FCC TEST REPORT

FCC ID: 2AGTU-V15

Product	:	Powered Subwoofer
Model Name	:	V15+
Additional model	:	V12+
Brand	:	MILLER&KREISEL
Report No.	:	PTC20110303601E-FC01

Prepared for

Audio Components International, Inc

716 Yarmouth Road, Suite 212 Palos Verdes Estates, CA 90274, USA

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	:	Audio Components International, Inc
Address	:	716 Yarmouth Road, Suite 212 Palos Verdes Estates, CA 90274, USA
Manufacture's name	:	Audio Components International, Inc
Address	:	716 Yarmouth Road, Suite 212 Palos Verdes Estates, CA 90274, USA
Product name	:	Powered Subwoofer
Model name	:	V15+
Additional model	:	V12+
Standards	:	FCC CFR47 Part 15 Section 15.247 ANSI C63.10: 2013
Test procedure	:	ANSI C63.10:2013
Test Date	:	Oct. 21 ~ Nov, 09, 2020
Date of Issue	:	Nov. 10, 2020
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.
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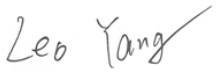
Test Engineer:



Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

Contents

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Spurious Emissions	15.205(a); 15.209; 15.247(d)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Peak Output Power	15.247(b)(1)	PASS
Power Spectral Density	15.247(e)	PASS
Conducted Bandege	15.247(d)	PASS
Spurious RF Conducted Emissions	15.247(d)	PASS
Antenna Requirement	15.203	PASS

Remark: N/A

2.1 Test Site

Precise Testing & Certification Co., Ltd.

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

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Powered Subwoofer
Model Name	:	V15+
Additional model	:	V12+ (All models have same circuits diagram of Bluetooth module PCB, RF Chip constructionl; All models have same circuits diagram of Power; Only the model name is different)
Sample ID	:	PTC20110303601E-1#
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	40
Antenna Type	:	PCB Antenna
Antenna Gain	:	2.26 dBi
Type of Modulation	:	GFSK
Power supply	:	100-120V~,60Hz /220-240V~50Hz

3.2 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	**2402**	14	2430	28	2458
01	2404	15	2432	29	2460
02	2406	16	2434	30	2462
03	2408	17	2436	31	2464
04	2410	18	2438	32	2466
05	2412	**19**	**2440**	33	2468
06	2414	20	2442	34	2470
07	2416	21	2444	35	2472
08	2418	22	2446	36	2474
09	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	**2480**
12	2426	26	2454		
13	2428	27	2456		

Note: 1. Test of channel was included the lowest 2402MHz, middle 2440MHz and highest frequency 2480MHz in highest data rate and to perform the test, then record on this report.
2. Test SW Version: sscom32E

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
MXG Signal Analyzer	Agilent	N9020A	SER MY5111038	10Hz-30GHz	Aug. 21, 2021
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Aug. 21, 2021
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Aug. 21, 2021
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Aug. 21, 2021

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.

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 21, 2021
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Aug. 21, 2021
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug. 21, 2021
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Aug. 21, 2021
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Aug. 21, 2021
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Aug. 21, 2021
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug. 21, 2021
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Aug. 21, 2021
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	Aug. 21, 2021
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Aug. 21, 2021
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Aug. 21, 2021
RF Cable	R&S	R204	R21X	1GHz-40GHz	Aug. 21, 2021

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 21, 2021
Artificial Mains Network	Rohde&Schwarz	ENV216	102453	9KHz-300MHz	Aug. 21, 2021
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Aug. 21, 2021
Test software					
E3	Audix	6.101223a	N/A	N/A	E3

4.2 Description of Support Units

Equipment	Model No.	Series No.
Notebook	Lenovo G475	GB14477457

4.3 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
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

5 Conducted Emission

5.1 Conducted Power Line Emission Limit

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency	Limit (dBuV)	
MHz	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
NOTE: 1.The lower limit shall apply at the transition frequencies. 2.The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

5.2 EUT Operation

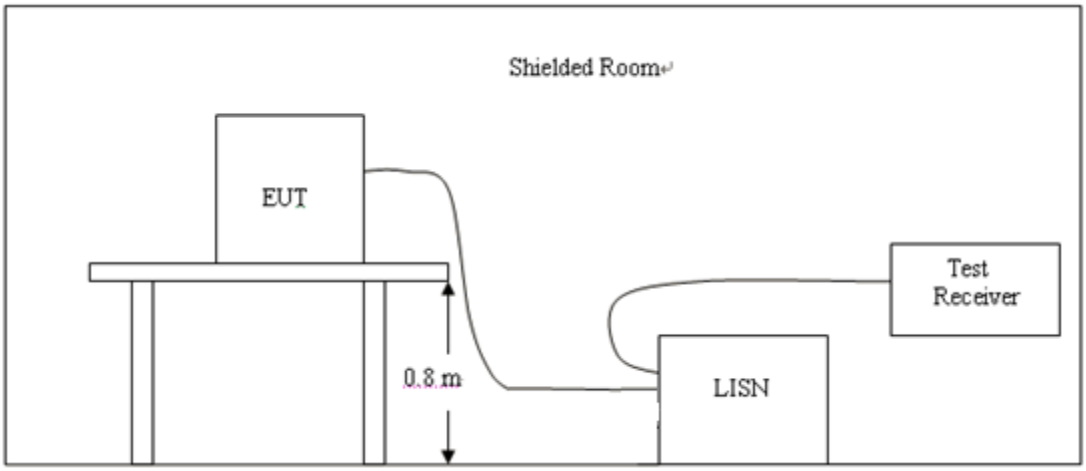
Operating Environment :

Temperature : 24.7 °C

Humidity : 56 % RH

Atmospheric Pressure : 101.5kPa

5.3 Test Setup



5.4 Test Procedure

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. 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.

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. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.

5. All support equipments received AC power from a second LISN, if any.

6. The EUT 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.

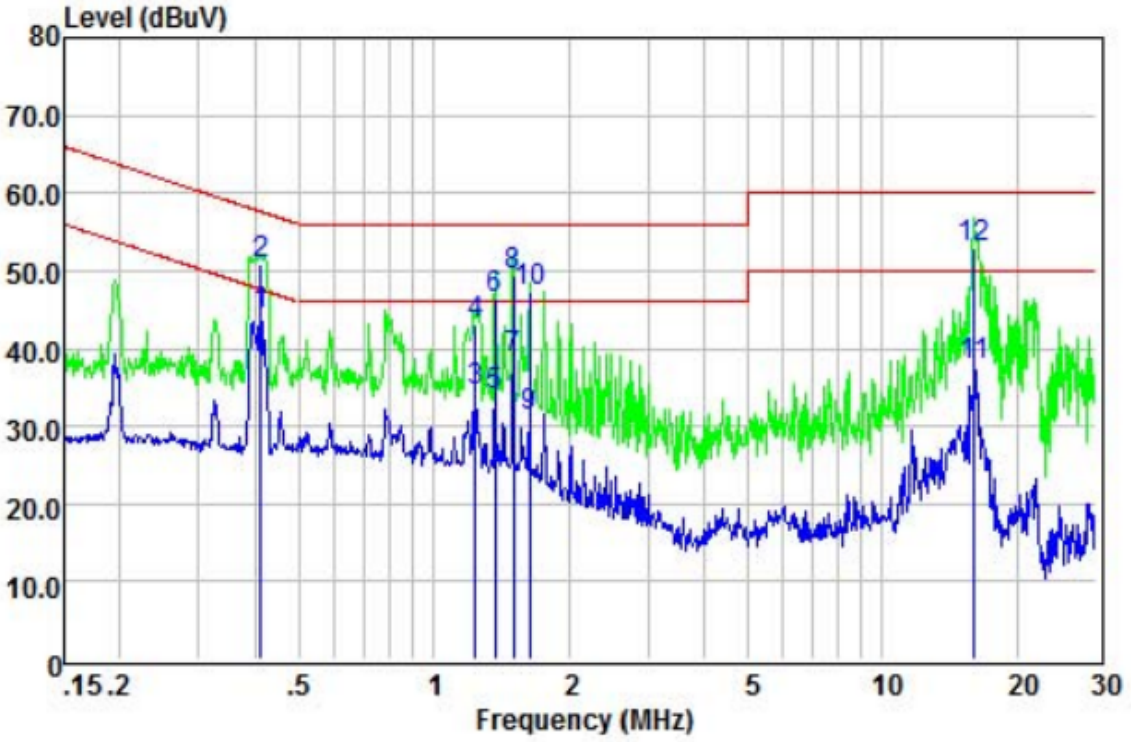
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

5.5 Summary of Test Results

Pass

Remark:
1. All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below.

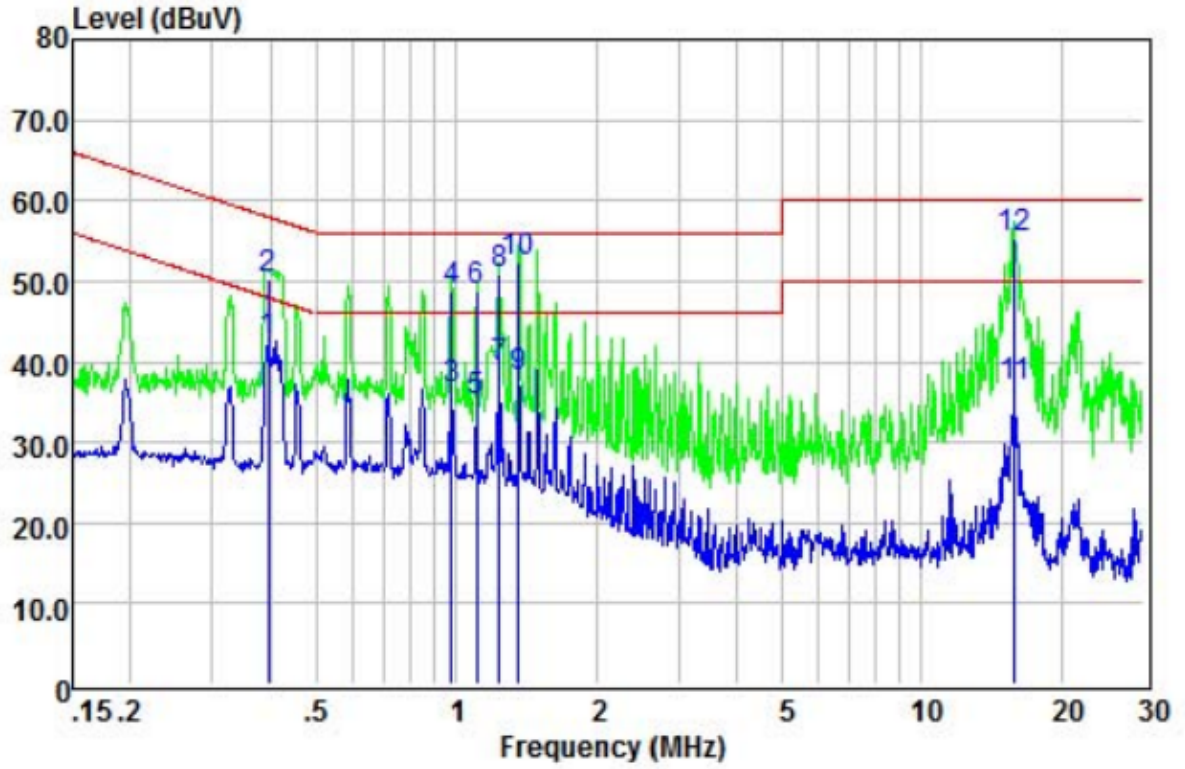
Phase: Line GFSK(Transmitting mode of GFSK 2480MHz)



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.41	34.46	9.67	0.05	44.18	47.59	-3.41	Average
2	0.41	41.08	9.67	0.05	50.80	57.59	-6.79	QP
3	1.24	24.81	9.60	0.06	34.47	46.00	-11.53	Average
4	1.24	33.52	9.60	0.06	43.18	56.00	-12.82	QP
5	1.37	24.21	9.60	0.06	33.87	46.00	-12.13	Average
6	1.37	36.72	9.60	0.06	46.38	56.00	-9.62	QP
7	1.51	28.93	9.60	0.06	38.59	46.00	-7.41	Average
8	1.51	39.64	9.60	0.06	49.30	56.00	-6.70	QP
9	1.64	21.45	9.60	0.06	31.11	46.00	-14.89	Average
10	1.64	37.72	9.60	0.06	47.38	56.00	-8.62	QP
11	16.05	28.27	9.55	0.10	37.92	50.00	-12.08	Average
12	16.05	43.26	9.55	0.10	52.91	60.00	-7.09	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

Phase: Neutral GFSK(Transmitting mode of GFSK 2480MHz)



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.40	32.81	9.62	0.05	42.48	47.95	-5.47	Average
2	0.40	40.45	9.62	0.05	50.12	57.95	-7.83	QP
3	0.98	26.75	9.63	0.06	36.44	46.00	-9.56	Average
4	0.98	39.13	9.63	0.06	48.82	56.00	-7.18	QP
5	1.11	25.38	9.62	0.06	35.06	46.00	-10.94	Average
6	1.11	39.21	9.62	0.06	48.89	56.00	-7.11	QP
7	1.24	29.54	9.61	0.06	39.21	46.00	-6.79	Average
8	1.24	41.29	9.61	0.06	50.96	56.00	-5.04	QP
9	1.37	28.39	9.60	0.06	38.05	46.00	-7.95	Average
10	1.37	42.66	9.60	0.06	52.32	56.00	-3.68	QP
11	15.89	26.97	9.76	0.10	36.83	50.00	-13.17	Average
12	15.89	45.35	9.76	0.10	55.21	60.00	-4.79	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

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 : 24.7 °C

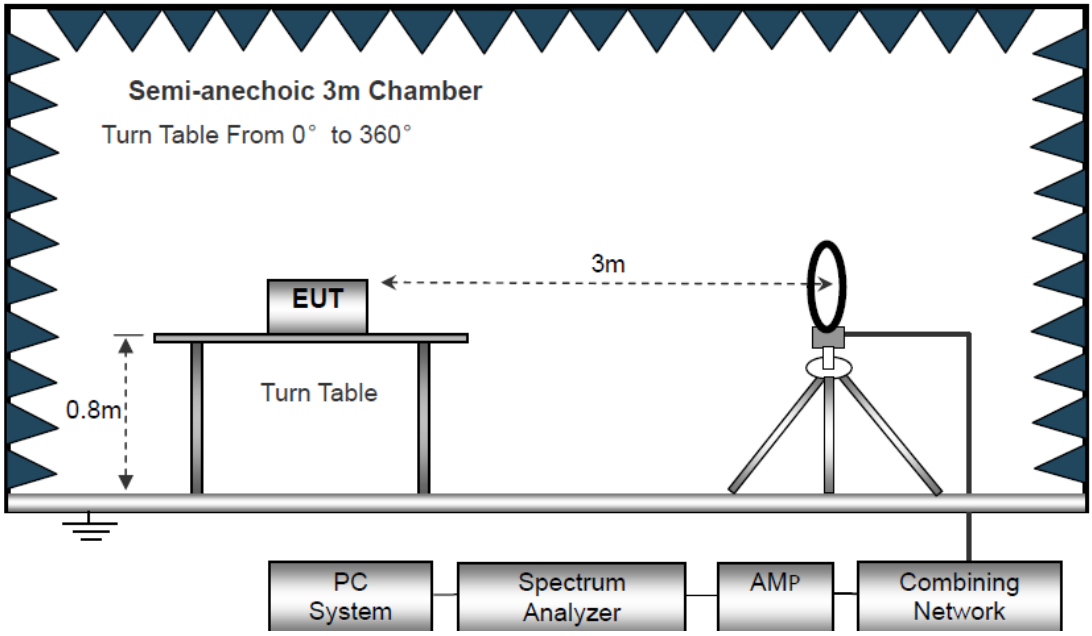
Humidity : 56 % RH

Atmospheric Pressure : 101.5kPa

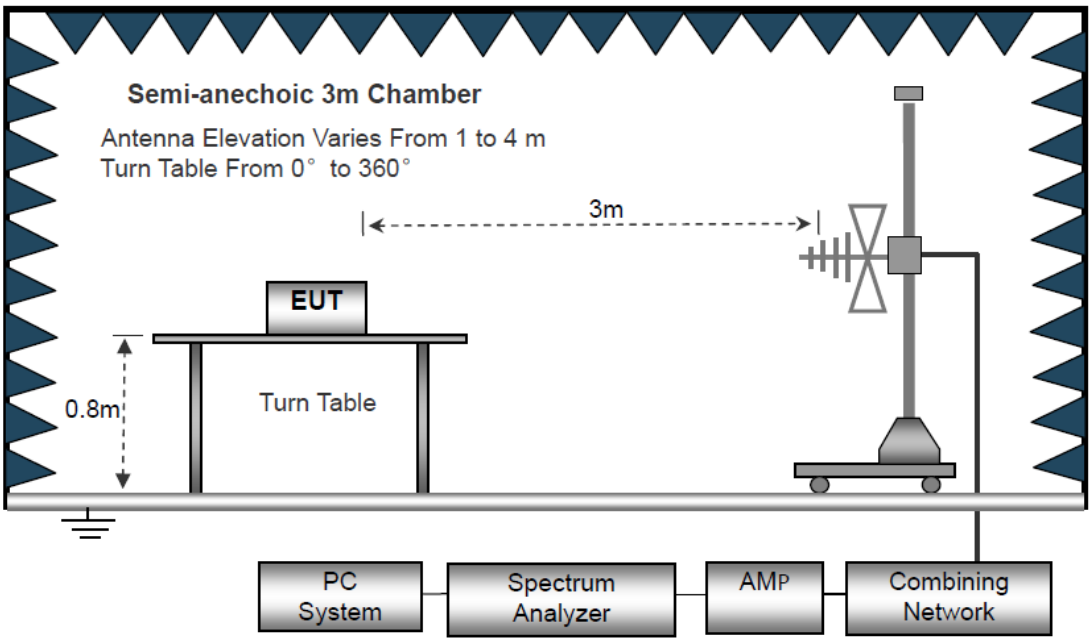
6.2 Test Setup

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

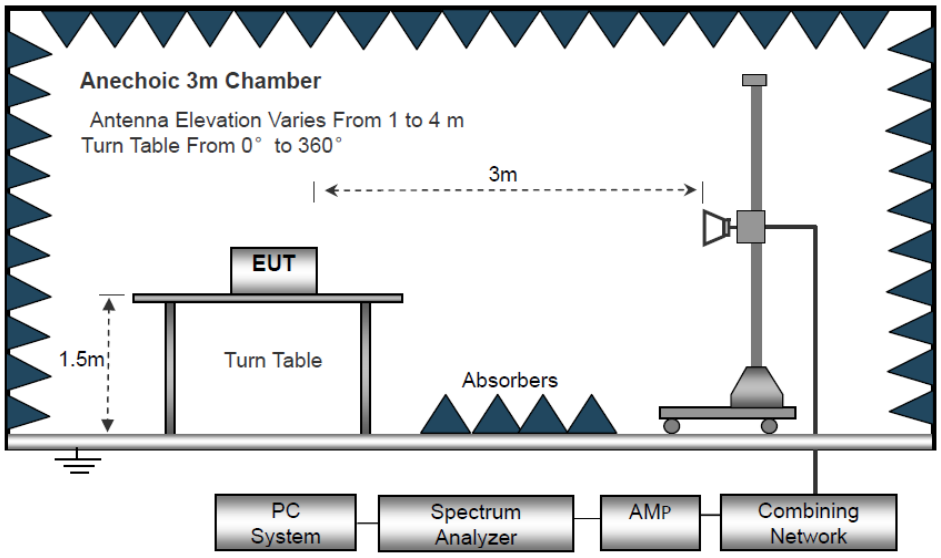
The test setup for emission measurement below 30MHz



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

Receiver Setup	Frequency	Detector	RBW	VBW	Remark
	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. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.

2. 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.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

8. 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.

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.

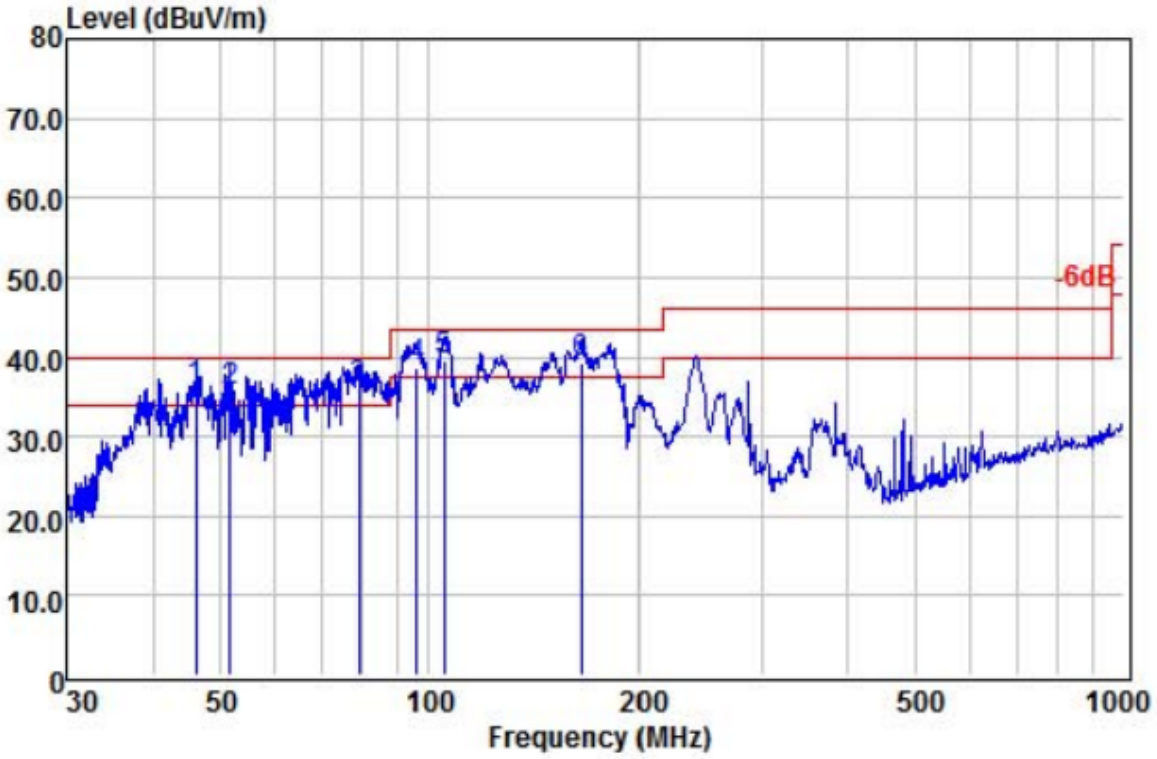
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass

Remark:
All the test modes completed for test. The worst case of Radiated Emission is High channel, the test data of this mode was reported.

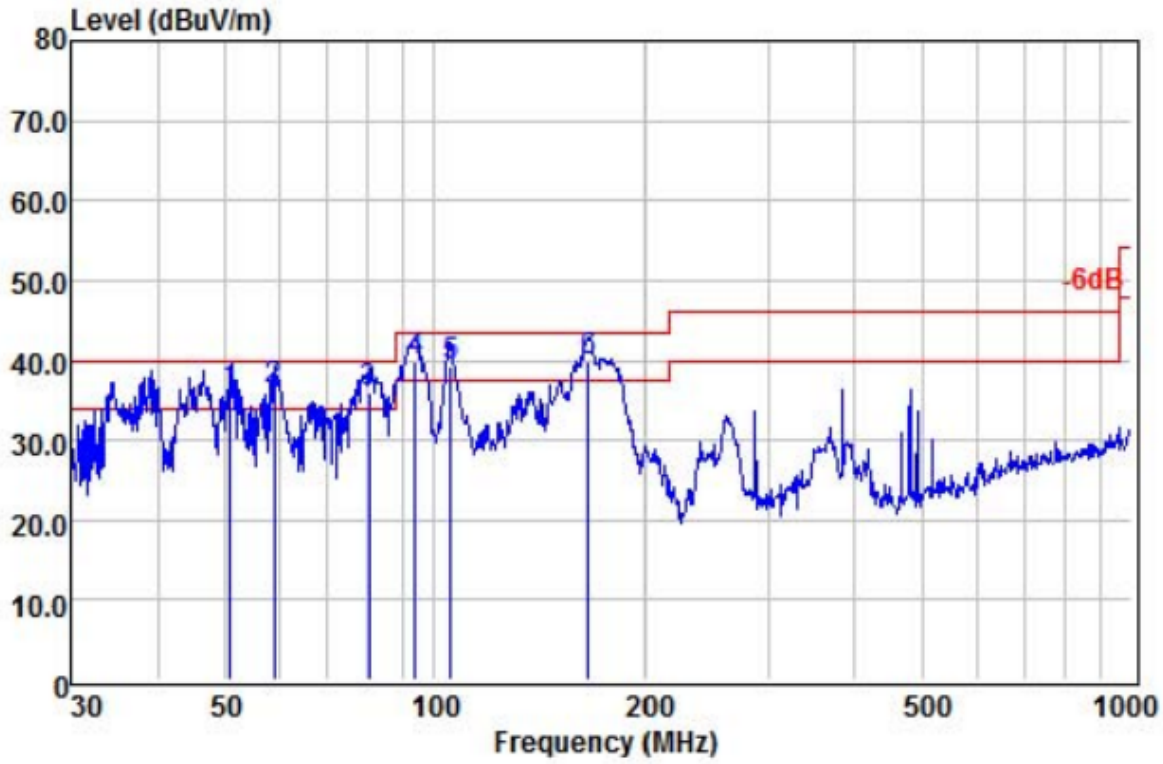
Polarization: Horizontal GFSK(Transmitting mode of GFSK 2480MHz)



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1 !	46.02	22.31	13.28	0.27	35.86	40.00	-4.14	QP
2 !	51.66	22.15	13.37	0.31	35.83	40.00	-4.17	QP
3 !	79.24	26.41	8.78	0.87	36.06	40.00	-3.94	QP
4 !	96.10	28.07	9.86	0.83	38.76	43.50	-4.74	QP
5 !	104.90	26.86	11.85	0.82	39.53	43.50	-3.97	QP
6 !	165.49	23.67	14.78	0.86	39.31	43.50	-4.19	QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Polarization: Vertical GFSK(Transmitting mode of GFSK 2480MHz)



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1 !	50.76	22.12	13.50	0.28	35.90	40.00	-4.10	QP
2 !	58.82	23.76	12.06	0.51	36.33	40.00	-3.67	QP
3 !	80.36	26.40	8.71	0.87	35.98	40.00	-4.02	QP
4 !	93.77	29.73	9.32	0.84	39.89	43.50	-3.61	QP
5 !	105.27	26.56	11.89	0.82	39.27	43.50	-4.23	QP
6 !	166.07	24.31	14.69	0.86	39.86	43.50	-3.64	QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier

Test Frequency 1GHz-25GHz:

GFSK Low Channel (2402MHz)								
Detector: Peak Value								
Frequency (MHz)	Reading Level (dBuV)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity (H/V)
4804.00	36.59	34.06	6.59	34.11	43.13	74	-30.87	V
7206.00	31.52	37.13	7.75	34.51	41.89	74	-32.11	V
9608.00	32.58	39.34	9.25	34.81	46.36	74	-27.64	V
4804.00	38.79	34.06	6.59	34.11	45.33	74	-28.67	H
7206.00	31.24	37.13	7.75	34.51	41.61	74	-32.39	H
9608.00	30.53	39.34	9.25	34.81	44.31	74	-29.69	H
Detector: Average Value								
4804.00	25.16	34.06	6.59	34.11	31.7	54	-22.3	V
7206.00	21.43	37.13	7.75	34.51	31.8	54	-22.2	V
9608.00	19.53	39.34	9.25	34.81	33.31	54	-20.69	V
4804.00	29.68	34.06	6.59	34.11	36.22	54	-17.78	H
7206.00	23.54	37.13	7.75	34.51	33.91	54	-20.09	H
9608.00	22.53	39.34	9.25	34.81	36.31	54	-17.69	H
GFSK Middle Channel (2440MHz)								
Detector: Peak Value								
Frequency (MHz)	Reading Level (dBuV)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity (H/V)
4880.00	36.59	34.05	6.59	34.11	43.12	74.00	-30.88	V
7320.00	32.49	37.12	7.74	34.53	42.82	74.00	-31.18	V
9760.00	31.4	39.34	9.24	34.8	45.18	74.00	-28.82	V
4880.00	40.16	34.05	6.59	34.11	46.69	74.00	-27.31	H
7320.00	35.26	37.12	7.74	34.53	45.59	74.00	-28.41	H
9760.00	32.59	39.34	9.24	34.8	46.37	74.00	-27.63	H
Detector: Average Value								
4880.00	26.33	34.05	6.59	34.11	32.86	54.00	-21.14	V
7320.00	23.15	37.12	7.74	34.53	33.48	54.00	-20.52	V
9760.00	18.46	39.34	9.24	34.8	32.24	54.00	-21.76	V
4880.00	29.68	34.05	6.59	34.11	36.21	54.00	-17.79	H
7320.00	23.46	37.12	7.74	34.53	33.79	54.00	-20.21	H
9760.00	21.27	39.34	9.24	34.8	35.05	54.00	-18.95	H

GFSK High Channel (2480MHz)								
Detector: Peak Value								
Frequency (MHz)	Reading Level (dBuV)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity (H/V)
4960.00	36.47	34.07	6.61	34.13	43.02	74.00	-30.98	V
7440.00	32.56	37.15	7.76	34.52	42.95	74.00	-31.05	V
9920.00	31.24	39.36	9.27	34.82	45.05	74.00	-28.95	V
4960.00	41.28	34.07	6.61	34.13	47.83	74.00	-26.17	H
7440.00	32.59	37.15	7.76	34.52	42.98	74.00	-31.02	H
9920.00	31.24	39.36	9.27	34.82	45.05	74.00	-28.95	H
Detector: Average Value								
4960.00	26.35	34.07	6.61	34.11	32.92	54.00	-21.08	V
7440.00	22.53	37.15	7.76	34.51	32.93	54.00	-21.07	V
9920.00	20.49	39.36	9.27	34.81	34.31	54.00	-19.69	V
4960.00	27.46	34.07	6.61	34.11	34.03	54.00	-19.97	H
7440.00	23.16	37.15	7.76	34.51	33.56	54.00	-20.44	H
9920.00	22.15	39.36	9.27	34.81	35.97	54.00	-18.03	H

Note: 1. Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission Level = Reading + Factor

Margin=Emission Level-Limit

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Test Mode: BLE Low Channel 2402MHz									
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
2390.00	47.38	29.19	3.44	34.06	45.95	74.00	-28.05	H	Peak
2400.00	64.53	29.22	3.46	34.06	63.15	74.00	-10.85	H	Peak
2390.00	48.26	29.19	3.44	34.06	46.83	74.00	-27.17	V	Peak
2400.00	66.63	29.22	3.46	34.06	65.25	74.00	-8.75	V	Peak
2390.00	37.49	29.19	3.44	34.06	36.06	54.00	-17.94	H	AV
2400.00	48.52	29.22	3.46	34.06	47.14	54.00	-6.86	H	AV
2390.00	37.46	29.19	3.44	34.06	36.03	54.00	-17.97	V	AV
2400.00	45.29	29.22	3.46	34.06	43.91	54.00	-10.09	V	AV

Test Mode: BLE High Channel 2480MHz									
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
2483.50	49.63	29.19	3.44	34.06	48.2	74.00	-25.8	H	Peak
2500.00	64.35	29.22	3.46	34.06	62.97	74.00	-11.03	H	Peak
2483.50	48.52	29.19	3.44	34.06	47.09	74.00	-26.91	V	Peak
2500.00	66.39	29.22	3.46	34.06	65.01	74.00	-8.99	V	Peak
2483.50	38.49	29.19	3.44	34.06	37.06	54.00	-16.94	H	AV
2500.00	48.92	29.22	3.46	34.06	47.54	54.00	-6.46	H	AV
2483.50	35.46	29.19	3.44	34.06	34.03	54.00	-19.97	V	AV
2500.00	46.53	29.22	3.46	34.06	45.15	54.00	-8.85	V	AV

7 Occupied Bandwidth

7.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

7.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

7.3 Measurement Equipment Used

Same as Radiated Emission Measurement.

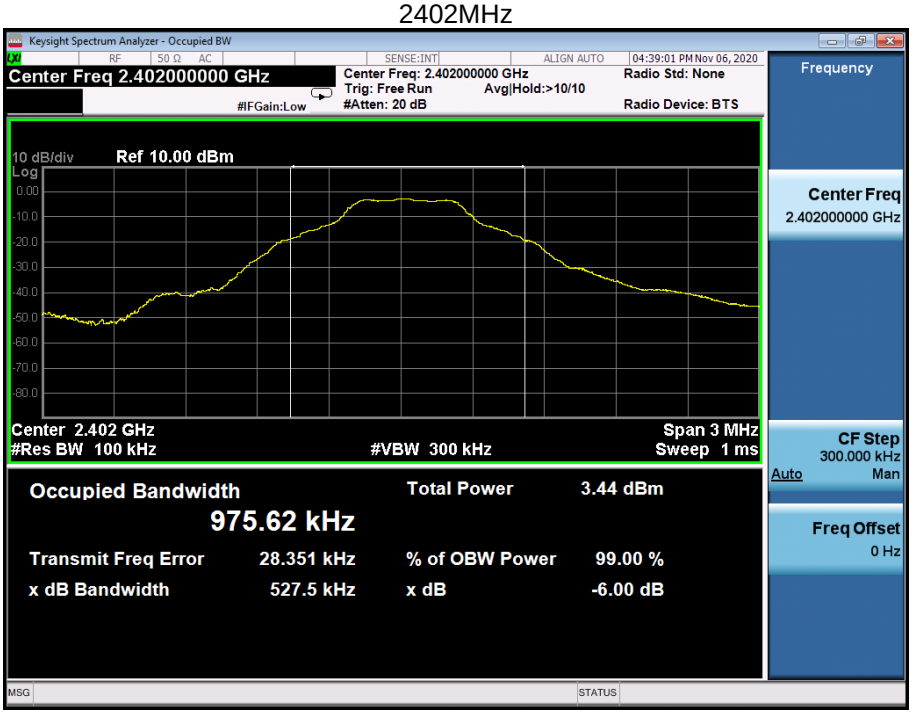
7.4 Test Result

PASS

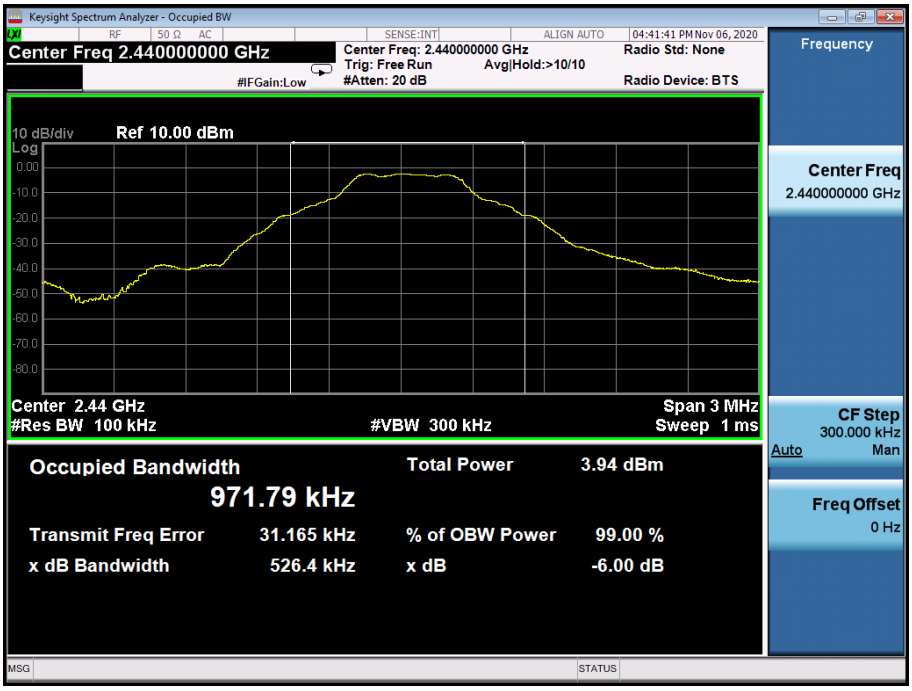
Frequency (MHz)	6dB Bandwidth (MHz)	Result
2402	0.528	PASS
2440	0.526	PASS
2480	0.523	PASS

6dB Bandwidth

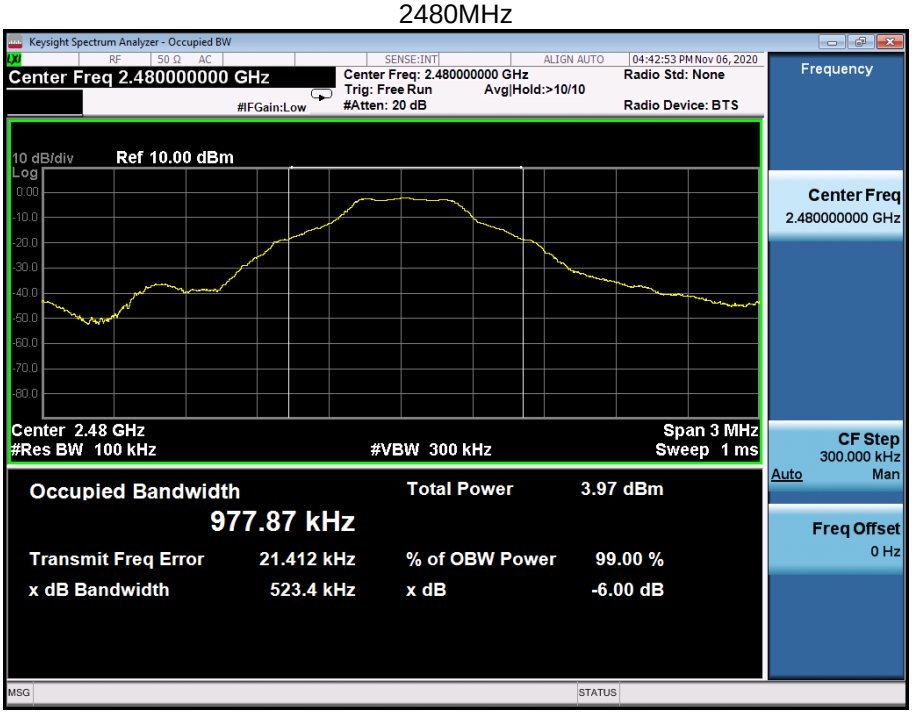
2402MHz



2440MHz



2480MHz


Keysight Spectrum Analyzer - Occupied BW
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
04:42:53 PM Nov 06, 2020
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
Frequency
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
977.87 kHz
Total Power
3.97 dBm
Transmit Freq Error
21.412 kHz
% of OBW Power
99.00 %
x dB Bandwidth
523.4 kHz
x dB
-6.00 dB
Freq Offset
0 Hz
MSG
STATUS

8 Peak Output Power

8.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

8.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The EUT was directly connected to the Power meter.

8.3 Measurement Equipment Used

Same as Radiated Emission Measurement.

8.4 Test Result

PASS

Type	Channel	Peak Output power (dBm)	Limit (dBm)	Result
GFSK	0	-1.646	30	Pass
	19	-1.436		
	39	-1.147		

9 Power Spectral Density

9.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

9.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on FCC Part15 C Section 15.247: RBW=3KHz, VBW=10KHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

9.3 Measurement Equipment Used

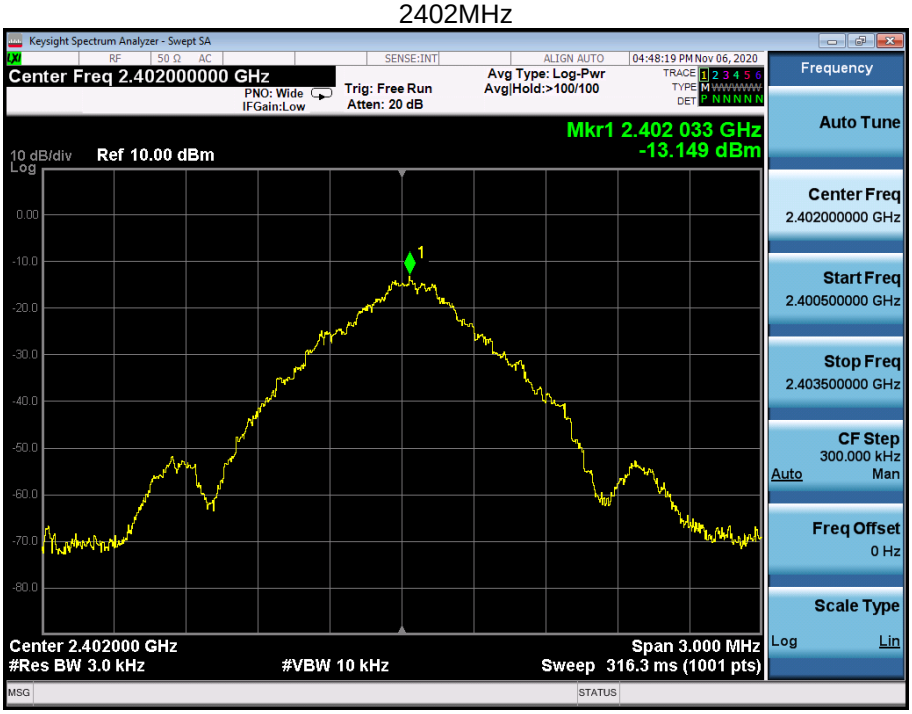
Same as Radiated Emission Measurement

9.4 Test Result

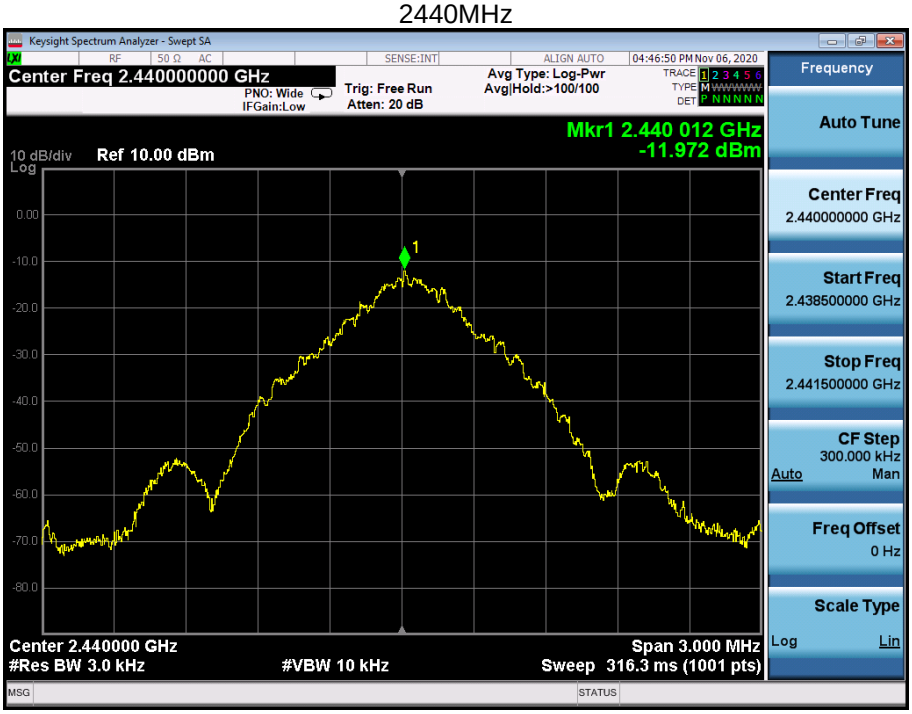
PASS

Type	Channel	Power Spectral Density	Limit (dBm/3KHz)	Result
GFSK	0	-13.149	8.00	Pass
	19	-11.972		
	39	-12.118		

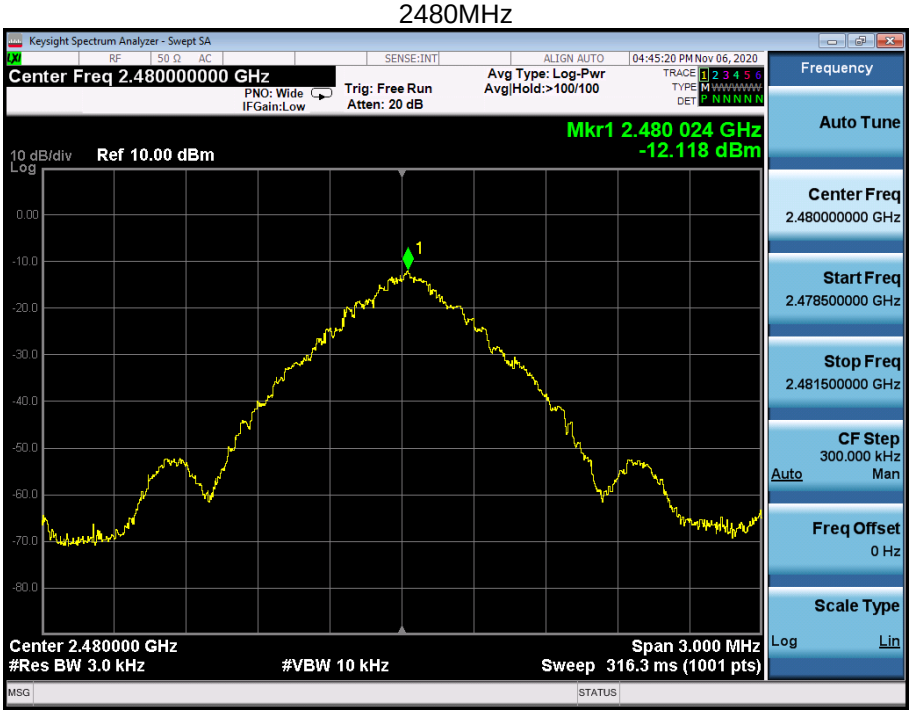
2402MHz



2440MHz



2480MHz


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
04:45:20 PM Nov 06, 2020
Mkr1 2.480 024 GHz
-12.118 dBm
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.480000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 3.000 MHz
Sweep 316.3 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

10 Conducted Band Edge

10.1 Test Setup

10.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. Set detected by the spectrum analyzer with peak detector.

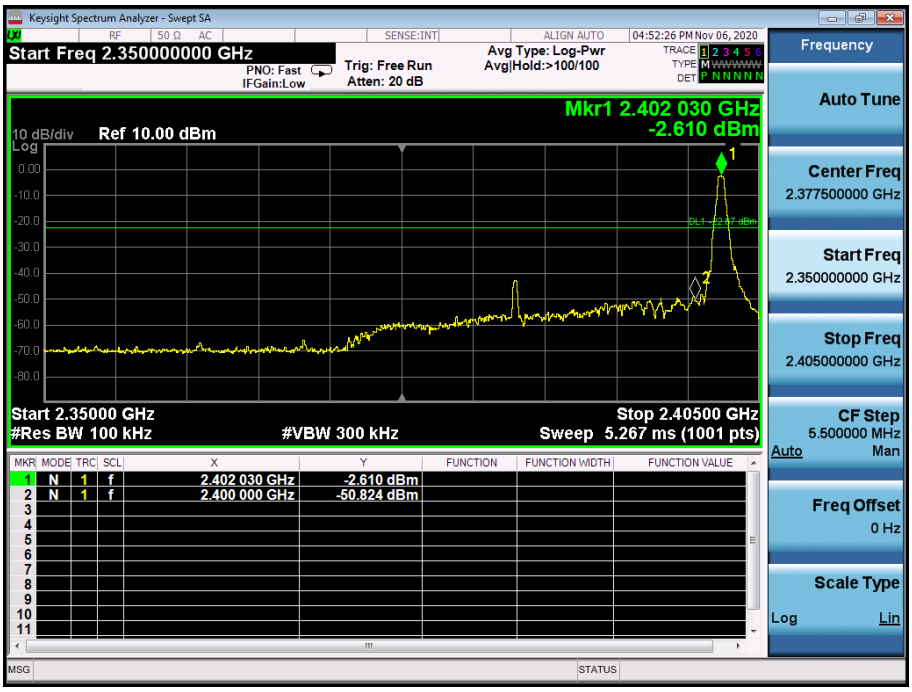
10.3 Limit

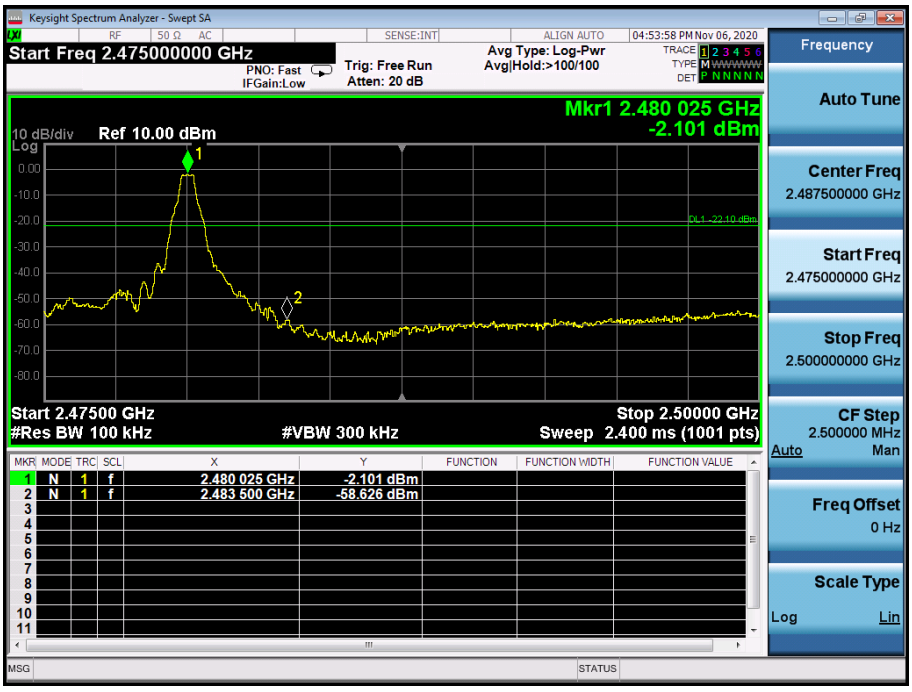
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 20dB.

10.4 Test Result

PASS

Frequency Band	Delta Peak to band emission(dBc)	＞Limit (dBc)	Result
Left-band	48.56	20	Pass
Right-band	56.53	20	Pass


Keysight Spectrum Analyzer - Swept SA
Start Freq 2.350000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
04:52:26 PM Nov 06, 2020
Mkr1 2.402 030 GHz
-2.610 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.35000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.40500 GHz
Sweep 5.267 ms (1001 pts)
1 N 1 f 2.402 030 GHz -2.610 dBm
2 N 1 f 2.400 000 GHz -50.824 dBm
Frequency
Auto Tune
Center Freq
2.377500000 GHz
Start Freq
2.350000000 GHz
Stop Freq
2.405000000 GHz
CF Step
5.500000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin


Keysight Spectrum Analyzer - Swept SA
Start Freq 2.475000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
04:53:58 PM Nov 06, 2020
Mkr1 2.480 025 GHz
-2.101 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.400 ms (1001 pts)
1 N 1 f 2.480 025 GHz -2.101 dBm
2 N 1 f 2.483 500 GHz -58.626 dBm
Frequency
Auto Tune
Center Freq
2.487500000 GHz
Start Freq
2.475000000 GHz
Stop Freq
2.500000000 GHz
CF Step
2.500000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

11 Spurious RF Conducted Emissions

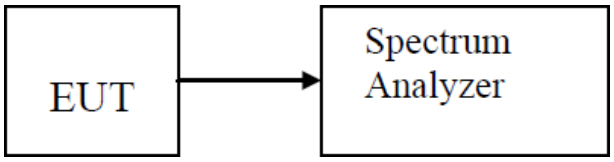
11.1 Test Limit

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.
3.For below 30MHz,For 9KHz-150kHz,150K-10MHz,We use the RBW 1KHz,10KHz, So the limit need to calculated by “10lg(BW1/BW2)“. for example For9KHz-150kHz,RBW 1KHz, The Limit= the highest emission level-20-10log(100/1)= the highest emission level-40.

11.2 Test Procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013, For 9KHz-150kHz, Set RBW=1kHz and VBW= 3KHz; For 150KHz-10MHz, Set RBW=10kHz and VBW= 30KHz:For 10MHz-25GHz ,Set RBW=100kHz and VBW= 300KHz in order to measure the peak field strength, and mwasure frequeny range from 9KHz to 25GHz.

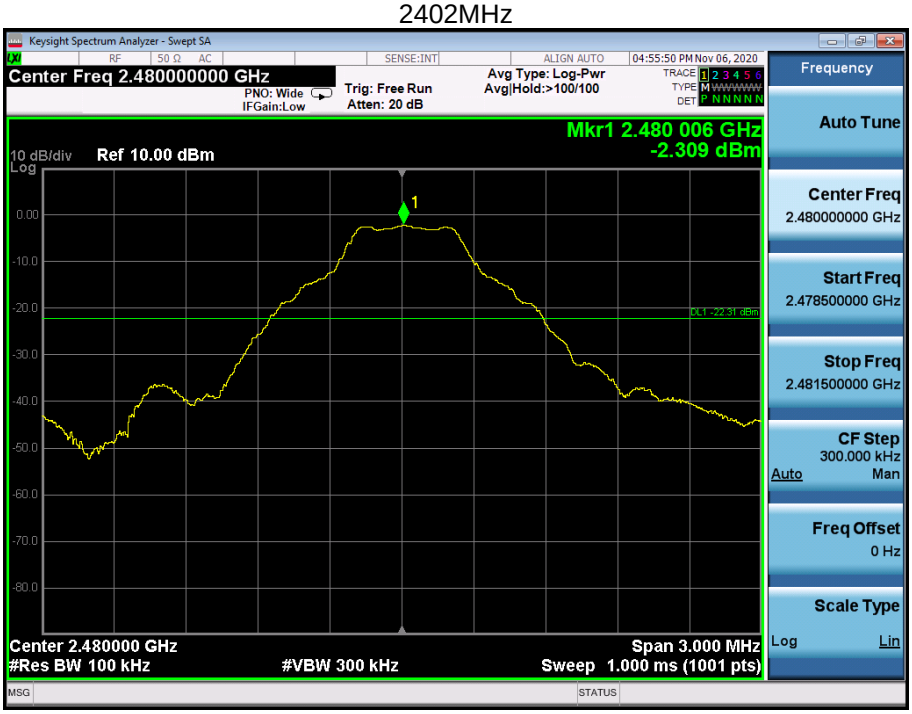
11.3 Test Setup



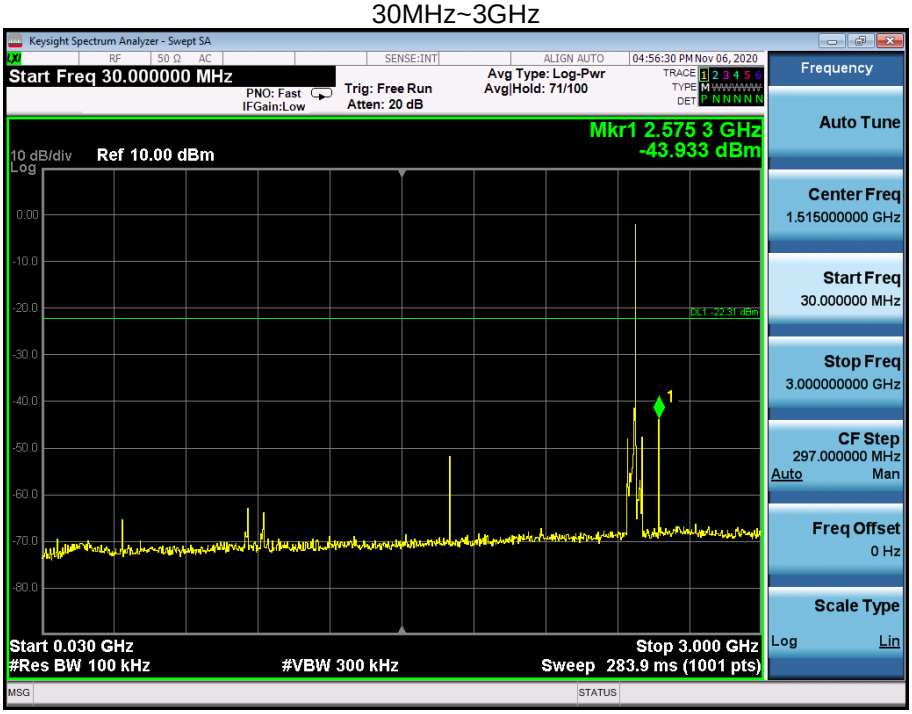
11.4 Test Result

PASS

2402MHz



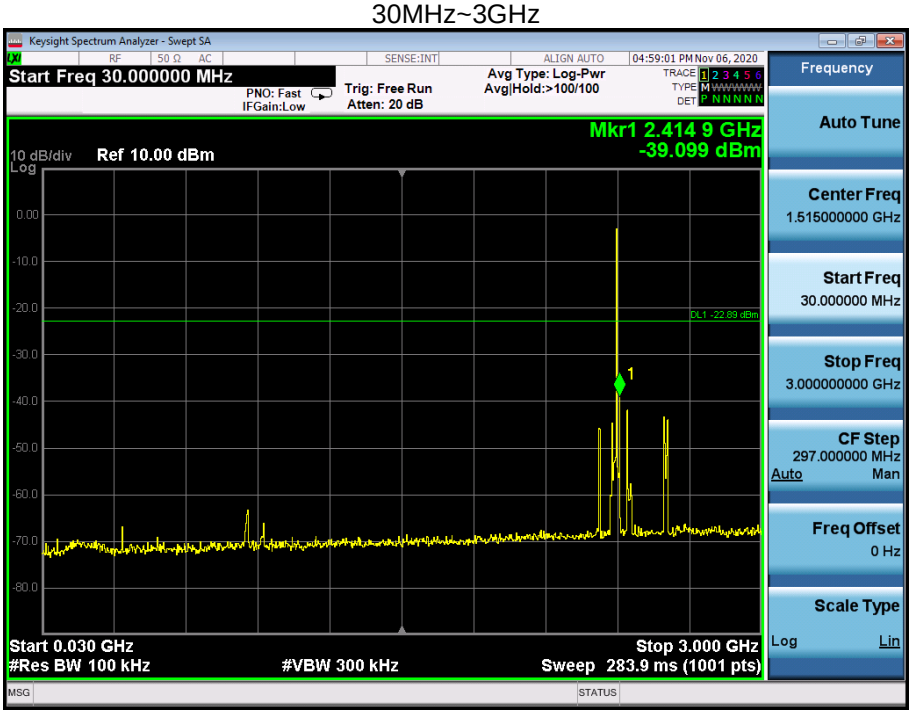
30MHz~3GHz



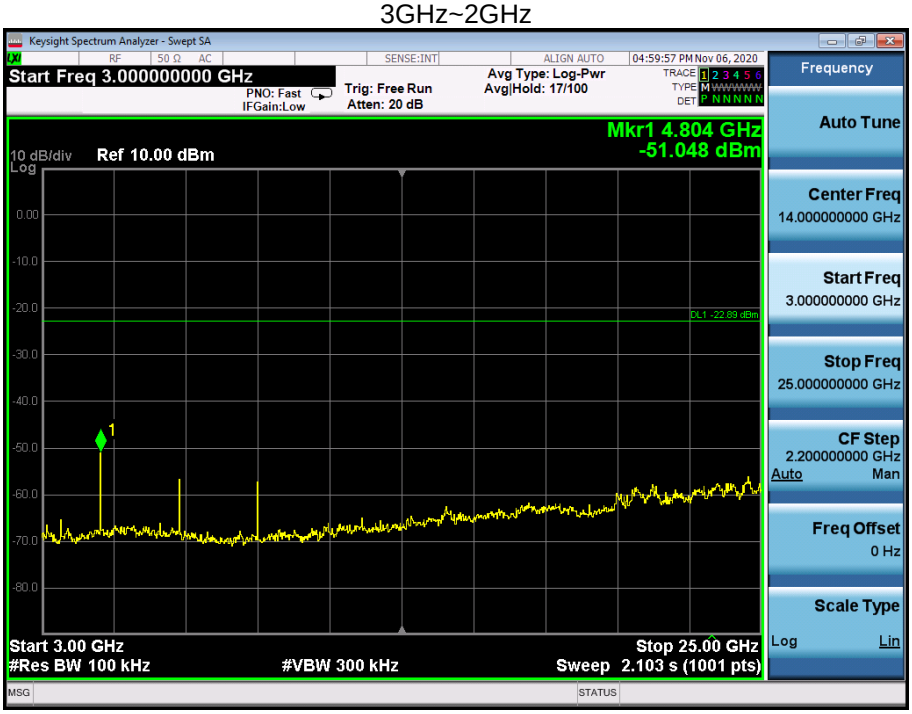
3GHz~25GHz

2440MHz

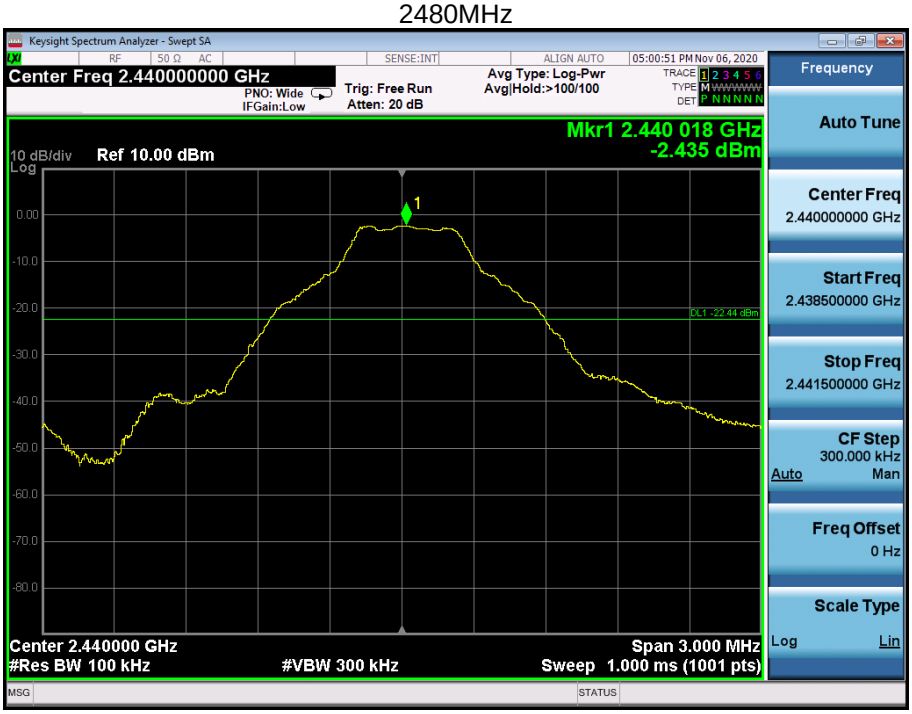
30MHz~3GHz



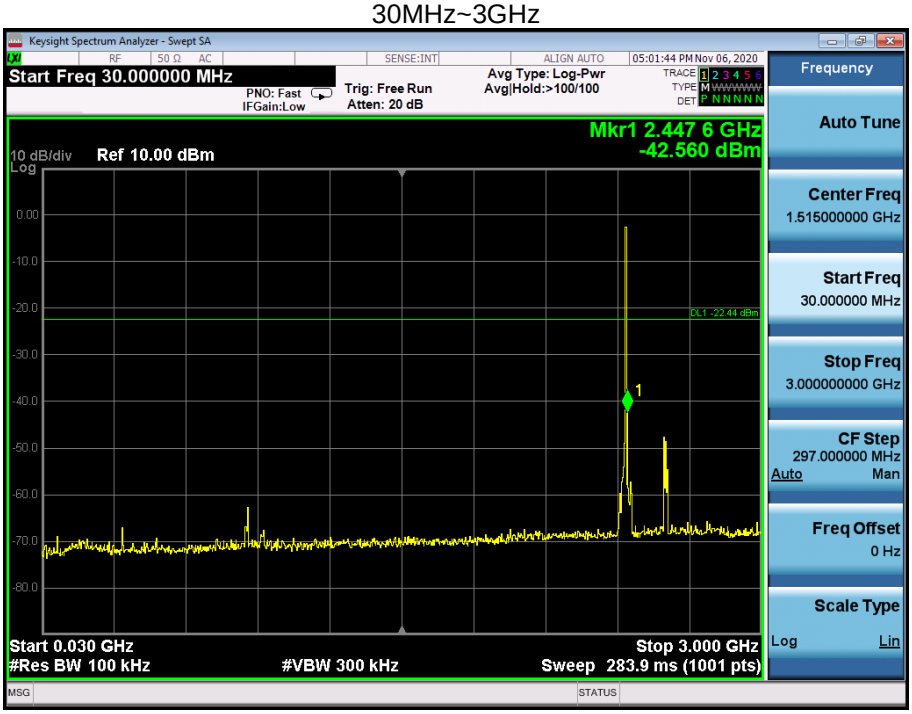
3GHz~2GHz



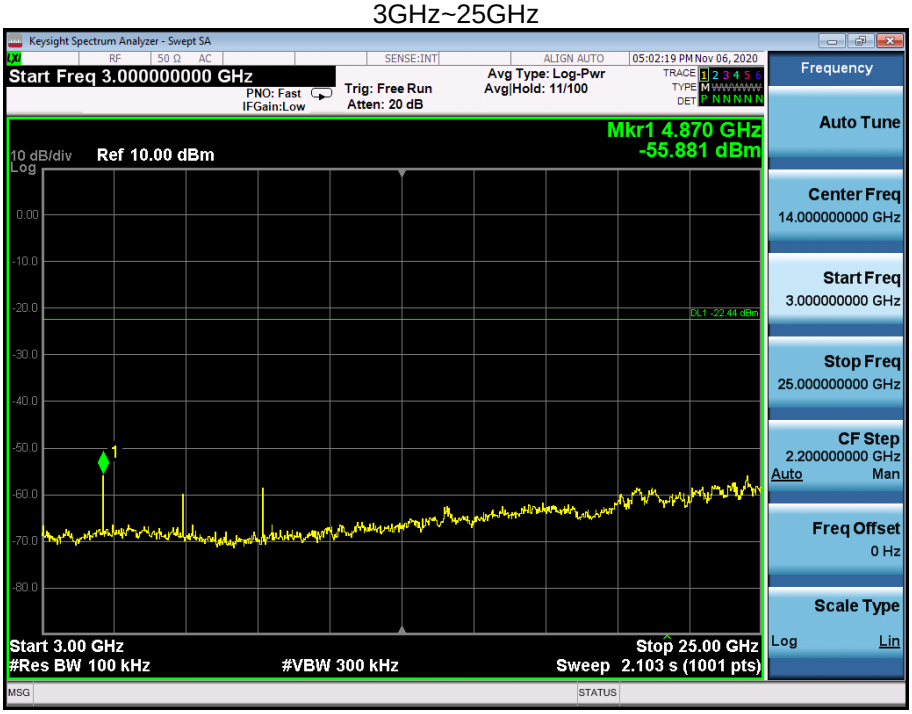
2480MHz



30MHz~3GHz



3GHz~25GHz


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω
AC
SENSE:INT
ALIGN AUTO
05:02:19 PM Nov 06, 2020
Start Freq 3.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 11/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Mkr1 4.870 GHz
-55.881 dBm
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
DL1 -22.44 dBm
1
Start 3.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.103 s (1001 pts)
Frequency
Auto Tune
Center Freq
14.000000000 GHz
Start Freq
3.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
2.200000000 GHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

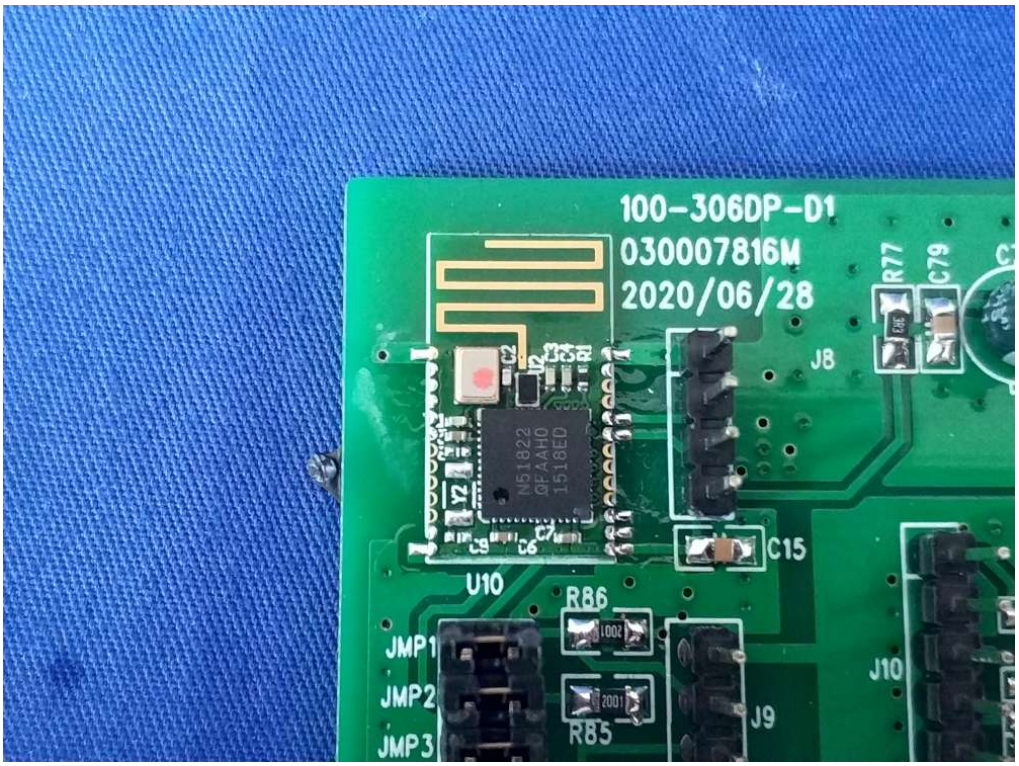
12 Antenna Requirement

12.1 Standard Applicable

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.

12.2 Antenna Connected Construction

The antenna used in this product is an PCB Antenna, The directional gains of antenna used for transmitting is 2.26dBi



13 Test Setup

Radiated Spurious Emissions

Below 1000MHz

Above 1GHz

Conducted Emissions

---------- End of Report ----------