TEST REPORT

Reference No.	:	WTS14S0615035E
FCC ID	:	2ACFX16888
Applicant	:	Chitech Industries II ., Ltd
Address	:	Room 1609A, 16/F, Tower3, China HK City, 33 Canton Road, Tsimshatsui, Kowloon, HongKong
Manufacturer	:	The same as above
Address	:	The same as above
Product Name	:	Monster High Wireless Speaker
Model No.	:	16888
Standards	:	FCC CFR47 Part 15 C Section 15.247:2012
Date of Receipt sample	:	Jun.13, 2014
Date of Test	:	Jun.16-25, 2014
Date of Issue	:	Jul.11, 2014
Test Result	:	**Pass ***

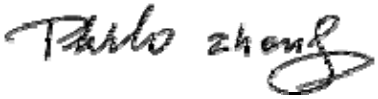
*Remarks:
The results shown in this test report refer only to the sample(s) tested; this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:
Waltek Services (Shenzhen) Co., Ltd.
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Testing location: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400

Compiled by:

Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Spurious Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge Emissions	15.247(d)	PASS
20dB Bandwidth	15.215c 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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

3 Contents

Page

4 General Information

4.1 General Description of E.U.T.

Product Name : Monster High Wireless Speaker

Model No. : 16888

Operation Frequency : 2402 ~ 2480MHz, 79 channels in total

Type of Modulation : GFSK, Pi/4DQPSK, 8DPSK

Lowest OSC Frequency : 26MHz

Antenna installation : PCB Printed Antenna

Antenna Gain : 0dBi

4.2 Details of E.U.T.

Technical Data ..... : (1) DC 5V, 1A from USB Charging
(3) DC 3.7V, 200mAh by battery

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 Test Facility

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

- **IC – Registration No.: 7760A-1**

  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-1, July 12, 2012.

- **FCC – 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.

4.5 Test Location

All the tests were performed at:
Waltek Services (Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd.,Songgang Street, Baoan District, Shenzhen, China

4.5.2 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

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions at Mains Terminals Disturbance Voltage						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.18,2013	Sep.17,2014
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.18,2013	Sep.17,2014
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.18,2013	Sep.17,2014
4.	Cable	LARGE	RF300	-	Sep.18,2013	Sep.17,2014
3m Semi-anechoic Chamber for Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.18,2013	Sep.17,2014
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.18,2013	Sep.17,2014
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2014	Apr.18,2015
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.18,2013	Sep.17,2014
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2014	Apr.18,2015
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2014	Apr.18,2015
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2014	Mar.16,2015
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2014	Apr.09,2015

5.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
MacBook Air	APPLE	A1465(EW03039-1)	C17KTQDNF5N7

5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
DC Source	±0.05%
Radiated Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	±3.64dB (150kHz~30MHz)

5.4 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 Conducted Emission Test

Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	ANSI C63.4: 2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	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)
	Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Test Condition

Operating Environment:

Temperature: 22°C
Humidity: 52.5 % RH
Atmospheric Pressure: 101.1kPa

EUT Operation:

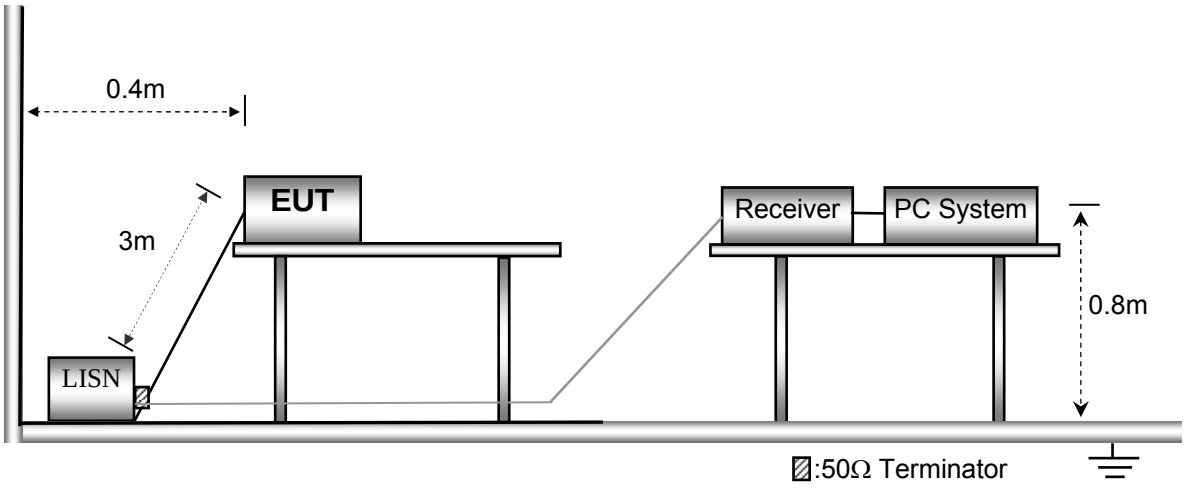
The pre-test was performed in communication mode, and the test data were shown as follow.

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

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.

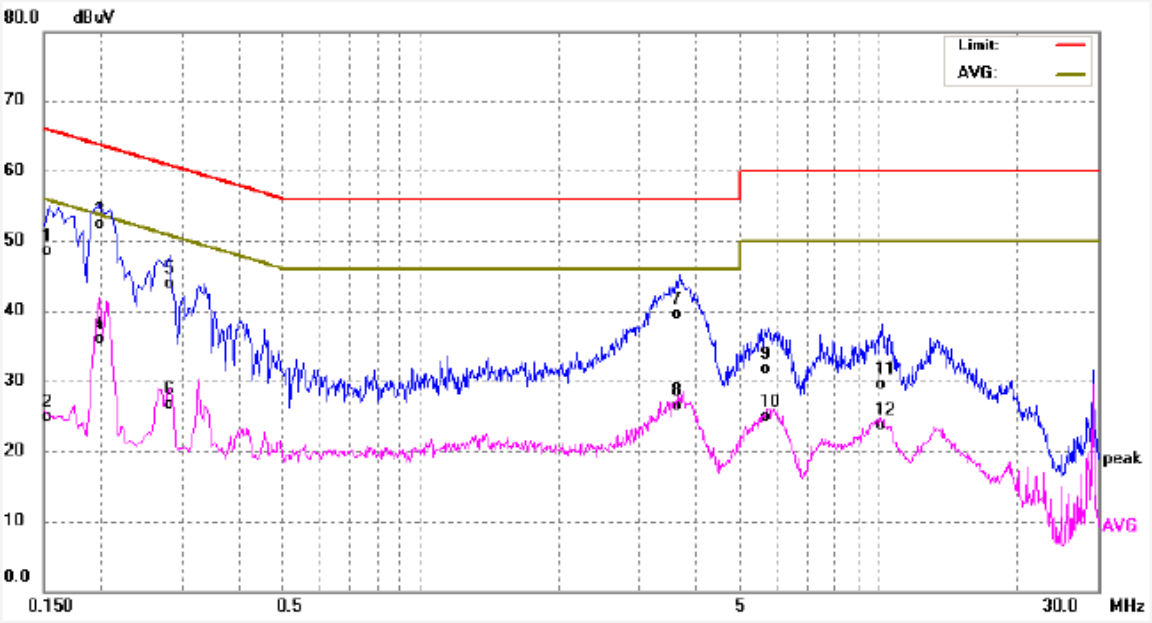
6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



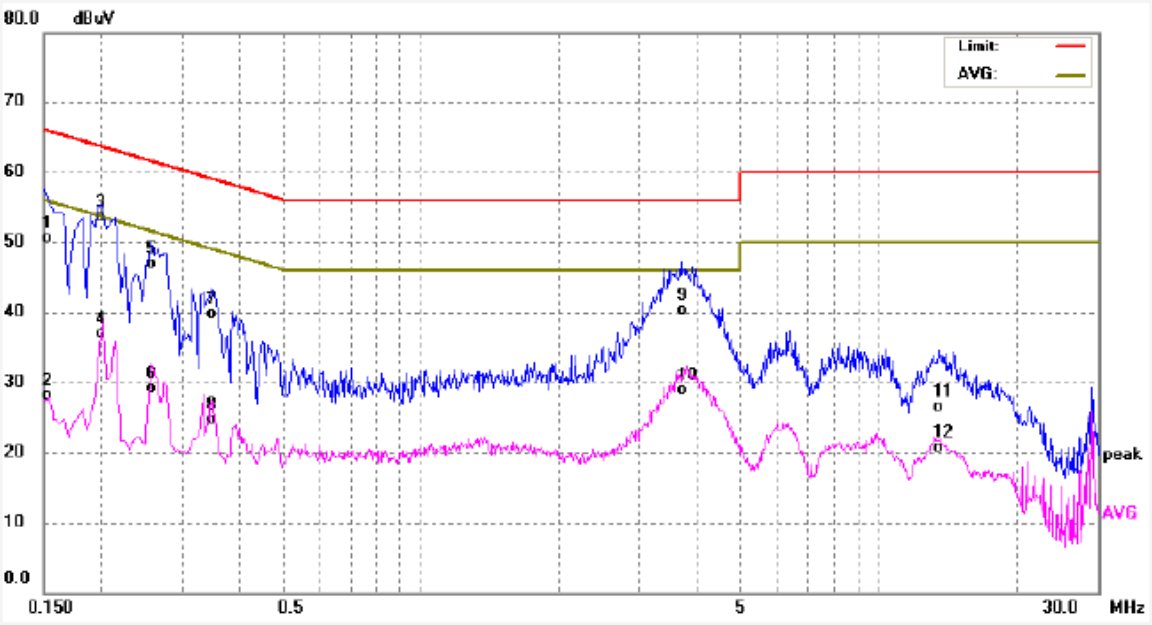
6.3 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	37.97	10.57	48.54	65.78	-17.24	QP	
2	0.1539	14.34	10.57	24.91	55.78	-30.87	AVG	
3	0.1980	41.83	10.57	52.40	63.69	-11.29	QP	
4	0.1980	25.36	10.57	35.93	53.69	-17.76	AVG	
5	0.2819	33.25	10.57	43.82	60.76	-16.94	QP	
6	0.2819	16.08	10.57	26.65	50.76	-24.11	AVG	
7	3.6700	28.50	11.03	39.53	56.00	-16.47	QP	
8	3.6700	15.43	11.03	26.46	46.00	-19.54	AVG	
9	5.7380	20.96	10.74	31.70	60.00	-28.30	QP	
10	5.7380	14.18	10.74	24.92	50.00	-25.08	AVG	
11	10.1380	18.67	10.82	29.49	60.00	-30.51	QP	
12	10.1380	12.92	10.82	23.74	50.00	-26.26	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	39.85	10.57	50.42	65.99	-15.57	QP	
2	0.1500	17.48	10.57	28.05	55.99	-27.94	AVG	
3	0.1980	42.96	10.57	53.53	63.69	-10.16	QP	
4	0.1980	26.41	10.57	36.98	53.69	-16.71	AVG	
5	0.2589	36.34	10.57	46.91	61.46	-14.55	QP	
6	0.2589	18.60	10.57	29.17	51.46	-22.29	AVG	
7	0.3500	29.18	10.57	39.75	58.96	-19.21	QP	
8	0.3500	14.19	10.57	24.76	48.96	-24.20	AVG	
9	3.6860	29.26	11.02	40.28	56.00	-15.72	QP	
10	3.6860	17.79	11.02	28.81	46.00	-17.19	AVG	
11	13.5340	15.48	11.08	26.56	60.00	-33.44	QP	
12	13.5340	9.65	11.08	20.73	50.00	-29.27	AVG	

7 Spurious Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

Test Result: PASS

Measurement Distance: 3m

Limit:

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: 52.5 % RH

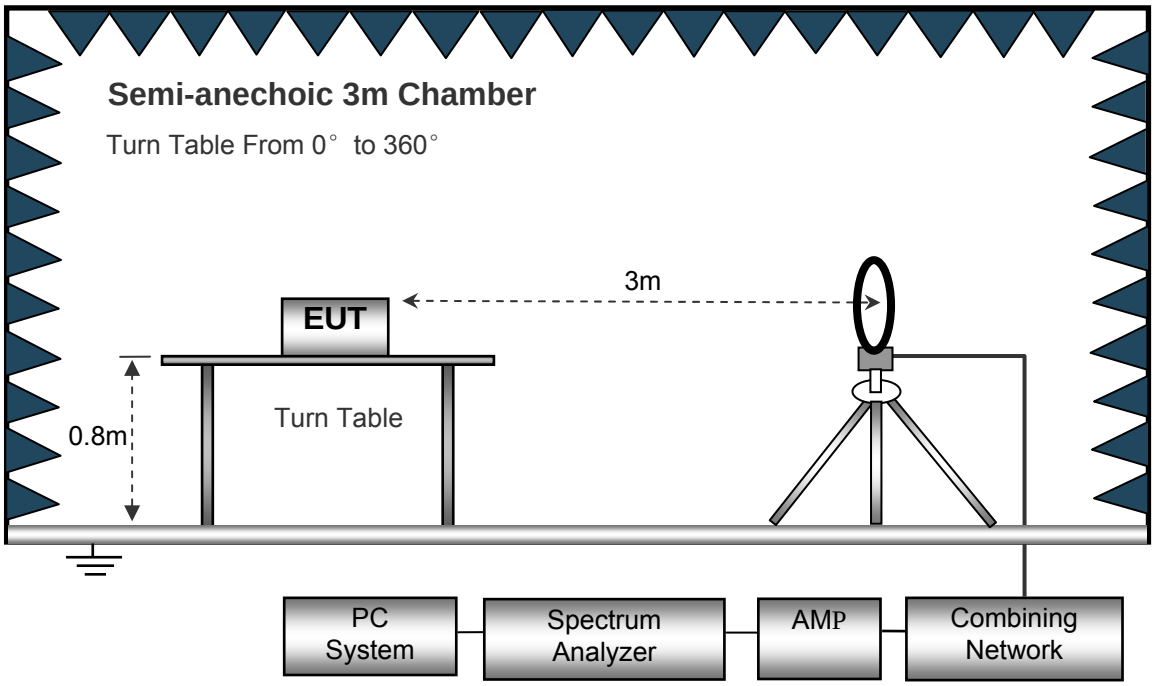
Atmospheric Pressure:100.8kPa

EUT Operation:

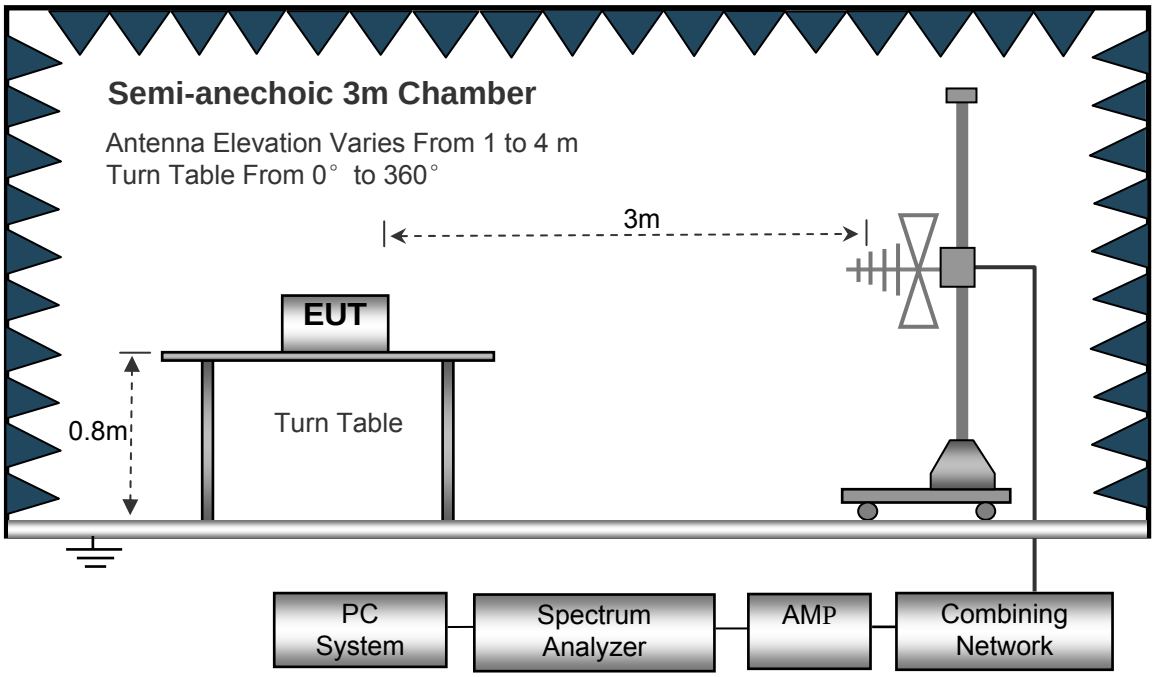
The test was performed in Bluetooth transmitting mode (adapter/battery operation), and the worst data is show in the report.

7.2 Test Setup

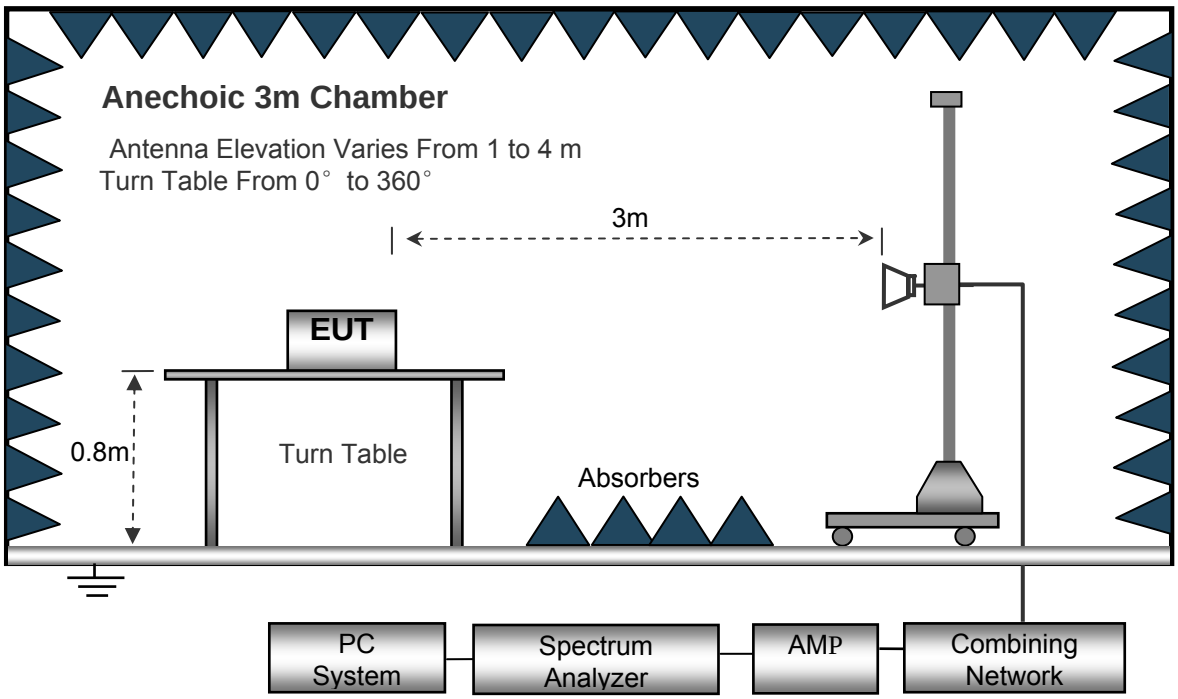
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyser Setup

Below 30MHz

Sweep Speed .....Auto
IF Bandwidth.....10KHz
Resolution Bandwidth.....10KHz
Video 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

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m 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.
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.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Receiver Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

Corrected factor=Antenna Factor + Cable Factor - Amplifier Gain

7.6 Summary of Test Results

Test Frequency: 26MHz-30MHz

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

Test Frequency: 30MHz ~ 18GHz

The Worst Mode: Bluetooth transmitting

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
82.23	12.32	PK	30	1.9	H	17.01	29.33	40.00	-10.67
82.23	10.52	PK	29	1.6	V	17.01	27.53	40.00	-12.47
4804.00	55.21	PK	207	1.6	V	-1.06	54.15	74.00	-19.85
4804.00	45.63	Ave	207	1.6	V	-1.06	44.57	54.00	-9.43
7206.00	43.52	PK	349	1.8	H	1.33	44.85	74.00	-29.15
7206.00	40.47	Ave	349	1.8	H	1.33	41.80	54.00	-12.20
2325.08	45.25	PK	96	1.6	V	-13.19	32.06	74.00	-41.94
2325.08	39.73	Ave	96	1.6	V	-13.19	26.54	54.00	-27.46
2380.15	42.39	PK	168	1.5	H	-13.14	29.25	74.00	-44.75
2380.15	38.18	Ave	168	1.5	H	-13.14	25.04	54.00	-28.96
2488.67	43.35	PK	39	1.3	V	-13.08	30.27	74.00	-43.73
2488.67	36.74	Ave	39	1.3	V	-13.08	23.66	54.00	-30.34

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441MHz									
82.23	12.68	PK	348	1.8	H	17.01	29.69	40.00	-10.31
82.23	10.25	PK	75	1.3	V	17.01	27.26	40.00	-12.74
4882.00	54.63	PK	182	1.9	V	-0.62	54.01	74.00	-19.99
4882.00	45.32	Ave	182	1.9	V	-0.62	44.70	54.00	-9.30
7323.00	42.98	PK	245	1.2	H	2.21	45.19	74.00	-28.81
7323.00	40.91	Ave	245	1.2	H	2.21	43.12	54.00	-10.88
2313.19	45.85	PK	349	1.1	V	-13.19	32.66	74.00	-41.34
2313.19	37.59	Ave	349	1.1	V	-13.19	24.40	54.00	-29.60
2368.51	42.22	PK	243	1.1	H	-13.14	29.08	74.00	-44.92
2368.51	36.73	Ave	243	1.1	H	-13.14	23.59	54.00	-30.41
2485.98	43.20	PK	357	1.9	V	-13.08	30.12	74.00	-43.88
2485.98	38.42	Ave	357	1.9	V	-13.08	25.34	54.00	-28.66

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
82.23	12.36	PK	40	1.6	H	17.01	29.37	40.00	-10.63
82.23	10.15	PK	311	1.3	V	17.01	27.16	40.00	-12.84
4960.00	54.71	PK	53	1.2	V	-0.24	54.47	74.00	-19.53
4960.00	45.62	Ave	53	1.2	V	-0.24	45.38	54.00	-8.62
7440.00	43.02	PK	98	1.1	H	2.84	45.86	74.00	-28.14
7440.00	41.25	Ave	98	1.1	H	2.84	44.09	54.00	-9.91
2348.04	46.88	PK	132	1.6	V	-13.19	33.69	74.00	-40.31
2348.04	39.91	Ave	132	1.6	V	-13.19	26.72	54.00	-27.28
2363.32	44.64	PK	255	2.0	H	-13.14	31.50	74.00	-42.50
2363.32	36.96	Ave	255	2.0	H	-13.14	23.82	54.00	-30.18
2491.87	44.88	PK	34	1.8	V	-13.08	31.80	74.00	-42.20
2491.87	37.61	Ave	34	1.8	V	-13.08	24.53	54.00	-29.47

Remark: Scan with GFSK, Pi/4DQPSK, 8DPSK, the worst case is GFSK mode.

Test Frequency: 18GHz-25GHz
The measurements were more than 20 dB below the limit and not reported.

8 Band edge Emissions

Test Requirement: FCC Part 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.

Test Method: DA 00-705

Test Status: Transmitting mode

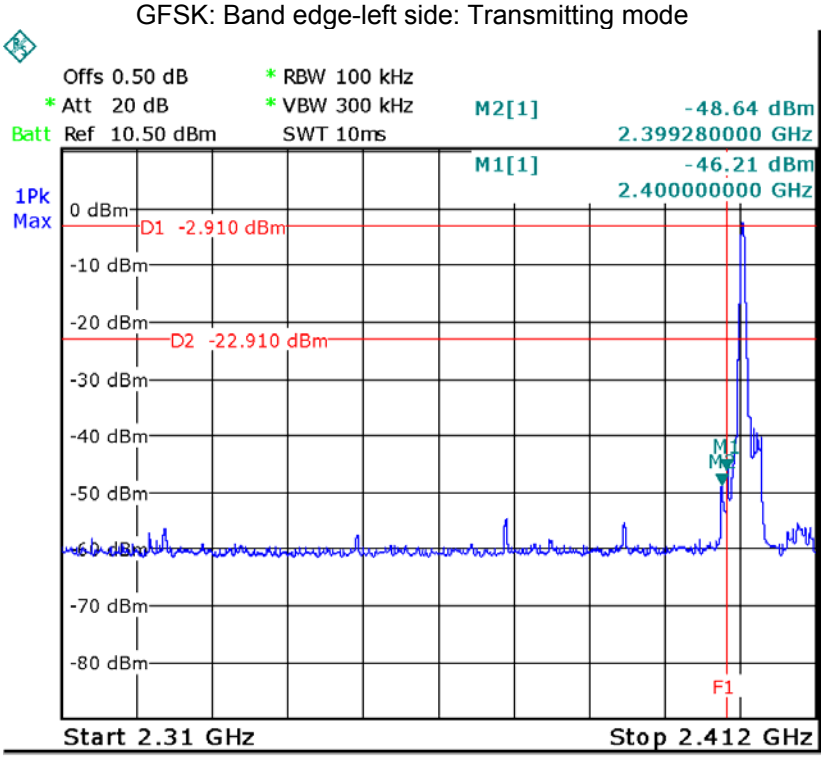
8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 300kHz.Sweep =auto.
4. Mark the worst point and record.

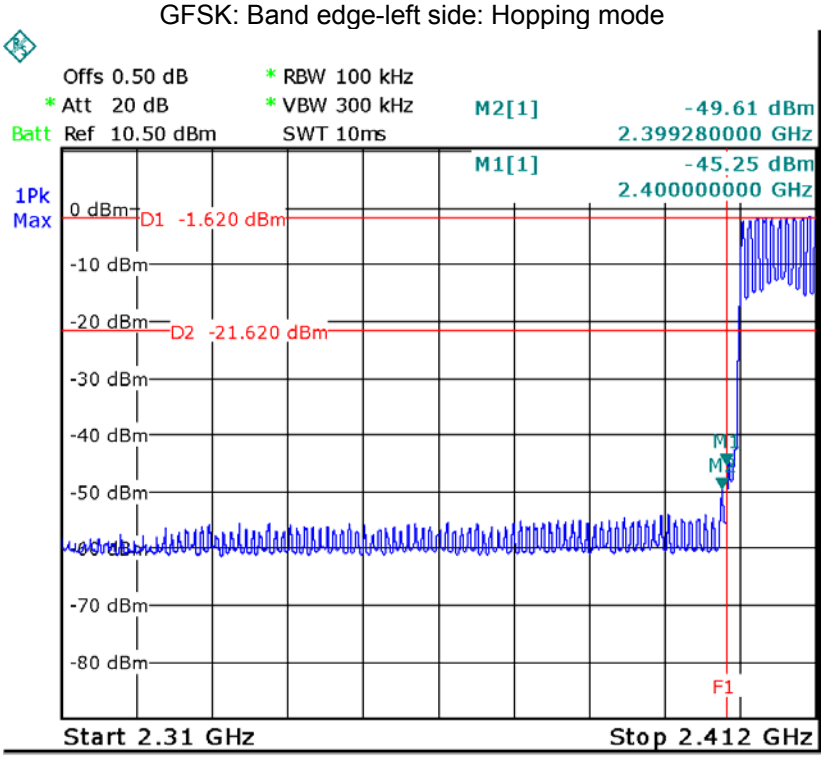
8.2 Test Result

Test result plots shown as follows:

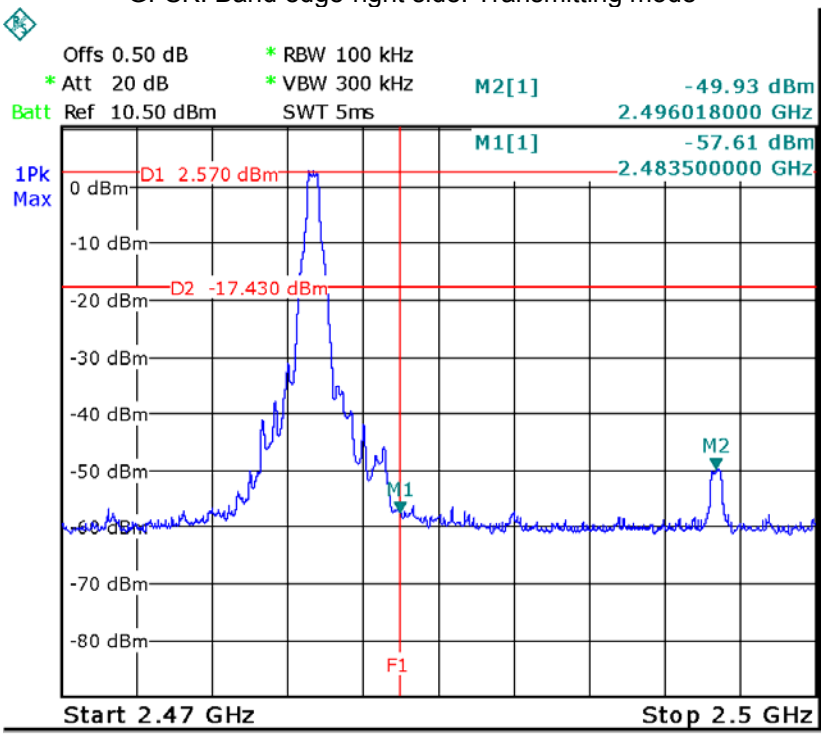
GFSK: Band edge-left side: Transmitting mode



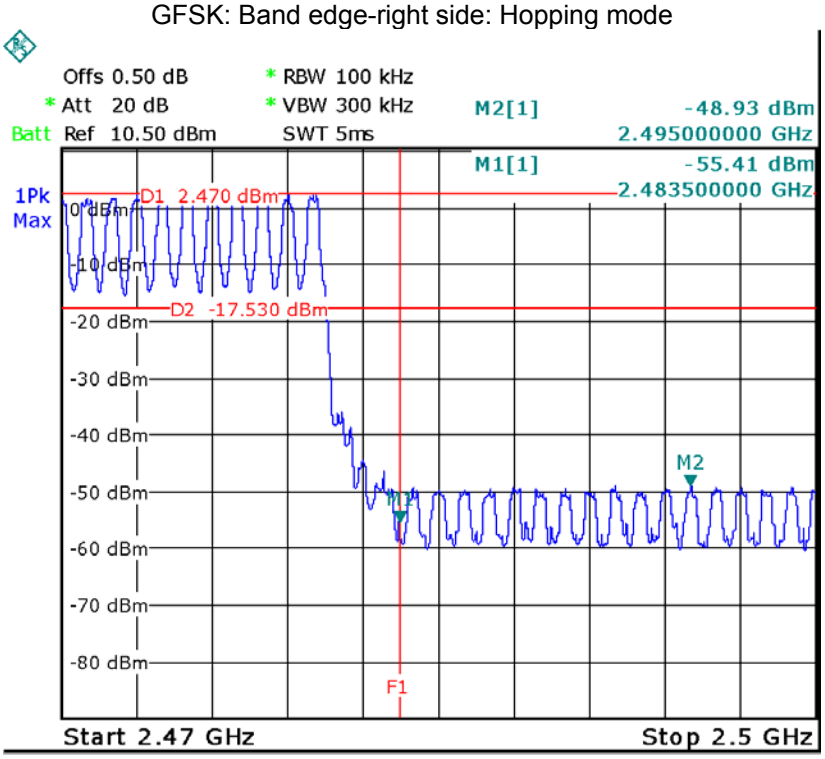
GFSK: Band edge-left side: Hopping mode



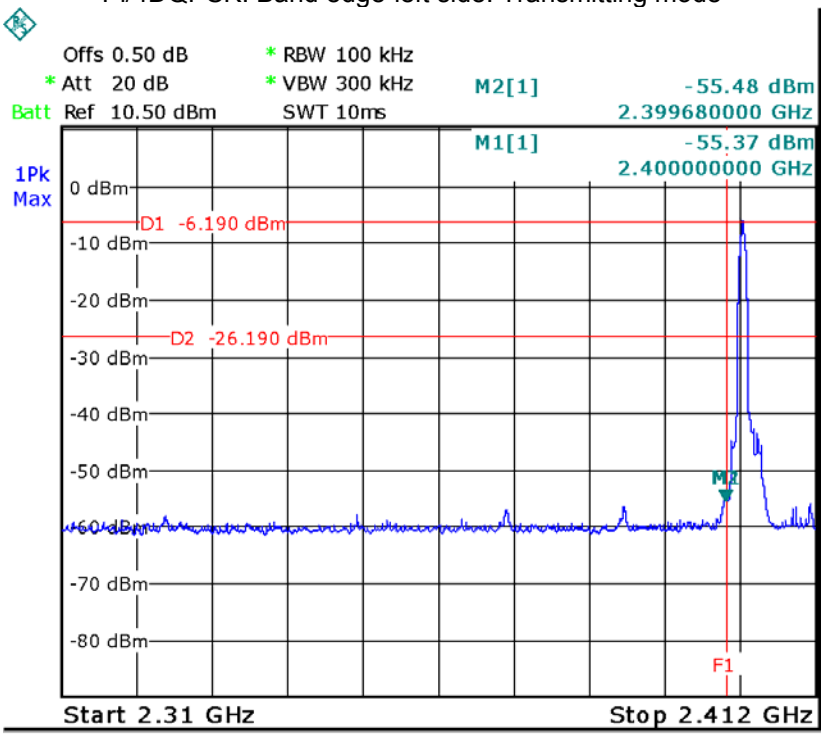
GFSK: Band edge-right side: Transmitting mode



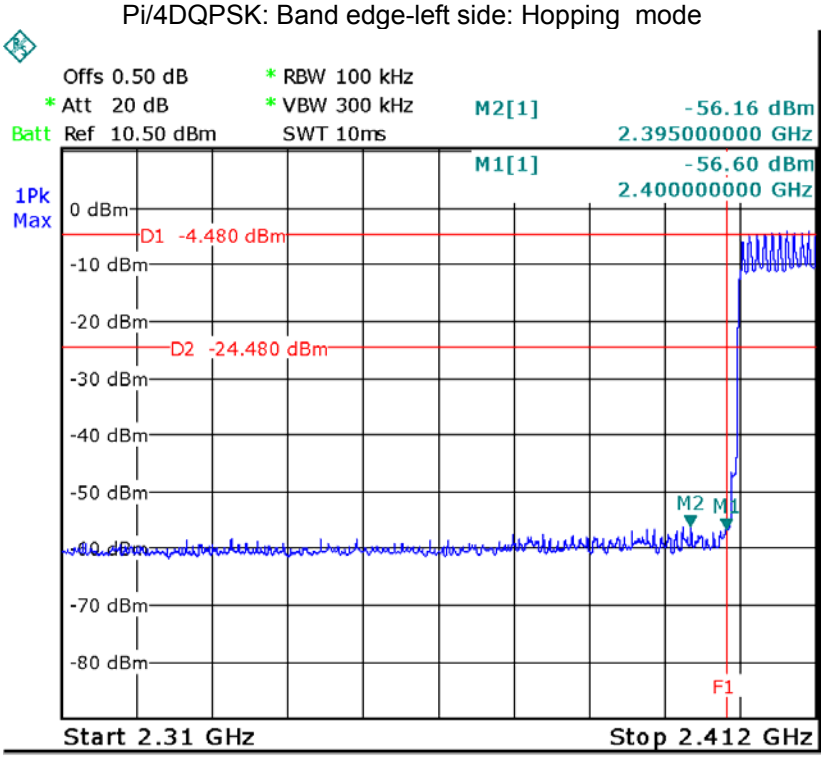
GFSK: Band edge-right side: Hopping mode



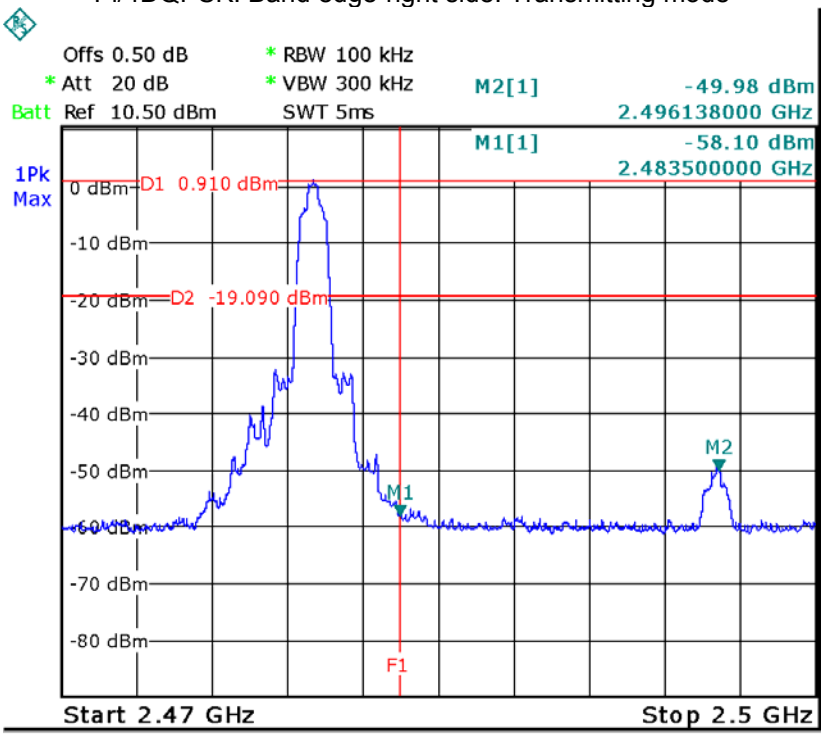
Pi/4DQPSK: Band edge-left side: Transmitting mode



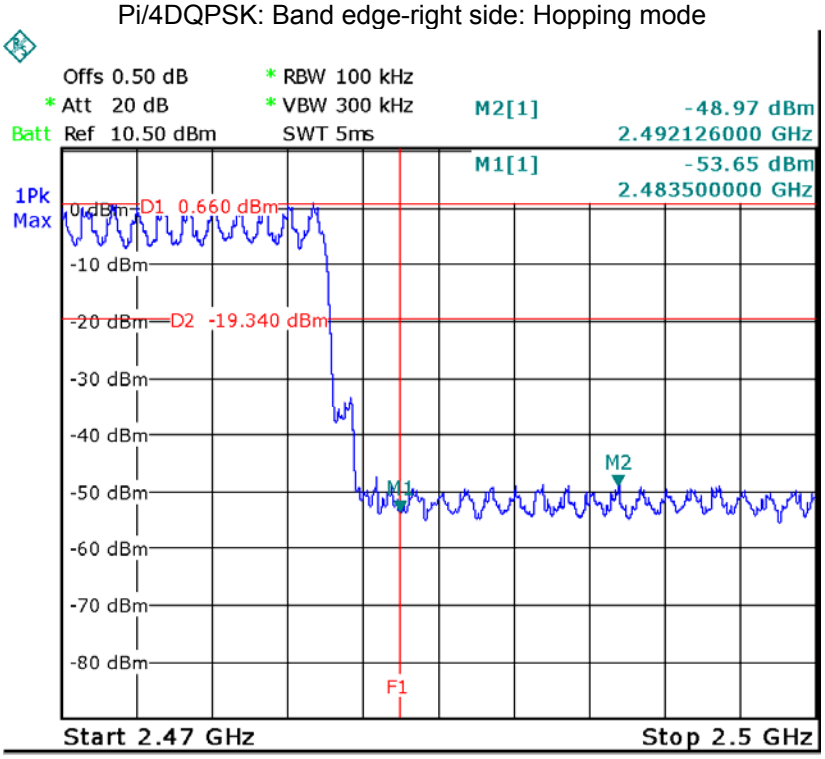
Pi/4DQPSK: Band edge-left side: Hopping mode



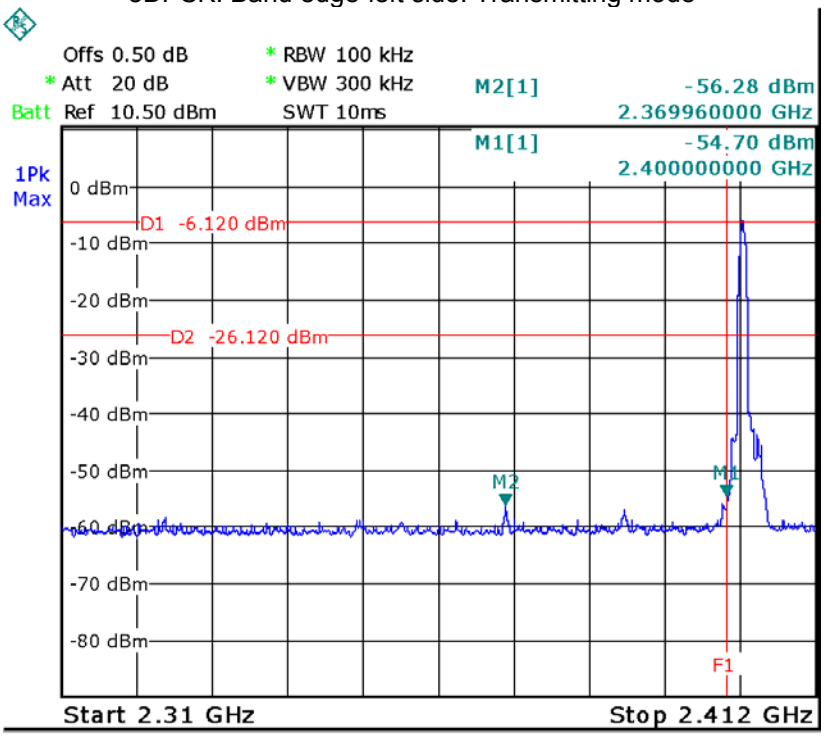
Pi/4DQPSK: Band edge-right side: Transmitting mode



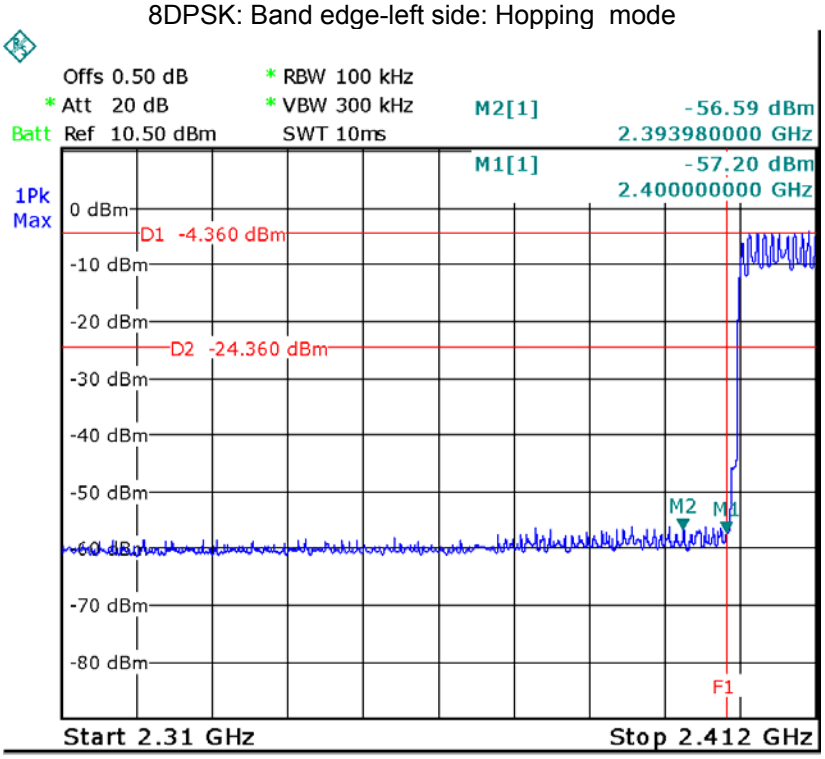
Pi/4DQPSK: Band edge-right side: Hopping mode



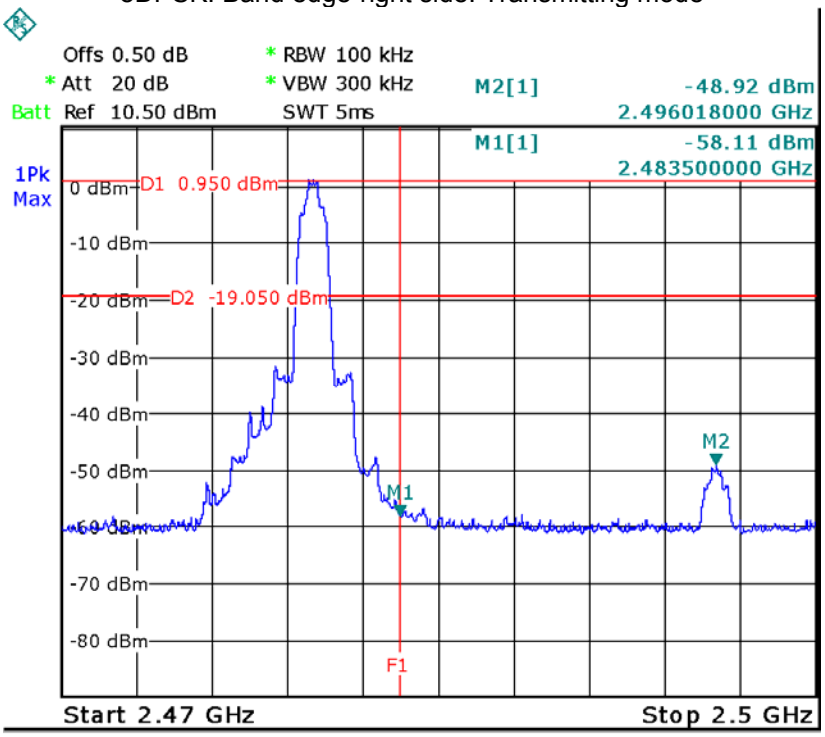
8DPSK: Band edge-left side: Transmitting mode



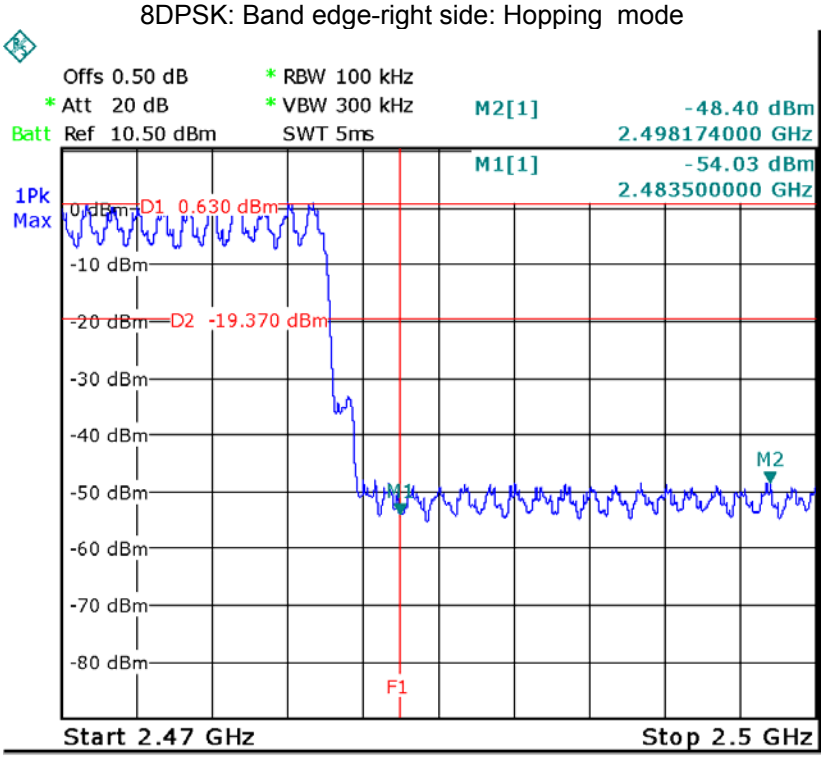
8DPSK: Band edge-left side: Hopping mode



8DPSK: Band edge-right side: Transmitting mode



8DPSK: Band edge-right side: Hopping mode



9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

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

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 = 30 kHz, VBW = 100kHz

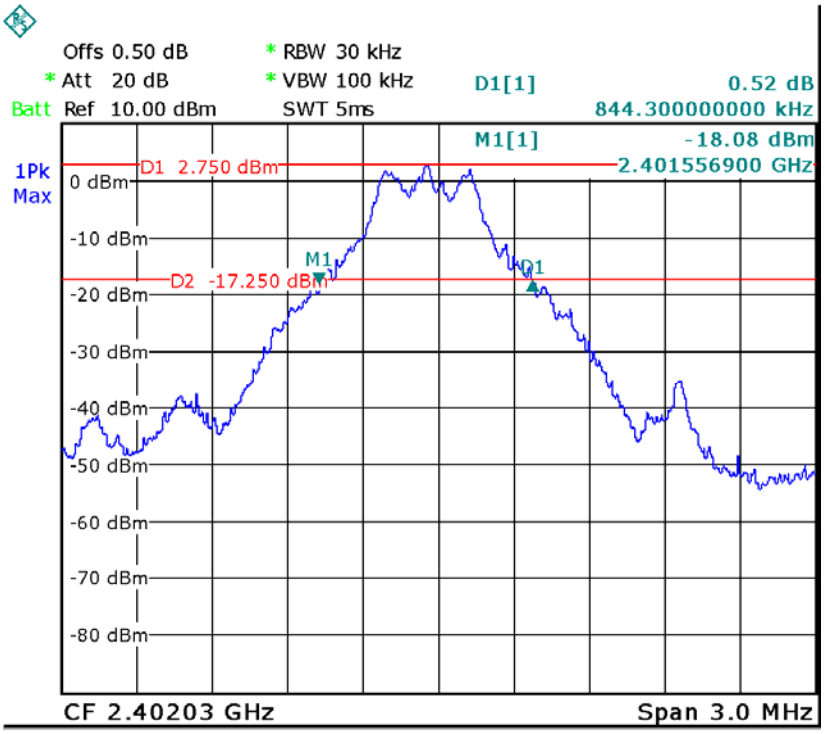
9.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.844
	Middle	0.880
	High	0.856
Pi/4-DQPSK	Low	1.323
	Middle	1.281
	High	1.287
8-DPSK	Low	1.258
	Middle	1.270
	High	1.281

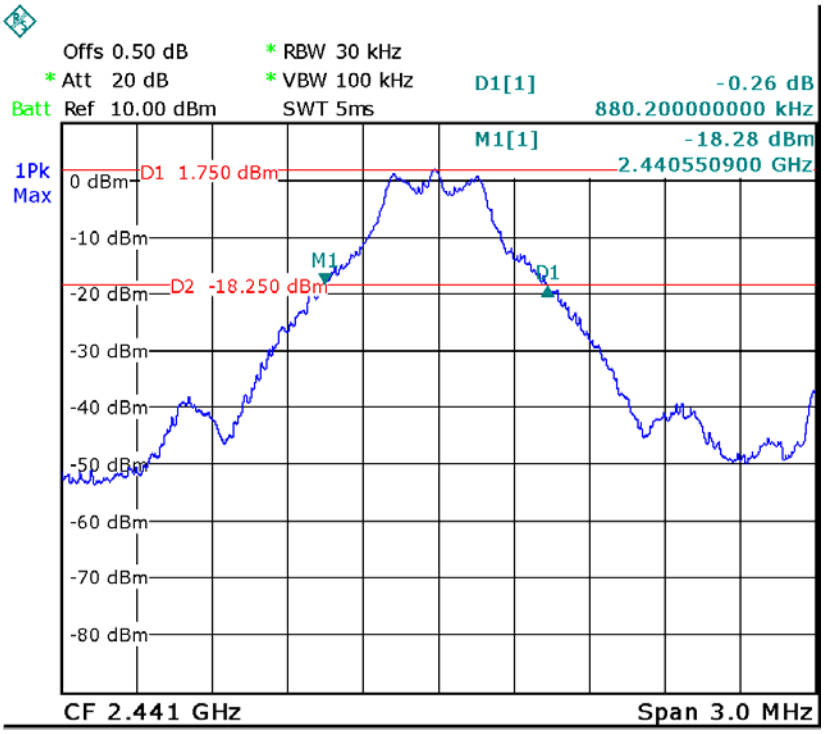
Test result plot as follows:

Modulation: GFSK

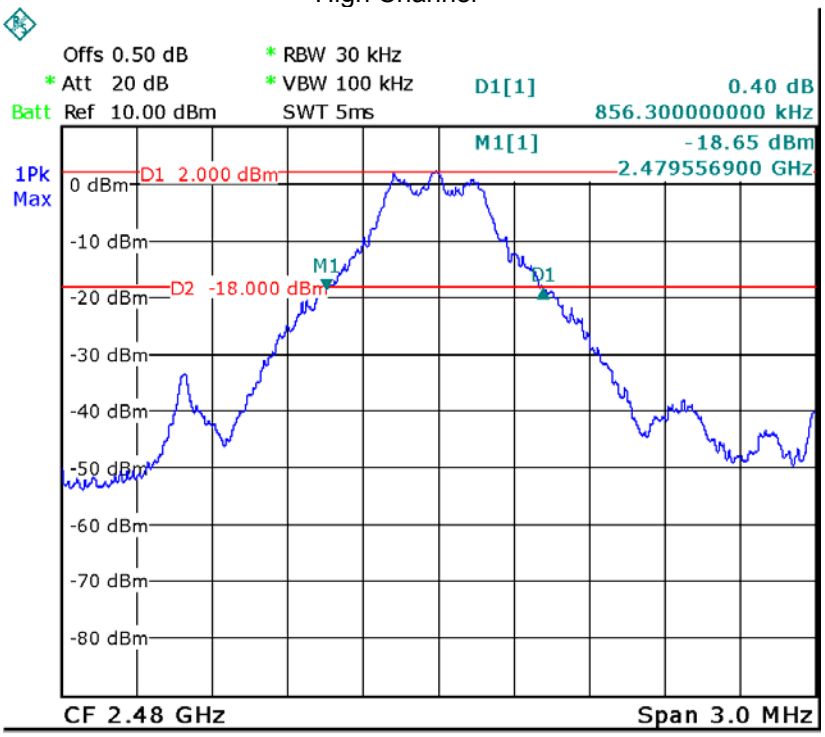
Low Channel



Middle Channel

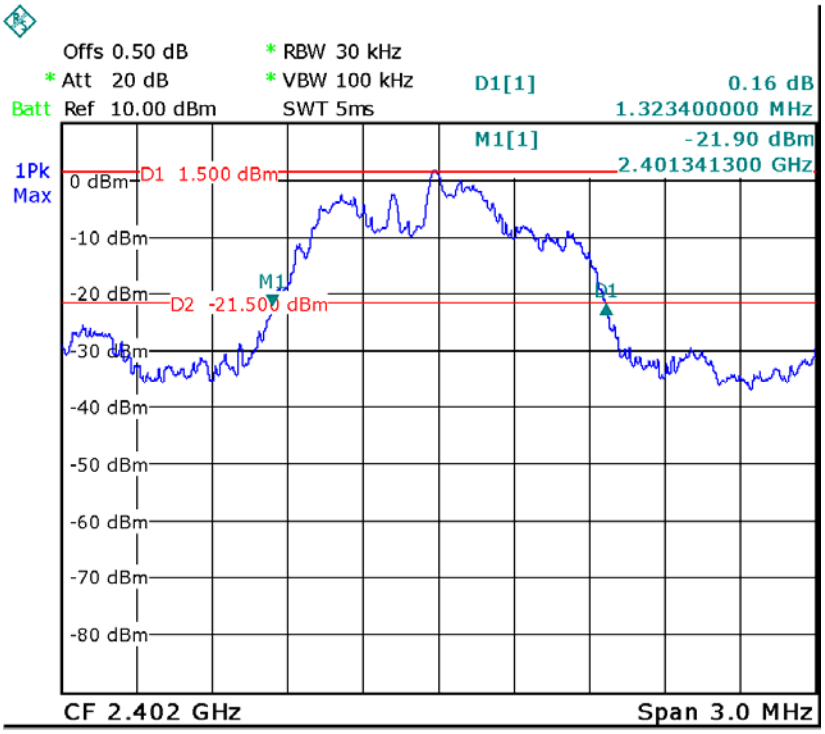


High Channel

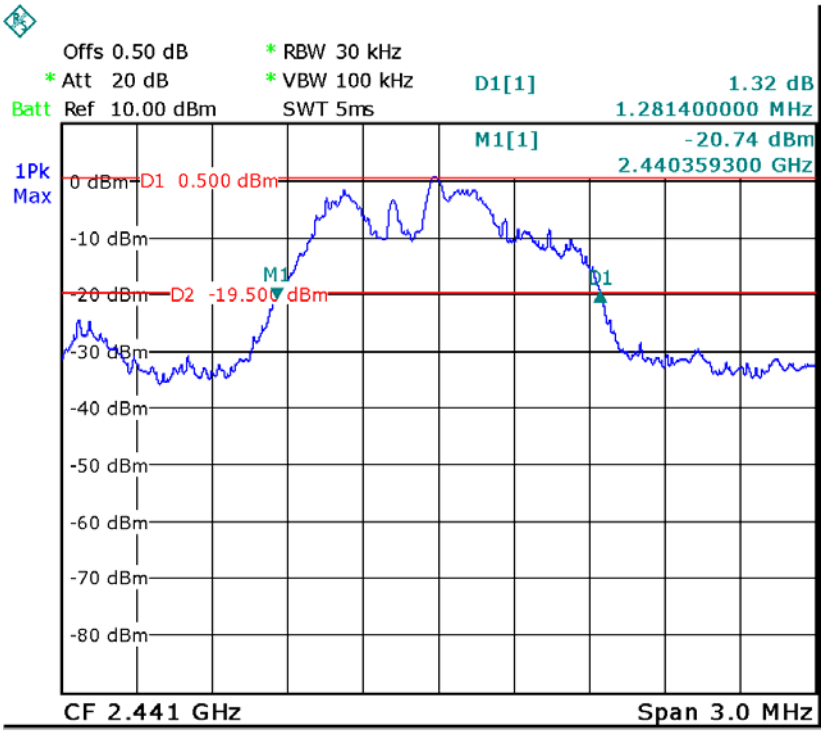


Modulation: Pi/4DQPSK

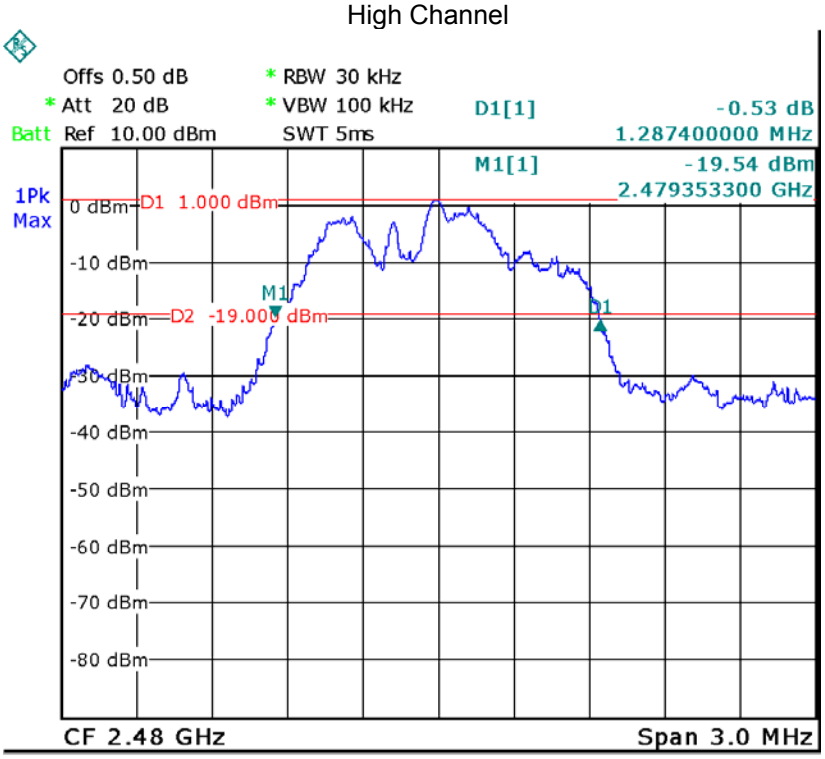
Low Channel



Middle Channel

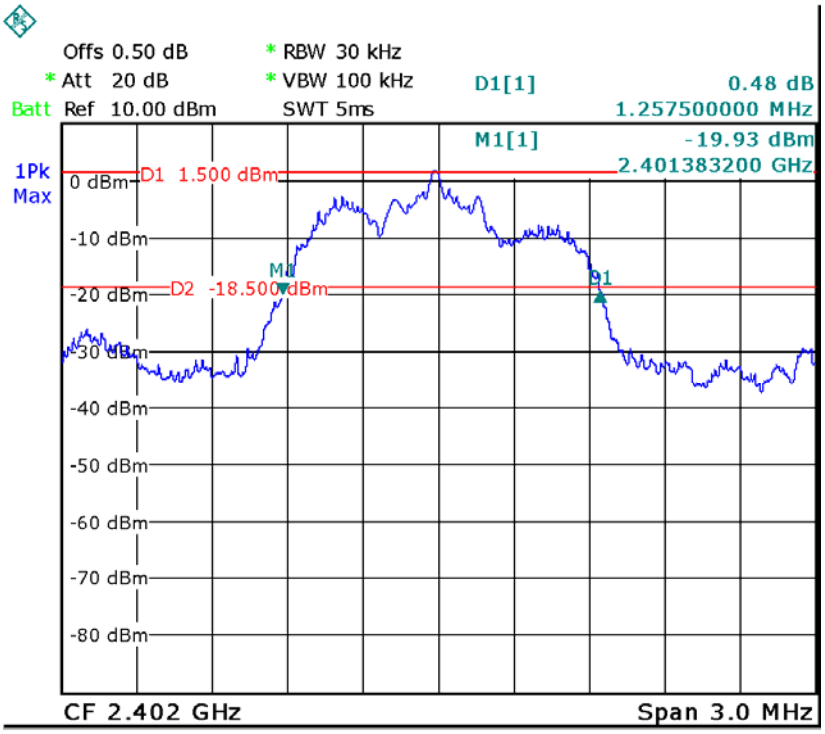


High Channel

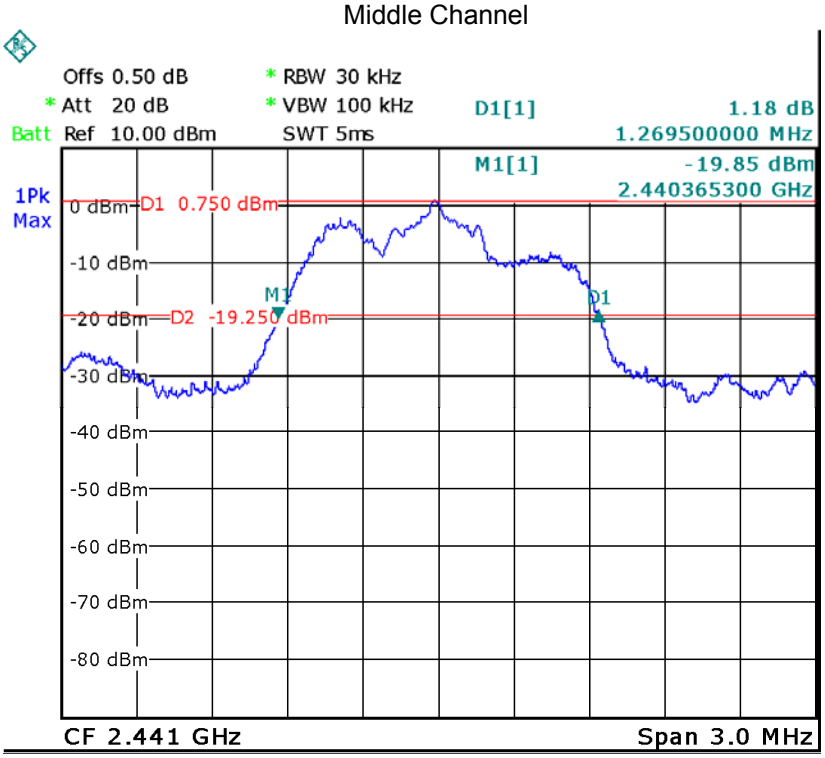


Modulation: 8DPSK

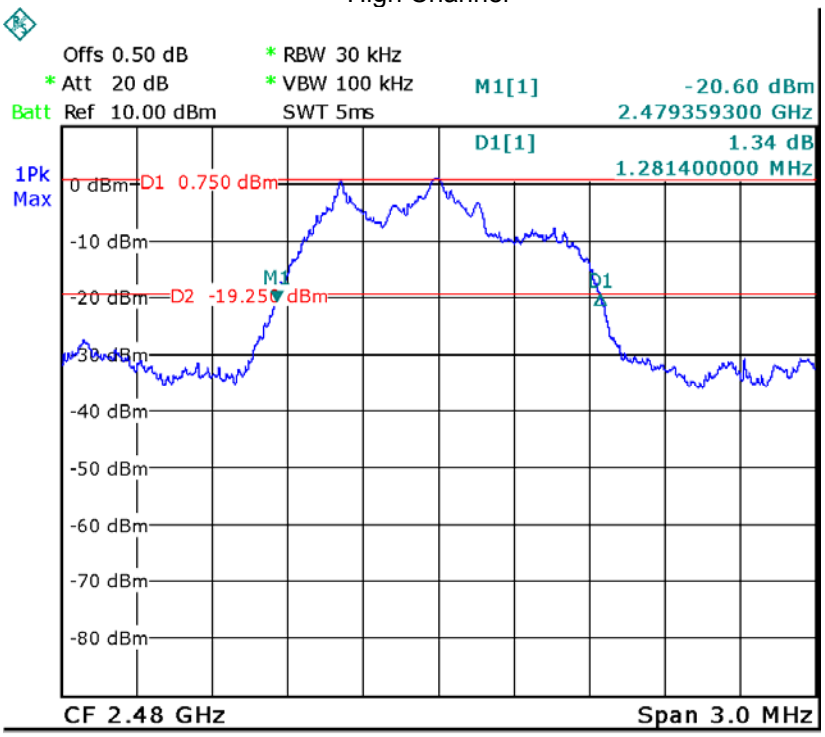
Low Channel



Middle Channel



High Channel



10 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 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 1watts (30dBm) limit applies.

Test mode: Transmitting

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 analyser: RBW = 1 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.

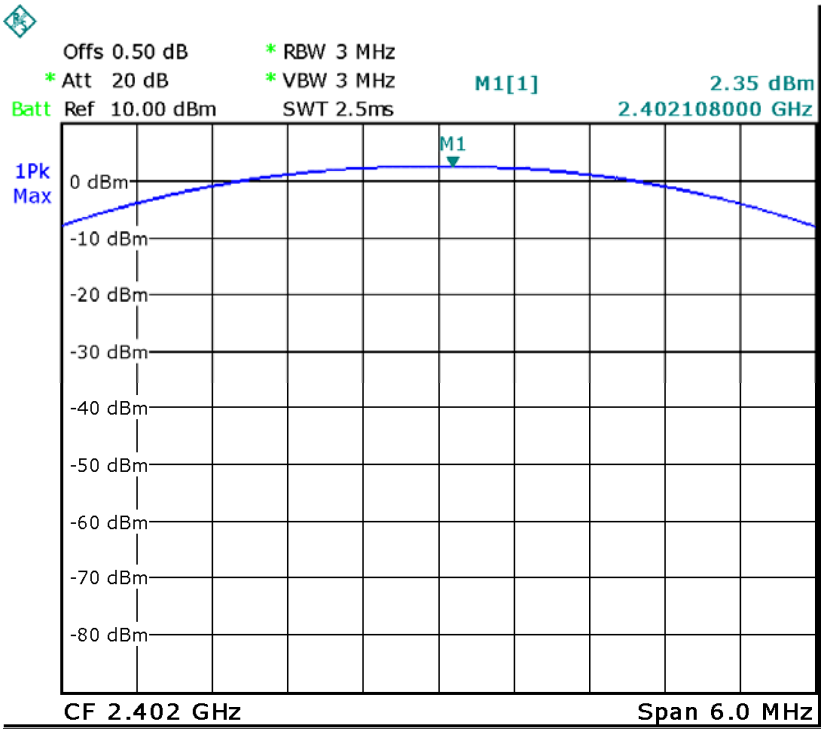
10.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	2.35	30
	Middle	2.08	30
	High	2.30	30
Pi/4DQPSK	Low	1.70	30
	Middle	1.36	30
	High	1.54	30
8DPSK	Low	1.78	30
	Middle	1.45	30
	High	1.68	30

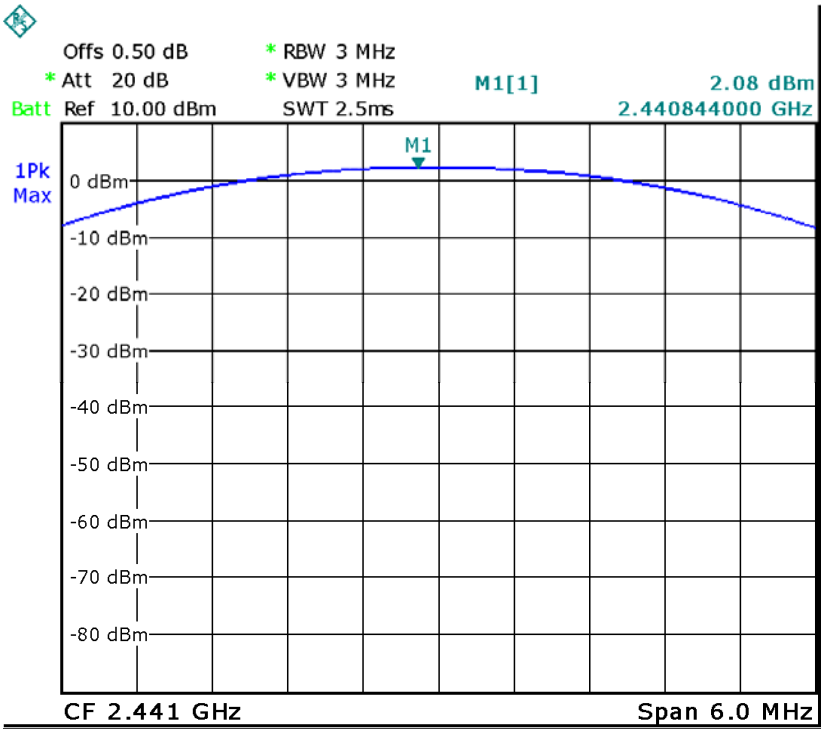
Test result plot as follows:

Modulation: GFSK

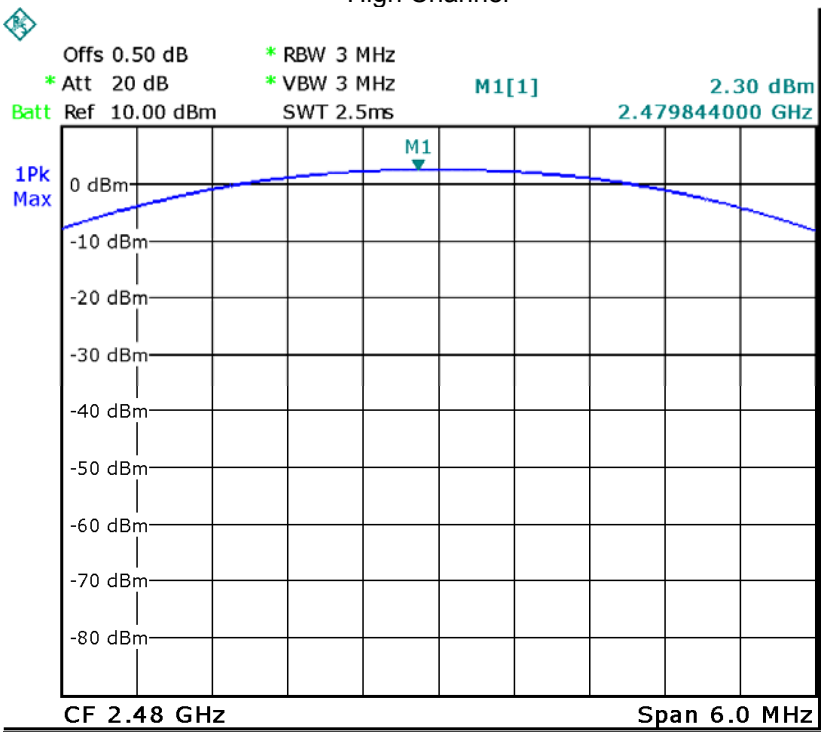
Low Channel



Middle Channel

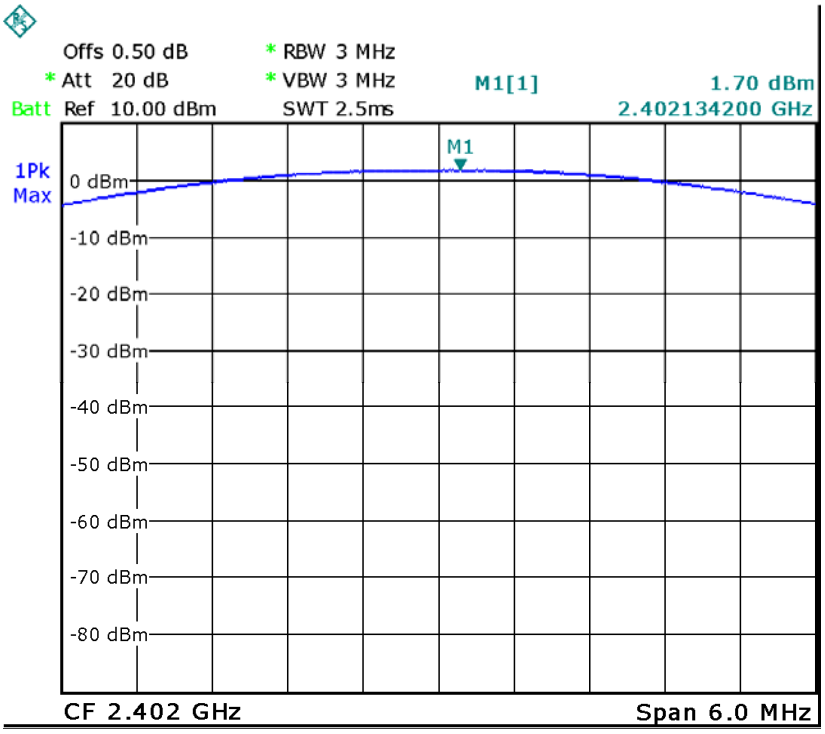


High Channel

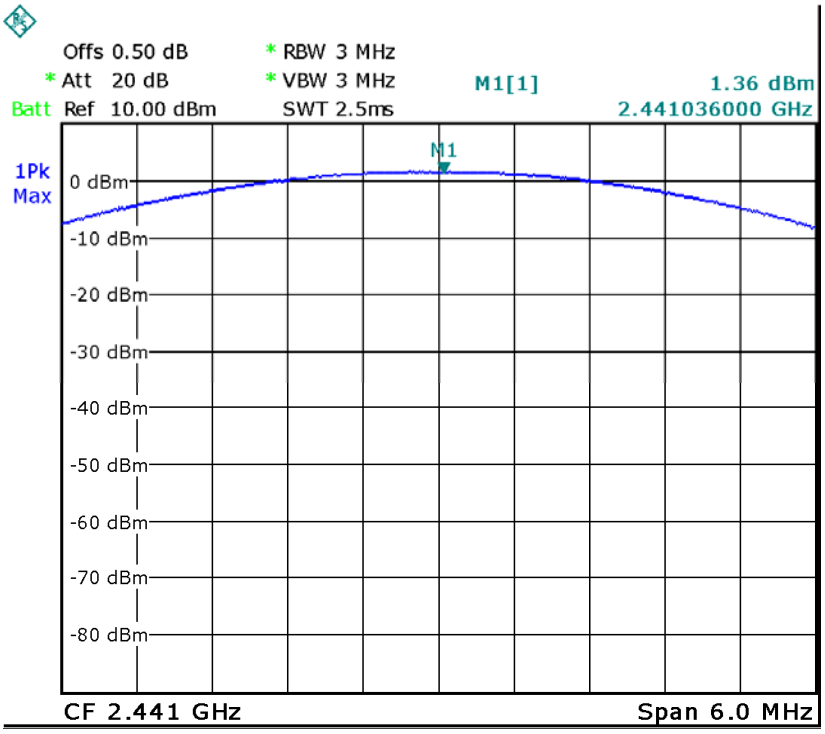


Modulation: Pi/4DQPSK

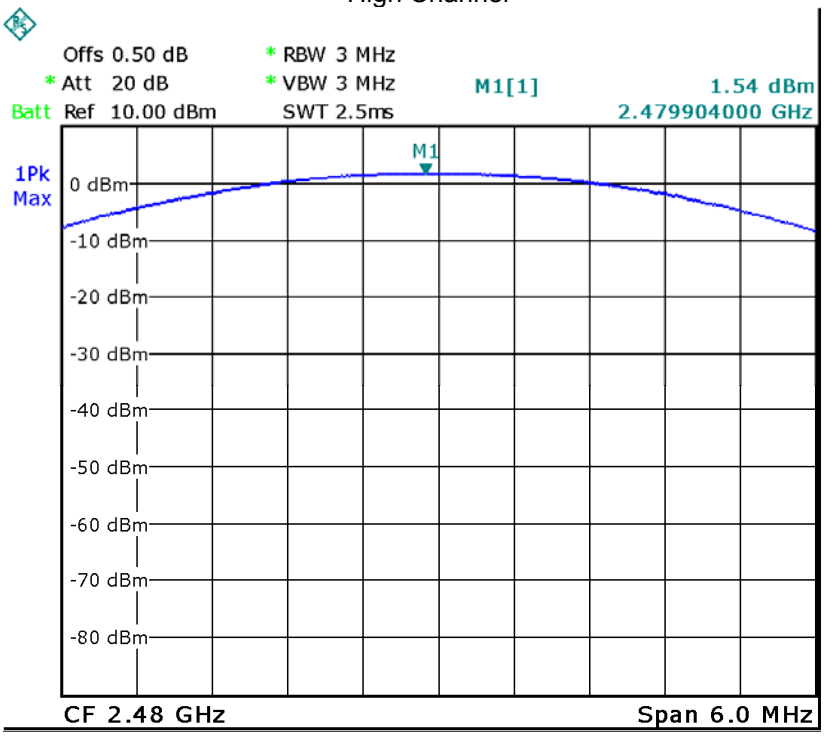
Low Channel



Middle Channel

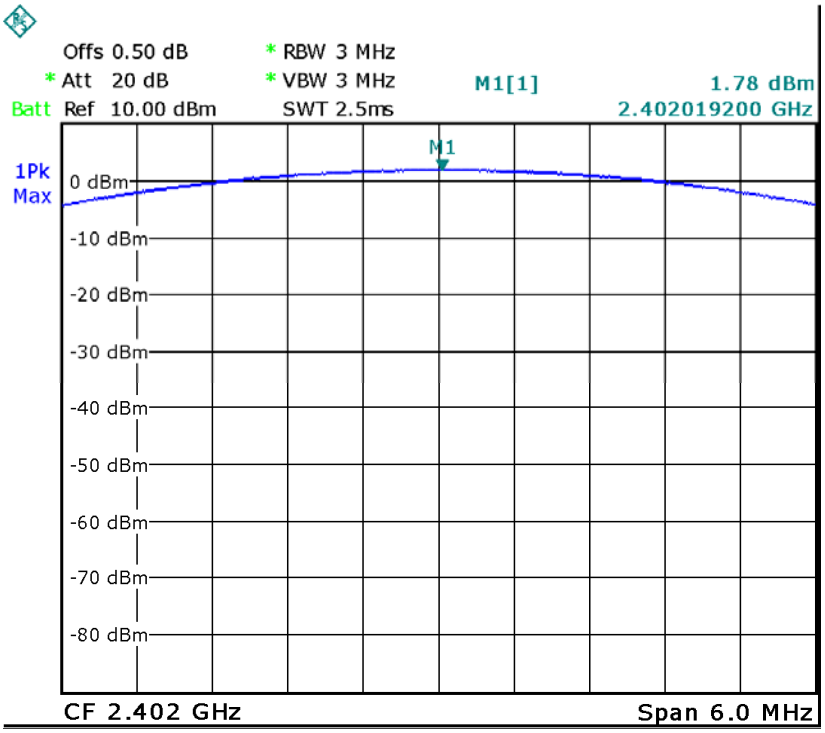


High Channel

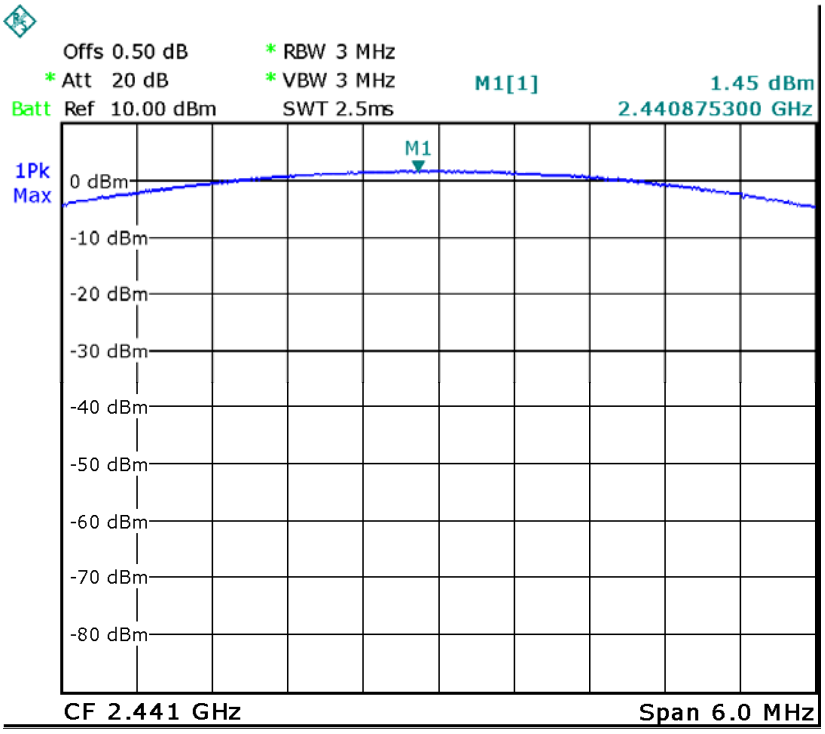


Modulation: 8DPSK

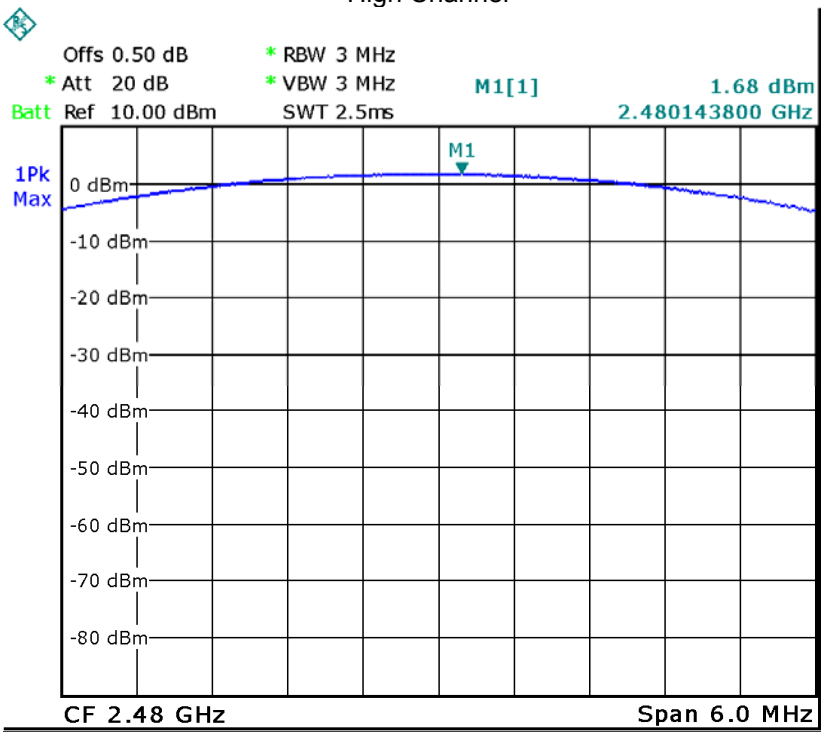
Low Channel



Middle Channel



High Channel



11 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 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 two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz 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 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 analyser: RBW = 30kHz. VBW = 100kHz, Span = 3.0MHz. 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.

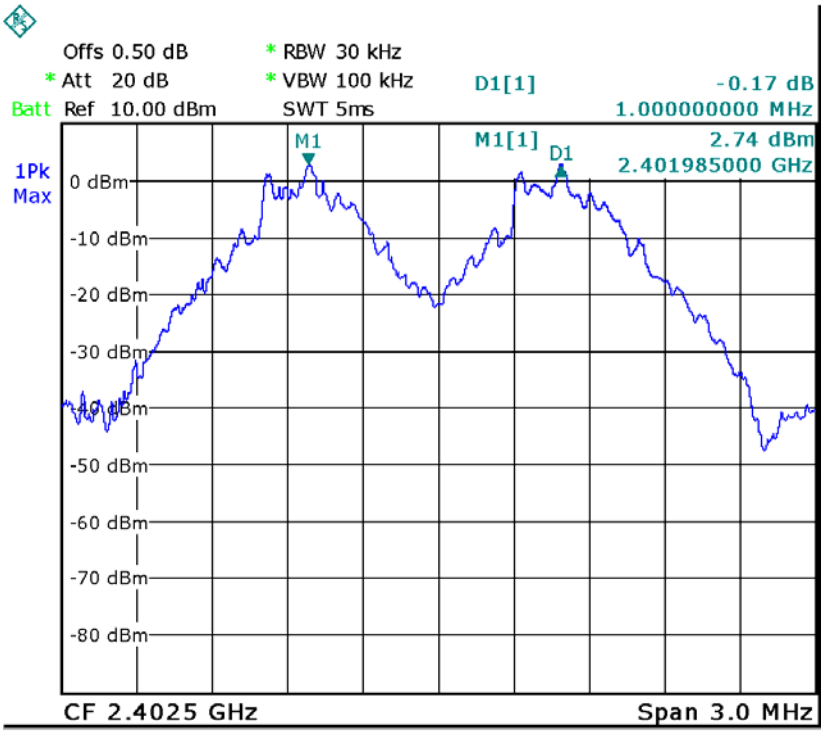
11.2 Test Result:

Modulation	Test Channel	Separation (MHz)	Limit(MHz)
GFSK	Low	1.000	0.563
	Middle	1.000	0.587
	High	1.000	0.571
Pi/4DQPSK	Low	1.006	0.882
	Middle	1.000	0.854
	High	1.000	0.858
8DPSK	Low	1.002	0.839
	Middle	1.006	0.847
	High	1.002	0.854

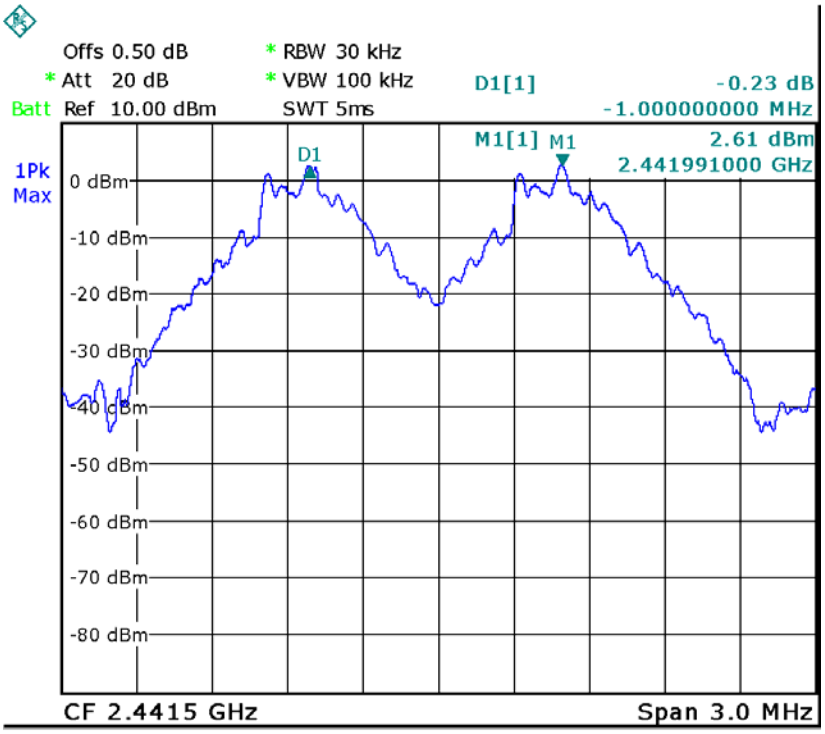
Test result plot as follows:

Modulation: GFSK

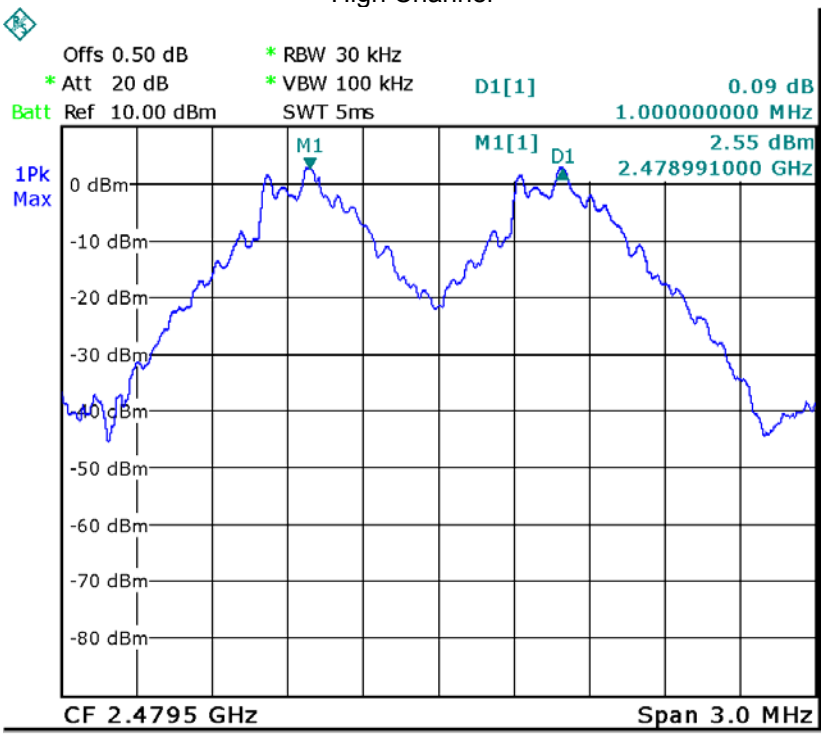
Low Channel



Middle Channel

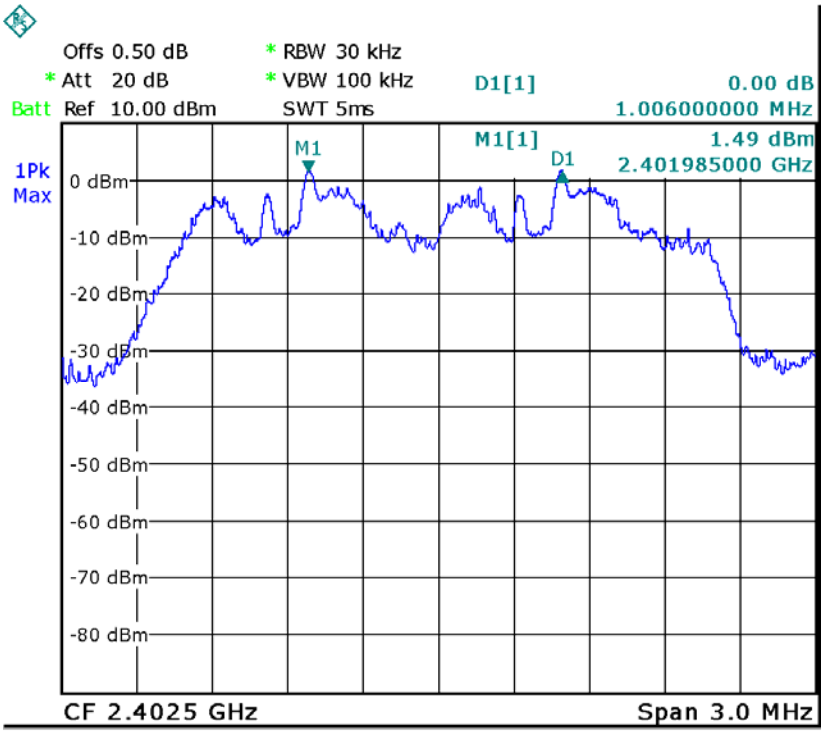


High Channel

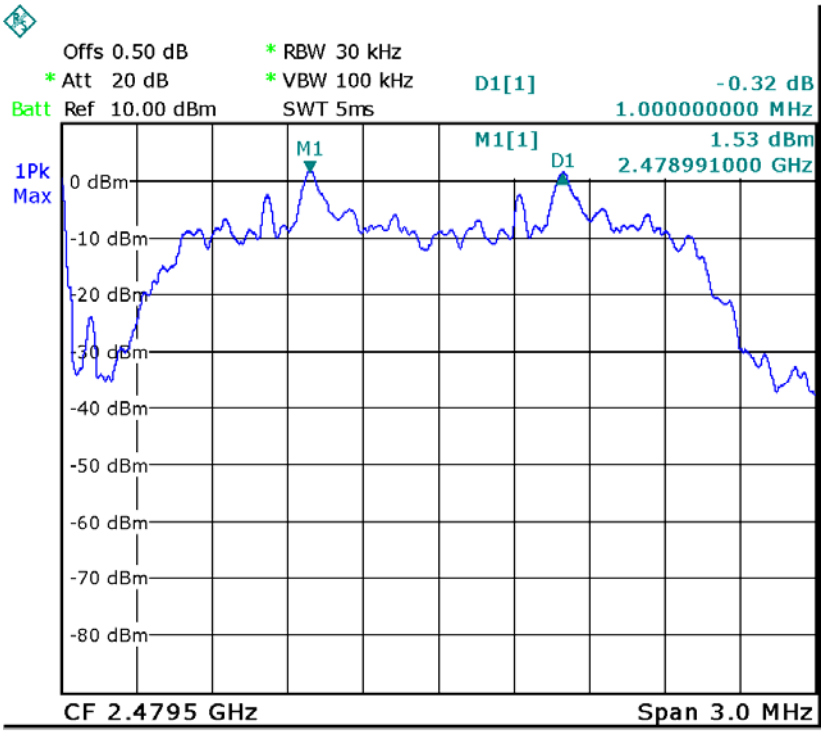


Modulation: Pi/4DQPSK

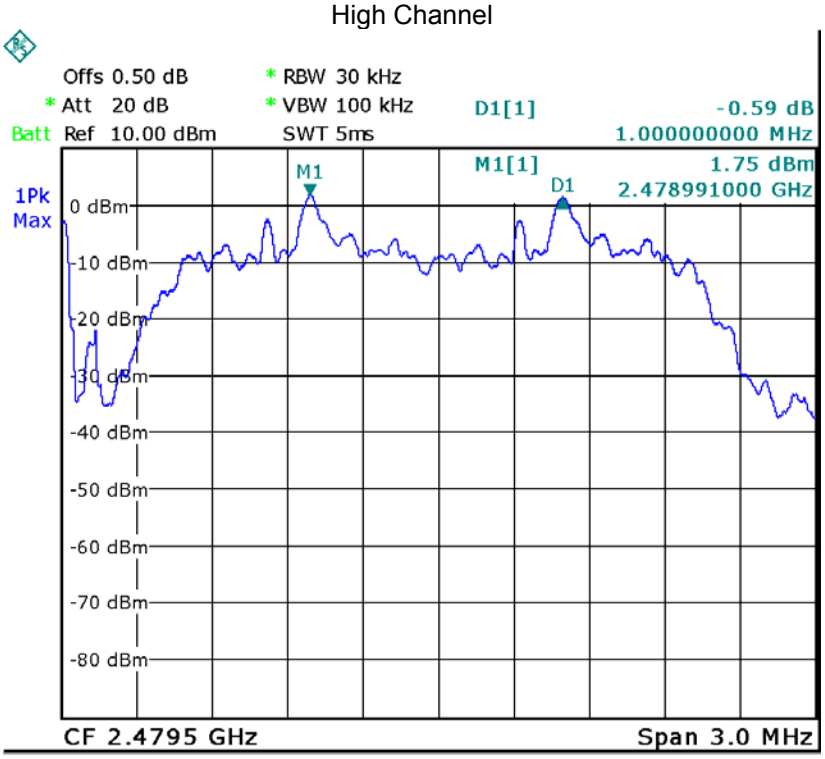
Low Channel



Middle Channel

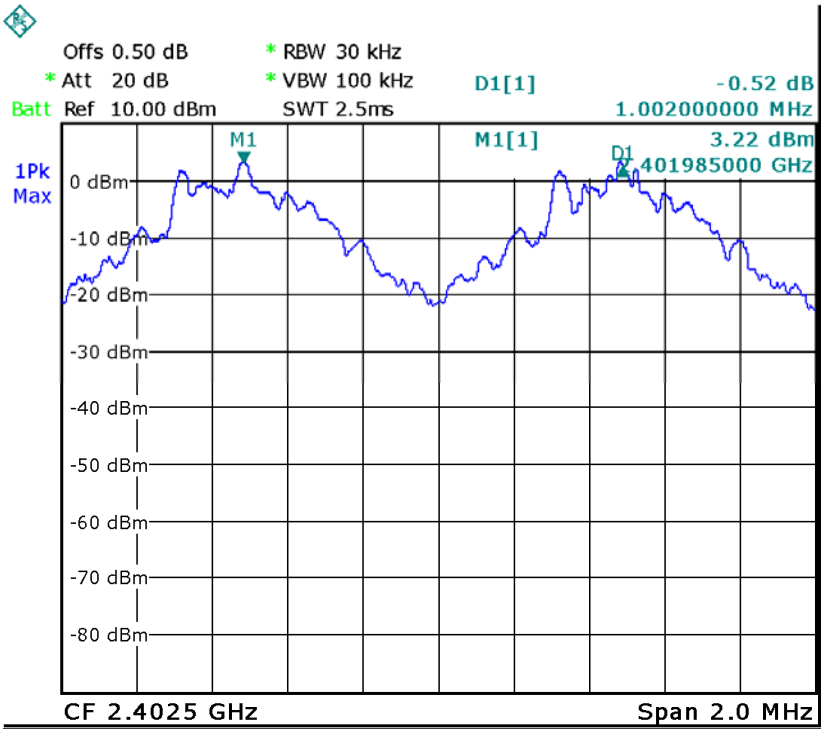


High Channel

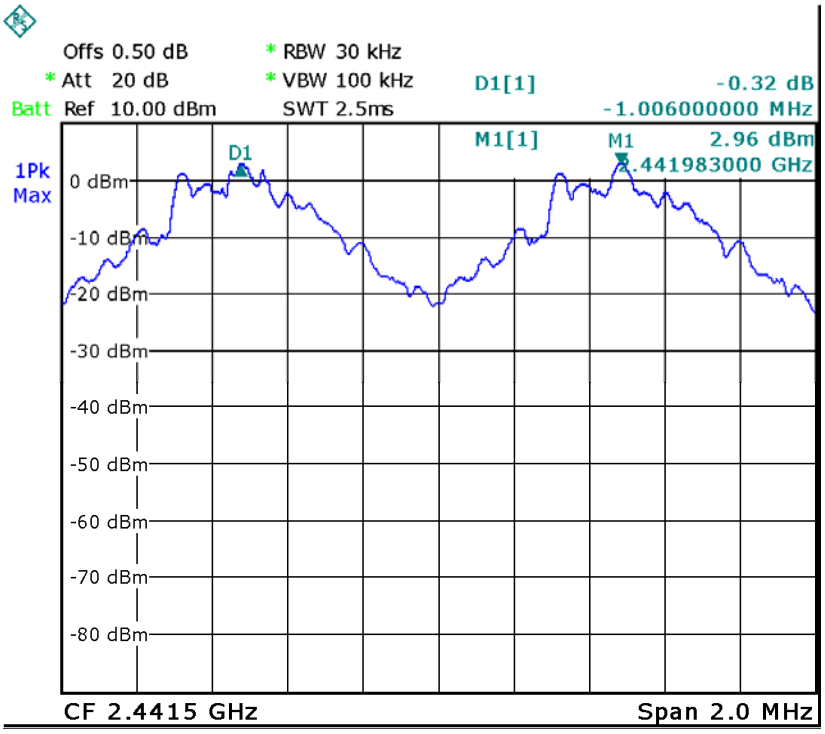


Modulation: 8DPSK

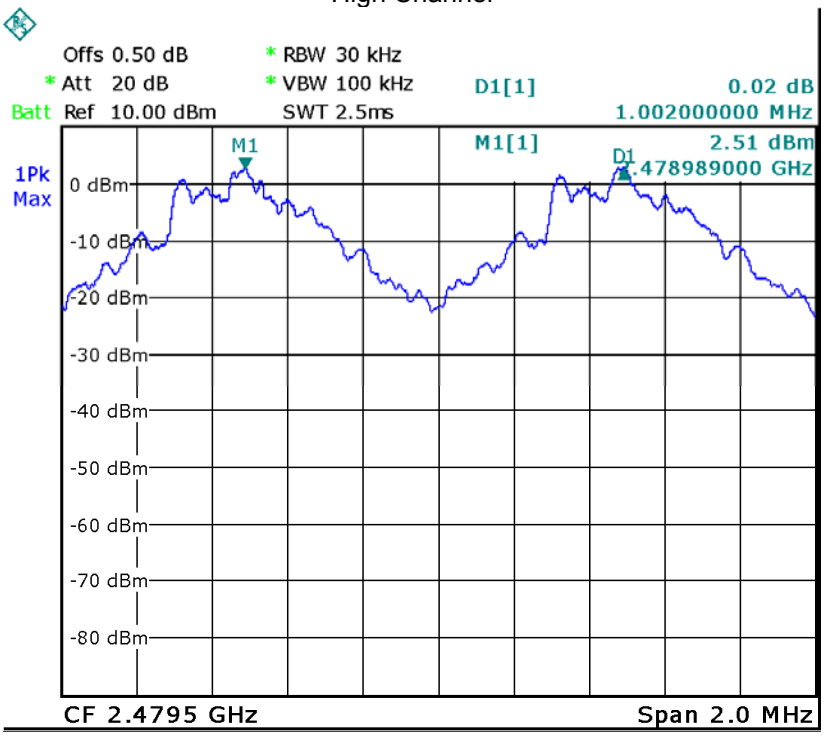
Low Channel



Middle Channel



High Channel



12 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	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:	Test in hopping mode.

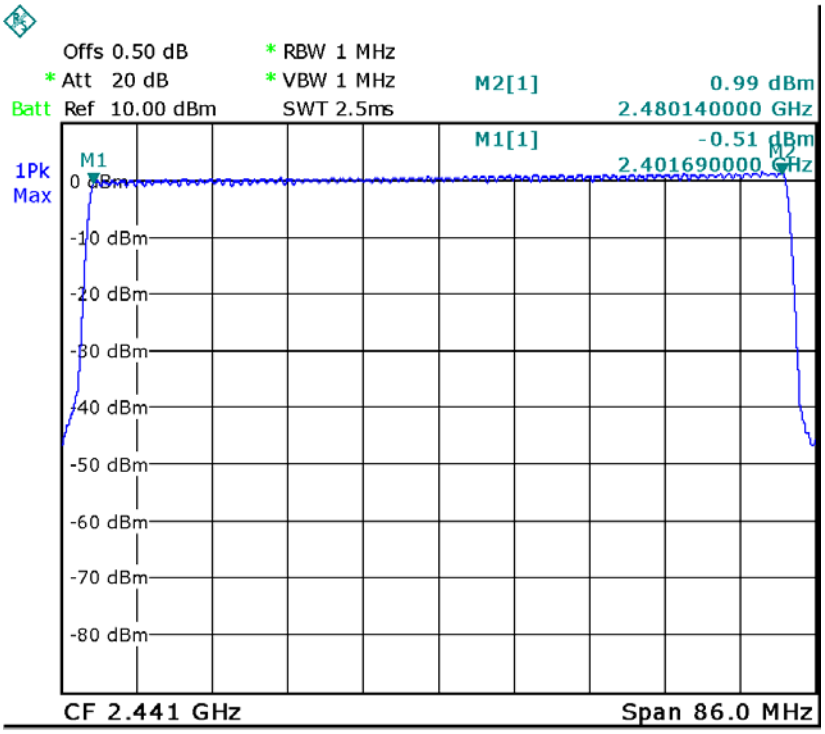
12.1 Test Procedure:

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 analyser: 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 analyser: Centre Frequency = 2.441GHz, Span = 86MHz. Sweep=auto;

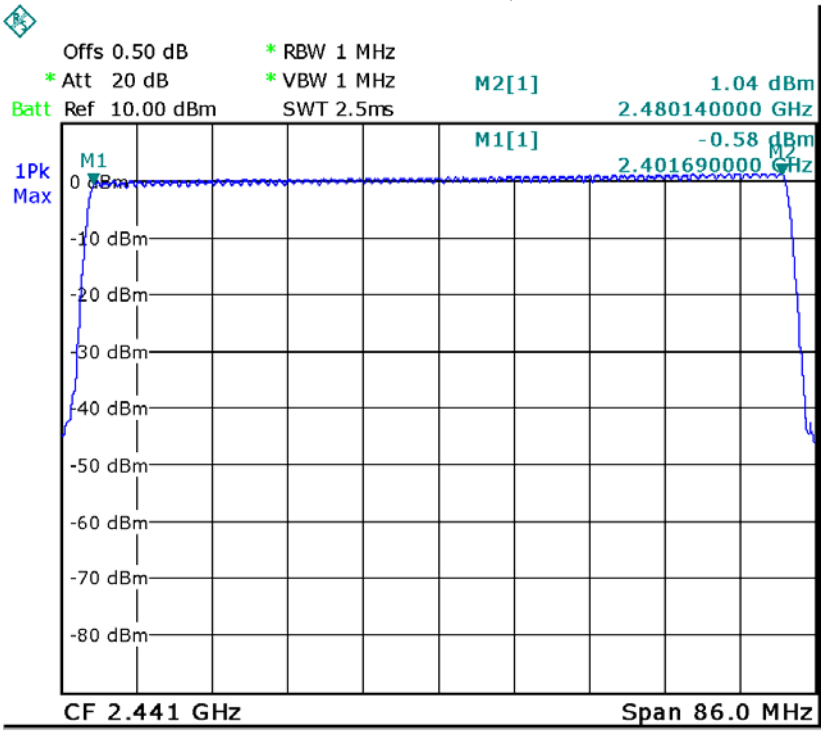
12.2 Test Result:

Total Channels are 79 Channels.

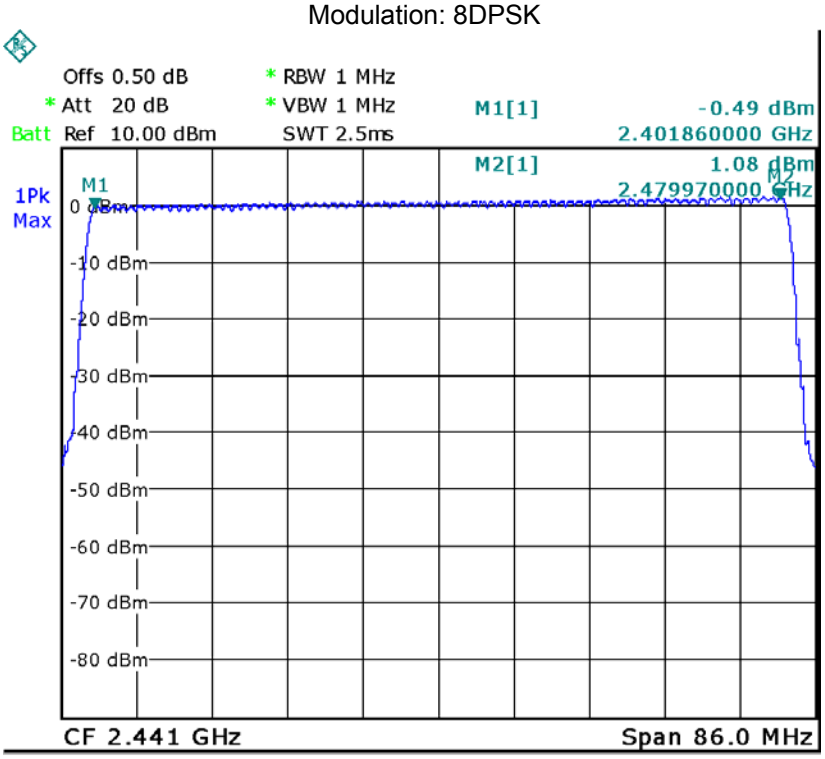
Modulation: GFSK



Modulation: Pi/4DQPSK



Modulation: 8DPSK



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	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. Frequency hopping systems may avoid or suppress transmitting on a particular hopping frequency provided that a minimum of 15 channels are used.
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 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.

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:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period
The test period: T= 0.4(s) * 79 = 31.6 (s)
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).

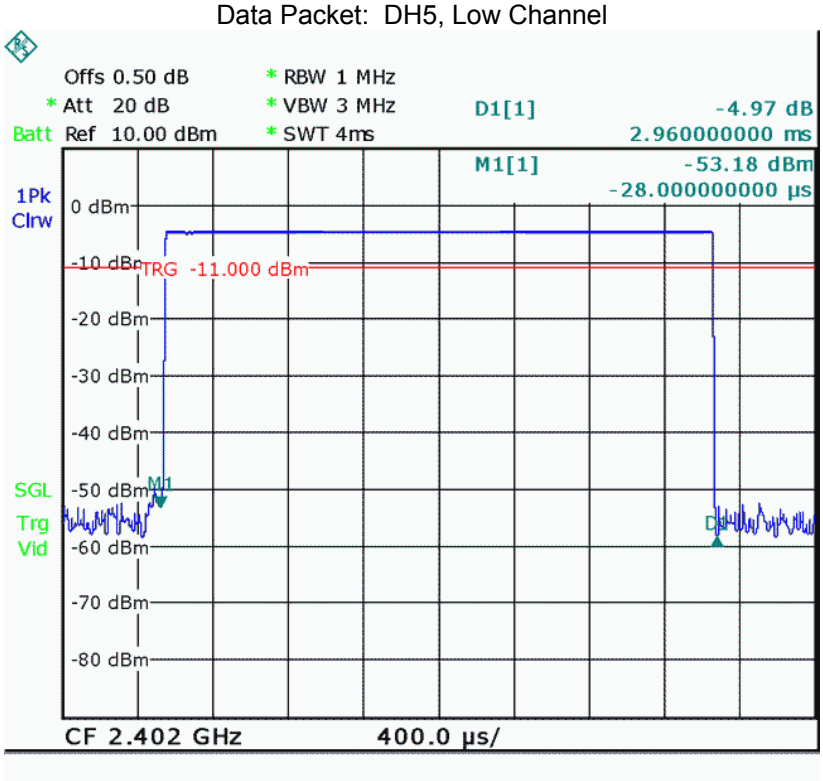
DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

Data Packet	Dwell Time(s)
DH5	1600/79/6*31.6*(MkrDelta)/1000
DH3	1600/79/4*31.6*(MkrDelta)/1000
DH1	1600/79/2*31.6*(MkrDelta)/1000
Remark	Mkr Delta is single pulse time.

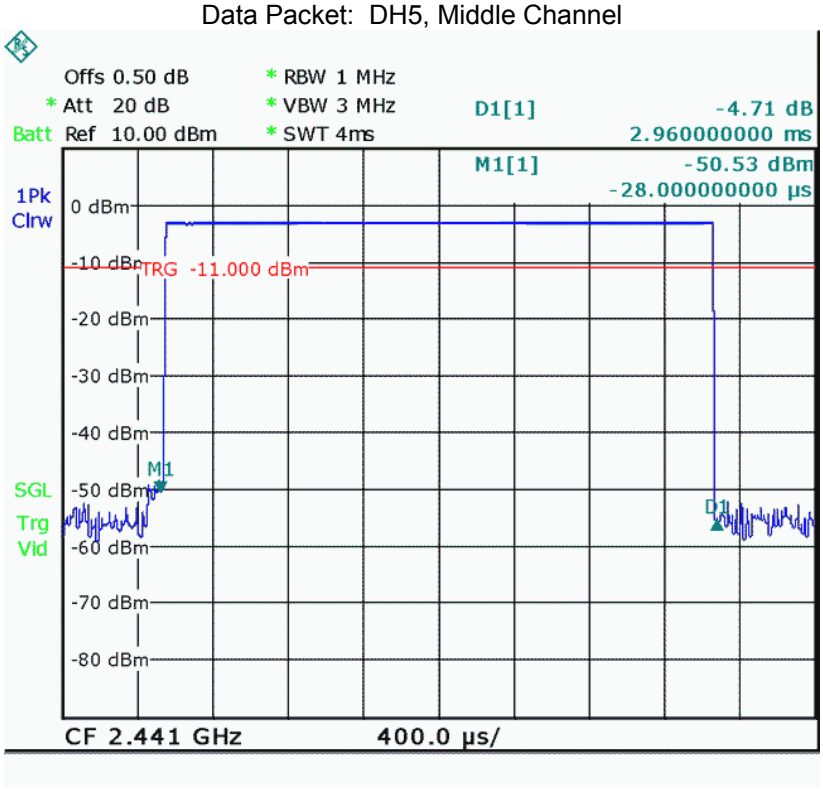
Test condition: Normal					
Modulation	**Data Packet**	**Channel**	**pulse time(ms)**	**Dwell Time(s)**	**Limits(s)**
GFSK	DH5	Low	2.960	0.316	0.4
		middle	2.960	0.316	0.4
		High	2.960	0.316	0.4
Pi/4DQPSK	DH5	Low	2.960	0.316	0.4
		middle	2.960	0.316	0.4
		High	2.960	0.316	0.4
8DPSK	DH5	Low	2.960	0.316	0.4
		middle	2.960	0.316	0.4
		High	2.968	0.317	0.4

Remark: Only the worst case(DH5) is recorded.

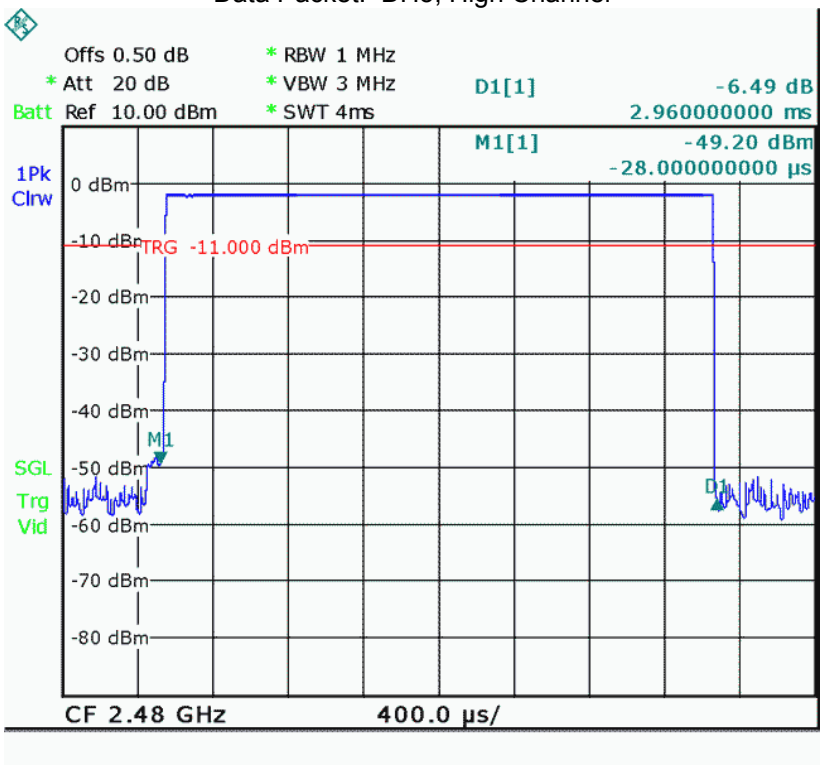
Modulation: GFSK
Data Packet: DH5, Low Channel



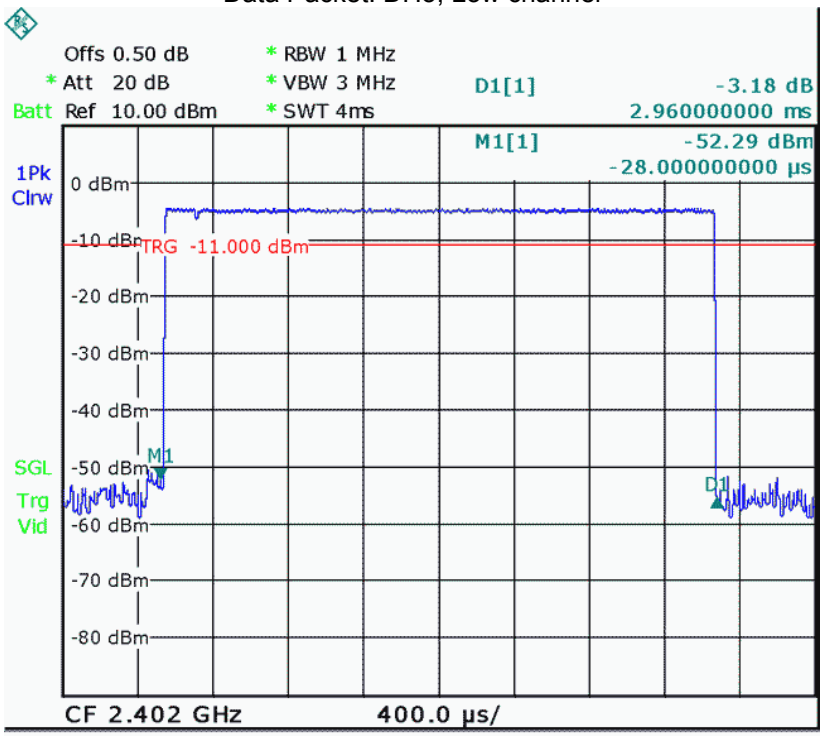
Data Packet: DH5, Middle Channel



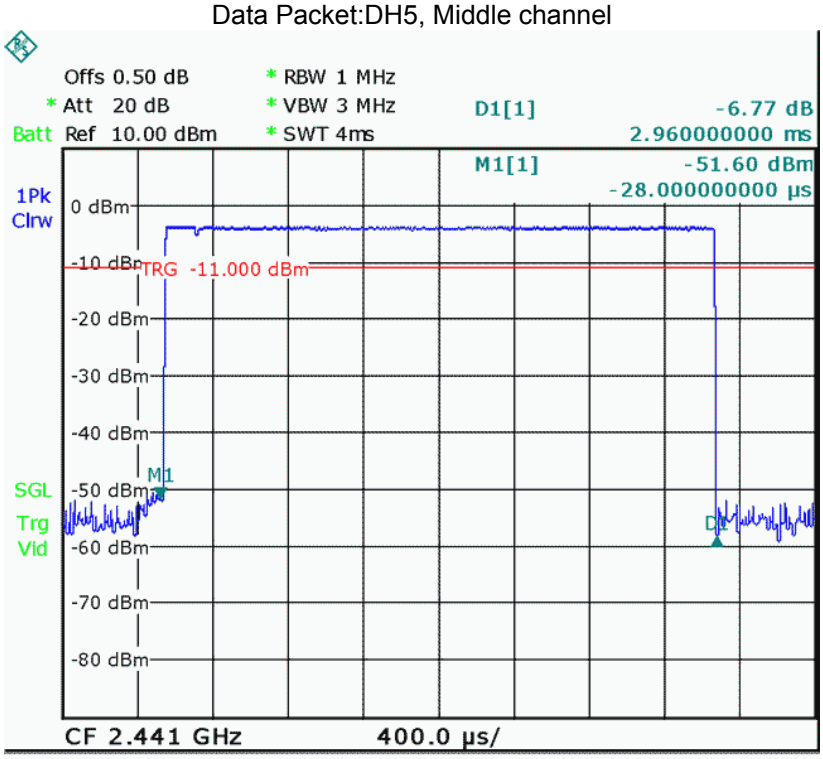
Data Packet: DH5, High Channel



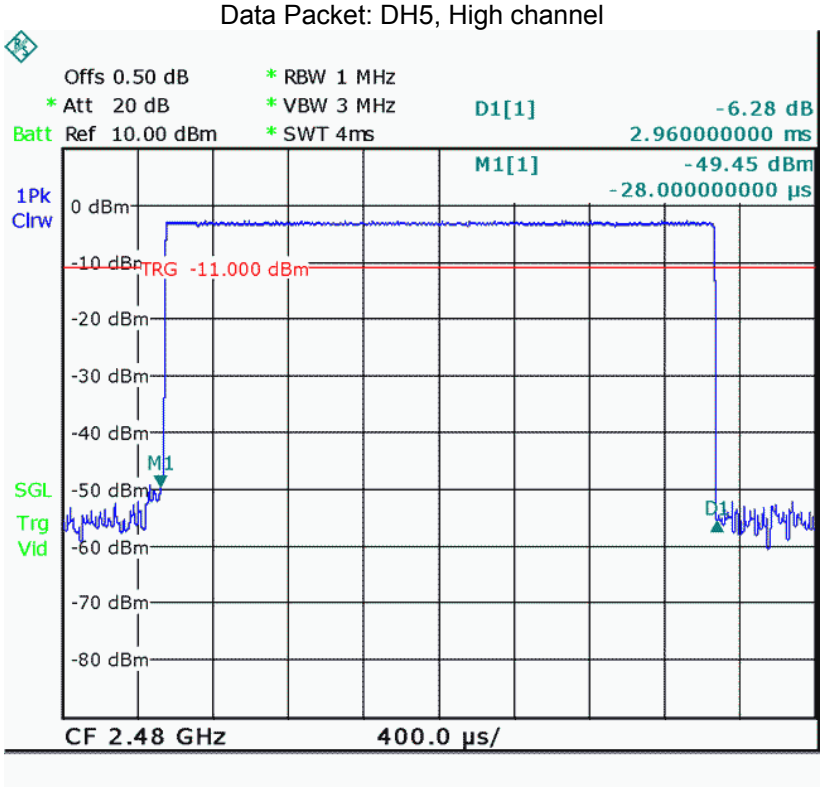
Modulation: Pi/4DQPSK
Data Packet: DH5, Low channel



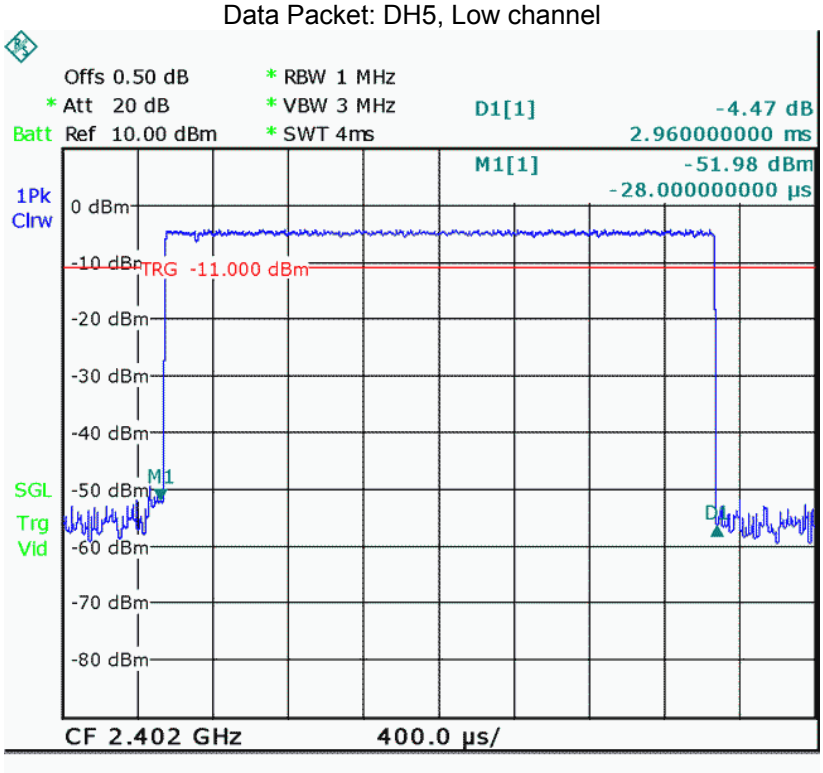
Data Packet:DH5, Middle channel



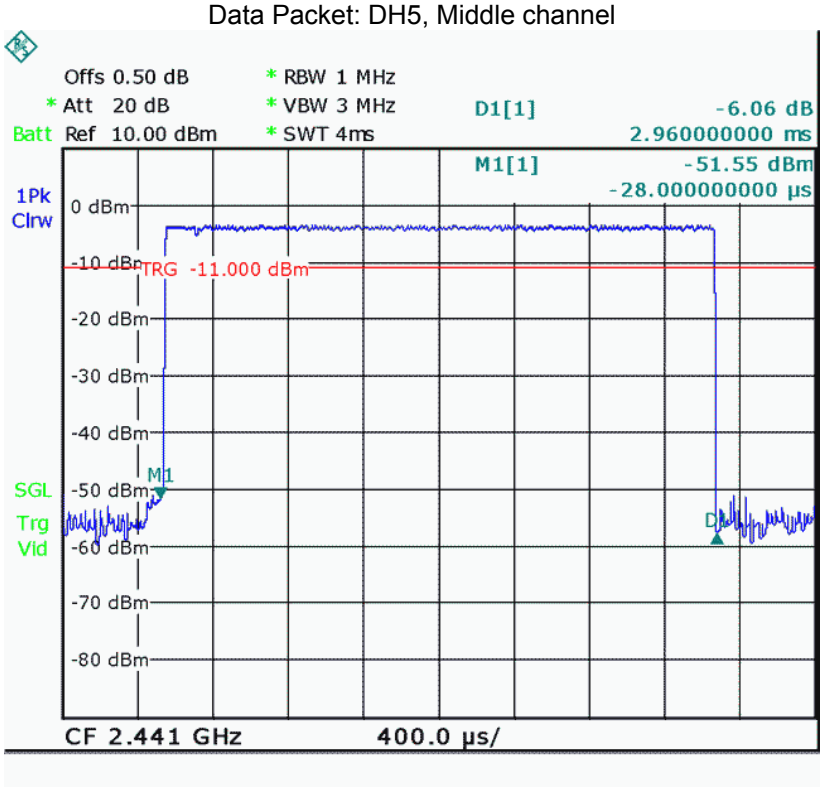
Data Packet: DH5, High channel



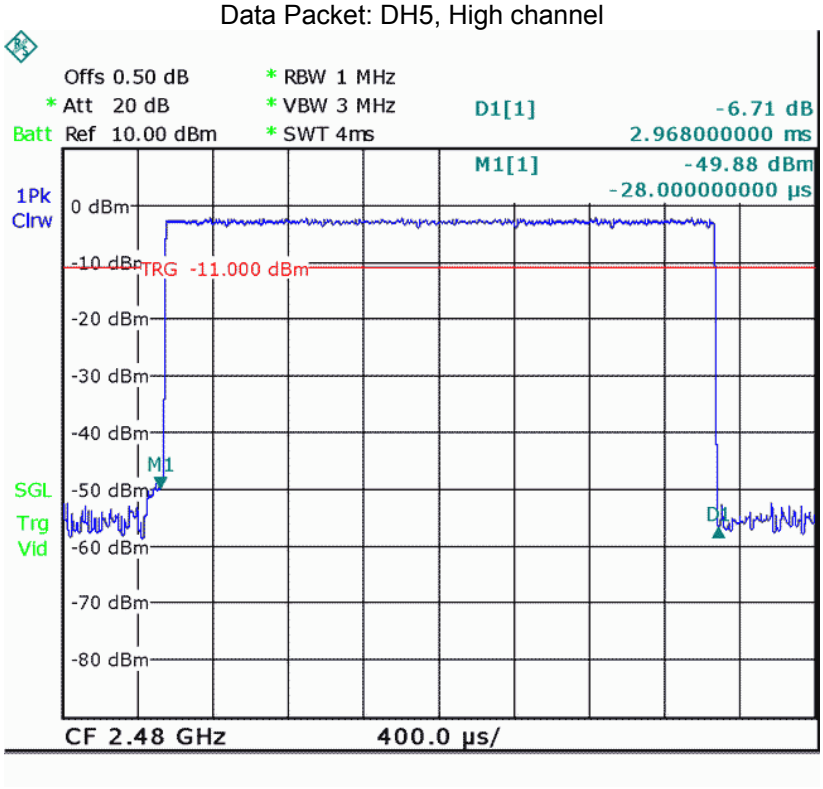
Modulation: 8DPSK
Data Packet: DH5, Low channel



Data Packet: DH5, Middle channel



Data Packet: DH5, High channel



14 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a PCB Printed Antenna, fulfil the requirement of this section.

15 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in transmitting mode

15.1 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.

15.2 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

15.3 MPE Calculation Method

$$\text{E (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m²)} = \frac{E^2}{377}$$

E = Electric field (V/m)
P = Peak RF output power (W)
G = EUT Antenna numeric gain (numeric)
d = Separation distance between radiator and human body (m)
The formula can be changed to

$$\boldsymbol{Pd} = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

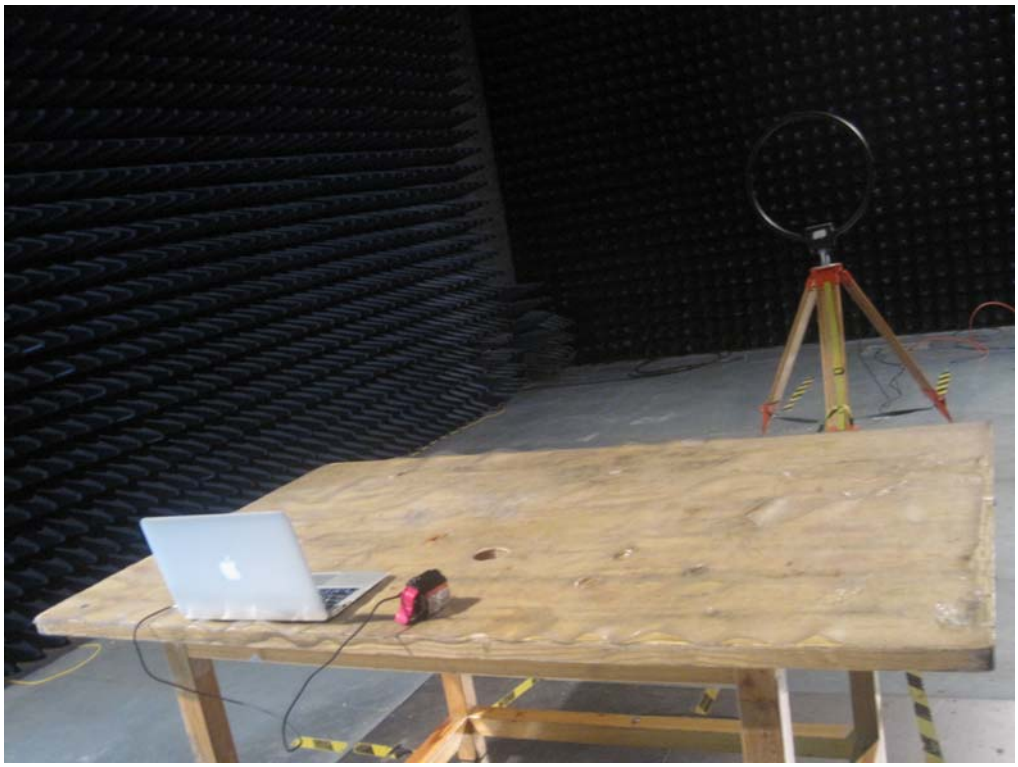
Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
1.000	2.35	1.718	0.000342	1.0

16 Photographs – Test Setup

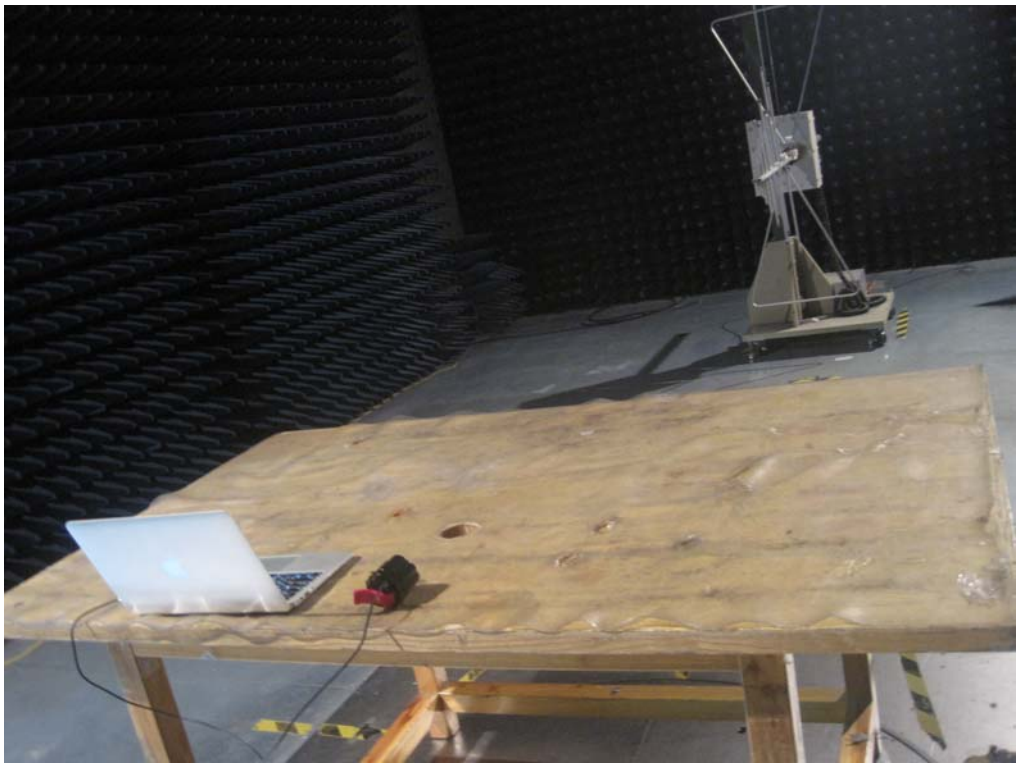
16.1 Photograph –Power Line Conducted Emission Test Setup

16.2 Photograph – Radiated Emission Test Setup

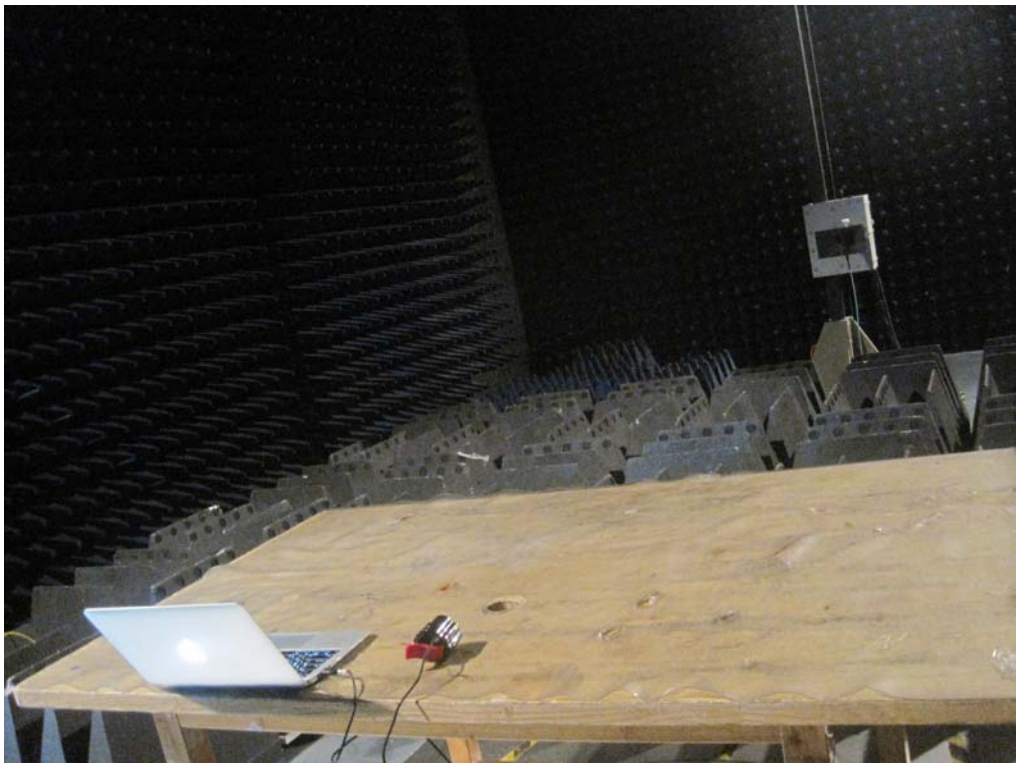
Below 30MHz



From 30-1000MHz

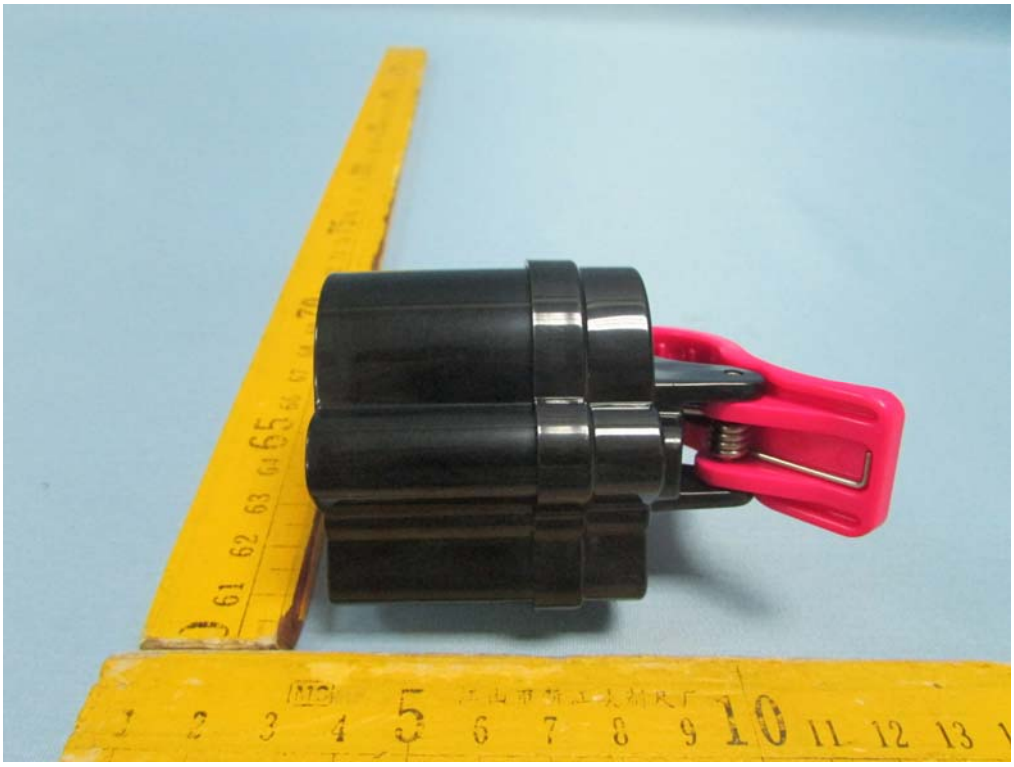


Above 1GHz

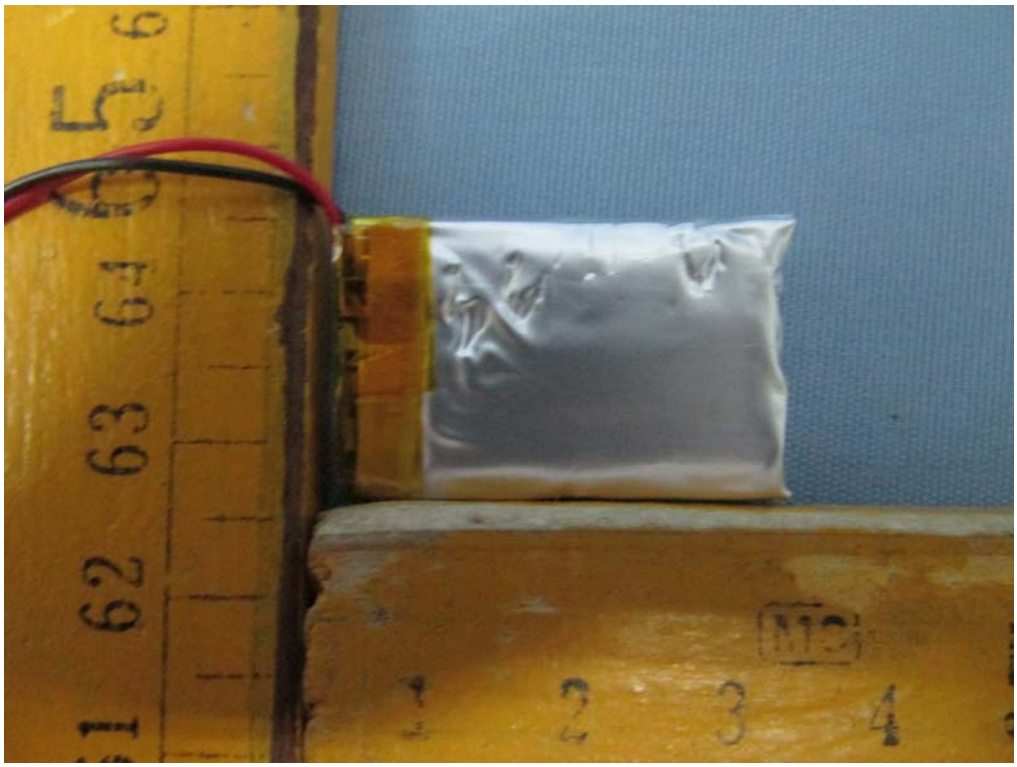


17 Photographs - Constructional Details

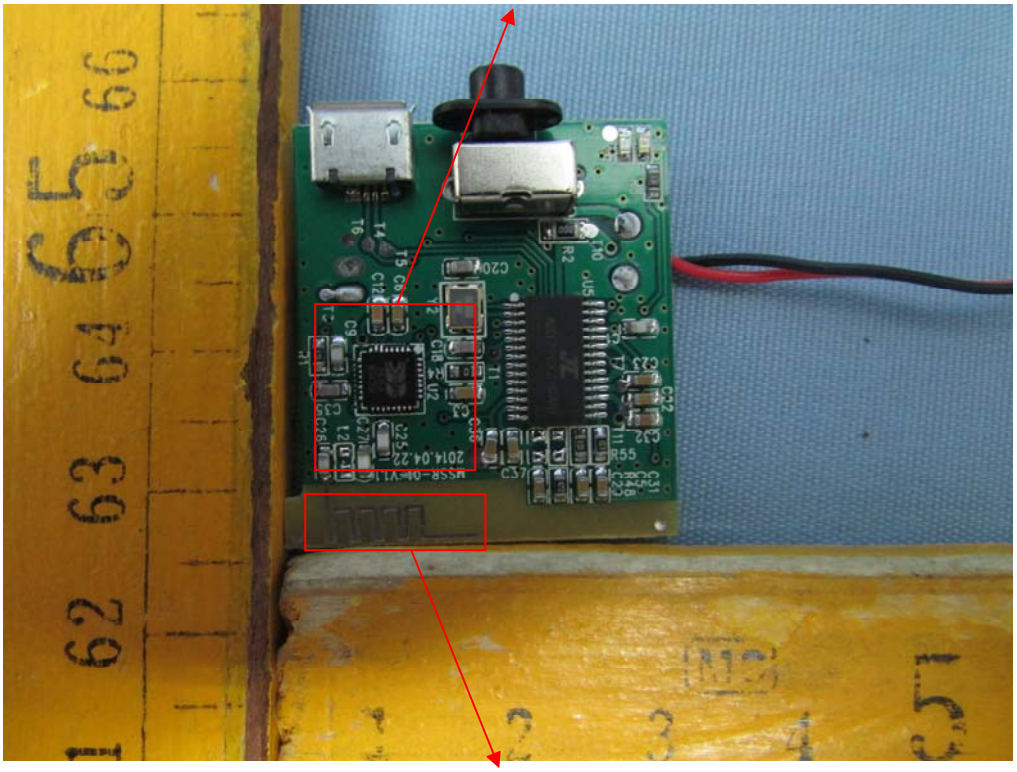
17.1 EUT – Appearance View



17.2 EUT – Internal View



RF module



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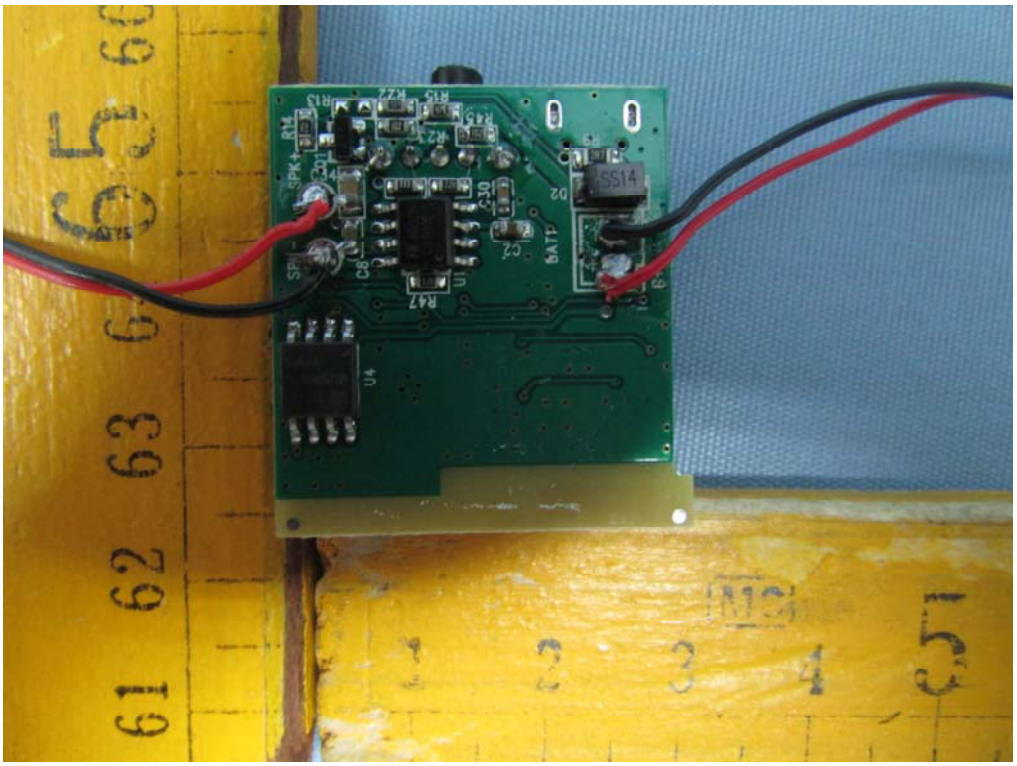

=======End of Report======