PRECISE TESTING

FCC TEST REPORT

FCC ID: 2AQJQLN0710

Product Name	:	LED Flood lights
Model Name	:	99A50-BSO, 98A06-BSO, 98A05-BSO, 98A05-BS3, 99A20-BOO, 99A50-BSOT, 98A06-BSOT, 98A05-BSOT, 98A05-BS3T, 99A20-BOOT
Brand Name	:	N/A
Report No.	:	PTC18053101301E-FC01

Prepared for

CIXI LEONLUX TECHNOLOGY CO .,LTD

NO.36, Xujia, Yiyuan Village, Zonghan Street, Cixi, China

Prepared by

Dongguan Precise Testing & Certification Corp., Ltd.

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

1TEST RESULT CERTIFICATION

Applicant's name	:	CIXI LEONLUX TECHNOLOGY CO .,LTD
Address	:	NO.36, Xujia, Yiyuan Village, Zonghan Street, Cixi, China
Manufacture's name	:	CIXI LEONLUX TECHNOLOGY CO .,LTD
Address	:	NO.36, Xujia, Yiyuan Village, Zonghan Street, Cixi, China
Product name	:	LED Flood lights
Model name	:	99A50-BSO, 98A06-BSO, 98A05-BSO, 98A05-BS3, 99A20-BOO, 99A50-BSOT, 98A06-BSOT, 98A05-BSOT, 98A05-BS3T, 99A20-BOOT
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	June 25, 2018 to July 07, 2018
Date of Issue	:	July 07, 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
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	PASS

3 TEST FACILITY

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)

4 General Information

4.1 General Description of E.U.T.

Product Name	:	LED Flood lights
Model Name	:	99A50-BSO, 98A06-BSO, 98A05-BSO, 98A05-BS3, 99A20-BOO, 99A50-BSOT, 98A06-BSOT, 98A05-BSOT, 98A05-BS3T, 99A20-BOOT (Note: The samples are the same except LED qualities and plugs. So 99A50-BSO was selected for full tested.)
Bluetooth Version	:	BT 4.2+EDR
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	79 channels
Antenna Type	:	Internal PCB Antenna
Antenna Gain	:	0.7 dBi
Type of Modulation	:	GFSK, Π/4-DQPSK, 8DPSK
Power supply	:	AC 120V/60Hz
Hardware Version	:	V1.0
Software Version	:	V1.0

4.2 Test Mode

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 harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, Π/4-DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

Channel	**Frequency(MHz)**
0	2402
39	2441
78	2480

5 Equipment During Test

5.1 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
Antenna Connector	Florida RF Labs	N/A	RF01#	N/A	Aug. 26, 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

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

5.2 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%	

5.3 Description of Support Units

Equipment	Model No.	Series No.
N/A	N/A	N/A

6 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
Detector:	:	Peak for pre-scan (9kHz Resolution Bandwidth)

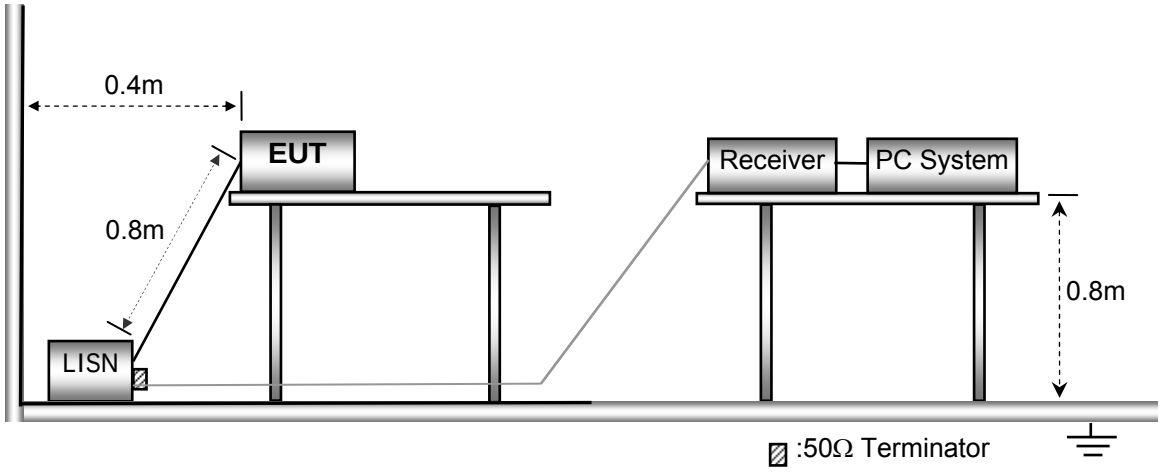
6.1 E.U.T. Operation

Operating Environment **:**

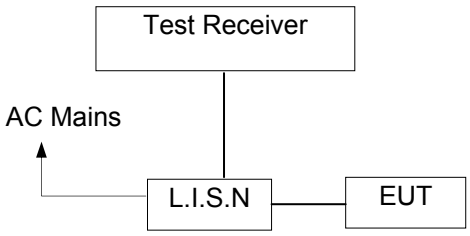
Temperature:	:	25.5 °C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.2kPa
Test Voltage	:	AC 120V/60Hz

6.2 EUT Setup

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



6.3 Test SET-UP (Block Diagram of Configuration)



6.4 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.

6.5 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.

6.6 Measurement Description

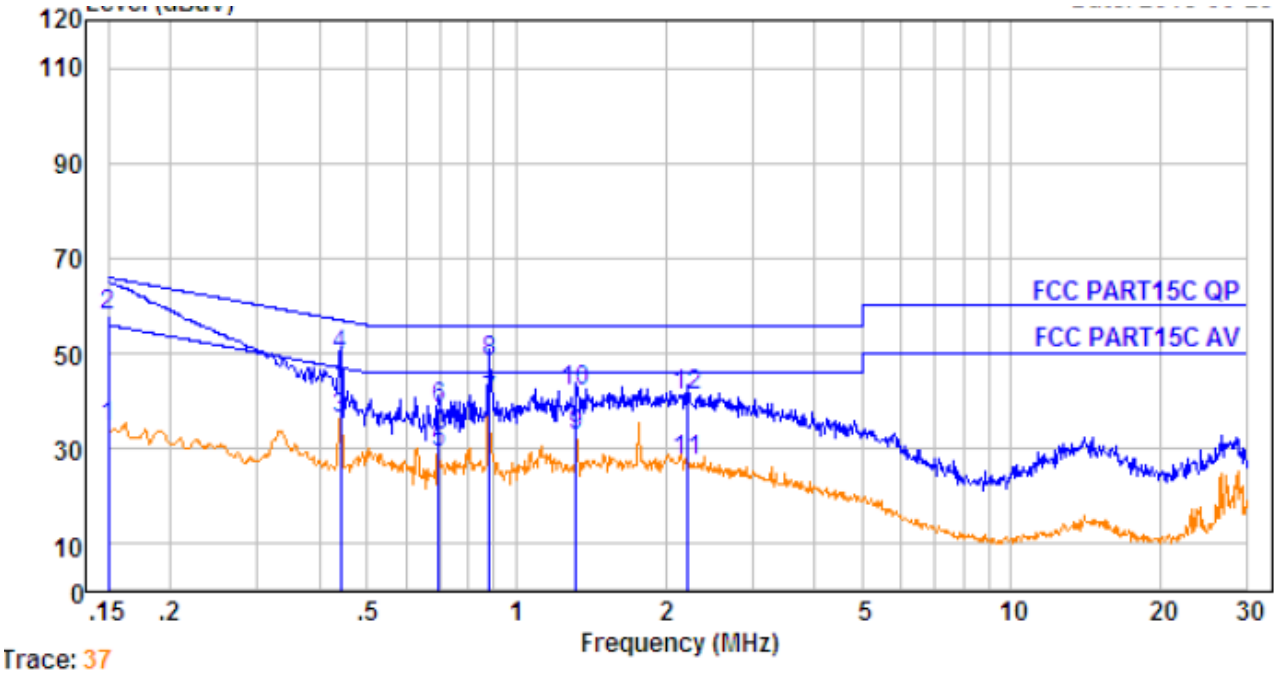
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

Pass.

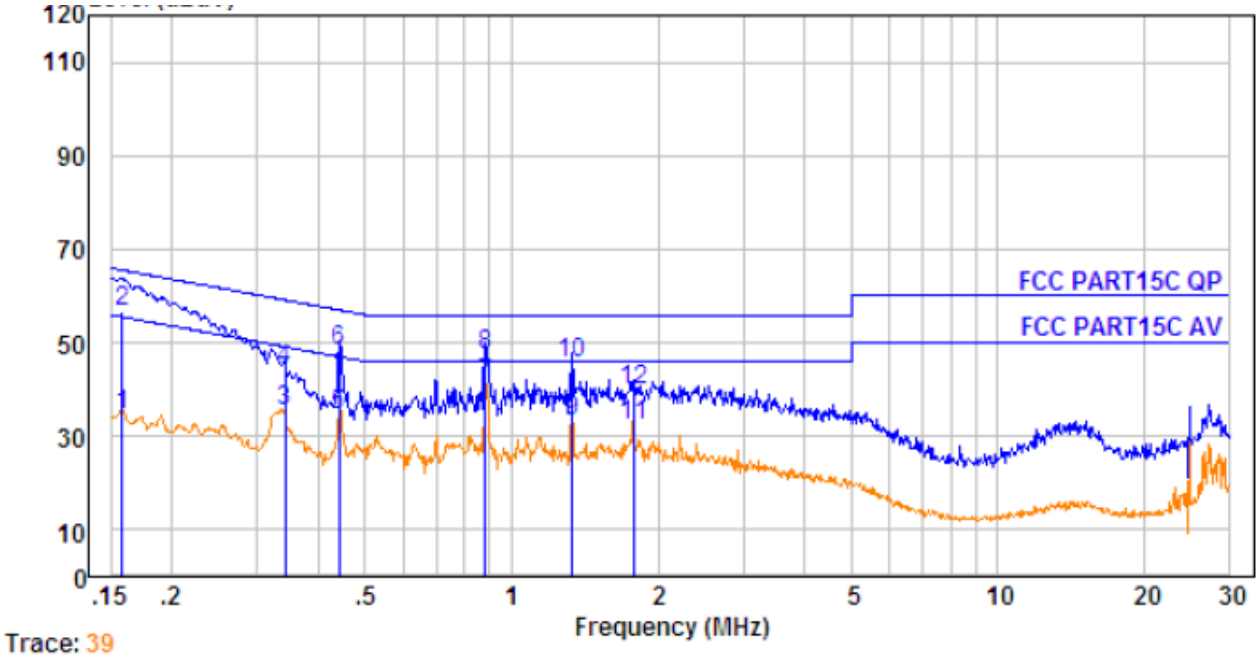
All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Line -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	9.50	24.99	34.70	56.00	-21.30	Average
2.	0.150	0.21	9.50	48.39	58.10	66.00	-7.90	QP
3.	0.442	0.42	9.75	26.08	36.25	47.02	-10.77	Average
4.	0.442	0.42	9.75	39.27	49.44	57.02	-7.58	QP
5.	0.697	0.44	9.80	18.79	29.03	46.00	-16.97	Average
6.	0.697	0.44	9.80	28.26	38.50	56.00	-17.50	QP
7.	0.885	0.45	9.81	29.49	39.75	46.00	-6.25	Average
8.	0.885	0.45	9.81	38.16	48.42	56.00	-7.58	QP
9.	1.324	0.46	9.83	22.51	32.80	46.00	-13.20	Average
10.	1.324	0.46	9.83	31.76	42.05	56.00	-13.95	QP
11.	2.225	0.47	9.86	16.91	27.24	46.00	-18.76	Average
12.	2.225	0.47	9.86	30.83	41.16	56.00	-14.84	QP

Neutral -120V/60Hz:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.158	0.22	9.54	24.80	34.56	55.56	-21.00	Average
2.	0.158	0.22	9.54	47.00	56.76	65.56	-8.80	QP
3.	0.343	0.39	9.73	25.37	35.49	49.13	-13.64	Average
4.	0.343	0.39	9.73	34.21	44.33	59.13	-14.80	QP
5.	0.442	0.42	9.78	24.14	34.34	47.02	-12.68	Average
6.	0.442	0.42	9.78	38.22	48.42	57.02	-8.60	QP
7.	0.885	0.45	9.84	30.74	41.03	46.00	-4.97	Average
8.	0.885	0.45	9.84	37.16	47.45	56.00	-8.55	QP
9.	1.331	0.46	9.86	22.70	33.02	46.00	-12.98	Average
10.	1.331	0.46	9.86	35.22	45.54	56.00	-10.46	QP
11.	1.781	0.47	9.87	21.89	32.23	46.00	-13.77	Average
12.	1.781	0.47	9.87	29.36	39.70	56.00	-16.30	QP

7 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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature : 23.5 °C

Humidity : 51.1 % RH

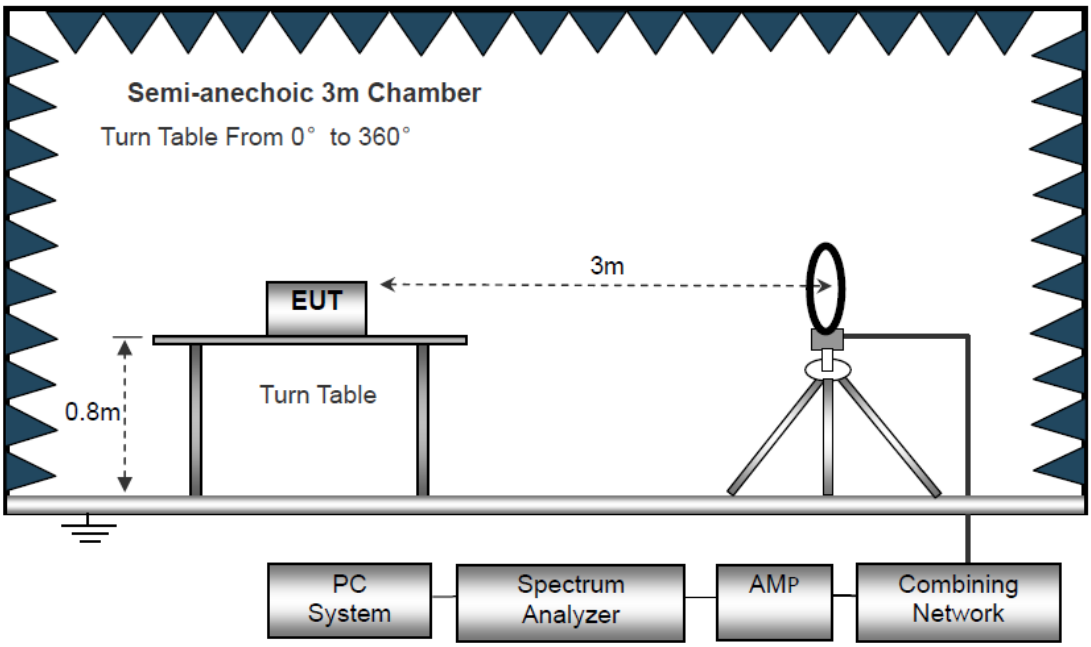
Atmospheric Pressure : 101.2kPa

Test Voltage : AC 120V/60Hz

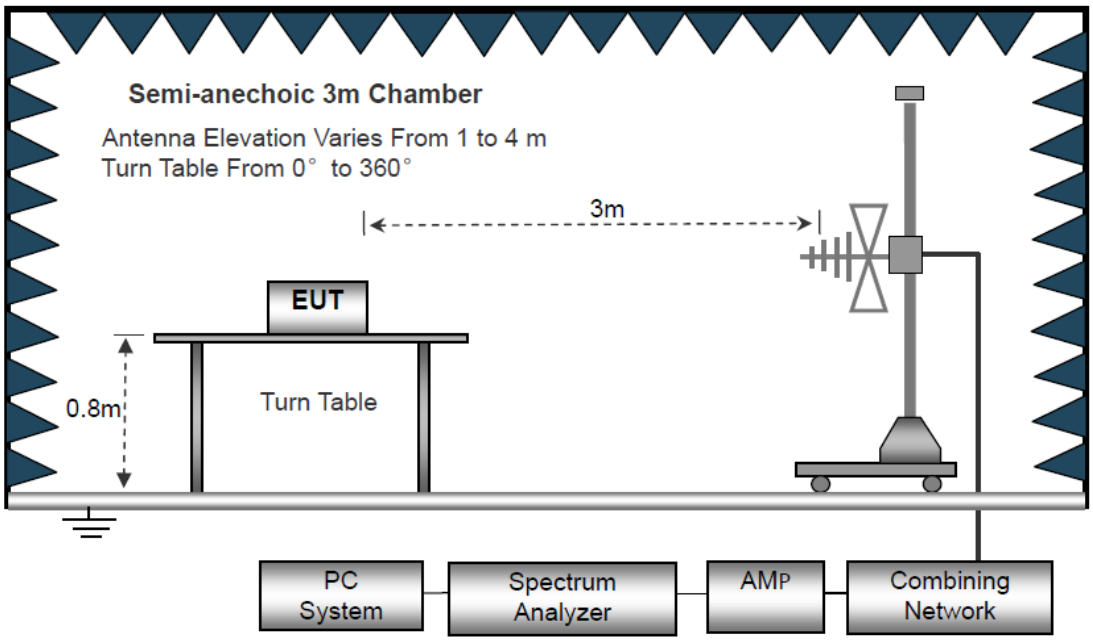
7.2 Test Setup

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

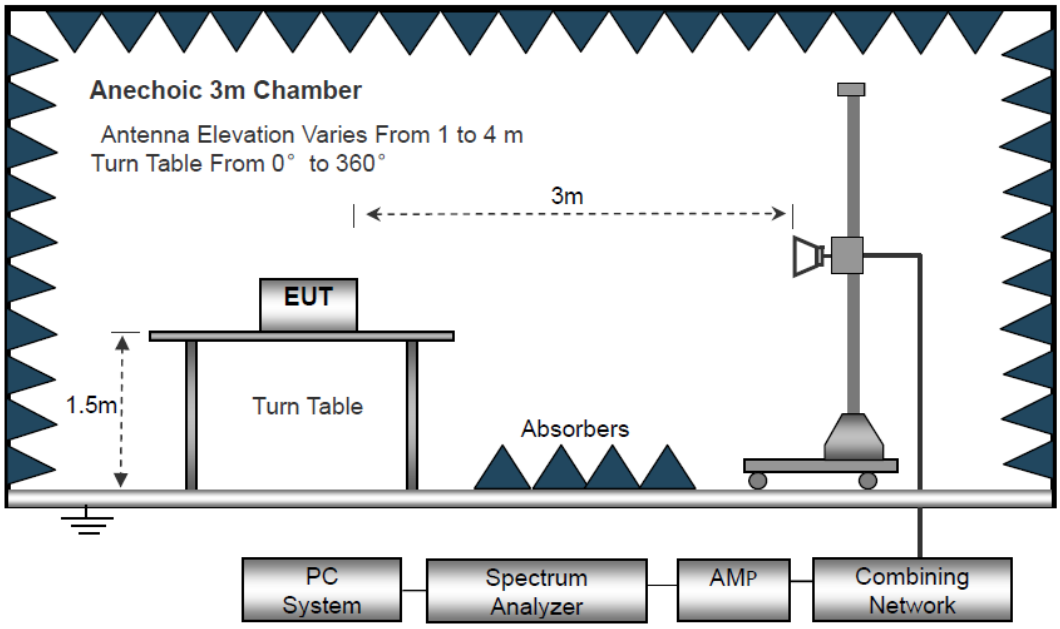
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

7.4 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.

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.

7.5 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.

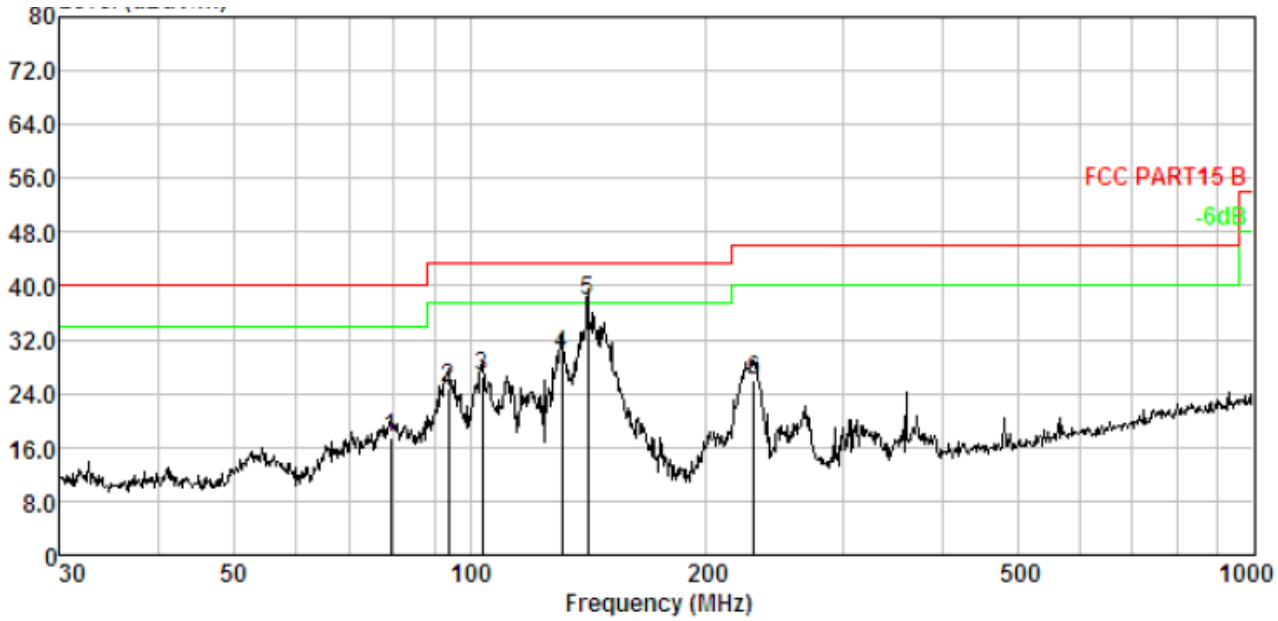
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots:

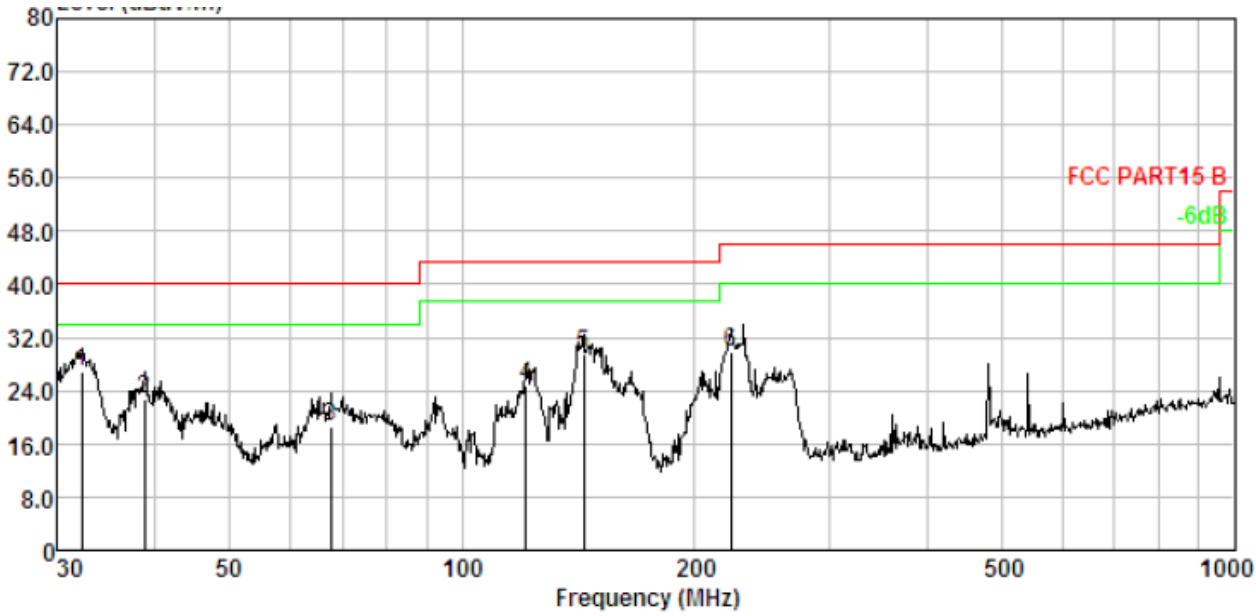
All the modulation modes were tested the data of the worst mode (AC 120V/60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Test plot for Horizontal: GFSK(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.	32.179	1.12	13.22	42.63	29.99	26.98	40.00	-13.02	QP
2.	38.888	1.29	13.62	37.97	30.06	22.82	40.00	-17.18	QP
3.	67.675	1.79	10.83	36.12	30.25	18.49	40.00	-21.51	QP
4.	121.123	2.32	12.10	40.97	30.46	24.93	43.50	-18.57	QP
5.	143.830	2.47	13.57	44.06	30.52	29.58	43.50	-13.92	QP
6.	222.950	2.87	10.91	46.82	30.67	29.93	46.00	-16.07	QP

Test plot for Vertical: GFSK(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.	32.179	1.12	13.22	42.63	29.99	26.98	40.00	-13.02	QP
2.	38.888	1.29	13.62	37.97	30.06	22.82	40.00	-17.18	QP
3.	67.675	1.79	10.83	36.12	30.25	18.49	40.00	-21.51	QP
4.	121.123	2.32	12.10	40.97	30.46	24.93	43.50	-18.57	QP
5.	143.830	2.47	13.57	44.06	30.52	29.58	43.50	-13.92	QP
6.	222.950	2.87	10.91	46.82	30.67	29.93	46.00	-16.07	QP

Test Frequency 1GHz-18GHz

Low Channel (2402MHz) Worst case GFSK

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	29.75	AV	V	8.18	10.46	10.43	37.96	54	-16.04
4824	30.26	AV	H	8.18	10.46	10.43	38.47	54	-15.53
4824	32.14	PK	V	8.18	10.46	10.43	40.35	74	-33.65
4824	35.29	PK	H	8.18	10.46	10.43	43.5	74	-30.5
14859	30.26	AV	V	9.22	11.05	12.36	38.17	54	-15.83
14859	31.47	AV	H	9.22	11.05	12.36	39.38	54	-14.62
14859	34.29	PK	V	9.22	11.05	12.36	42.2	74	-31.8
14859	36.28	PK	H	9.22	11.05	12.36	44.19	74	-29.81

Middle Channel (2441MHz) Worst case π/4-DQPSK

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)
4882	28.43	AV	V	7.86	9.73	10.75	35.27	54	-18.73
4882	30.12	AV	H	7.86	9.73	10.75	36.96	54	-17.04
4882	32.69	PK	V	7.86	9.73	10.75	39.53	74	-34.47
4882	35.06	PK	H	7.86	9.73	10.75	41.9	74	-32.1
15896	29.43	AV	V	8.25	10.29	11.23	36.74	54	-17.26
15896	30.27	AV	H	8.25	10.29	11.23	37.58	54	-16.42
15896	33.29	PK	V	8.25	10.29	11.23	40.6	74	-33.4
15896	35.74	PK	H	8.25	10.29	11.23	43.05	74	-30.95

High Channel (2480MHz) Worst case GFSK

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	29.35	AV	V	8.23	9.86	11.46	35.98	54	-18.02
4960	30.22	AV	H	8.23	9.86	11.46	36.85	54	-17.15
4960	33.37	PK	V	8.23	9.86	11.46	40	74	-34
4960	36.29	PK	H	8.23	9.86	11.46	42.92	74	-31.08
15483	30.29	AV	V	9.32	10.24	12.09	37.76	54	-16.24
15483	32.48	AV	H	9.32	10.24	12.09	39.95	54	-14.05
15483	35.98	PK	V	9.32	10.24	12.09	43.45	74	-30.55
15483	37.29	PK	H	9.32	10.24	12.09	44.76	74	-29.24

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

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

8 BAND EDGE AND CONDUCT SPURIOUS EMISSION

8.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

8.2 TEST PROCEDURE

For Conducted Test

1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

For Radiated emission Test

The EUT was placed on a styrofoam table which is 1.5m above ground plane.

The measurement procedure at the ban edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maximum peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limit for the emissions in the unrestricted band. A maximum-peak-detector marks the highest emission in the unrestricted band next to the band edge.

The measurements were performed at the lower end of the 2.4GHz band.

Use the following spectrum analyzer settings:

For Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

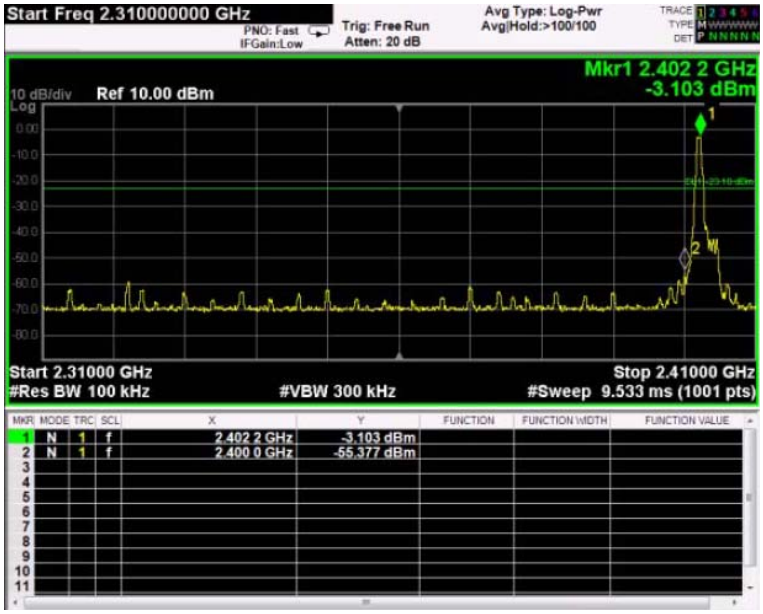
EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

8.3 TEST RESULTS

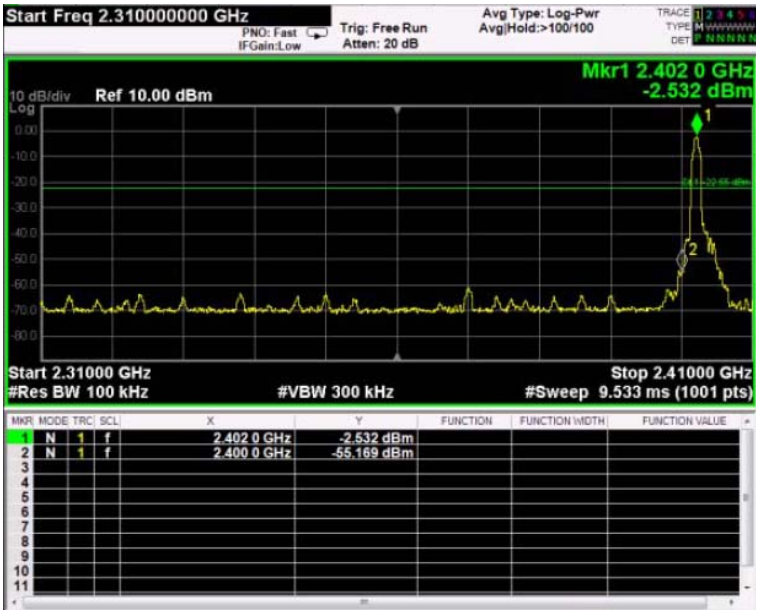
1. For Conducted Test

For Non-Hopping Mode:

GFSK

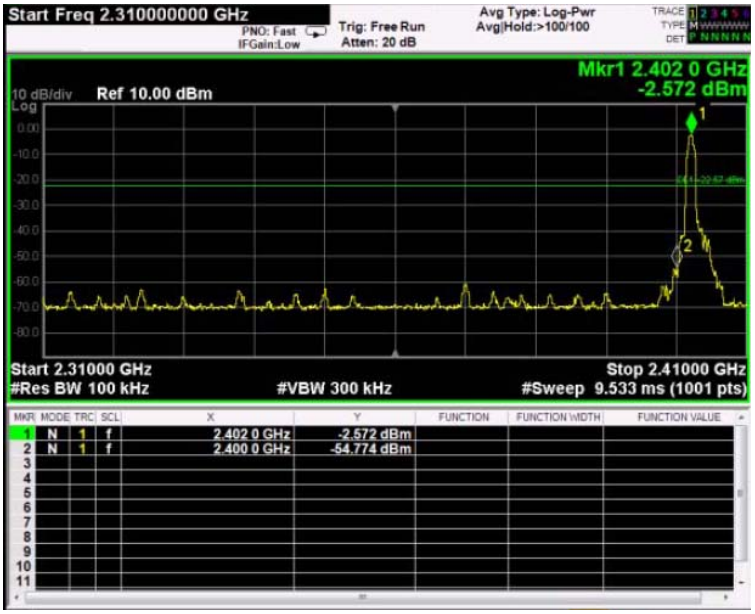


π/4-DQPSK


Start Freq 2.310000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.402 0 GHz
-2.532 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.41000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.402 0 GHz -2.532 dBm
2 N 1 f 2.400 0 GHz -55.169 dBm

Start Freq 2.475000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.480 000 GHz
-3.610 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.480 000 GHz -3.610 dBm
2 N 1 f 2.483 500 GHz -61.926 dBm

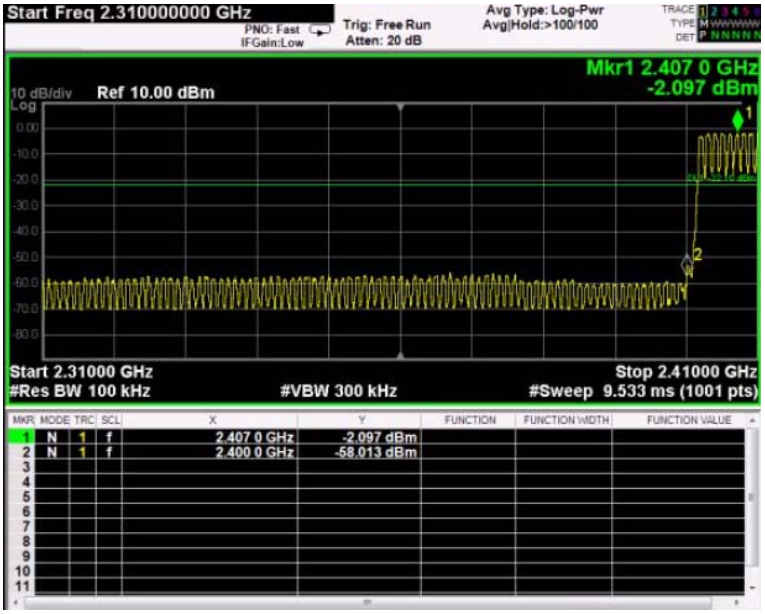
8DPSK

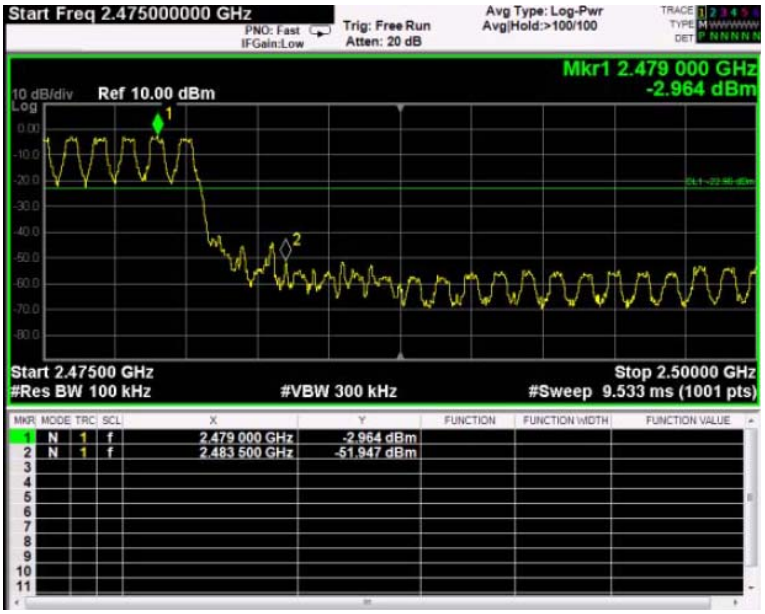

Start Freq 2.310000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.402 0 GHz
-2.572 dBm
10 dB/div
Ref 10.00 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.41000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.402 0 GHz -2.572 dBm
2 N 1 f 2.400 0 GHz -54.774 dBm

Start Freq 2.475000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.479 825 GHz
-2.567 dBm
10 dB/div
Ref 10.00 dBm
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.479 825 GHz -2.567 dBm
2 N 1 f 2.483 500 GHz -61.251 dBm

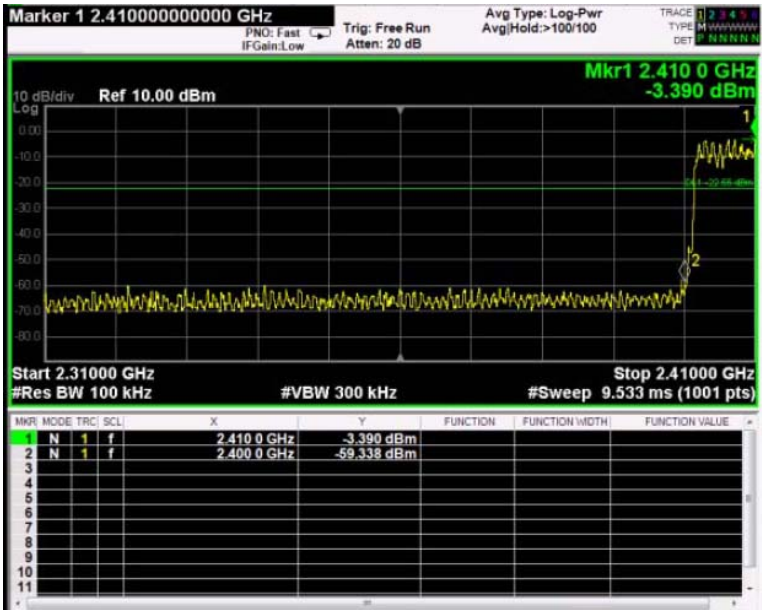
For Hopping Mode:

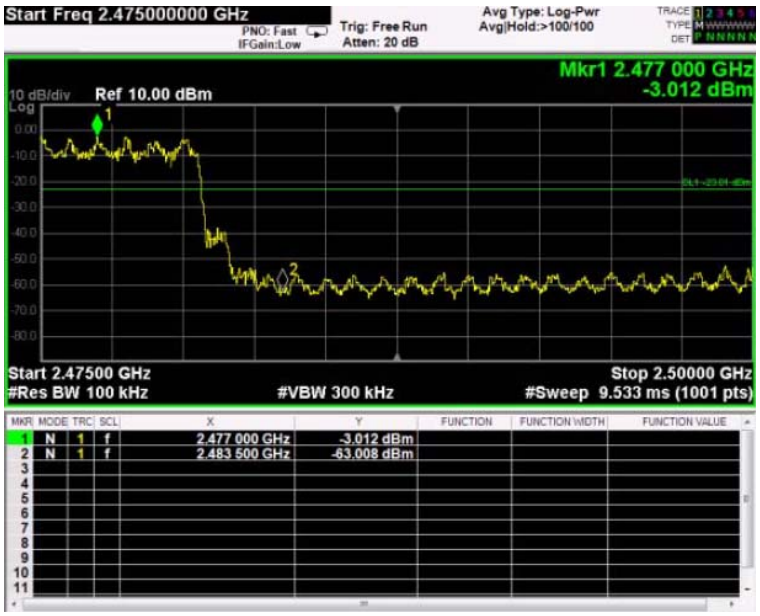
GFSK



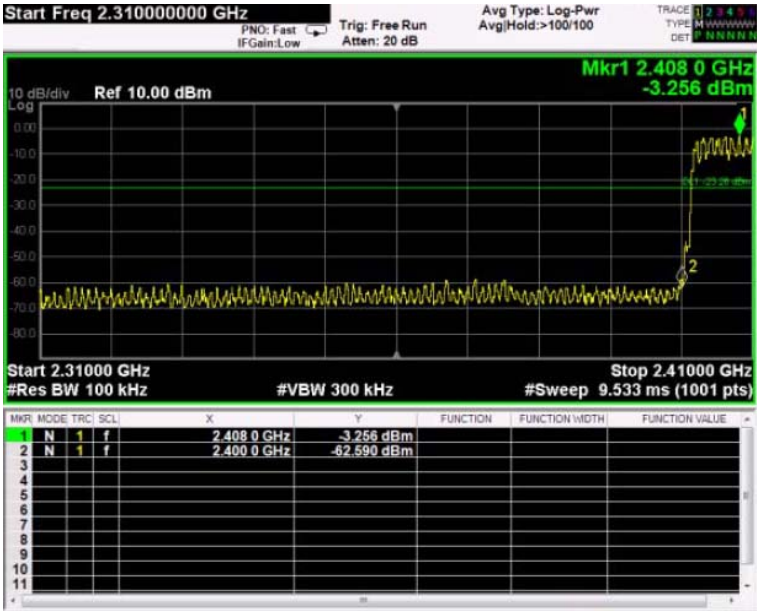


π/4-DQPSK


Marker 1 2.410000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.410 0 GHz
-3.390 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.41000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.410 0 GHz -3.390 dBm
2 N 1 f 2.400 0 GHz -59.338 dBm


Start Freq 2.475000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.477 000 GHz
-3.012 dBm
10 dB/div
Ref 10.00 dBm
Log
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.477 000 GHz -3.012 dBm
2 N 1 f 2.483 500 GHz -63.008 dBm

8DPSK


Start Freq 2.310000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.408 0 GHz
-3.256 dBm
10 dB/div
Ref 10.00 dBm
Start 2.31000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.41000 GHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.408 0 GHz -3.256 dBm
2 N 1 f 2.400 0 GHz -62.590 dBm

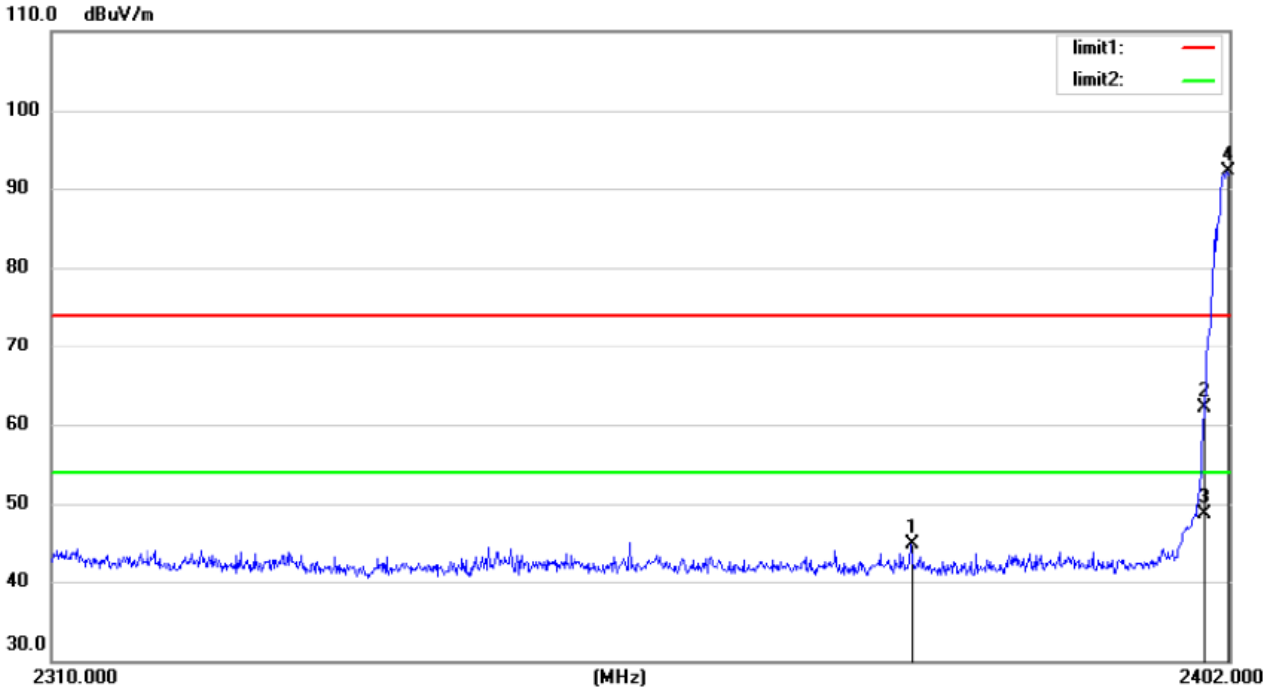
Center Freq 2.487500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.479 000 GHz
-2.777 dBm
10 dB/div
Ref 10.00 dBm
Center 2.48750 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 25.00 MHz
#Sweep 9.533 ms (1001 pts)
1 N 1 f 2.479 000 GHz -2.777 dBm
2 N 1 f 2.483 500 GHz -61.796 dBm

2. For Radiated Test

Worst Test Modulation: GFSK

For Non-Hopping Mode:

Horizontal

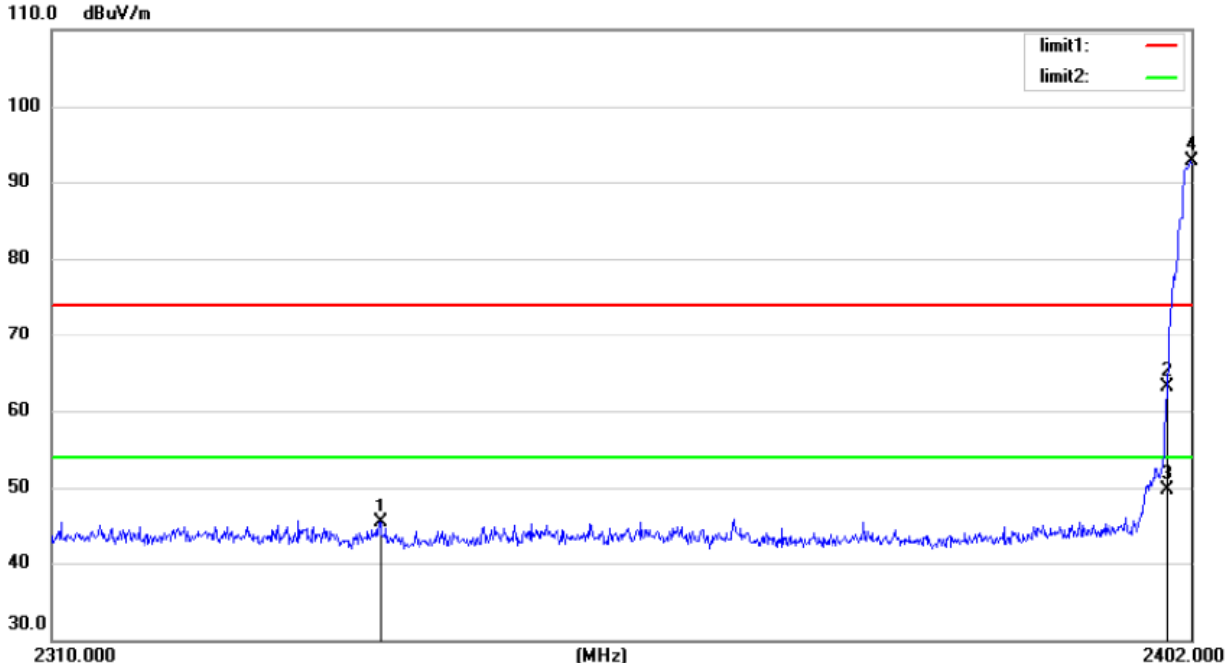


Mode: TX2402

Note:

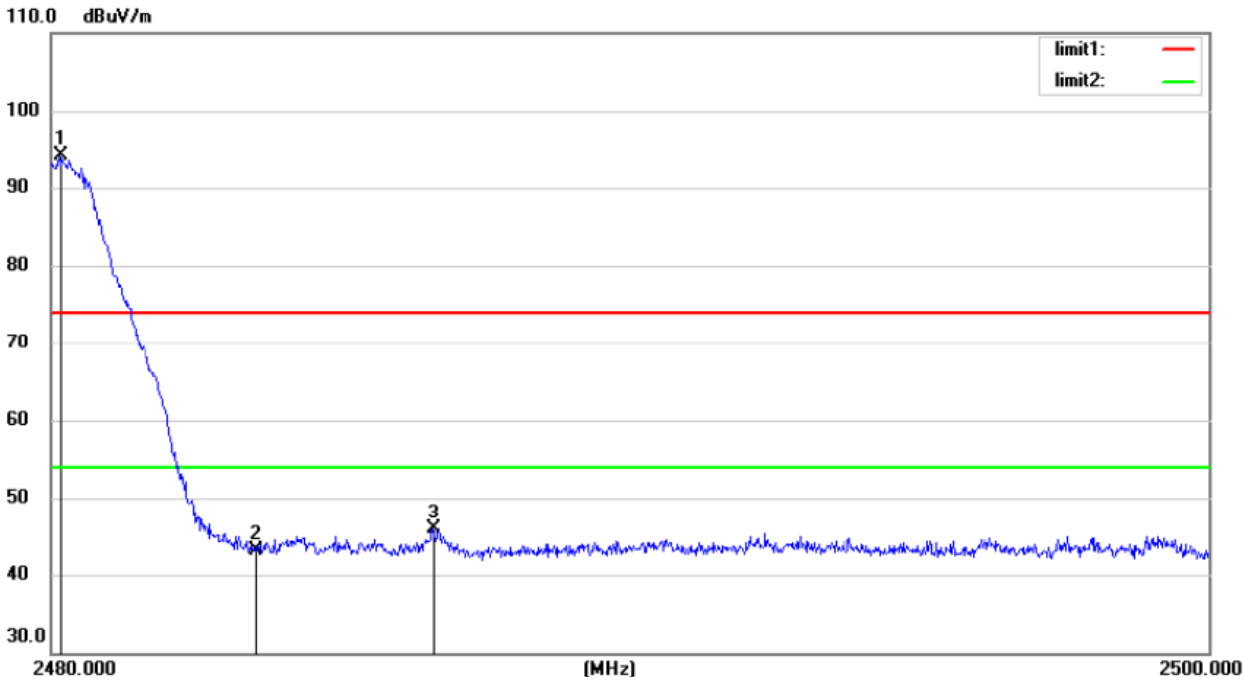
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2376.884	56.42	-11.68	44.74	74.00	-29.26	peak			
2		2400.000	73.77	-11.63	62.14	74.00	-11.86	peak			
3		2400.000	60.30	-11.63	48.67	54.00	-5.33	AVG			
4	*	2401.816	104.00	-11.63	92.37	74.00	18.37	peak			

Vertical:



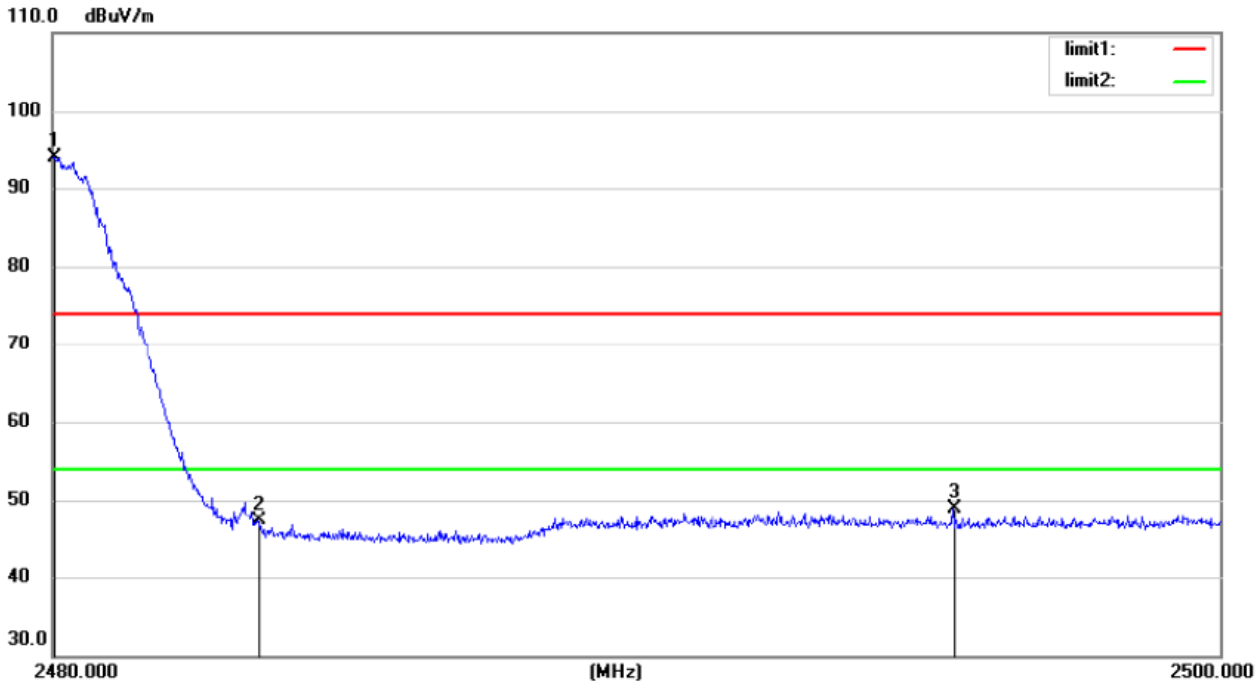
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2336.128	56.14	-10.82	45.32	74.00	-28.68	peak			
2		2400.000	73.54	-10.47	63.07	74.00	-10.93	peak			
3		2400.000	60.25	-10.47	49.78	54.00	-4.22	AVG			
4	*	2401.908	103.31	-10.46	92.85	74.00	18.85	peak			

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.140	105.66	-11.45	94.21	74.00	20.21	peak			
2		2483.500	54.49	-11.46	43.03	74.00	-30.97	peak			
3		2486.600	57.40	-11.44	45.96	74.00	-28.04	peak			

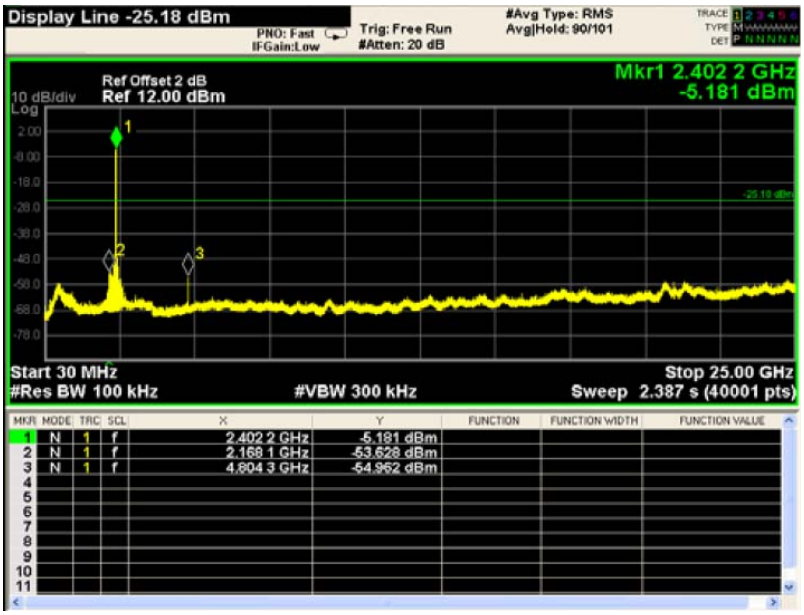
Vertical:

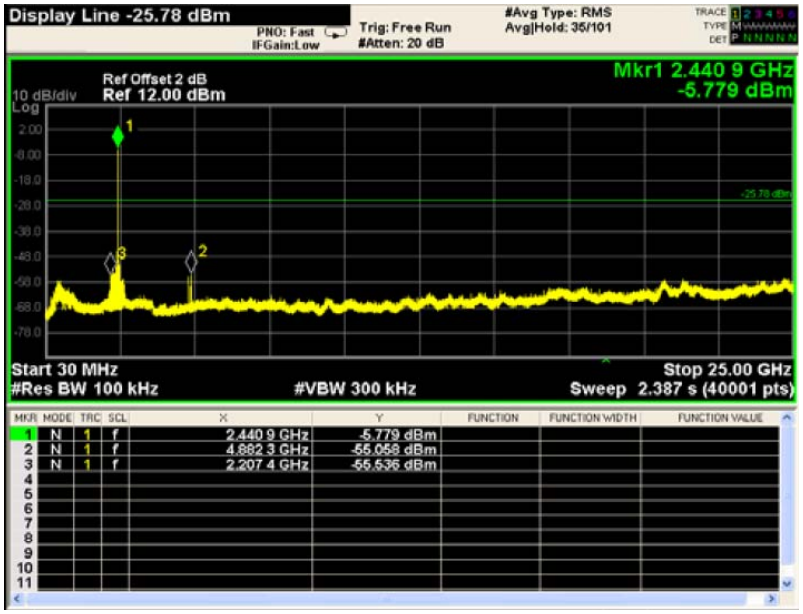


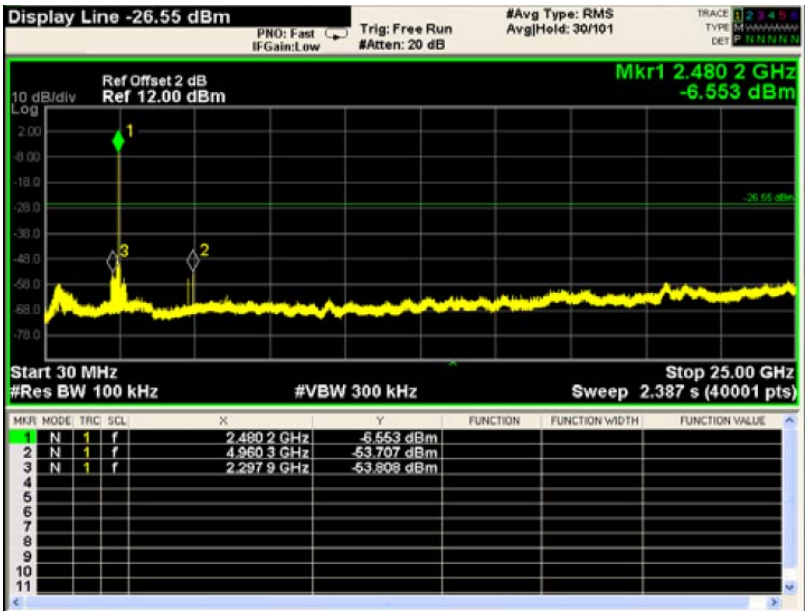
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.020	104.21	-10.02	94.19	74.00	20.19	peak			
2		2483.500	57.30	-10.01	47.29	74.00	-26.71	peak			
3		2495.420	58.88	-9.95	48.93	74.00	-25.07	peak			

3. For Conduct spurious emissions

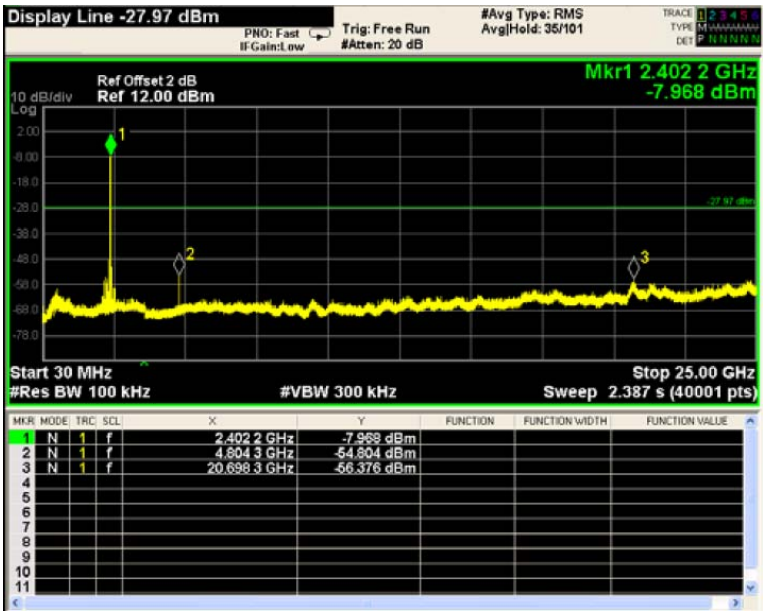
GFSK

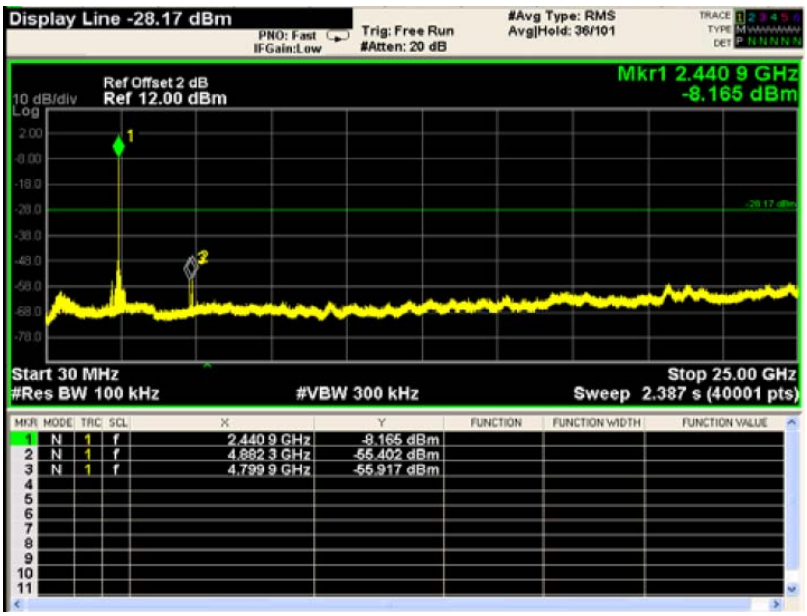


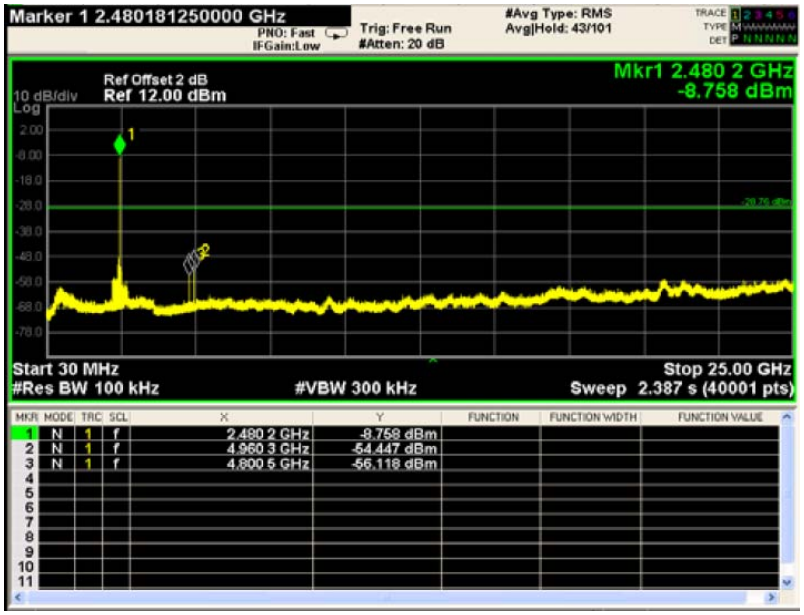



Display Line -26.55 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 30/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Mkr1 2.480 2 GHz
-6.553 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.480 2 GHz -6.553 dBm
2 N 1 f 4.960 3 GHz -53.707 dBm
3 N 1 f 2.297 9 GHz -63.808 dBm

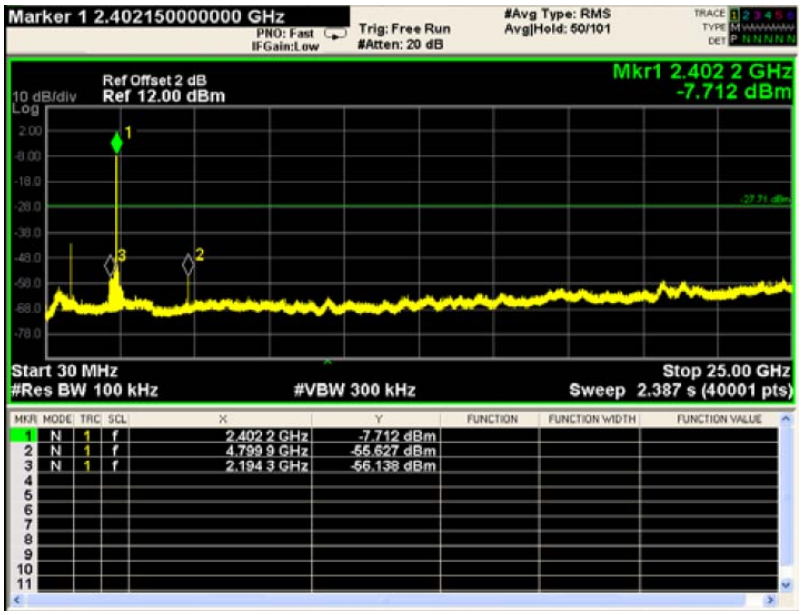
Π/4-DQPSK

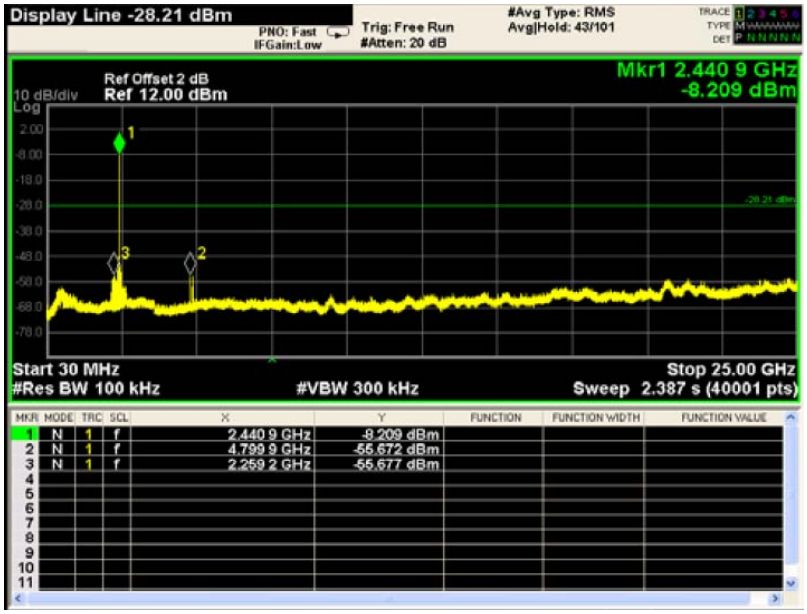

Display Line -27.97 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 35/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Mkr1 2.402 2 GHz
-7.968 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.402 2 GHz -7.968 dBm
2 N 1 f 4.804 3 GHz -54.804 dBm
3 N 1 f 20.698 3 GHz -56.376 dBm

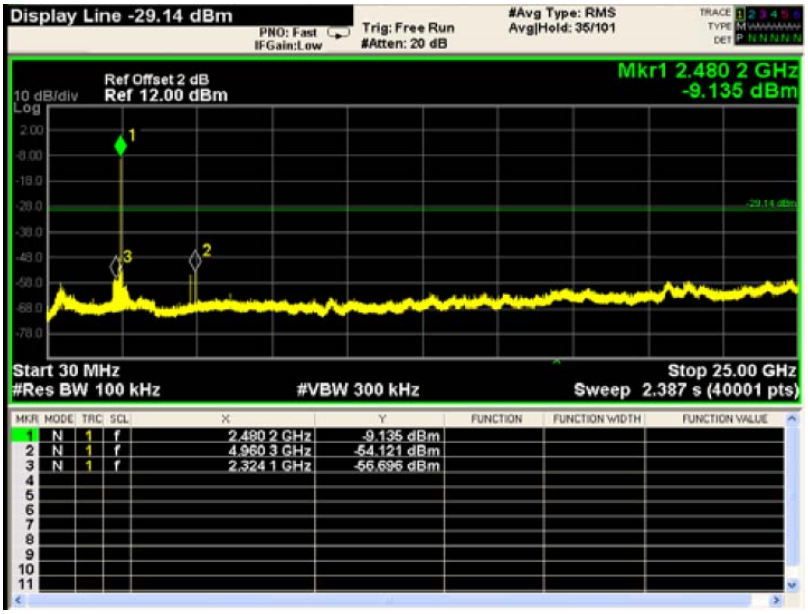

Display Line -28.17 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 36/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Log
Mkr1 2.440 9 GHz
-8.165 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.440 9 GHz -8.165 dBm
2 N 1 f 4.882 3 GHz -55.402 dBm
3 N 1 f 4.799 9 GHz -55.917 dBm


Marker 1 2.480181250000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 43/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Log
Mkr1 2.480 2 GHz
-8.758 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.480 2 GHz -8.758 dBm
2 N 1 f 4.960 3 GHz -54.447 dBm
3 N 1 f 4.800 5 GHz -55.118 dBm

8DPSK


Marker 1 2.402150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 50/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Mkr1 2.402 2 GHz
-7.712 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.402 2 GHz -7.712 dBm
2 N 1 f 4.799 9 GHz -55.627 dBm
3 N 1 f 2.194 3 GHz -56.138 dBm


Display Line -28.21 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 43/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Mkr1 2.440 9 GHz
-8.209 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.440 9 GHz -8.209 dBm
2 N 1 f 4.799 9 GHz -55.672 dBm
3 N 1 f 2.259 2 GHz -55.677 dBm


Display Line -29.14 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 35/101
Ref Offset 2 dB
10 dB/div
Ref 12.00 dBm
Log
Mkr1 2.480 2 GHz
-9.135 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.480 2 GHz -9.135 dBm
2 N 1 f 4.960 3 GHz -54.121 dBm
3 N 1 f 2.324 1 GHz -56.696 dBm

9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

9.1 Test Procedure

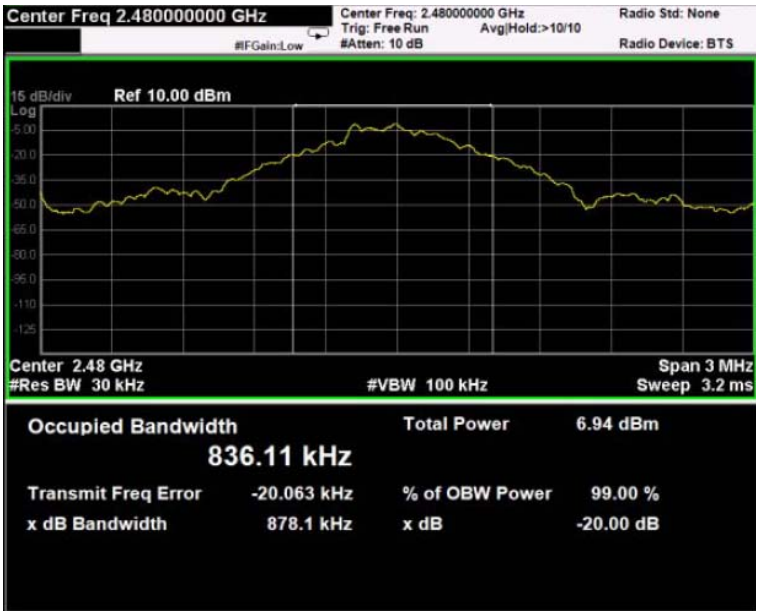
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW =30kHz, VBW = 100kHz

9.2 Test Result

Test Mode: CH00 / CH39 / CH78 (GFSK/(1Mbps)Mode)

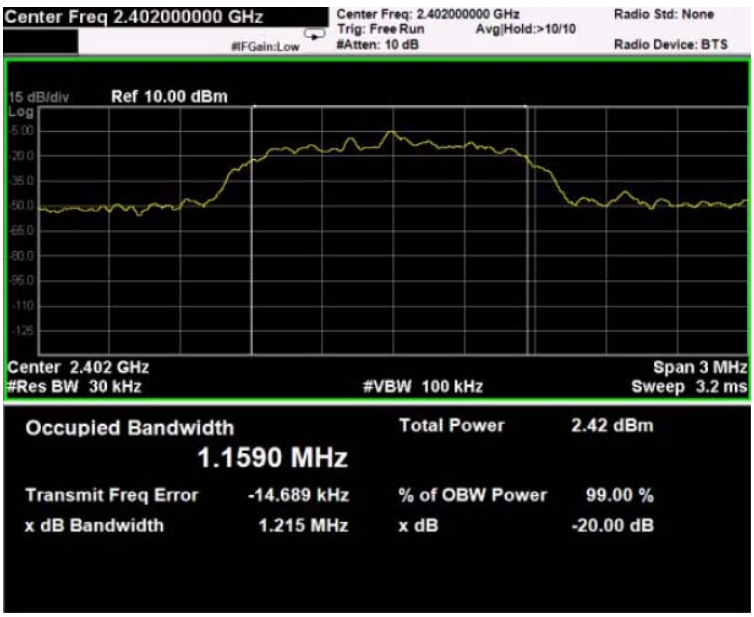
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	909
39	2441	884
78	2480	878

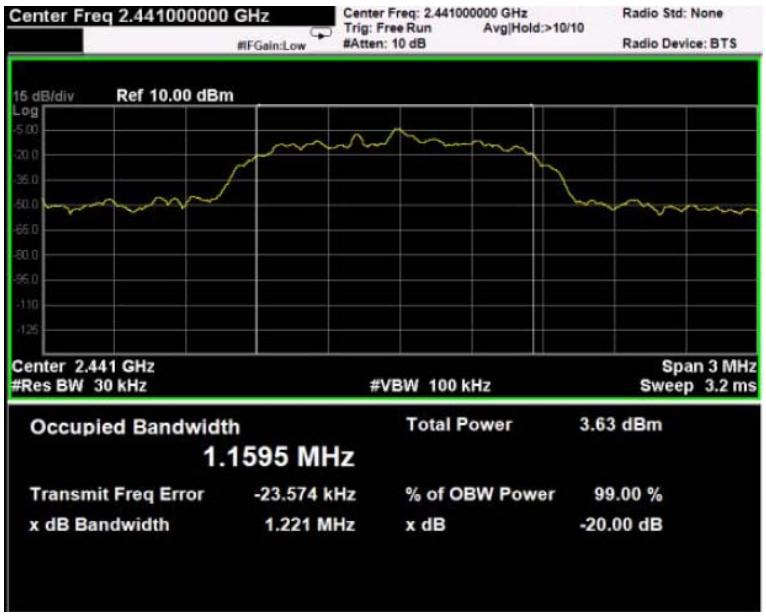
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
833.01 kHz
Total Power 7.21 dBm
Transmit Freq Error -21.174 kHz
% of OBW Power 99.00 %
x dB Bandwidth 883.6 kHz
x dB -20.00 dB

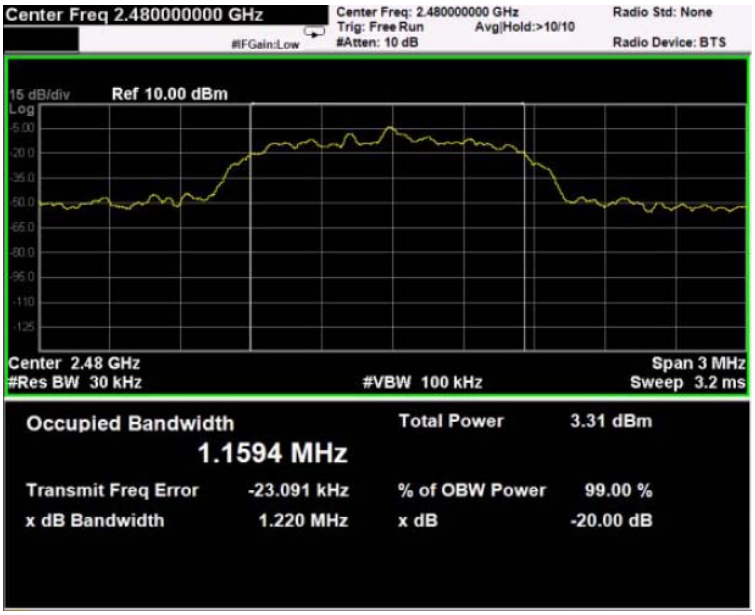

Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
836.11 kHz
Total Power 6.94 dBm
Transmit Freq Error -20.063 kHz
% of OBW Power 99.00 %
x dB Bandwidth 878.1 kHz
x dB -20.00 dB

Test Mode: CH00 / CH39 / CH78 (Π/4-DQPSK /(2Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1215
39	2441	1221
78	2480	1220

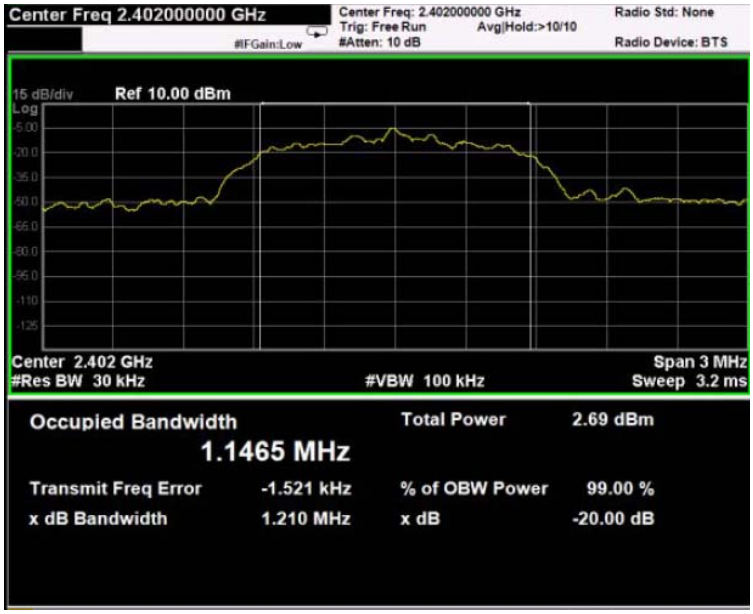


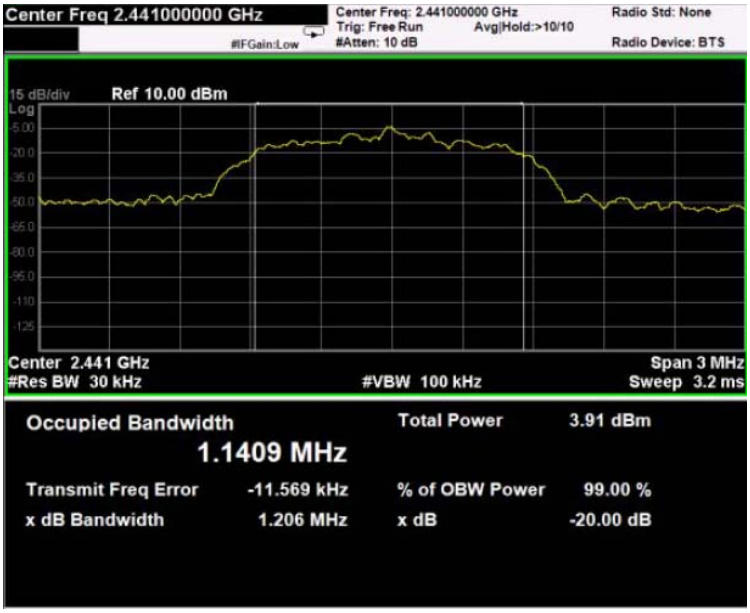

Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1595 MHz
Total Power 3.63 dBm
Transmit Freq Error -23.574 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.221 MHz
x dB -20.00 dB

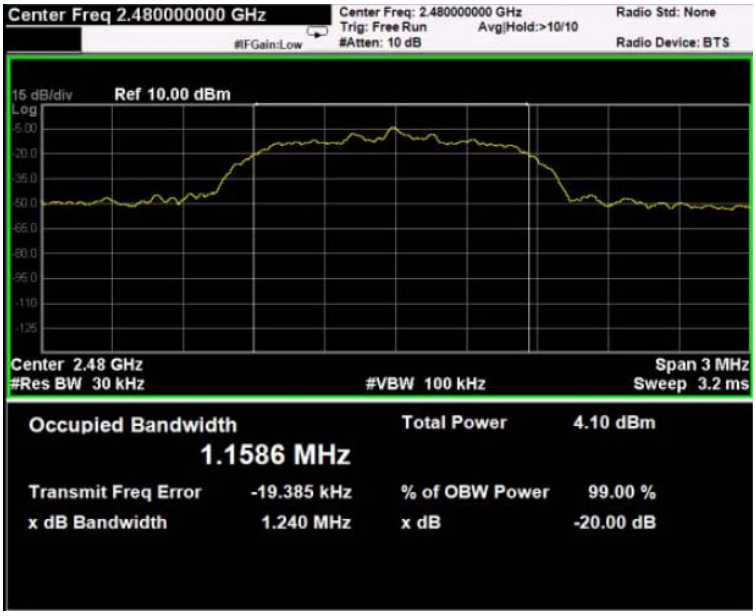

Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1594 MHz
Total Power 3.31 dBm
Transmit Freq Error -23.091 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.220 MHz
x dB -20.00 dB

Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1210
39	2441	1206
78	2480	1240




Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1409 MHz
Total Power 3.91 dBm
Transmit Freq Error -11.569 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.206 MHz
x dB -20.00 dB


Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
15 dB/div
Ref 10.00 dBm
Log
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1586 MHz
Total Power 4.10 dBm
Transmit Freq Error -19.385 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.240 MHz
x dB -20.00 dB

10 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)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band eploying at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies.

10.1Test Procedure

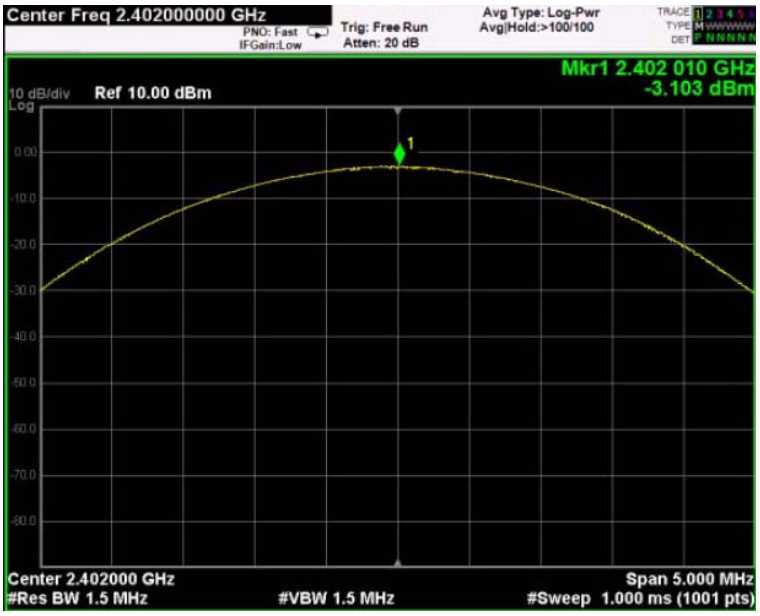
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

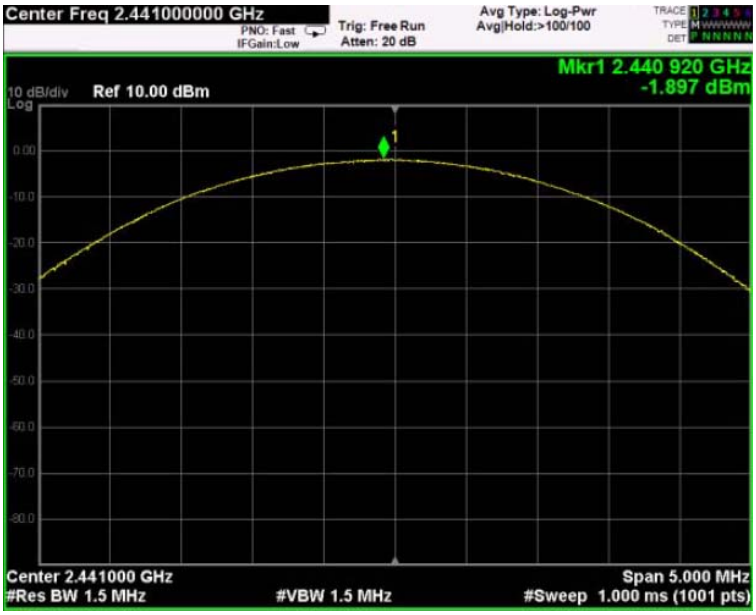
2. Set the spectrum analyser: RBW = 1.5 MHz. VBW =1.5 MHz. Sweep = auto; Detector Function = Peak.

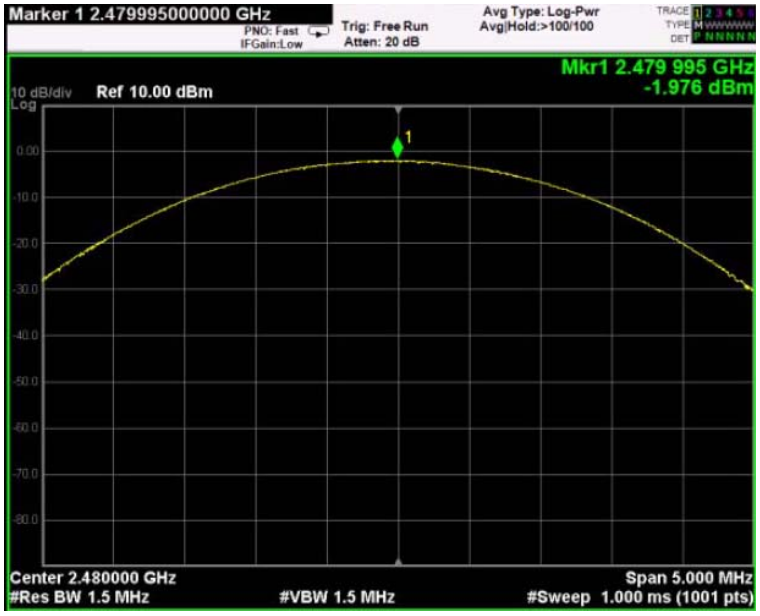
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2Test Result

GFSK(1Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(W)	(W)	
CH00	2402	-3.103	0.00049	1	Pass
CH39	2441	-1.897	0.00065	1	Pass
CH78	2480	-1.976	0.00063	1	Pass

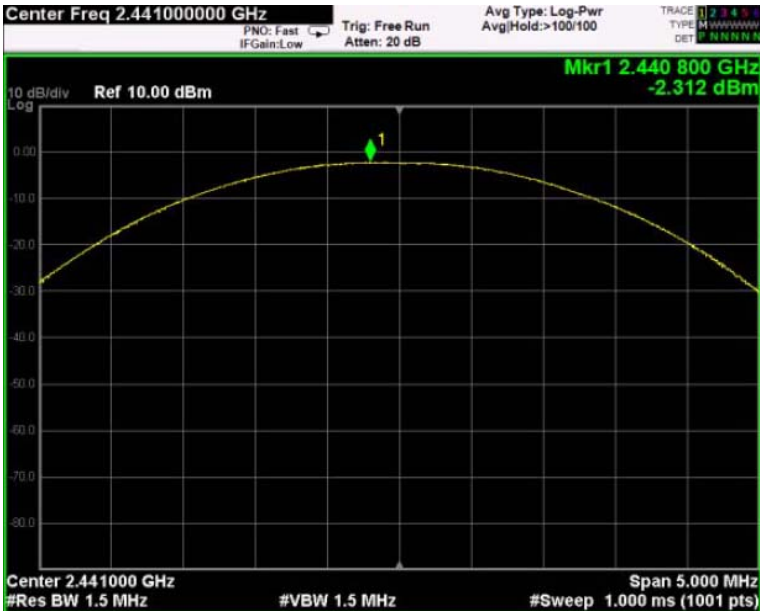

Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.402 010 GHz
-3.103 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.402000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)


Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 920 GHz
-1.897 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)

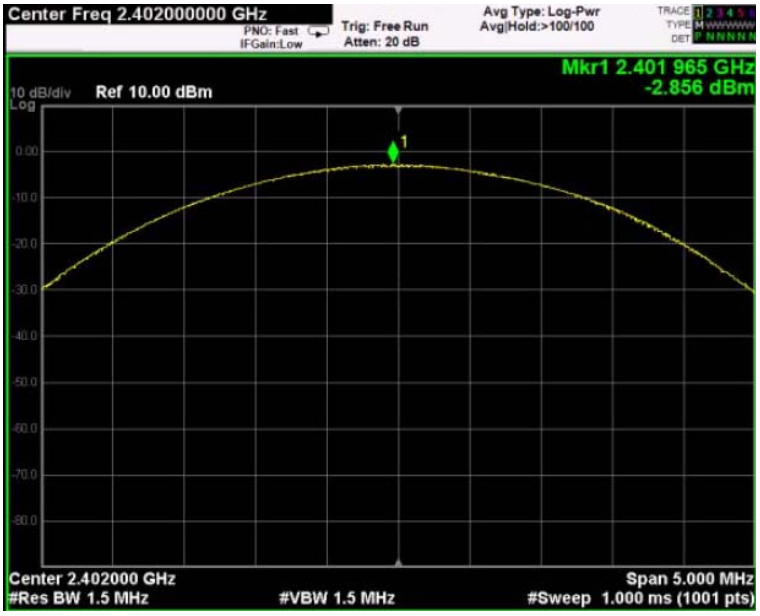


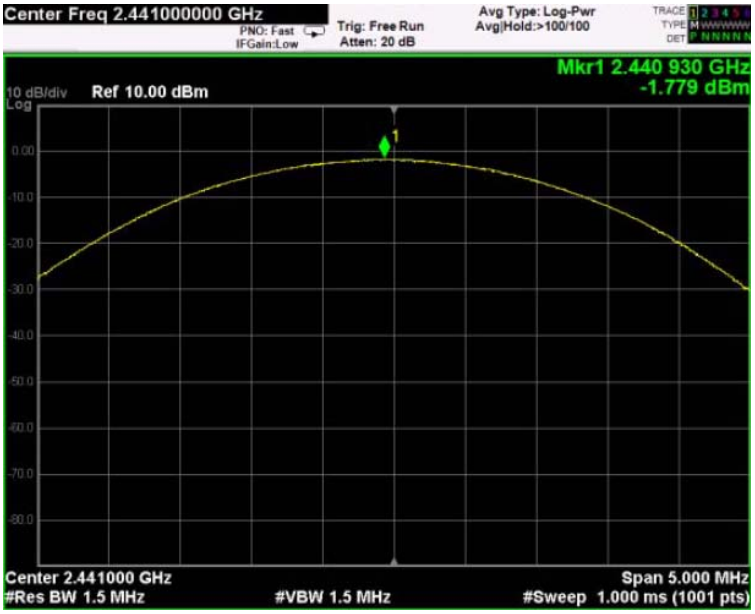
π/4QPSK(2Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(W)	(W)	
CH00	2402	-3.492	0.00045	0.125	Pass
CH39	2441	-2.312	0.00059	0.125	Pass
CH78	2480	-2.364	0.00058	0.125	Pass

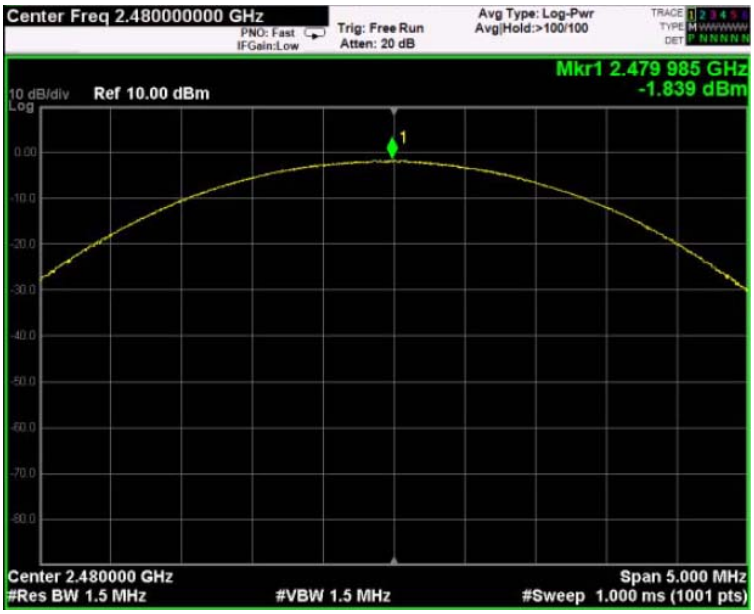
Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.402 070 GHz
-3.492 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.402000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)


Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 800 GHz
-2.312 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)

8DPSK(3Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(W)	(W)	
CH00	2402	-2.856	0.00052	0.125	Pass
CH39	2441	-1.779	0.00066	0.125	Pass
CH78	2480	-1.839	0.00065	0.125	Pass


Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.401 965 GHz
-2.856 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.402000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)


Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.440 930 GHz
-1.779 dBm
10 dB/div
Log
Ref 10.00 dBm
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)


Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P NNNNN
Mkr1 2.479 985 GHz
-1.839 dBm
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
1
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 1.5 MHz
Span 5.000 MHz
#Sweep 1.000 ms (1001 pts)

11 Hopping Channel Separation

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode	:	Hopping

11.1 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 = 30KHz. VBW =100KHz, Span = 2.0MHz. 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.

11.2 Test Result

Test Mode:	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)

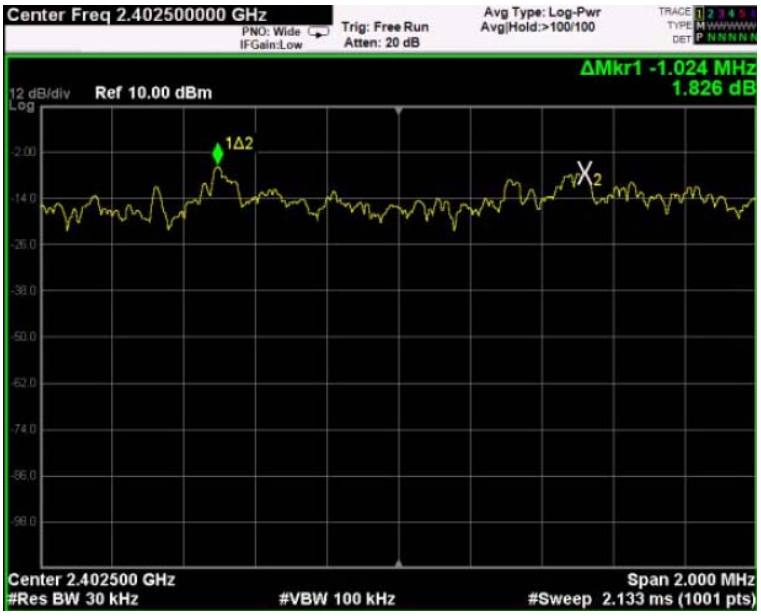
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 20dB Down BW(kHz)
00	2402	992	>909
39	2441	1004	>884
78	2480	1004	>878

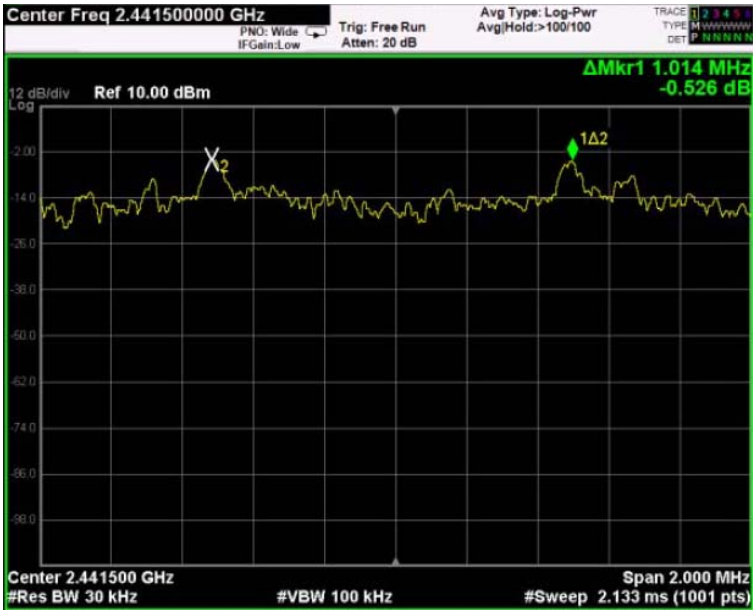
Center Freq 2.441500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.004 MHz
-0.147 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.441500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)

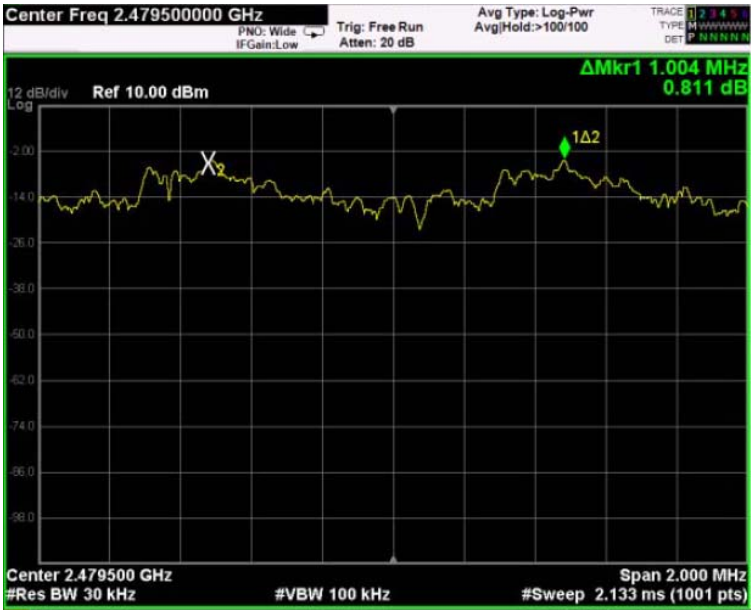
Center Freq 2.479500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.004 MHz
0.811 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.479500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)

Test Mode:	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
00	2402	1024	>810
39	2441	1014	>814
78	2480	1004	>813

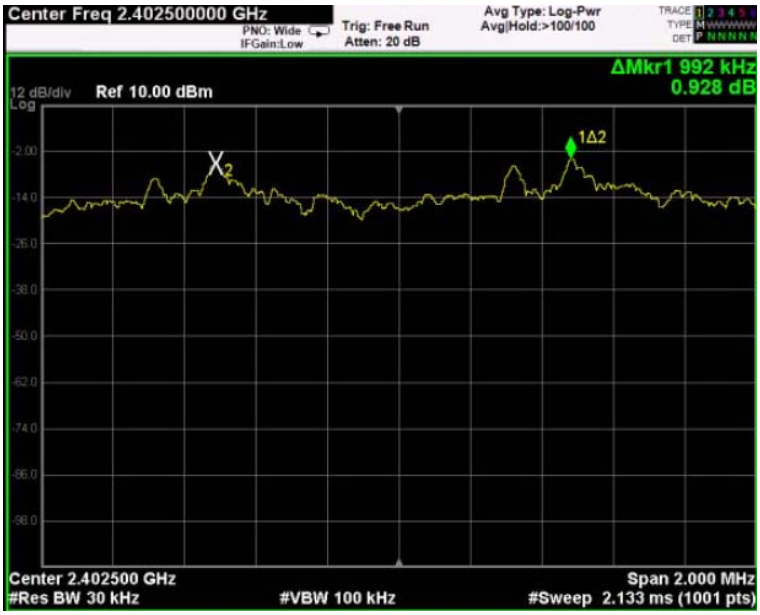


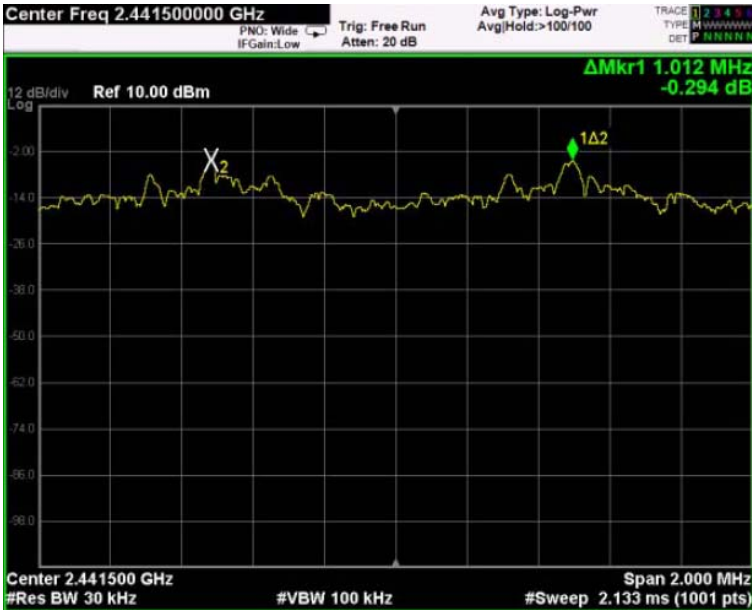

Center Freq 2.441500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.014 MHz
-0.526 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.441500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)


Center Freq 2.479500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.004 MHz
0.811 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.479500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)

Test Mode:	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
00	2402	992	>807
39	2441	1012	>804
78	2480	1014	>827




Center Freq 2.441500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.012 MHz
-0.294 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.441500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)

Center Freq 2.479500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
ΔMkr1 1.014 MHz
-0.426 dB
12 dB/div
Ref 10.00 dBm
Log
1Δ2
Center 2.479500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
#Sweep 2.133 ms (1001 pts)

12 Number of Hopping Frequency

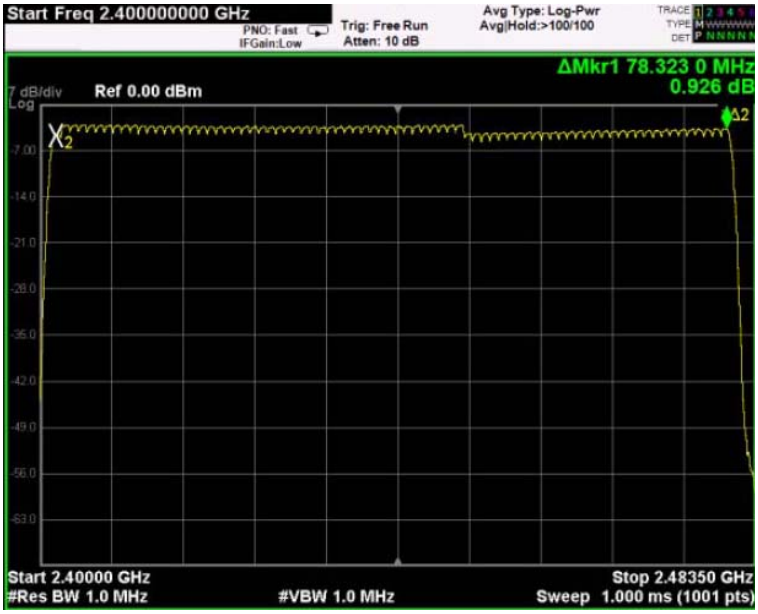
Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode	:	Hopping(GFSK)

12.1 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 = 1Hz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

12.2 Test Result

Channel Number	Limit
79	≥15



13 Dwell Time

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Test Mode	:	The worst case(GFSK) was recorded

13.1 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 spectrum analyzer span = 0. Centred on a hopping channel;

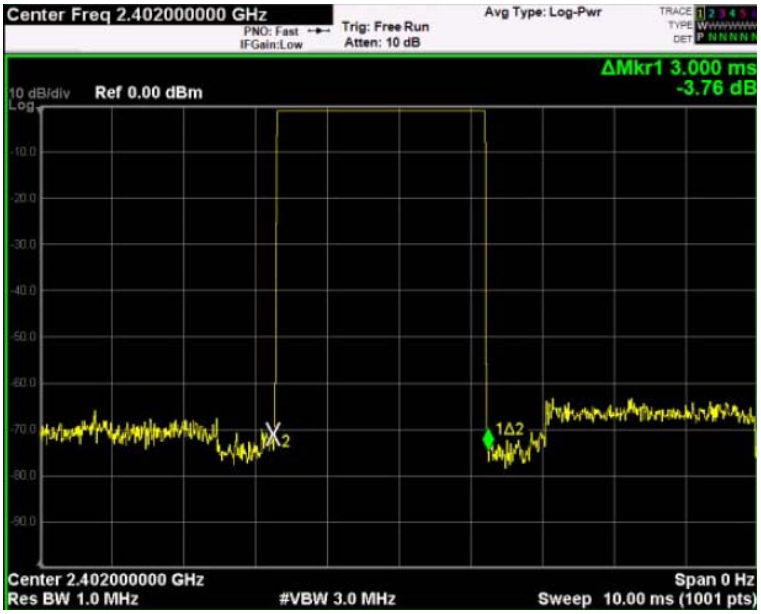
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

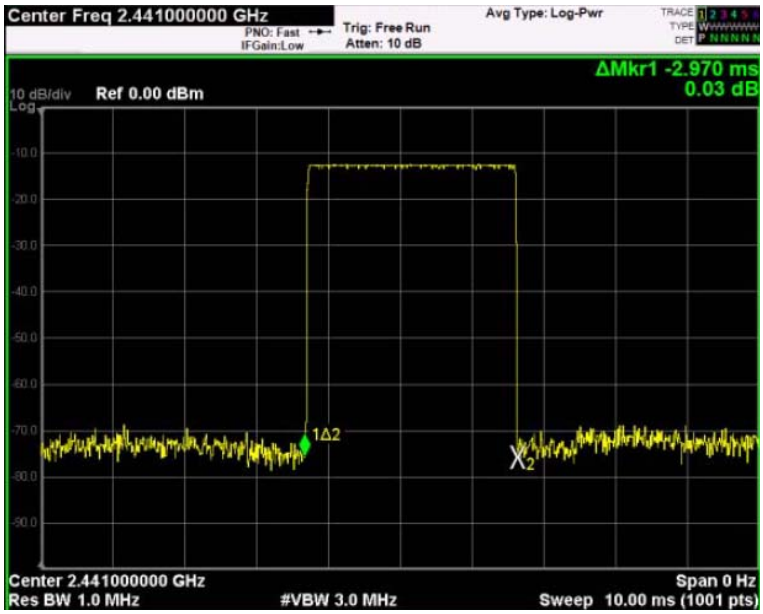
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

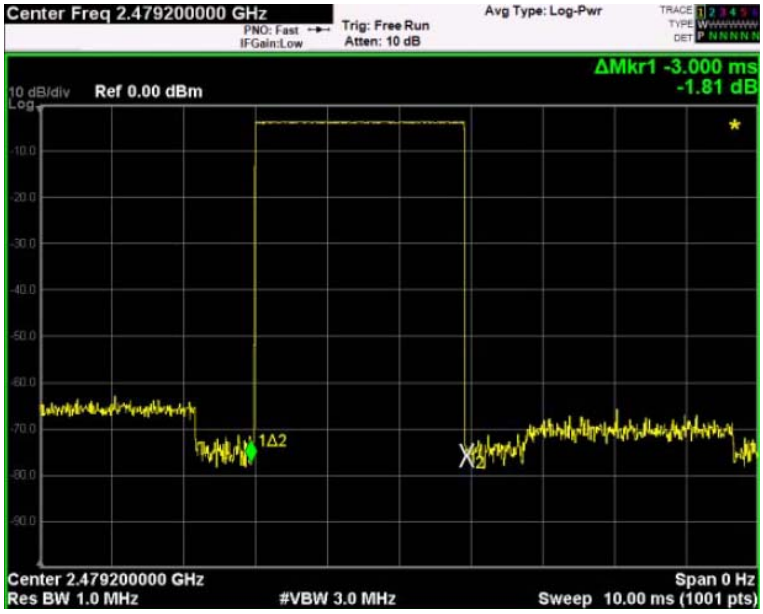
13.2 Test Result

Test Mode:	GFSK(1Mbps)

Mode	CH	Length of transmissions time(msec)	Result (msec)	Limit (msec)
GFSK	Low	3.00	320.00	400
	Middle	2.97	316.80	400
	High	3.00	326.00	400
	Note: Dwell Time= Pulse Time (ms)*1600/6/79*31.6			


Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE
TYPE
DET
ΔMkr1 3.000 ms
-3.76 dB
10 dB/div
Ref 0.00 dBm
Log
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
Center 2.402000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)


Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE
TYPE
DET
ΔMkr1 -2.970 ms
0.03 dB
10 dB/div
Ref 0.00 dBm
Log
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)


Center Freq 2.479200000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
ΔMkr1 -3.000 ms
-1.81 dB
10 dB/div
Ref 0.00 dBm
Log
1Δ2
Center 2.479200000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)

14 Antenna Requirement

14.1 Antenna Requirement

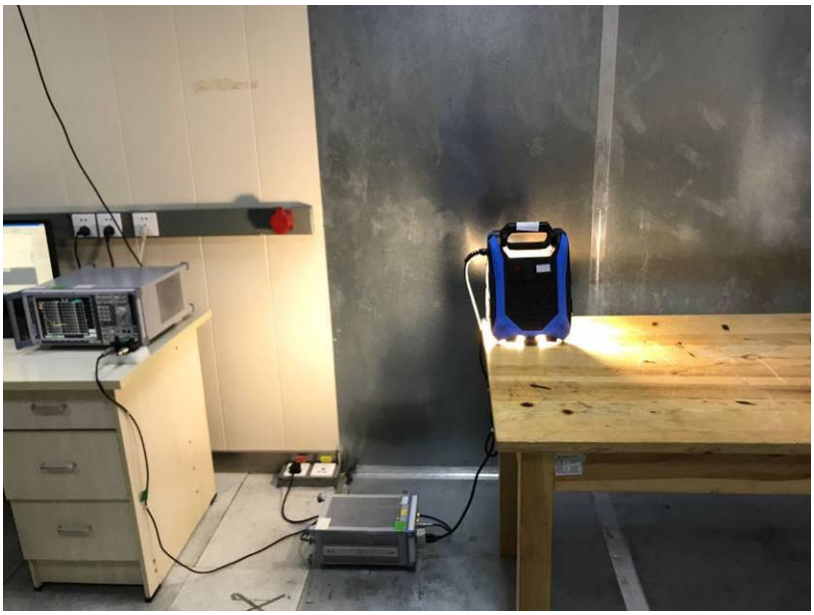
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional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

14.2 Result

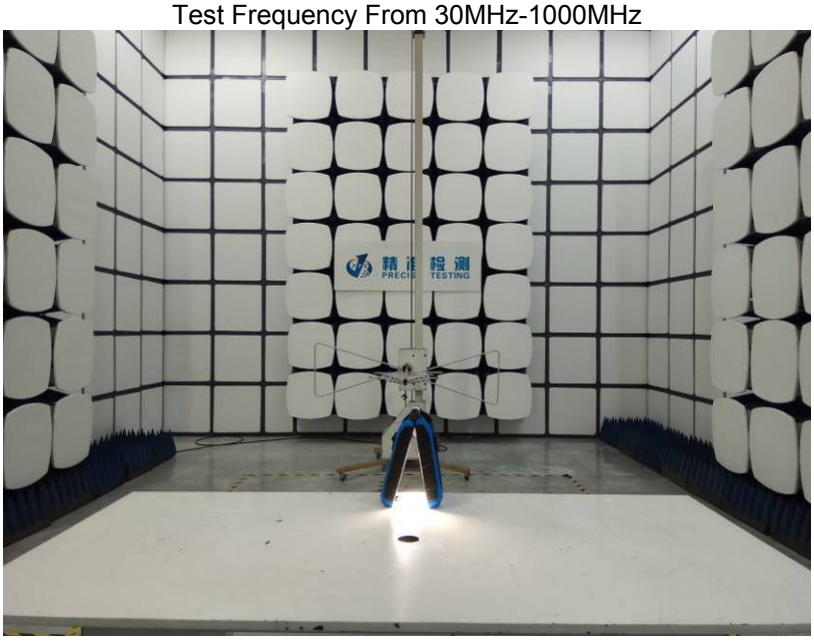
The EUT'S antenna, permanent attached antenna, is Internal PCB Antenna. The antenna's gain is 0.7dBi and meets the requirement.

15 TEST PHOTOS

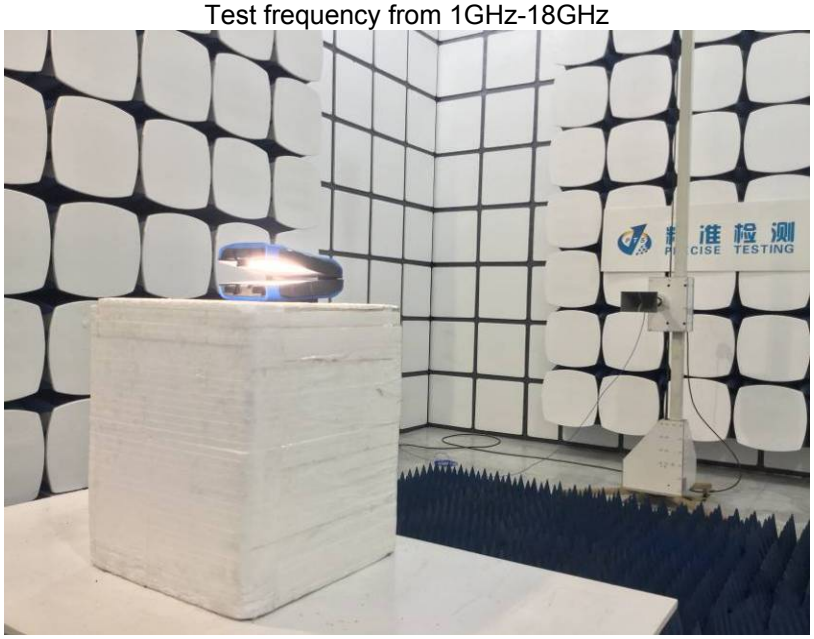
Conducted Emissions



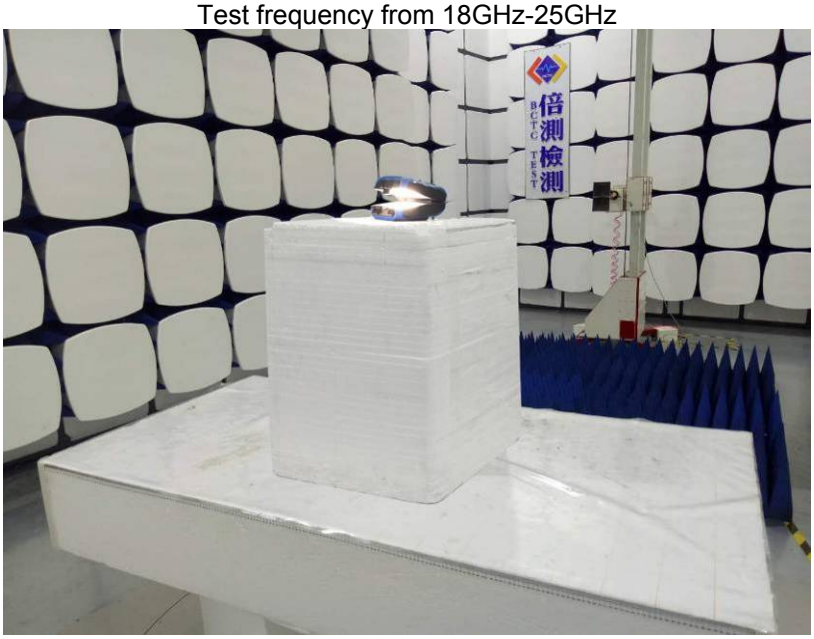
Radiated Spurious Emissions
Test Frequency From 30MHz-1000MHz



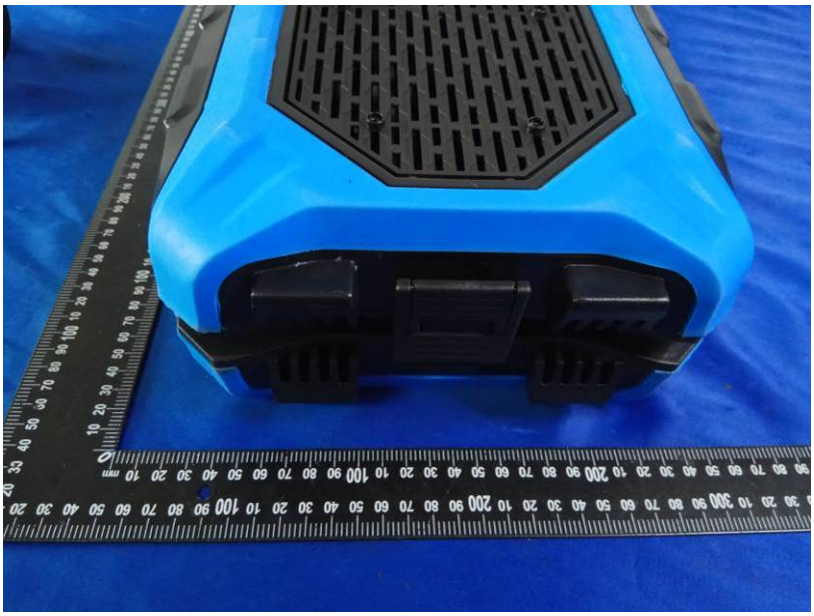
Test frequency from 1GHz-18GHz

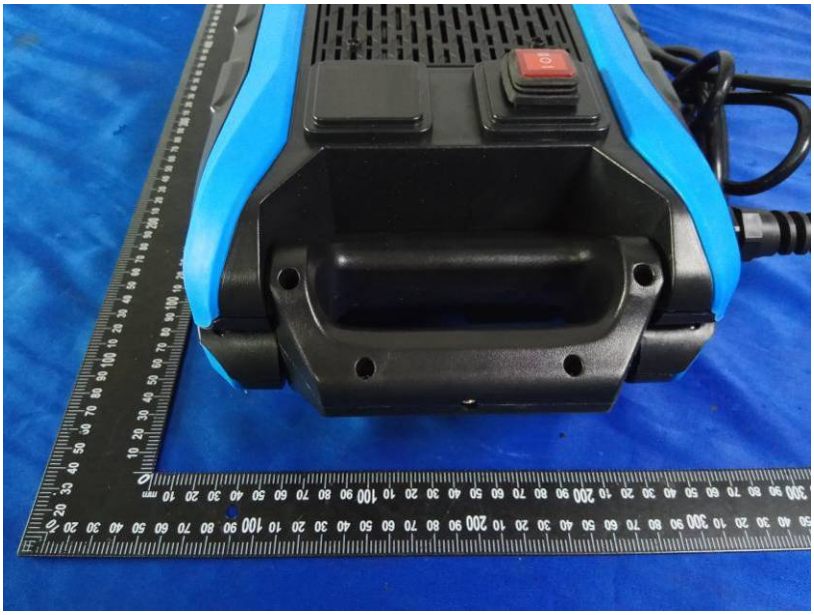


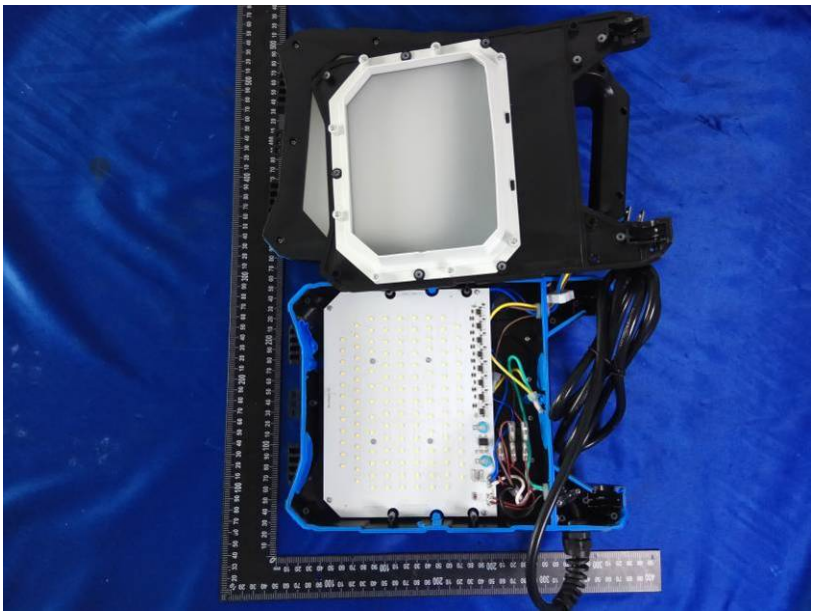
Test frequency from 18GHz-25GHz

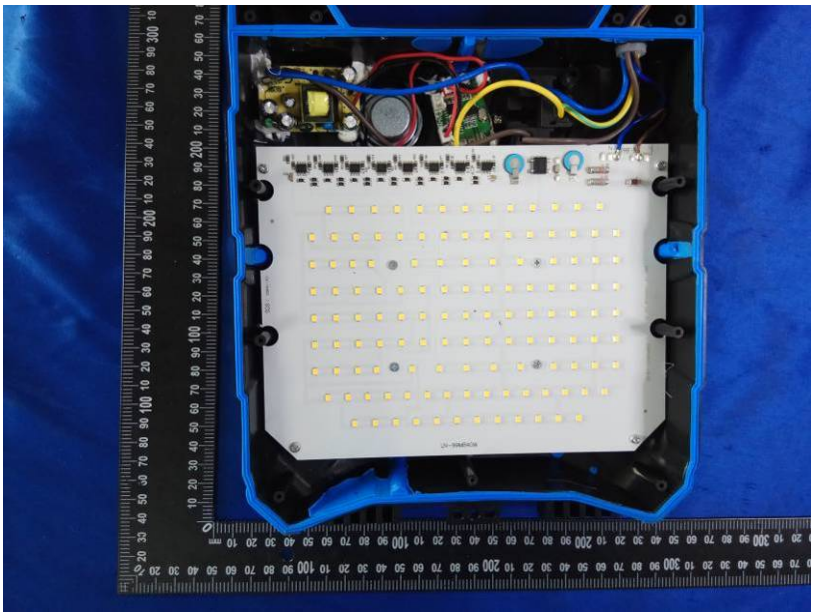


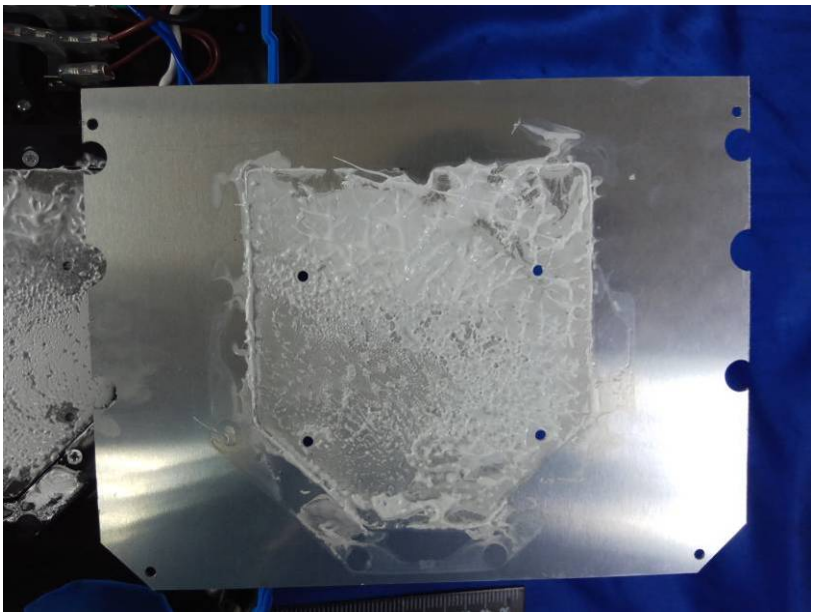
16 EUT PHOTOS

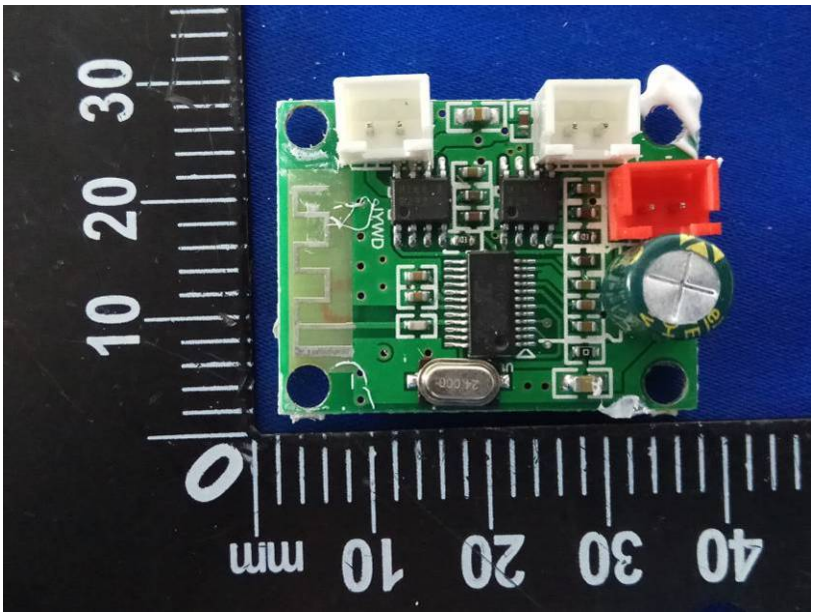


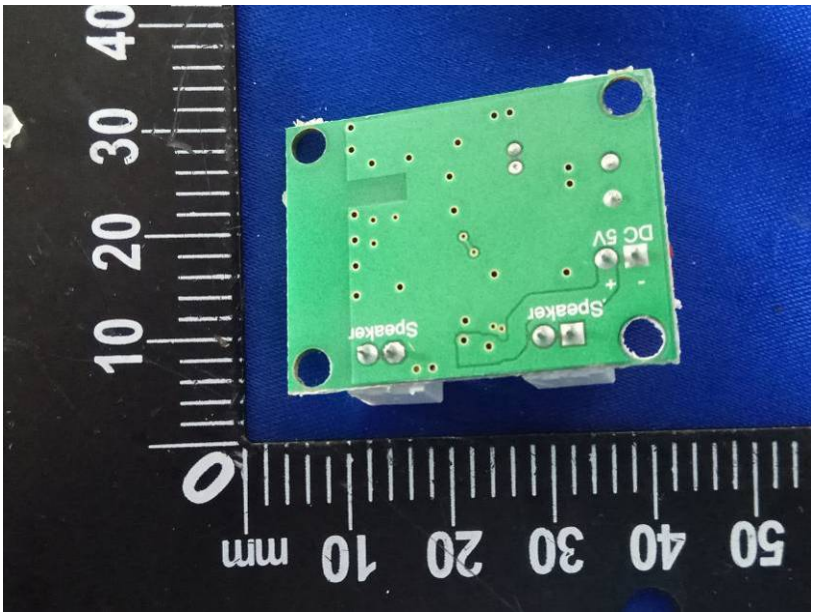


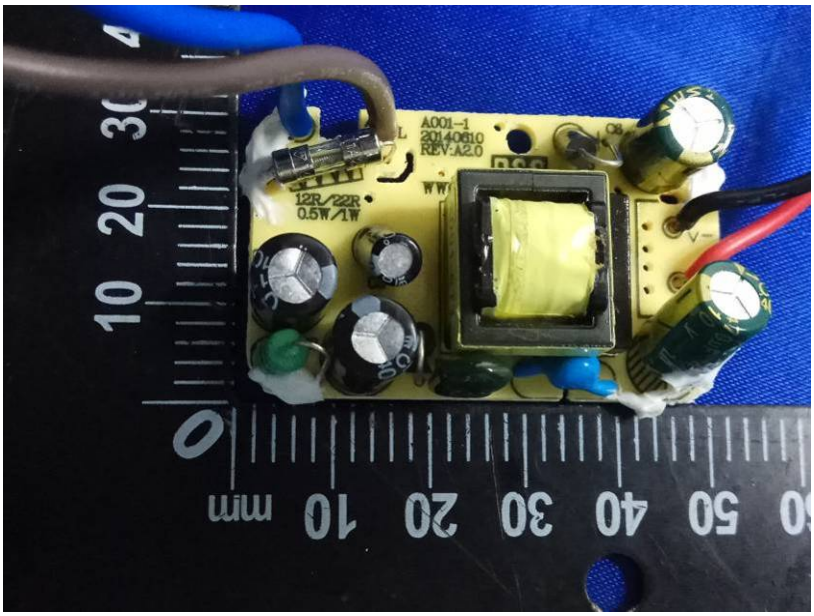


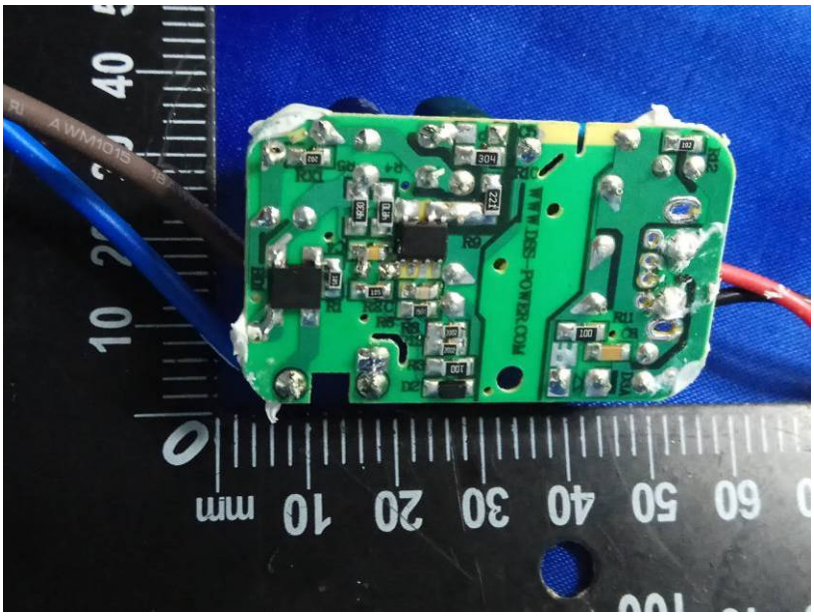


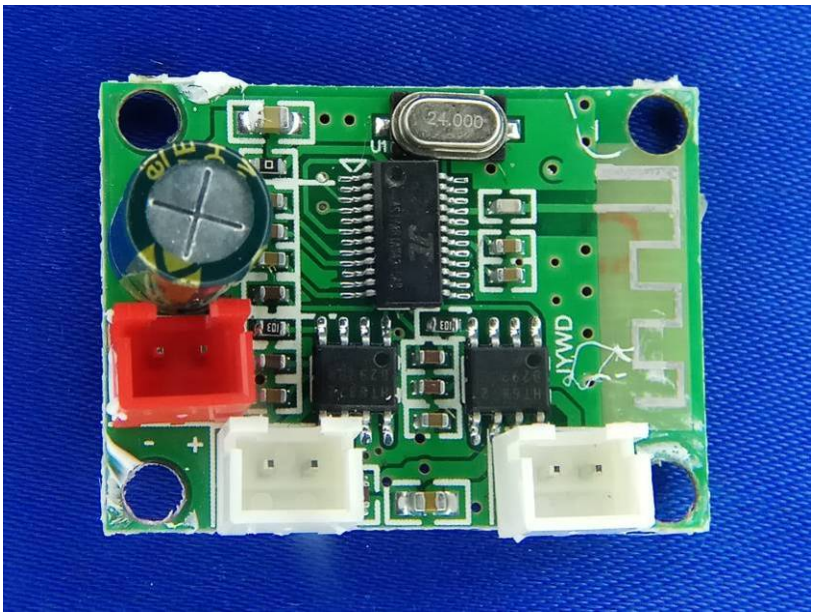



mm
0
10
20
30
40
10
20
30


mm
0
10
20
30
40
50
10
20
30
40
Speaker
Speaker
DC 5V


A001-1
20140610
REV:A2.0
12R/222R
0.5W/1W





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