

# TEST REPORT

**Reference No.**..... : WTS15S0730535-1E  
**FCC ID** ..... : 2AEE8LAVASTARALPHA  
**Applicant**..... : LAVA INTERNATIONAL (H.K) LIMITED  
**Address**..... : UNIT L 1/F MAU LAM COMM BLDG 16-18 MAU LAM ST, JORDAN  
KL, HK  
**Manufacturer** ..... : The same as above  
**Address**..... : The same as above  
**Product Name**..... : Mobile Phone  
**Model No**..... : Star Alpha  
**Brand**..... : LAVA  
**Standards**..... : FCC CFR47 Part 15 Section 15.247:2014  
**Date of Receipt sample** .... : Jul. 24, 2015  
**Date of Test** ..... : Jul. 25, 2015 – Aug. 12, 2015  
**Date of Issue**..... : Aug.12, 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:**

**Waltek Services (Shenzhen) Co., Ltd.**

Address: 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
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious emissions	15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	Complies
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

### 3 Contents

	<b>Page</b>
<b>1 COVER PAGE.....</b>	<b>1</b>
<b>2 TEST SUMMARY .....</b>	<b>2</b>
<b>3 CONTENTS .....</b>	<b>3</b>
<b>4 GENERAL INFORMATION.....</b>	<b>5</b>
4.1 GENERAL DESCRIPTION OF E.U.T. ....	5
4.2 DETAILS OF E.U.T. ....	5
4.3 CHANNEL LIST.....	7
4.4 TEST MODE .....	8
4.5 TEST FACILITY.....	8
<b>5 EQUIPMENT USED DURING TEST .....</b>	<b>9</b>
5.1 EQUIPMENTS LIST .....	9
5.2 DESCRIPTION OF SUPPORT UNITS .....	10
5.3 MEASUREMENT UNCERTAINTY .....	10
5.4 TEST EQUIPMENT CALIBRATION .....	10
<b>6 CONDUCTED EMISSION .....</b>	<b>11</b>
6.1 E.U.T. OPERATION .....	11
6.2 EUT SETUP.....	11
6.3 MEASUREMENT DESCRIPTION .....	11
6.4 CONDUCTED EMISSION TEST RESULT .....	12
<b>7 RADIATED SPURIOUS EMISSIONS.....</b>	<b>14</b>
7.1 EUT OPERATION.....	14
7.2 TEST SETUP .....	15
7.3 SPECTRUM ANALYZER SETUP .....	16
7.4 TEST PROCEDURE .....	17
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION .....	17
7.6 SUMMARY OF TEST RESULTS .....	18
<b>8 CONDUCTED SPURIOUS EMISSIONS.....</b>	<b>21</b>
8.1 TEST PROCEDURE .....	21
8.2 TEST RESULT .....	22
<b>9 BAND EDGE MEASUREMENT .....</b>	<b>27</b>
9.1 TEST PROCEDURE .....	27
9.2 TEST RESULT .....	28
<b>10 20 DB BANDWIDTH MEASUREMENT .....</b>	<b>34</b>
10.1 TEST PROCEDURE.....	34
10.2 TEST RESULT .....	34
<b>11 MAXIMUM PEAK OUTPUT POWER .....</b>	<b>40</b>
11.1 TEST PROCEDURE.....	40
11.2 TEST RESULT .....	40
<b>12 HOPPING CHANNEL SEPARATION .....</b>	<b>46</b>
12.1 TEST PROCEDURE.....	46
12.2 TEST RESULT .....	46
<b>13 NUMBER OF HOPPING FREQUENCY.....</b>	<b>52</b>
13.1 TEST PROCEDURE.....	52
13.2 TEST RESULT .....	52

<b>14</b>	<b>DWELL TIME .....</b>	<b>54</b>
14.1	TEST PROCEDURE.....	54
14.2	TEST RESULT .....	54
<b>15</b>	<b>ANTENNA REQUIREMENT .....</b>	<b>60</b>
<b>16</b>	<b>RF EXPOSURE.....</b>	<b>61</b>

## 4 General Information

### 4.1 General Description of E.U.T.

Product Name	: Mobile Phone
Model No.	: Star Alpha
Model Description	: N/A
GSM Band(s)	: GSM 850/900/1800/1900MHz
GPRS/EGPRS Class	: 12
WCDMA Band(s)	: FDD Band I/II/V
Wi-Fi Specification	: 802.11b/g/n HT20/n HT40
Bluetooth Version	: Bluetooth v4.0 with BLE
GPS	: Support
NFC	: N/A
Hardware Version	: V2.0
Software Version	: LAVA_Star_Alpha_S102_20150721

### 4.2 Details of E.U.T.

Operation Frequency	: GSM/GPRS/EGPRS 850: 824~849MHz PCS/GPRS/EGPRS1900: 1850~1910MHz WCDMA Band II: 1850-1910MHz WCDMA Band V: 824~849MHz WiFi: 802.11b/g/n HT20: 2412-2462MHz 802.11n HT40: 2422-2452MHz Bluetooth: 2402-2480MHz
Max. RF output power	: GSM 850: 32.51dBm EGPRS 850: 27.02dBm PCS1900:29.88dBm EGPRS 1900:26.05dBm WCDMA Band II: 22.81dBm WCDMA Band V: 22.68dBm WiFi: 9.44dBm Bluetooth: 3.29dBm
Type of Modulation	: GSM,GPRS: GMSK EGPRS: GMSK, 8PSK WCDMA: BPSK WiFi: CCK, OFDM Bluetooth: GFSK, Pi/4 DQPSK,8DPSK

Antenna installation	: GSM/WCDMA: internal permanent antenna WiFi/Bluetooth: internal permanent antenna
Antenna Gain	: GSM 850: 1.1dBi PCS1900: 1.1dBi WCDMA Band II: 1.2dBi WCDMA Band V: 1.2dBi WiFi: 1.2dBi Bluetooth: 1.2dBi
Technical Data	: Battery DC 3.8V, 2500mAh DC 5V, 1A, Charging form adapter Adapter Input: 100-300V~50/60Hz, 0.15A
Adapter	:: Manufacture: LAVA Model No.: CLV-14

### 4.3 Channel List

Normal

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 number 7760A, July 12, 2012.

- **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

<b>Conducted Emissions Test Site 1#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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
<b>Conducted Emissions Test Site 2#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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
<b>3m Semi-anechoic Chamber for Radiation Emissions Test site 1#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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.18,2015	Apr.17,2016
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.18,2015	Apr.17,2016
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.18,2015	Apr.17,2016
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.09,2015	Apr.08,2016
<b>3m Semi-anechoic Chamber for Radiation Emissions Test site 2#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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.
/	/	/	/

## 5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	$\pm 1.0$ dB
RF Power Density	$\pm 2.2$ dB
Radiated Spurious Emissions test	$\pm 5.03$ dB (Bilog antenna 30M~1000MHz)
	$\pm 5.47$ dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	$\pm 3.64$ 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 C63.4:2009
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

### 6.1 E.U.T. Operation

Operating Environment :

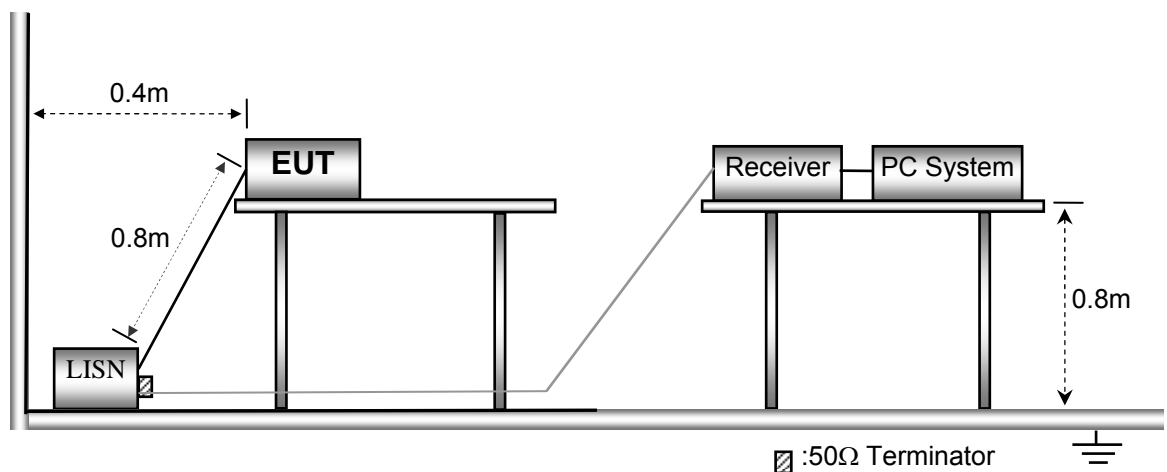
Temperature:	22.8 °C
Humidity:	52.6 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

The test was performed in BT link 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 C63.4:2009.

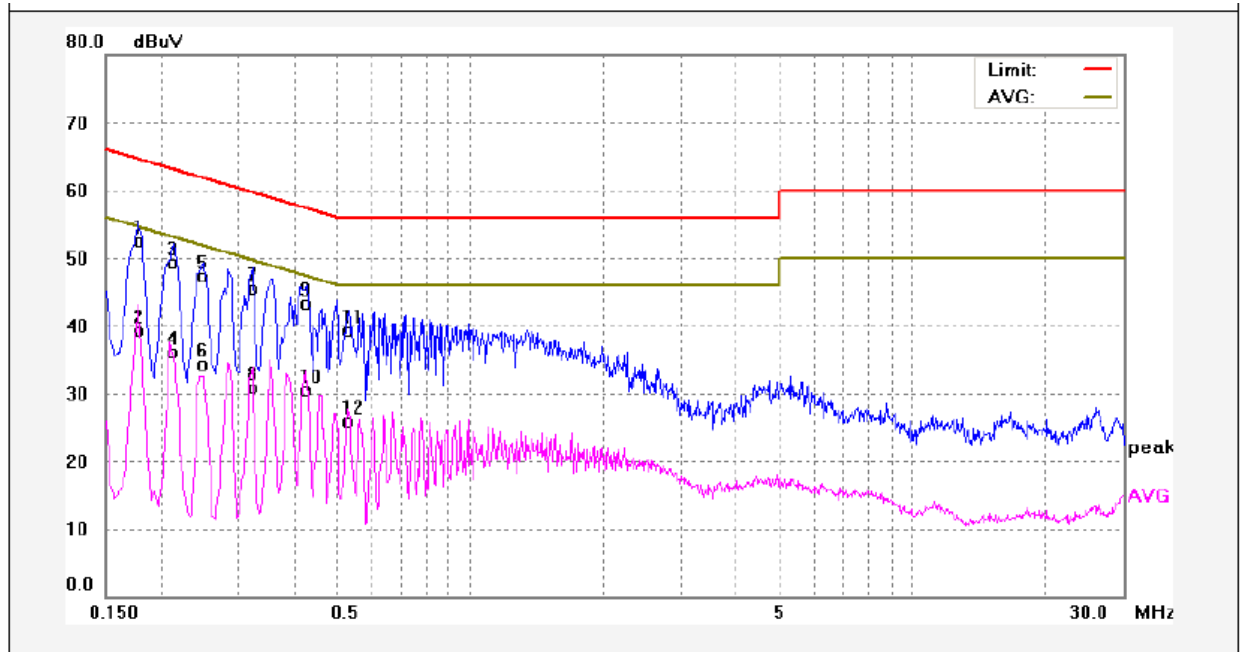


### 6.3 Measurement Description

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.

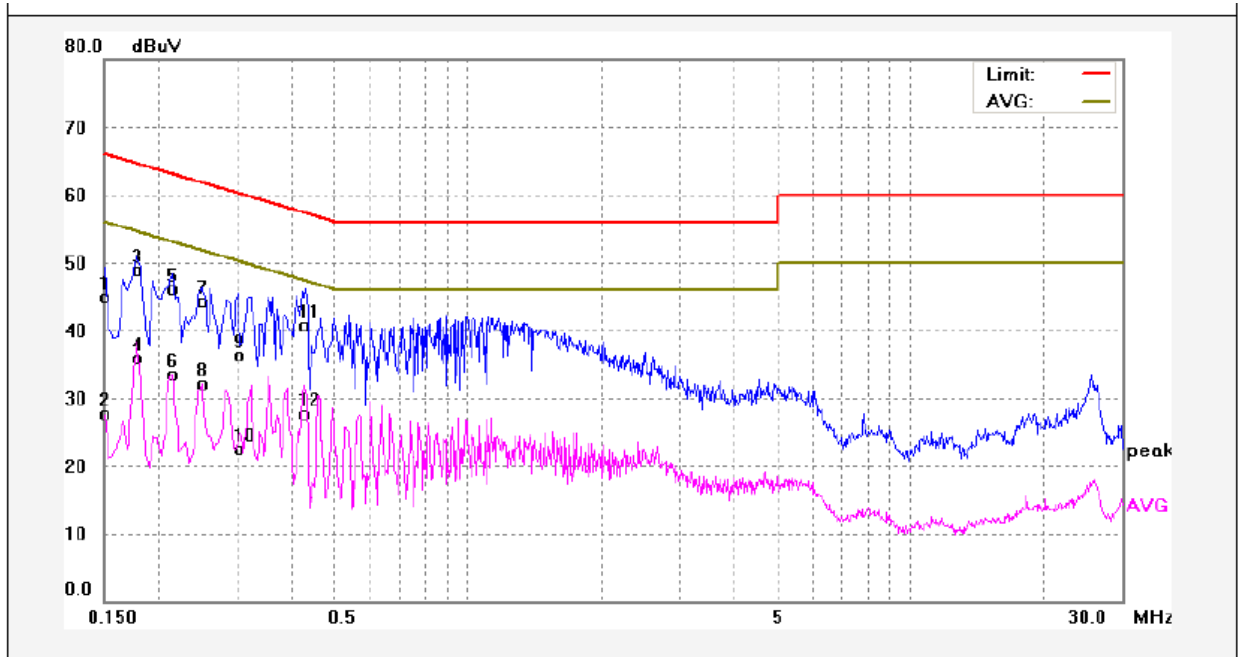
### 6.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1780	42.28	10.14	52.42	64.57	-12.15	QP	
2	0.1780	29.10	10.14	39.24	54.57	-15.33	AVG	
3	0.2140	39.10	10.15	49.25	63.04	-13.79	QP	
4	0.2140	26.02	10.15	36.17	53.04	-16.87	AVG	
5	0.2500	37.08	10.16	47.24	61.75	-14.51	QP	
6	0.2500	24.06	10.16	34.22	51.75	-17.53	AVG	
7	0.3220	35.27	10.17	45.44	59.65	-14.21	QP	
8	0.3220	20.69	10.17	30.86	49.65	-18.79	AVG	
9	0.4300	33.17	10.18	43.35	57.25	-13.90	QP	
10	0.4300	20.40	10.18	30.58	47.25	-16.67	AVG	
11	0.5340	29.20	10.19	39.39	56.00	-16.61	QP	
12	0.5340	15.77	10.19	25.96	46.00	-20.04	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	34.84	10.13	44.97	65.99	-21.02	QP	
2	0.1500	17.50	10.13	27.63	55.99	-28.36	AVG	
3	0.1780	38.82	10.14	48.96	64.57	-15.61	QP	
4	0.1780	25.86	10.14	36.00	54.57	-18.57	AVG	
5	0.2140	36.05	10.15	46.20	63.04	-16.84	QP	
6	0.2140	23.33	10.15	33.48	53.04	-19.56	AVG	
7	0.2500	34.08	10.16	44.24	61.75	-17.51	QP	
8	0.2500	21.95	10.16	32.11	51.75	-19.64	AVG	
9	0.3020	26.07	10.16	36.23	60.19	-23.96	QP	
10	0.3020	12.36	10.16	22.52	50.19	-27.67	AVG	
11	0.4300	30.48	10.18	40.66	57.25	-16.59	QP	
12	0.4300	17.43	10.18	27.61	47.25	-19.64	AVG	

## 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(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

### 7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

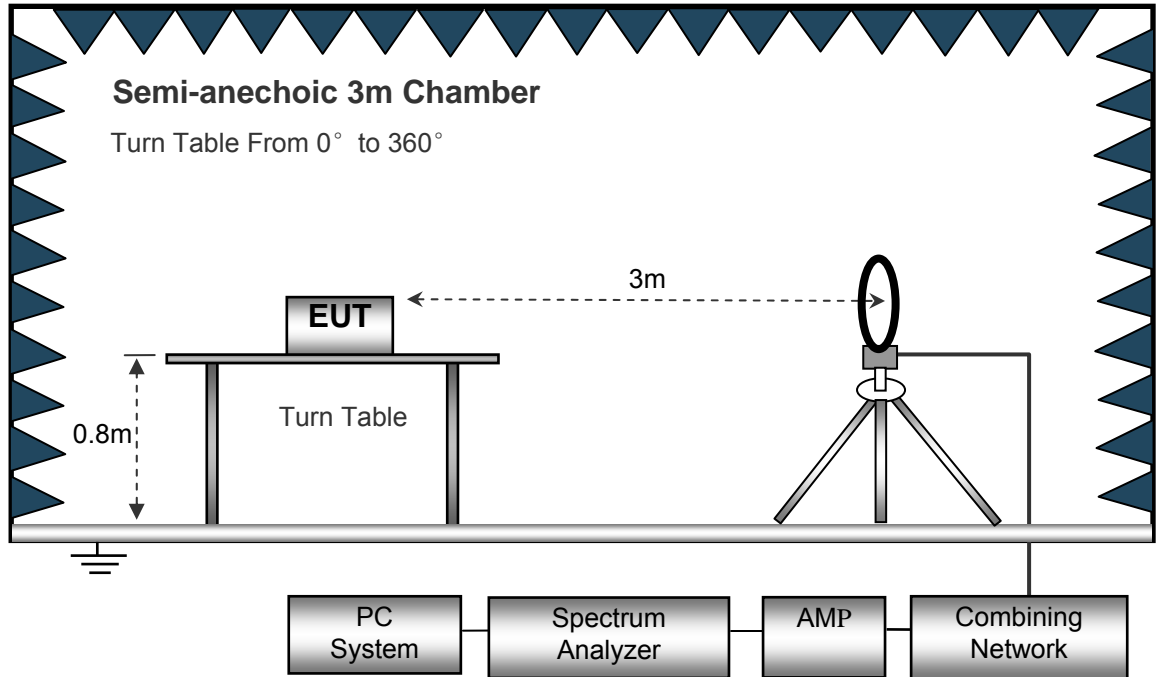
EUT Operation :

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

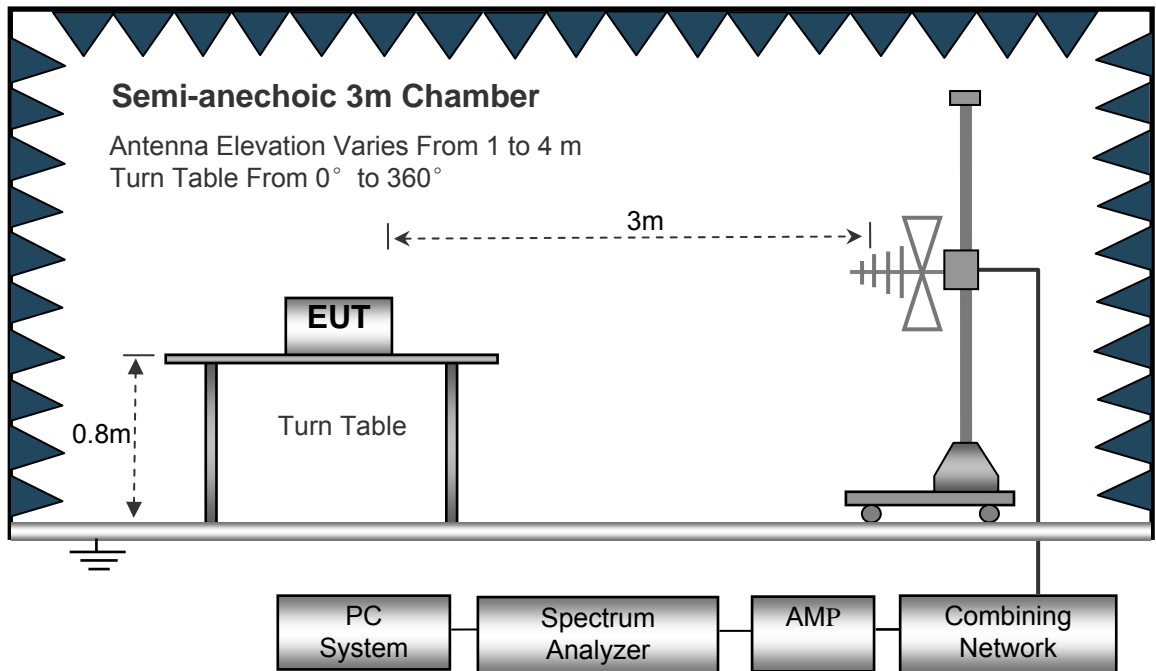
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2009.

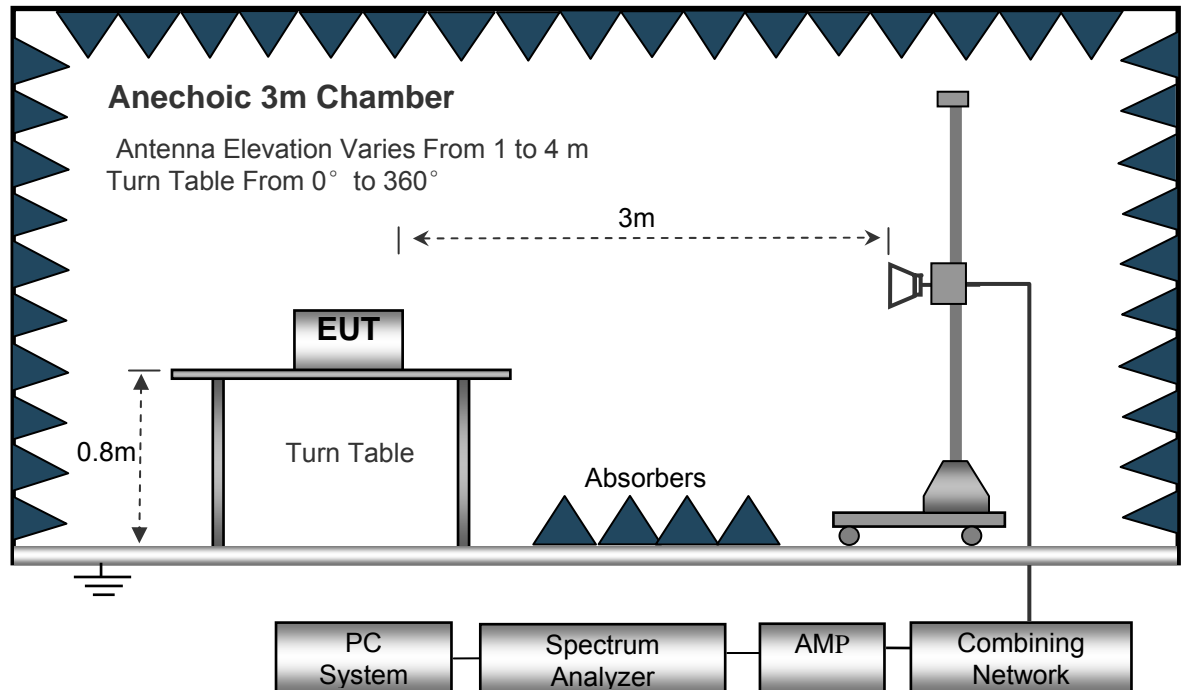
The test setup for emission measurement below 30MHz.



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 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## 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

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)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
GFSK Low Channel									
268.35	36.88	QP	174	1.4	H	-13.35	23.53	46.00	-22.47
268.35	41.35	QP	228	2.0	V	-13.35	28.00	46.00	-18.00
4804.00	46.16	PK	271	1.9	V	-1.06	45.10	74.00	-28.90
4804.00	43.52	Ave	271	1.9	V	-1.06	42.46	54.00	-11.54
7206.00	40.62	PK	187	1.2	H	1.33	41.95	74.00	-32.05
7206.00	35.39	Ave	187	1.2	H	1.33	36.72	54.00	-17.28
2327.17	46.18	PK	6	1.5	V	-13.19	32.99	74.00	-41.01
2327.17	40.00	Ave	6	1.5	V	-13.19	26.81	54.00	-27.19
2381.81	42.85	PK	67	1.5	H	-13.14	29.71	74.00	-44.29
2381.81	37.50	Ave	67	1.5	H	-13.14	24.36	54.00	-29.64
2489.87	44.03	PK	317	1.9	V	-13.08	30.95	74.00	-43.05
2489.87	36.02	Ave	317	1.9	V	-13.08	22.94	54.00	-31.06

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
GFSK Middle Channel									
268.35	37.36	QP	176	1.1	H	-13.35	24.01	46.00	-21.99
268.35	40.13	QP	186	1.5	V	-13.35	26.78	46.00	-19.22
4882.00	47.35	PK	168	1.7	V	-0.62	46.73	74.00	-27.27
4882.00	44.83	Ave	168	1.7	V	-0.62	44.21	54.00	-9.79
7323.00	40.27	PK	168	1.2	H	2.21	42.48	74.00	-31.52
7323.00	35.69	Ave	168	1.2	H	2.21	37.90	54.00	-16.10
2310.22	45.60	PK	7	1.9	V	-13.19	32.41	74.00	-41.59
2310.22	38.54	Ave	7	1.9	V	-13.19	25.35	54.00	-28.65
2376.80	43.54	PK	63	1.7	H	-13.14	30.40	74.00	-43.60
2376.80	37.95	Ave	63	1.7	H	-13.14	24.81	54.00	-29.19
2492.69	42.53	PK	129	1.6	V	-13.08	29.45	74.00	-44.55
2492.69	37.94	Ave	129	1.6	V	-13.08	24.86	54.00	-29.14

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
GFSK High Channel									
268.35	34.13	QP	235	1.9	H	-13.35	20.78	46.00	-25.22
268.35	39.71	QP	99	1.4	V	-13.35	26.36	46.00	-19.64
4960.00	47.43	PK	86	1.8	V	-0.24	47.19	74.00	-26.81
4960.00	44.19	Ave	86	1.8	V	-0.24	43.95	54.00	-10.05
7440.00	40.40	PK	197	1.2	H	2.84	43.24	74.00	-30.76
7440.00	34.81	Ave	197	1.2	H	2.84	37.65	54.00	-16.35
2347.87	45.77	PK	350	1.2	V	-13.19	32.58	74.00	-41.42
2347.87	37.18	Ave	350	1.2	V	-13.19	23.99	54.00	-30.01
2372.08	43.63	PK	294	1.6	H	-13.14	30.49	74.00	-43.51
2372.08	36.68	Ave	294	1.6	H	-13.14	23.54	54.00	-30.46
2496.69	44.64	PK	286	1.1	V	-13.08	31.56	74.00	-42.44
2496.69	37.01	Ave	286	1.1	V	-13.08	23.93	54.00	-30.07

**Test Frequency: 18GHz~25GHz**

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

## 8 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Result: PASS

Limit:

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

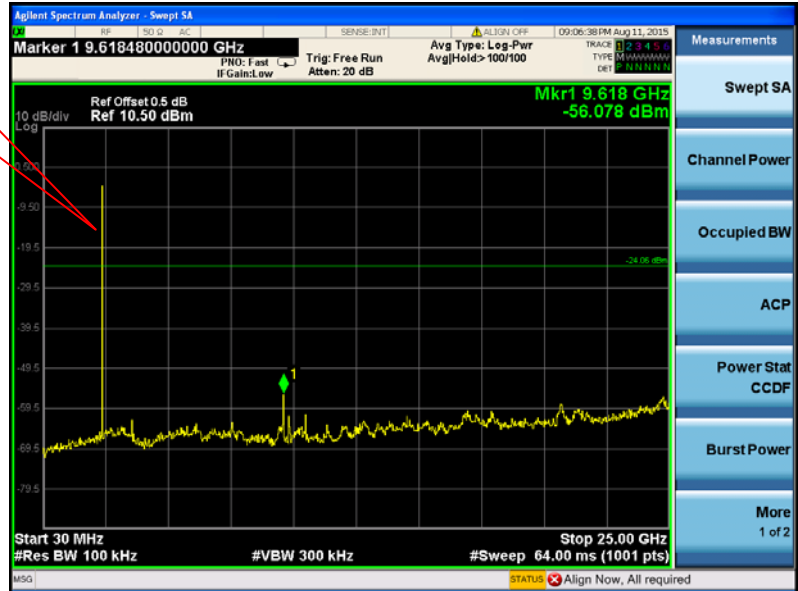
### 8.1 Test Procedure

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

GFSK Low Channel

Fundamental

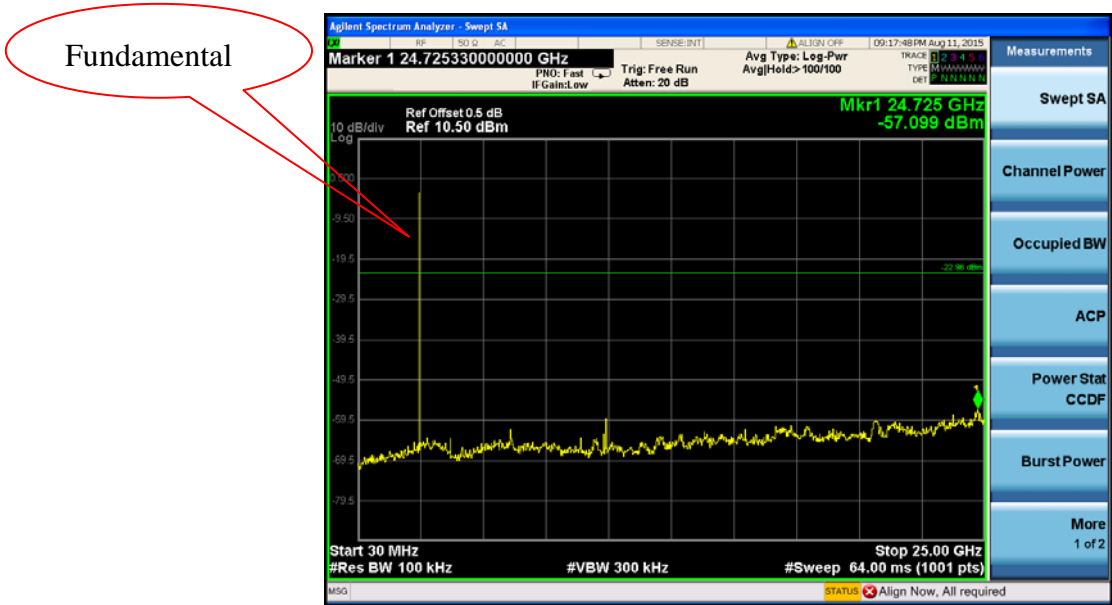


GFSK Middle Channel

Fundamental



GFSK High Channel

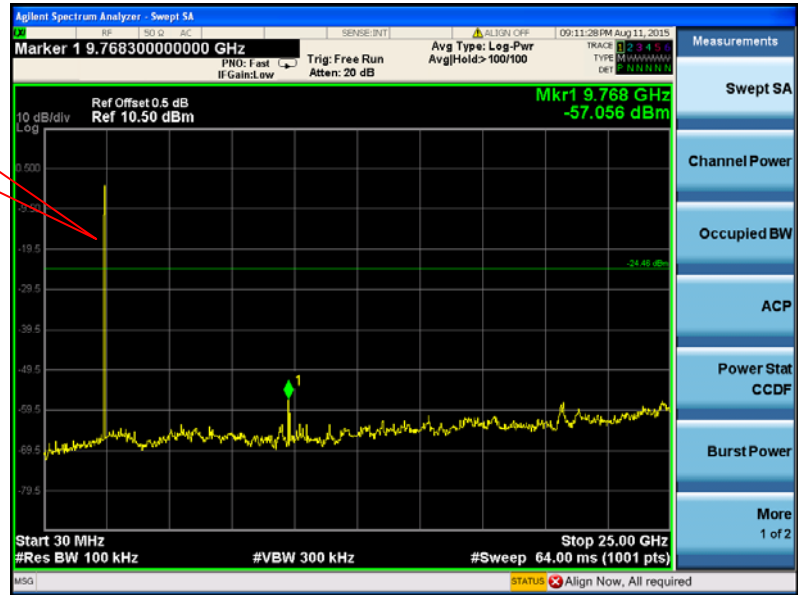


Pi/4 DQPSK Low Channel



Pi/4 DQPSK Middle Channel

Fundamental



Pi/4 DQPSK High Channel

Fundamental





8DPSK Low Channel

Fundamental



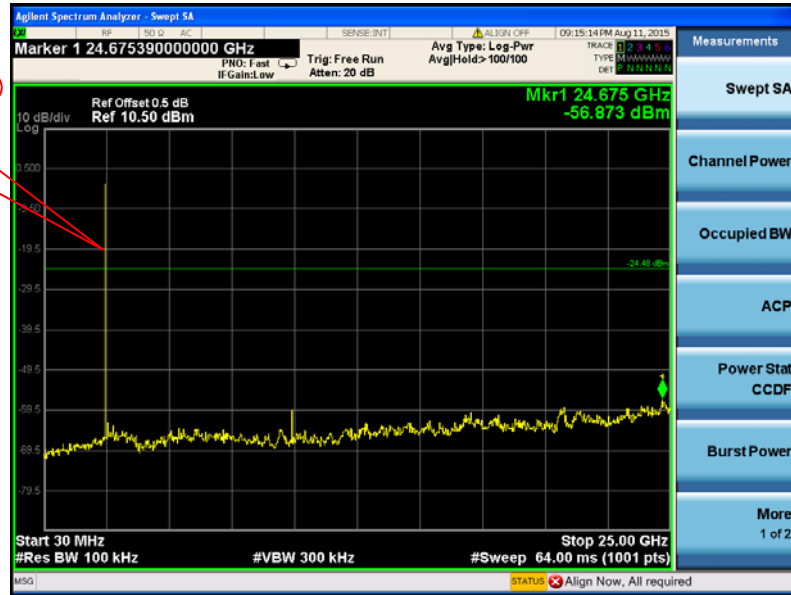
8DPSK Middle Channel

Fundamental



8DPSK High Channel

Fundamental



## 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:	DA 00-705
Test Limit:	Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

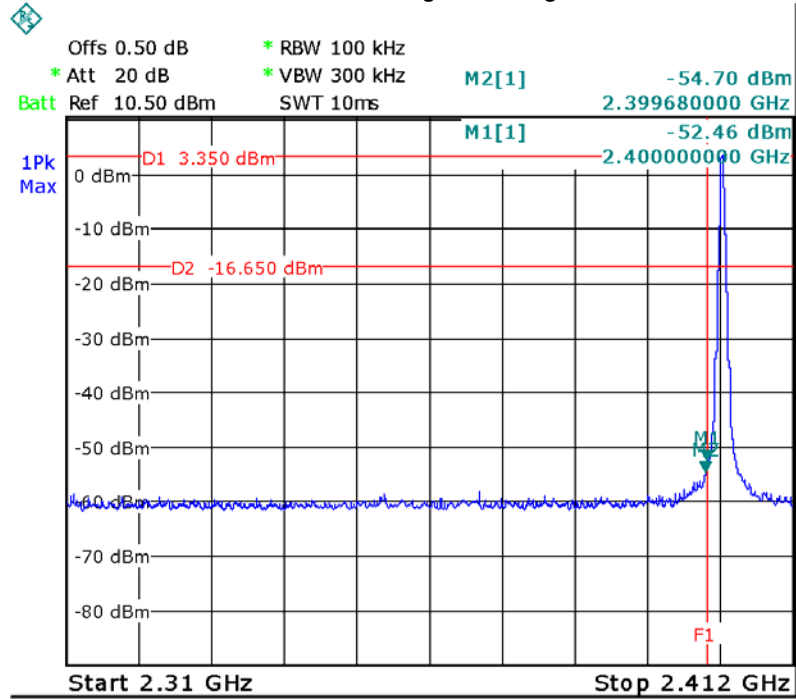
### 9.1 Test Procedure

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

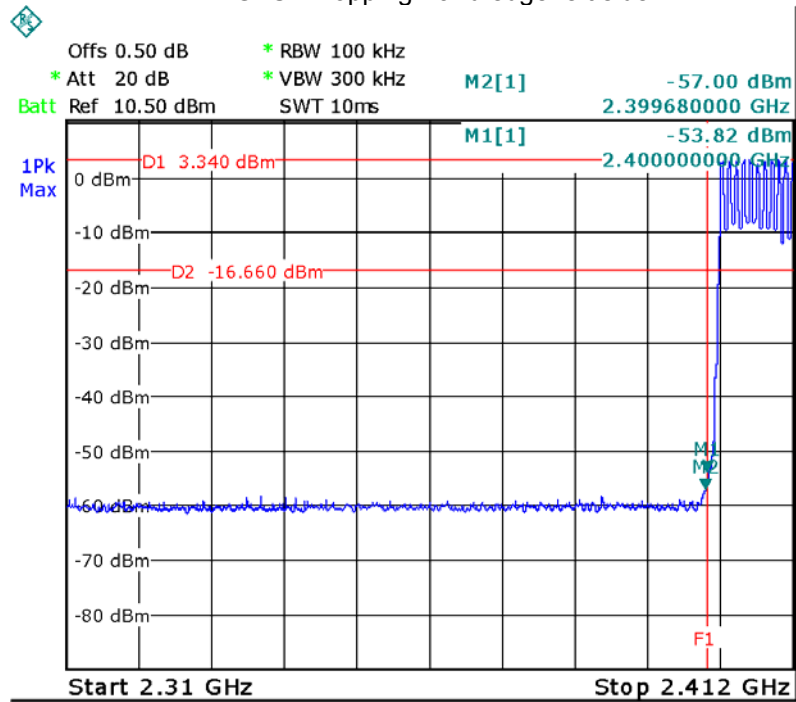
## 9.2 Test Result

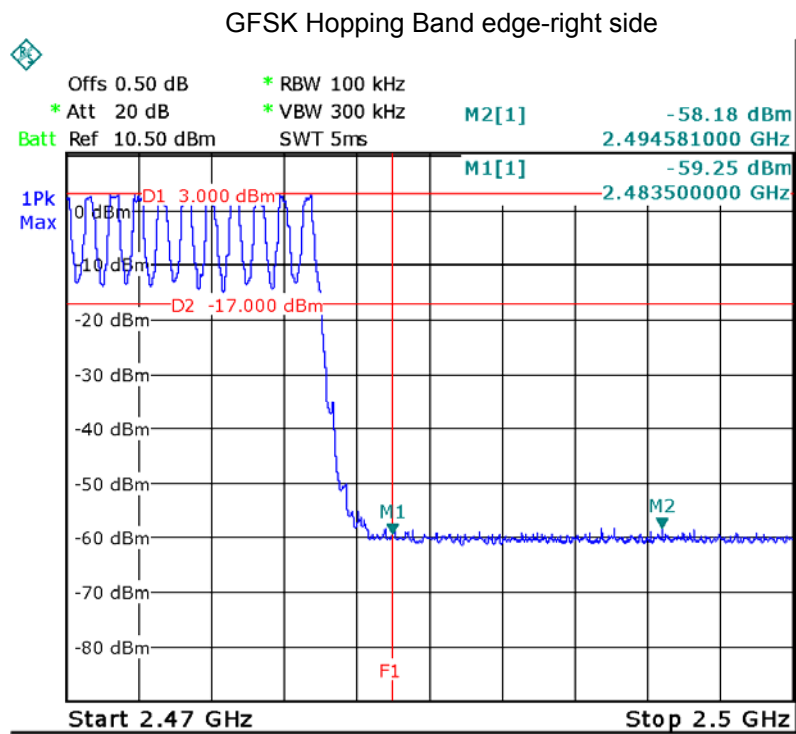
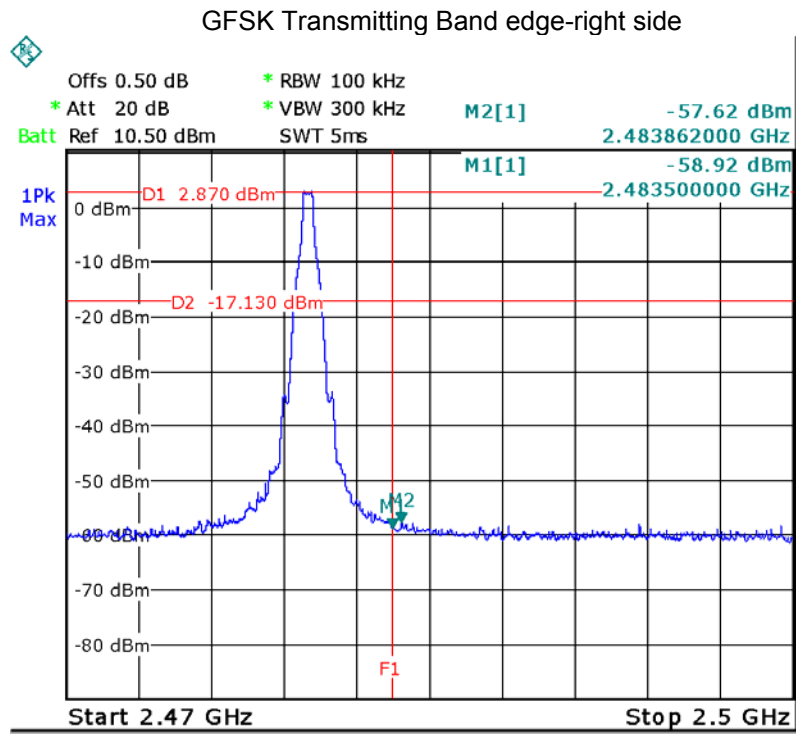
### Test plots

GFSK Transmitting Band edge-left side

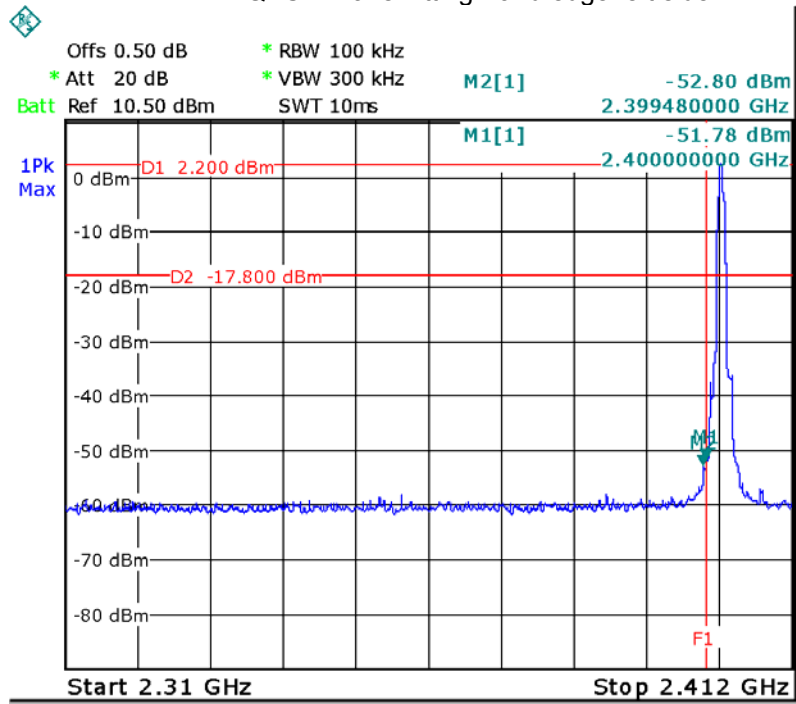


GFSK Hopping Band edge-left side

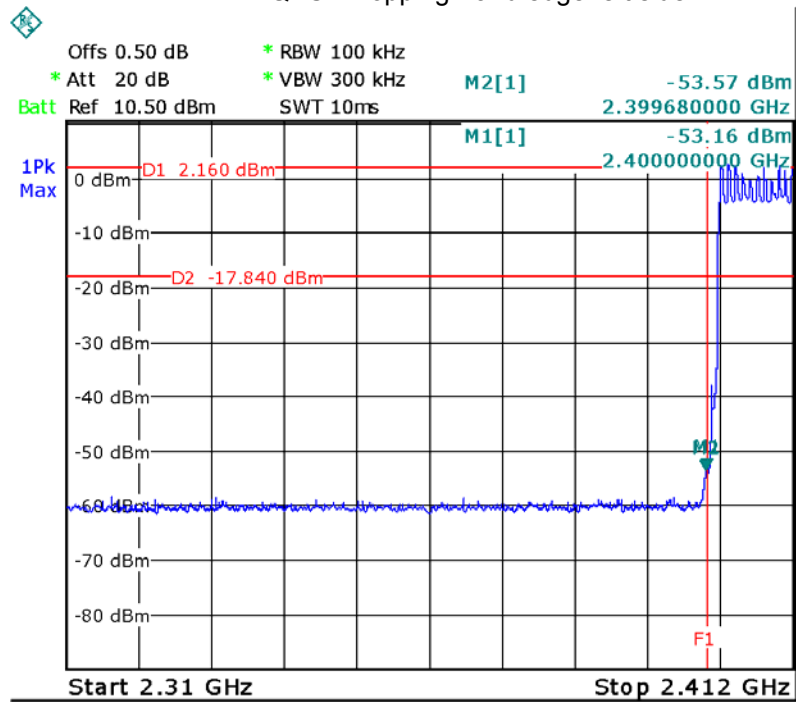




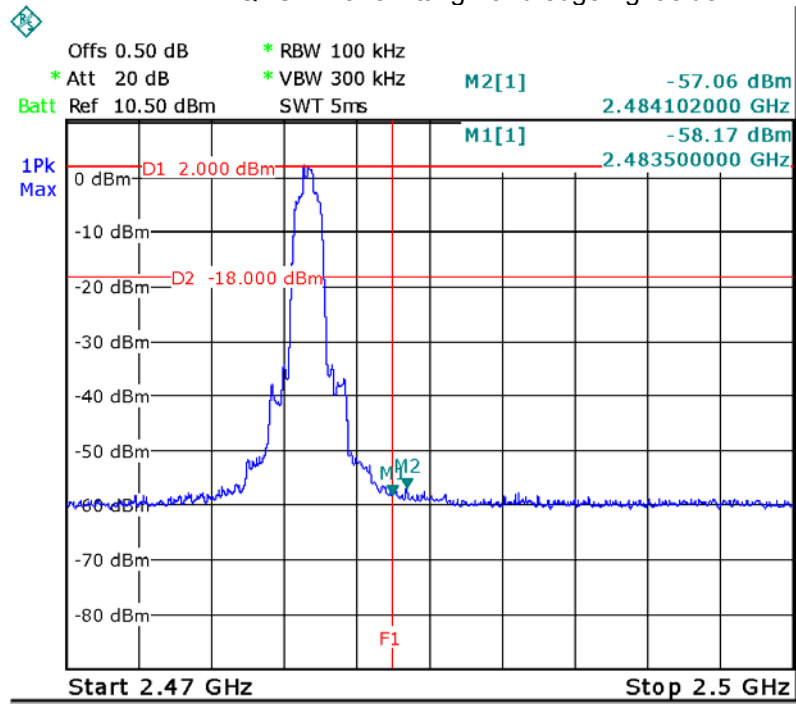
Pi/4 DQPSK Transmitting Band edge-left side



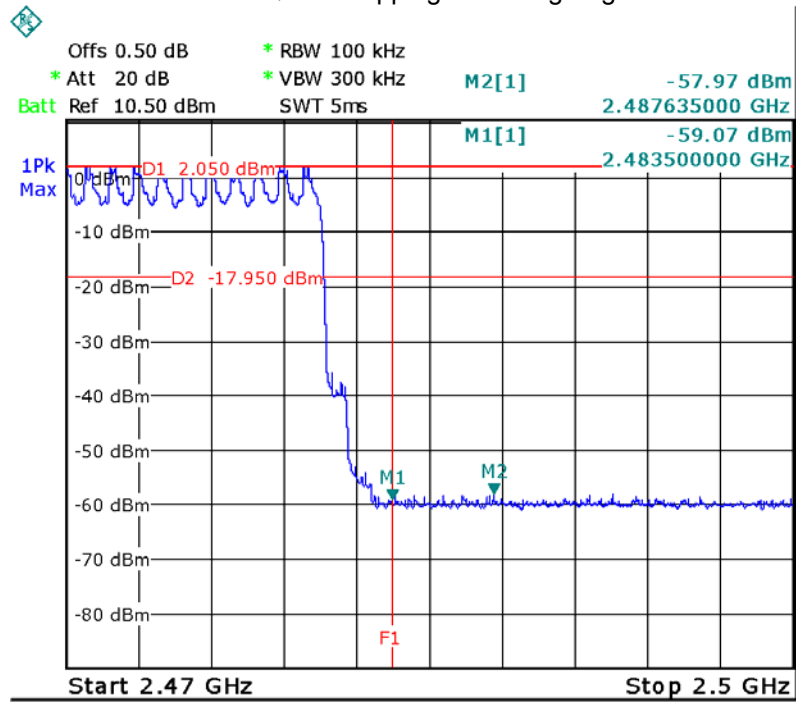
Pi/4 DQPSK Hopping Band edge-left side

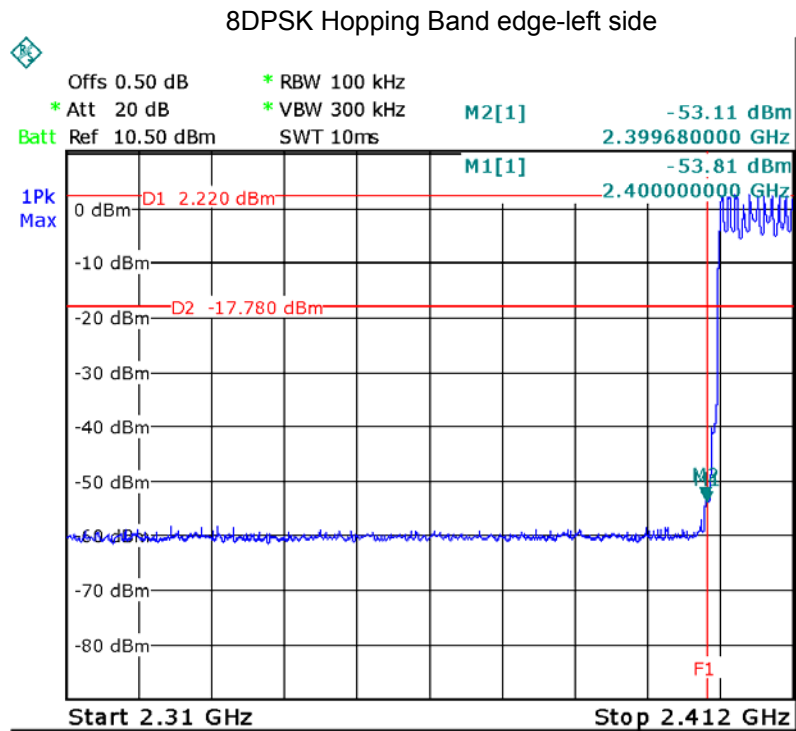
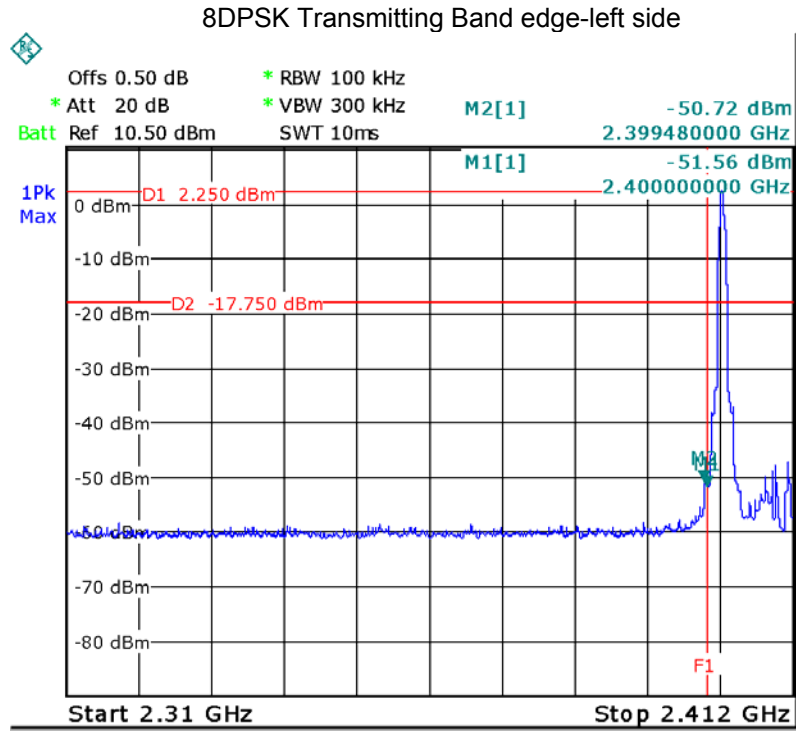


Pi/4 DQPSK Transmitting Band edge-right side

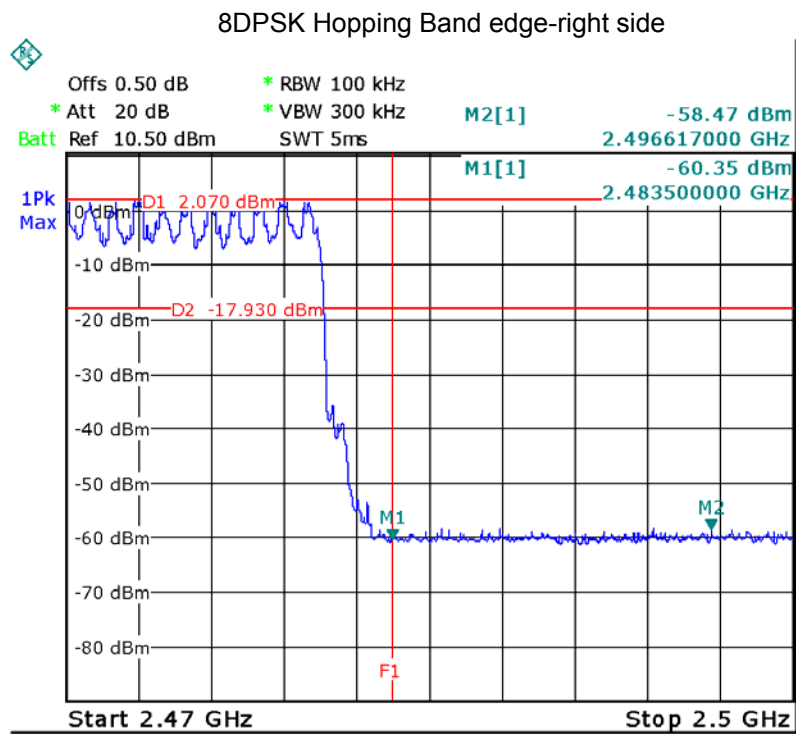
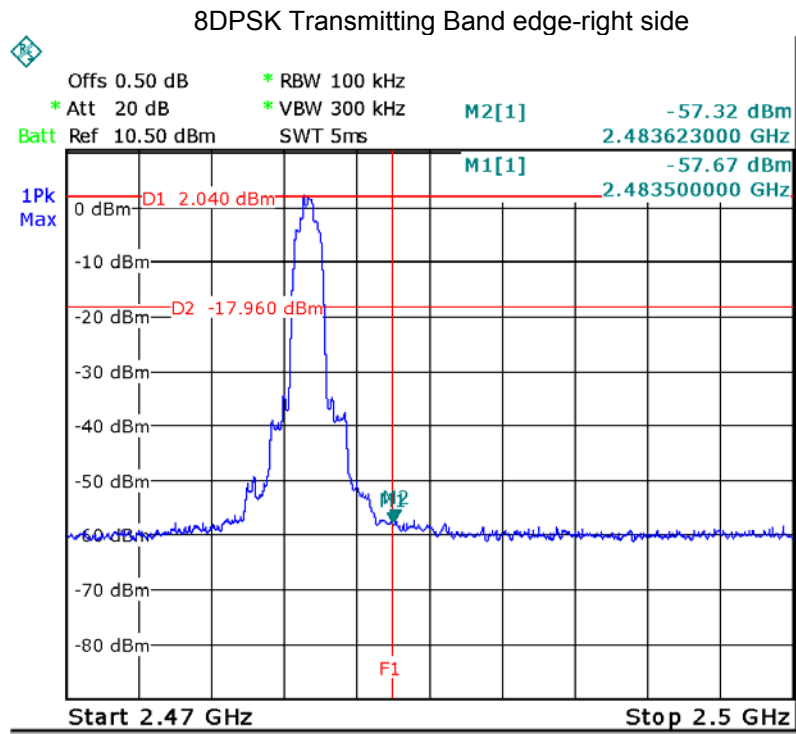


Pi/4 DQPSK Hopping Band edge-right side









## 10 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.

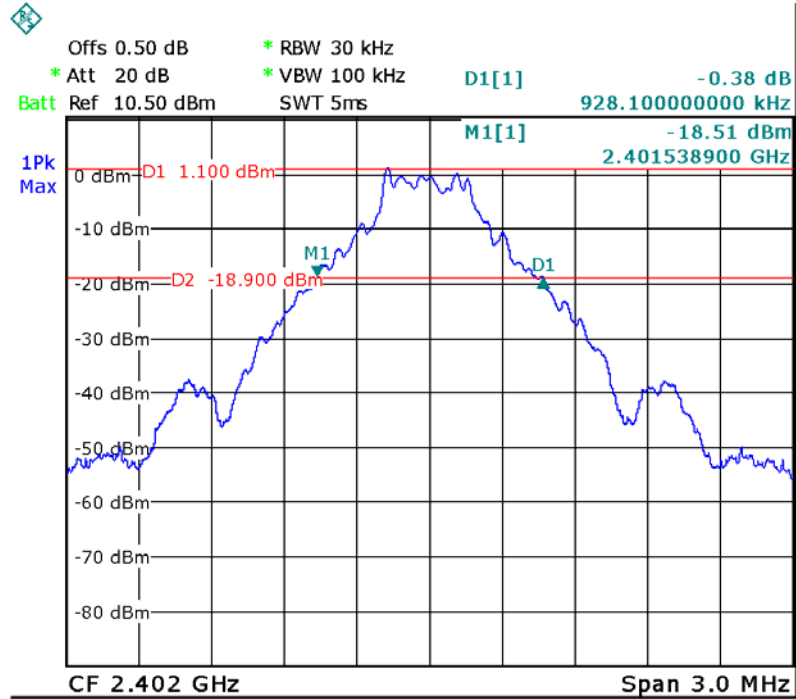
### 10.1 Test Procedure

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

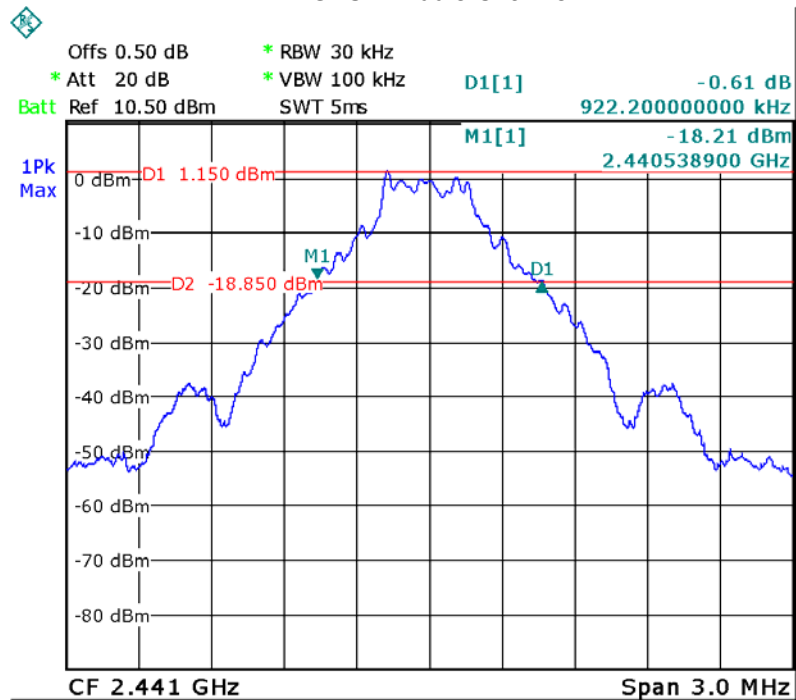
### 10.2 Test Result

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.928
GFSK	Middle	0.922
GFSK	High	0.922
Pi/4 DQPSK	Low	1.252
Pi/4 DQPSK	Middle	1.252
Pi/4 DQPSK	High	1.252
8DPSK	Low	1.258
8DPSK	Middle	1.258
8DPSK	High	1.258

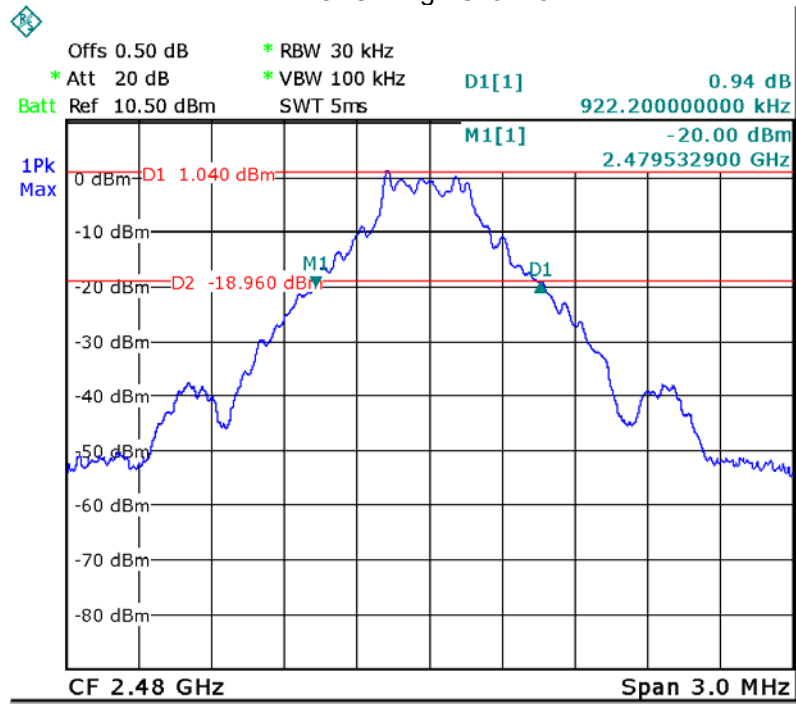
Test plots  
GFSK Low Channel



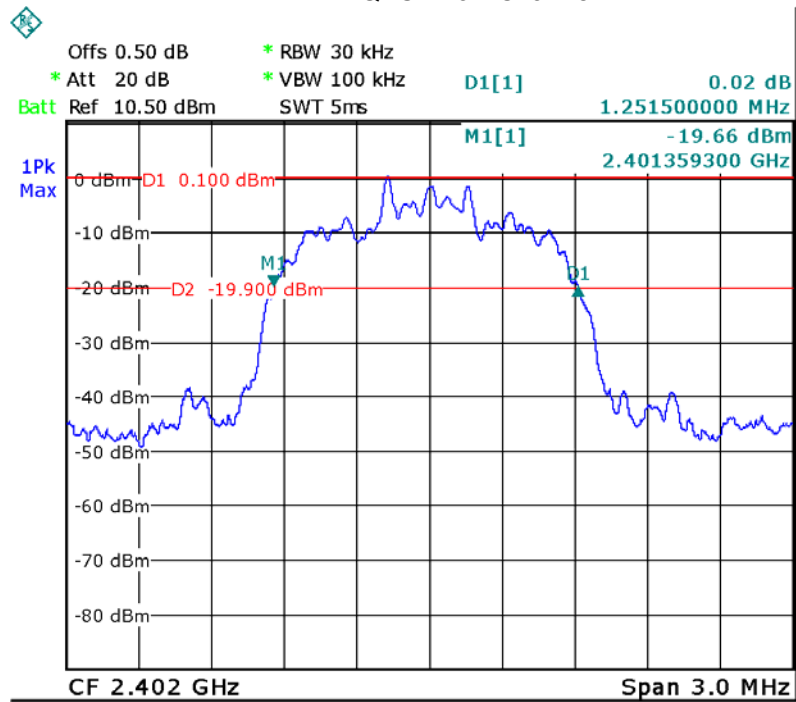
GFSK Middle Channel

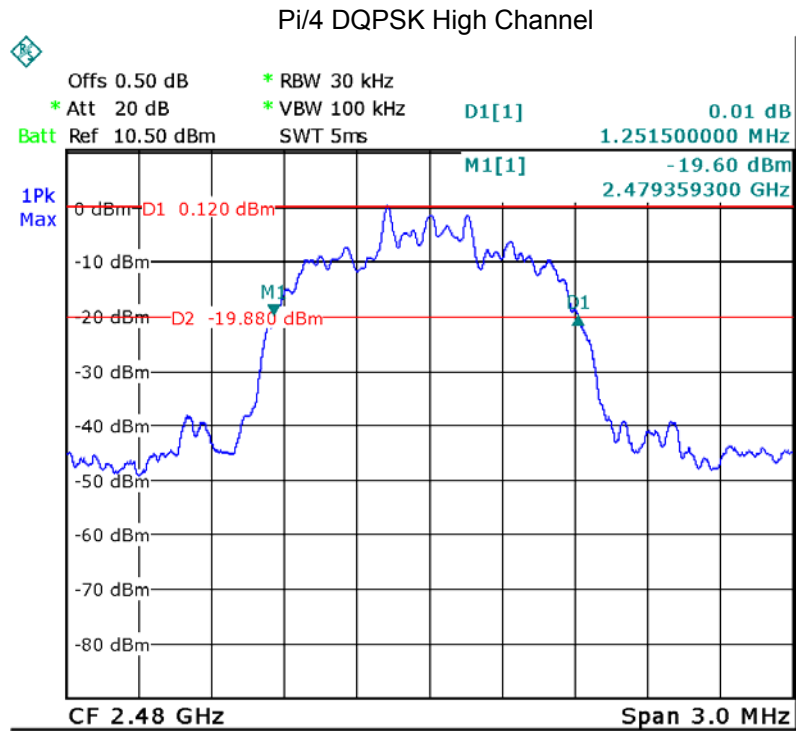
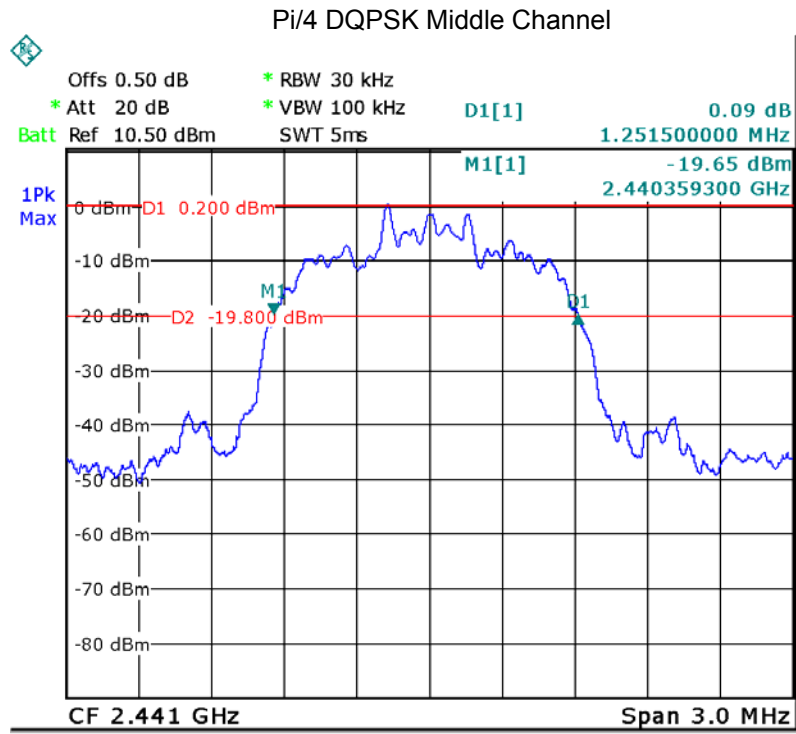


### GFSK High Channel

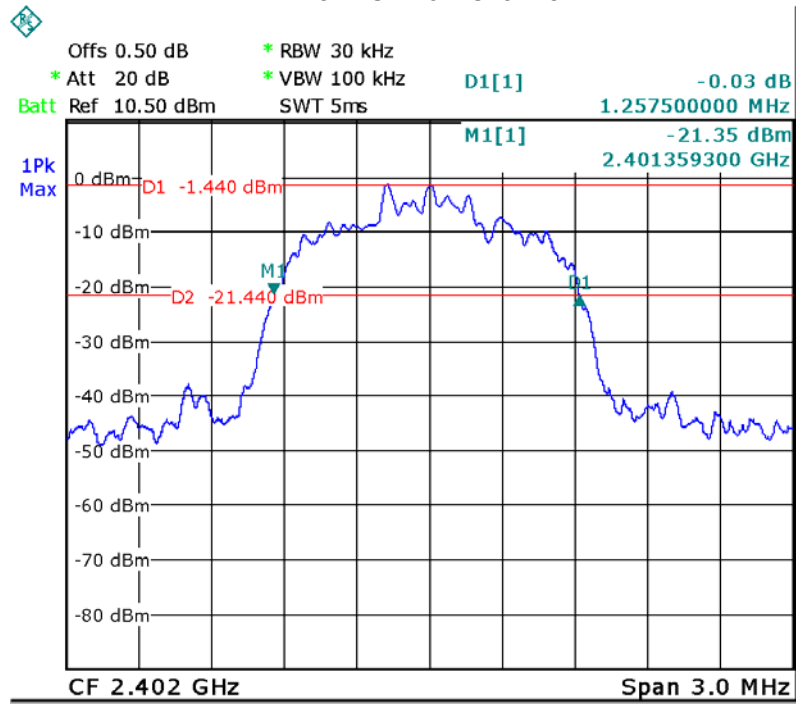


### Pi/4 DQPSK Low Channel

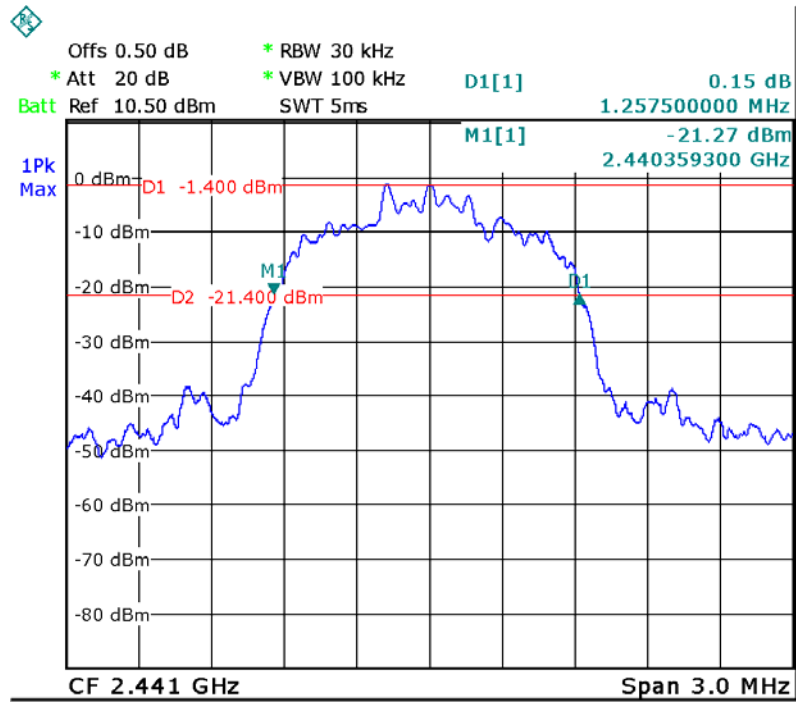


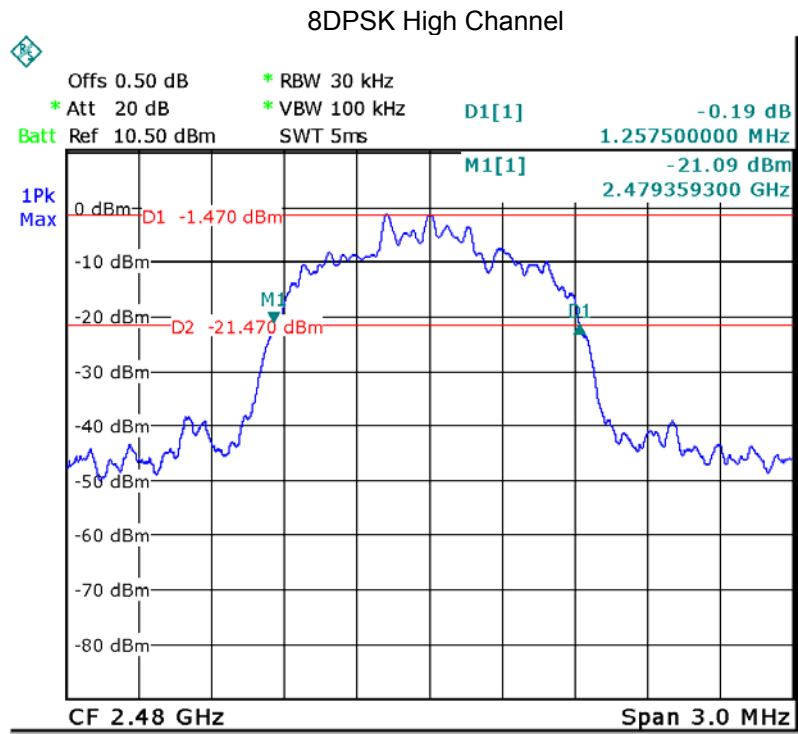


### 8DPSK Low Channel



### 8DPSK Middle Channel





## 11 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.
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 = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

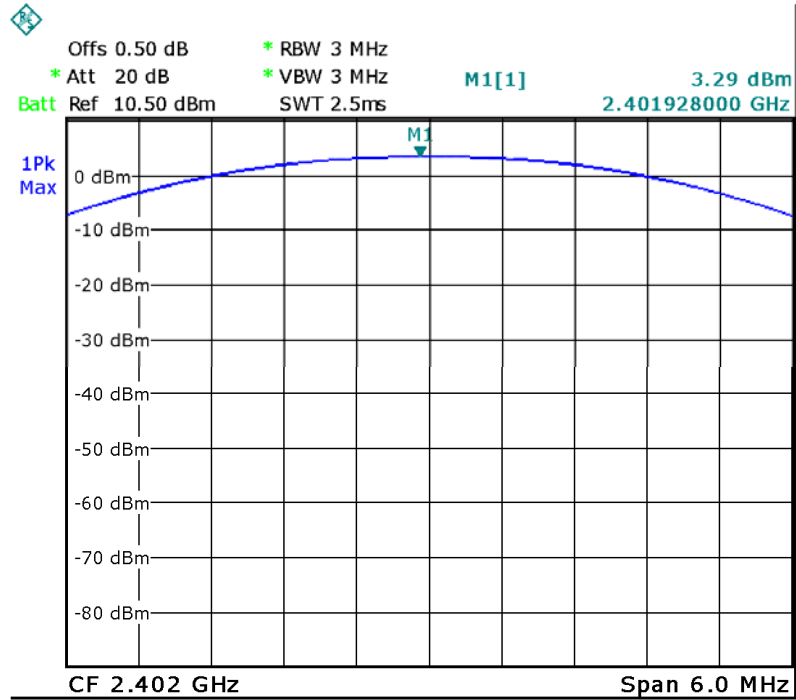
### 11.2 Test Result

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	3.29	30
GFSK	Middle	3.26	30
GFSK	High	3.14	30
Pi/4 DQPSK	Low	3.08	21
Pi/4 DQPSK	Middle	3.05	21
Pi/4 DQPSK	High	2.95	21
8DPSK	Low	3.25	21
8DPSK	Middle	3.22	21
8DPSK	High	3.11	21

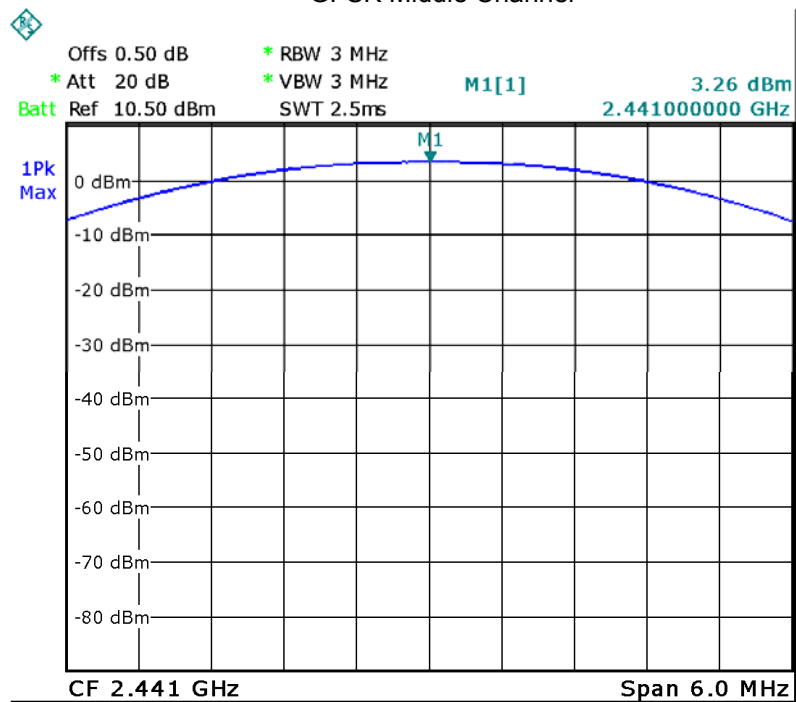


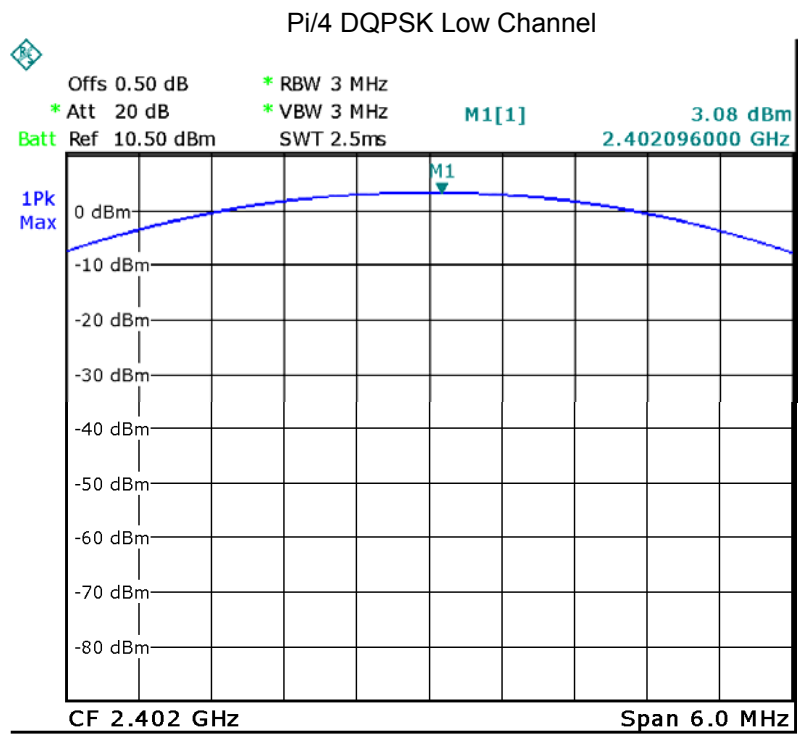
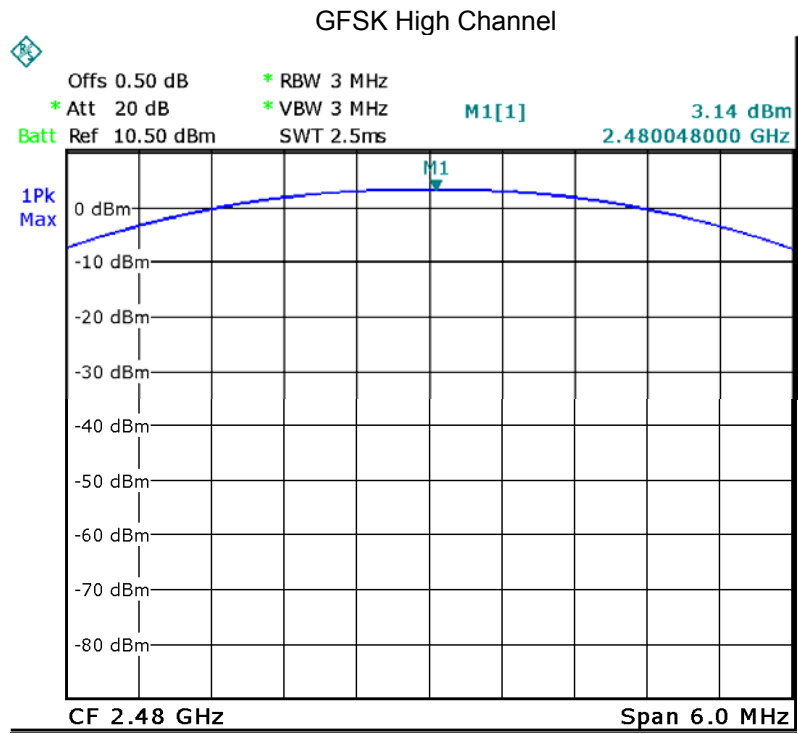
Test plots

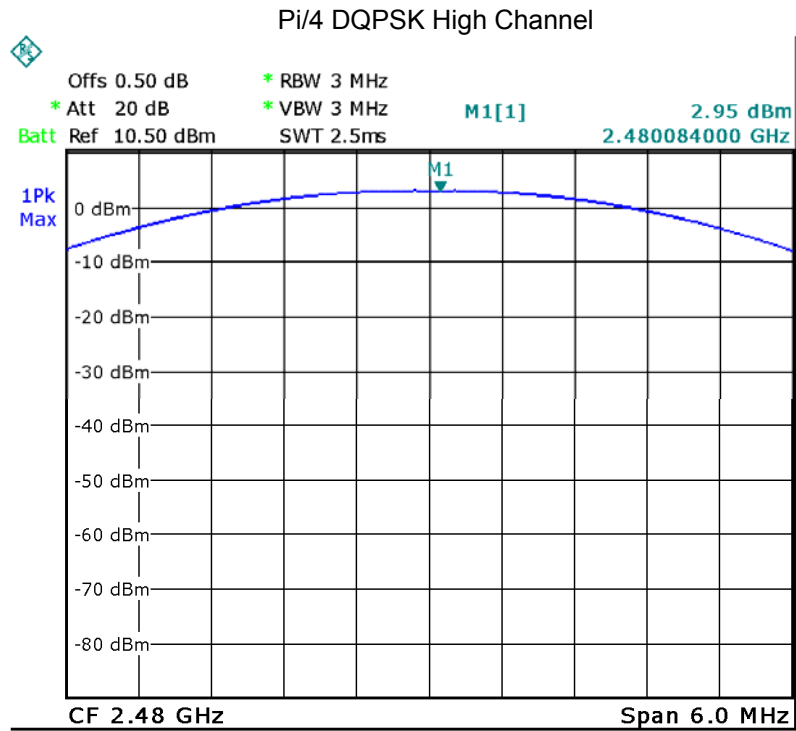
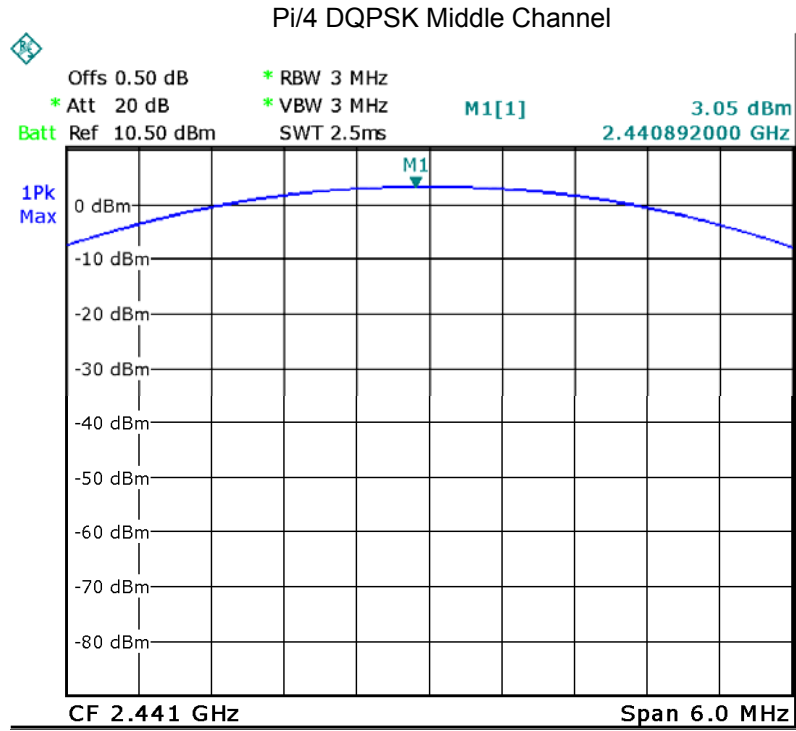
GFSK Low Channel



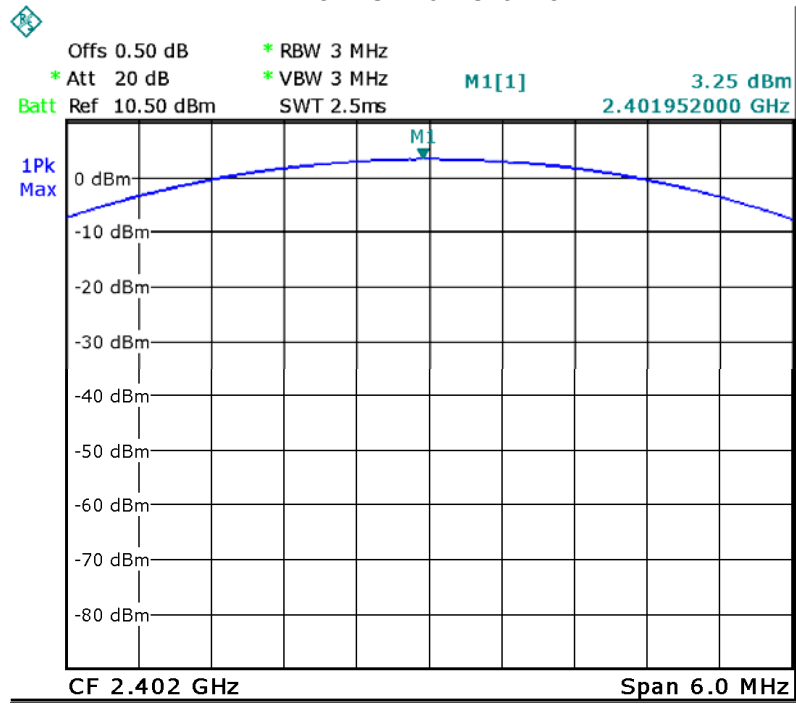
GFSK Middle Channel



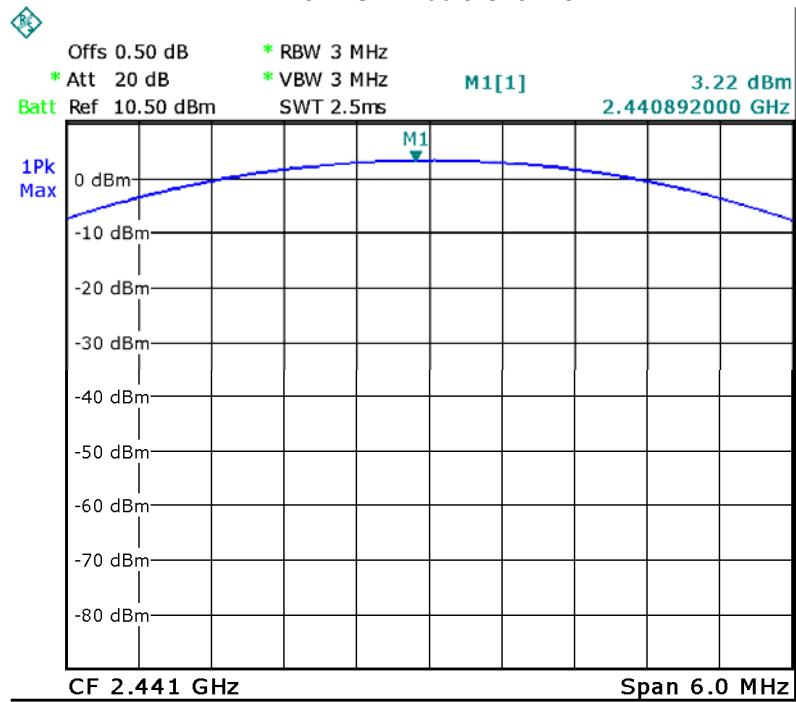


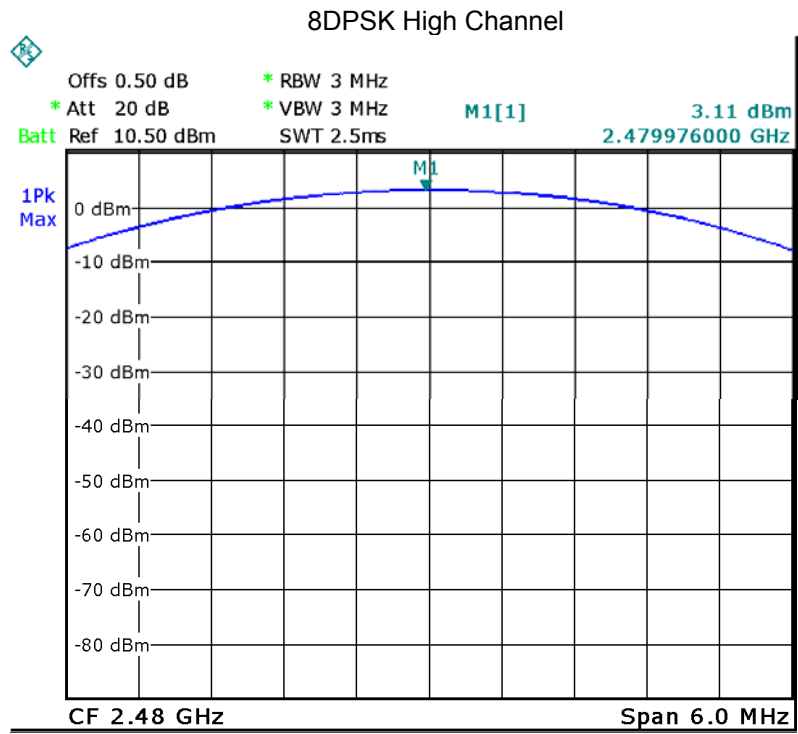


### 8DPSK Low Channel



### 8DPSK Middle Channel





## 12 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 2400-2483.5 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 transmitting operating mode.

### 12.1 Test Procedure

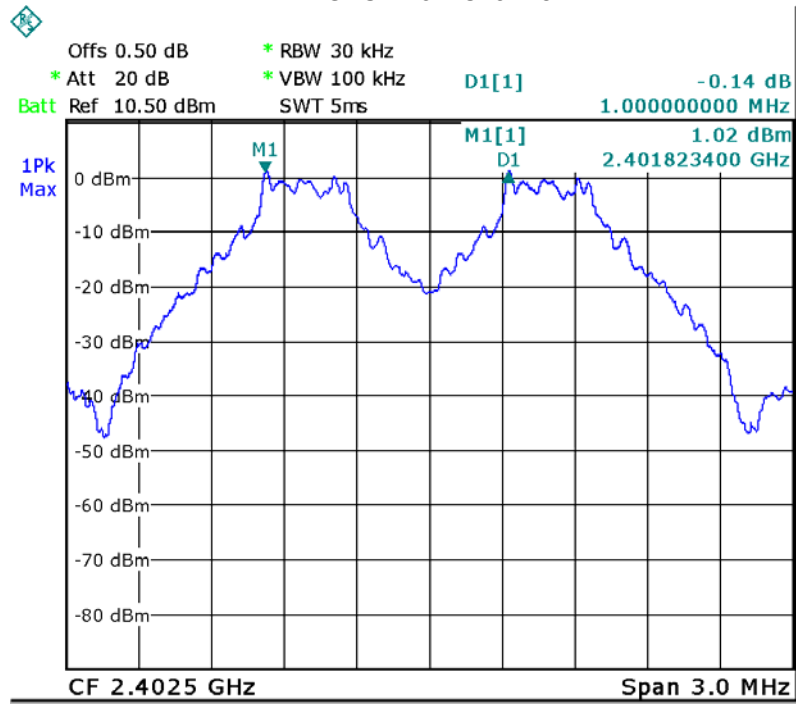
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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.

### 12.2 Test Result

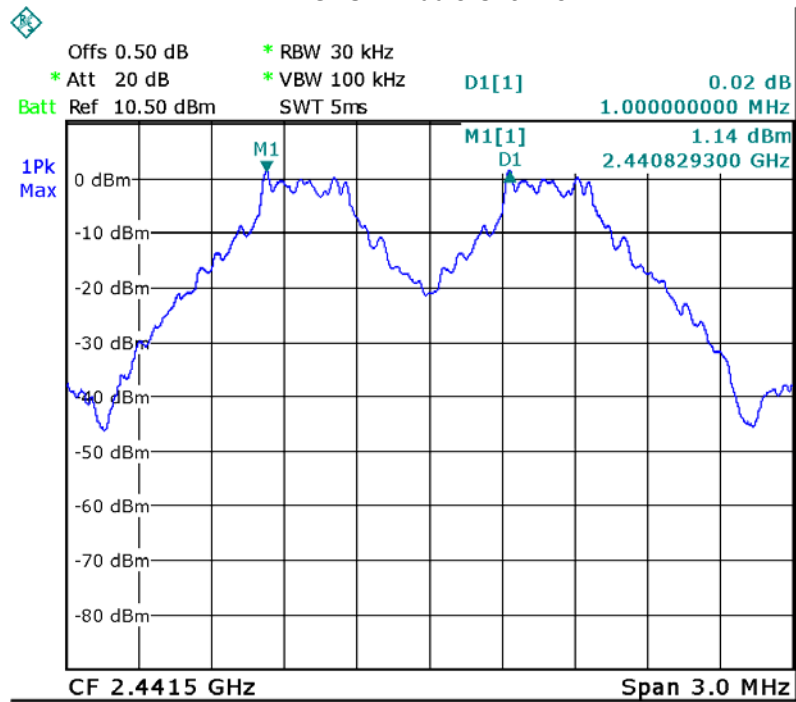
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	1.000	PASS
GFSK	Middle	1.000	PASS
GFSK	High	1.000	PASS
Pi/4 DQPSK	Low	1.000	PASS
Pi/4 DQPSK	Middle	1.000	PASS
Pi/4 DQPSK	High	1.000	PASS
8DPSK	Low	1.000	PASS
8DPSK	Middle	1.000	PASS
8DPSK	High	1.000	PASS

Test plots

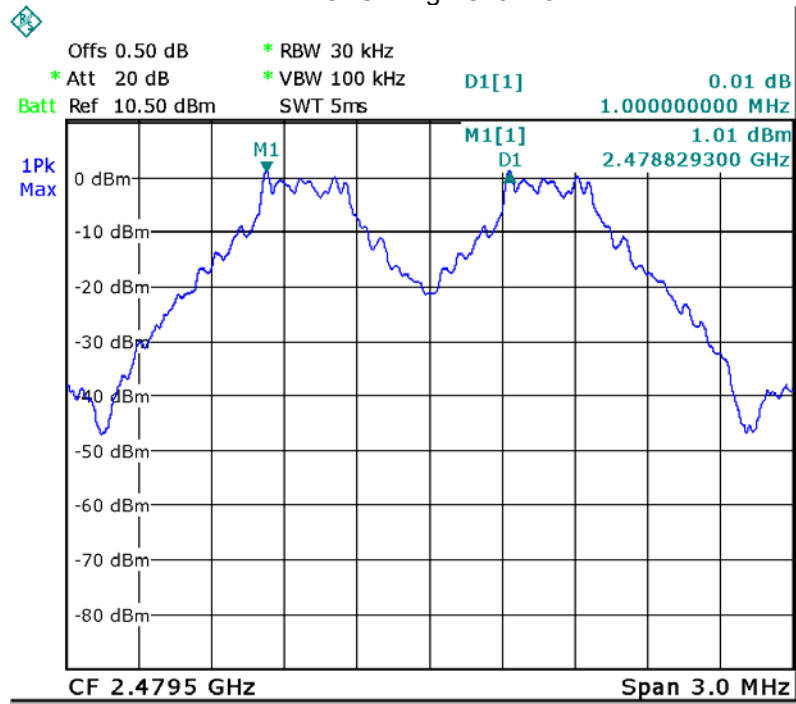
GFSK Low Channel



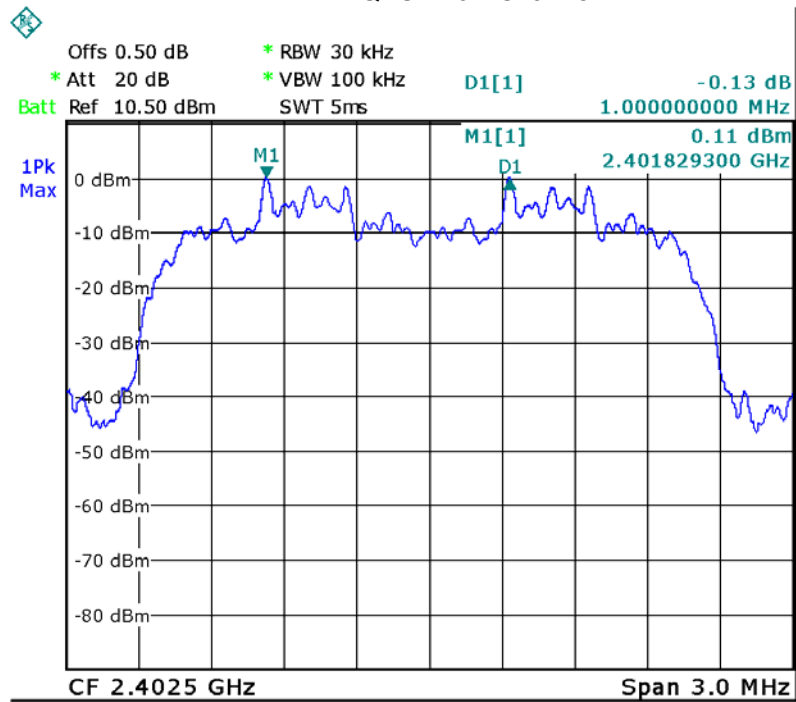
GFSK Middle Channel



### GFSK High Channel

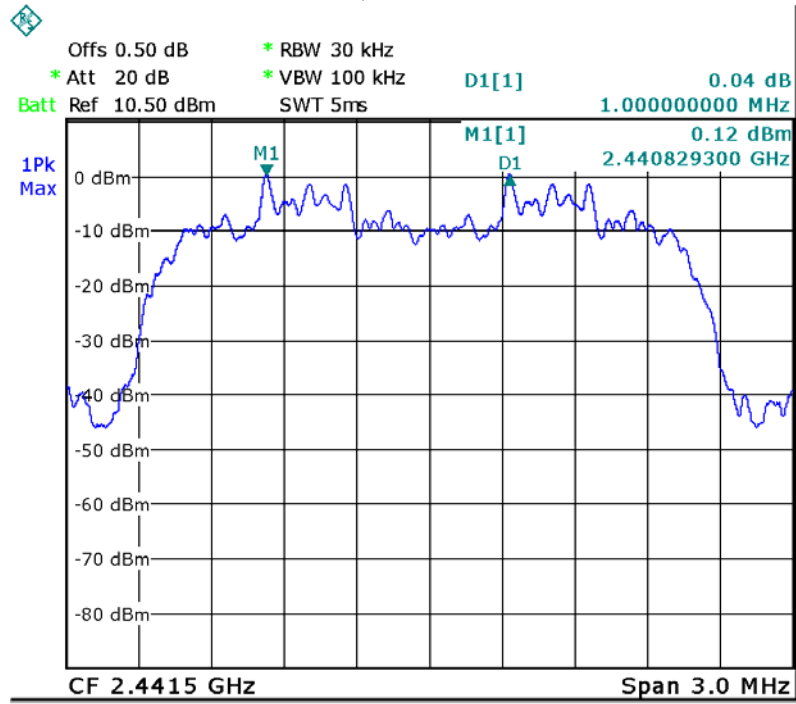


### Pi/4 DQPSK Low Channel

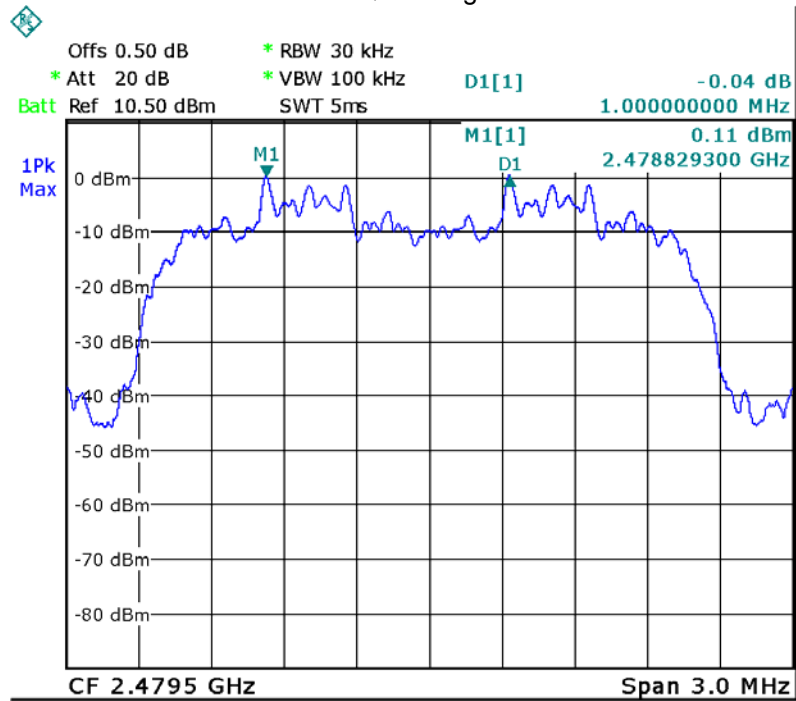




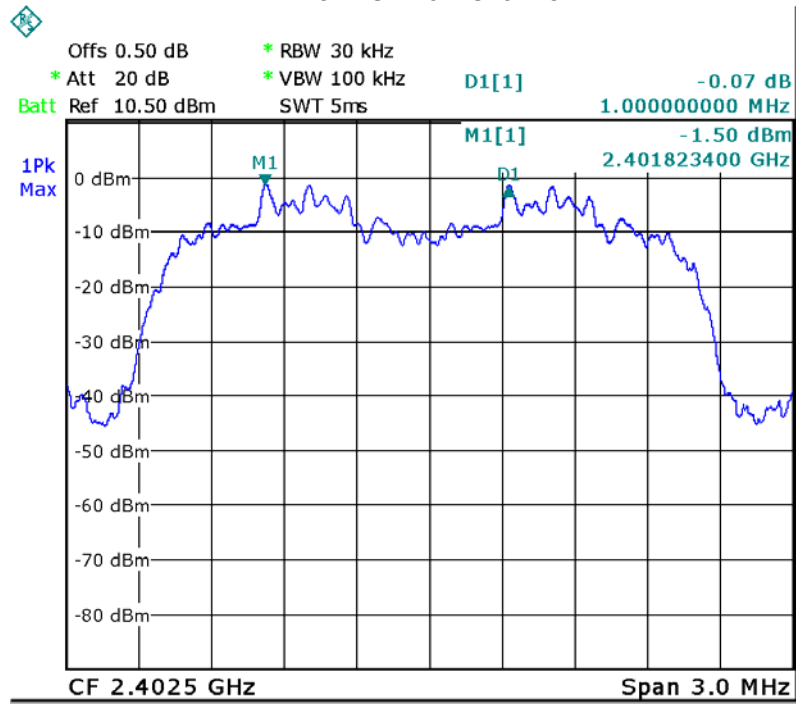
Pi/4 DQPSK Middle Channel



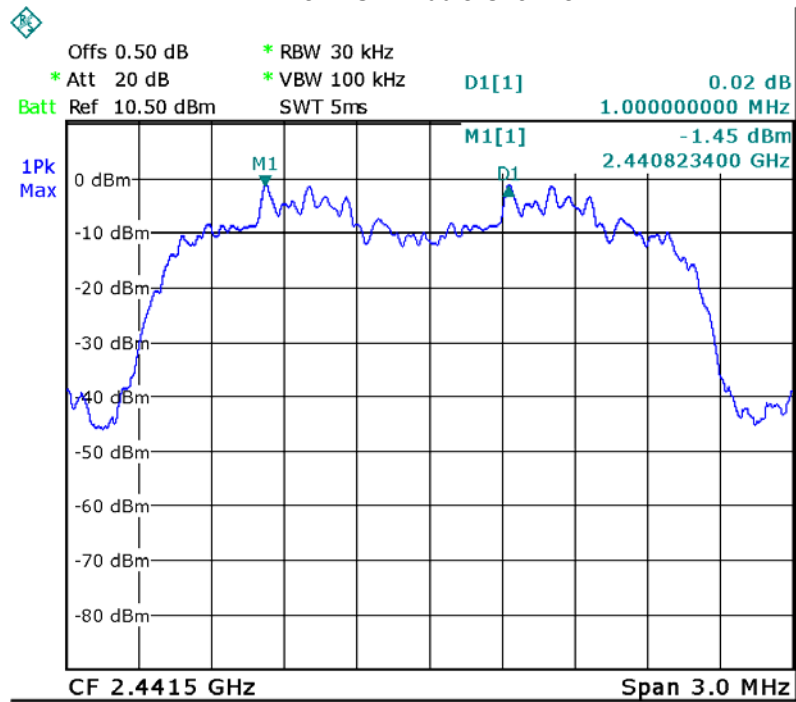
Pi/4 DQPSK High Channel

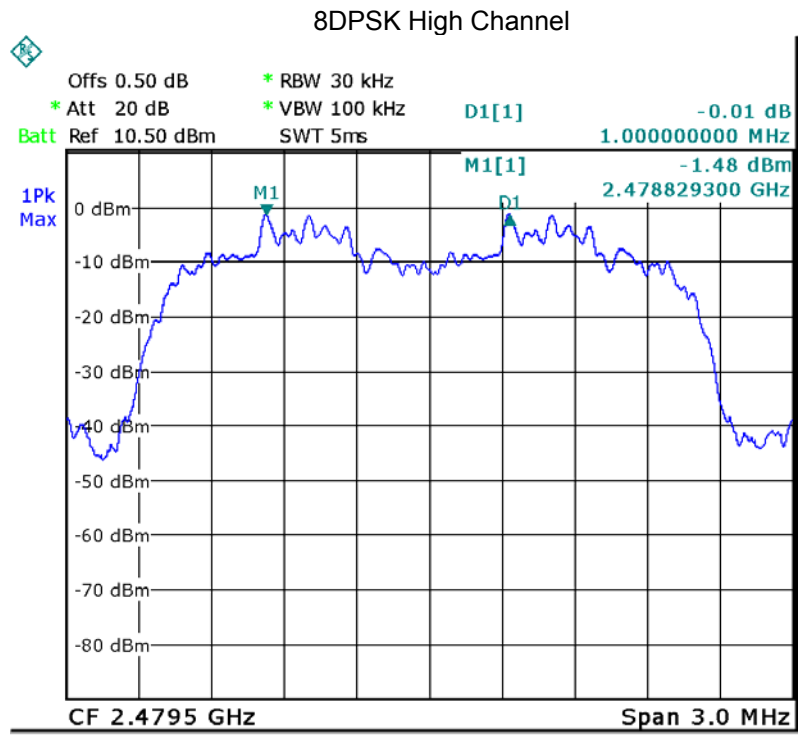


### 8DPSK Low Channel



### 8DPSK Middle Channel





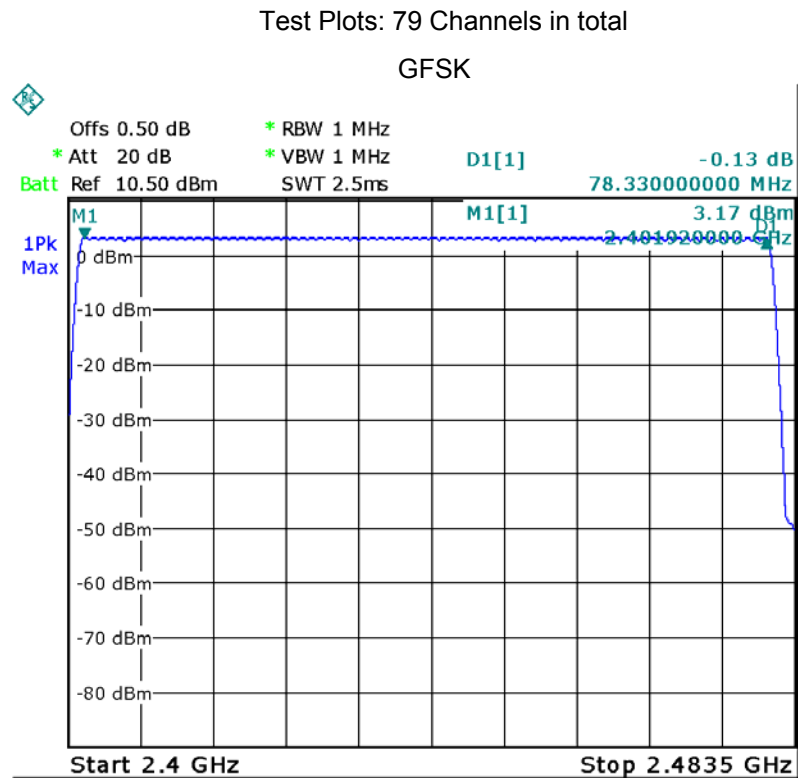
### 13 Number of Hopping Frequency

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.

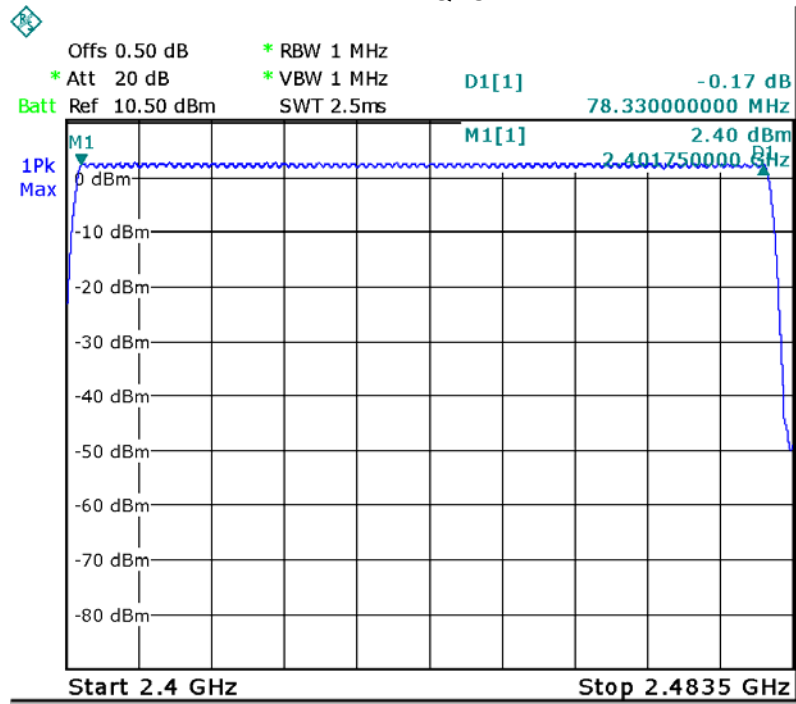
#### 13.1 Test Procedure

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 = 2.483GHz. Sweep=auto;

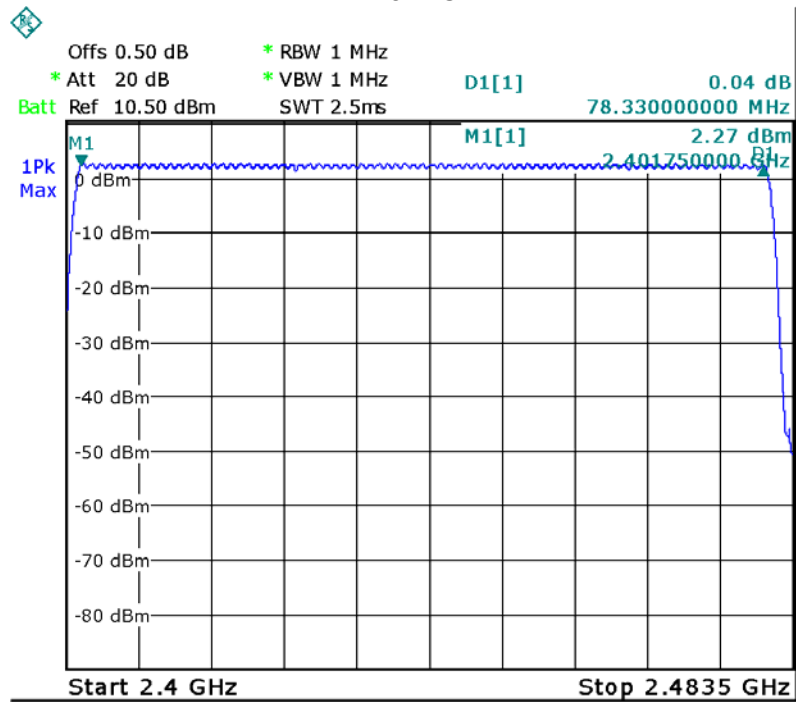
#### 13.2 Test Result



### Pi/4 DQPSK



### 8DPSK



## 14 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.

### 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).

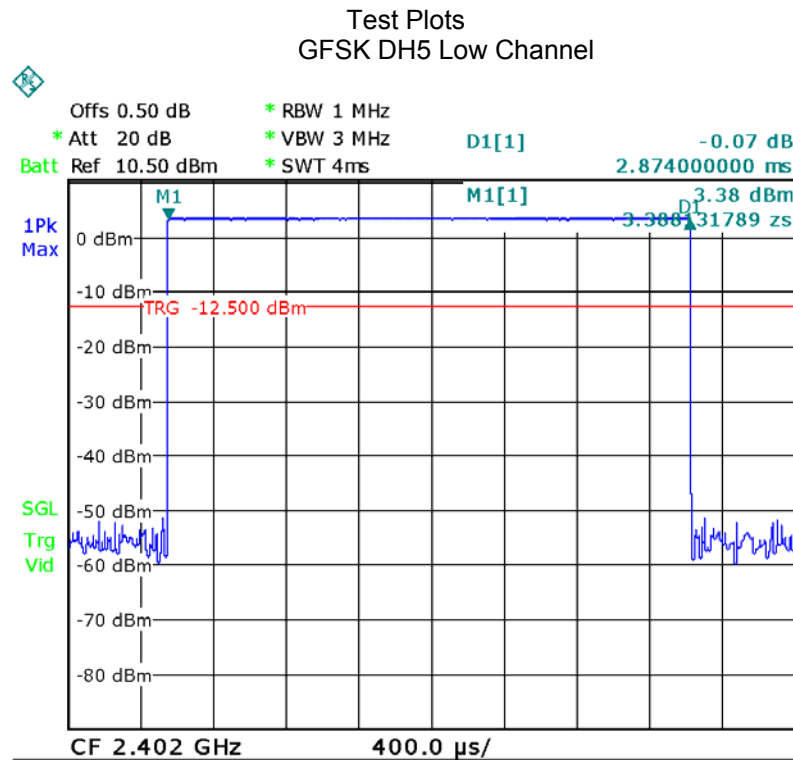
DH3 Packet permit maximum  $1600 / 79 / 4$  hops per second in each channel (3 time slots RX, 1 time slot TX).

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:

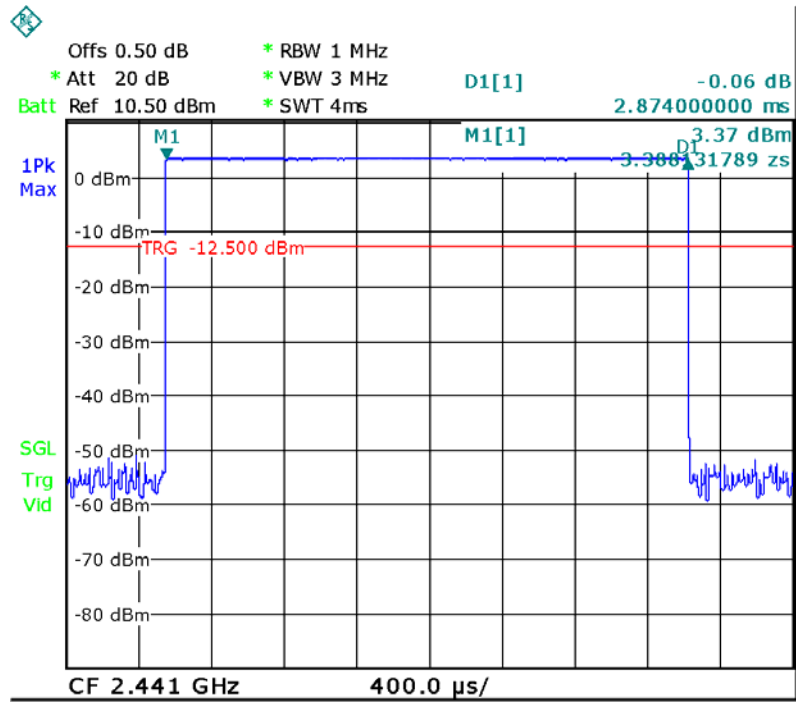
Data Packet	Dwell Time(s)
DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time.	

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.874	0.307	0.4
		middle	2.874	0.307	0.4
		High	2.874	0.307	0.4
Pi/4DQPSK	DH5	Low	2.874	0.307	0.4
		middle	2.874	0.307	0.4
		High	2.874	0.307	0.4
8DPSK	DH5	Low	2.874	0.307	0.4
		middle	2.874	0.307	0.4
		High	2.874	0.307	0.4

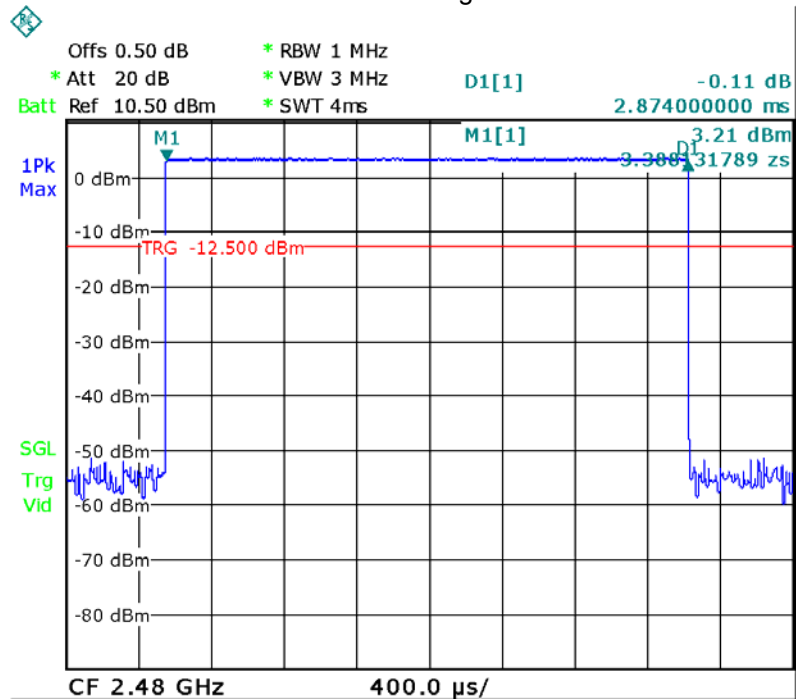
Remark: only the worst data were recorded.



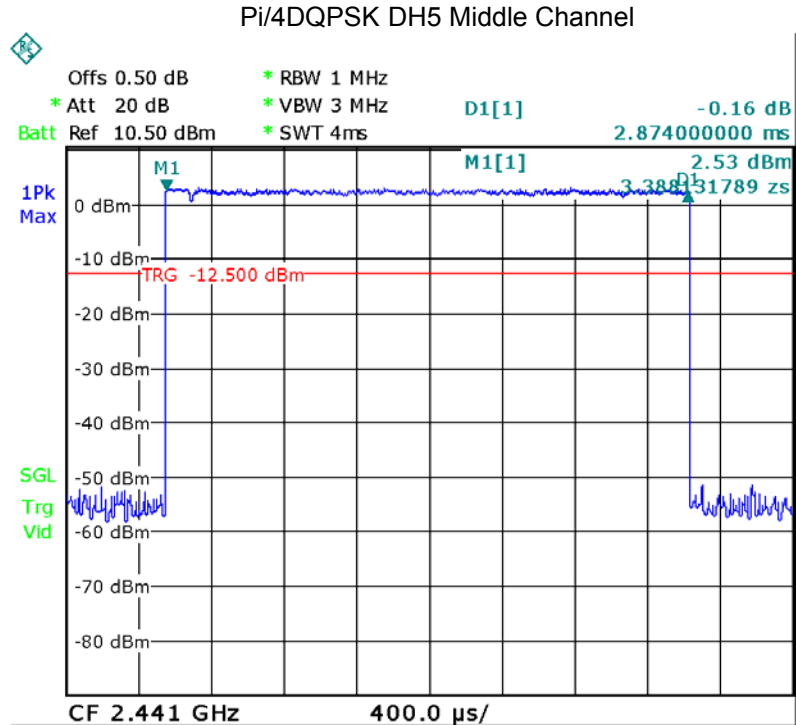
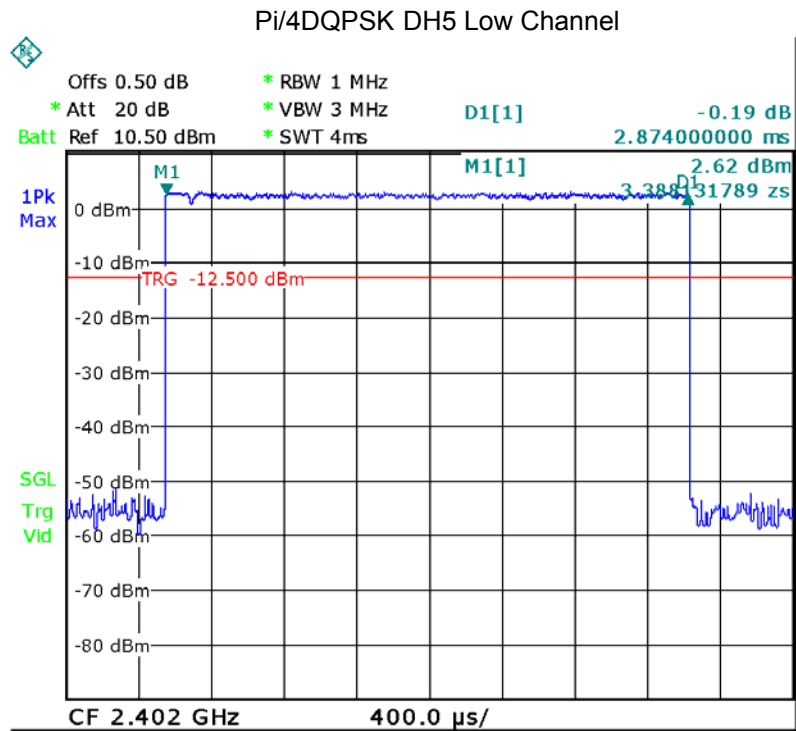
GFSK DH5 Middle Channel



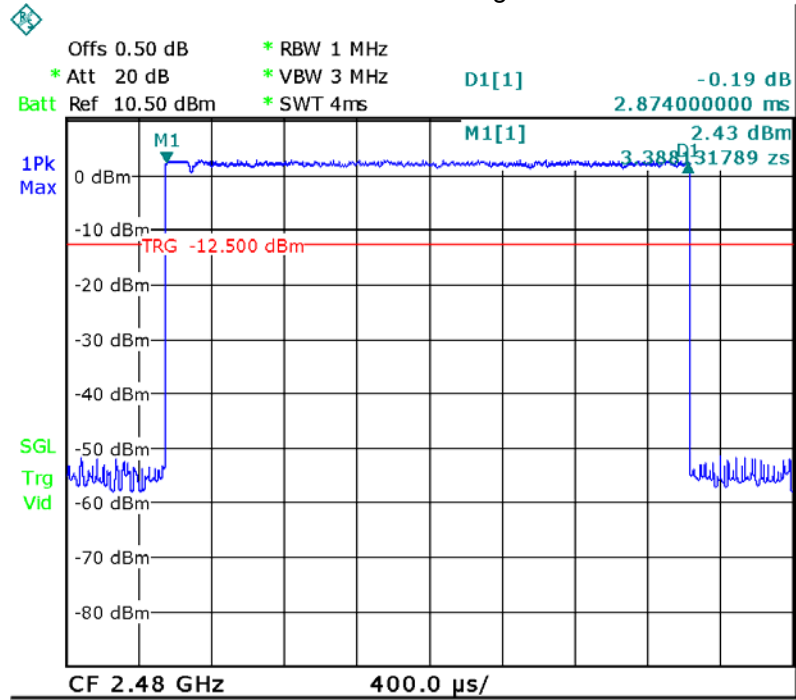
GFSK DH5 High Channel



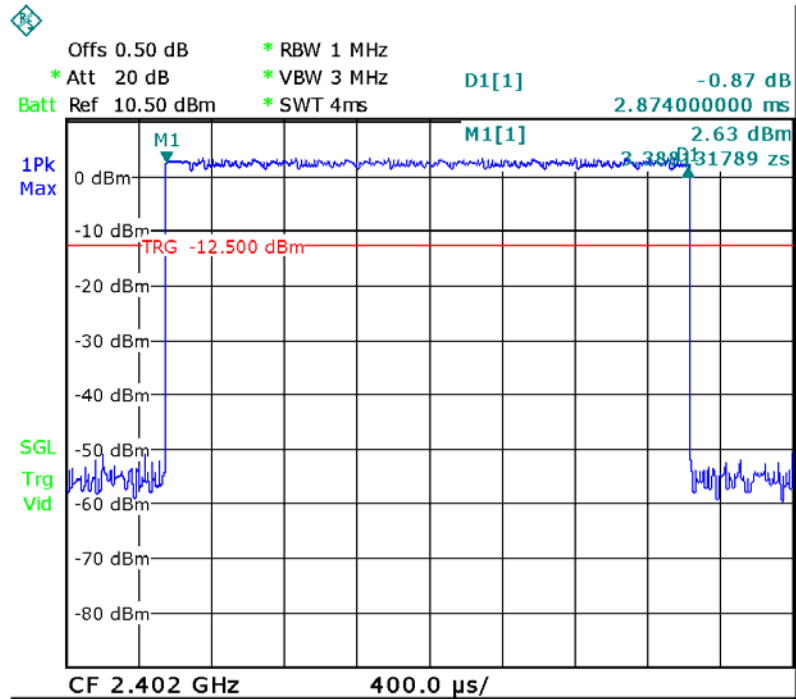




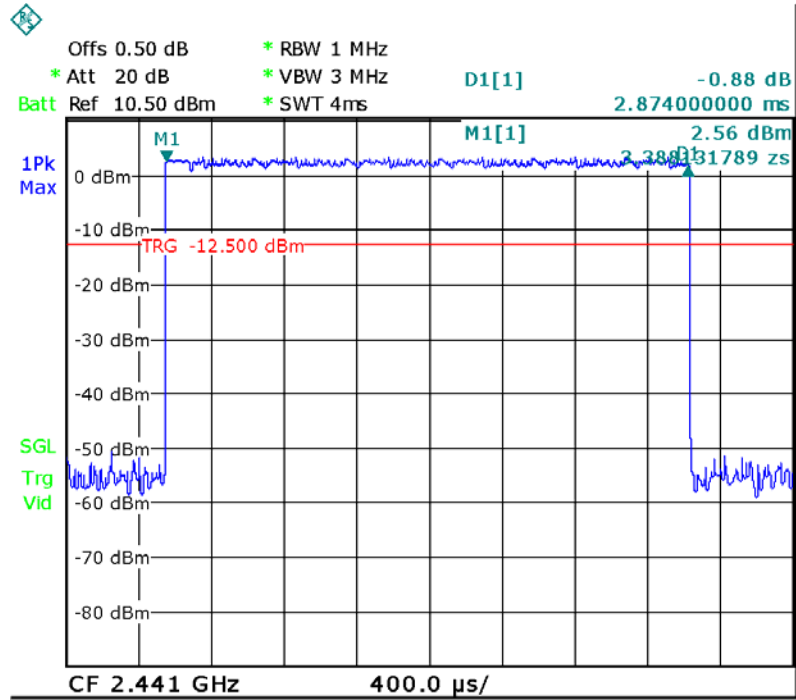
Pi/4DQPSK DH5 High Channel



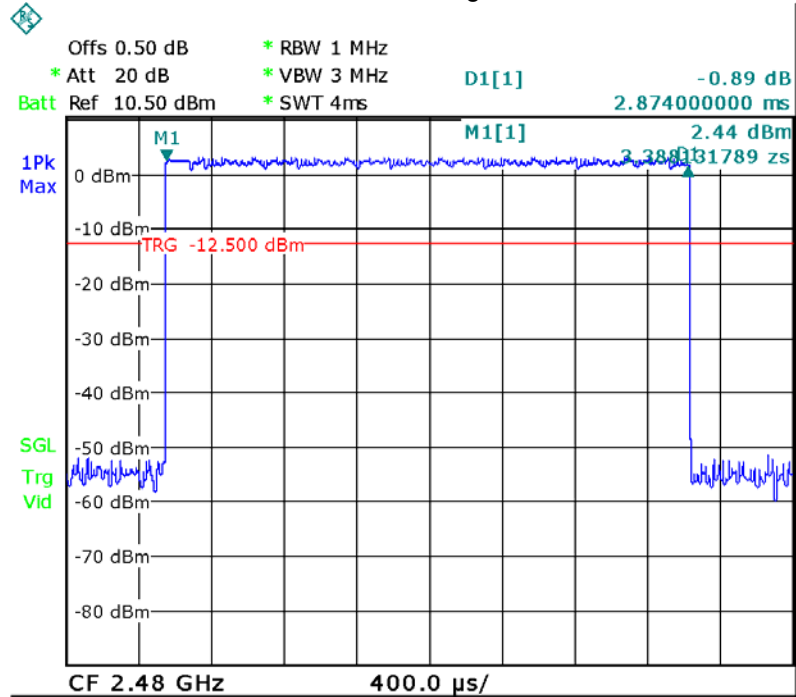
8DPSK DH5 Low Channel



### 8DPSK DH5 Middle Channel



### 8DPSK DH5 High Channel



## **15 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 an integrated antenna, fulfil the requirement of this section.

