FCC TEST REPORT

FCC ID: 2ATPR-INVUE-MS1002

Product	:	INVUE MicroPlayer5 MS1002
Model Name	:	MicroPlayer5 MS1002
Brand	:	N/A
Report No.	:	PTC19040801405E-FC01

Prepared for

ShangHai B&M technology Co., LTD

Room 2707, C Building, No.526 NianJiaBang Road,Pudong New District, Shanghai, China

Prepared by

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Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	ShangHai B&M technology Co., LTD
Address	:	Room 2707, C Building, No.526 NianJiaBang Road,Pudong New District, Shanghai, China
Manufacture's name	:	ShangHai B&M technology Co., LTD
Address	:	Room 2707, C Building, No.526 NianJiaBang Road,Pudong New District, Shanghai, China
Product name	:	INVUE MicroPlayer5 MS1002MS1002
Model name	:	SMicroPlayer5 MS1002，
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	Mar. 05, 2019 to May 15, 2019
Date of Issue	:	May 16, 2019
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

Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

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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)(1)	PASS
Power Spectral Density	15.247(e)	PASS
Antenna Requirement	15.203	PASS

2.1 Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

Address: Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, 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	:	INVUE MicroPlayer5 MS1002
Model Name	:	MicroPlayer5 MS1002，
Bluetooth Version	:	BLE 4.0
Operating frequency	:	2402-2480MHz
Number of Channels	:	40
Type of Modulation	:	GFSK
Antenna installation	:	Internal PCB Antenna
Antenna Gain	:	0dBi
Power supply	:	DC 5V
Hardware Version	:	V1.2
Software Version	:	V1.1

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**	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.

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	MY56070279	10Hz-30GHz	Sep. 19, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Sep. 19, 2019
Antenna Connector	Florida RF Labs	N/A	RF01#	N/A	Sep. 19, 2019

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
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 19, 2019
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Sep. 19, 2019
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Sep. 19, 2019
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Sep. 19, 2019
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Sep. 19, 2019
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Sep. 19, 2019
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Sep. 19, 2019
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Sep. 19, 2019
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Sep. 19, 2019
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	Sep.25, 2019
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Sep.19, 2019
RF Cable	R&S	R204	R21X	1GHz-40GHz	Sep.19, 2019

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 19, 2019
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	9KHz-300MHz	Sep. 19, 2019
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Sep. 19, 2019

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

Equipment	Model No.	Series No.
Power Adapter	Model: CS-217 Input: AC100-240V, 50/60Hz Output: DC 5V, 3.1A	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

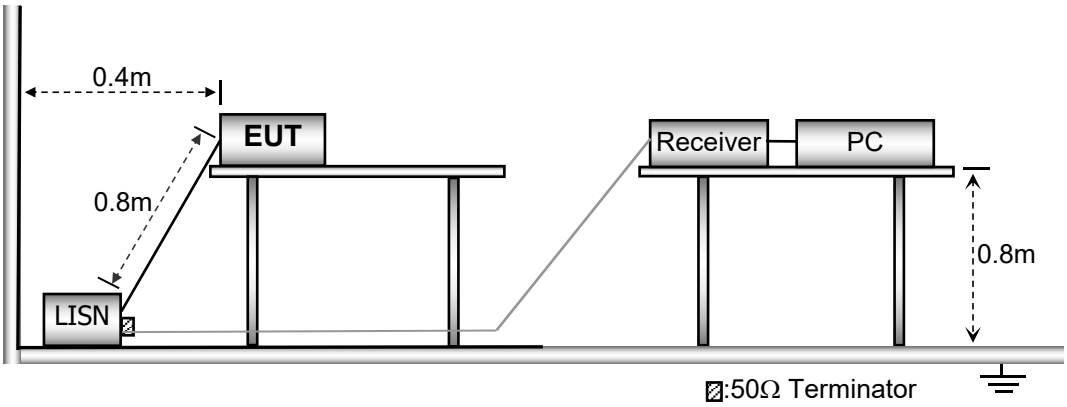
5.1 E.U.T. Operation

Operating Environment :

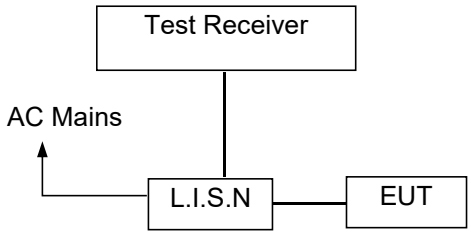
Temperature:	:	25.5 °C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.2kPa

5.2 EUT Setup

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



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

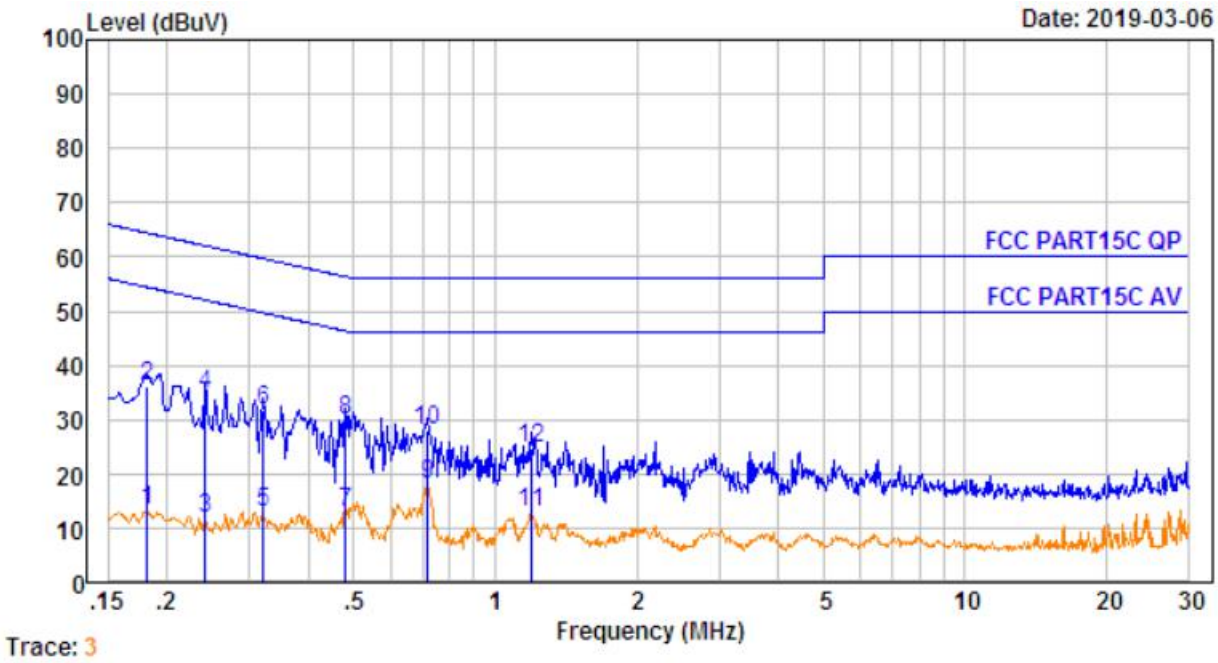
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

Pass.

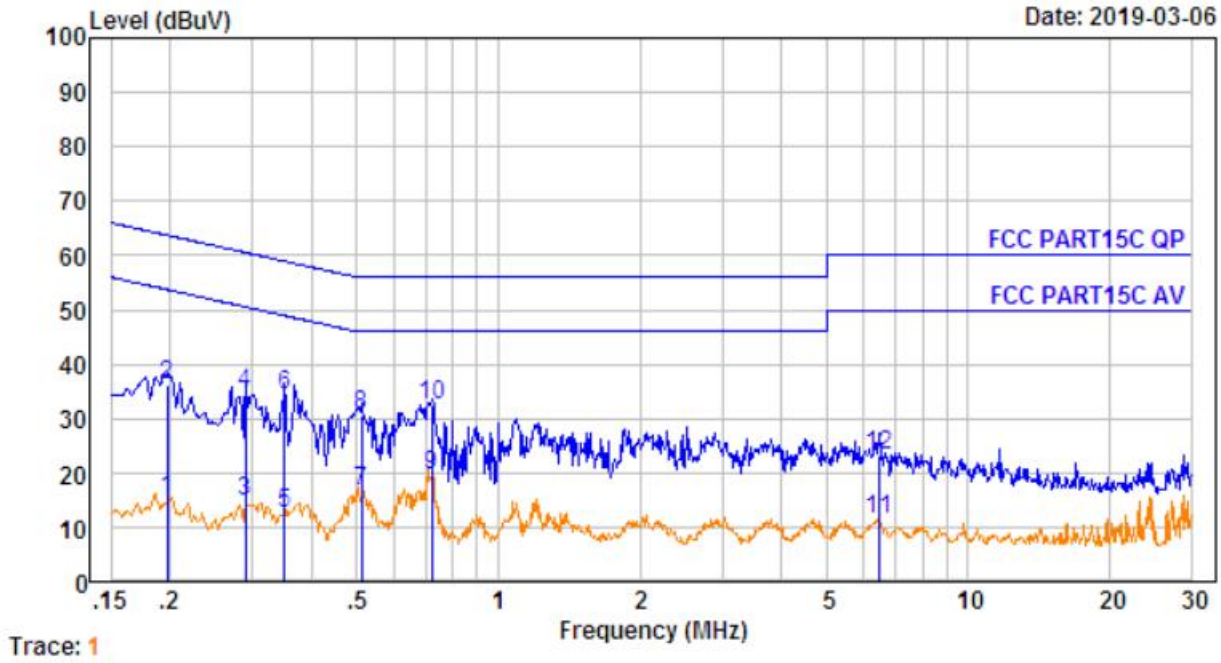
All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Line:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.182	0.25	9.56	3.50	13.31	54.42	-41.11	Average
2.	0.182	0.25	9.56	26.32	36.13	64.42	-28.29	QP
3.	0.242	0.32	9.63	1.78	11.73	52.04	-40.31	Average
4.	0.242	0.32	9.63	24.86	34.81	62.04	-27.23	QP
5.	0.322	0.38	9.69	2.79	12.86	49.66	-36.80	Average
6.	0.322	0.38	9.69	21.73	31.80	59.66	-27.86	QP
7.	0.481	0.43	9.77	2.86	13.06	46.32	-33.26	Average
8.	0.481	0.43	9.77	19.84	30.04	56.32	-26.28	QP
9.	0.720	0.44	9.80	7.90	18.14	46.00	-27.86	Average
10.	0.720	0.44	9.80	17.82	28.06	56.00	-27.94	QP
11.	1.197	0.46	9.83	2.55	12.84	46.00	-33.16	Average
12.	1.197	0.46	9.83	14.53	24.82	56.00	-31.18	QP

Neutral



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.198	0.28	9.62	5.33	15.23	53.71	-38.48	Average
2.	0.198	0.28	9.62	26.29	36.19	63.71	-27.52	QP
3.	0.289	0.36	9.70	4.64	14.70	50.54	-35.84	Average
4.	0.289	0.36	9.70	24.80	34.86	60.54	-25.68	QP
5.	0.350	0.39	9.74	2.25	12.38	48.96	-36.58	Average
6.	0.350	0.39	9.74	24.28	34.41	58.96	-24.55	QP
7.	0.513	0.43	9.81	6.53	16.77	46.00	-29.23	Average
8.	0.513	0.43	9.81	20.56	30.80	56.00	-25.20	QP
9.	0.724	0.44	9.83	9.23	19.50	46.00	-26.50	Average
10.	0.724	0.44	9.83	22.20	32.47	56.00	-23.53	QP
11.	6.488	0.54	9.98	0.87	11.39	50.00	-38.61	Average
12.	6.488	0.54	9.98	12.89	23.41	60.00	-36.59	QP

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 : 23.5 °C

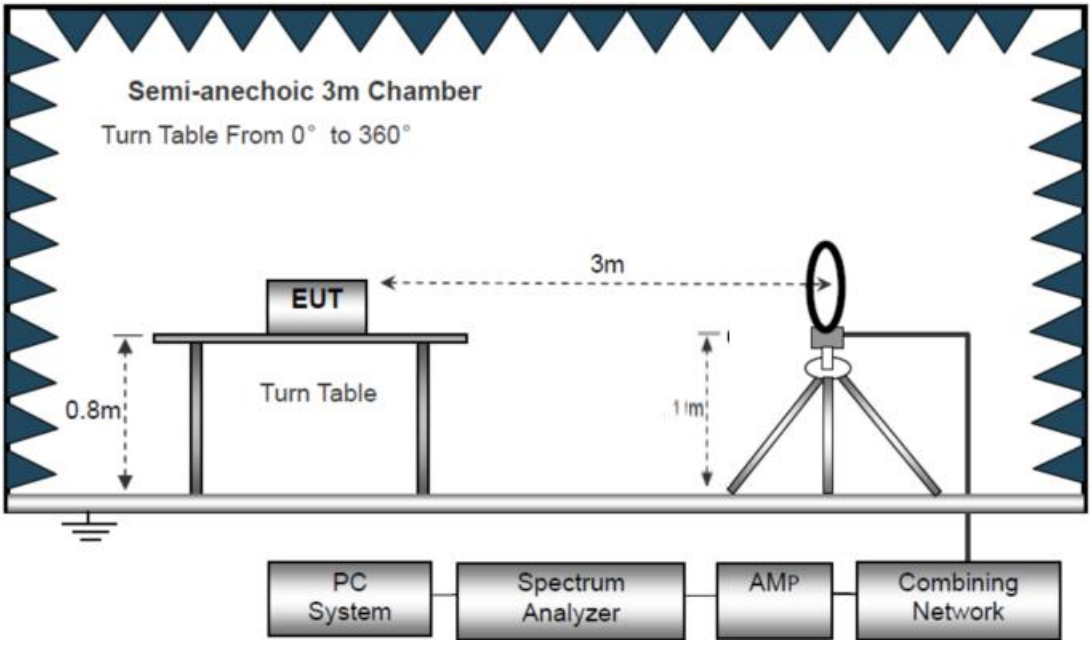
Humidity : 51.1 % RH

Atmospheric Pressure : 101.2kPa

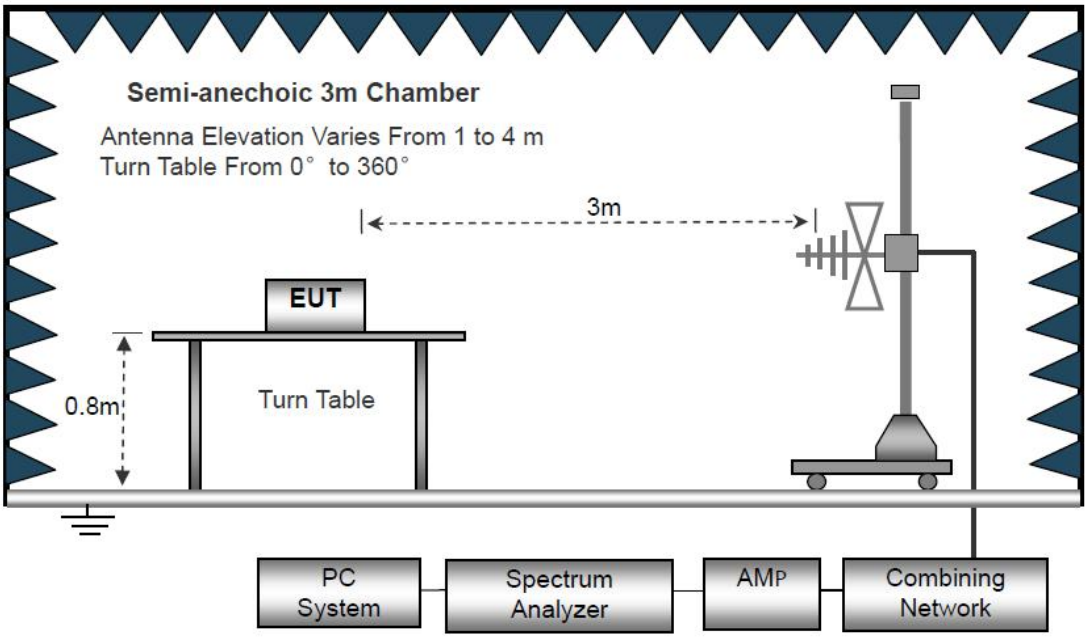
6.2 Test Setup

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

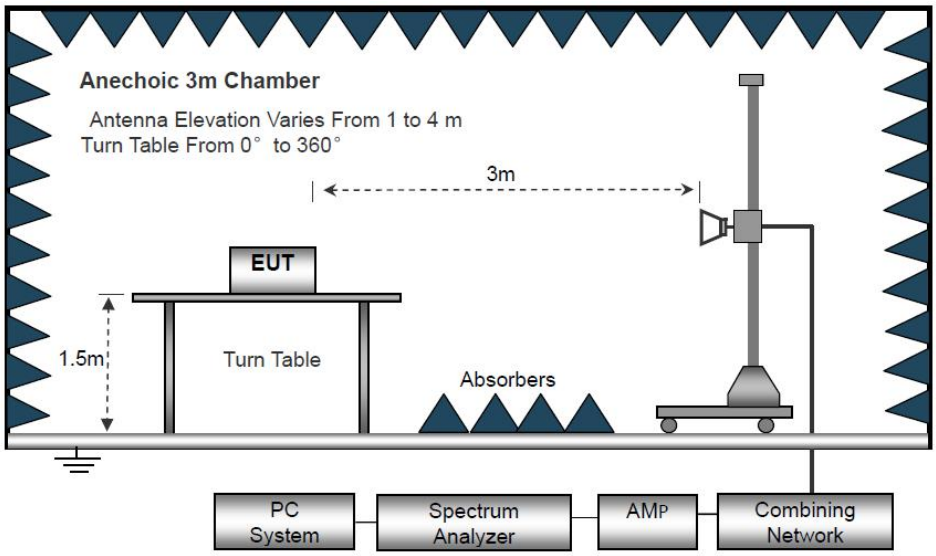
The test setup for emission measurement below 30MHz



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

Below 30MHz			
IF Bandwidth	:	10kHz	
Resolution Bandwidth	:	10kHz	
Video Bandwidth	:	10kHz	
30MHz ~ 1GHz			
Detector	:	PK	QP
Resolution Bandwidth	:	100kHz	120kHz
Video Bandwidth	:	300kHz	300kHz
Above 1GHz			
Detector	:	PK	AV
Resolution Bandwidth	:	1MHz	1MHz
Video Bandwidth	:	3MHz	10Hz

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.

Band	Duty Cycle(%)	T(μs)	1/T(KHz)	Average Correction Factor	VBW Setting
2402-2480	100	-	-	0	10Hz

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.

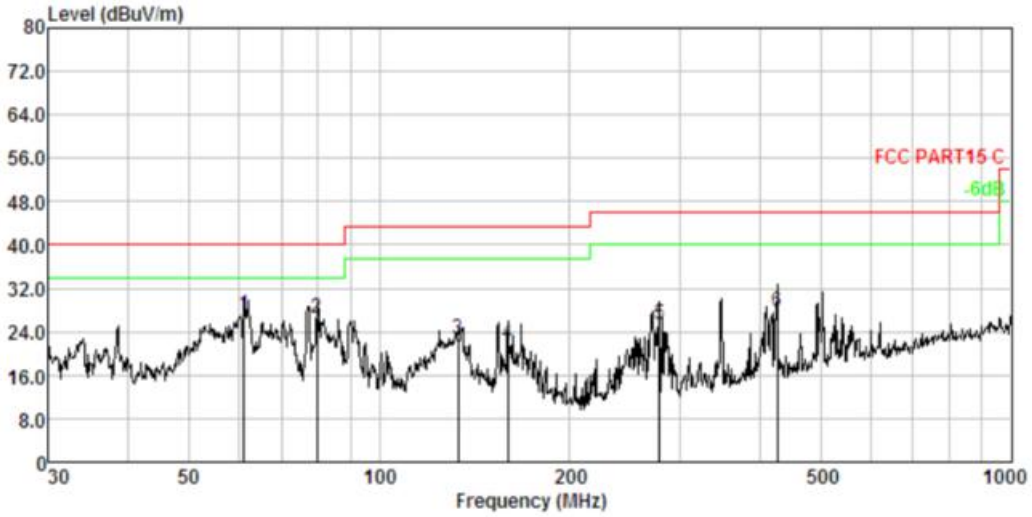
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass.

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

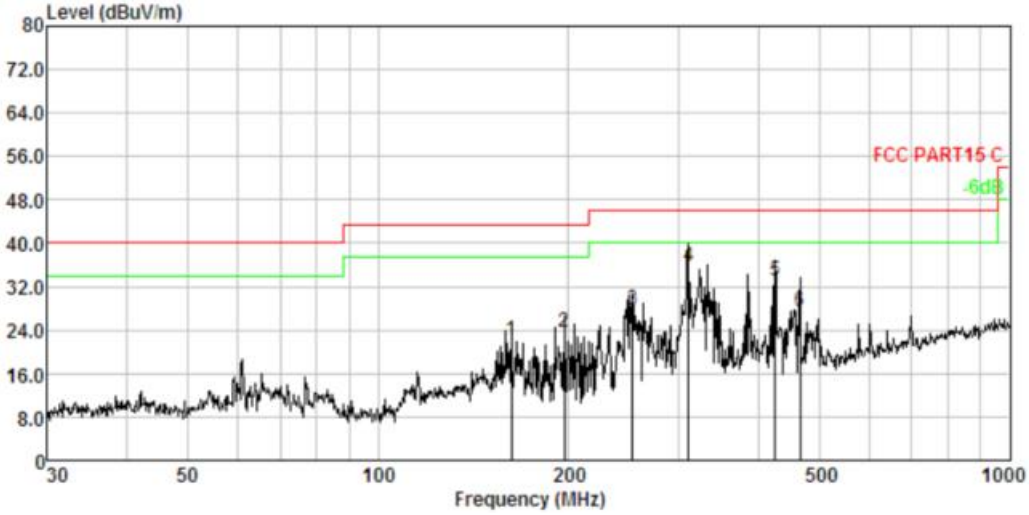
Antenna Polarization: Horizontal GFSK(CH00: 2402MHz)



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	61.132	2.43	12.09	42.80	30.22	27.10	40.00	-12.90	QP
2.	79.800	2.88	8.81	45.14	30.31	26.52	40.00	-13.48	QP
3.	133.151	3.76	12.87	36.73	30.49	22.87	43.50	-20.63	QP
4.	159.784	4.08	13.88	34.56	30.55	21.97	43.50	-21.53	QP
5.	278.067	5.03	12.75	38.37	30.74	25.41	46.00	-20.59	QP
6.	426.521	5.77	15.87	37.07	30.89	27.82	46.00	-18.18	QP

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

Antenna Polarization: Vertical GFSK(CH00: 2402MHz)



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	162.611	4.11	13.73	34.97	30.56	22.25	43.50	-21.25	QP
2.	197.200	4.44	10.58	39.16	30.63	23.55	43.50	-19.95	QP
3.	252.948	4.87	11.99	41.62	30.71	27.77	46.00	-18.23	QP
4.	309.998	5.22	13.42	47.95	30.78	35.81	46.00	-10.19	QP
5.	425.028	5.76	15.83	42.26	30.89	32.96	46.00	-13.04	QP
6.	465.599	5.92	16.62	35.91	30.92	27.53	46.00	-18.47	QP

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

Test Frequency 1GHz-25GHz:

GFSK Low Channel (2402MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	28.43	PK	V	16.84	8.22	16.04	37.45	54	-16.55
4804	27.95	PK	H	16.84	8.22	16.04	36.97	54	-17.03
4804	26.18	AV	V	16.84	8.22	16.04	35.2	74	-38.8
4804	27.05	AV	H	16.84	8.22	16.04	36.07	74	-37.93
17358	29.34	AV	V	20.17	8.46	19.34	38.63	54	-15.37
17358	30.11	AV	H	20.17	8.46	19.34	39.4	54	-14.6
17358	29.46	PK	V	20.17	8.46	19.34	38.75	74	-35.25
17358	31.08	PK	H	20.17	8.46	19.34	40.37	74	-33.63

GFSK Middle Channel (2440MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4880	30.33	PK	V	15.32	7.14	16.34	36.45	54	-19.54
4880	29.05	PK	H	15.32	7.14	16.34	35.17	54	-18.83
4880	28.34	AV	V	15.32	7.14	16.34	34.46	74	-37.55
4880	27.46	AV	H	15.32	7.14	16.34	33.58	74	-40.42
16753	31.26	PK	V	24.08	8.25	21.49	42.1	54	-11.9
16753	30.68	PK	H	24.08	8.25	21.49	41.52	54	-15.7
16753	29.05	AV	V	24.08	8.25	21.49	39.89	74	-34.11
16753	27.46	AV	H	24.08	8.25	21.49	38.3	74	-32.48

GFSK High Channel (2480MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	29.14	PK	V	14.05	7.86	13.64	37.41	54	-18.1
4960	28.04	PK	H	14.05	7.86	13.64	36.31	54	-17.69
4960	27.63	AV	V	14.05	7.86	13.64	35.9	74	-36.59
4960	26.04	AV	H	14.05	7.86	13.64	34.31	74	-39.69
17248	30.18	PK	V	20.47	8.83	20.44	39.04	54	-14.96
17248	29.49	PK	H	20.47	8.83	20.44	38.35	54	-15.65
17248	28.04	AV	V	20.47	8.83	20.44	36.9	74	-37.1
17248	29.18	AV	H	20.47	8.83	20.44	38.04	74	-35.96

Note: 1. The testing has been conformed to 10*2480MHz=24800MHz.

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

7 Band Edge Measurement and RF Conducted Spurious Emissions

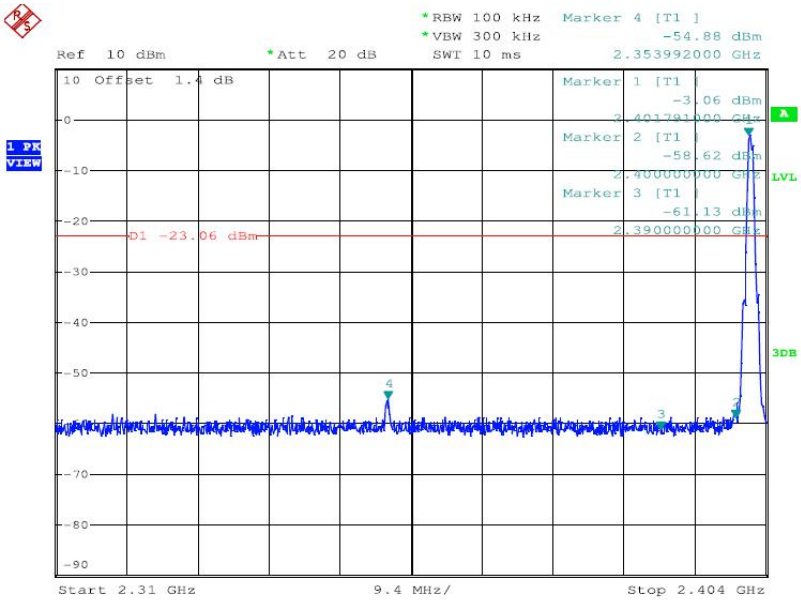
Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (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)).

7.1 Test Procedure

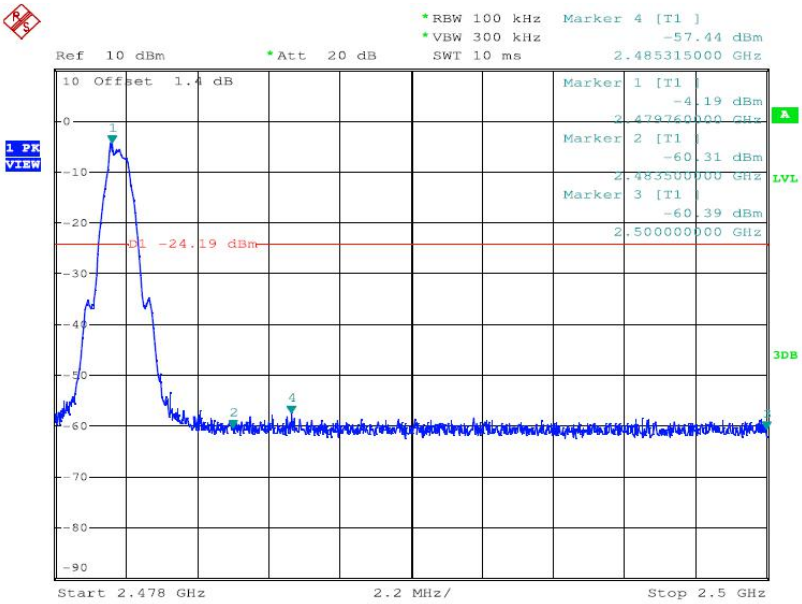
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

7.2 Test Result

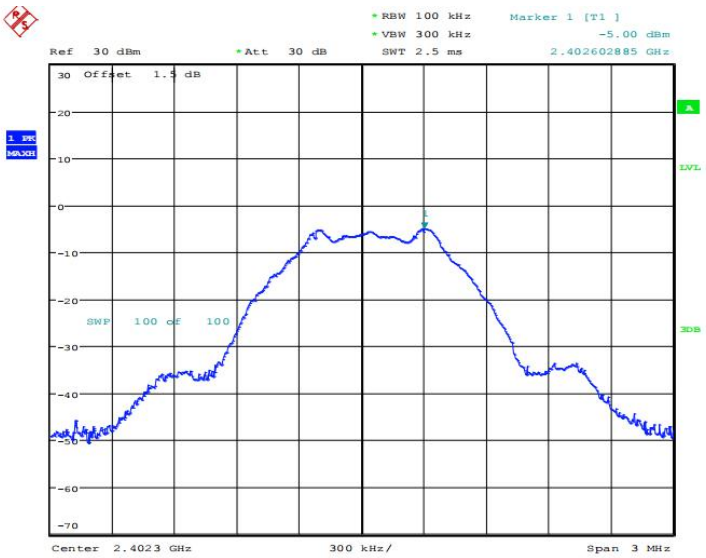
Low Band Edge Plot on Channel 00

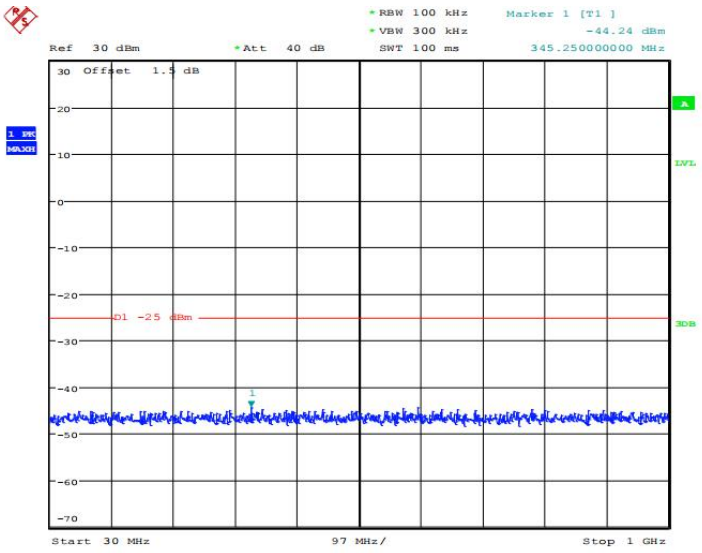


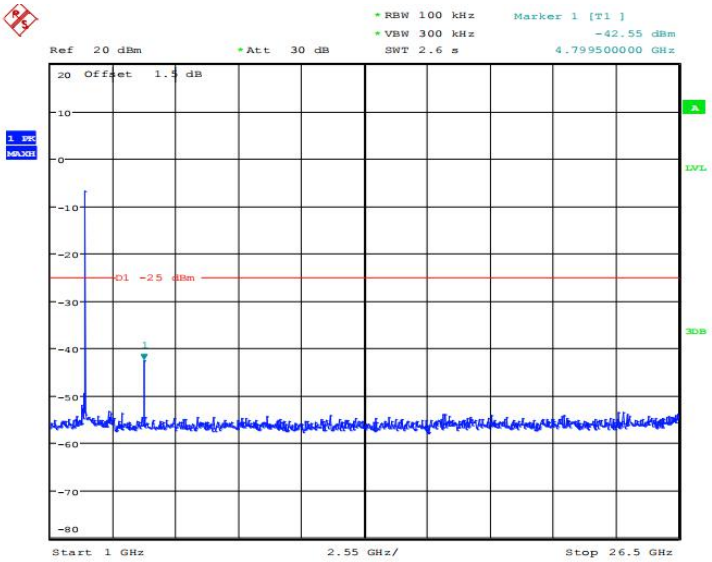
High Band Edge Plot on Channel 39

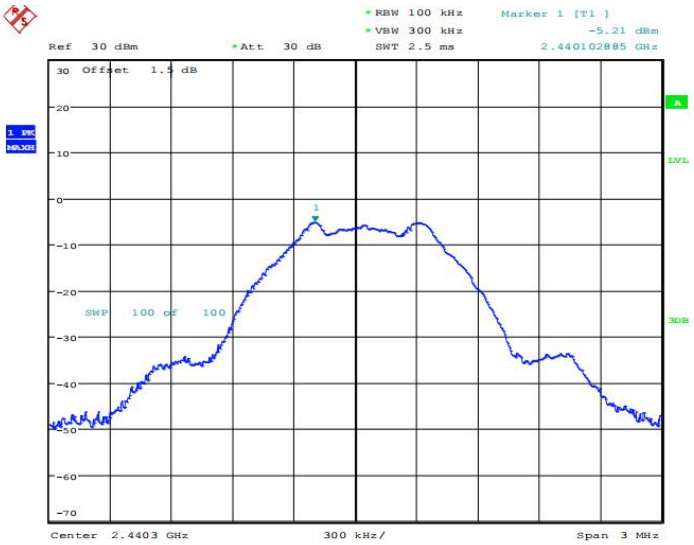


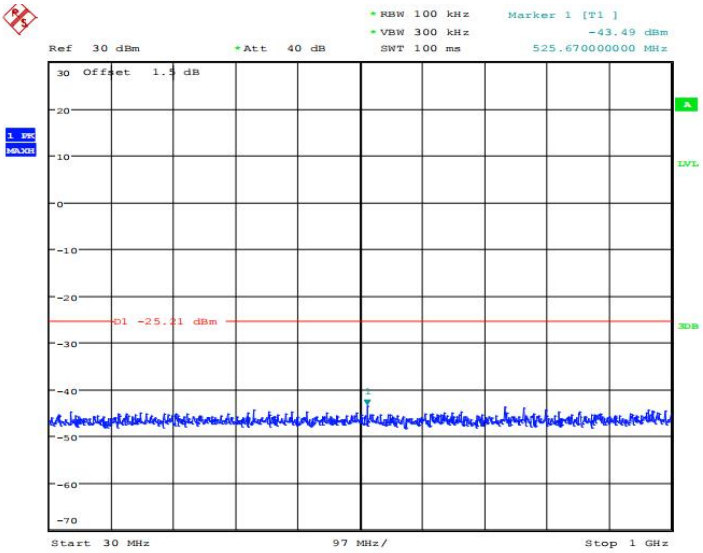
Mode	Freq. (MHz)	Conclusion
GFSK	2402	PASS
	2440	PASS
	2480	PASS

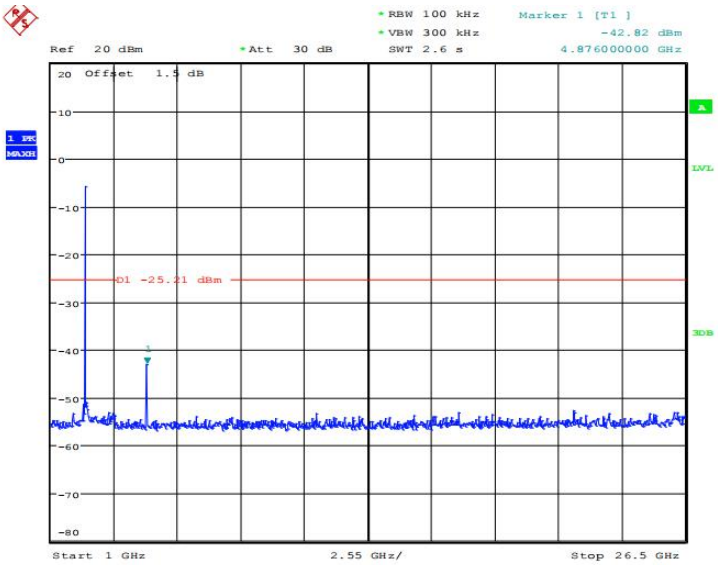


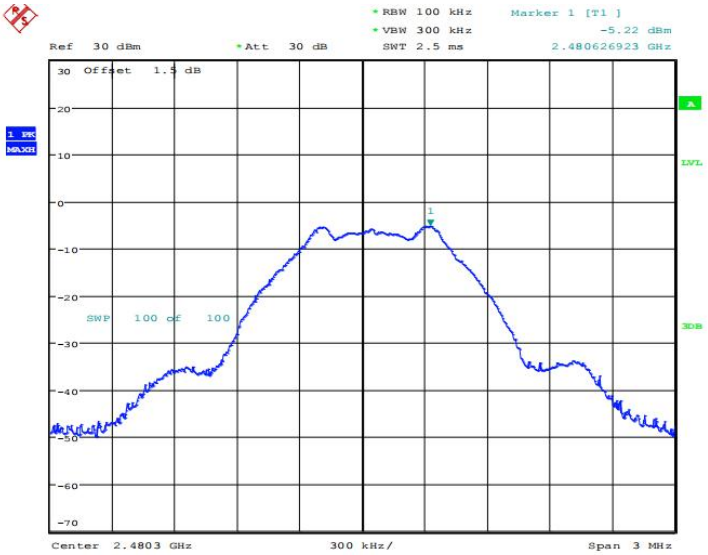


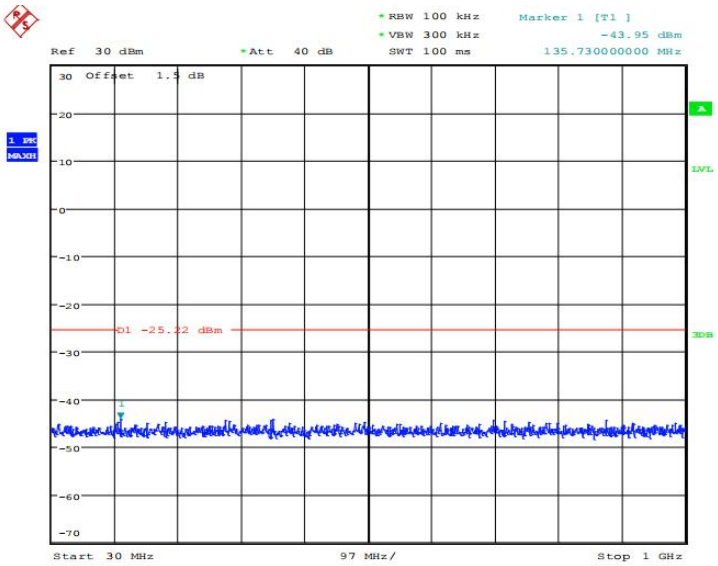

RBW 100 kHz
VBW 300 kHz
SWT 2.6 s
Marker 1 [T1]
-42.55 dBm
4.799500000 GHz
Ref 20 dBm
Att 30 dB
20 Offset 1.5 dB
D1 -25 dBm
Start 1 GHz
2.55 GHz/
Stop 26.5 GHz

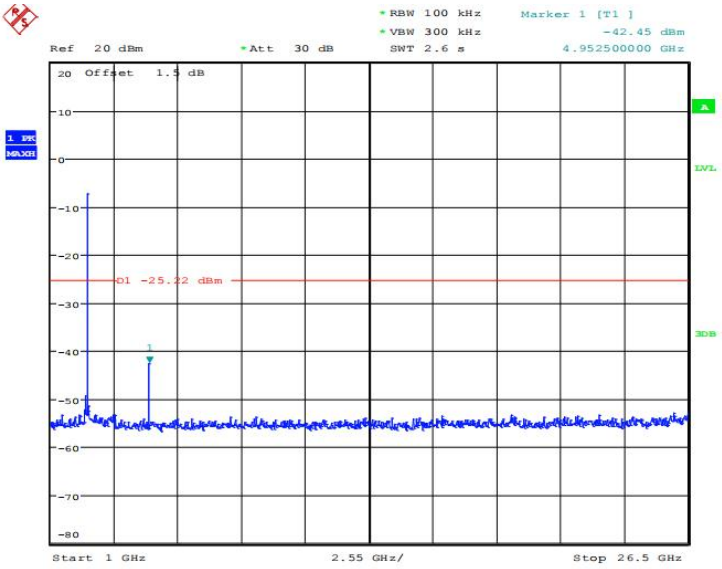

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
-5.21 dBm
2.440102885 GHz
Ref 30 dBm
Att 30 dB
30 Offset 1.5 dB
SWP 100 of 100
Center 2.4403 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 100 ms
Marker 1 [T1]
-43.49 dBm
525.670000000 MHz
Ref 30 dBm
Att 40 dB
Offset 1.5 dB
D1 -25.21 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz


RBW 100 kHz
VBW 300 kHz
SWT 2.6 s
Marker 1 [T1]
-42.82 dBm
4.876000000 GHz
Ref 20 dBm
Att 30 dB
Offset 1.5 dB
D1 -25.21 dBm
Start 1 GHz
2.55 GHz/
Stop 26.5 GHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
-5.22 dBm
2.480626923 GHz
Ref 30 dBm
Att 30 dB
Offset 1.5 dB
SWP 100 of 100
Center 2.4803 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 100 ms
Marker 1 [T1]
-43.95 dBm
135.730000000 MHz
Ref 30 dBm
Att 40 dB
Offset 1.5 dB
D1 -25.22 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz


RBW 100 kHz
VBW 300 kHz
SWT 2.6 s
Marker 1 [T1]
-42.45 dBm
4.952500000 GHz
Ref 20 dBm
Att 30 dB
Offset 1.5 dB
D1 -25.22 dBm
Start 1 GHz
2.55 GHz/
Stop 26.5 GHz

8 6dB Bandwidth Measurement

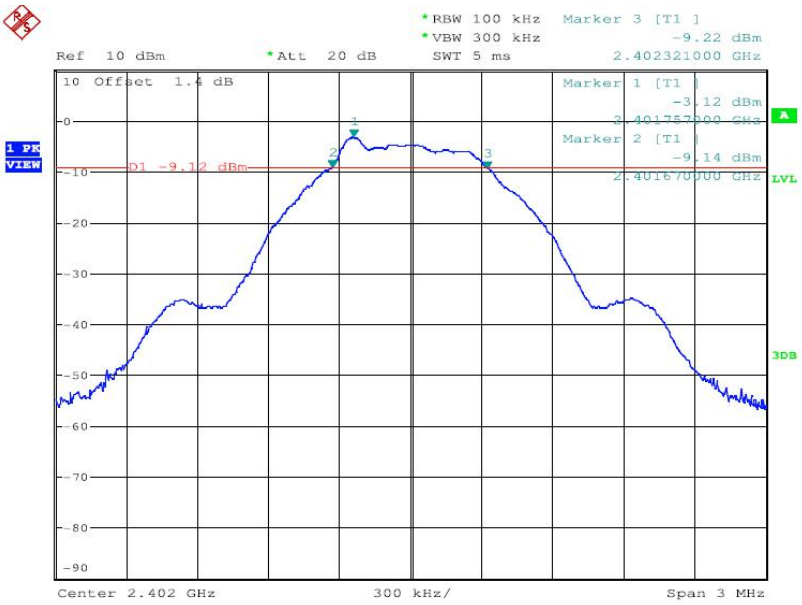
Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit		Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

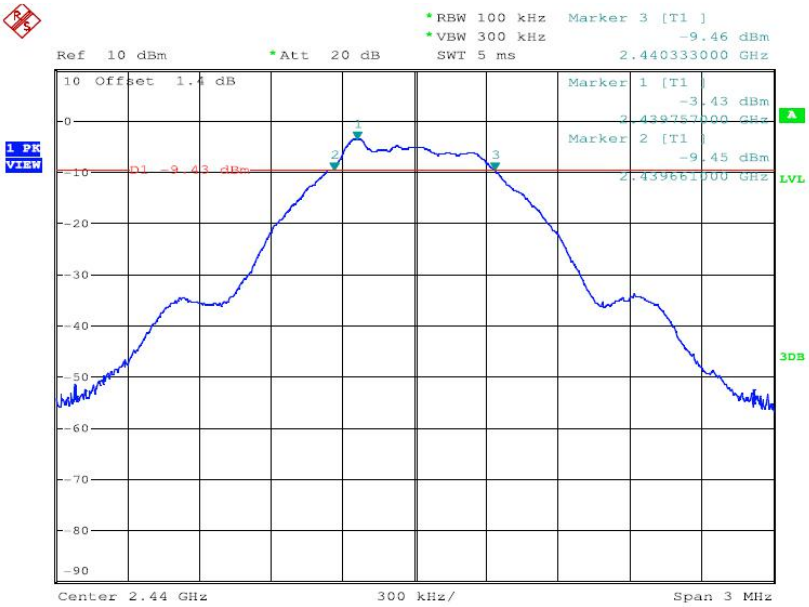
8.1 Test Procedure

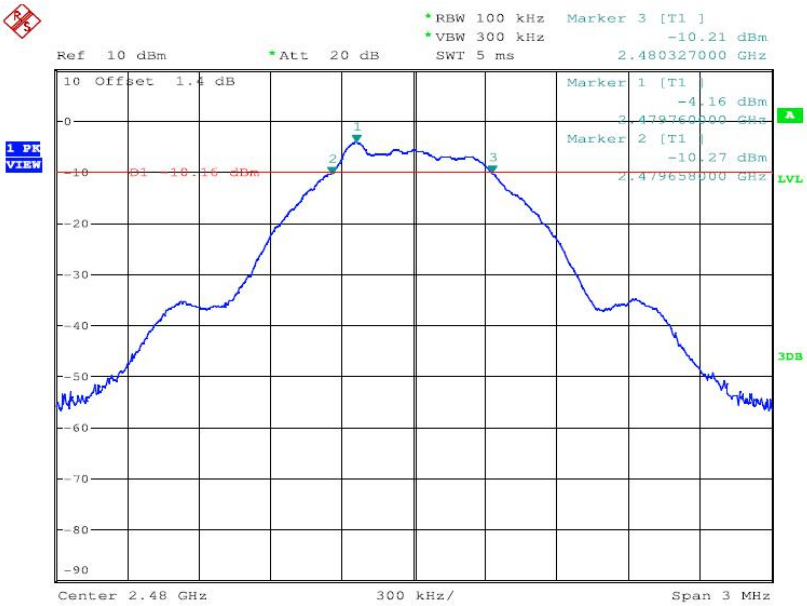
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

8.2 Test Result

Channel number	Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)
00	2402	651	>500
19	2440	672	>500
39	2480	669	>500


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Marker 3 [T1]
-9.22 dBm
2.402321000 GHz
Ref 10 dBm
Att 20 dB
10 Offset 1.4 dB
Marker 1 [T1]
-3.12 dBm
Marker 2 [T1]
-9.14 dBm
D1 -9.12 dBm
1 PK VIEW
A
LVL
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Marker 3 [T1]
-9.46 dBm
2.440333000 GHz
Ref 10 dBm
Att 20 dB
10 Offset 1.4 dB
Marker 1 [T1]
-3.43 dBm
Marker 2 [T1]
-9.45 dBm
D1 -9.43 dBm
1 PK VIEW
A
LVL
3DB
Center 2.44 GHz
300 kHz/
Span 3 MHz


*RBW 100 kHz
*VBW 300 kHz
Marker 3 [T1]
-10.21 dBm
2.480327000 GHz
Ref 10 dBm
*Att 20 dB
SWT 5 ms
10 Offset 1.4 dB
Marker 1 [T1]
-4.16 dBm
2.479760000 GHz
Marker 2 [T1]
-10.27 dBm
2.479658000 GHz
1 PK
VIEW
D1 -10.16 dBm
A
LVL
3DB
Center 2.48 GHz
300 kHz/
Span 3 MHz

9 Maximum Peak Output Power

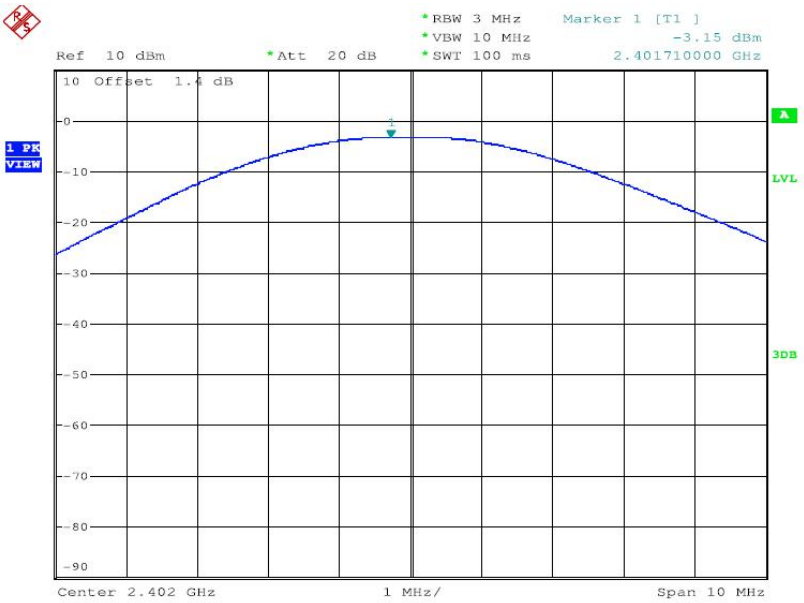
Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

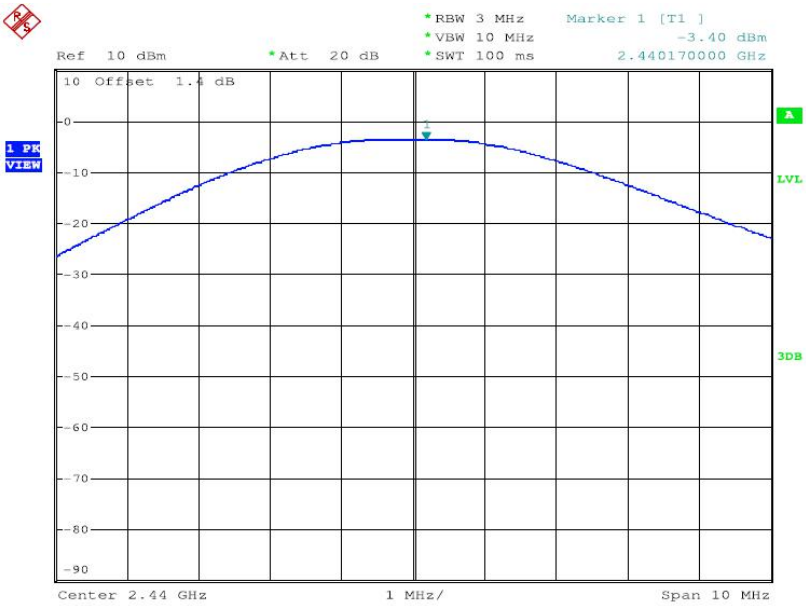
9.1 Test Procedure

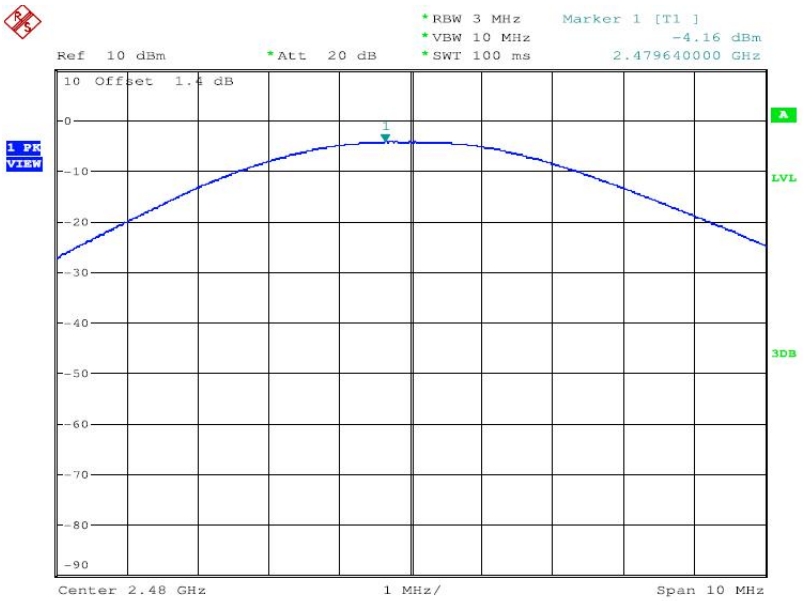
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power and record the results in the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

9.2 Test Result

Channel number	Channel Frequency(MHz)	Peak Power Output(dBm)	Peak Power Output(W)	Peak Power Limit(W)	Verdict
00	2402	-3.15	0.00048	1	PASS
19	2440	-3.40	0.00046	1	PASS
39	2480	-4.16	0.00038	1	PASS


RBW 3 MHz
VBW 10 MHz
SWT 100 ms
Marker 1 [T1]
-3.15 dBm
2.401710000 GHz
Ref 10 dBm
Att 20 dB
10 Offset 1.4 dB
1 PK VIEW
A
LVL
3DB
Center 2.402 GHz
1 MHz/
Span 10 MHz


RBW 3 MHz
VBW 10 MHz
SWT 100 ms
Marker 1 [T1]
-3.40 dBm
2.440170000 GHz
Ref 10 dBm
Att 20 dB
10 Offset 1.4 dB
1 PK VIEW
A
LVL
3DB
Center 2.44 GHz
1 MHz/
Span 10 MHz


RBW 3 MHz
VBW 10 MHz
SWT 100 ms
Marker 1 [T1]
-4.16 dBm
2.479640000 GHz
Ref 10 dBm
Att 20 dB
10 Offset 1.4 dB
1 PK VIEW
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
1 MHz/
Span 10 MHz

10 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.

10.1 Test Procedure

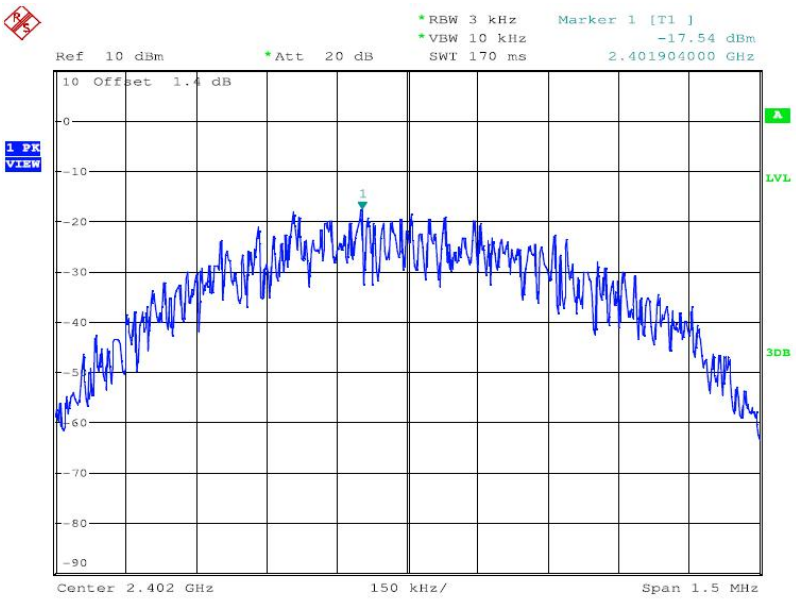
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

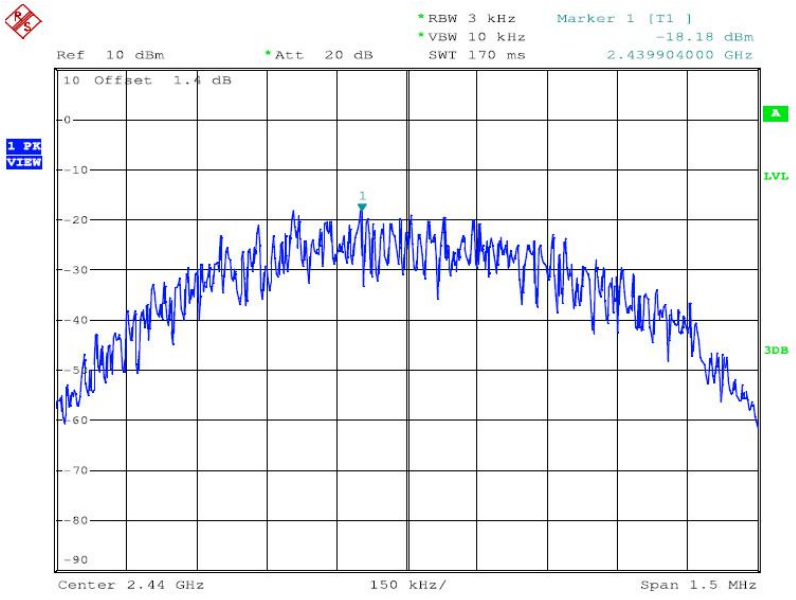
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

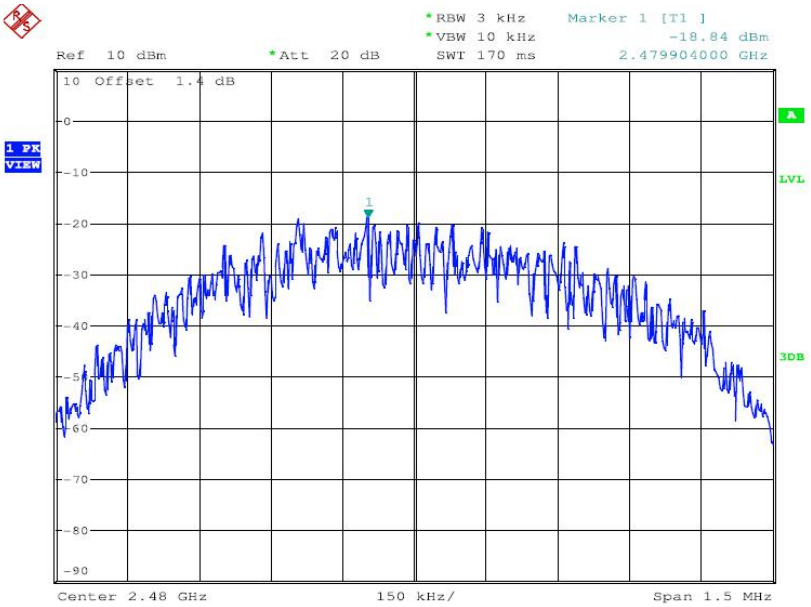
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

10.2 Test Result

Channel number	Channel frequency (MHz)	Measurement level (dBm)	Required Limit (dBm/3kHz)	Pass/Fail
		PSD/3kHz		
00	2402	-17.54	8	PASS
19	2440	-18.18	8	PASS
39	2480	-18.84	8	PASS


*RBW 3 kHz
Marker 1 [T1]
*VBW 10 kHz
-17.54 dBm
Ref 10 dBm
*Att 20 dB
SWT 170 ms
2.401904000 GHz
10 Offset 1.4 dB
1 PK
VIEW
A
LVL
3DB
Center 2.402 GHz
150 kHz/
Span 1.5 MHz


*RBW 3 kHz
Marker 1 [T1]
*VBW 10 kHz
-18.18 dBm
Ref 10 dBm
*Att 20 dB
SWT 170 ms
2.439904000 GHz
10 Offset 1.4 dB
1 PK
VIEW
A
LVL
3DB
Center 2.44 GHz
150 kHz/
Span 1.5 MHz


*RBW 3 kHz
*VBW 10 kHz
SWT 170 ms
Marker 1 [T1]
-18.84 dBm
2.479904000 GHz
Ref 10 dBm
*Att 20 dB
10 Offset 1.4 dB
1 PK
VIEW
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
150 kHz/
Span 1.5 MHz

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 EUT'S antenna, permanent attached antenna, is internal antenna. The antenna's gain is 0dBi and meets the requirement.

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