FCC Part 15C TEST REPORT

FCC ID: 2AHFN-PODV002

IC: 21168-PODV002

Product	:	**Omni One System**
Model Name	:	**PODV002**
Brand	:	**OMNI**
Report No.	:	**NCT24013303-2**

Prepared for

Virtuix, Inc

1826 Kramer Lane Suite H, Austin, Texas, United States 78758

Prepared by

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1 TEST RESULT CERTIFICATION

Applicant's name	:	Virtuix, Inc
Address	:	1826 Kramer Lane Suite H, Austin, Texas, United States 78758
Manufacture's name	:	Virtuix, Inc
Address	:	1826 Kramer Lane Suite H, Austin, Texas, United States 78758
Product name	:	Omni One System
Model name	:	PODV002
Additional model	:	N/A
Model difference	:	N/A
Standards	:	FCC CFR47 Part 15 Section 15.247 RSS-247 Issue 3: August 2023
Test procedure	:	ANSI C63.10:2013 RSS-GEN, Issue 5: March 2019
Date of test	:	Mar. 14, 2024 to Mar. 27, 2024
Date of Issue	:	Apr. 01, 2024
Test Result	:	Pass

This device described above has been tested by NCT, 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:

Hugh Zhang

Hugh Zhang / Engineer

Technical Manager:

Henry Wang

Henry Wang / Manager

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2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207 RSS-Gen 8.8	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d) RSS-Gen 8.9 RSS-Gen 8.10	PASS
Conducted Spurious Emission	15.247(d) RSS-247 5.5	PASS
Band edge	15.247(d) 15.205(a) RSS-247 5.5	PASS
6dB Bandwidth & 99% OCB	15.247(a)(2) RSS-247 [5.2(1)]	PASS
Maximum Peak Output Power	15.247(b)(3) RSS-247.5.4(4)	PASS
Power Spectral Density	15.247(e) RSS-247 [5.2(2)]	PASS
Antenna Requirement	15.203 15.247 (c) RSS-Gen 6.8	PASS

Remark:

1. “N/A” denotes test is not applicable in this Test Report.

2.1 Test Site

Site Description

EMC Lab.	:	Accredited by CNAS, 2022-09-27
		The certificate is valid until 2028.01.07
		The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017)
		The Certificate Registration Number is L8251
		Designation Number: CN1347
		Test Firm Registration Number: 894804
		Accredited by A2LA, June 14, 2023
		The Certificate Registration Number is 6837.01
		Accredited by Industry Canada, November 09, 2018
		The Conformity Assessment Body Identifier is CN0150
		Company Number: 30806
Name of Firm	:	Shenzhen NCT Testing Technology Co., Ltd.
Site Location	:	A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Omni One System
Model Name	:	PODV002
Sample ID	:	240315013
Sample(s) Status:	:	Production sample
Additional model	:	N/A
Model difference	:	N/A
Operating frequency	:	2402-2479MHz
Number of Channels	:	78 channels
Type of Modulation	:	GFSK
Antenna installation	:	Chip Antenna
Antenna Gain	:	2.5dBi
Power supply	:	DC 3.7V from battery; DC 5V from Adapter(Only charging)
Hardware Version	:	V002
Software Version	:	V002
Remark：the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.		

3.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The details of test channels and bandwidth were for RF conductive measurement.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	**2402**	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	**39**	**2441**	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	**77**	**2479**
24	2426	51	2453		
25	2427	52	2454		
26	2428	53	2455		

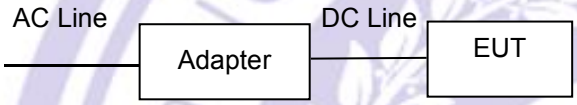
Note:

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

Channel	Frequency(MHz)
0	2402
39	2441
77	2479

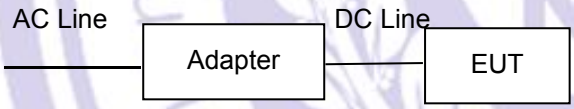
3.3 Test Setup Configuration

Conducted Emission



Radiated Emission

Conducted Spurious



3.4 Test Mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and use a new battery for testing. So the report only displays conditional data.	

Test Software	teraterm-4.104.exe
Power level setup	≤8dBm

4 Equipment During Test

4.1 Equipments List

Conducted emission Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
944 Shielded Room	944 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESPI	101604	Rohde & Schwarz	2023/6/21	2024/6/20
LISN	ENV 216	102796	Rohde & Schwarz	2023/6/21	2024/6/20
LISN	VN1-13S	004023	CRANAGE	2023/6/21	2024/6/20
Cable	RG223-1500MM	NA	RG	2023/6/21	2024/6/20

Radiated emission & Radio Frequency Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
966 Shielded Room	966 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESCI	101178	Rohde & Schwarz	2023/6/21	2024/6/20
Spectrum Analyze （10Hz-26.5GHz）	N9020A	MY50510202	Agilent	2023/6/21	2024/6/20
Amplifi （30MHz-1GHz）	BBV 9743 B	00374	SCHNARZBECK	2023/6/21	2024/6/20
Bilog Antenna （30MHz-1GHz）	VULB9162	00473	SCHNARZBECK	2023/3/19	2025/3/18
Horn antenna （1GHz-18GHz）	BBHA 9120 D	02622	SCHNARZBECK	2023/3/19	2025/3/18
Pream plifier （1GHz-18GHz）	BBV 9718D	0024	SCHNARZBECK	2023/6/21	2024/6/20
Spectrum Analyze （10Hz-40GHz）	FSV 40	100952	Rohde & Schwarz	2023/6/21	2024/6/20
Pream plifier （15GHz-40GHz）	BBV 9718D	0024	SCHNARZBECK	2023/6/21	2024/6/20
Double Ridge Guide Horn Antenna （18GHz-40GHz）	SAS-574	588	A.H.System	2023/3/19	2025/3/18
Loop Antenna (9KHz-30MHz)	FMZB1519B	014	SCHNARZBECK	2023/6/21	2024/6/20

Amplifier (9KHz-30MHz)	CVP 9222 C	00109	SCHNARZBECK	2023/6/21	2024/6/20
Power Sensor	TR1029-2	00473	SCHNARZBECK	2023/6/21	2024/6/20
RF Swith	TR1029-1	02622	SCHNARZBECK	2023/6/21	2024/6/20
Cable	DA800-4000MM	NA	DA	2023/6/21	2024/6/20
Cable	DA800-11000MM	NA	DA	2023/6/21	2024/6/20

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	AUDIX	e3	6.120718
2	EMC radiation test system	AUDIX	e3	6.120718
3	RF test system	TACHOY	RFTest	V1.0.0
4	RF communication test system	TACHOY	RFTest	V1.0.0

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

4.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Omni One System	OMNI	PODV002	N/A	EUT
E-2	Notebook	Lenovo	300-15SK	GB14477457	AE
E-3	Adapter	N/A	HA728	N/A	AE

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

5 Conducted Emission

Test Requirement	:	FCC CFR 47 Part 15 Section 15.207&RSS-Gen 8.8
Test Method	:	ANSI C63.10: 2013 and RSS-Gen
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

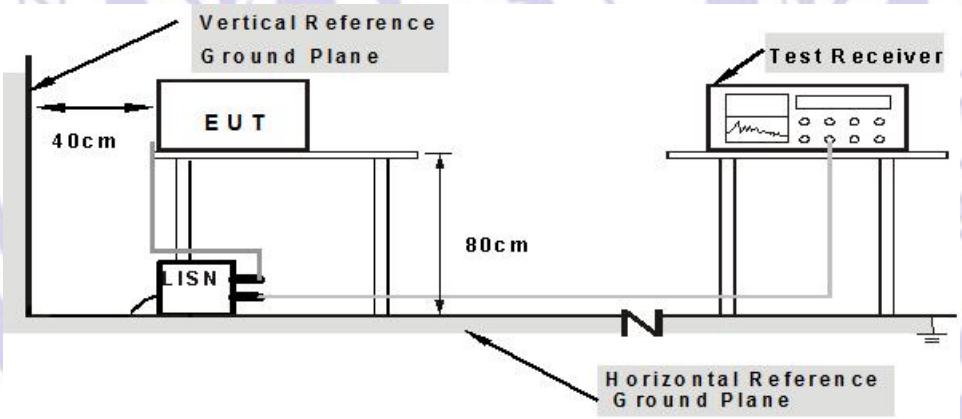
5.1 E.U.T. Operation

Operating Environment :

Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

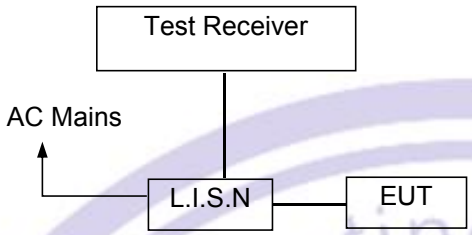
5.2 EUT Setup

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



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

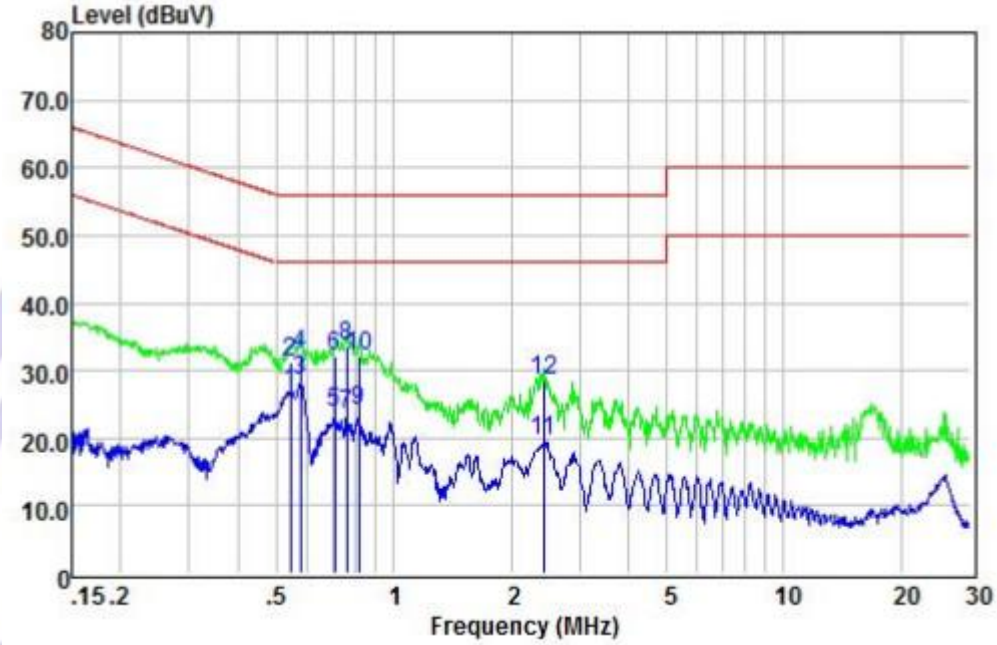
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

Pass

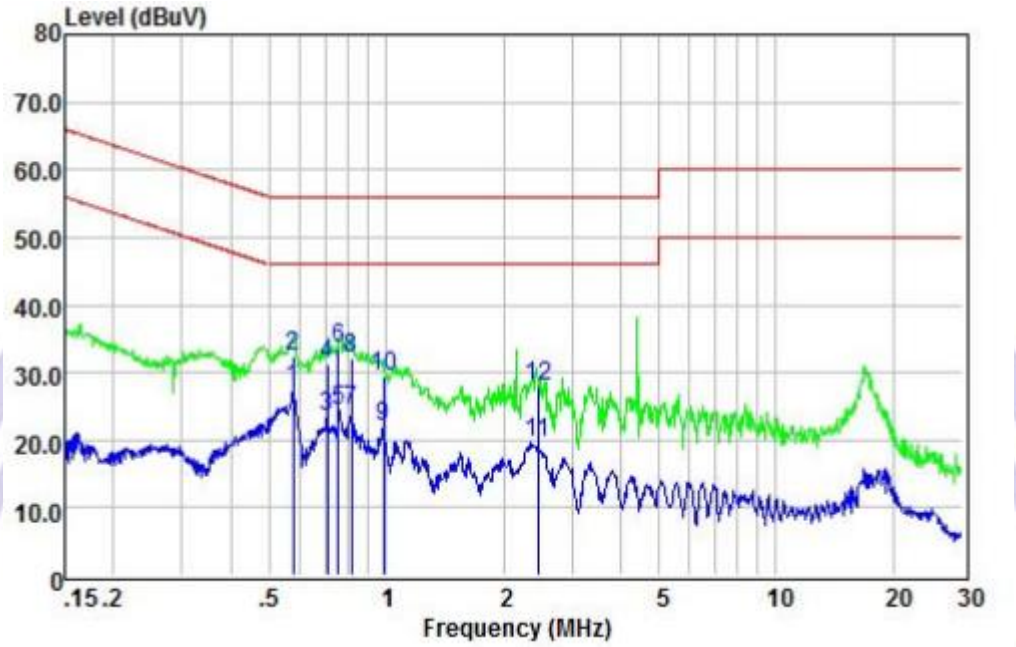
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Channel:	Middle	Phase :	L



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.54	17.15	9.68	0.05	26.88	46.00	-19.12	Average
2	0.54	21.53	9.68	0.05	31.26	56.00	-24.74	QP
3	0.58	18.71	9.67	0.05	28.43	46.00	-17.57	Average
4	0.58	22.57	9.67	0.05	32.29	56.00	-23.71	QP
5	0.71	14.14	9.64	0.05	23.83	46.00	-22.17	Average
6	0.71	22.55	9.64	0.05	32.24	56.00	-23.76	QP
7	0.76	13.89	9.63	0.05	23.57	46.00	-22.43	Average
8	0.76	23.91	9.63	0.05	33.59	56.00	-22.41	QP
9	0.81	14.33	9.63	0.05	24.01	46.00	-21.99	Average
10	0.81	22.49	9.63	0.05	32.17	56.00	-23.83	QP
11	2.42	9.91	9.58	0.06	19.55	46.00	-26.45	Average
12	2.42	18.92	9.58	0.06	28.56	56.00	-27.44	QP

Channel:	Middle	Phase :	N



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.58	18.06	9.63	0.05	27.74	46.00	-18.26	Average
2	0.58	22.70	9.63	0.05	32.38	56.00	-23.62	QP
3	0.70	13.80	9.63	0.05	23.48	46.00	-22.52	Average
4	0.70	21.58	9.63	0.05	31.26	56.00	-24.74	QP
5	0.75	14.69	9.63	0.05	24.37	46.00	-21.63	Average
6	0.75	24.00	9.63	0.05	33.68	56.00	-22.32	QP
7	0.81	14.66	9.63	0.05	24.34	46.00	-21.66	Average
8	0.81	22.58	9.63	0.05	32.26	56.00	-23.74	QP
9	0.98	12.33	9.63	0.06	22.02	46.00	-23.98	Average
10	0.98	19.72	9.63	0.06	29.41	56.00	-26.59	QP
11	2.45	9.93	9.60	0.06	19.59	46.00	-26.41	Average
12	2.45	18.33	9.60	0.06	27.99	56.00	-28.01	QP

Notes:
1.An initial pre-scan was performed on the line and neutral lines with peak detector.
2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3.Mesurement Level = Reading level + Correct Factor

6 Radiated Spurious Emissions

Test Requirement	:	FCC CFR47 Part 15 Section 15.209 & 15.247 RSS-Gen 8.9, RSS-Gen 8.10
Test Method	:	ANSI C63.10:2013 and RSS-Gen
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

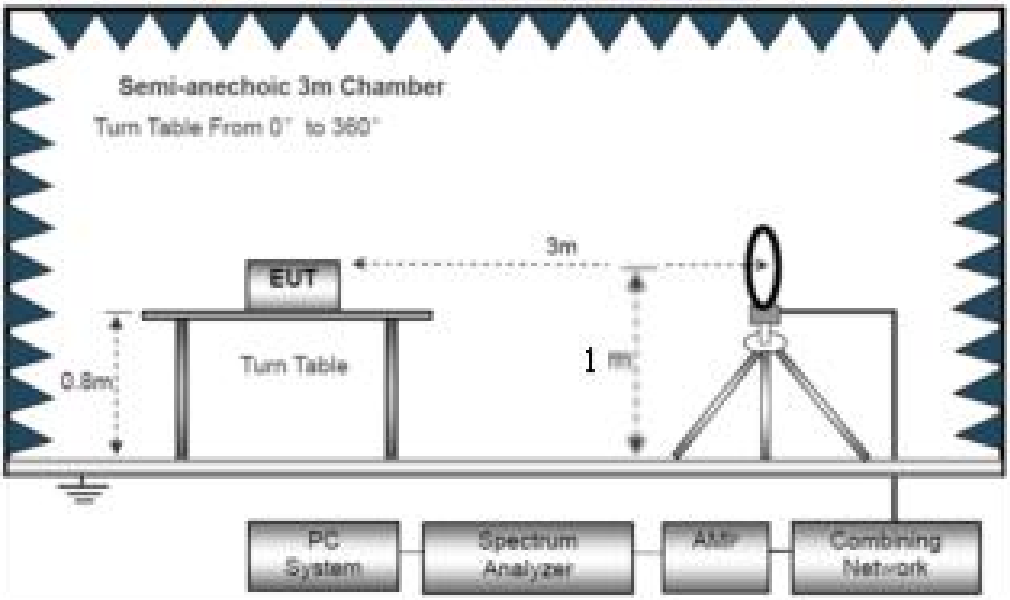
Operating Environment :

Temperature	:	23.5 °C
Humidity	:	51.1 % RH
Atmospheric Pressure	:	101.2kPa

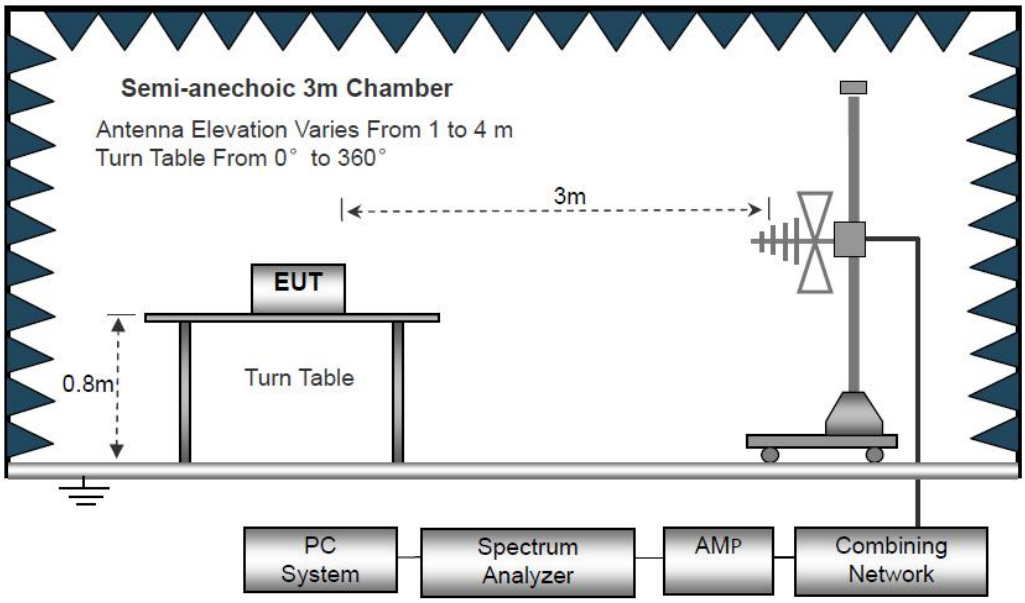
6.2 Test Setup

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

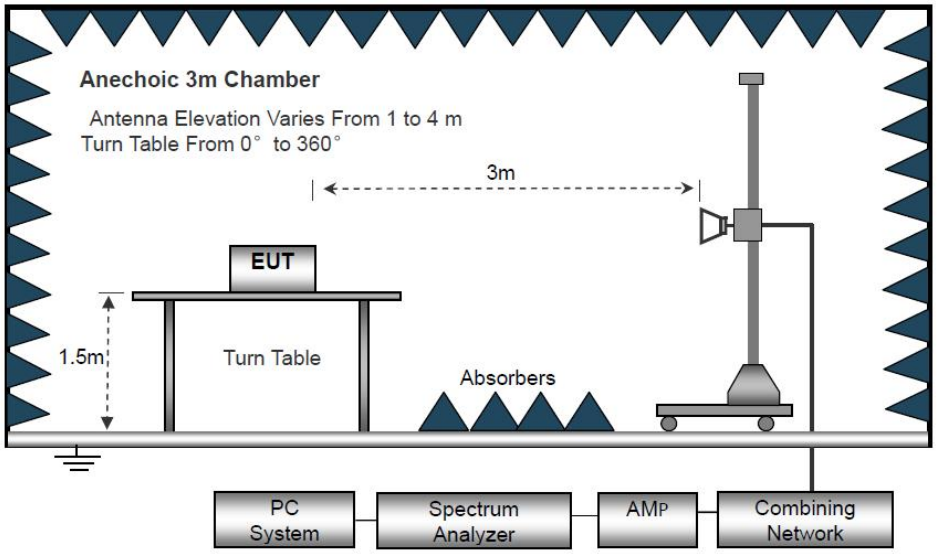
The test setup for emission measurement below 30MHz



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. 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.

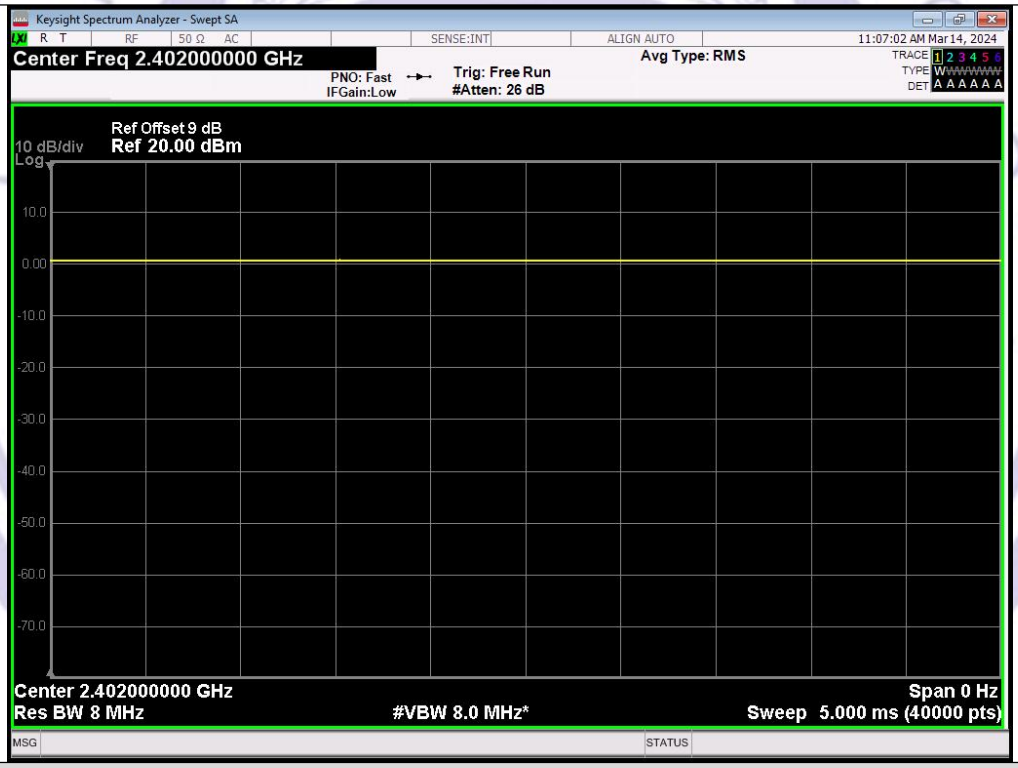
8. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

For Average Measurement:

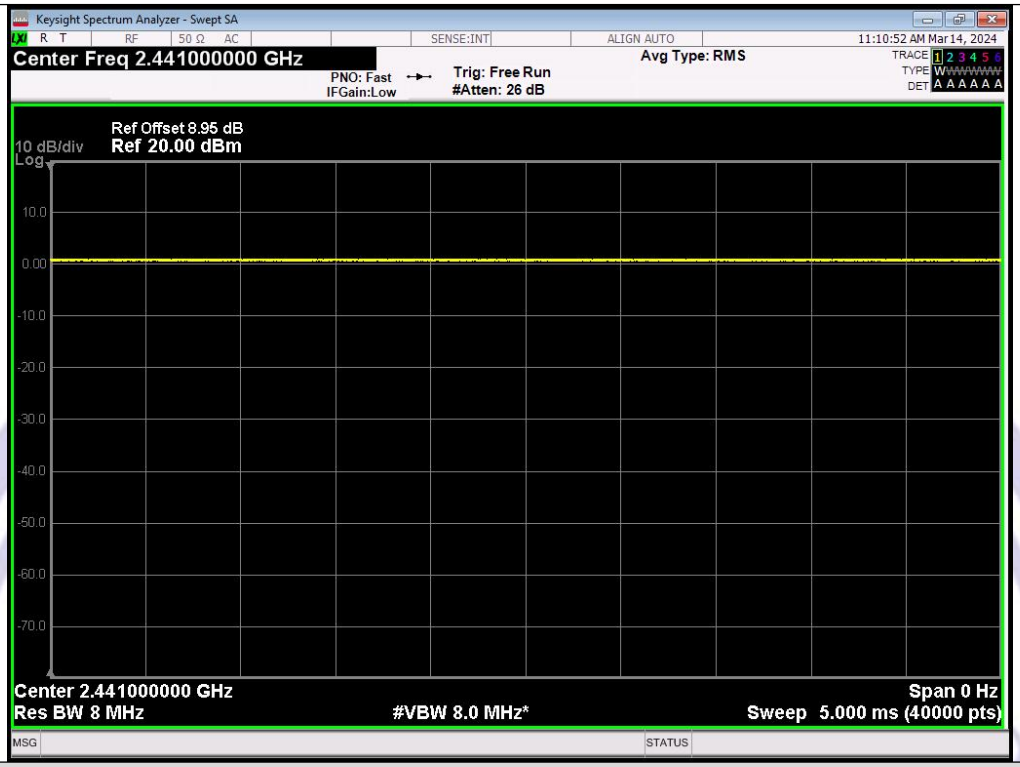
VBW=10Hz, when duty cycle is no less than 98 percent.

VBW≥1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

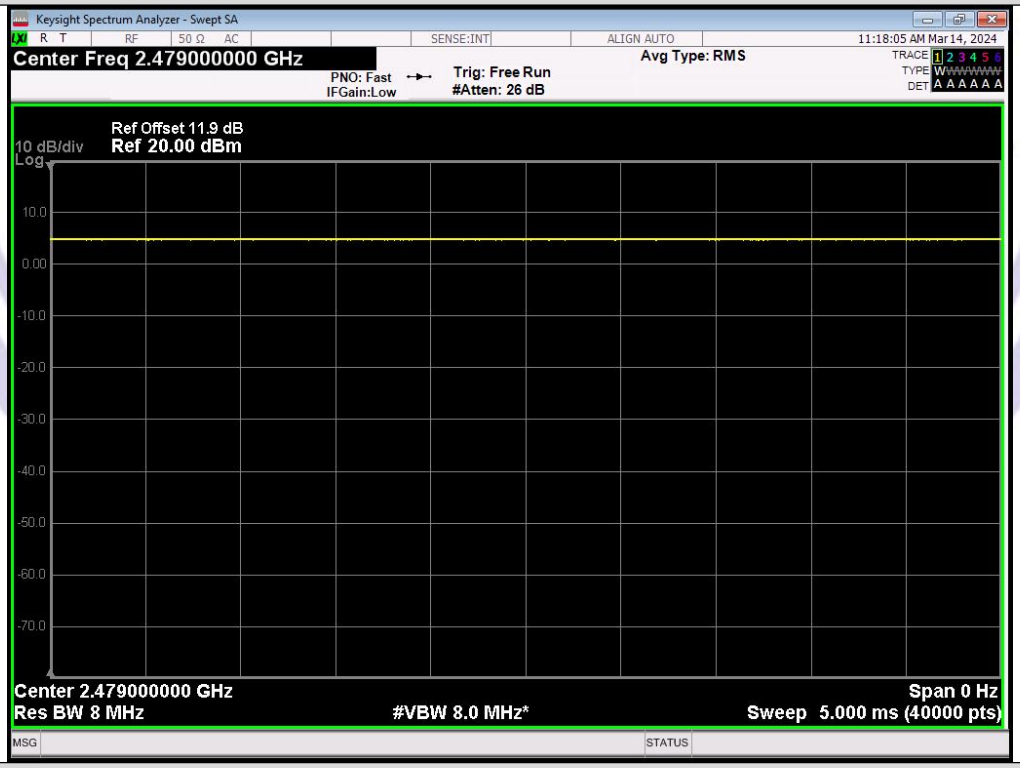
Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)
0	5.000	5.000	100	1	0.0
39	5.000	5.000	100	1	0.0
77	5.000	5.000	100	1	0.0



CH00


Keysight Spectrum Analyzer - Swept SA
R T RF 50 Ω AC SENSE:INT ALIGN AUTO 11:10:52 AM Mar 14, 2024
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: RMS
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET A A A A A A
Ref Offset 8.95 dB
10 dB/div Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.441000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz*
Span 0 Hz
Sweep 5.000 ms (40000 pts)
MSG
STATUS

CH39


Keysight Spectrum Analyzer - Swept SA
R T RF 50 Ω AC SENSE:INT ALIGN AUTO 11:18:05 AM Mar 14, 2024
Center Freq 2.479000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 26 dB
Avg Type: RMS
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET A A A A A A
Ref Offset 11.9 dB
10 dB/div Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.479000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz*
Span 0 Hz
Sweep 5.000 ms (40000 pts)
MSG
STATUS

CH77

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.

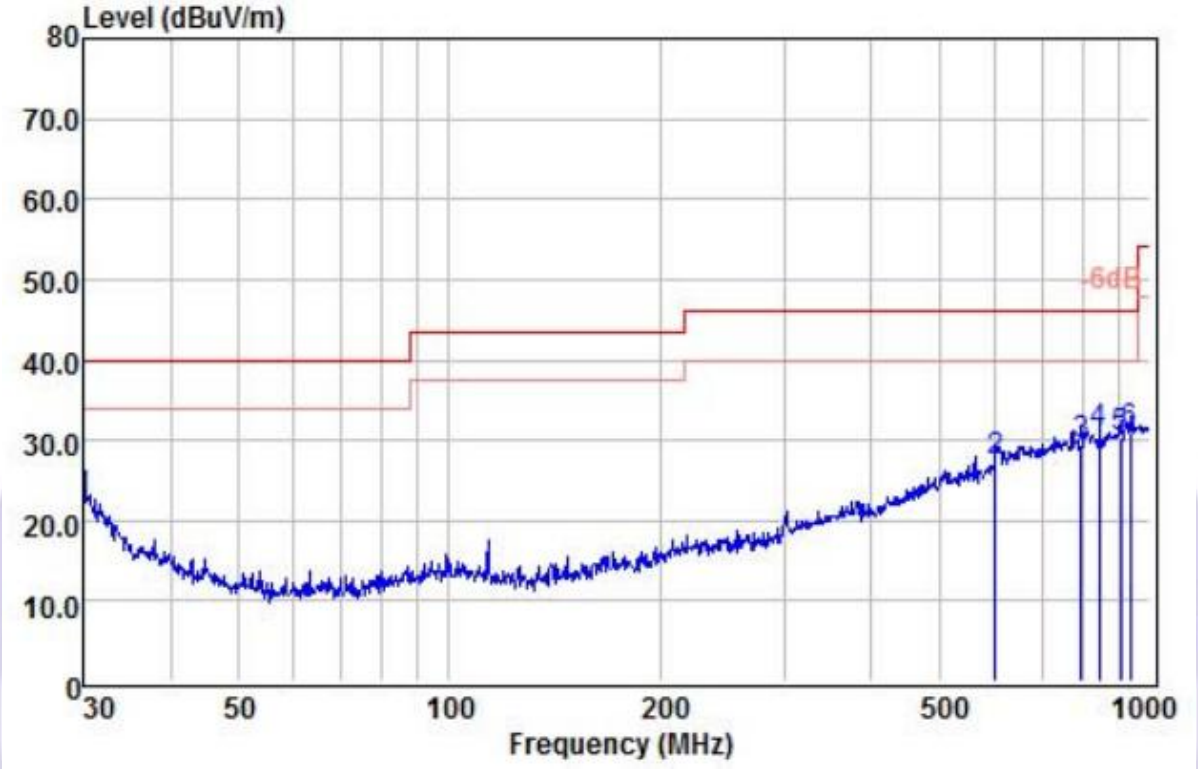
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass.

Please refer to the following test plots for the worst test mode (GFSK (CH00: 2402MHz)).

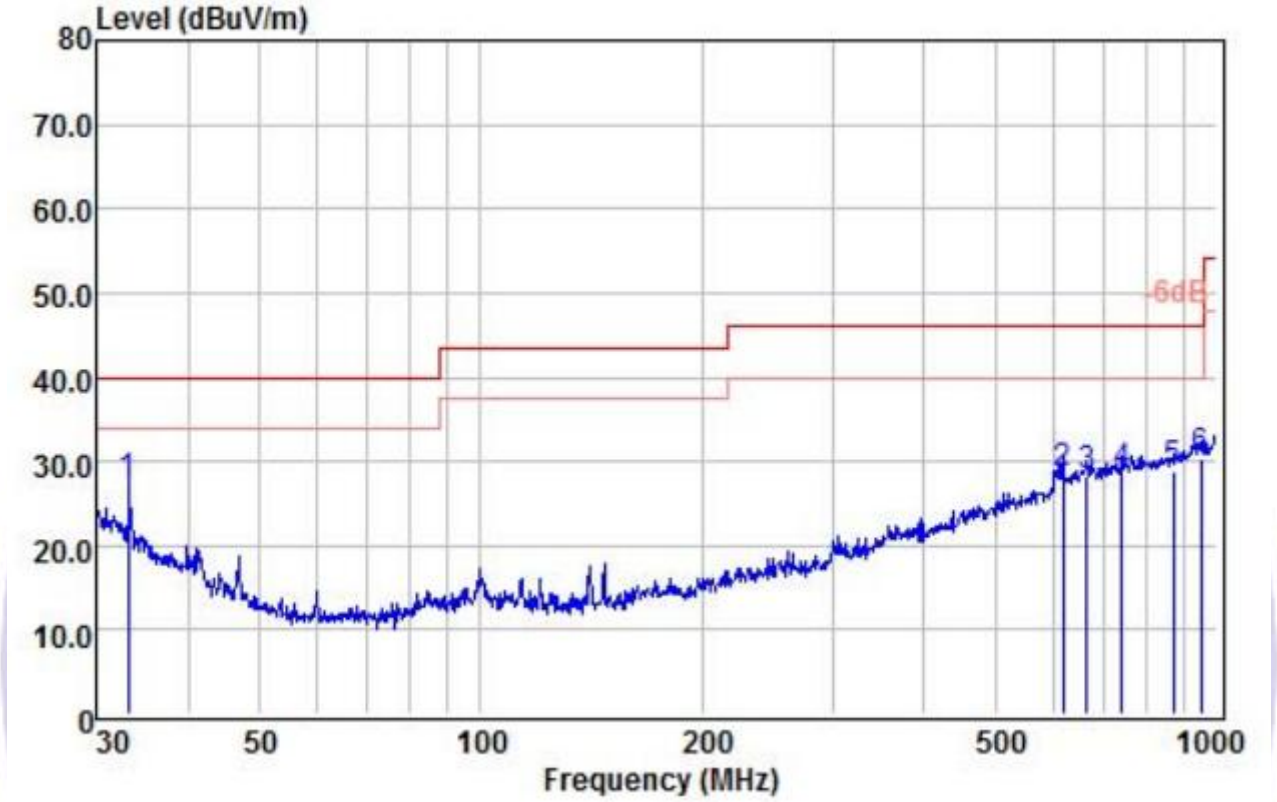
Test plot for Horizontal



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	30.11	34.73	18.80	0.58	31.41	22.70	40.00	-17.30	QP
2	601.43	35.93	20.60	1.49	30.62	27.40	46.00	-18.60	QP
3	798.98	34.80	23.00	2.19	30.56	29.43	46.00	-16.57	QP
4	848.06	35.93	23.10	2.16	30.37	30.82	46.00	-15.18	QP
5	909.67	33.83	24.35	2.16	29.99	30.35	46.00	-15.65	QP
6	935.55	33.75	24.66	2.24	29.75	30.90	46.00	-15.10	QP

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

Test plot for Vertical



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	33.21	41.23	16.91	0.47	31.39	27.22	40.00	-12.78	QP
2	618.54	36.50	21.12	1.58	30.65	28.55	46.00	-17.45	QP
3	665.80	35.40	21.78	1.80	30.80	28.18	46.00	-17.82	QP
4	744.87	34.53	22.76	2.06	30.67	28.68	46.00	-17.32	QP
5	872.18	33.49	23.45	2.15	30.23	28.86	46.00	-17.14	QP
6	952.09	33.05	24.62	2.28	29.60	30.35	46.00	-15.65	QP

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

Test Frequency 1GHz-25GHz:

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel:2402MHz									
V	4804	55.93	30.55	5.77	24.66	55.81	74.00	-18.19	Pk
V	4804	45.84	30.55	5.77	24.66	45.72	54.00	-8.28	AV
V	7206	53.62	30.33	6.32	24.55	54.16	74.00	-19.84	Pk
V	7206	44.62	30.33	6.32	24.55	45.16	54.00	-8.84	AV
V	9608	52.16	30.85	7.45	24.69	53.45	74.00	-20.55	Pk
V	9608	42.61	30.85	7.45	24.69	43.9	54.00	-10.1	AV
V	12010	49.37	31.02	8.99	25.57	52.91	74.00	-21.09	Pk
V	12010	39.52	31.02	8.99	25.57	43.06	54.00	-10.94	AV
H	4804	55.23	30.55	5.77	24.66	55.11	74.00	-18.89	Pk
H	4804	45.39	30.55	5.77	24.66	45.27	54.00	-8.73	AV
H	7206	53.16	30.33	6.32	24.55	53.7	74.00	-20.3	Pk
H	7206	46.51	30.33	6.32	24.55	47.05	54.00	-6.95	AV
H	9608	51.23	30.85	7.45	24.69	52.52	74.00	-21.48	Pk
H	9608	41.72	30.85	7.45	24.69	43.01	54.00	-10.99	AV
H	12010	48.93	31.02	8.99	25.57	52.47	74.00	-21.53	Pk
H	12010	39.52	31.02	8.99	25.57	43.06	54.00	-10.94	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Middle Channel:2441MHz									
V	4882	55.82	30.55	5.77	24.66	55.7	74.00	-18.3	Pk
V	4882	45.93	30.55	5.77	24.66	45.81	54.00	-8.19	AV
V	7323	53.41	30.33	6.32	24.55	53.95	74.00	-20.05	Pk
V	7323	44.21	30.33	6.32	24.55	44.75	54.00	-9.25	AV
V	9764	51.39	30.85	7.45	24.69	52.68	74.00	-21.32	Pk
V	9764	42.63	30.85	7.45	24.69	43.92	54.00	-10.08	AV
V	12205	49.62	31.02	8.99	25.57	53.16	74.00	-20.84	Pk
V	12205	40.02	31.02	8.99	25.57	43.56	54.00	-10.44	AV
H	4882	55.93	30.55	5.77	24.66	55.81	74.00	-18.19	Pk
H	4882	45.61	30.55	5.77	24.66	45.49	54.00	-8.51	AV
H	7323	53.21	30.33	6.32	24.55	53.75	74.00	-20.25	Pk
H	7323	42.36	30.33	6.32	24.55	42.9	54.00	-11.1	AV
H	9764	51.02	30.85	7.45	24.69	52.31	74.00	-21.69	Pk
H	9764	41.63	30.85	7.45	24.69	42.92	54.00	-11.08	AV
H	12205	50.12	31.02	8.99	25.57	53.66	74.00	-20.34	Pk
H	12205	40.32	31.02	8.99	25.57	43.86	54.00	-10.14	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
High Channel:2479MHz									
V	4958	55.23	30.55	5.77	24.66	55.11	74.00	-18.89	Pk
V	4958	45.12	30.55	5.77	24.66	45	54.00	-9	AV
V	7437	53.62	30.33	6.32	24.55	54.16	74.00	-19.84	Pk
V	7437	42.19	30.33	6.32	24.55	42.73	54.00	-11.27	AV
V	9916	51.63	30.85	7.45	24.69	52.92	74.00	-21.08	Pk
V	9916	42.31	30.85	7.45	24.69	43.6	54.00	-10.4	AV
V	12395	48.63	31.02	8.99	25.57	52.17	74.00	-21.83	Pk
V	12395	38.74	31.02	8.99	25.57	42.28	54.00	-11.72	AV
H	4958	55.46	30.55	5.77	24.66	55.34	74.00	-18.66	Pk
H	4958	44.36	30.55	5.77	24.66	44.24	54.00	-9.76	AV
H	7437	52.37	30.33	6.32	24.55	52.91	74.00	-21.09	Pk
H	7437	41.52	30.33	6.32	24.55	42.06	54.00	-11.94	AV
H	9916	50.16	30.85	7.45	24.69	51.45	74.00	-22.55	Pk
H	9916	41.32	30.85	7.45	24.69	42.61	54.00	-11.39	AV
H	12395	49.62	31.02	8.99	25.57	53.16	74.00	-20.84	Pk
H	12395	39.86	31.02	8.99	25.57	43.4	54.00	-10.6	AV

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

Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limit (dBuV/m)	Detector Type	Result
GFSK	Low Channel: 2402MHz									
	H	2390	55.93	30.22	4.85	23.98	54.54	74	PK	PASS
	H	2390	45.64	30.22	4.85	23.98	44.25	54	AV	PASS
	H	2400	55.74	30.22	4.85	23.98	54.35	74	PK	PASS
	H	2400	45.83	30.22	4.85	23.98	44.44	54	AV	PASS
	V	2390	56.32	30.22	4.85	23.98	54.93	74	PK	PASS
	V	2390	45.91	30.22	4.85	23.98	44.52	54	AV	PASS
	V	2400	56.32	30.22	4.85	23.98	54.93	74	PK	PASS
	V	2400	45.92	30.22	4.85	23.98	44.53	54	AV	PASS
	High Channel: 2479MHz									
	H	2483.5	55.72	30.22	4.85	23.98	54.33	74	PK	PASS
	H	2483.5	45.93	30.22	4.85	23.98	44.54	54	AV	PASS
	H	2500	55.39	30.22	4.85	23.98	54	74	PK	PASS
	H	2500	46.21	30.22	4.85	23.98	44.82	54	AV	PASS
	V	2483.5	55.24	30.22	4.85	23.98	53.85	74	PK	PASS
	V	2483.5	45.13	30.22	4.85	23.98	43.74	54	AV	PASS
	V	2500	55.72	30.22	4.85	23.98	54.33	74	PK	PASS
	V	2500	45.93	30.22	4.85	23.98	44.54	54	AV	PASS

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

7 Conduct Band Edge And Spurious Emissions 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)). RSS-247 5.5
Test Method	:	ANSI C63.10:2013 and RSS-Gen
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)).

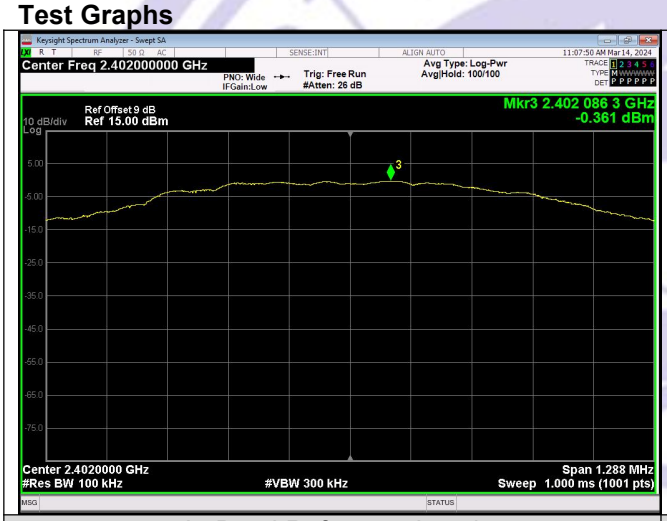
7.1 Test Procedure

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

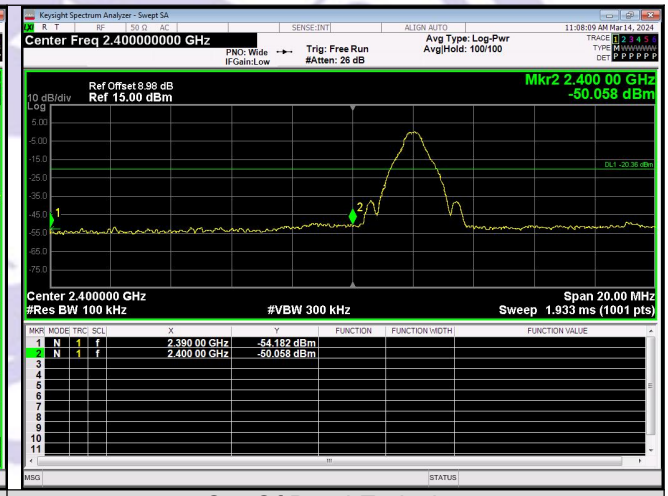
7.2 Test Result

Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
0	2400.00	-50.058	-20.36	-29.698	PASS
	2390.00	-54.182	-20.36	-33.922	PASS
	2562.02	-53.818	-20.36	-33.458	PASS
39	2587.62	-52.562	-19.98	-32.582	PASS
77	2483.50	-48.532	-16.09	-32.442	PASS
	2623.20	-54.139	-16.09	-38.049	PASS

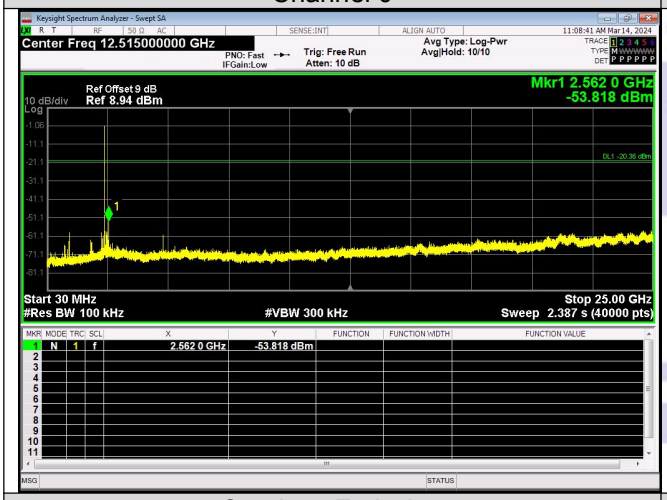
Test Graphs



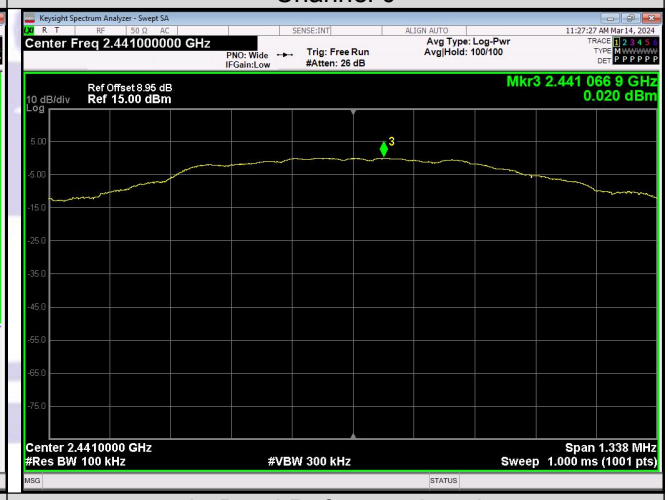
In-Band Reference Level
Channel 0



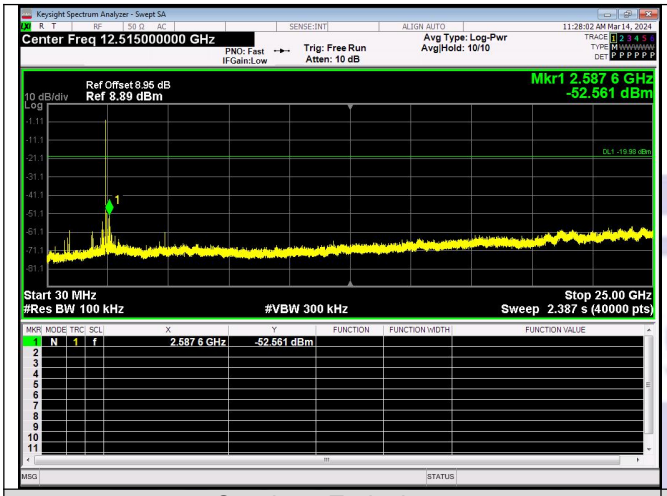
Out Of Band Emission
Channel 0



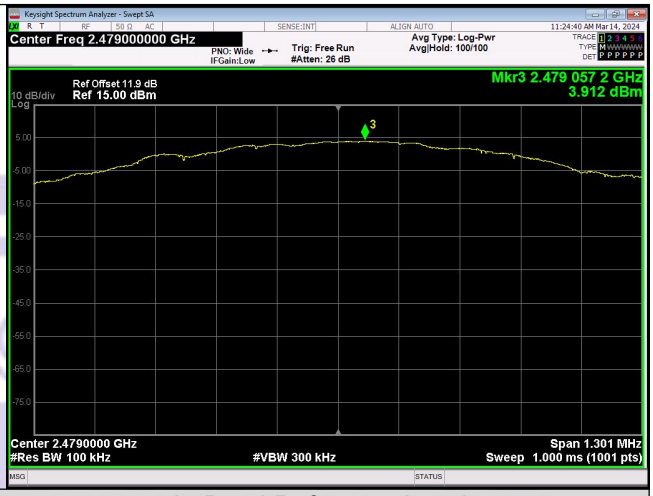
Spurious Emission
Channel 0



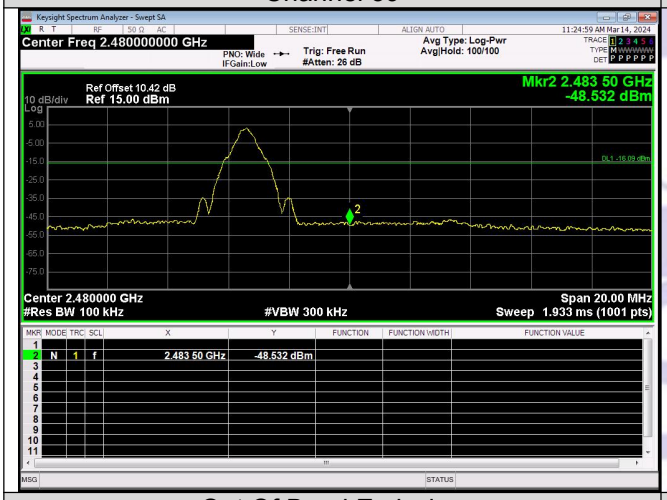
In-Band Reference Level
Channel 39



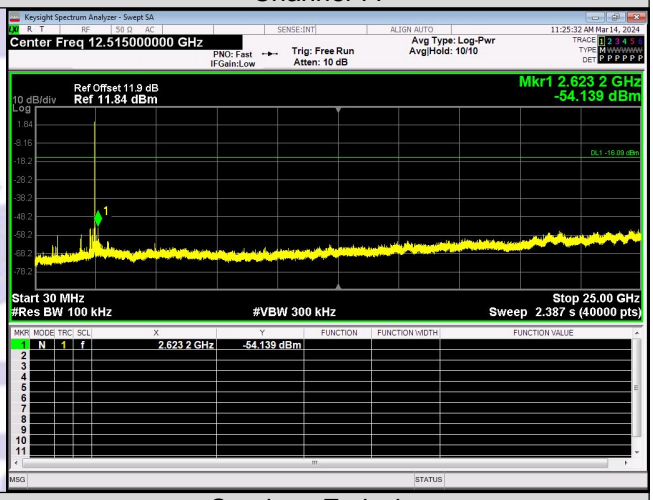
Spurious Emissions
Channel 39



In-Band Reference Level
Channel 77



Out Of Band Emission
Channel 77



Spurious Emission
Channel 77

8 6dB Bandwidth Measurement & 99% OCB Test

Test Requirement	:	FCC CFR47 Part 15 Section 15.247 (a)(2)&RSS-247[5.2(1)]
Test Method	:	ANSI C63.10:2013 and RSS-Gen
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.

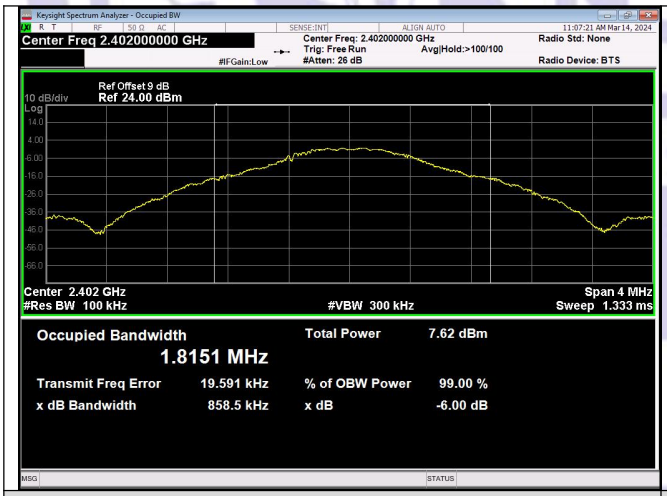
8.1 Test Procedure

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(For 6dB bandwidth)
3. Set the spectrum analyzer: RBW = 30kHz, VBW = 91kHz(99% bandwidth)

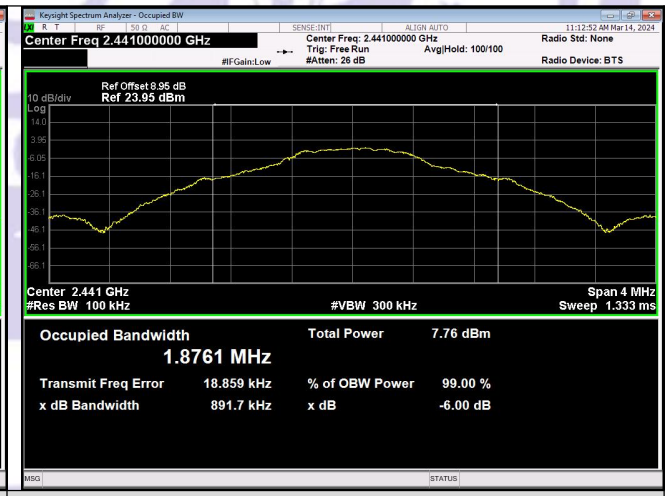
8.2 Test Result

Channel	Center Frequency (MHz)	6 dB Bandwidth (MHz)	99% BW (MHz)	6dB BW Limit (MHz)	Result
0	2402	0.8585	1.7351	0.5	PASS
39	2441	0.8917	1.8102		PASS
77	2479	0.8670	1.7930		PASS

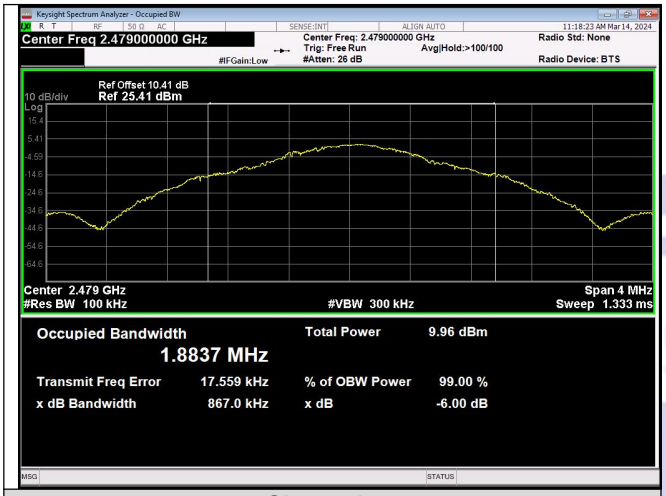
Test Graphs



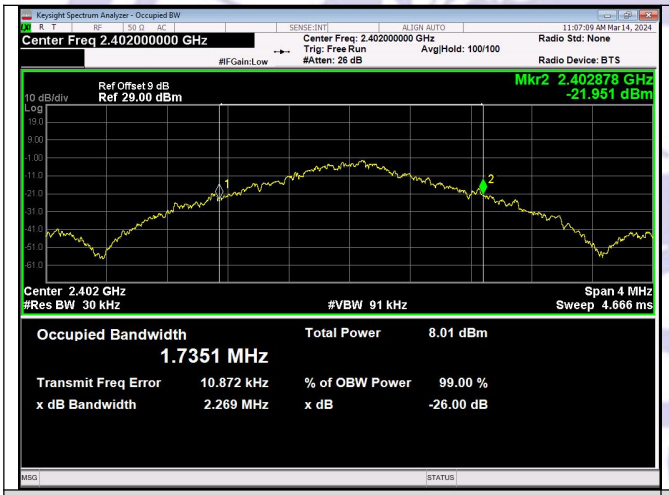
Channel 0



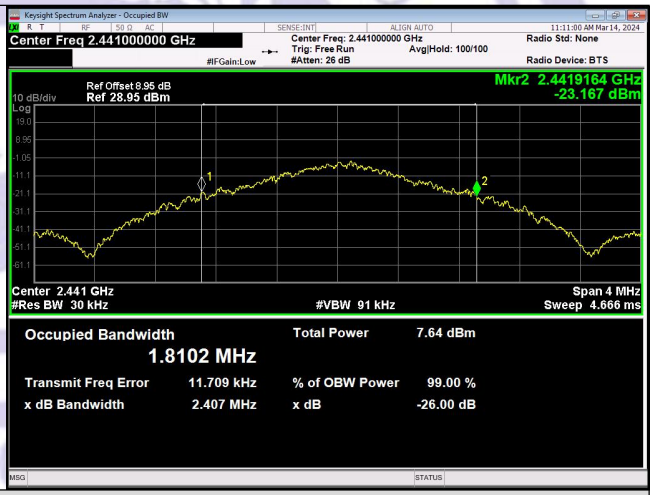
Channel 39



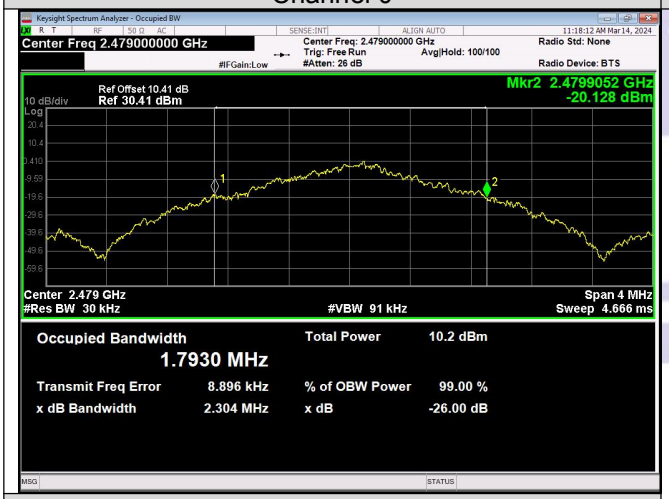
Channel 77



Channel 0



Channel 39



Channel 77

9 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247 (b)(3)&RSS-247 5.4(4)

Test Method : ANSI C63.10:2013 and RSS-Gen

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.

9.1 Test Procedure

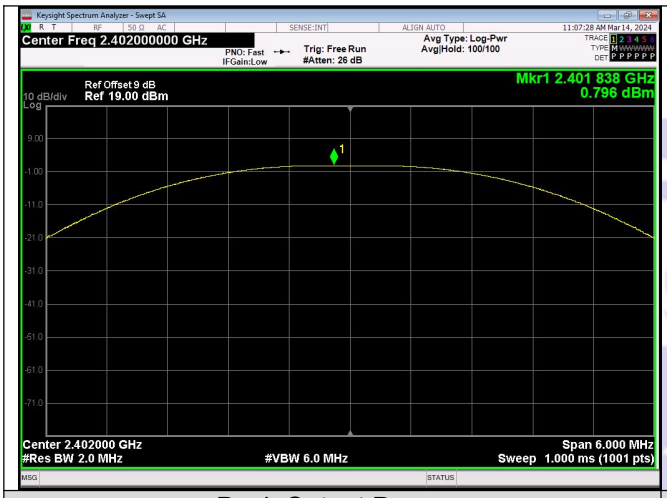
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power and record the results in the test report.

9.2 Test Result

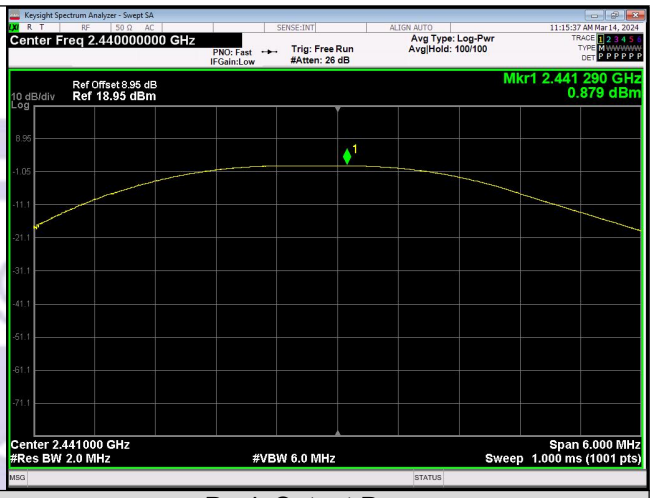
Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Max. Avg. Power (dBm)	Limit (dBm)	Result
0	0.796	1.2	None	30	PASS
39	0.879	1.22	None	30	PASS
77	1.079	1.28	None	30	PASS

Channel	Peak Output Power (dBm)	Peak Power Limit (dBm)	ISED EIRP (dBm)	ISED EIRP Limit (dBm)	Max. Avg. Power (dBm)	Result
0	0.796	30	3.296	36.02	None	PASS
39	0.879	30	2.379	36.02	None	PASS
77	1.079	30	3.579	36.02	None	PASS

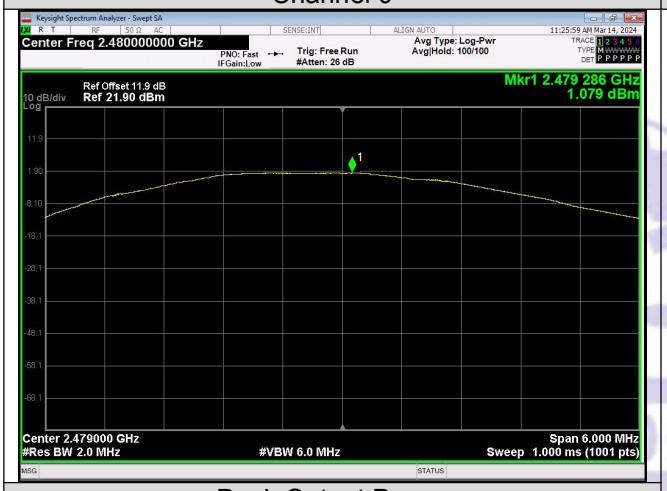
Test Graphs



Peak Output Power
Channel 0



Peak Output Power
Channel 39



Peak Output Power
Channel 77

10 Power Spectral density

Test Requirement : FCC CFR47 Part 15 Section 15.247 (e)&RSS-247 [5.2(2)]

Test Method : ANSI C63.10:2013 and RSS-Gen

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.

10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

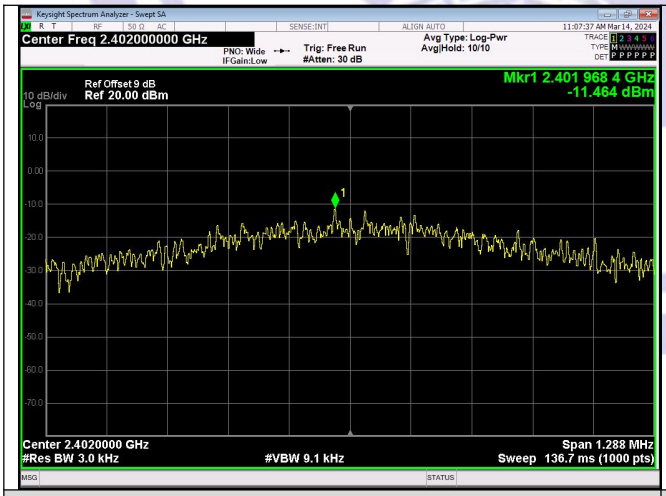
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 9.1kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

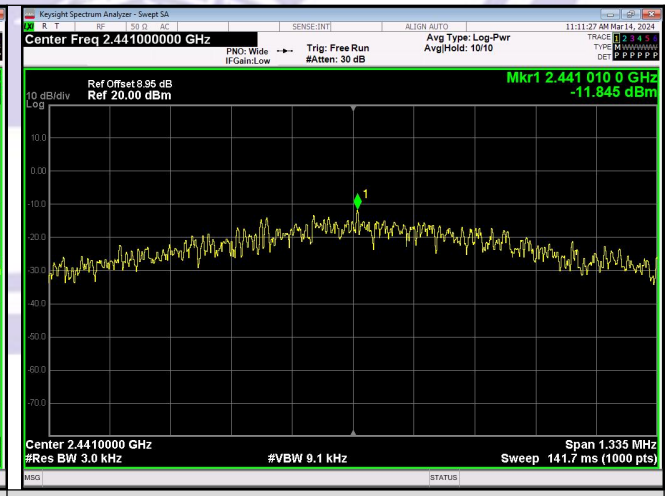
10.2 Test Result

Channel	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
0	-11.464	8	PASS
39	-11.845	8	PASS
77	-7.186	8	PASS

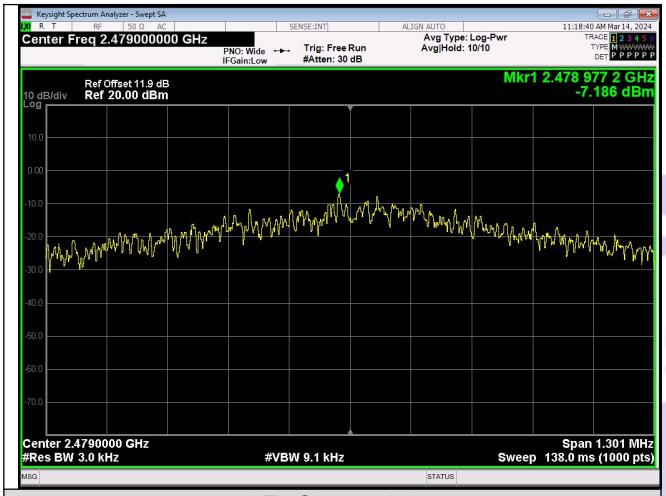
Test Graphs



2LE_Channel 0



2LE_Channel 19



2LE_Channel 39

11 Antenna Application

11.1 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.

11.2 Result

The antenna is Chip Antenna, the best case gain of the antennas is 2.5dBi, reference to the appendix II for details

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12 Test Setup

Please see the attachment for details.

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13 EUT Photos

Please see the attachment for details.

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