

TEST REPORT

Reference No...... : WTS17S0169025-1E V1
FCC ID : 2AC88-G1611
Applicant..... : HONGKONG UCLOUDLINK NETWORK TECHNOLOGY LIMITED
Address..... : Unit D.16F.chenknang plaza 250 Hennessy Road, Wanchai
Hongkong
Manufacturer : Shenzhen uCloudlink Network Technology, Co., Ltd
3rd Floor, A Part of Building 1, Shenzhen Software Industry Base,
Address..... : nanshan district xuefu Road, Post Code 518057, Shenzhen City,
Guangdong Province, P.R.China
Product Name..... : 4G Wireless Data Terminal
Model No..... : G1611
Brand..... : GlocalMe
Standards..... : FCC CFR47 Part 15.247:2016
Date of Receipt sample : Jan. 05, 2017
Date of Test : Jan. 06 ~ Mar. 12, 2017
Date of Issue..... : Apr. 05, 2017
Test Result..... : **Pass**

Remarks:

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

Prepared By:

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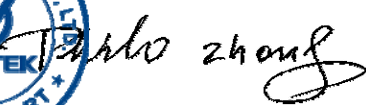
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2 Laboratories Introduction

Waltek Services Test Group Ltd is a professional third-party testing and certification organization with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by CNAS (China National Accreditation Service for Conformity Assessment) AQSIC, CMA and IECEE for CBTL. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc.



Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen and have branches in Foshan, Dongguan, Zhongshan, Suzhou, Ningbo and Hong Kong, Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), reliability and energy performance, Chemical test. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

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4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0169025-1E	Jan.05, 2017	Jan.06 ~ Mar.12, 2017	Mar.13, 2017	original	-	Replaced
WTS17S0169025-1E V1	Jan.05, 2017	Jan.06 ~ Mar.12, 2017	Apr. 05, 2017	original	Updated	Valid

5 General Information

5.1 General Description of E.U.T.

Product Name:	4G Wireless Data Terminal
Model No.:	G1611
Model Description:	N/A
GSM Band(s):	GSM 850/900/1800/1900MHz
GPRS/EGPRS Class:	12
CDMA2000 Band(s):	BC0/ BC1
WCDMA Band(s):	FDD Band I/II/IV/V/VIII
LTE Band(s):	FDD Band 2/4/5/17/41
Wi-Fi Specification:	2.4G-802.11b/g/n HT20
Bluetooth Version:	Bluetooth v4.0 with BLE
GPS:	Support
NFC:	N/A
Hardware Version:	G3 VER.B
Software Version:	G3_HTSV1.1.001.003.170112
storage location:	Internal Storage
Test Exercise:	The EUT was operated in a normal mode.
Note:	<p>Main board(Modem1): The EUT Main board support GSM850/900/DCS1800/PCS1900, WCDMA Band 1/2/4/5/8, CDMA2000 BC0/BC1, LTE Band 2/4/5/17/41 function. It is intended for speech, Multimedia Message Service (MMS) transmission and 4G free roaming hotspot. It is equipped with GPRS/EDGE class 12 for GSM850/900/DCS1800/PCS1900, GPS,Bluetooth and Wi-Fi functions. For more information see the following datasheet.</p> <p>Vice board(Modem2): The EUT Vice board support GSM850/900/DCS1800/PCS1900, WCDMA Band 1/2/4/5/8, CDMA2000 BC0/BC1,. It is intended for system localization. It is equipped with GPRS/EDGE class 12 for GSM850/900/DCS1800/PCS1900</p>

5.2 Details of E.U.T.

Operation Frequency:	GPRS/EDGE 850: 824~849MHz
	GPRS/EDGE 1900: 1850~1910MHz
	CDMA2000 BC0: 824.70~848.31MHz
	CDMA2000 BC1: 1851.25~1908.75MHz
	WCDMA Band II: 1850~1910MHz
	WCDMA Band IV: 1710~1755MHz
	WCDMA Band V: 824~849MHz
	LTE Band 2: 1850~1910MHz

	LTE Band 4: 1710~1755MHz
	LTE Band 5: 823~850MHz
	LTE Band 17: 704~716MHz
	LTE Band 41: 2498~2688MHz
	WiFi:
	802.11b/g/n HT20: 2412~2462MHz
	Bluetooth: 2402~2480MHz
Max. RF output power:	Main Board:
	GSM 850: 32.83dBm
	PCS1900:30.09dBm
	WCDMA Band II: 22.29dBm
	WCDMA Band IV: 22.54dBm
	WCDMA Band V: 22.21dBm
	CDMA2000 BC0: 24.82dBm
	CDMA2000 BC1: 24.59dBm
	LTE Band 2: 22.99dBm
	LTE Band 4: 23.52dBm
	LTE Band 5: 22.66dBm
	LTE Band 17: 22.68dBm
	LTE Band 41: 23.80dBm
	Vice Board:
	GSM 850: 32.89dBm
	PCS1900:30.05dBm
	WCDMA Band II: 22.78dBm
	WCDMA Band V: 22.46dBm
	WCDMA Band IV: 22.56dBm
	CDMA2000 BC0: 24.65dBm
	CDMA2000 BC1: 24.44dBm
	WiFi(2.4G): 9.41dBm
	Bluetooth: 7.73dBm
Type of Modulation:	GPRS: GMSK
	EDGE: GMSK, 8PSK
	CDMA2000:QPSK, 8PSK
	WCDMA: BPSK, 16QAM
	LTE: QPSK, 16QAM
	WiFi: CCK, OFDM
	Bluetooth: GFSK, Pi/4 DQPSK, 8DPSK
Antenna installation:	GSM/WCDMA/CDMA2000/LTE: internal permanent antenna
	WiFi/Bluetooth: internal permanent antenna
Antenna Gain	GSM 850: 3.47dBi
(Main board same as	PCS1900: 1.77dBi

vice board):	CDMA2000 BC0: -0.3dBi
	CDMA2000 BC1: -1.9dBi
	WCDMA Band II: 1.77dBi
	WCDMA Band V: 3.47dBi
	WCDMA Band IV: 2.2dBi
	LTE Band 2: 1.77dBi
	LTE Band 4: 2.2dBi
	LTE Band 5: 3.47dBi
	LTE Band 17: 5.20dBi
	LTE Band 41: 0.75dBi
	WiFi(2.4G): 1.4dBi
Technical Data:	Bluetooth: 1.4dBi
	Input: DC 3.8V, 5350mWh by battery,
	or DC 5V, 1.0A by USB port
	Output: 5V 1.0A by USB port

5.3 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	-	-

5.4 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

5.5 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, October 15, 2016.
- 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.

Waltek Services (Shenzhen) Co.,Ltd.

<http://www.waltek.com.cn>

6 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

7 Equipment Used during Test

7.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.12,2016	Sep.11,2017
2.	LISN	R&S	ENV216	101215	Sep.12,2016	Sep.11,2017
3.	Cable	Top	TYPE16(3.5M)	-	Sep.12,2016	Sep.11,2017
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.12,2016	Sep.11,2017
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.12,2016	Sep.11,2017
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.12,2016	Sep.11,2017
4.	Cable	LARGE	RF300	-	Sep.12,2016	Sep.11,2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	Apr.29, 2016	Apr.28, 2017
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Apr.09,2016	Apr.08,2017
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.09,2016	Apr.08,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.12,2016	Sep.11,2017
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.09,2016	Apr.08,2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.09,2016	Apr.08,2017
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.13,2016	Apr.12,2017
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.13,2016	Apr.12,2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Apr.13,2016	Apr.12,2017
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr.09,2016	Apr.08,2017
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Apr.13,2016	Apr.12,2017
4	Cable	HUBER+SUHNER	CBL2	525178	Apr.13,2016	Apr.12,2017

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

7.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

7.3 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 Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Conducted Spurious Emissions test	± 3.12 dB (150KHz~30MHz)
	± 4.21 dB (30M~1000MHz)
	± 5.14 dB (1000M~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

7.4 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.

8 Conducted Emission

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Class/Severity: Class B

Limit:

Frequency (MHz)	Limit (dB μ V)	
	Quasi-peak	average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	60
5 to 30	60	50

8.1 E.U.T. Operation

Operating Environment :

Temperature: 22.8 °C

Humidity: 52.6 % RH

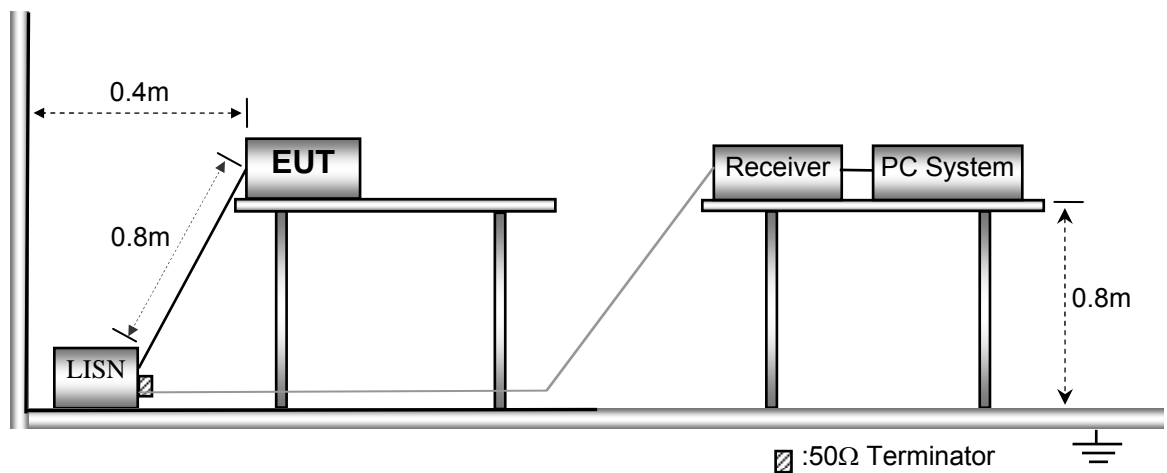
Atmospheric Pressure: 101.2kPa

EUT Operation :

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

8.2 EUT Setup

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



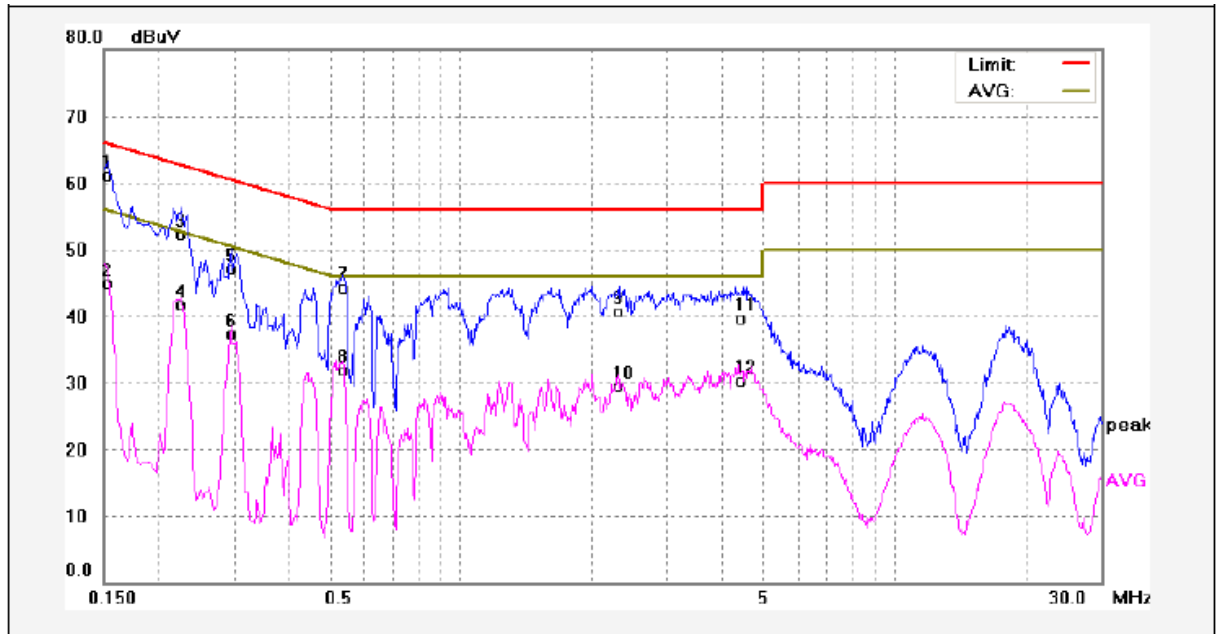
8.3 Measurement Description

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.

8.4 Conducted Emission Test Result

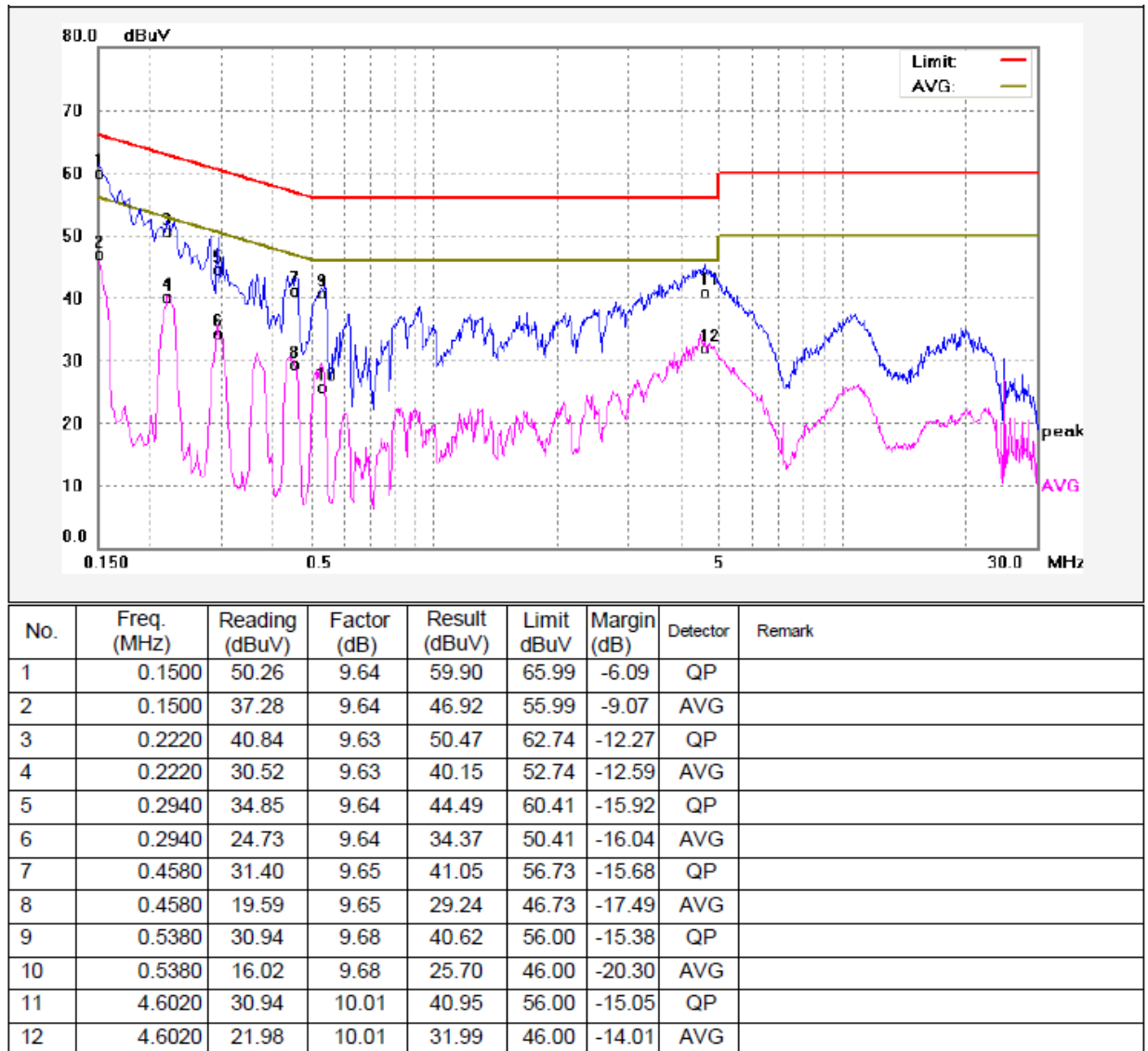
Remark: only the worst data (GFSK modulation Low channel mode) were reported

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	51.53	9.64	61.17	65.78	-4.61	QP	
2	0.1539	35.31	9.64	44.95	55.78	-10.83	AVG	
3	0.2260	42.76	9.63	52.39	62.59	-10.20	QP	
4	0.2260	32.17	9.63	41.80	52.59	-10.79	AVG	
5	0.2940	37.44	9.64	47.08	60.41	-13.33	QP	
6	0.2940	27.62	9.64	37.26	50.41	-13.15	AVG	
7	0.5340	34.59	9.67	44.26	56.00	-11.74	QP	
8	0.5340	22.31	9.67	31.98	46.00	-14.02	AVG	
9	2.3140	30.81	9.94	40.75	56.00	-15.25	QP	
10	2.3140	19.54	9.94	29.48	46.00	-16.52	AVG	
11	4.4740	29.74	9.99	39.73	56.00	-16.27	QP	
12	4.4740	20.38	9.99	30.37	46.00	-15.63	AVG	

Neutral line:



9 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10: 2013

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	$20\log^{(500)}$

9.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

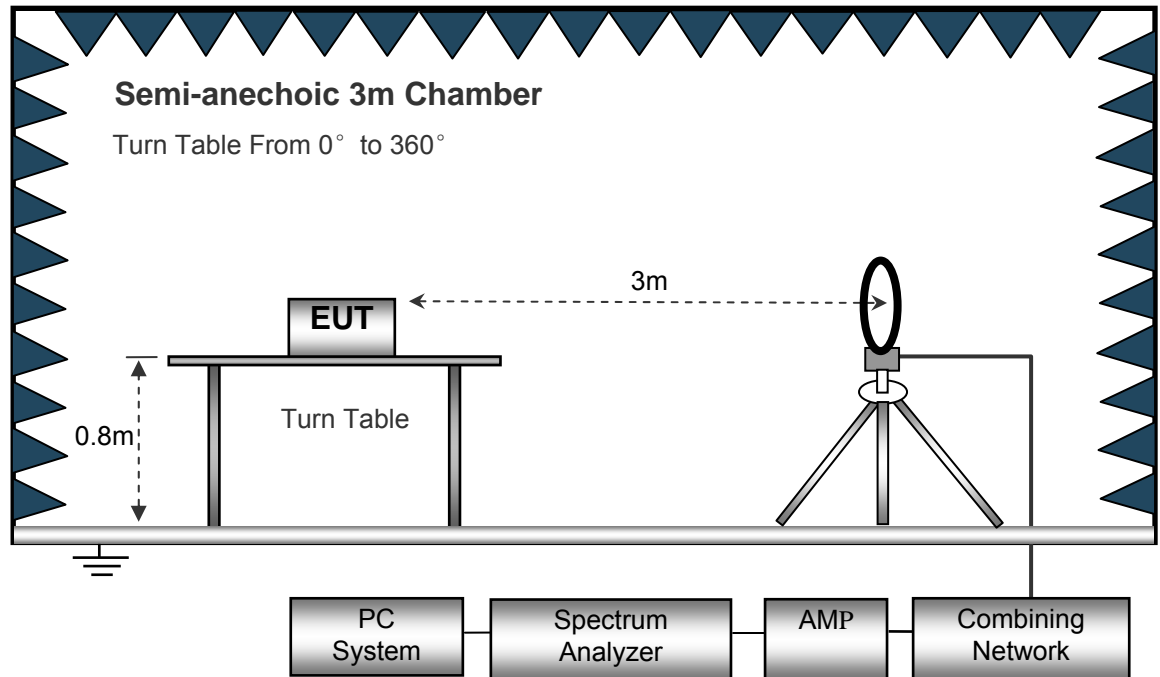
EUT Operation :

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

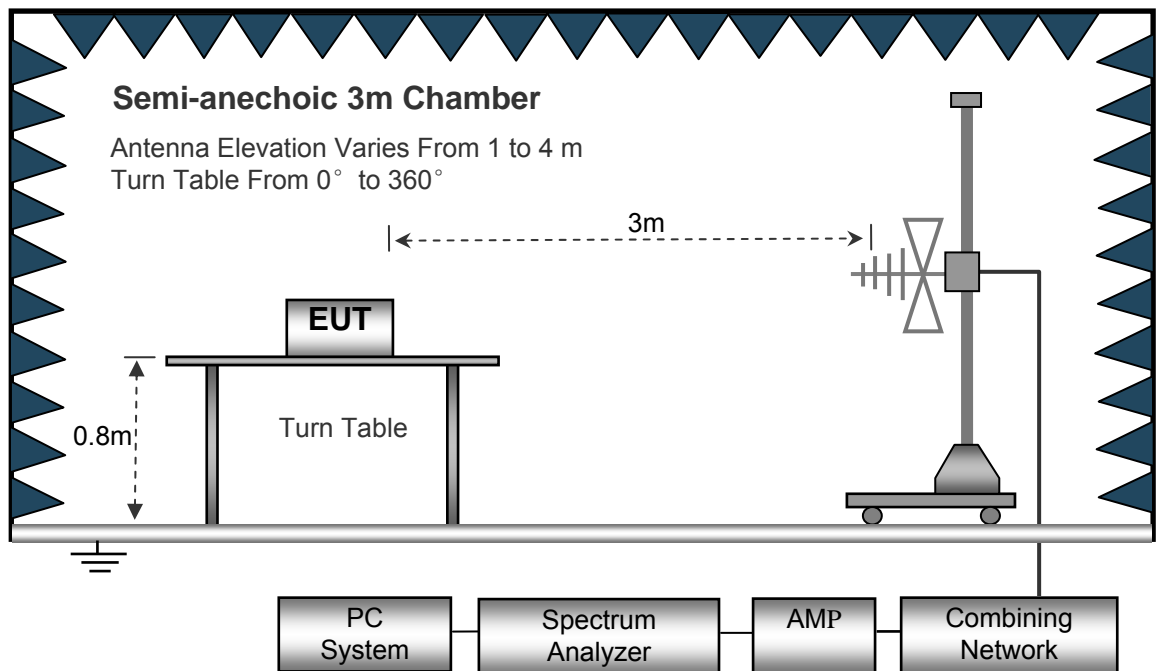
9.2 Test Setup

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

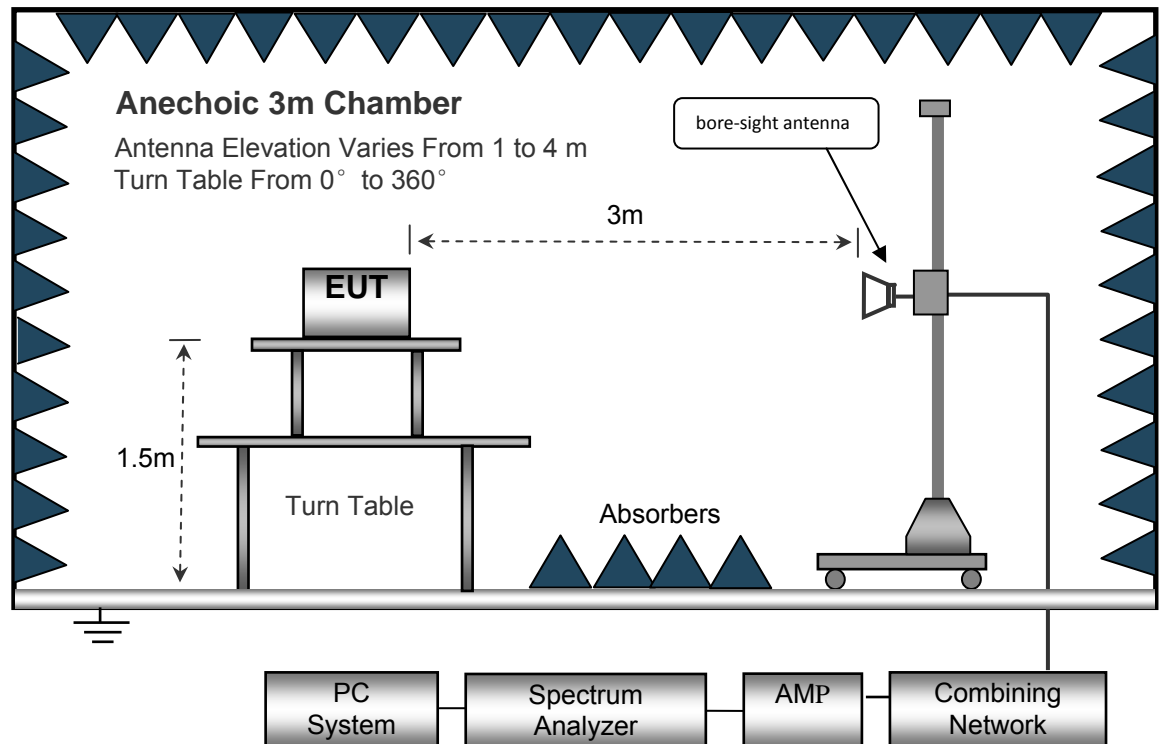
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



9.3 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

9.4 Test Procedure

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

9.5 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:

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

9.6 Summary of Test Results

Test Frequency: 9KHz~30MHz

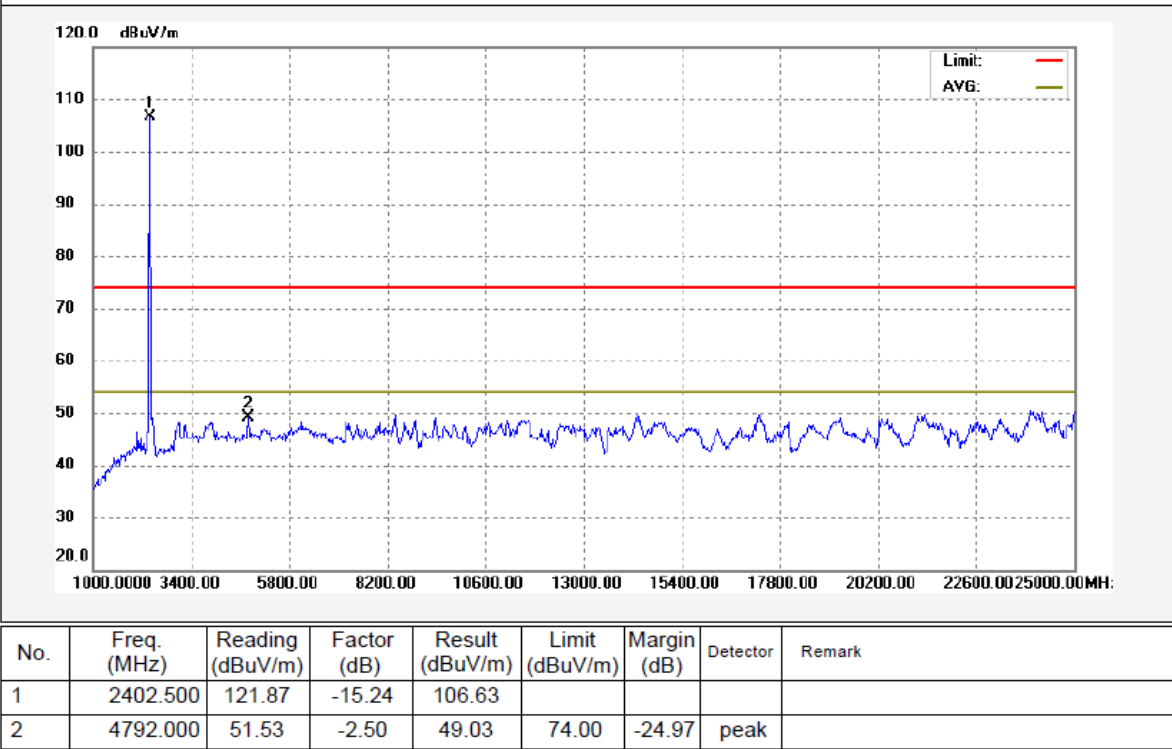
Remark: only the worst data (GFSK modulation Low channel mode) were reported

Frequency	Measurement results dB μ V @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dB μ V/m @30m	Limits dB μ V/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
6.021	25.34	QP	21.84	40.00	7.18	29.54	-22.36
8.304	26.13	QP	21.02	40.00	7.15	29.54	-22.39
26.127	24.02	QP	20.55	40.00	4.57	29.54	-24.97

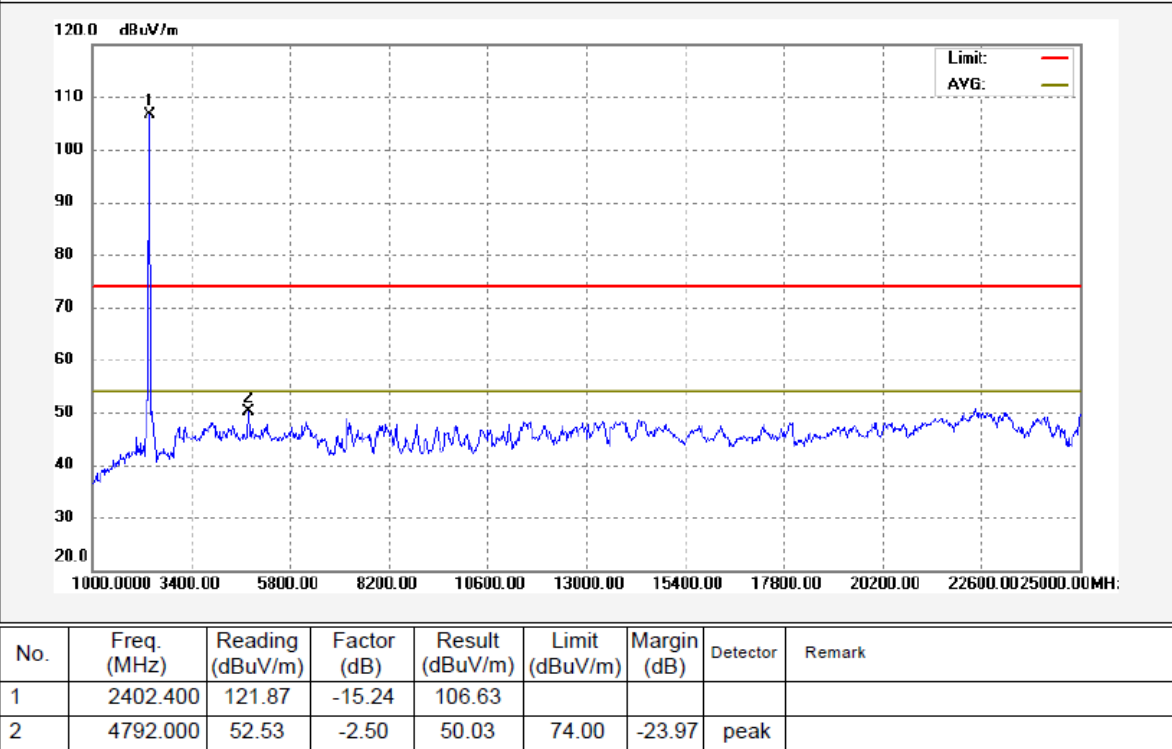
Test Frequency: Above 1GHz

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

Low Channel - Horizontal



Low Channel – Vertical



10 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

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)).

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:

Below 1GHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

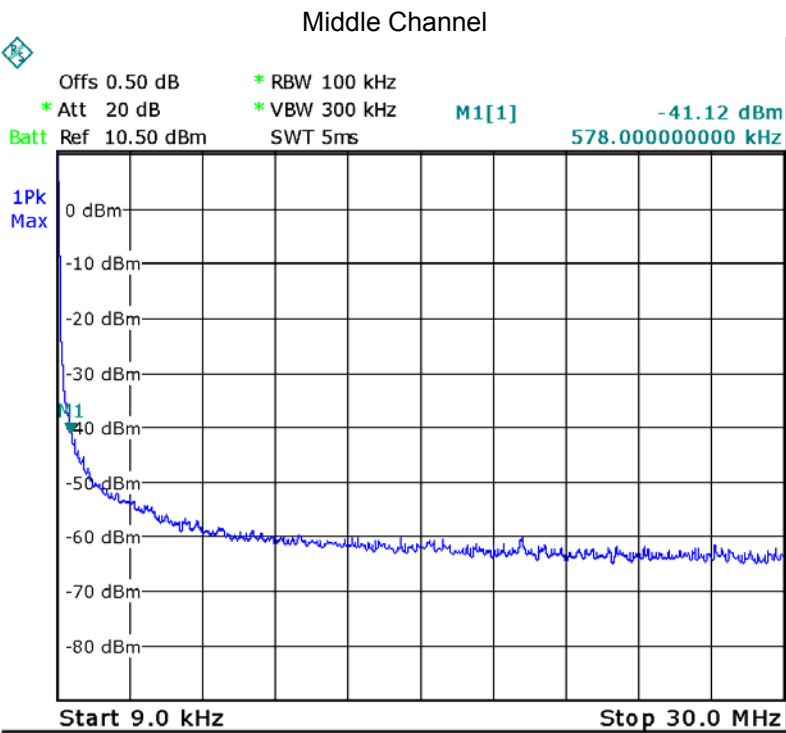
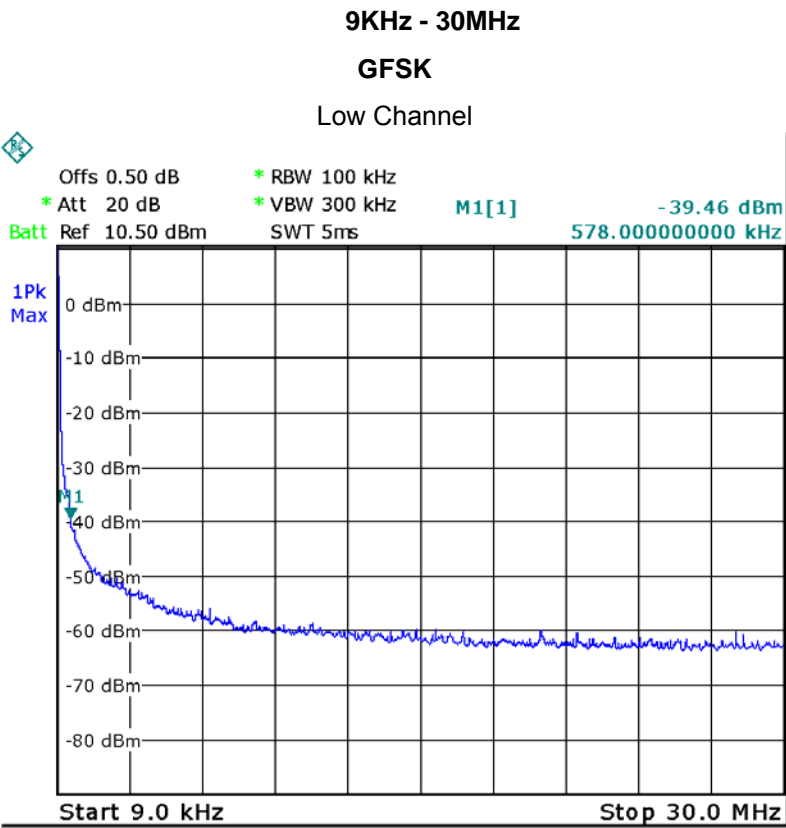
Detector function = peak, Trace = max hold

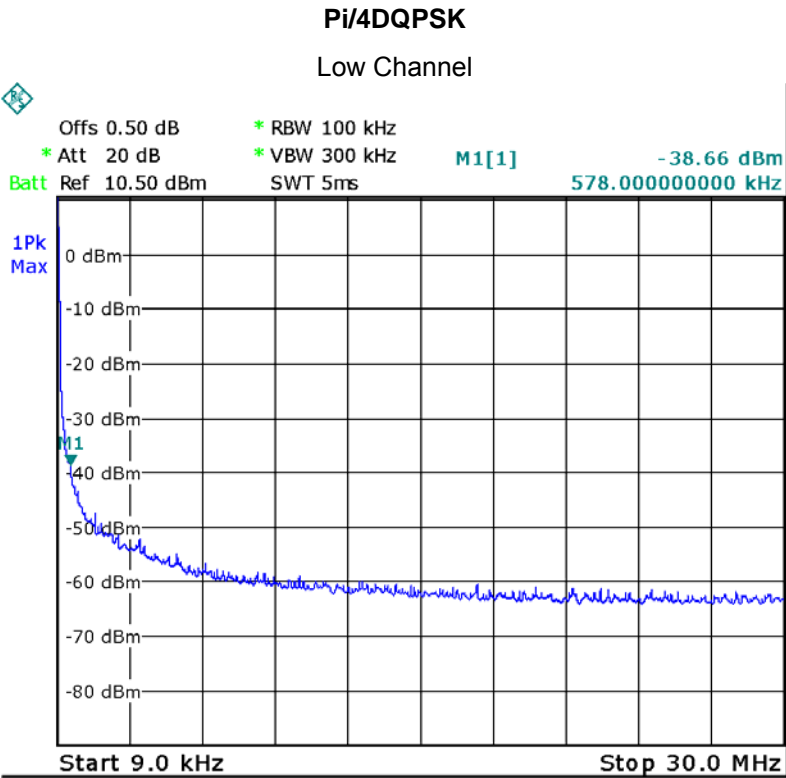
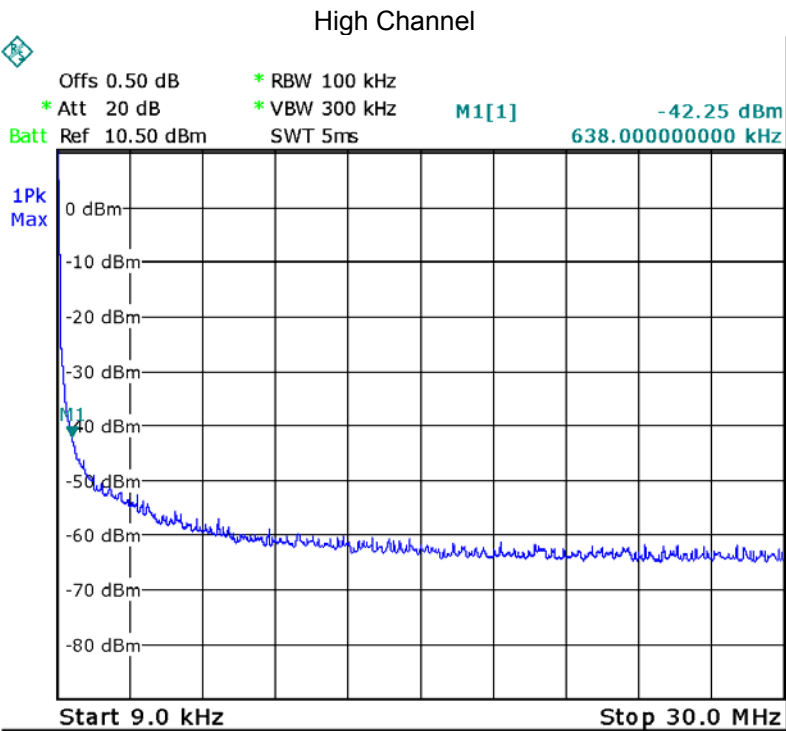
Above 1GHz:

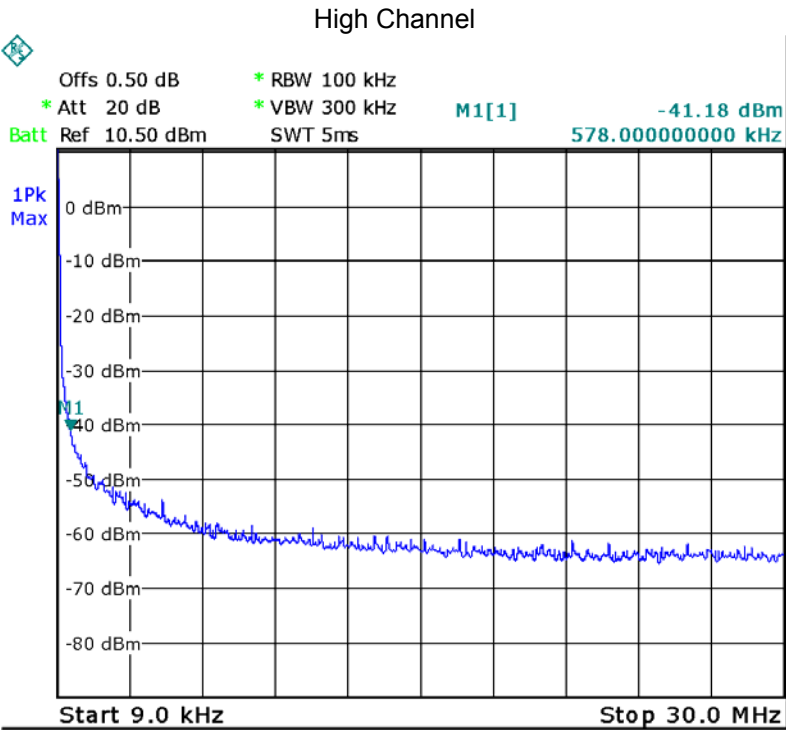
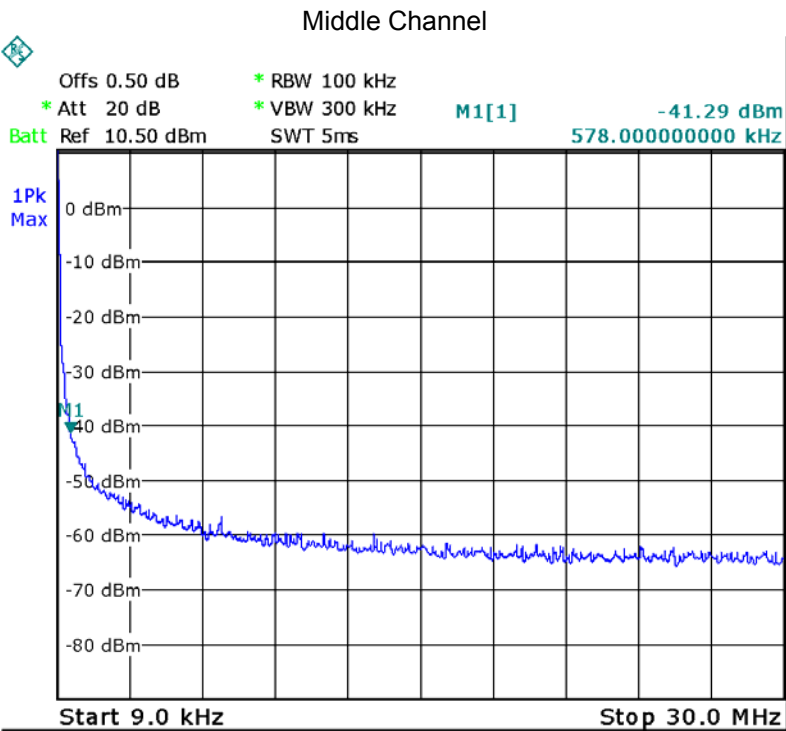
RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

10.2 Test Result

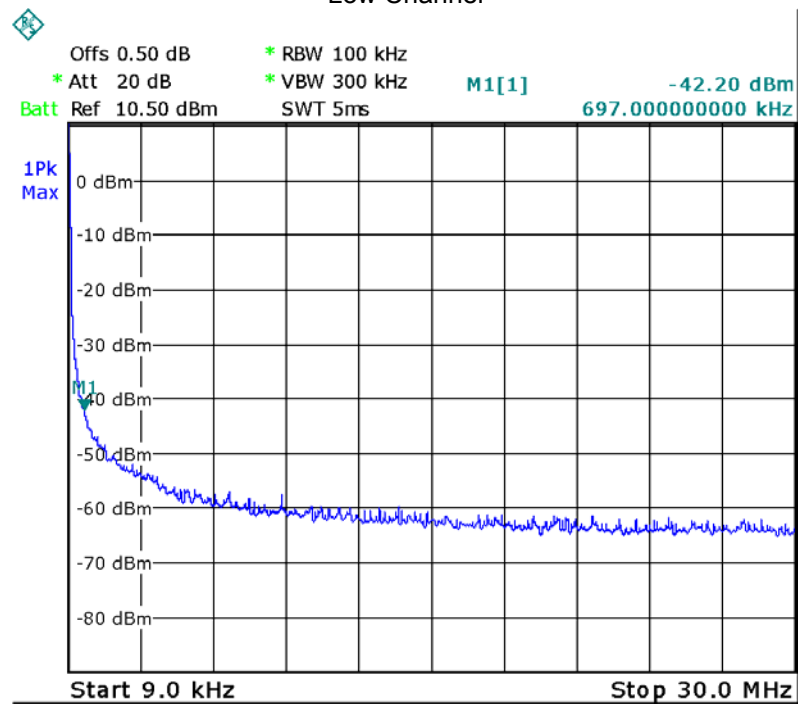




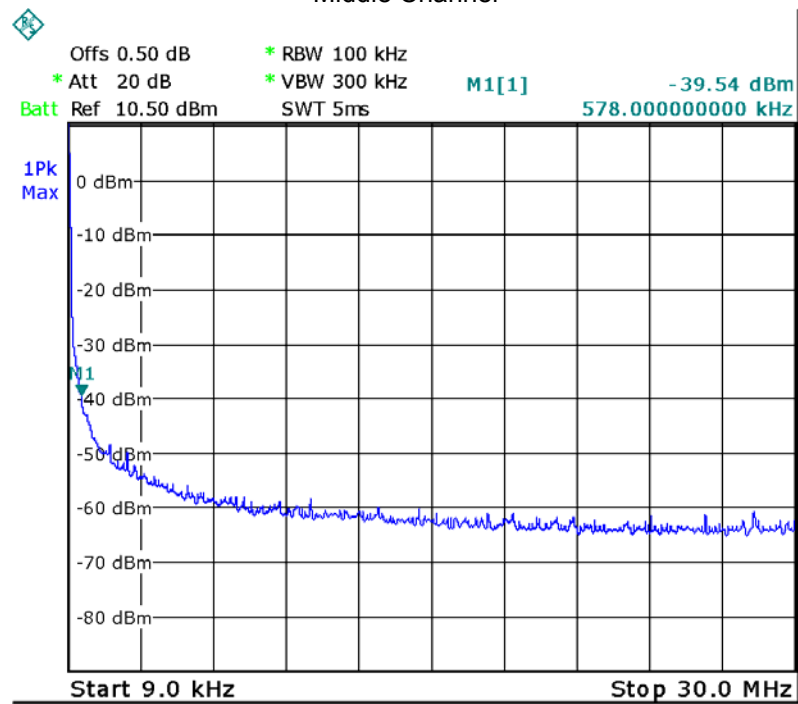


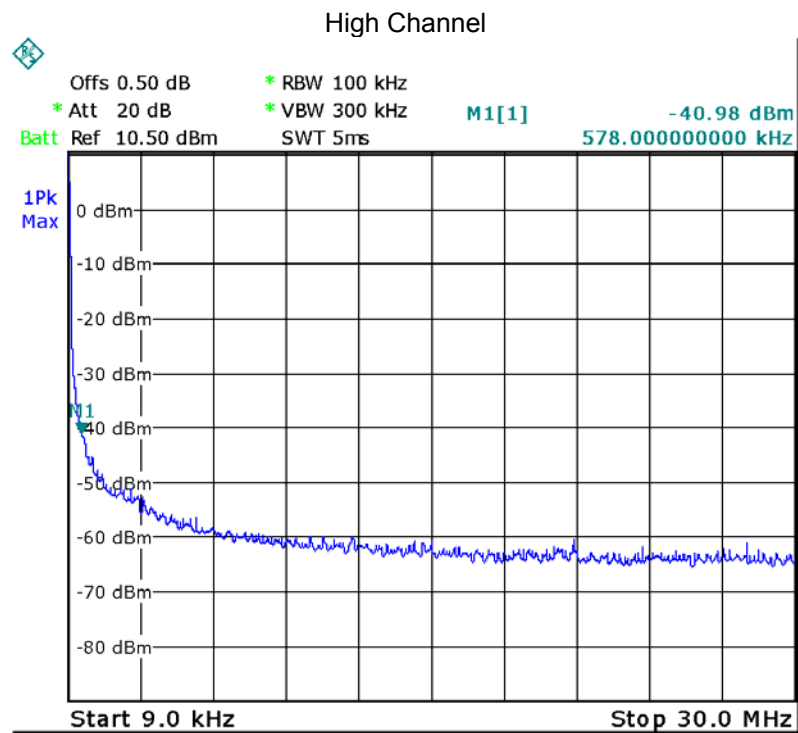
8DPSK

Low Channel



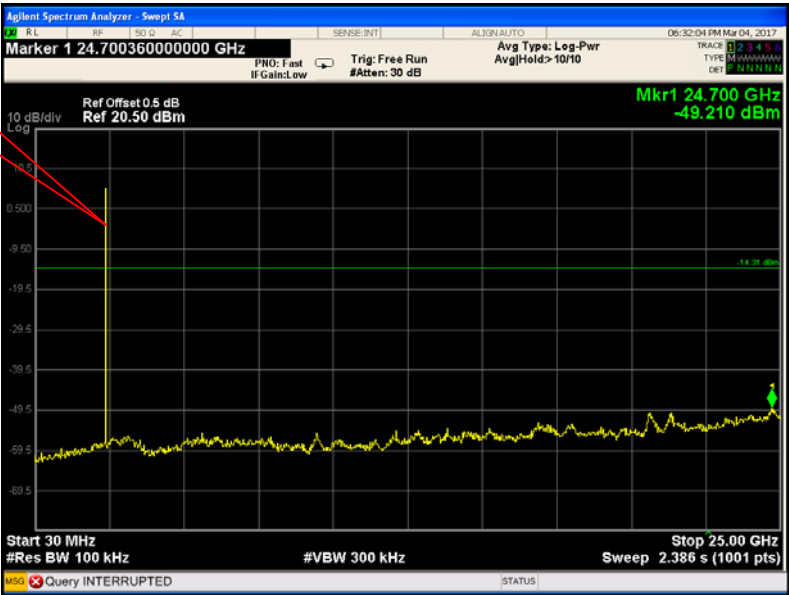
Middle Channel





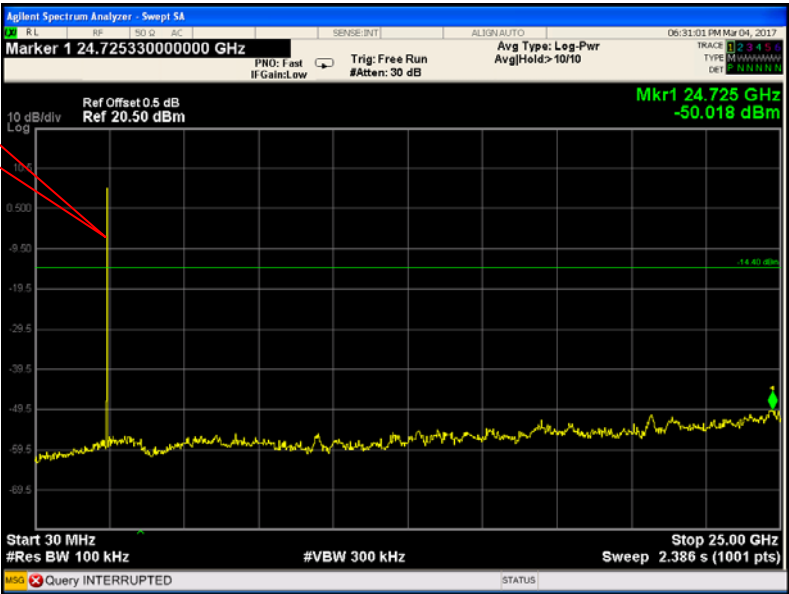
30MHz – 25GHz
GFSK Low Channel

Fundamental



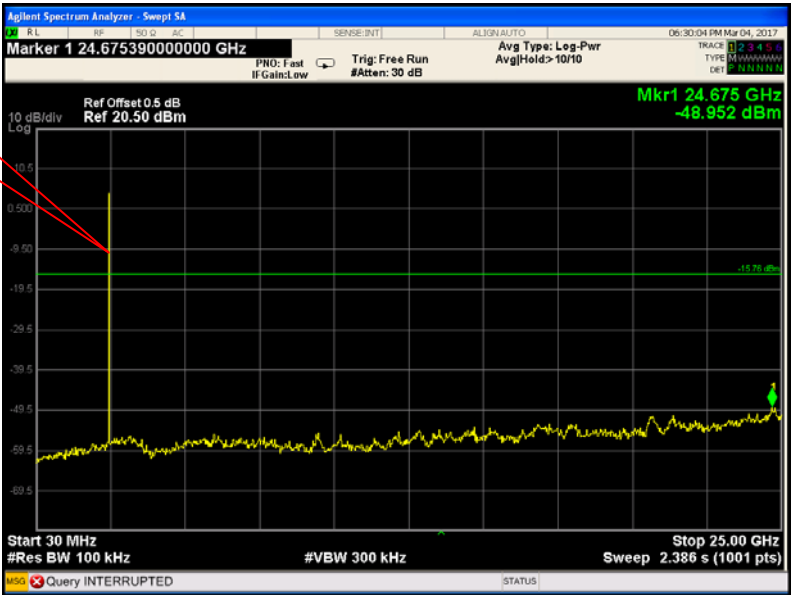
GFSK Middle Channel

Fundamental



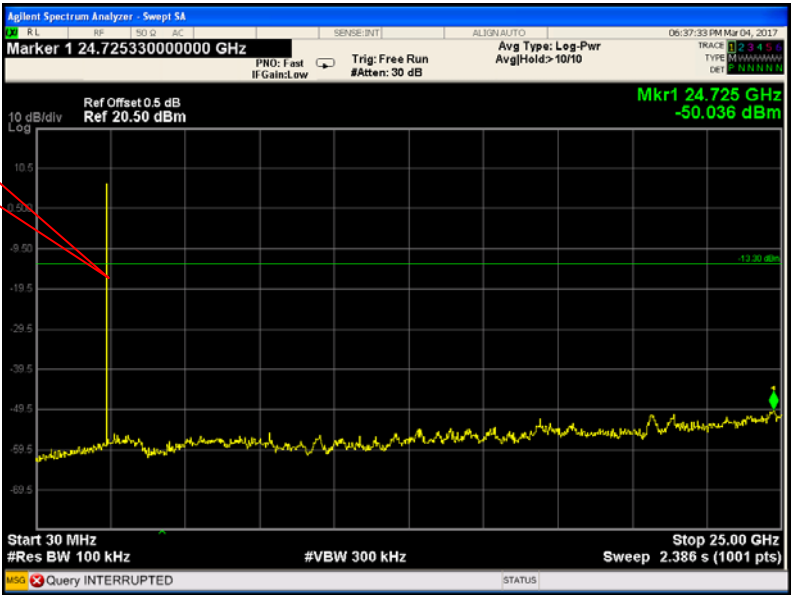
GFSK High Channel

Fundamental



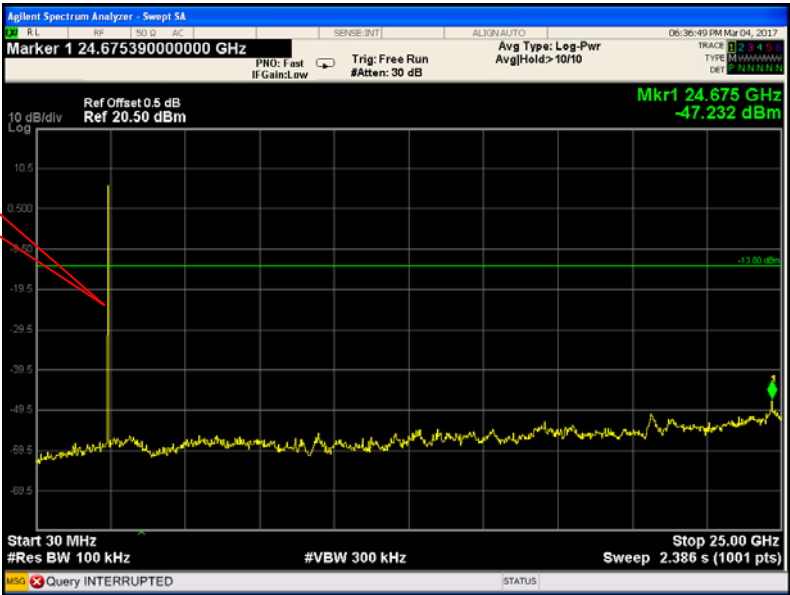
Pi/4 DQPSK Low Channel

Fundamental



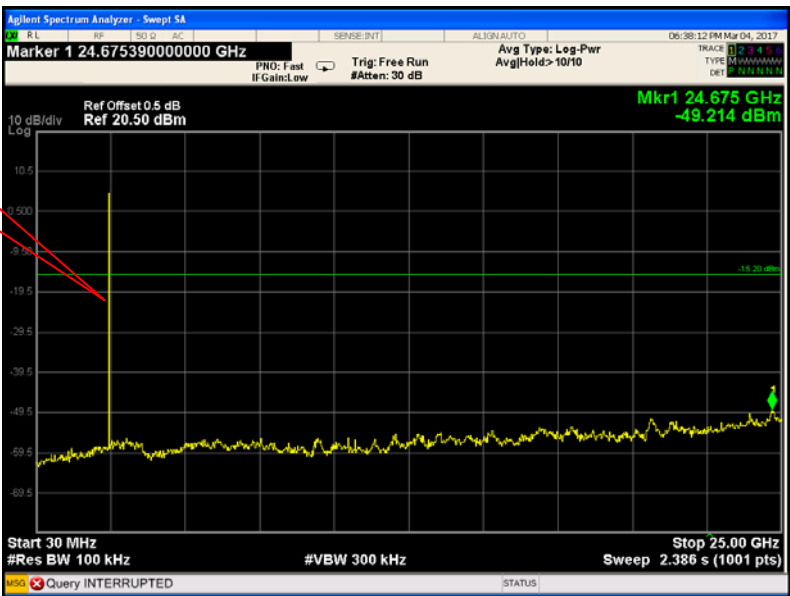
Pi/4 DQPSK Middle Channel

Fundamental

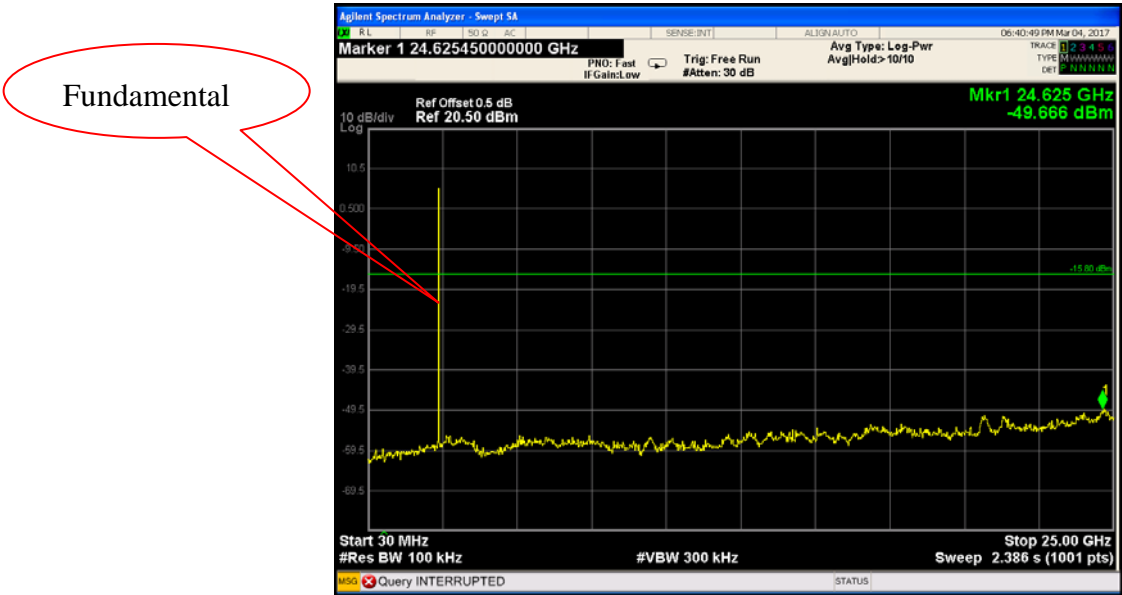


Pi/4 DQPSK High Channel

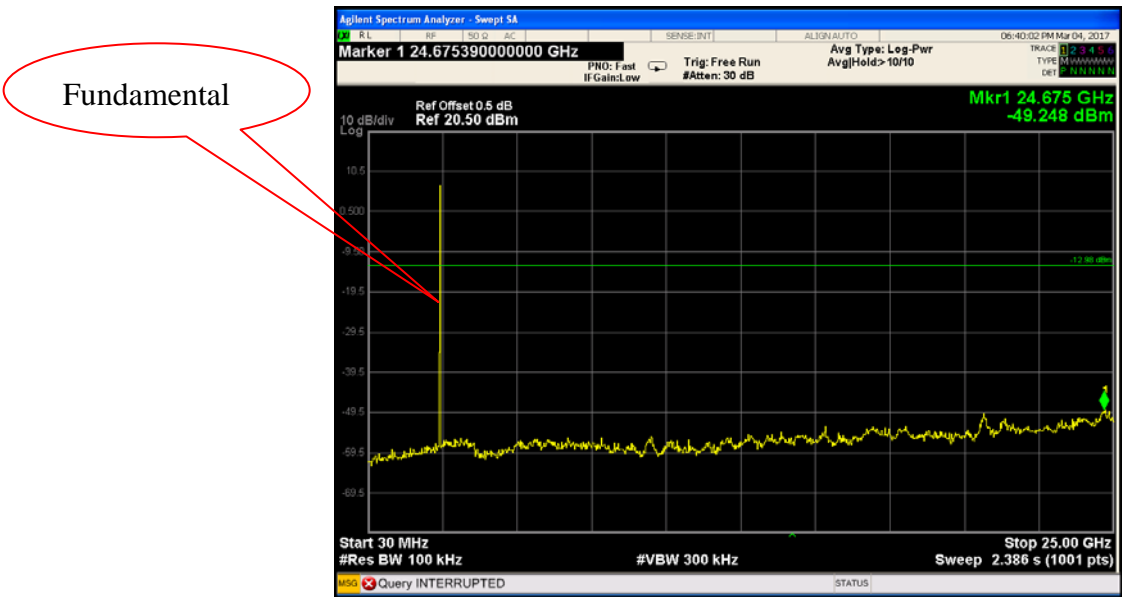
Fundamental



8DPSK Low Channel

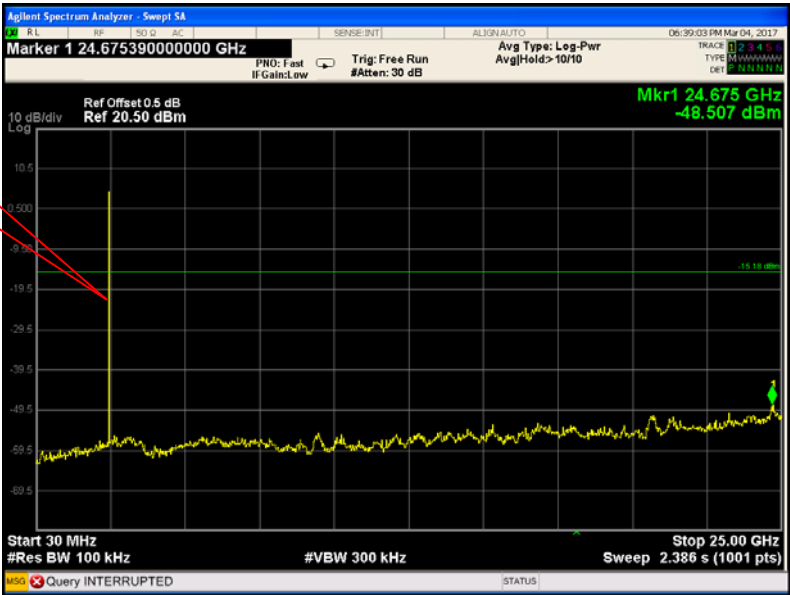


8DPSK Middle Channel



8DPSK High Channel

Fundamental



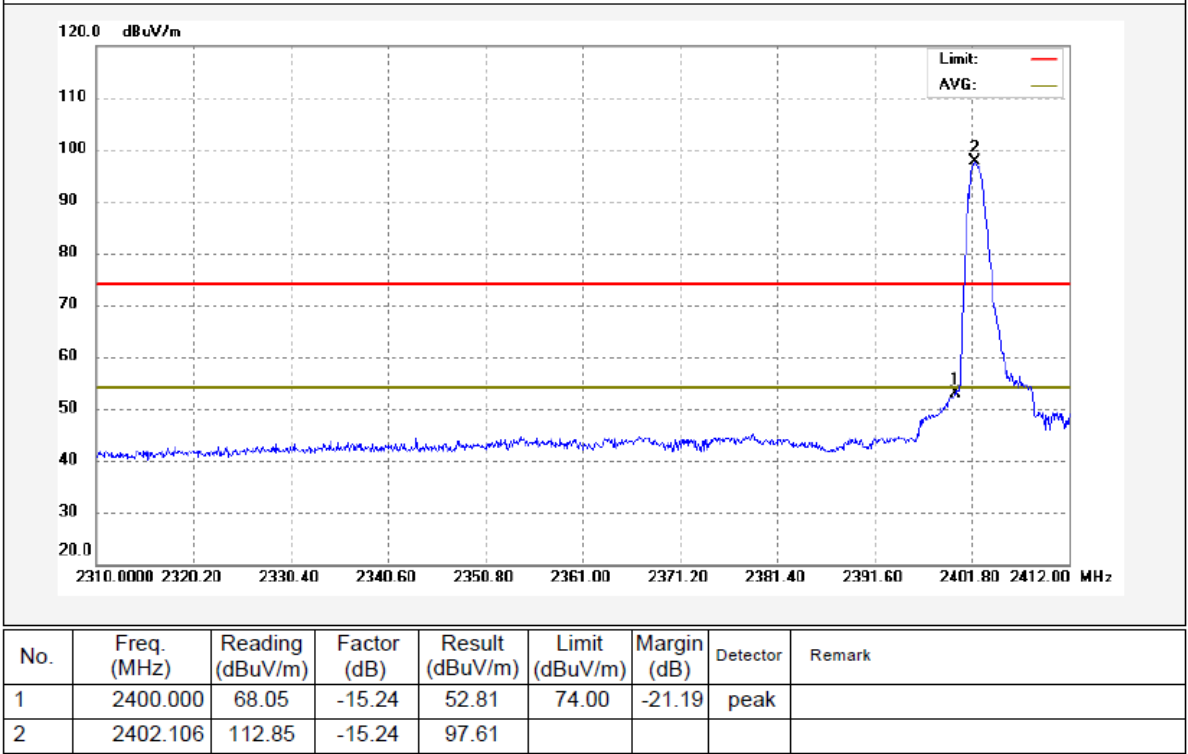
11 Band Edge Measurement

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

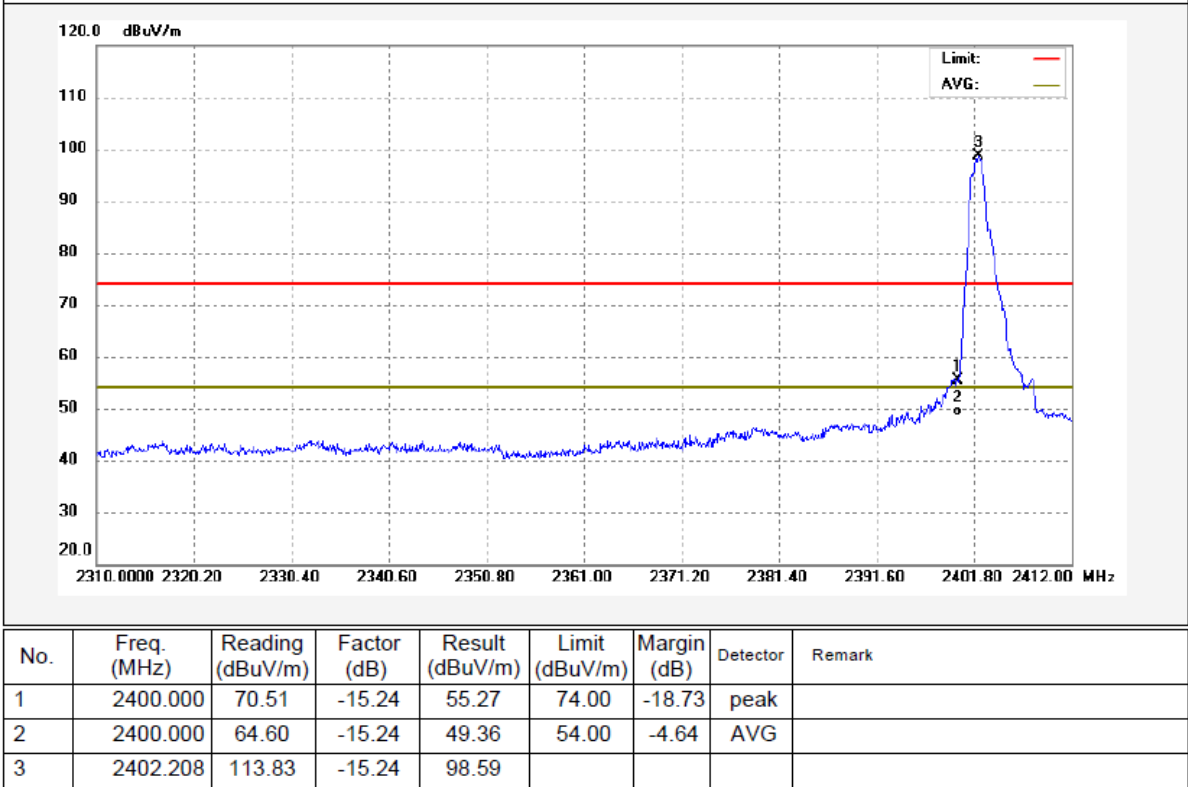
11.1 Test Procedure

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

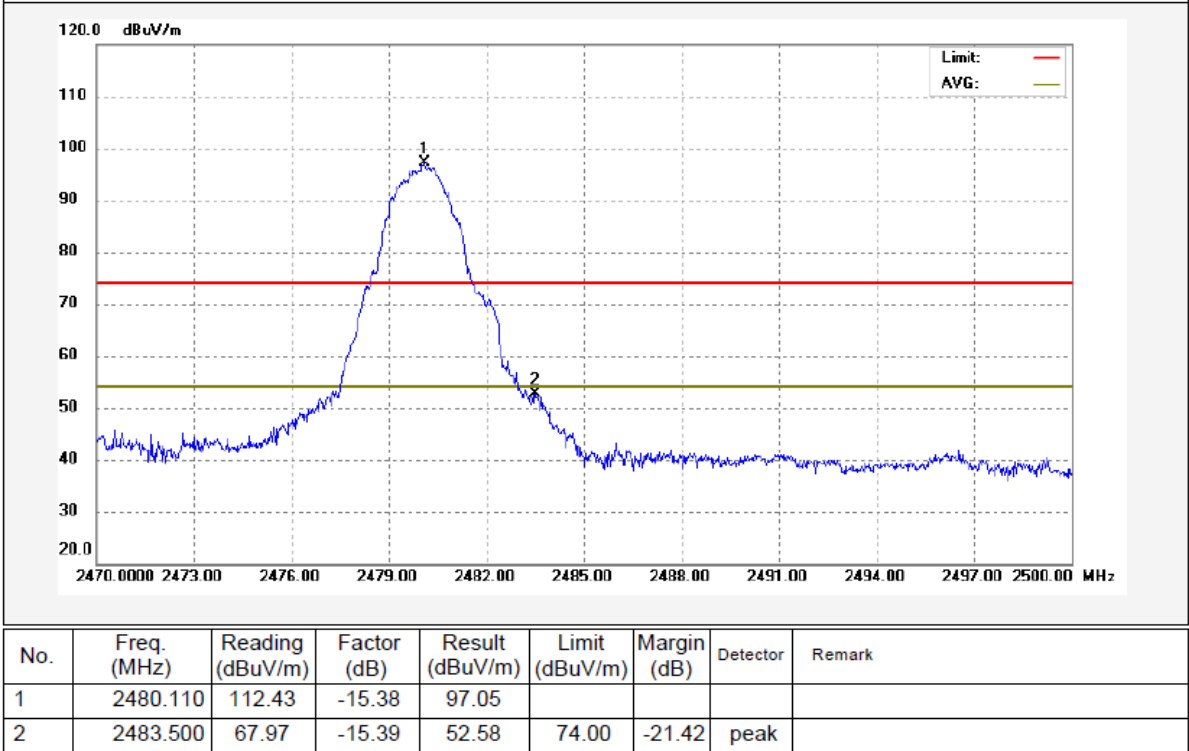
GFSK Transmitting Band edge-left side Horizontal



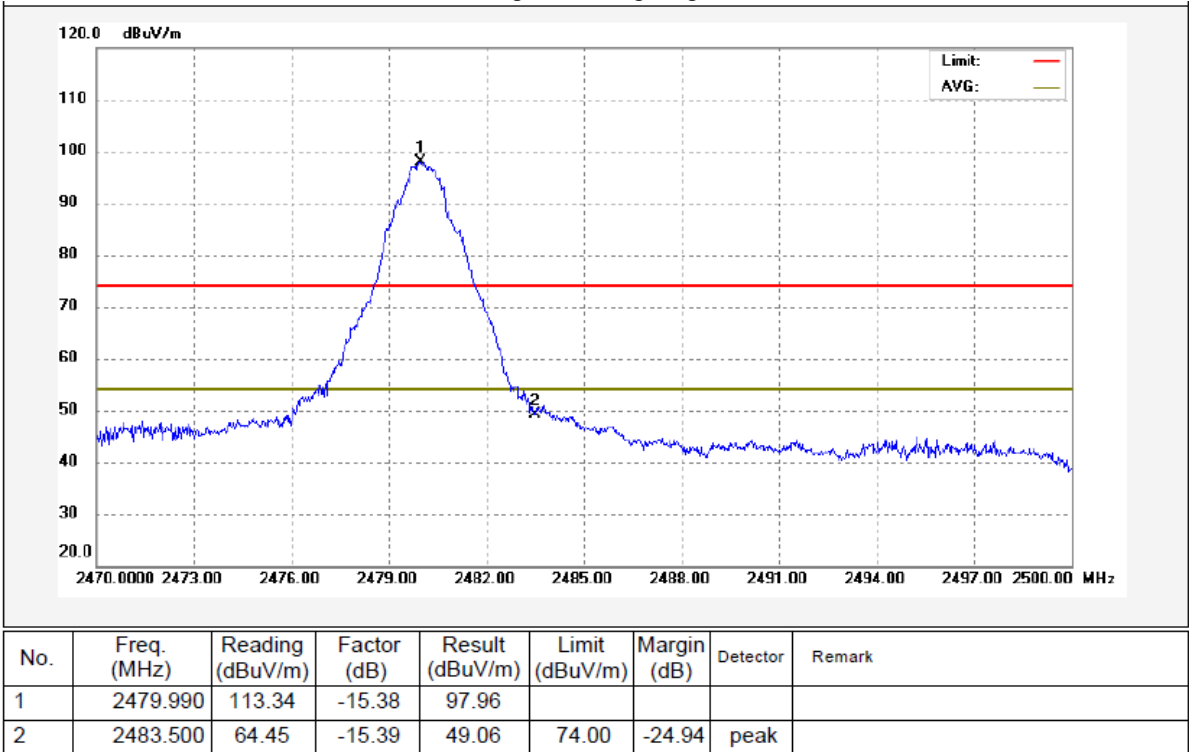
GFSK Transmitting Band edge-left side Vertical



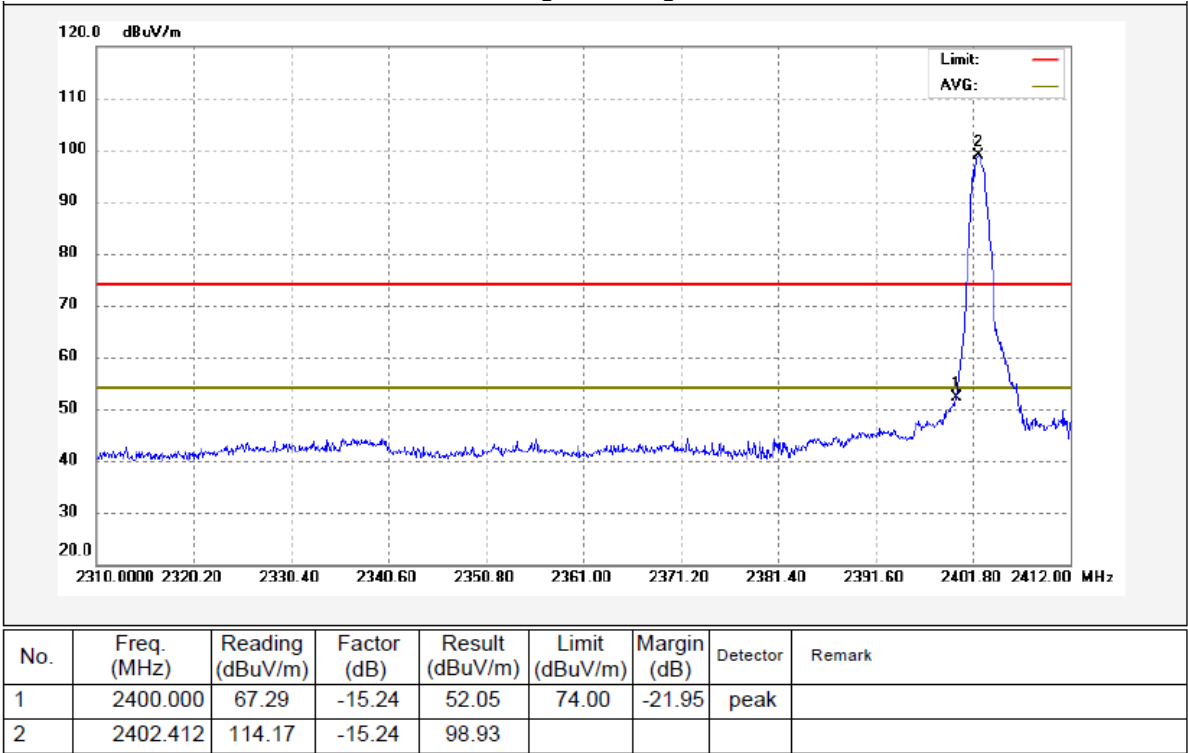
GFSK Transmitting Band edge-right side Horizontal



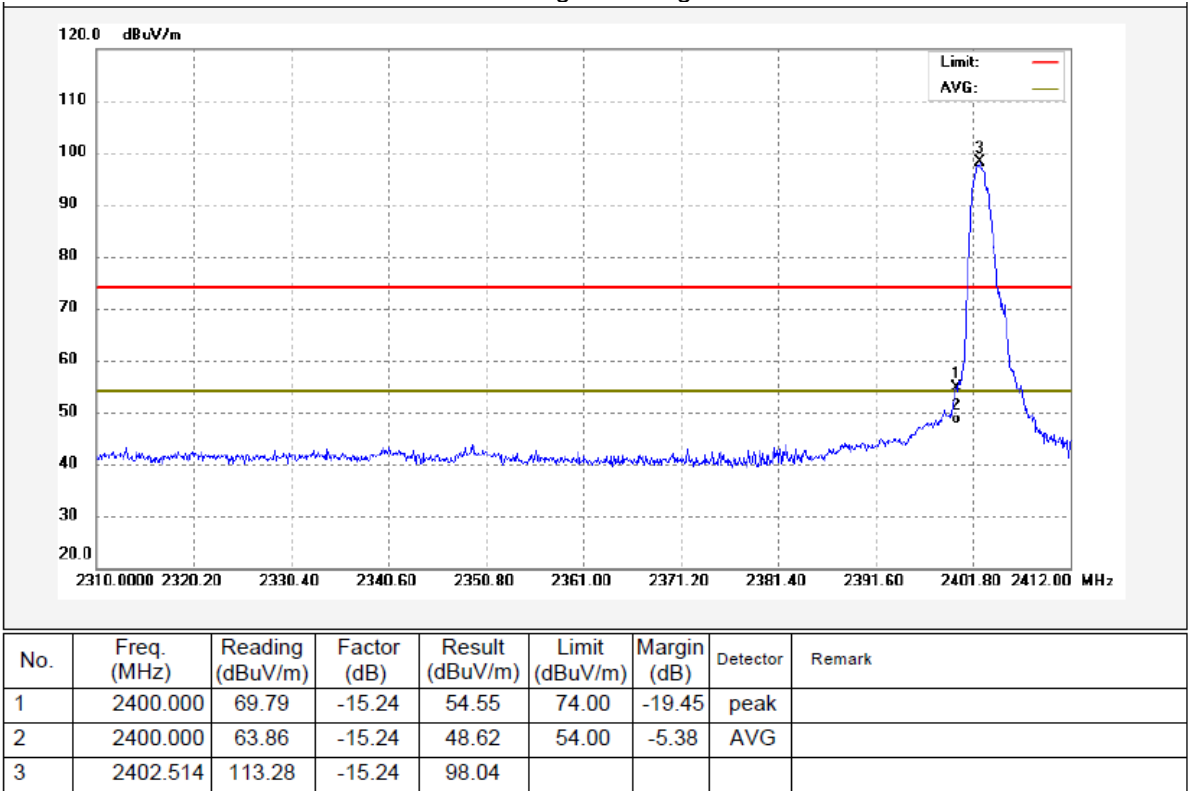
GFSK Transmitting Band edge-right side Vertical



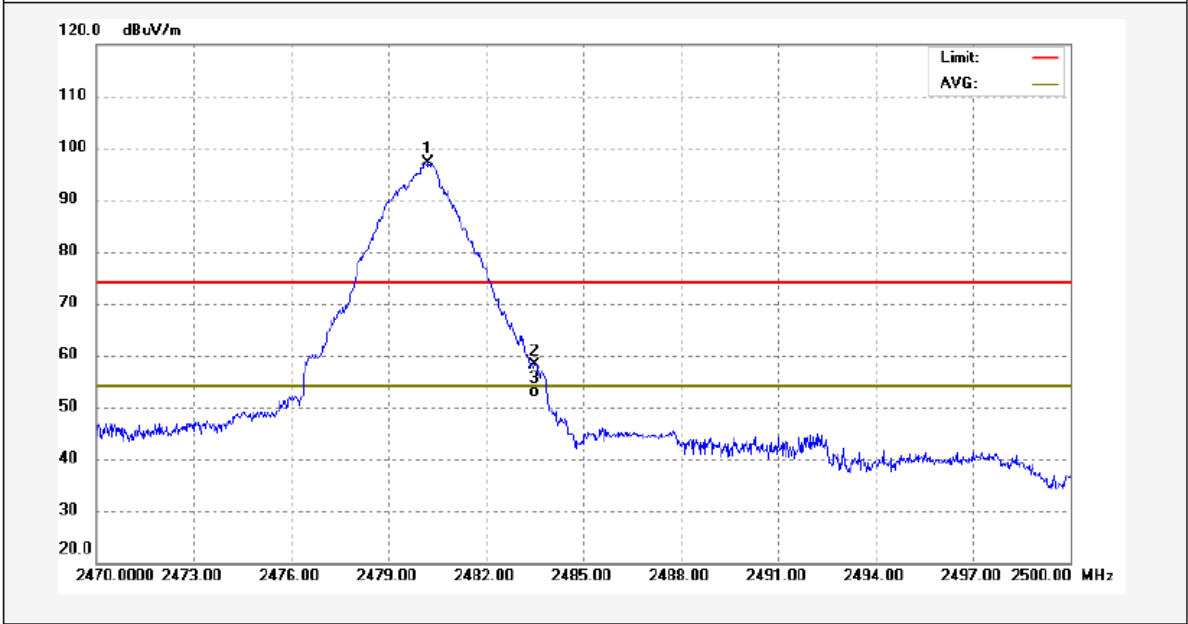
Pi/4 DQPSK Transmitting Band edge-left side Horizontal



Pi/4 DQPSK Transmitting Band edge-left side Vertical

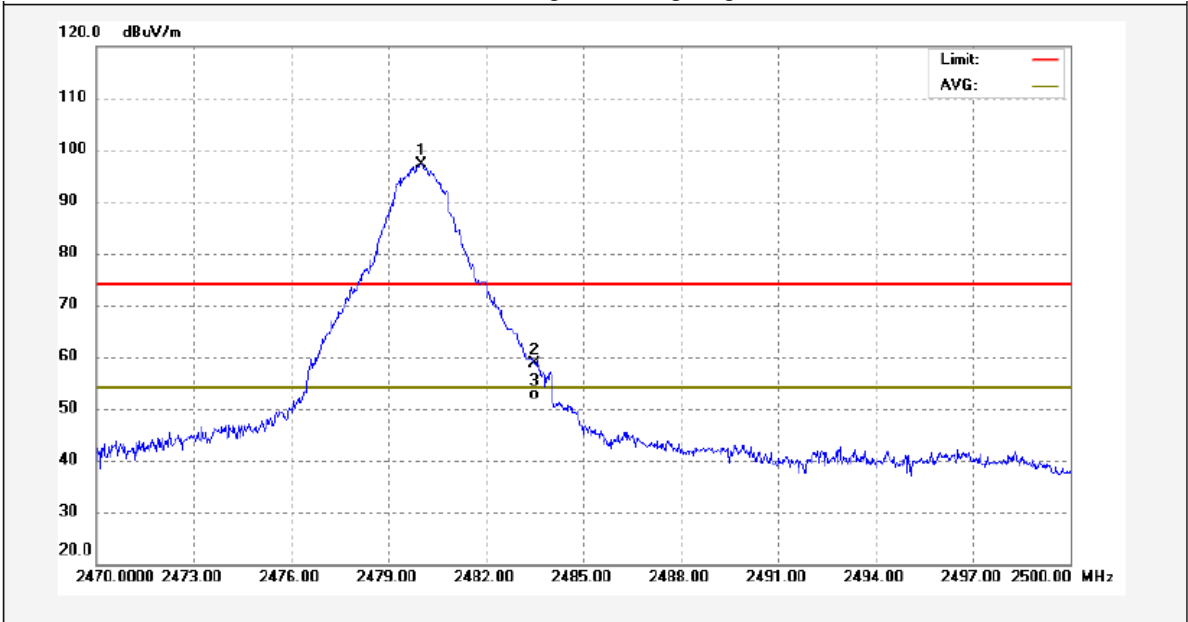


Pi/4 DQPSK Transmitting Band edge-right side Horizontal



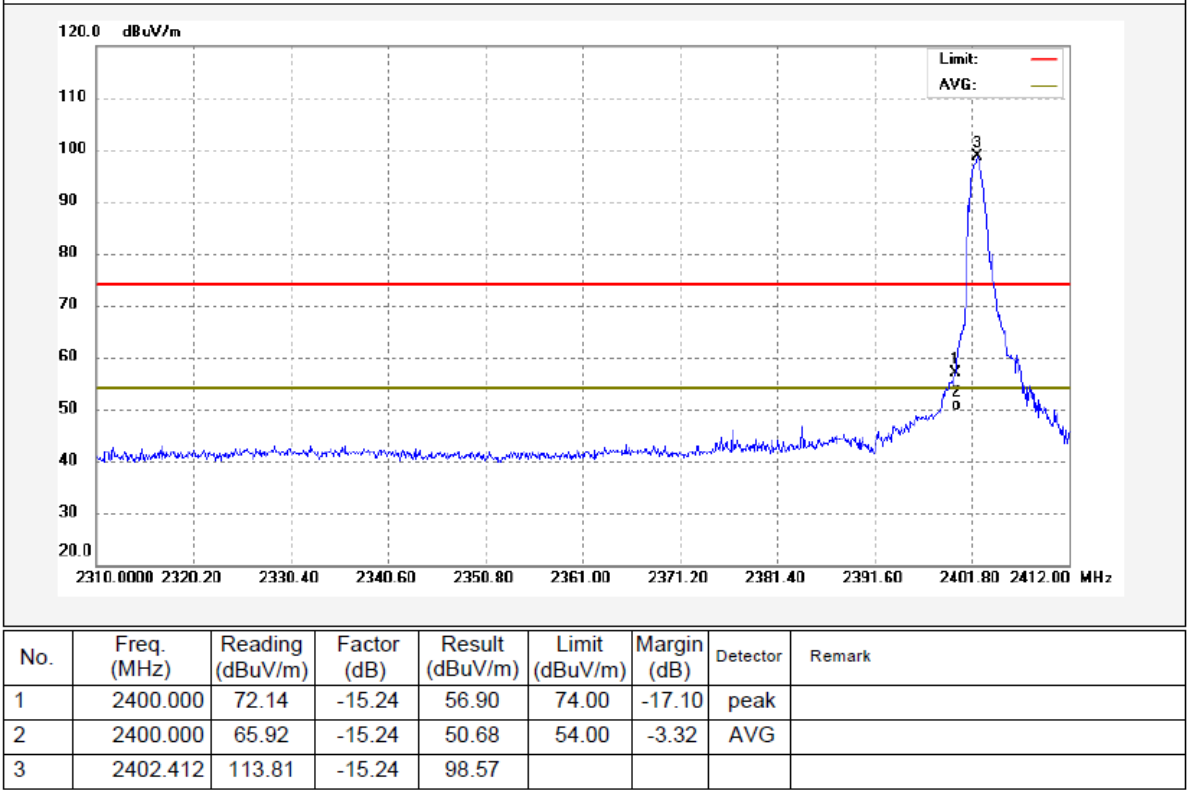
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.230	112.56	-15.38	97.18				
2	2483.500	73.57	-15.39	58.18	74.00	-15.82	peak	
3	2483.500	68.37	-15.39	52.98	54.00	-1.02	AVG	

Pi/4 DQPSK Transmitting Band edge-right side Vertical

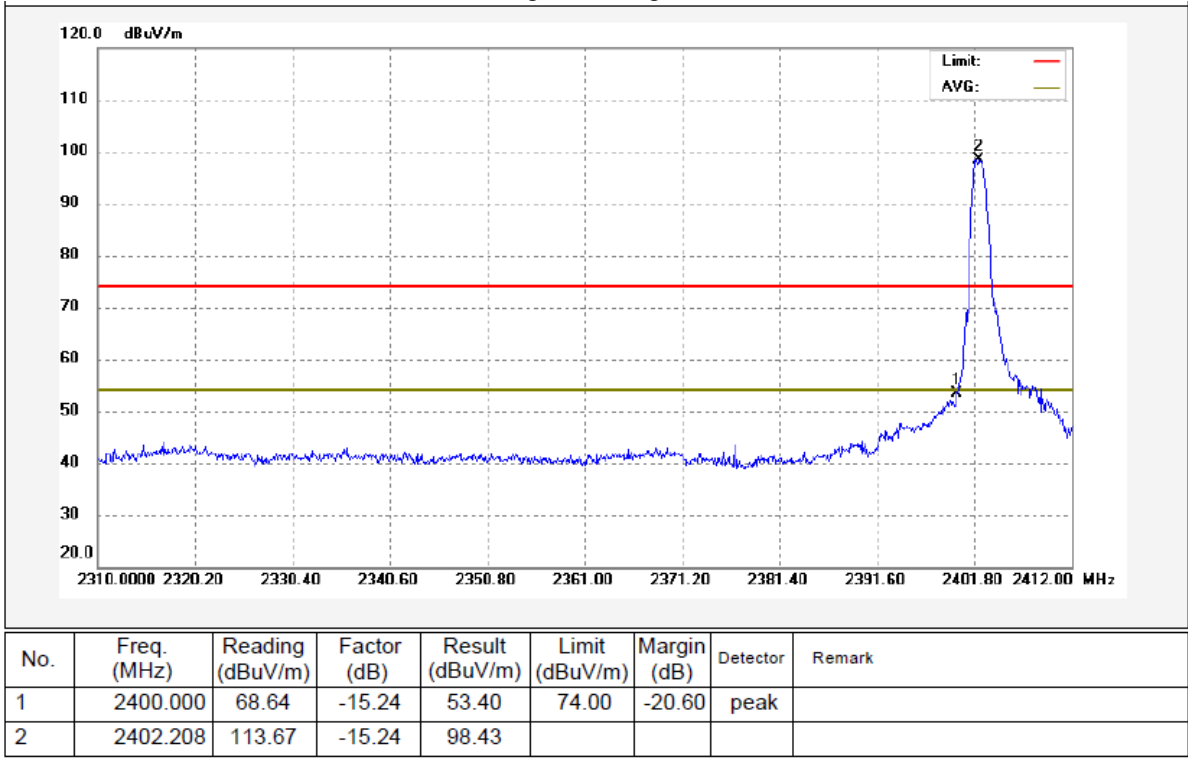


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.020	112.58	-15.38	97.20				
2	2483.500	74.00	-15.39	58.61	74.00	-15.39	peak	
3	2483.500	68.10	-15.39	52.71	54.00	-1.29	AVG	

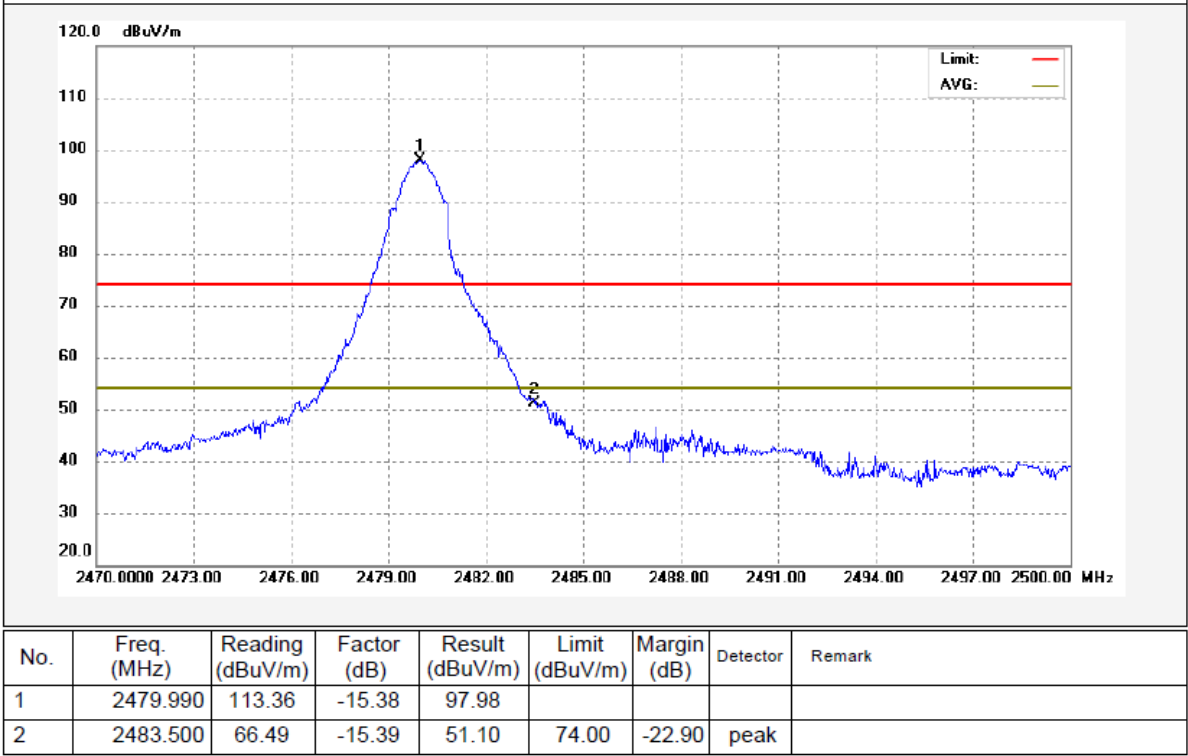
8DPSK Transmitting Band edge-left side Horizontal



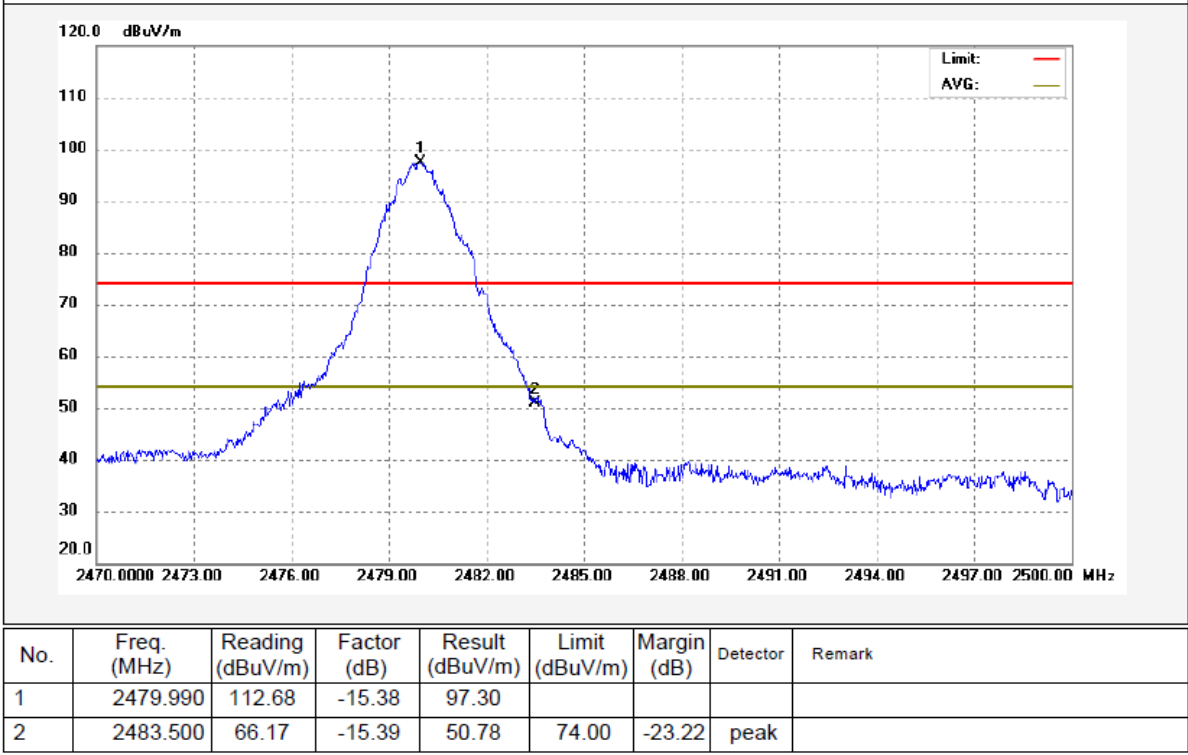
8DPSK Transmitting Band edge-left side Vertical



8DPSK Transmitting Band edge-right side Horizontal



8DPSK Transmitting Band edge-right side Vertical



12 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

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

12.1 Test Procedure

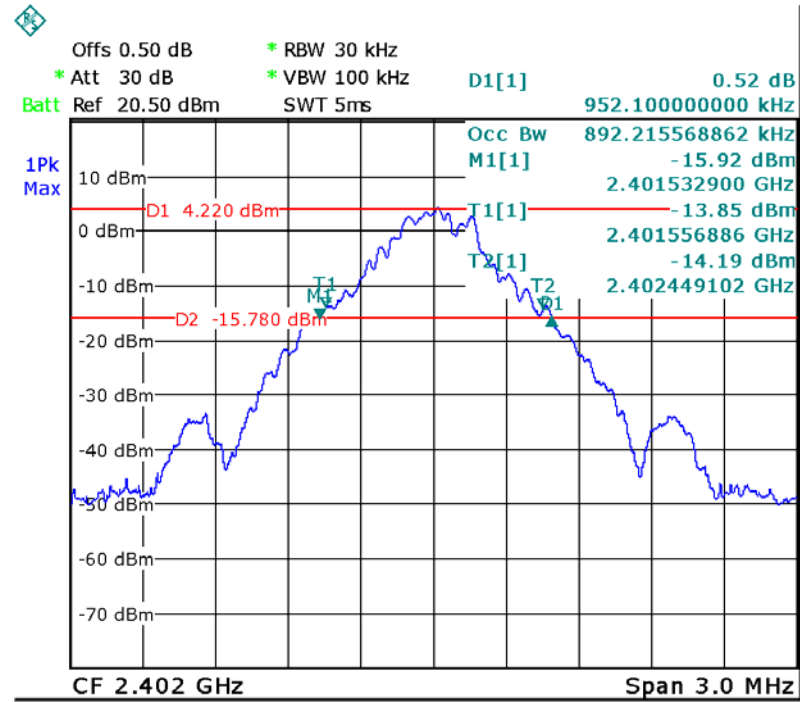
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

12.2 Test Result

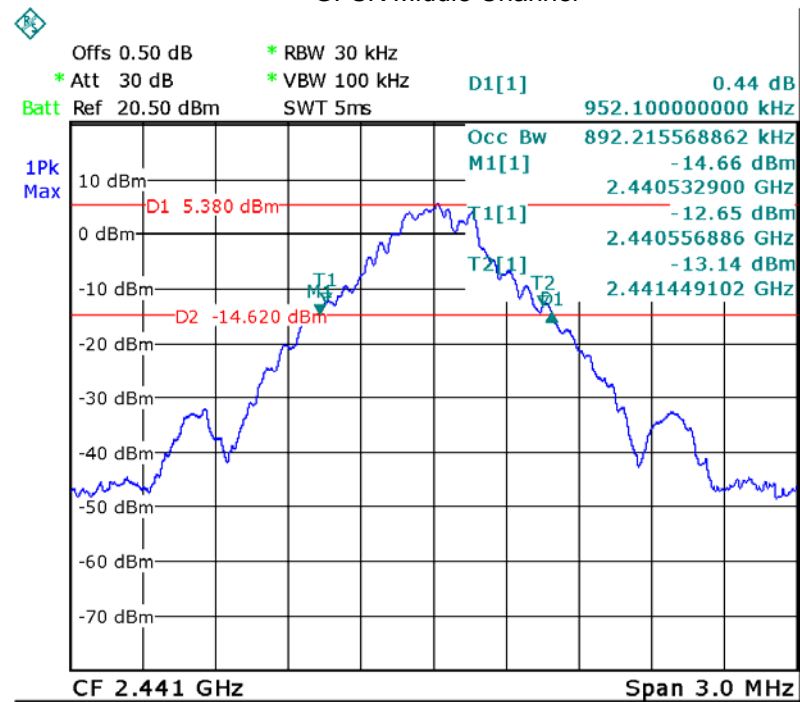
Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.952
GFSK	Middle	0.952
GFSK	High	0.952
Pi/4 DQPSK	Low	1.281
Pi/4 DQPSK	Middle	1.281
Pi/4 DQPSK	High	1.281
8DPSK	Low	1.287
8DPSK	Middle	1.287
8DPSK	High	1.287

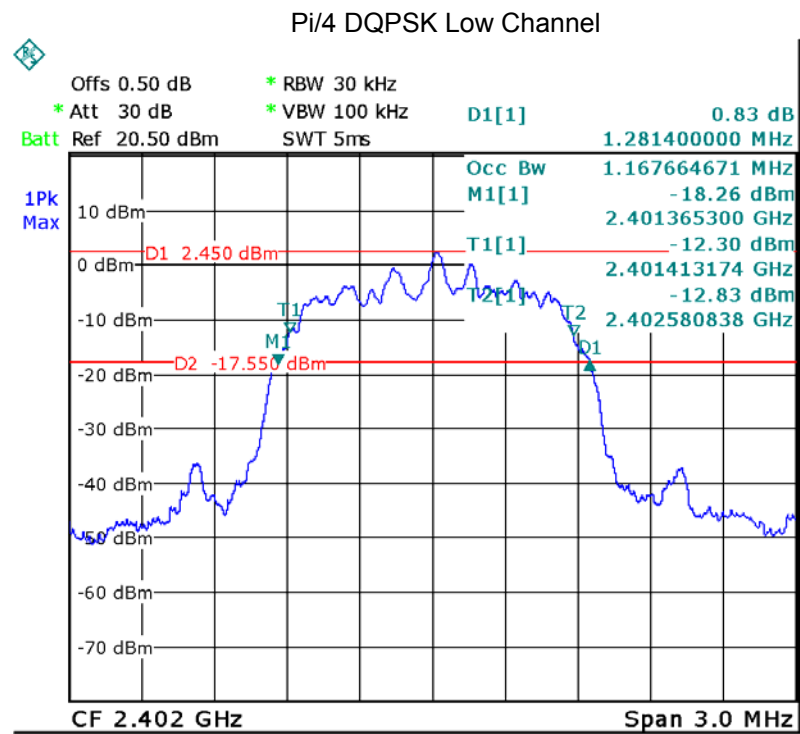
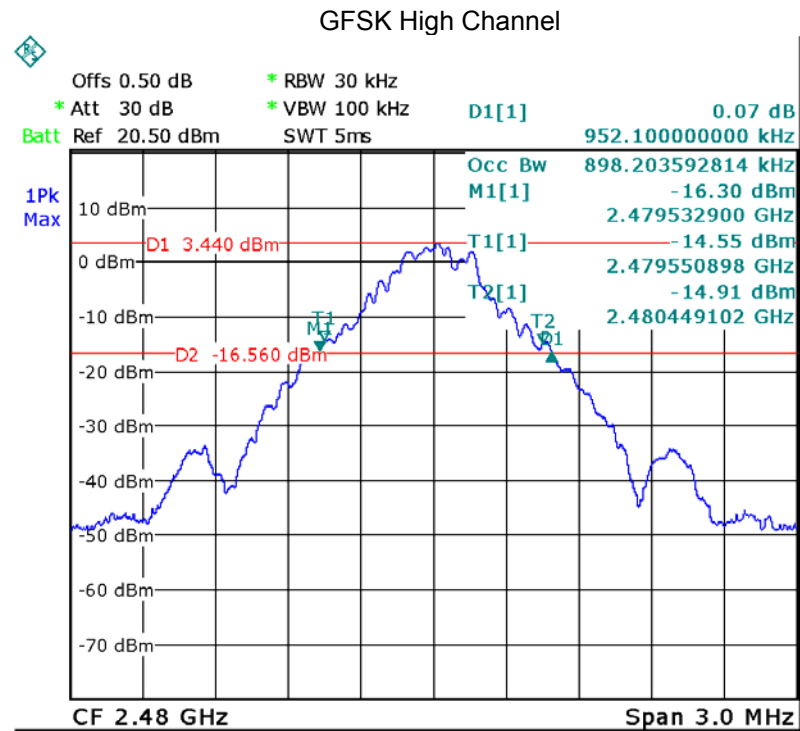
Test plots

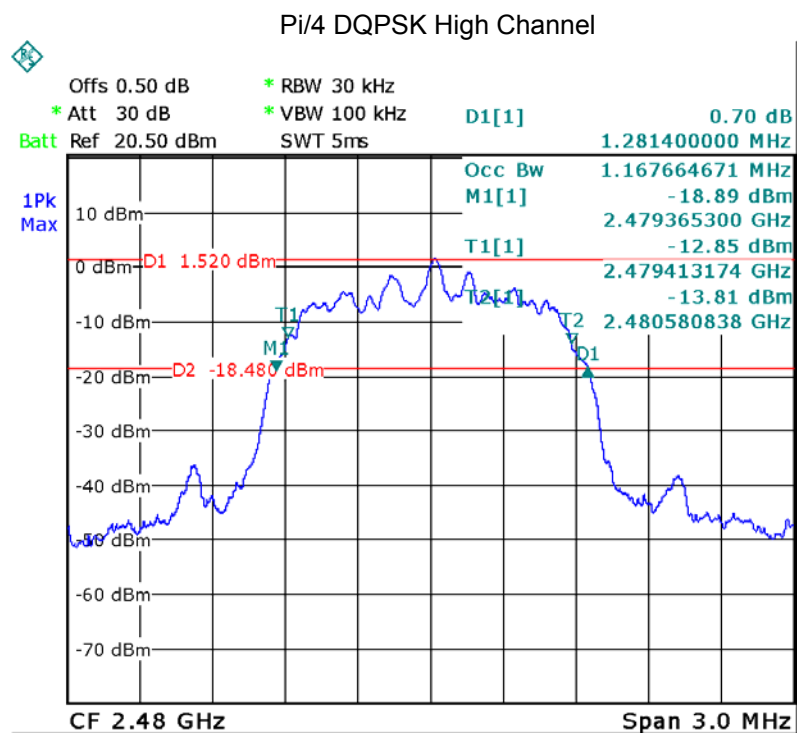
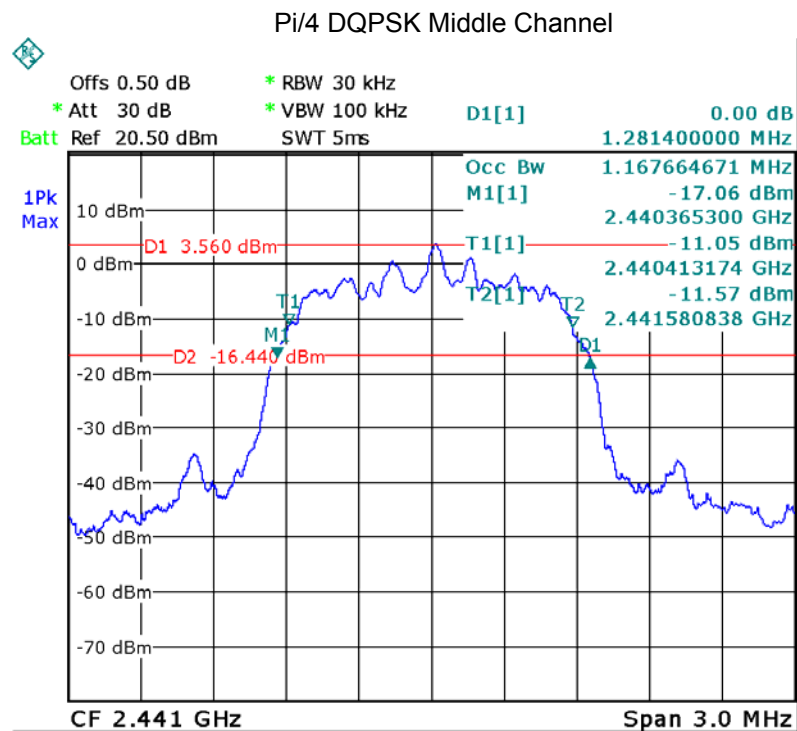
GFSK Low Channel

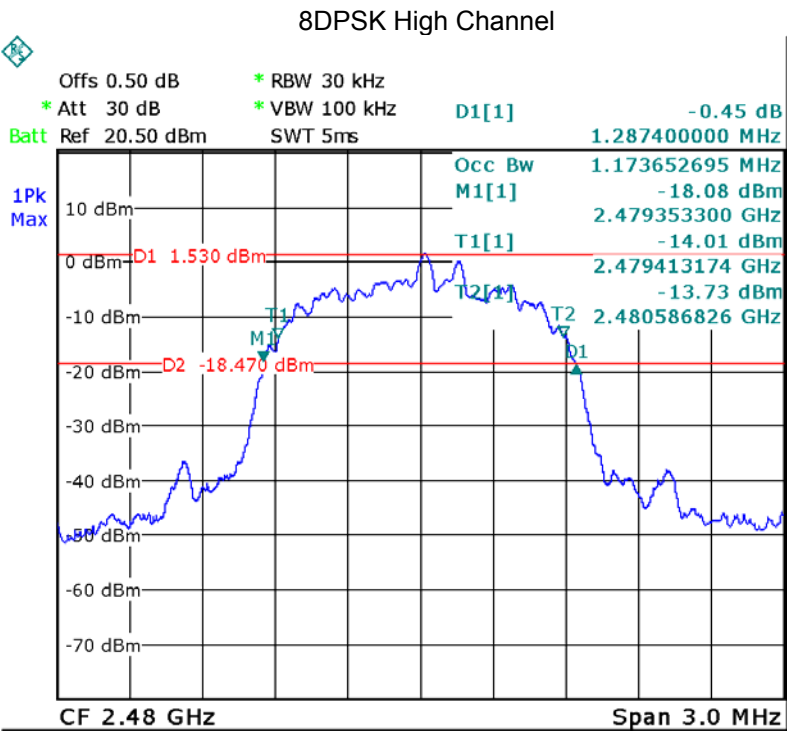


GFSK Middle Channel









13 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10: 2013
Test Limit:	Regulation 15.247 (a)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater: 0.125 watts..
Test mode:	Test in fixing frequency transmitting mode.

13.1 Test Procedure

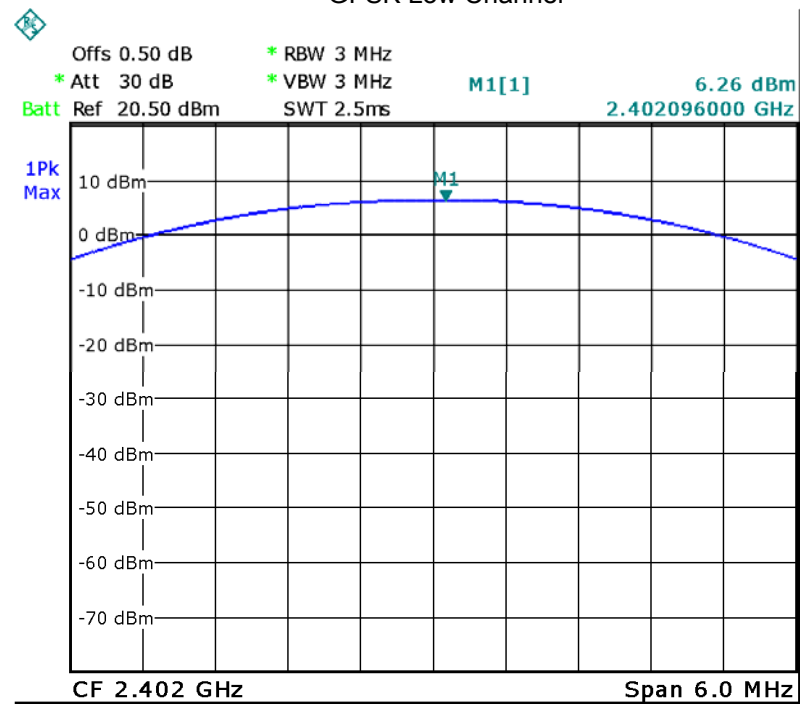
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.///

13.2 Test Result

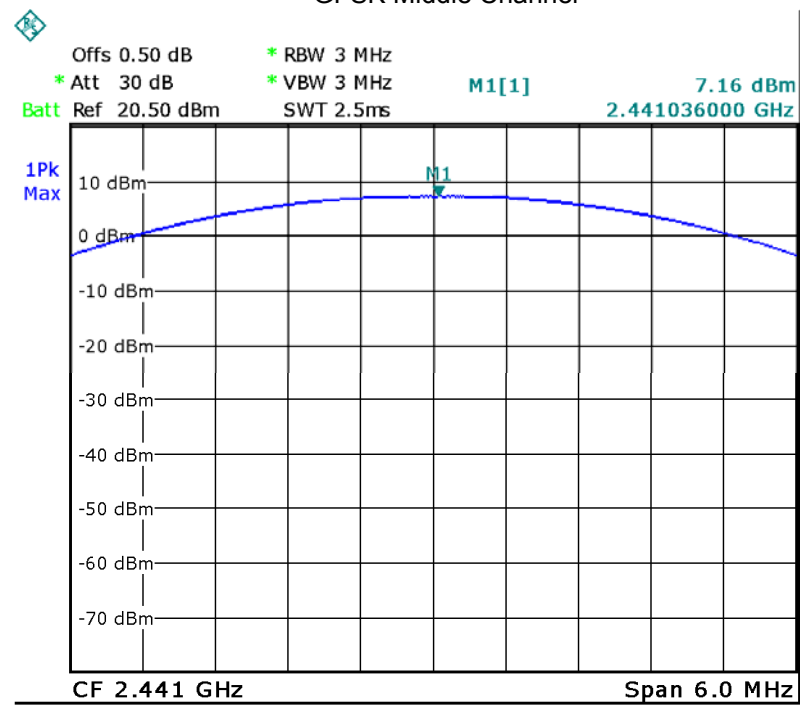
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	6.26	30
GFSK	Middle	7.16	30
GFSK	High	5.43	30
Pi/4 DQPSK	Low	6.31	21
Pi/4 DQPSK	Middle	7.25	21
Pi/4 DQPSK	High	5.45	21
8DPSK	Low	6.79	21
8DPSK	Middle	7.73	21
8DPSK	High	5.84	21

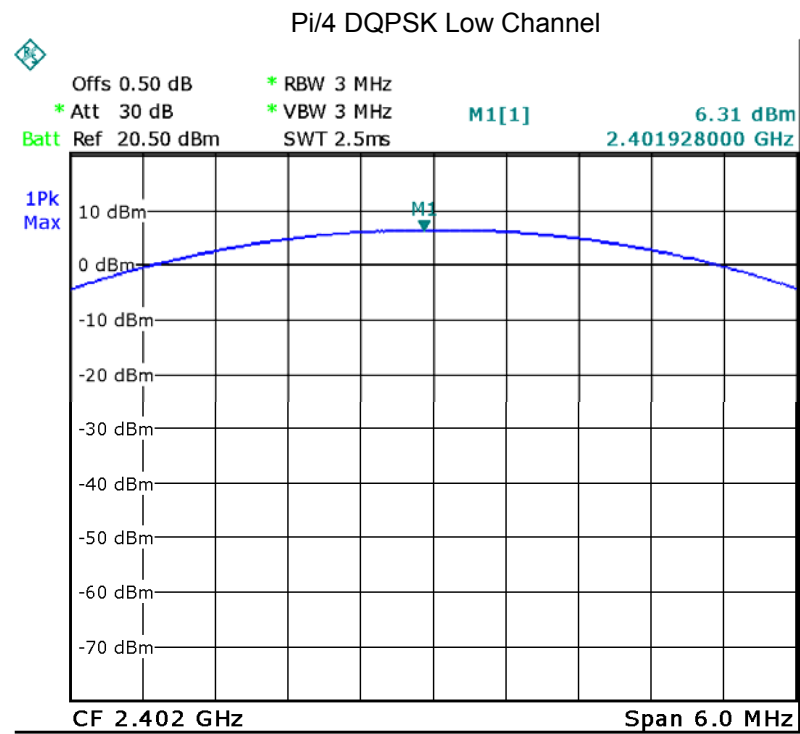
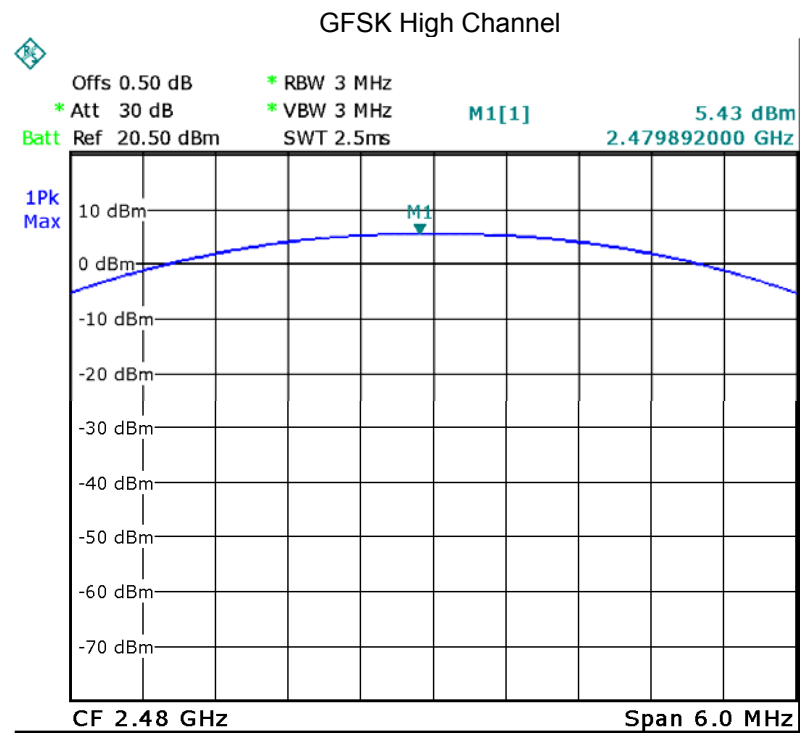
Test plots

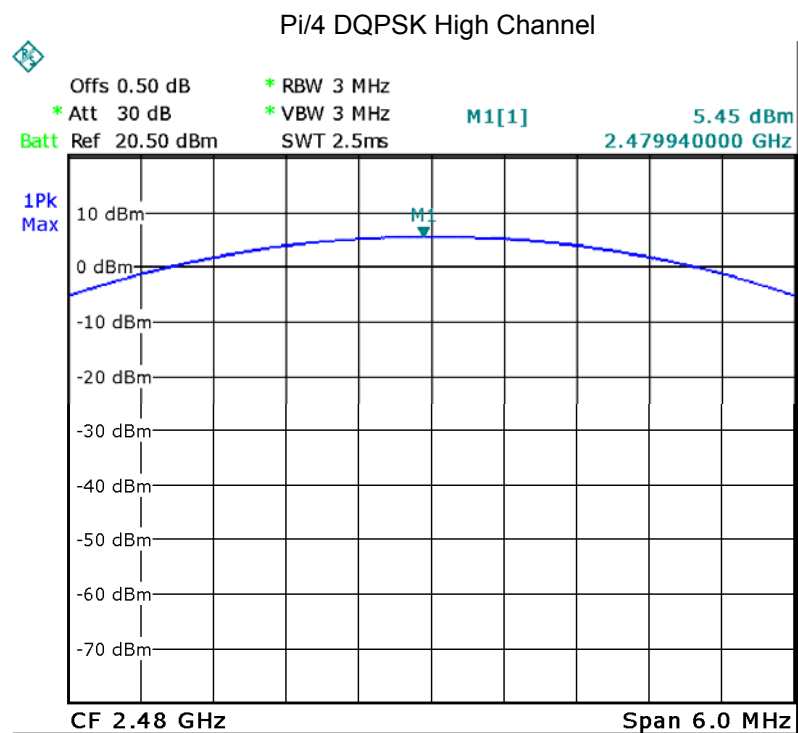
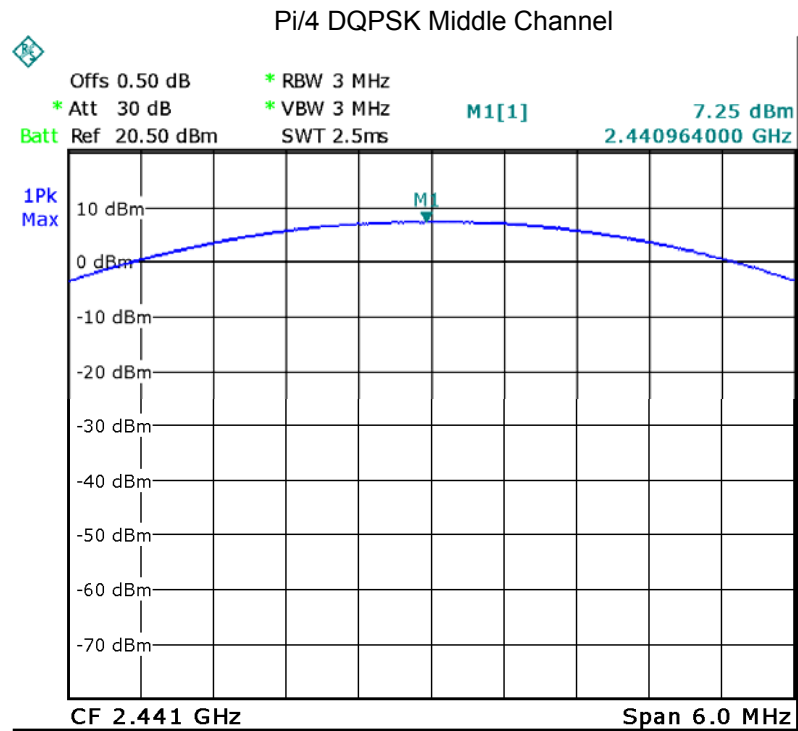
GFSK Low Channel

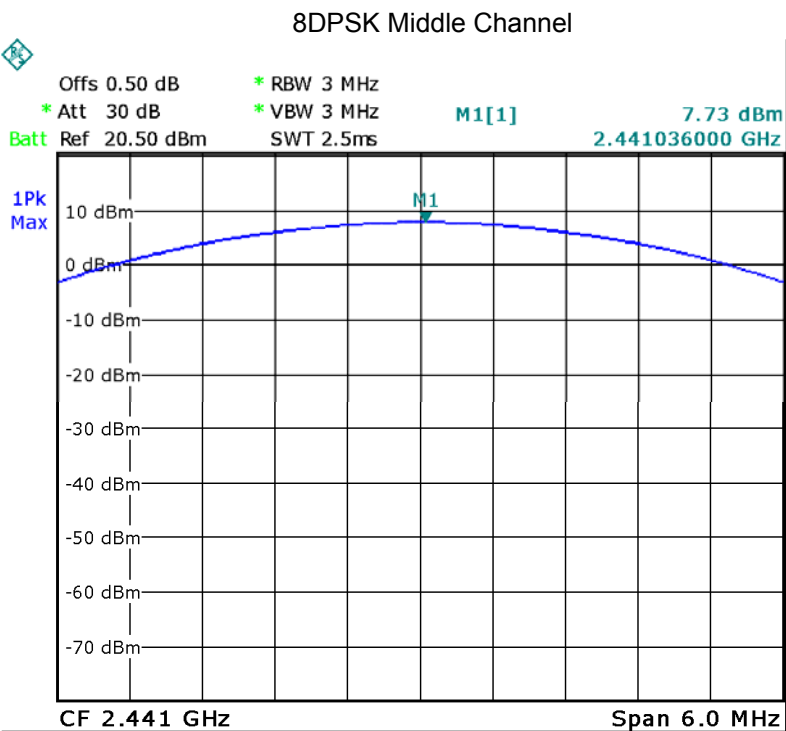
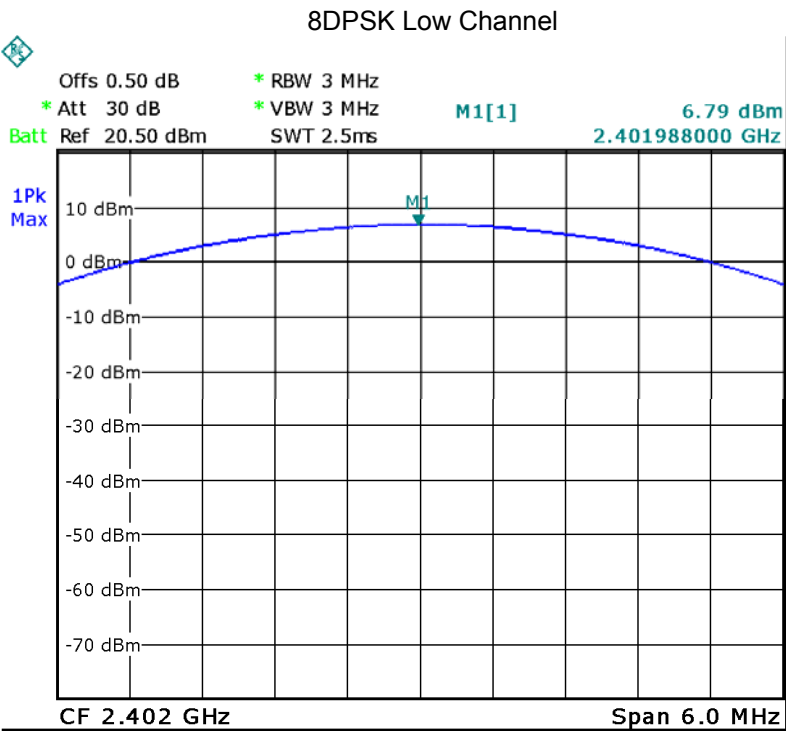


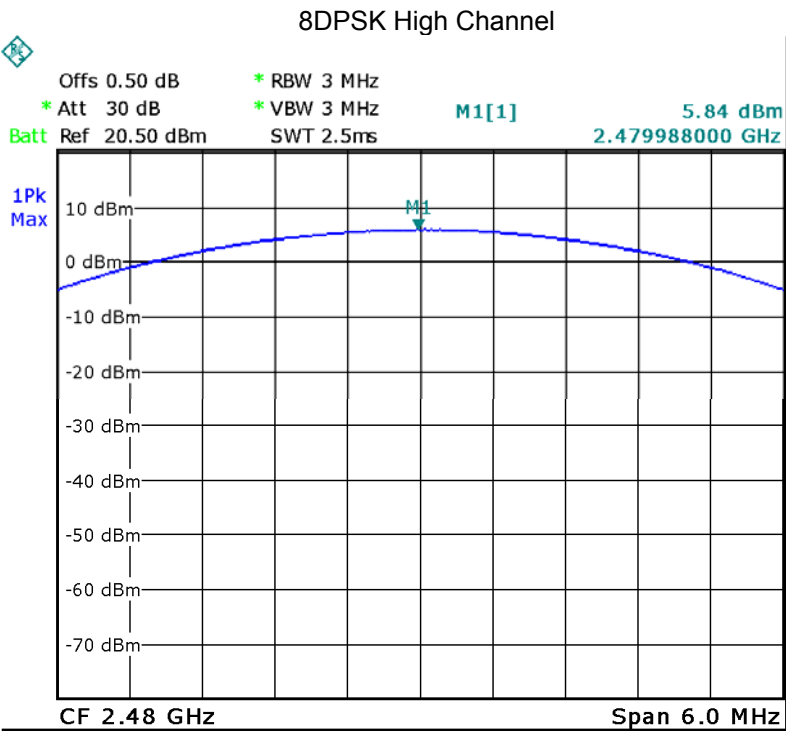
GFSK Middle Channel











14 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10: 2013
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 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 0.125W.
Test Mode:	Test in hopping transmitting operating mode.

14.1 Test Procedure

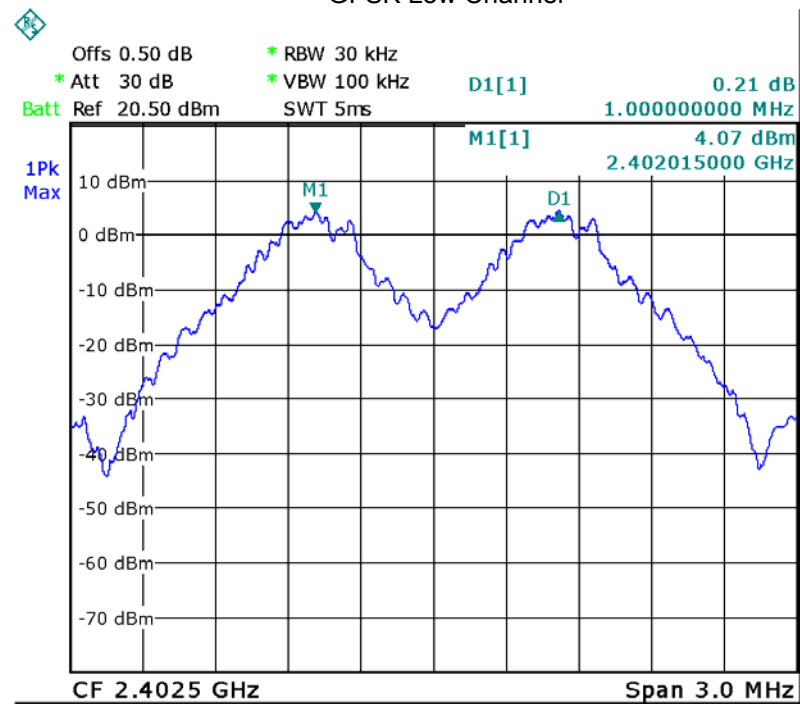
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to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

14.2 Test Result

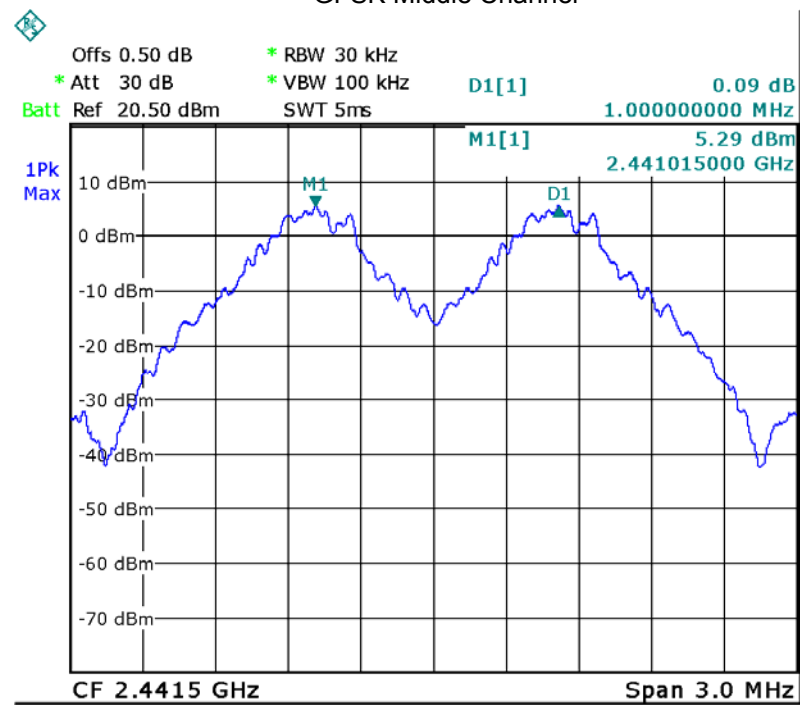
Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.952	PASS
GFSK	Middle	1.000	0.952	PASS
GFSK	High	1.000	0.952	PASS
Pi/4 DQPSK	Low	1.000	0.854	PASS
Pi/4 DQPSK	Middle	1.000	0.854	PASS
Pi/4 DQPSK	High	1.000	0.854	PASS
8DPSK	Low	1.000	0.858	PASS
8DPSK	Middle	1.000	0.858	PASS
8DPSK	High	1.000	0.858	PASS

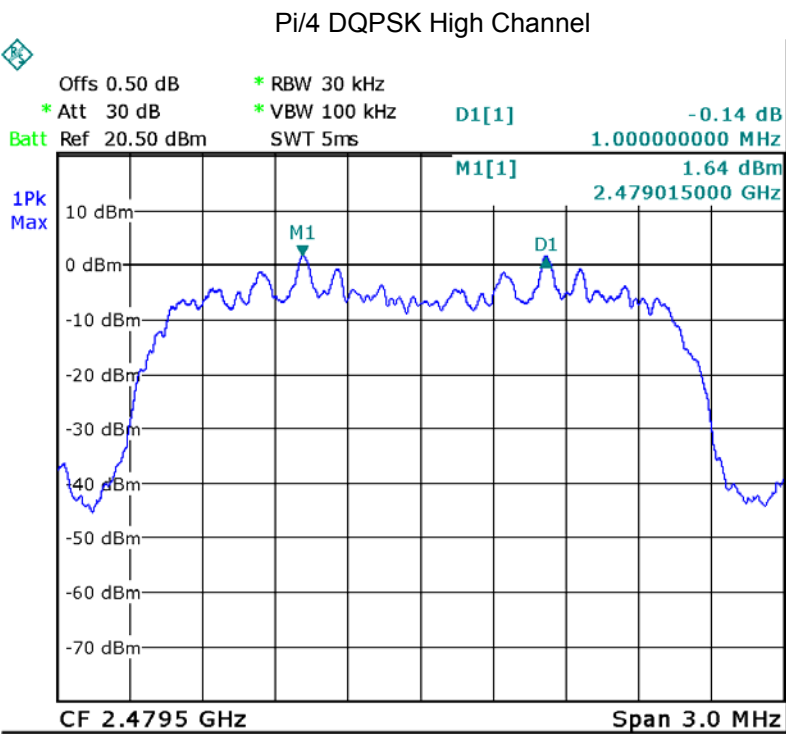
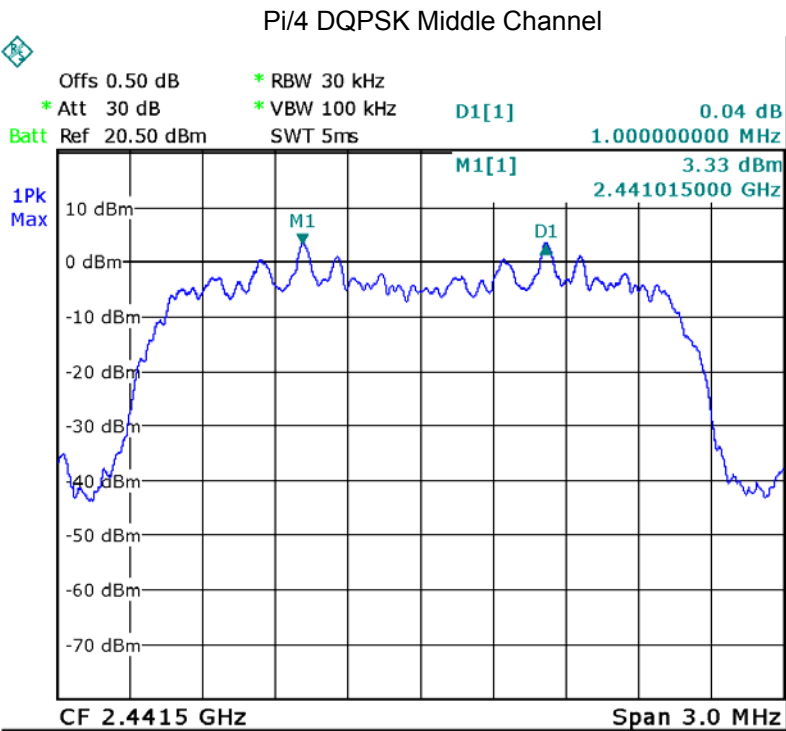
Test plots

GFSK Low Channel



GFSK Middle Channel





15 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10: 2013
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

15.1 Test Procedure

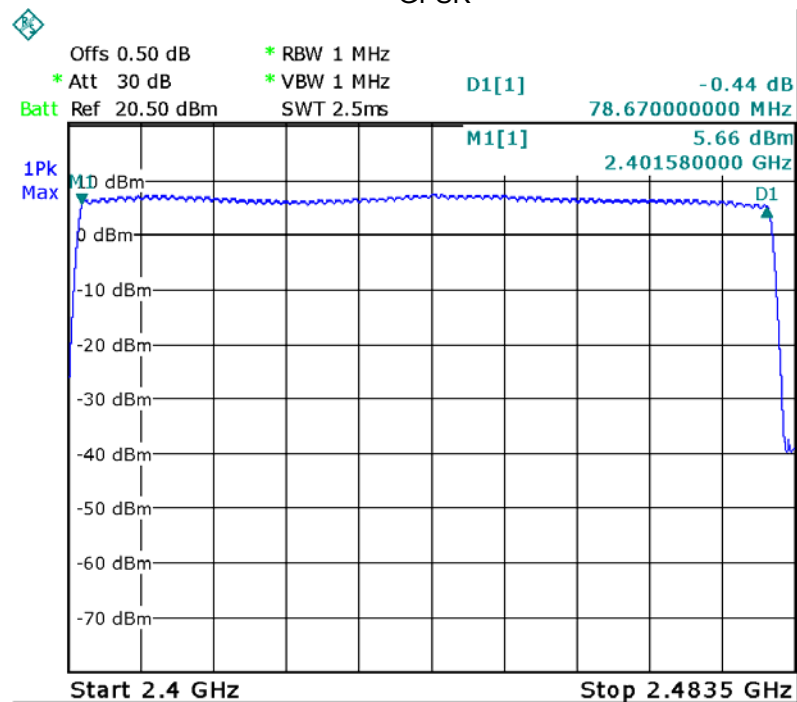
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

15.2 Test Result

Test Plots:

79 Channels in total

GFSK



16 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10: 2013
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

16.1 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).

16.2 Test Result

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

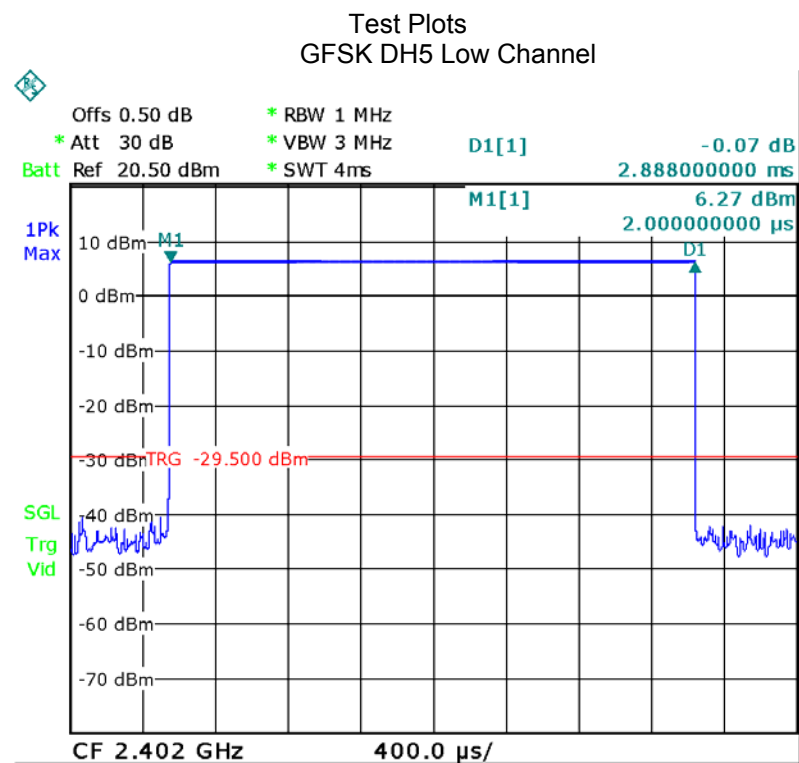
DH3 Packet permit maximum $1600 / 79 / 4$ hops per second in each channel (3 time slots RX, 1 time slot TX).

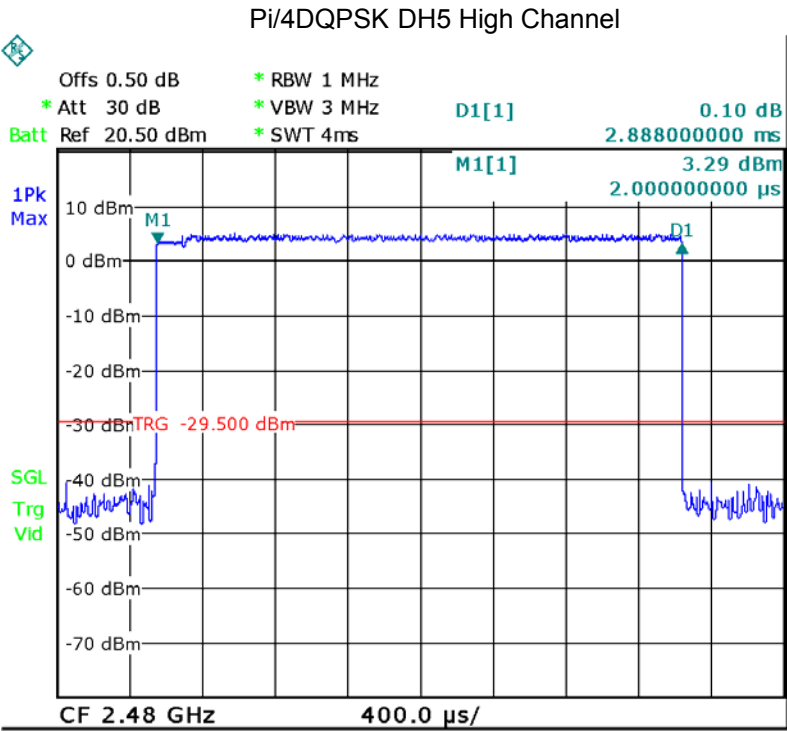
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

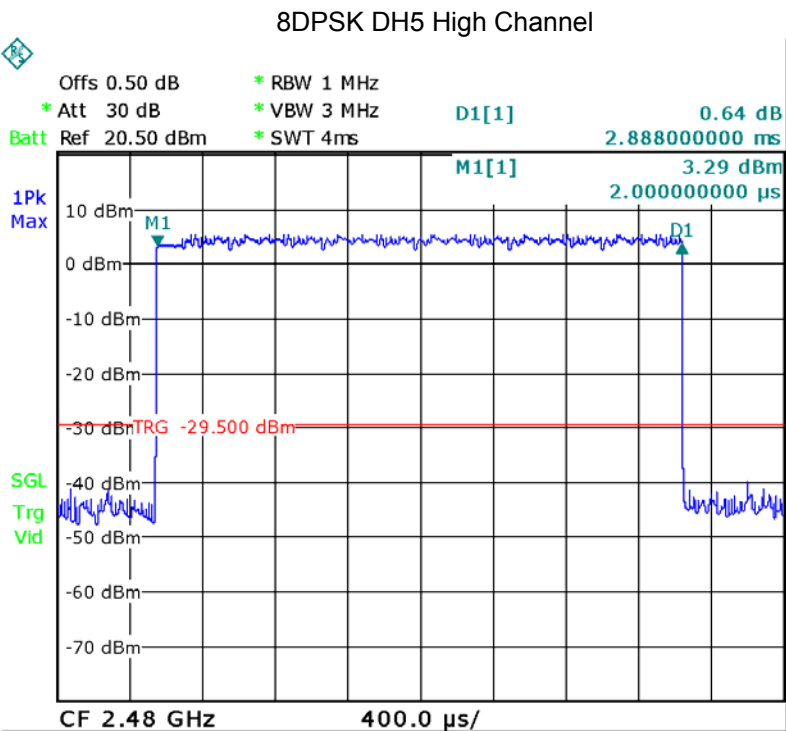
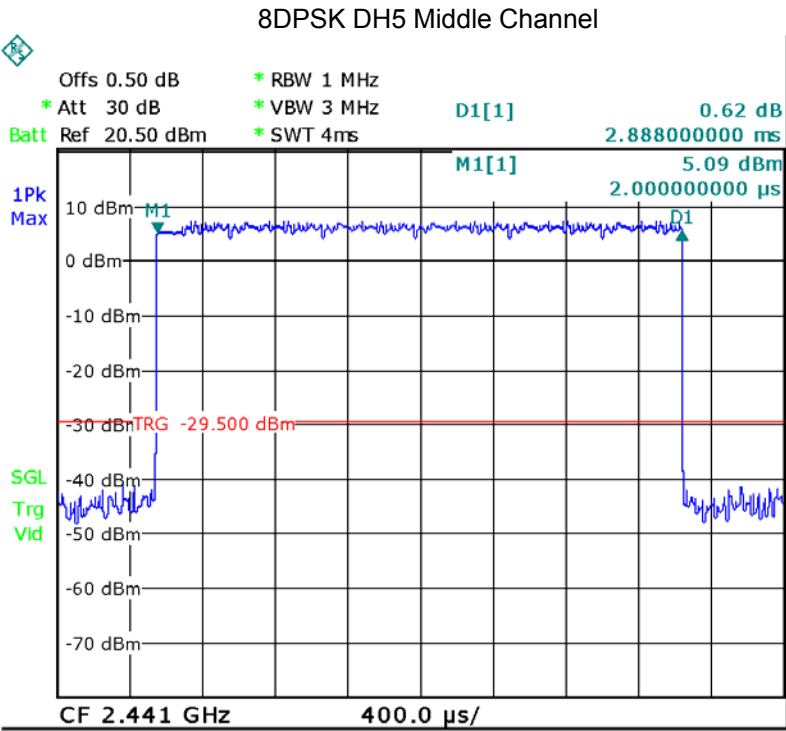
Data Packet	Dwell Time(s)
DH5	$1600/79/6*0.4*79*(MkrDelta)/1000$
DH3	$1600/79/4*0.4*79*(MkrDelta)/1000$
DH1	$1600/79/2*0.4*79*(MkrDelta)/1000$
Remark: Mkr Delta is once pulse time.	

Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	DH5	Low	2.888	0.308	0.4
		middle	2.888	0.308	0.4
		High	2.888	0.308	0.4
Pi/4DQPSK	DH5	Low	2.888	0.308	0.4
		middle	2.888	0.308	0.4
		High	2.888	0.308	0.4
8DPSK	DH5	Low	2.888	0.308	0.4
		middle	2.888	0.308	0.4
		High	2.888	0.308	0.4

Remark: Only the worst-case mode DH5 is recorded.







17 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.

18 RF Exposure

Remark: refer to SAR test report: WTS17S0169022E.

19 Photographs of test setup and EUT.

Note: Please refer to appendix: WTS17S0169025E_Photo.

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