

FCC TEST REPORT

FCC ID: 2AIWRTRILOGY

Product	:	Wireless headphone
Model Name	:	Trilogy,SM-BT670
Brand	:	SoundPal
Report No.	:	PTC801011160613E-FC01
Prepared for		
The One Technologies LLC		
44 court street,suite 1217,Brooklyn,NY 11201,USA		
Prepared by		
DongGuan Precise Testing Service Co.,Ltd.		
Building D, Baoding Technology Park, Guangming Road 2, Guangming Community		
Dongcheng District, Dongguan, Guangdong, China		



TEST RESULT CERTIFICATION

Applicant's name : The One Technologies LLC
 Address : 44 court street,suite 1217,Brooklyn,NY 11201,USA
 Manufacture's name : Senmai Electron Ltd.
 Address : Block 8,Wangxin Road,Shuiling Industrial Zone,Zhouwu District,Dongcheng,Dongguan,Guangdong,China
 Product name : Wireless headphone
 Model name : Trilogy,SM-BT670
 Standards : FCC CFR47 Part 15 Section 15.247
 Test procedure : ANSI C63.10:2013, DA 00-705
 Test Date : Jun.17, 2016 ~ Jul.12, 2016
 Date of Issue : Jul.12, 2016
 Test Result : Pass

This device described above has been tested by PTS, 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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Testing Engineer

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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious emissions	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

Remark:

N/A: Not Applicable



3 General Information

3.1 General Description of E.U.T.

Product Name	:	Wireless headphone
Model Name	:	Trilogy,SM-BT670
Model Description	:	Only the model names are different
Bluetooth Version	:	V4.1+HS
Operating frequency	:	2402-2480MHz
Max. RF output power	:	-1.14dBm
Type of Modulation	:	GFSK, Pi/4 DQPSK,8DPSK
Antenna installation:	:	PCB printed antenna
Antenna Gain:	:	0dBi
Power supply	:	DC 3.7V 450mAh Power by battery, DC 5V charging by USB port



3.2 Channel List

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

3.3 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2441MHz	2480MHz
Hopping	2402-2480MHz		

3.4 Test Site

Dongguan Precise Testing Service Co., Ltd.

Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan,

Guangdong, China, Dongguan, 523129

China

FCC Registration Number: 371540

IC Registration Number: 12191A-1



4 Equipment During Test

4.1 Equipments List

RF Conducted Test							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug.04, 2015	Aug.03, 2016	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	Aug.04, 2015	Aug.03, 2016	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde&Schwarz	ESCI	101417	July 15, 2015	July 14, 2016	1 year
2	Trilog Broadband Antenna	SCHWARZECK	VULB9160	9160-3355	July 15, 2015	July 14, 2016	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2015	July 14, 2016	1 year
4	Horn Antenna	SCHWARZECK	BBHA9120D	9120D-1246	July 15, 2015	July 14, 2016	1 year
Conducted Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
2	LISN	SCHWARZECK	NSLK 8128	8128-289	July 15, 2015	July 14, 2016	1 year
3	Cable	LARGE	RF300	-	July 15, 2015	July 14, 2016	1 year



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

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

Limit: : 66-56 dB μ V between 0.15MHz & 0.5MHz
 : 56 dB μ V between 0.5MHz & 5MHz
 : 60 dB μ V between 5MHz & 30MHz

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

5.1 E.U.T. Operation

Operating Environment :

Temperature: : 25.5 °C

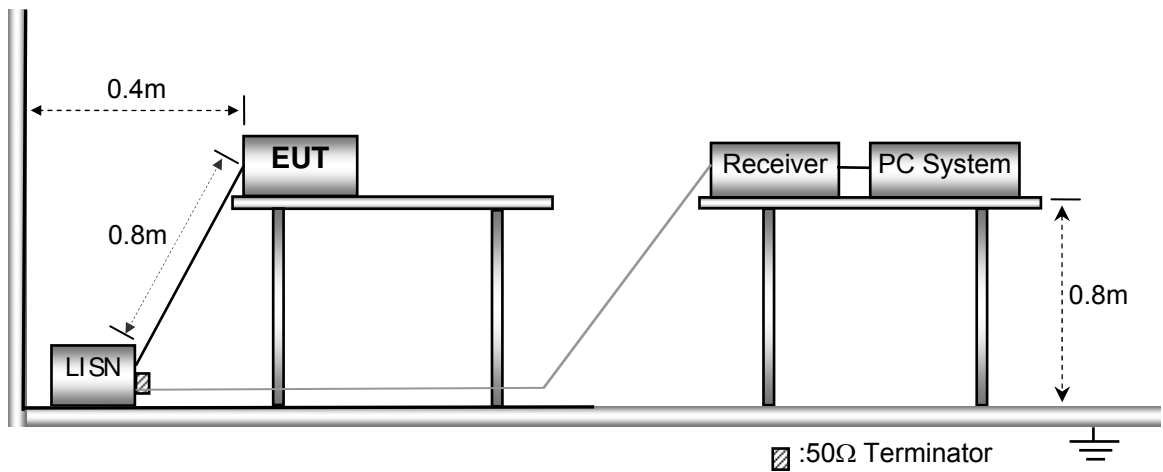
Humidity: : 51 % RH

Atmospheric Pressure: : 101.2kPa

EUT Operation : : Refer to section 3.3

5.2 EUT Setup

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



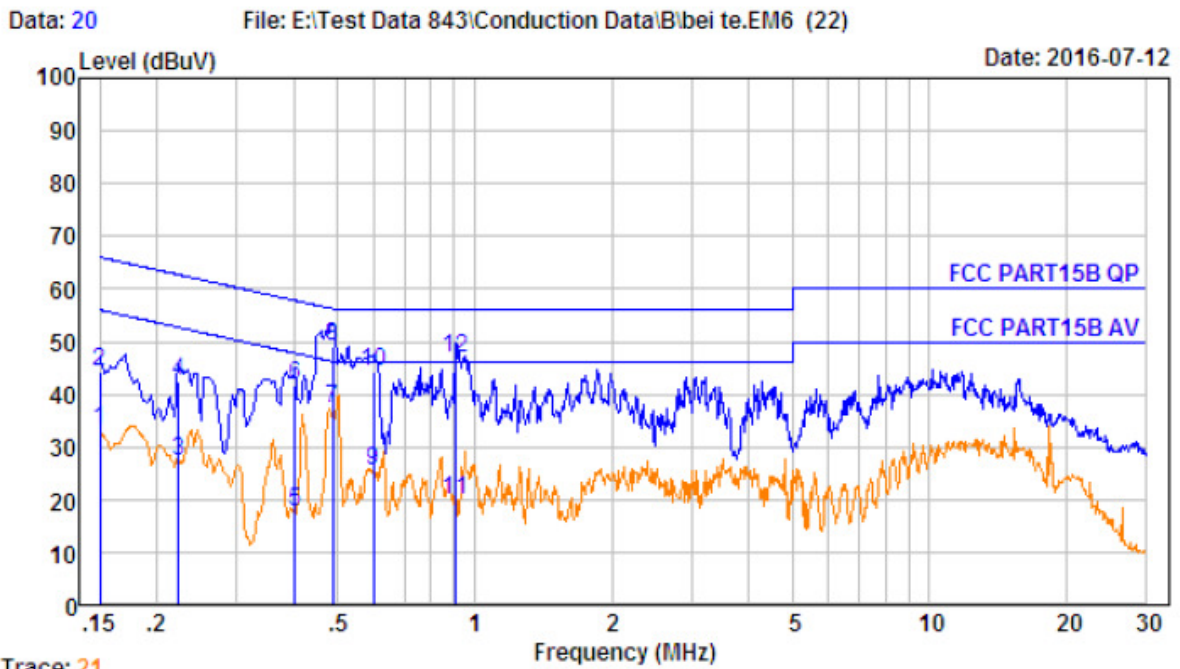


5.3 Measurement Description

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.

5.4 Conducted Emission Test Result

Live line:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.150	10.60	0.60	22.00	33.20	56.00	-22.80	Average
2.	0.150	10.60	0.60	33.03	44.23	66.00	-21.77	QP
3.	0.223	10.61	0.60	16.09	27.30	52.70	-25.40	Average
4.	0.223	10.61	0.60	31.15	42.36	62.70	-20.34	QP
5.	0.402	10.64	0.60	6.56	17.80	47.81	-30.01	Average
6.	0.402	10.64	0.60	30.57	41.81	57.81	-16.00	QP
7.	0.486	10.64	0.60	25.86	37.10	46.23	-9.13	Average
8.	0.486	10.64	0.60	37.90	49.14	56.23	-7.09	QP
9.	0.598	10.66	0.60	14.14	25.40	46.00	-20.60	Average
10.	0.598	10.66	0.60	33.16	44.42	56.00	-11.58	QP
11.	0.909	10.67	0.60	8.53	19.80	46.00	-26.20	Average
12.	0.909	10.67	0.60	35.55	46.82	56.00	-9.18	QP

Remark: Emission level = Reading + Cable loss + AMN Factor

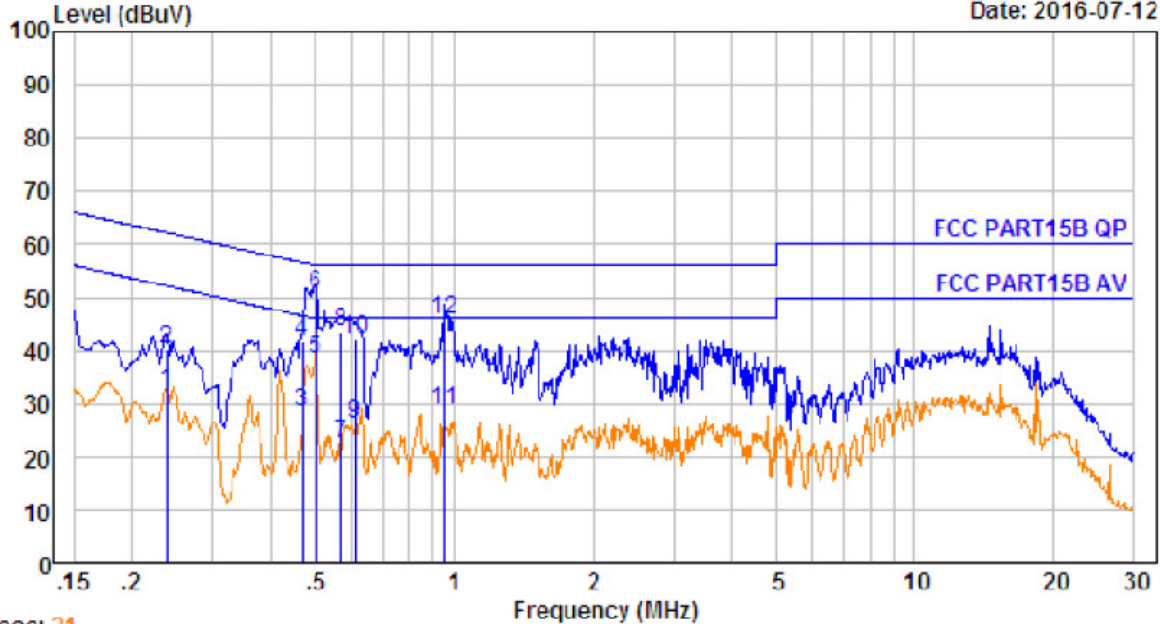


Neutral line:

Data: 22

File: E:\Test Data 843\Conduction Data\B\bei te.EM6 (22)

Date: 2016-07-12



Trace: 21

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.238	10.62	0.60	20.88	32.10	52.17	-20.07	Average
2.	0.238	10.62	0.60	28.97	40.19	62.17	-21.98	QP
3.	0.469	10.64	0.60	17.26	28.50	46.54	-18.04	Average
4.	0.469	10.64	0.60	30.35	41.59	56.54	-14.95	QP
5.	0.502	10.65	0.60	27.25	38.50	46.00	-7.50	Average
6.	0.502	10.65	0.60	39.28	50.53	56.00	-5.47	QP
7.	0.567	10.65	0.60	11.25	22.50	46.00	-23.50	Average
8.	0.567	10.65	0.60	32.32	43.57	56.00	-12.43	QP
9.	0.611	10.66	0.60	14.94	26.20	46.00	-19.80	Average
10.	0.611	10.66	0.60	30.96	42.22	56.00	-13.78	QP
11.	0.948	10.67	0.60	17.53	28.80	46.00	-17.20	Average
12.	0.948	10.67	0.60	34.58	45.85	56.00	-10.15	QP

Remark: Emission level = Reading + Cable loss + AMN Factor



6 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: : ANSI C63.10:2013,DA 00-705
 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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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

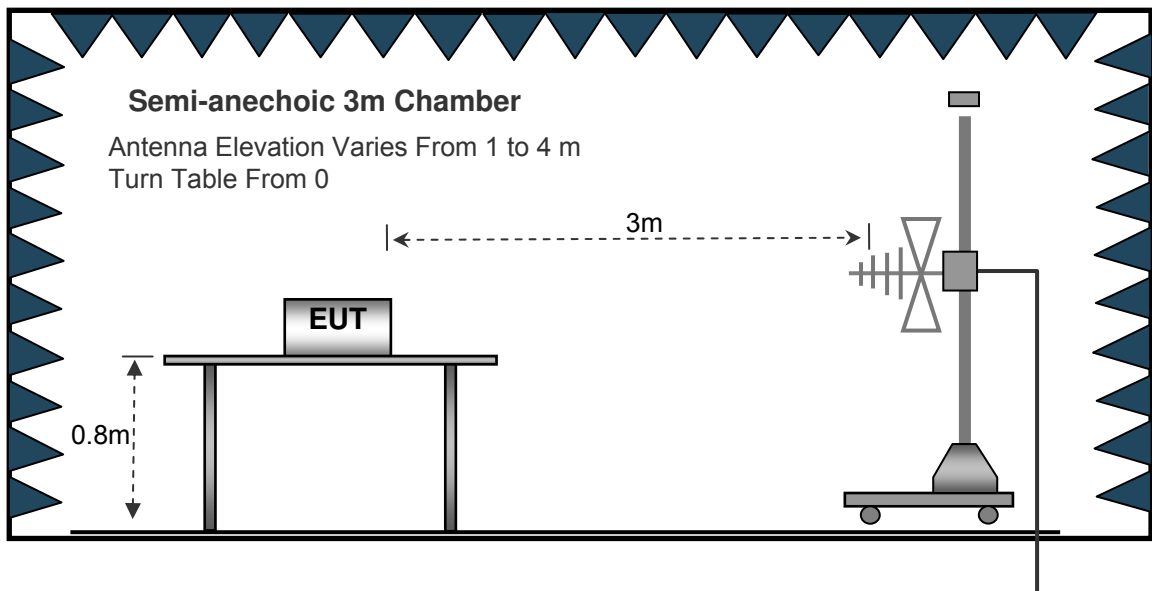
Operating Environment :
 Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

6.2 Test Setup

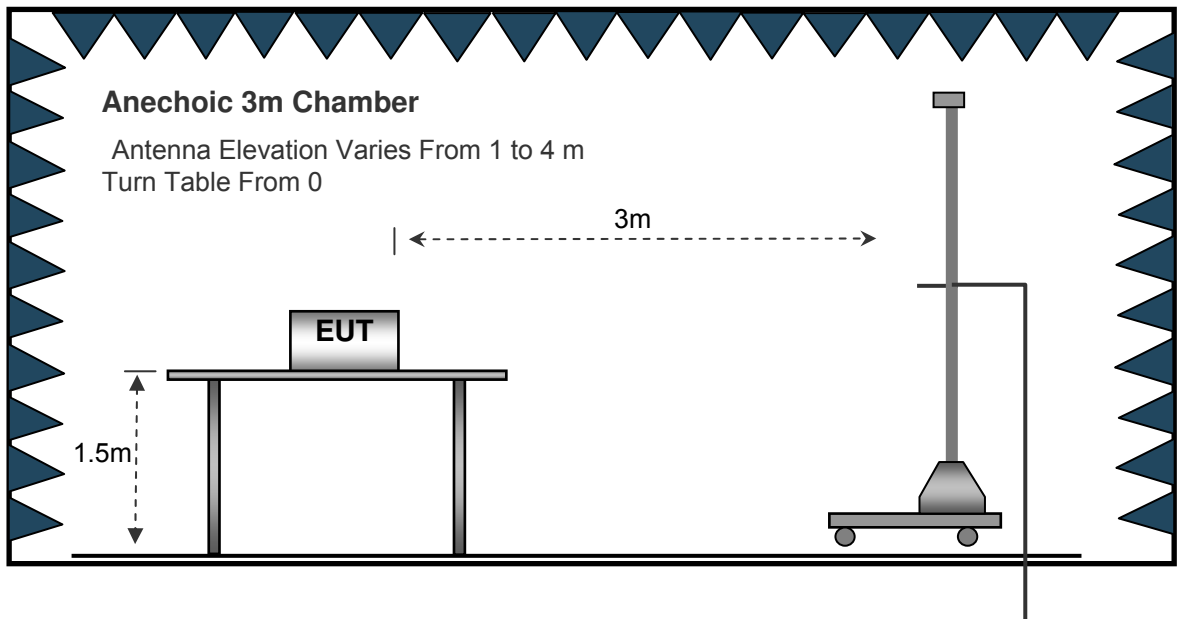
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

The test setup for emission measurement below 30MHz.

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



The test setup for emission measurement above 1 GHz.



6.3 Spectrum Analyzer Setup

Below 30MHz

IF Bandwidth	10kHz
Resolution Bandwidth	10kHz
Video Bandwidth	10kHz

30MHz ~ 1GHz

Detector	: PK
Resolution Bandwidth	: 100kHz
Video Bandwidth	: 300kHz
Detector	: QP
Resolution Bandwidth	: 120kHz
Video Bandwidth	: 300kHz

Above 1GHz

Detector	: PK
Resolution Bandwidth	: 1MHz
Video Bandwidth	: 3MHz
Detector	: AV
Resolution Bandwidth	: 1MHz
Video Bandwidth	: 10Hz



6.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.
8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room.



6.5 Summary of Test Results

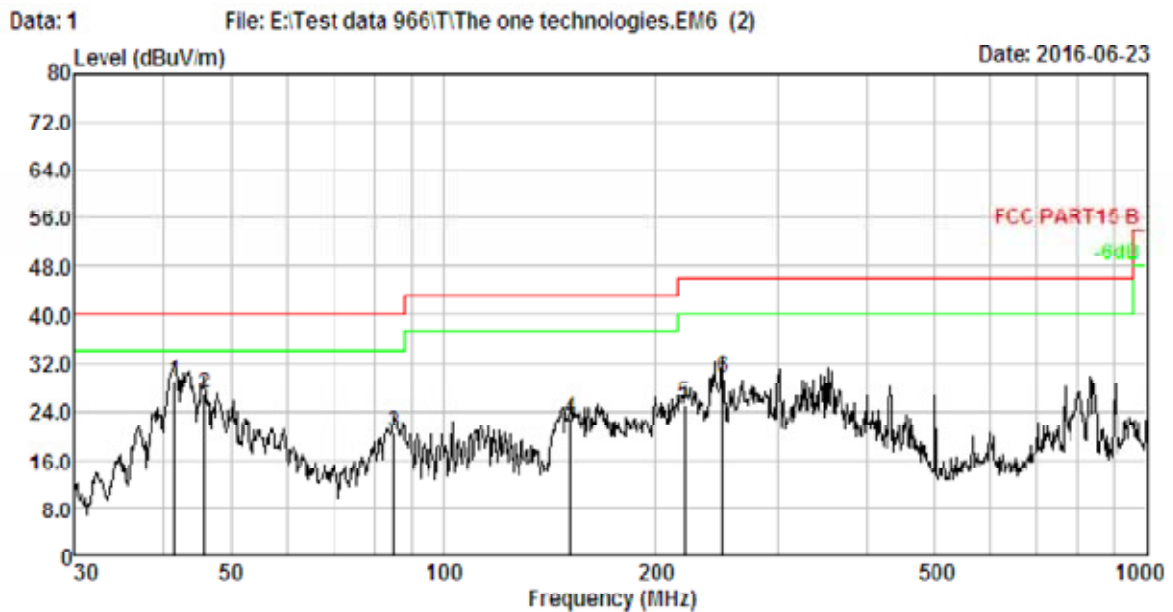
Test Frequency: Below 30MHz

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

Test Frequency: 30MHz ~ 1GHz

All applicable test modes have been tested and only the worst case (GFSK TX in middle channel) is recorded.

Antenna Polarization: Horizontal

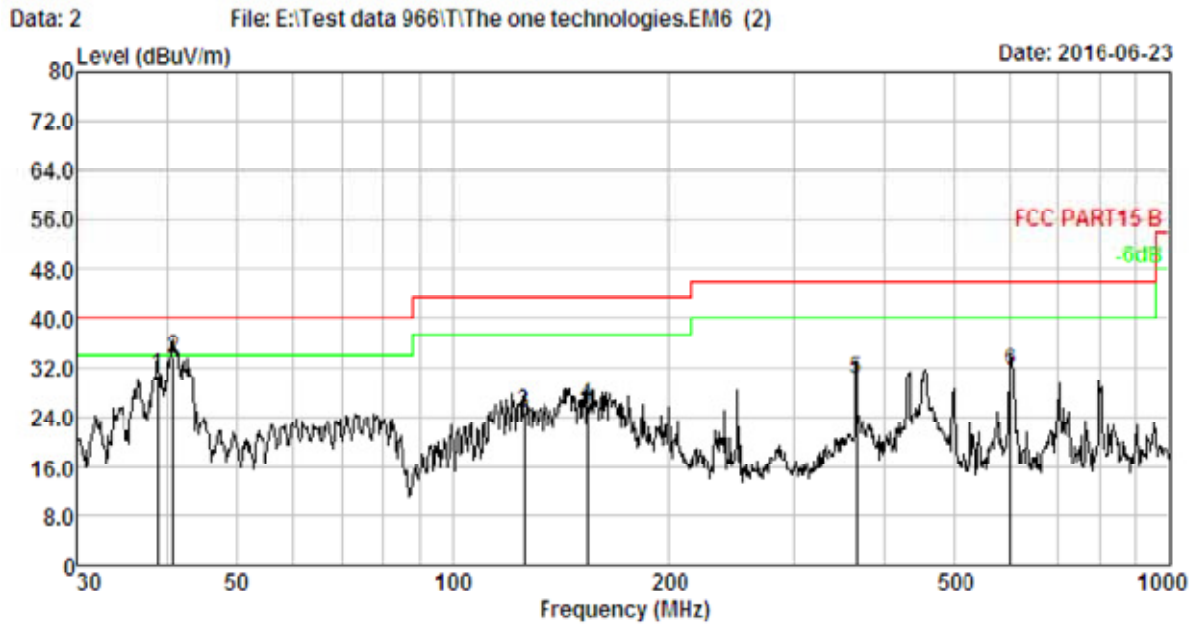


No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBUV	Preamp Factor dB	Emission Level dBUV/m	Limit dBUV/m	Over Limit dB	Remark
1.	41.567	1.35	13.56	44.10	30.08	28.93	40.00	-11.07	QP
2.	45.855	1.44	13.07	42.51	30.12	26.90	40.00	-13.10	QP
3.	85.298	2.00	8.72	40.07	30.33	20.46	40.00	-19.54	QP
4.	152.130	2.53	13.90	36.90	30.53	22.80	43.50	-20.70	QP
5.	220.617	2.86	10.79	42.05	30.66	25.04	46.00	-20.96	QP
6.	250.301	2.98	11.93	45.46	30.71	29.66	46.00	-16.34	QP

Remark: Emission level = Reading + Cable loss + ANT Factor - Preamp gain



Antenna Polarization: Vertical



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.	38.888	1.29	13.62	45.78	30.06	30.63	40.00	-9.37	QP
2.	40.845	1.33	13.63	48.69	30.08	33.57	40.00	-6.43	QP
3.	125.886	2.35	12.39	40.67	30.47	24.94	43.50	-18.56	QP
4.	154.279	2.54	13.89	40.20	30.54	26.09	43.50	-17.41	QP
5.	366.823	3.32	14.56	42.96	30.84	30.00	46.00	-16.00	QP
6.	601.427	3.77	19.16	39.75	31.01	31.67	46.00	-14.33	QP

Remark: Emission level = Reading + Cable loss + ANT Factor - Preamp gain



Test Frequency: 1GHz ~ 18GHz

All applicable test modes have been tested and only the worst case (GFSK Mode) is recorded.

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel						
1184.32	45.25	PK	-18.92	26.33	74.00	-47.67
1184.32	37.91	Ave	-18.92	18.99	54.00	-35.01
4804.00	49.07	PK	-1.06	48.01	74.00	-25.99
4804.00	44.56	Ave	-1.06	43.50	54.00	-10.50
7206.00	50.49	PK	1.33	51.82	74.00	-22.18
7206.00	42.51	Ave	1.33	43.84	54.00	-10.16
Restricted bands Emission						
2331.63	45.91	PK	-13.19	32.72	74.00	-41.28
2331.63	39.15	Ave	-13.19	25.96	54.00	-28.04
2766.60	41.06	PK	-13.14	27.92	74.00	-46.08
2766.60	38.31	Ave	-13.14	25.17	54.00	-28.83
3334.34	42.61	PK	-13.08	29.53	74.00	-44.47
3334.34	41.25	Ave	-13.08	28.17	54.00	-25.83
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel						
1184.32	45.34	PK	-18.92	26.42	74.00	-47.58
1184.32	37.81	Ave	-18.92	18.89	54.00	-35.11
4880.00	49.90	PK	-0.93	48.97	74.00	-25.03
4880.00	44.72	Ave	-0.93	43.79	54.00	-10.21
7320.00	49.61	PK	1.67	51.28	74.00	-22.72
7320.00	42.86	Ave	1.67	44.53	54.00	-9.47
Restricted bands Emission						
2314.09	45.05	PK	-13.19	31.86	74.00	-42.14
2314.09	38.95	Ave	-13.19	25.76	54.00	-28.24
2670.38	40.80	PK	-13.14	27.66	74.00	-46.34
2670.38	37.49	Ave	-13.14	24.35	54.00	-29.65
3349.48	43.52	PK	-13.08	30.44	74.00	-43.56
3349.48	40.65	Ave	-13.08	27.57	54.00	-26.43
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel						
1184.32	45.57	PK	-18.92	26.65	74.00	-47.35
1184.32	36.89	Ave	-18.92	17.97	54.00	-36.03
4960.00	49.29	PK	-0.87	48.42	74.00	-25.58
4960.00	44.20	Ave	-0.87	43.33	54.00	-10.67
7440.00	49.39	PK	1.84	51.23	74.00	-22.77
7440.00	43.84	Ave	1.84	45.68	54.00	-8.32
Restricted bands Emission						
2313.86	44.68	PK	-13.19	31.49	74.00	-42.51
2313.86	37.99	Ave	-13.19	24.80	54.00	-29.20
2687.21	40.22	PK	-13.14	27.08	74.00	-46.92
2687.21	37.85	Ave	-13.14	24.71	54.00	-29.29
3355.95	43.52	PK	-13.08	30.44	74.00	-43.56
3355.95	41.30	Ave	-13.08	28.22	54.00	-25.78
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Radiated band edge:

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK						
2400.00	48.69	PK	-13.12	35.57	74.00	-38.43
2400.00	40.85	PK	-13.12	27.73	74.00	-46.27
2483.50	46.64	PK	-13.06	33.58	74.00	-40.42
2483.50	43.02	PK	-13.06	29.96	74.00	-44.04
Pi/4 DQPSK						
2400.00	49.17	PK	-13.12	36.05	74.00	-37.95
2400.00	40.85	PK	-13.12	27.73	74.00	-46.27
2483.50	46.05	PK	-13.06	32.99	74.00	-41.01
2483.50	42.09	PK	-13.06	29.03	74.00	-44.97
8DPSK						
2400.00	48.02	PK	-13.12	34.90	74.00	-39.10
2400.00	39.86	PK	-13.12	26.74	74.00	-47.26
2483.50	46.68	PK	-13.06	33.62	74.00	-40.38
2483.50	42.54	PK	-13.06	29.48	74.00	-44.52
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						

Test Frequency: Above 18GHz

The measurements were more than 20 dB below the limit and 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,DA 00-705
- 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)).
- Test Mode : Refer to section 3.3

7.1 Test Procedure

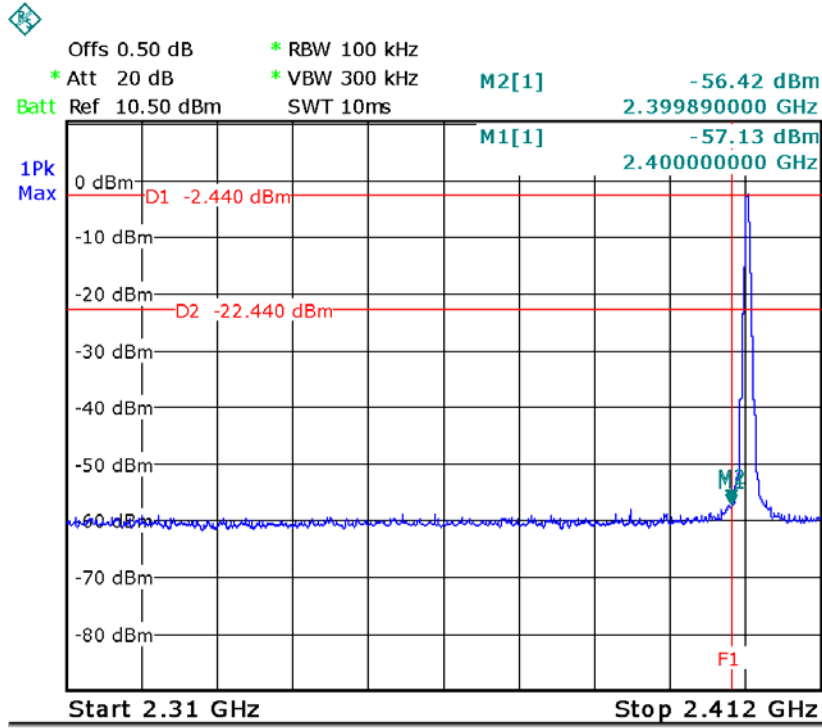
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

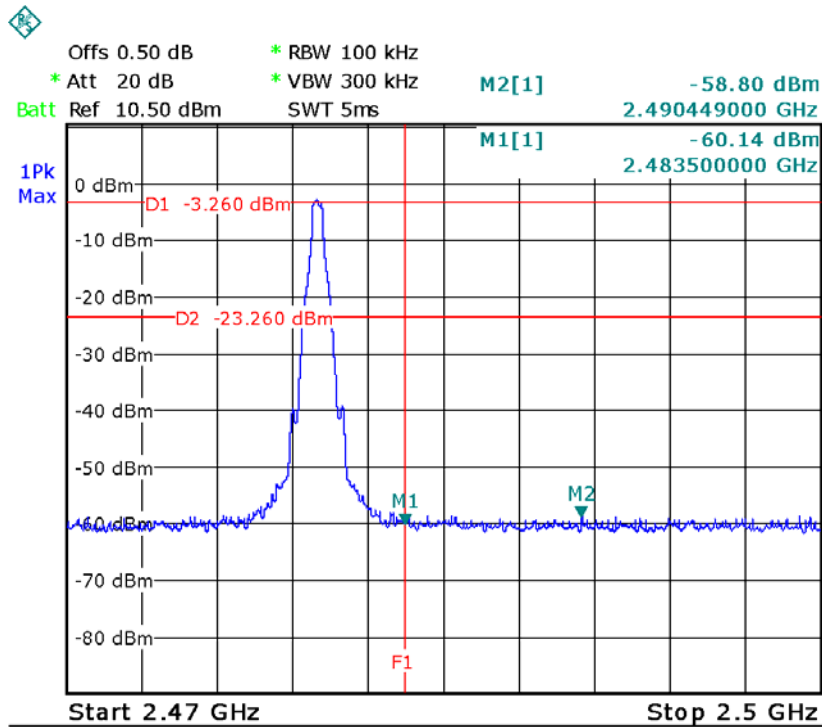


7.2 Test Result

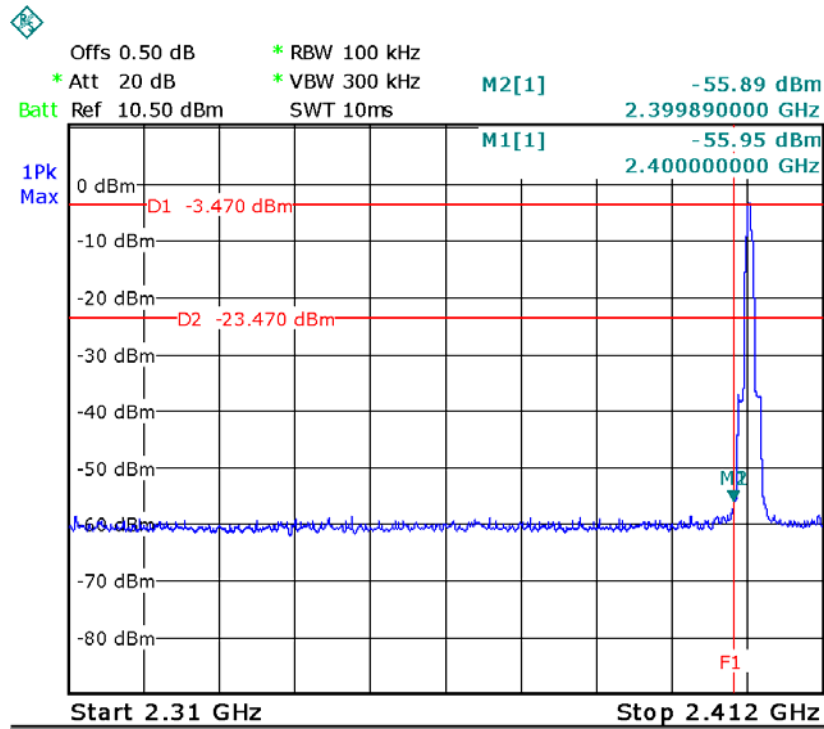
GFSK Band edge-left side



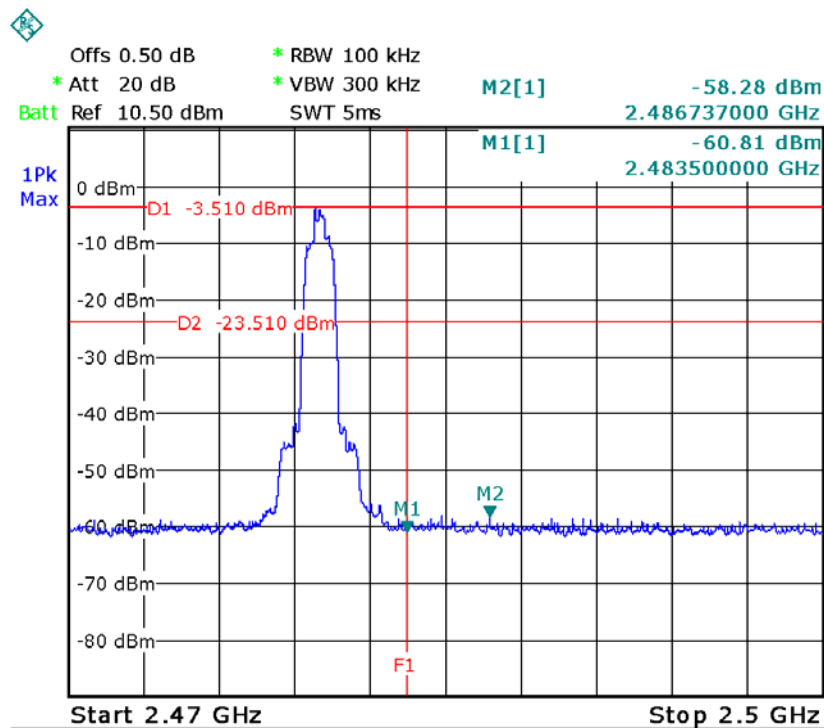
GFSK Band edge-right side



Pi/4 DQPSK Band edge-left side



Pi/4 DQPSK Band edge-right side





8 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247
Test Method : ANSI C63.10:2013, DA 00-705
Test Mode : Refer to section 3.3

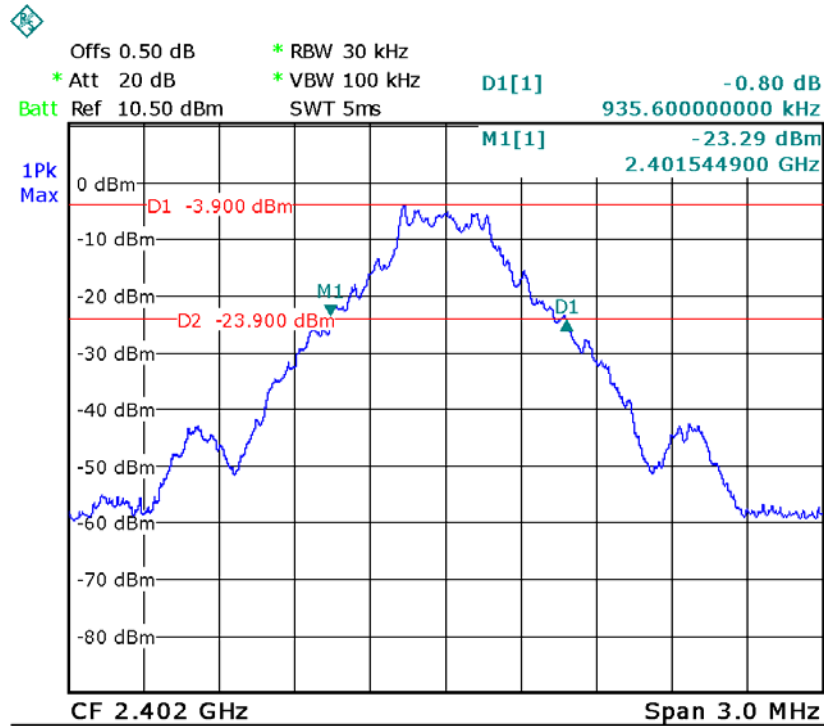
8.1 Test Procedure

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

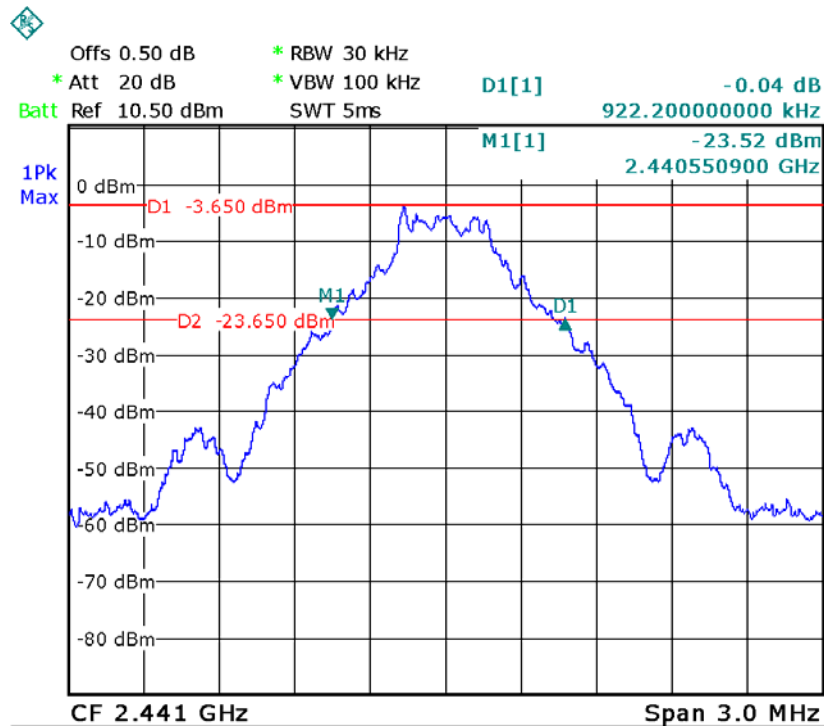
8.2 Test Result

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.9356
GFSK	Middle	0.9222
GFSK	High	0.9222
Pi/4 DQPSK	Low	1.2635
Pi/4 DQPSK	Middle	1.2515
Pi/4 DQPSK	High	1.2515
8DPSK	Low	1.2455
8DPSK	Middle	1.2575
8DPSK	High	1.2575

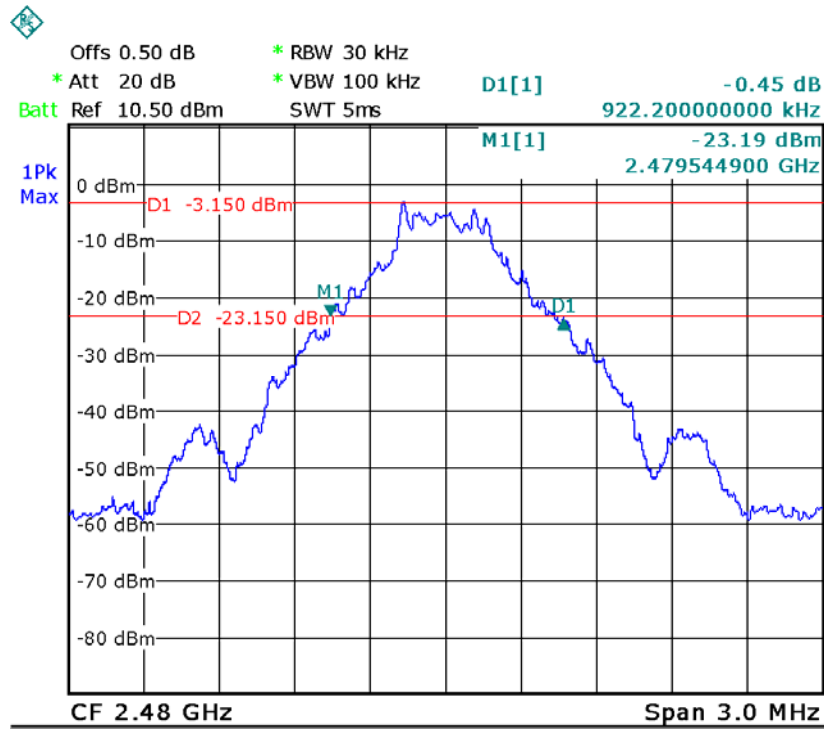
GFSK Low Channel



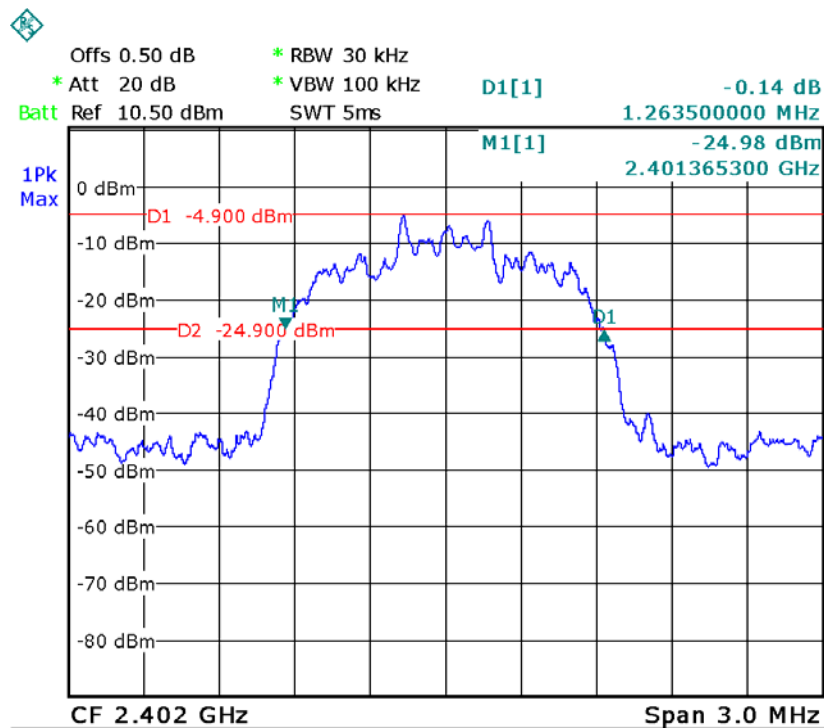
GFSK Middle Channel



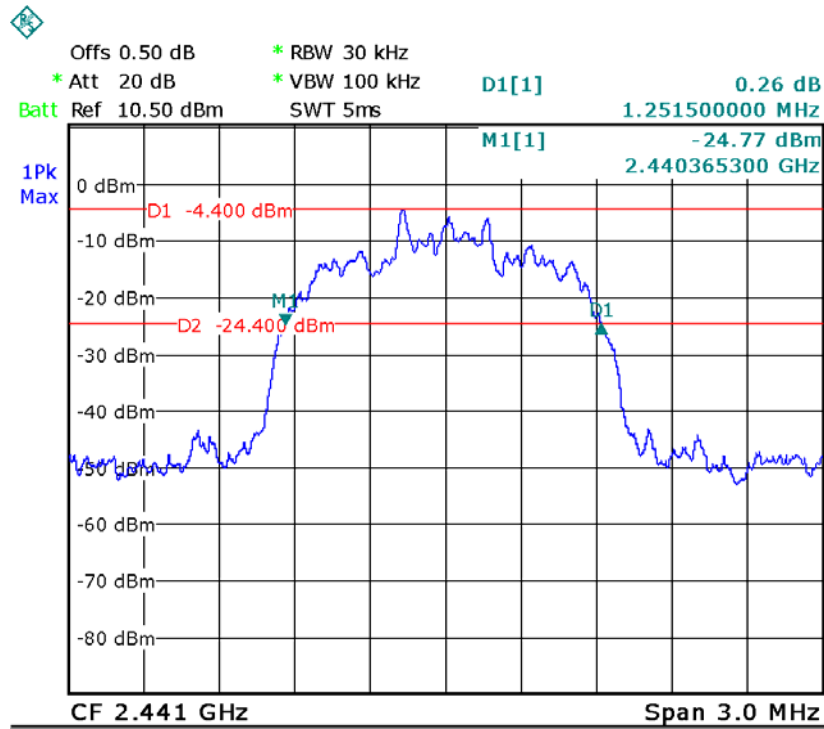
GFSK High Channel



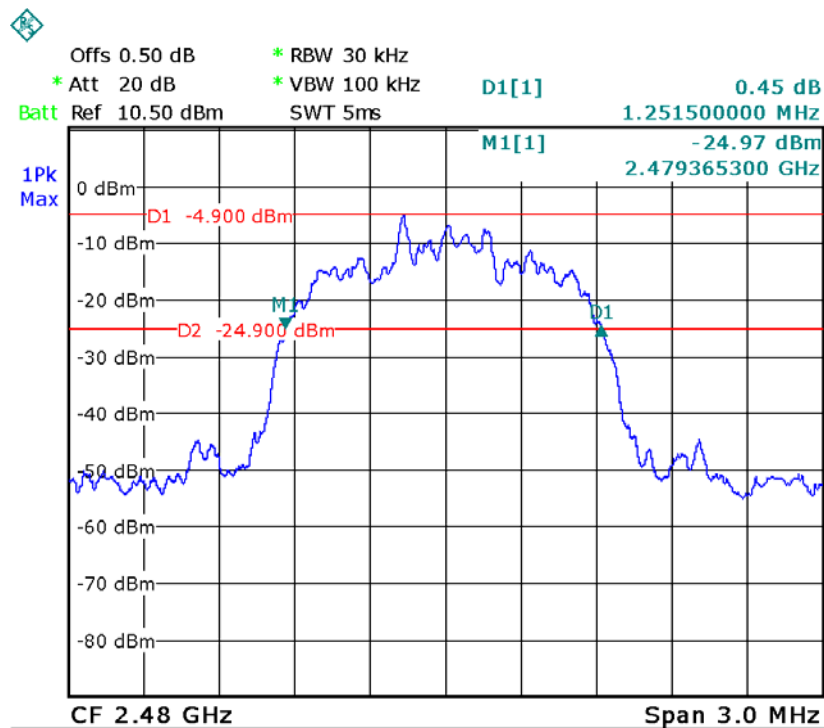
Pi/4DQPSK Low Channel



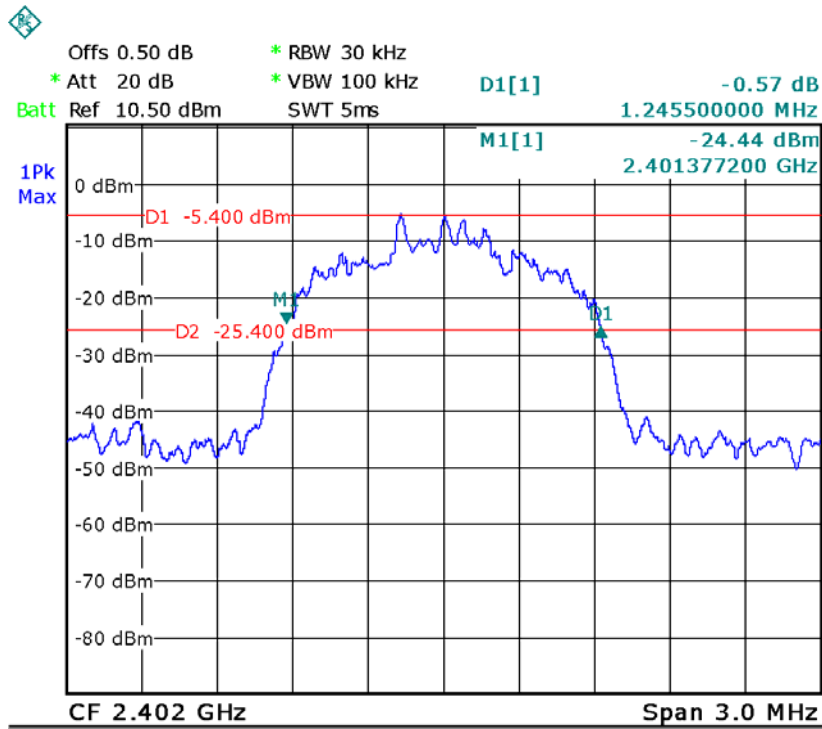
Pi/4DQPSK Middle Channel



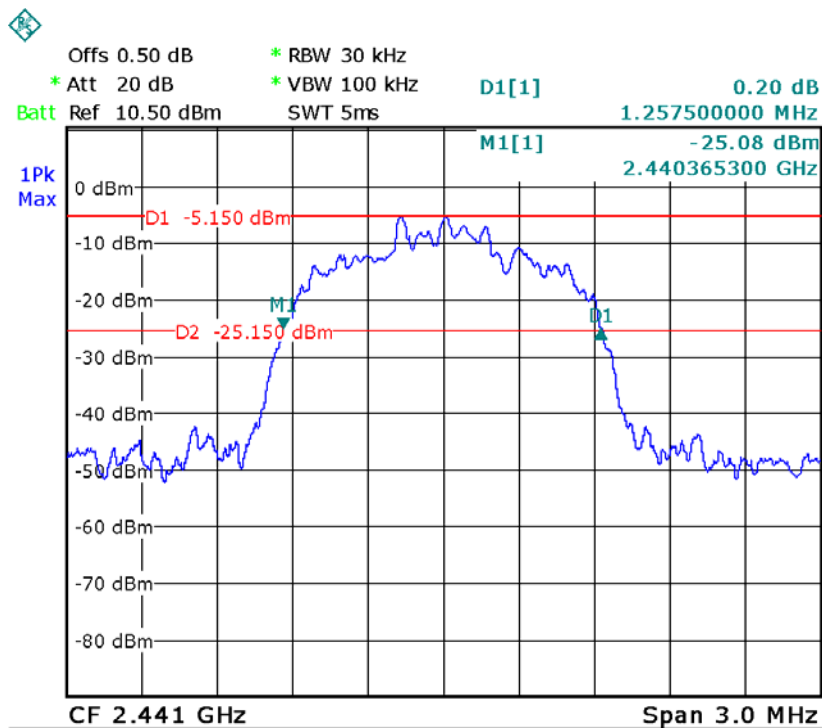
Pi/4DQPSK High Channel



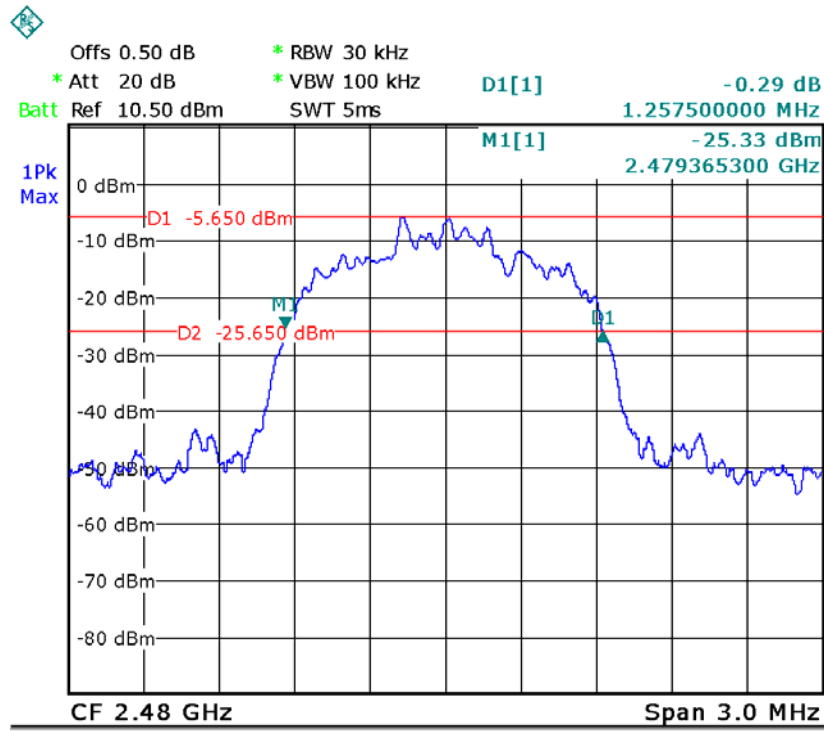
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel





9 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013, DA 00-705

Test Limit : Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. 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.

Test Mode : Refer to section 3.3

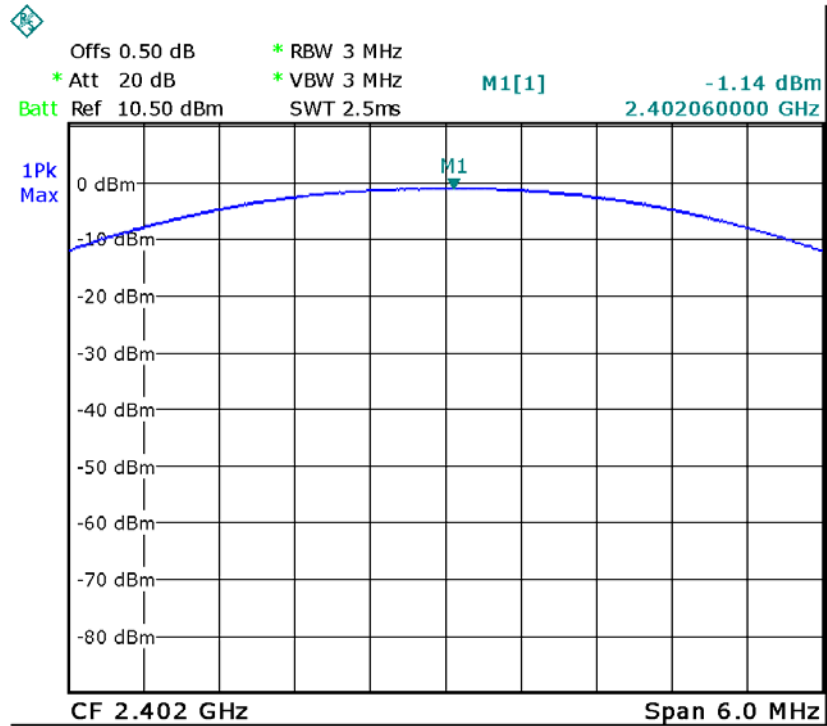
9.1 Test Procedure

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 analyser: RBW = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

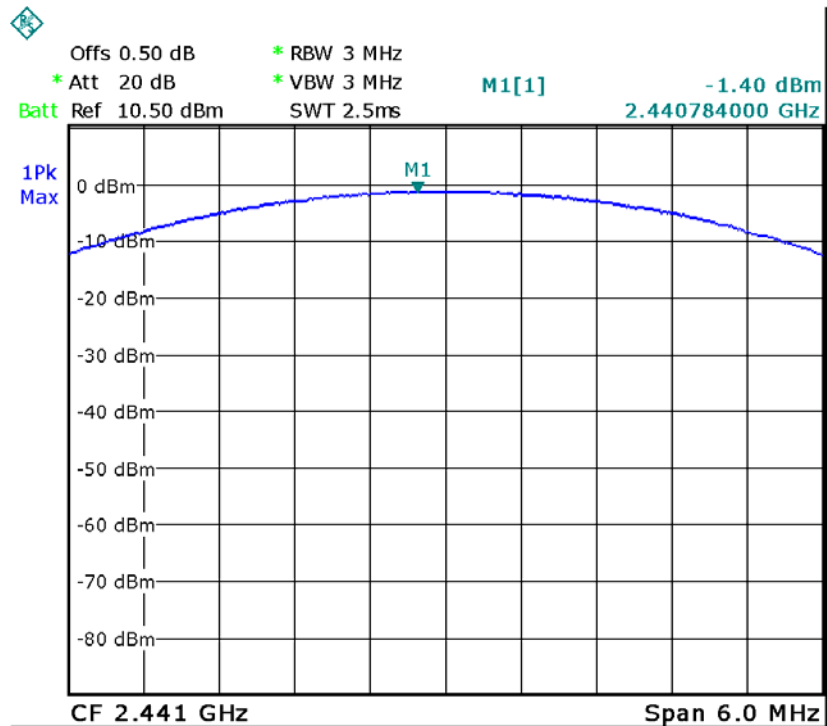
9.2 Test Result

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-1.14	30
GFSK	Middle	-1.40	30
GFSK	High	-1.36	30
Pi/4 DQPSK	Low	-1.63	20.97
Pi/4 DQPSK	Middle	-1.70	20.97
Pi/4 DQPSK	High	-1.87	20.97
8DPSK	Low	-1.23	20.97
8DPSK	Middle	-1.45	20.97
8DPSK	High	-1.66	20.97

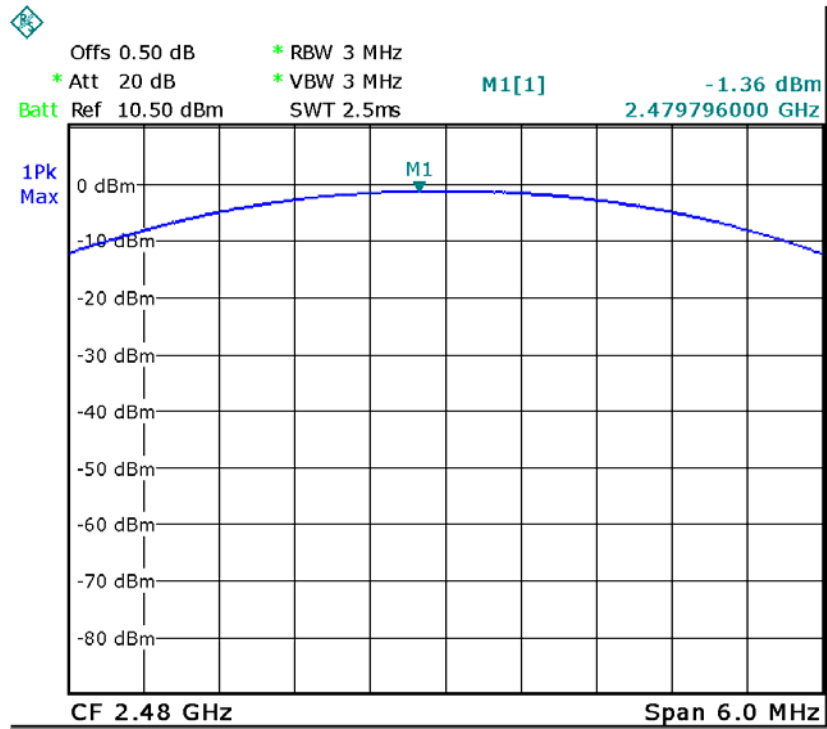
GFSK Low Channel



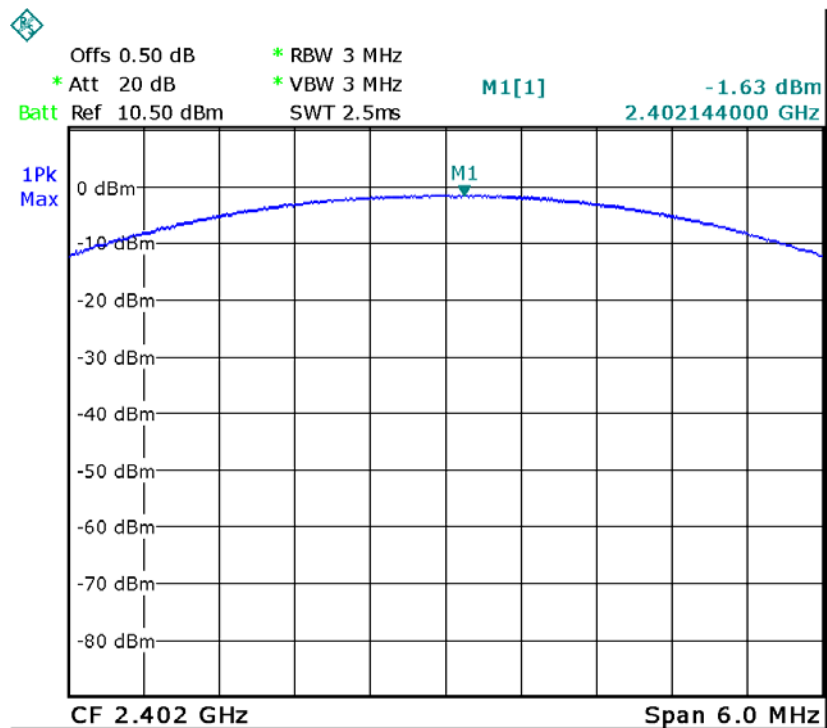
GFSK Middle Channel



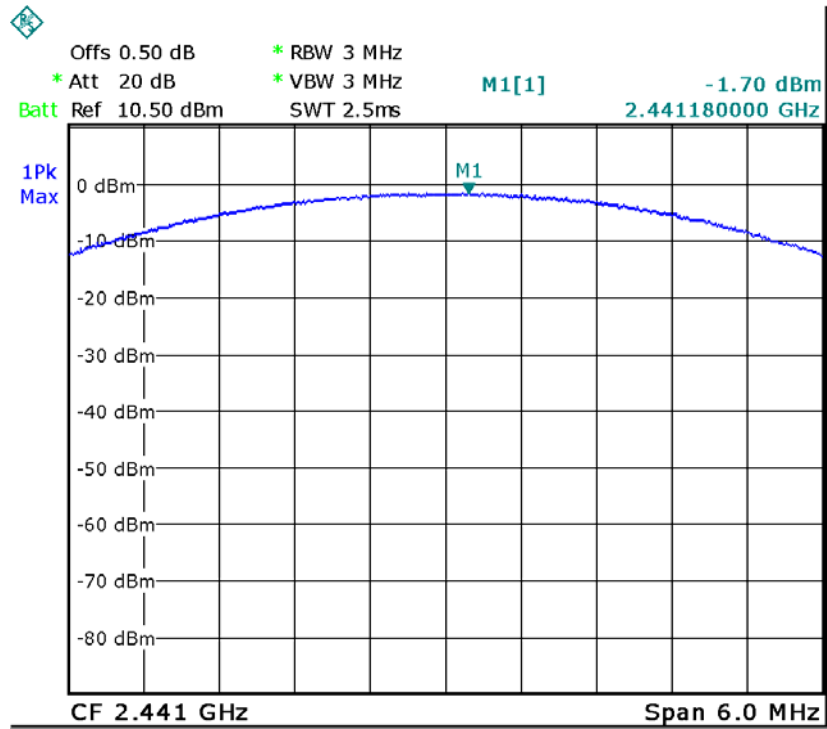
GFSK High Channel



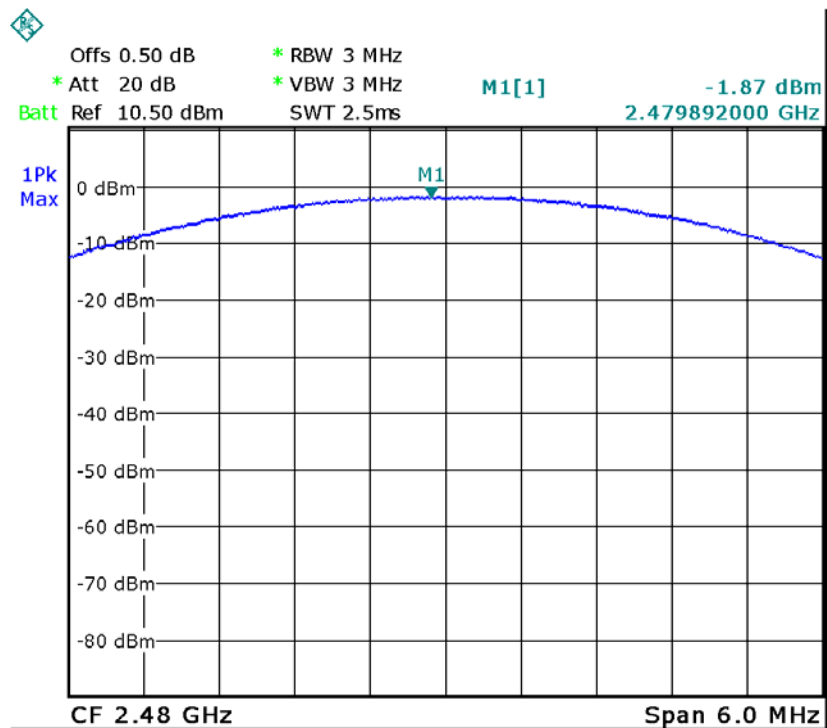
Pi/4DQPSK Low Channel



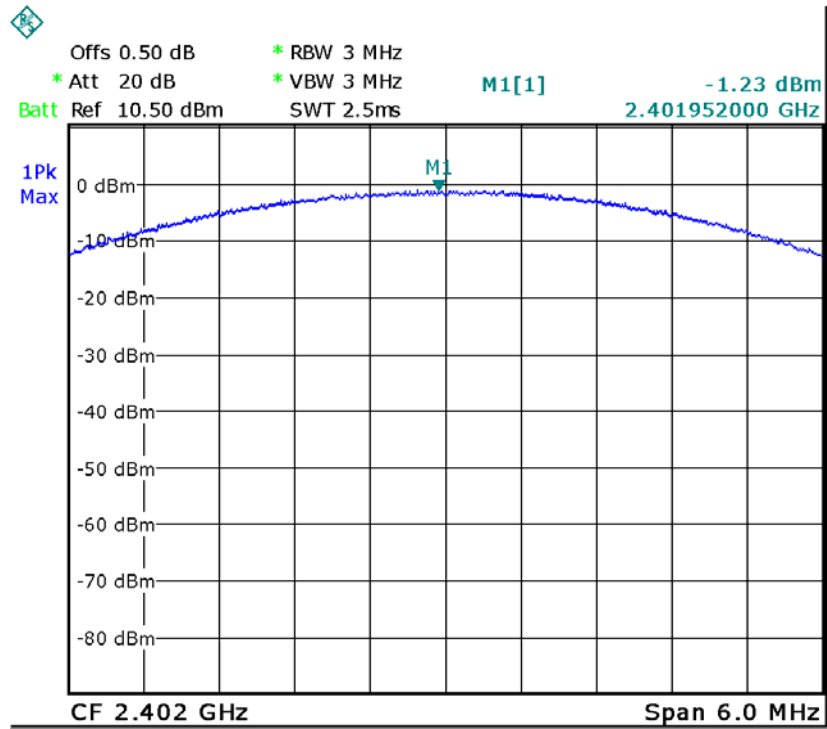
Pi/4DQPSK Middle Channel



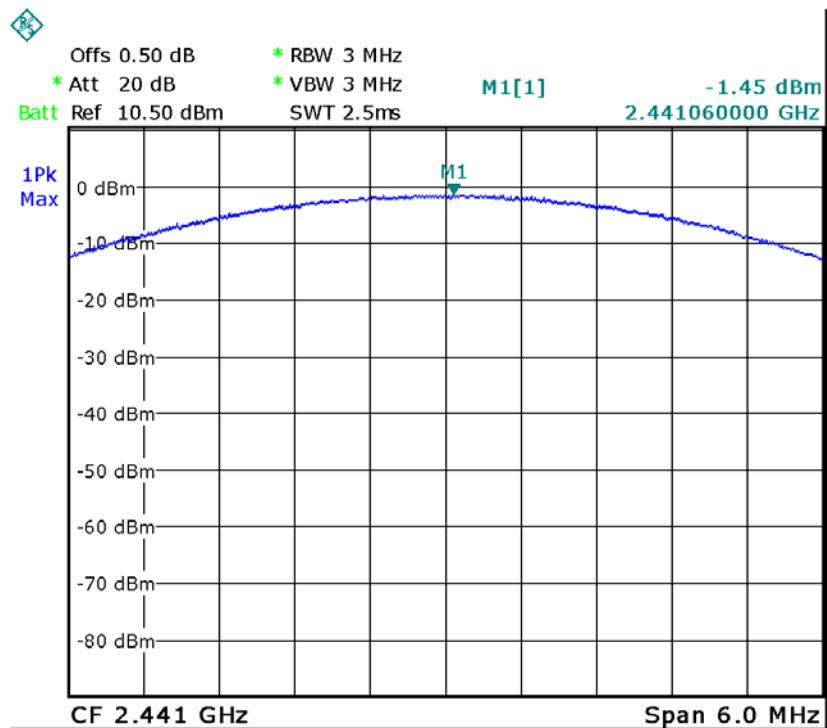
Pi/4DQPSK High Channel



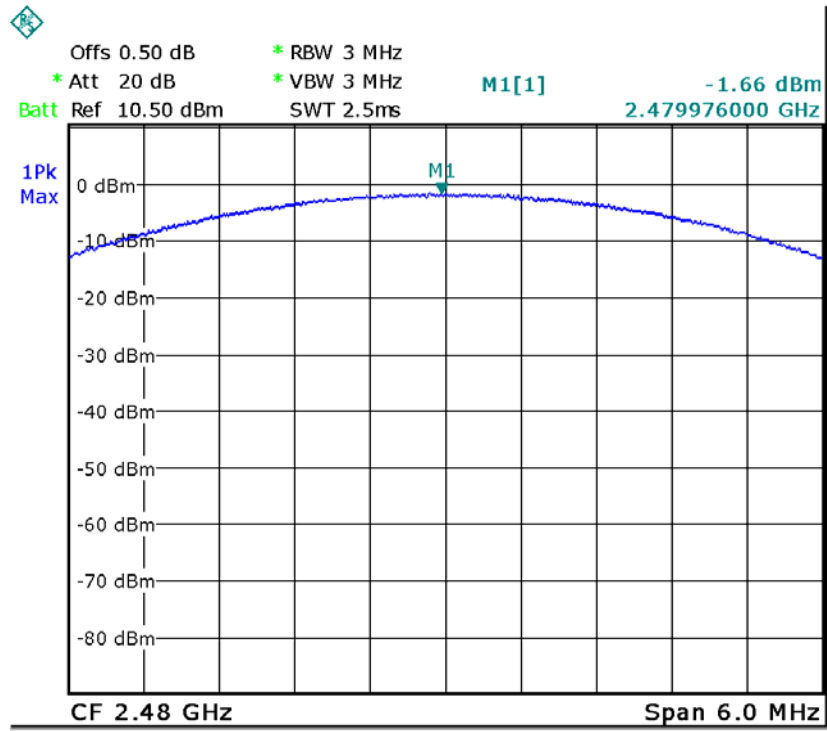
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel





10 Hopping Channel Separation

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- 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

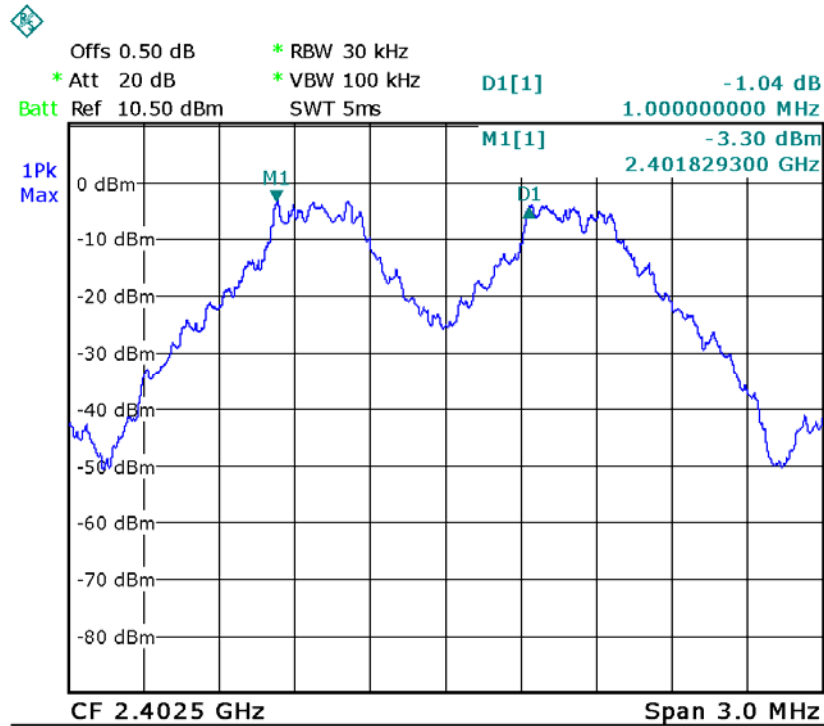
10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

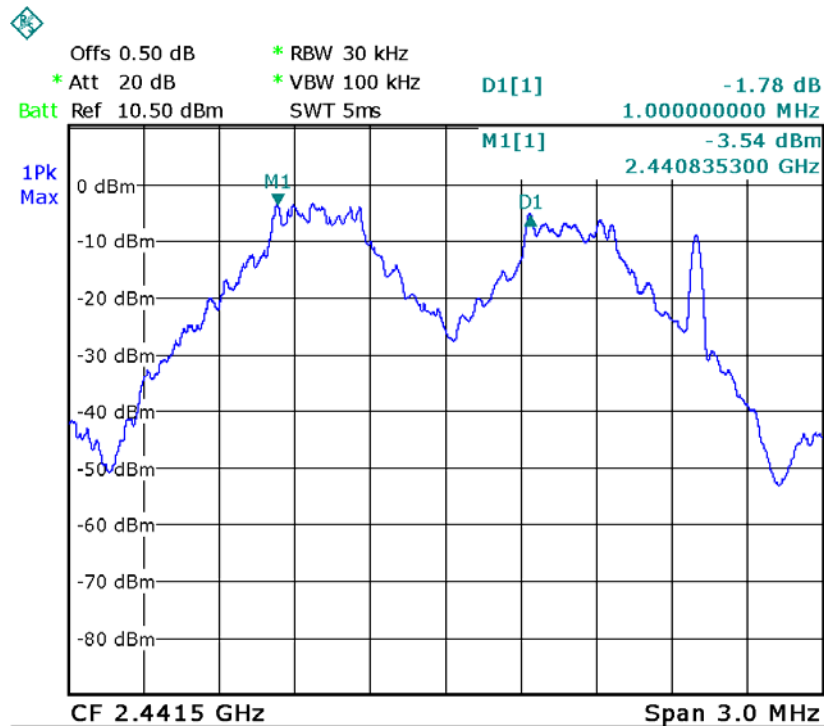
10.2 Test Result

Modulation	Test Channel	Separation (MHz)	Limit (MHz)	Result
GFSK	Low	1.000	0.935	PASS
GFSK	Middle	1.000	0.922	PASS
GFSK	High	1.000	0.922	PASS
Pi/4 DQPSK	Low	1.000	0.843	PASS
Pi/4 DQPSK	Middle	1.000	0.835	PASS
Pi/4 DQPSK	High	1.000	0.835	PASS
8DPSK	Low	1.000	0.831	PASS
8DPSK	Middle	1.000	0.839	PASS
8DPSK	High	1.000	0.839	PASS

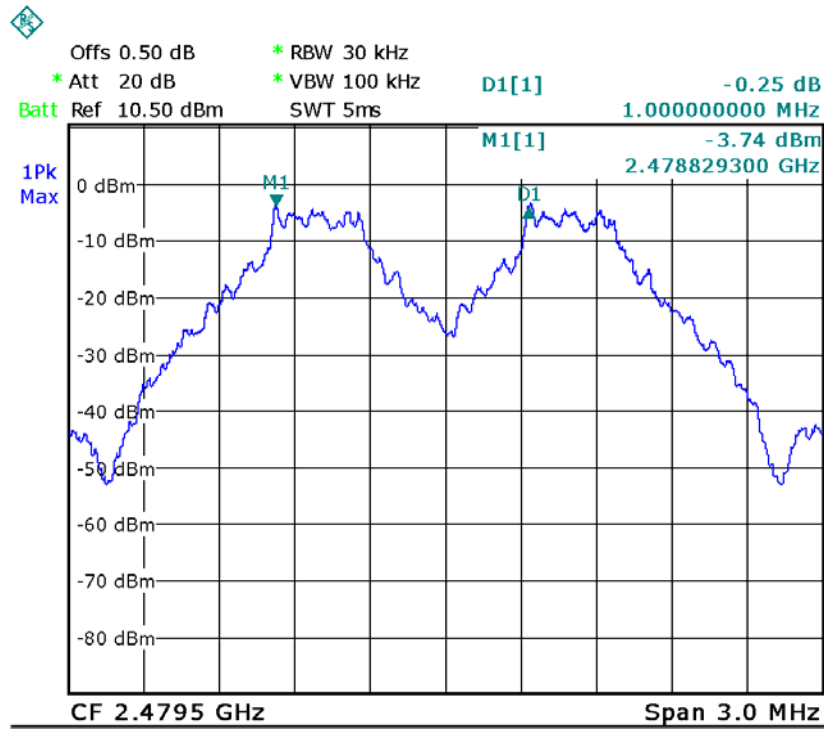
GFSK Low Channel



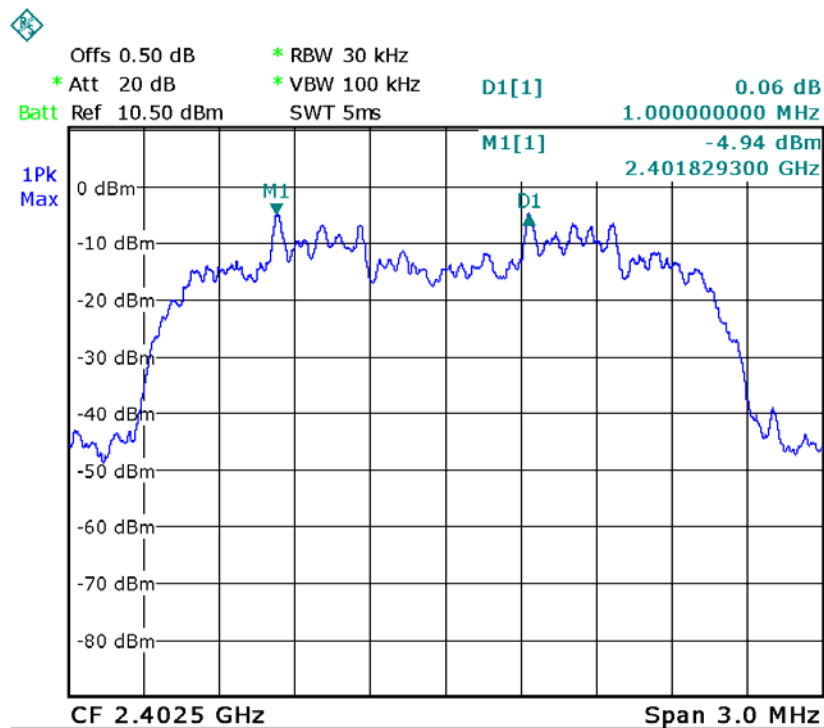
GFSK Middle Channel



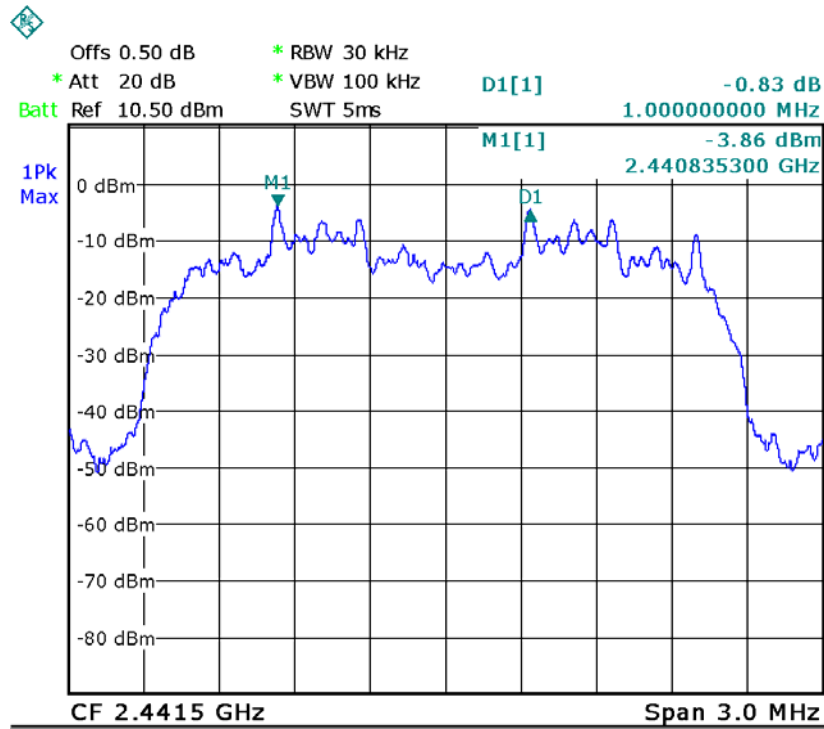
GFSK High Channel



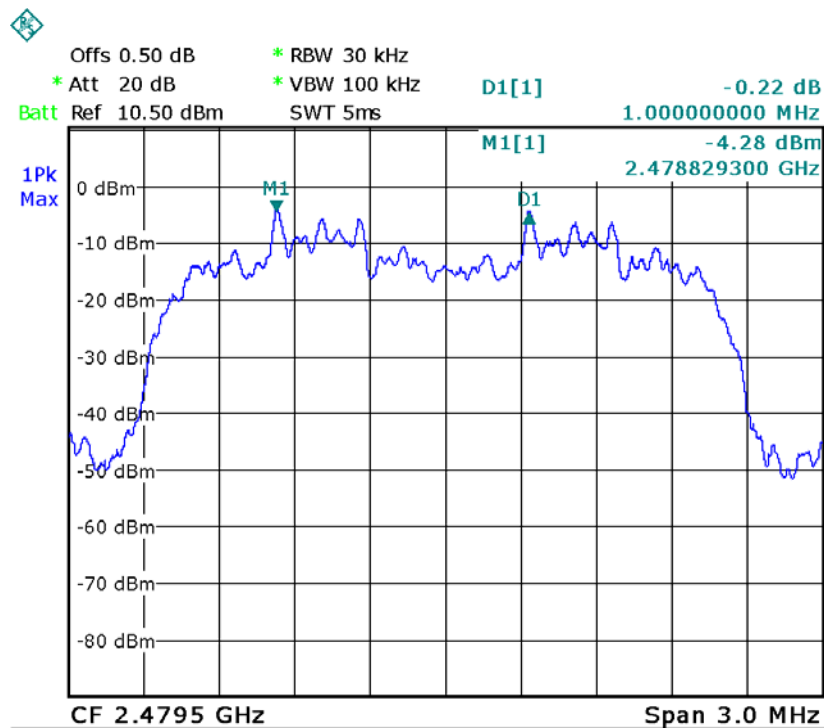
Pi/4DQPSK Low Channel



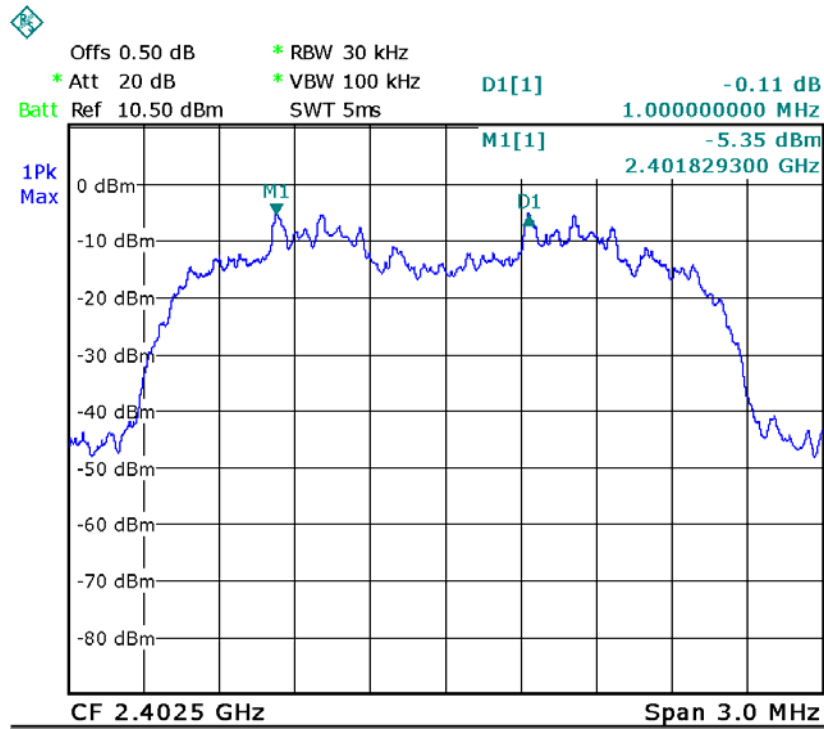
Pi/4DQPSK Middle Channel



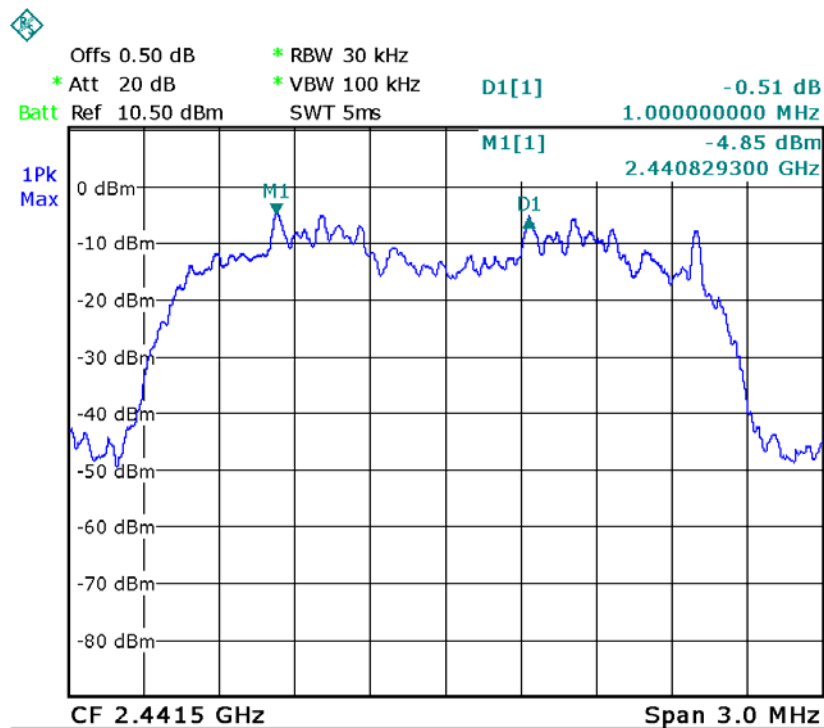
Pi/4DQPSK High Channel



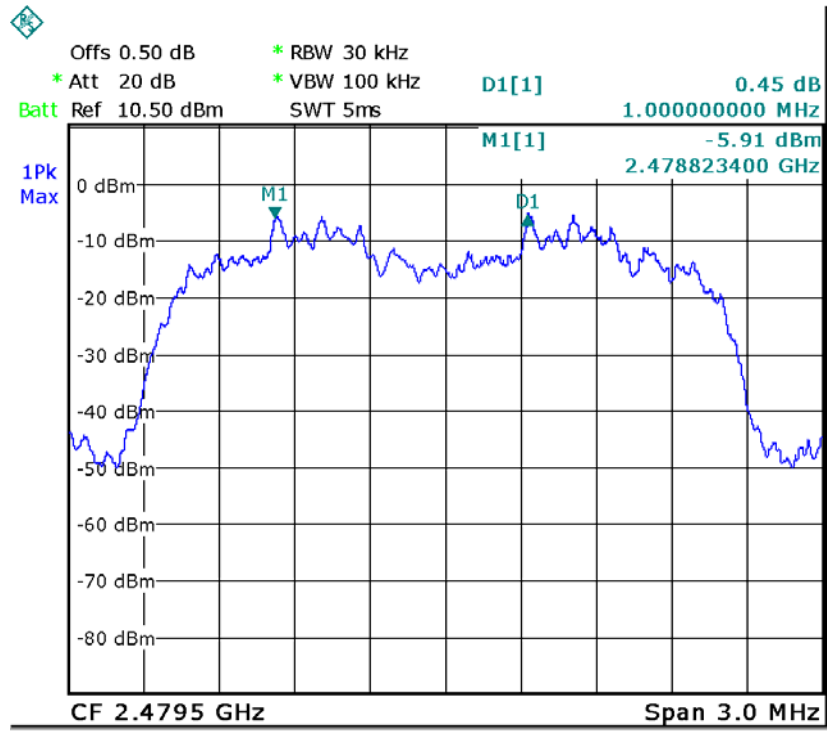
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel





11 Number of Hopping Frequency

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- 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)

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 = 1MHz. VBW = 1MHz. 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;

11.2 Test Result

Channel Number	Limit
79	



12 Dwell Time

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, DA 00-705
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	: Hopping
Remark	: The worst case(8DPSK,DH5) was recorded

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 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).

12.2 Test Result

DH5 Packet permit maximum $1600 / 79 / 6$ hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

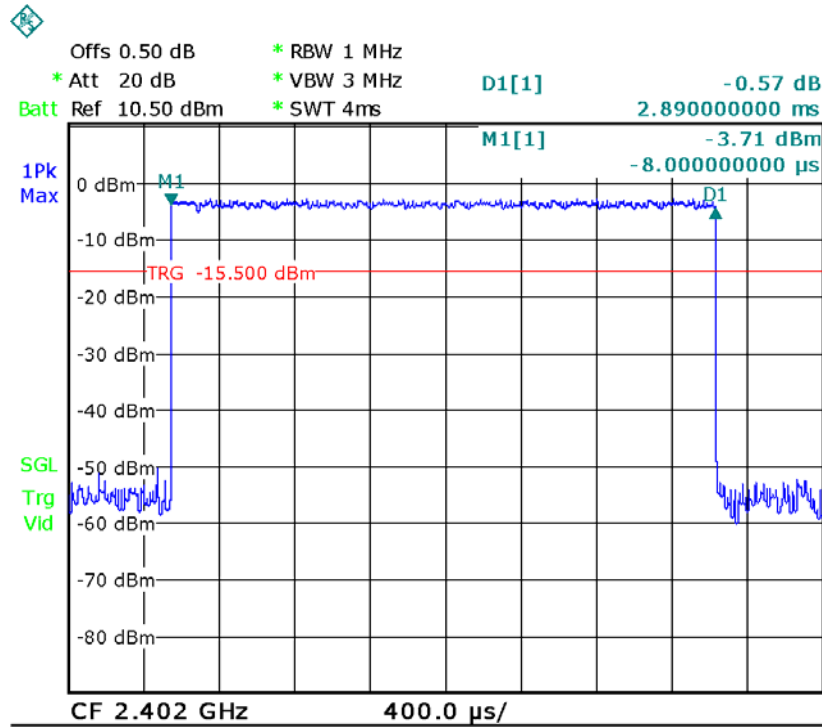
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow.	

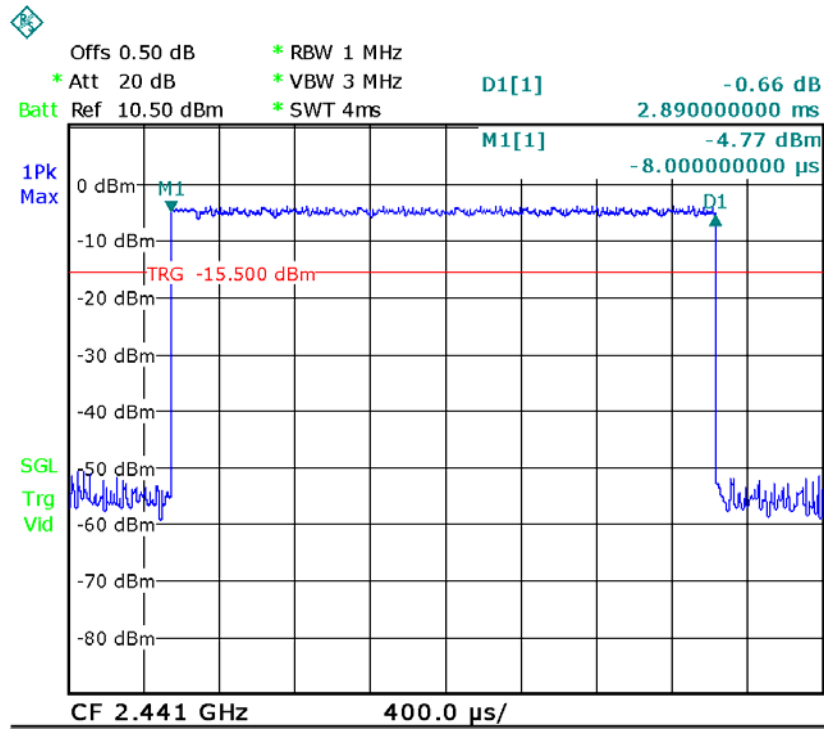


Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
8DPSK	DH5	Low	2.890	0.308	0.4
		middle	2.890	0.308	0.4
		High	2.890	0.308	0.4

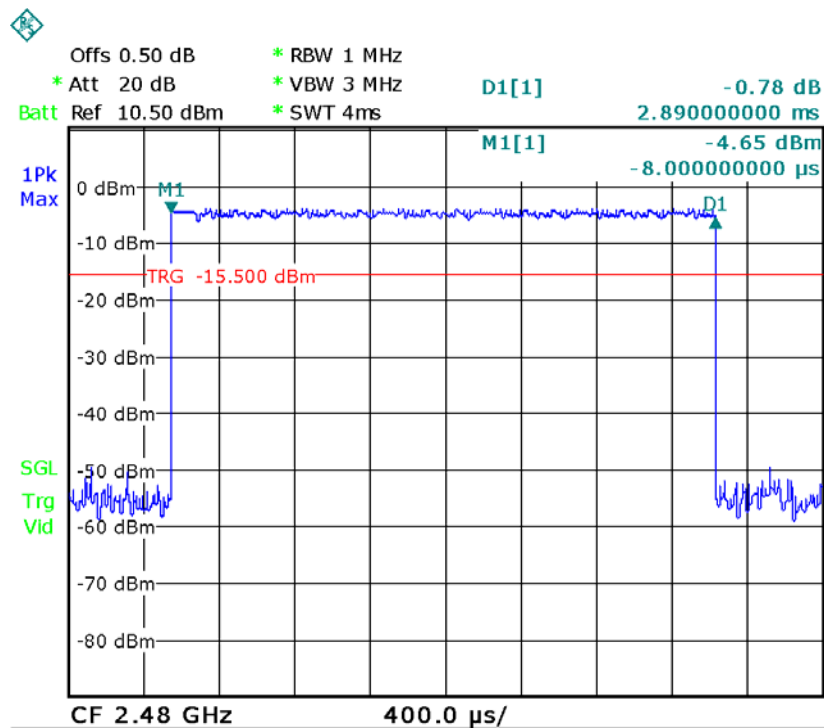
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel





13 Conducted Spurious Emissions

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : DA 00-705
- Test Limit : 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 Section 15.209(a) is not required. 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 Result : PASS

13.1 Test Procedure

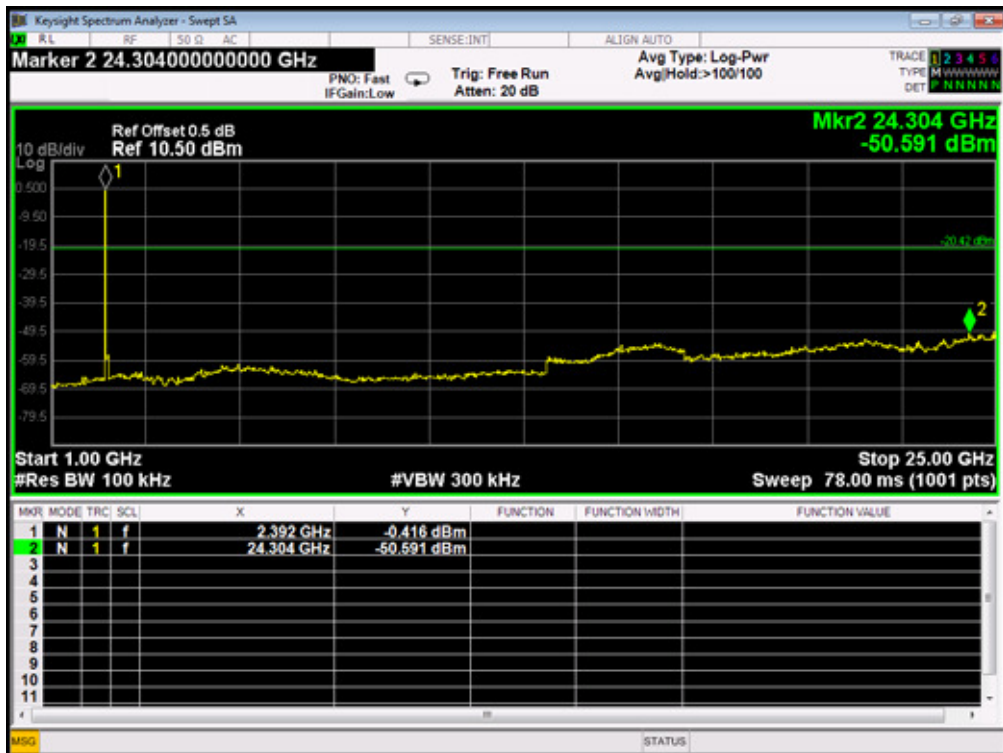
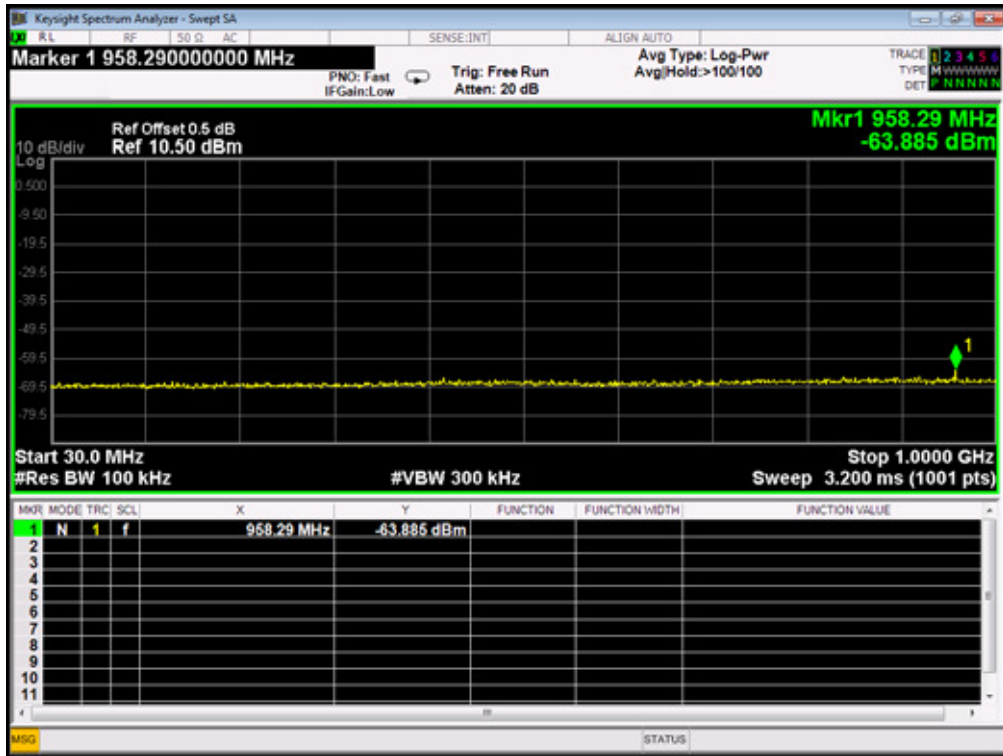
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

13.2 Test Result

Remark: only the worst data(GFSK modulation mode) were reported.

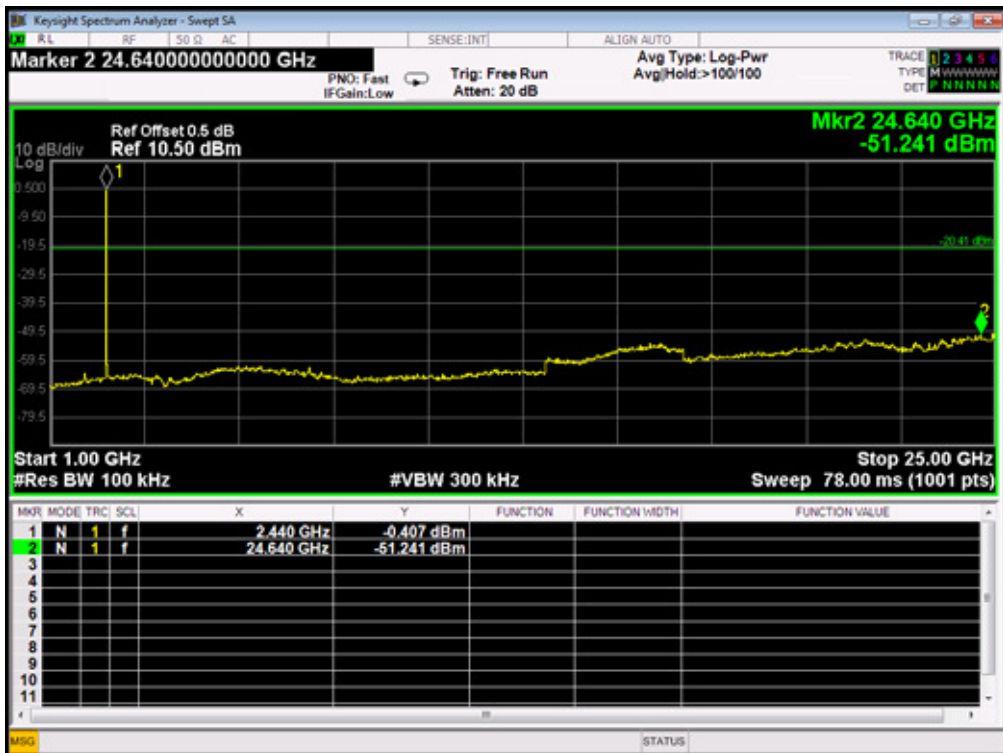
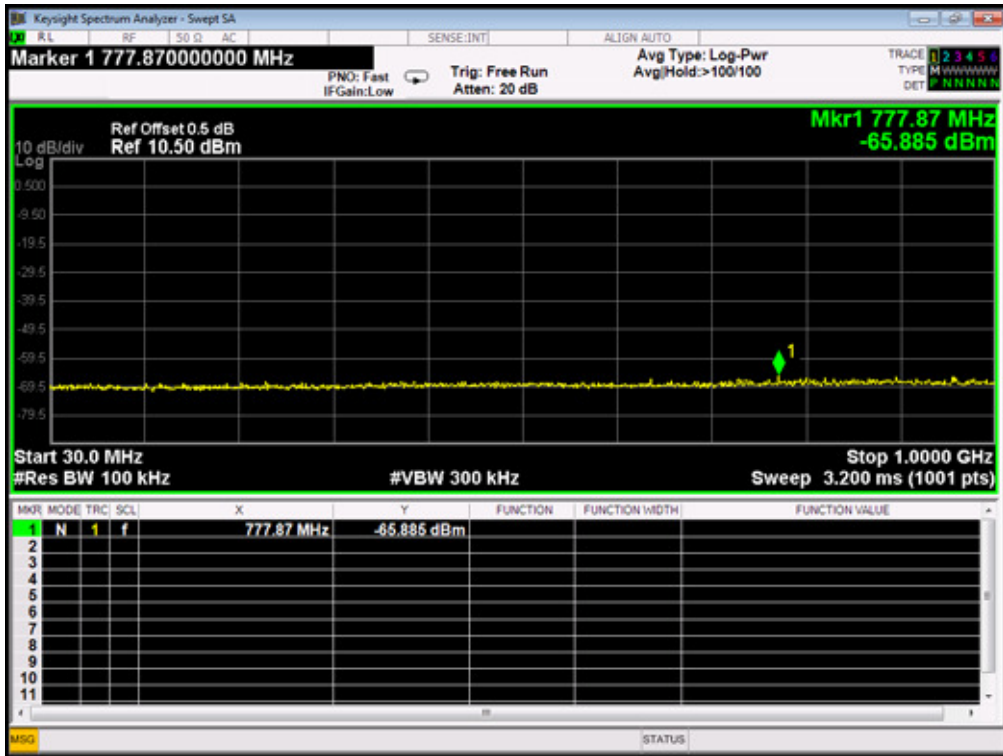


Low Channel



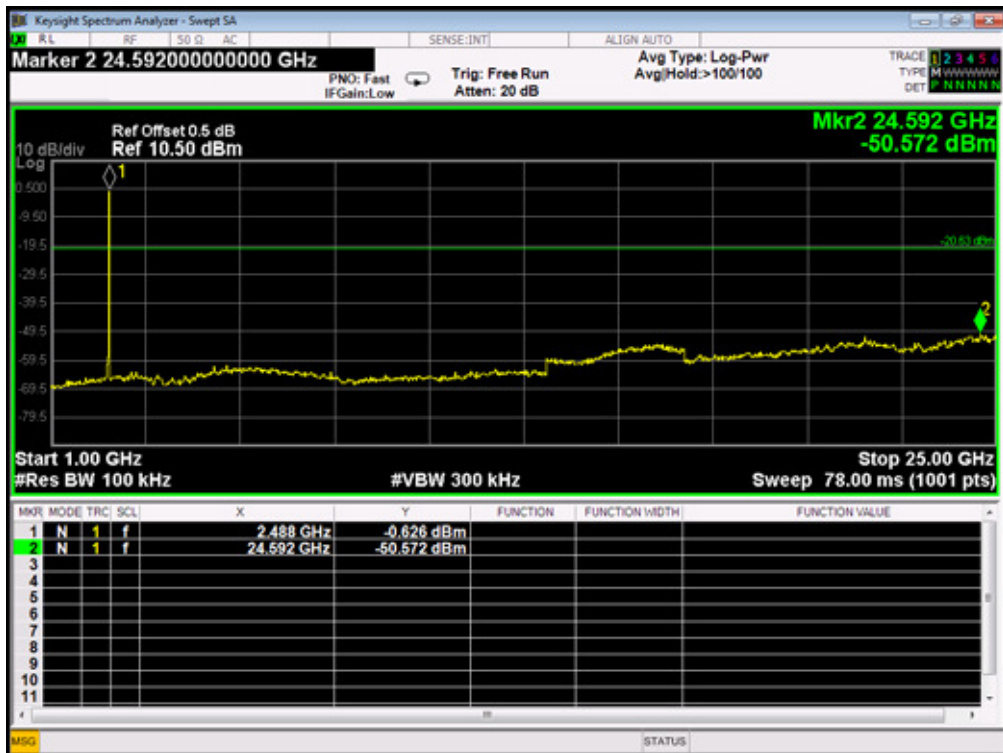
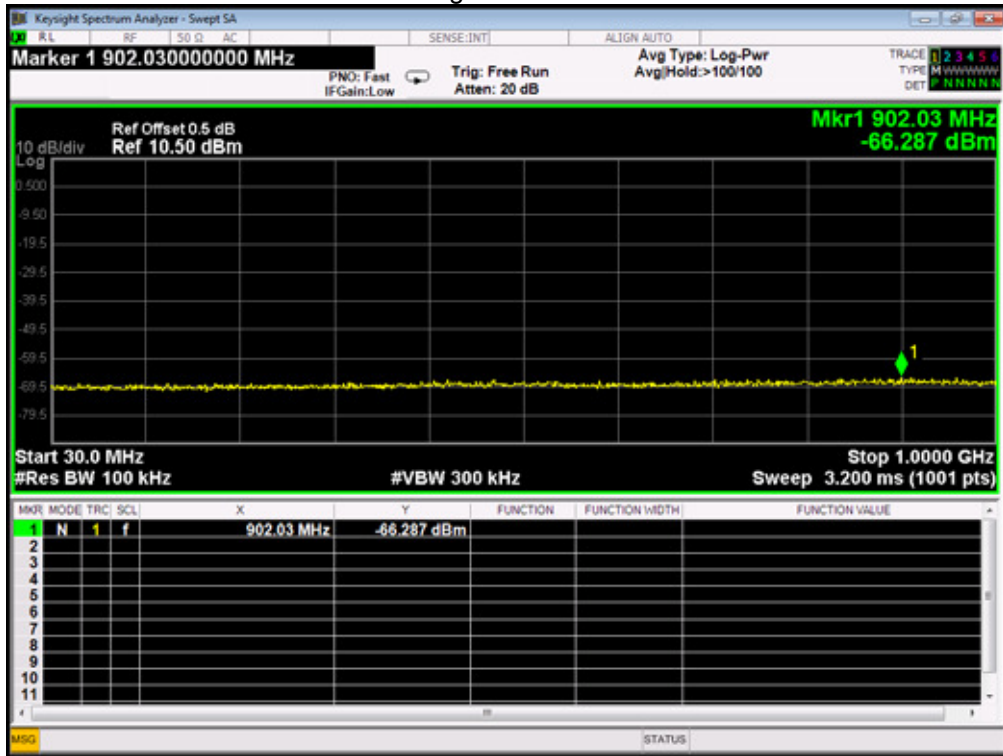


Middle Channel





High Channel





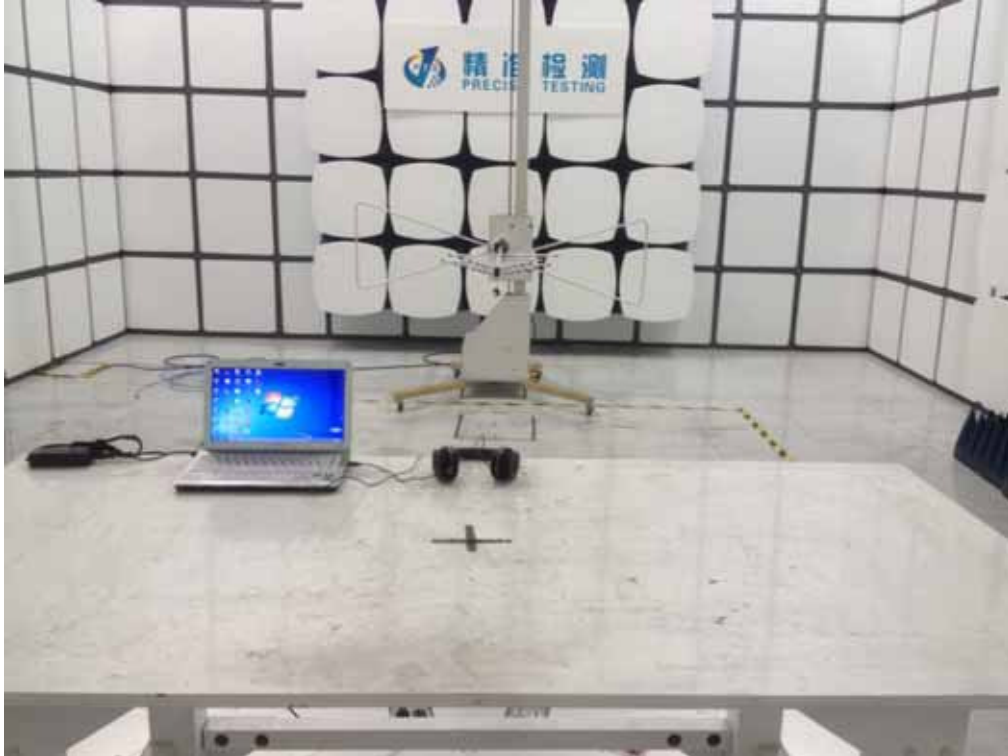
14 Antenna Requirement

According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an PCB printed antenna, it meet the requirement of this section.



15 Test Setup

Spurious Emissions
From 30MHz-1000MHz



Above 1GHz





Conducted Emissions





16 EUT Photos

External Photos



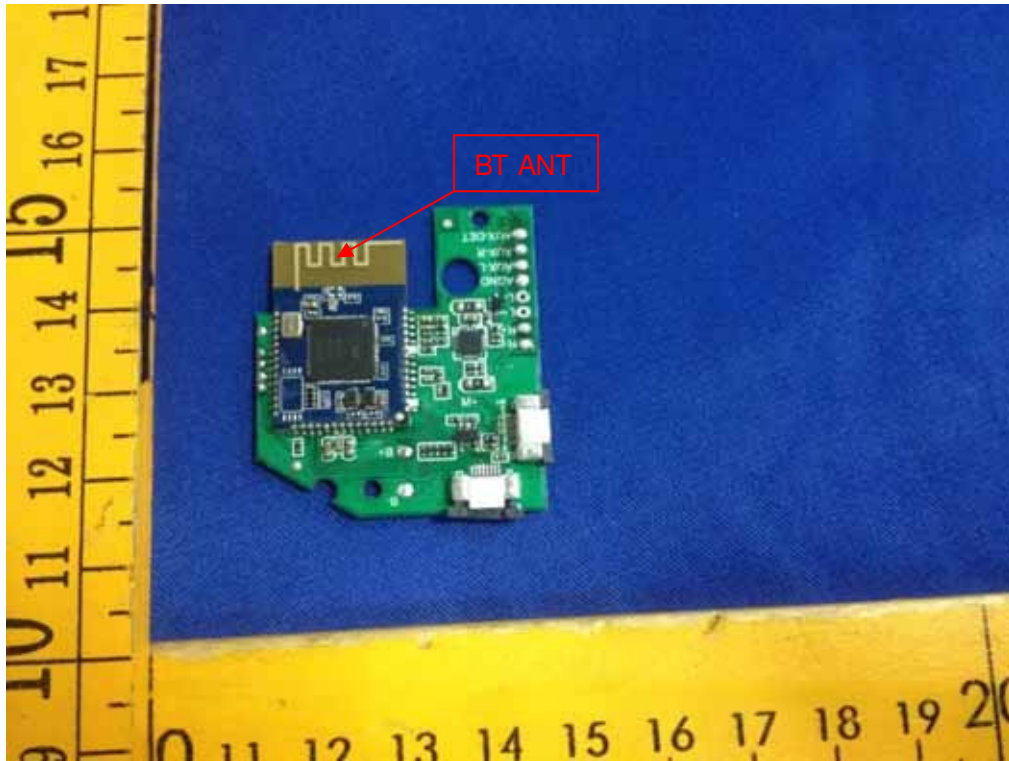


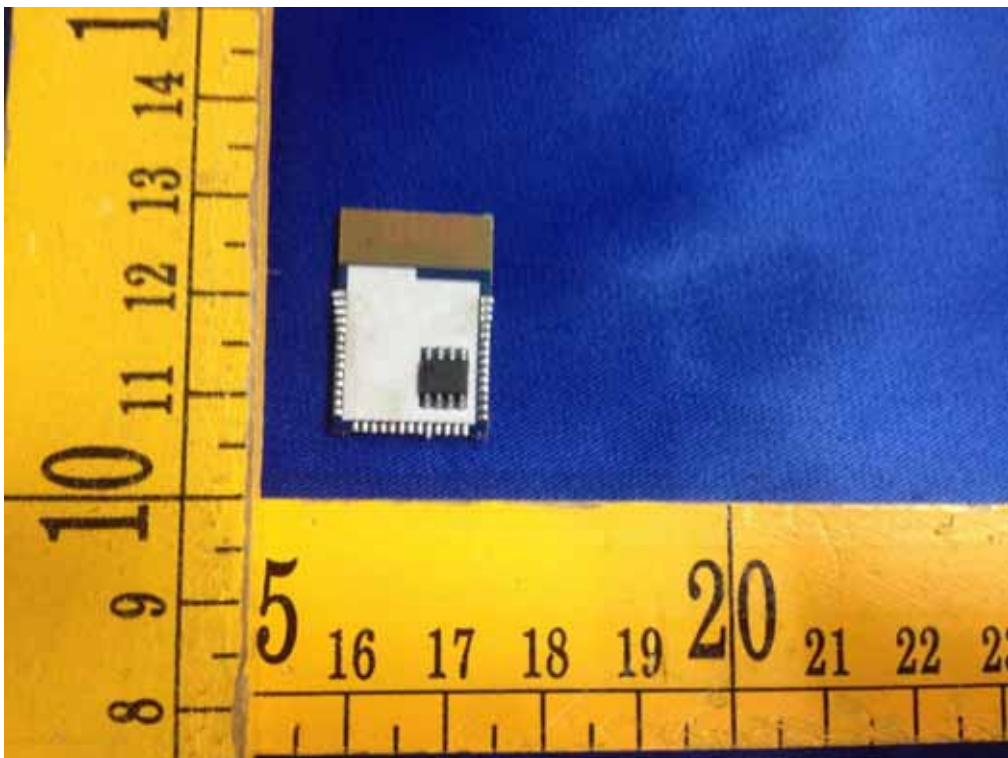
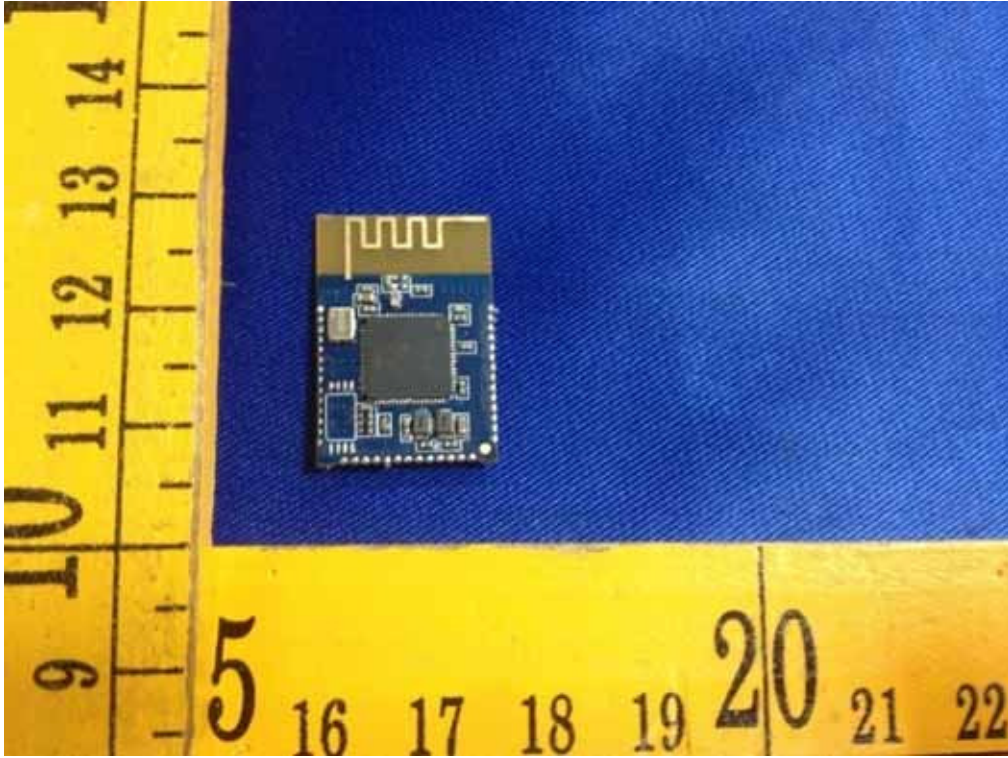


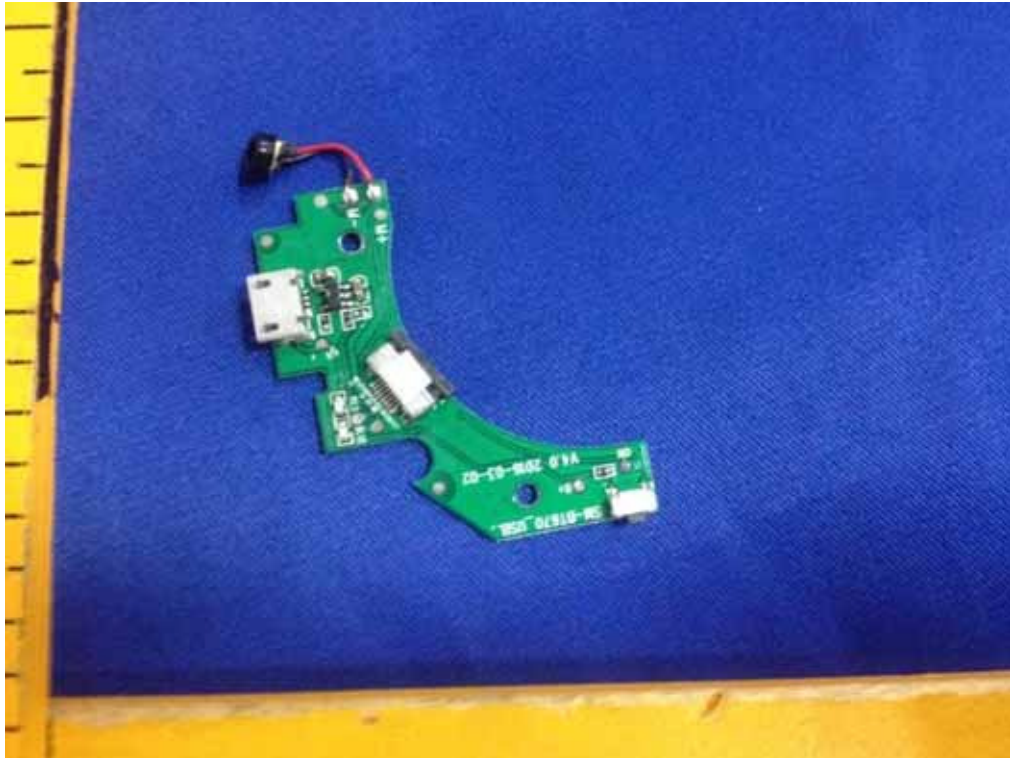


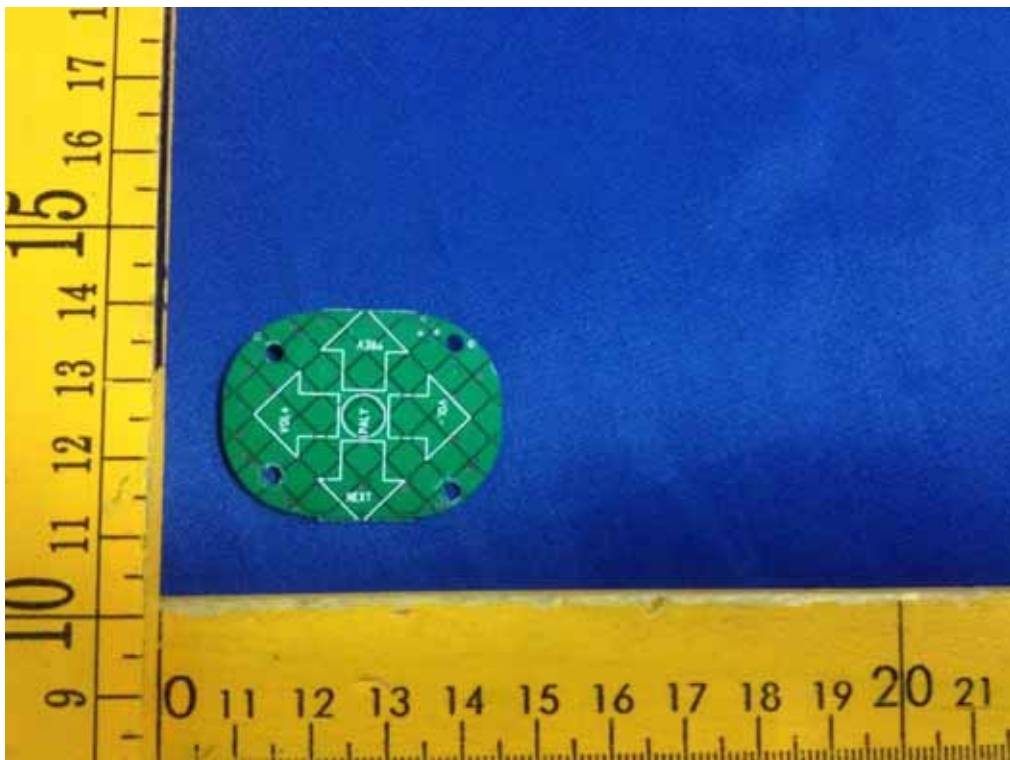
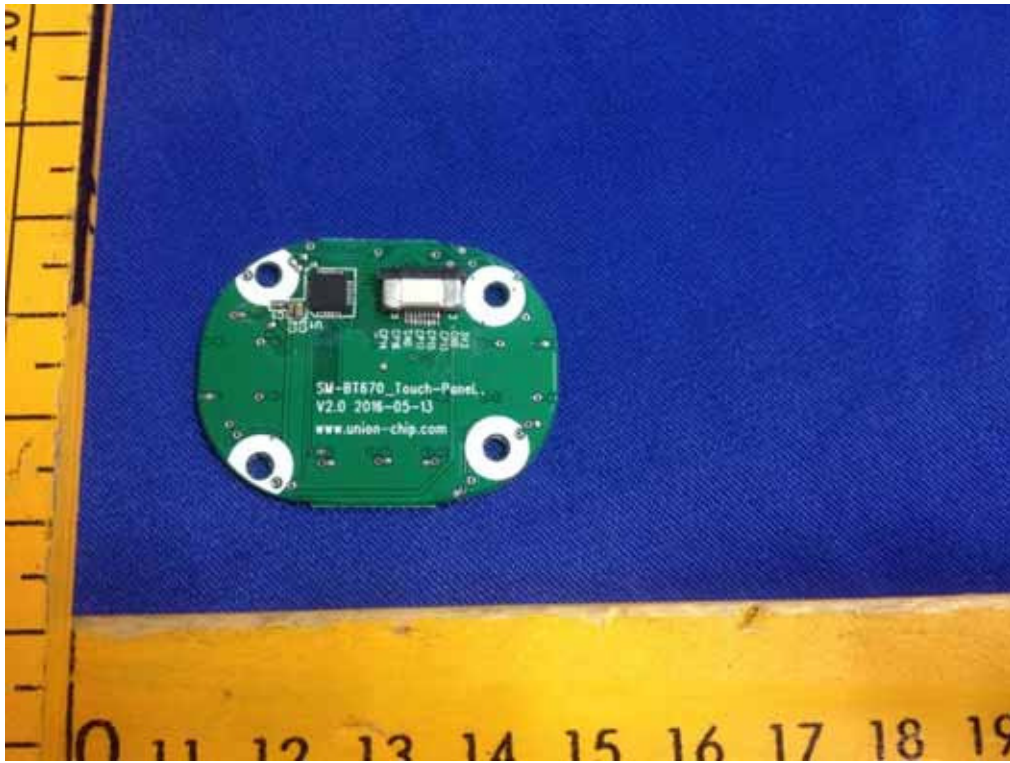
Internal Photos

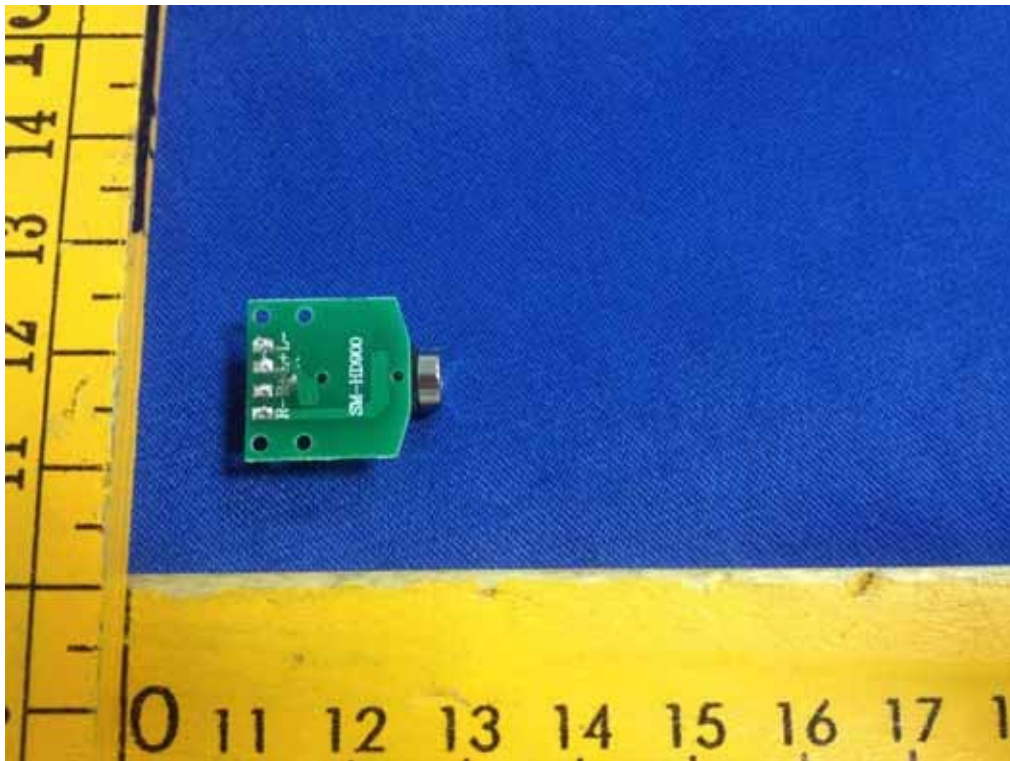
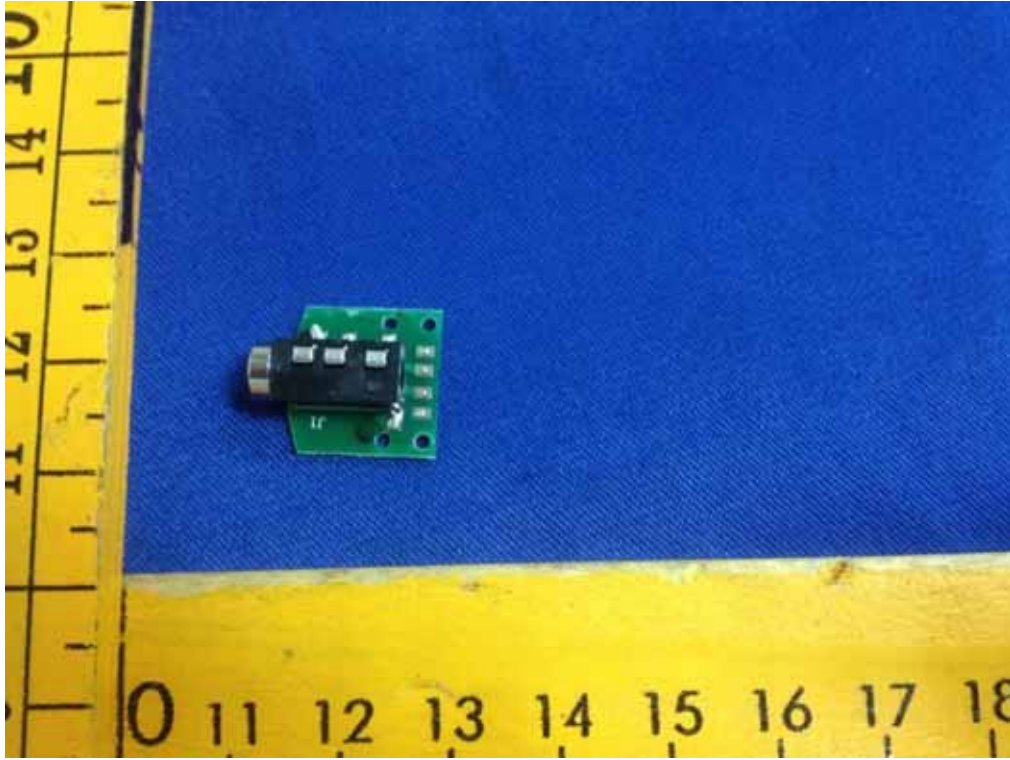


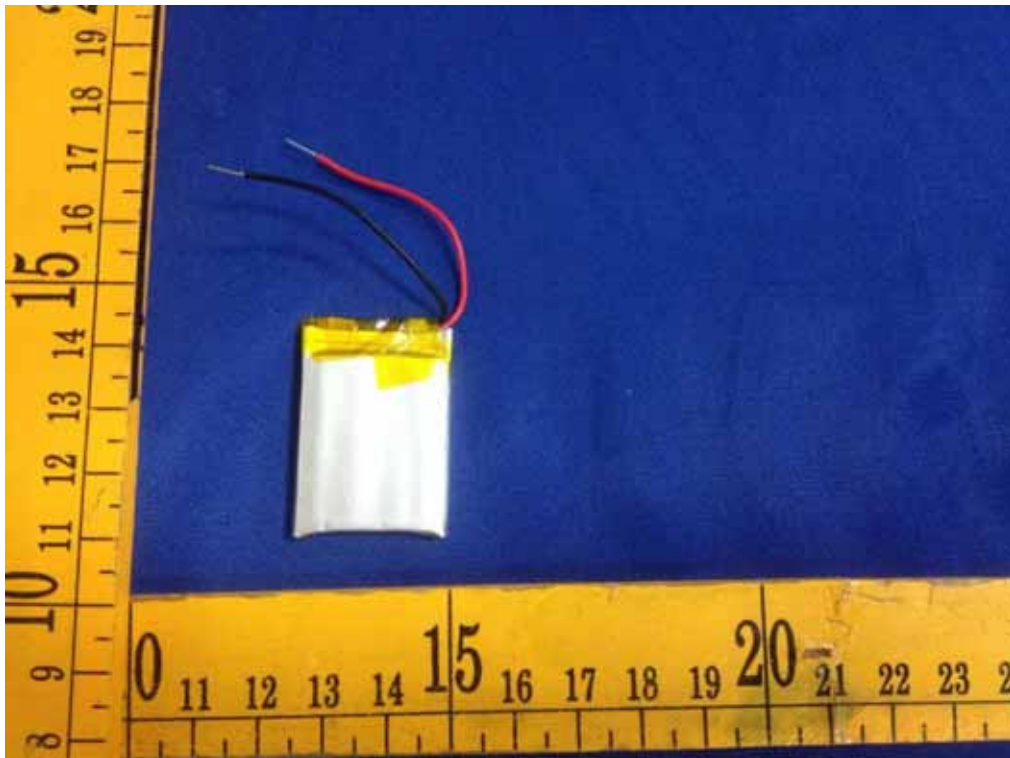












***** THE END REPORT*****