FCC TEST REPORT

FCC ID: 2ARZZSW03

Product	:	Wireless earphone
Model Name	:	SW03, SW02, SW05
Brand	:	N/A
Report No.	:	PTC18052927604E-FC02

Prepared for

Dongguan Timbretek electronic technology Co,.Ltd

No.33, Mingzhu Road, Ershangfang, Xiansha Village, Gaobu Town, Dongguan city, 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	:	Dongguan Timbretek electronic technology Co,.Ltd
Address	:	No.33, Mingzhu Road, Ershangfang, Xiansha Village, Gaobu Town, Dongguan city, Guangdong, China
Manufacture's name	:	Dongguan Timbretek electronic technology Co,.Ltd
Address	:	No.33, Mingzhu Road, Ershangfang, Xiansha Village, Gaobu Town, Dongguan city, Guangdong, China
Product name	:	Wireless earphone
Model name	:	SW03, SW02, SW05
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	Nov. 26, 2018 to Dec. 05, 2018
Date of Issue	:	December 06, 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
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

Remark:

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

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

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)

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Wireless earphone
Model Name	:	SW03, SW02, SW05 (Note: The samples are the same except appearance and model number. So SW03 was selected for full tested.)
Equipment Type	:	DTS
Version	:	BLE 4.2
Operating frequency	:	2402-2480MHz
Number of Channels	:	40
Type of Modulation	:	GFSK
Antenna installation	:	Internal PCB Antenna
Antenna Gain	:	0dBi
Power supply	:	DC 3.7V 80mAH Battery

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(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.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

Radiated Emission (Test Frequency from 18GHz-25GHz) (For Shenzhen BCTC Testing Co., Ltd.)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-26.5GHz	Sep.25, 2019
Test Receiver	R&S	ESPI	101396	9KHz-7GHz	Sep.25, 2019
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	Sep.25, 2019
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Sep.25, 2019
RF Cable	R&S	R204	R21X	1GHz-40GHz	Sep.25, 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.
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

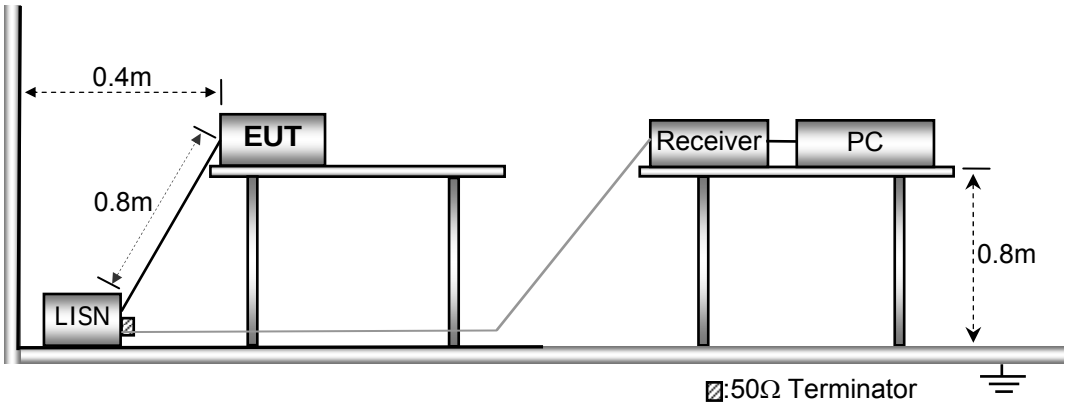
5.1 E.U.T. Operation

Operating Environment **:**

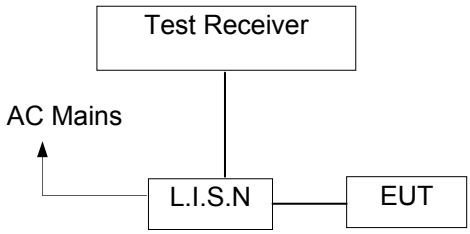
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

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

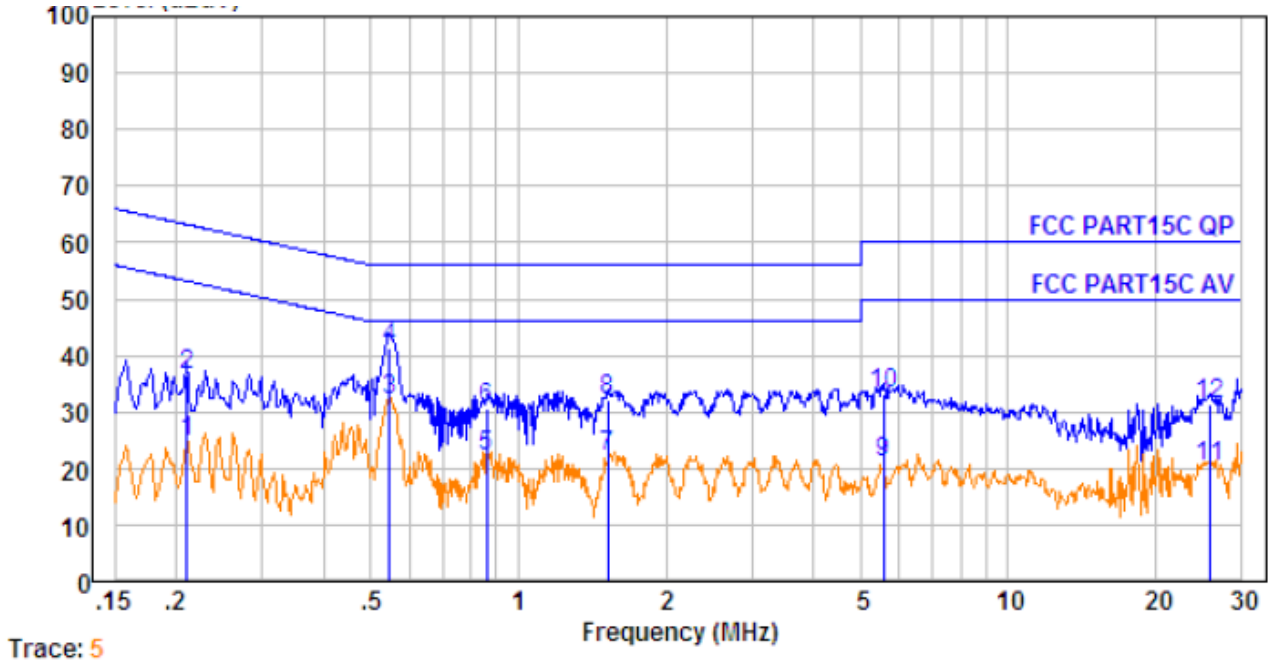
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

Pass.

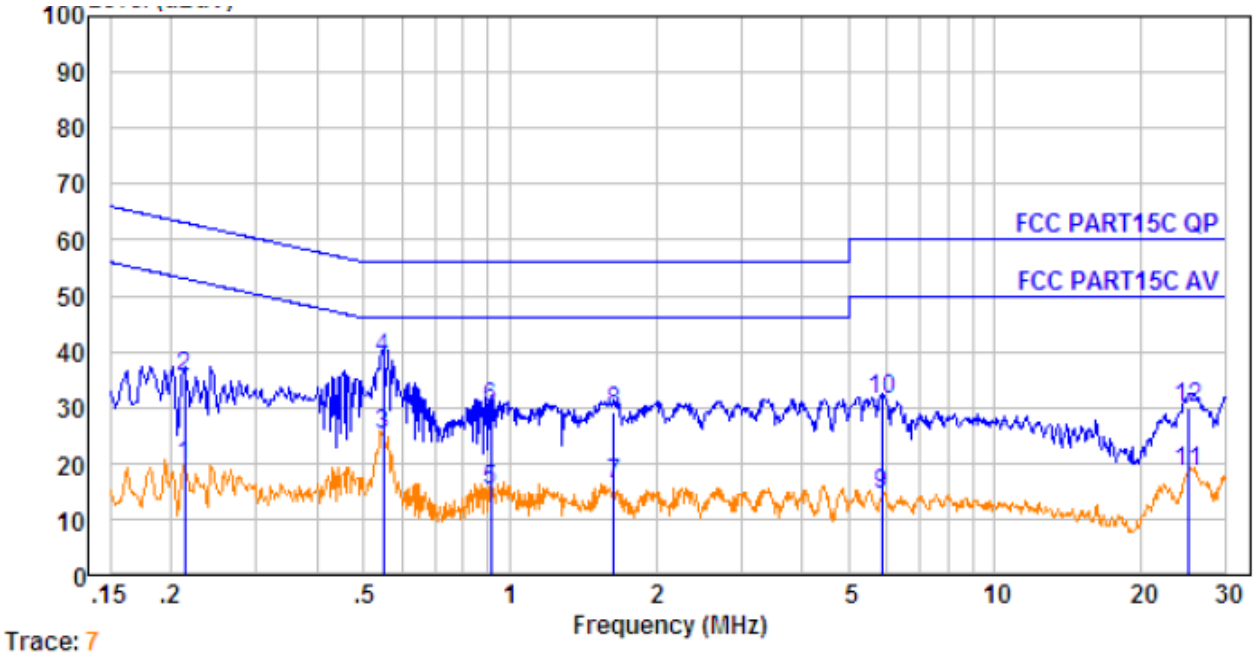
All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

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.	0.211	0.29	9.60	14.76	24.65	53.18	-28.53	Average
2.	0.211	0.29	9.60	26.63	36.52	63.18	-26.66	QP
3.	0.546	0.43	9.79	21.74	31.96	46.00	-14.04	Average
4.	0.546	0.43	9.79	31.21	41.43	56.00	-14.57	QP
5.	0.862	0.45	9.81	11.97	22.23	46.00	-23.77	Average
6.	0.862	0.45	9.81	20.31	30.57	56.00	-25.43	QP
7.	1.519	0.47	9.84	11.72	22.03	46.00	-23.97	Average
8.	1.519	0.47	9.84	21.86	32.17	56.00	-23.83	QP
9.	5.564	0.52	9.94	10.52	20.98	50.00	-29.02	Average
10.	5.564	0.52	9.94	22.64	33.10	60.00	-26.90	QP
11.	25.727	0.53	9.90	9.96	20.39	50.00	-29.61	Average
12.	25.727	0.53	9.90	20.96	31.39	60.00	-28.61	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.	0.214	0.29	9.63	9.50	19.42	53.05	-33.63	Average
2.	0.214	0.29	9.63	25.55	35.47	63.05	-27.58	QP
3.	0.549	0.43	9.82	14.71	24.96	46.00	-21.04	Average
4.	0.549	0.43	9.82	28.57	38.82	56.00	-17.18	QP
5.	0.914	0.45	9.84	4.78	15.07	46.00	-30.93	Average
6.	0.914	0.45	9.84	19.76	30.05	56.00	-25.95	QP
7.	1.636	0.47	9.87	5.95	16.29	46.00	-29.71	Average
8.	1.636	0.47	9.87	18.74	29.08	56.00	-26.92	QP
9.	5.836	0.52	9.97	4.08	14.57	50.00	-35.43	Average
10.	5.836	0.52	9.97	20.84	31.33	60.00	-28.67	QP
11.	25.188	0.54	10.06	7.98	18.58	50.00	-31.42	Average
12.	25.188	0.54	10.06	19.34	29.94	60.00	-30.06	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

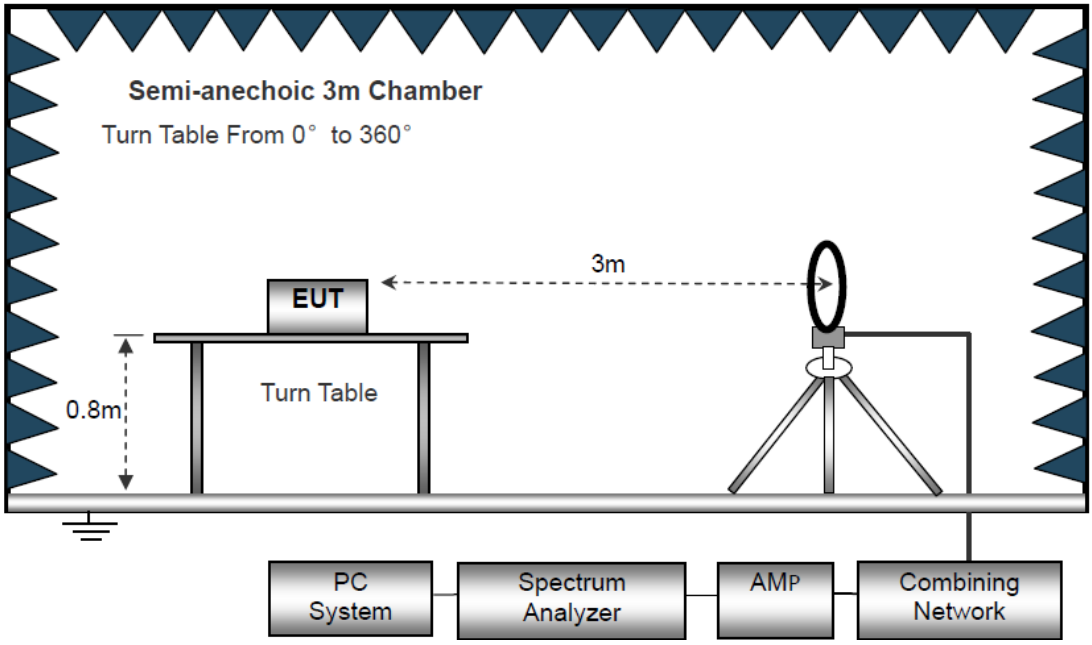
Humidity : 51.1 % RH

Atmospheric Pressure : 101.2kPa

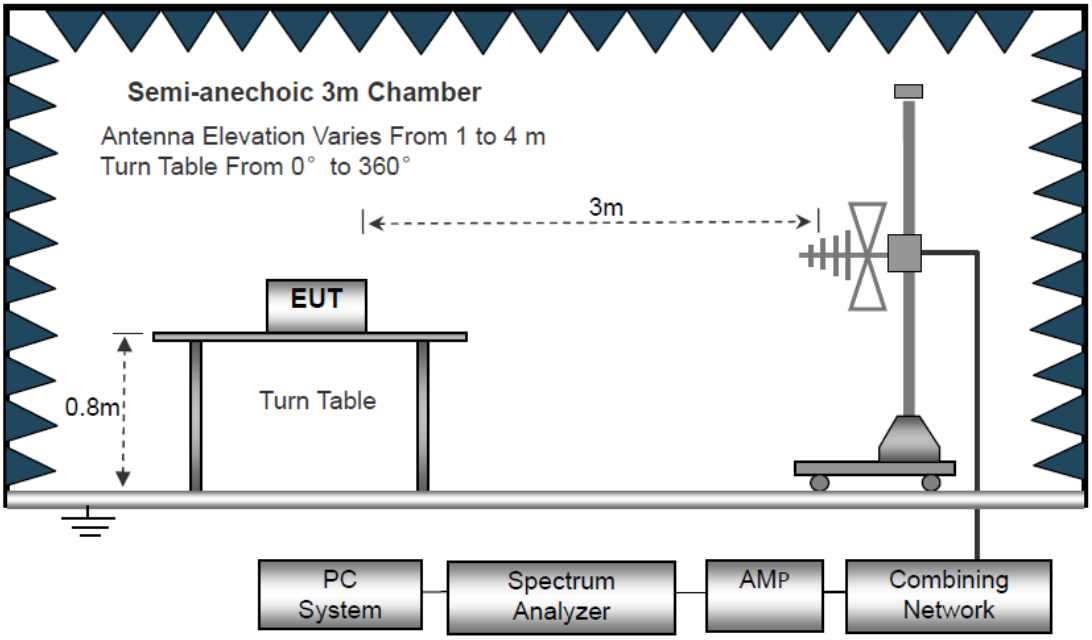
6.2 Test Setup

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

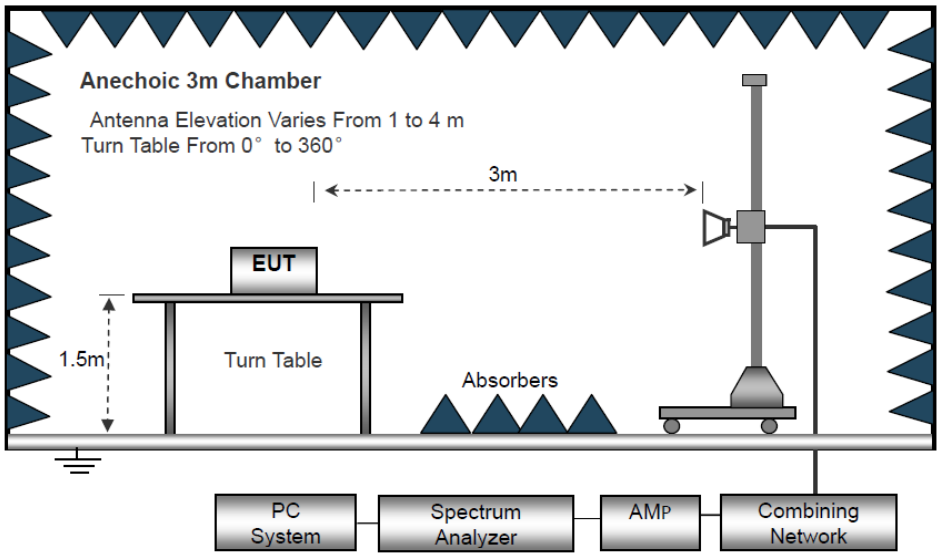
The test setup for emission measurement below 30MHz



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

	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.

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.

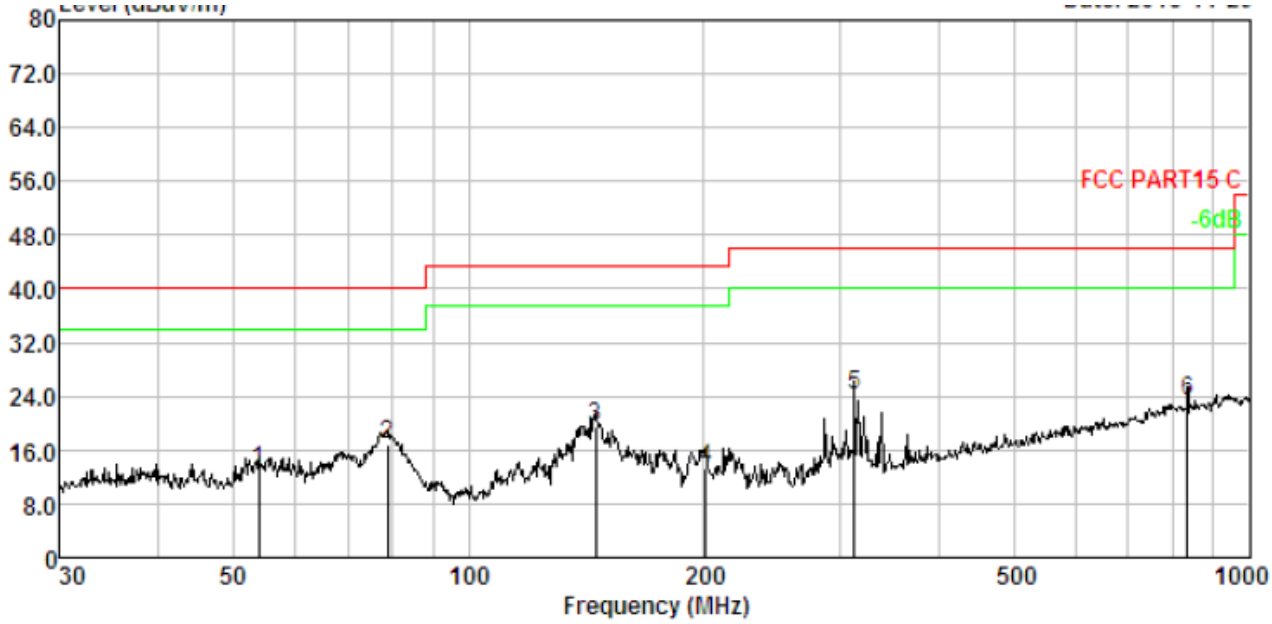
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass.

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

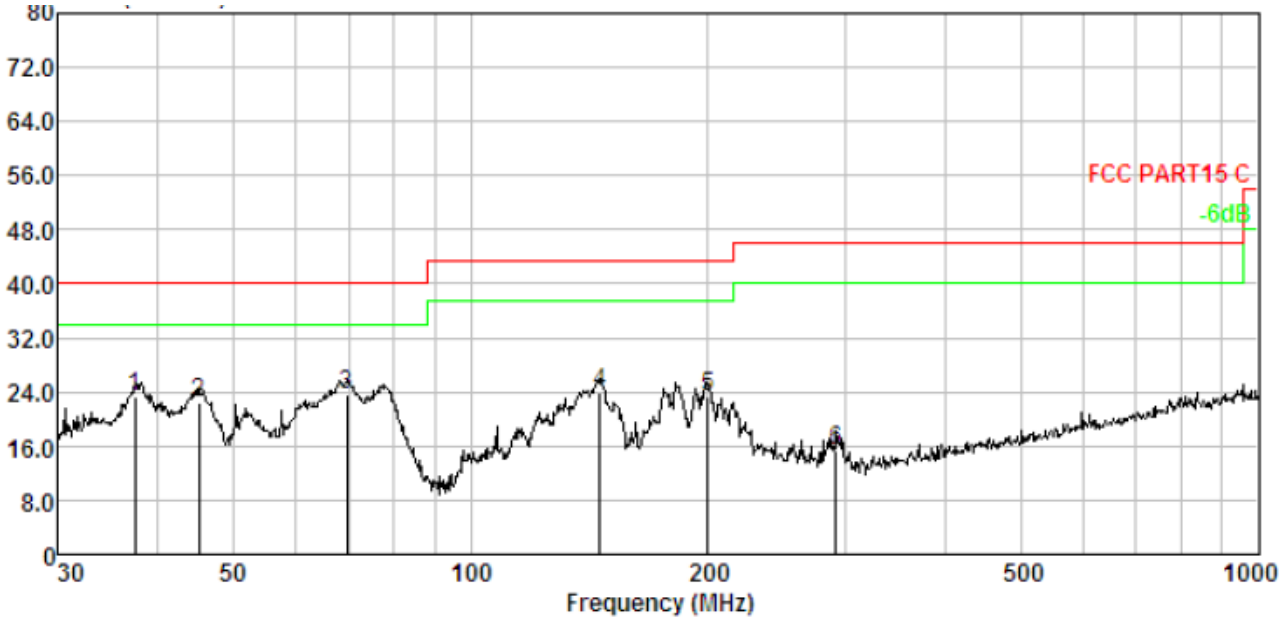
Antenna Polarization: Horizontal GFSK(CH00: 2402MHz)



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.	53.882	1.59	11.98	29.65	30.17	13.05	40.00	-26.95	QP
2.	78.689	1.93	9.05	36.26	30.31	16.93	40.00	-23.07	QP
3.	145.351	2.48	13.65	33.88	30.52	19.49	43.50	-24.01	QP
4.	201.393	2.78	10.41	30.70	30.63	13.26	43.50	-30.24	QP
5.	312.179	3.18	13.47	38.27	30.78	24.14	46.00	-21.86	QP
6.	833.317	4.06	21.97	28.53	31.13	23.43	46.00	-22.57	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.	37.548	1.26	13.51	38.72	30.05	23.44	40.00	-16.56	QP
2.	45.217	1.43	13.21	38.04	30.11	22.57	40.00	-17.43	QP
3.	69.600	1.82	10.13	42.03	30.26	23.72	40.00	-16.28	QP
4.	145.861	2.49	13.68	38.34	30.52	23.99	43.50	-19.51	QP
5.	199.986	2.77	10.38	40.82	30.63	23.34	43.50	-20.16	QP
6.	291.036	3.11	13.02	29.97	30.76	15.34	46.00	-30.66	QP

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

Test Frequency 1GHz-18GHz:

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	26.33	AV	V	34.22	6.58	34.09	33.04	54	-20.96
4804	27.14	AV	H	34.22	6.58	34.09	33.85	54	-20.15
4804	32.05	PK	V	34.22	6.58	34.09	38.76	74	-35.24
4804	36.29	PK	H	34.22	6.58	34.09	43	74	-31
16814	28.41	AV	V	36.17	7.29	34.14	37.73	54	-16.27
16814	26.87	AV	H	36.17	7.29	34.14	36.19	54	-17.81
16814	35.15	PK	V	36.17	7.29	34.14	44.47	74	-29.53
16814	37.04	PK	H	36.17	7.29	34.14	46.36	74	-27.64

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	27.35	AV	V	34.18	6.61	34.11	34.03	54	-19.97
4880	28.13	AV	H	34.18	6.61	34.11	34.81	54	-19.19
4880	35	PK	V	34.18	6.61	34.11	41.68	74	-32.32
4880	36.94	PK	H	34.18	6.61	34.11	43.62	74	-30.38
17080	26.35	AV	V	36.59	7.55	34.67	35.82	54	-18.18
17080	27.13	AV	H	36.59	7.55	34.67	36.6	54	-17.4
17080	34.25	PK	V	36.59	7.55	34.67	43.72	74	-30.28
17080	36.21	PK	H	36.59	7.55	34.67	45.68	74	-28.32

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	25.48	AV	V	34.11	6.63	34.26	31.96	54	-22.04
4960	26.59	AV	H	34.11	6.63	34.26	33.07	54	-20.93
4960	35.04	PK	V	34.11	6.63	34.26	41.52	74	-32.48
4960	36.12	PK	H	34.11	6.63	34.26	42.6	74	-31.4
17360	26.18	AV	V	36.61	7.58	34.75	35.62	54	-18.38
17360	27.54	AV	H	36.61	7.58	34.75	36.98	54	-17.02
17360	36.11	PK	V	36.61	7.58	34.75	45.55	74	-28.45
17360	37.24	PK	H	36.61	7.58	34.75	46.68	74	-27.32

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

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

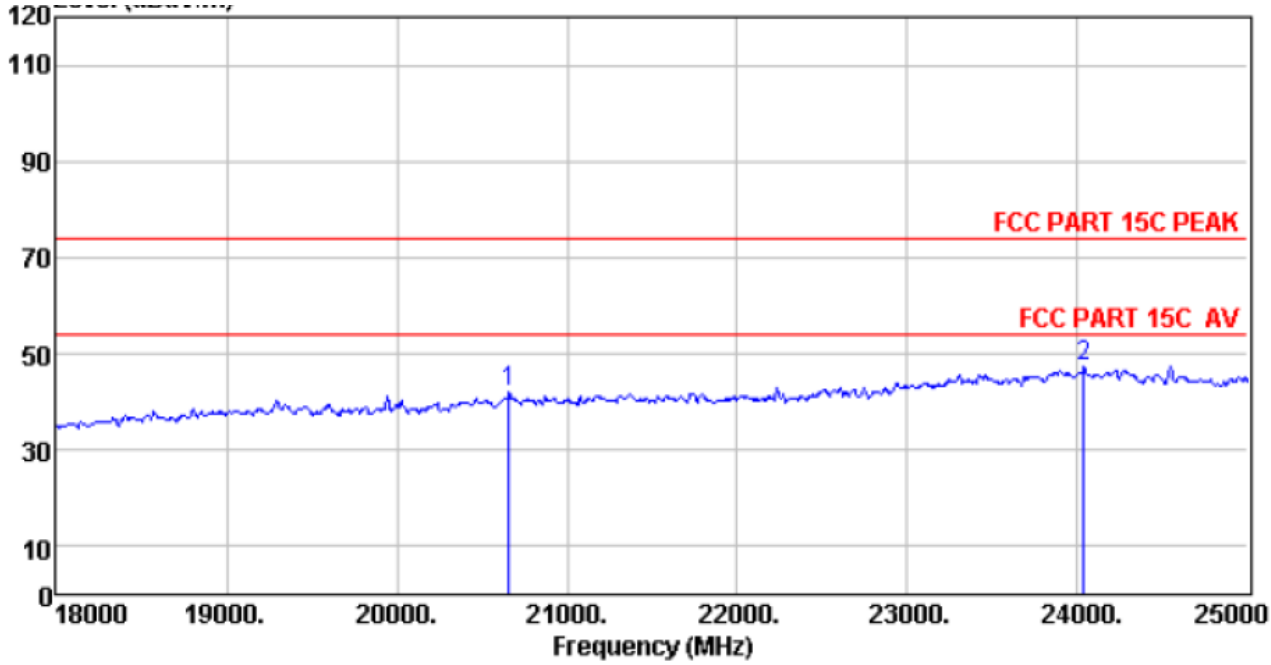
Test Mode: BLE Low Channel 2402MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2310.00	32.11	28.11	6.73	37.12	29.83	74.00	-44.17	V	Peak
2390.00	34.08	28.04	6.92	38.06	30.98	74.00	-43.02	V	
2310.00	30.15	28.11	6.73	37.12	27.87	74.00	-46.13	H	
2390.00	33.29	28.04	6.92	38.06	30.19	74.00	-43.81	H	
2310.00	28.42	28.11	6.73	37.12	26.14	54.00	-27.86	V	Average
2390.00	29.16	28.04	6.92	38.06	26.06	54.00	-27.94	V	
2310.00	27.46	28.11	6.73	37.12	25.18	54.00	-28.82	H	
2390.00	28.65	28.04	6.92	38.06	25.55	54.00	-28.45	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	40.29	27.33	6.32	35.69	38.25	74.00	-35.75	V	Peak
2500.00	38.15	26.84	6.42	37.04	34.37	74.00	-39.63	V	
2483.50	41.32	27.33	6.32	35.69	39.28	74.00	-34.72	H	
2500.00	40.69	26.84	6.42	37.04	36.91	74.00	-37.09	H	
2483.50	38.65	27.33	6.32	35.69	36.61	54.00	-17.39	V	Average
2500.00	37.46	26.84	6.42	37.04	33.68	54.00	-10.32	V	
2483.50	36.29	27.33	6.32	35.69	34.25	54.00	-19.75	H	
2500.00	35.04	26.84	6.42	37.04	31.26	54.00	-22.74	H	

Test Frequency: From 18GHz to 25GHz

Worst Test mode: GFSK (2402MHz)

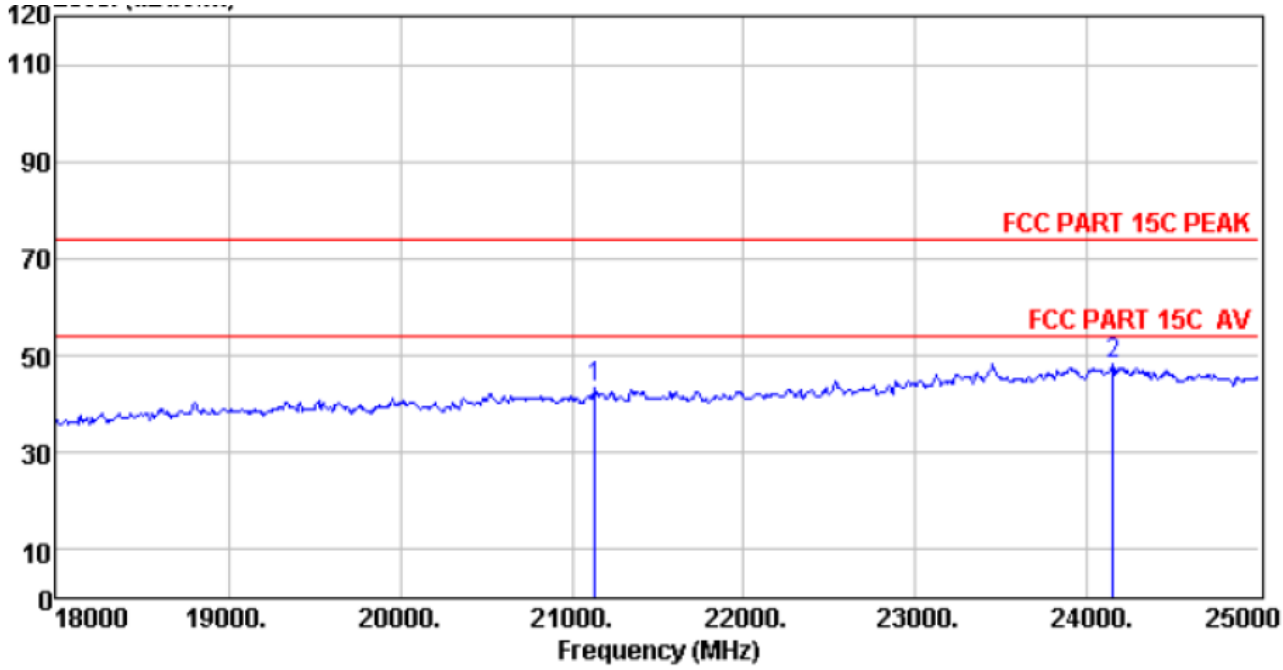
Vertical:



	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	20660.00	46.10	19.98	12.11	42.07	74.00	31.93	Peak
2	24034.00	45.60	22.06	12.43	47.25	74.00	26.75	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Horizontal:



	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	21136.00	46.21	20.19	12.62	43.33	74.00	30.67	Peak
2	24146.00	45.63	22.13	13.47	48.20	74.00	25.80	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7 Band Edge Measurement

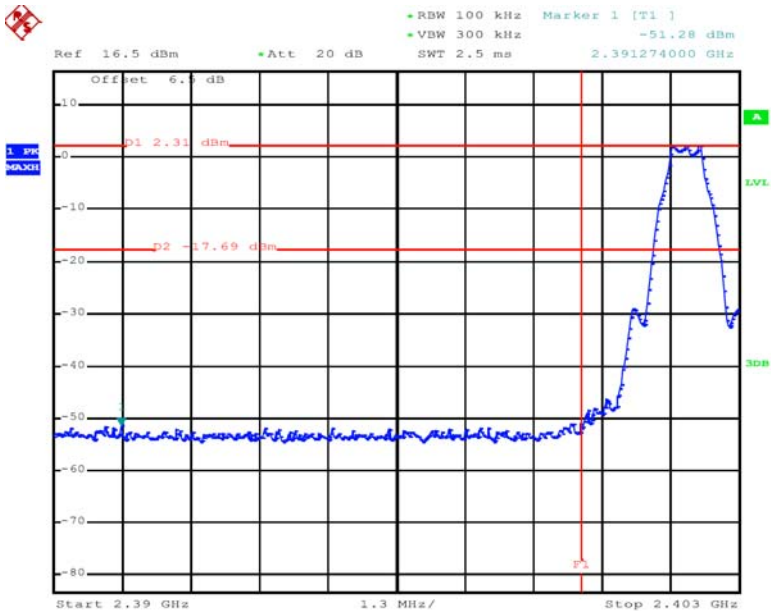
Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247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

7.1 Test Procedure

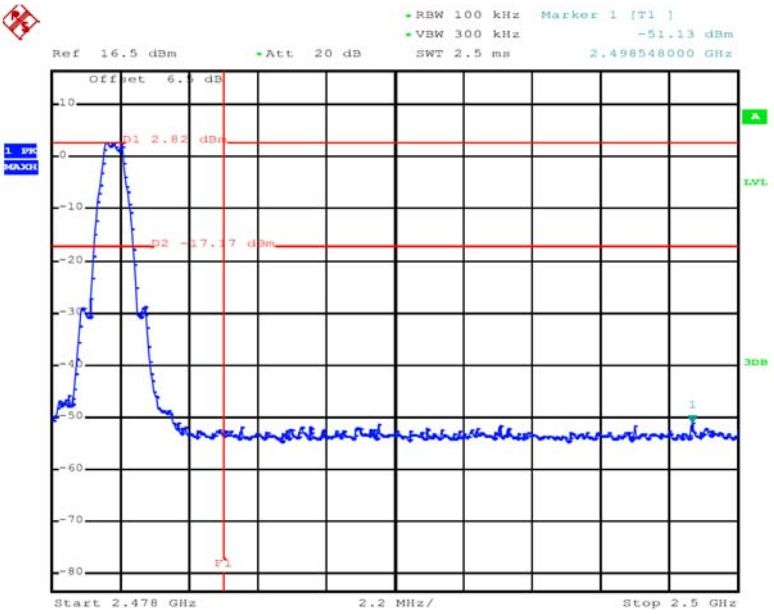
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

7.2 Test Result

Low Band Edge Plot on Channel 00



High Band Edge Plot on Channel 39



8 6dB Bandwidth Measurement

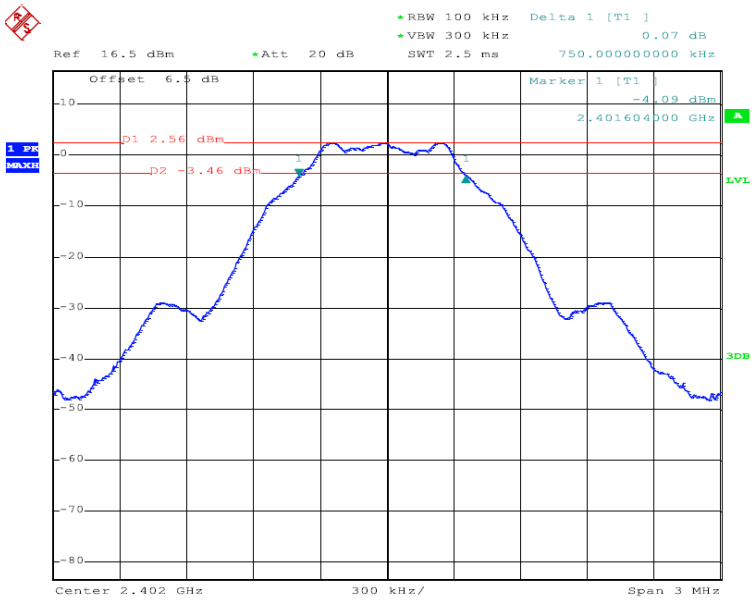
Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit		Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

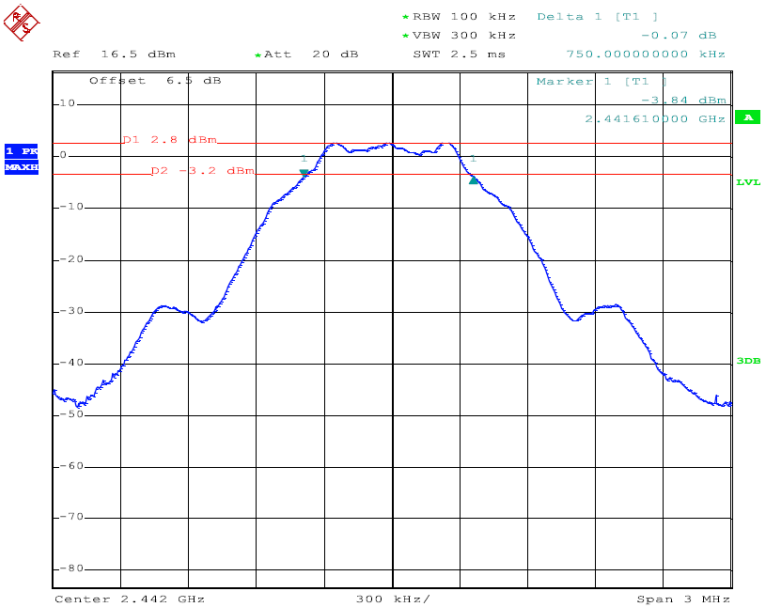
8.1 Test Procedure

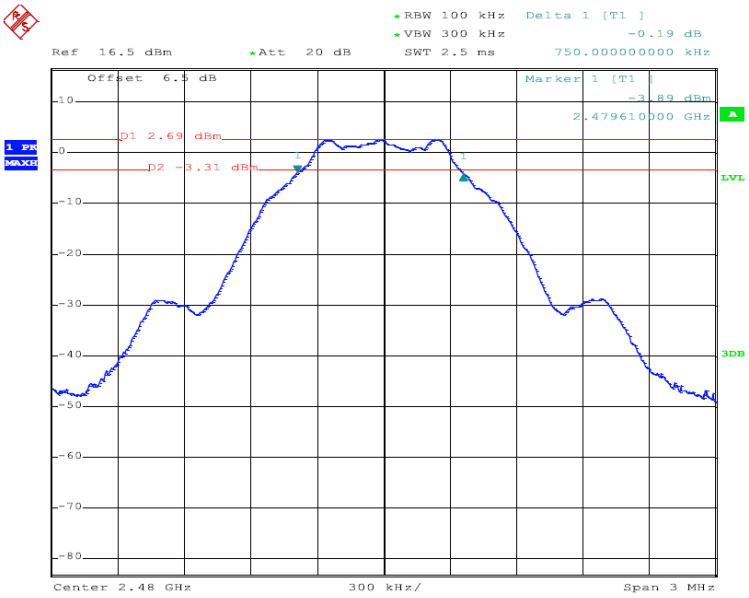
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100KHz, Set the Video Bandwidth(VBW)= 300KHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500KHz.
4. Measure and record the results in the test report.

8.2 Test Result

Channel number	Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)
00	2402	750	>500
20	2442	750	>500
39	2480	750	>500


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 1 [T1]
0.07 dB
750.000000000 kHz
Ref 16.5 dBm
Att 20 dB
Offset 6.5 dB
Marker 1 [T1]
-4.09 dBm
2.401604000 GHz
D1 2.56 dBm
D2 -3.46 dBm
1 PK
MAXH
A
LVL
3DB
Center 2.402 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 1 [T1]
-0.07 dB
750.000000000 kHz
Ref 16.5 dBm
Att 20 dB
Offset 6.5 dB
Marker 1 [T1]
-3.84 dBm
2.441610000 GHz
D1 2.8 dBm
D2 -3.2 dBm
1 PK
MAXH
A
LVL
3DB
Center 2.442 GHz
300 kHz/
Span 3 MHz


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 1 [T1]
-0.19 dB
750.000000000 kHz
Ref 16.5 dBm
Att 20 dB
Offset 6.5 dB
Marker 1 [T1]
-3.89 dBm
2.479610000 GHz
D1 2.69 dBm
D2 -3.31 dBm
1 PK
MAXH
A
LVL
3DB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.48 GHz
300 kHz/
Span 3 MHz

9 Maximum Peak Output Power

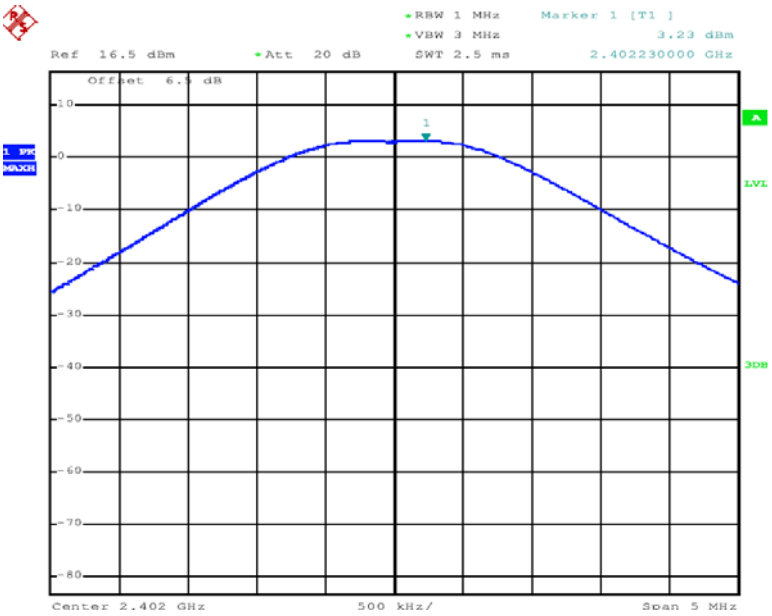
Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt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

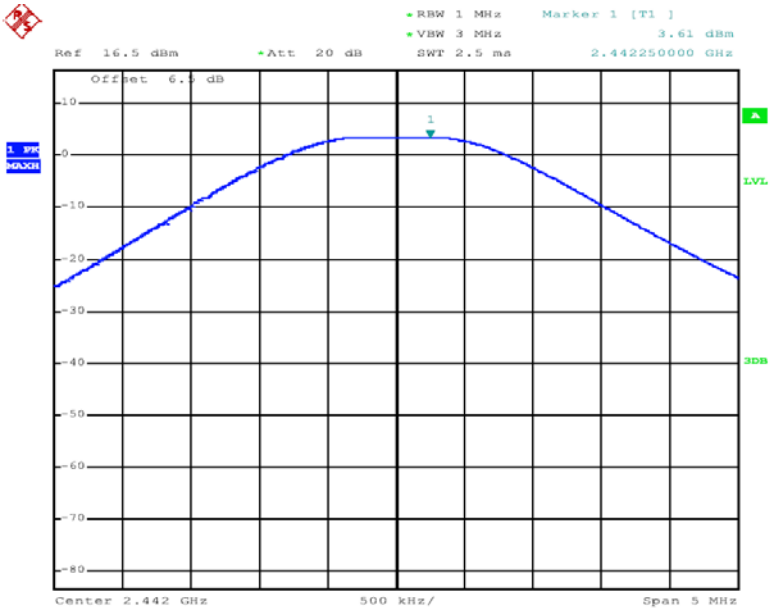
9.1 Test Procedure

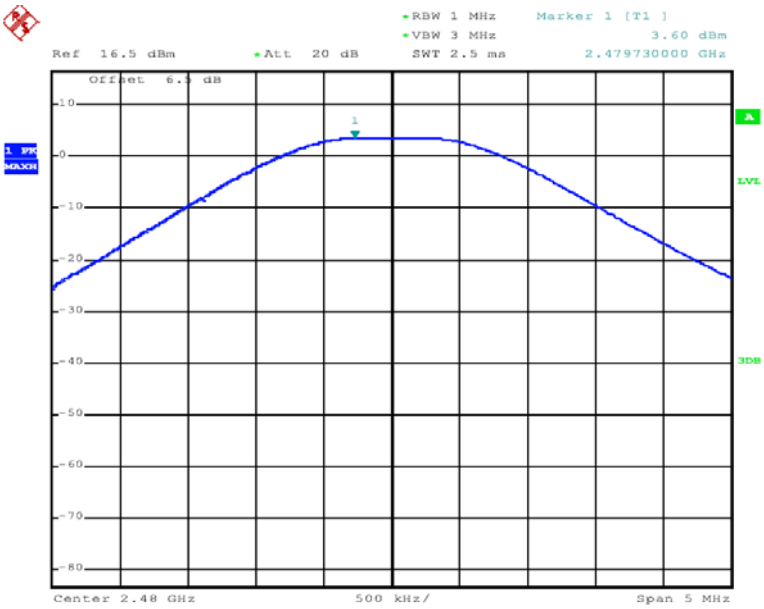
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power and record the results in the 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	3.23	0.00210	1	PASS
20	2442	3.61	0.00230	1	PASS
39	2480	3.60	0.00229	1	PASS


RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
3.23 dBm
2.402230000 GHz
Ref 16.5 dBm
Att 20 dB
Offset 6.5 dB
1 PK MAXH
LVL
3DB
Center 2.402 GHz
500 kHz/
Span 5 MHz


RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
3.61 dBm
2.442250000 GHz
Ref 16.5 dBm
Att 20 dB
Offset 6.5 dB
1 PK MAXH
LVL
3DB
Center 2.442 GHz
500 kHz/
Span 5 MHz


RBW 1 MHz
VBW 3 MHz
Marker 1 [T1]
3.60 dBm
2.479730000 GHz
Ref 16.5 dBm
Att 20 dB
SWT 2.5 ms
Offset 6.1 dB
1 PK
MAXH
A
LVL
3DB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.48 GHz
500 kHz/
Span 5 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. 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.

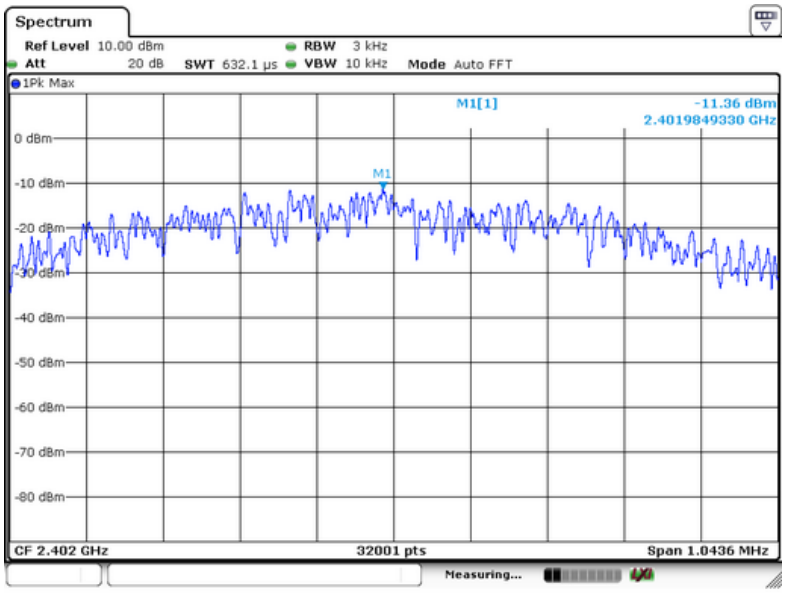
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW0 = 3KHz, Video Bandwidth (VBW) = 10KHz, in order to make an accurate measurement, set the span to 1.5 times DTS channel bandwidth.

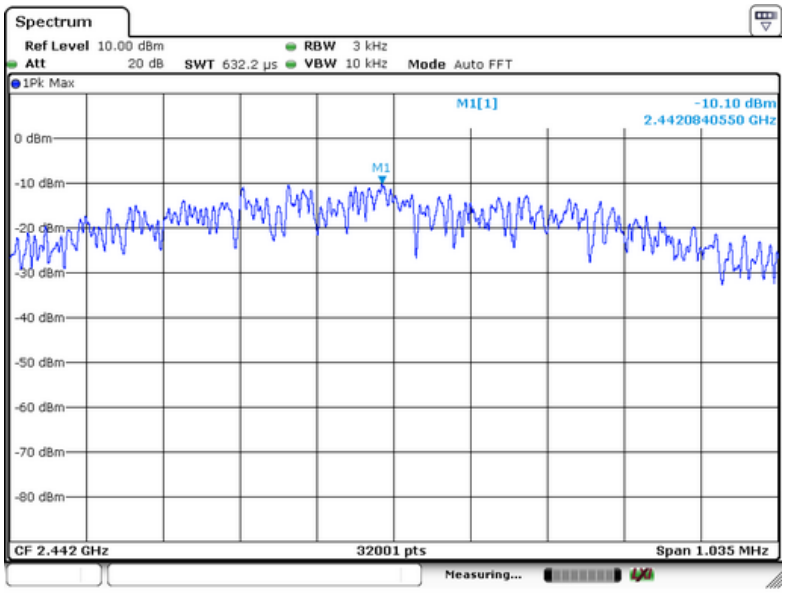
4. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.

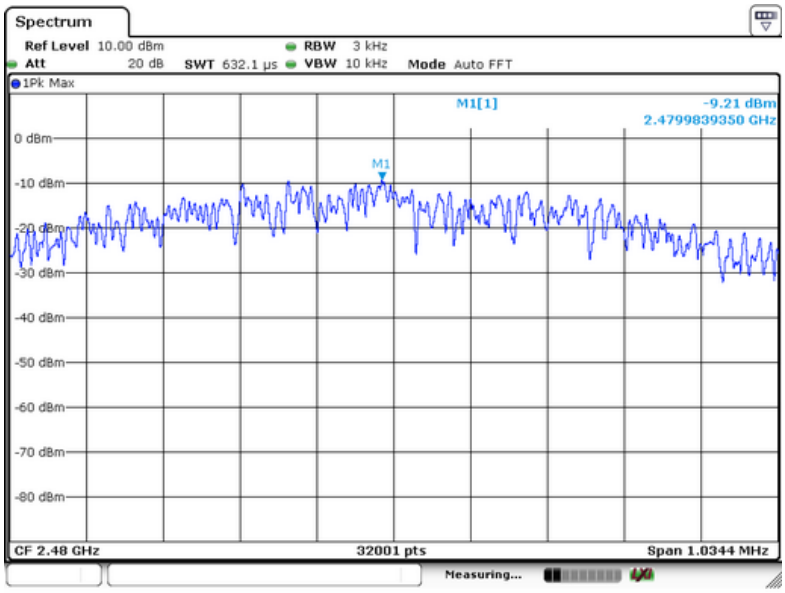
5. Measure and record the result in the test report.

10.2 Test Result

Channel number	Channel frequency (MHz)	Measurement level (dBm)	Required Limit (dBm/3kHz)	Pass/Fail
		PSD/3kHz		
00	2402	-11.36	8	PASS
20	2442	-10.10	8	PASS
39	2480	-9.21	8	PASS


Spectrum
Ref Level 10.00 dBm
RBW 3 kHz
Att 20 dB
SWT 632.1 µs
VBW 10 kHz
Mode Auto FFT
1Pk Max
M1[1]
-11.36 dBm
2.4019849330 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 1.0436 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 kHz
Att 20 dB
SWT 632.2 µs
VBW 10 kHz
Mode Auto FFT
1Pk Max
M1[1]
-10.10 dBm
2.4420840550 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.442 GHz
32001 pts
Span 1.035 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 kHz
Att 20 dB
SWT 632.1 µs
VBW 10 kHz
Mode Auto FFT
1Pk Max
M1[1]
-9.21 dBm
2.4799839350 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 1.0344 MHz
Measuring...

11 Antenna Application

11.1 Antenna Requirement

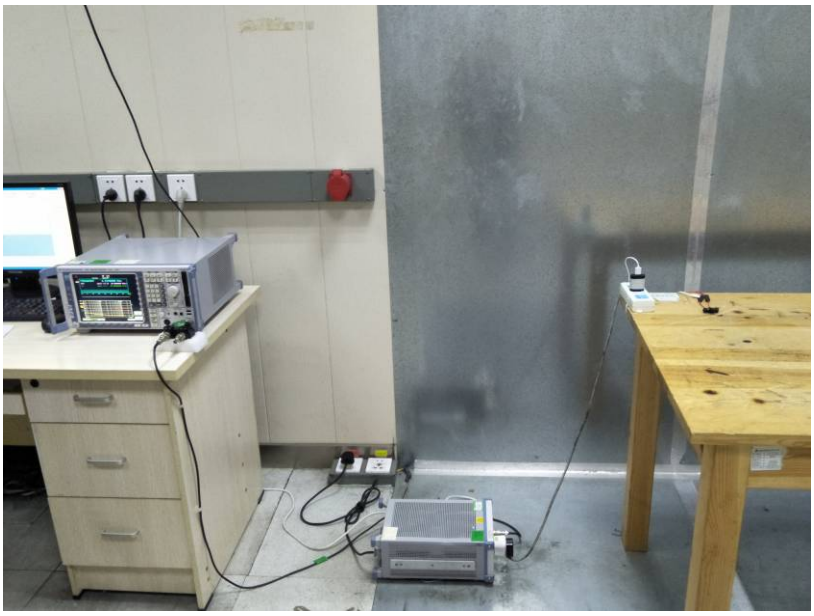
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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

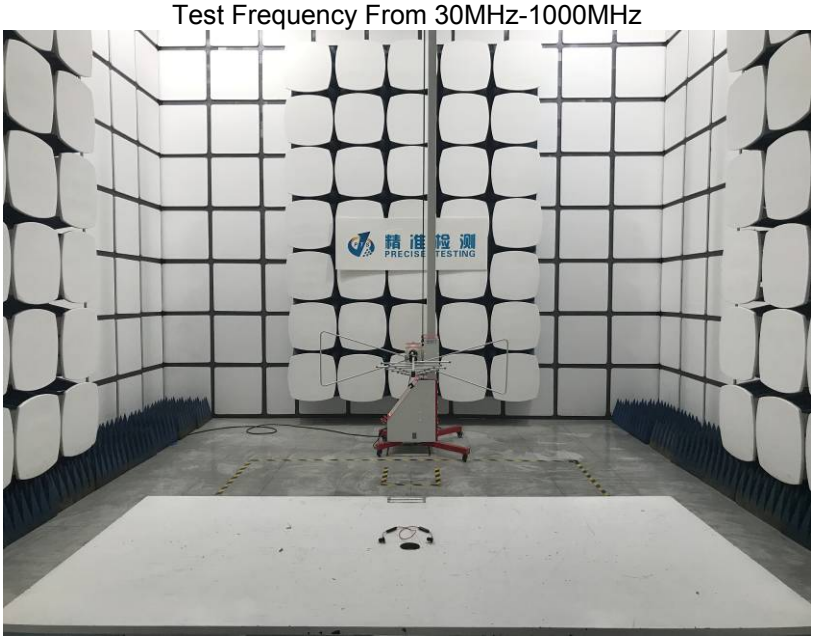
The EUT'S antenna, permanent attached antenna, is internal PCB antenna. The antenna's gain is 0dBi and meets the requirement.

12 Test Setup

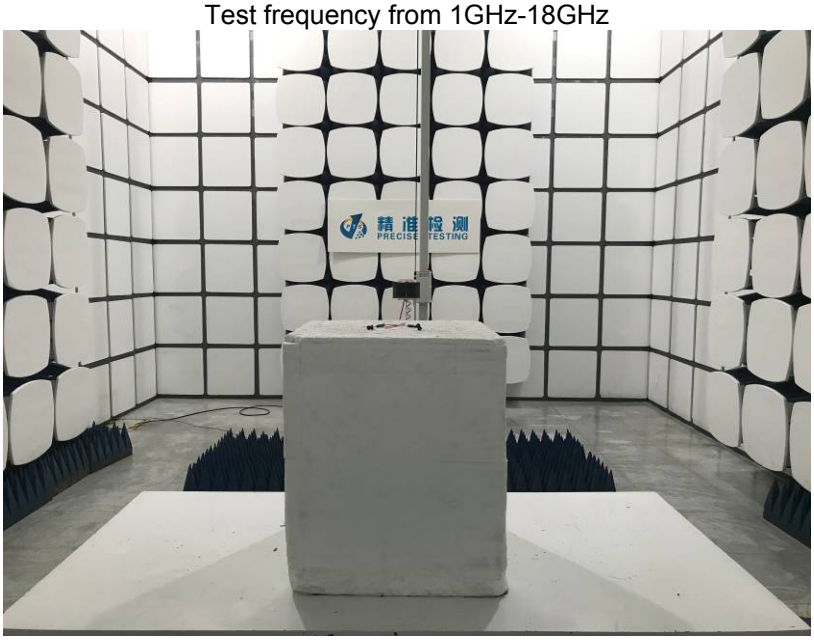
Conducted Emissions



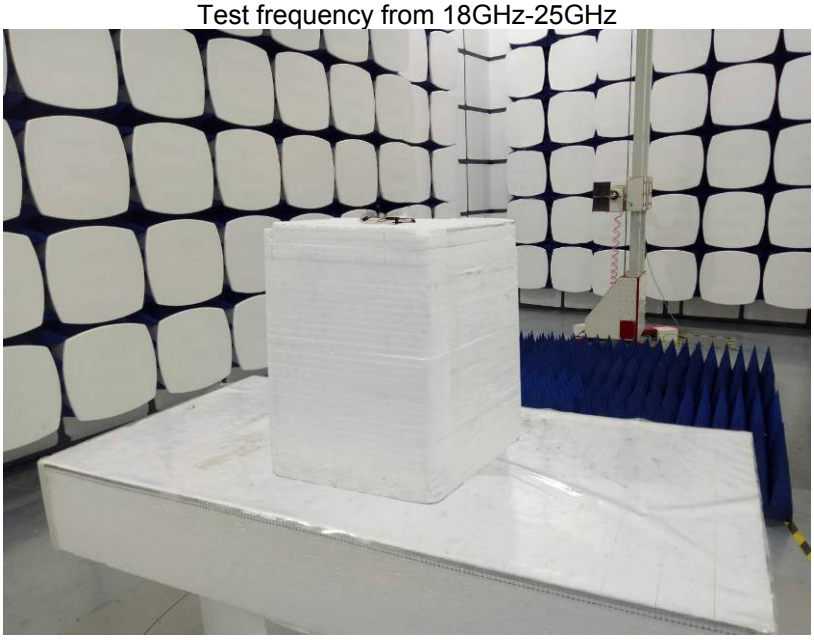
Radiated Spurious Emissions
Test Frequency From 30MHz-1000MHz



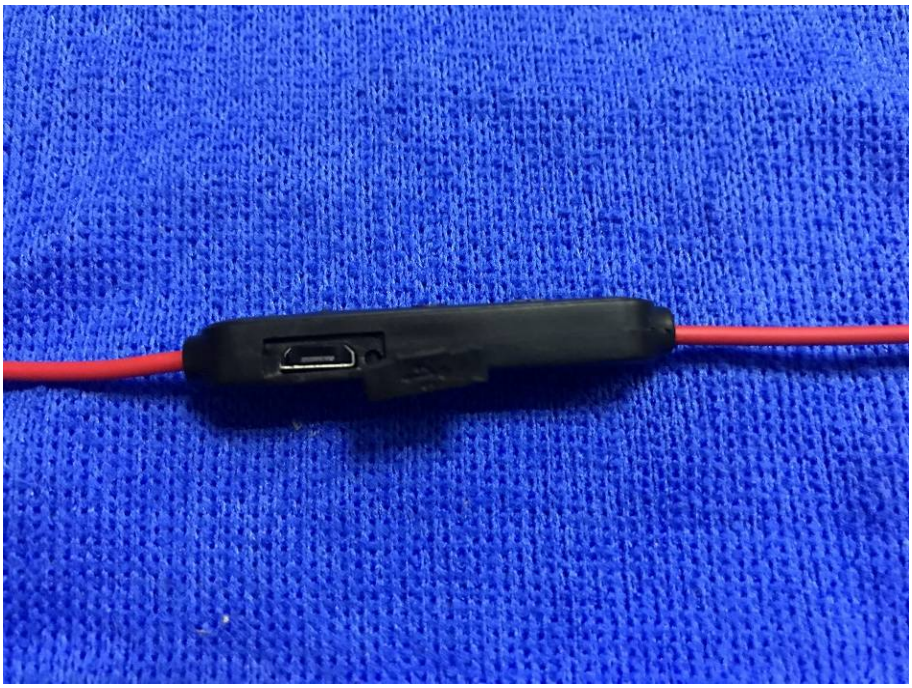
Test frequency from 1GHz-18GHz

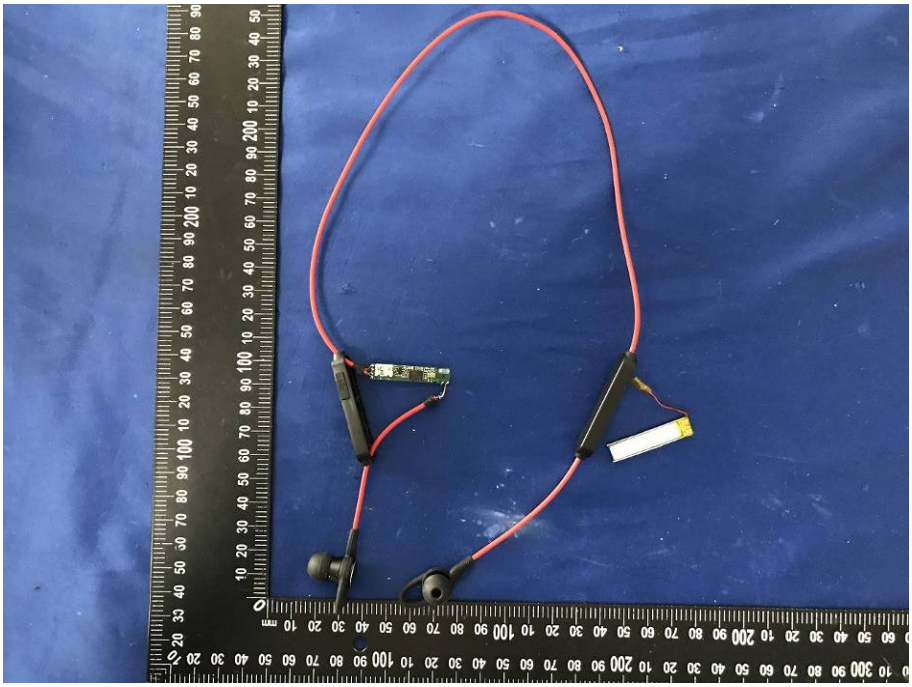


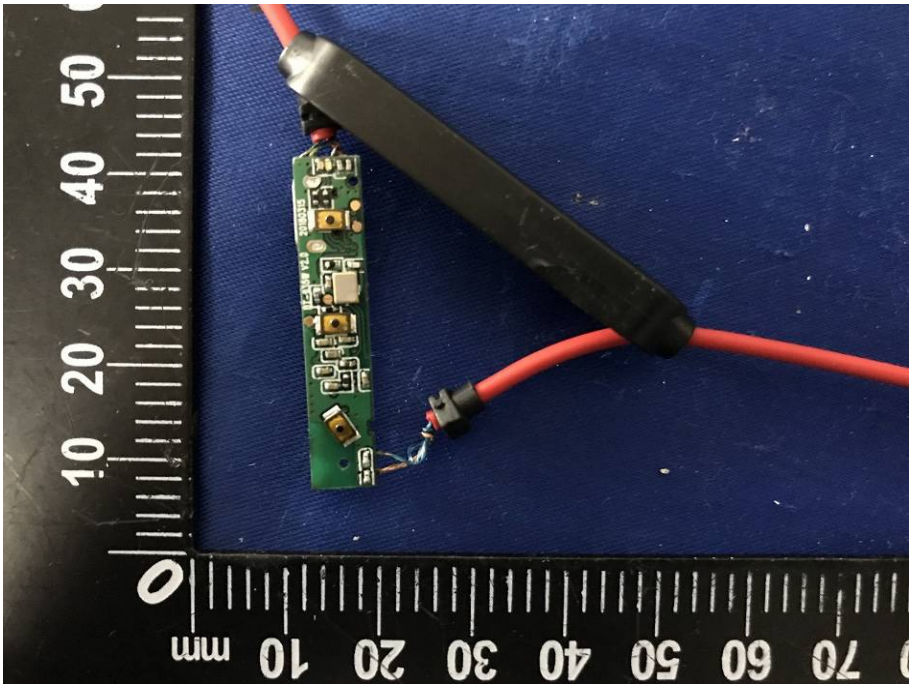
Test frequency from 18GHz-25GHz

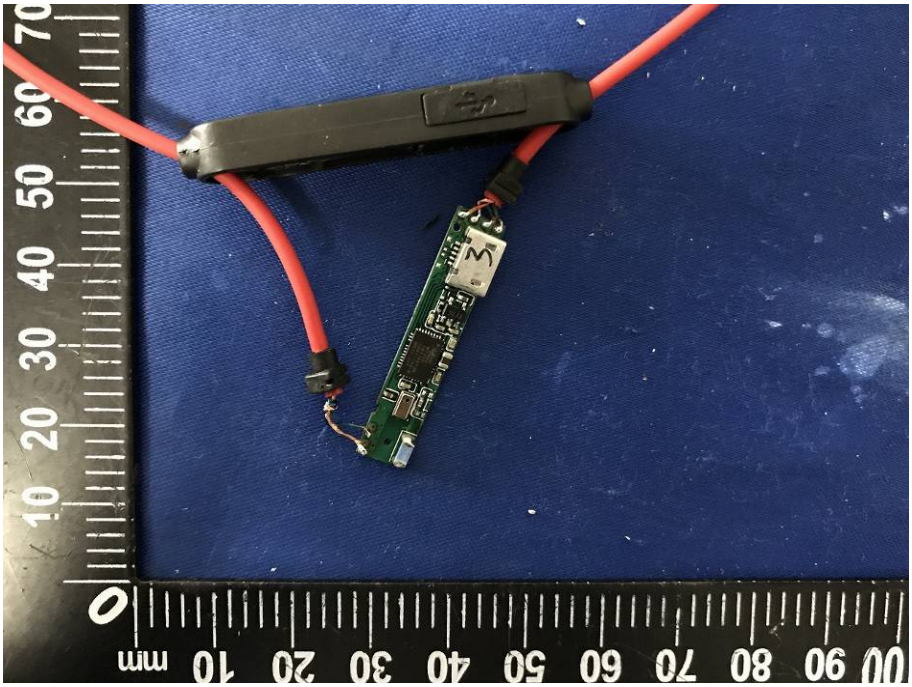


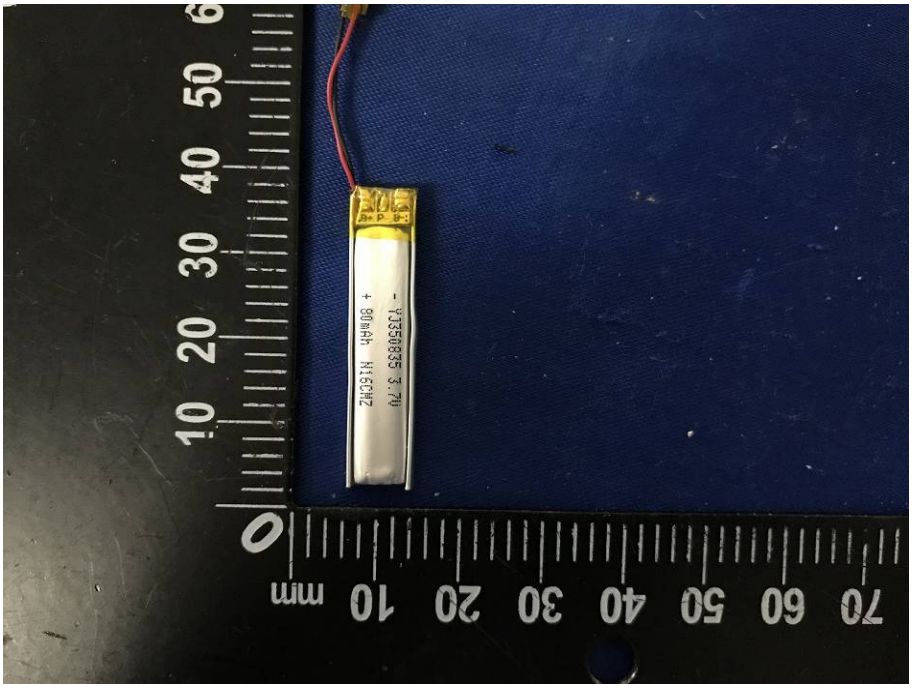
13 EUT Photos

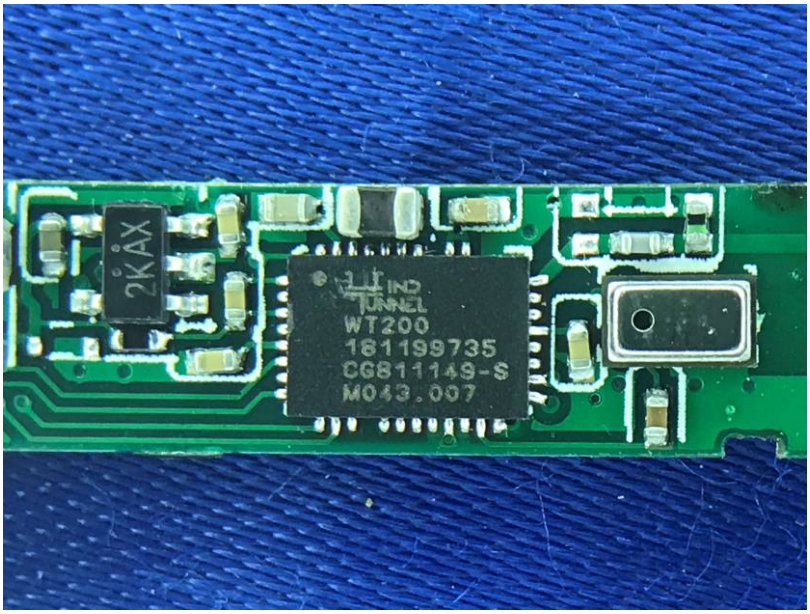









YJ350835 3.7V
90mAh



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