PRECISE TESTING

FCC TEST REPORT

FCC ID: 2APNJHIFIU8

Product	:	Portable Audio Player
Model Name	:	Colorfly Pocket HiFi U8, Colorfly Pocket Hifi U10 II, Colorfly Pocket Hifi U8 II, Colorfly Pocket Hifi U8 PLUS, Colorfly Pocket Hifi U8 PRO, Colorfly Pocket Hifi U6, Colorfly Pocket Hifi U6 II, Colorfly Pocket Hifi T5, Colorfly Pocket Hifi T5 II, Colorfly Pocket Hifi T5 PRO, Colorfly Pocket Hifi T3, Colorfly Pocket Hifi T3 II, Colorfly Pocket Hifi T1, Colorfly Pocket Hifi T1 II, Colorfly Pocket Hifi C3, Colorfly Wireless Hifi BT-C1, Colorfly Wireless Hifi BT-C2
Brand	:	COLORFLY
Report No.	:	PTC18031000302E-FC02

Prepared for

Seethru Communication Equipment (SZ) Co., LTD

15/F, The Central Tower, No,88 Fuhua Ei Road , Futian Dist, Shenzhen, Guangdong, China

Prepared by

Dongguan Precise Testing & Certification Corp., Ltd.

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

1 TEST RESULT CERTIFICATION

Applicant's name	:	Seethru Communication Equipment (SZ) Co., LTD
Address	:	15/F, The Central Tower, No,88 Fuhua Ei Road , Futian Dist, Shenzhen, Guangdong, China
Manufacture's name	:	Seethru Communication Equipment (SZ) Co., LTD
Address	:	15/F, The Central Tower, No,88 Fuhua Ei Road , Futian Dist, Shenzhen, Guangdong, China
Product name	:	Portable Audio Player
Model name	:	Pocket HiFi U8, Colorfly Pocket Hifi U10 II, Colorfly Pocket Hifi U8 II, Colorfly Pocket Hifi U8 PLUS, Colorfly Pocket Hifi U8 PRO, Colorfly Pocket Hifi U6, Colorfly Pocket Hifi U6 II, Colorfly Pocket Hifi T5, Colorfly Pocket Hifi T5 II, Colorfly Pocket Hifi T5 PRO, Colorfly Pocket Hifi T3, Colorfly Pocket Hifi T3 II, Colorfly Pocket Hifi T1, Colorfly Pocket Hifi T1 II, Colorfly Pocket Hifi C3, Colorfly Wireless Hifi BT-C1, Colorfly Wireless Hifi BT-C2
Standards	:	FCC CFR47 Part 15 Section 15.247: 2017
Test procedure	:	ANSI C63.10:2013
Test Date	:	April 11, 2018 to June 20, 2018
Date of Issue	:	June 20, 2018
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

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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
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

Remark:

1. The EUT is powered by full-charged battery during the test.

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Portable Audio Player
Model Name	:	Colorfly Pocket HiFi U8, Colorfly Pocket Hifi U10 II, Colorfly Pocket Hifi U8 II, Colorfly Pocket Hifi U8 PLUS, Colorfly Pocket Hifi U8 PRO, Colorfly Pocket Hifi U6, Colorfly Pocket Hifi U6 II, Colorfly Pocket Hifi T5, Colorfly Pocket Hifi T5 II, Colorfly Pocket Hifi T5 PRO, Colorfly Pocket Hifi T3, Colorfly Pocket Hifi T3 II, Colorfly Pocket Hifi T1, Colorfly Pocket Hifi T1 II, Colorfly Pocket Hifi C3, Colorfly Wireless Hifi BT-C1, Colorfly Wireless Hifi BT-C2 (Note: The samples are the same except appearance and model number. So Colorfly pocket HiFi U8 was selected for full tested.)
Equipment Type	:	DTS
Specification	:	802.11b/g/n HT20 BLE
Operation Frequency	:	2.4G Wi-Fi: 2412-2462MHz BLE: 2402-2480MHz
Number of Channel	:	802.11b/g/n: 11 Channels BLE: 40 Channels
Type of Modulation	:	802.11b/g/n: DSSS, OFDM BLE: GFSK
Antenna installation	:	Internal Antenna
Antenna Gain	:	2 dBi
Power supply	:	DC 3.8V 3300mAh Battery
Hardware Version	:	V1.0
Software Version	:	V1.0

3.2 Channel List

The system was configured for testing in testing mode, which was provided by manufacturer.

For 2.4GHz Band, 11 channels are provided to testing:

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

EUT was tested with channel 1, 6, 11.

For Bluetooth LE mode, 40 channels are provided for testing:

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		

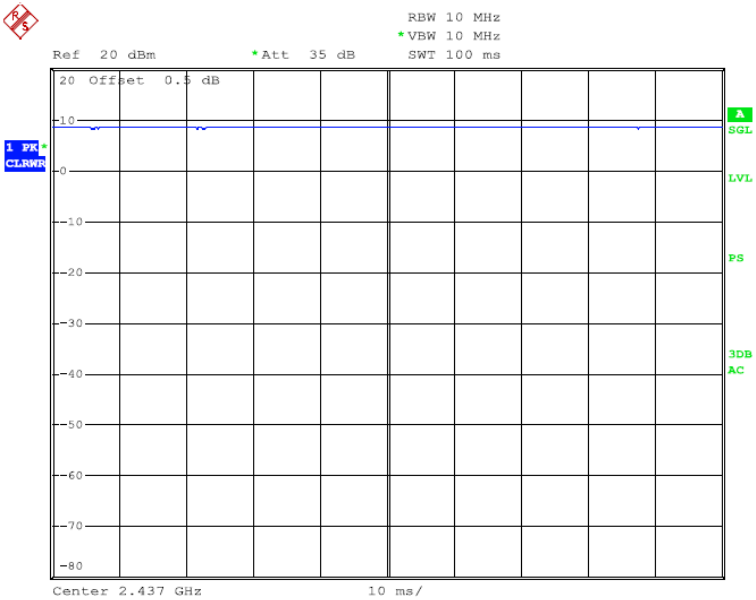
EUT was tested with channel 0, 19 and 39.

The maximum duty cycle as following table:

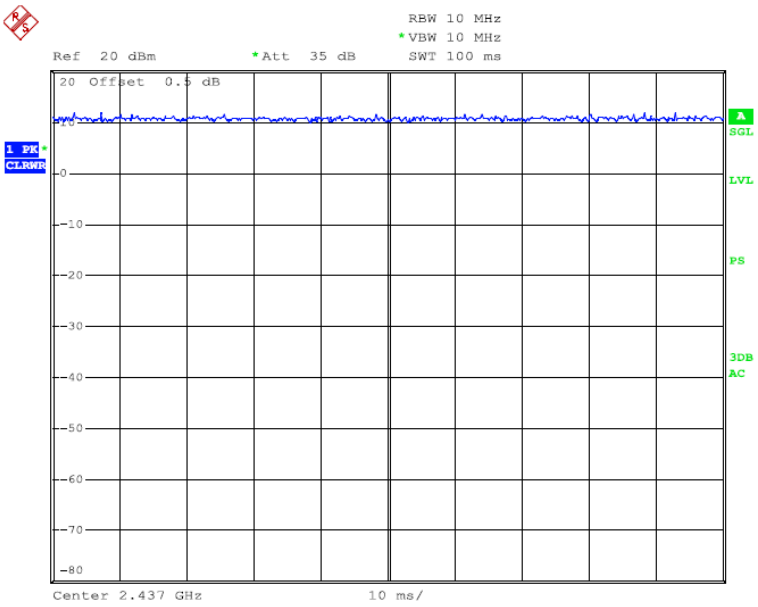
Test Mode	T_{on}(ms)	T_{on+off}(ms)	Duty Cycle(%)
802.11b	100	100	100%
802.11g	100	100	100%
802.11n(HT20)	100	100	100%
BLE	5.0	5.0	100%

Test Plots:

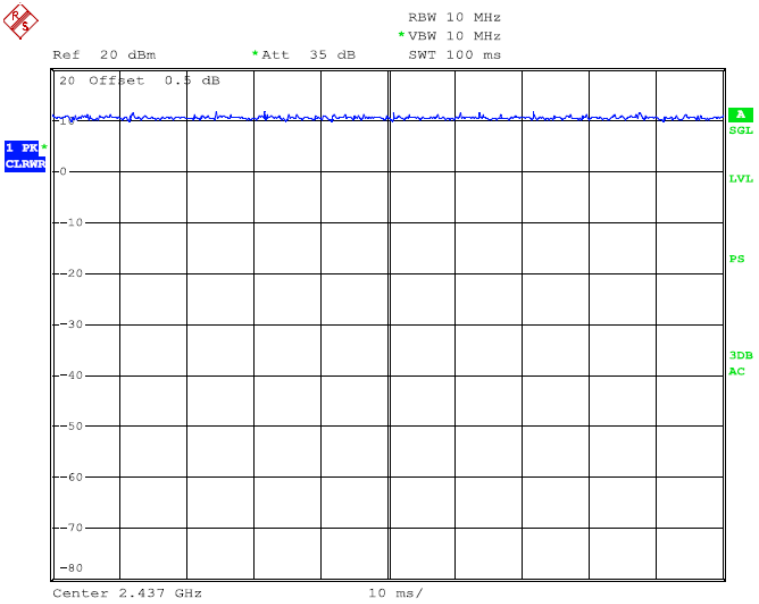
802.11b



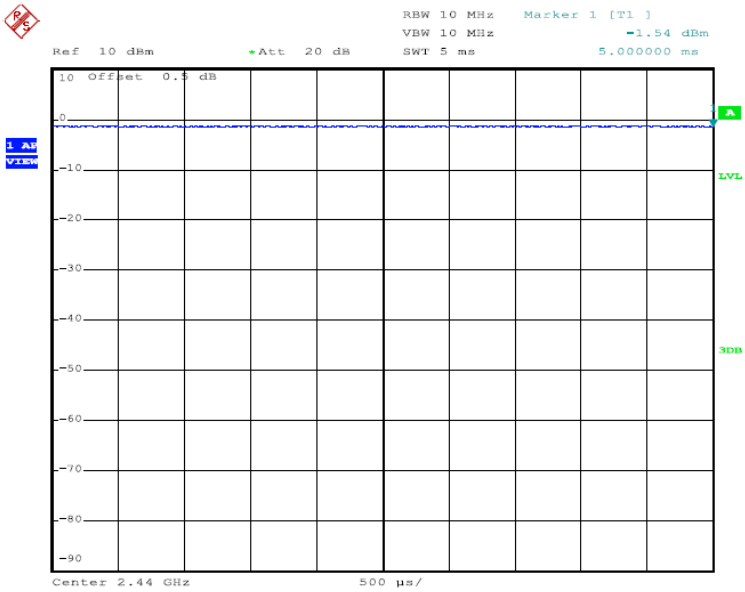
802.11g



802.11n(HT20)



BLE


RBW 10 MHz
VBW 10 MHz
SWT 5 ms
Marker 1 [T1]
-1.54 dBm
5.000000 ms
Ref 10 dBm
Att 20 dB
10 Offset 0.5 dB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
A
LVL
3DB
Center 2.44 GHz
500 µs/

3.3 Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

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

Test Lab: Shenzhen BCTC Testing Co., Ltd.

Address: BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

FCC Registered No.: 712850

Test items: Radiated Spurious Emission(18GHz to 25GHz)

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	Apr 07, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Oct 09, 2018
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Oct 09, 2018
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Oct 09, 2018

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(Test Frequency from 9KHz-18GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 03, 2018
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Aug 31, 2018
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug 31, 2018
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Sep. 03, 2018
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Sep. 03, 2018
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Oct. 13, 2018
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug. 31, 2018
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Aug. 31, 2018
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Sep. 03, 2018

Radiated Emission (Test Frequency from 18GHz-25GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-26.5GHz	2018.08.26
Test Receiver	R&S	ESPI	101396	9KHz-7GHz	2018.08.26
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	2018.09.02
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	2018.08.26
RF Cable	R&S	R204	R21X	1GHz-40GHz	2018.08.26
Antenna Connector	Florida RF Labs	N/A	RF01#	N/A	2018.08.26

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 03, 2018
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	9KHz-300MHz	Sep. 03, 2018
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Sep. 03, 2018

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

4.3 Description of Support Units

Equipment	Model No.	Series No.
Adapter	Model: PS65B150Y3000S Input: AC120V, 60Hz, 1.5A Output: DC 5V, 3000mA	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

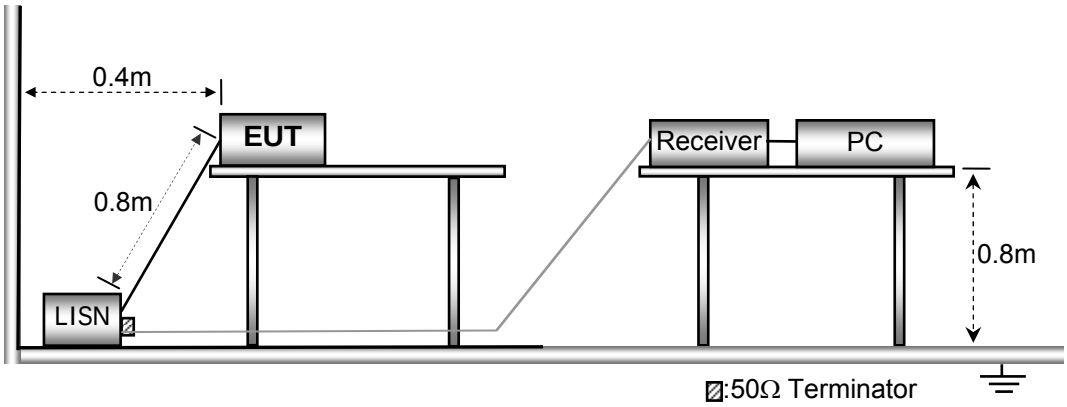
5.1 E.U.T. Operation

Operating Environment **:**

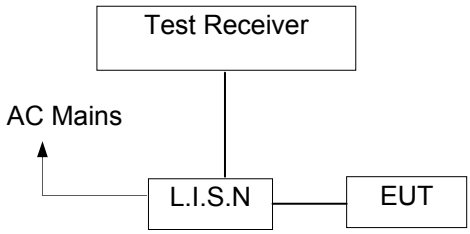
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

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.

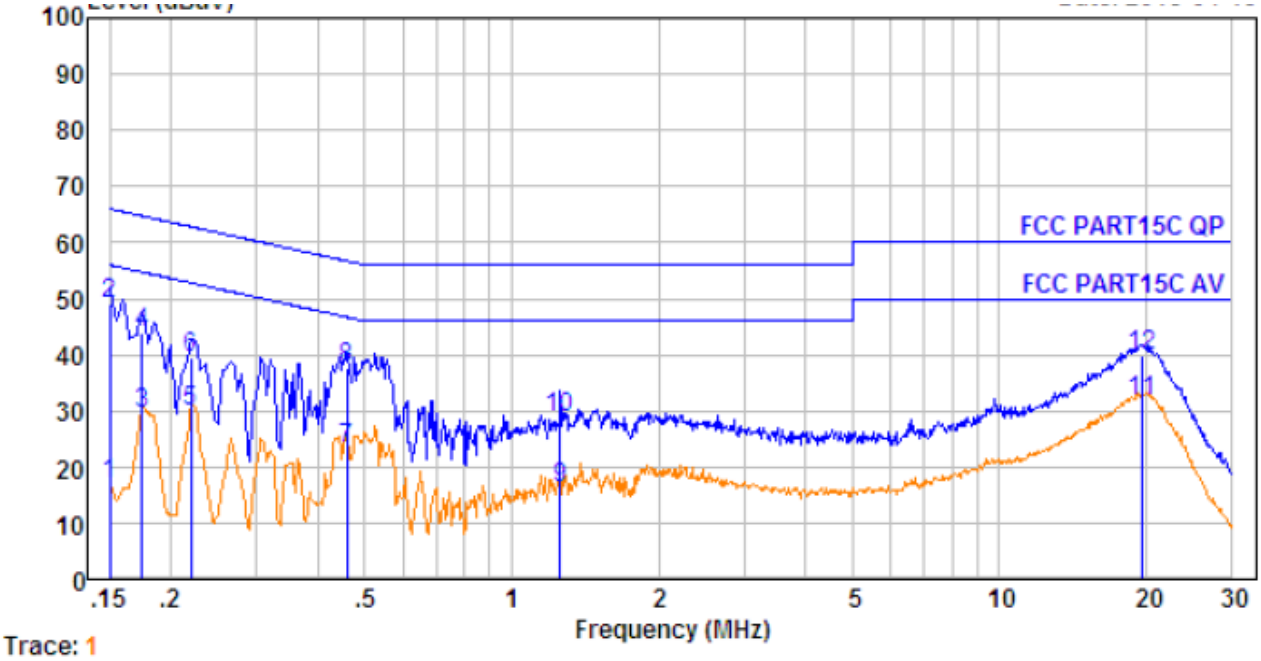
5.7 Conducted Emission Test Result

Pass.

Please refer to the following pages.

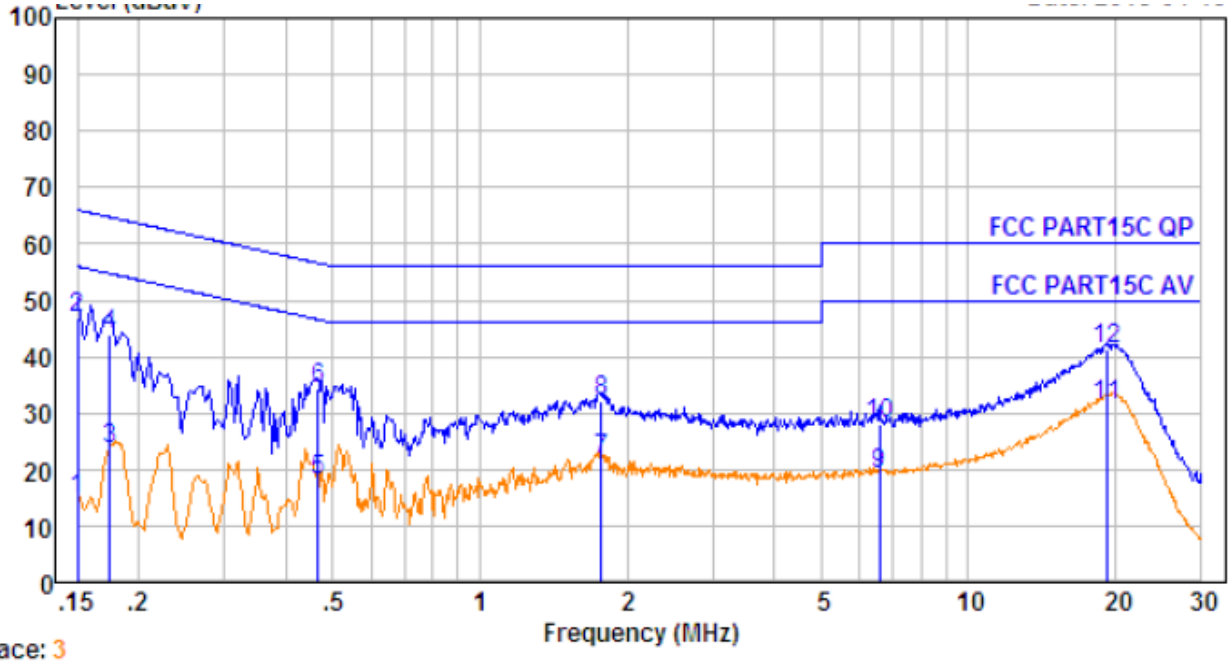
Test Mode: Wi-Fi Transmitting

Line-AC 120V/60Hz



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.150	0.21	9.53	7.16	16.90	56.00	-39.10	Average
2.	0.150	0.21	9.53	39.46	49.20	66.00	-16.80	QP
3.	0.175	0.25	9.58	19.67	29.50	54.72	-25.22	Average
4.	0.175	0.25	9.58	34.16	43.99	64.72	-20.73	QP
5.	0.220	0.30	9.64	19.82	29.76	52.83	-23.07	Average
6.	0.220	0.30	9.64	29.46	39.40	62.83	-23.43	QP
7.	0.459	0.42	9.79	13.04	23.25	46.71	-23.46	Average
8.	0.459	0.42	9.79	27.35	37.56	56.71	-19.15	QP
9.	1.255	0.46	9.86	6.09	16.41	46.00	-29.59	Average
10.	1.255	0.46	9.86	18.35	28.67	56.00	-27.33	QP
11.	19.635	0.40	9.97	21.34	31.71	50.00	-18.29	Average
12.	19.635	0.40	9.97	29.65	40.02	60.00	-19.98	QP

Neutral-AC 120V/60Hz

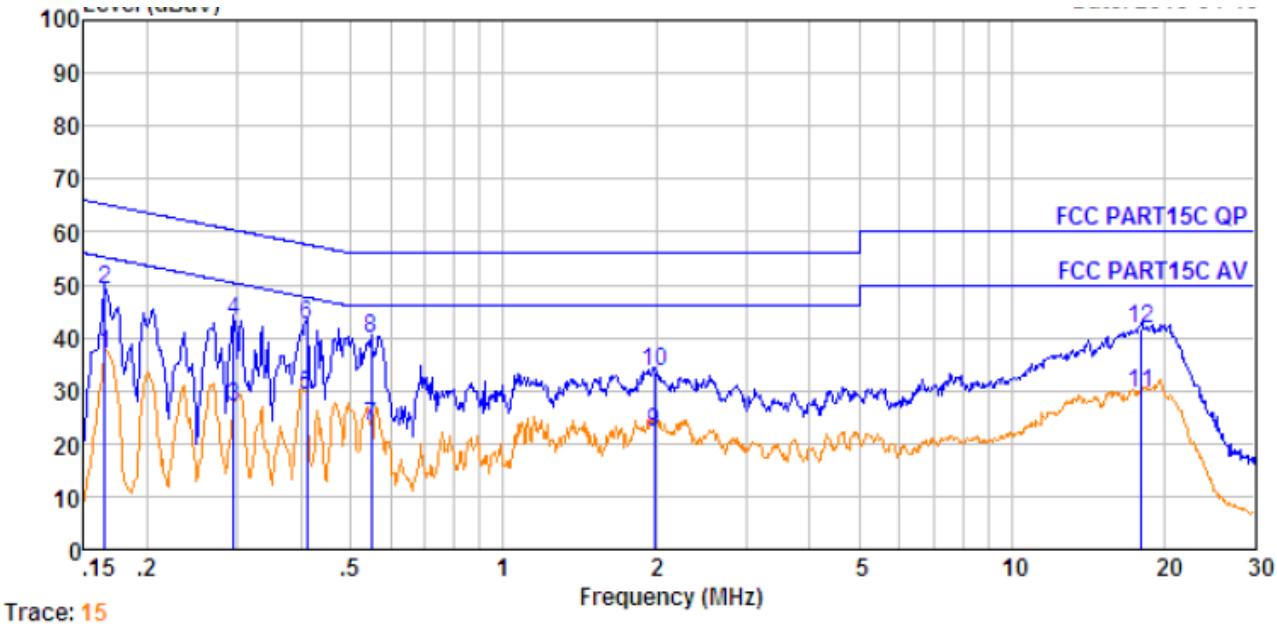


Trace: 3

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.150	0.21	9.50	4.95	14.66	56.00	-41.34	Average
2.	0.150	0.21	9.50	37.29	47.00	66.00	-19.00	QP
3.	0.175	0.25	9.55	13.93	23.73	54.72	-30.99	Average
4.	0.175	0.25	9.55	34.27	44.07	64.72	-20.65	QP
5.	0.466	0.42	9.77	8.07	18.26	46.58	-28.32	Average
6.	0.466	0.42	9.77	24.14	34.33	56.58	-22.25	QP
7.	1.772	0.47	9.84	11.37	21.68	46.00	-24.32	Average
8.	1.772	0.47	9.84	21.96	32.27	56.00	-23.73	QP
9.	6.592	0.54	9.98	8.72	19.24	50.00	-30.76	Average
10.	6.592	0.54	9.98	17.64	28.16	60.00	-31.84	QP
11.	19.326	0.41	9.86	21.09	31.36	50.00	-18.64	Average
12.	19.326	0.41	9.86	30.96	41.23	60.00	-18.77	QP

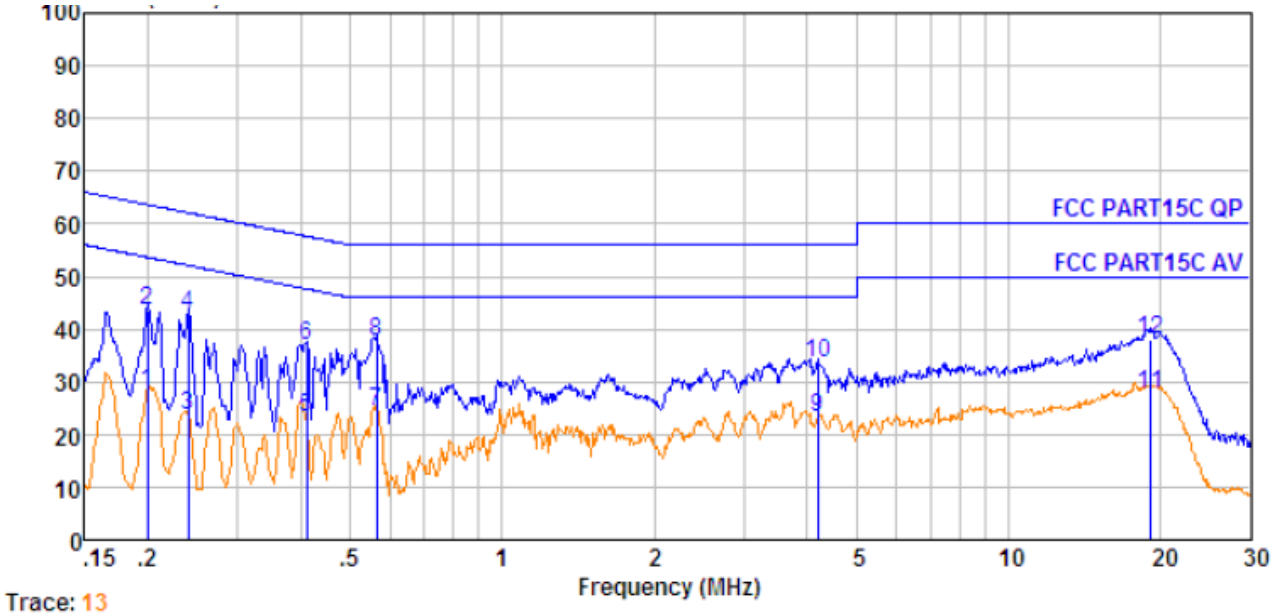
Test Mode: BLE Transmitting:

Line-AC 120V/60Hz



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.165	0.23	9.53	27.10	36.86	55.21	-18.35	Average
2.	0.165	0.23	9.53	39.31	49.07	65.21	-16.14	QP
3.	0.296	0.37	9.67	17.00	27.04	50.37	-23.33	Average
4.	0.296	0.37	9.67	33.22	43.26	60.37	-17.11	QP
5.	0.410	0.41	9.74	19.01	29.16	47.64	-18.48	Average
6.	0.410	0.41	9.74	32.24	42.39	57.64	-15.25	QP
7.	0.549	0.43	9.79	12.90	23.12	46.00	-22.88	Average
8.	0.549	0.43	9.79	29.55	39.77	56.00	-16.23	QP
9.	1.980	0.47	9.85	11.70	22.02	46.00	-23.98	Average
10.	1.980	0.47	9.85	23.18	33.50	56.00	-22.50	QP
11.	17.944	0.45	9.90	19.31	29.66	50.00	-20.34	Average
12.	17.944	0.45	9.90	31.52	41.87	60.00	-18.13	QP

Neutral-AC 120V/60Hz



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.200	0.28	9.62	18.30	28.20	53.62	-25.42	Average
2.	0.200	0.28	9.62	33.66	43.56	63.62	-20.06	QP
3.	0.240	0.32	9.66	13.70	23.68	52.08	-28.40	Average
4.	0.240	0.32	9.66	32.83	42.81	62.08	-19.27	QP
5.	0.410	0.41	9.77	13.20	23.38	47.64	-24.26	Average
6.	0.410	0.41	9.77	26.54	36.72	57.64	-20.92	QP
7.	0.564	0.43	9.82	14.20	24.45	46.00	-21.55	Average
8.	0.564	0.43	9.82	27.53	37.78	56.00	-18.22	QP
9.	4.202	0.48	9.95	12.79	23.22	46.00	-22.78	Average
10.	4.202	0.48	9.95	22.99	33.42	56.00	-22.58	QP
11.	19.021	0.42	9.98	17.30	27.70	50.00	-22.30	Average
12.	19.021	0.42	9.98	27.79	38.19	60.00	-21.81	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

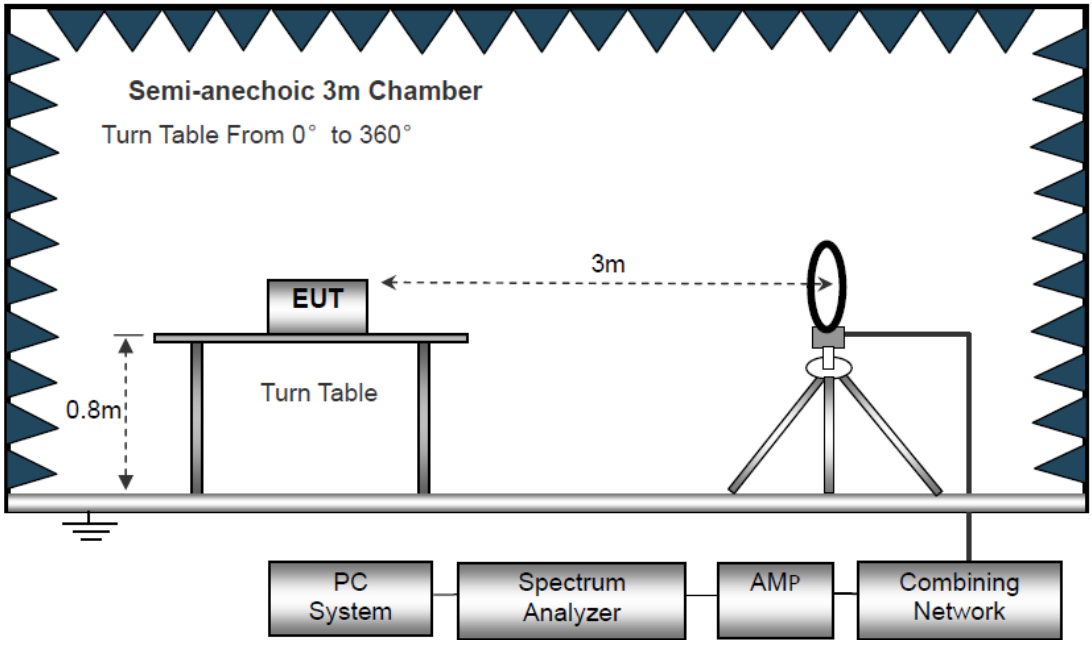
Atmospheric Pressure: : 101.2kPa

Test Voltage : DC 3.8V Battery

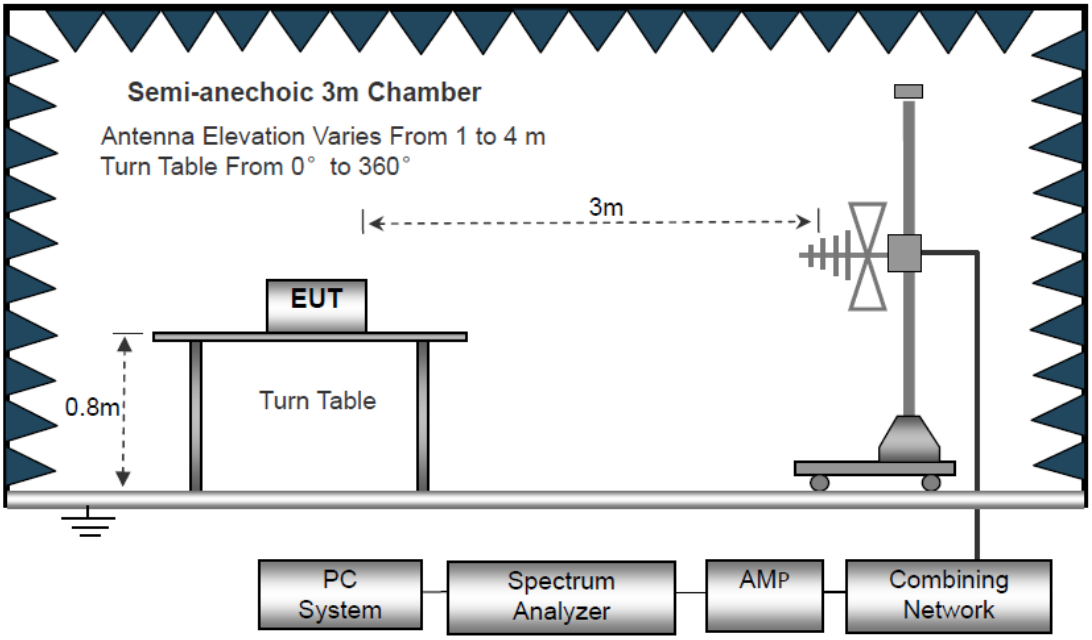
6.2 Test Setup

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

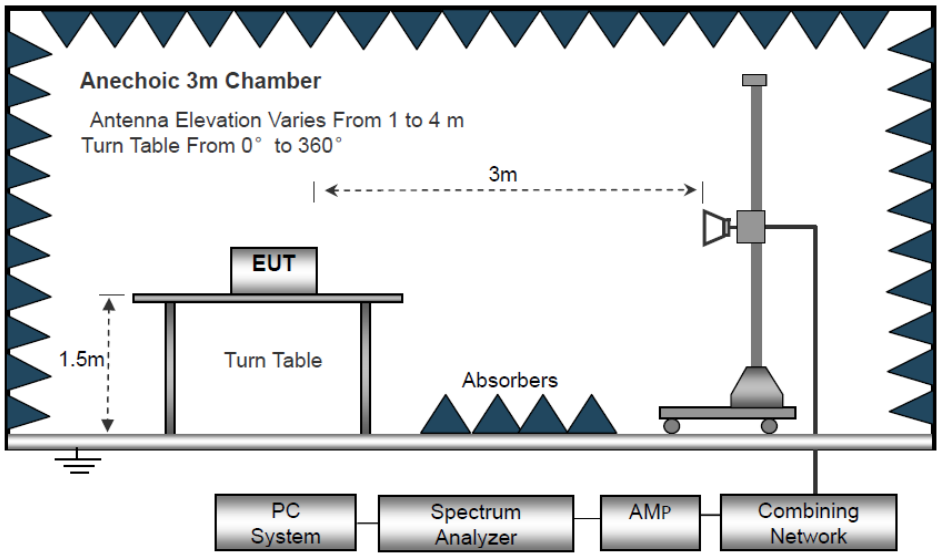
The test setup for emission measurement below 30MHz



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

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

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

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

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

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

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

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

6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

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

Note:

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

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

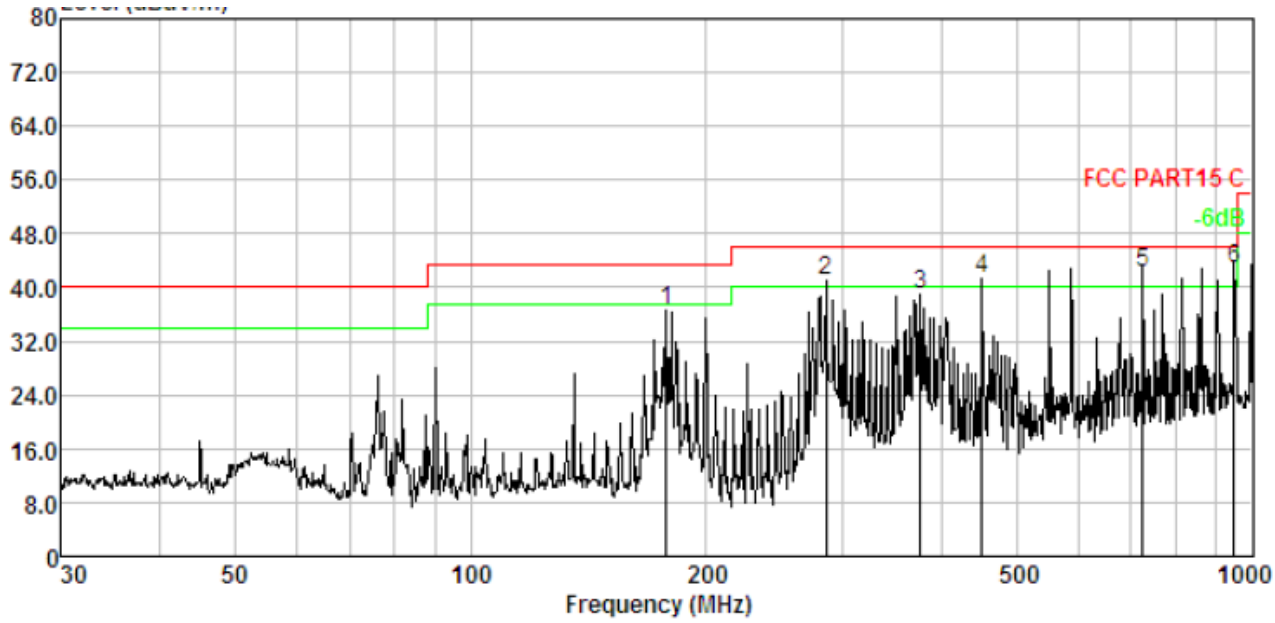
Test Frequency: 30MHz ~ 1GHz

All the modulation modes were tested the data of the worst mode are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

Test Mode: 802.11b (2412MHz)

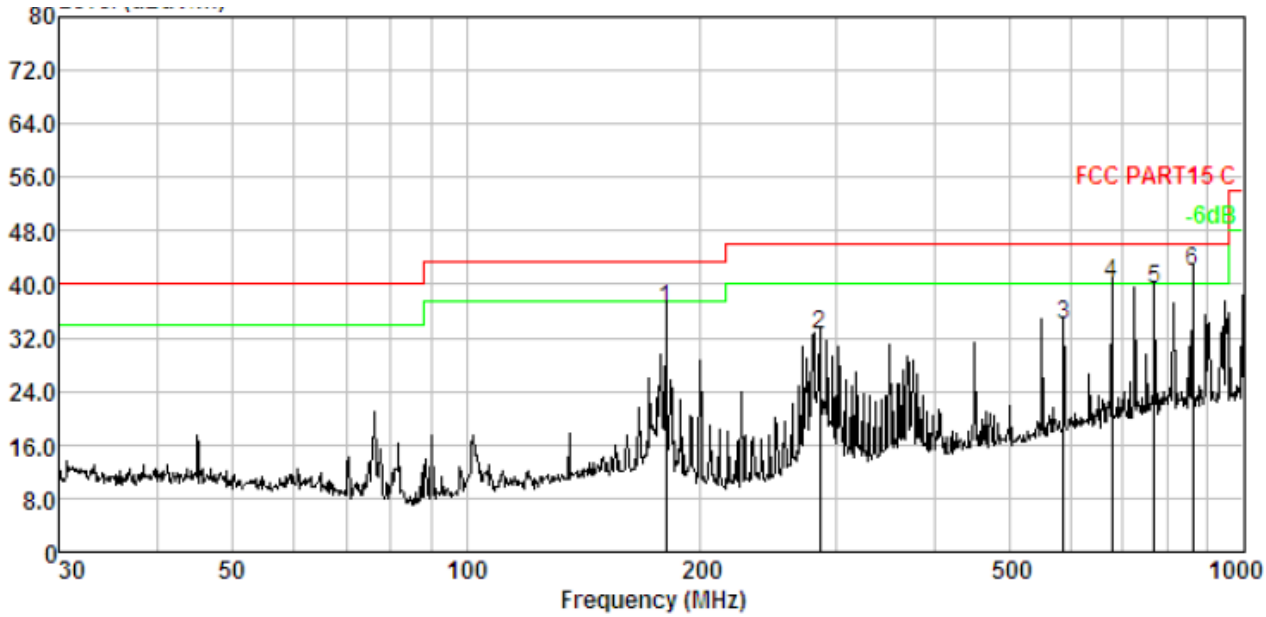
Antenna Polarization: Horizontal



No.	Freq MHz	Cable Loss dB	ANT Factor dB	Receiver Reading dBuV/m	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	178.133	2.67	12.60	51.89	30.59	36.57	43.50	-6.93	QP
2.	284.977	3.09	12.91	55.68	30.75	40.93	46.00	-5.07	QP
3.	375.939	3.34	14.78	51.84	30.85	39.11	46.00	-6.89	QP
4.	451.135	3.51	16.38	52.49	30.91	41.47	46.00	-4.53	QP
5.	724.261	3.94	20.59	48.70	31.08	42.15	46.00	-3.85	QP
6.	948.761	4.18	23.41	46.31	31.17	42.73	46.00	-3.27	QP

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

Antenna Polarization: Vertical

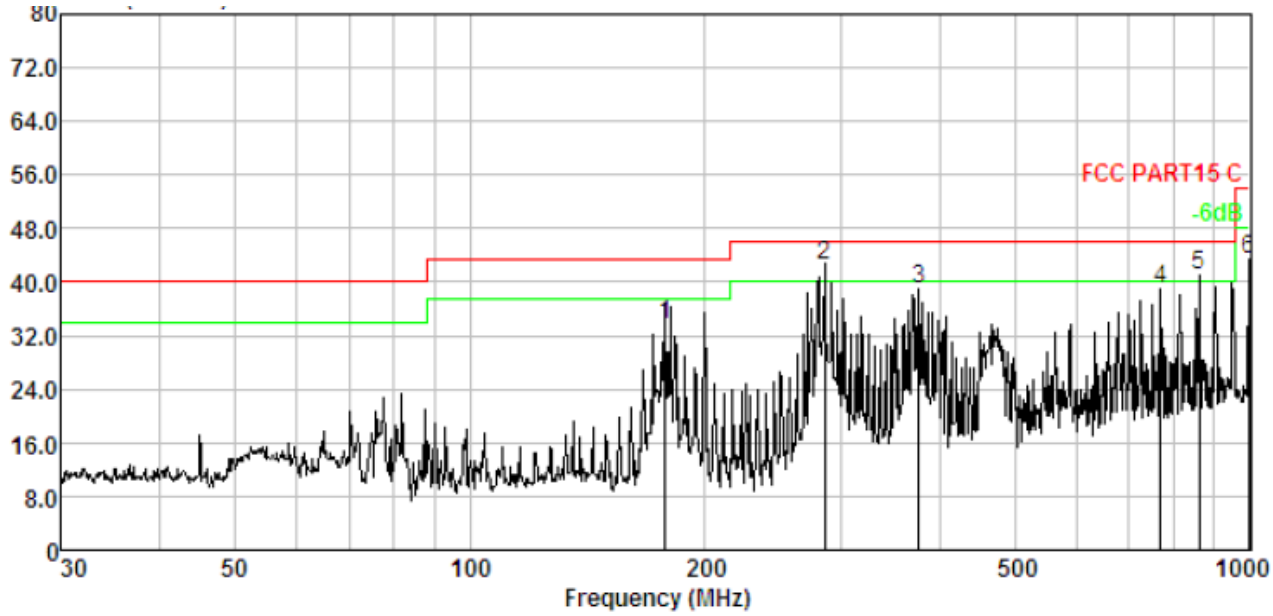


No.	Freq MHz	Cable Loss dB	ANT Factor dB	Receiver Reading dBuV/m	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	180.649	2.68	12.35	51.82	30.59	36.26	43.50	-7.24	QP
2.	284.977	3.09	12.91	47.32	30.75	32.57	46.00	-13.43	QP
3.	586.844	3.75	18.81	42.36	31.00	33.92	46.00	-12.08	QP
4.	677.580	3.88	19.85	47.44	31.05	40.12	46.00	-5.88	QP
5.	768.748	3.99	21.40	45.00	31.10	39.29	46.00	-6.71	QP
6.	860.035	4.09	22.06	46.97	31.14	41.98	46.00	-4.02	QP

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

Test Mode: BLE (2402MHz)

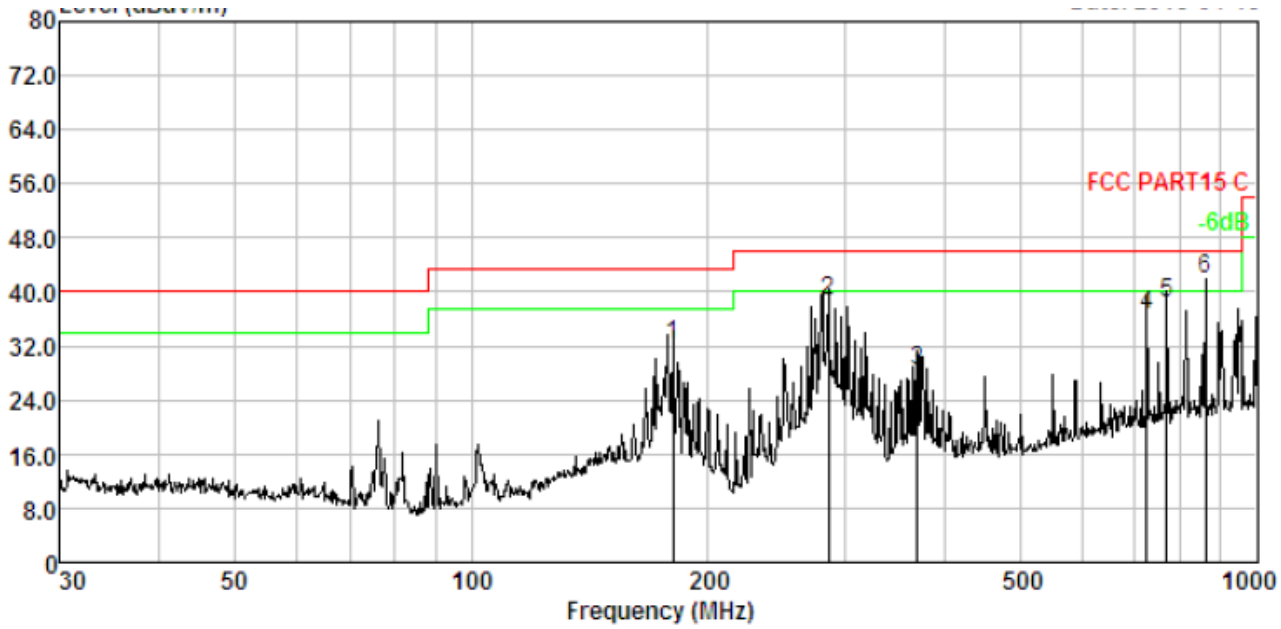
Antenna Polarization: Horizontal



No.	Freq MHz	Cable Loss dB	ANT Factor dB	Receiver Reading dBuV/m	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	178.133	2.67	12.60	48.89	30.59	33.57	43.50	-9.93	QP
2.	284.977	3.09	12.91	57.40	30.75	42.65	46.00	-3.35	QP
3.	375.939	3.34	14.78	51.84	30.85	39.11	46.00	-6.89	QP
4.	768.748	3.99	21.40	44.66	31.10	38.95	46.00	-7.05	QP
5.	860.035	4.09	22.06	45.90	31.14	40.91	46.00	-5.09	QP
6.	996.500	4.23	23.44	46.79	31.19	43.27	54.00	-10.73	QP

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

Antenna Polarization: Vertical



No.	Freq MHz	Cable Loss dB	ANT Factor dB	Receiver Reading dBuV/m	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	180.649	2.68	12.35	47.82	30.59	32.26	43.50	-11.24	QP
2.	284.977	3.09	12.91	53.32	30.75	38.57	46.00	-7.43	QP
3.	369.405	3.33	14.62	41.14	30.84	28.25	46.00	-17.75	QP
4.	724.261	3.94	20.59	43.07	31.08	36.52	46.00	-9.48	QP
5.	768.748	3.99	21.40	44.00	31.10	38.29	46.00	-7.71	QP
6.	860.035	4.09	22.06	47.00	31.14	42.01	46.00	-3.99	QP

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

Test Frequency: From 1GHz to 18GHz

Low Channel (2412MHz) Worst case 802.11g

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)
4824	26.33	AV	V	8.14	10.47	10.83	34.11	54	-19.89
4824	28.12	AV	H	8.14	10.47	10.83	35.9	54	-18.1
4824	32.48	PK	V	8.14	10.47	10.83	40.26	74	-33.74
4824	36.28	PK	H	8.14	10.47	10.83	44.06	74	-29.94
16329	30.49	AV	V	9.28	11.06	12.29	38.54	54	-15.46
16329	31.58	AV	H	9.28	11.06	12.29	39.63	54	-14.37
16329	36.72	PK	V	9.28	11.06	12.29	44.77	74	-29.23
16329	39.58	PK	H	9.28	11.06	12.29	47.63	74	-26.37

Middle Channel (2437MHz) Worst case 802.11n (HT20)

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)
4874	26.35	AV	V	7.83	9.72	11.48	32.42	54	-21.58
4874	27.49	AV	H	7.83	9.72	11.48	33.56	54	-20.44
4874	30.68	PK	V	7.83	9.72	11.48	36.75	74	-37.25
4874	36.27	PK	H	7.83	9.72	11.48	42.34	74	-31.66
14853	29.35	AV	V	8.29	10.26	12.76	35.14	54	-18.86
14853	33.26	AV	H	8.29	10.26	12.76	39.05	54	-14.95
14853	36.84	PK	V	8.29	10.26	12.76	42.63	74	-31.37
14853	39.08	PK	H	8.29	10.26	12.76	44.87	74	-29.13

High Channel (2462MHz) Worst case 802.11b

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)
4924	26.35	AV	V	8.04	9.76	11.46	32.69	54	-21.31
4924	28.48	AV	H	8.04	9.76	11.46	34.82	54	-19.18
4924	31.27	PK	V	8.04	9.76	11.46	37.61	74	-36.39
4924	33.06	PK	H	8.04	9.76	11.46	39.4	74	-34.6
13256	28.49	AV	V	9.26	10.42	12.73	35.44	54	-18.56
13256	30.69	AV	H	9.26	10.42	12.73	37.64	54	-16.36
13256	32.57	PK	V	9.26	10.42	12.73	39.52	74	-34.48
13256	36.59	PK	H	9.26	10.42	12.73	43.54	74	-30.46

High Channel (2480MHz) BLE

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	27.69	AV	V	8.23	10.48	12.48	33.92	54	-20.08
4960	29.36	AV	H	8.23	10.48	12.48	35.59	54	-18.41
4960	32.54	PK	V	8.23	10.48	12.48	38.77	74	-35.23
4960	36.21	PK	H	8.23	10.48	12.48	42.44	74	-31.56
15221	29.57	AV	V	9.11	11.59	13.29	36.98	54	-17.02
15221	31.62	AV	H	9.11	11.59	13.29	39.03	54	-14.97
15221	33.25	PK	V	9.11	11.59	13.29	40.66	74	-33.34
15221	35.48	PK	H	9.11	11.59	13.29	42.89	74	-31.11

Note:

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

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

2.4G WiFi (802.11b/g/n)mode have been tested, and the worst result(802.11b) was report as below

Test Mode: 802.11b Low Channel 2412MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2310.00	13.85	28.05	6.62	0.00	48.52	74.00	-25.48	V	Peak
2390.00	13.86	27.65	6.75	0.00	48.26	74.00	-25.74	V	
2310.00	13.41	28.05	6.62	0.00	48.08	54.00	-25.92	V	
2390.00	12.72	27.65	6.75	0.00	47.12	54.00	-26.88	V	
2310.00	11.12	28.05	6.62	0.00	45.79	74.00	-8.21	H	Average
2390.00	10.73	27.65	6.75	0.00	45.13	74.00	-8.87	H	
2310.00	11.15	28.05	6.62	0.00	45.82	54.00	-8.18	H	
2390.00	10.63	27.65	6.75	0.00	45.03	54.00	-8.97	H	

Test Mode: 802.11b High Channel 2462MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2483.50	12.90	27.26	6.83	0.00	46.99	74.00	-27.01	V	Peak
2500.00	13.93	27.20	6.84	0.00	47.97	74.00	-26.03	V	
2483.50	13.40	27.26	6.83	0.00	47.49	54.00	-26.51	V	
2500.00	12.08	27.20	6.84	0.00	46.12	54.00	-27.88	V	
2483.50	10.77	27.26	6.83	0.00	44.88	74.00	-9.12	H	Average
2500.00	10.67	27.20	6.84	0.00	44.71	74.00	-9.29	H	
2483.50	10.72	27.26	6.83	0.00	44.81	54.00	-9.19	H	
2500.00	10.66	27.20	6.84	0.00	44.70	54.00	-9.30	H	

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
2310.00	34.07	28.05	6.62	37.65	31.09	74.00	-42.91	V	Peak
2390.00	33.92	27.65	6.75	37.87	30.45	74.00	-43.55	V	
2310.00	26.95	28.05	6.62	37.65	23.97	54.00	-30.03	V	
2390.00	26.13	27.65	6.75	37.65	22.66	54.00	-31.34	V	
2310.00	33.79	28.05	6.62	37.87	30.81	74.00	-43.19	H	Average
2390.00	34.96	27.65	6.75	37.65	31.49	74.00	-42.51	H	
2310.00	26.64	28.05	6.62	37.65	23.66	54.00	-30.34	H	
2390.00	25.94	27.65	6.75	37.87	22.47	54.00	-31.53	H	

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	41.62	27.26	6.83	37.87	37.84	74.00	-36.16	V	Peak
2500.00	33.79	27.20	6.84	37.87	29.96	74.00	-44.04	V	
2483.50	44.67	27.26	6.83	37.87	40.89	54.00	-13.11	V	
2500.00	26.16	27.20	6.84	37.87	22.33	54.00	-31.67	V	
2483.50	47.03	27.26	6.83	37.87	43.25	74.00	-30.75	H	Average
2500.00	33.34	27.20	6.84	37.87	29.51	74.00	-44.49	H	
2483.50	45.59	27.26	6.83	37.87	41.81	54.00	-12.19	H	
2500.00	26.06	27.20	6.84	37.87	22.23	54.00	-31.77	H	

Test Frequency: From 18GHz to 25GHz

The measurements were more than 20dB below the limit and not reported.

7 Band Edge Measurement & Unwanted Emissions into Restricted Frequency Bands

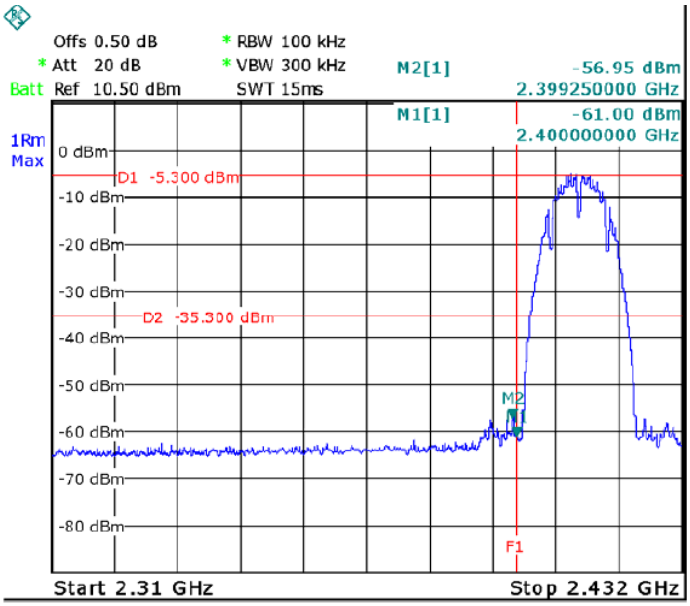
Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247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

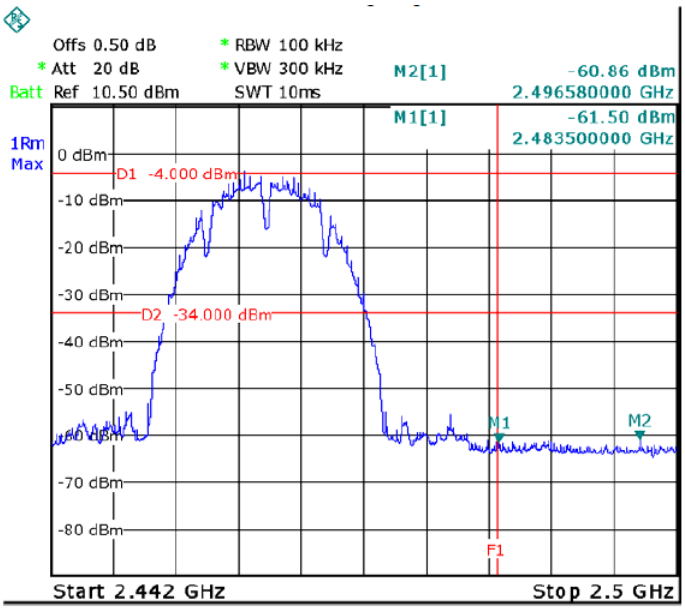
7.1 Test Procedure

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 = 1MHz, VBW = 3MHz, Sweep = auto
Detector function = peak, Trace = max hold

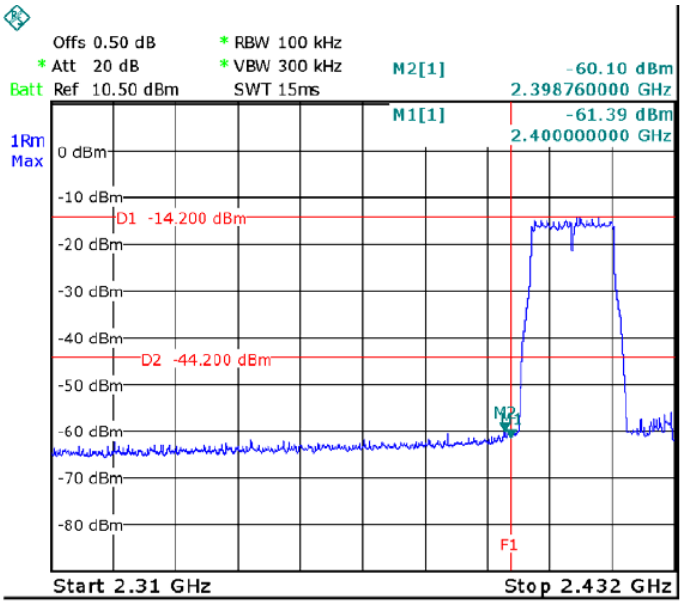
7.2 Test Result

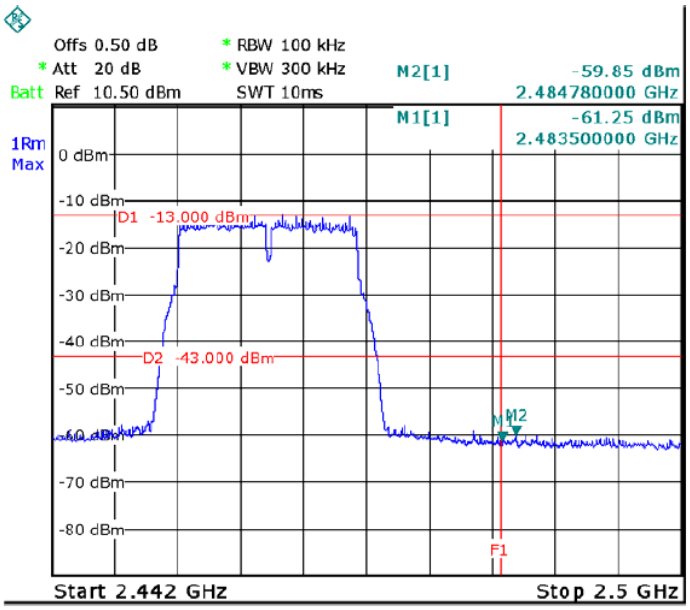
802.11b



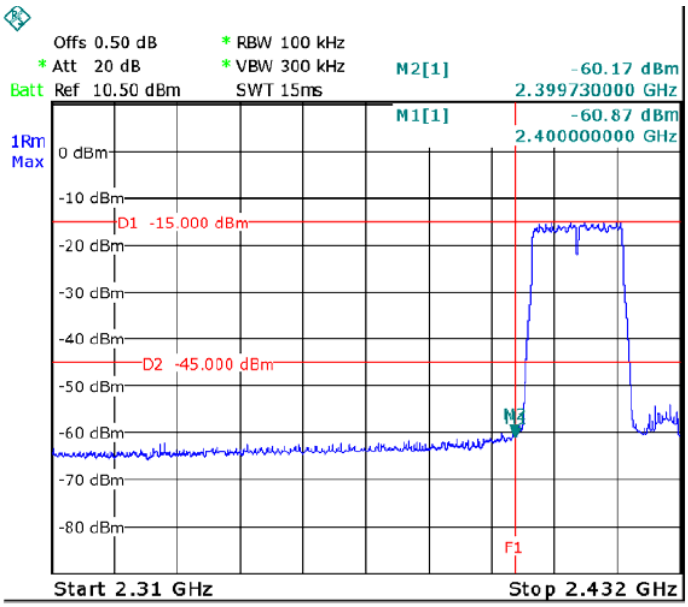


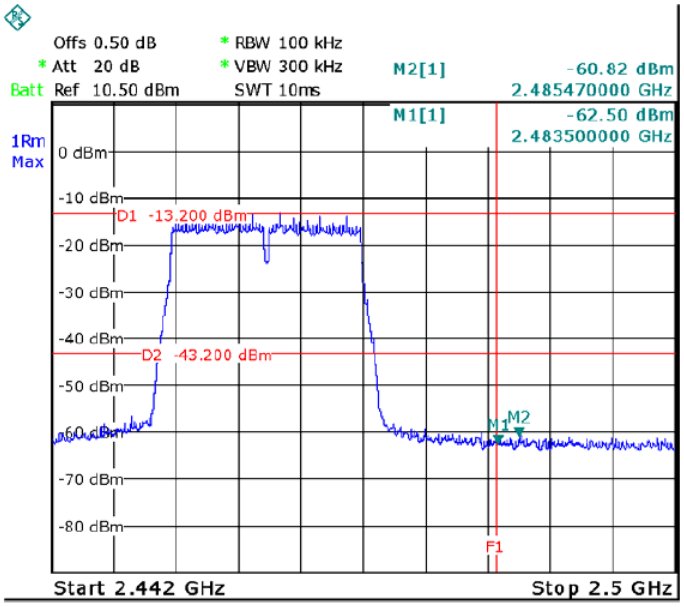
802.11g


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 15ms
M2[1] -60.10 dBm
2.398760000 GHz
M1[1] -61.39 dBm
2.400000000 GHz
1Rm
Max
0 dBm
-10 dBm
D1 -14.200 dBm
-20 dBm
-30 dBm
-40 dBm
D2 -44.200 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.31 GHz
Stop 2.432 GHz

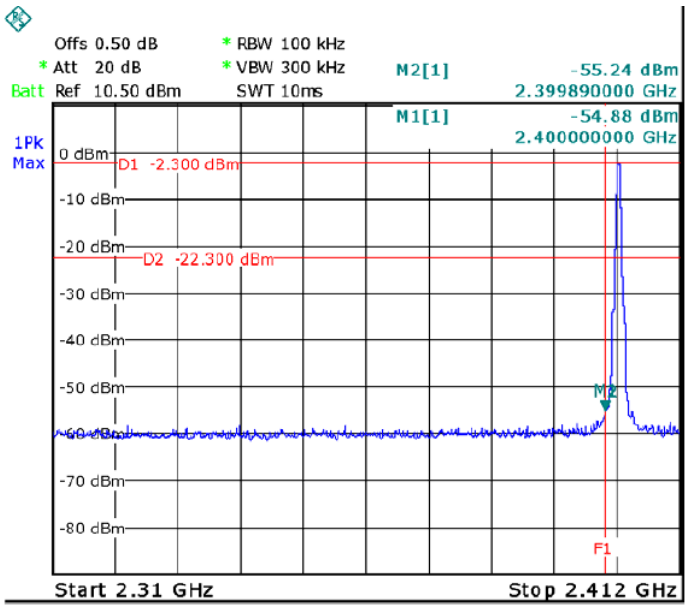

Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1] -59.85 dBm
2.484780000 GHz
M1[1] -61.25 dBm
2.483500000 GHz
1Rm
Max
0 dBm
-10 dBm
D1 -13.000 dBm
-20 dBm
-30 dBm
-40 dBm
D2 -43.000 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.442 GHz
Stop 2.5 GHz

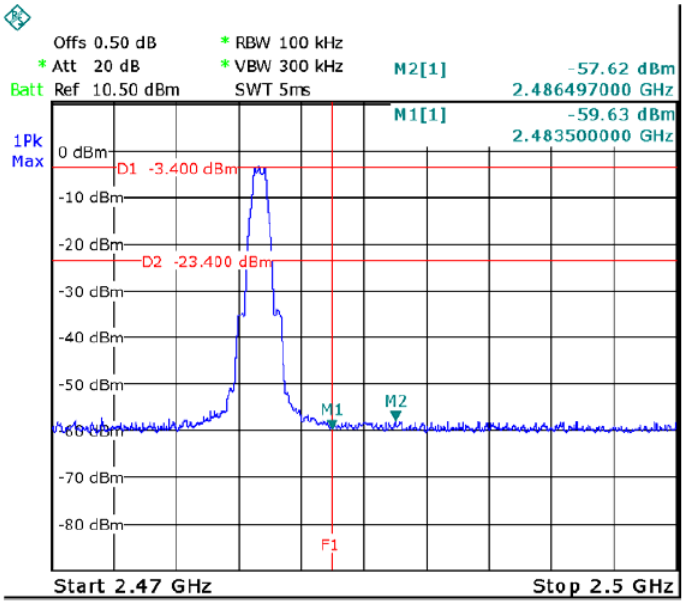
802.11n-HT20


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 15ms
M2[1] -60.17 dBm
2.399730000 GHz
M1[1] -60.87 dBm
2.400000000 GHz
1Rm
Max
0 dBm
-10 dBm
D1 -15.000 dBm
-20 dBm
-30 dBm
-40 dBm
D2 -45.000 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.31 GHz
Stop 2.432 GHz


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1] -60.82 dBm
2.485470000 GHz
M1[1] -62.50 dBm
2.483500000 GHz
1Rm
Max
0 dBm
-10 dBm
D1 -13.200 dBm
-20 dBm
-30 dBm
-40 dBm
D2 -43.200 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
F1
Start 2.442 GHz
Stop 2.5 GHz

BLE


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 10ms
M2[1]
-55.24 dBm
2.399890000 GHz
M1[1]
-54.88 dBm
2.400000000 GHz
1Pk
Max
0 dBm
D1 -2.300 dBm
-10 dBm
-20 dBm
D2 -22.300 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
-80 dBm
M2
F1
Start 2.31 GHz
Stop 2.412 GHz


Offs 0.50 dB
* Att 20 dB
Batt Ref 10.50 dBm
* RBW 100 kHz
* VBW 300 kHz
SWT 5ms
M2[1]
-57.62 dBm
2.486497000 GHz
M1[1]
-59.63 dBm
2.483500000 GHz
1Pk
Max
0 dBm
D1 -3.400 dBm
-10 dBm
-20 dBm
D2 -23.400 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
-80 dBm
M1
M2
F1
Start 2.47 GHz
Stop 2.5 GHz

For conducted spurious emission

802.11b

Low Channel

Middle Channel

High Channel

802.11g

Low Channel

Middle Channel

High Channel

802.11n(20)

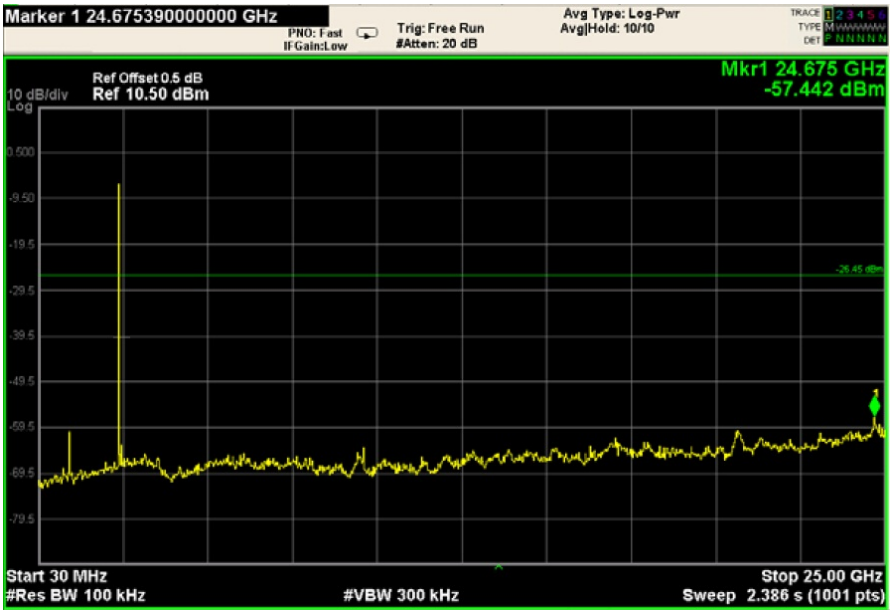
Low Channel

Middle Channel

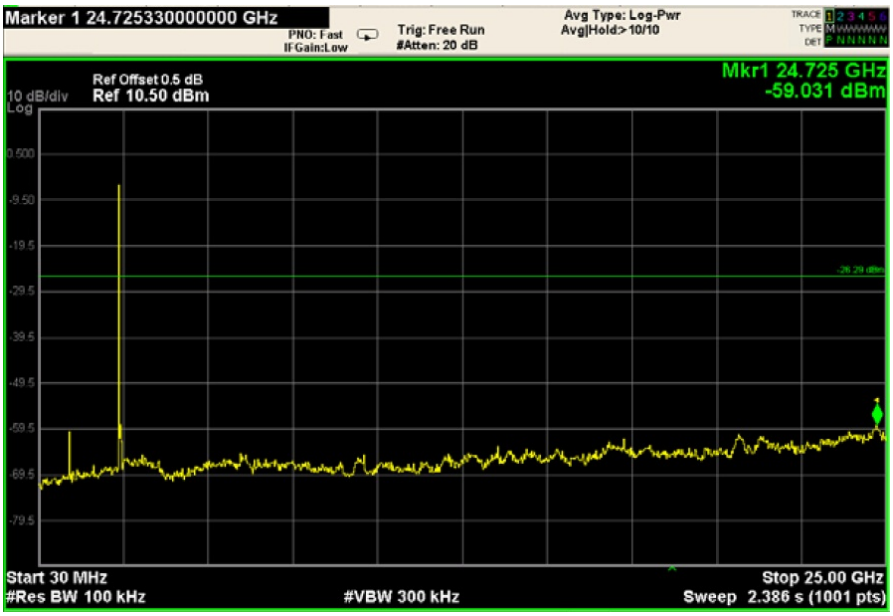
High Channel

BLE

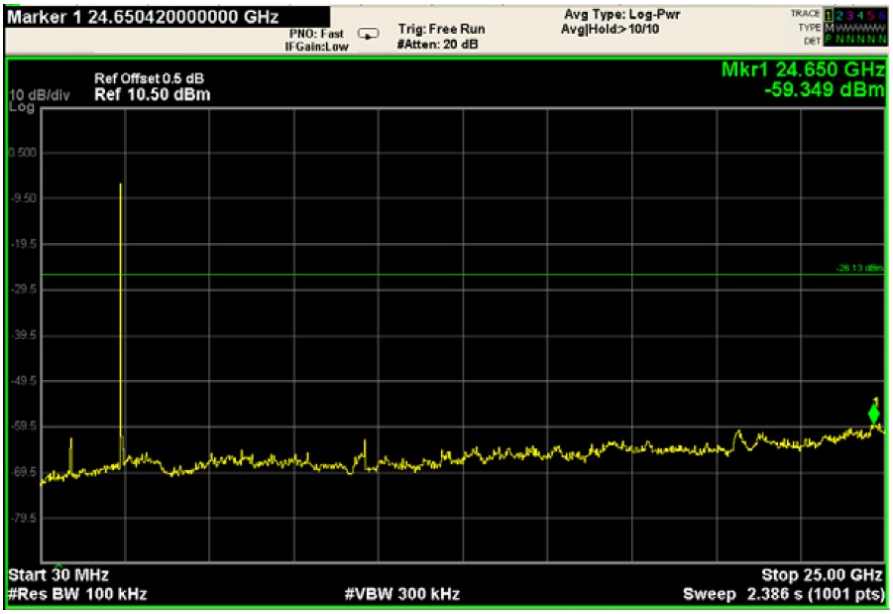
Low Channel



Middle Channel



High Channel



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.

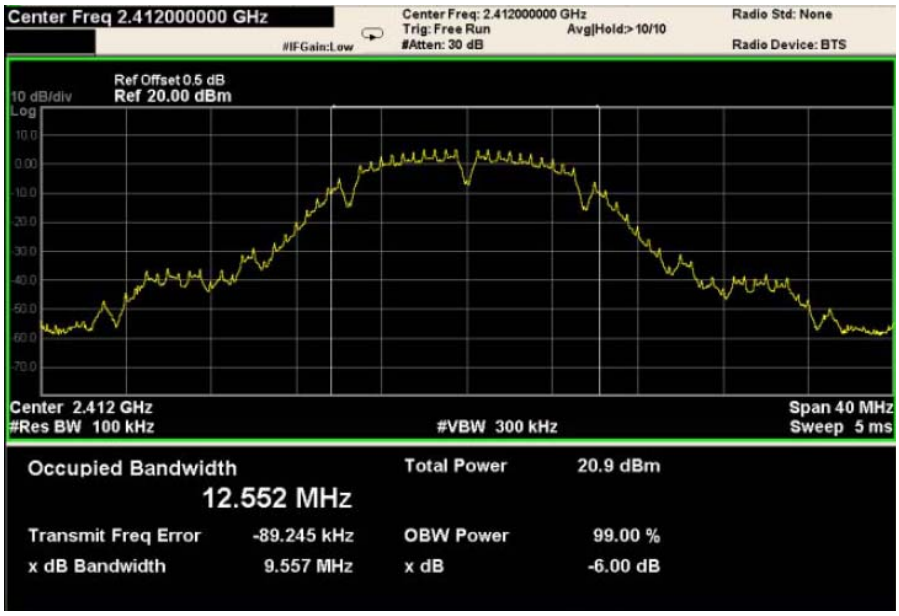
8.1 Test Procedure

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

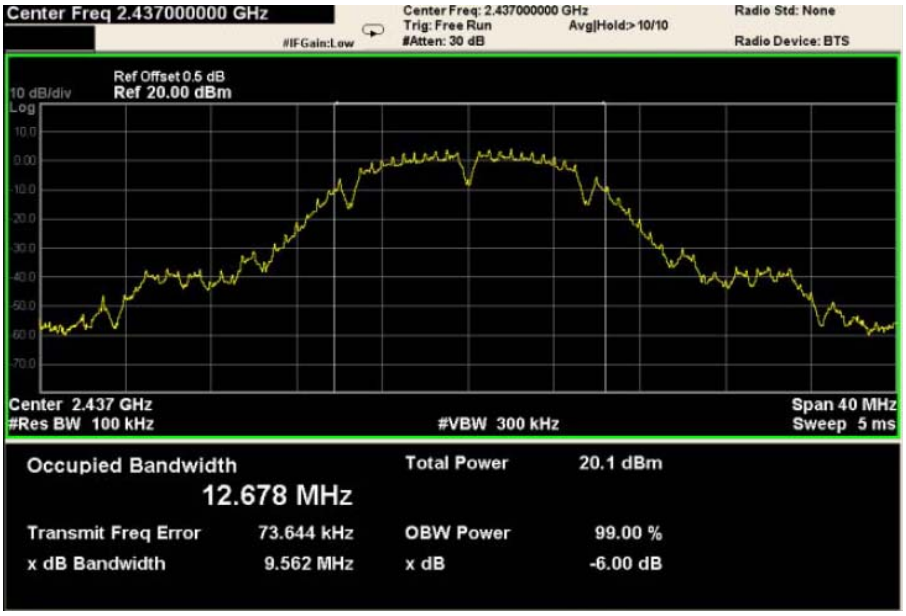
8.2 Test Result

Modulation	Bandwidth(MHz)			Limit
	Low Channel	Middle Channel	High Channel	
802.11b	9.557	9.562	9.073	≥500kHz
802.11g	15.430	15.880	15.110	≥500kHz
802.11n-HT20	15.450	15.960	15.110	≥500kHz
BLE	0.731	0.734	0.743	≥500kHz

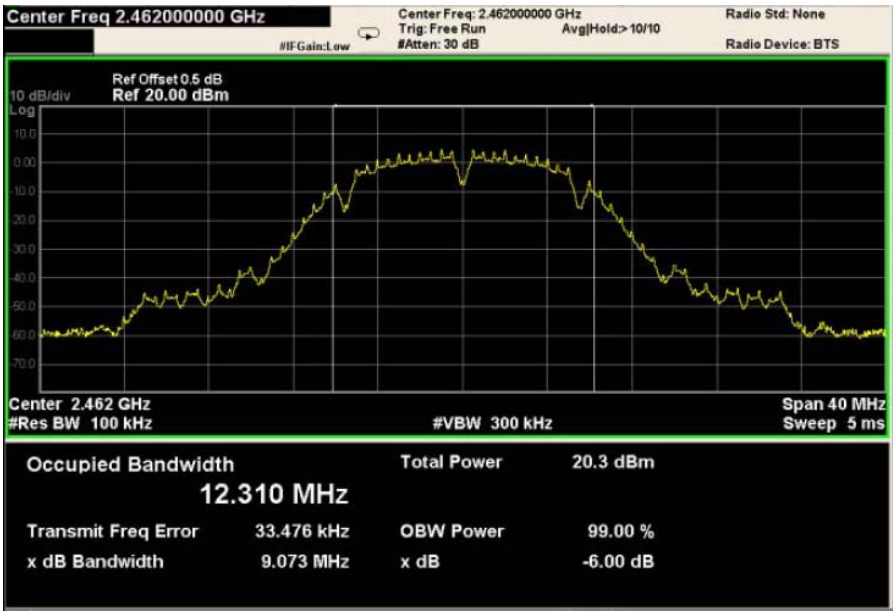
802.11b Low Channel



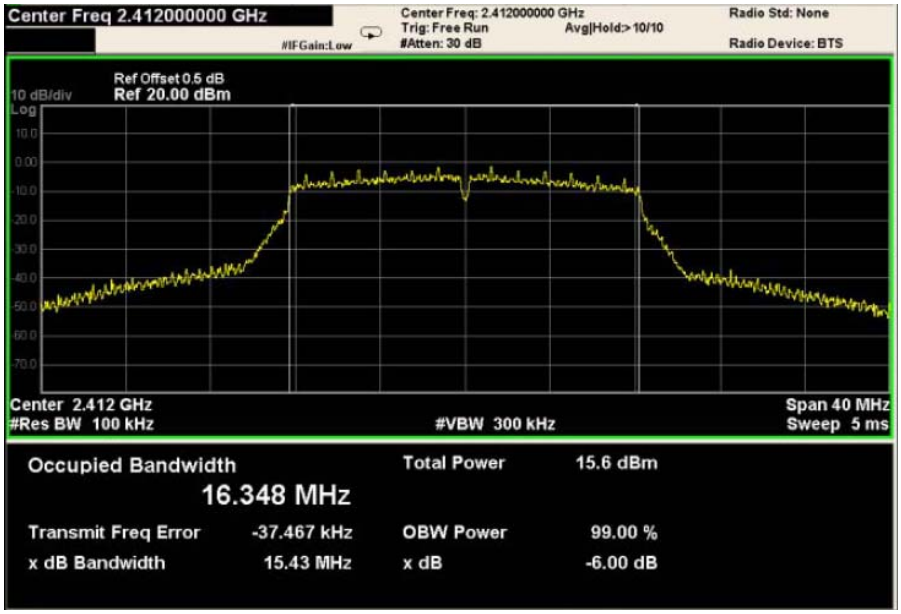
802.11b Middle Channel



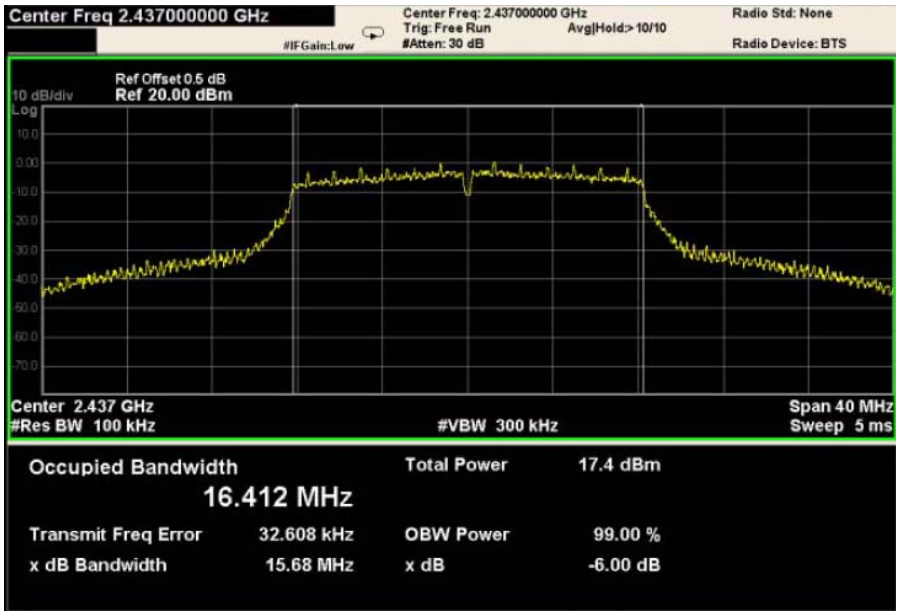
802.11b High Channel



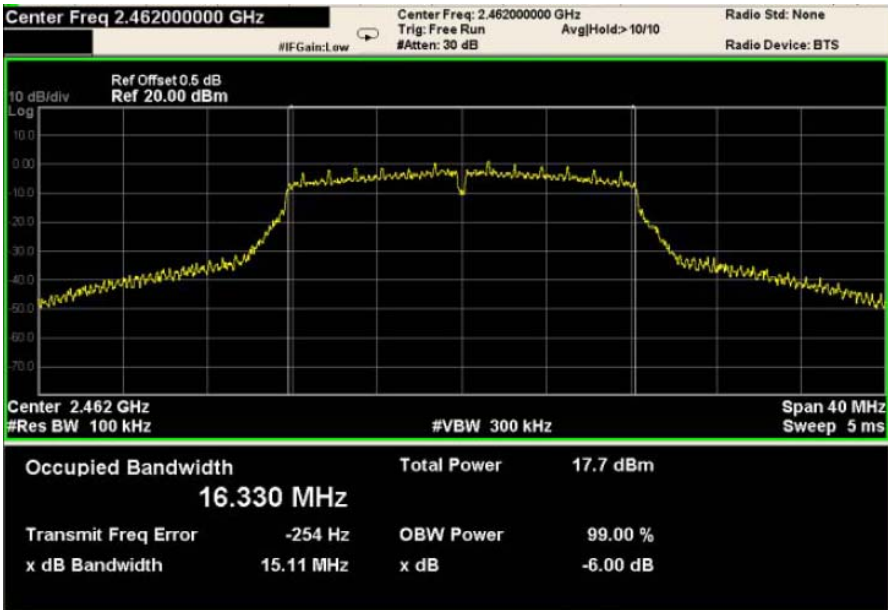
802.11g Low Channel



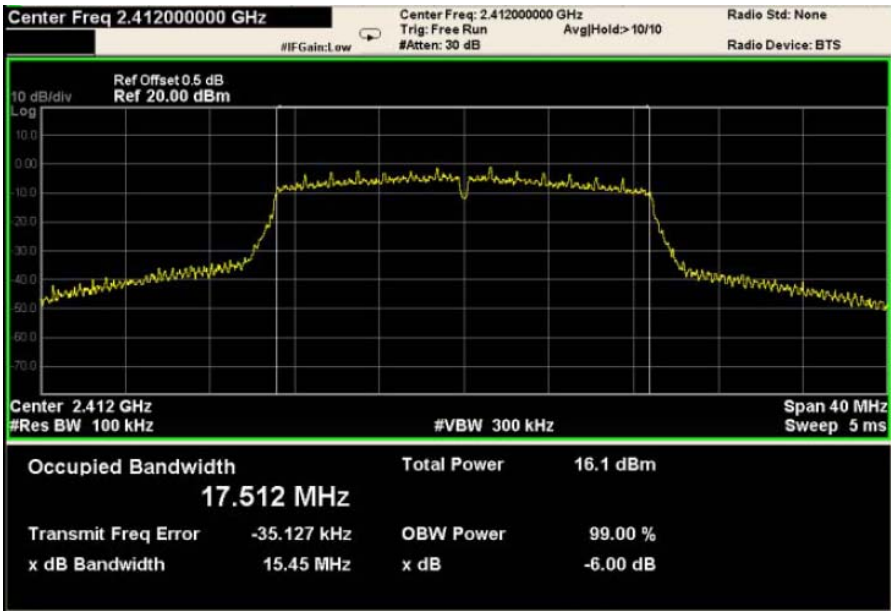
802.11g Middle Channel



802.11g High Channel

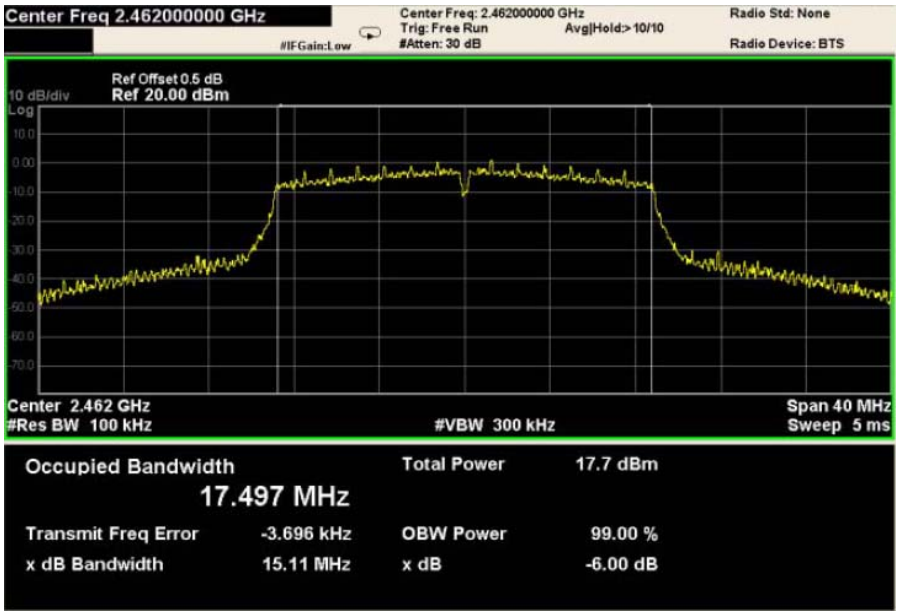


802.11n-HT20 Low Channel

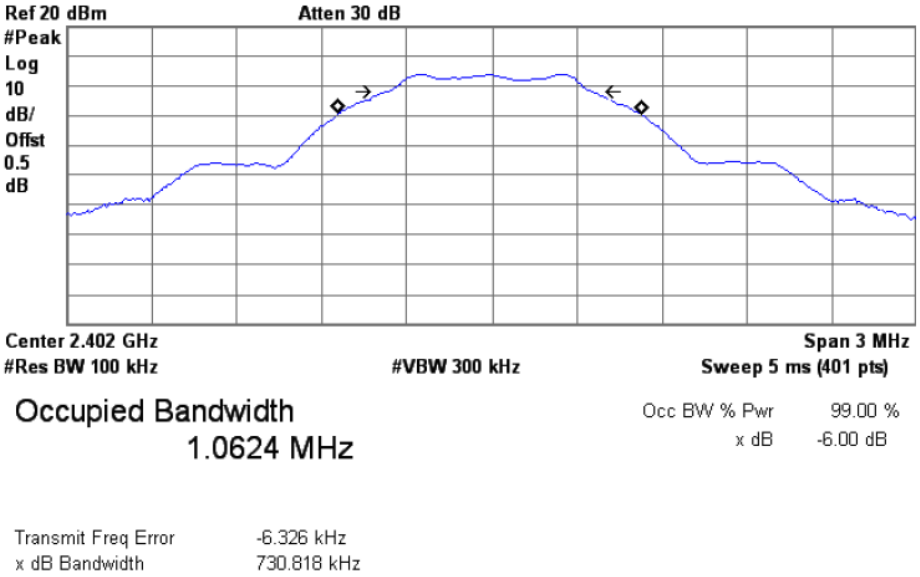


802.11n-HT20 Middle Channel

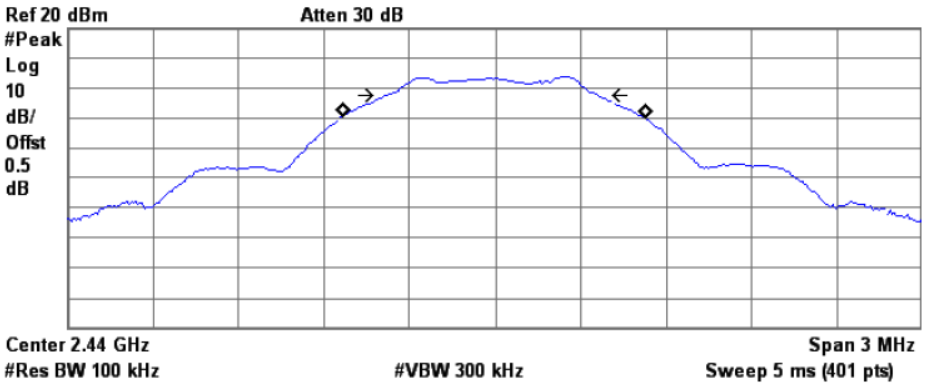
802.11n-HT20 High Channel



BLE Low Channel



BLE Middle Channel

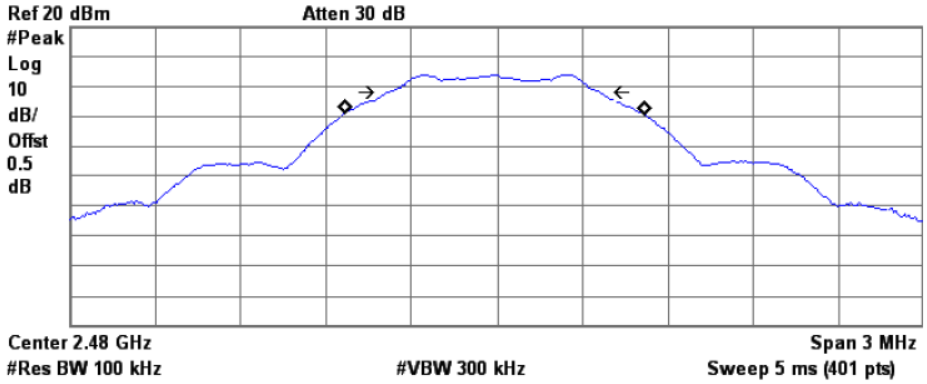


Occupied Bandwidth
1.0560 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error -6.285 kHz
x dB Bandwidth 734.282 kHz

BLE High Channel



Occupied Bandwidth
1.0552 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error -6.970 kHz
x dB Bandwidth 743.221 kHz

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

For 2.4G Wi-Fi

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak Power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

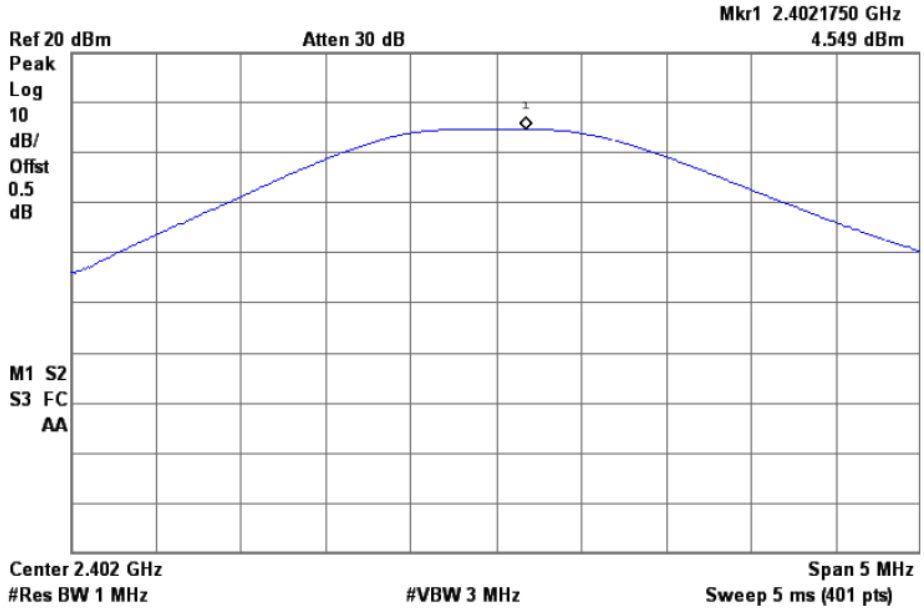
For BLE

1. The Transmitter output (antenna port) was connected to the spectrum Analyzer.
2. Turn on the EUT and then record the peak power value.
3. Repeat above procedures on all channels needed to be tested.

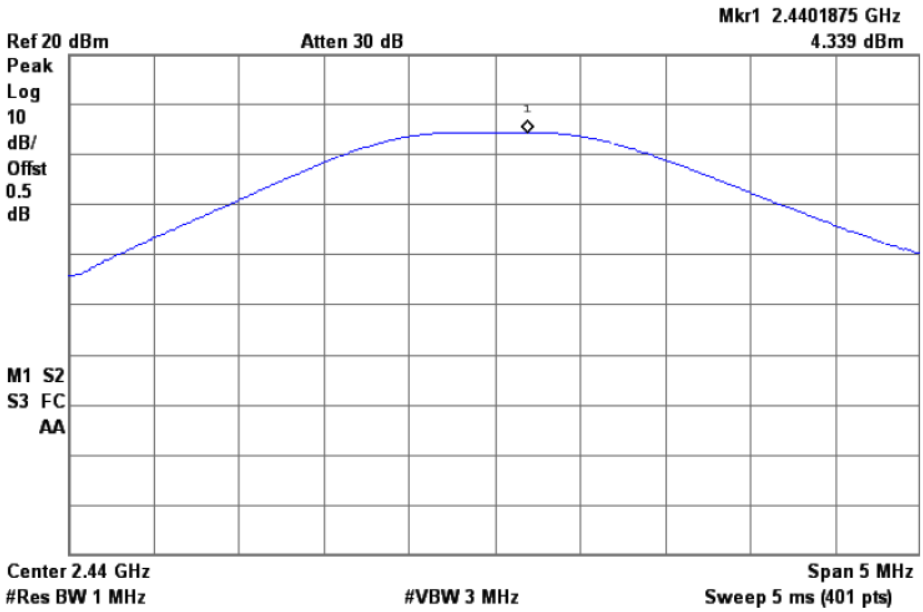
9.2 Test Result

Modulation	Maximum Peak Output Power (dBm)			Limit
	Low Channel	Middle Channel	High Channel	
802.11b	9.24	9.55	9.05	1W(30dBm)
802.11g	9.54	9.44	9.05	1W(30dBm)
802.11n-HT20	9.16	9.08	9.34	1W(30dBm)
BLE	4.55	4.34	4.83	1W(30dBm)

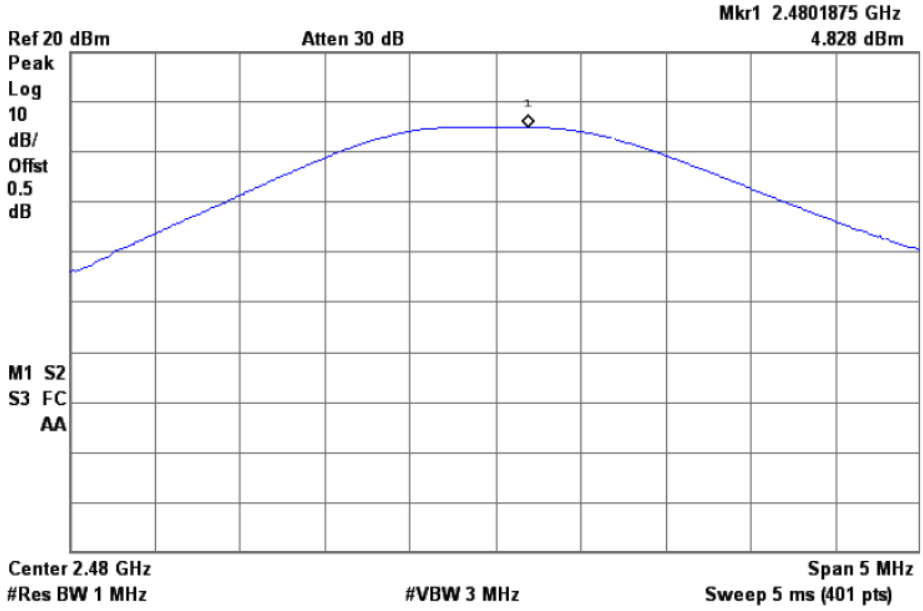
BLE Low Channel



BLE Middle Channel



BLE High Channel



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

Modulation	Power Spectral density (dBm/3kHz)			Limit
	Low Channel	Middle Channel	High Channel	
802.11b	-7.192	-8.387	-7.480	8dBm/3kHz
802.11g	-14.470	-12.940	-11.929	8dBm/3kHz
802.11n-HT20	-11.635	-12.596	-11.703	8dBm/3kHz
BLE	-4.792	-4.988	-4.715	8dBm/3kHz

802.11b Low Channel

802.11b Middle Channel

802.11b High Channel

802.11g Low Channel

802.11g Middle Channel

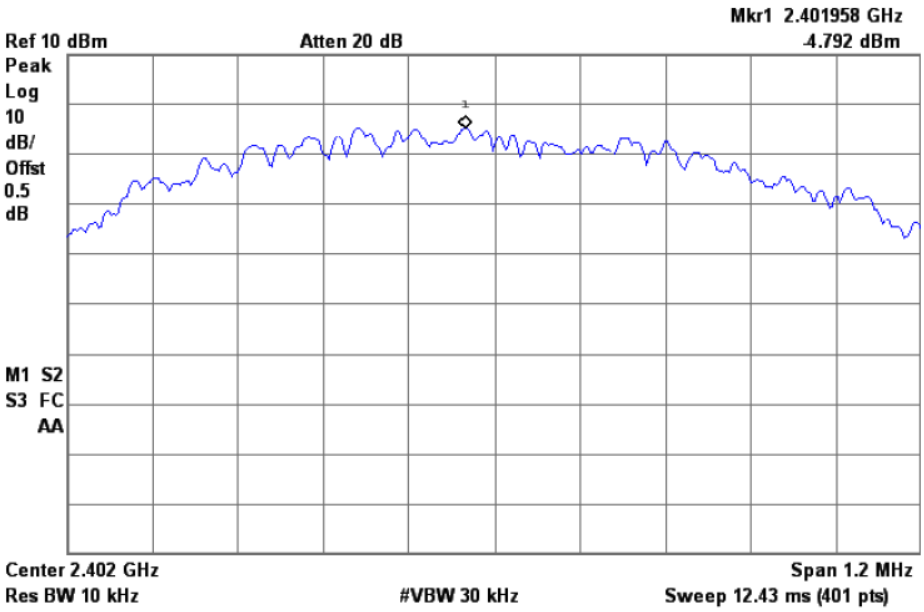
802.11g High Channel

802.11n-HT20 Low Channel

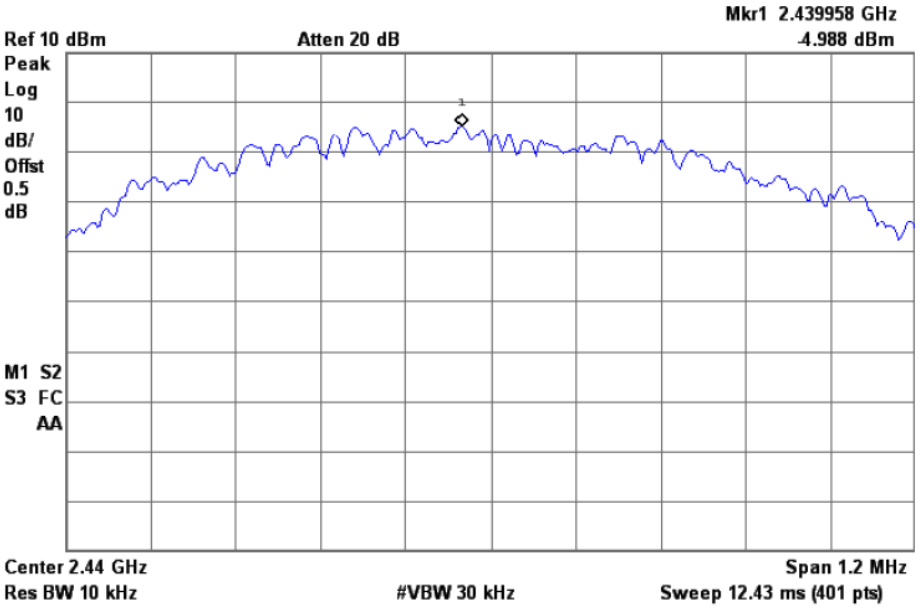
802.11n-HT20 Middle Channel

802.11n-HT20 High Channel

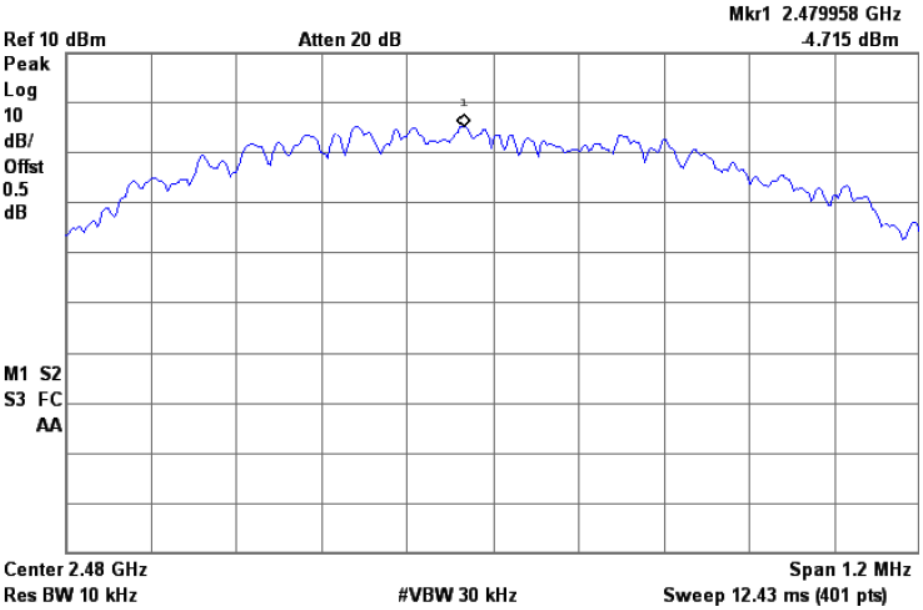
BLE Low Channel



BLE Middle Channel



BLE High Channel



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.

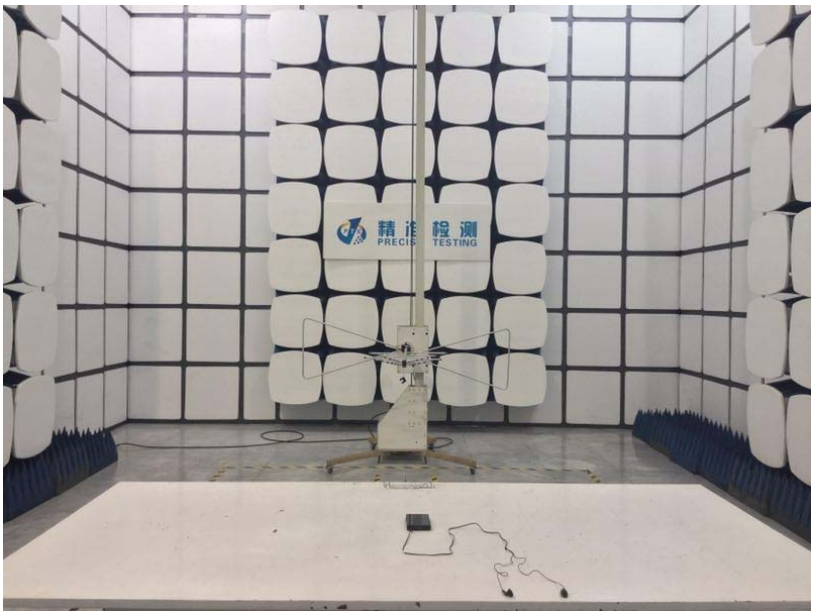
11.2 Result

The EUT'S antenna, permanent attached antenna, is internal antenna. The antenna's gain is 2dBi and meets the requirement.

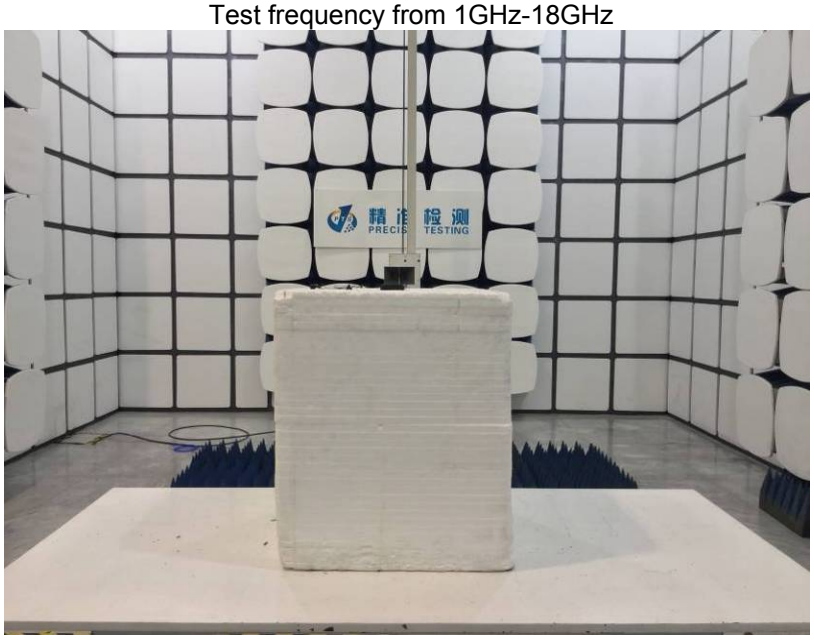
12 Test Setup

Conducted Emissions

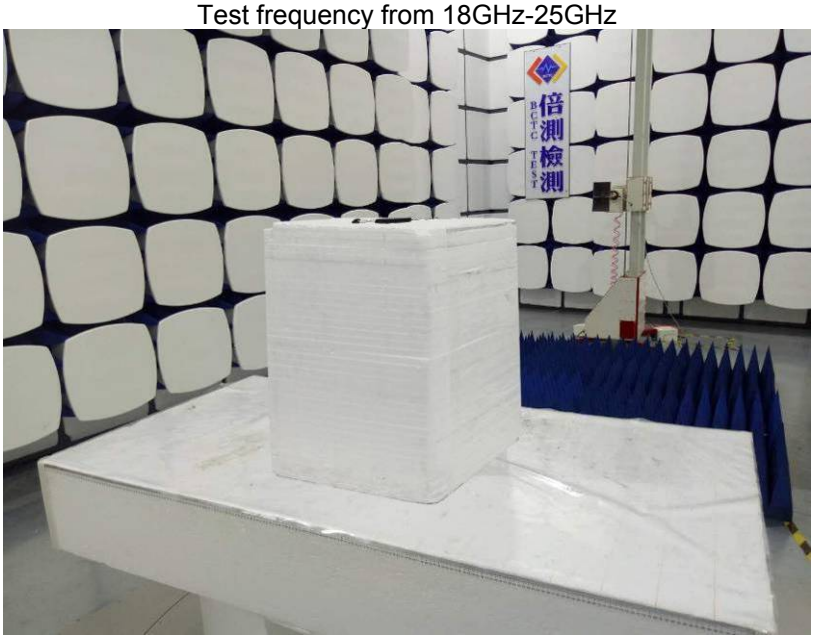
Radiated Spurious Emissions
From 30MHz-1000MHz



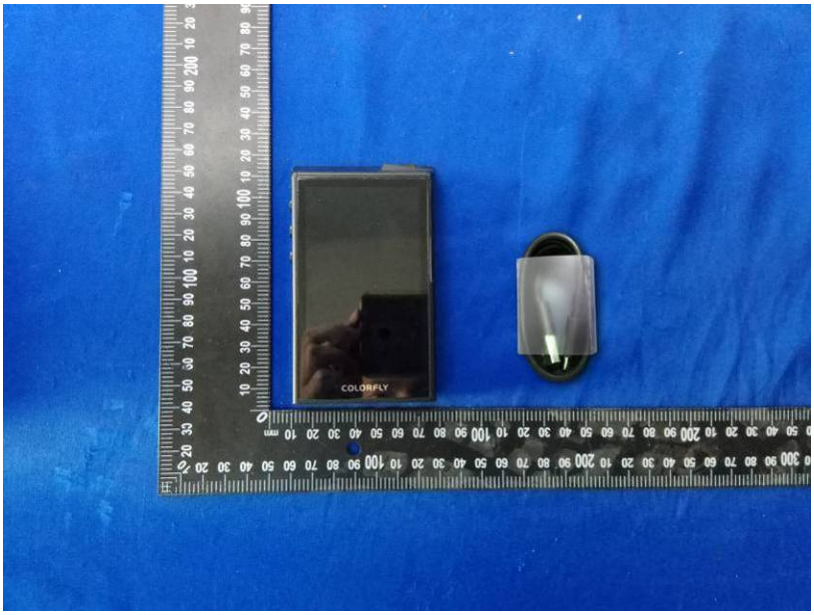
Test frequency from 1GHz-18GHz

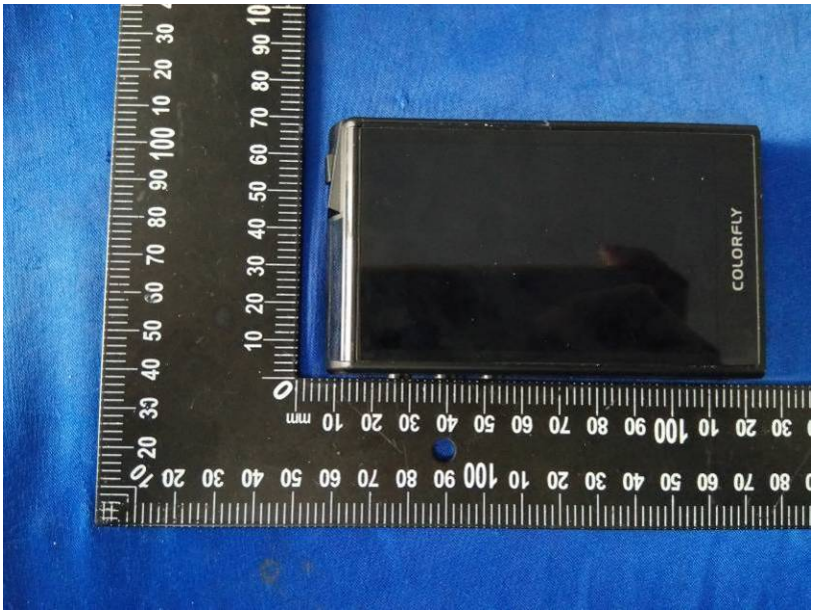


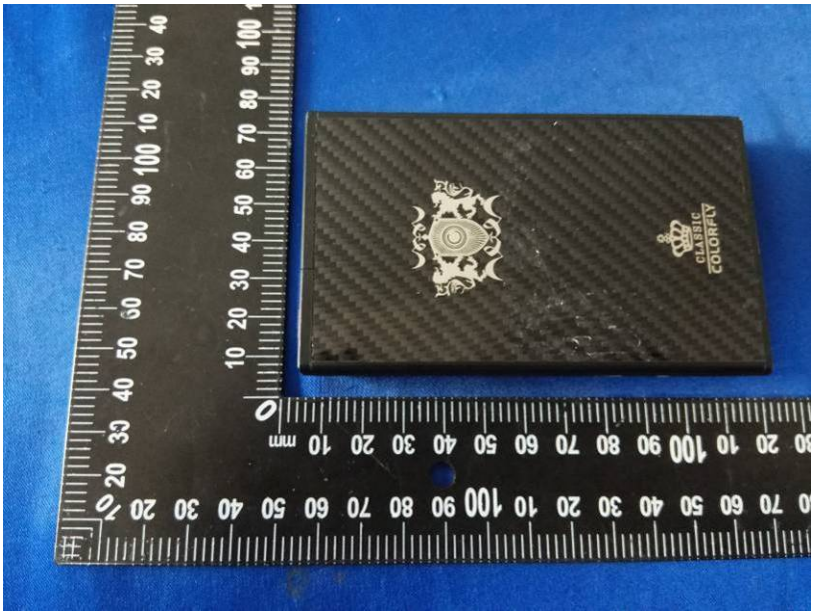
Test frequency from 18GHz-25GHz



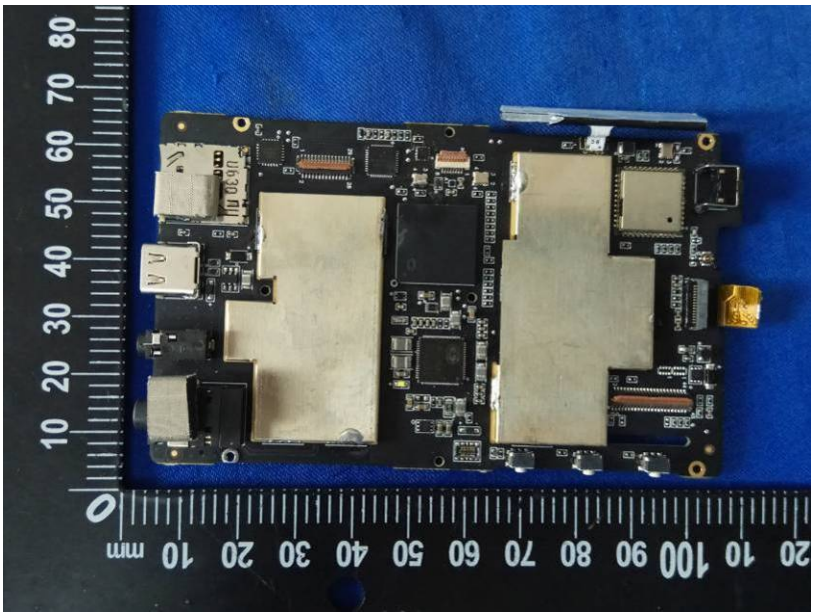
13 EUT Photos

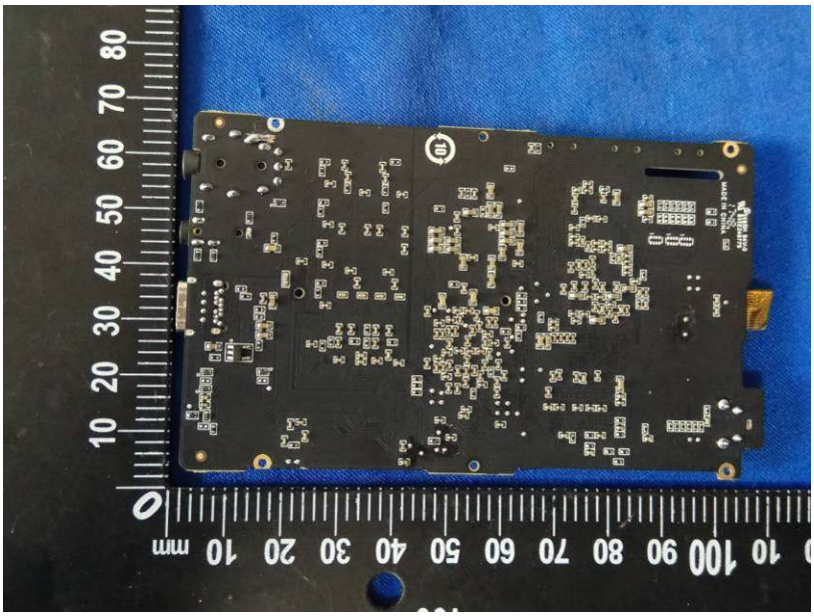


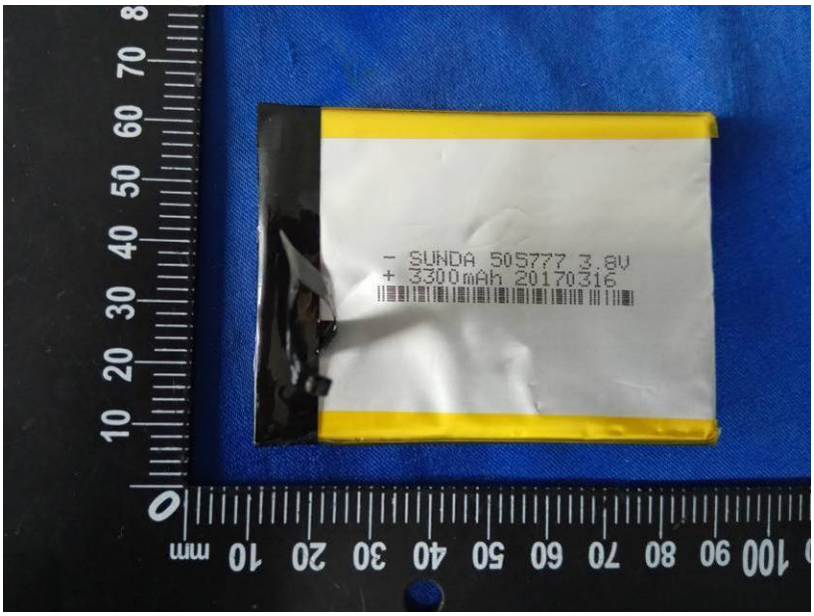


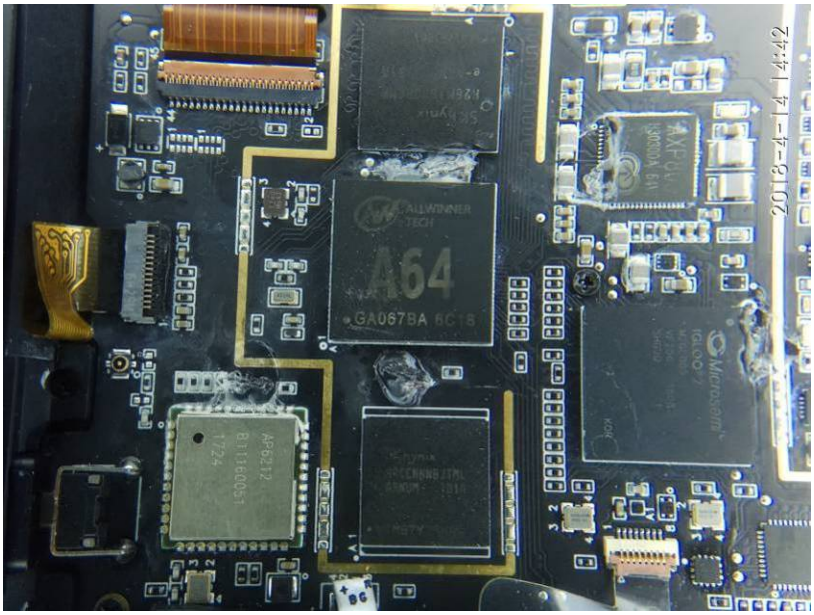

CLASSIC
COLORFLY

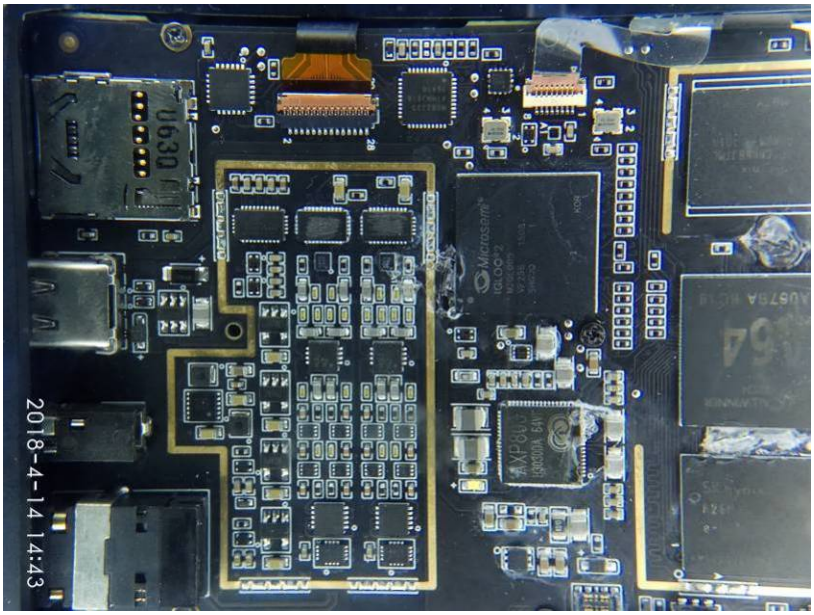
COLORFLY
BAL
USB






- SUNDA 505777 3.8V
+ 3300mAh 20170316





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