TEST REPORT

Reference No.	:	WTS17S0372984E
FCC ID	:	2AANE-BTX1
Applicant	:	Advance Bright Limited
Address	:	Room 1206, Tower 2, Silvercord, 30 Canton Road, Tsim Sha Tsui, Kowloon, HongKong, China.
Manufacturer	:	Fu Yuan Electronics Shenzhen Co., Ltd
Address	:	Minzhu 99 Industrial City, Shajing Western Industrial Park, Ban An District, Shenzhen, China.
Product Name	:	Portable Bluetooth Speaker
Model No.	:	BTX1
Brand	:	Ye!!
Standards	:	FCC CFR47 Part 15 Section 15.247:2016
Date of Receipt sample	:	Mar. 09, 2017
Date of Test	:	Mar. 10 – 29, 2017
Date of Issue	:	Mar. 30, 2017
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:
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Tested by: Zero Zhou / Test Engineer

Approved by: Philo Zhong / Manager

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0372984E	Mar. 09, 2017	Mar. 10 – 29, 2017	Mar. 30, 2017	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name:	Portable Bluetooth Speaker
Model No.:	BTX1
Bluetooth Version:	V4.1
Operation Frequency:	2402-2480MHz, 79 Channels in total
Type of Modulation:	GFSK, Pi/4DQPSK, 8DPSK
The lowest oscillator:	32.768KHz
Antenna Gain:	0 dBi
Antenna installation:	PCB printed antenna

4.2 Details of E.U.T.

Technical Data: Input: DC 5V ⎓ 2A

4.3 Channel List

EDR mode

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	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	-	-

4.4 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

4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A**

  Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A, October 15, 2015

- **FCC Test Site 1#– Registration No.: 880581**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.12, 2016	Sep.11, 2017
2.	LISN	R&S	ENV216	101215	Sep.15,2016	Sep.14,2017
3.	Cable	Top	TYPE16(3.5M)	-	Sep.12, 2016	Sep.11, 2017
Conducted Emissions Test Site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.12, 2016	Sep.11, 2017
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.12, 2016	Sep.11, 2017
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.12, 2016	Sep.11, 2017
4.	Cable	LARGE	RF300	-	Sep.12, 2016	Sep.11, 2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2016	Sep.14,2017
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Oct.17, 2016	Oct.16, 2017
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.12, 2016	Sep.11, 2017
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2016	Apr.18,2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2016	Apr.18,2017
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2016	Mar.16,2017
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2016	Apr.09,2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Apr.13, 2016	Apr.12, 2017
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr.09, 2016	Apr.08, 2017
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2016	Sep.14,2017
4	Cable	HUBER+SUHNER	CBL2	525178	Apr.13, 2016	Apr.12, 2017

RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2016	Sep.14,2017
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.12, 2016	Sep.11, 2017
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Apr.29, 2016	Apr.28, 2017

5.2 Measurement Uncertainty

Parameter	**Uncertainty**
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Emissions	15.207(a)	PASS
Band edge	15.247(d) 15.205(a)	PASS
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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS
Note: N/A=Not Applicable.		

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013&ANSI C63.4:2014
Test Result:	PASS
Frequency Range:	150KHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment **:**

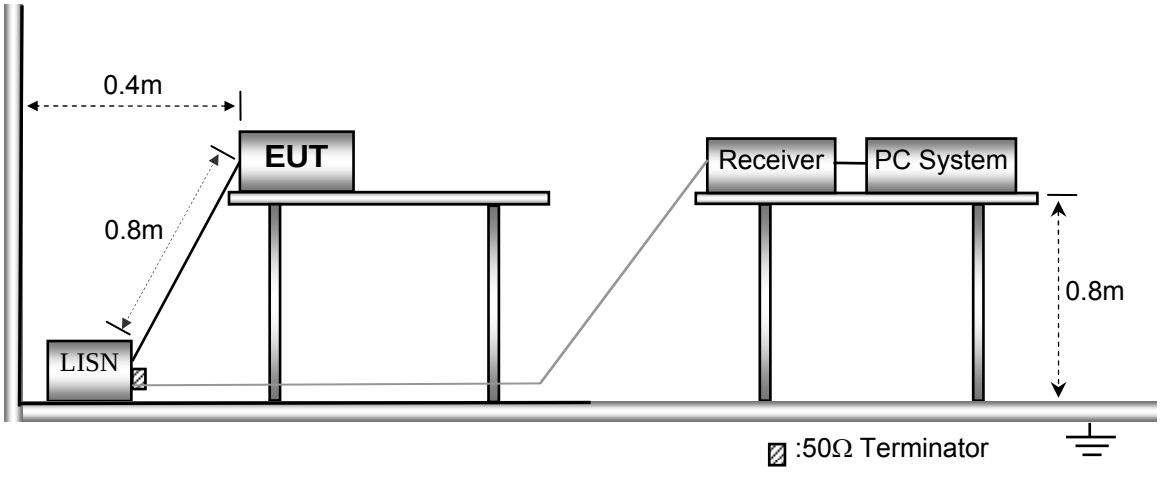
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

7.2 EUT Setup

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

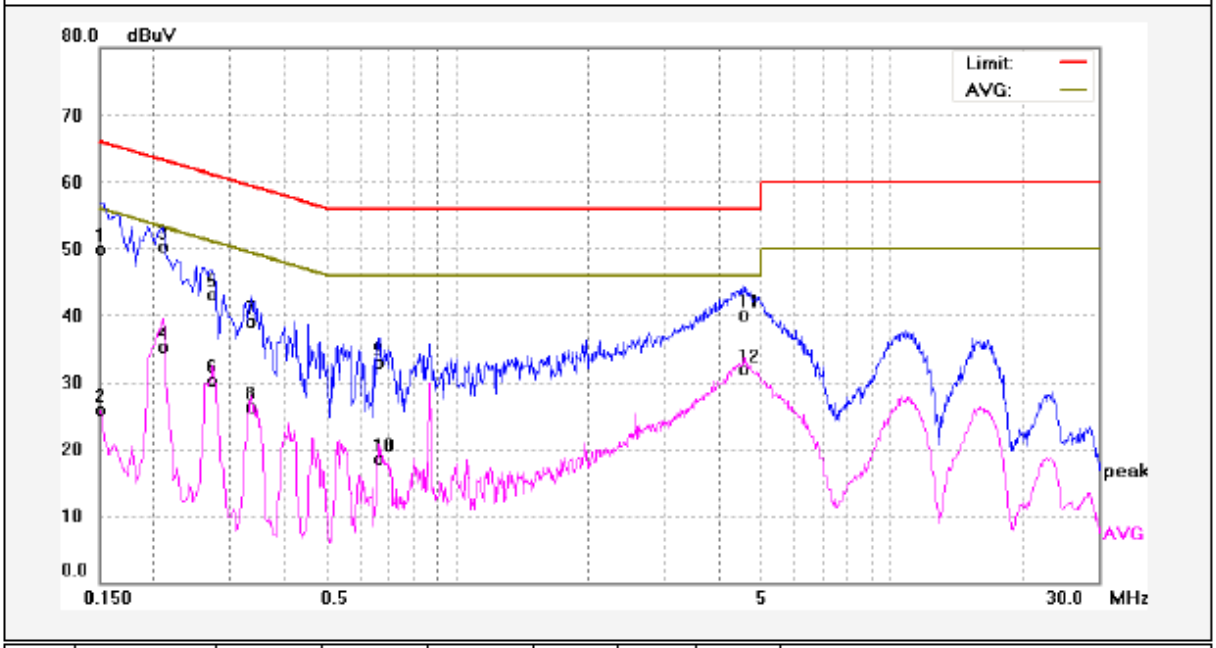


7.3 Measurement Description

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.

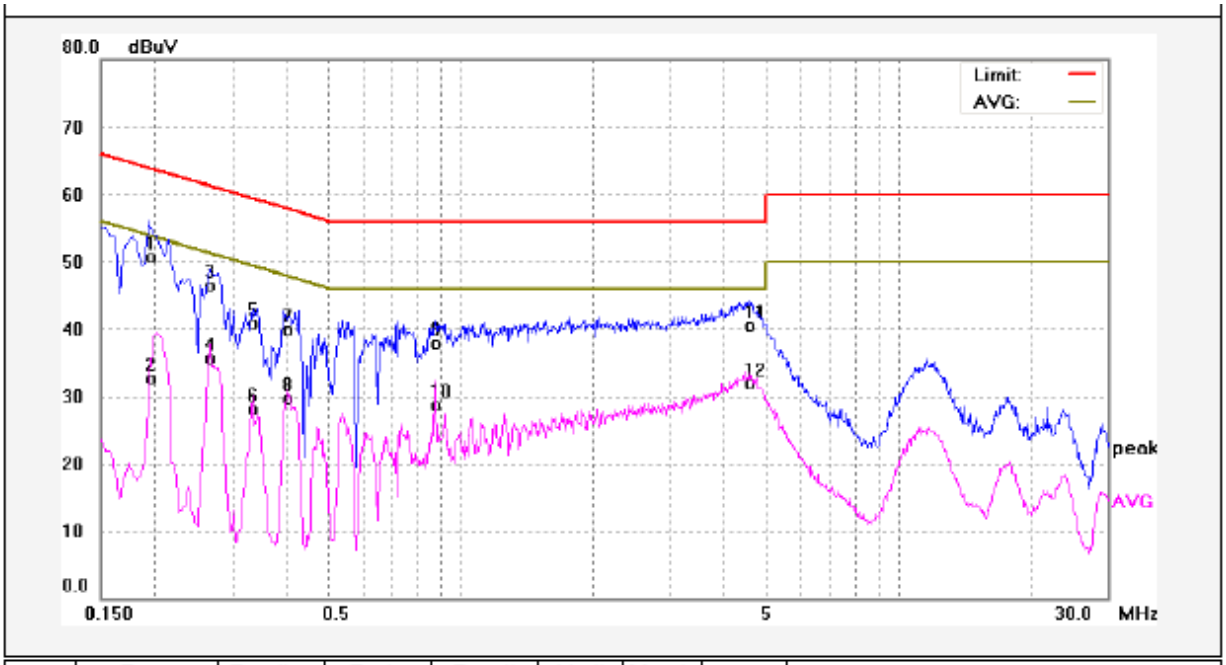
7.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	40.30	9.64	49.94	65.99	-16.05	QP	
2	0.1500	16.19	9.64	25.83	55.99	-30.16	AVG	
3	0.2100	40.71	9.62	50.33	63.20	-12.87	QP	
4	0.2100	25.71	9.62	35.33	53.20	-17.87	AVG	
5	0.2759	33.54	9.64	43.18	60.94	-17.76	QP	
6	0.2759	20.76	9.64	30.40	50.94	-20.54	AVG	
7	0.3379	29.57	9.63	39.20	59.25	-20.05	QP	
8	0.3379	16.68	9.63	26.31	49.25	-22.94	AVG	
9	0.6580	23.21	9.72	32.93	56.00	-23.07	QP	
10	0.6580	8.82	9.72	18.54	46.00	-27.46	AVG	
11	4.5420	30.18	10.00	40.18	56.00	-15.82	QP	
12	4.5420	21.81	10.00	31.81	46.00	-14.19	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1940	41.10	9.62	50.72	63.86	-13.14	QP	
2	0.1940	23.07	9.62	32.69	53.86	-21.17	AVG	
3	0.2700	36.77	9.64	46.41	61.12	-14.71	QP	
4	0.2700	26.07	9.64	35.71	51.12	-15.41	AVG	
5	0.3339	31.35	9.63	40.98	59.35	-18.37	QP	
6	0.3339	18.49	9.63	28.12	49.35	-21.23	AVG	
7	0.4020	30.18	9.64	39.82	57.81	-17.99	QP	
8	0.4020	20.15	9.64	29.79	47.81	-18.02	AVG	
9	0.8780	28.07	9.79	37.86	56.00	-18.14	QP	
10	0.8780	18.83	9.79	28.62	46.00	-17.38	AVG	
11	4.5340	30.47	10.00	40.47	56.00	-15.53	QP	
12	4.5340	21.85	10.00	31.85	46.00	-14.15	AVG	

8 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013&ANSI C63.4:2014

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Distance	
	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	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

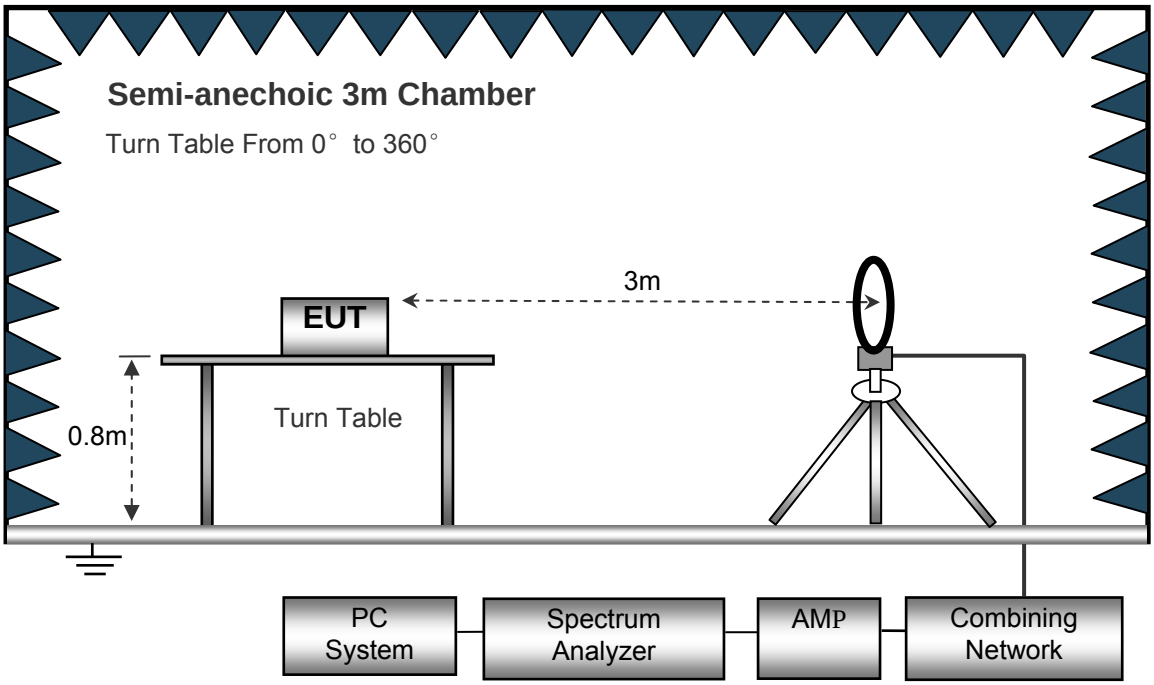
EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

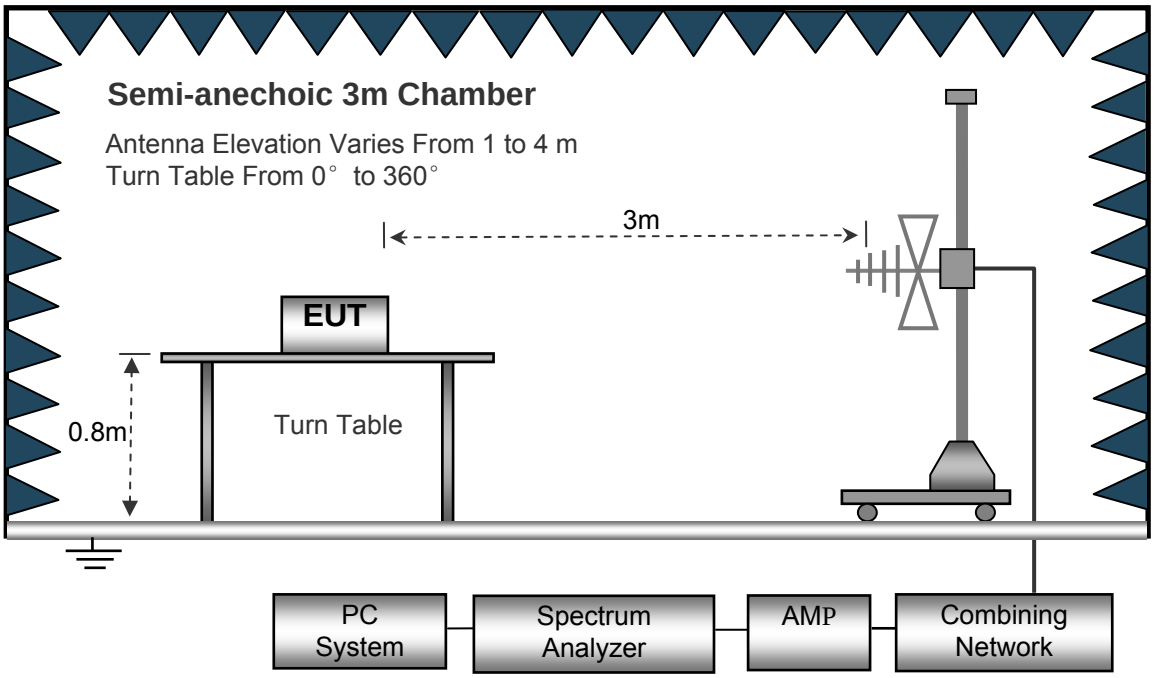
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013.

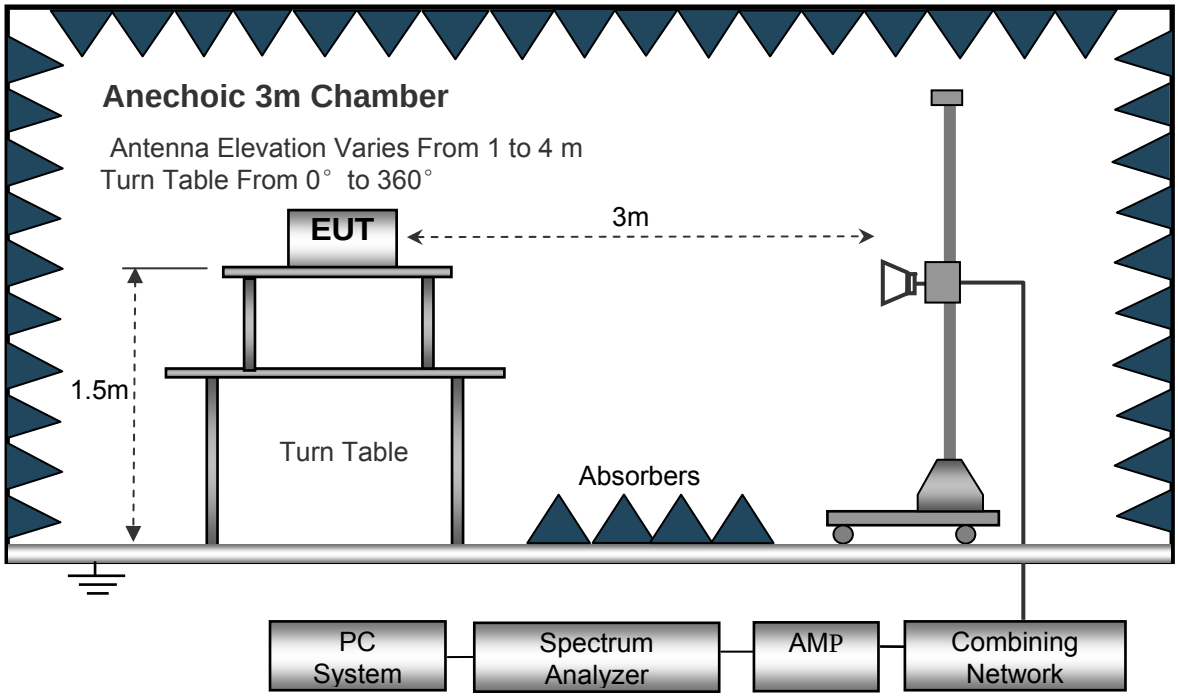
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz

Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

8.4 Test Procedure

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

8.5 Summary of Test Results

Test Frequency: 32.768KHz to 30MHz

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

Test Frequency: 30MHz ~ 18GHz

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

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel									
268.42	36.35	QP	207	1.1	H	-13.35	23.00	46.00	-23.00
268.42	40.26	QP	204	1.6	V	-13.35	26.91	46.00	-19.09
4804.00	46.09	PK	108	1.1	V	-1.06	45.03	74.00	-28.97
4804.00	43.26	Ave	108	1.1	V	-1.06	42.20	54.00	-11.80
7206.00	40.29	PK	238	1.7	H	1.33	41.62	74.00	-32.38
7206.00	35.26	Ave	238	1.7	H	1.33	36.59	54.00	-17.41
2336.90	45.45	PK	287	1.9	V	-13.19	32.26	74.00	-41.74
2336.90	39.44	Ave	287	1.9	V	-13.19	26.25	54.00	-27.75
2375.72	42.64	PK	183	1.4	H	-13.14	29.50	74.00	-44.50
2375.72	37.85	Ave	183	1.4	H	-13.14	24.71	54.00	-29.29
2492.26	44.86	PK	349	1.2	V	-13.08	31.78	74.00	-42.22
2492.26	36.90	Ave	349	1.2	V	-13.08	23.82	54.00	-30.18

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel									
268.42	37.20	QP	346	1.8	H	-13.35	23.85	46.00	-22.15
268.42	42.45	QP	309	1.6	V	-13.35	29.10	46.00	-16.90
4882.00	46.20	PK	137	1.7	V	-0.62	45.58	74.00	-28.42
4882.00	42.23	Ave	137	1.7	V	-0.62	41.61	54.00	-12.39
7323.00	38.90	PK	313	1.5	H	2.21	41.11	74.00	-32.89
7323.00	34.56	Ave	313	1.5	H	2.21	36.77	54.00	-17.23
2344.38	45.95	PK	55	1.4	V	-13.19	32.76	74.00	-41.24
2344.38	39.96	Ave	55	1.4	V	-13.19	26.77	54.00	-27.23
2371.34	43.48	PK	287	1.9	H	-13.14	30.34	74.00	-43.66
2371.34	37.88	Ave	287	1.9	H	-13.14	24.74	54.00	-29.26
2491.83	43.15	PK	113	1.4	V	-13.08	30.07	74.00	-43.93
2491.83	38.86	Ave	113	1.4	V	-13.08	25.78	54.00	-28.22

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel									
268.42	38.56	QP	219	1.8	H	-13.35	25.21	46.00	-20.79
268.42	42.56	QP	125	1.2	V	-13.35	29.21	46.00	-16.79
4960.00	43.89	PK	282	1.5	V	-0.24	43.65	74.00	-30.35
4960.00	40.39	Ave	282	1.5	V	-0.24	40.15	54.00	-13.85
7440.00	39.26	PK	68	1.9	H	2.84	42.10	74.00	-31.90
7440.00	36.23	Ave	68	1.9	H	2.84	39.07	54.00	-14.93
2339.91	46.95	PK	132	1.0	V	-13.19	33.76	74.00	-40.24
2339.91	39.61	Ave	132	1.0	V	-13.19	26.42	54.00	-27.58
2356.95	44.22	PK	336	1.7	H	-13.14	31.08	74.00	-42.92
2356.95	38.61	Ave	336	1.7	H	-13.14	25.47	54.00	-28.53
2493.92	42.75	PK	320	1.1	V	-13.08	29.67	74.00	-44.33
2493.92	37.30	Ave	320	1.1	V	-13.08	24.22	54.00	-29.78

Test Frequency : 18GHz to 25GHz

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

9 Band Edge Measurement

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

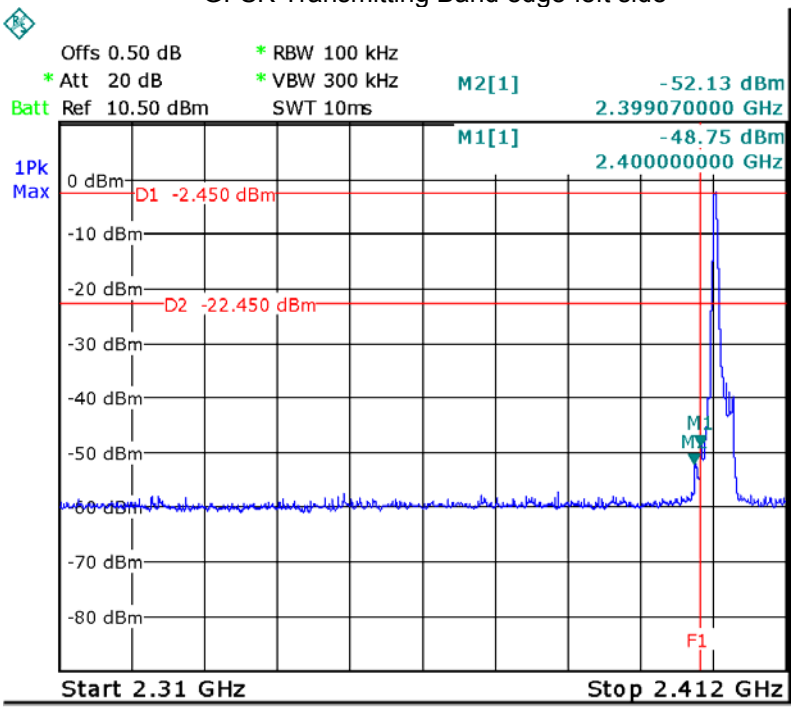
9.1 Test Procedure

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 = 100kHz, VBW = 300kHz, Sweep = auto
   Detector function = peak, Trace = max hold

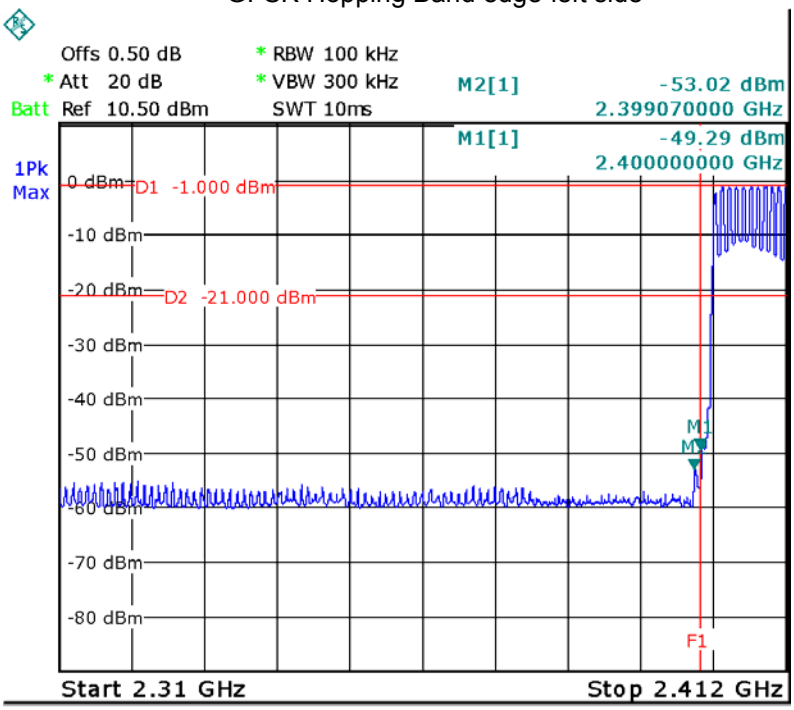
9.2 Test Result

Test plots

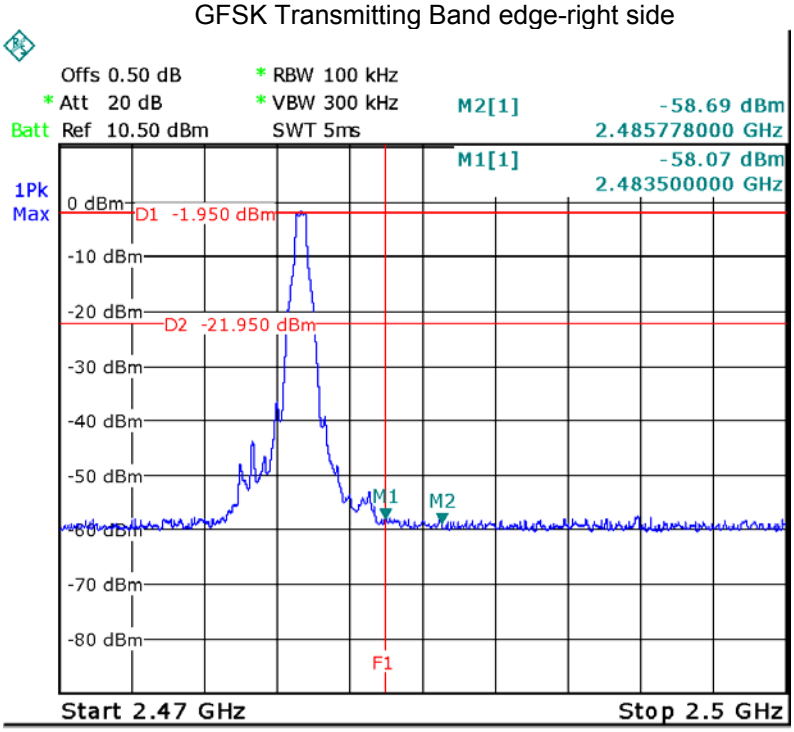
GFSK Transmitting Band edge-left side



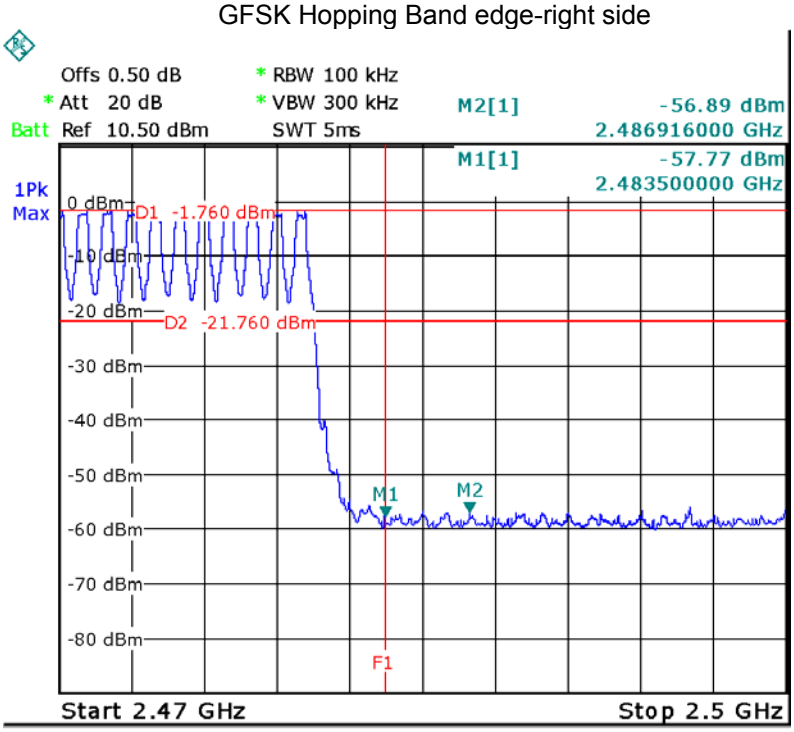
GFSK Hopping Band edge-left side



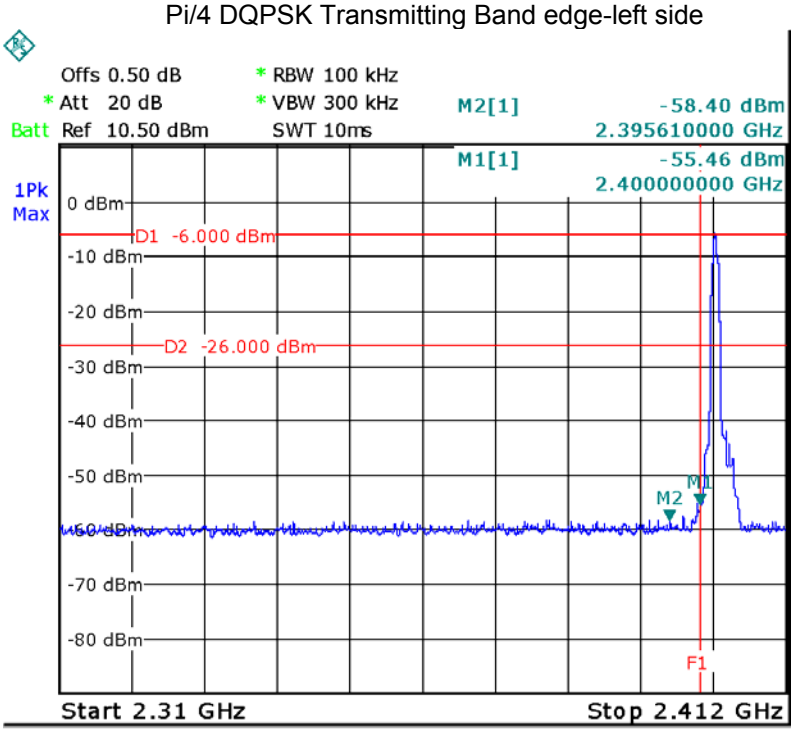
GFSK Transmitting Band edge-right side



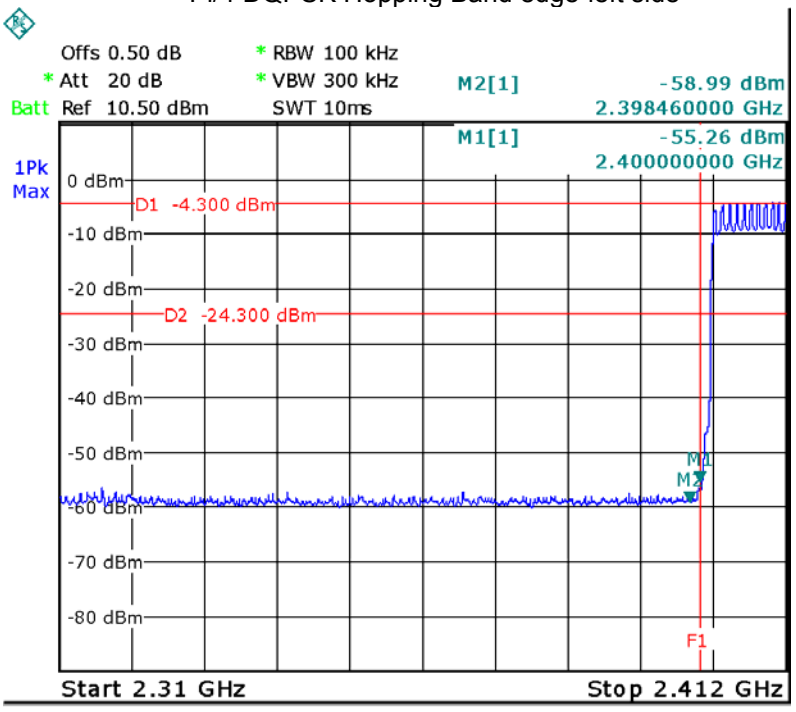
GFSK Hopping Band edge-right side



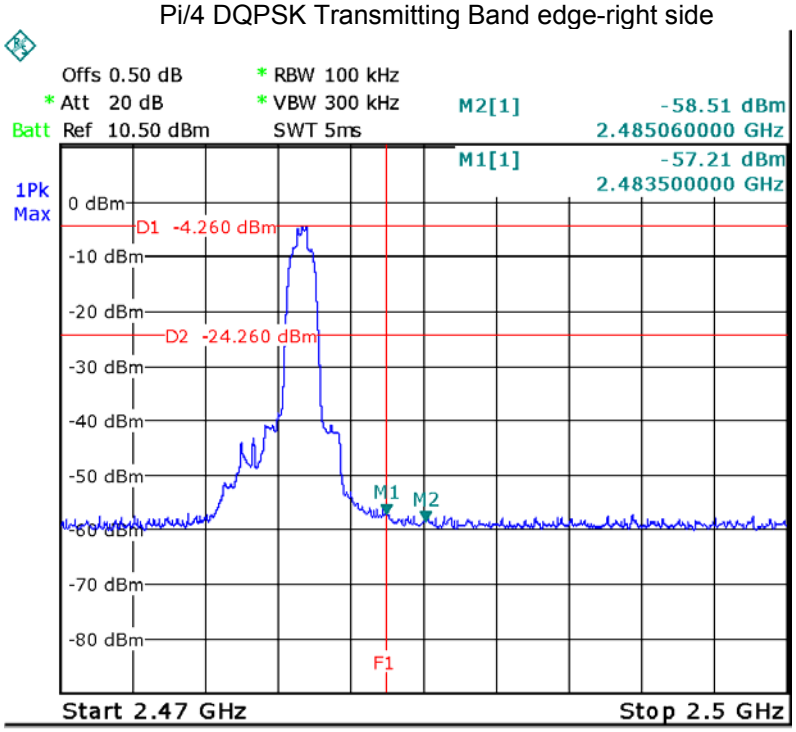
Pi/4 DQPSK Transmitting Band edge-left side



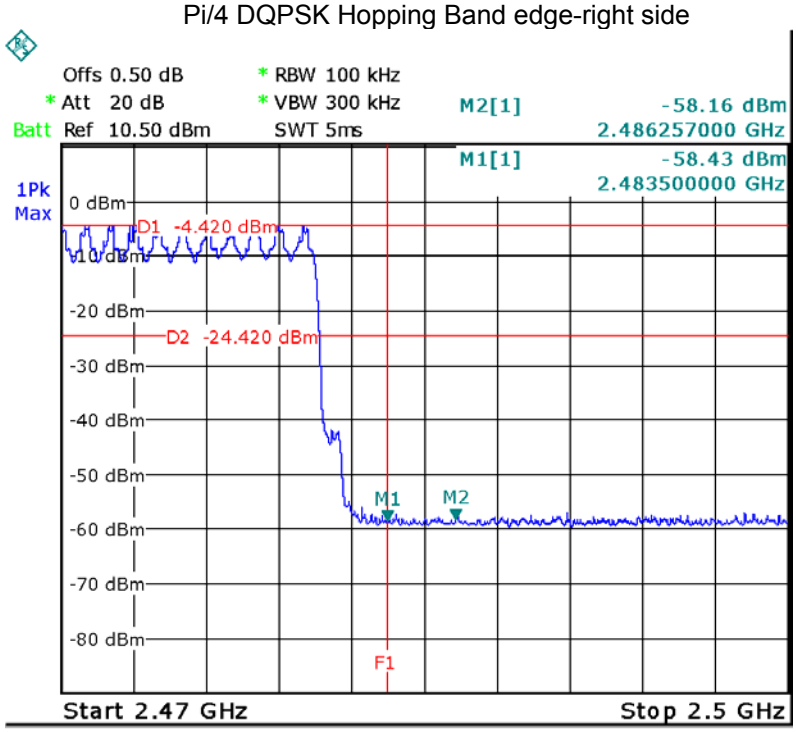
Pi/4 DQPSK Hopping Band edge-left side



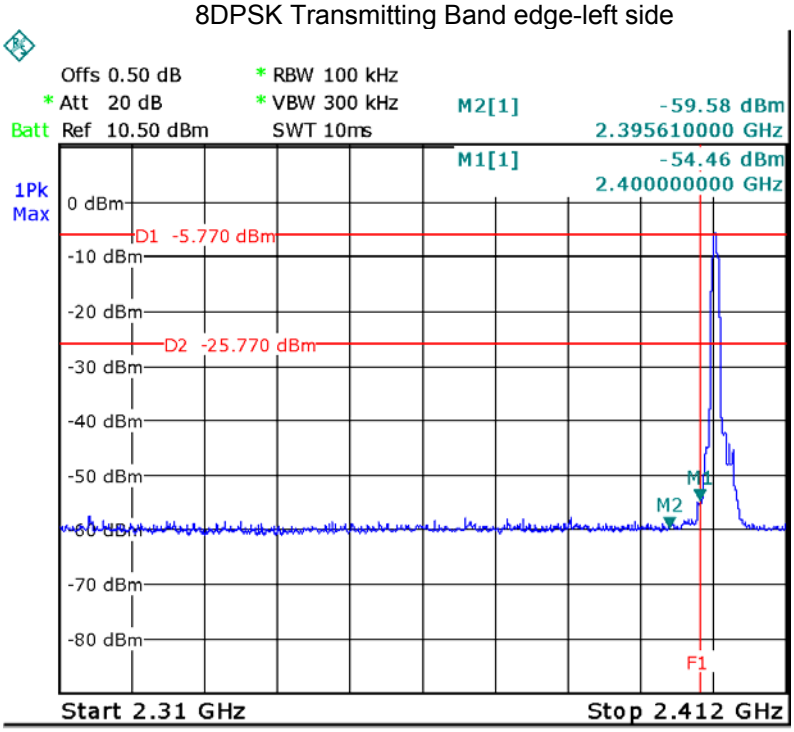
Pi/4 DQPSK Transmitting Band edge-right side



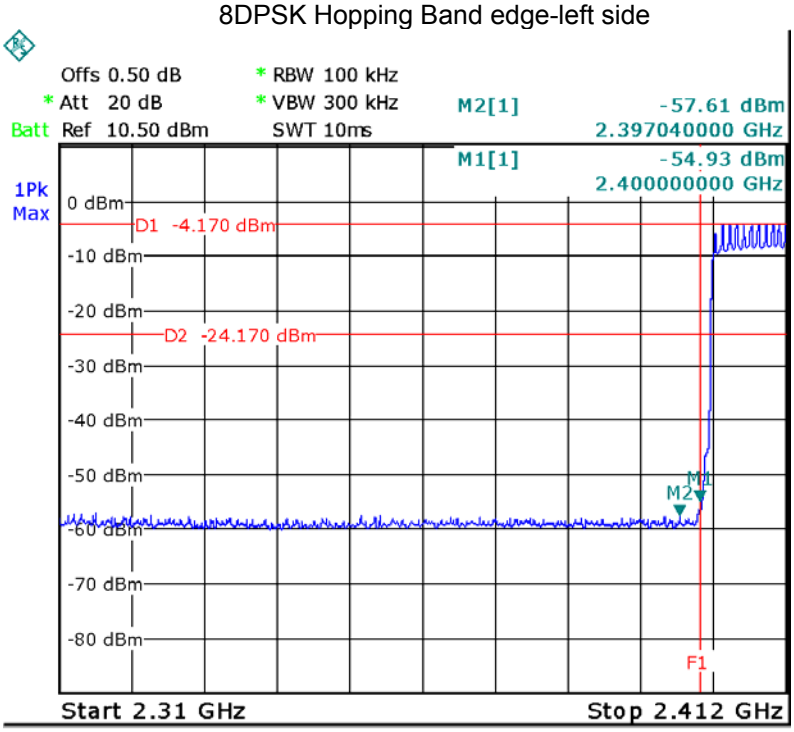
Pi/4 DQPSK Hopping Band edge-right side



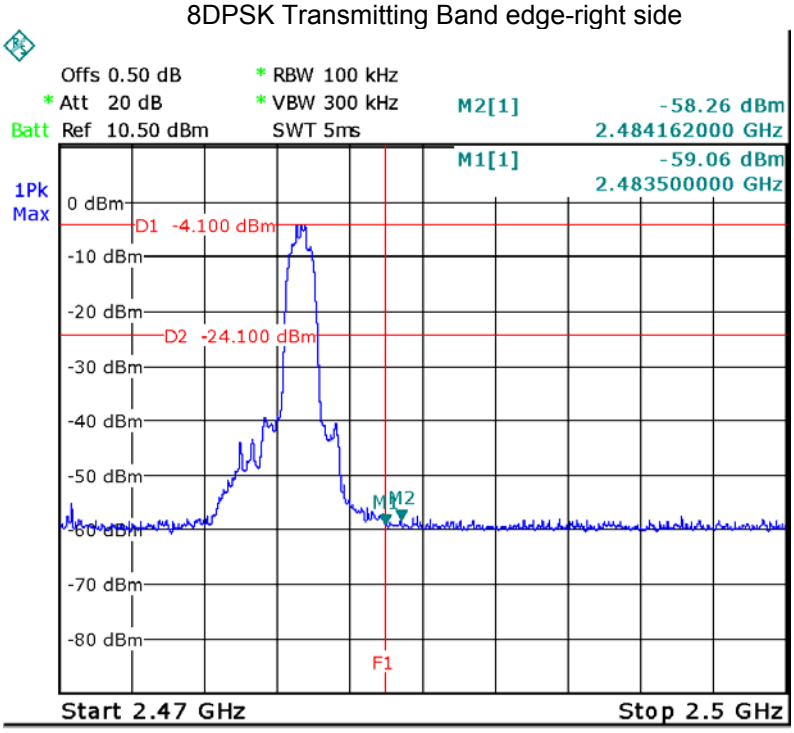
8DPSK Transmitting Band edge-left side



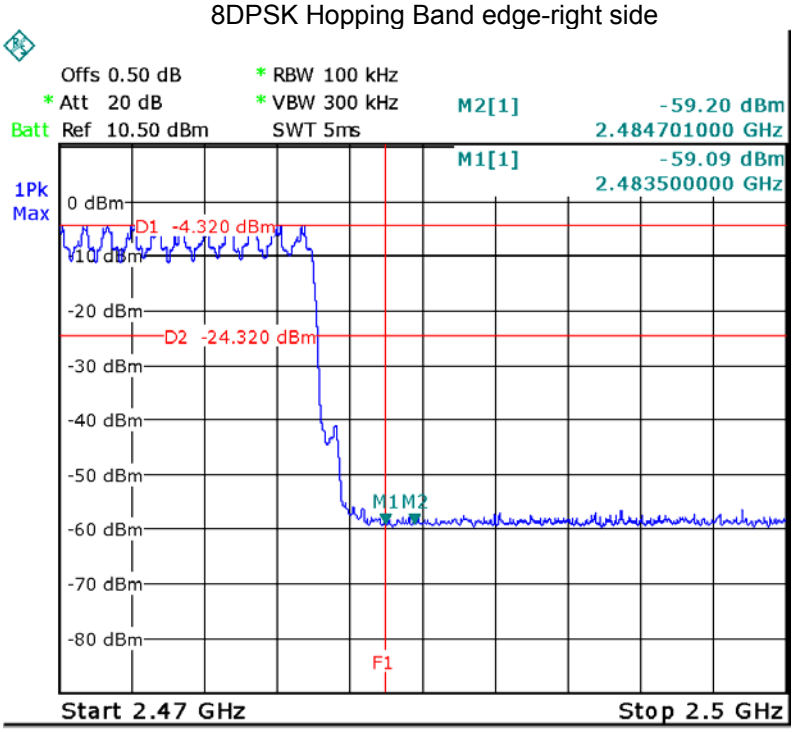
8DPSK Hopping Band edge-left side



8DPSK Transmitting Band edge-right side



8DPSK Hopping Band edge-right side



10 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10:2013

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

10.1 Test Procedure

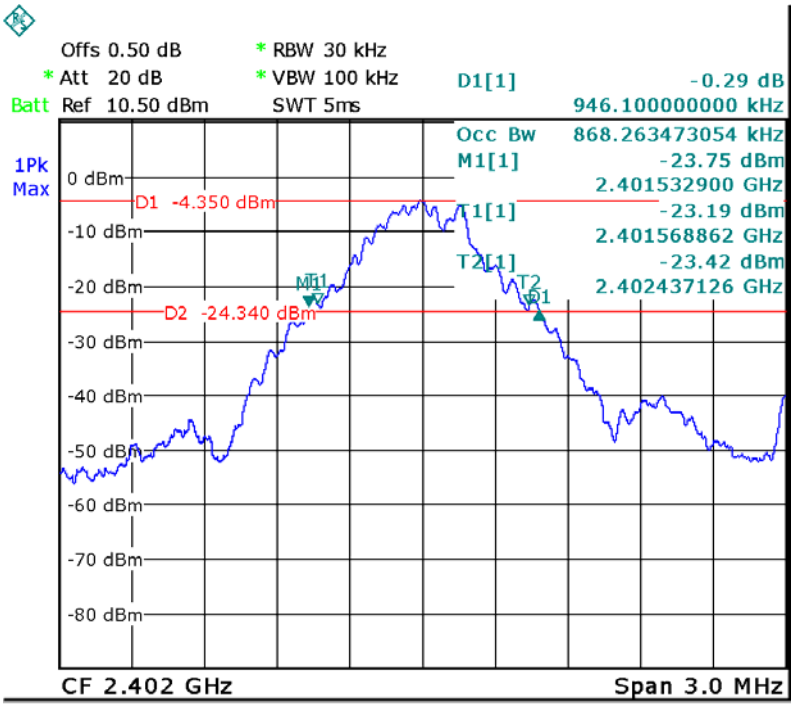
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

10.2 Test Result

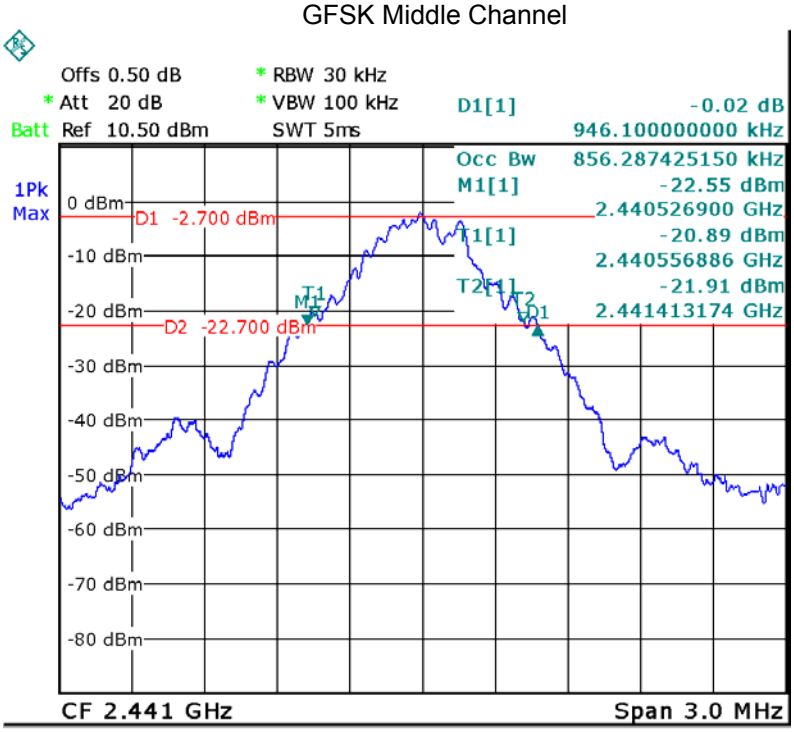
Modulation	Test Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	Low	0.946	0.868
	Middle	0.946	0.856
	High	0.946	0.856
Pi/4DQPSK	Low	1.258	1.162
	Middle	1.258	1.162
	High	1.258	1.162
8DPSK	Low	1.258	1.156
	Middle	1.258	1.156
	High	1.258	1.156

Test plots

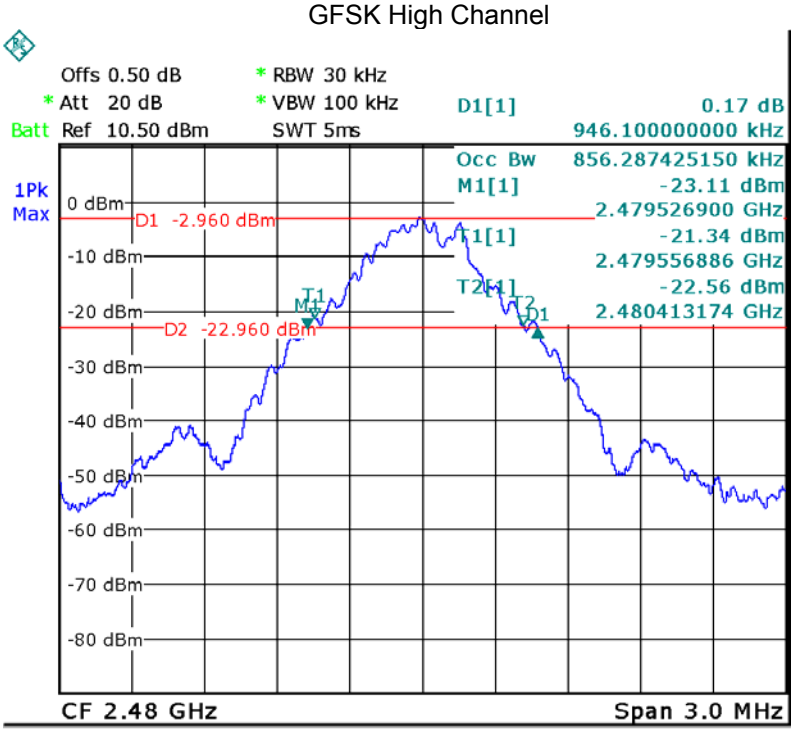
GFSK Low Channel



GFSK Middle Channel

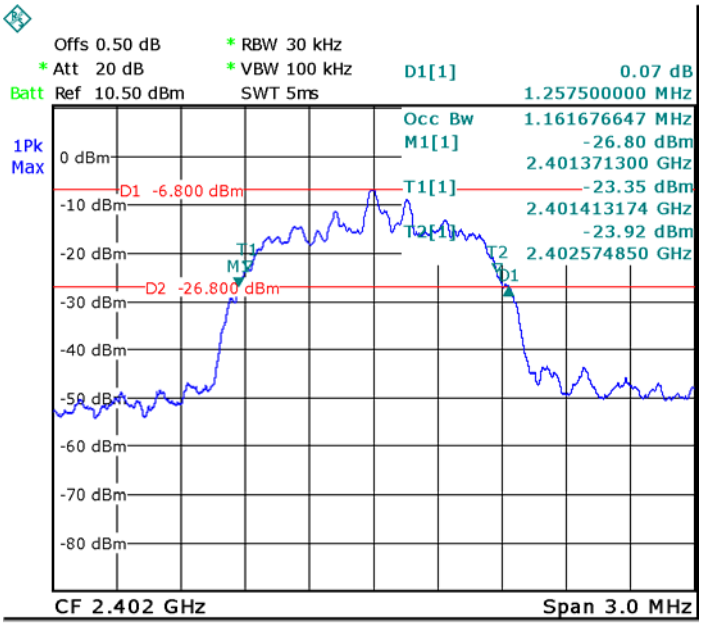


GFSK High Channel

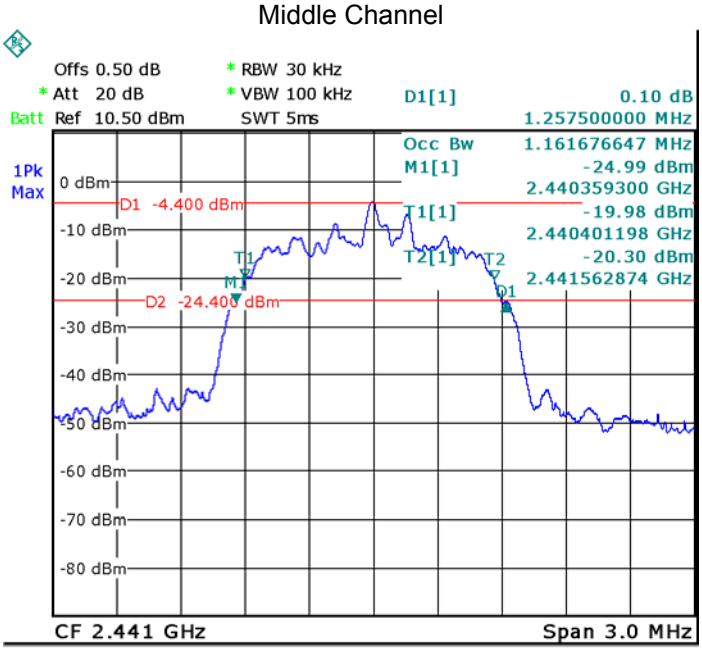


Modulation: Pi/4DQPSK

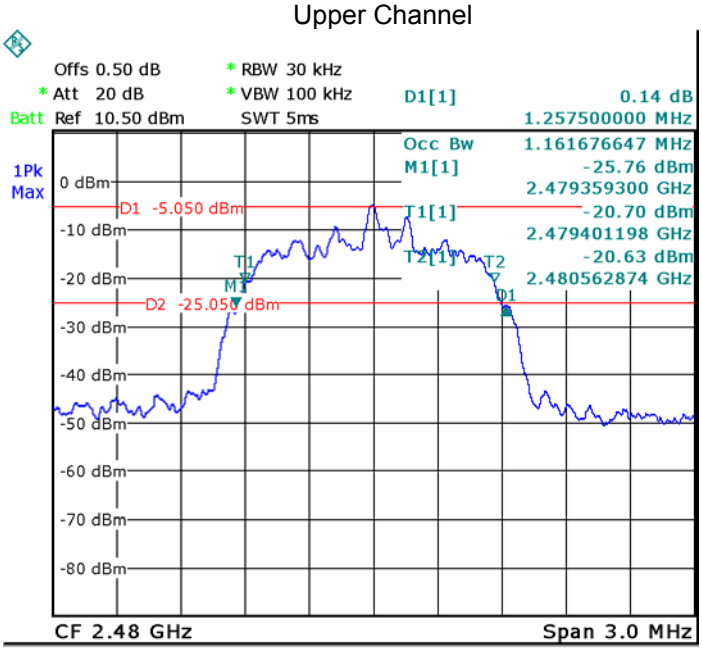
Lower Channel



Middle Channel

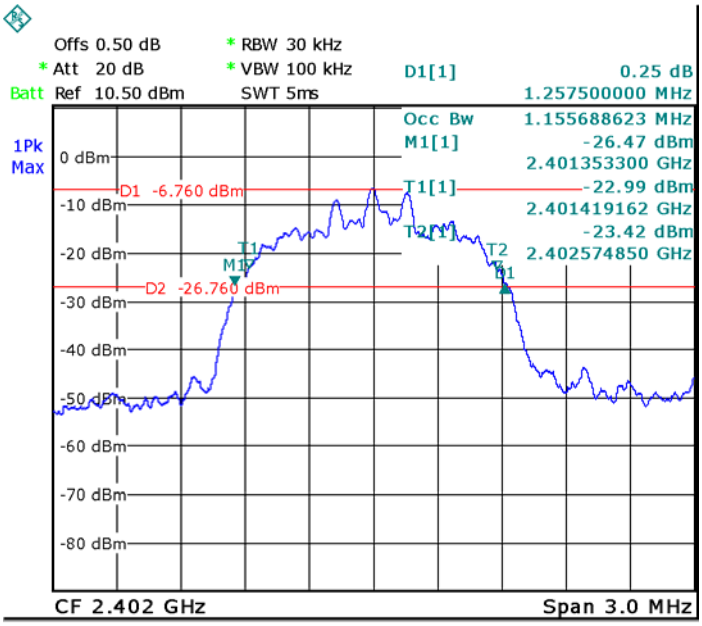


Upper Channel

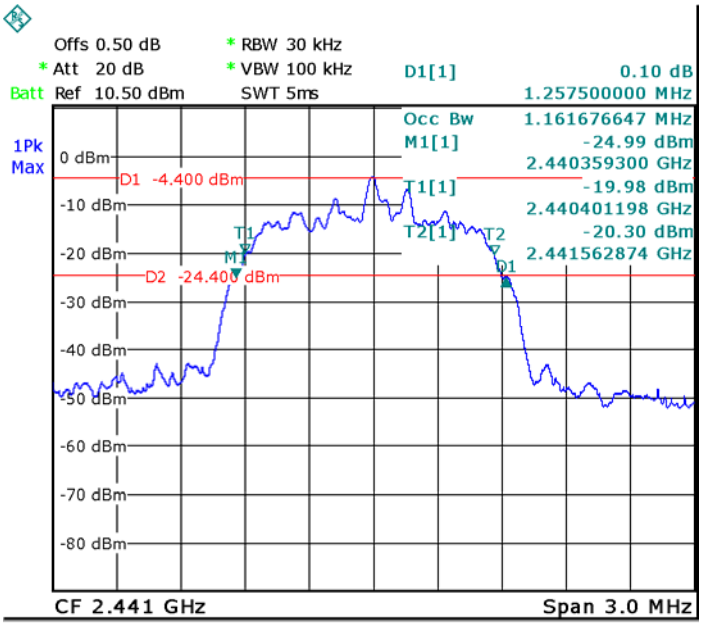


Modulation: 8DPSK

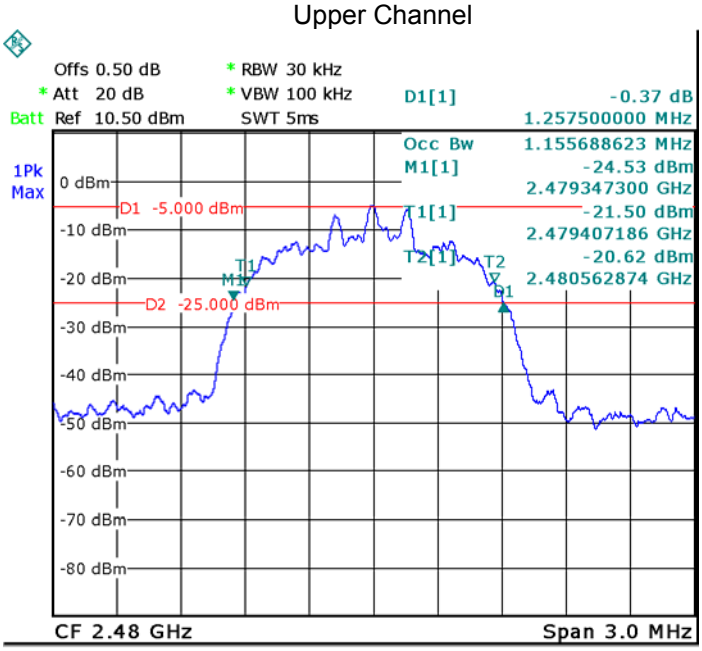
Lower Channel



Middle Channel



Upper Channel



11 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 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:	Test in fixing frequency transmitting mode.

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 = 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.

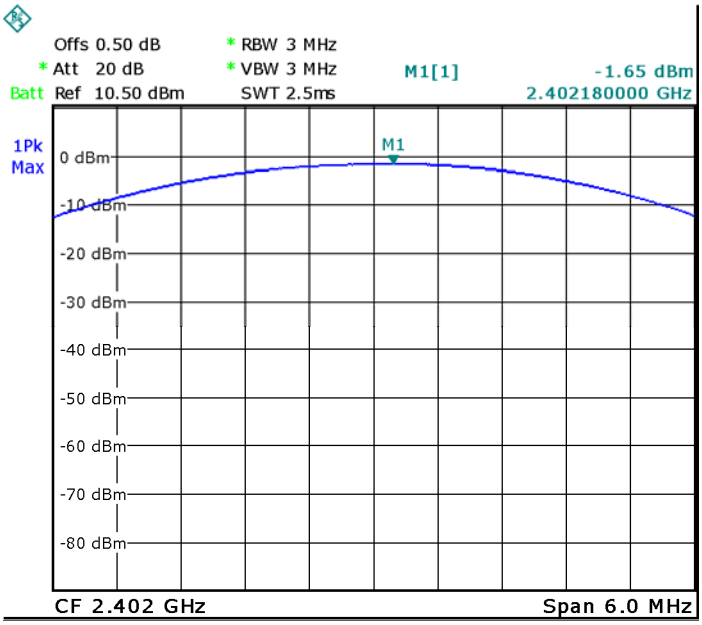
11.2 Test Result

Test Mode	Data Rate	Peak Power(dBm)			Limit (dBm)
		CH00	CH39	CH78	
GFSK	1Mbps	-1.65	0.02	-1.35	20.97
Pi/4DQPSK	2Mbps	-4.02	-1.95	-2.62	20.97
8DPSK	3Mbps	-3.60	-1.63	-2.16	20.97

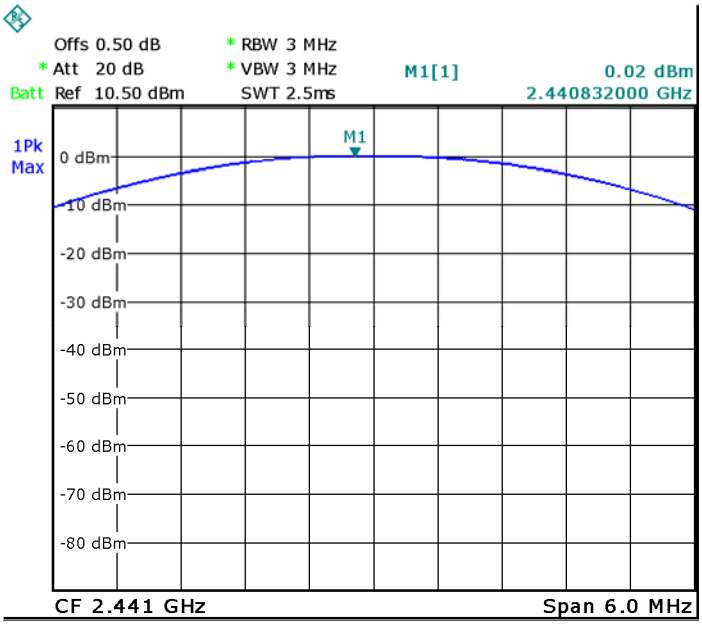
Test plots

Modulation: GFSK

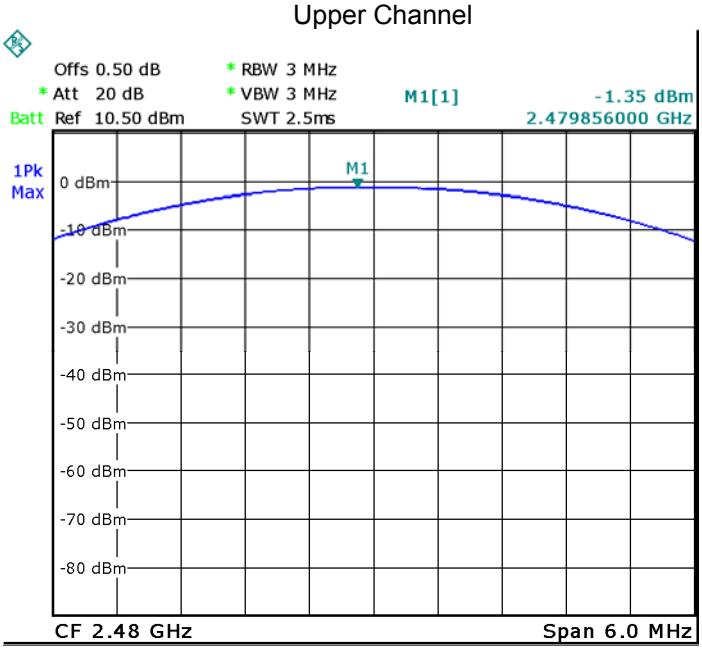
Lower Channel



Middle Channel

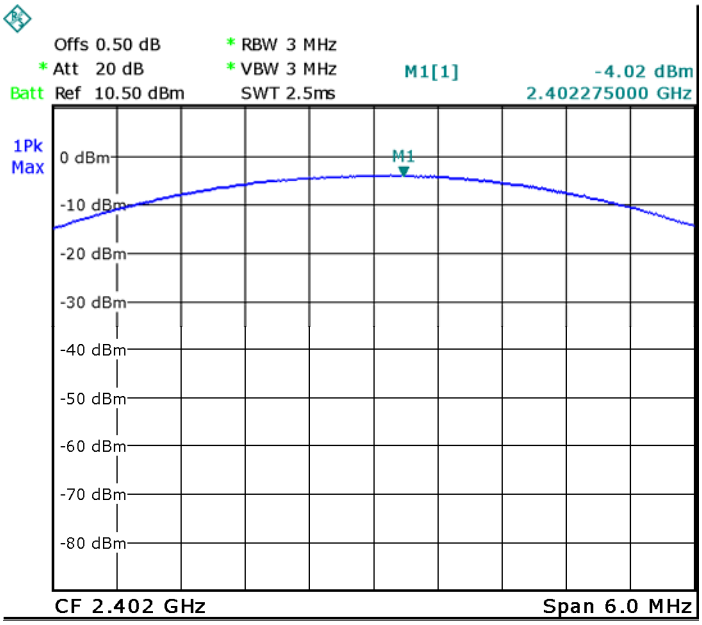


Upper Channel

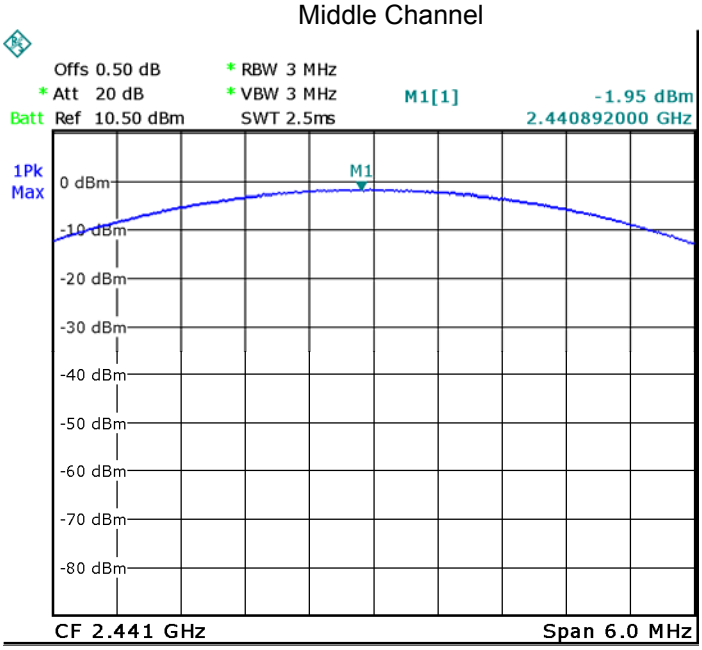


Modulation: Pi/4DQPSK

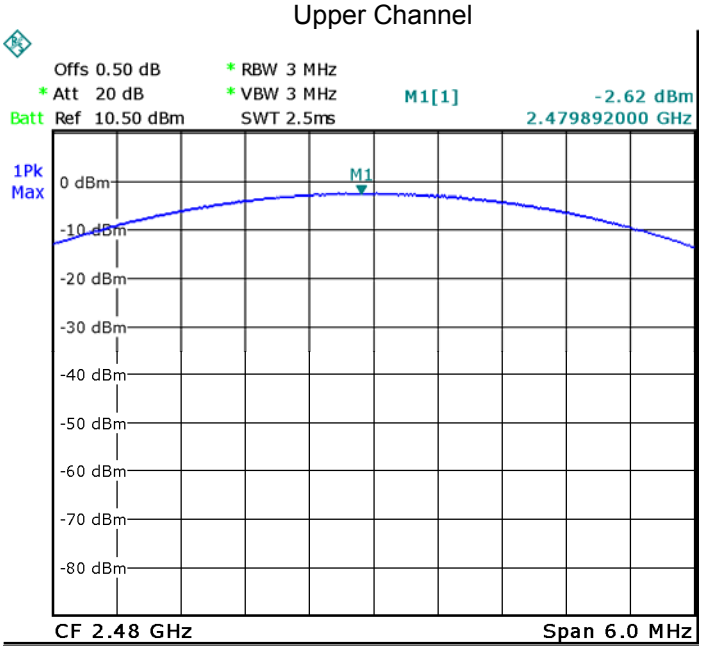
Lower Channel



Middle Channel

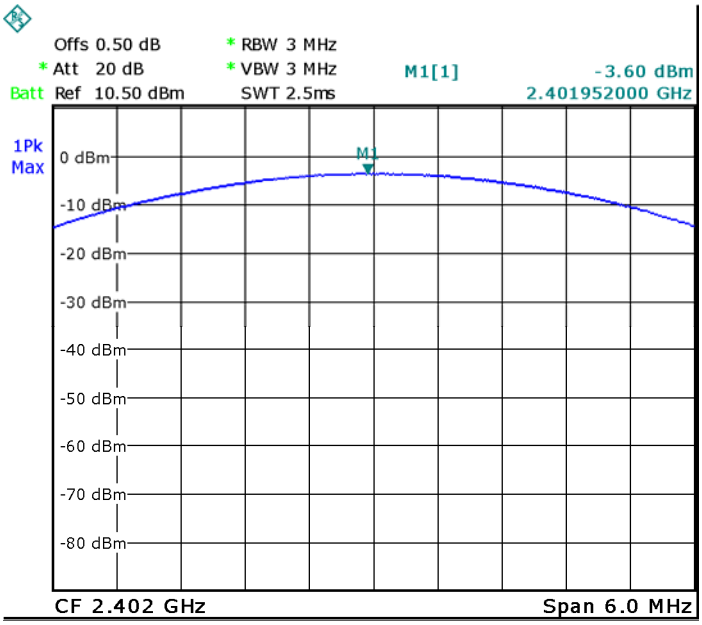


Upper Channel

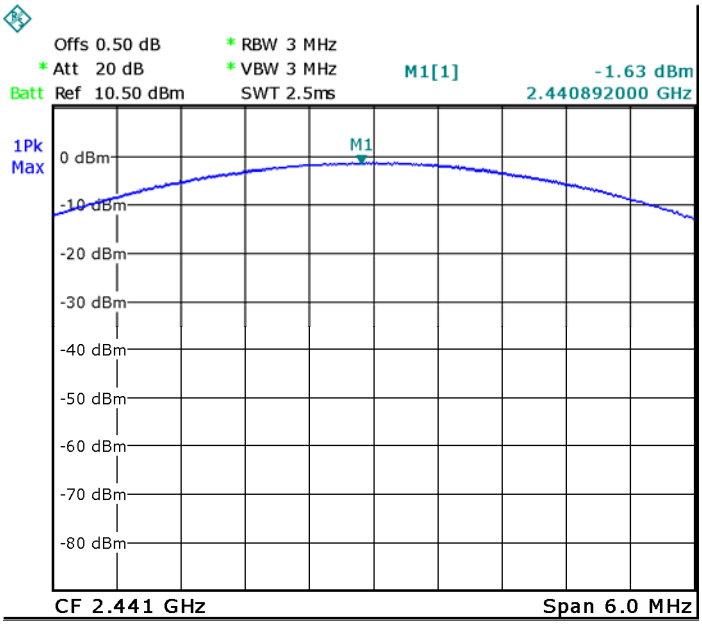


Modulation: 8DPSK

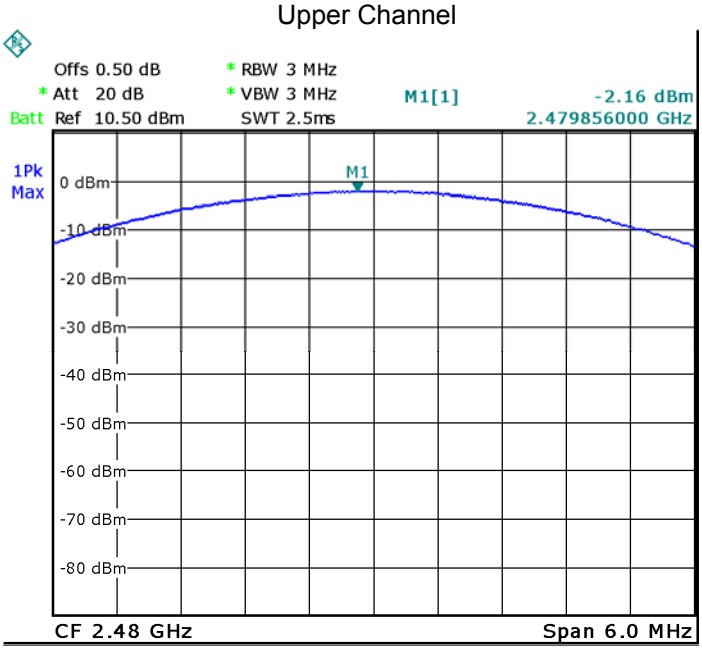
Lower Channel



Middle Channel



Upper Channel



12 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: Test in hopping transmitting operating mode.

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 = 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.

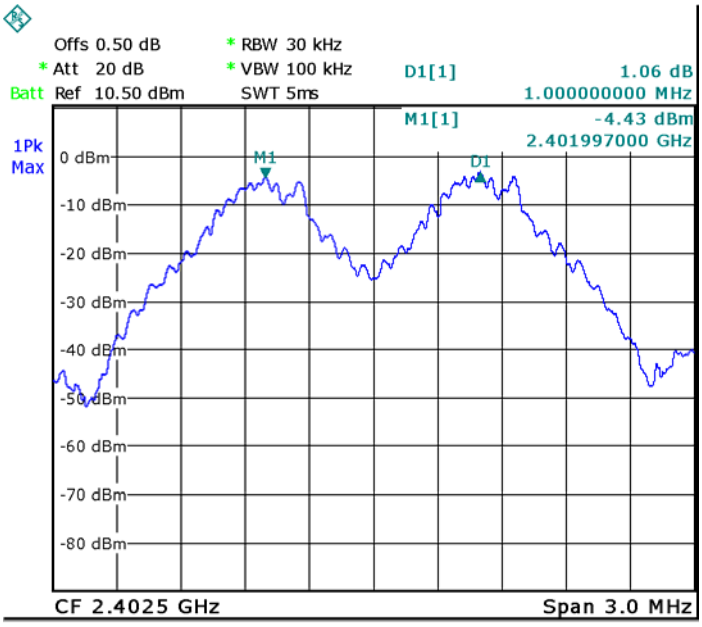
12.2 Test Result

Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	1.000	PASS
	Middle	1.000	PASS
	High	1.000	PASS
Pi/4DQPSK	Low	1.000	PASS
	Middle	1.000	PASS
	High	1.000	PASS
8DPSK	Low	1.000	PASS
	Middle	1.000	PASS
	High	1.000	PASS

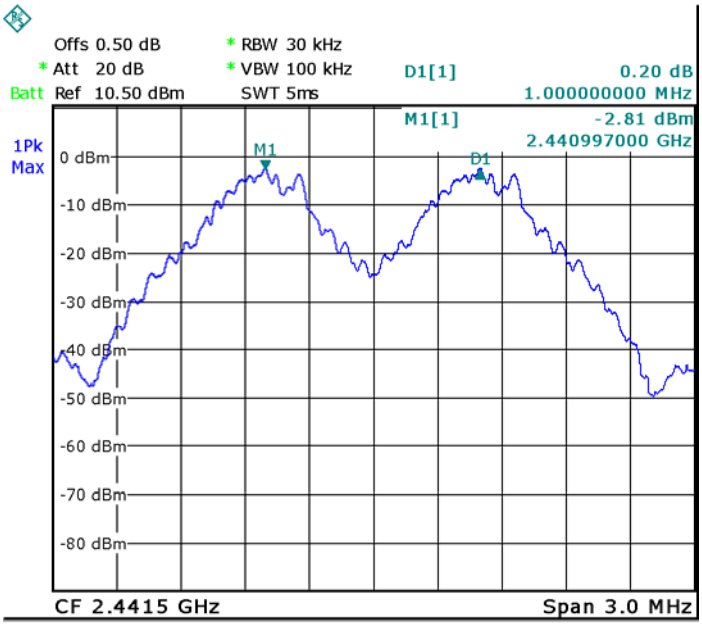
Test plots

Modulation:GFSK

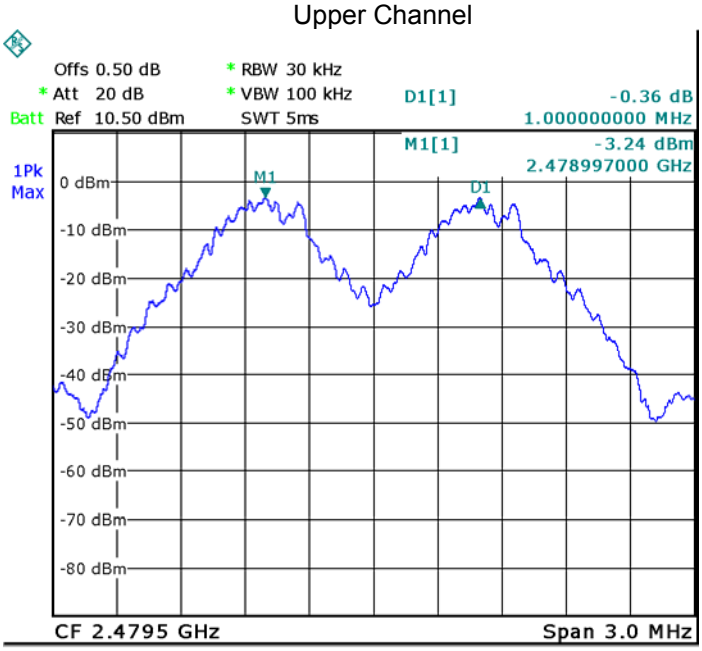
Lower Channel



Middle Channel

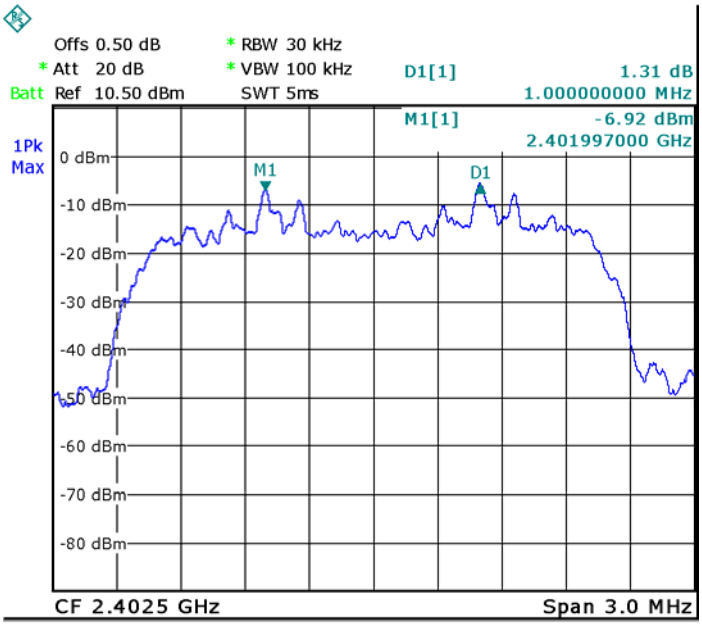


Upper Channel

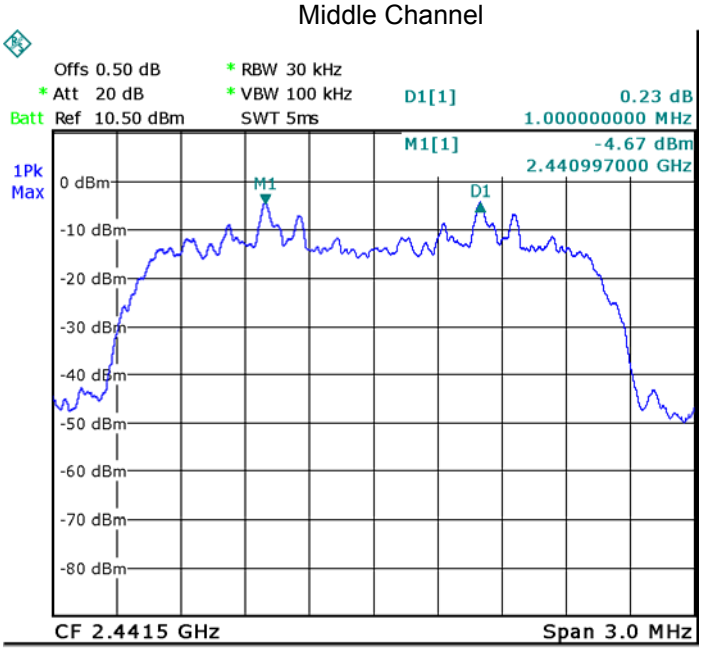


Modulation: Pi/4DQPSK

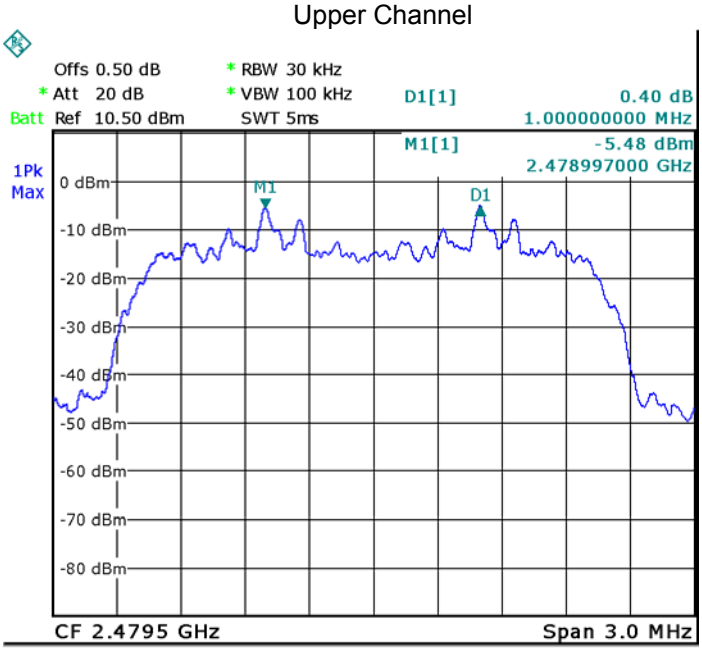
Lower Channel



Middle Channel

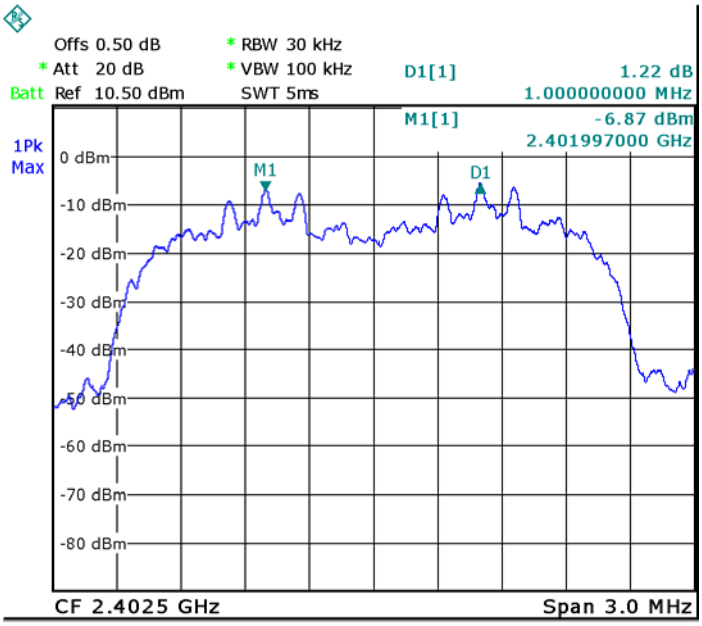


Upper Channel

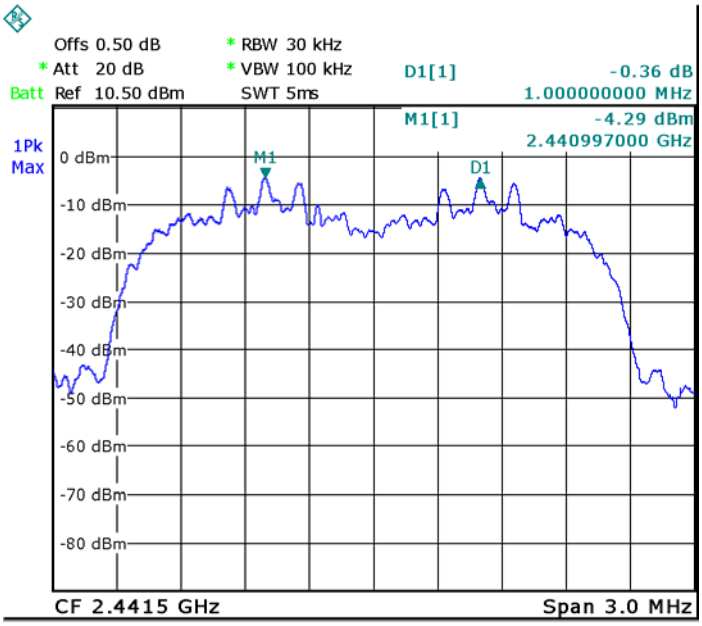


Modulation: 8DPSK

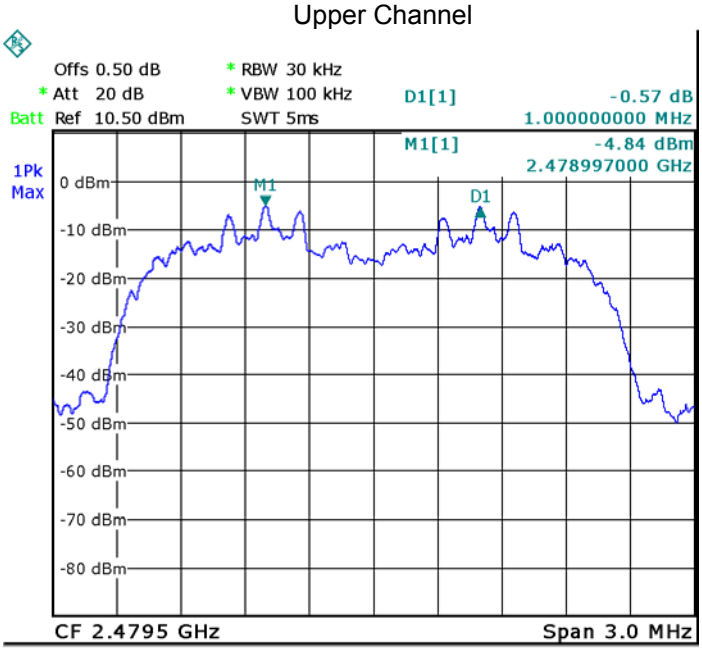
Lower Channel



Middle Channel



Upper Channel



13 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:	Test in hopping transmitting operating mode.

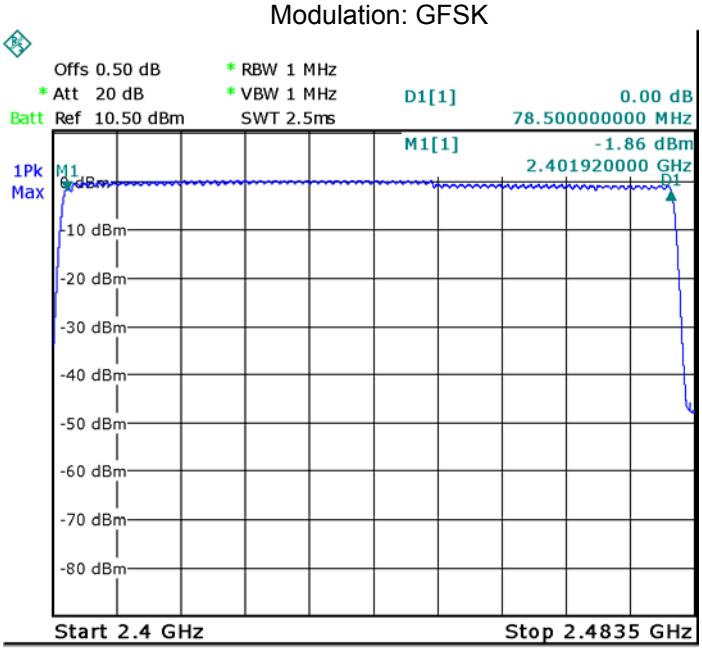
13.1 Test Procedure

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 = 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 = 2.4835GHz. Sweep=auto;

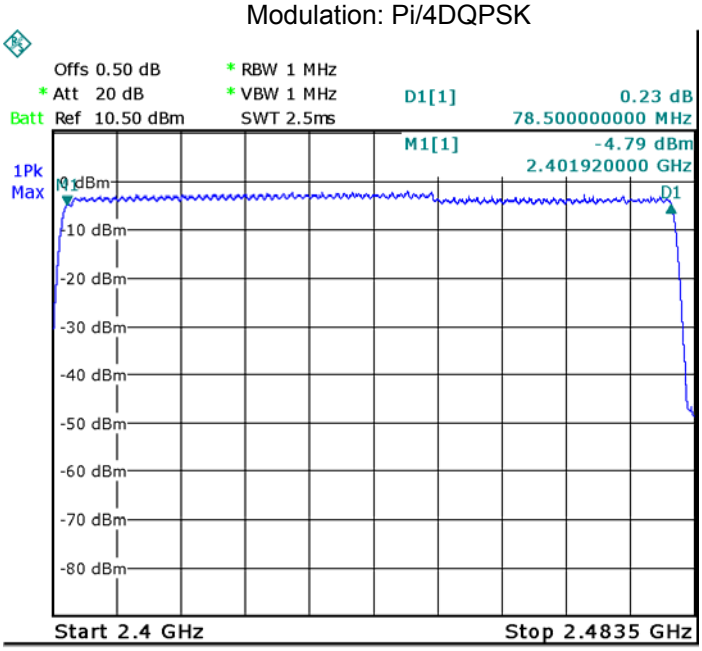
13.2 Test Result

Test Plots: 79 Channels in total

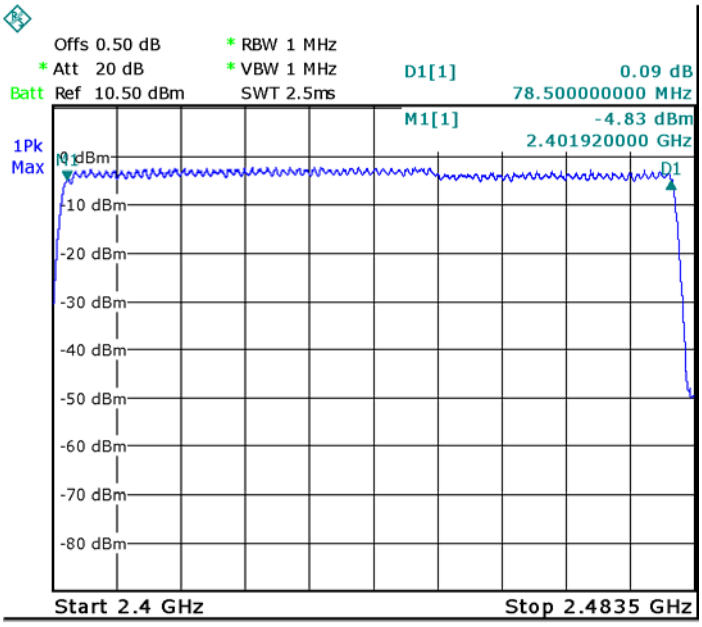
Modulation: GFSK



Modulation: Pi/4DQPSK



Modulation: 8DPSK



14 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

14.1 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).

14.2 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:

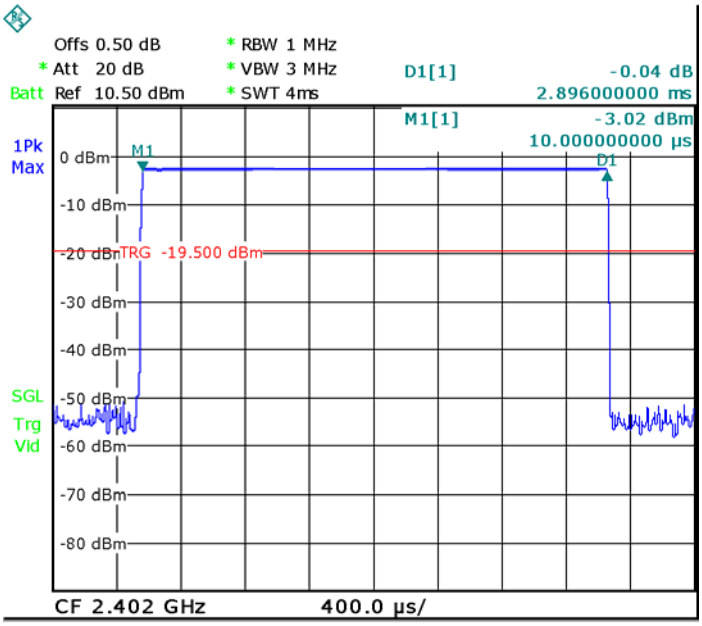
Data Packet	Dwell Time(s)
DH5	1600/79/6*0.4*79*(MkrDelta)/1000
DH3	1600/79/4*0.4*79*(MkrDelta)/1000
DH1	1600/79/2*0.4*79*(MkrDelta)/1000
Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow.	

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.896	0.309	0.4
		middle	2.896	0.309	0.4
		High	2.896	0.309	0.4
Pi/4DQPSK	DH5	Low	2.896	0.309	0.4
		middle	2.896	0.309	0.4
		High	2.896	0.309	0.4
8DPSK	DH5	Low	2.896	0.309	0.4
		middle	2.896	0.309	0.4
		High	2.896	0.309	0.4

Modulation: GFSK

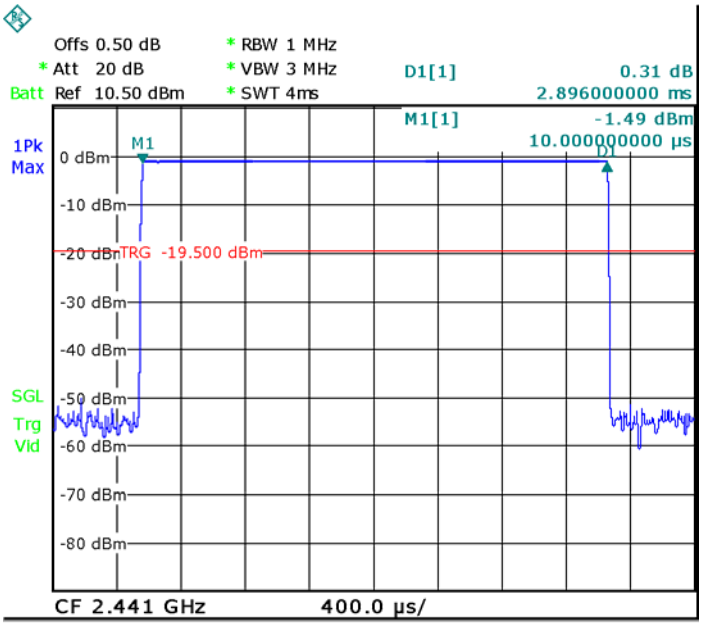
Data Packet:

DH5.Lower channel



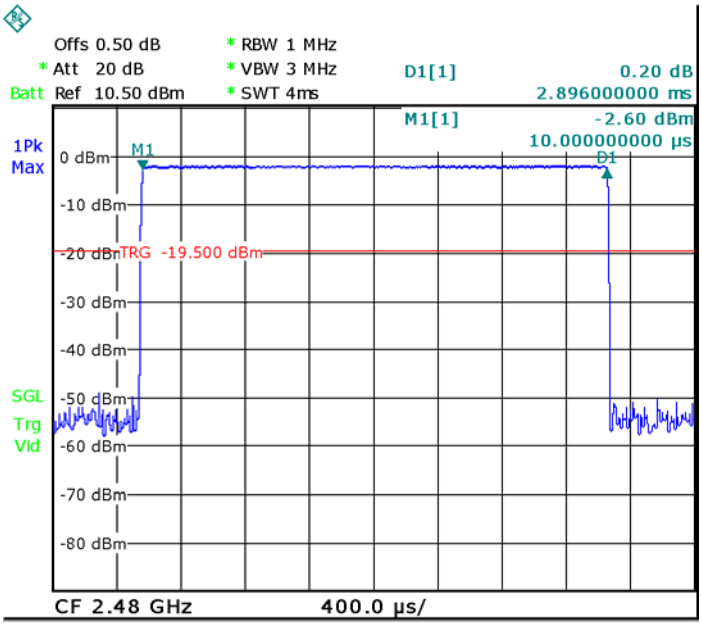
Data Packet:

DH5.Middle channel



Data Packet:

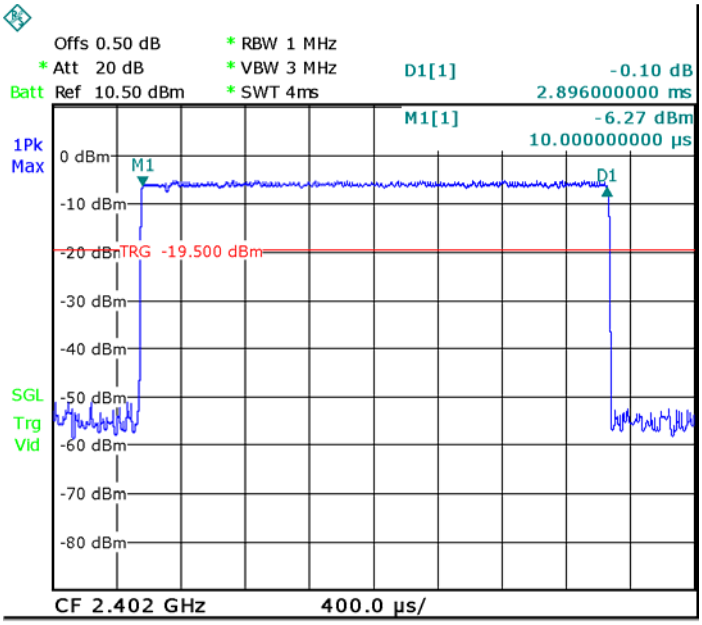
DH5,Upper channel



Pi/4DQPSK

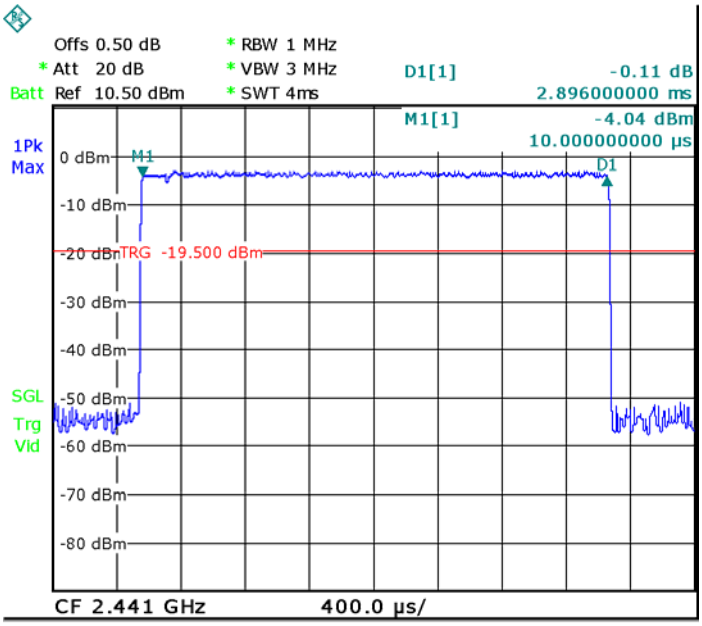
Data Packet:

DH5,Lower channel



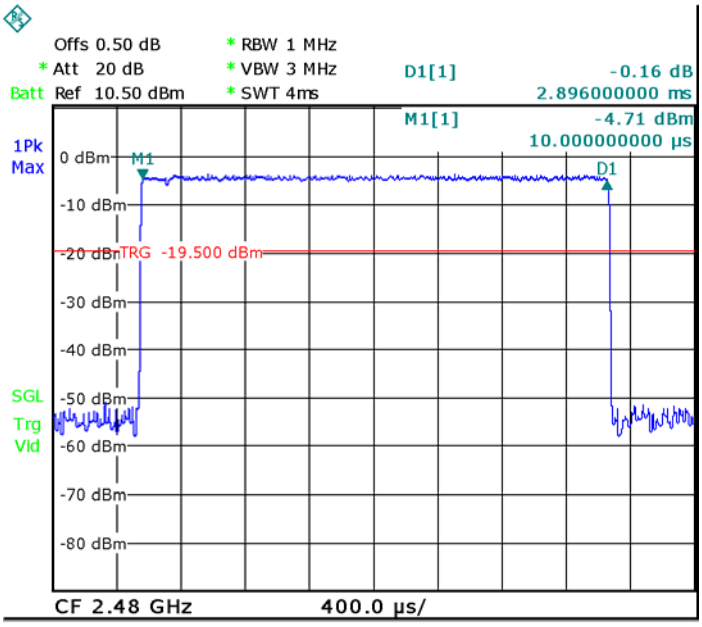
Data Packet:

DH5,Middle channel



Data Packet:

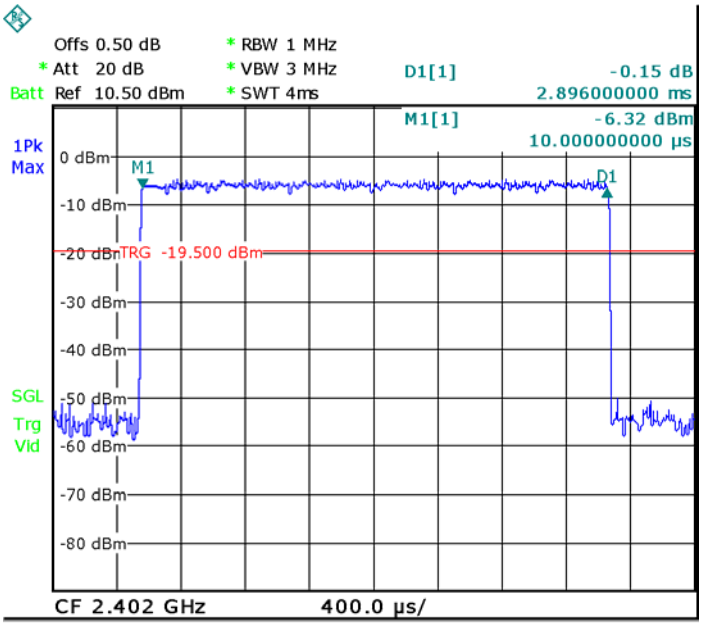
DH5,Upper channel



8DPSK

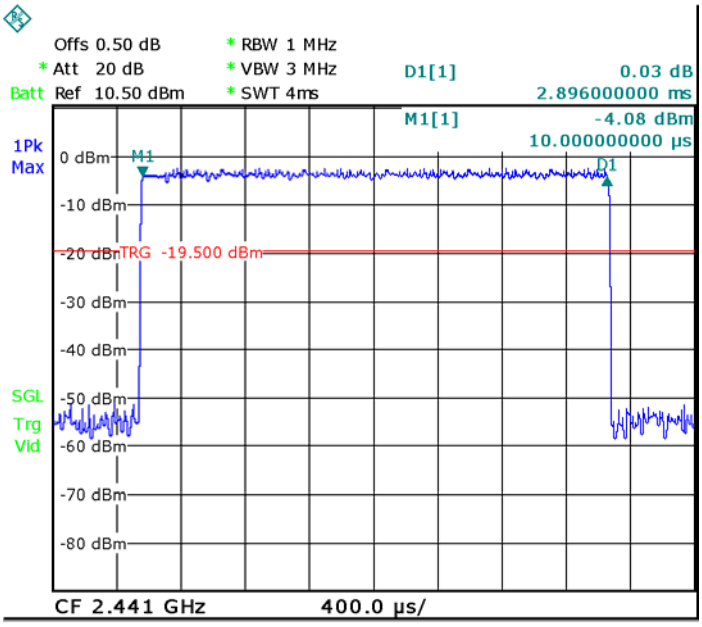
Data Packet:

DH5,Lower channel



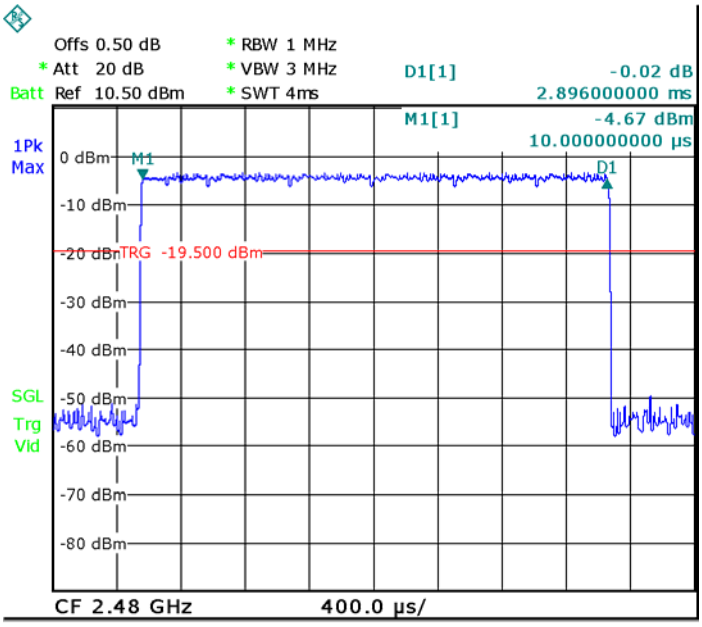
Data Packet:

DH5,Middle channel



Data Packet:

DH5,Upper channel



15 Antenna Requirement

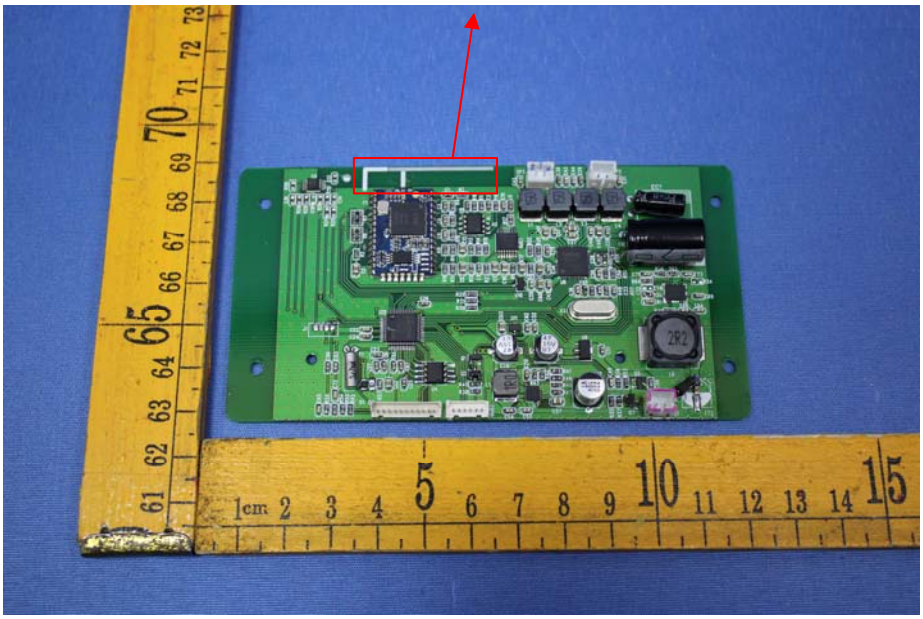
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

Result:

The EUT has one PCB printed antenna. meets the requirements of FCC 15.203.

ANT



16 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091 & KDB 447498 D01 General RF Exposure Guidance v06

16.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

16.2 The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

16.3 MPE Calculation Method

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = output power to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

From the peak EUT RF output power, the minimum mobile separation distance, R=20cm, as well as the gain of the used antenna, the RF power density can be obtained

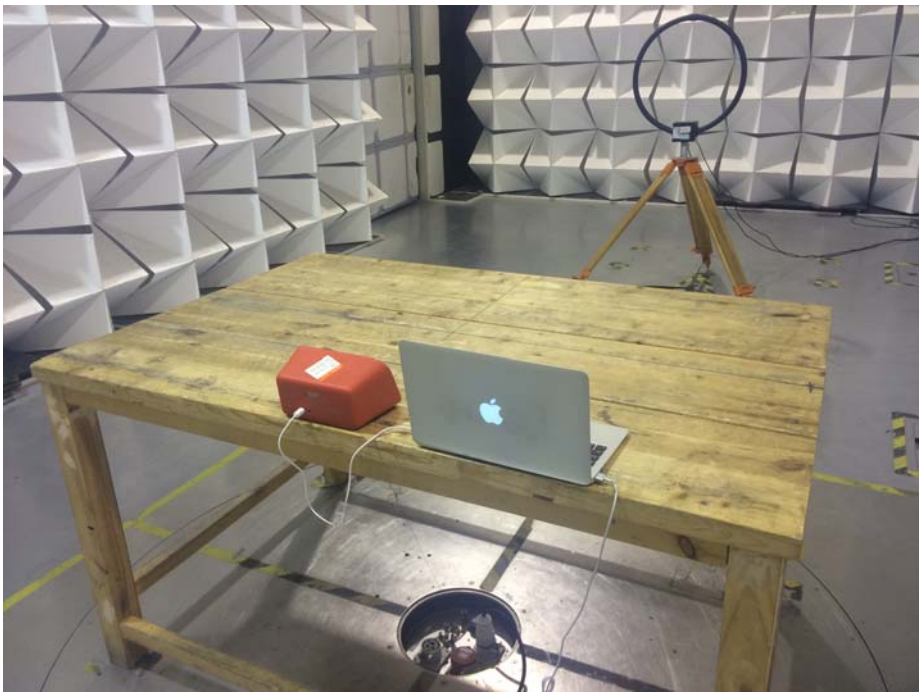
Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
0.00	1.000	0.02	1.00	0.0002	1

17 Photographs –Model BTX1 Test Setup Photos

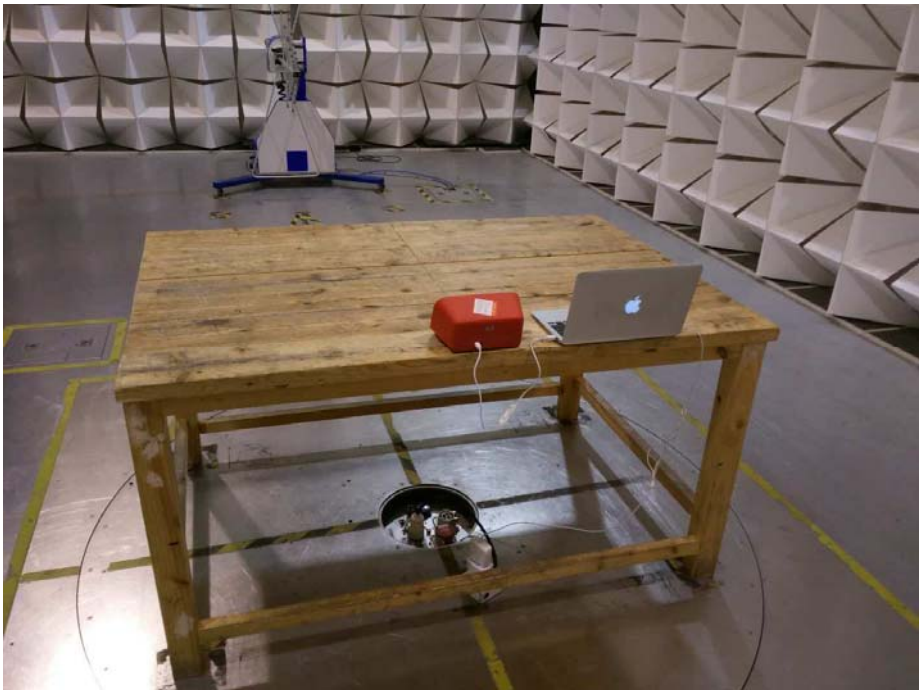
17.1 Photograph – Conducted Emission Test Setup at Test Site 2#

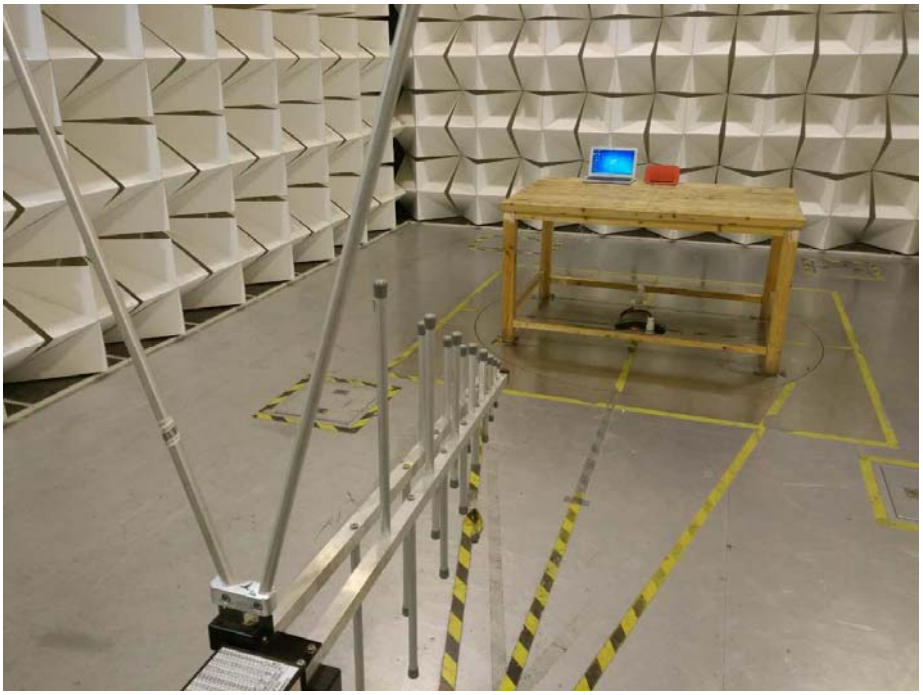
17.2 Photograph – Radiated Emission

Test frequency Below 30MHz

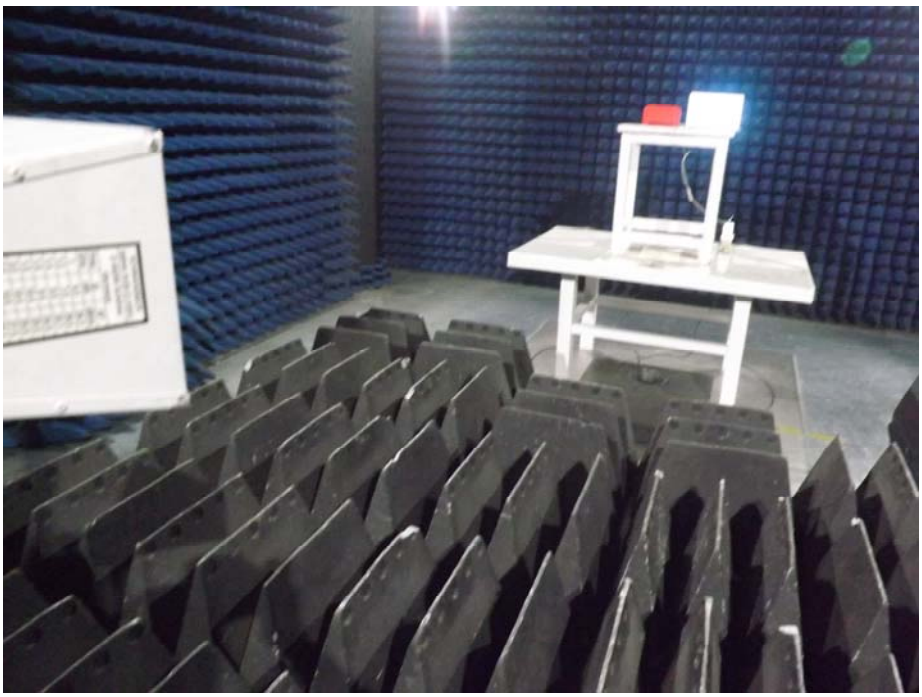


Test frequency from 30MHz to 1GHz Test Site 2#



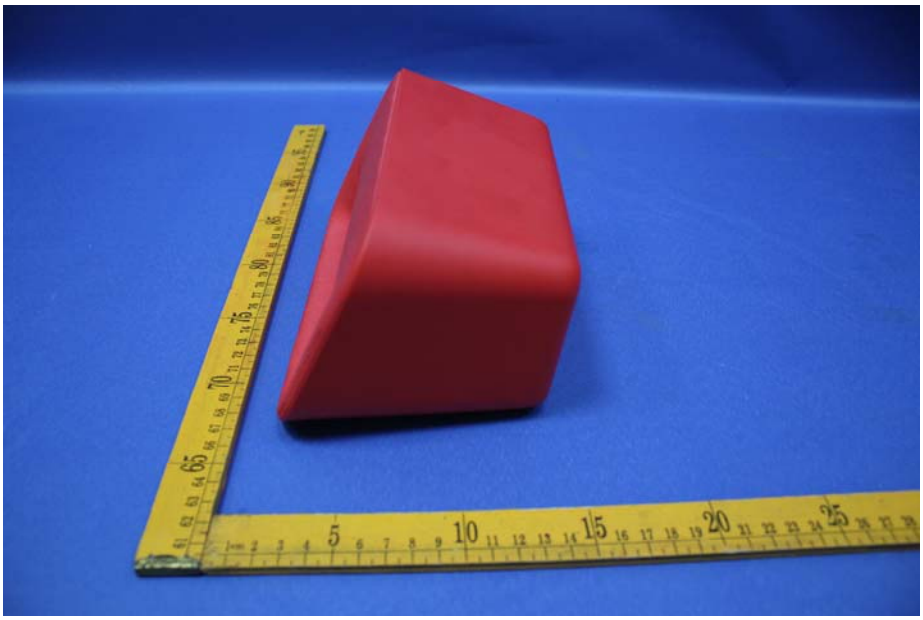


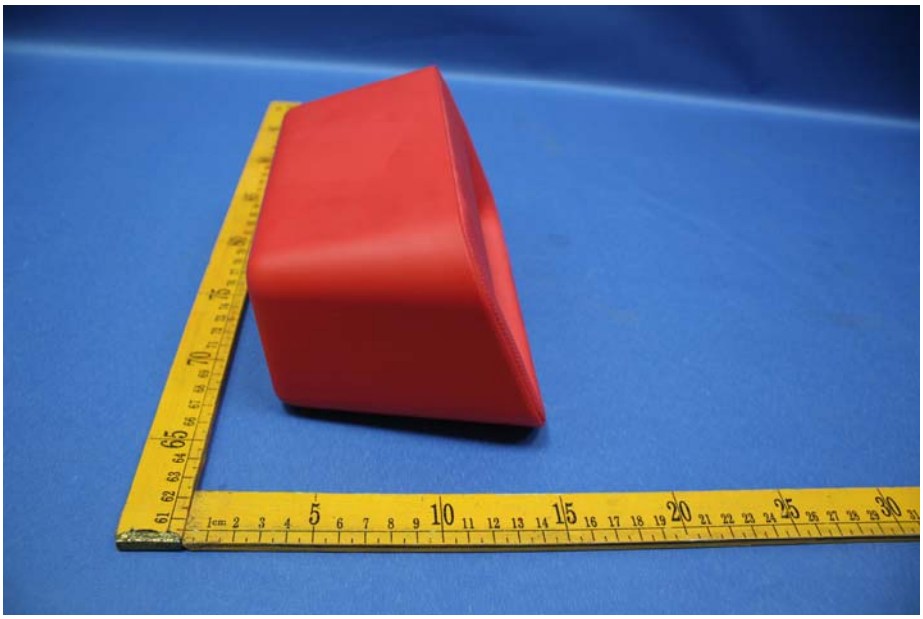
Test frequency above 1GHz Test Site 1#



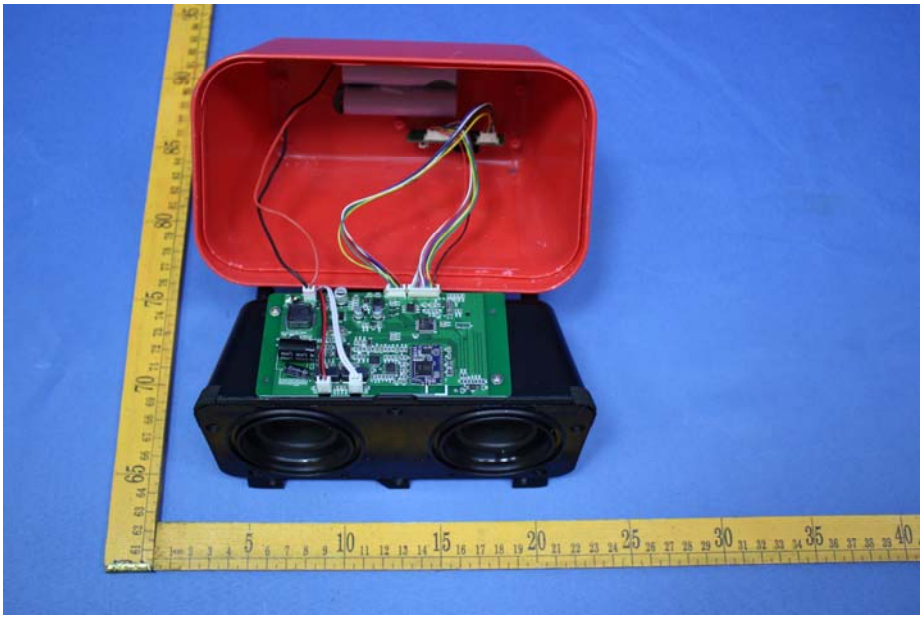
18 Photographs - Constructional Details

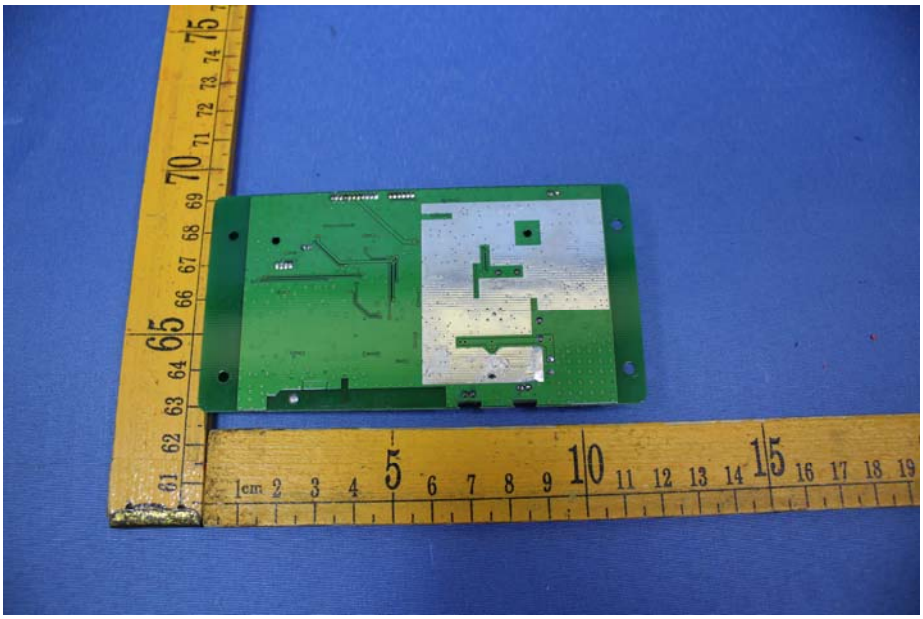
18.1 Model BTX1 - External Photos

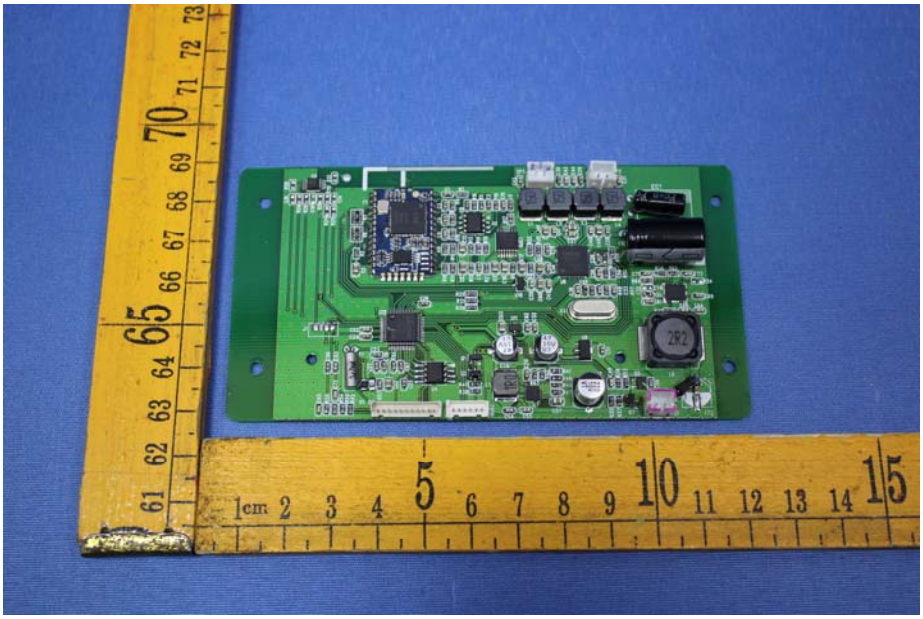


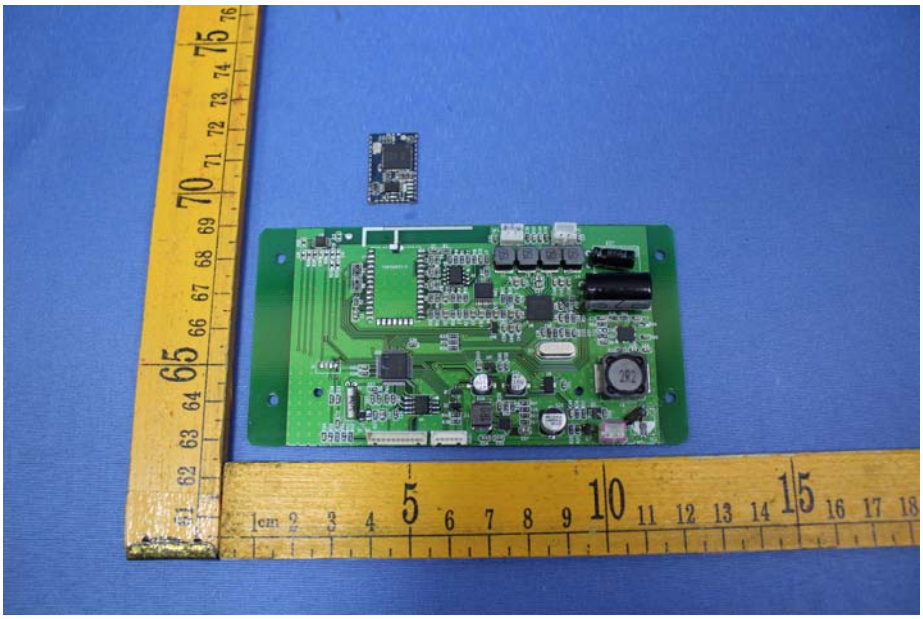


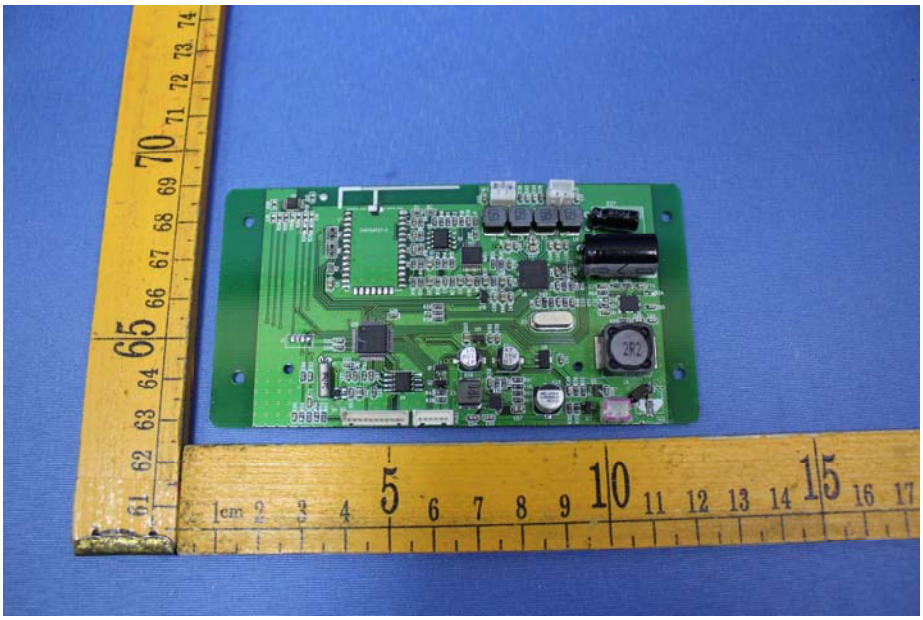
18.2 Model BTX1 -Internal Photos

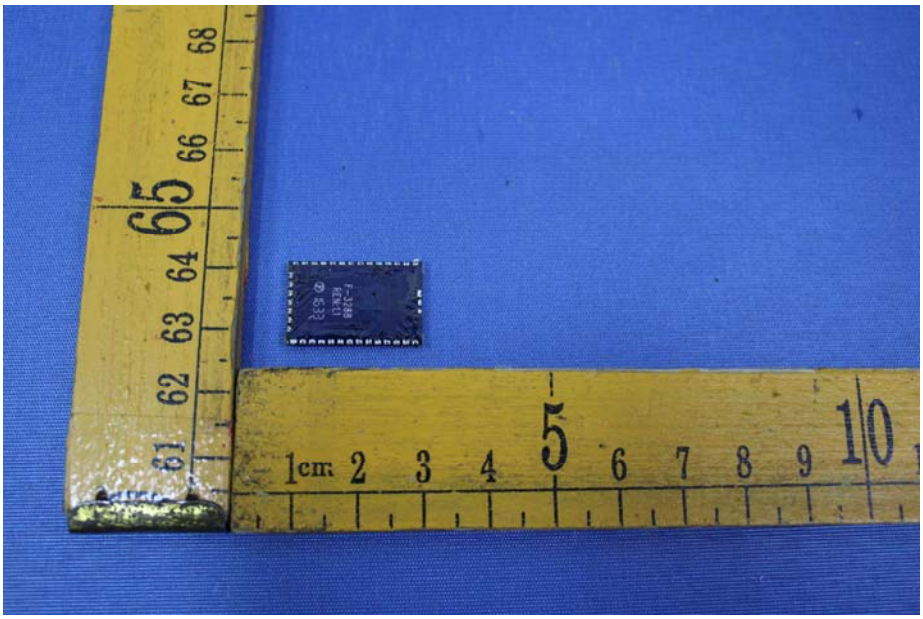


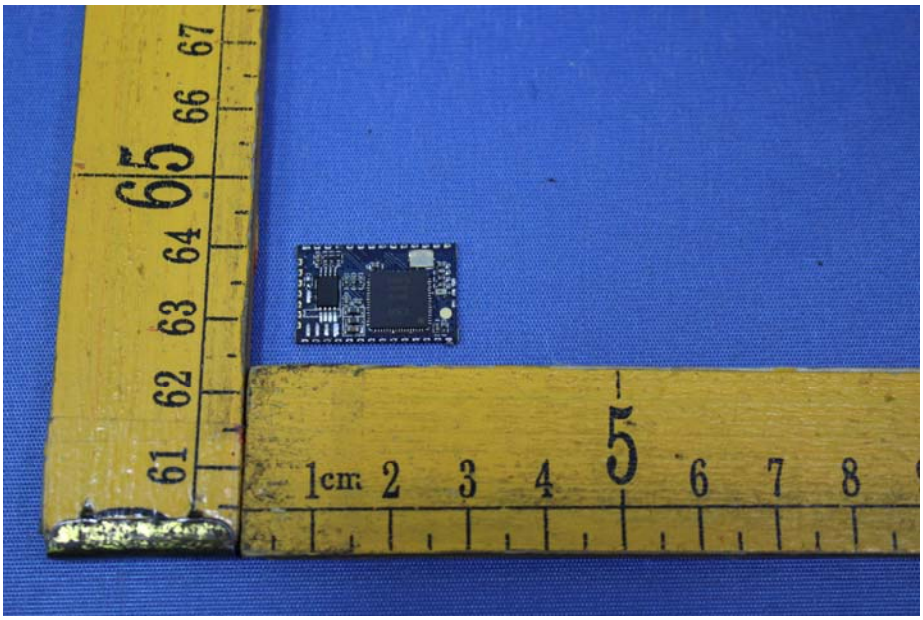









68
67
66
65
64
63
62
61
1cm
2
3
4
5
6
7
8
9
10


67
66
65
64
63
62
61
1cm
2
3
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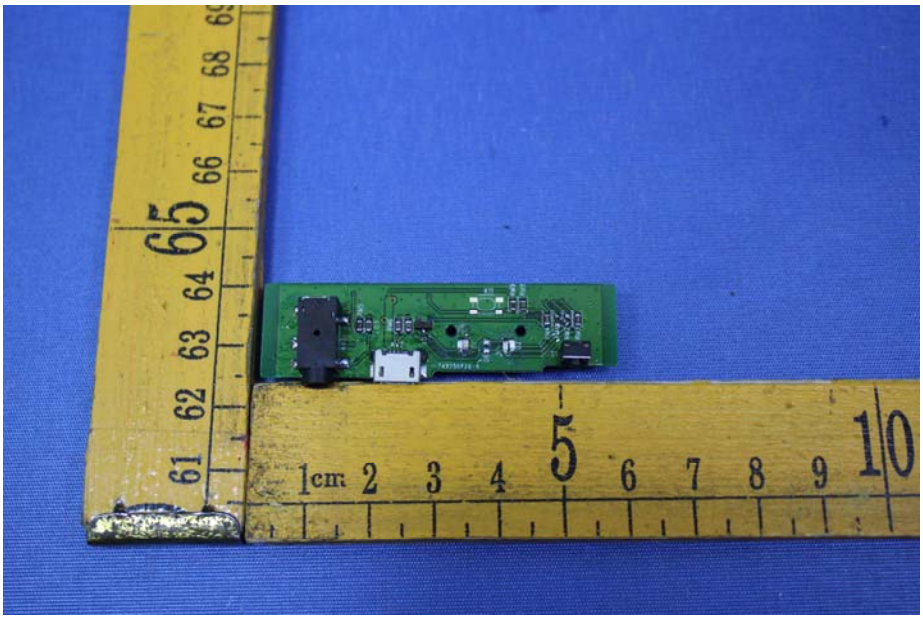
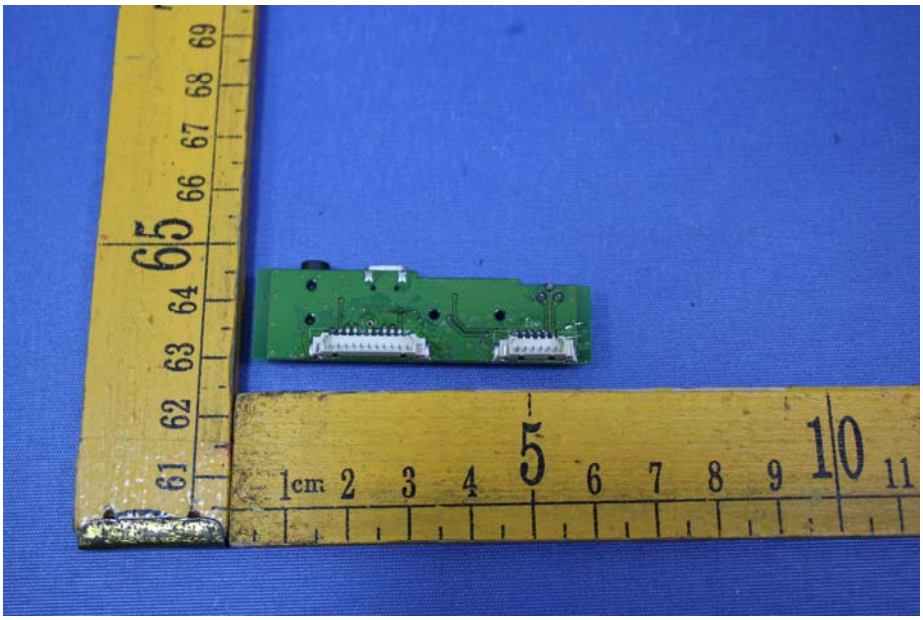
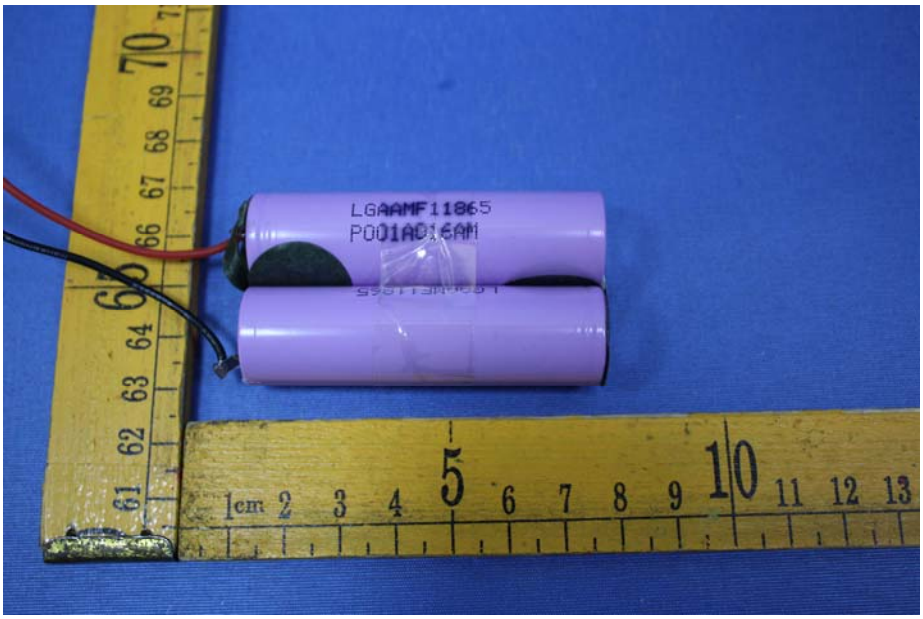
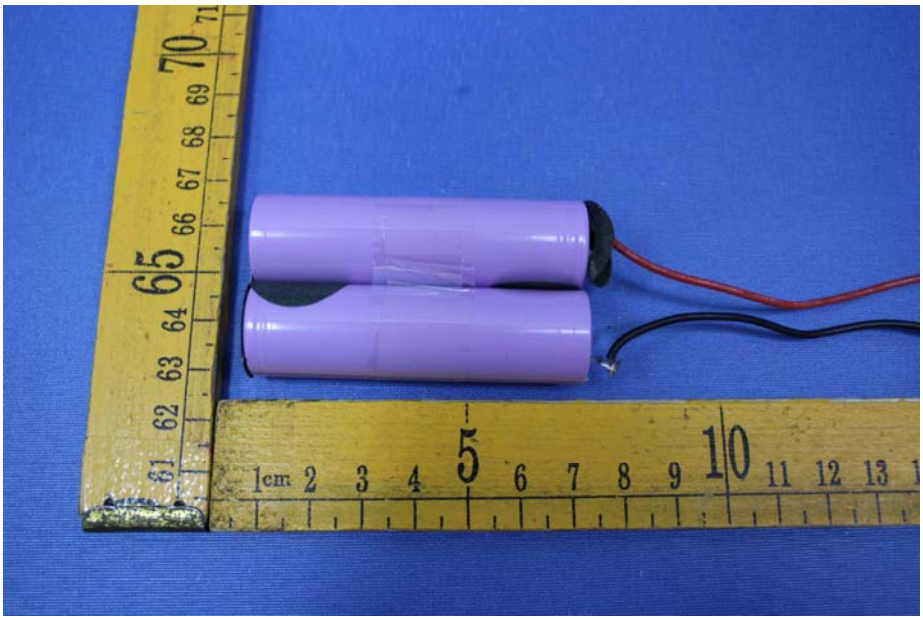
7
8









======End of Report======