

FCC TEST REPORT

FCC ID: 2AIEGS1PRO

Product : Alarm Clock Radio Speaker System

Model Name : S1pro

Brand : N/A

Report No. : PTC801186160622E-FC01

Prepared for

All Best Technology Limited
No.9, Yincheng 1st Rd., Xiabian Village, Chang'an Town,
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Prepared by

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TEST RESULT CERTIFICATION

Applicant's name : All Best Technology Limited

Address : No.9, Yincheng 1st Rd., Xiabian Village, Chang'an Town, Dongguan City, Guangdong Province, China

Manufacture's name : All Best Technology Limited

Address : No.9, Yincheng 1st Rd., Xiabian Village, Chang'an Town, Dongguan City, Guangdong Province, China

Product name : Alarm Clock Radio Speaker System

Model name : S1pro

Standards : FCC CFR47 Part 15 Section 15.247

Test procedure : ANSI C63.10:2013, DA 00-705

Test Date : Jun.24. 2016 ~ Jul.14. 2016

Date of Issue : Jul.15. 2016

Test Result : Pass

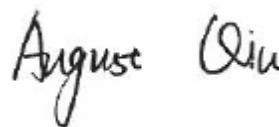
FCC Registration Number: 371540

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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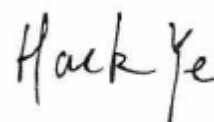
Testing Engineer

August Qiu



Technical Manager

Hack Ye



Authorized Signatory

Chris Du



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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	PASS

Remark:

N/A: Not Applicable

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Alarm Clock Radio Speaker System
Model Name	:	S1pro
Model Description	:	N/A
Bluetooth Version	:	V4.0
Operating frequency	:	2402-2480MHz, 79 channels
Max. RF output power	:	0.79dBm
Type of Modulation	:	GFSK, Pi/4 DQPSK, 8DPSK
Antenna installation:	:	PCB printed antenna
Antenna Gain:	:	0.79dBi
Power supply	:	AC 100-240V 50/60Hz 0.65A Max power by adapter
Adapter	:	Input AC 100-240V 50/60Hz 0.65A Max, Output 5V 3A



3.2 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	/	/

3.3 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
Hopping	2402-2480MHz		

4 Equipment During Test

4.1 Equipments List

RF Conducted Test							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug.04, 2015	Aug.03, 2016	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	Aug.04, 2015	Aug.03, 2016	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde&Schwarz	ESCI	101417	July 15, 2015	July 14, 2016	1 year
2	Trilog Broadband Antenna	SCHWARZECK	VULB9160	9160-3355	July 15, 2015	July 14, 2016	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2015	July 14, 2016	1 year
4	Horn Antenna	SCHWARZECK	BBHA9120D	9120D-1246	July 15, 2015	July 14, 2016	1 year
Conducted Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	R&S	ESCI	101155	July 15, 2015	July 14, 2016	1 year
2	LISN	SCHWARZECK	NSLK 8128	8128-289	July 15, 2015	July 14, 2016	1 year
3	Cable	LARGE	RF300	-	July 15, 2015	July 14, 2016	1 year



4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	$\pm 1.0\text{dB}$
Power Spectral Density, conducted	$\pm 2.2\text{dB}$
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
Time	$\pm 2\%$
Duty Cycle	$\pm 2\%$
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 3\%$
Conducted Emissions (150kHz~30MHz)	$\pm 3.64\text{dB}$
Radiated Emission(30MHz~1GHz)	$\pm 5.03\text{dB}$
Radiated Emission(1GHz~25GHz)	$\pm 4.74\text{dB}$

5 Conducted Emission

Test Requirement:	: FCC CFR 47 Part 15 Section 15.207
Test Method:	: ANSI C63.4:2014
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)

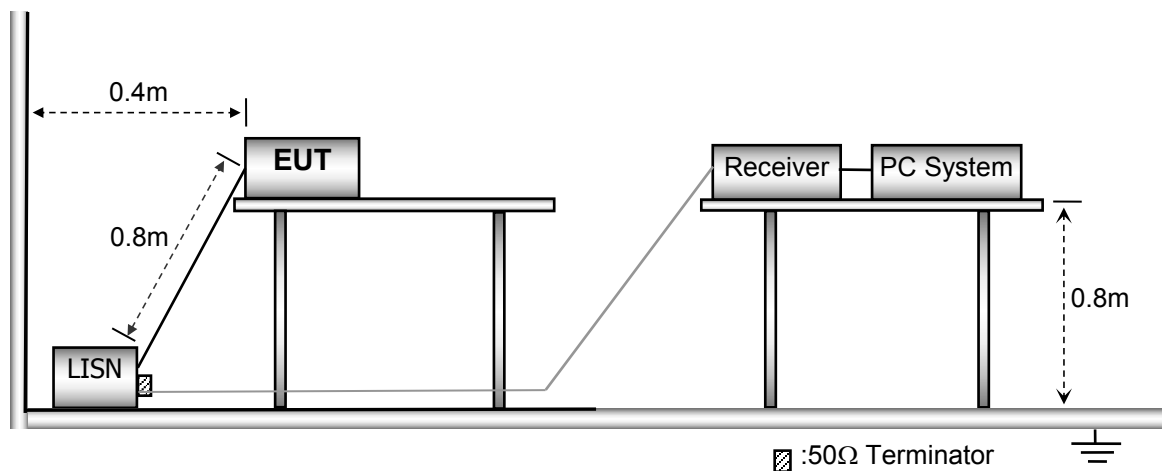
5.1 E.U.T. Operation

Operating Environment :

Temperature:	: 25.5 °C
Humidity:	: 51 % RH
Atmospheric Pressure:	: 101.2kPa
EUT Operation :	: Refer to section 3.3

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2013.

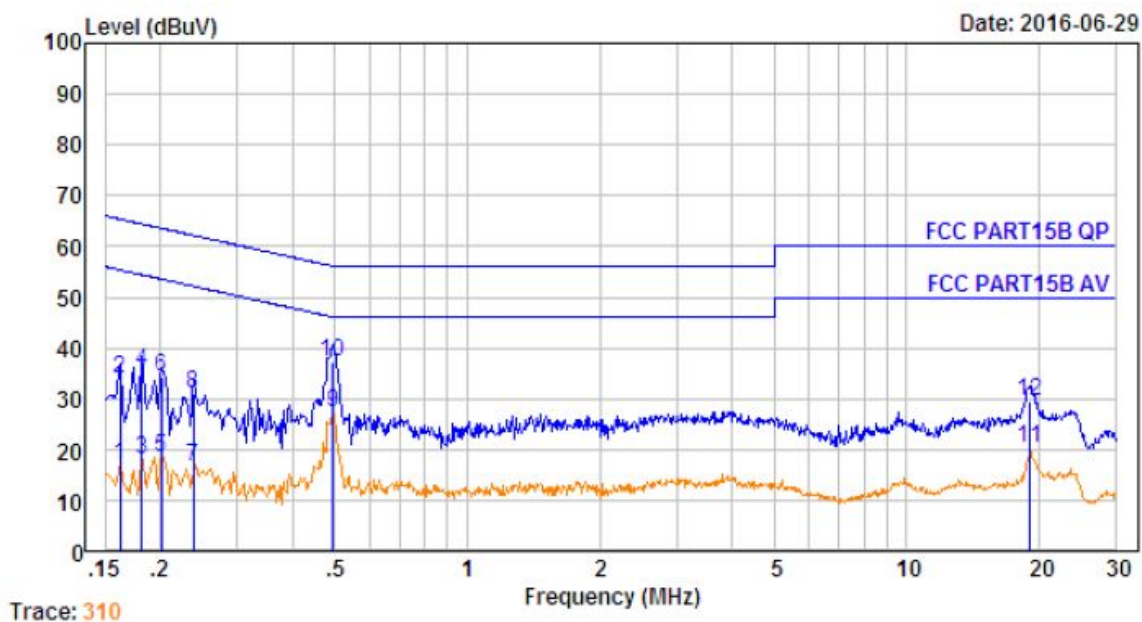


5.3 Measurement Description

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.

5.4 Conducted Emission Test Result

Live line:

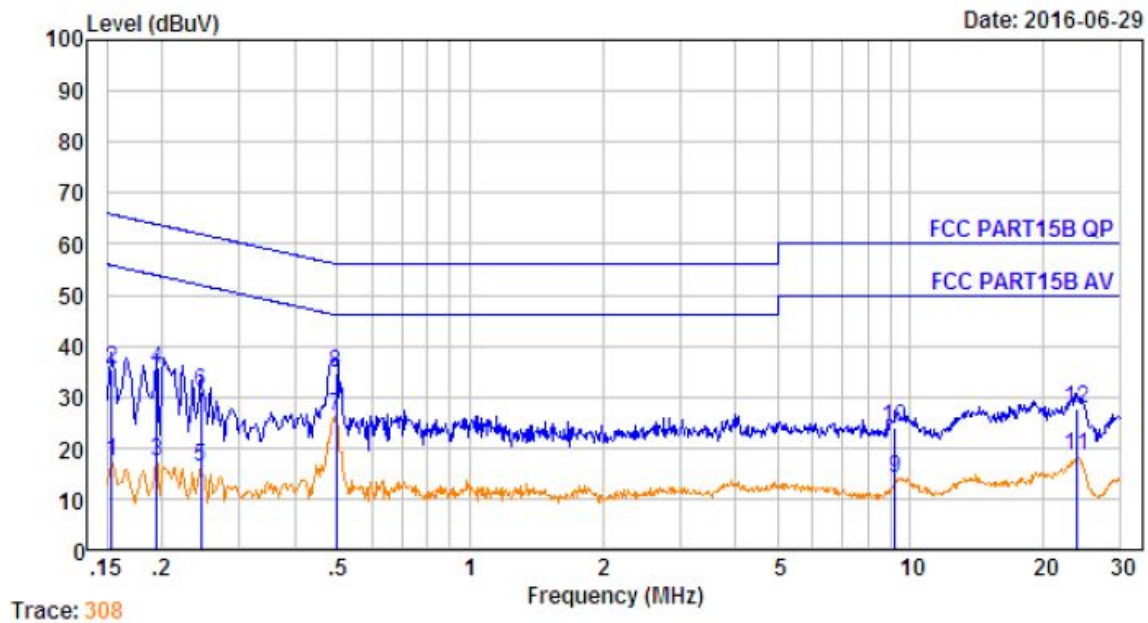


No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.162	10.60	0.60	5.67	16.87	55.34	-38.47	Average
2.	0.162	10.60	0.60	22.77	33.97	65.34	-31.37	QP
3.	0.182	10.61	0.60	6.84	18.05	54.42	-36.37	Average
4.	0.182	10.61	0.60	24.04	35.25	64.42	-29.17	QP
5.	0.202	10.61	0.60	7.30	18.51	53.54	-35.03	Average
6.	0.202	10.61	0.60	23.00	34.21	63.54	-29.33	QP
7.	0.238	10.62	0.60	5.35	16.57	52.17	-35.60	Average
8.	0.238	10.62	0.60	19.65	30.87	62.17	-31.30	QP
9.	0.494	10.64	0.60	16.09	27.33	46.10	-18.77	Average
10.	0.494	10.64	0.60	26.19	37.43	56.10	-18.67	QP
11.	19.021	10.78	0.60	8.79	20.17	50.00	-29.83	Average
12.	19.021	10.78	0.60	17.99	29.37	60.00	-30.63	QP

Remark: Emission Level = Receiver Reading + Cable Loss + AMN Factor



Neutral line:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.154	10.60	0.60	6.29	17.49	55.78	-38.29	Average
2.	0.154	10.60	0.60	24.39	35.59	65.78	-30.19	QP
3.	0.194	10.61	0.60	5.96	17.17	53.84	-36.67	Average
4.	0.194	10.61	0.60	24.06	35.27	63.84	-28.57	QP
5.	0.246	10.62	0.60	5.15	16.37	51.91	-35.54	Average
6.	0.246	10.62	0.60	19.95	31.17	61.91	-30.74	QP
7.	0.497	10.65	0.60	15.09	26.34	46.05	-19.71	Average
8.	0.497	10.65	0.60	23.49	34.74	56.05	-21.31	QP
9.	9.253	10.76	0.60	2.70	14.06	50.00	-35.94	Average
10.	9.253	10.76	0.60	12.80	24.16	60.00	-35.84	QP
11.	23.888	10.79	0.60	6.88	18.27	50.00	-31.73	Average
12.	23.888	10.79	0.60	16.28	27.67	60.00	-32.33	QP

Remark: Emission Level = Receiver Reading + Cable Loss + AMN Factor

6 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: : ANSI C63.10:2013, DA 00-705
 Test Result: : PASS
 Measurement Distance: : 3m
 Limit: : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	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	$20\log^{(500)}$

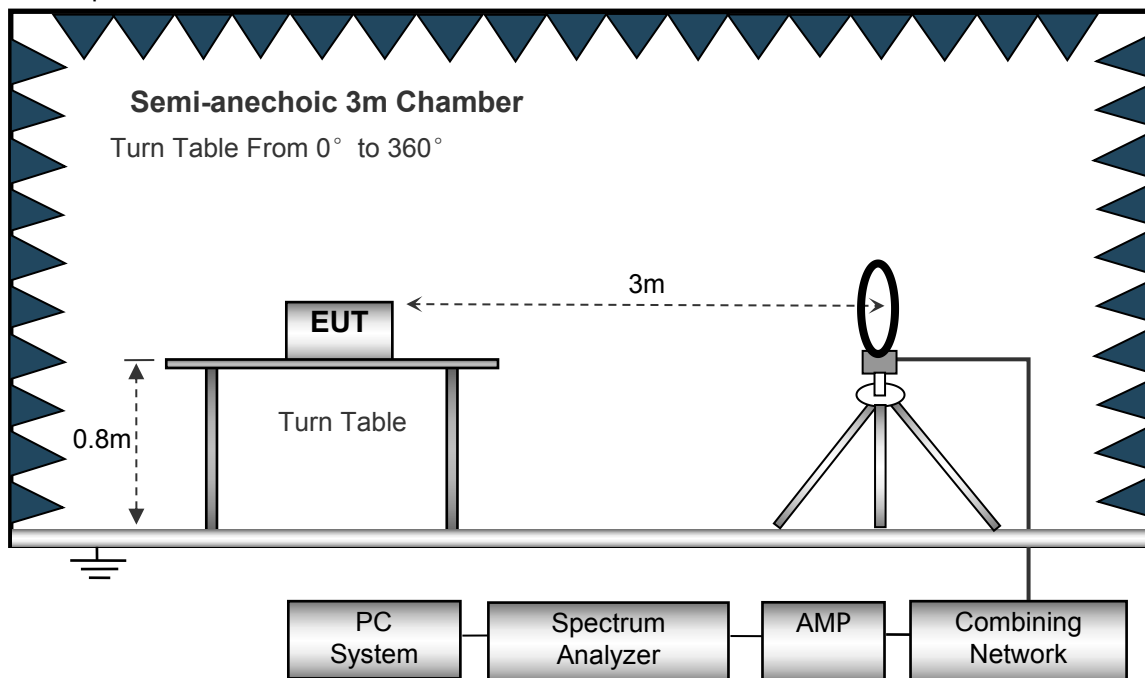
6.1 EUT Operation

Operating Environment :
 Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

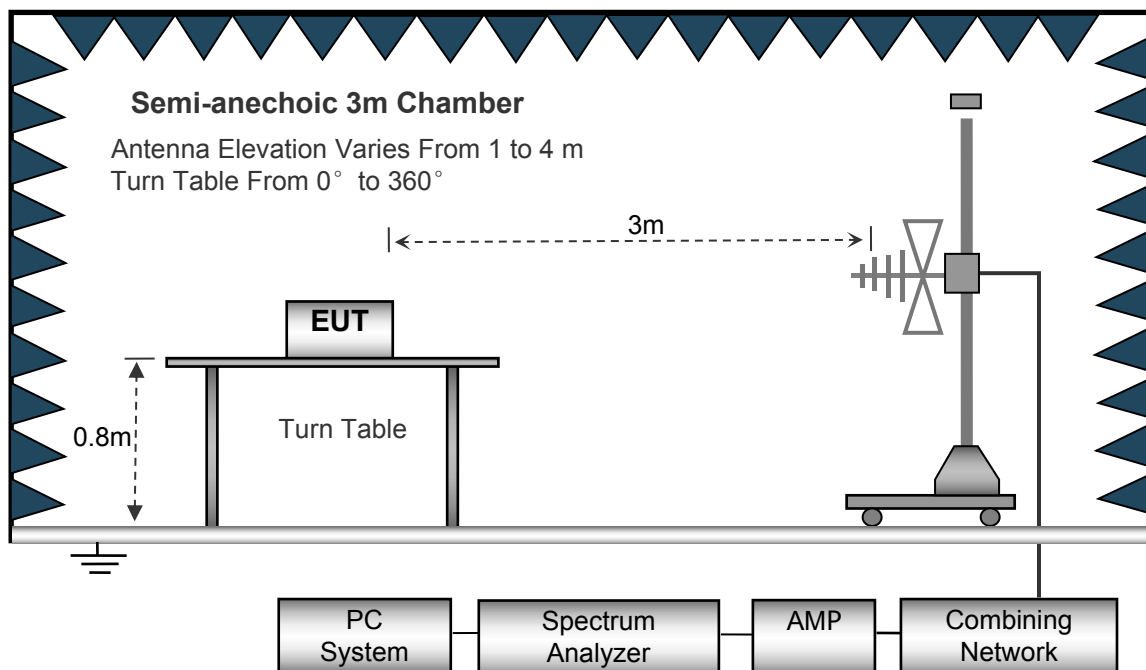
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

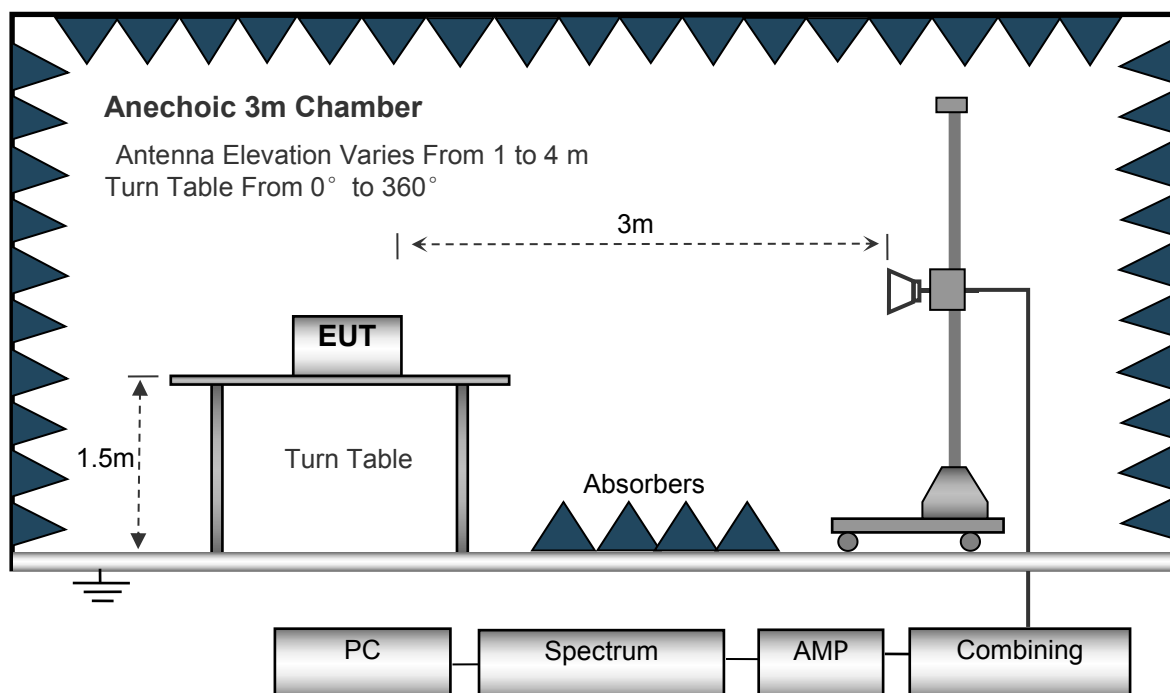
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 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..... 3MHz

6.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m with Below 1G and 1.5m above 1G 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.

6.5 Summary of Test Results

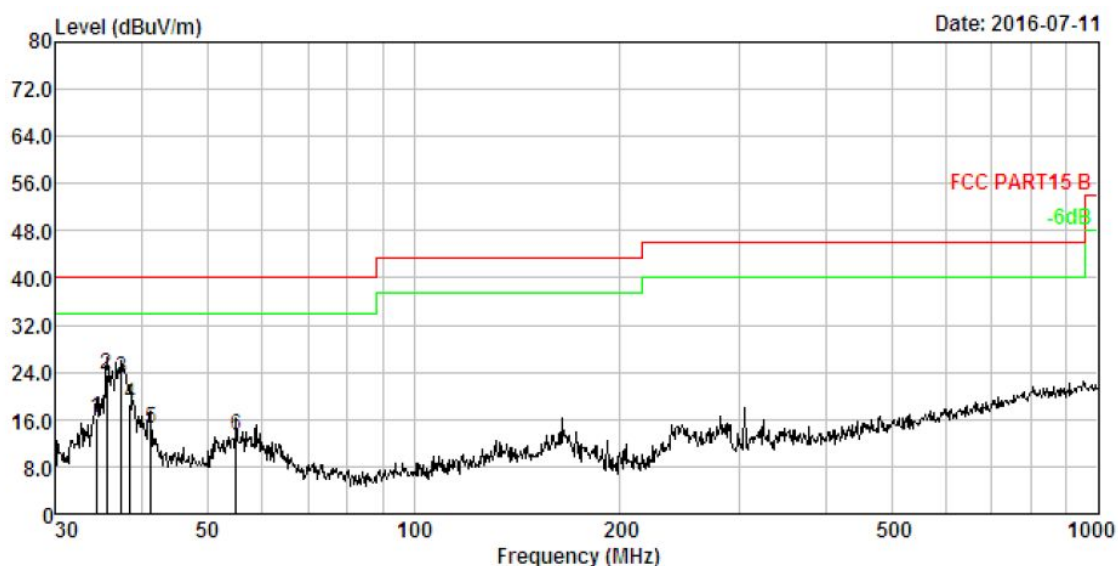
Test Frequency: Below 30MHz

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

Test Frequency: 30MHz ~ 1GHz

All applicable test modes have been tested and only the worst case (GFSK TX in middle channel) is recorded.

Antenna Polarization: Horizontal

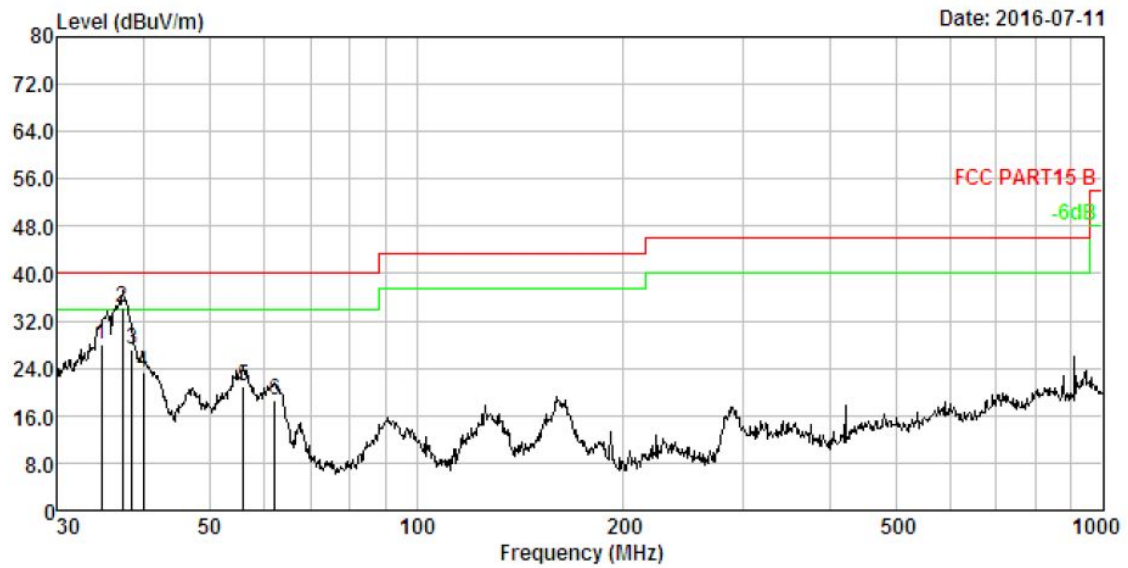


No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	34.396	1.18	13.36	31.64	30.02	16.16	40.00	-23.84	QP
2.	35.624	1.21	13.43	38.95	30.03	23.56	40.00	-16.44	QP
3.	37.416	1.26	13.51	38.40	30.05	23.12	40.00	-16.88	QP
4.	38.481	1.28	13.59	33.93	30.06	18.74	40.00	-21.26	QP
5.	41.277	1.34	13.59	29.50	30.08	14.35	40.00	-25.65	QP
6.	55.027	1.60	11.90	29.84	30.18	13.16	40.00	-26.84	QP

Remark: Emission Level = Receiver Reading + Cable Loss + ANT Factor - AMP Factor



Antenna Polarization: Vertical



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	34.760	1.19	13.38	43.63	30.02	28.18	40.00	-11.82	QP
2.	37.285	1.25	13.50	49.61	30.05	34.31	40.00	-5.69	QP
3.	38.481	1.28	13.59	42.22	30.06	27.03	40.00	-12.97	QP
4.	39.994	1.32	13.71	38.41	30.07	23.37	40.00	-16.63	QP
5.	56.001	1.62	11.96	37.69	30.19	21.08	40.00	-18.92	QP
6.	62.213	1.72	12.02	35.08	30.22	18.60	40.00	-21.40	QP

Remark: Emission Level = Receiver Reading + Cable Loss + ANT Factor - AMP Factor



Test Frequency: 1GHz ~ 18GHz

All applicable test modes have been tested and only the worst case (GFSK Mode) is recorded.

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel						
1199.64	48.54	PK	-18.67	29.87	74.00	-44.13
1199.64	43.53	Ave	-18.67	24.86	54.00	-29.14
4804.00	49.33	PK	-1.06	48.27	74.00	-25.73
4804.00	40.72	Ave	-1.06	39.66	54.00	-14.34
7206.00	45.73	PK	1.33	47.06	74.00	-26.94
7206.00	41.46	Ave	1.33	42.79	54.00	-11.21
Restricted bands Emission						
2338.83	45.02	PK	-13.19	31.83	74.00	-42.17
2338.83	39.30	Ave	-13.19	26.11	54.00	-27.89
2355.06	42.91	PK	-13.14	29.77	74.00	-44.23
2355.06	38.12	Ave	-13.14	24.98	54.00	-29.02
2486.18	42.47	PK	-13.08	29.39	74.00	-44.61
2486.18	40.29	Ave	-13.08	27.21	54.00	-26.79
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel						
1199.64	49.48	PK	-18.67	30.81	74.00	-43.19
1199.64	44.08	Ave	-18.67	25.41	54.00	-28.59
4882.00	49.74	PK	-0.93	48.81	74.00	-25.19
4882.00	40.04	Ave	-0.93	39.11	54.00	-14.89
7323.00	46.03	PK	1.67	47.70	74.00	-26.30
7323.00	41.13	Ave	1.67	42.80	54.00	-11.20
Restricted bands Emission						
2330.91	45.78	PK	-13.19	32.59	74.00	-41.41
2330.91	39.96	Ave	-13.19	26.77	54.00	-27.23
2384.06	43.20	PK	-13.14	30.06	74.00	-43.94
2384.06	38.44	Ave	-13.14	25.30	54.00	-28.70
2493.35	41.83	PK	-13.08	28.75	74.00	-45.25
2493.35	40.62	Ave	-13.08	27.54	54.00	-26.46
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel						
1199.64	50.26	PK	-18.67	31.59	74.00	-42.41
1199.64	44.89	Ave	-18.67	26.22	54.00	-27.78
4960.00	48.84	PK	-0.87	47.97	74.00	-26.03
4960.00	40.29	Ave	-0.87	39.42	54.00	-14.58
7440.00	46.87	PK	1.84	48.71	74.00	-25.29
7440.00	41.36	Ave	1.84	43.20	54.00	-10.80
Restricted bands Emission						
2341.12	46.37	PK	-13.19	33.18	74.00	-40.82
2341.12	39.72	Ave	-13.19	26.53	54.00	-27.47
2362.87	43.54	PK	-13.14	30.40	74.00	-43.60
2362.87	38.57	Ave	-13.14	25.43	54.00	-28.57
2495.69	41.48	PK	-13.08	28.40	74.00	-45.60
2495.69	39.85	Ave	-13.08	26.77	54.00	-27.23
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						

Radiated band edge:

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK						
2400.00	47.49	PK	-13.12	34.37	74.00	-39.63
2400.00	40.32	PK	-13.12	27.20	74.00	-46.80
2483.50	47.18	PK	-13.06	34.12	74.00	-39.88
2483.50	43.34	PK	-13.06	30.28	74.00	-43.72
Pi/4 DQPSK						
2400.00	48.86	PK	-13.12	35.74	74.00	-38.26
2400.00	39.04	PK	-13.12	25.92	74.00	-48.08
2483.50	48.09	PK	-13.06	35.03	74.00	-38.97
2483.50	44.11	PK	-13.06	31.05	74.00	-42.95
8DPSK						
2400.00	48.32	PK	-13.12	35.20	74.00	-38.80
2400.00	39.13	PK	-13.12	26.01	74.00	-47.99
2483.50	47.58	PK	-13.06	34.52	74.00	-39.48
2483.50	43.84	PK	-13.06	30.78	74.00	-43.22

Test Frequency :Above 18GHz

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

Remark 1. The testing has been conformed to 10*2480 =24800MHz.

2. All other emissions more than 30dB below the limit.

7 Conducted Spurious Emissions

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: DA 00-705
Test 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)).
Test Result	: PASS

7.1 Test Procedure

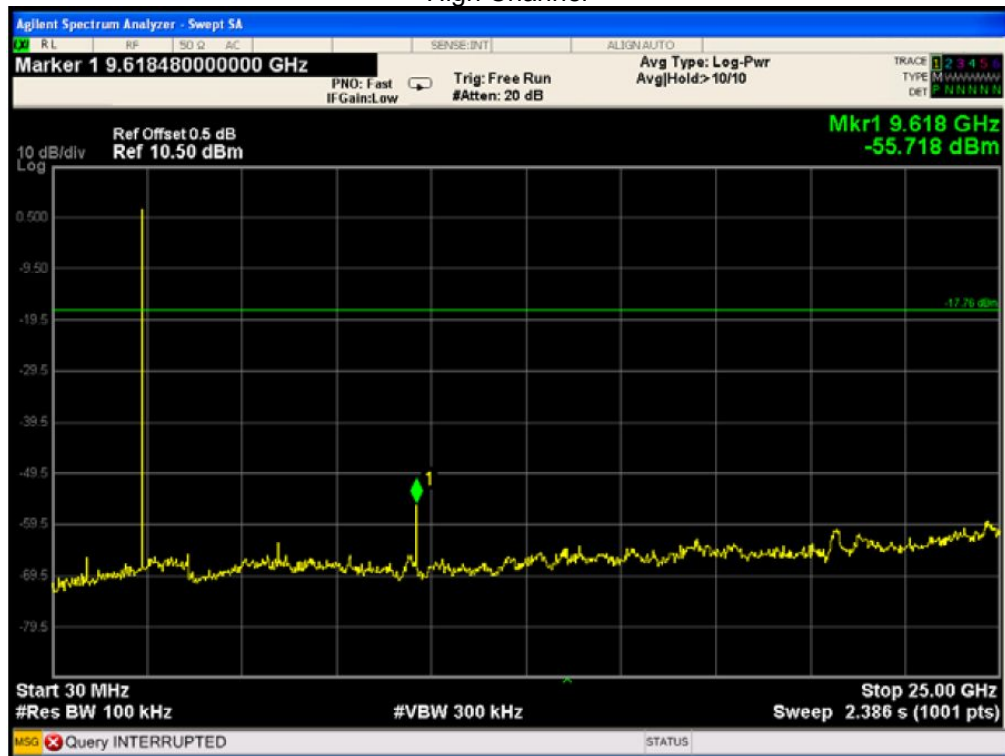
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

7.2 Test Result

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



High Channel



8 Band Edge Measurement

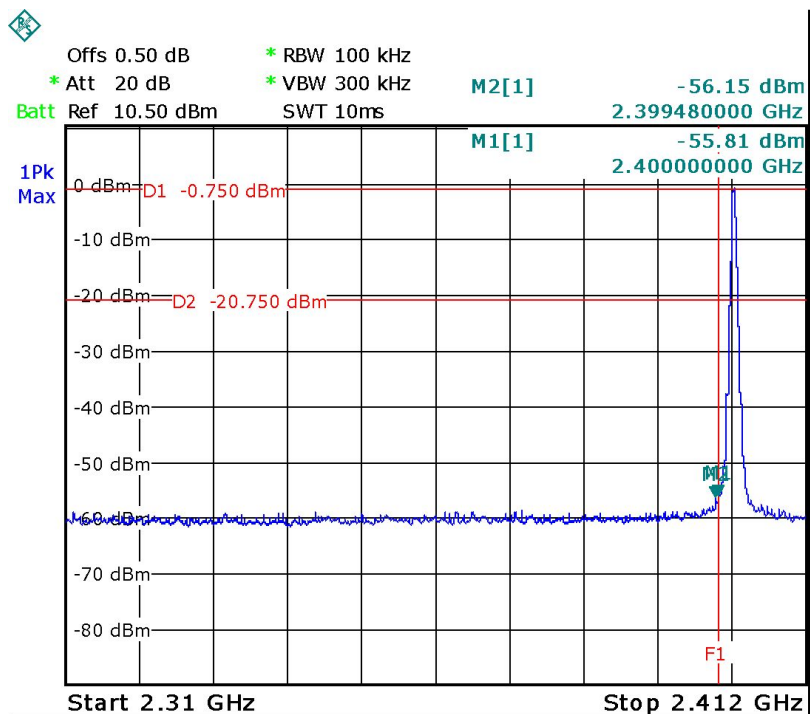
Test Requirement	: Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	: ANSI C63.10:2013, DA 00-705
Test Limit	: Regulation 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	: Refer to section 3.3

8.1 Test Procedure

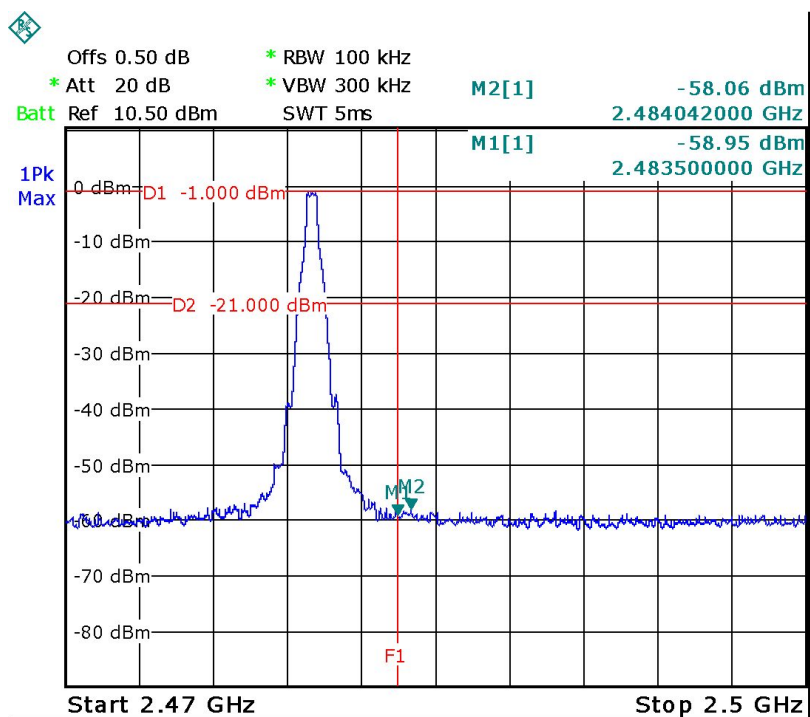
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
 2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
- Detector function = peak, Trace = max hold

8.2 Test Result

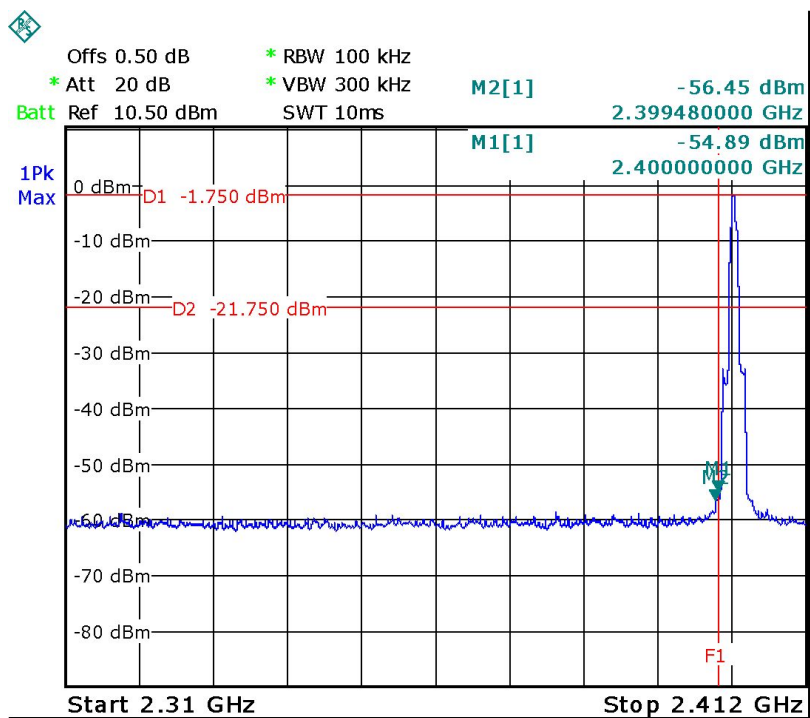
GFSK Band edge-left side



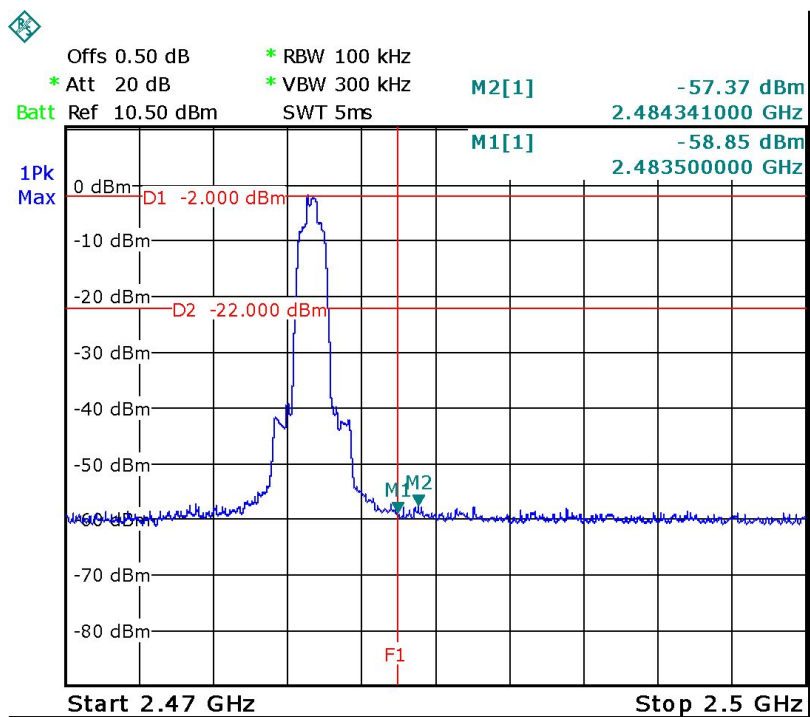
GFSK Band edge-right side



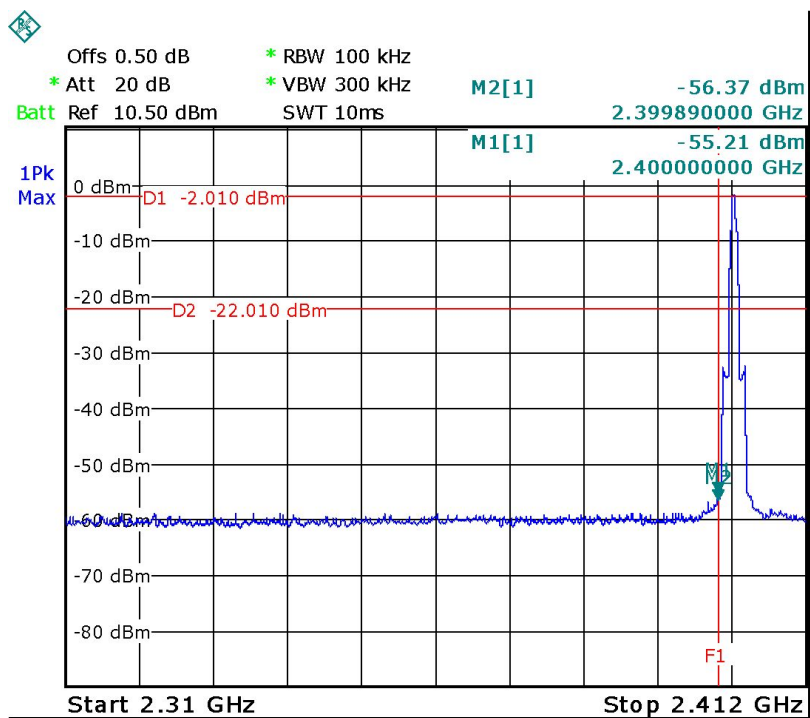
Pi/4 DQPSK Band edge-left side



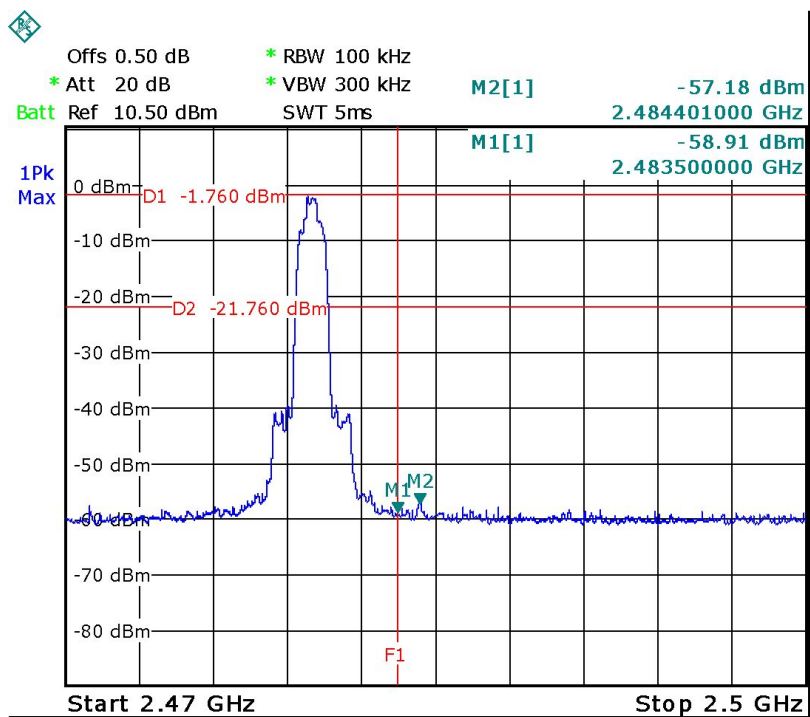
Pi/4 DQPSK Band edge-right side



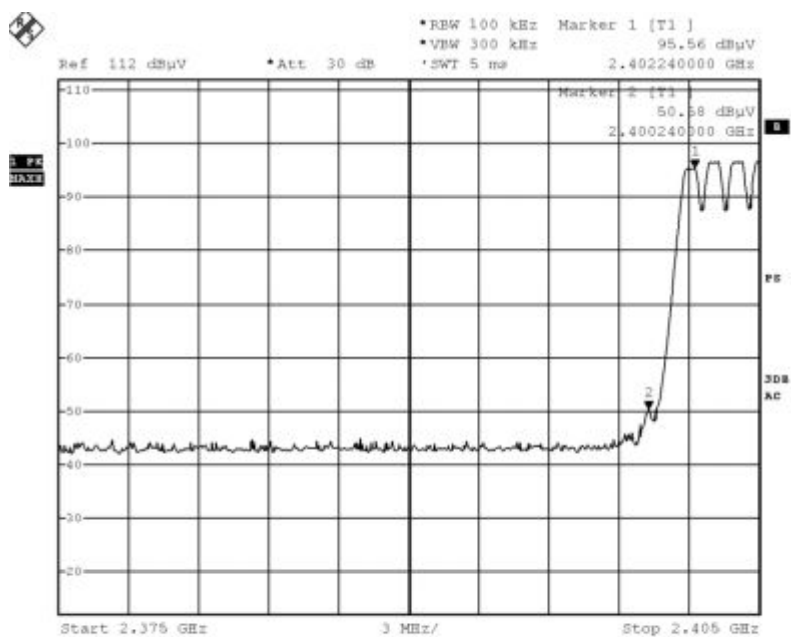
8DPSK Band edge-left side



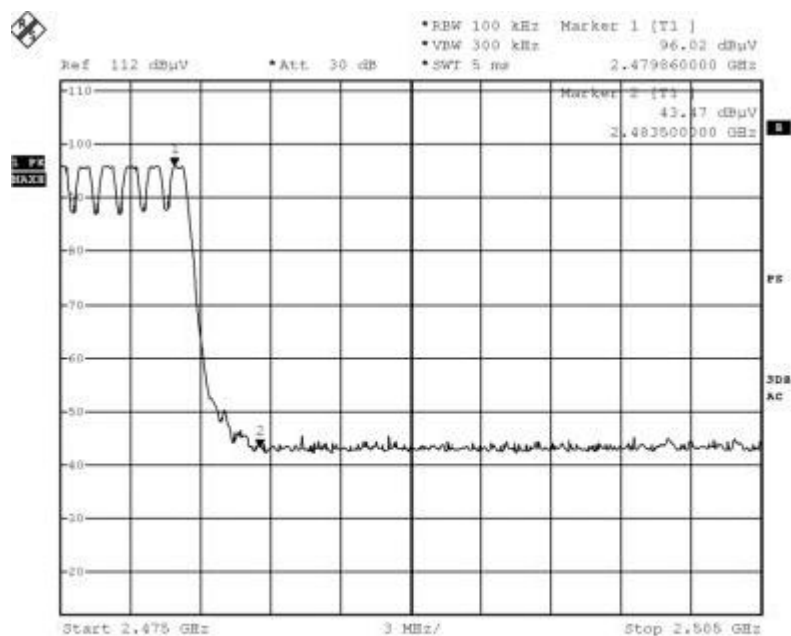
8DPSK Band edge-right side



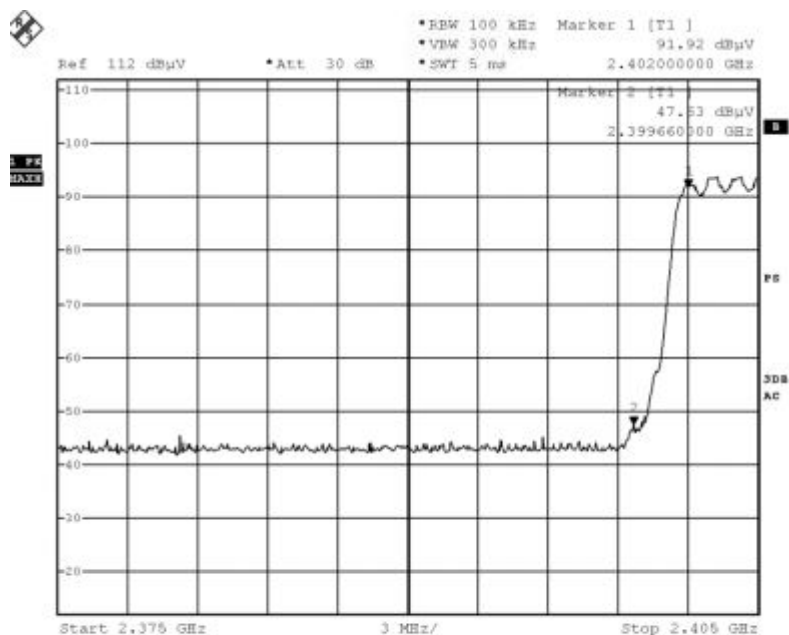
Hopping in GFSK Band edge-left side



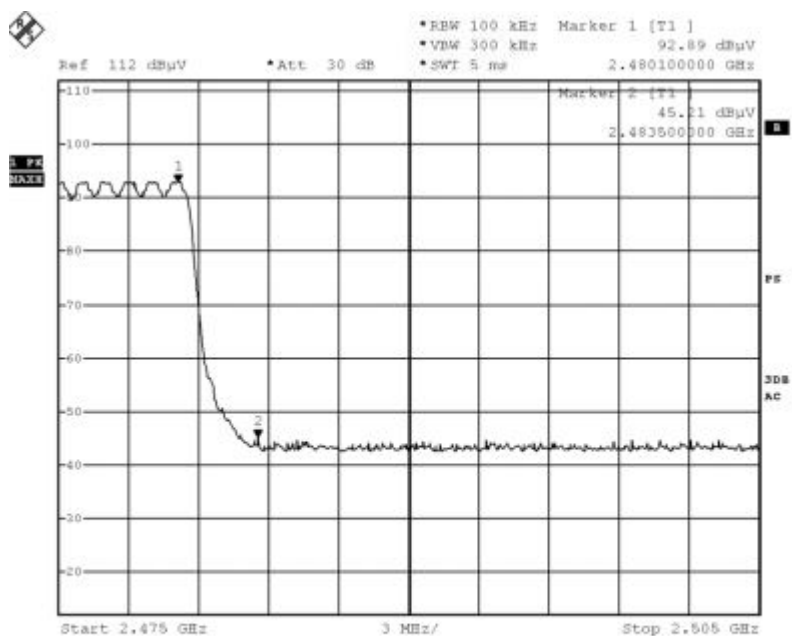
Hopping in GFSK Band edge-right side



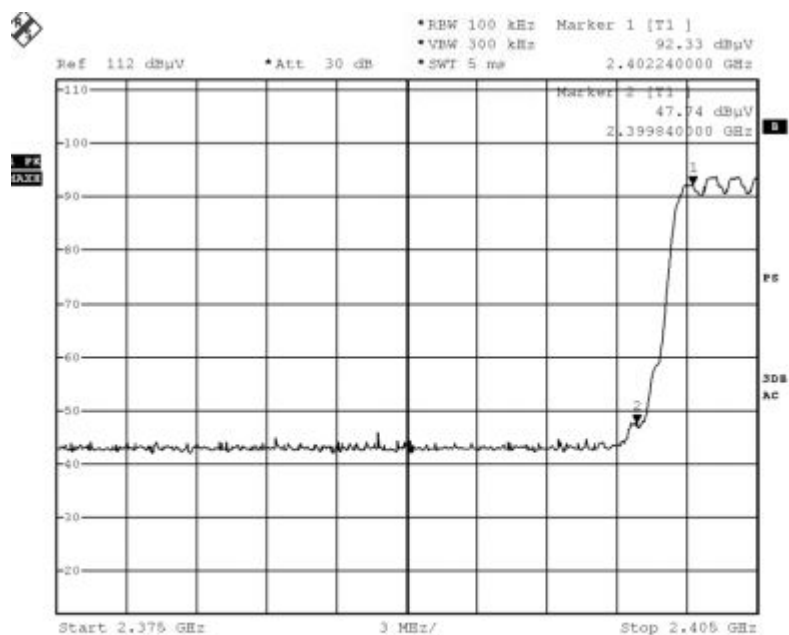
Hopping in Pi/4 DQPSK Band edge-left side



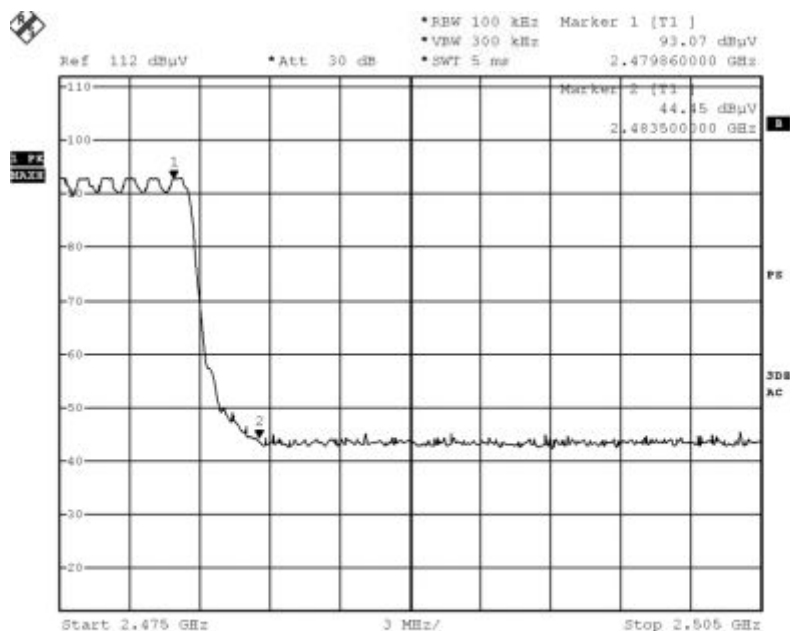
Hopping in Pi/4 DQPSK Band edge-right side



Hopping in 8DPSK Band edge-left side



Hopping in 8DPSK Band edge-right side



9 20 dB Bandwidth Measurement

Test Requirement : FCC CFR47 Part 15 Section 15.247
 Test Method : ANSI C63.10:2013, DA 00-705
 Test Mode : Refer to section 3.3

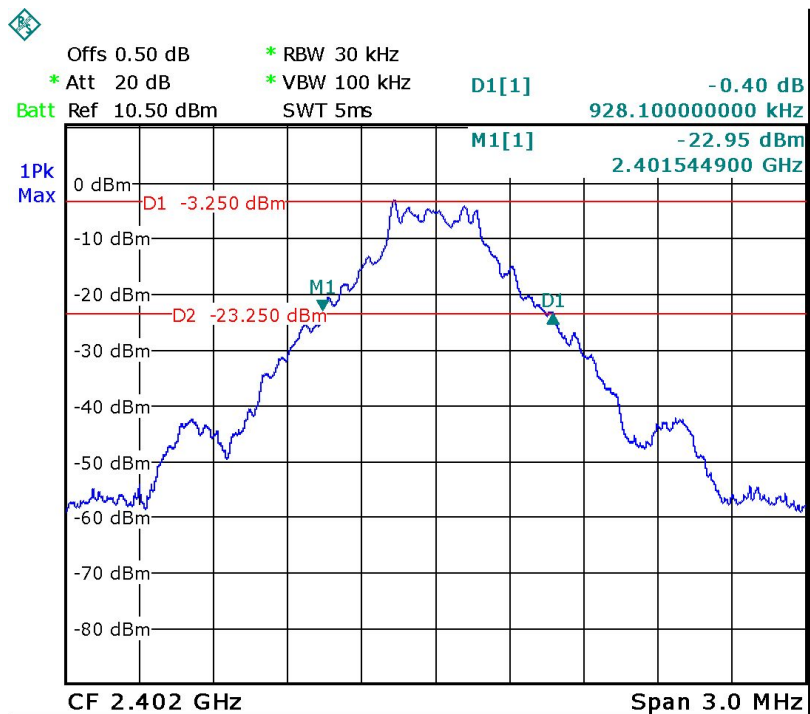
9.1 Test Procedure

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

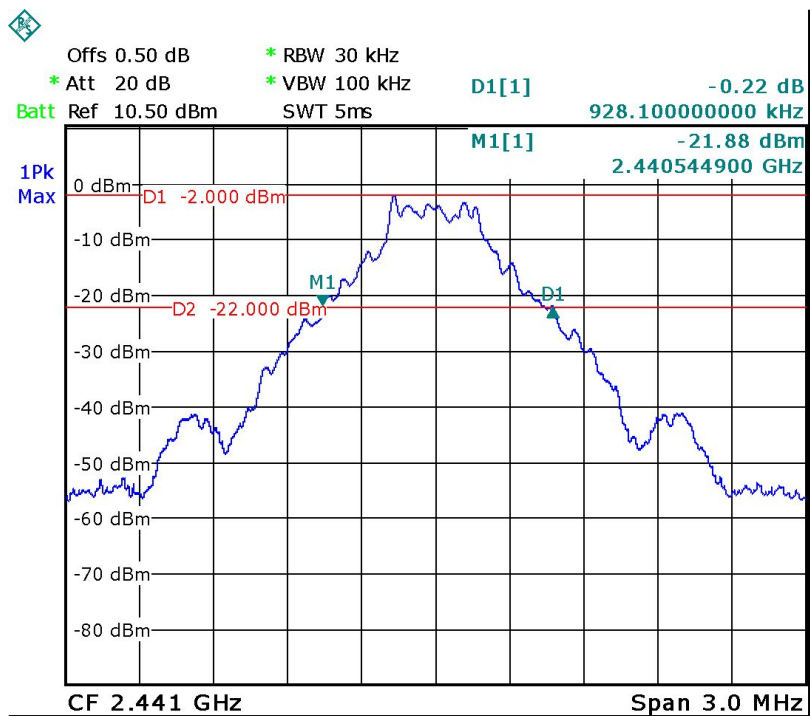
9.2 Test Result

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.928
GFSK	Middle	0.928
GFSK	High	0.928
Pi/4 DQPSK	Low	1.234
Pi/4 DQPSK	Middle	1.246
Pi/4 DQPSK	High	1.246
8DPSK	Low	1.246
8DPSK	Middle	1.258
8DPSK	High	1.258

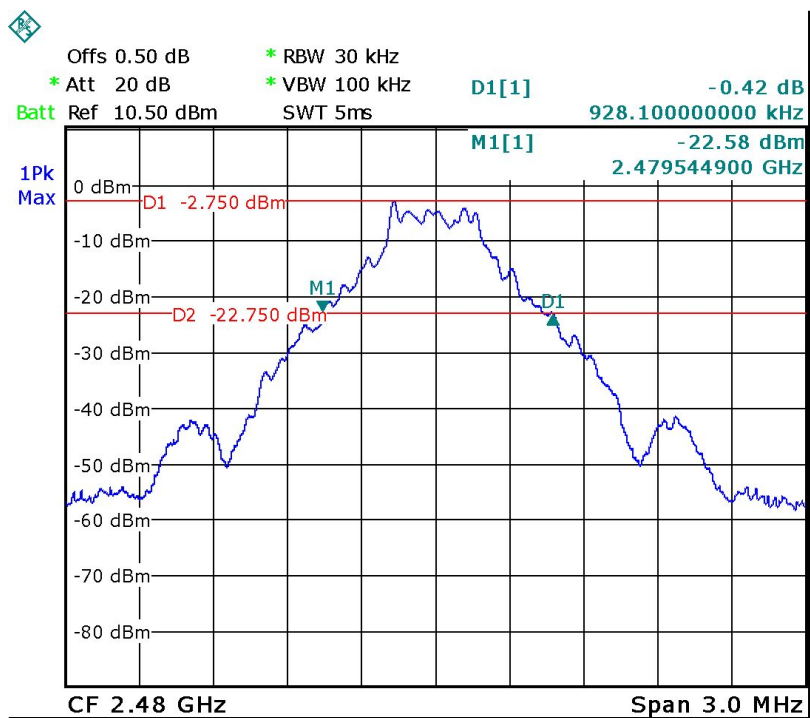
GFSK Low Channel



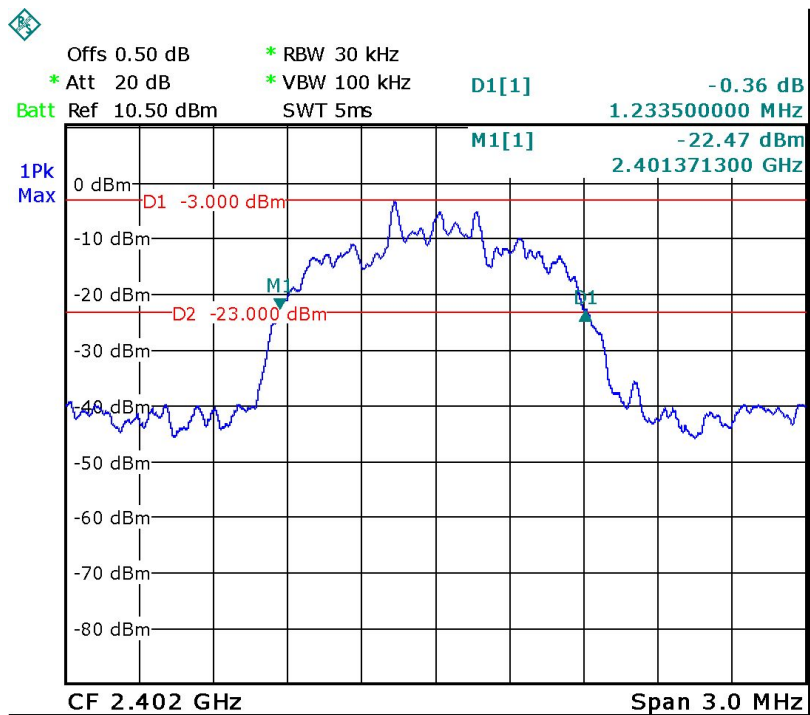
GFSK Middle Channel



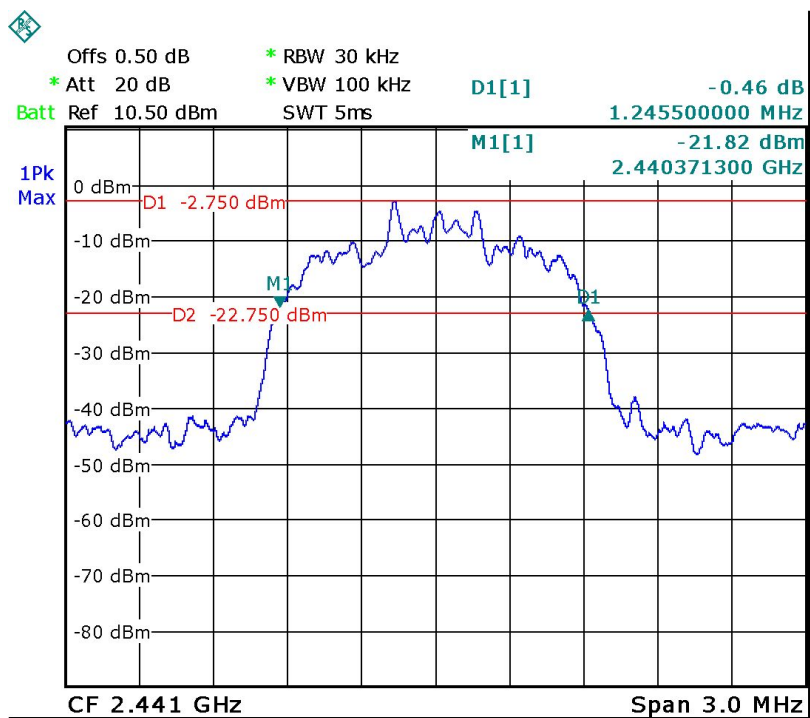
GFSK High Channel



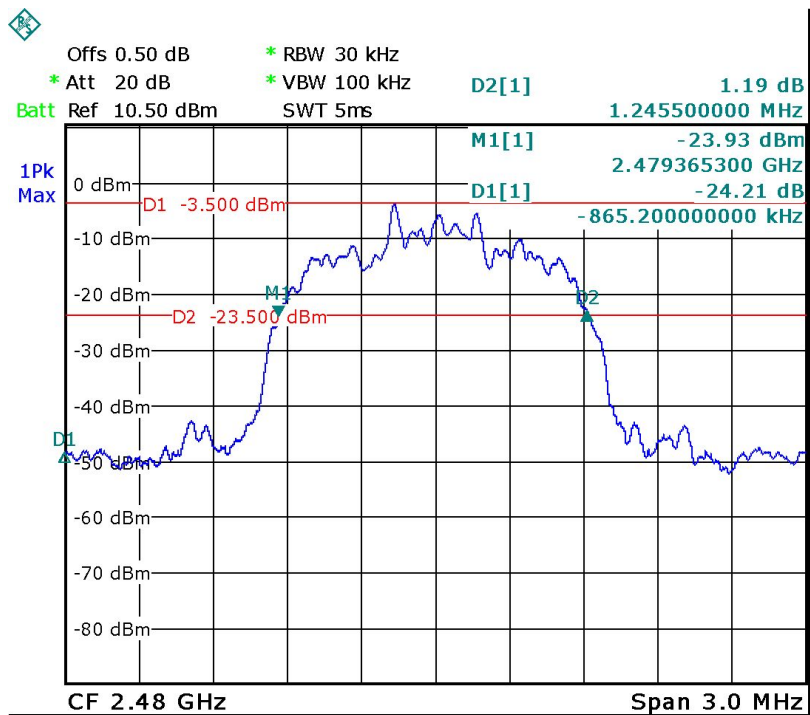
Pi/4DQPSK Low Channel



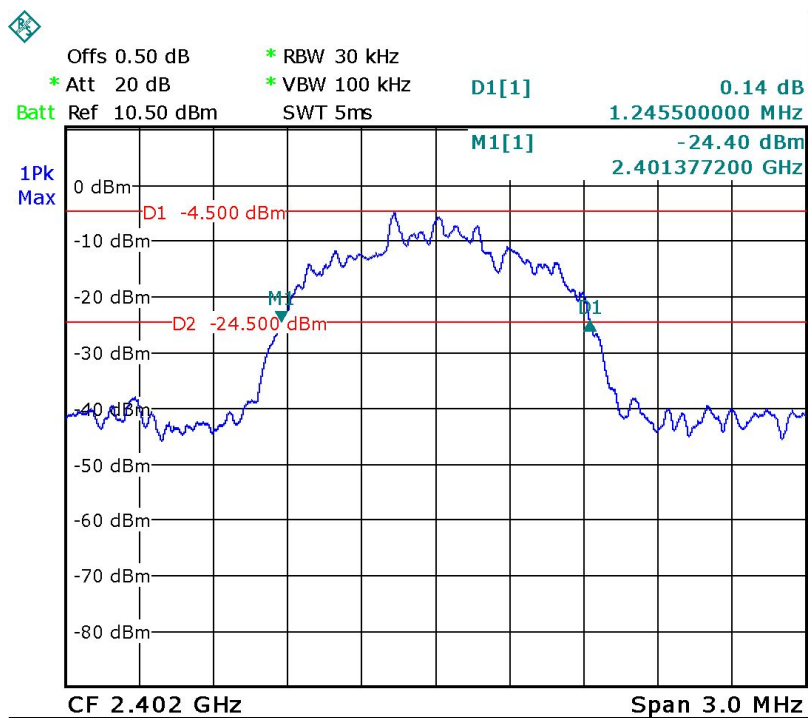
Pi/4DQPSK Middle Channel



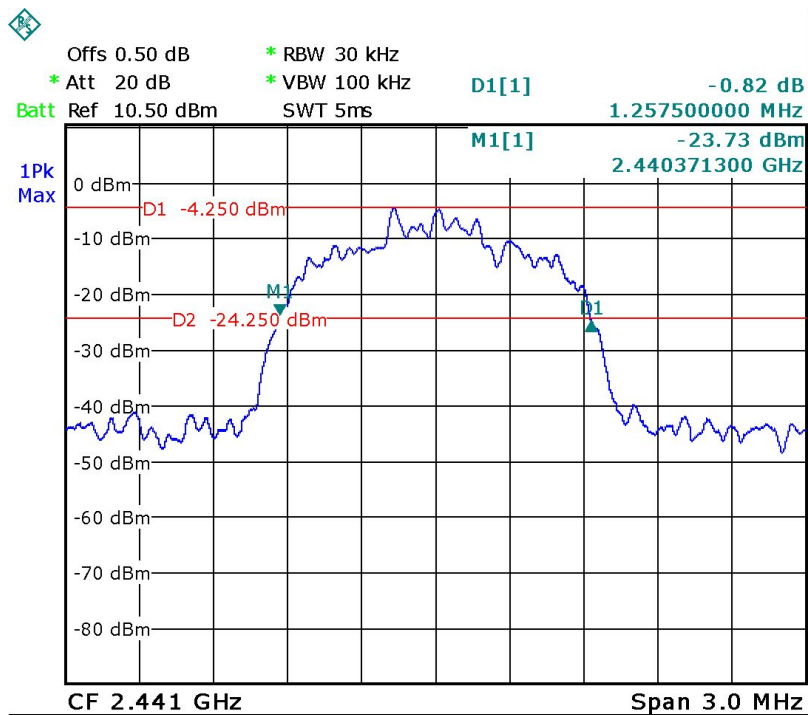
Pi/4DQPSK High Channel



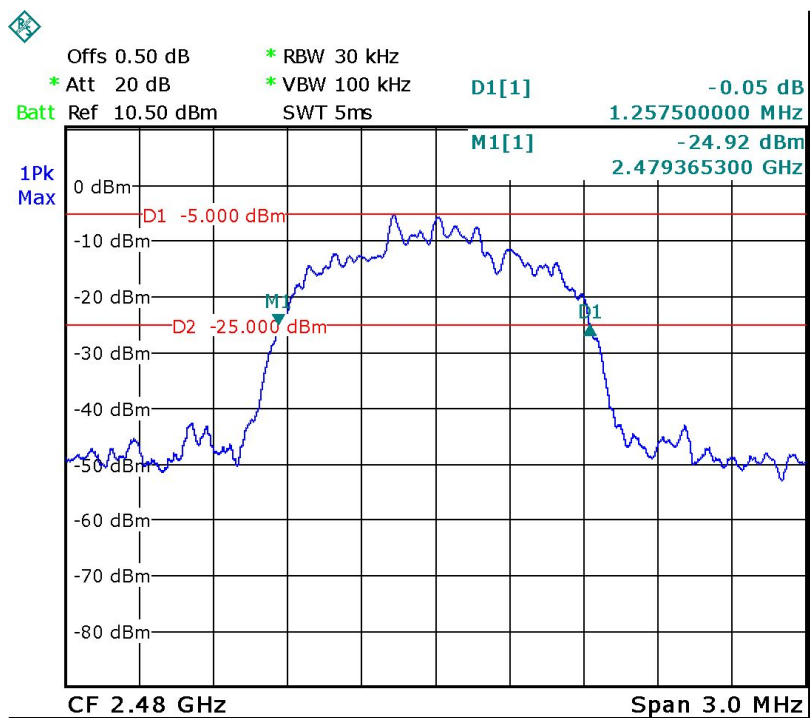
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel



10 Maximum Peak Output Power

- Test Requirement : FCC CFR47 Part 15 Section 15.247
- Test Method : ANSI C63.10:2013, DA 00-705
- Test Limit : Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
- Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.
- Test Mode : Refer to section 3.3

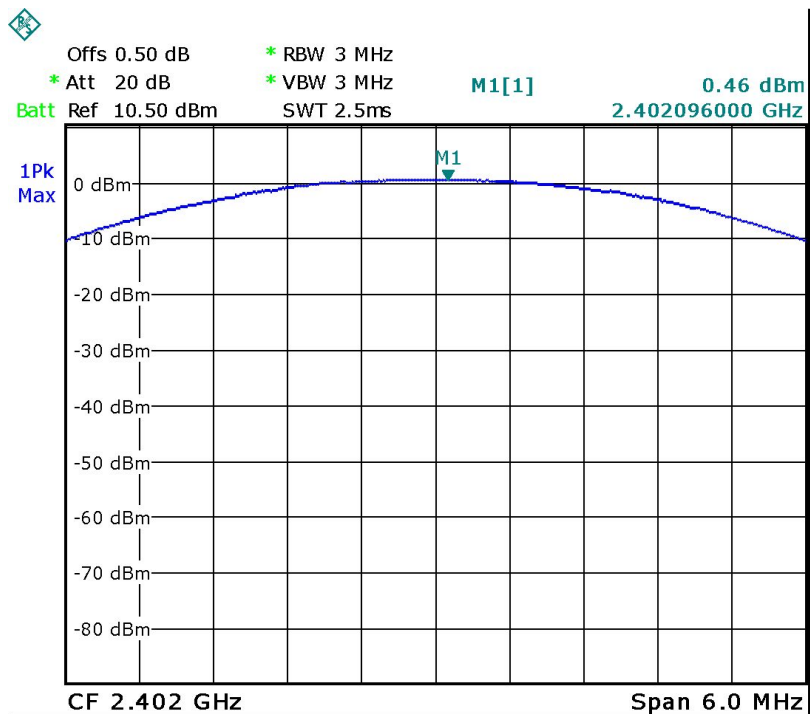
10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyser: RBW = 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.

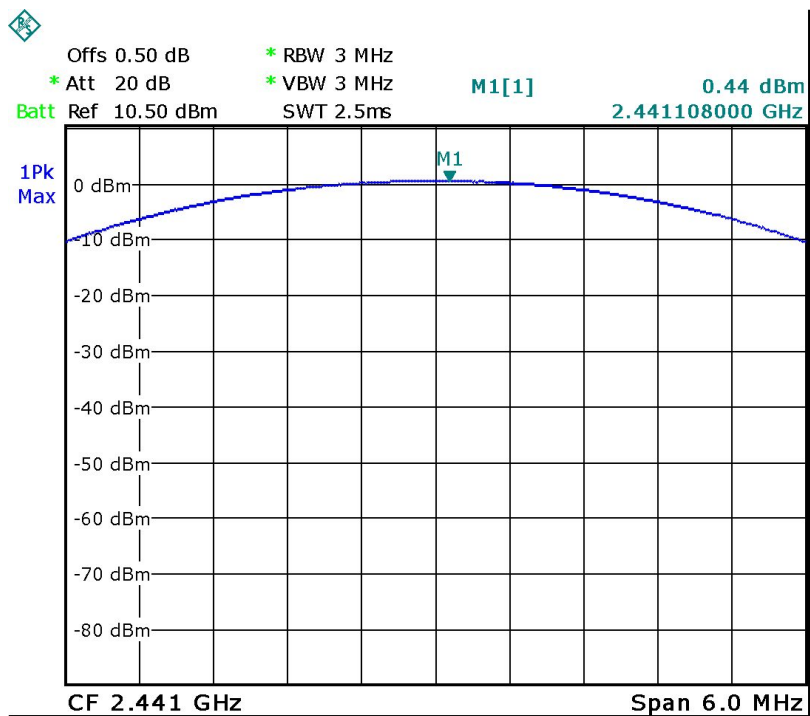
10.2 Test Result

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	0.46	30
GFSK	Middle	0.44	30
GFSK	High	0.61	30
Pi/4 DQPSK	Low	0.79	20.97
Pi/4 DQPSK	Middle	0.57	20.97
Pi/4 DQPSK	High	0.34	20.97
8DPSK	Low	0.58	20.97
8DPSK	Middle	0.56	20.97
8DPSK	High	0.58	20.97

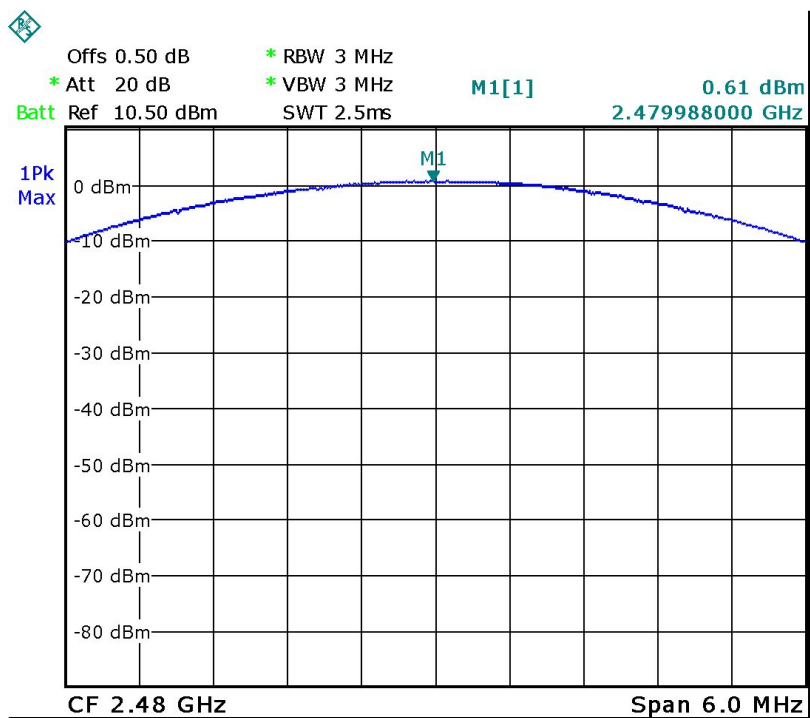
GFSK Low Channel



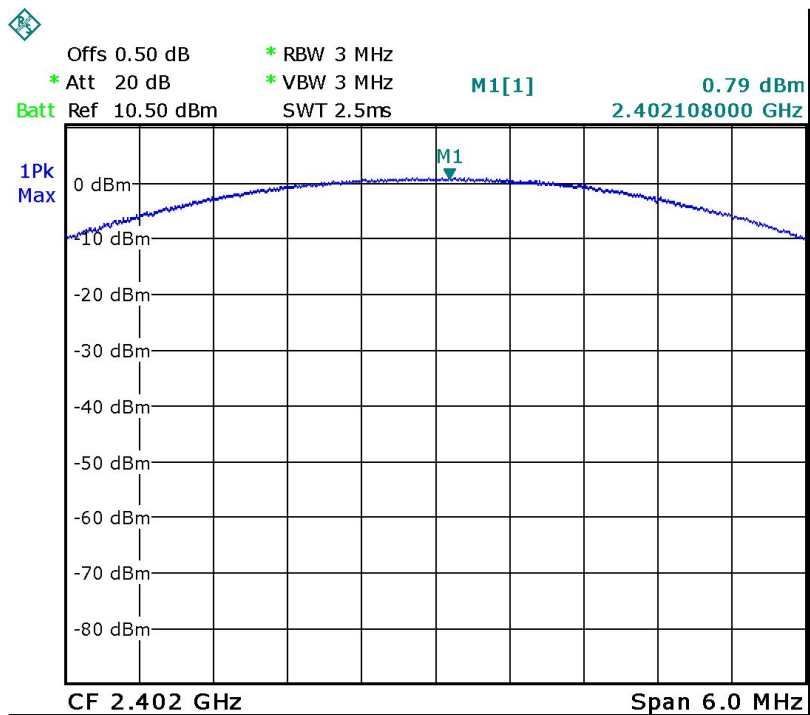
GFSK Middle Channel



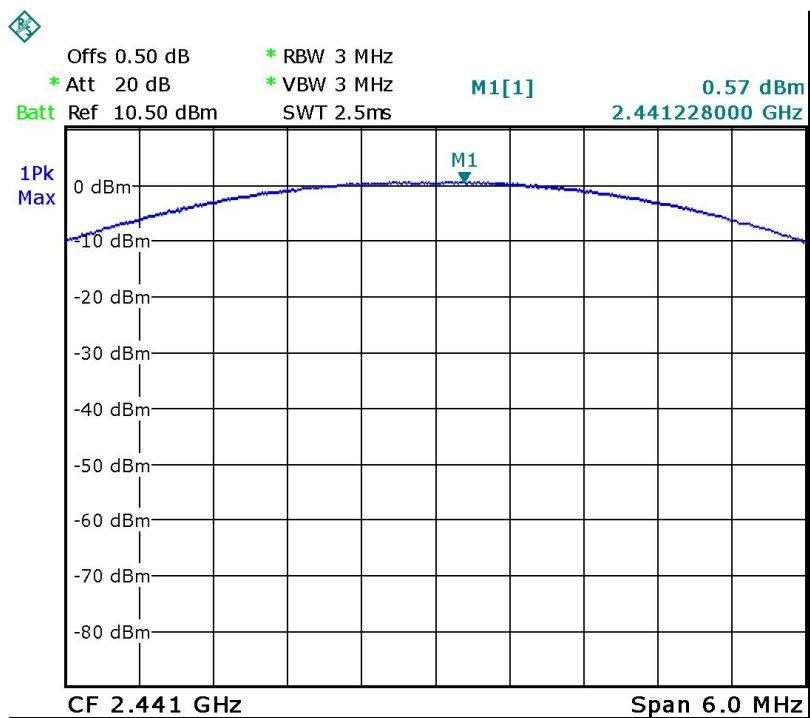
GFSK High Channel



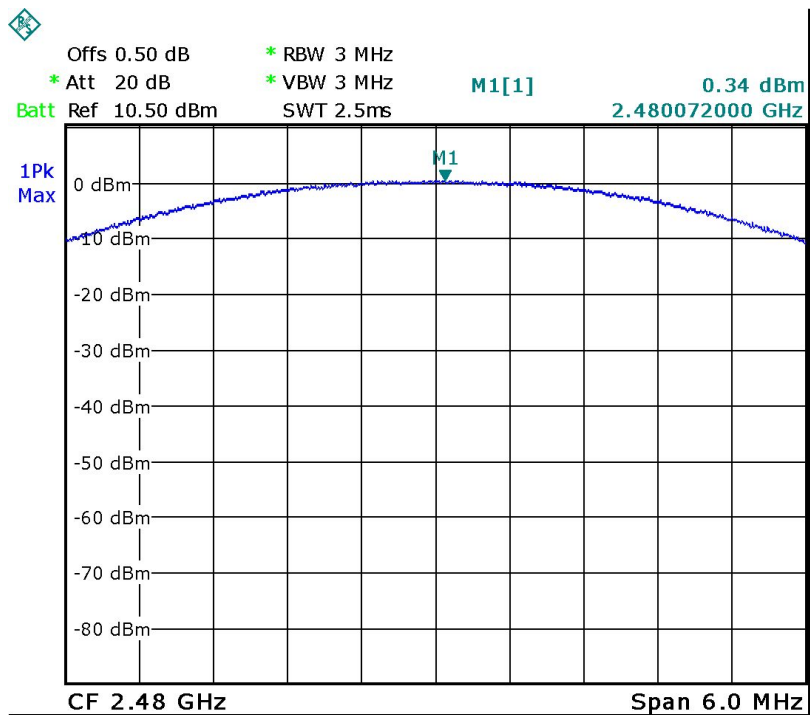
Pi/4DQPSK Low Channel



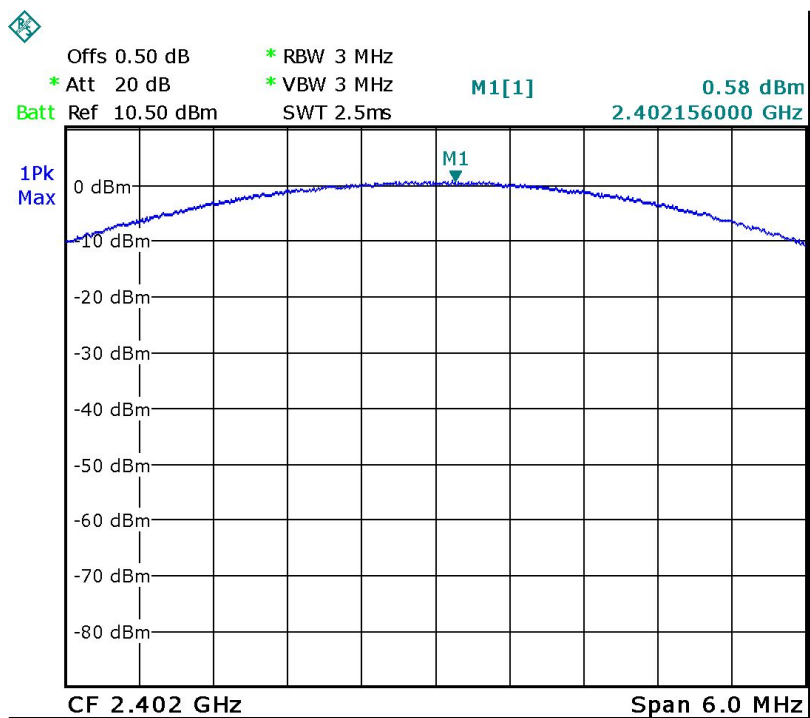
Pi/4DQPSK Middle Channel



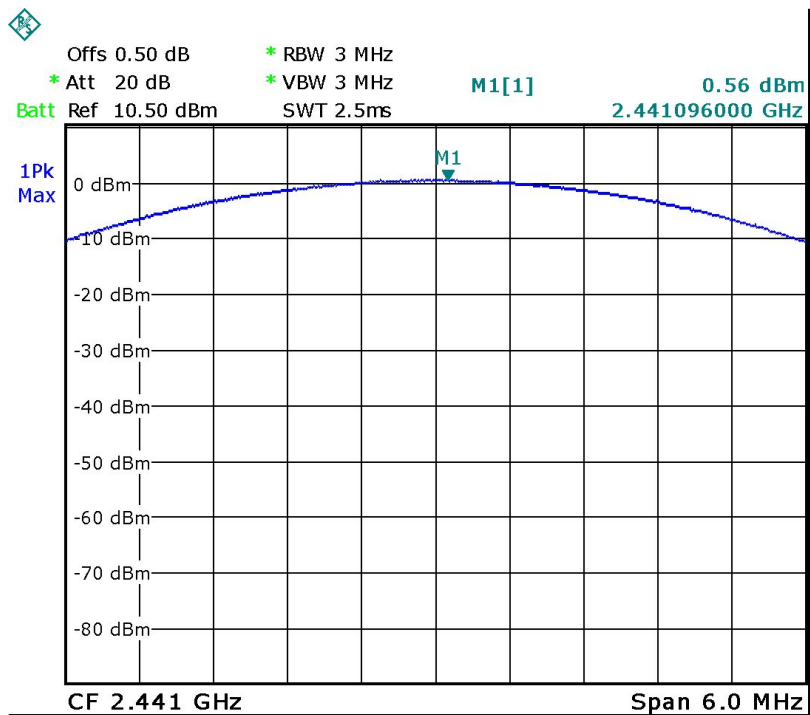
Pi/4DQPSK High Channel



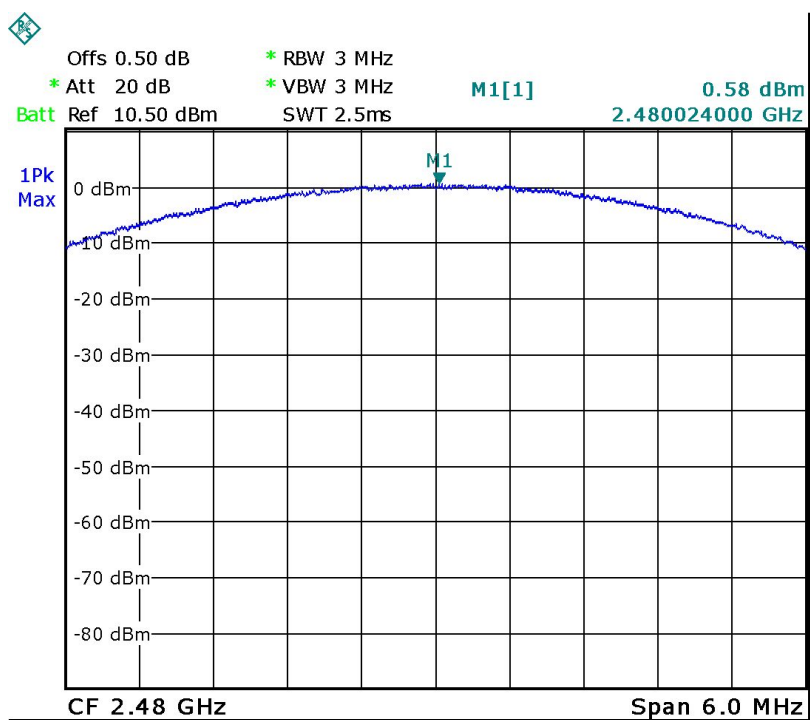
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel



11 Hopping Channel Separation

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, 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 125mW.
Test Mode	: Hopping

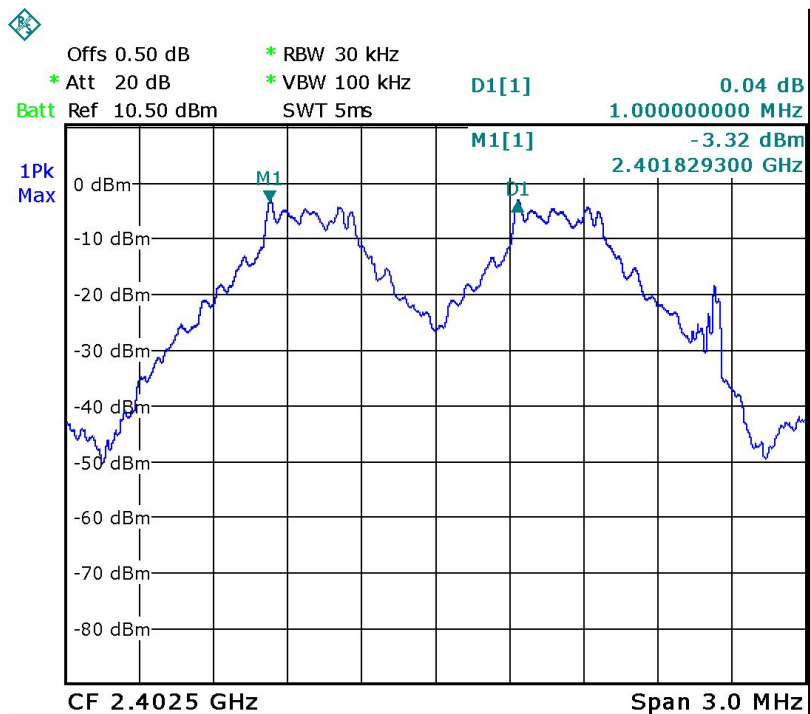
11.1 Test Procedure

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 = 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.

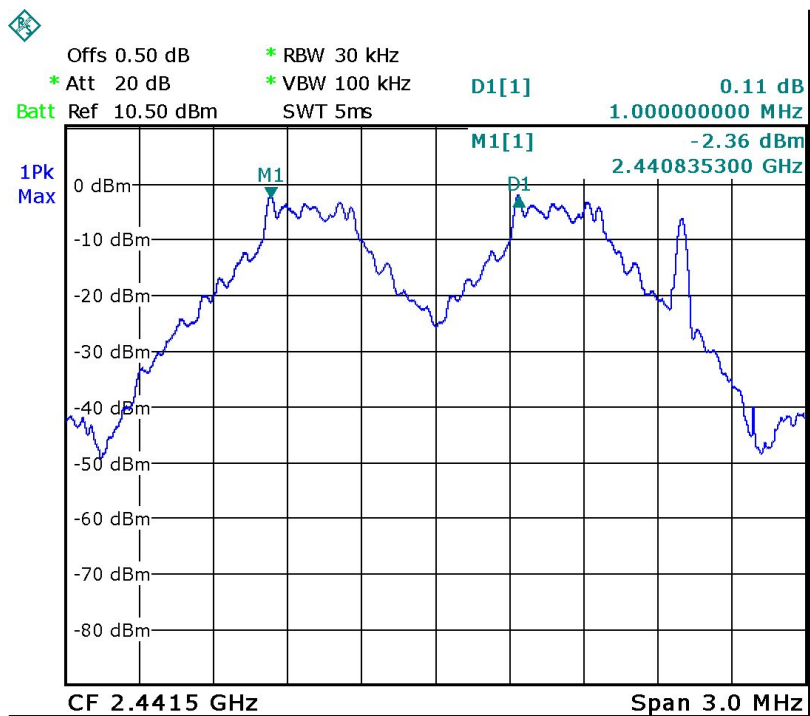
11.2 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	≥ 0.928	PASS
GFSK	Middle	1.000	≥ 0.928	PASS
GFSK	High	1.000	≥ 0.928	PASS
Pi/4 DQPSK	Low	1.000	≥ 0.823	PASS
Pi/4 DQPSK	Middle	1.000	≥ 0.831	PASS
Pi/4 DQPSK	High	1.000	≥ 0.831	PASS
8DPSK	Low	1.000	≥ 0.831	PASS
8DPSK	Middle	1.000	≥ 0.839	PASS
8DPSK	High	1.000	≥ 0.839	PASS

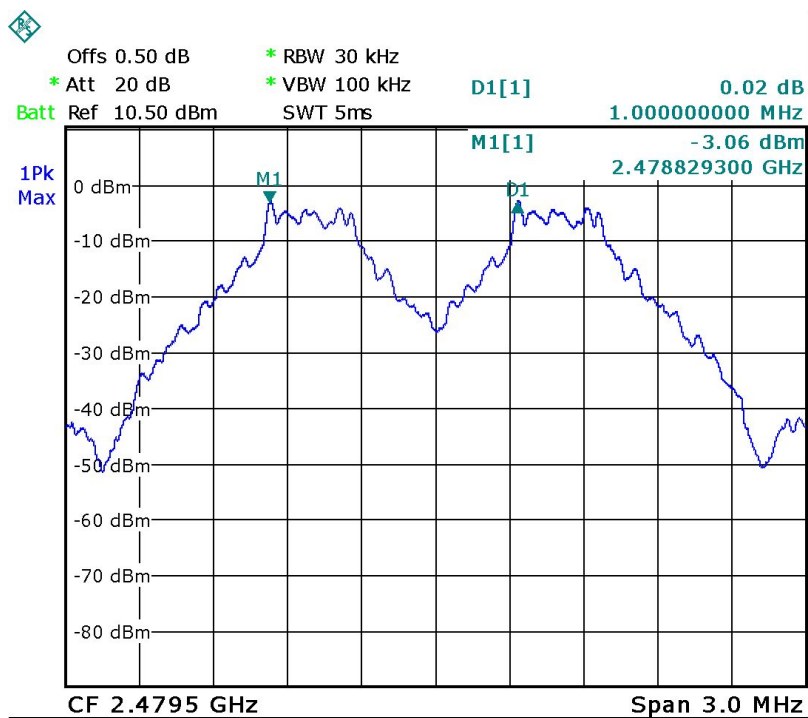
GFSK Low Channel



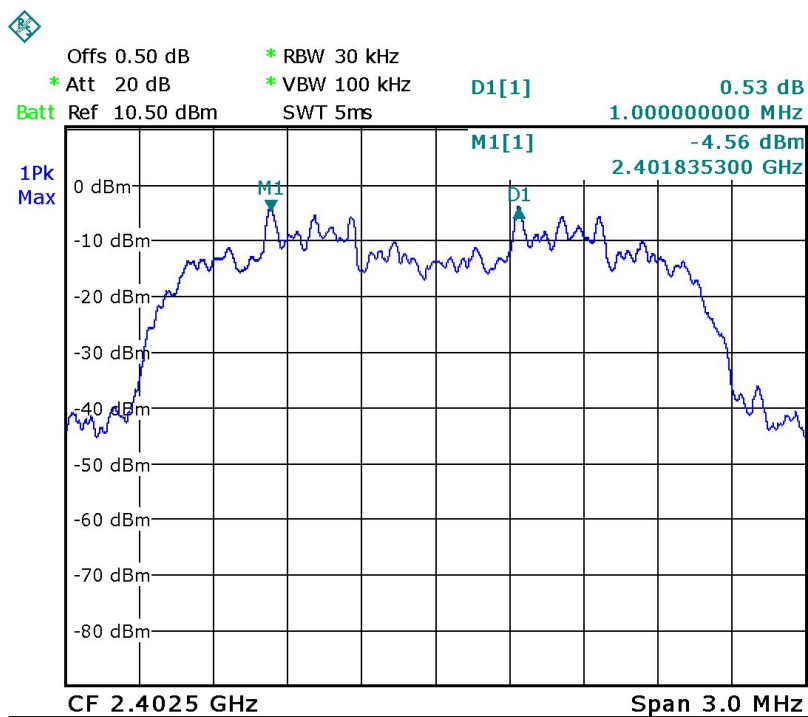
GFSK Middle Channel



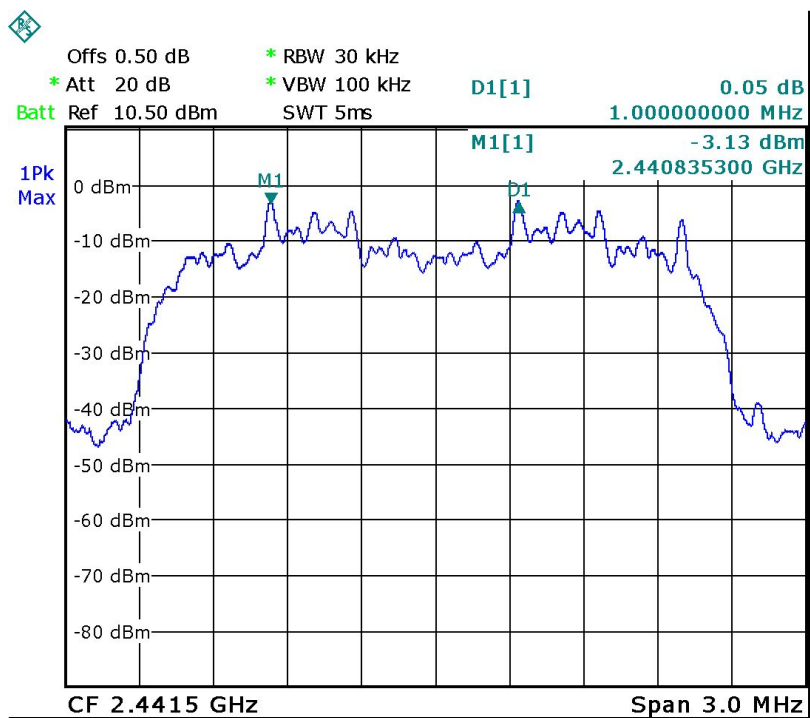
GFSK High Channel



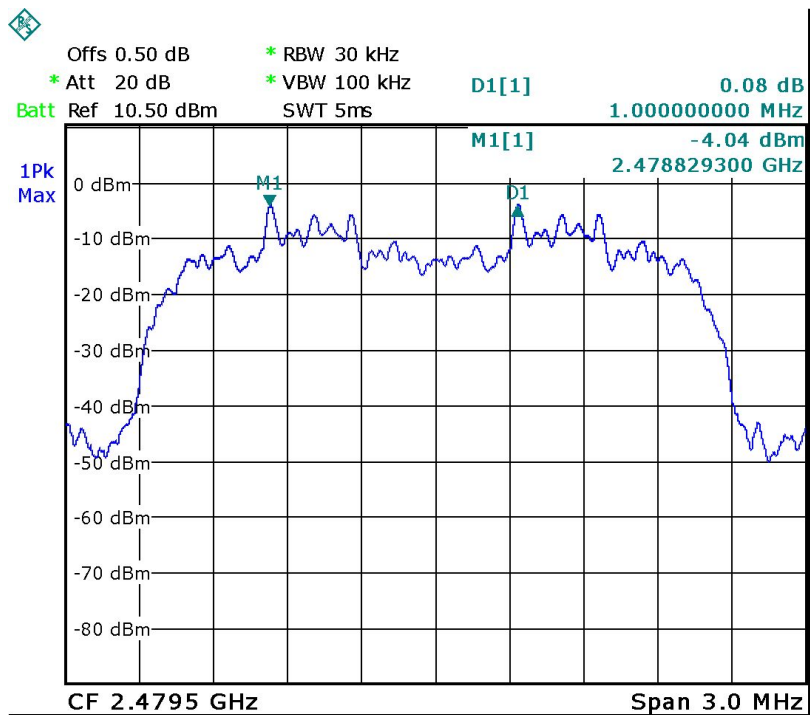
Pi/4DQPSK Low Channel



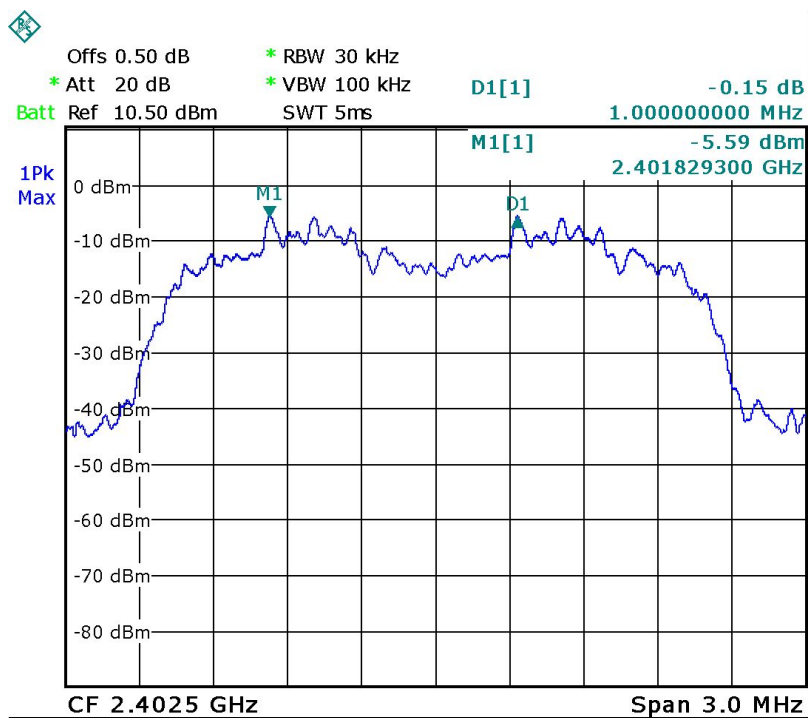
Pi/4DQPSK Middle Channel



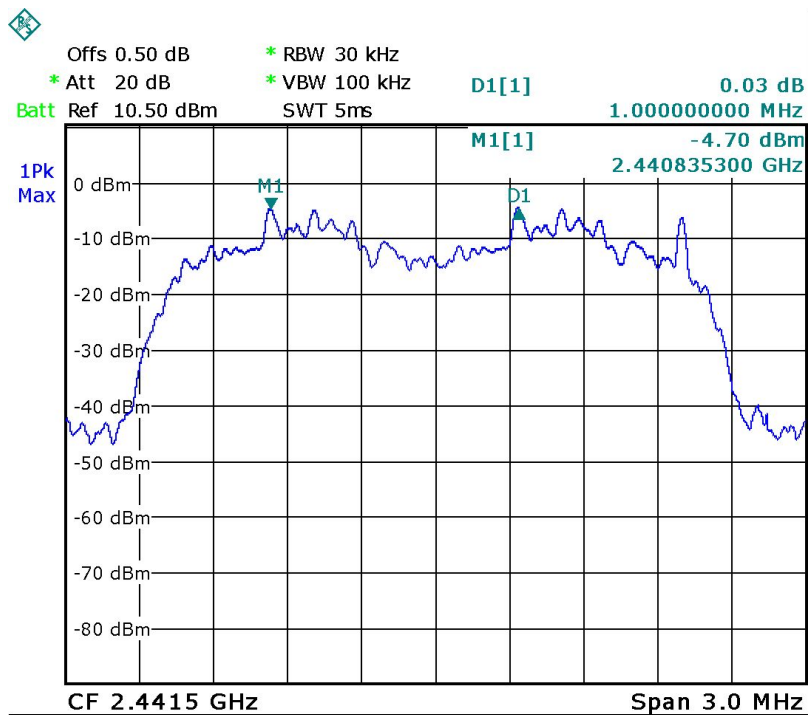
Pi/4DQPSK High Channel



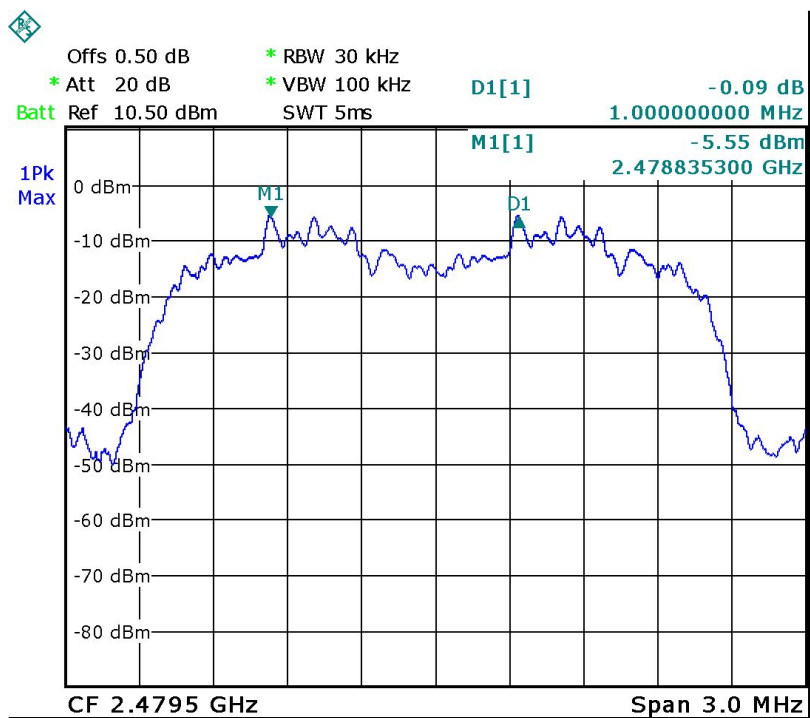
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel



12 Number of Hopping Frequency

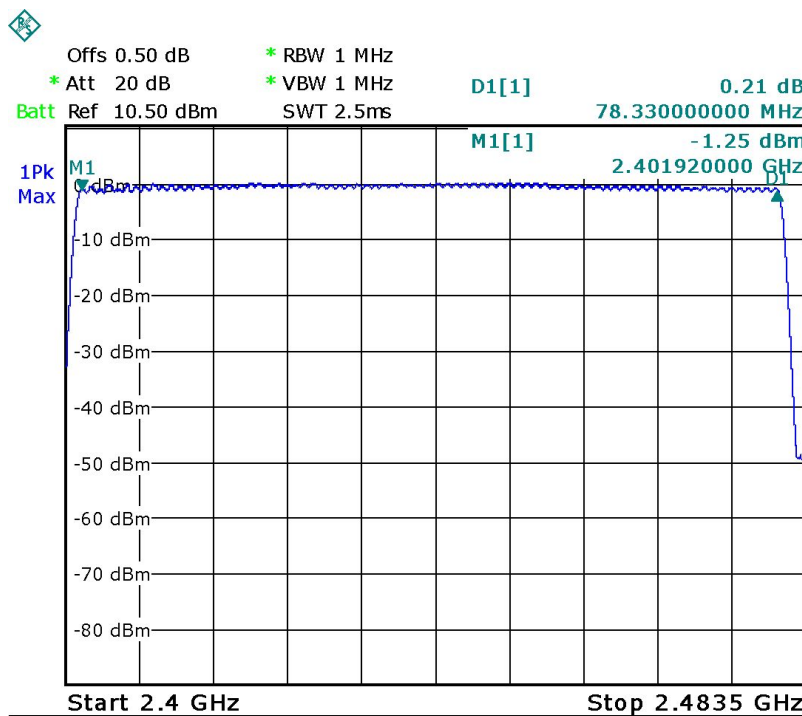
Test Requirement : FCC CFR47 Part 15 Section 15.247
 Test Method : ANSI C63.10:2013, DA 00-705
 Test Limit : Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
 Test Mode : Hopping(GFSK)

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 = 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;

12.2 Test Result

Channel Number	Limit
79	≥ 15



13 Dwell Time

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, 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.
Test Mode	: Hopping
Remark	: The worst case(8DPSK,DH5) was recorded

13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. 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).

13.2 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).

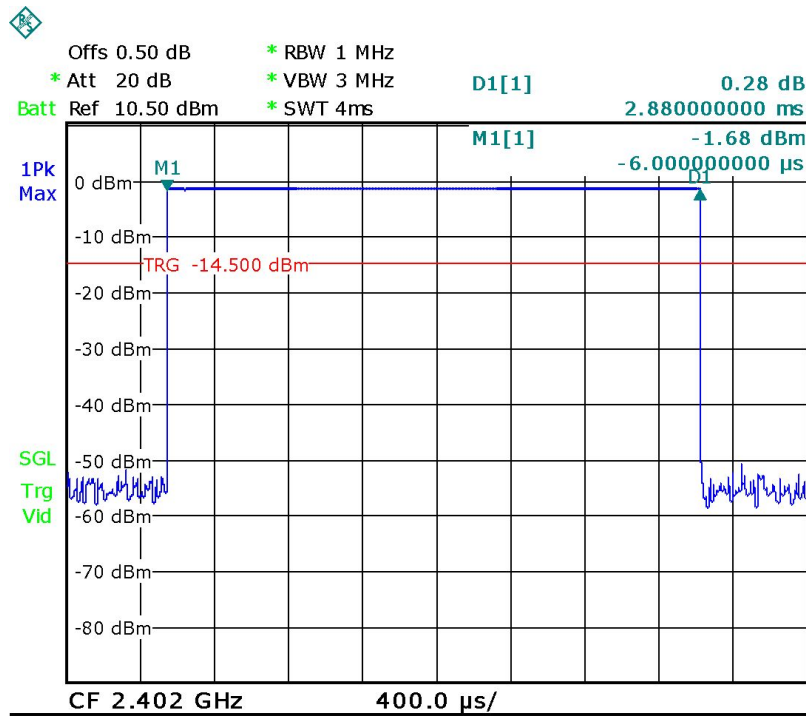
DH1 Packet permit maximum $1600 / 79 / 2$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

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.	

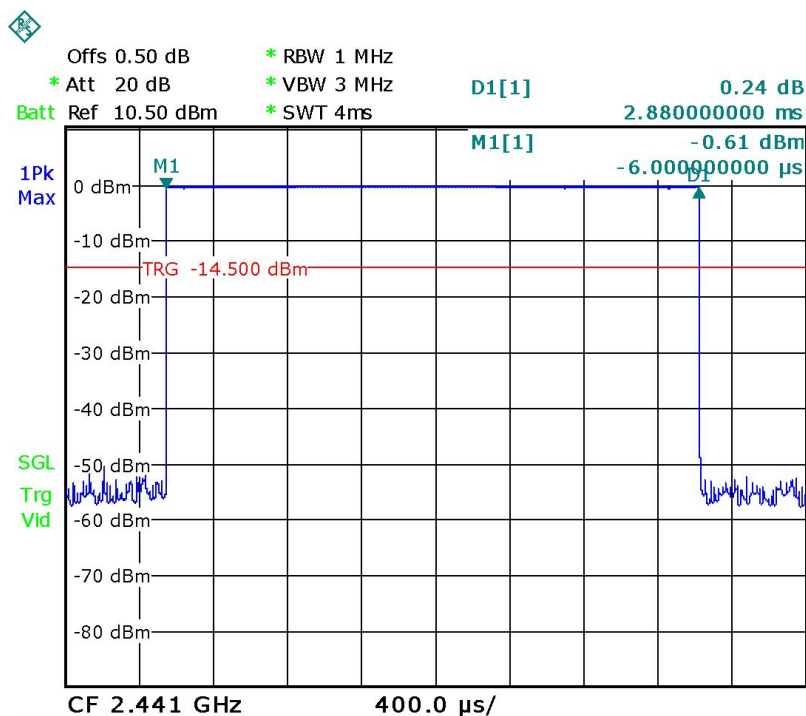


Modulation	Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
8DPSK	DH5	Low	2.880	0.307	0.4
		middle	2.880	0.307	0.4
		High	2.880	0.307	0.4

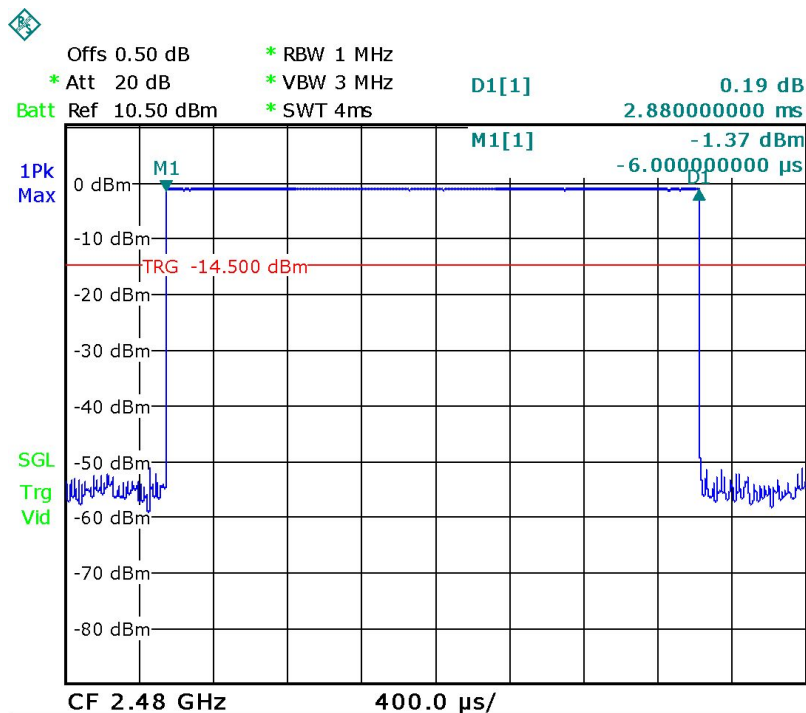
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel





14 Antenna Requirement

According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an **PCB printed antenna**, it meet the requirement of this section.

*******THE END REPORT*******