FCC TEST REPORT

FCC ID: 2AR7CLXKJ18

Product	:	Wireless earbuds
Model Name	:	XI8S, XI8T, TI8S, TI9S
Brand	:	N/A
Report No.	:	PTC18112704302E-FC02

Prepared for

Shenzhen Lingxin Technology Co., Ltd.

No. 28 Hongwei Science and Technology Park, Shanmen Ind. Zone, Songgang Street, Baoan Dis., Shenzhen, 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	:	Shenzhen Lingxin Technology Co., Ltd.
Address	:	No. 28 Hongwei Science and Technology Park, Shanmen Ind. Zone, Songgang Street, Baoan Dis., Shenzhen, China
Manufacture's name	:	Shenzhen Lingxin Technology Co., Ltd.
Address	:	No. 28 Hongwei Science and Technology Park, Shanmen Ind. Zone, Songgang Street, Baoan Dis., Shenzhen, China
Product name	:	Wireless earbuds
Model name	:	XI8S, XI8T, TI8S, TI9S
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	December 06, 2018 to December 26, 2018
Date of Issue	:	December 26, 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

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. BT will not work when charging.

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 earbuds
Model Name	:	XI8S, XI8T, TI8S, TI9S (Note: The samples are the same except appearance and model number. So XI8S was selected for full tested.)
Version	:	BLE 5.0
Operating frequency	:	2402-2480MHz
Number of Channels	:	40
Type of Modulation	:	GFSK
Antenna installation	:	Internal PCB Antenna
Antenna Gain	:	-0.68 dBi
Power supply	:	DC 3.7V, 50mAh 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		

Model	Frequency Range (MHz)	Tested Frequency (MHz)	Modulation	Data Rate(Mbps)
Bluetooth LE	2402-2480	2402, 2442, 2480	GFSK	1
Bluetooth LE	2402-2480	2402, 2442, 2480	GFSK	2

Note:

1. Test of channel was included the lowest 2402MHz, middle 2442MHz 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
Power Meter	Anritsu	ML2495A	0949003	N/A	Sep.19, 2019
Power Sensor	Anritsu	MA2411B	0917017	N/A	Sep.19, 2019
Attenuator	Marvelous	MVE2213-10	RF30	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.
Charging Station	XI8S	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

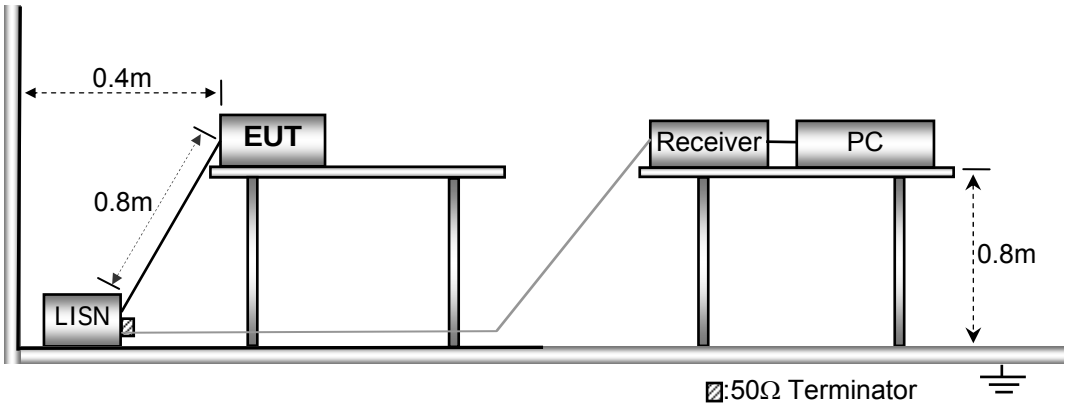
5.1 E.U.T. Operation

Operating Environment **:**

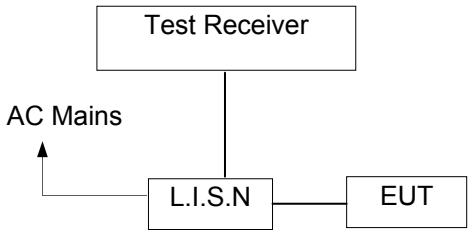
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

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.

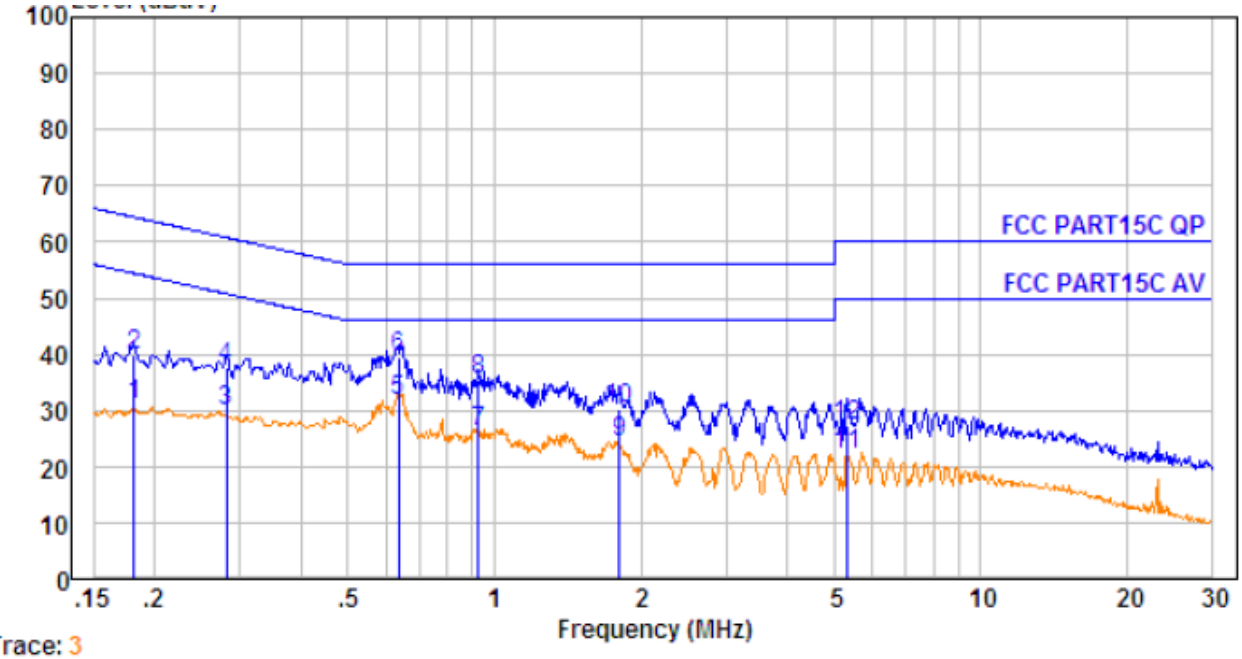
5.6 Measurement Description

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.

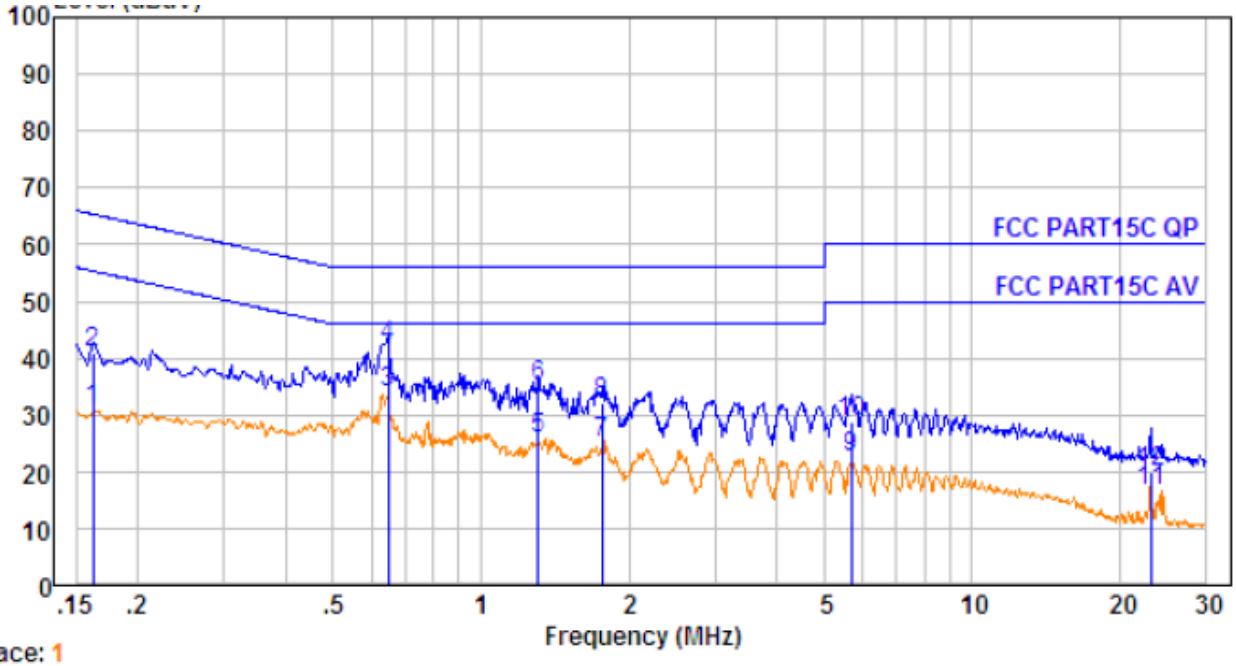
Line:



Trace: 3

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.182	0.25	9.56	21.24	31.05	54.42	-23.37	Average
2.	0.182	0.25	9.56	30.21	40.02	64.42	-24.40	QP
3.	0.282	0.36	9.66	19.80	29.82	50.76	-20.94	Average
4.	0.282	0.36	9.66	27.65	37.67	60.76	-23.09	QP
5.	0.634	0.44	9.79	21.58	31.81	46.00	-14.19	Average
6.	0.634	0.44	9.79	29.36	39.59	56.00	-16.41	QP
7.	0.928	0.46	9.82	16.04	26.32	46.00	-19.68	Average
8.	0.928	0.46	9.82	25.12	35.40	56.00	-20.60	QP
9.	1.810	0.47	9.85	14.14	24.46	46.00	-21.54	Average
10.	1.810	0.47	9.85	20.11	30.43	56.00	-25.57	QP
11.	5.305	0.51	9.93	11.61	22.05	50.00	-27.95	Average
12.	5.305	0.51	9.93	16.69	27.13	60.00	-32.87	QP

Neutral



Trace: 1

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.162	0.23	9.55	21.13	30.91	55.34	-24.43	Average
2.	0.162	0.23	9.55	31.20	40.98	65.34	-24.36	QP
3.	0.647	0.44	9.83	23.77	34.04	46.00	-11.96	Average
4.	0.647	0.44	9.83	31.73	42.00	56.00	-14.00	QP
5.	1.310	0.46	9.86	15.62	25.94	46.00	-20.06	Average
6.	1.310	0.46	9.86	24.64	34.96	56.00	-21.04	QP
7.	1.762	0.47	9.87	14.69	25.03	46.00	-20.97	Average
8.	1.762	0.47	9.87	21.60	31.94	56.00	-24.06	QP
9.	5.683	0.52	9.97	12.04	22.53	50.00	-27.47	Average
10.	5.683	0.52	9.97	18.14	28.63	60.00	-31.37	QP
11.	23.140	0.49	10.02	6.25	16.76	50.00	-33.24	Average
12.	23.140	0.49	10.02	9.30	19.81	60.00	-40.19	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

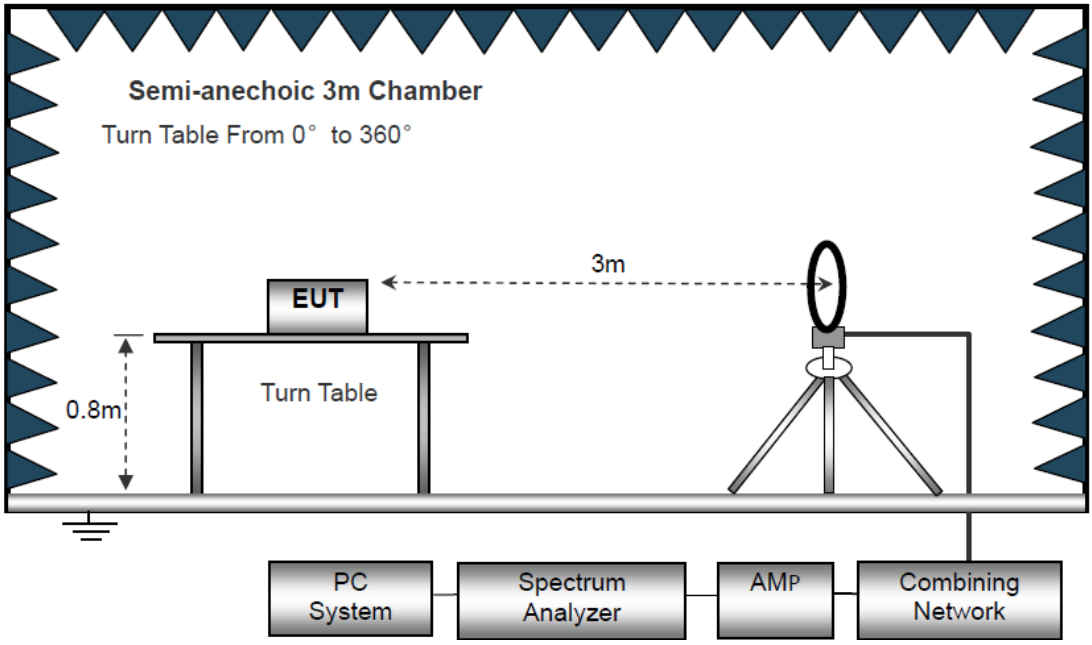
Humidity : 51.1 % RH

Atmospheric Pressure : 101.2kPa

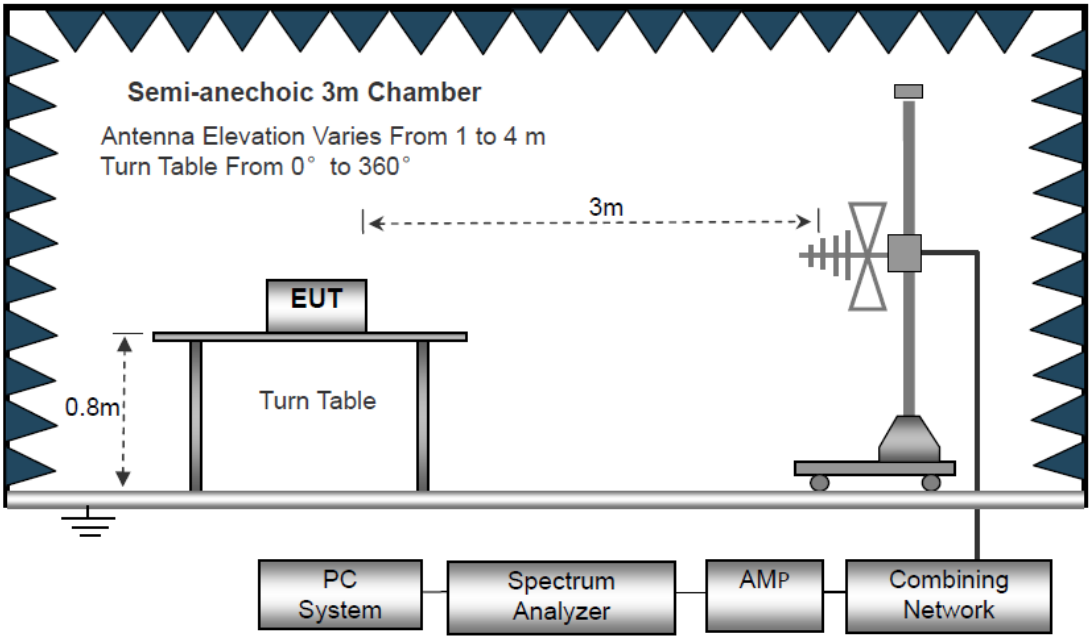
6.2 Test Setup

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

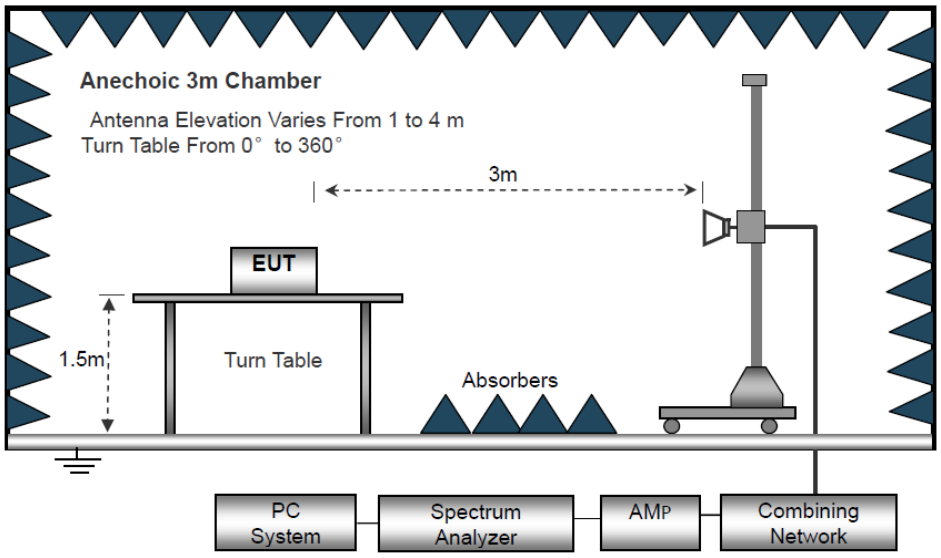
The test setup for emission measurement below 30MHz



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.

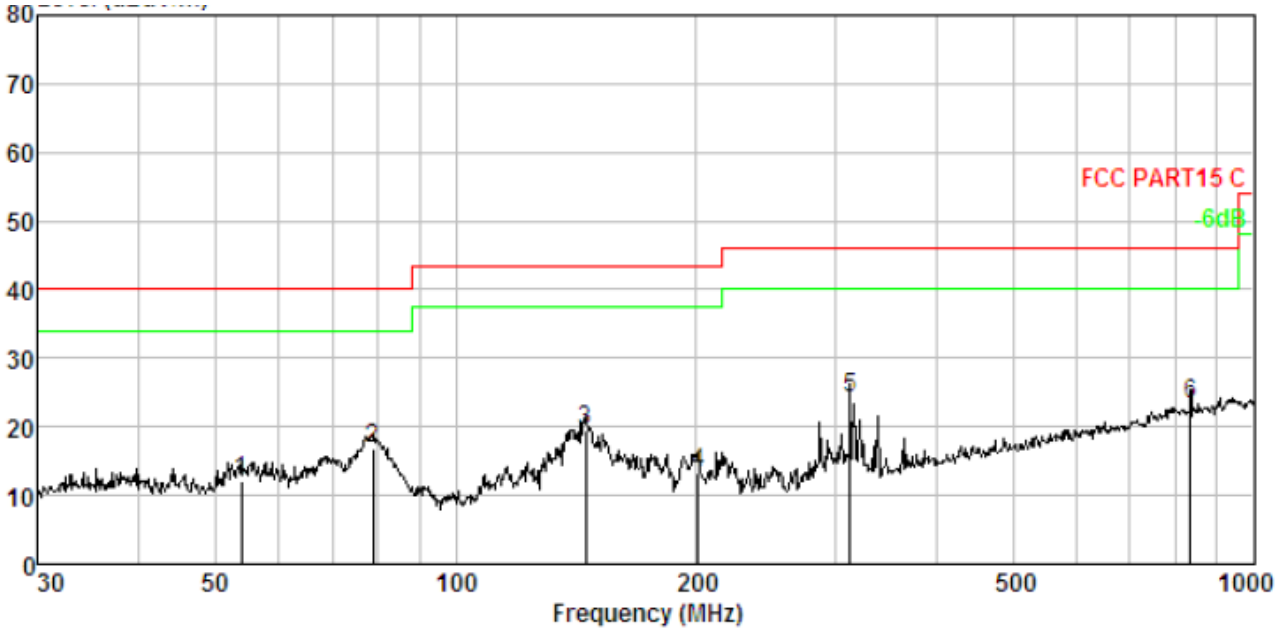
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass.

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

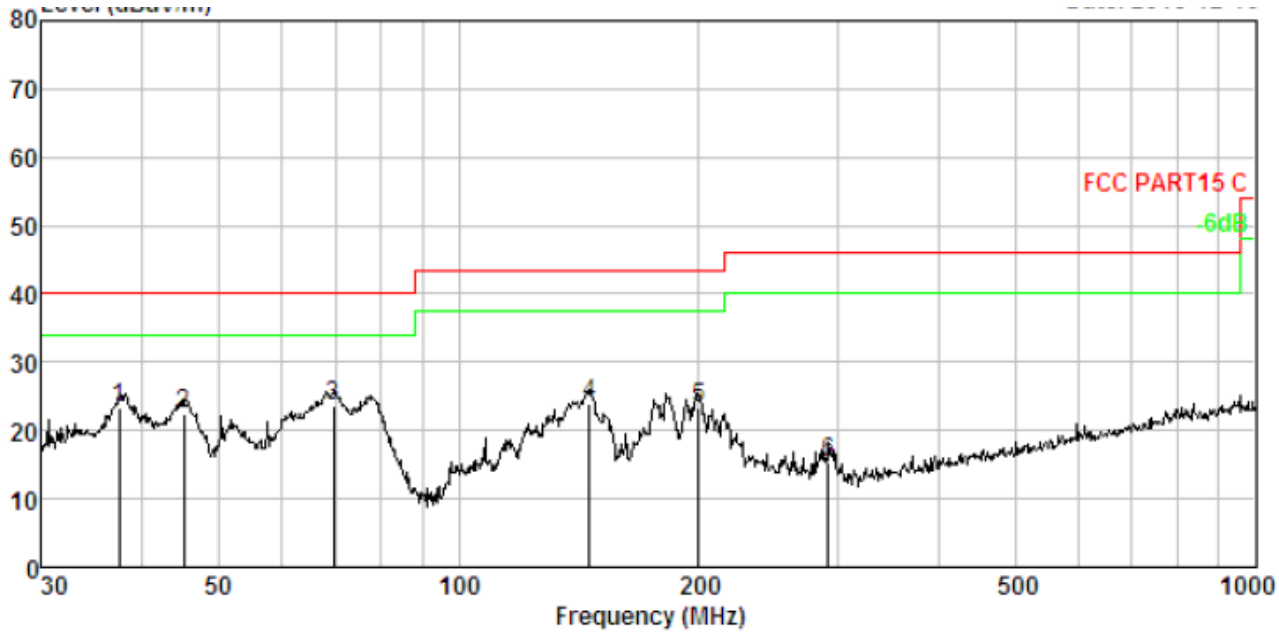
Antenna Polarization: Horizontal GFSK(CH00: 2402MHz)



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	28.65	30.17	12.05	40.00	-27.95	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:

BLE Mode

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	35.69	AV	V	30.58	4.92	35.87	35.32	54	-18.68
4804	36.15	AV	H	30.58	4.92	35.87	35.78	54	-18.22
4804	41.45	PK	V	30.58	4.92	35.87	41.08	74	-32.92
4804	46.22	PK	H	30.58	4.92	35.87	45.85	74	-28.15
7206	34.28	AV	V	30.76	4.98	35.04	34.98	54	-19.02
7206	35.02	AV	H	30.76	4.98	35.04	35.72	54	-18.28
7206	46.82	PK	V	30.76	4.98	35.04	47.52	74	-26.48
7206	48.12	PK	H	30.76	4.98	35.04	48.82	74	-25.18

Middle Channel (2442MHz)

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)
4884	36.21	AV	V	30.63	4.93	35.98	35.79	54	-18.21
4884	37.04	AV	H	30.63	4.93	35.98	36.62	54	-17.38
4884	42.15	PK	V	30.63	4.93	35.98	41.73	74	-32.27
4884	43.68	PK	H	30.63	4.93	35.98	43.26	74	-30.74
7326	35.22	AV	V	30.71	4.97	35.42	35.48	54	-18.52
7326	37.81	AV	H	30.71	4.97	35.42	38.07	54	-15.93
7326	44.29	PK	V	30.71	4.97	35.42	44.55	74	-29.45
7326	47.58	PK	H	30.71	4.97	35.42	47.84	74	-26.16

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	34.15	AV	V	31.22	5.10	36.51	33.96	54	-20.04
4960	35.29	AV	H	31.22	5.10	36.51	35.1	54	-18.9
4960	41.02	PK	V	31.22	5.10	36.51	40.83	74	-33.17
4960	42.16	PK	H	31.22	5.10	36.51	41.97	74	-32.03
7440	33.28	AV	V	31.53	5.22	35.16	34.87	54	-19.13
7440	34.35	AV	H	31.53	5.22	35.16	35.94	54	-18.06
7440	42.55	PK	V	31.53	5.22	35.16	44.14	74	-29.86
7440	43.69	PK	H	31.53	5.22	35.16	45.28	74	-28.72

BT 5.0 Mode

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	35.26	AV	V	30.55	4.95	36.05	34.71	54	-19.29
4804	36.47	AV	H	30.55	4.95	36.05	35.92	54	-18.08
4804	41.28	PK	V	30.55	4.95	36.05	40.73	74	-33.27
4804	43.66	PK	H	30.55	4.95	36.05	43.11	74	-30.89
7206	36.08	AV	V	30.78	4.98	35.92	35.92	54	-18.08
7206	38.41	AV	H	30.78	4.98	35.92	38.25	54	-15.75
7206	44.29	PK	V	30.78	4.98	35.92	44.13	74	-29.87
7206	45.12	PK	H	30.78	4.98	35.92	44.96	74	-29.04

Middle Channel (2442MHz)

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)
4884	36.15	AV	V	30.66	4.94	35.86	35.89	54	-18.11
4884	37.05	AV	H	30.66	4.94	35.86	36.79	54	-17.21
4884	43.15	PK	V	30.66	4.94	35.86	42.89	74	-31.11
4884	47.21	PK	H	30.66	4.94	35.86	46.95	74	-27.05
7326	37.21	AV	V	30.79	4.51	35.51	37	54	-17
7326	38.04	AV	H	30.79	4.51	35.51	37.83	54	-16.17
7326	45.92	PK	V	30.79	4.51	35.51	45.71	74	-28.29
7326	46.35	PK	H	30.79	4.51	35.51	46.14	74	-27.86

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	37.15	AV	V	30.69	4.82	36.04	36.62	54	-17.38
4960	38.06	AV	H	30.69	4.82	36.04	37.53	54	-16.47
4960	44.22	PK	V	30.69	4.82	36.04	43.69	74	-30.31
4960	46.91	PK	H	30.69	4.82	36.04	46.38	74	-27.62
7440	38.42	AV	V	30.84	4.91	35.87	38.3	54	-15.7
7440	39.06	AV	H	30.84	4.91	35.87	38.94	54	-15.06
7440	46.38	PK	V	30.84	4.91	35.87	46.26	74	-27.74
7440	47.11	PK	H	30.84	4.91	35.87	46.99	74	-27.01

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

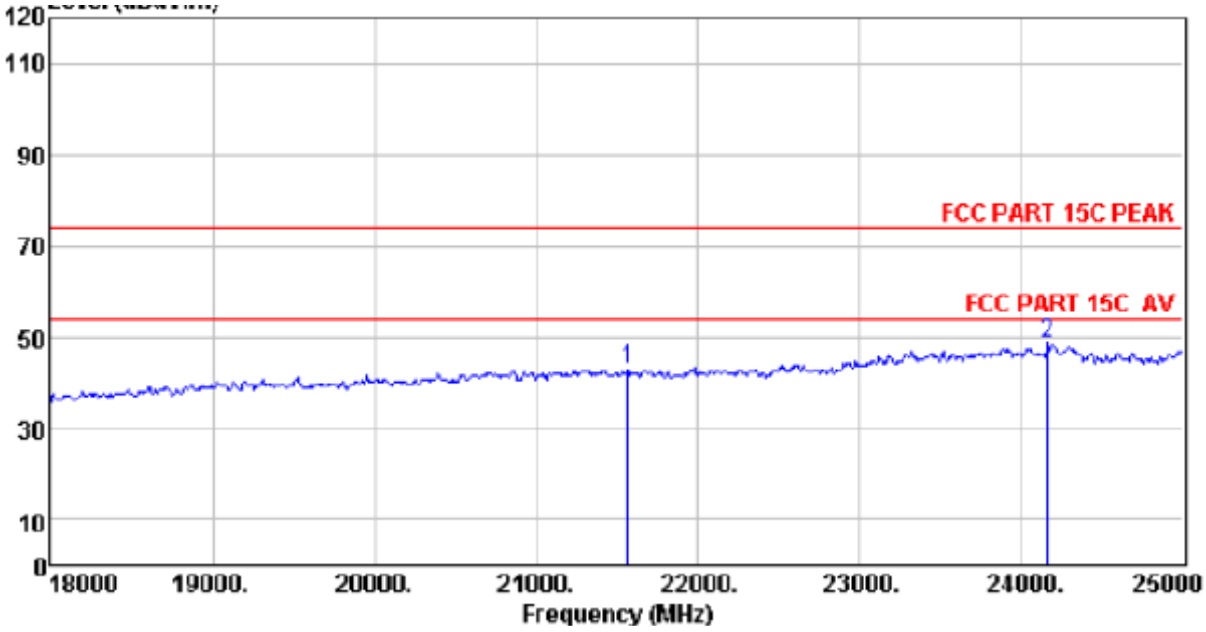
2. All other emissions more than 30dB below the limit.

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

Test Frequency: From 18GHz to 25GHz

Worst Test mode: GFSK (2402MHz)

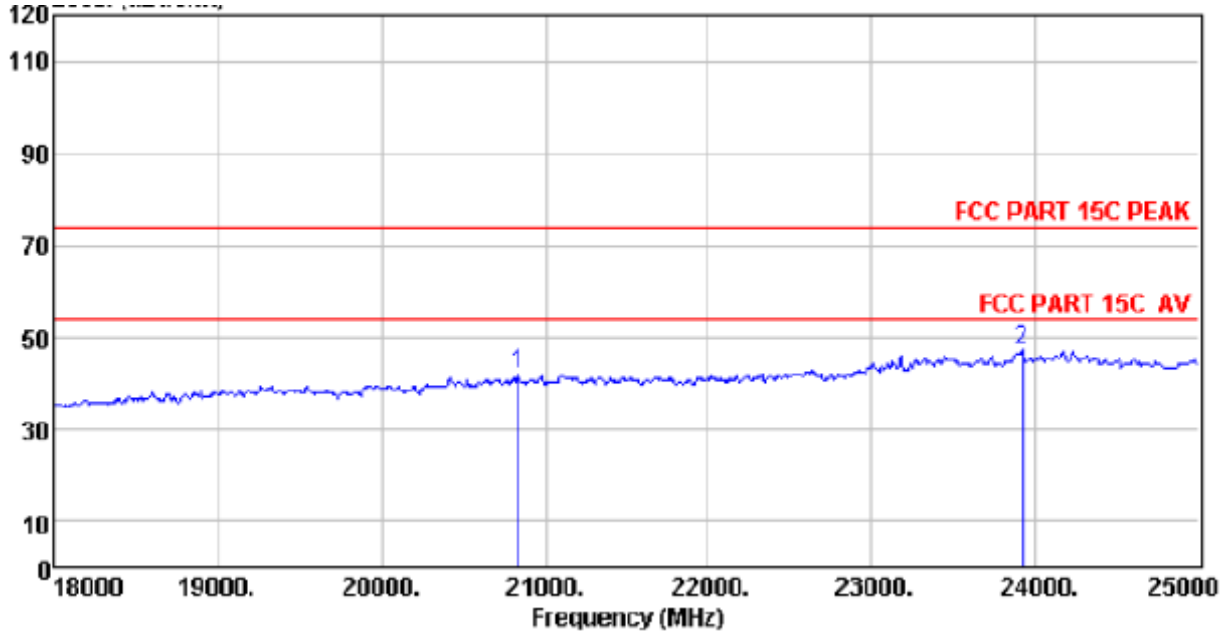
Vertical:



	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	21570.00	45.96	20.38	11.95	43.01	74.00	30.99	Peak
2	24160.00	45.63	22.13	14.02	48.75	74.00	25.25	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	20835.00	46.20	20.06	11.69	41.99	74.00	32.01	Peak
2	23915.00	45.62	21.97	12.71	47.42	74.00	26.58	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)).

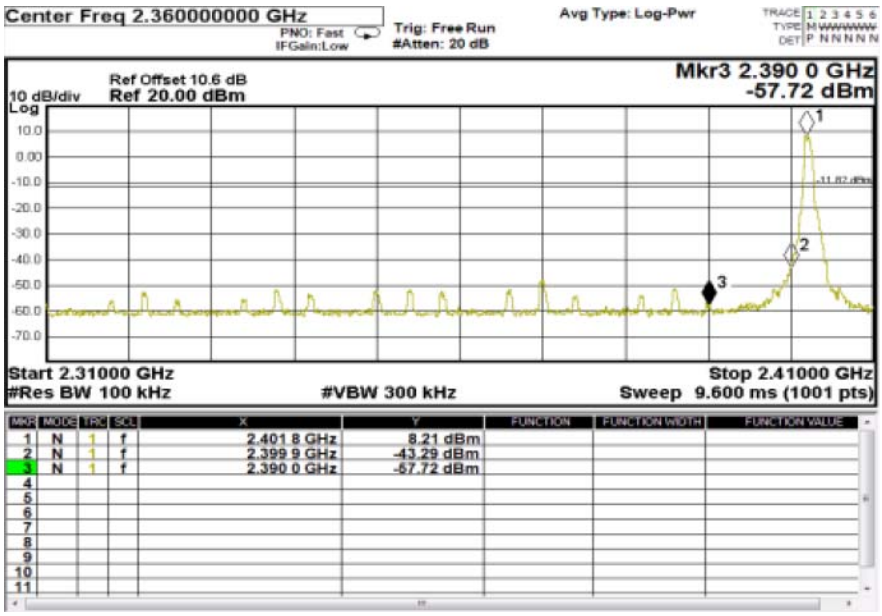
7.1 Test Procedure

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

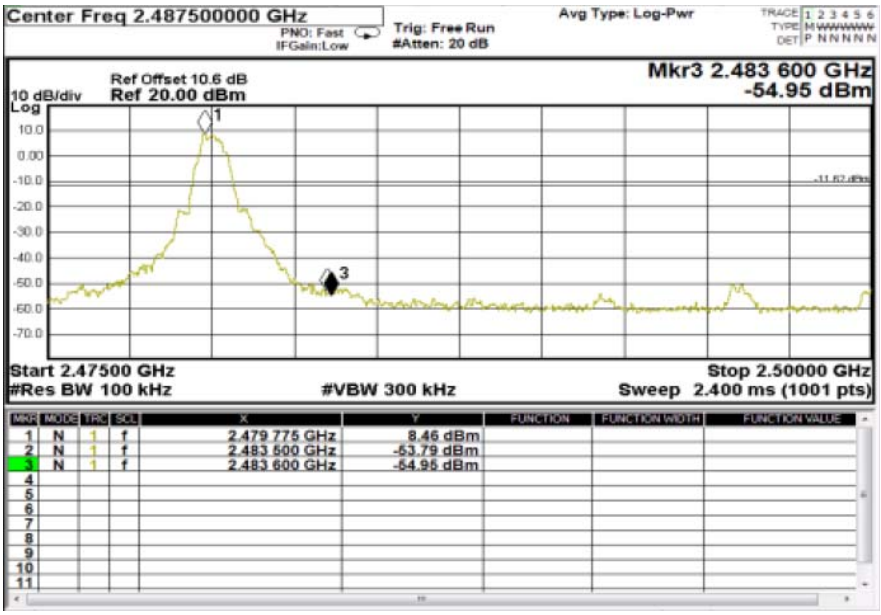
7.2 Test Result

BLE Mode:

Band Edges Test Data CH-Low

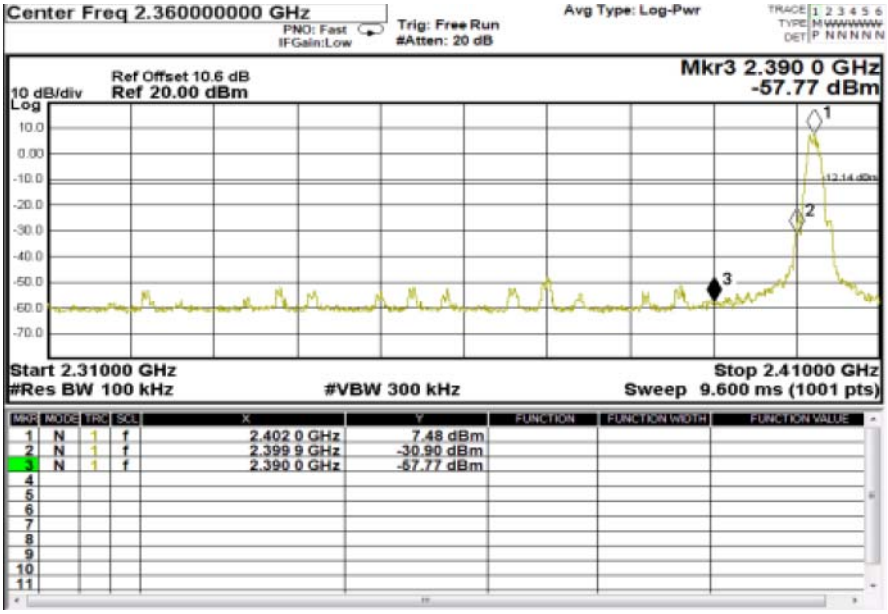


Band Edges Test Data CH-High

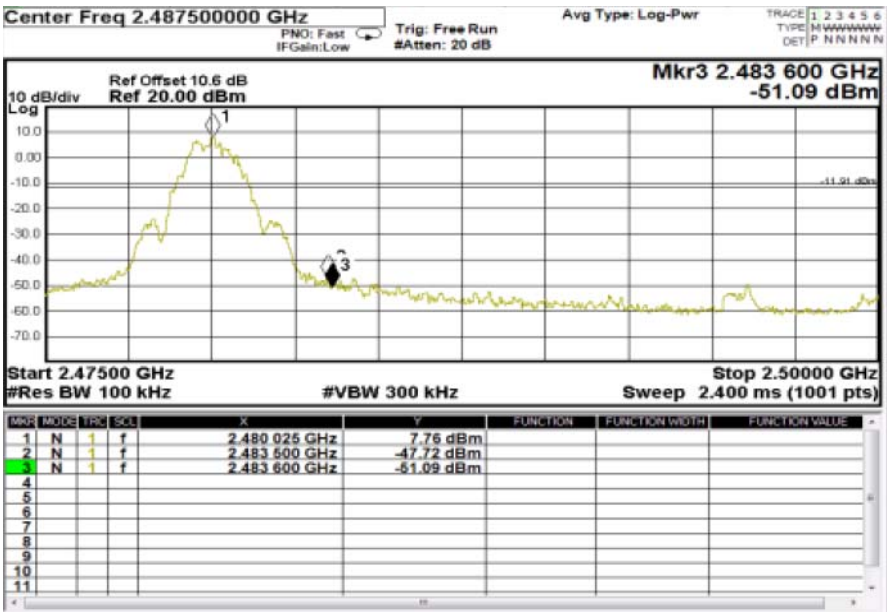


BT 5.0 Mode

Band Edges Test Data CH-Low



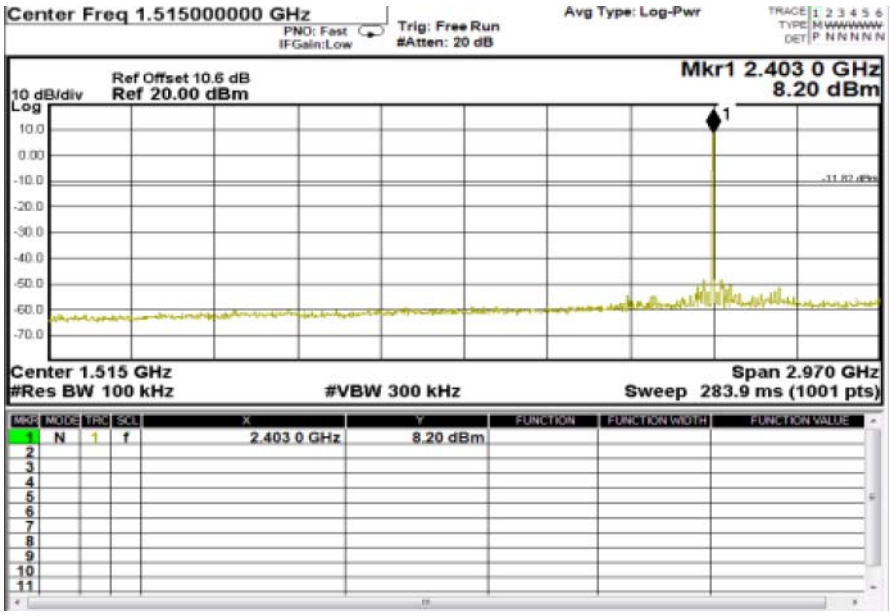
Band Edges Test Data CH-High



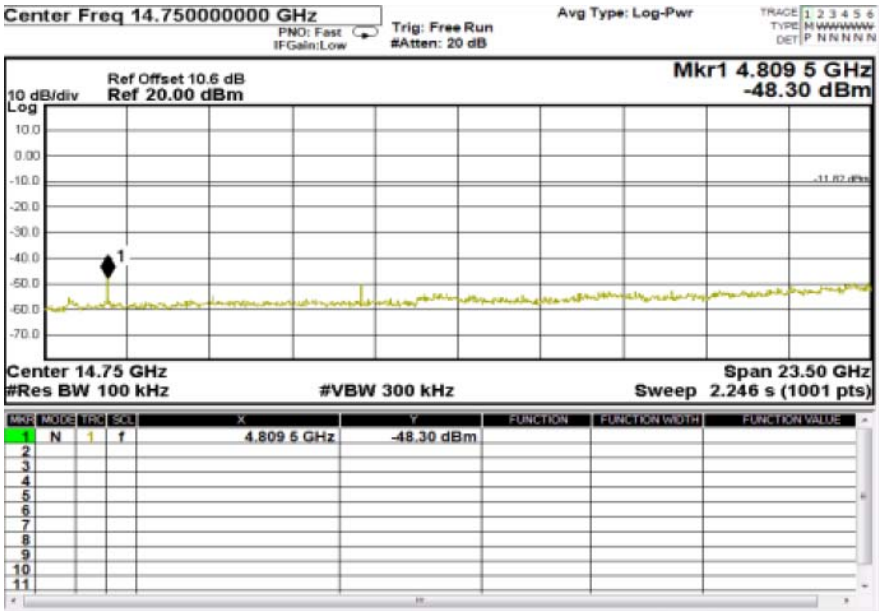
Conducted Spurious Emission Measurement Result

BLE Mode:

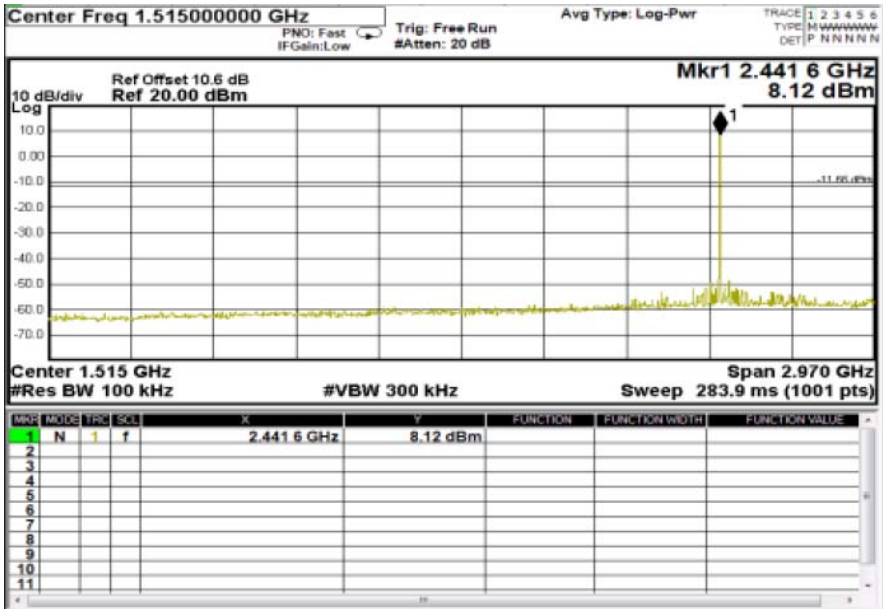
CH-Low 30MHz-3GHz



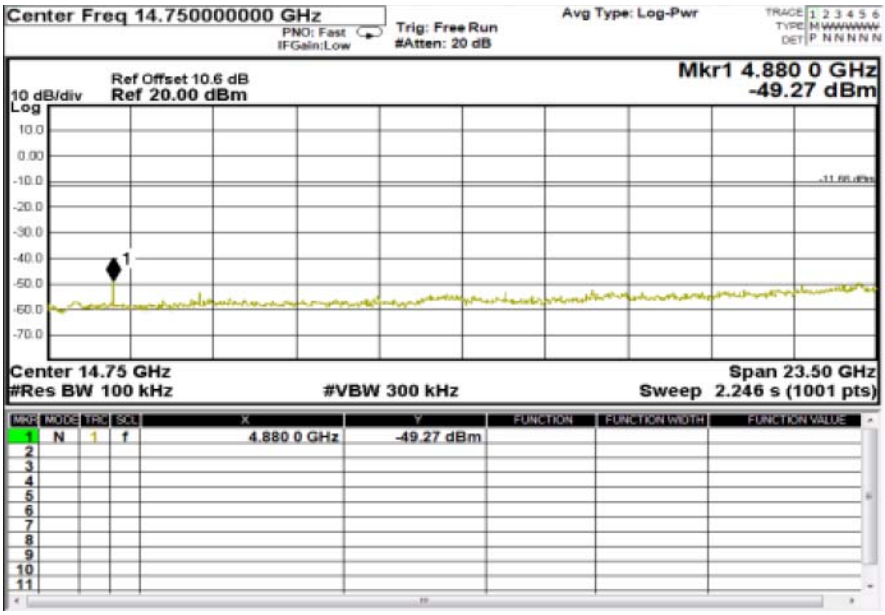
CH-Low 3GHz-26.5GHz



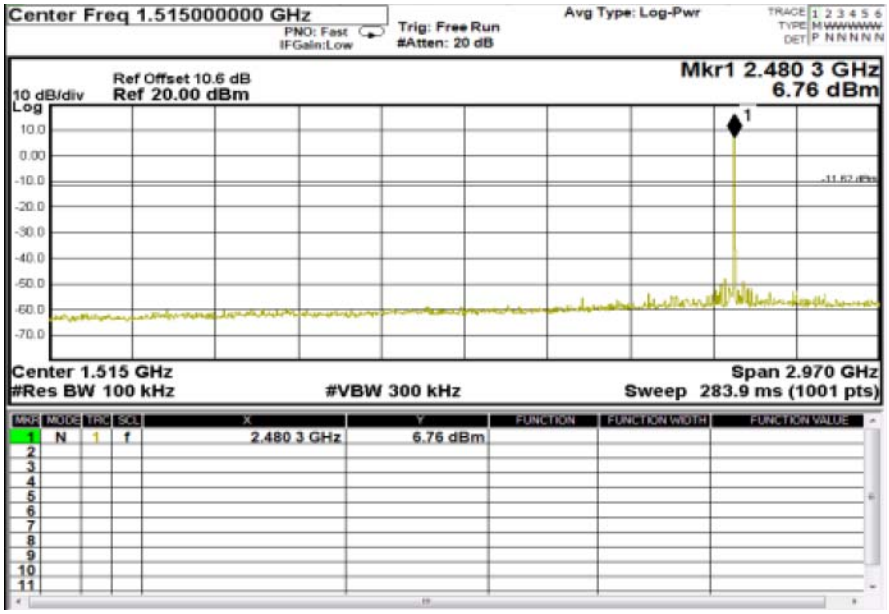
CH-Mid 30MHz-3GHz



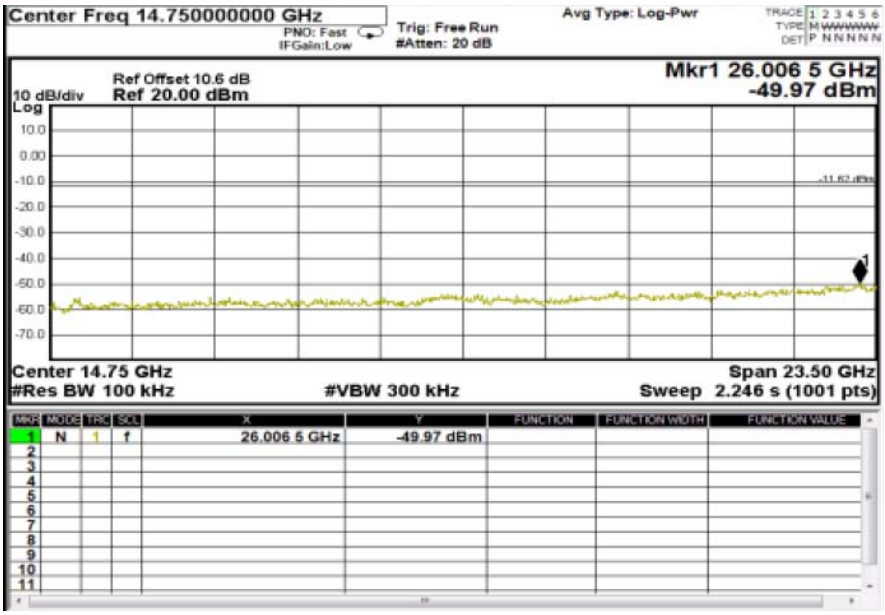
CH-Mid3GHz-26.5GHz



CH-High30MHz-3GHz

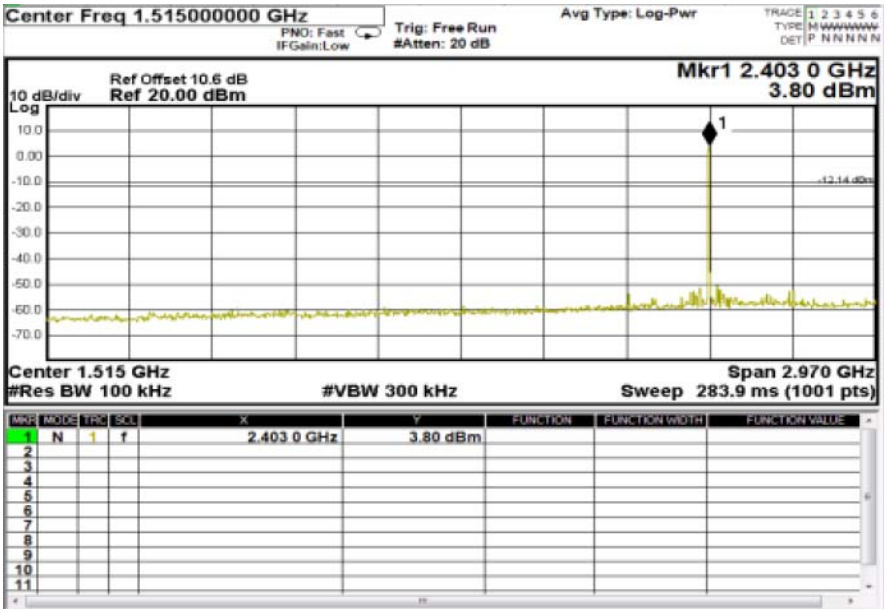


CH-High3GHz-26.5GHz

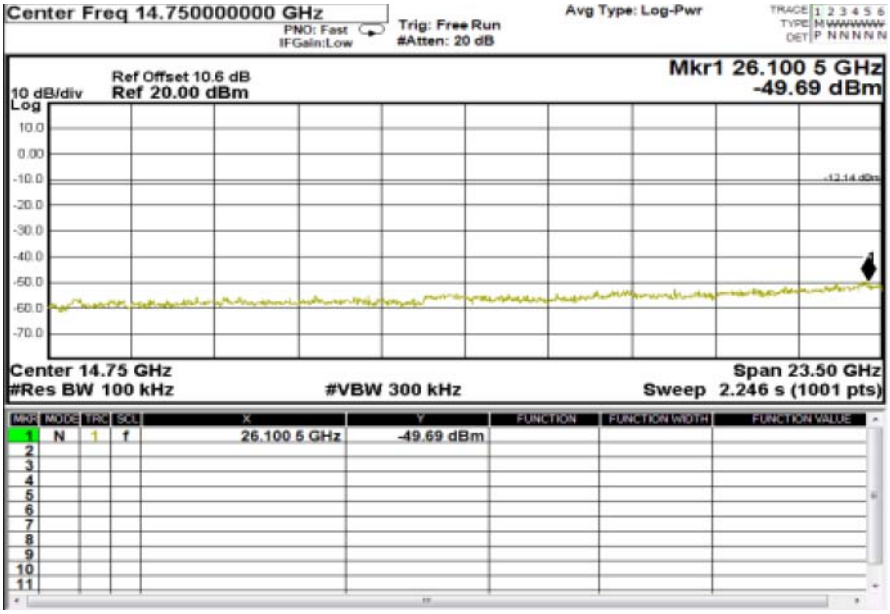


BT 5.0 Mode

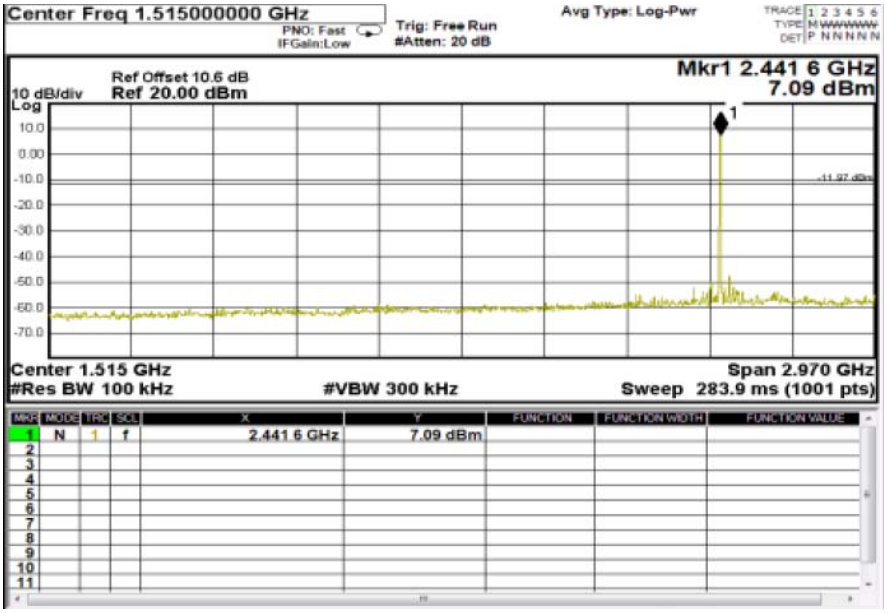
CH-Low 30MHz-3GHz



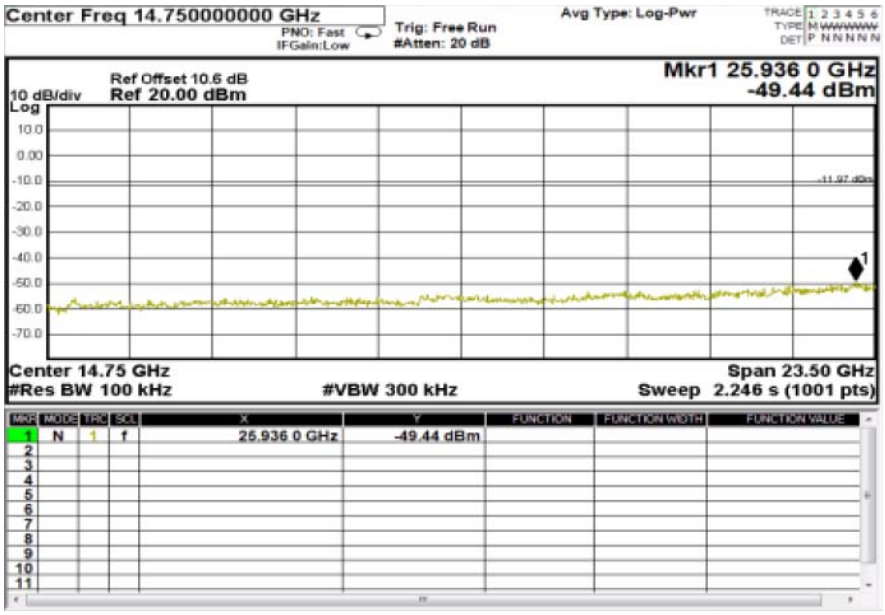
CH-Low 3GHz-26.5GHz



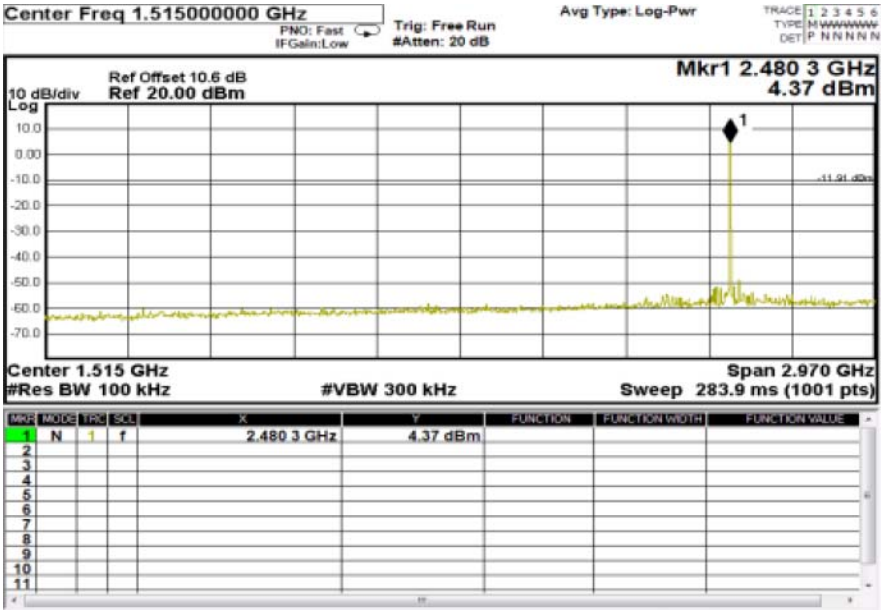
CH-Mid 30MHz-3GHz



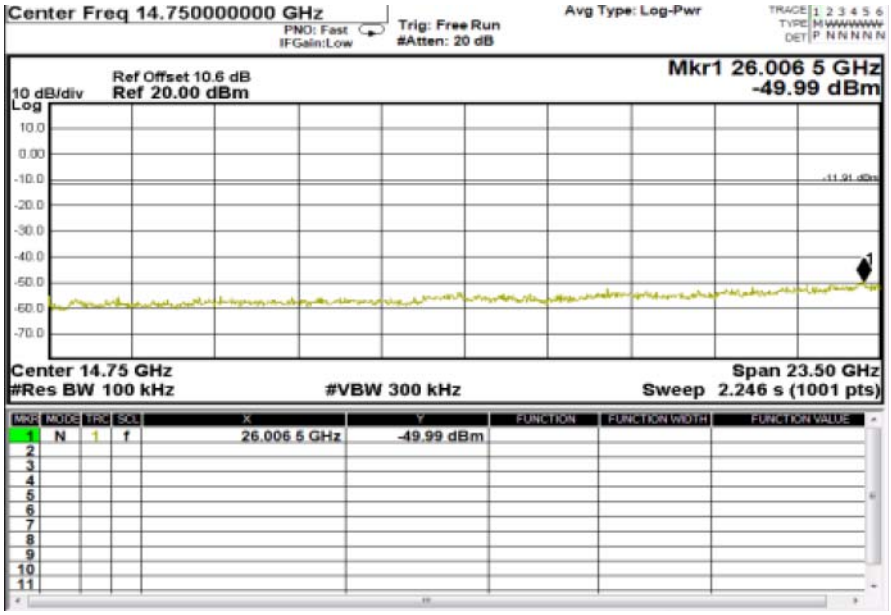
CH-Mid3GHz-26.5GHz



CH-High30MHz-3GHz



CH-High3GHz-26.5GHz



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

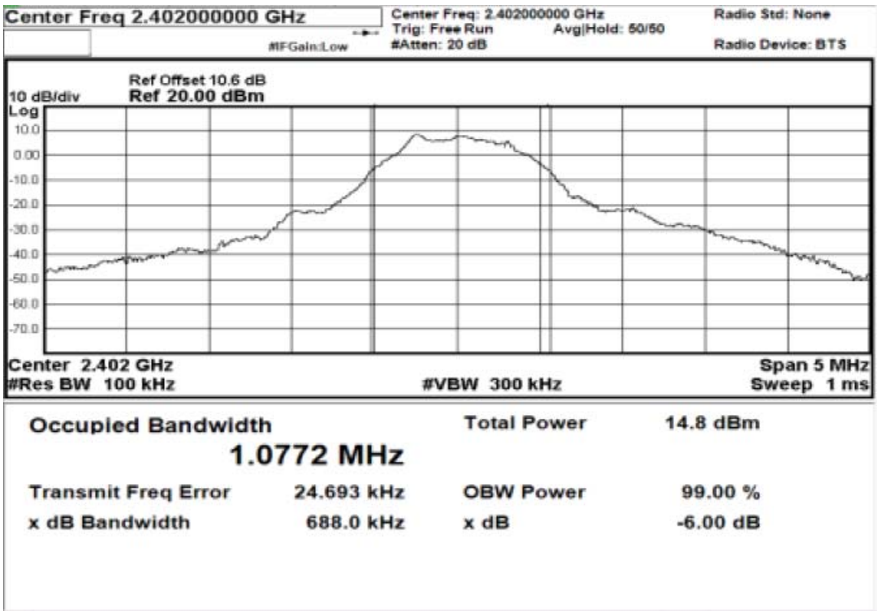
BLE Mode

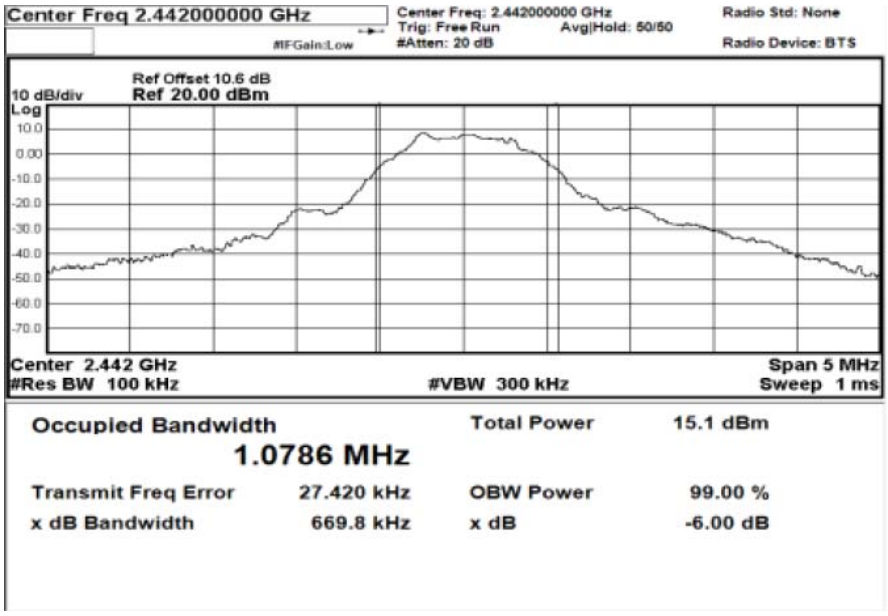
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)
2402	688	>500
2440	670	>500
2480	721	>500

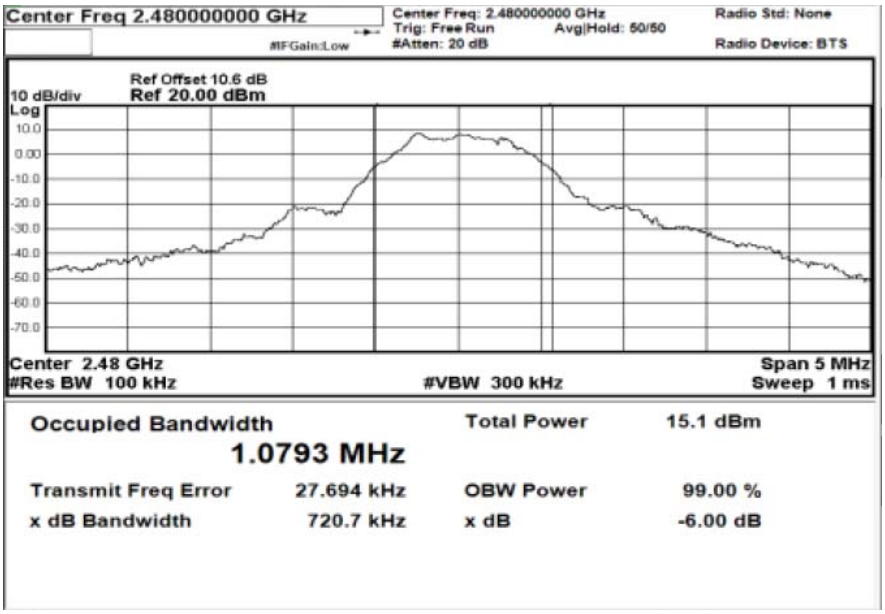
BT5.0 Mode

Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)
2402	1191	>500
2440	1197	>500
2480	1200	>500

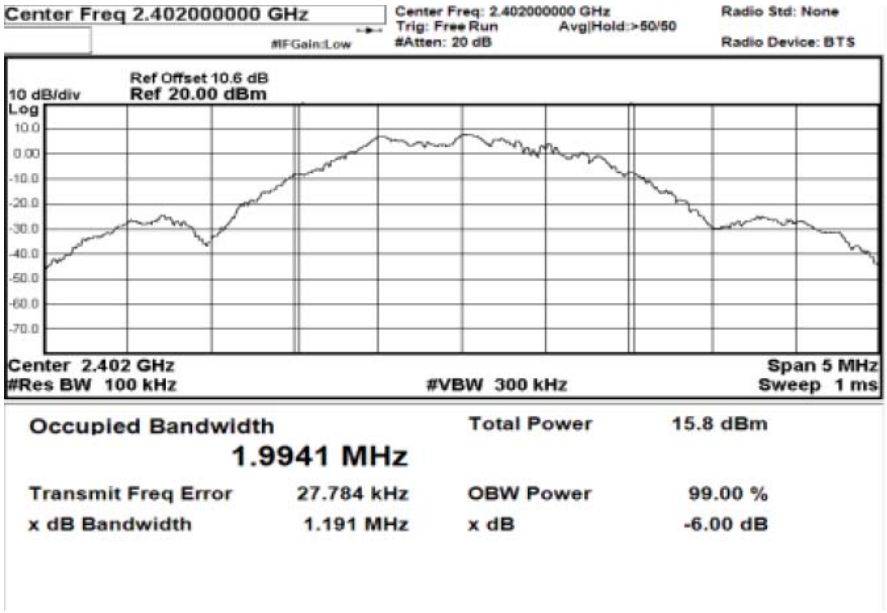
BLE Mod

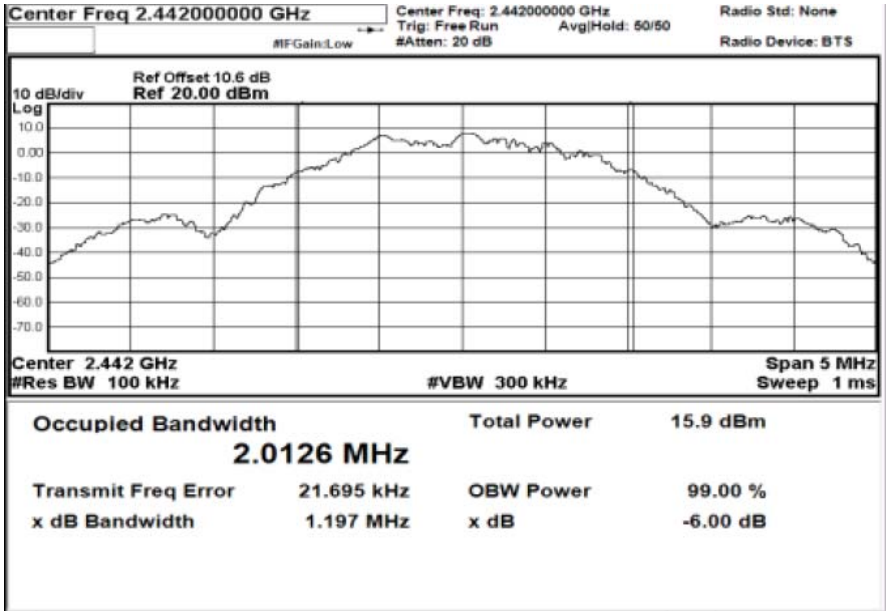

Center Freq 2.402000000 GHz
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold: 50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.402 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
1.0772 MHz
Total Power 14.8 dBm
Transmit Freq Error 24.693 kHz
OBW Power 99.00 %
x dB Bandwidth 688.0 kHz
x dB -6.00 dB

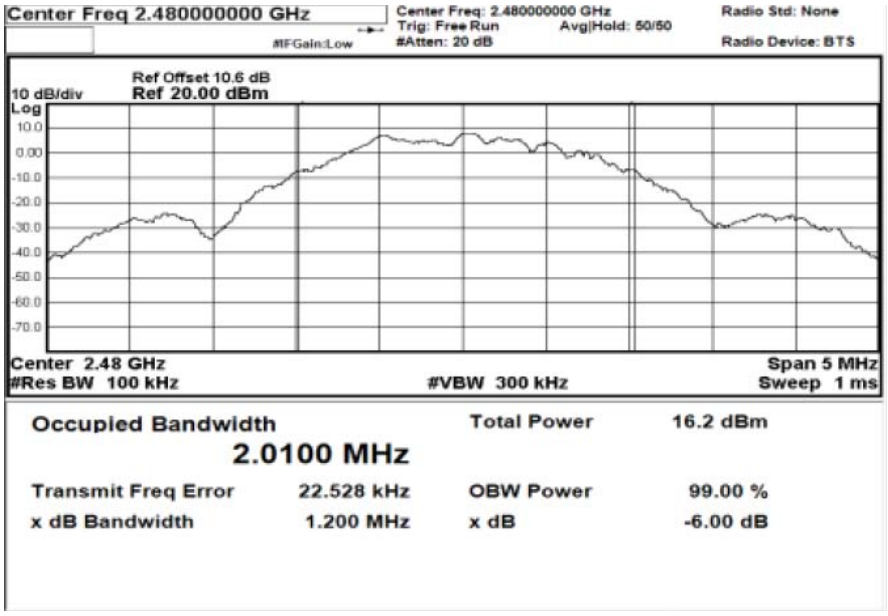

Center Freq 2.442000000 GHz
Center Freq: 2.442000000 GHz
Trig: Free Run
Avg|Hold: 50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.442 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
1.0786 MHz
Total Power 15.1 dBm
Transmit Freq Error 27.420 kHz
OBW Power 99.00 %
x dB Bandwidth 669.8 kHz
x dB -6.00 dB


Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
1.0793 MHz
Total Power 15.1 dBm
Transmit Freq Error 27.694 kHz
OBW Power 99.00 %
x dB Bandwidth 720.7 kHz
x dB -6.00 dB

BT 5.0 Mode


Center Freq 2.402000000 GHz
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.402 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
1.9941 MHz
Total Power 15.8 dBm
Transmit Freq Error 27.784 kHz
OBW Power 99.00 %
x dB Bandwidth 1.191 MHz
x dB -6.00 dB

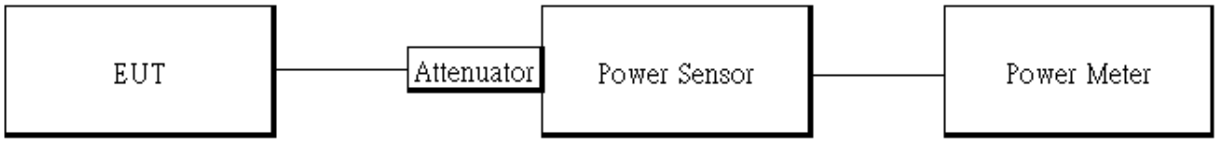

Center Freq 2.442000000 GHz
Center Freq: 2.442000000 GHz
Trig: Free Run
Avg|Hold: 50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.442 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
2.0126 MHz
Total Power 15.9 dBm
Transmit Freq Error 21.695 kHz
OBW Power 99.00 %
x dB Bandwidth 1.197 MHz
x dB -6.00 dB


Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 50/50
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 5 MHz
Sweep 1 ms
Occupied Bandwidth
2.0100 MHz
Total Power 16.2 dBm
Transmit Freq Error 22.528 kHz
OBW Power 99.00 %
x dB Bandwidth 1.200 MHz
x dB -6.00 dB

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 Setup



9.2 Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to th power meter.
4. Record the max. Reading as observed from Power Meter.
5. Repeat above procedures until all test default channel measured was complete.

9.3 Test Result

BLE Mode:

Frequency (MHz)	Peak Power Output (dBm)	Limit(dBm)
2402	7.79	30
2442	7.92	30
2480	8.03	30

BT5.0 Mode:

Frequency (MHz)	Peak Power Output (dBm)	Limit(dBm)
2402	7.93	30
2442	8.09	30
2480	8.19	30

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

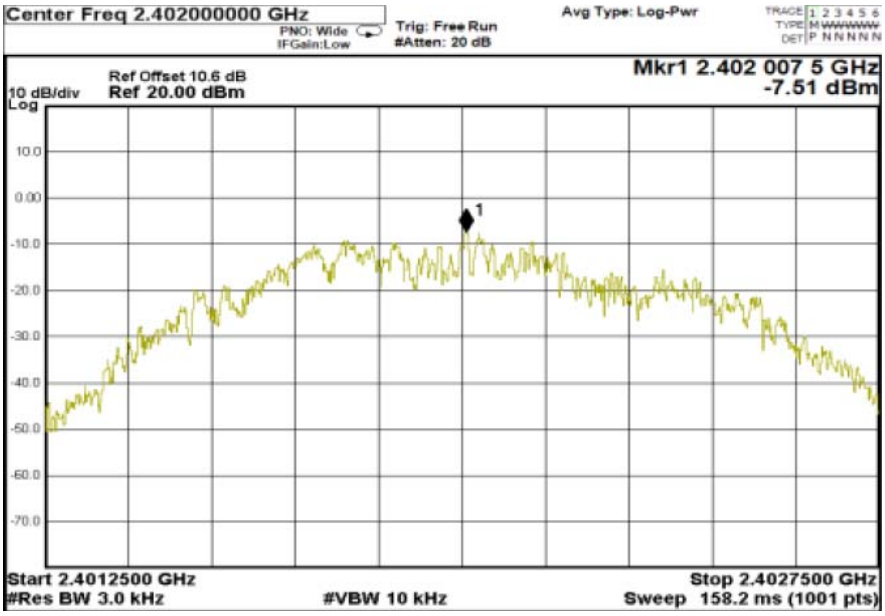
BLE Mode

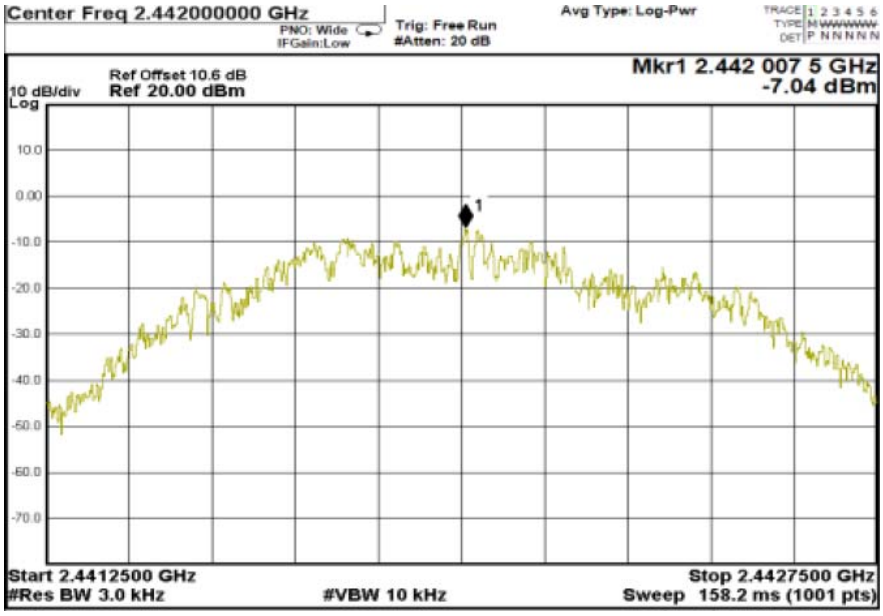
Channel frequency (MHz)	Measurement level (dBm)	Required Limit (dBm/3kHz)	Pass/Fail
	PSD/3kHz		
2402	-7.51	8	PASS
2442	-7.04	8	PASS
2480	-7.21	8	PASS

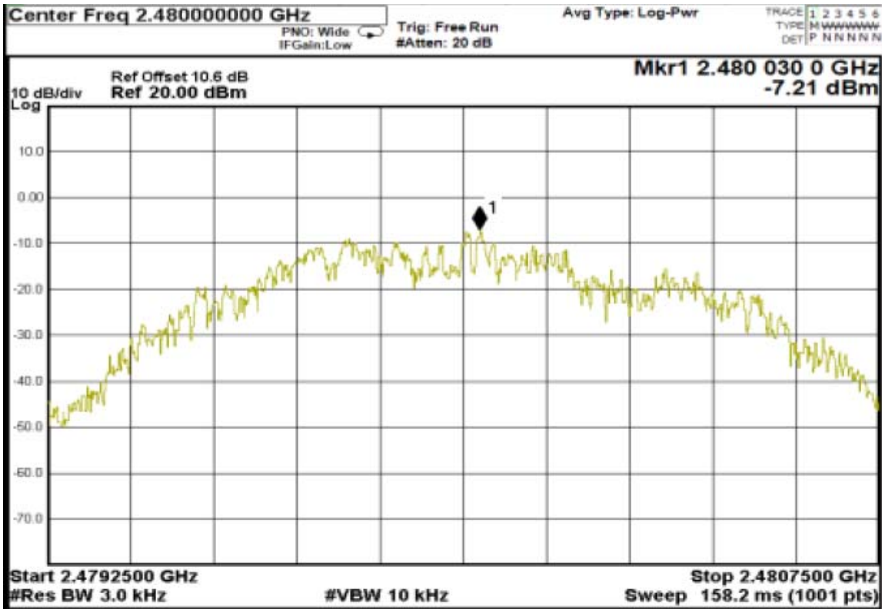
BT 5.0 Mode

Channel frequency (MHz)	Measurement level (dBm)	Required Limit (dBm/3kHz)	Pass/Fail
	PSD/3kHz		
2402	-11.31	8	PASS
2442	-9.98	8	PASS
2480	-10.60	8	PASS

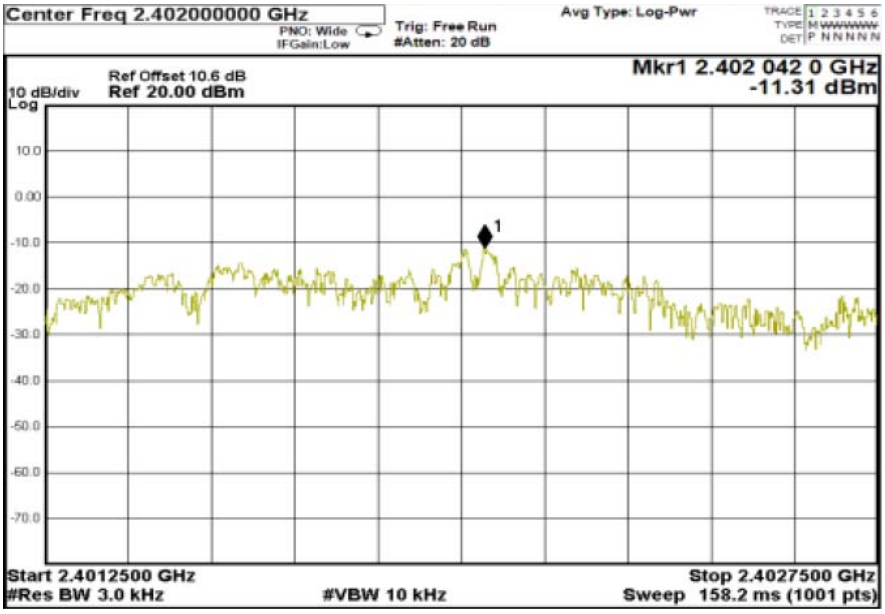
BLE Mode

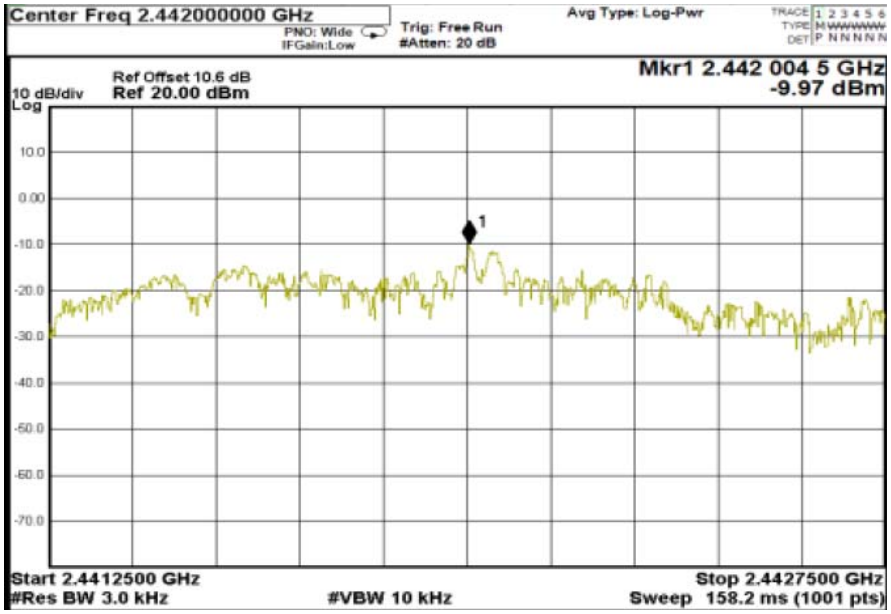

Center Freq 2.402000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.402 007 5 GHz
-7.51 dBm
Start 2.4012500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4027500 GHz
Sweep 158.2 ms (1001 pts)

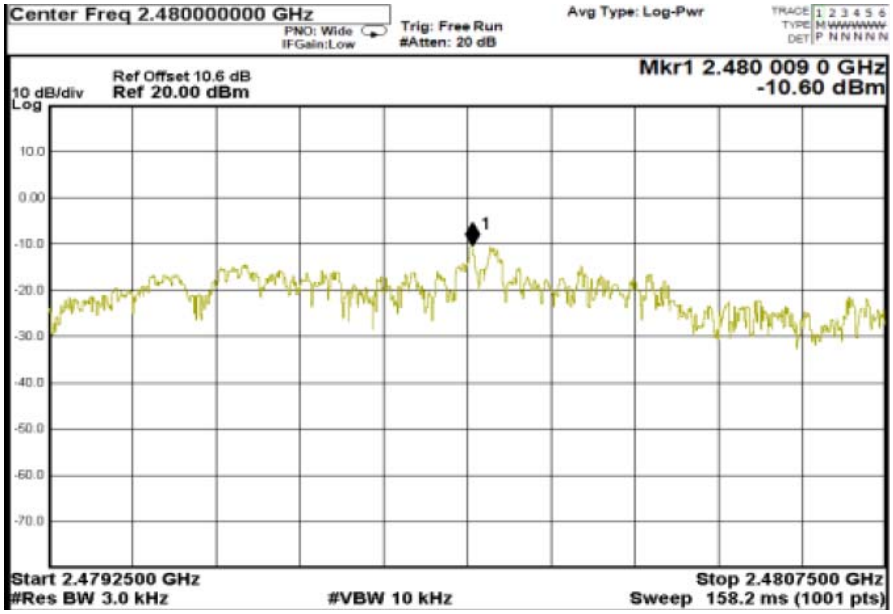

Center Freq 2.442000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.442 007 5 GHz
-7.04 dBm
Start 2.4412500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4427500 GHz
Sweep 158.2 ms (1001 pts)


Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.480 030 0 GHz
-7.21 dBm
Start 2.4792500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4807500 GHz
Sweep 158.2 ms (1001 pts)

BT 5.0 Mode


Center Freq 2.402000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.402 042 0 GHz
-11.31 dBm
Start 2.4012500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4027500 GHz
Sweep 158.2 ms (1001 pts)


Center Freq 2.442000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.442 004 5 GHz
-9.97 dBm
Start 2.4412500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4427500 GHz
Sweep 158.2 ms (1001 pts)


Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 10.6 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.480 009 0 GHz
-10.60 dBm
Start 2.4792500 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Stop 2.4807500 GHz
Sweep 158.2 ms (1001 pts)

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.

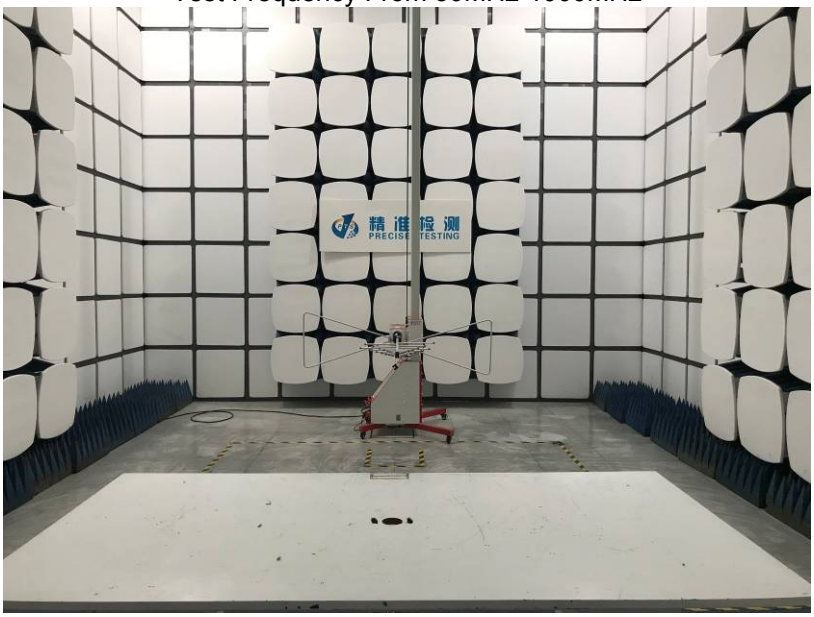
11.2 Result

The EUT'S antenna, permanent attached antenna, is internal antenna. The antenna's gain is -0.68dBi and meets the requirement.

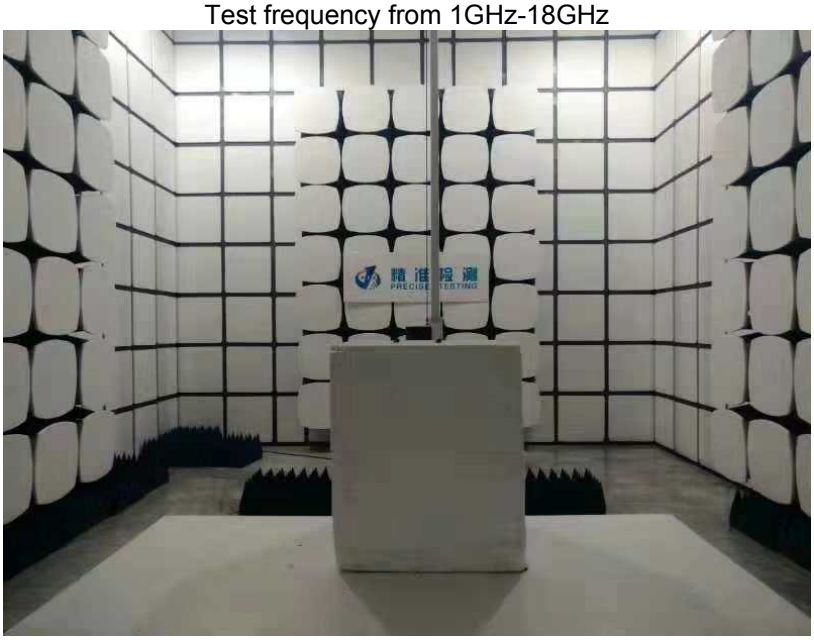
12 Test Setup

Conducted Emission

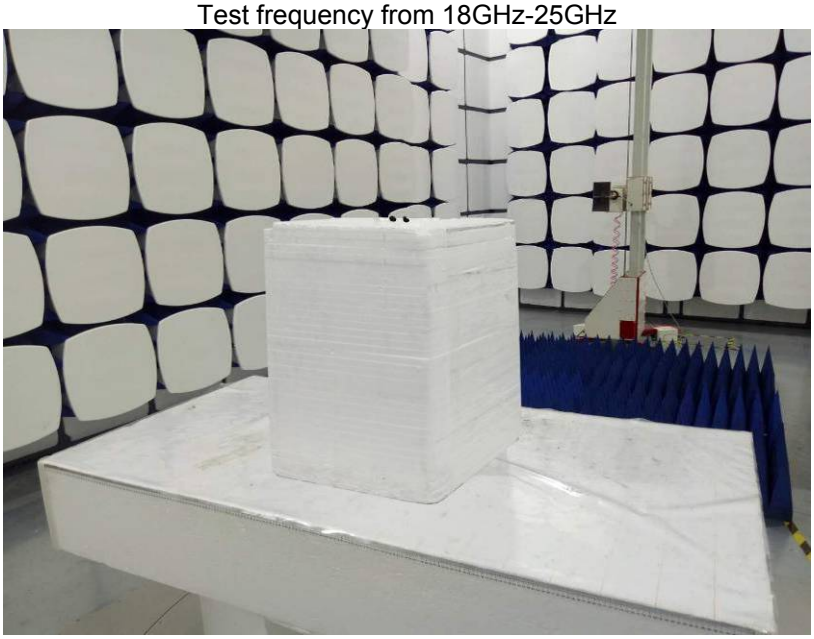
Radiated Spurious Emissions
Test Frequency From 30MHz-1000MHz



Test frequency from 1GHz-18GHz

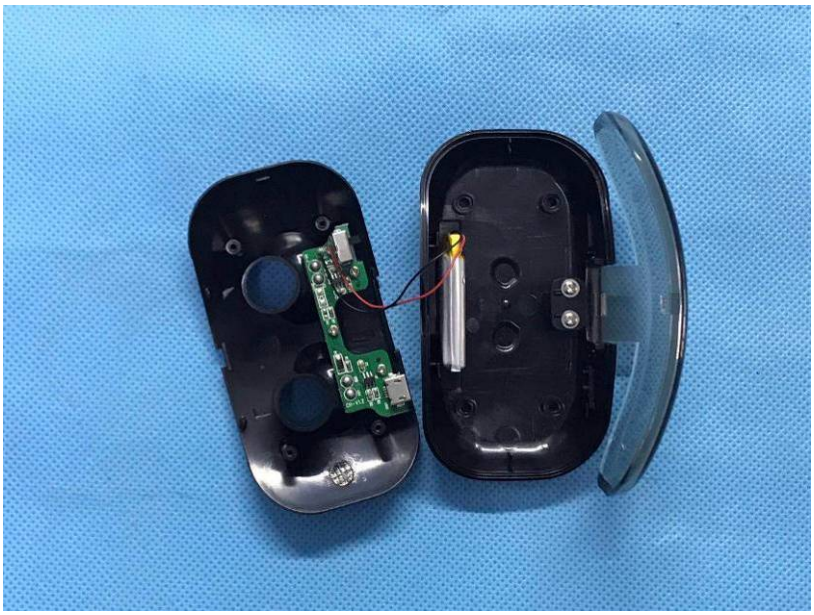


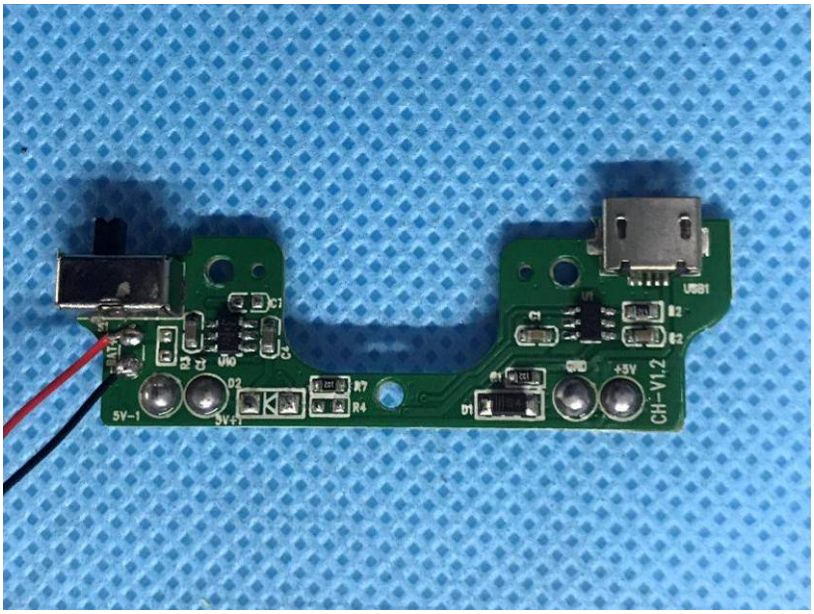
Test frequency from 18GHz-25GHz

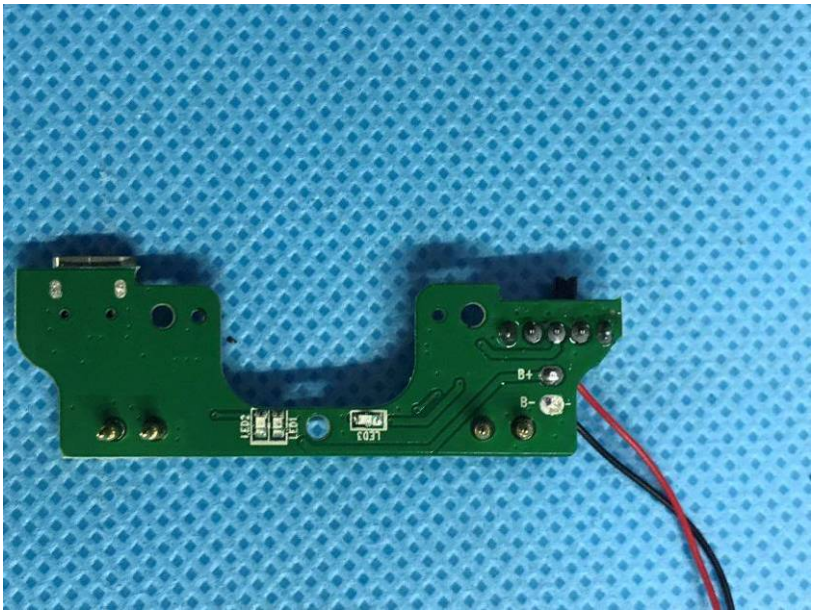


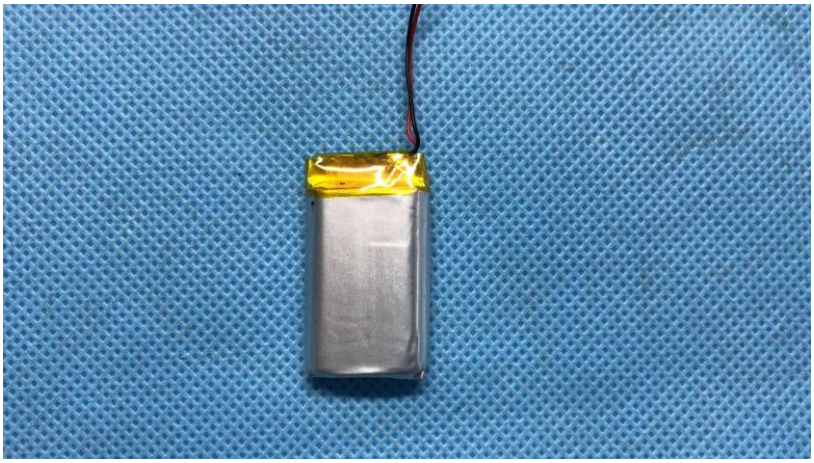
13 EUT Photos

OFF ON

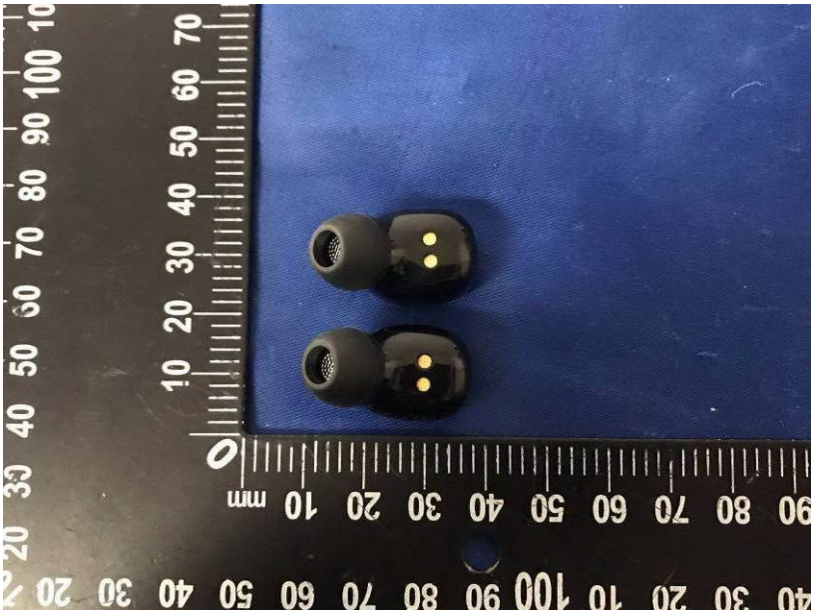


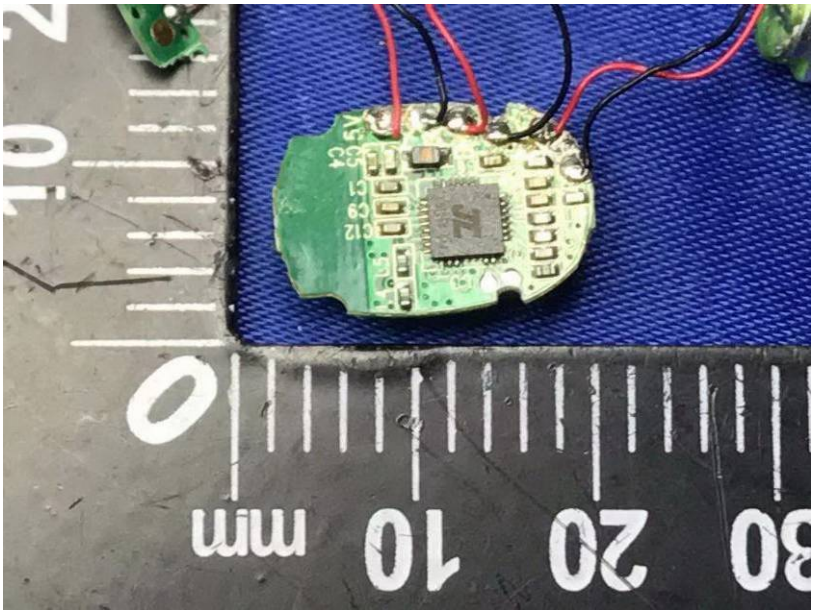

CH-V1.2
+5V
5V-1
5V+1

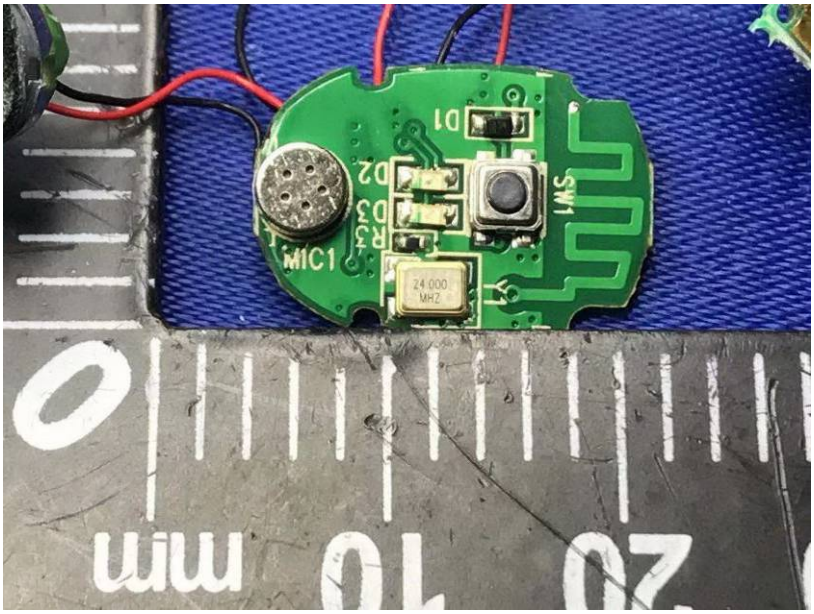

B+
B-

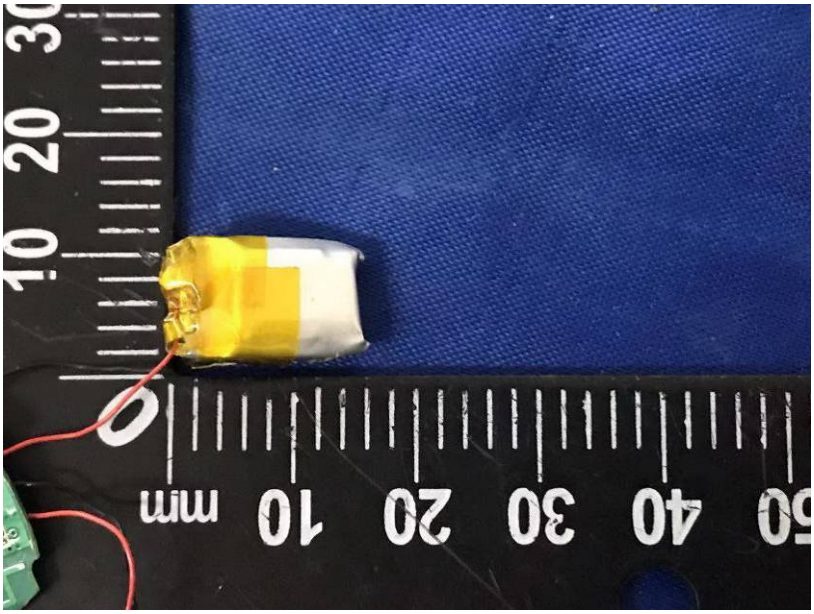


0
10
20
30
40
50
60
mm
10
20
30
40
50
60
70
80









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