

TEST REPORT

Reference No...... : WTD15S0729644E
FCC ID : TE7BS1001
Applicant..... : TP-LINK Technologies Co., Ltd.
Address..... : Building 24 (floors 1,3,4,5) and 28 (floors1-4), Central Science and Technology Park, Nanshan, Shenzhen, China
Manufacturer : Shenzhen 3nod Digital Technology Co., Ltd.
Address..... : Building D Park 8# Langhui Road Tangxiayong Village, Industrial Zone Songgang Town, Baoan District, Shenzhen City, China.
Product Name..... : Groovi Ripple
Model No..... : BS1001
Standards..... : FCC CFR47 Part 15 Section 15.247:2014
Date of Receipt sample : Jul. 07, 2015
Date of Test : Jul. 08 - 14, 2015
Date of Issue..... : Jul. 16, 2015
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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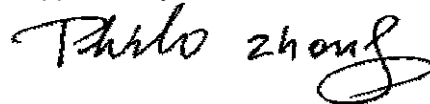
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Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Power Spectral Density	15.247(e)	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

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4 General Information

4.1 General Description of E.U.T.

Product Name:	Groovi Ripple
Model No.:	BS1001
Model Description:	N/A
Bluetooth Version:	4.0(including EDR to 3Mbps and Bluetooth low energy)
Frequency Range:	2402-2480MHz, 79(EDR)/40(BLE) Channels in total
Type of Modulation:	GFSK, Pi/4DQPSK, 8DPSK,CFSK(BLE)
The lowest oscillator:	26MHz
Antenna installation:	PCB printed antenna
Antenna Gain:	0dBi

4.2 Details of E.U.T.

Technical Data	: DC 3.7V, 750mAh by battery DC 5V by USB port
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4.3 Channel List

EDR

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	-	-

BLE

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	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.

Table 1 Tests Carried Out Under FCC part 15.247

Bluetooth mode	Test mode	Low channel	Middle channel	High channel
EDR	Transmitting	2402MHz	2441MHz	2480MHz
BLE	Transmitting	2402MHz	2440MHz	2480MHz

Table 2 Tests Carried Out Under FCC part 15.207 and 15.209

Test Item	Test Mode
Radiated Emissions	Communication
Conducted Emissions	Communication

4.5 Test Facility

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

- 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.15,2014	Sep.14,2015
2.	LISN	R&S	ENV216	101215	Sep.15,2014	Sep.14,2015
3.	Cable	Top	TYPE16(3.5M)	-	Sep.15,2014	Sep.14,2015
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.15,2014	Sep.14,2015
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2014	Sep.14,2015
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2014	Sep.14,2015
4.	Cable	LARGE	RF300	-	Sep.15,2014	Sep.14,2015
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.15,2014	Sep.14,2015
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2014	Sep.14,2015
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2015	Apr.18,2016
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2014	Sep.14,2015
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2015	Apr.18,2016
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2015	Apr.18,2016
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2015	Mar.16,2016
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2015	Apr.09,2016
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	Sep.15,2014	Sep.14,2015
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2014	Sep.14,2015
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2014	Sep.14,2015
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2014	Sep.14,2015

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.15,2014	Sep.14,2015
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2014	Sep.14,2015
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.15,2014	Sep.14,2015

5.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
Notebook	Apple	Macbook Air	/

5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
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)

5.4 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 Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
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)

6.1 E.U.T. Operation

Operating Environment :

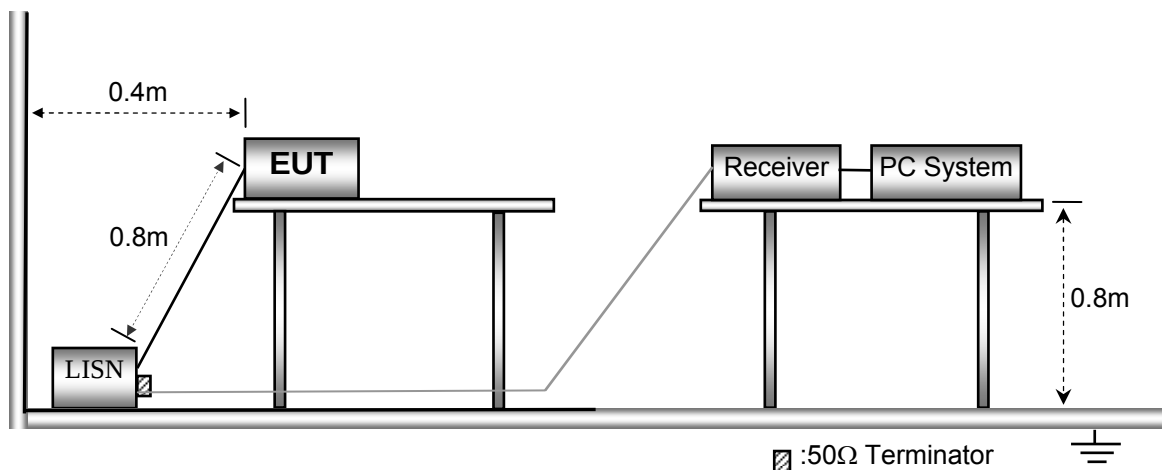
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

6.2 EUT Setup

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

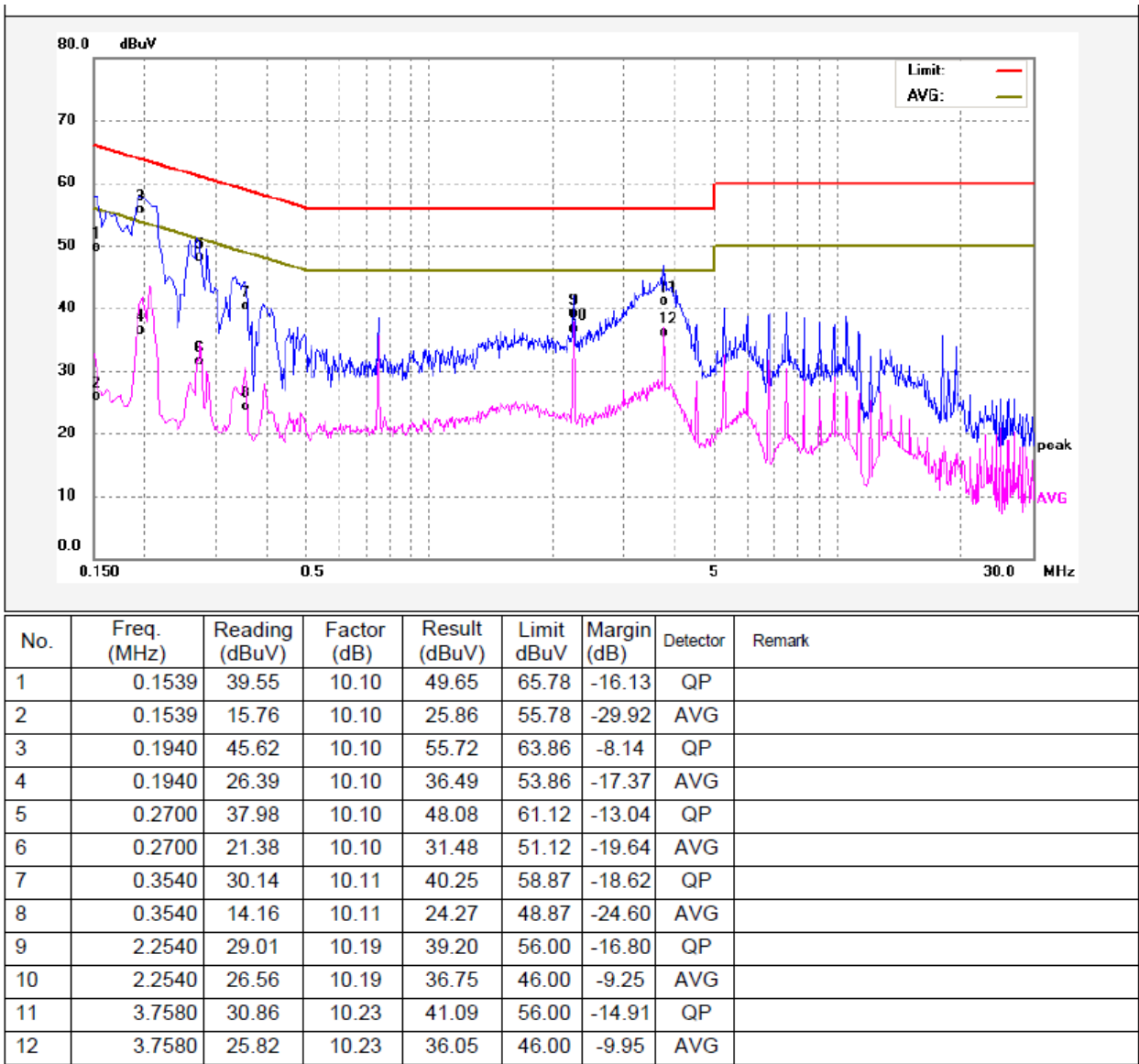


6.3 Measurement Description

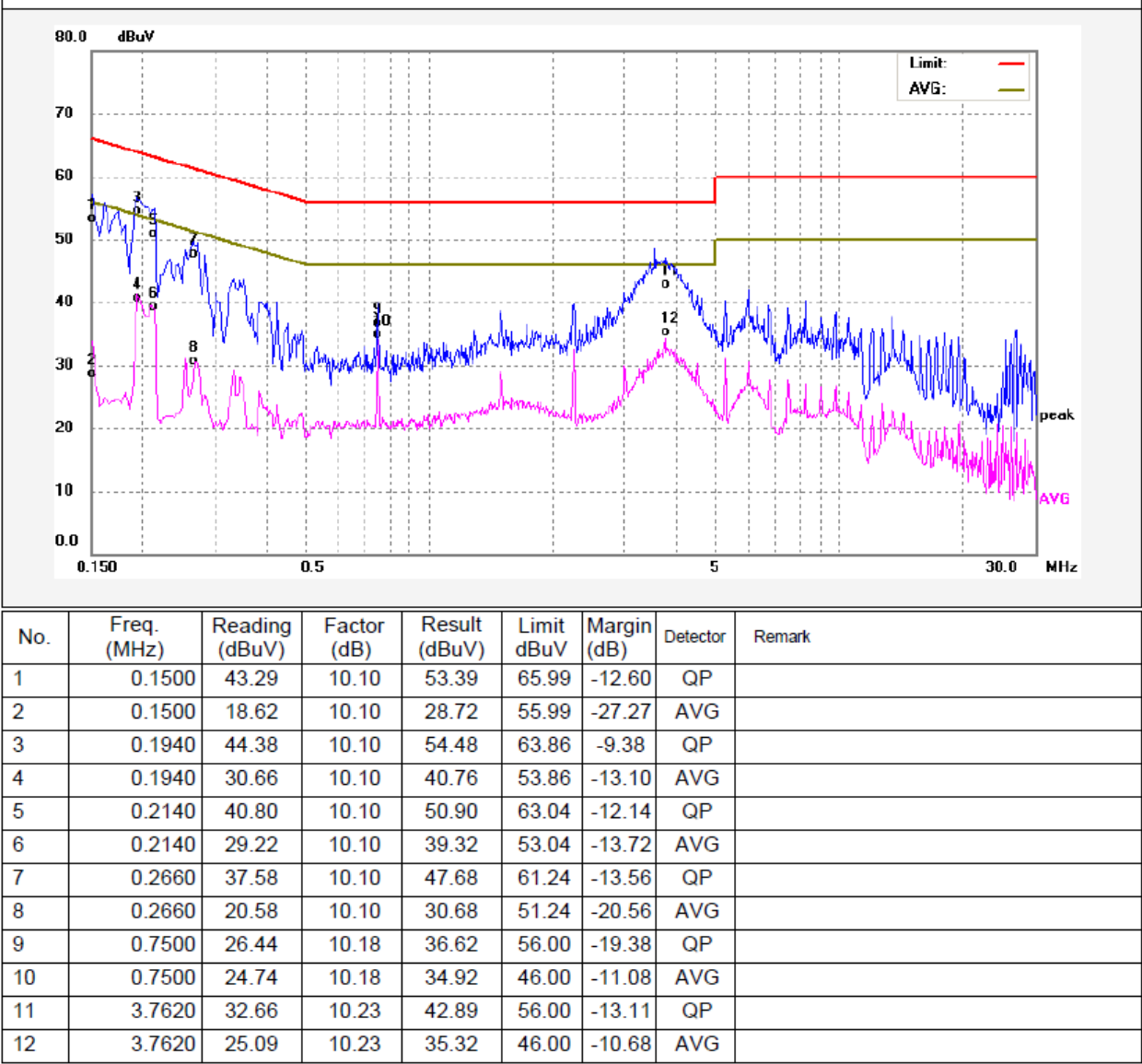
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.4 Conducted Emission Test Result

Live line:



Neutral line:



7 Radiated Spurious 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	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

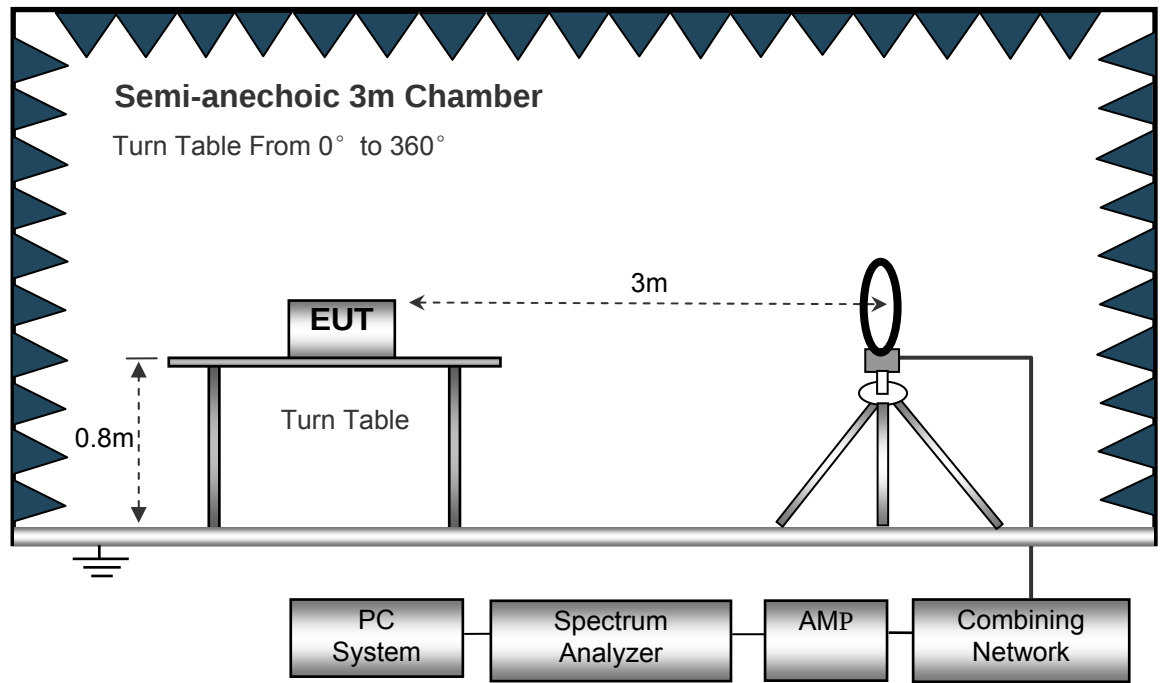
EUT Operation :

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

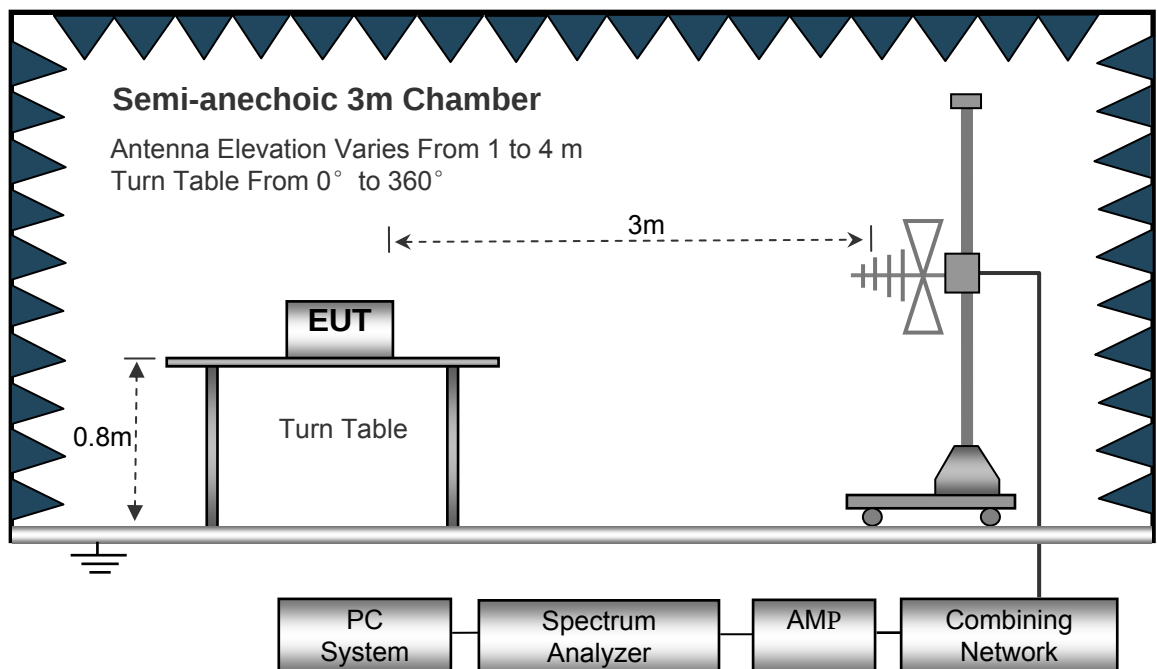
7.2 Test Setup

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

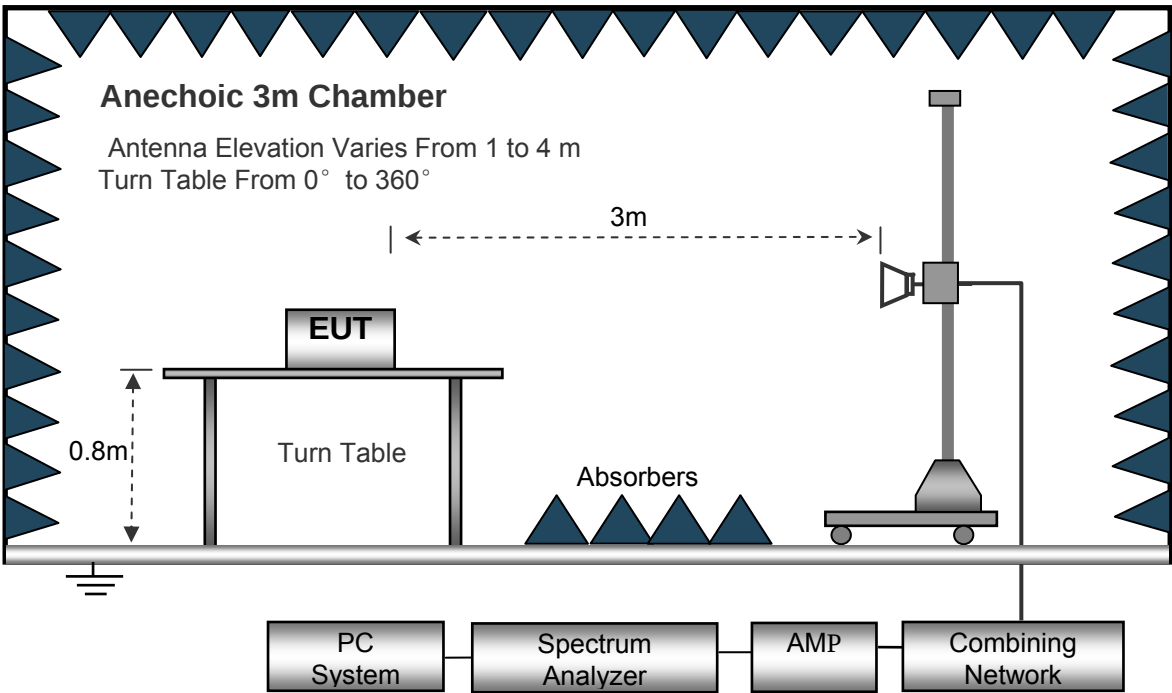
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum 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

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. 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.

7.5 Summary of Test Results

Test Frequency: 26MHz 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	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2402MHz									
288.60	20.44	QP	164	1.4	H	-13.35	7.09	46.00	-38.91
288.60	18.04	QP	299	1.1	V	-13.35	4.69	46.00	-41.31
4804.00	54.31	PK	35	2.0	V	-1.06	53.25	74.00	-20.75
4804.00	42.5	Ave	35	2.0	V	-1.06	41.44	54.00	-12.56
7206.00	51.41	PK	109	1.8	H	1.33	52.74	74.00	-21.26
7206.00	42.28	Ave	109	1.8	H	1.33	43.61	54.00	-10.39
2331.10	45.98	PK	274	2.0	V	-13.19	32.79	74.00	-41.21
2331.10	39.98	Ave	274	2.0	V	-13.19	26.79	54.00	-27.21
2371.42	42.89	PK	254	1.3	H	-13.14	29.75	74.00	-44.25
2371.42	36.95	Ave	254	1.3	H	-13.14	23.81	54.00	-30.19
2494.97	43.65	PK	87	1.1	V	-13.08	30.57	74.00	-43.43
2494.97	38.41	Ave	87	1.1	V	-13.08	25.33	54.00	-28.67

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441MHz									
288.60	20.24	QP	305	1.3	H	-13.35	6.89	46.00	-39.11
288.60	17.80	QP	180	1.3	V	-13.35	4.45	46.00	-41.55
4882.00	54.02	PK	305	1.9	V	-0.62	53.40	74.00	-20.60
4882.00	42.52	Ave	305	1.9	V	-0.62	41.90	54.00	-12.10
7323.00	51.02	PK	304	2.0	H	2.21	53.23	74.00	-20.77
7323.00	43.41	Ave	304	2.0	H	2.21	45.62	54.00	-8.38
2313.27	45.73	PK	200	1.2	V	-13.19	32.54	74.00	-41.46
2313.27	38.11	Ave	200	1.2	V	-13.19	24.92	54.00	-29.08
2358.36	44.48	PK	151	1.6	H	-13.14	31.34	74.00	-42.66
2358.36	38.25	Ave	151	1.6	H	-13.14	25.11	54.00	-28.89
2498.87	42.58	PK	297	1.2	V	-13.08	29.50	74.00	-44.50
2498.87	38.82	Ave	297	1.2	V	-13.08	25.74	54.00	-28.26

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2480MHz									
288.60	20.75	QP	30	1.5	H	-13.35	7.40	46.00	-38.60
288.60	19.28	QP	212	1.5	V	-13.35	5.93	46.00	-40.07
4960.00	55.01	PK	21	1.1	V	-0.24	54.77	74.00	-19.23
4960.00	41.20	Ave	21	1.1	V	-0.24	40.96	54.00	-13.04
7440.00	52.23	PK	137	1.3	H	2.84	55.07	74.00	-18.93
7440.00	43.86	Ave	137	1.3	H	2.84	46.70	54.00	-7.30
2331.37	46.34	PK	261	1.1	V	-13.19	33.15	74.00	-40.85
2331.37	37.85	Ave	261	1.1	V	-13.19	24.66	54.00	-29.34
2370.51	42.57	PK	266	1.1	H	-13.14	29.43	74.00	-44.57
2370.51	38.22	Ave	266	1.1	H	-13.14	25.08	54.00	-28.92
2495.21	43.72	PK	182	1.4	V	-13.08	30.64	74.00	-43.36
2495.21	37.07	Ave	182	1.4	V	-13.08	23.99	54.00	-30.01

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
BLE - GFSK Low Channel 2402MHz									
288.60	22.48	QP	147	1.7	H	-13.35	9.13	46.00	-36.87
288.60	18.33	QP	317	1.8	V	-13.35	4.98	46.00	-41.02
4804.00	54.01	PK	264	1.9	V	-1.06	52.95	74.00	-21.05
4804.00	42.53	Ave	264	1.9	V	-1.06	41.47	54.00	-12.53
7206.00	50.22	PK	96	1.0	H	1.33	51.55	74.00	-22.45
7206.00	45.32	Ave	96	1.0	H	1.33	46.65	54.00	-7.35
2341.03	46.77	PK	61	1.4	V	-13.19	33.58	74.00	-40.42
2341.03	37.84	Ave	61	1.4	V	-13.19	24.65	54.00	-29.35
2359.20	43.25	PK	85	1.8	H	-13.14	30.11	74.00	-43.89
2359.20	36.43	Ave	85	1.8	H	-13.14	23.29	54.00	-30.71
2487.45	44.79	PK	126	1.3	V	-13.08	31.71	74.00	-42.29
2487.45	36.67	Ave	126	1.3	V	-13.08	23.59	54.00	-30.41

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
BLE - GFSK Middle Channel 2440MHz									
288.60	21.91	QP	223	1.2	H	-13.35	8.56	46.00	-37.44
288.60	19.06	QP	243	1.4	V	-13.35	5.71	46.00	-40.29
4880.00	55.45	PK	264	1.5	V	-0.62	54.83	74.00	-19.17
4880.00	42.62	Ave	264	1.5	V	-0.62	42.00	54.00	-12.00
7320.00	51.43	PK	114	1.8	H	2.21	53.64	74.00	-20.36
7320.00	44.72	Ave	114	1.8	H	2.21	46.93	54.00	-7.07
2342.66	45.57	PK	332	1.1	V	-13.19	32.38	74.00	-41.62
2342.66	37.05	Ave	332	1.1	V	-13.19	23.86	54.00	-30.14
2375.59	44.46	PK	277	1.2	H	-13.14	31.32	74.00	-42.68
2375.59	38.48	Ave	277	1.2	H	-13.14	25.34	54.00	-28.66
2489.15	44.75	PK	174	1.8	V	-13.08	31.67	74.00	-42.33
2489.15	38.86	Ave	174	1.8	V	-13.08	25.78	54.00	-28.22

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	RSS-247/RSS-Gen	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
BLE - GFSK High Channel 2480MHz									
288.60	21.06	QP	81	1.7	H	-13.35	7.71	46.00	-38.29
288.60	17.66	QP	104	1.9	V	-13.35	4.31	46.00	-41.69
4960.00	55.14	PK	75	1.1	V	-0.24	54.90	74.00	-19.10
4960.00	42.39	Ave	75	1.1	V	-0.24	42.15	54.00	-11.85
7440.00	52.16	PK	54	1.2	H	2.84	55.00	74.00	-19.00
7440.00	44.63	Ave	54	1.2	H	2.84	47.47	54.00	-6.53
2334.99	46.40	PK	139	1.3	V	-13.19	33.21	74.00	-40.79
2334.99	37.45	Ave	139	1.3	V	-13.19	24.26	54.00	-29.74
2354.36	43.78	PK	246	1.7	H	-13.14	30.64	74.00	-43.36
2354.36	38.41	Ave	246	1.7	H	-13.14	25.27	54.00	-28.73
2493.82	42.76	PK	184	1.5	V	-13.08	29.68	74.00	-44.32
2493.82	37.73	Ave	184	1.5	V	-13.08	24.65	54.00	-29.35

Test Frequency : 18GHz to 25GHz

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

8 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:	DA 00-705 for BT3.0 (BDR+EDR) and KDB 558074 for BLE
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

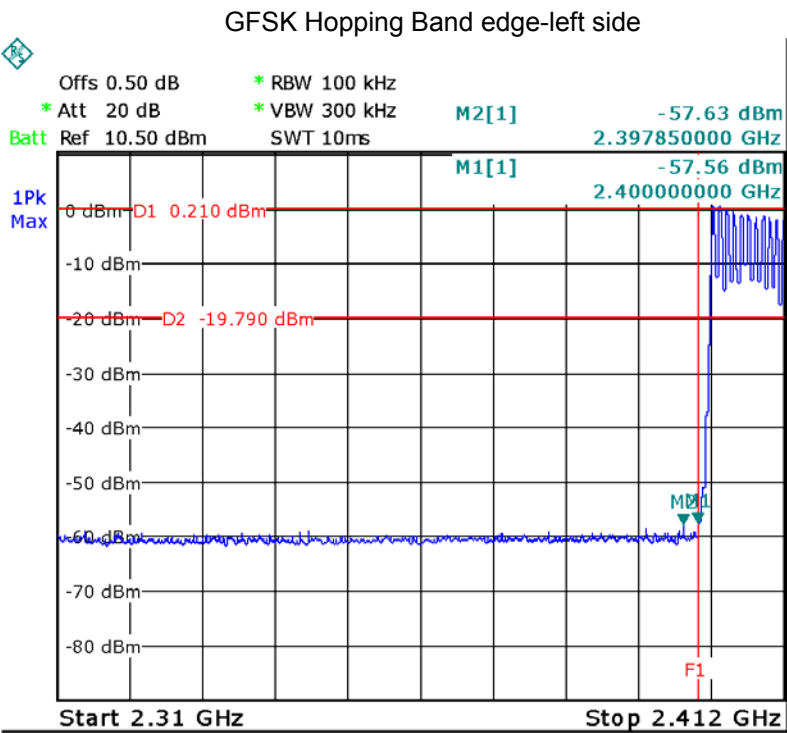
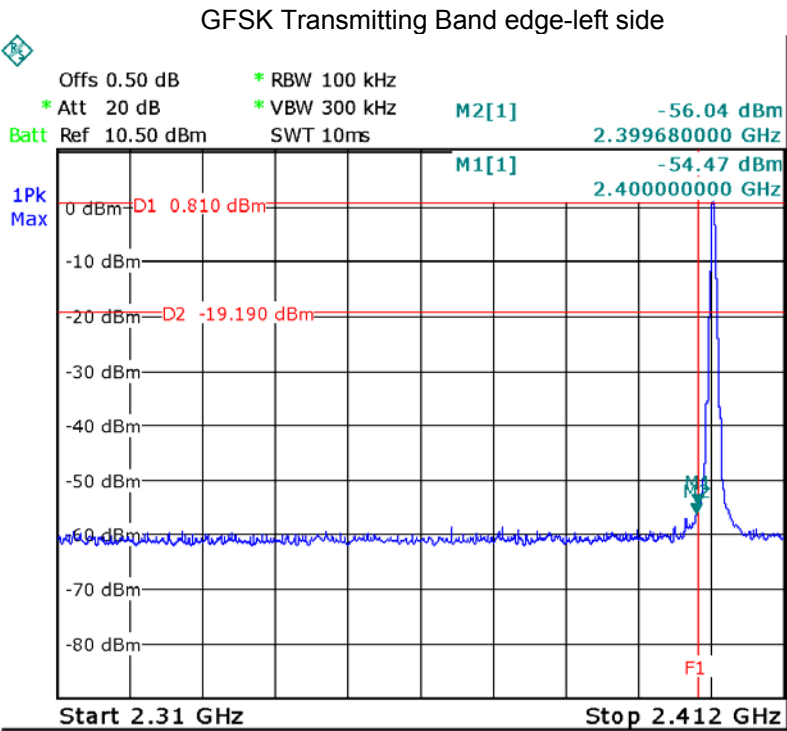
8.1 Test Procedure

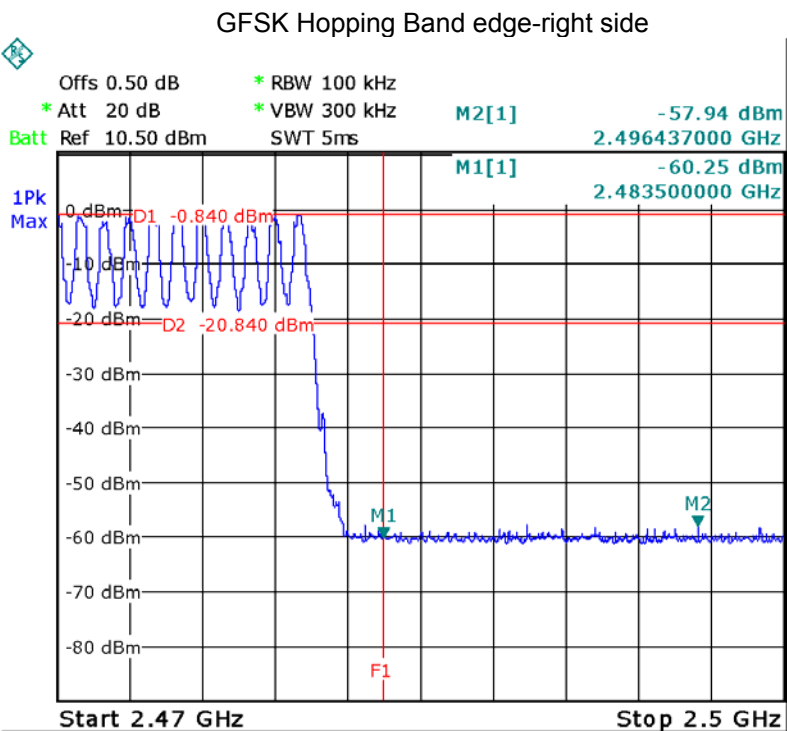
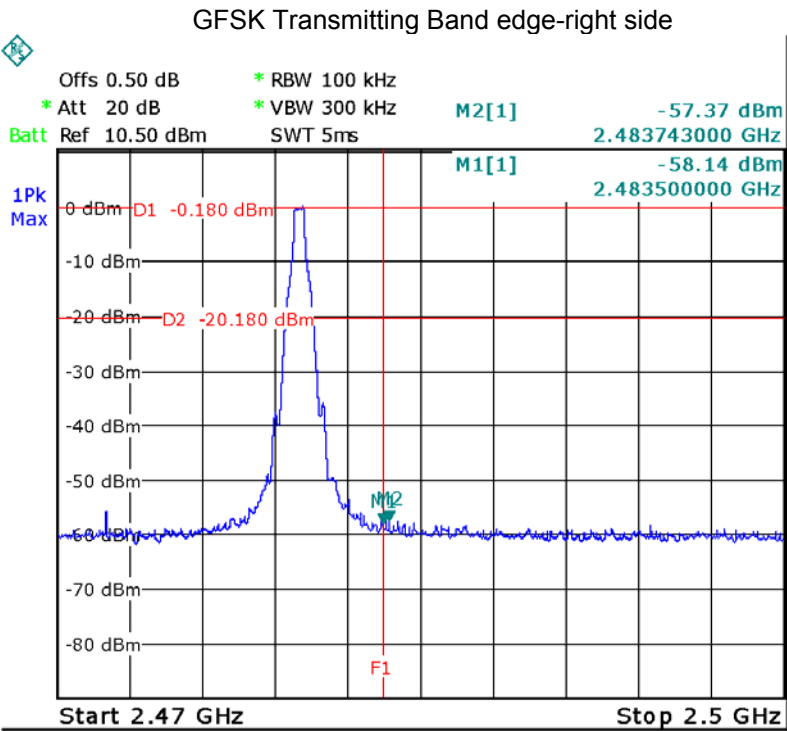
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

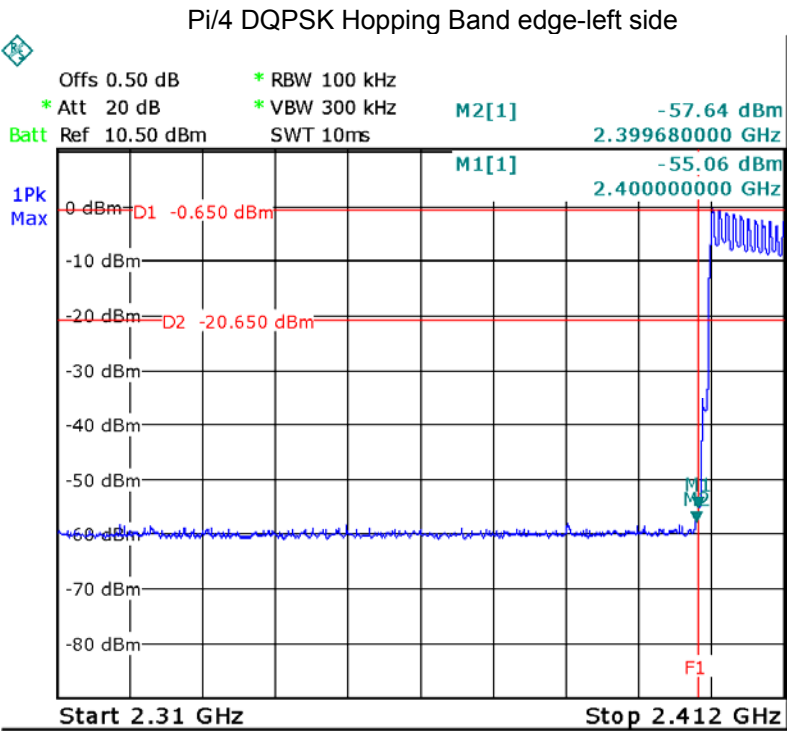
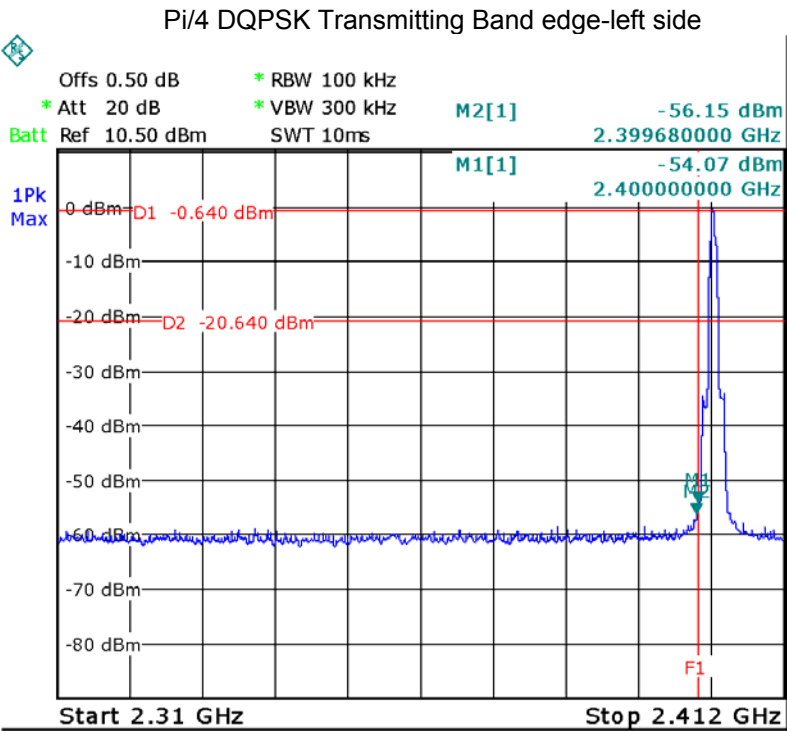
8.2 Test Result

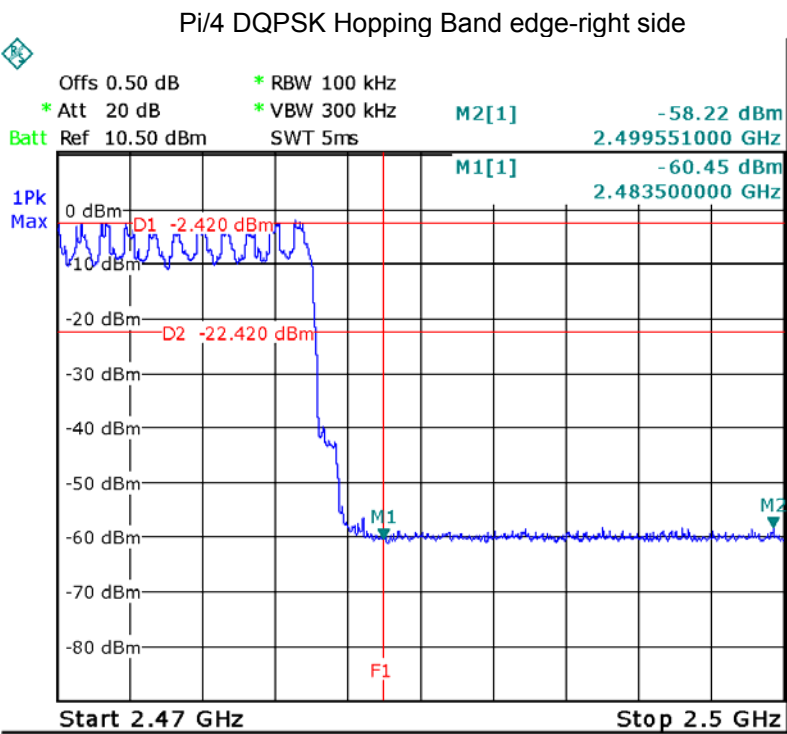
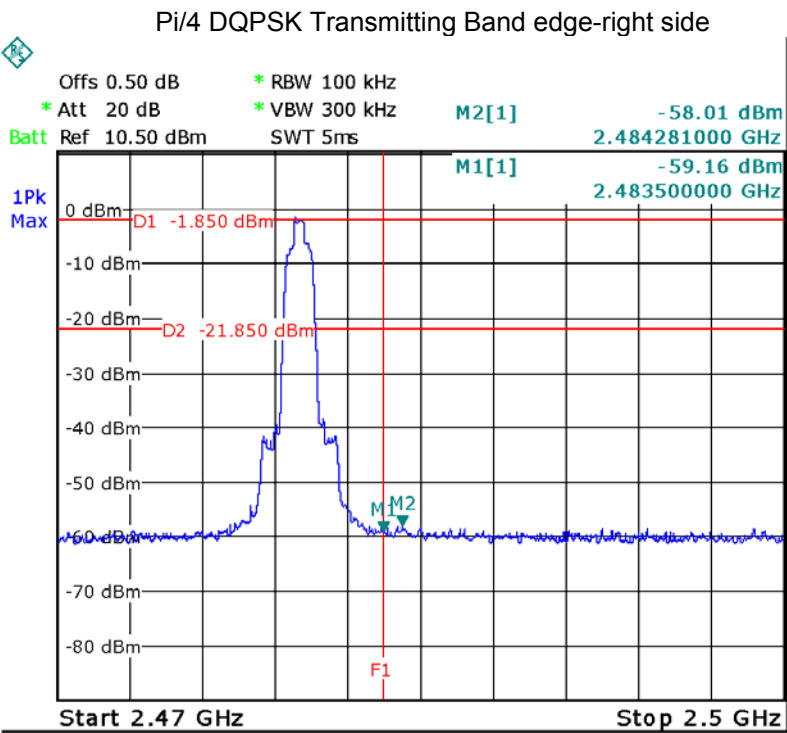
Test plots

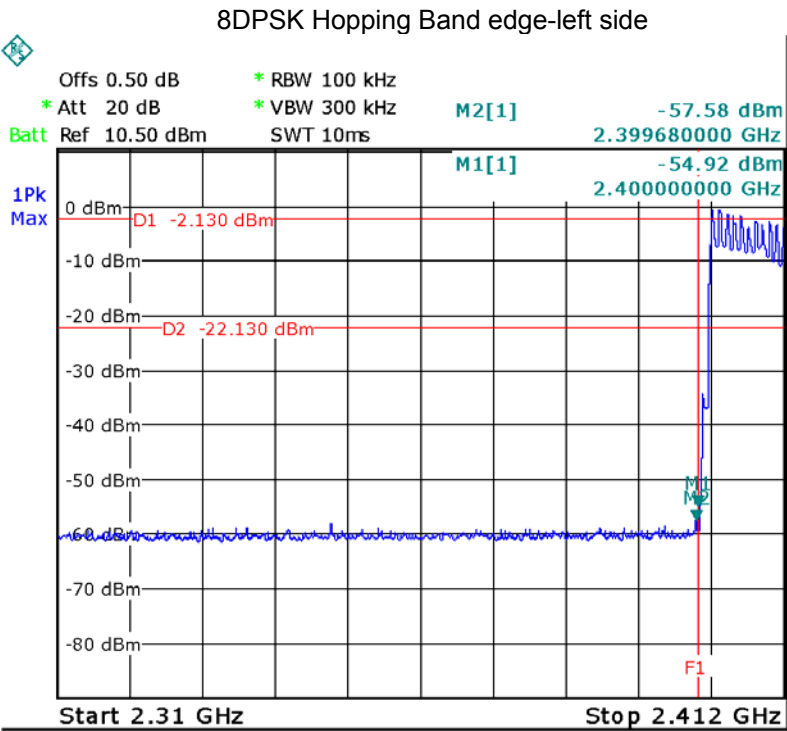
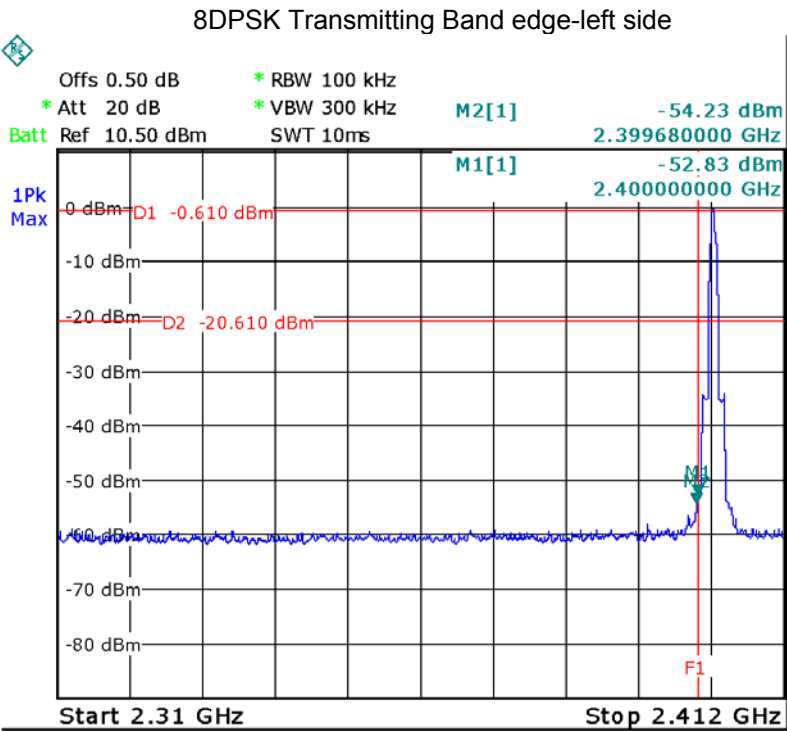
EDR mode

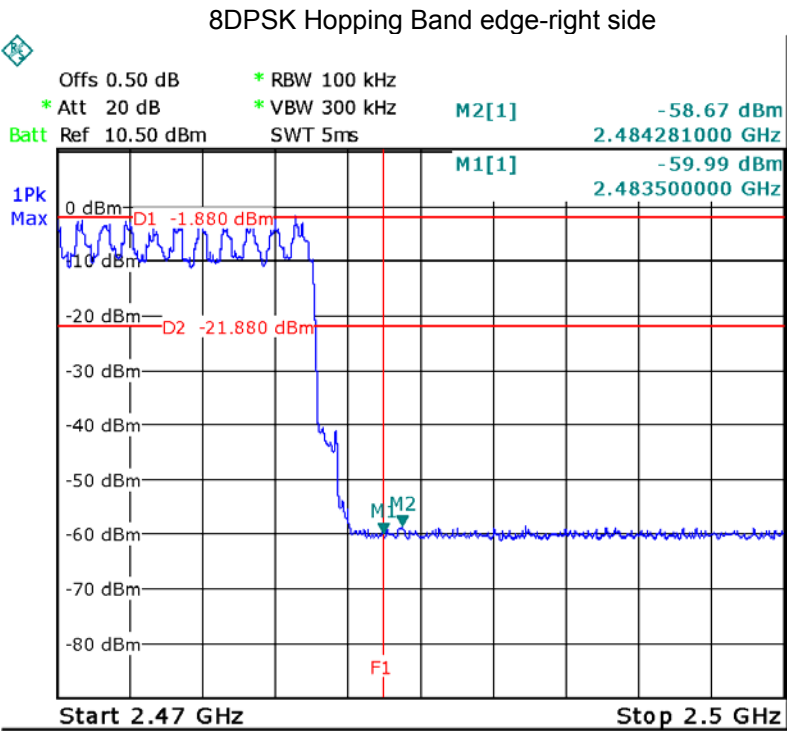
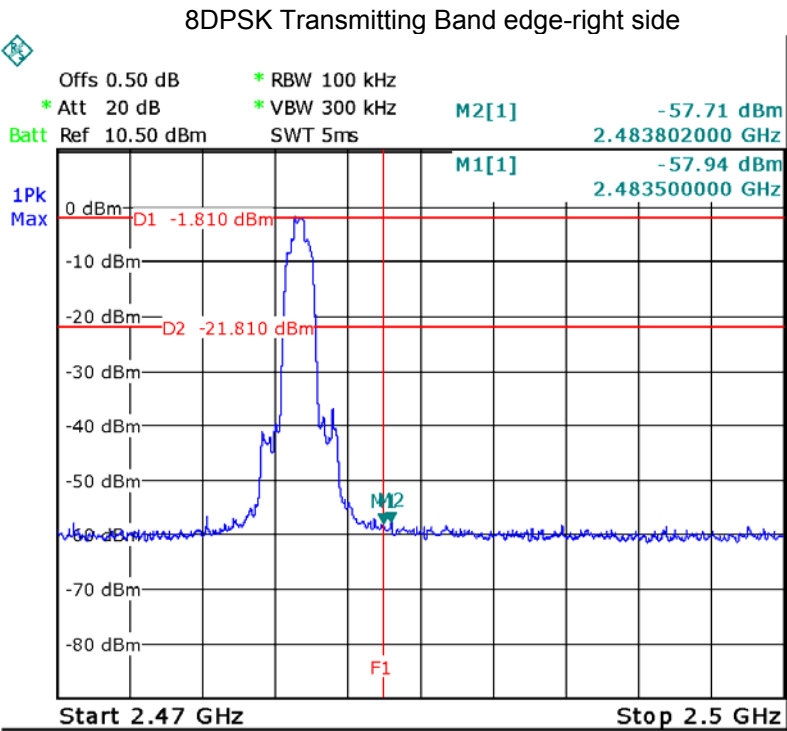






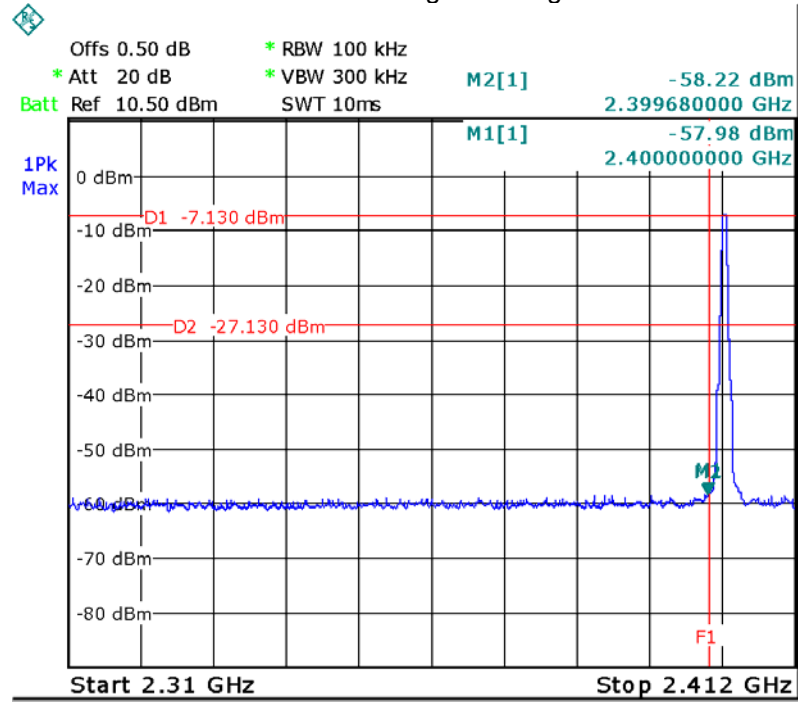




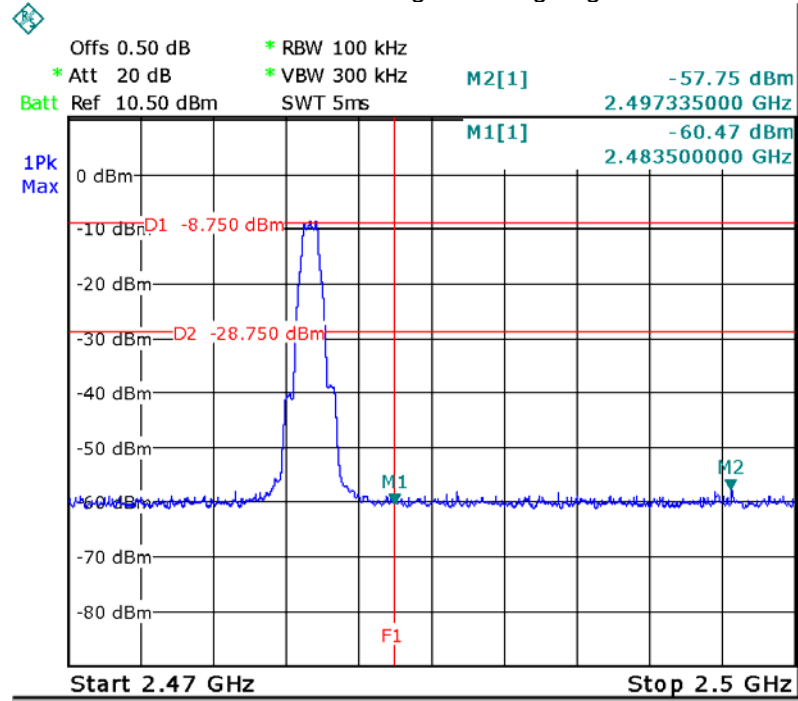


BLE mode

GFSK Transmitting Band edge-left side



GFSK Transmitting Band edge-right side



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.

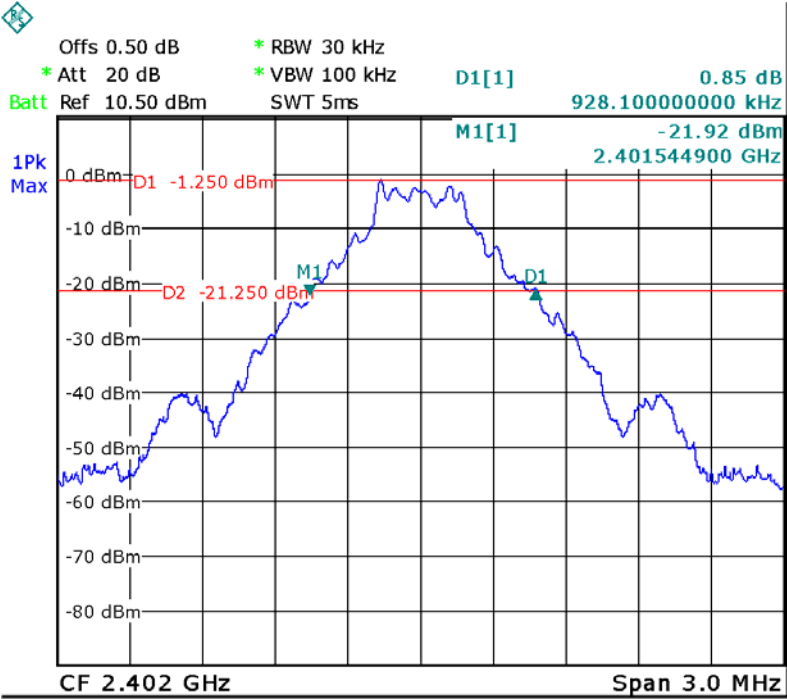
9.1 Test Procedure

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 analyzer: RBW = 30kHz, VBW = 100kHz

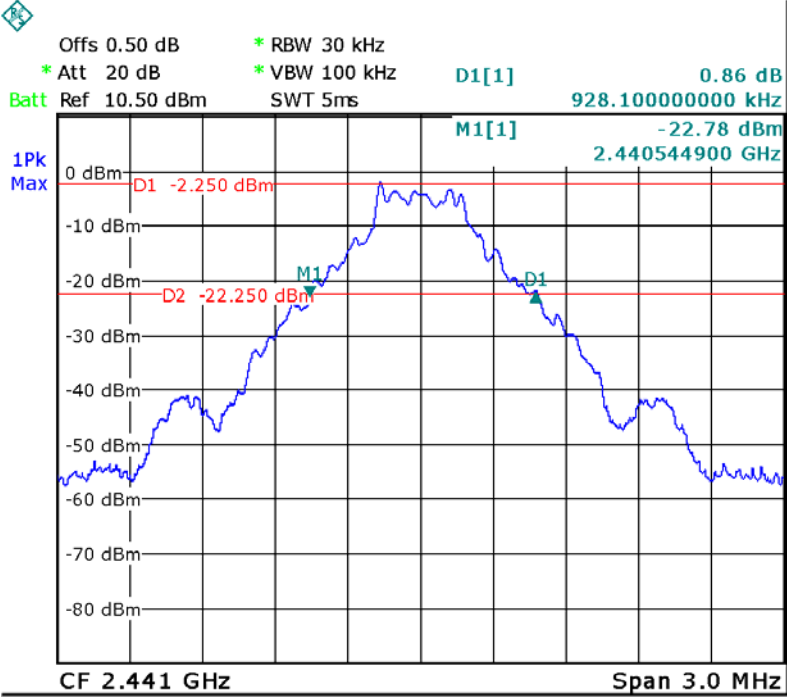
9.2 Test Result

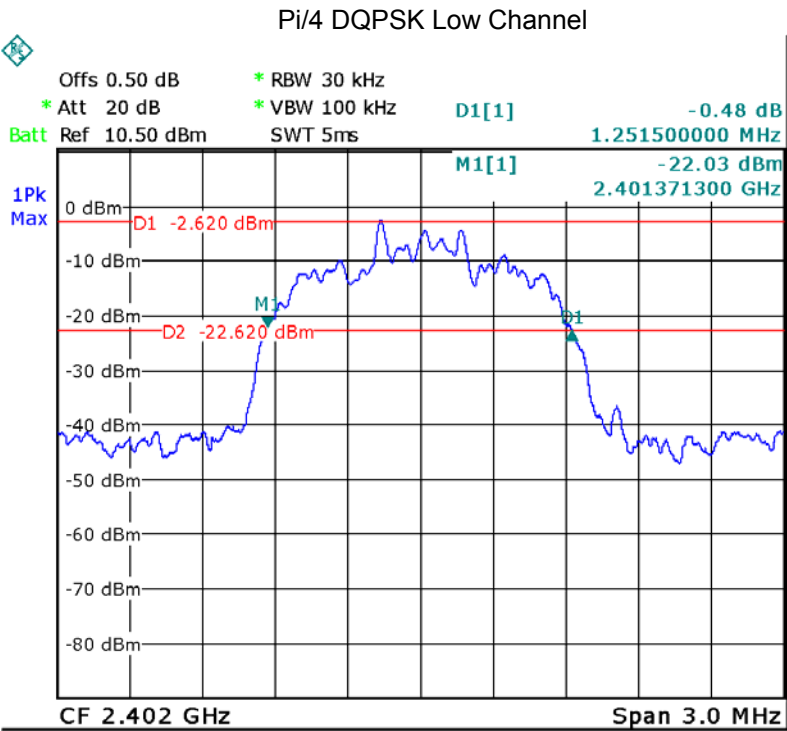
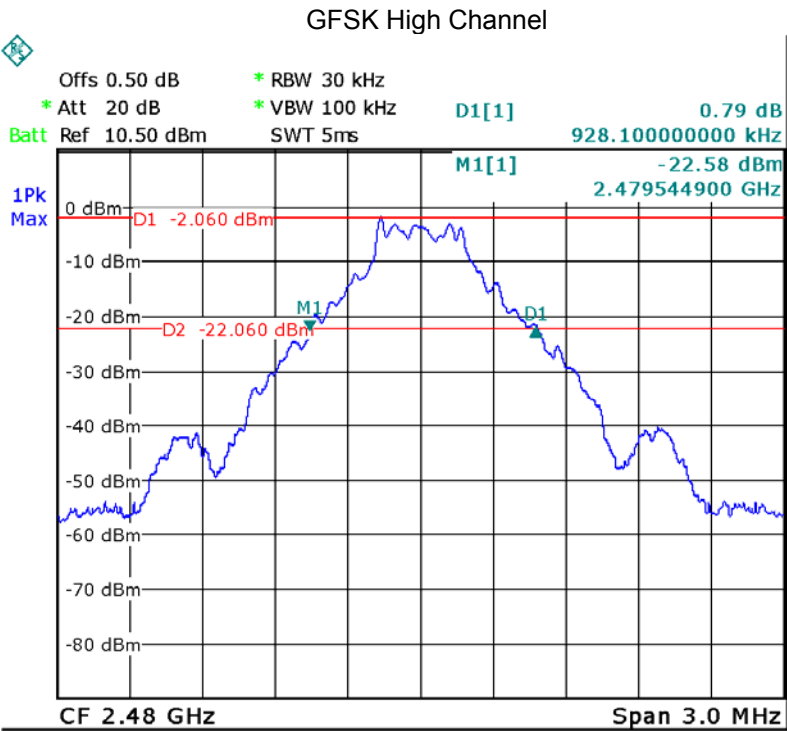
Modulation	Test Channel	Bandwidth
GFSK	Low	0.928MHz
GFSK	Middle	0.928MHz
GFSK	High	0.928MHz
Pi/4 DQPSK	Low	1.252MHz
Pi/4 DQPSK	Middle	1.252MHz
Pi/4 DQPSK	High	1.252MHz
8DPSK	Low	1.258MHz
8DPSK	Middle	1.258MHz
8DPSK	High	1.258MHz

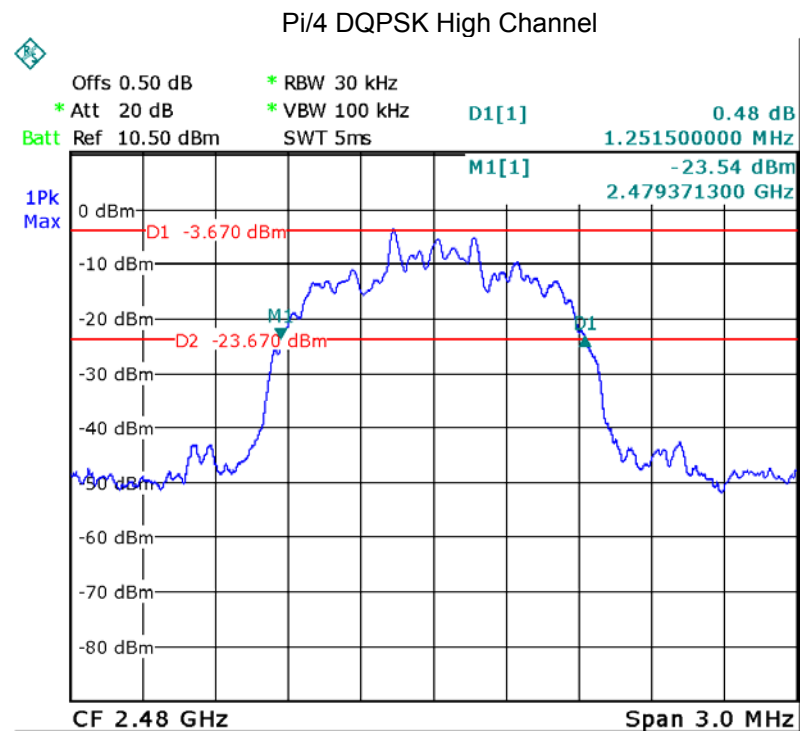
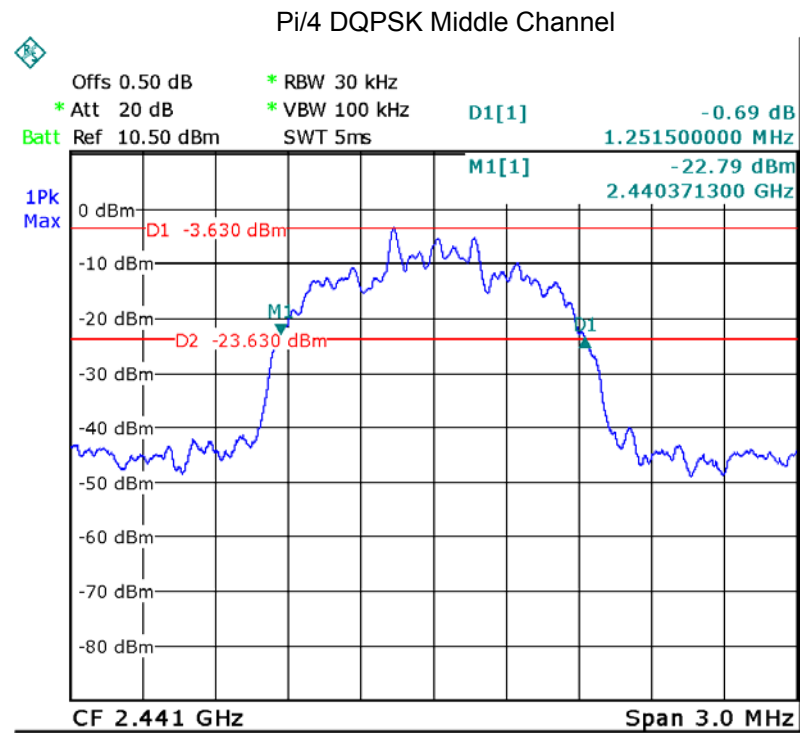
Test plots
GFSK Low Channel

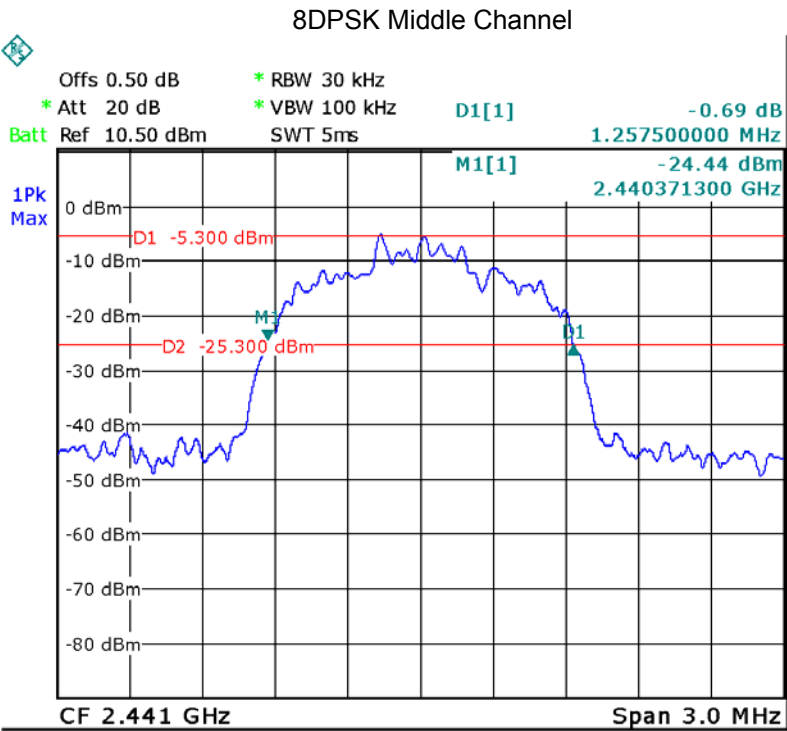
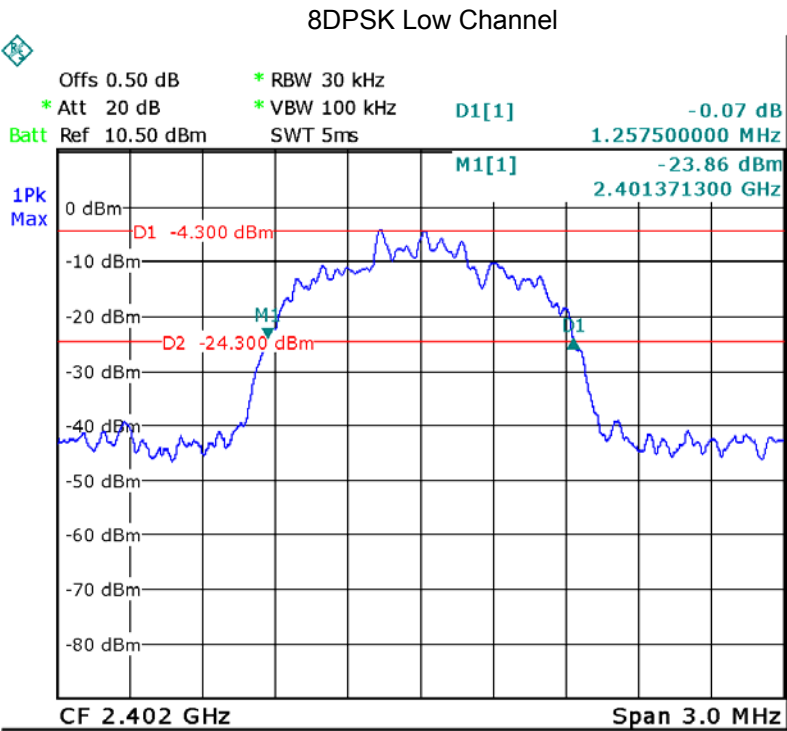


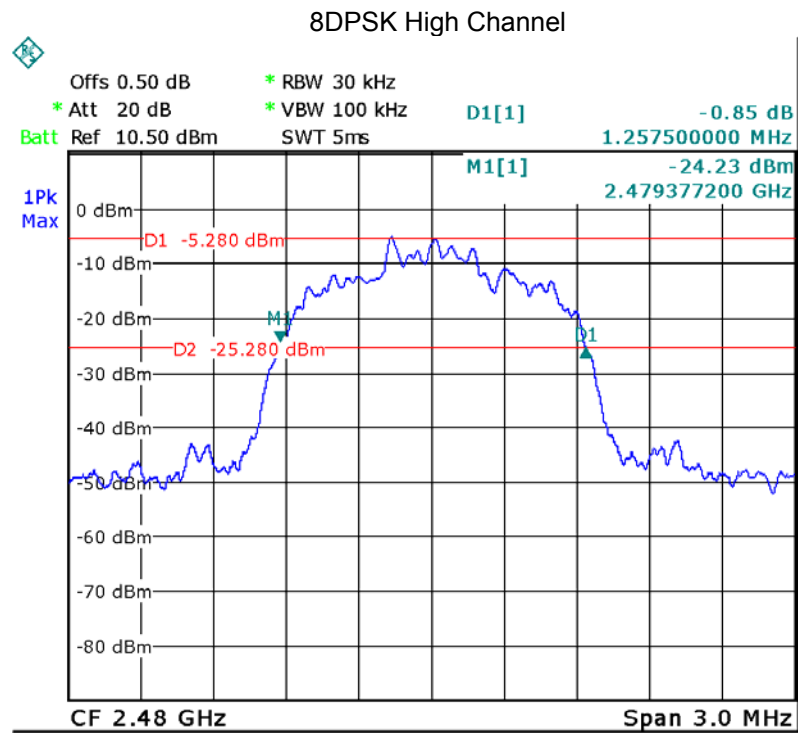
GFSK Middle Channel











10 6 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r02 June 5, 2014

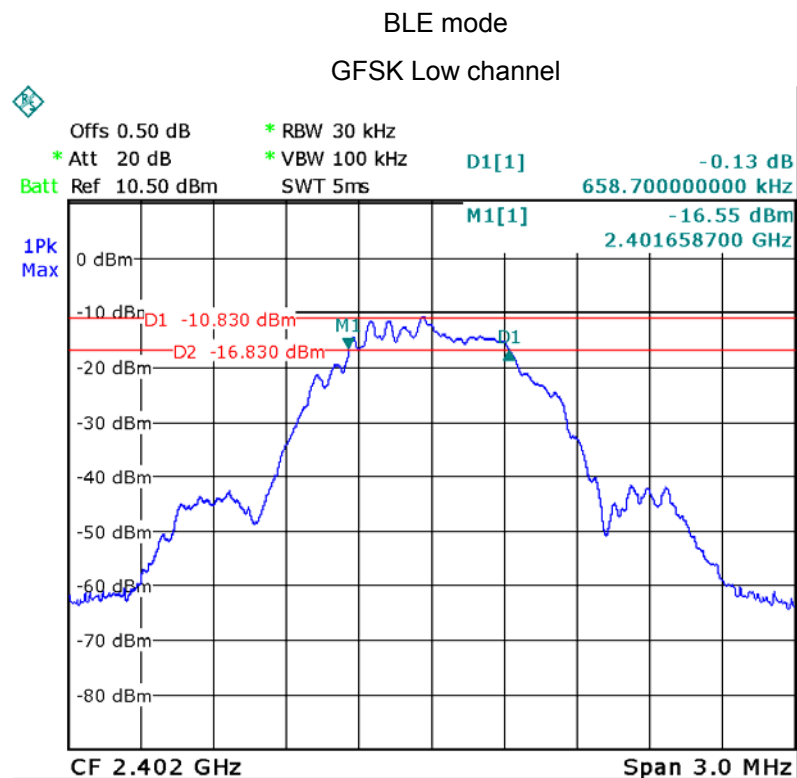
10.1 Test Procedure

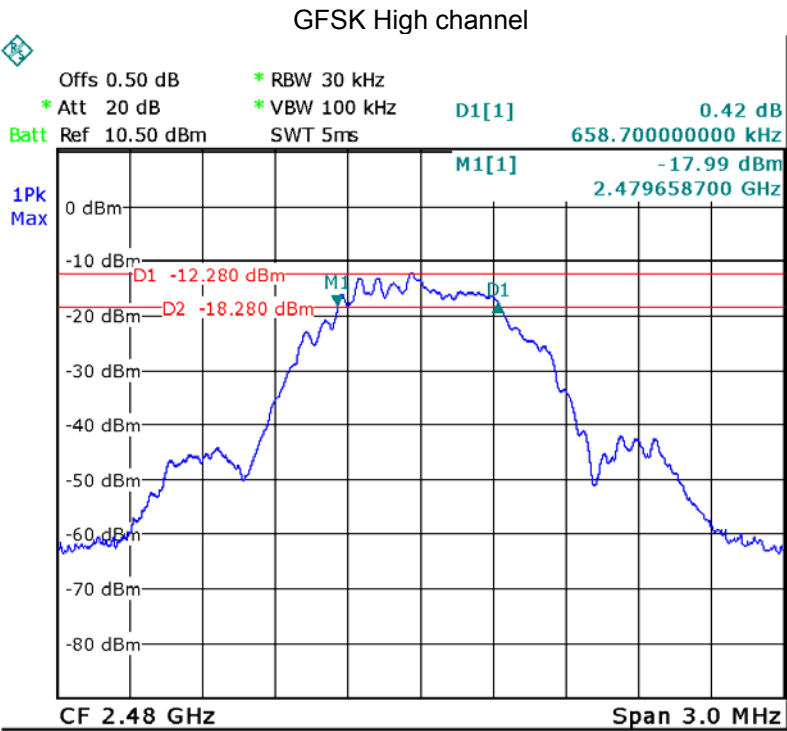
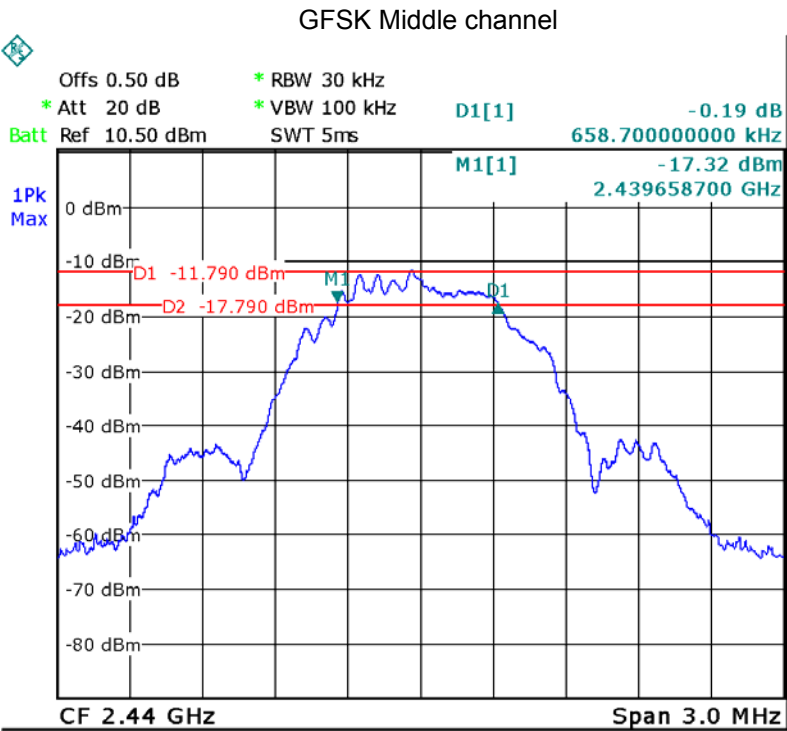
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

10.2 Test Result

Operation mode	Bandwidth (MHz)
Low channel	0.659
Middle channel	0.659
High channel	0.659

Test result plot as follows:





11 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705 for BT3.0 (BDR+EDR) and KDB 558074 for BLE
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

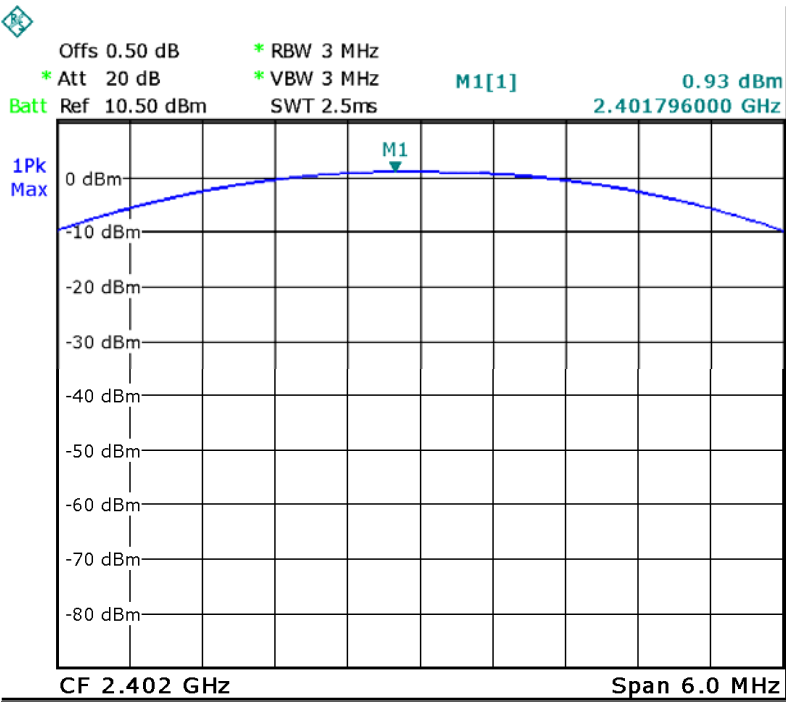
EDR mode					
Test Mode	Data Rate	Peak Power(dBm)			Limit (dBm)
		CH00	CH39	CH78	
GFSK	1Mbps	0.93	-0.21	0.20	20.97
4* π 4DQPSK	2Mbps	0.11	-1.05	-0.84	20.97
8DPSK	3Mbps	0.44	-0.72	-0.46	20.97

BLE mode					
Test Mode	Data Rate	Peak Power(dBm)			Limit (dBm)
		CH00	CH19	CH39	
GFSK	1Mbps	-6.21	-7.18	-7.68	20.97

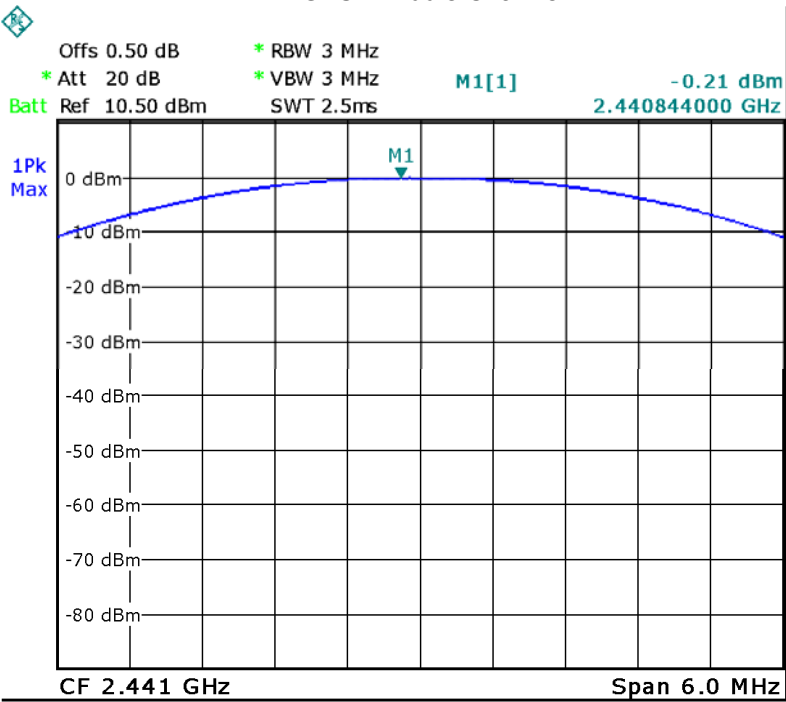
Test plots

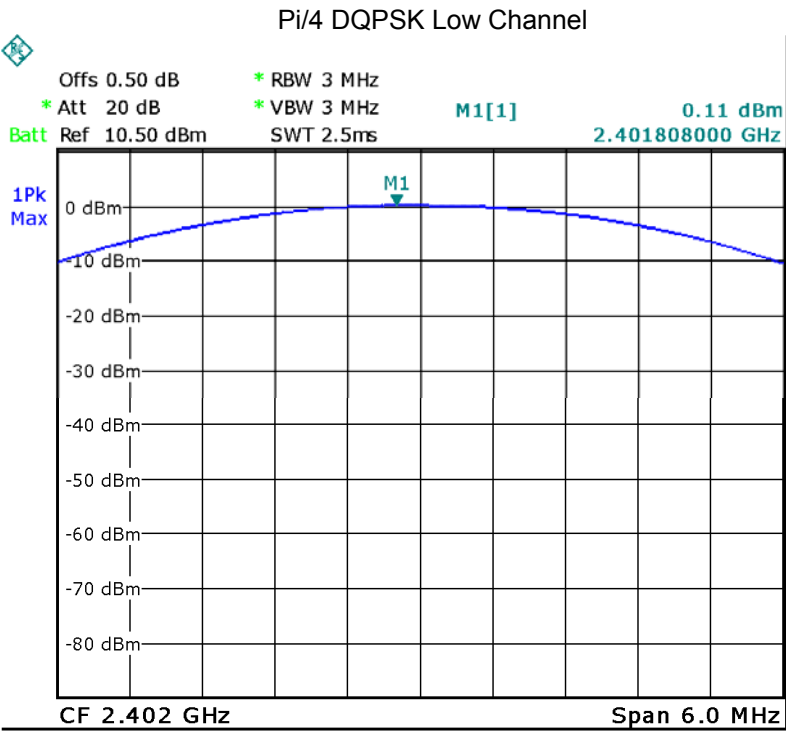
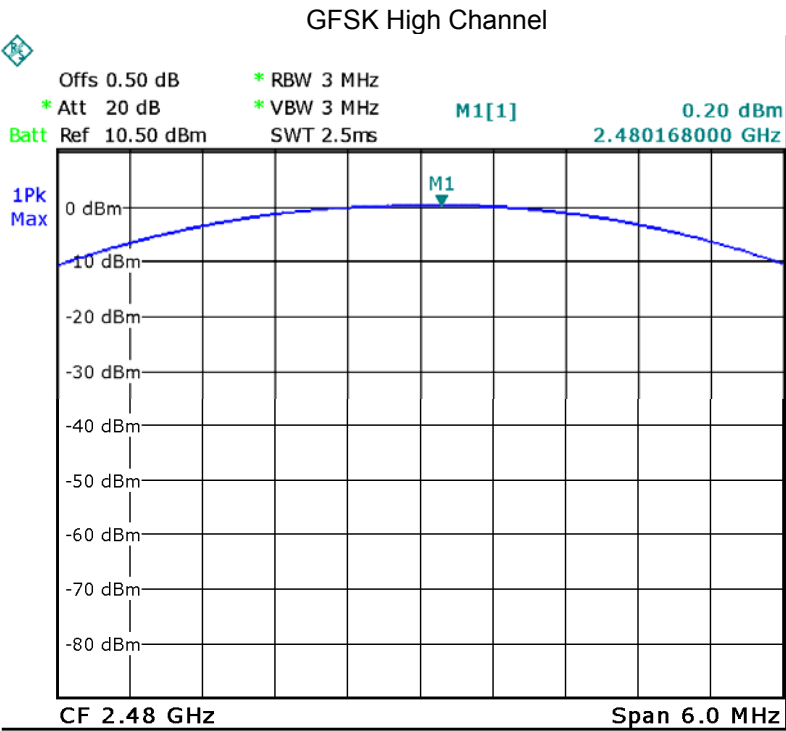
EDR mode

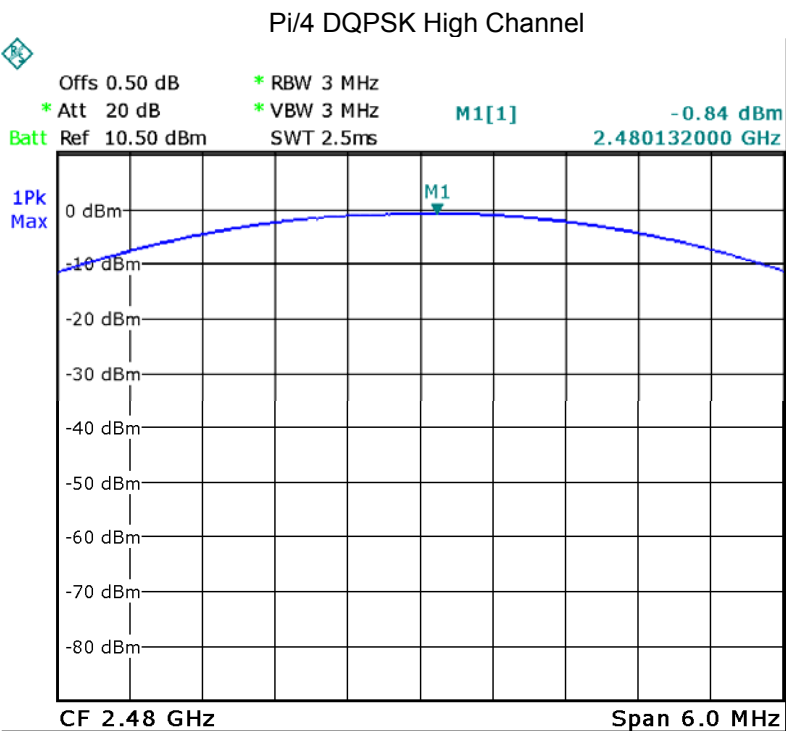
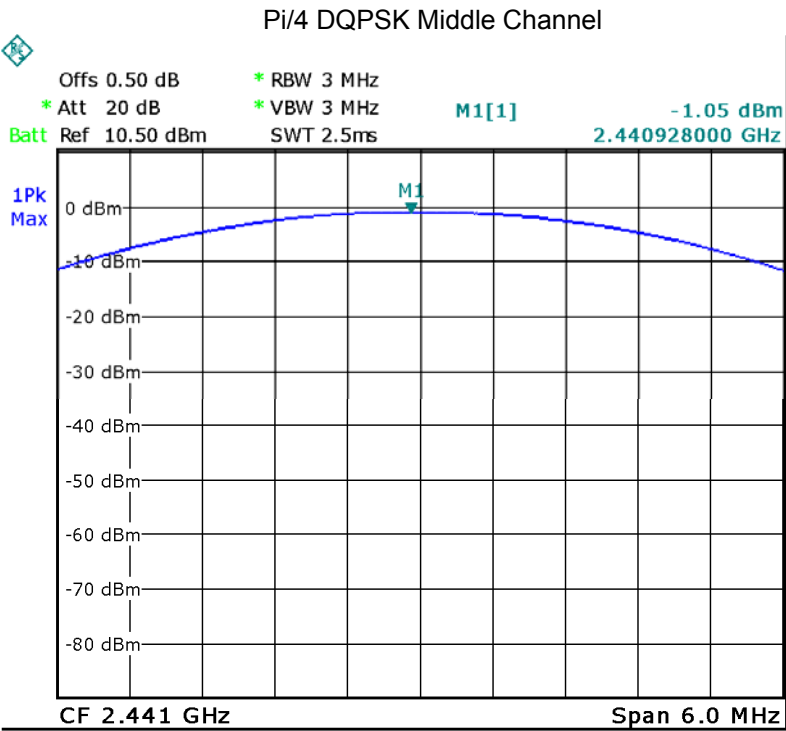
GFSK Low Channel

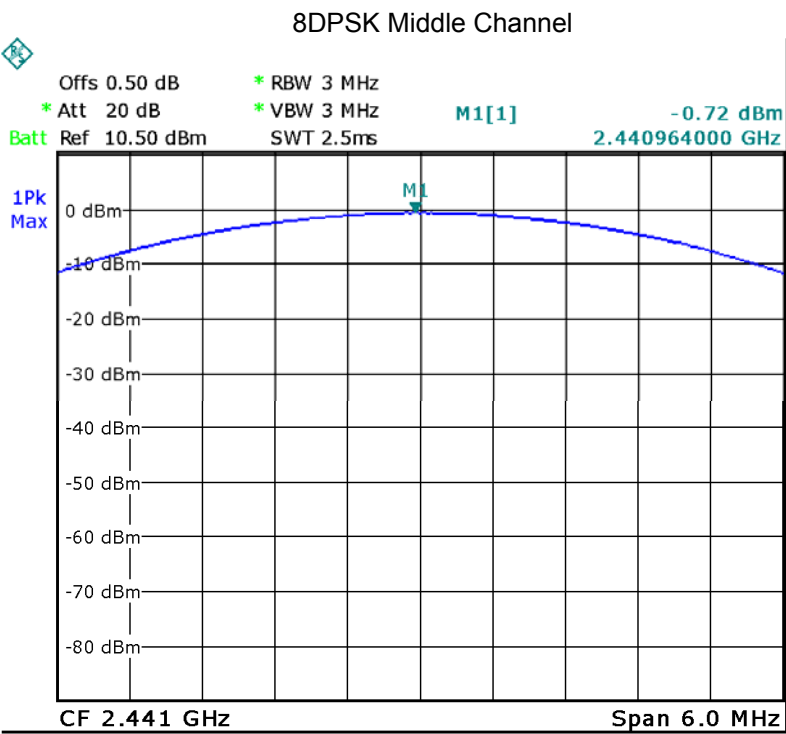
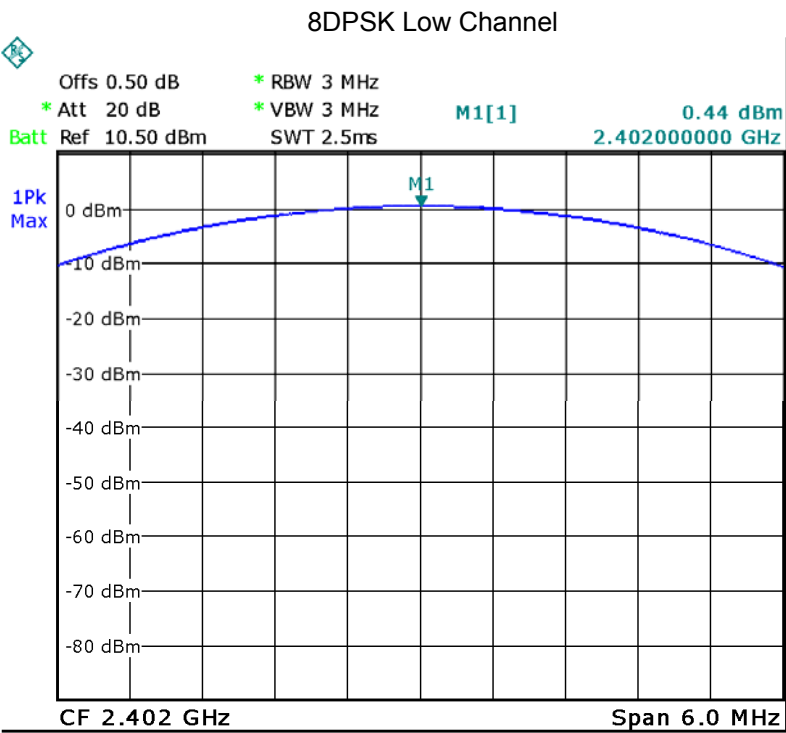


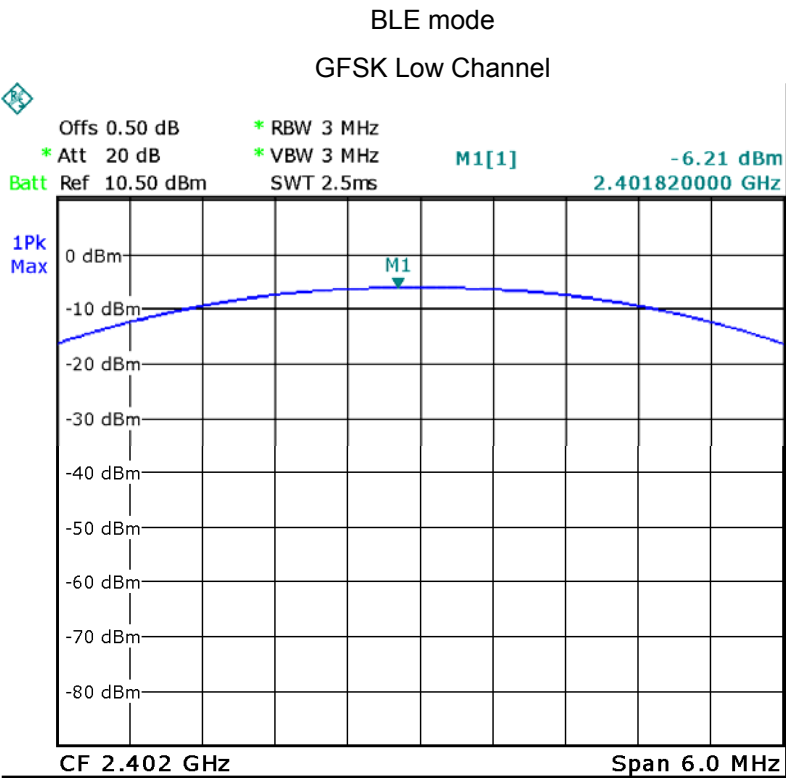
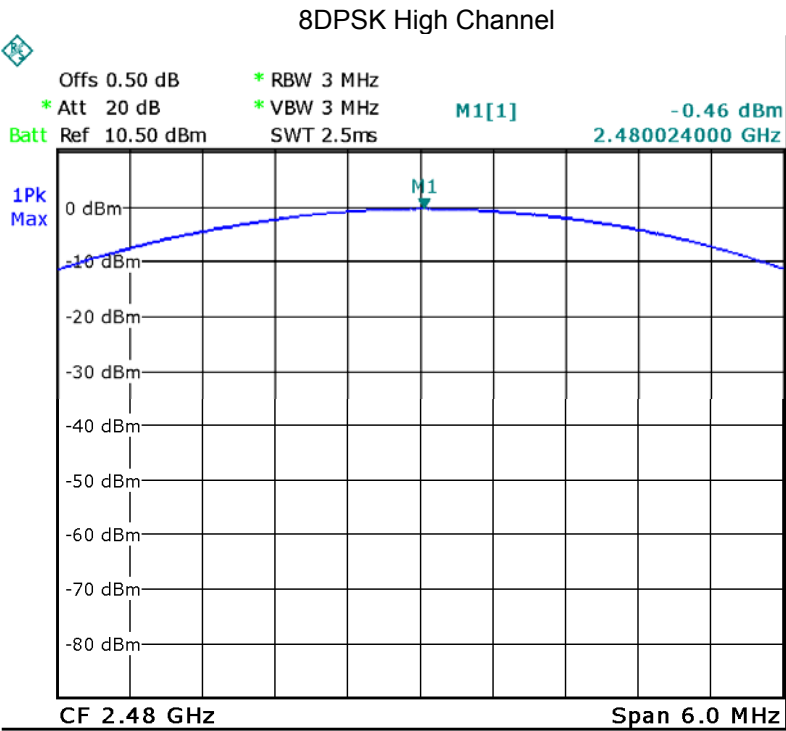
GFSK Middle Channel

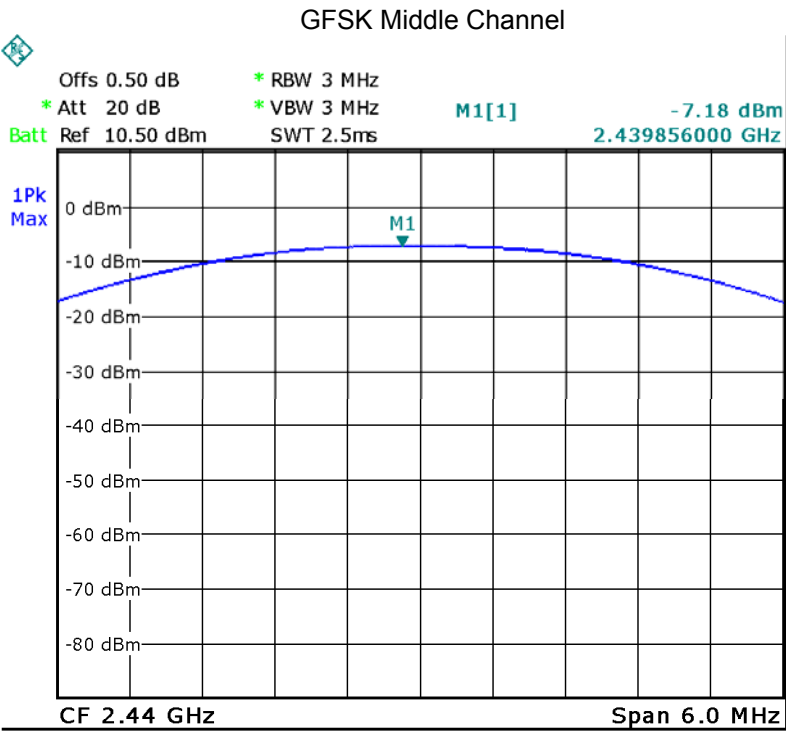














Batt



Ref 10.50 dBm



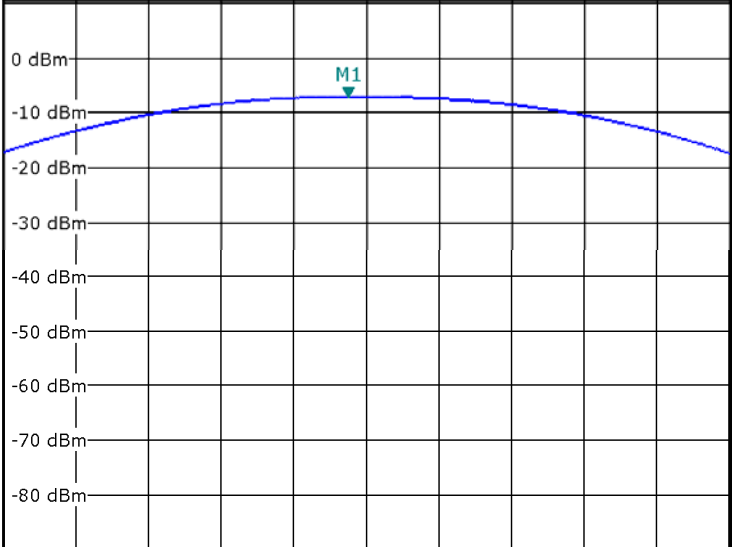
SWT 2.5ms



2.439856000 GHz

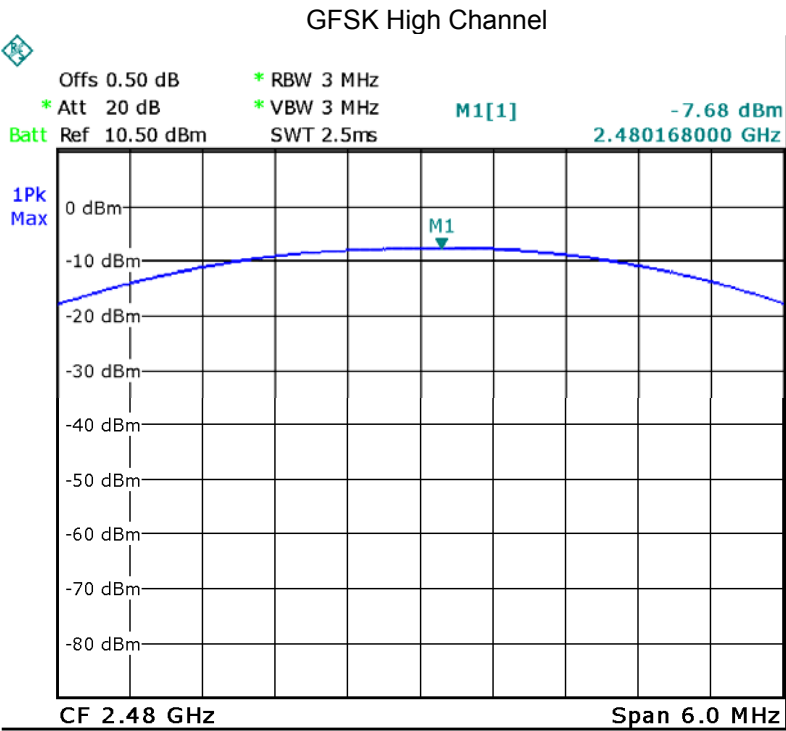
1Pk
Max

0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm



CF 2.44 GHz

Span 6.0 MHz





Batt



Ref 10.50 dBm



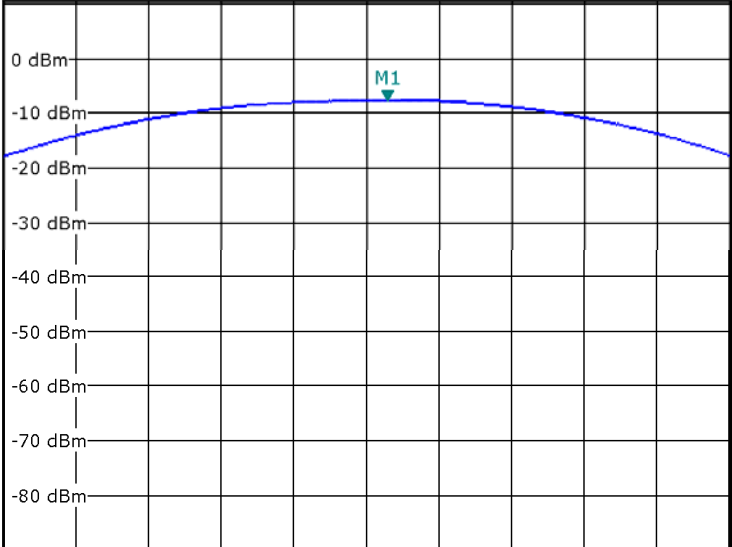
SWT 2.5ms



2.480168000 GHz

1Pk
Max

0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm



CF 2.48 GHz

Span 6.0 MHz

12 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance v03r02 June 5, 2014

12.1 Test Procedure

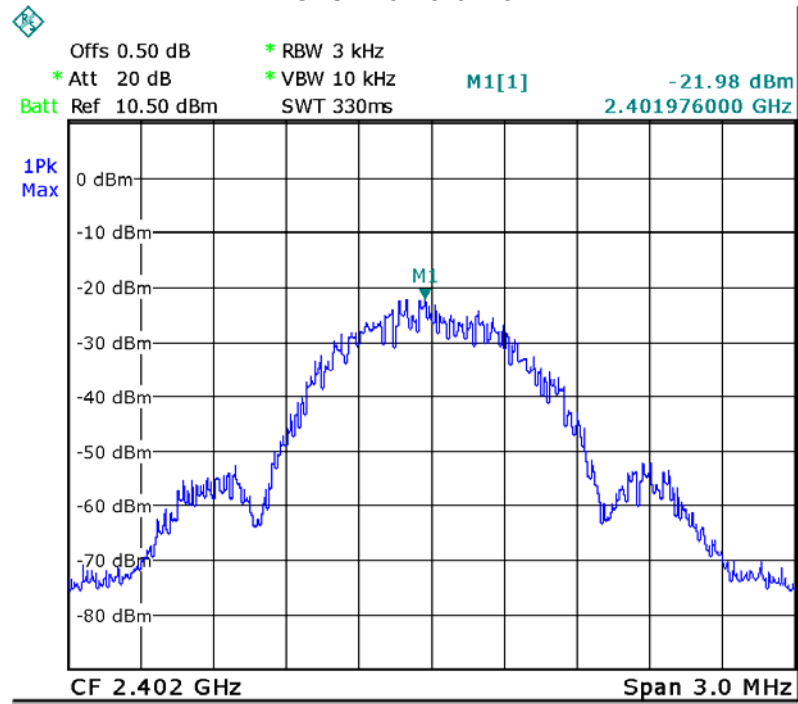
KDB558074 D01 DTS Meas Guidance v03r02 section 9.1 Option 1

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 = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). 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.

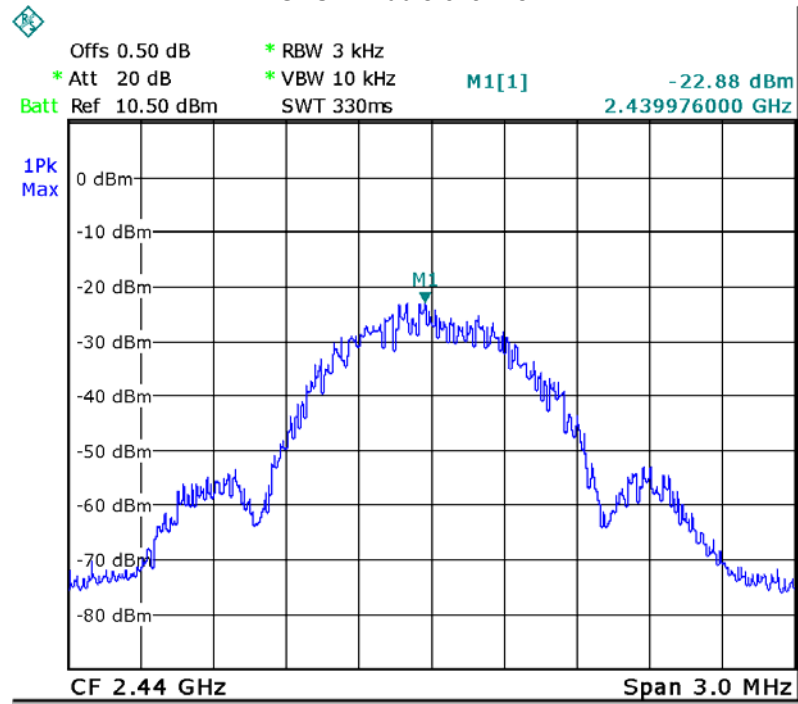
12.2 Test Result

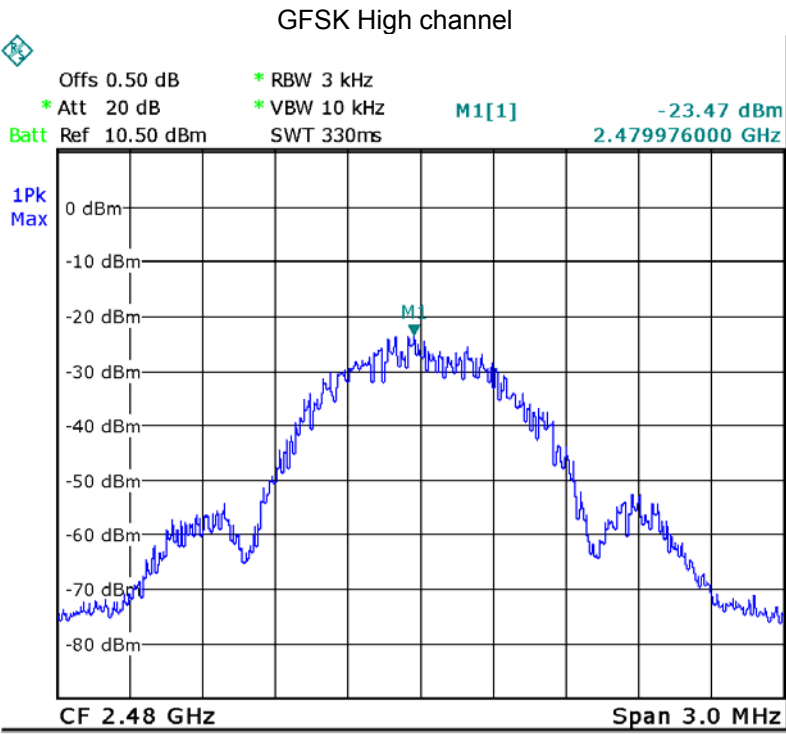
Power Spectral Density		
Low channel	Middle channel	High channel
-21.98	-22.88	-23.47
Limit		
8dBm per 3kHz		

BLE mode
GFSK Low channel



GFSK Middle channel





13 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 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.

13.1 Test Procedure

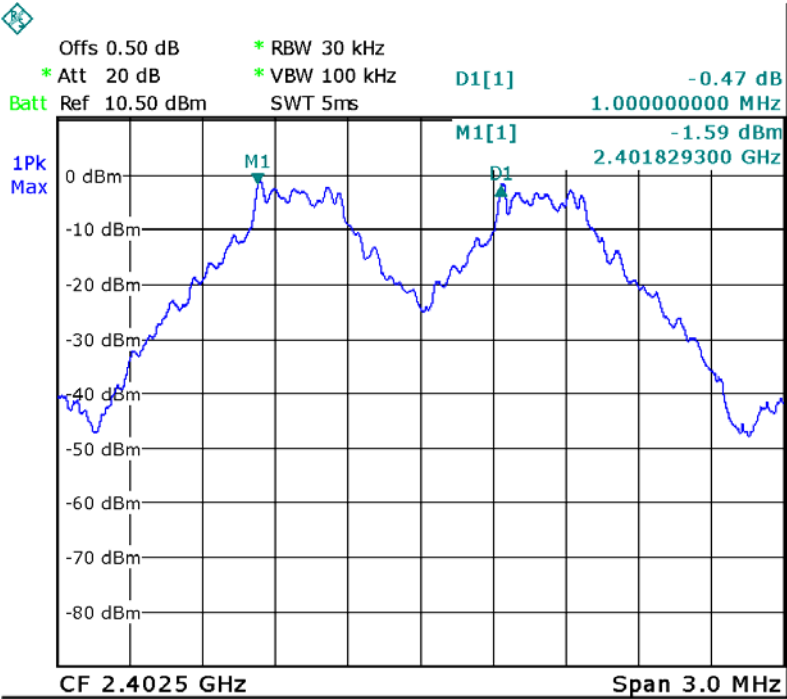
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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.

13.2 Test Result

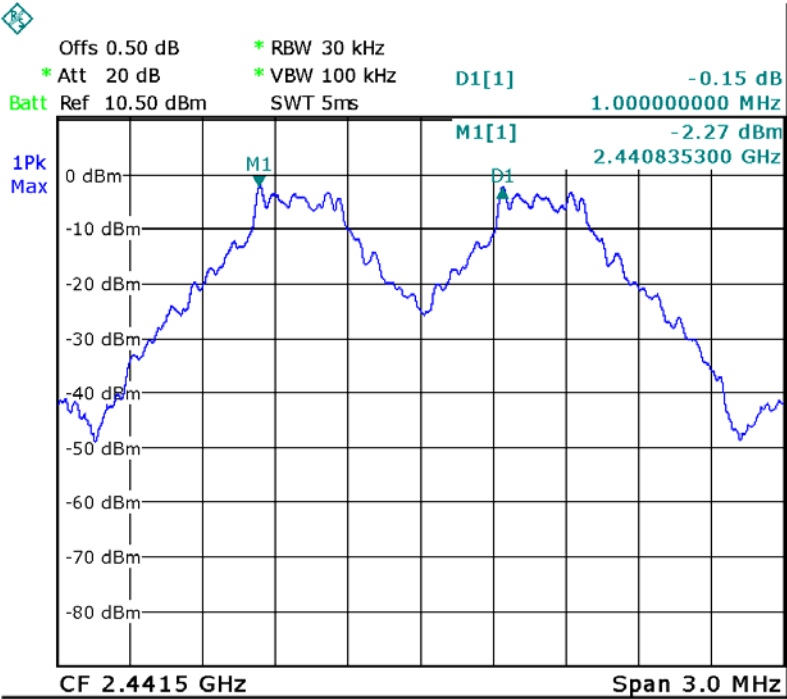
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	1.000	PASS
GFSK	Middle	1.000	PASS
GFSK	High	1.000	PASS
Pi/4 DQPSK	Low	1.000	PASS
Pi/4 DQPSK	Middle	1.000	PASS
Pi/4 DQPSK	High	1.000	PASS
8DPSK	Low	1.000	PASS
8DPSK	Middle	1.000	PASS
8DPSK	High	1.000	PASS

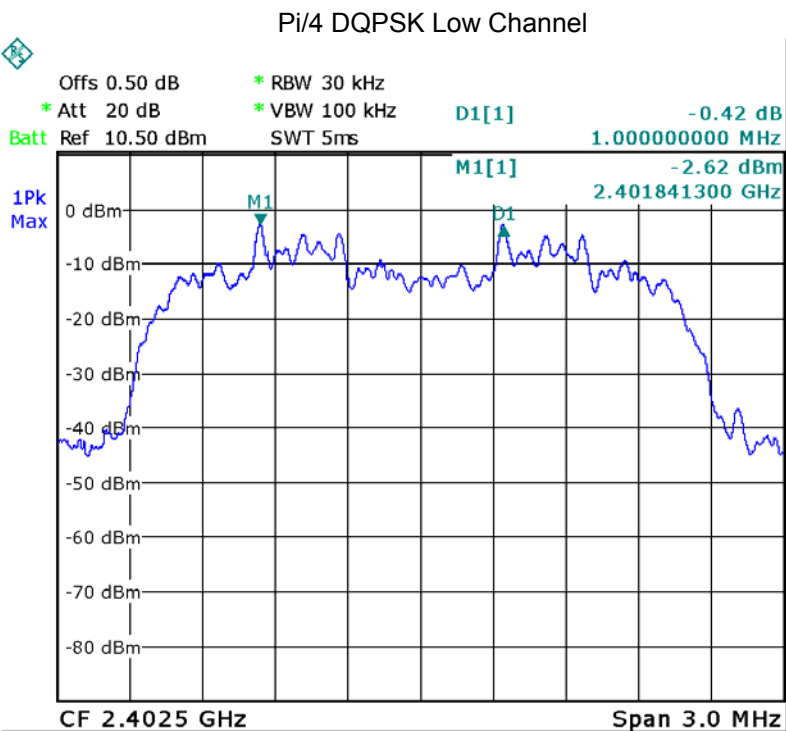
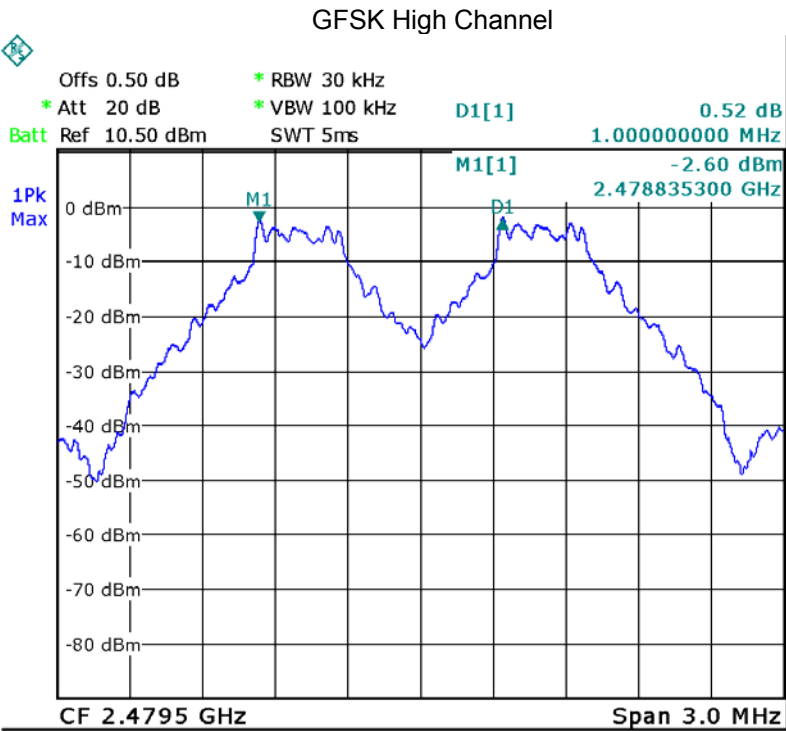
Test plots

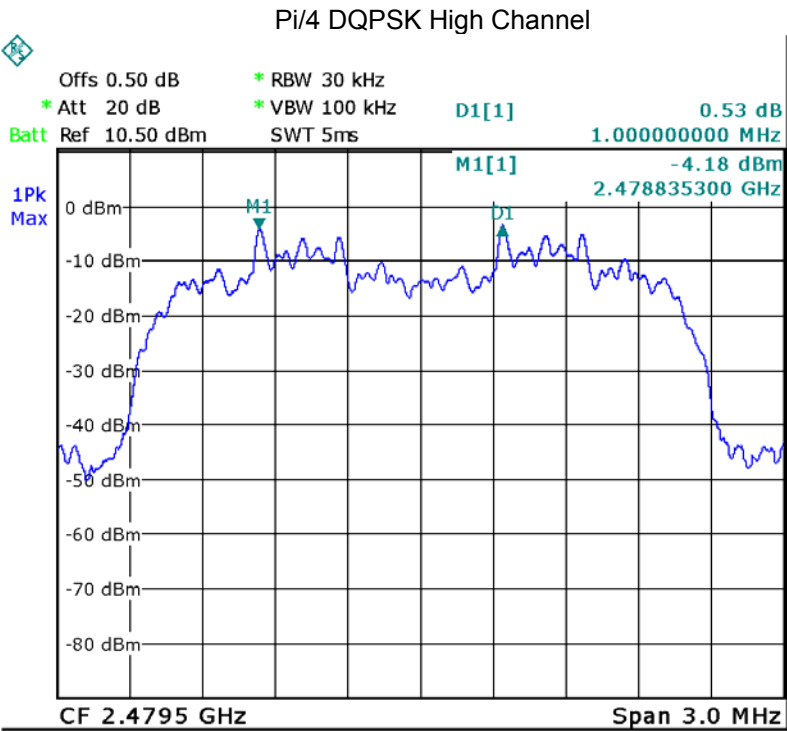
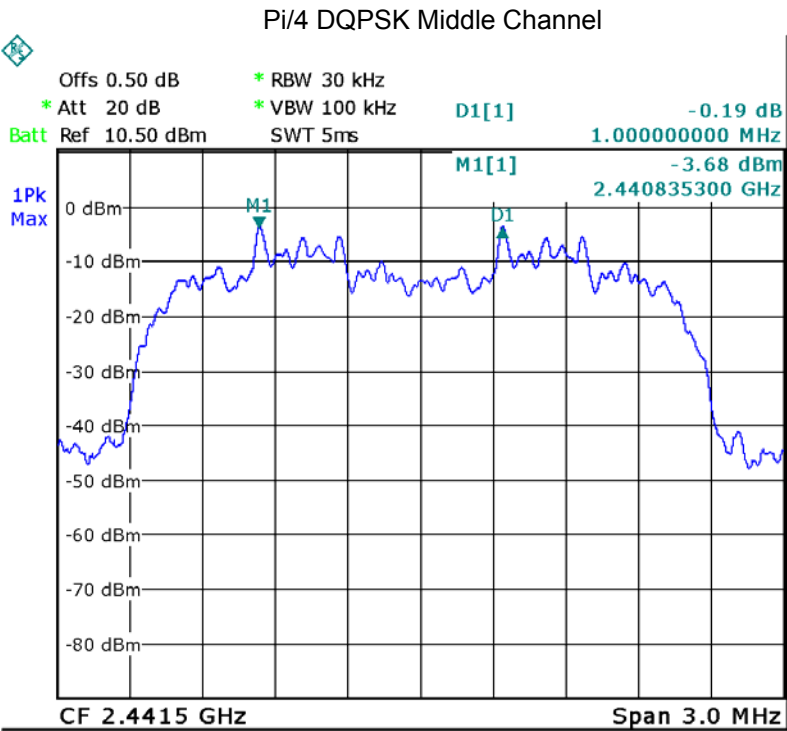
GFSK Low Channel

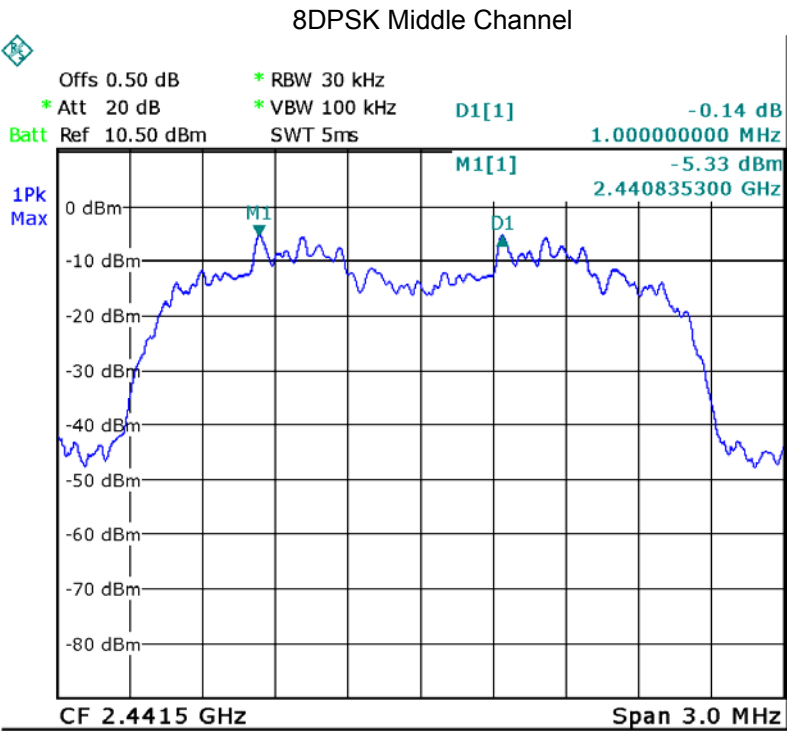
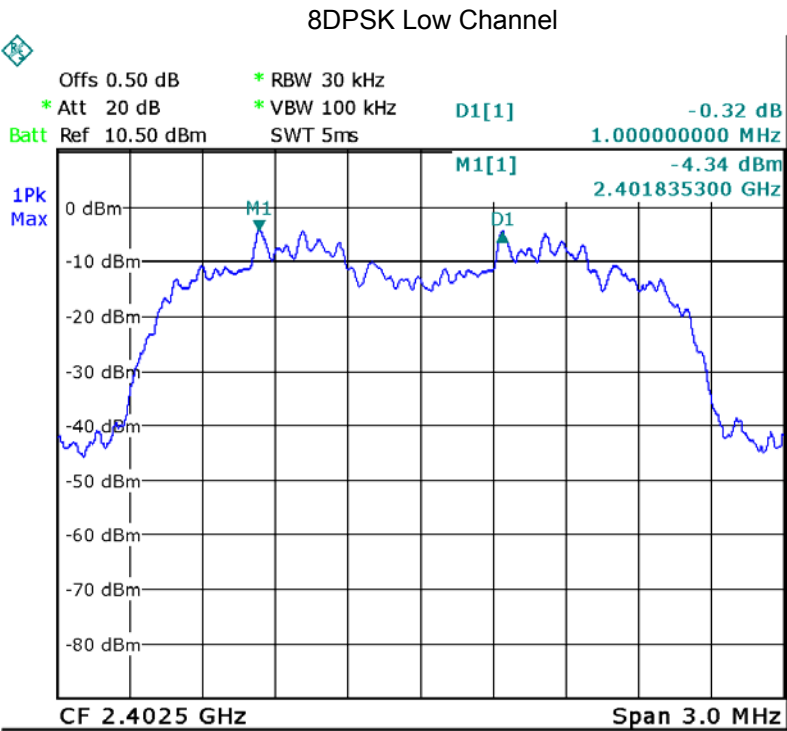


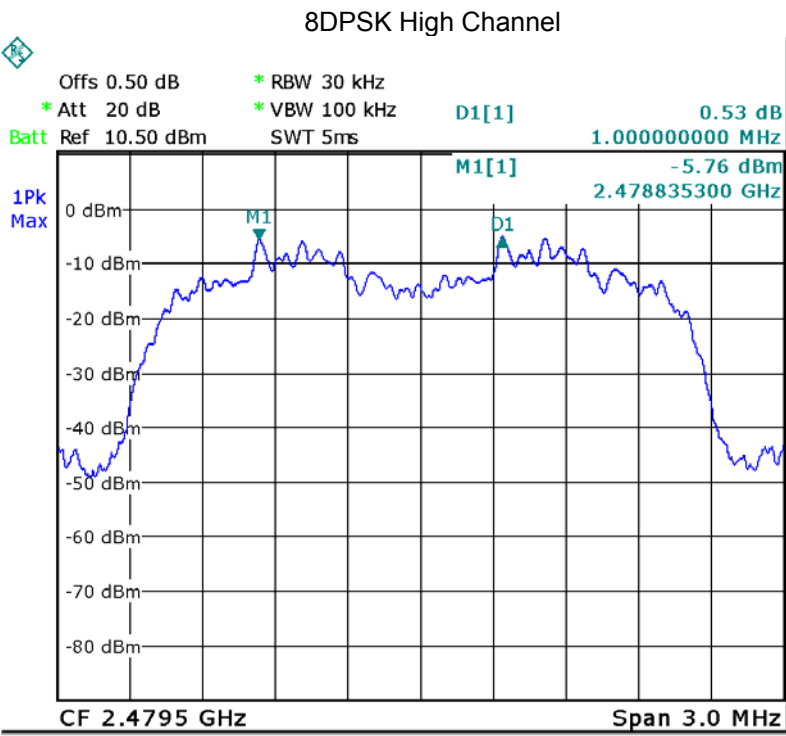
GFSK Middle Channel











14 Number of Hopping Frequency

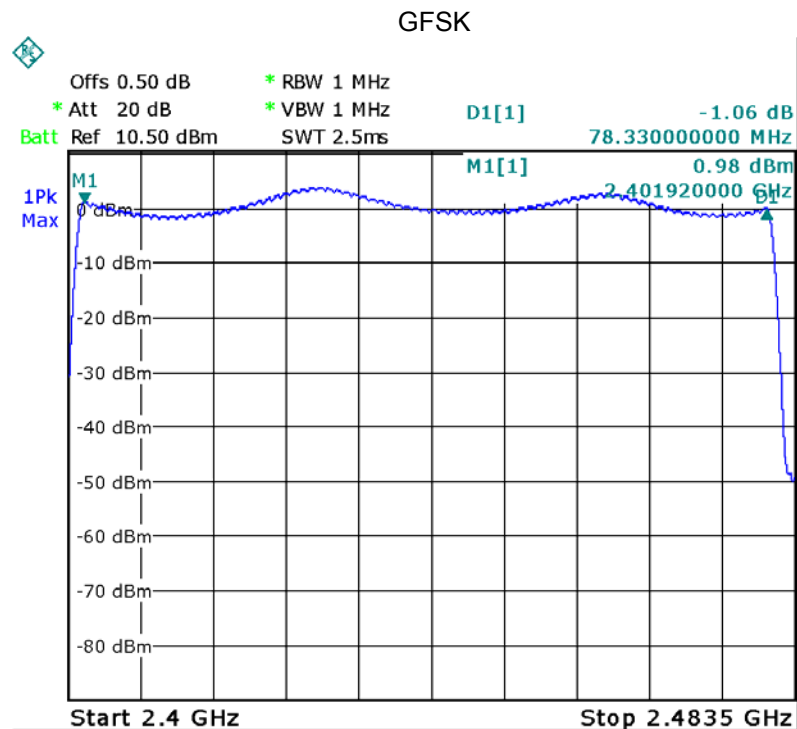
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

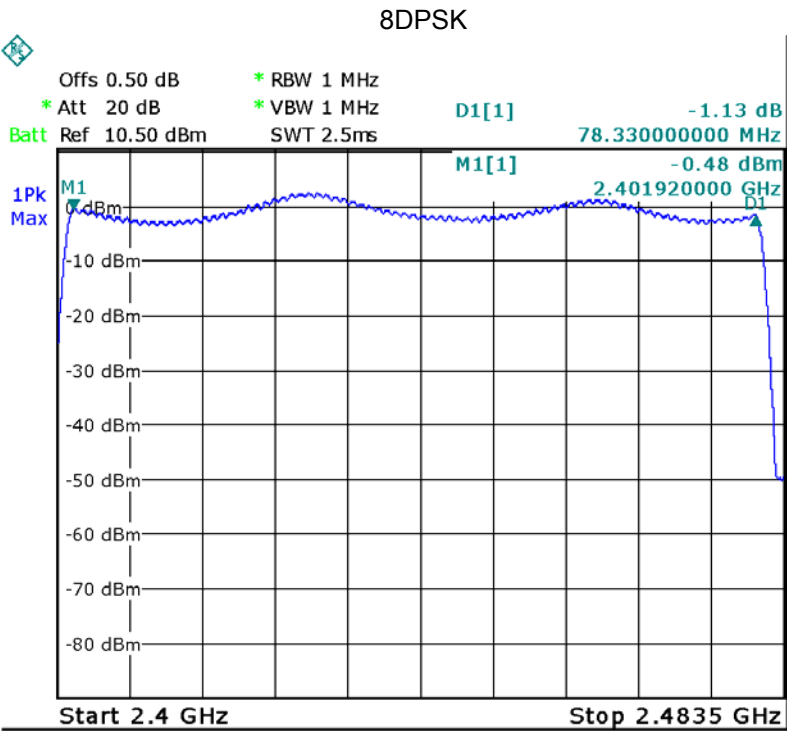
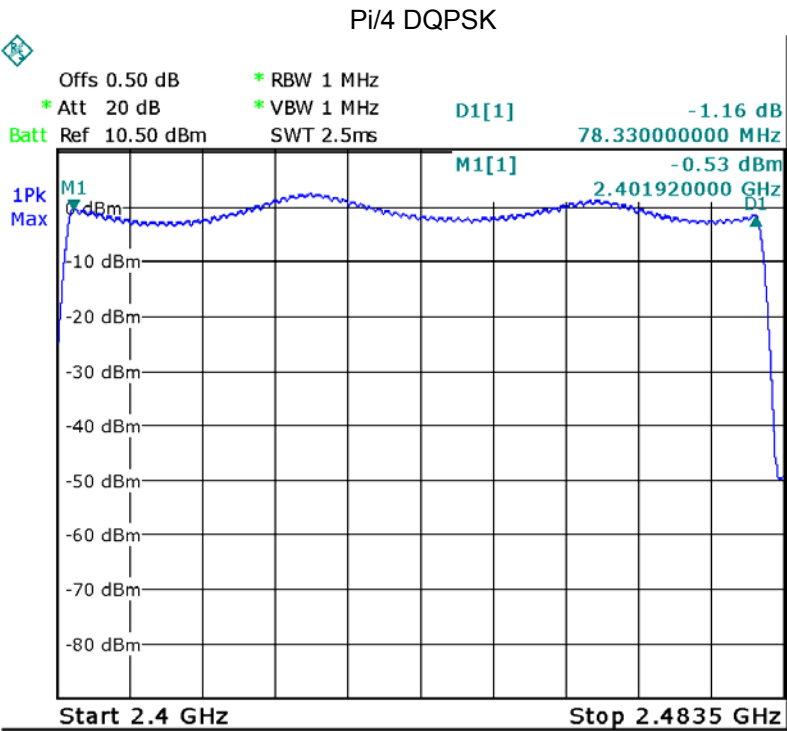
14.1 Test Procedure

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

14.2 Test Result

Test Plots: 79 Channels in total





15 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 transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

15.1 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).

15.2 Test Result

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

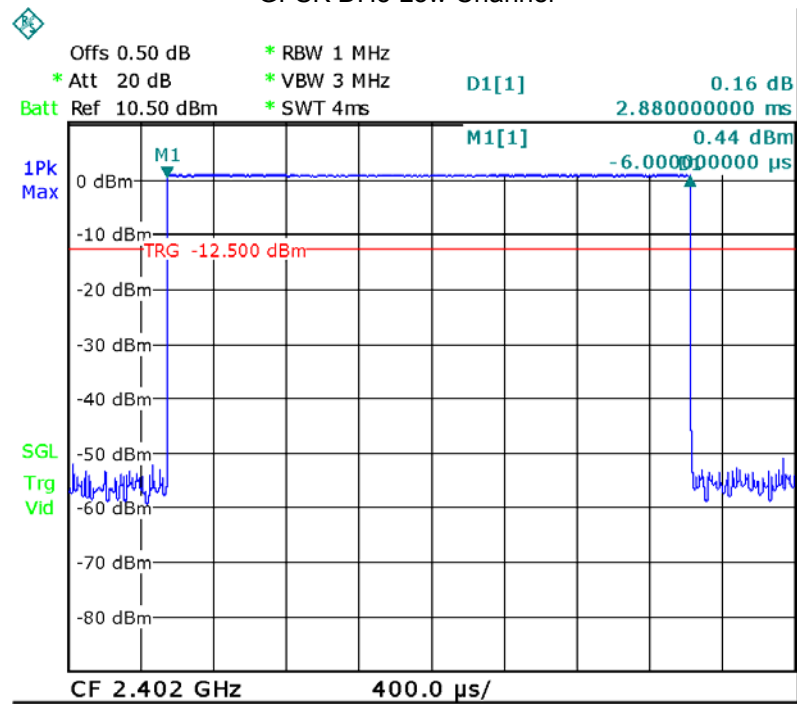
DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

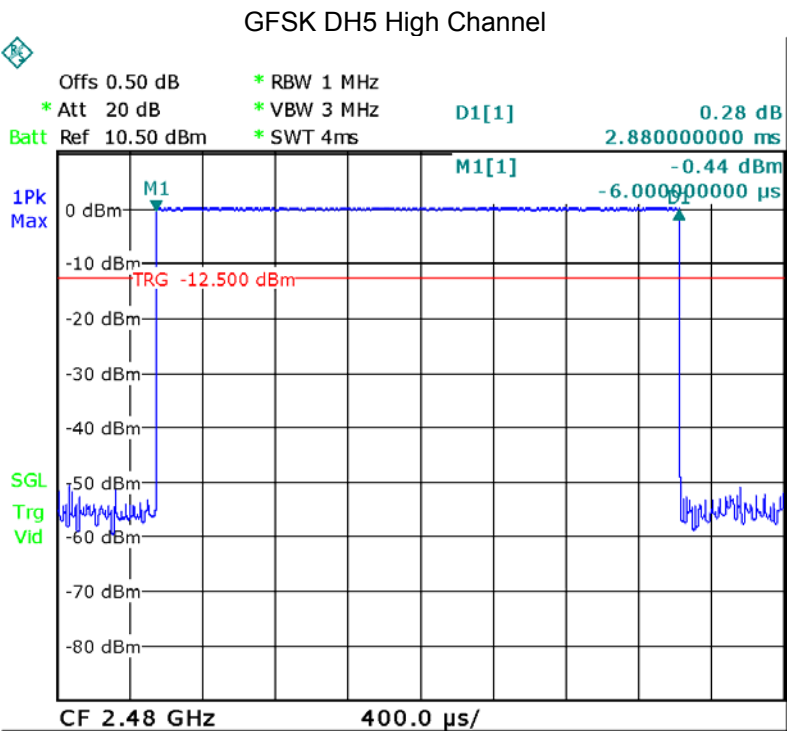
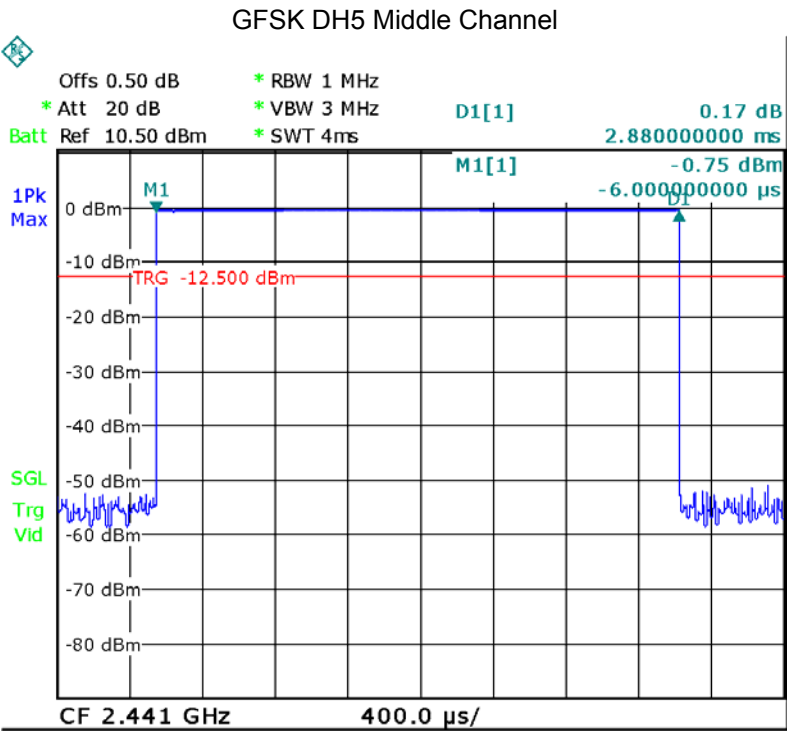
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

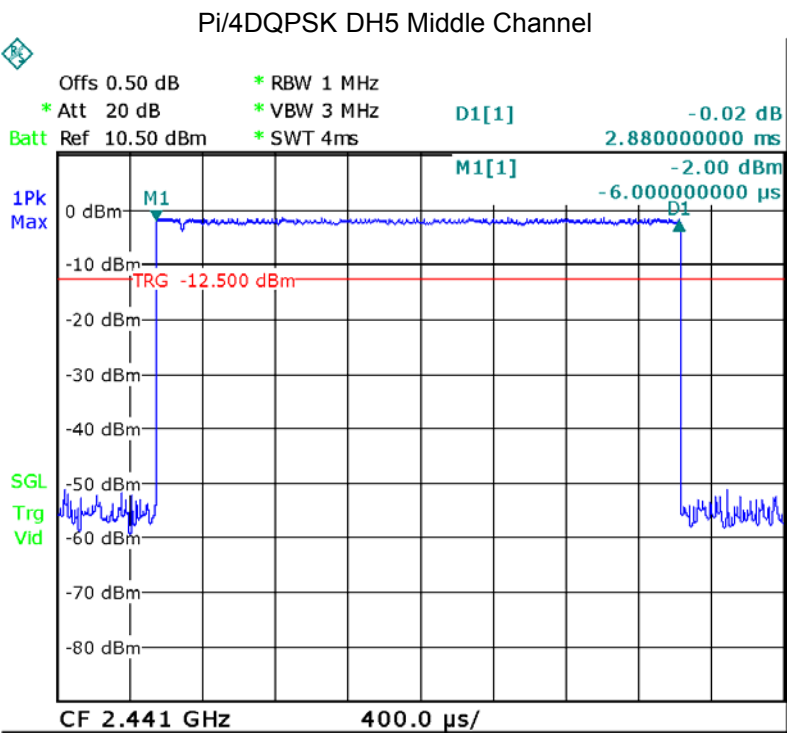
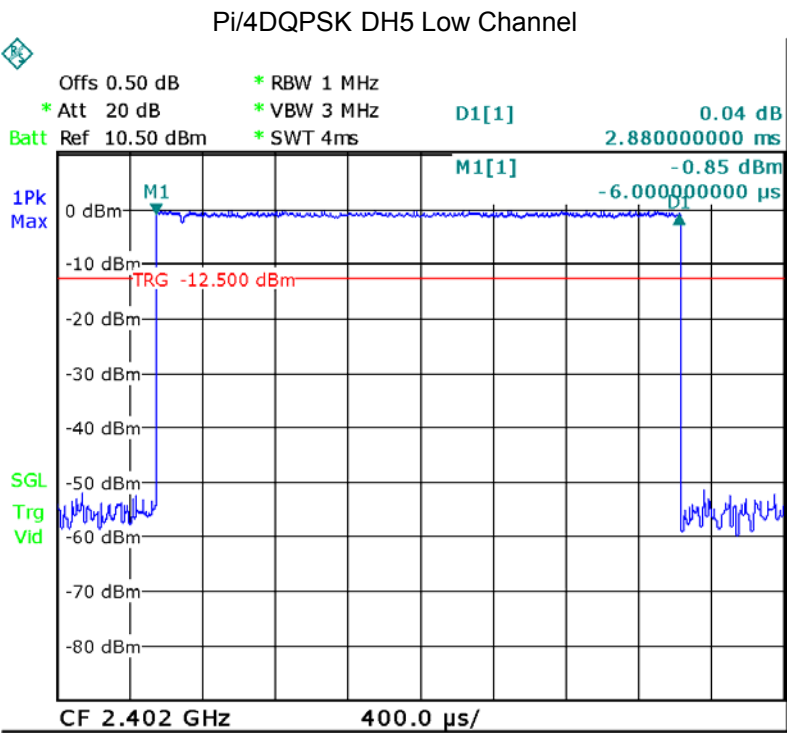
Data Packet	Dwell Time(s)
DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time. Only the worst data(DH5) were show as follow.	

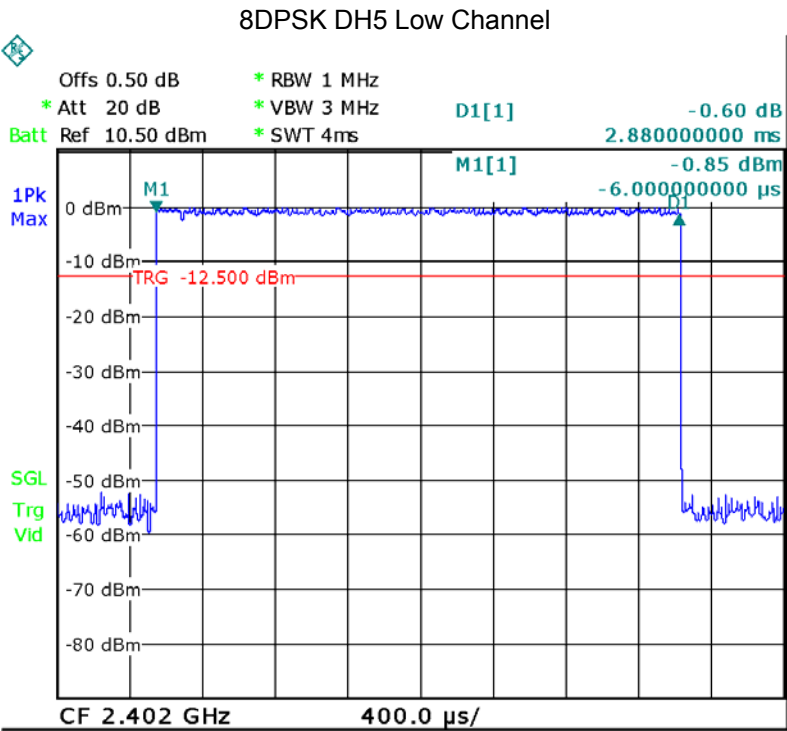
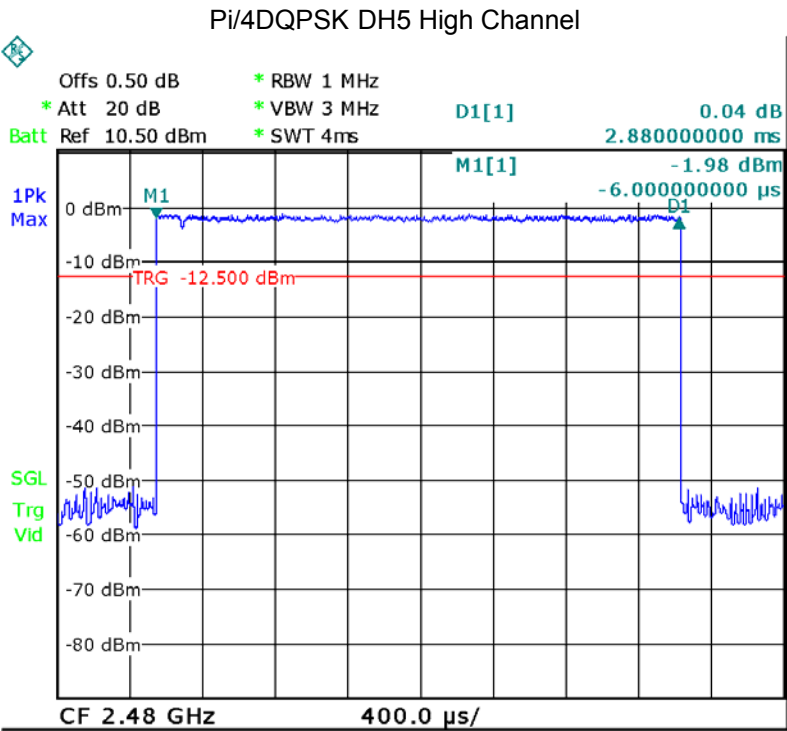
Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.880	0.307	0.4
		middle	2.880	0.307	0.4
		High	2.880	0.307	0.4
Pi/4DQPSK	DH5	Low	2.880	0.307	0.4
		middle	2.880	0.307	0.4
		High	2.880	0.307	0.4
8DPSK	DH5	Low	2.880	0.307	0.4
		middle	2.880	0.307	0.4
		High	2.880	0.307	0.4

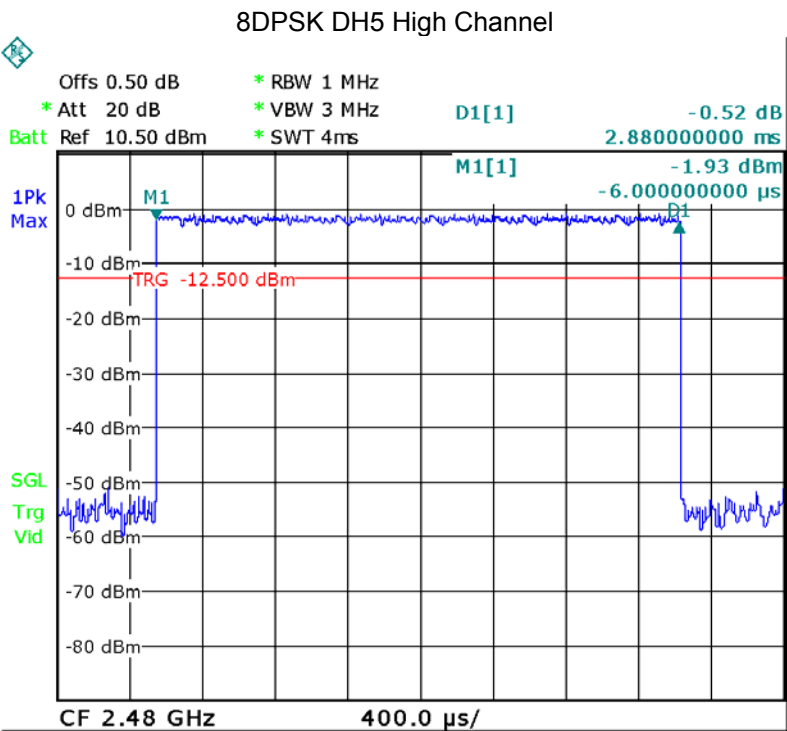
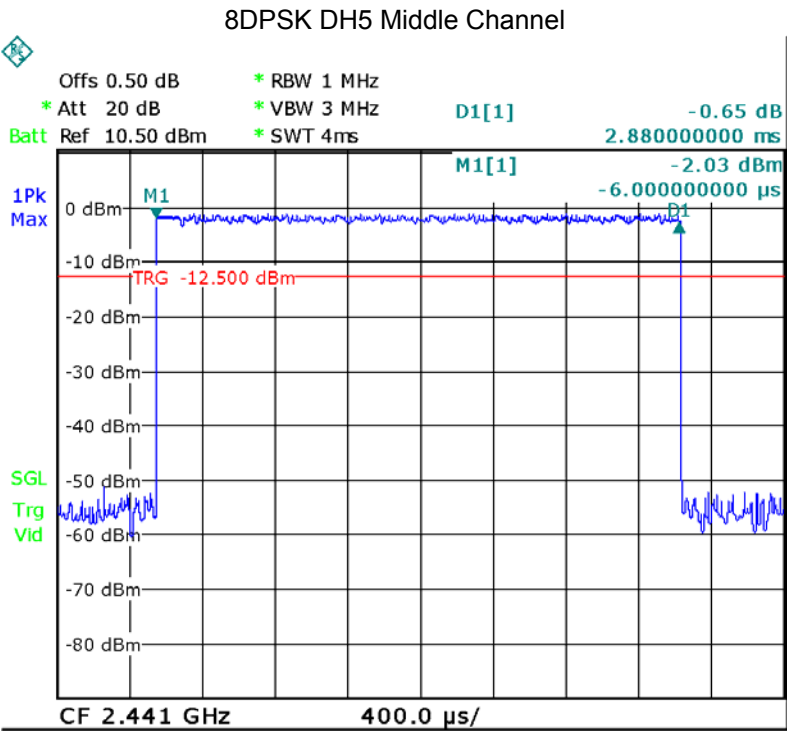
Test Plots
GFSK DH5 Low Channel











16 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.

17 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method 447498 D01 General RF Exposure Guidance v05r02

17.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right] \cdot \left[\sqrt{f(\text{GHz})} \right] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR where}$$

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

17.2 The procedures / limit

Conducted Peak power(dBm)	Conducted Peak power(mW)	Source-based time-averaged maximum conducted output power(mW)	Minimum test separation distance required for the exposure conditions (mm)	SAR Test Exclusion Thresholds(mW)
0.93	1.24	1.24	5	10

Remark: Max. duty factor is 1

Calculation formula: Source-based time-averaged maximum conducted output power(mW) = Conducted peak power(mW) * 1

The minimum test separation distance from extremity is 5mm.

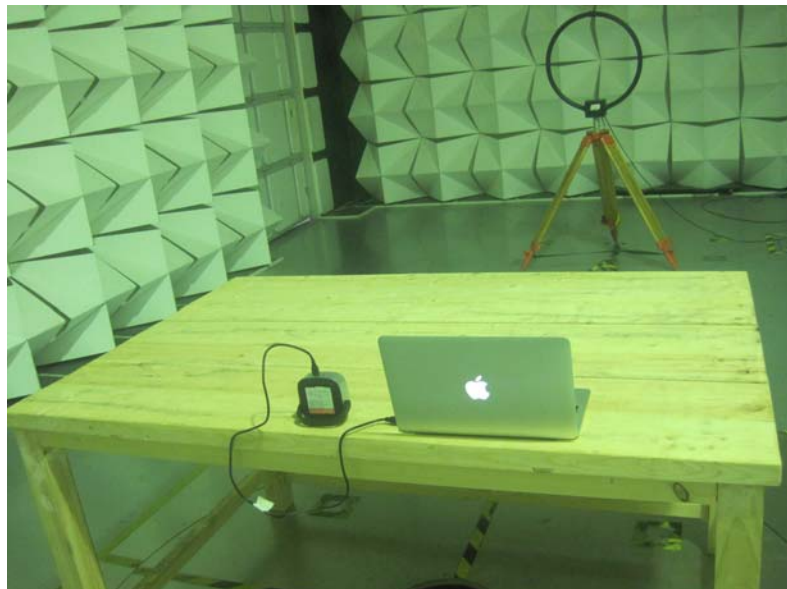
18 Photographs – Model BS1001 Test Setup

18.1 Photograph – Conducted Emission Test Setup at Test Site 1#

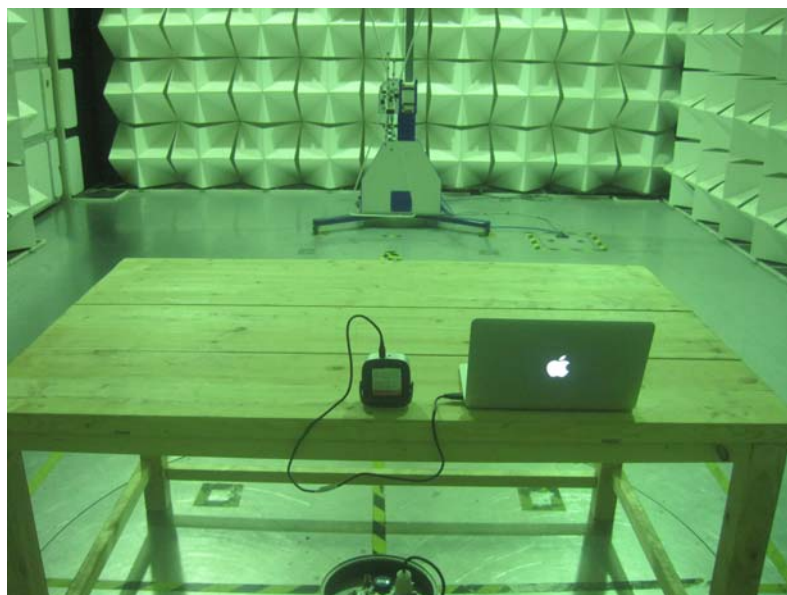


18.2 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz at Test Site 2#



30MHz-1GHz at Test Site 2#



Above 1GHz at Test Site 1#



19 Photographs - Constructional Details

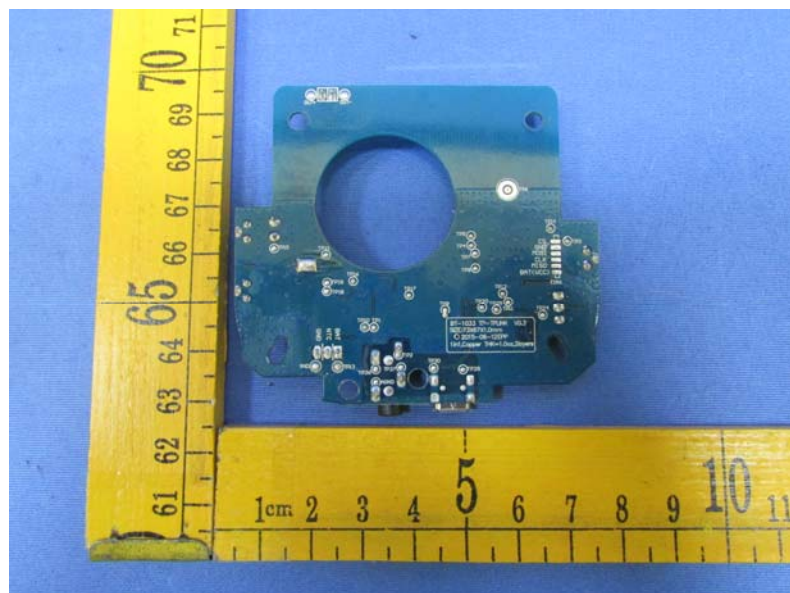
19.1 Model BS1001 External View

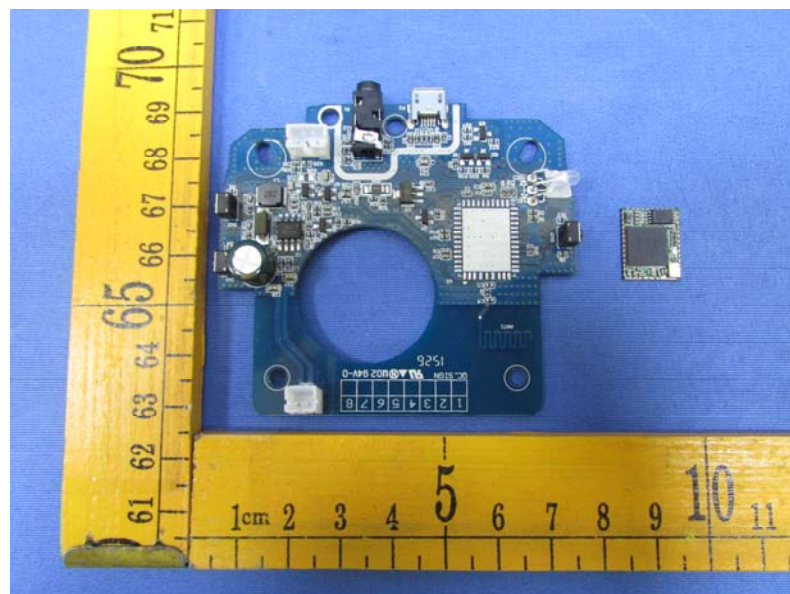
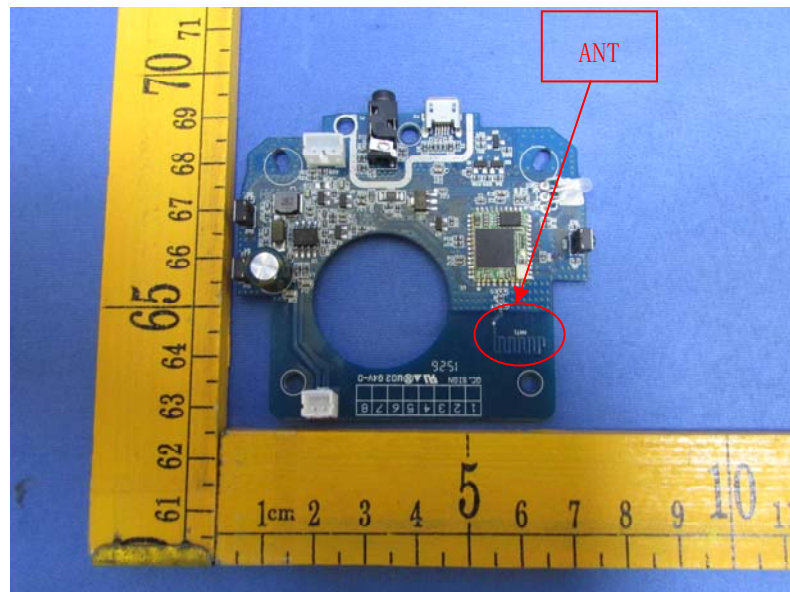


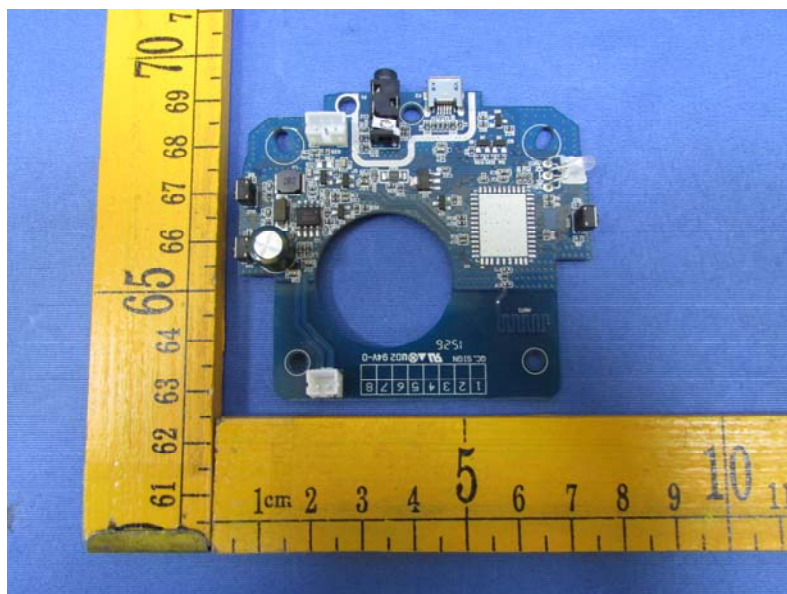




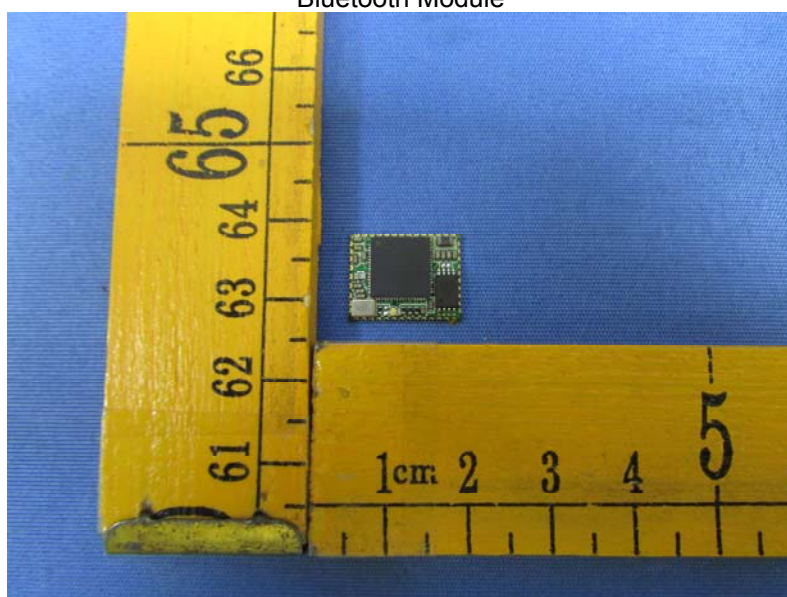
19.2 Model BS1001 Internal View

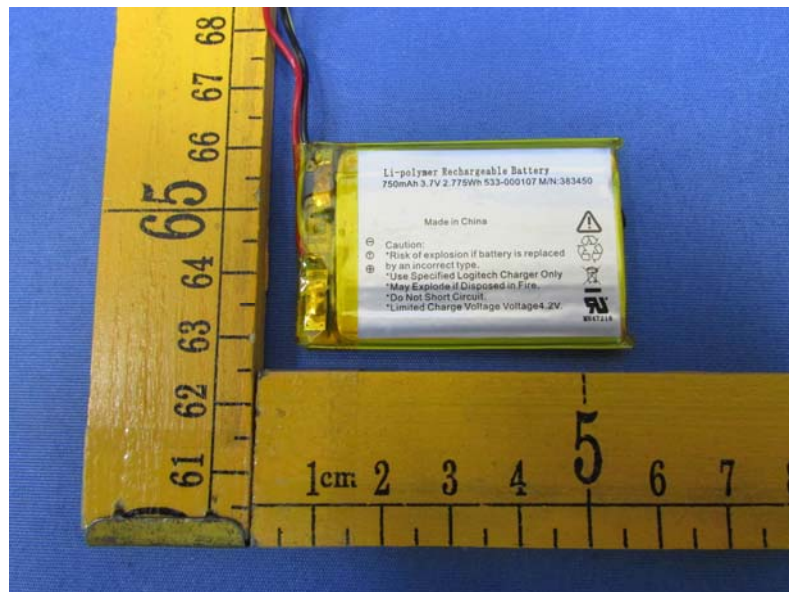
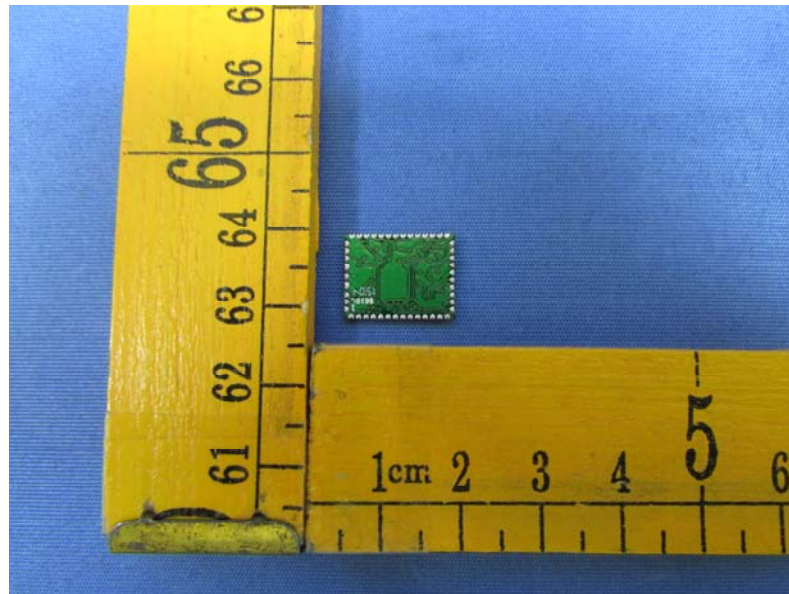


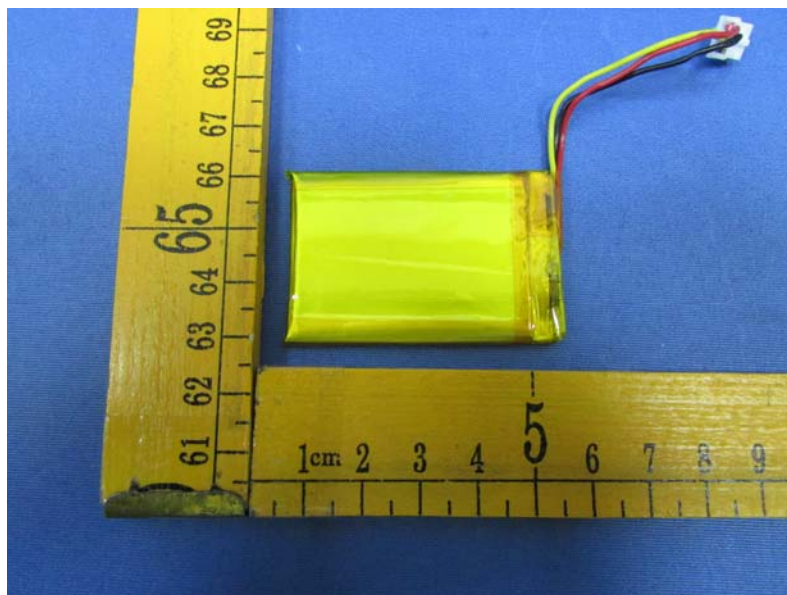




Bluetooth Module







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