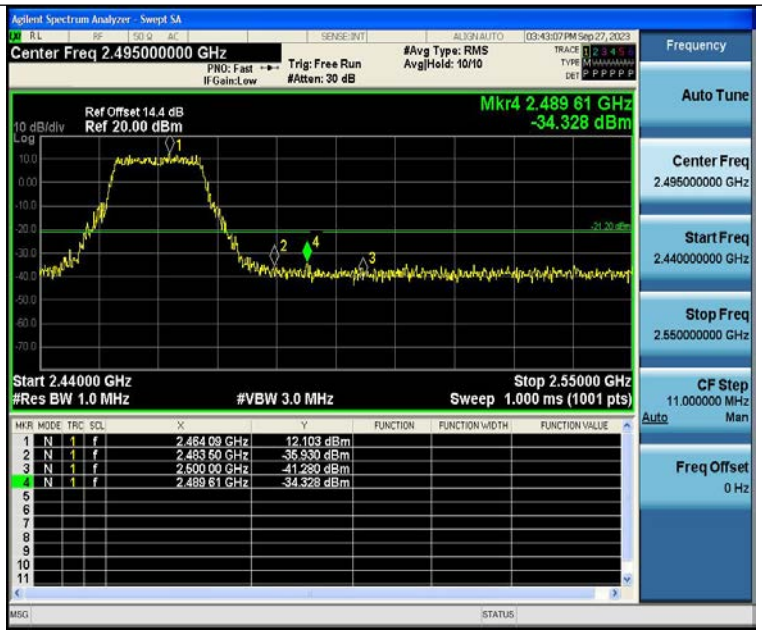


11B-Ant1-2462-PASS

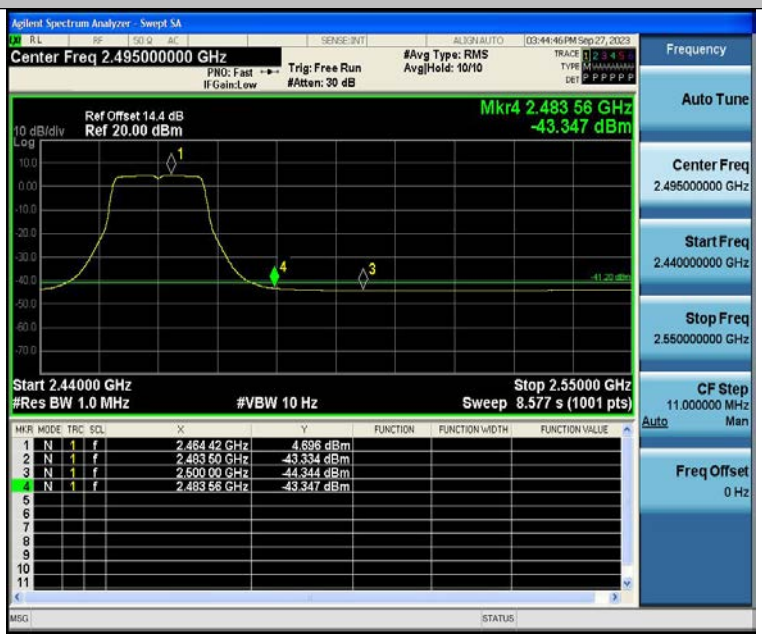
11G-Ant1-2412-PASS



11G-Ant1-2412-PASS

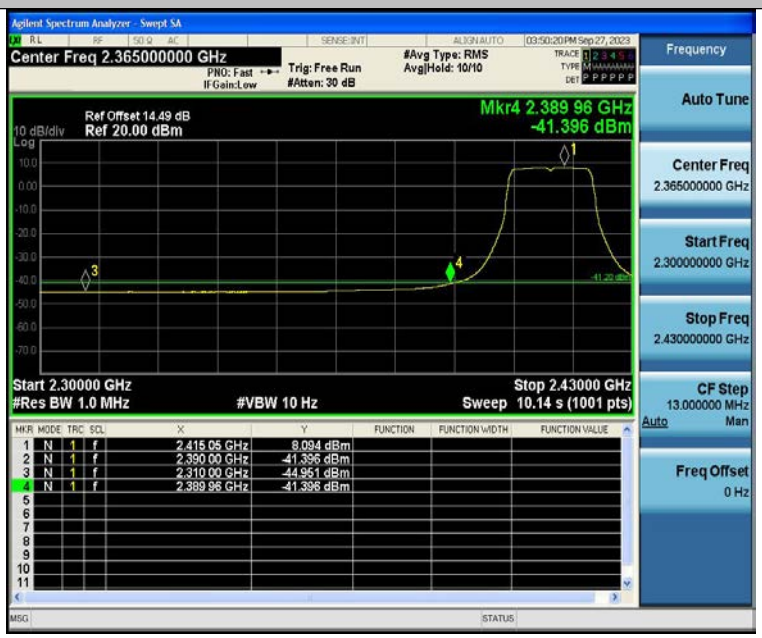


11G-Ant1-2462-PASS



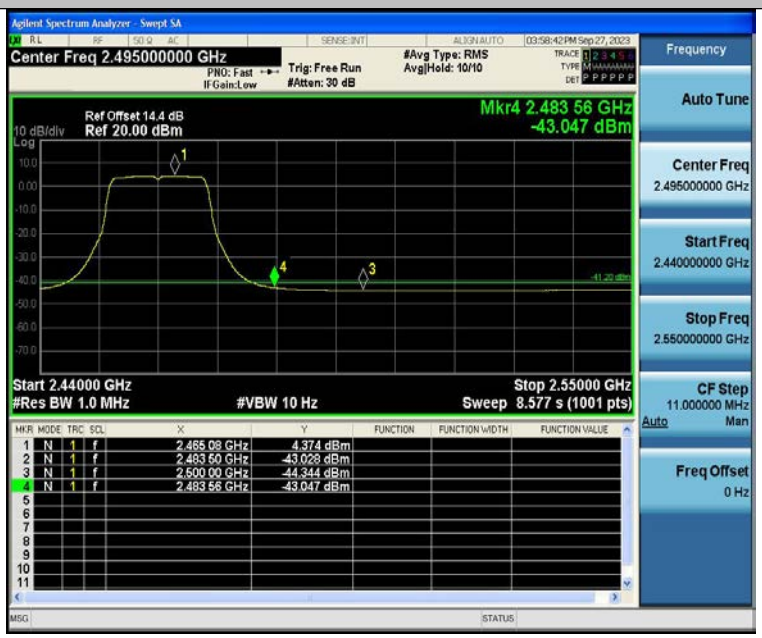
11G-Ant1-2462-PASS

11N20SISO-Ant1-2412-PASS



11N20SISO-Ant1-2412-PASS

11N20SISO-Ant1-2462-PASS



11N20SISO-Ant1-2462-PASS

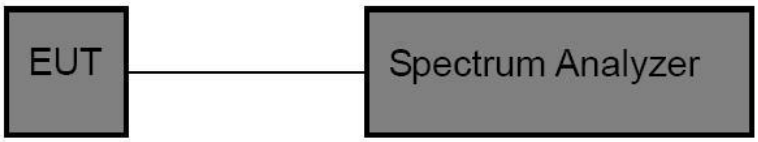
7 Conducted Spurious Emission

Test Requirement : FCC CFR47 Part 15 Section 15.247
Test Method : ANSI C63.10:2013
Test Limit : Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

7.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

7.2 Test Setup

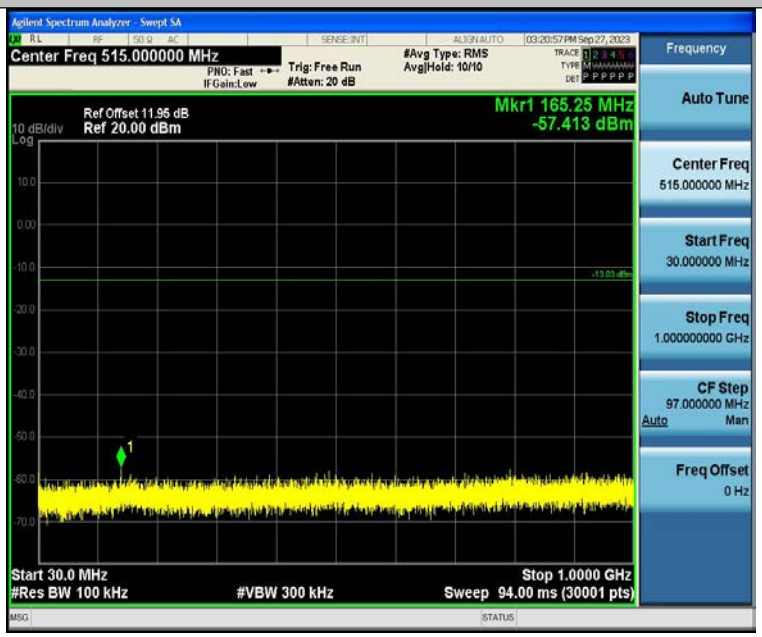


7.3 Test Result

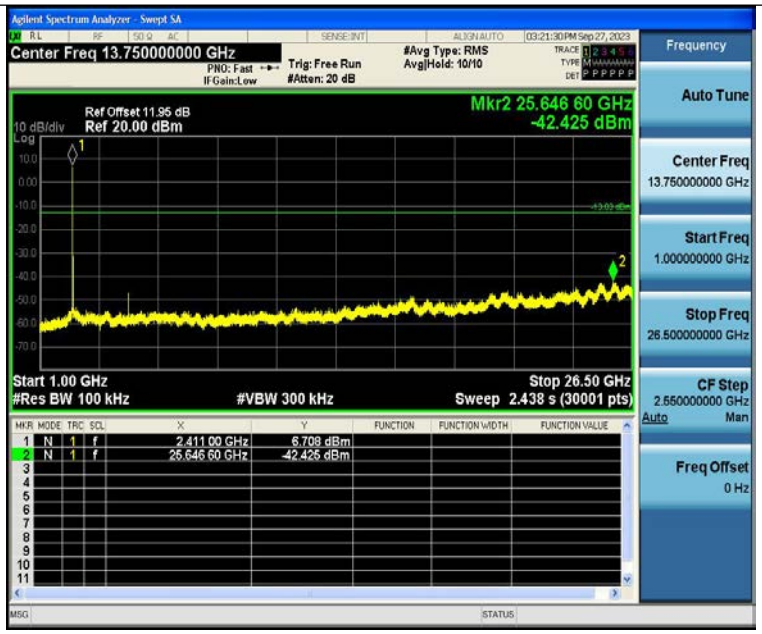
Test Mode	Antenna	Frequency[MHz]	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	0~Reference	6.97	6.97	---	PASS
11B	Ant1	2412	30~1000	6.97	-57.41	≤-13.03	PASS
11B	Ant1	2412	1000~26500	6.97	-42.43	≤-13.03	PASS
11B	Ant1	2437	0~Reference	7.11	7.11	---	PASS
11B	Ant1	2437	30~1000	7.11	-58.35	≤-12.89	PASS
11B	Ant1	2437	1000~26500	7.11	-42.29	≤-12.89	PASS

11B	Ant1	2462	0~Reference	6.02	6.02	---	PASS
11B	Ant1	2462	30~1000	6.02	-57.23	≤-13.98	PASS
11B	Ant1	2462	1000~26500	6.02	-41.86	≤-13.98	PASS
11G	Ant1	2412	0~Reference	-1.14	-1.14	---	PASS
11G	Ant1	2412	30~1000	-1.14	-56.46	≤-21.14	PASS
11G	Ant1	2412	1000~26500	-1.14	-41.91	≤-21.14	PASS
11G	Ant1	2437	0~Reference	-1.04	-1.04	---	PASS
11G	Ant1	2437	30~1000	-1.04	-56.36	≤-21.04	PASS
11G	Ant1	2437	1000~26500	-1.04	-41.5	≤-21.04	PASS
11G	Ant1	2462	0~Reference	-1.16	-1.16	---	PASS
11G	Ant1	2462	30~1000	-1.16	-57.27	≤-21.16	PASS
11G	Ant1	2462	1000~26500	-1.16	-42.34	≤-21.16	PASS
11N20SISO	Ant1	2412	0~Reference	2.19	2.19	---	PASS
11N20SISO	Ant1	2412	30~1000	2.19	-57.31	≤-17.81	PASS
11N20SISO	Ant1	2412	1000~26500	2.19	-42.78	≤-17.81	PASS
11N20SISO	Ant1	2437	0~Reference	-1.13	-1.13	---	PASS
11N20SISO	Ant1	2437	30~1000	-1.13	-57	≤-21.13	PASS
11N20SISO	Ant1	2437	1000~26500	-1.13	-42.07	≤-21.13	PASS
11N20SISO	Ant1	2462	0~Reference	-1.74	-1.74	---	PASS
11N20SISO	Ant1	2462	30~1000	-1.74	-58.29	≤-21.74	PASS
11N20SISO	Ant1	2462	1000~26500	-1.74	-42.14	≤-21.74	PASS

11B-Ant1-2412-0~Reference-PASS

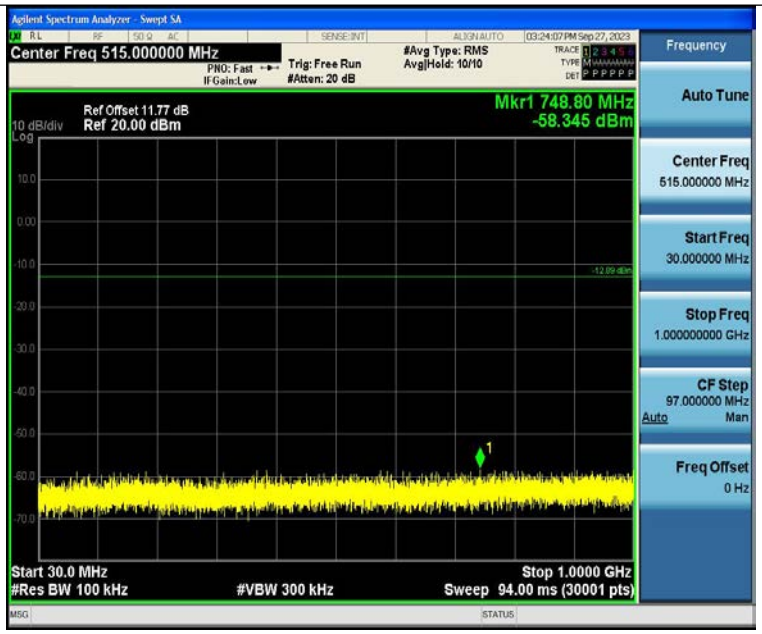


11B-Ant1-2412-30~1000-PASS

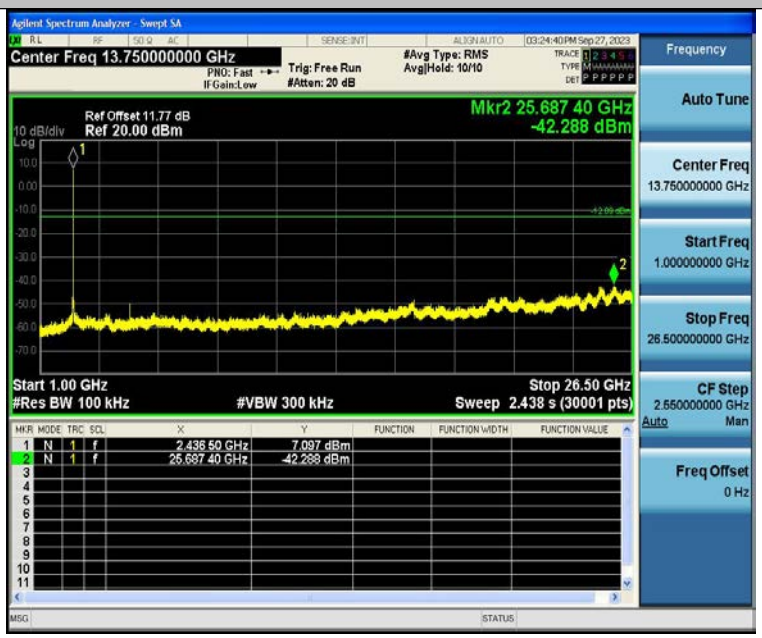


11B-Ant1-2412-1000~26500-PASS

11B-Ant1-2437-0~Reference-PASS

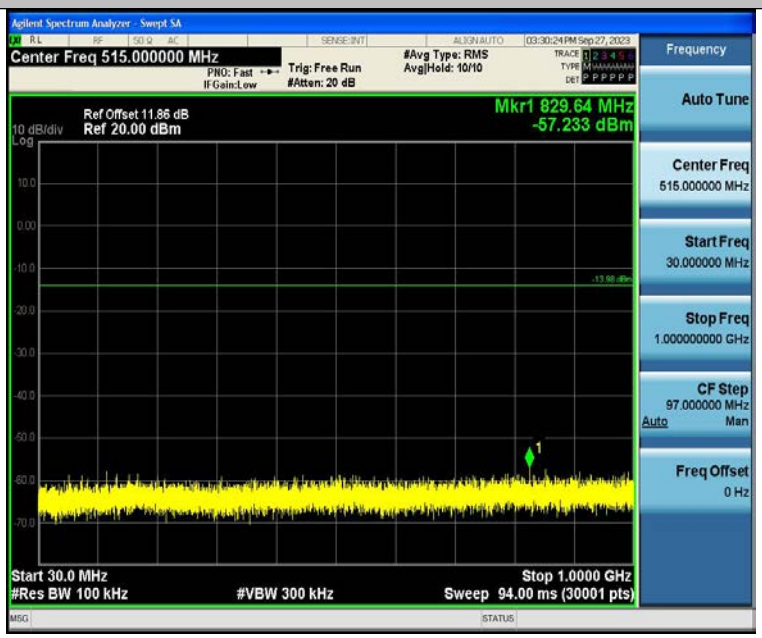


11B-Ant1-2437-30~1000-PASS

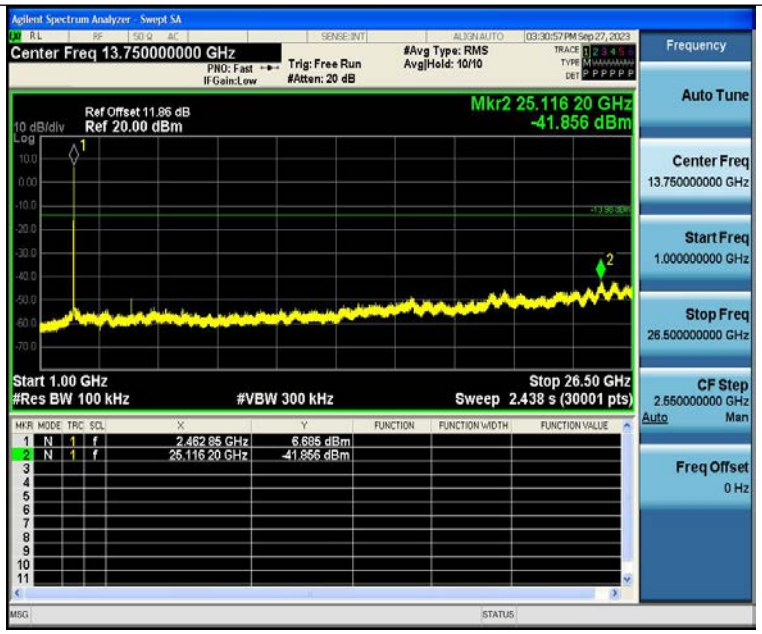


11B-Ant1-2437-1000~26500-PASS

11B-Ant1-2462-0~Reference-PASS

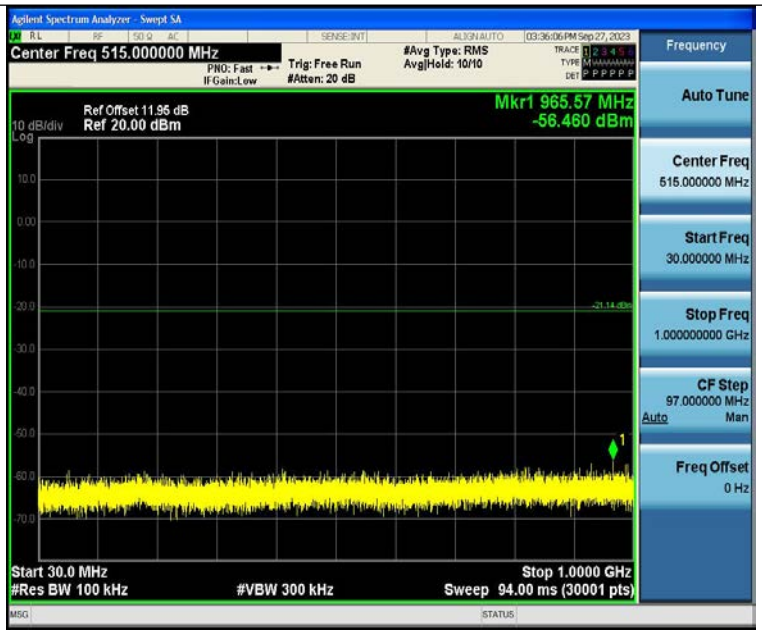


11B-Ant1-2462-30~1000-PASS

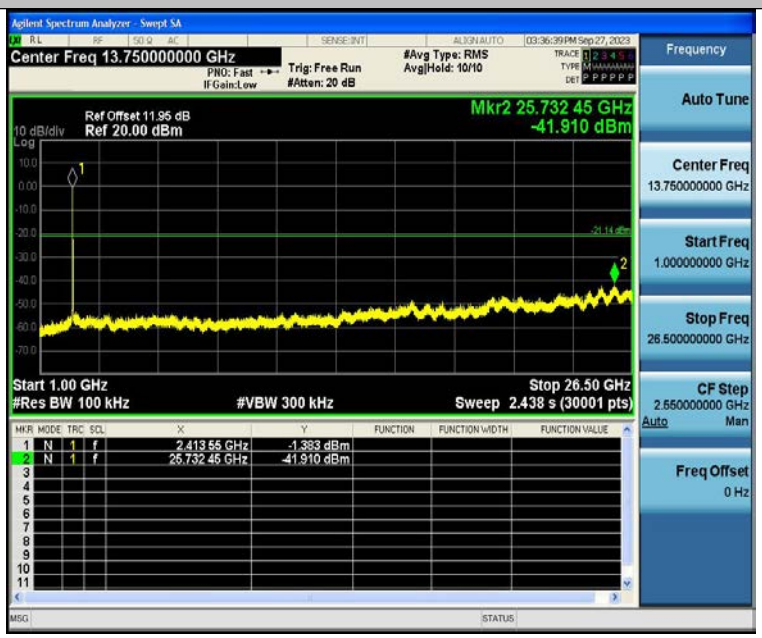


11B-Ant1-2462-1000~26500-PASS

11G-Ant1-2412-0~Reference-PASS

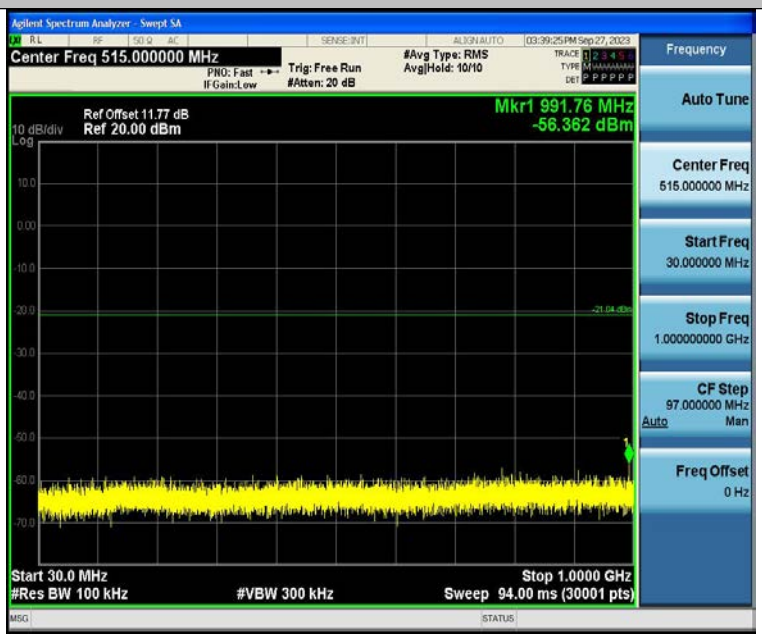


11G-Ant1-2412-30~1000-PASS

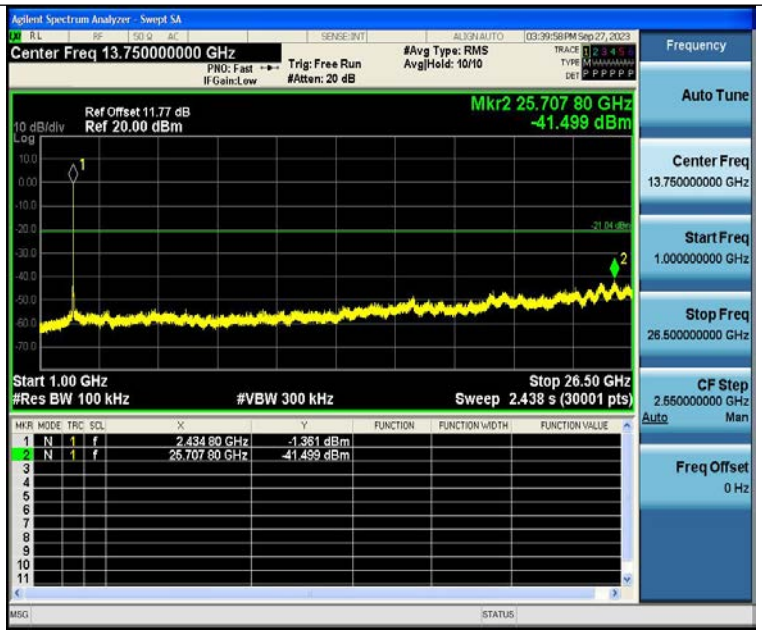


11G-Ant1-2412-1000~26500-PASS

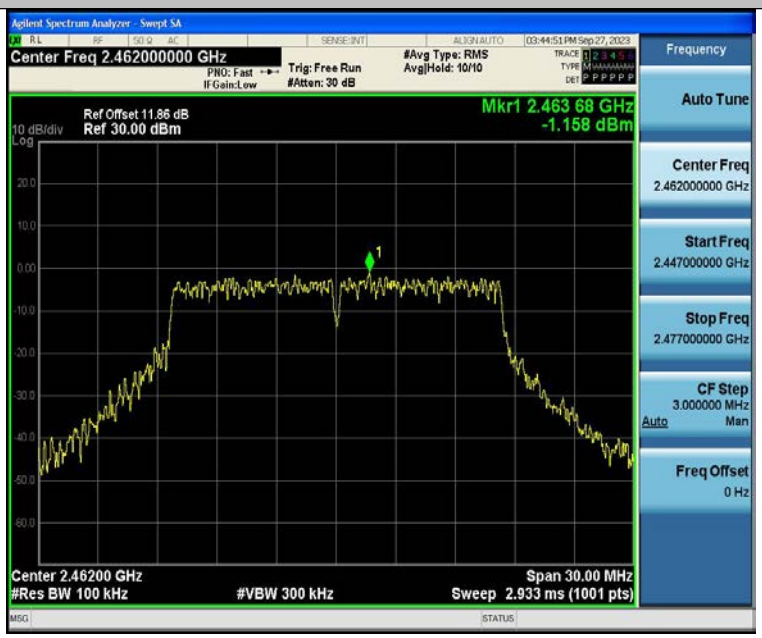
11G-Ant1-2437-0~Reference-PASS



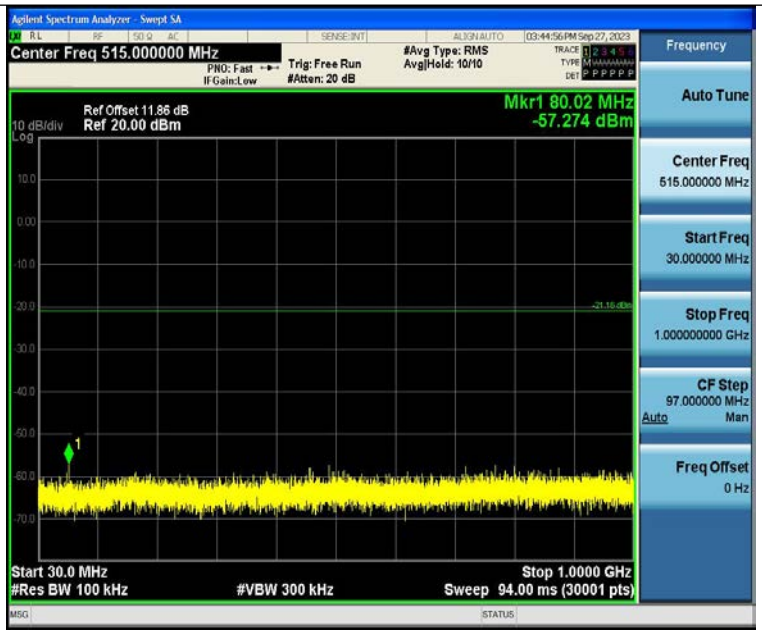
11G-Ant1-2437-30~1000-PASS



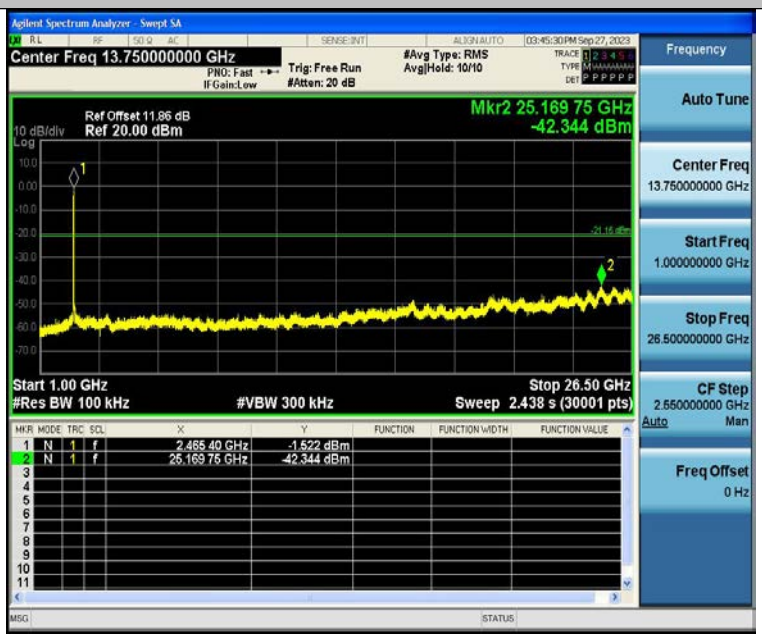
11G-Ant1-2437-1000~26500-PASS



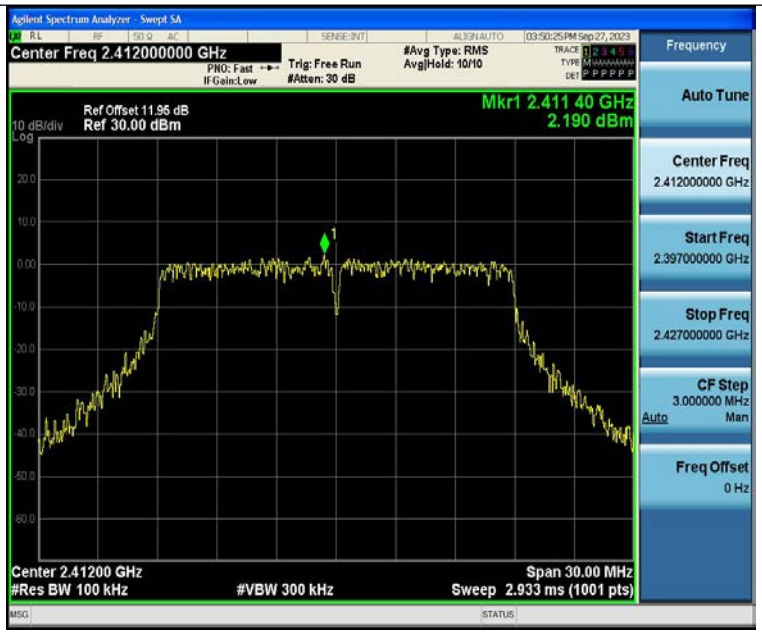
11G-Ant1-2462-0~Reference-PASS



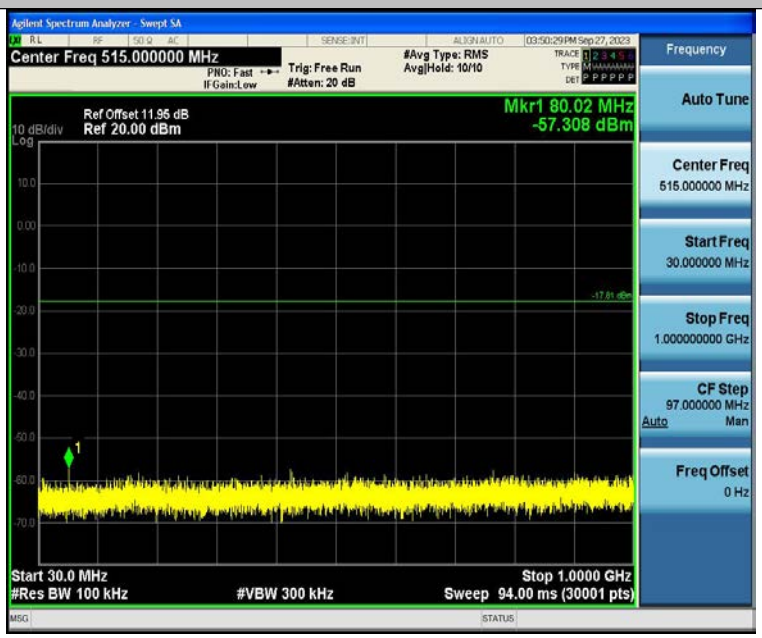
11G-Ant1-2462-30~1000-PASS



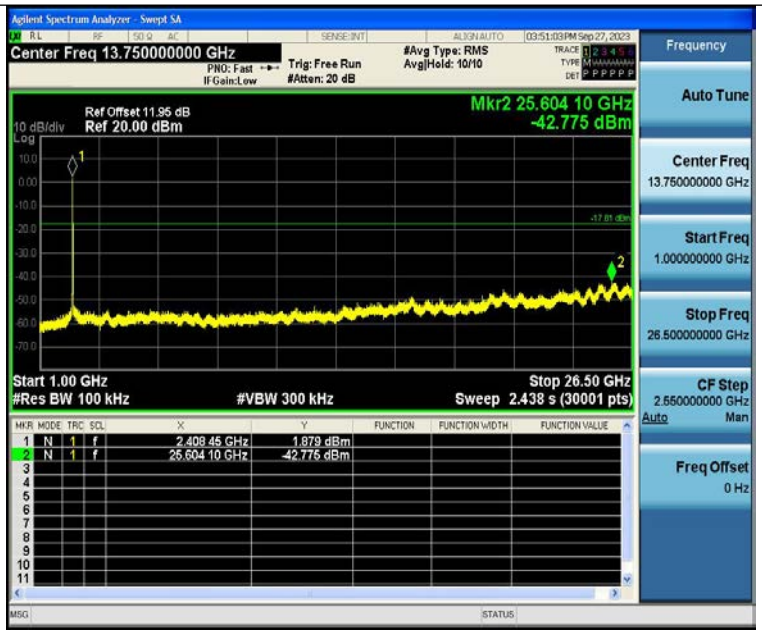
11G-Ant1-2462-1000~26500-PASS



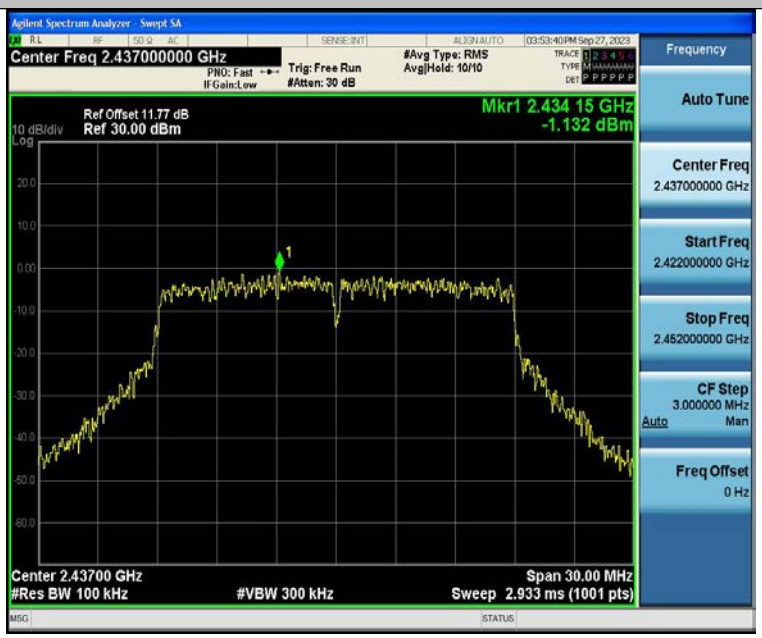
11N20SISO-Ant1-2412-0~Reference-PASS



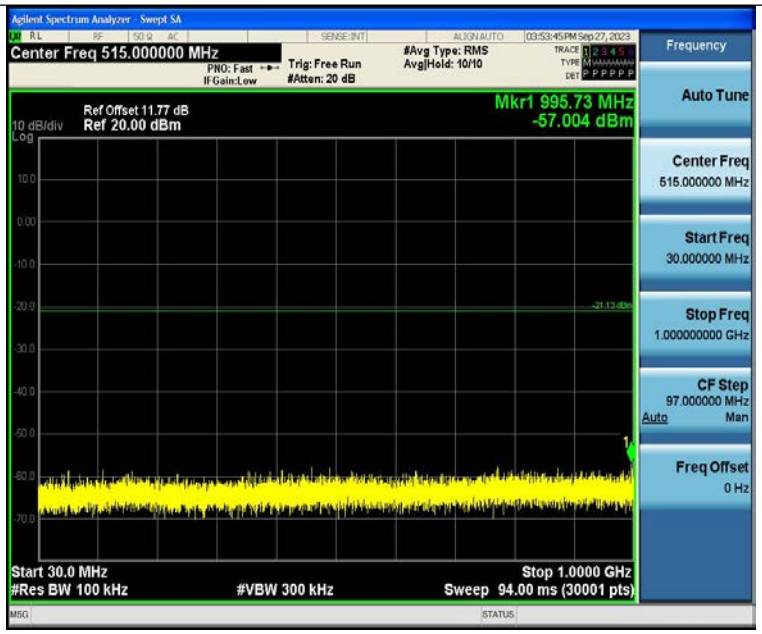
11N20SISO-Ant1-2412-30~1000-PASS



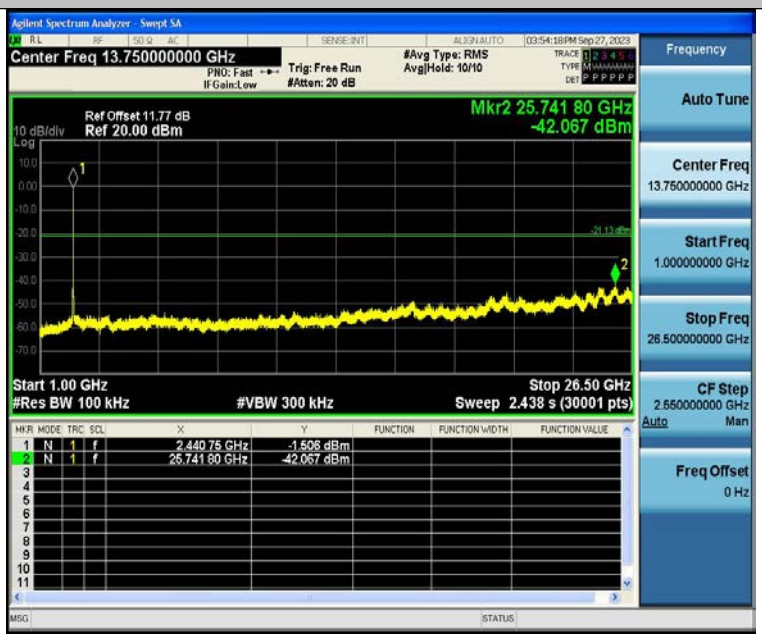
11N20SISO-Ant1-2412-1000~26500-PASS



11N20SISO-Ant1-2437-0~Reference-PASS

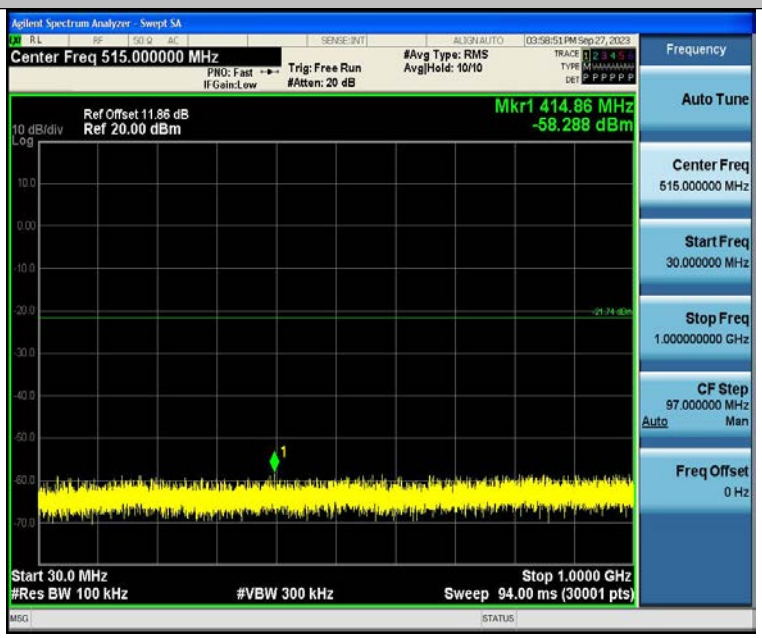


11N20SISO-Ant1-2437-30~1000-PASS

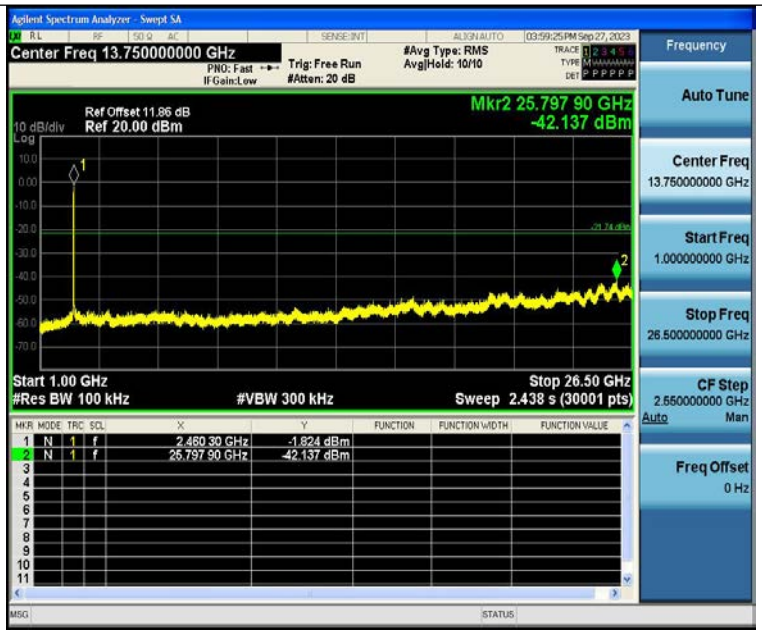


11N20SISO-Ant1-2437-1000~26500-PASS

11N20SISO-Ant1-2462-0~Reference-PASS



11N20SISO-Ant1-2462-30~1000-PASS



11N20SISO-Ant1-2462-1000~26500-PASS

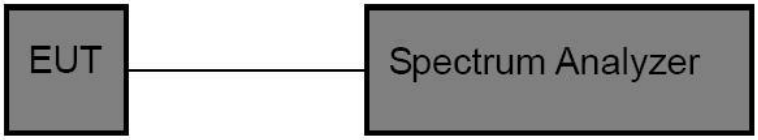
8 Band Edge Measurement

Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

8.1 Test Procedure

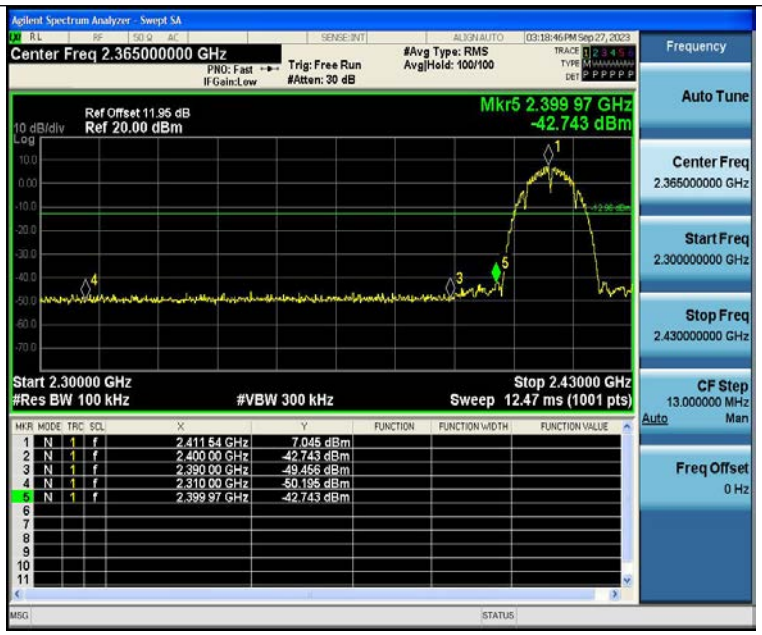
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

8.2 Test Setup

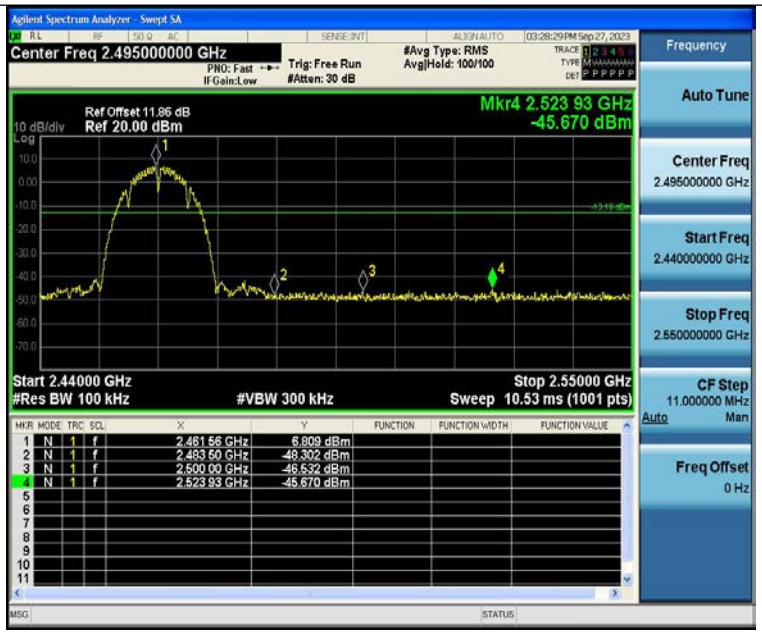


8.3 Test Result

Test Mode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	7.05	-42.74	≤-12.96	PASS
11B	Ant1	High	2462	6.81	-45.67	≤-13.19	PASS
11G	Ant1	Low	2412	-1.07	-32.87	≤-21.07	PASS
11G	Ant1	High	2462	-1.02	-45.26	≤-21.02	PASS
11N20SISO	Ant1	Low	2412	2.62	-27.98	≤-17.39	PASS
11N20SISO	Ant1	High	2462	-1.23	-45.59	≤-21.23	PASS

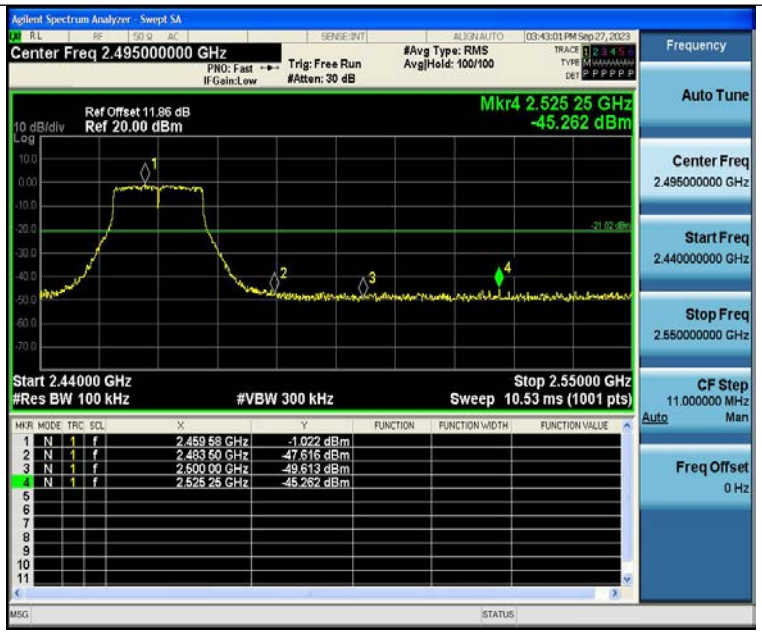


11B-Ant1-2412-PASS

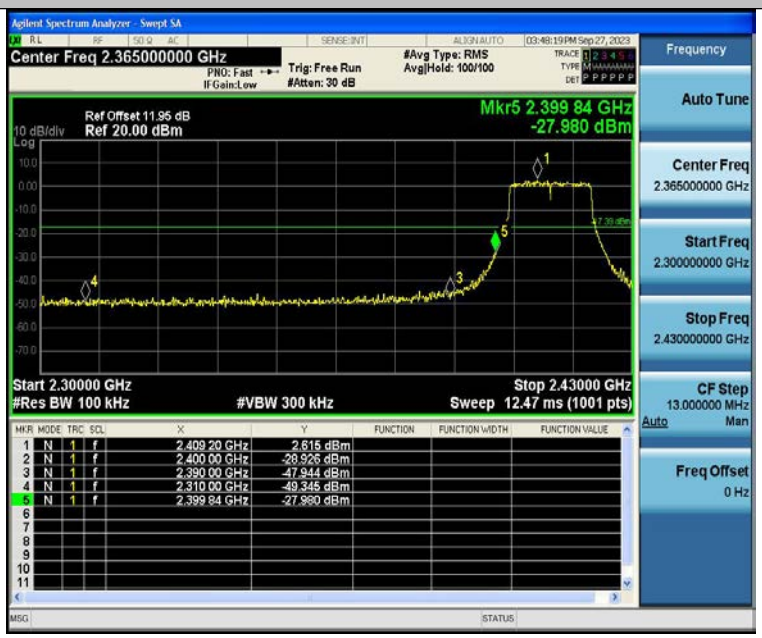


11B-Ant1-2462-PASS

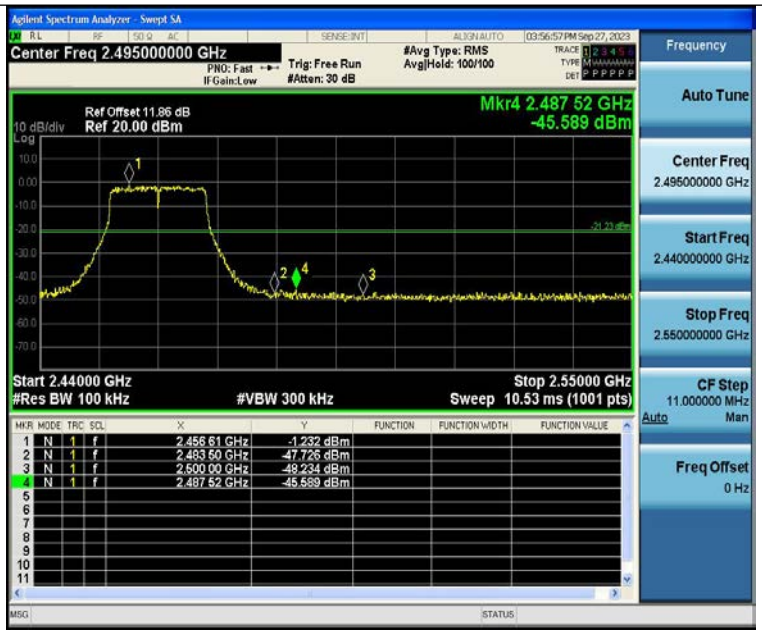
11G-Ant1-2412-PASS



11G-Ant1-2462-PASS



11N20SISO-Ant1-2412-PASS



11N20SISO-Ant1-2462-PASS

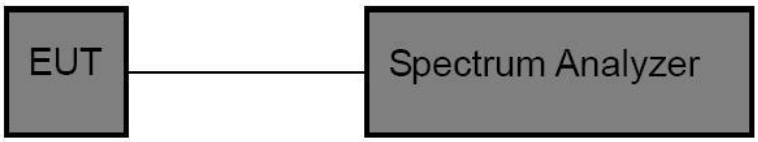
9 6dB Bandwidth Measurement

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit		Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.1 Test Procedure

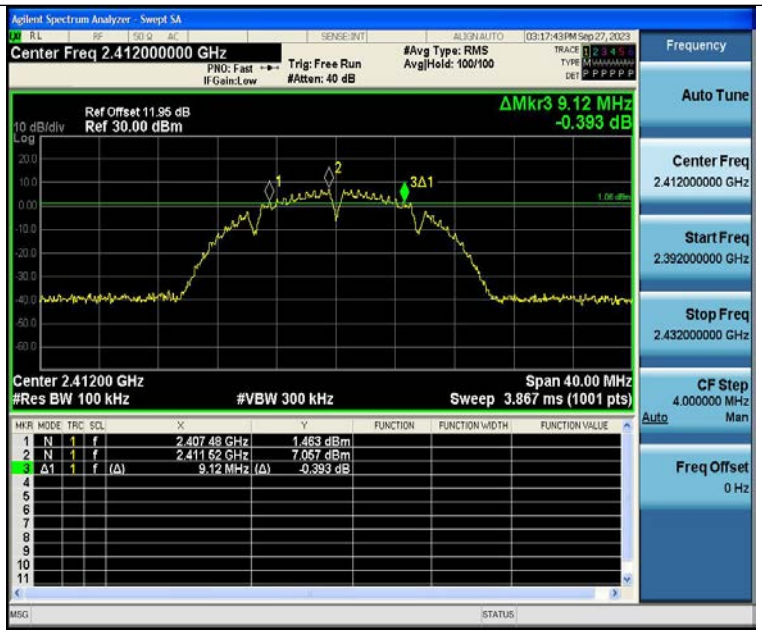
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

9.2 Test Setup

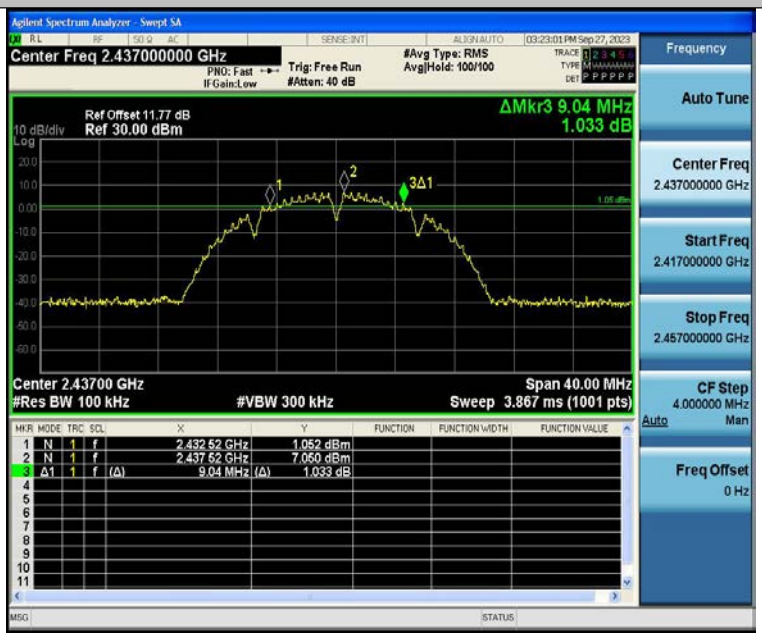


9.3 Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	9.120	2407.480	2416.600	0.5	PASS
11B	Ant1	2437	9.040	2432.520	2441.560	0.5	PASS
11B	Ant1	2462	9.040	2457.520	2466.560	0.5	PASS
11G	Ant1	2412	16.560	2403.760	2420.320	0.5	PASS
11G	Ant1	2437	16.560	2428.760	2445.320	0.5	PASS
11G	Ant1	2462	16.560	2453.760	2470.320	0.5	PASS
11N20SISO	Ant1	2412	17.760	2403.160	2420.920	0.5	PASS
11N20SISO	Ant1	2437	17.760	2428.160	2445.920	0.5	PASS
11N20SISO	Ant1	2462	17.760	2453.160	2470.920	0.5	PASS

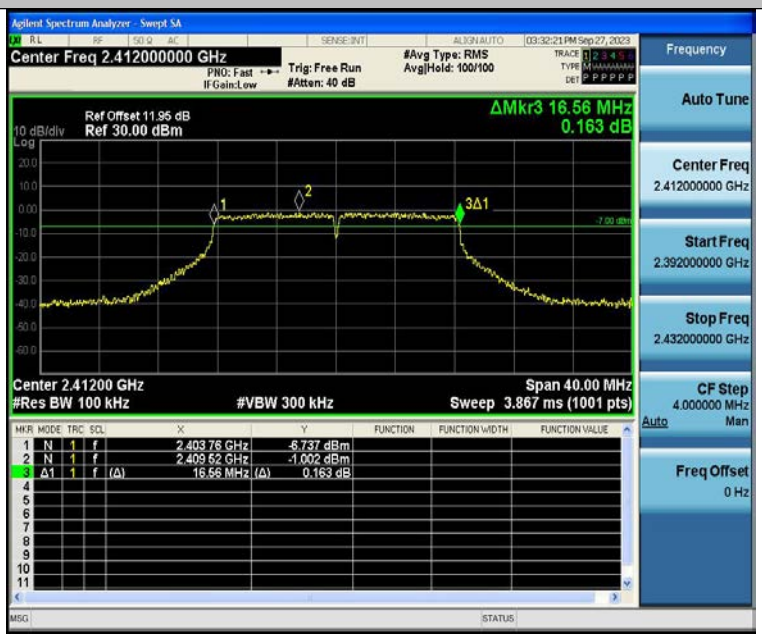


11B-Ant1-2412-PASS



11B-Ant1-2437-PASS

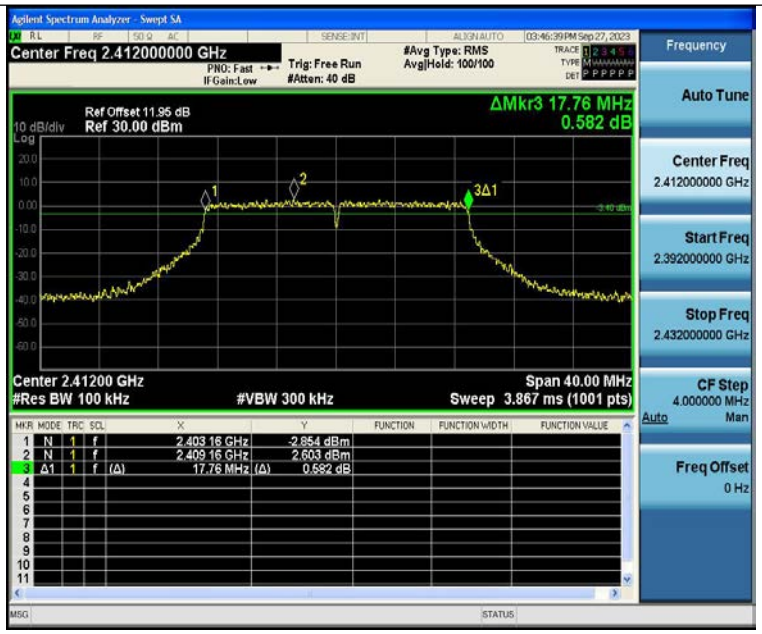
11B-Ant1-2462-PASS



11G-Ant1-2412-PASS

11G-Ant1-2437-PASS

11G-Ant1-2462-PASS



11N20SISO-Ant1-2412-PASS

11N20SISO-Ant1-2437-PASS

11N20SISO-Ant1-2462-PASS

10 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

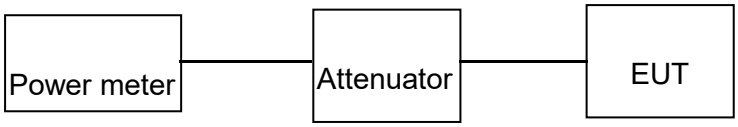
Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

10.1 Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 D01 15.247 Meas Guidance v05 section 8.3.1.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

10.2 Test Setup



10.3 Test Result

Test Mode	Antenna	Frequency[MHz]	Set Power	Peak Powert[dBm]	Conducted Limit[dBm]	EIRP [dBm]	EIRP Limit[dBm]	Verdict
11B	Ant1	2412	---	19.05	≤30.00	21.59	≤36.00	PASS
11B	Ant1	2437	---	19.13	≤30.00	21.67	≤36.00	PASS
11B	Ant1	2462	---	18.95	≤30.00	21.49	≤36.00	PASS
11G	Ant1	2412	---	20.22	≤30.00	22.76	≤36.00	PASS
11G	Ant1	2437	---	20.33	≤30.00	22.87	≤36.00	PASS
11G	Ant1	2462	---	20.22	≤30.00	22.76	≤36.00	PASS
11N20SISO	Ant1	2412	---	24.26	≤30.00	26.80	≤36.00	PASS
11N20SISO	Ant1	2437	---	20.55	≤30.00	23.09	≤36.00	PASS
11N20SISO	Ant1	2462	---	20.53	≤30.00	23.07	≤36.00	PASS

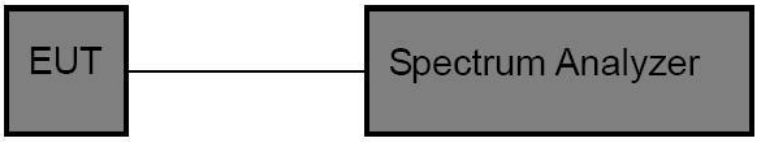
11 Power Spectral density

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

11.1 Test Procedure

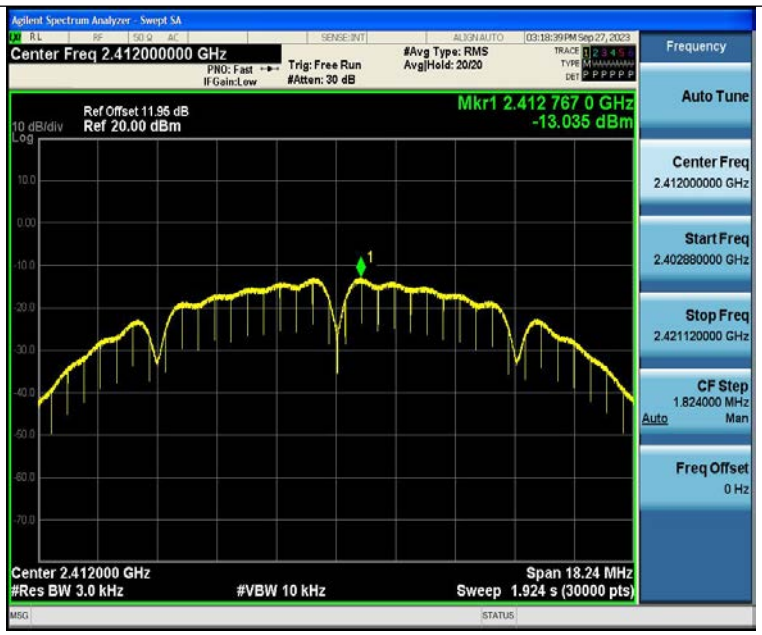
1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below:
   Center frequency=DTS channel center frequency
   Span = 1.5 times the DTS bandwidth
   RBW = 3KHz, VBW = 10KHz
   Sweep time = auto couple
   Detector = peak
   Trace mode =max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW(no less than 3KHz) and repeat.

11.2 Test Setup

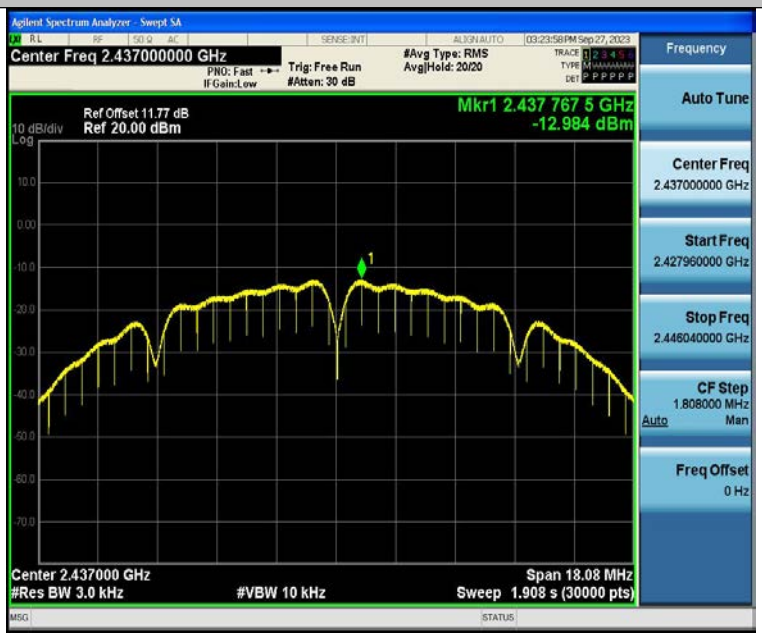


11.3 Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-13.04	≤8.00	PASS
11B	Ant1	2437	-12.98	≤8.00	PASS
11B	Ant1	2462	-13.12	≤8.00	PASS
11G	Ant1	2412	-15.03	≤8.00	PASS
11G	Ant1	2437	-14.9	≤8.00	PASS
11G	Ant1	2462	-15.1	≤8.00	PASS
11N20SISO	Ant1	2412	-11.22	≤8.00	PASS
11N20SISO	Ant1	2437	-14.9	≤8.00	PASS
11N20SISO	Ant1	2462	-14.99	≤8.00	PASS

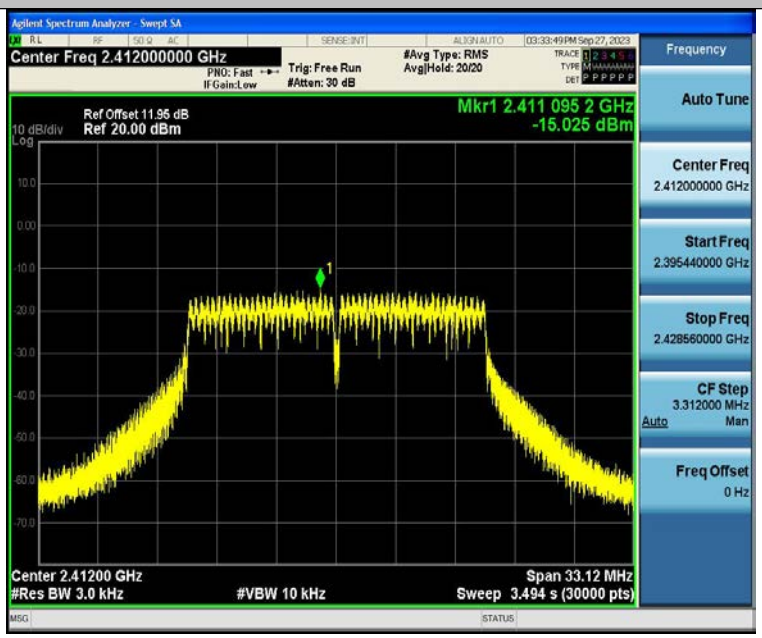


11B-Ant1-2412-PASS

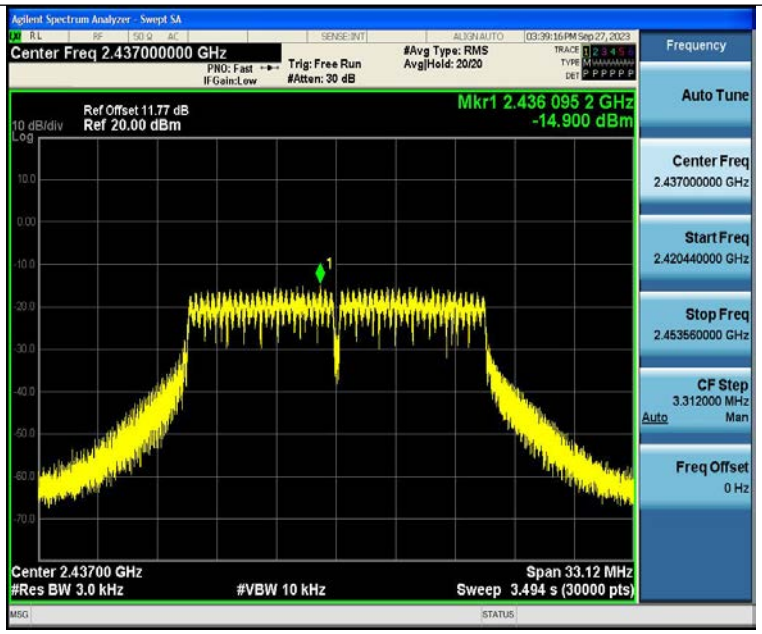


11B-Ant1-2437-PASS

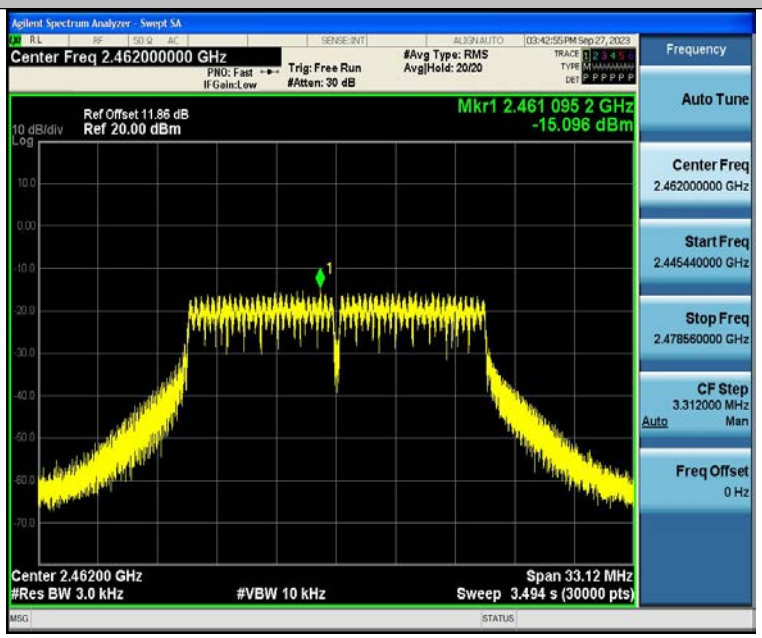
11B-Ant1-2462-PASS



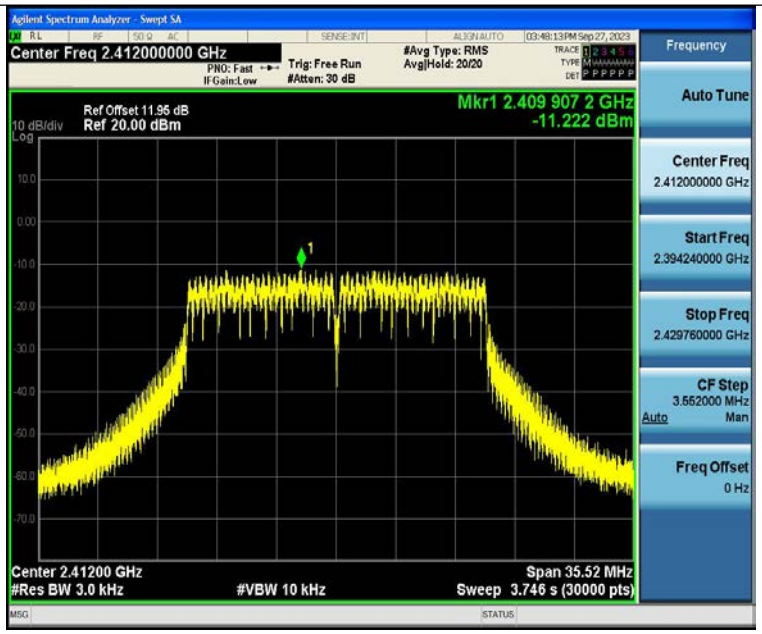
11G-Ant1-2412-PASS



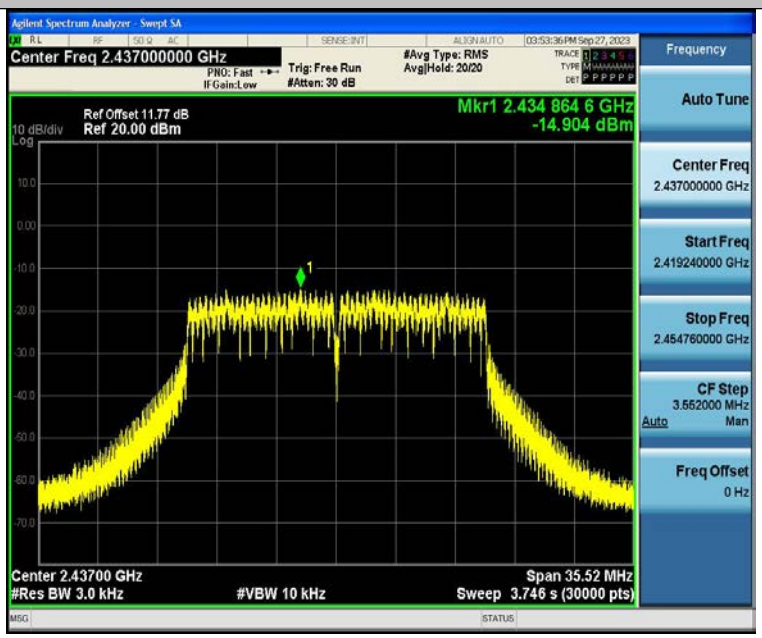
11G-Ant1-2437-PASS



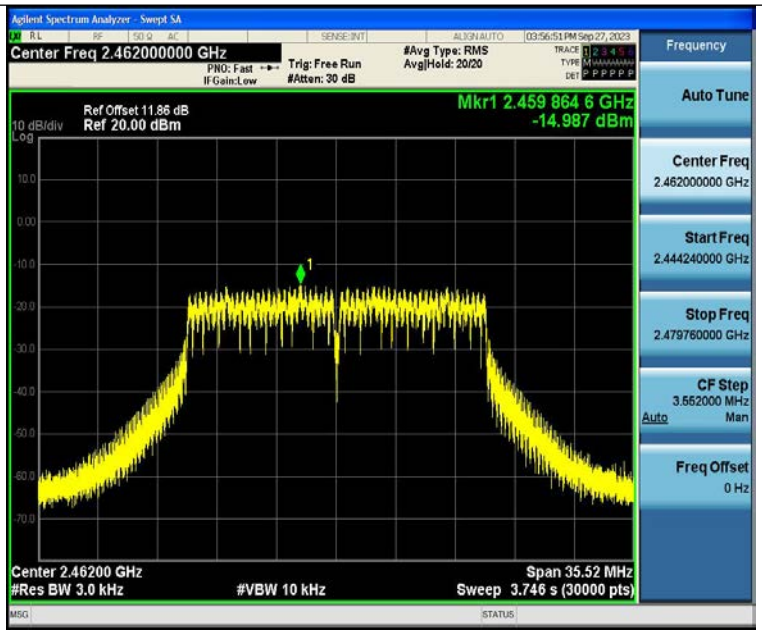
11G-Ant1-2462-PASS



11N20SISO-Ant1-2412-PASS



11N20SISO-Ant1-2437-PASS



11N20SISO-Ant1-2462-PASS

12 Antenna Application

12.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 Result

The EUT'S antenna, permanent attached antenna,is PCB Antenna. The antenna's gain is 2.54 dBi and meets the requirement.

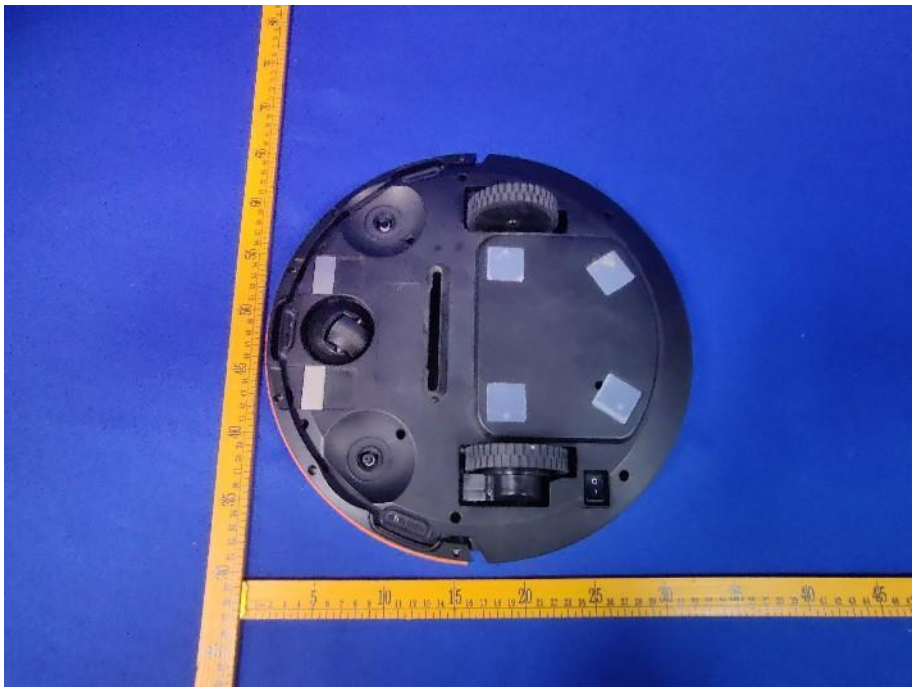
13 Test Setup

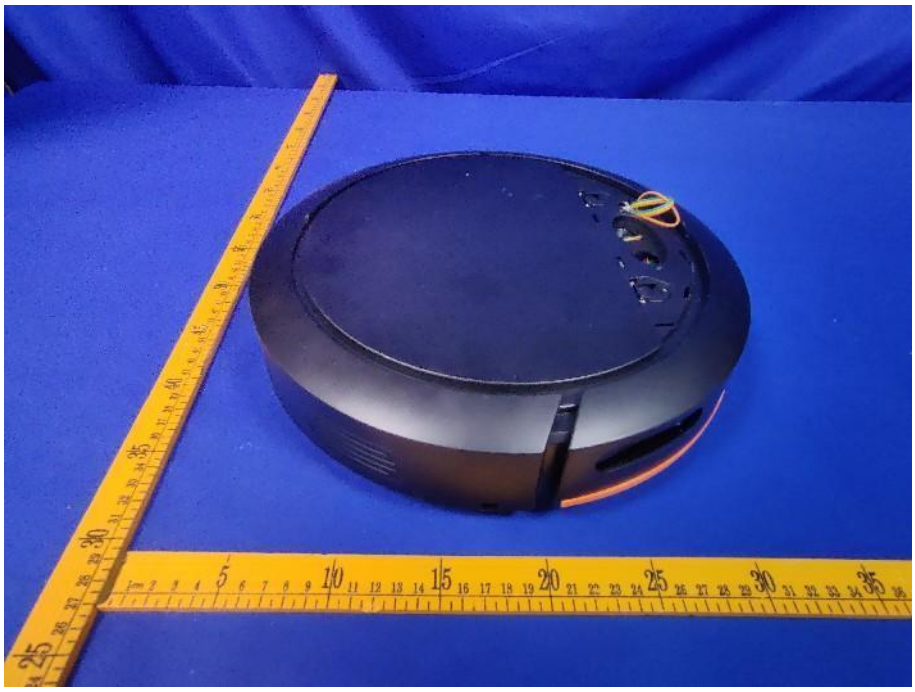
Conducted Emissions

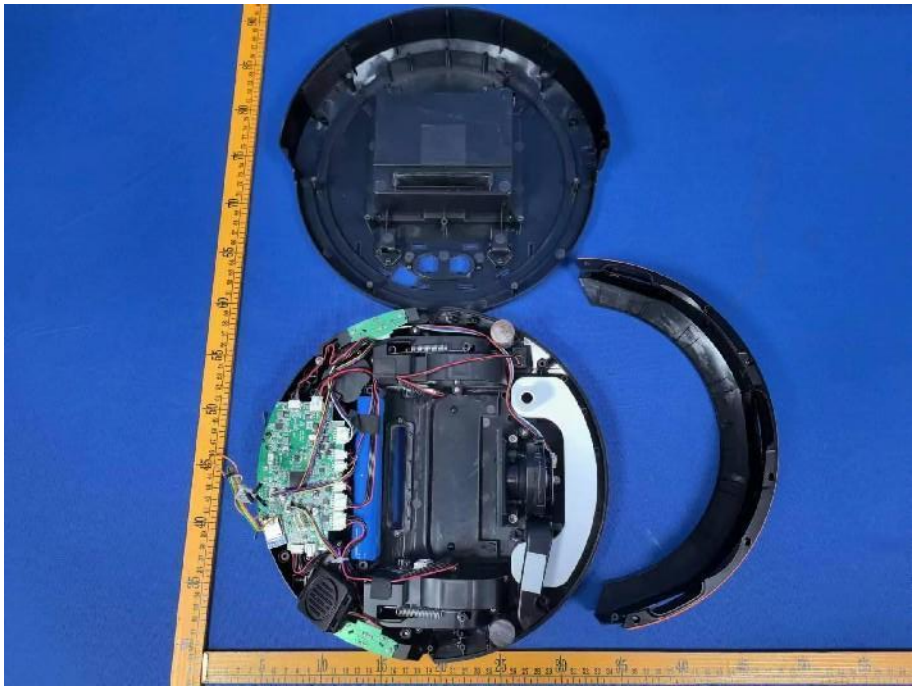
Radiated Spurious Emissions
From 30MHz-1000MHz

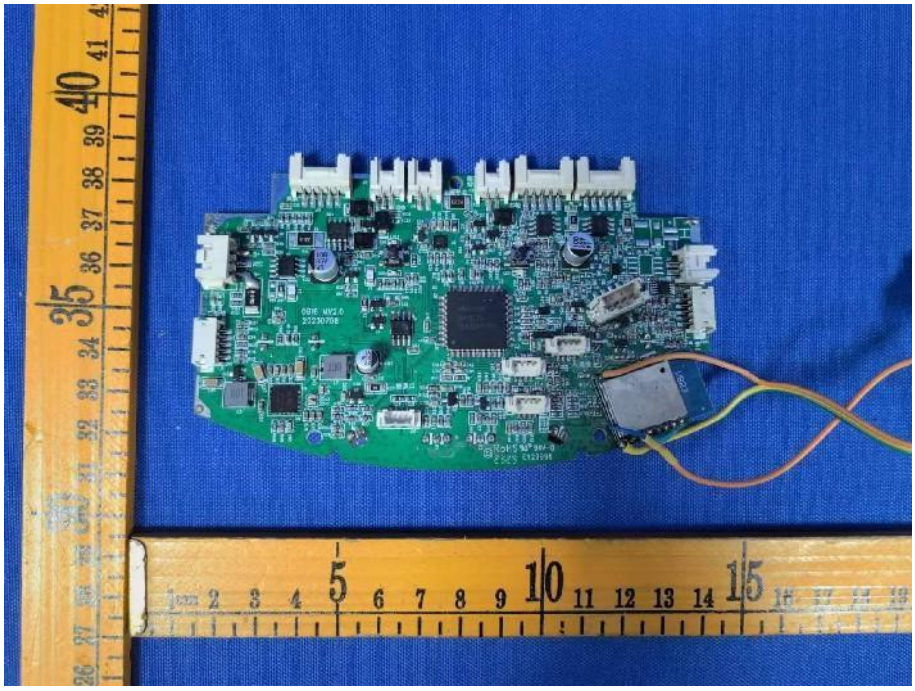
Test frequency from Above 1GHz

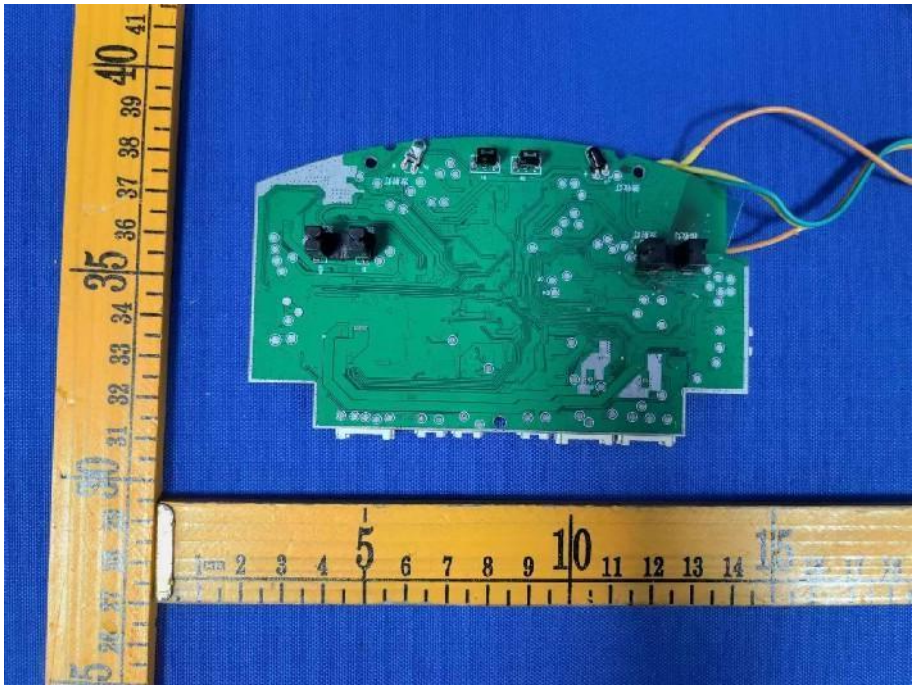
14 EUT PHOTOS

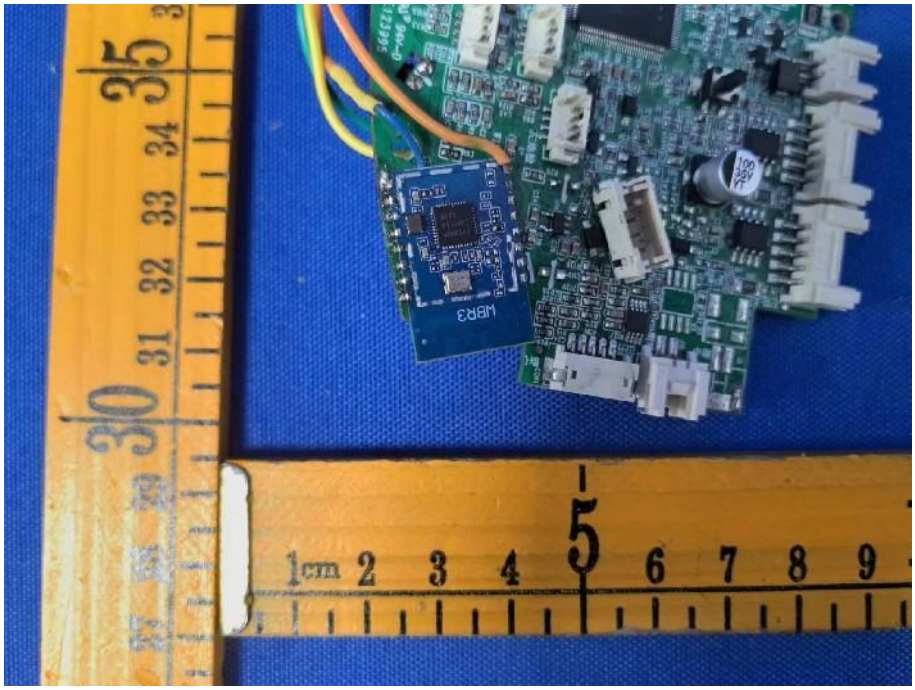


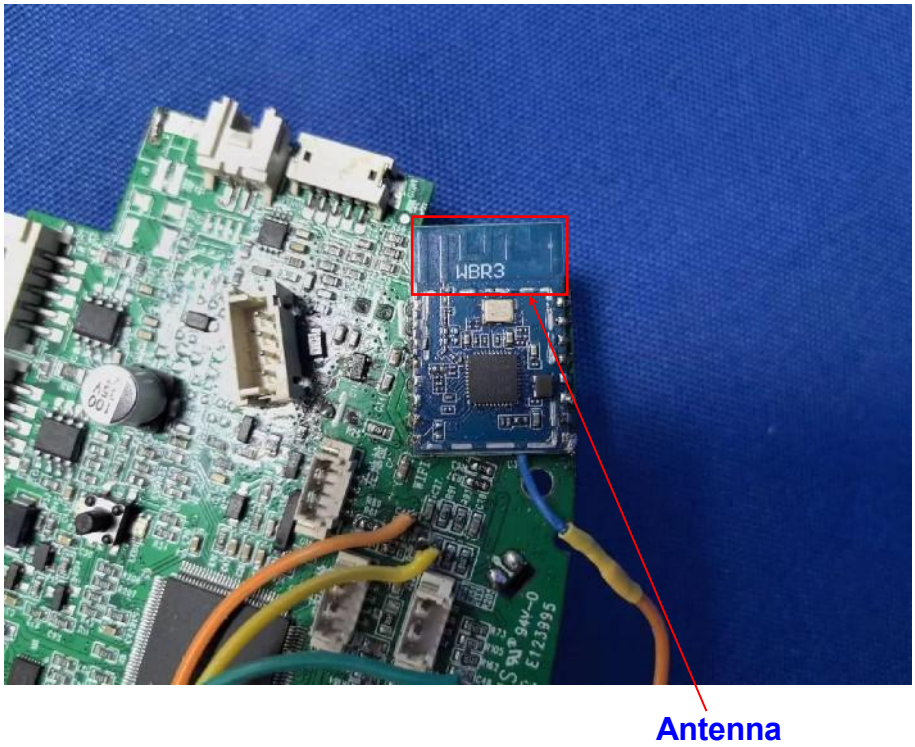


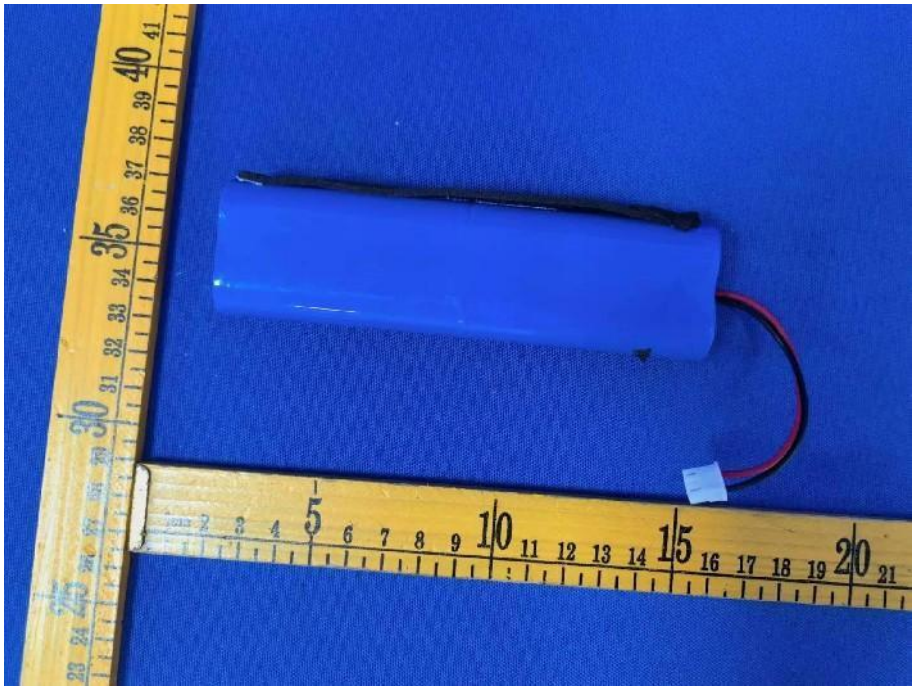









WBR3
Antenna



********THE END REPORT********