FCC TEST REPORT

FCC ID: 2AMFD1003315

Product Name	:	VR Remote Controller
Model Name	:	1003315
Brand Name	:	YINGFU
Report No.	:	PTC-DQ-03170650101-FC01

Prepared for

YINGFU (H.K.) Industrial Ltd.

Unit H ,15/F .,World Tech Centre, 95 How Ming Street, Kwun Tong, Kowloon Hong Kong.

Prepared by

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1TEST RESULT CERTIFICATION

Applicant's name	:	YINGFU (H.K.) Industrial Ltd.
Address	:	Unit H ,15/F .,World Tech Centre, 95 How Ming Street, Kwun Tong, Kowloon Hong Kong.
Manufacture's name	:	YINGFU (H.K.) Industrial Ltd.
Address	:	Unit H ,15/F .,World Tech Centre, 95 How Ming Street, Kwun Tong, Kowloon Hong Kong.
Product name	:	VR Remote Controller
Model name	:	1003315
Brand Name	:	YINGFU
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	June 06, 2017- June.19, 2017
Date of Issue	:	June 19, 2017
Test Result	:	Pass

This device described above has been tested by PTS, 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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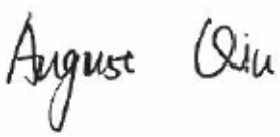
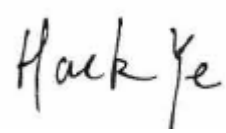
Testing Engineer

August Qiu



Technical Manager

Hack Ye



Authorized Signatory

Chris Du

Contents

2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	N/A
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	:	VR Remote Controller
Model Name	:	1003315
Bluetooth Version	:	Version3.0+EDR
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	79 channels
Antenna Type:	:	Internal PCB Antenna
Antenna Gain:	:	0 dBi
Type of Modulation	:	GFSK, π/4-DQPSK, 8DPSK
Power supply	:	DC 2*1.5V Battery

3.2 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	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	-	-

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		
Tests Carried Out Under FCC part 15.207			
Test Item	Test Mode		
Conduction Emission, 0.15MHz to 30MHz	BT Communication		

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, 2016	Aug.03, 2017	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	Aug.04, 2016	Aug.03, 2017	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2016	July 14, 2017	1 year
4	Humidity Chamber	GF	GTH-225-40-1P	IAA061225	July 15, 2016	July 14, 2017	1 year
5	USB RF power sensor	DARE	RPR3006W	15I00041SN O01	July 15, 2016	July 14, 2017	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, 2016	July 14, 2017	1 year
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3355	July 15, 2016	July 14, 2017	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2016	July 14, 2017	1 year
4	Horn Antenna	SCHWARZBECK	BBHA9120D	1246	July 15, 2016	July 14, 2017	1 year
5	Horn Antenna	SCHWARZBECK	BBHA9170D	1412	July 15, 2016	July 14, 2017	1 year
6	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	July 15, 2016	July 14, 2017	1 year
7	Coaxial Cable(above 1GHz)	LARGE	CALB2	-	July 15, 2016	July 14, 2017	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, 2016	July 14, 2017	1 year
2	LISN	SCHWARZBECK	NSLK 8128	8128-289	July 15, 2016	July 14, 2017	1 year
3	Cable	LARGE	RF300	-	July 15, 2016	July 14, 2017	1 year

4.2 Measurement Uncertainty

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

5 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: : 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(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	$20\log^{(500)}$

5.1 EUT Operation

Operating Environment :

Temperature: : 23.5 °C

Humidity: : 51.1 % RH

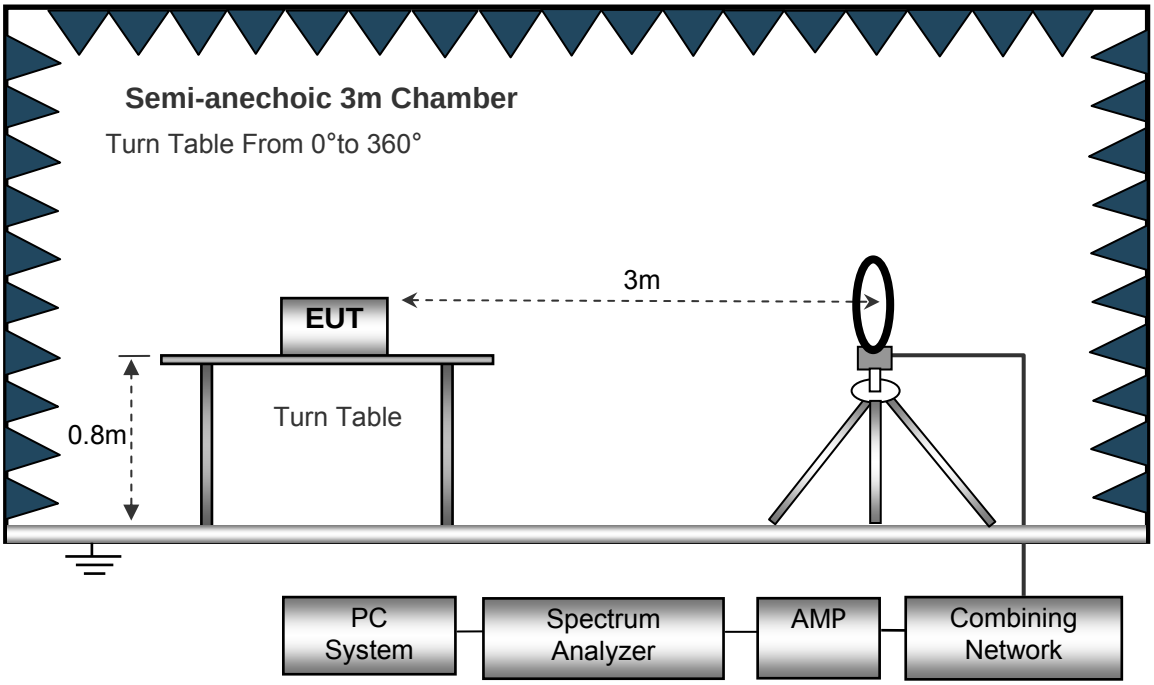
Atmospheric Pressure: : 101.2kPa

EUT Operation : : Refer to section 3.3

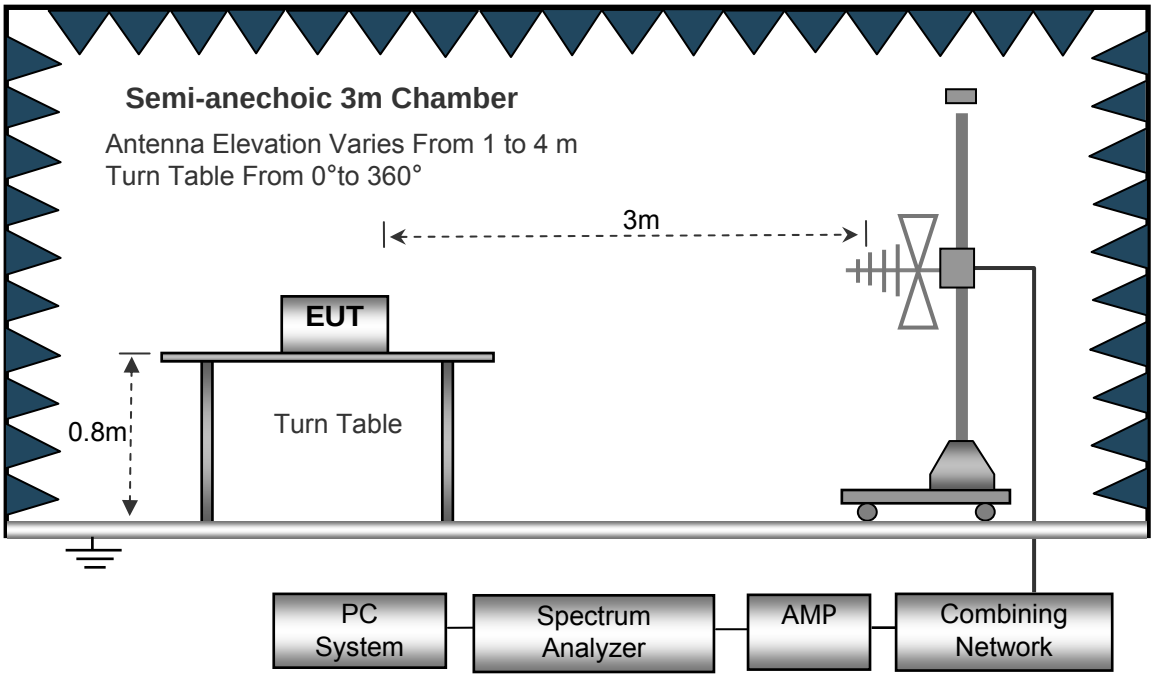
5.2 Test Setup

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

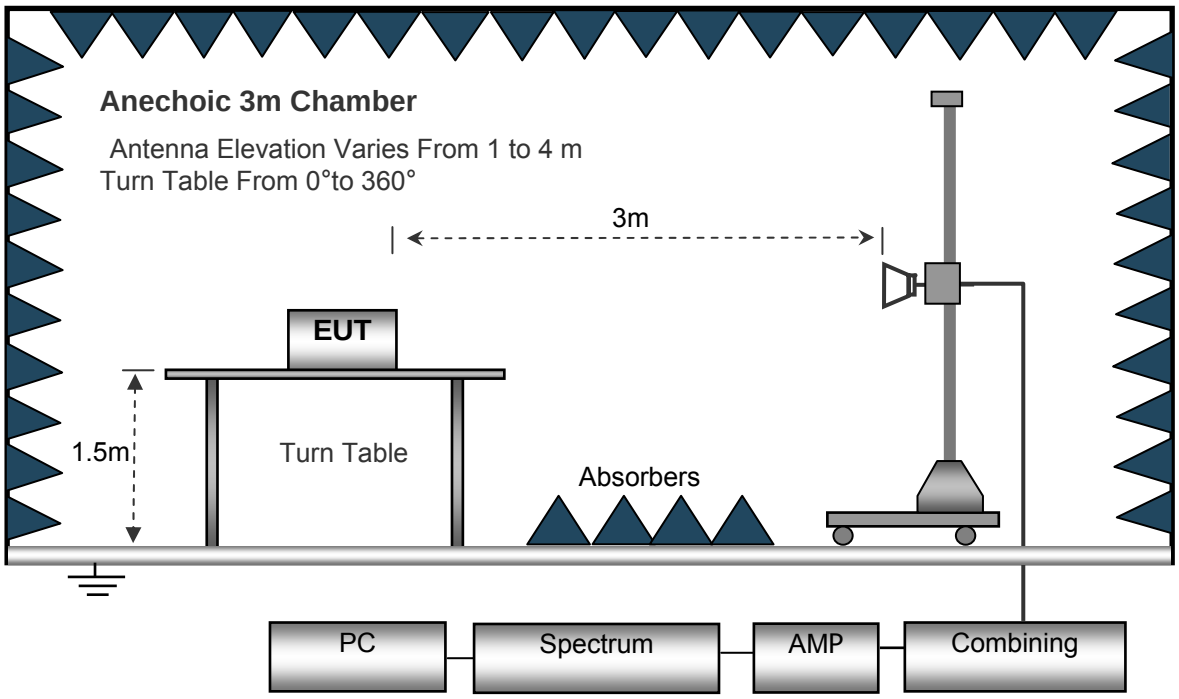
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



5.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

5.4 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. In the frequency above 1GHz, Place the measurement antenna 3m away from the EUT for each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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.

5.5 Summary of Test Results

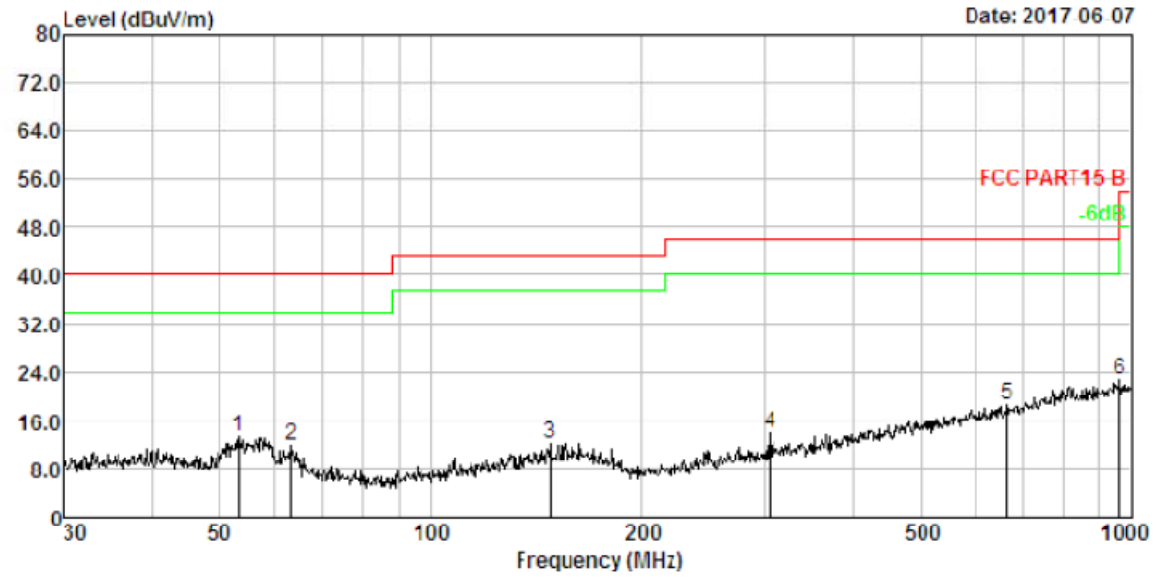
Test Frequency: Below 30MHz

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

Test Frequency: 30MHz ~ 1GHz

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

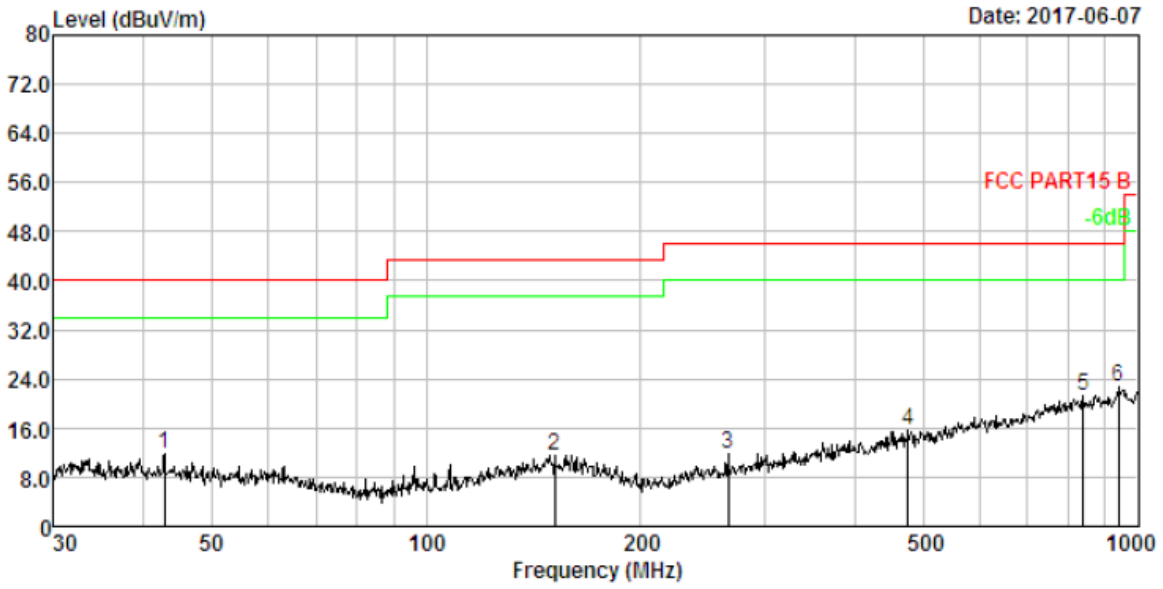
Test plot for Horizontal:



Remark: Absolute Level= Reading Level+ Factor, Margin= Limit- Absolute Level

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.	53.318	1.58	12.02	29.72	30.17	13.15	40.00	-26.85	QP
2.	63.313	1.73	11.95	28.26	30.23	11.71	40.00	-28.29	QP
3.	147.921	2.50	13.79	26.33	30.53	12.09	43.50	-31.41	QP
4.	304.610	3.15	13.30	28.09	30.78	13.76	46.00	-32.24	QP
5.	663.473	3.86	19.72	26.00	31.05	18.53	46.00	-27.47	QP
6.	958.794	4.19	23.43	26.35	31.18	22.79	46.00	-23.21	QP

Test plot for Vertical:



Remark:

Absolute Level= Reading Level+ Factor, Margin= Limit- Absolute Level

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.	42.900	1.38	13.44	27.18	30.09	11.91	40.00	-28.09	QP
2.	151.597	2.52	13.90	25.70	30.53	11.59	43.50	-31.91	QP
3.	265.676	3.03	12.33	27.20	30.73	11.83	46.00	-34.17	QP
4.	475.499	3.56	16.81	26.24	30.93	15.68	46.00	-30.32	QP
5.	839.182	4.07	22.00	26.44	31.13	21.38	46.00	-24.62	QP
6.	938.833	4.17	23.22	26.54	31.17	22.76	46.00	-23.24	QP

Test Frequency: Above 1000MHz~10th Harmonics:

GFSK Low Channel (2402MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	39.34	AV	V	33.67	6.86	32.66	47.21	54	-6.79
4804	39.84	AV	H	33.67	6.86	32.66	47.71	54	-6.29
4804	48.56	PK	V	33.67	6.86	32.66	56.43	74	-17.57
4804	45.27	PK	H	33.67	6.86	32.66	53.14	74	-20.86
17802	24.45	AV	V	45.03	11.21	32.38	48.31	54	-5.69
17802	25.01	AV	H	45.03	11.21	32.38	48.87	54	-5.13
17802	40.34	PK	V	45.03	11.21	32.38	64.2	74	-9.8
17802	41.34	PK	H	45.03	11.21	32.38	65.2	74	-8.8

GFSK Low Channel (2441MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882	39.34	AV	V	33.71	6.95	32.74	47.26	54	-6.74
4882	39.13	AV	H	33.71	6.95	32.74	47.16	54	-6.84
4882	49.04	PK	V	33.71	6.95	32.74	56.08	74	-17.92
4882	47.54	PK	H	33.71	6.95	32.74	55.46	74	-18.54
17815	25.59	AV	V	45.15	11.18	32.41	48.69	54	-5.31
17815	23.85	AV	H	45.15	11.18	32.41	47.16	54	-6.84
17815	40.15	PK	V	45.15	11.18	32.41	64.05	74	-9.95
17815	41.43	PK	H	45.15	11.18	32.41	65.34	74	-8.66

GFSK High Channel (2480MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	37.98	AV	V	33.90	6.76	32.74	46.02	54	-7.98
4960	38.85	AV	H	33.90	6.76	32.74	46.35	54	-7.65
4960	48.26	PK	V	33.90	6.76	32.74	55	74	-19
4960	47.63	PK	H	33.90	6.76	32.74	54.15	74	-19.85
17823	24.08	AV	V	45.22	11.35	32.38	47.36	54	-6.64
17823	24.81	AV	H	45.22	11.35	32.38	48.01	54	-5.99
17823	42.55	PK	V	45.22	11.35	32.38	65.35	74	-8.65
17823	41.39	PK	H	45.22	11.35	32.38	66.04	74	-7.96

π/4-DQPSK Low Channel (2402MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	39.13	AV	V	33.67	6.86	32.66	46.35	54	-7.65
4804	39.62	AV	H	33.67	6.86	32.66	47.01	54	-6.99
4804	48.32	PK	V	33.67	6.86	32.66	56.35	74	-17.65
4804	45.85	PK	H	33.67	6.86	32.66	54.15	74	-19.85
17801	24.32	AV	V	45.03	11.21	32.38	48.04	54	-5.96
17801	24.37	AV	H	45.03	11.21	32.38	47.15	54	-6.85
17801	40.34	PK	V	45.03	11.21	32.38	63.05	74	-10.95
17801	41.92	PK	H	45.03	11.21	32.38	64.15	74	-9.85

π/4-DQPSK Low Channel (2441MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882	38.78	AV	V	33.71	6.95	32.74	46.7	54	-7.3
4882	39.04	AV	H	33.71	6.95	32.74	46.96	54	-7.04
4882	48.42	PK	V	33.71	6.95	32.74	56.34	74	-17.66
4882	47.23	PK	H	33.71	6.95	32.74	55.15	74	-18.85
17812	24.84	AV	V	45.15	11.18	32.41	48.76	54	-5.24
17812	22.93	AV	H	45.15	11.18	32.41	46.85	54	-7.15
17812	40.43	PK	V	45.15	11.18	32.41	64.35	74	-9.65
17812	40.92	PK	H	45.15	11.18	32.41	64.84	74	-9.16

π/4-DQPSK High Channel (2480MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	38.23	AV	V	33.90	6.76	32.74	46.15	54	-7.85
4960	38.18	AV	H	33.90	6.76	32.74	46.1	54	-7.9
4960	47.62	PK	V	33.90	6.76	32.74	55.54	74	-18.46
4960	47.57	PK	H	33.90	6.76	32.74	55.49	74	-18.51
17824	23.56	AV	V	45.22	11.35	32.38	47.75	54	-6.25
17824	24.88	AV	H	45.22	11.35	32.38	49.07	54	-4.93
17824	42.84	PK	V	45.22	11.35	32.38	67.03	74	-6.97
17824	40.33	PK	H	45.22	11.35	32.38	64.52	74	-9.48

8DPSK Low Channel (2402MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	39.21	AV	V	33.67	6.86	32.66	47.08	54	-6.92
4804	39.13	AV	H	33.67	6.86	32.66	47	54	-7
4804	48.15	PK	V	33.67	6.86	32.66	56.02	74	-17.98
4804	46.06	PK	H	33.67	6.86	32.66	53.93	74	-20.07
17804	24.36	AV	V	45.03	11.21	32.38	48.22	54	-5.78
17804	23.57	AV	H	45.03	11.21	32.38	47.43	54	-6.57
17804	40.56	PK	V	45.03	11.21	32.38	64.42	74	-9.58
17804	39.39	PK	H	45.03	11.21	32.38	63.25	74	-10.75

8DPSK Low Channel (2441MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882	38.88	AV	V	33.71	6.95	32.74	46.8	54	-7.2
4882	38.53	AV	H	33.71	6.95	32.74	46.45	54	-7.55
4882	49.12	PK	V	33.71	6.95	32.74	57.04	74	-16.96
4882	46.54	PK	H	33.71	6.95	32.74	54.46	74	-19.54
17810	24.79	AV	V	45.15	11.18	32.41	48.71	54	-5.29
17810	23.26	AV	H	45.15	11.18	32.41	47.18	54	-6.82
17810	41.69	PK	V	45.15	11.18	32.41	65.61	74	-8.39
17810	41.25	PK	H	45.15	11.18	32.41	65.17	74	-8.83

8DPSK High Channel (2480MHz)

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	38.56	AV	V	33.90	6.76	32.74	46.48	54	-7.52
4960	37.14	AV	H	33.90	6.76	32.74	45.06	54	-8.94
4960	48.05	PK	V	33.90	6.76	32.74	55.97	74	-18.03
4960	46.52	PK	H	33.90	6.76	32.74	54.44	74	-19.56
17822	23.94	AV	V	45.22	11.35	32.38	48.13	54	-5.87
17822	23.55	AV	H	45.22	11.35	32.38	47.74	54	-6.26
17822	42.02	PK	V	45.22	11.35	32.38	66.21	74	-7.79
17822	41.55	PK	H	45.22	11.35	32.38	65.74	74	-8.26

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

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

3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Reading + Factor

Margin=Emission Level-Limit

6 CONDUCTED BAND EDGE EMISSION

6.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

6.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

. For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 – 2403 MHz Upper Band Edge: 2479 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

Remark : Hopping on and Hopping off mode all have been tested,only worst case hopping off is reported.

6.3 TEST SETUP

The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

6.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

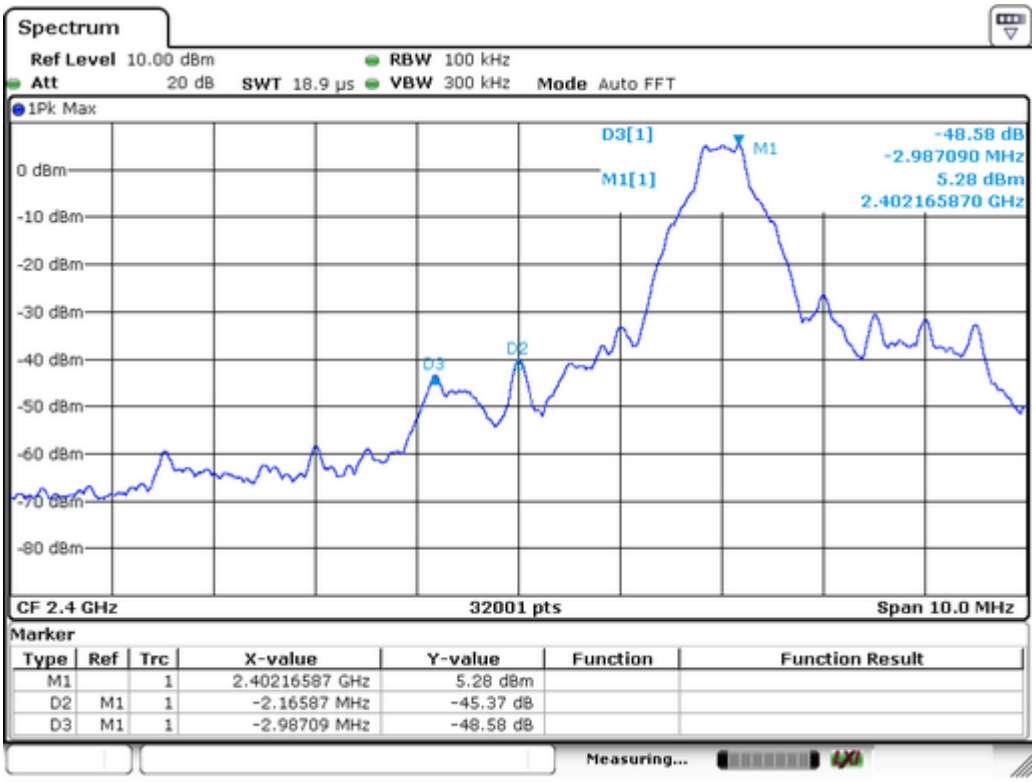
6.5 TEST RESULTS

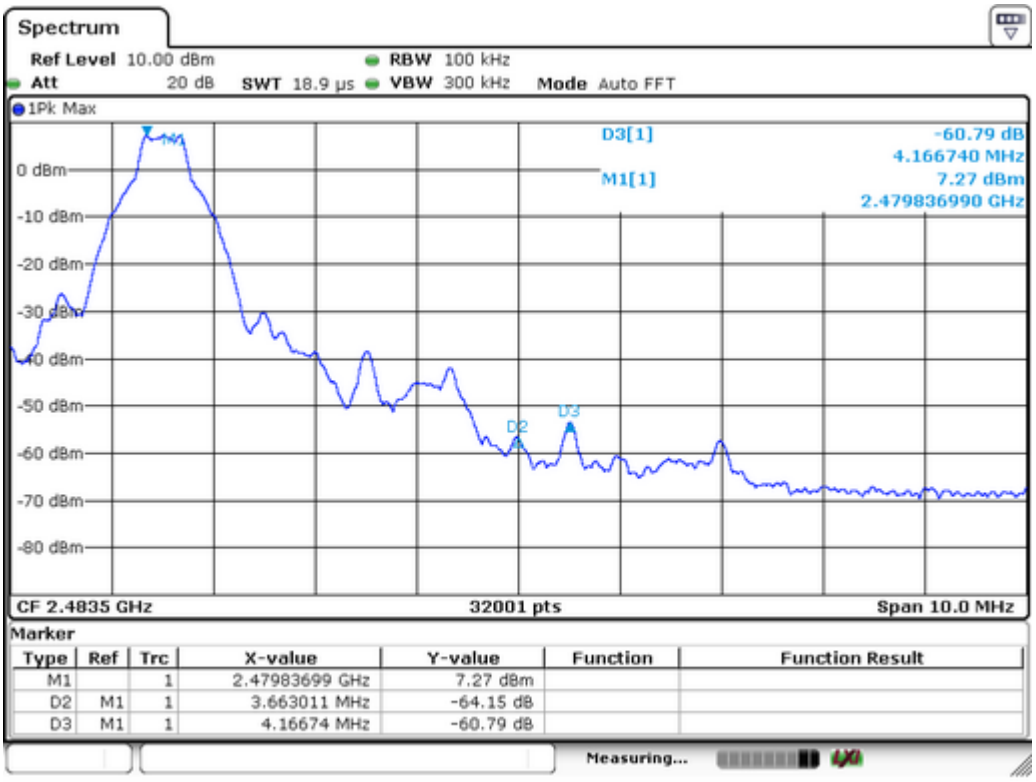
For Non-Hopping Mode:

Frequency(MHz)	Modulation	Peak Power Output (dBm)	Emission Read Value (dBm)	Result of Band edge (dBc)	Band Edge Limit (dBc)
2402.16	GFSK	5.28	-48.50	53.78	>20dBc
2402.00	π/4-DQPSK	1.95	-52.49	54.44	>20dBc
2402.16	8DPSK	2.08	-51.84	53.92	>20dBc
2479.83	GFSK	7.27	-60.79	68.06	>20dBc
2480.00	π/4-DQPSK	4.51	-65.19	69.70	>20dBc
2479.83	8DPSK	4.63	-64.76	69.39	>20dBc

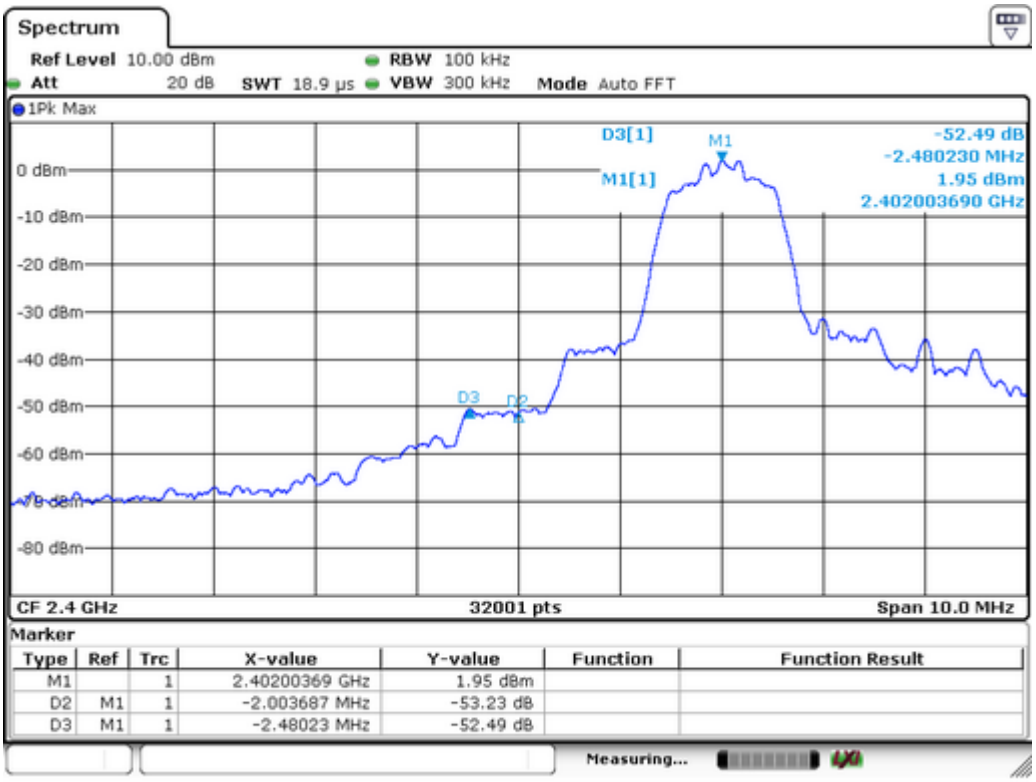
Test Plot:

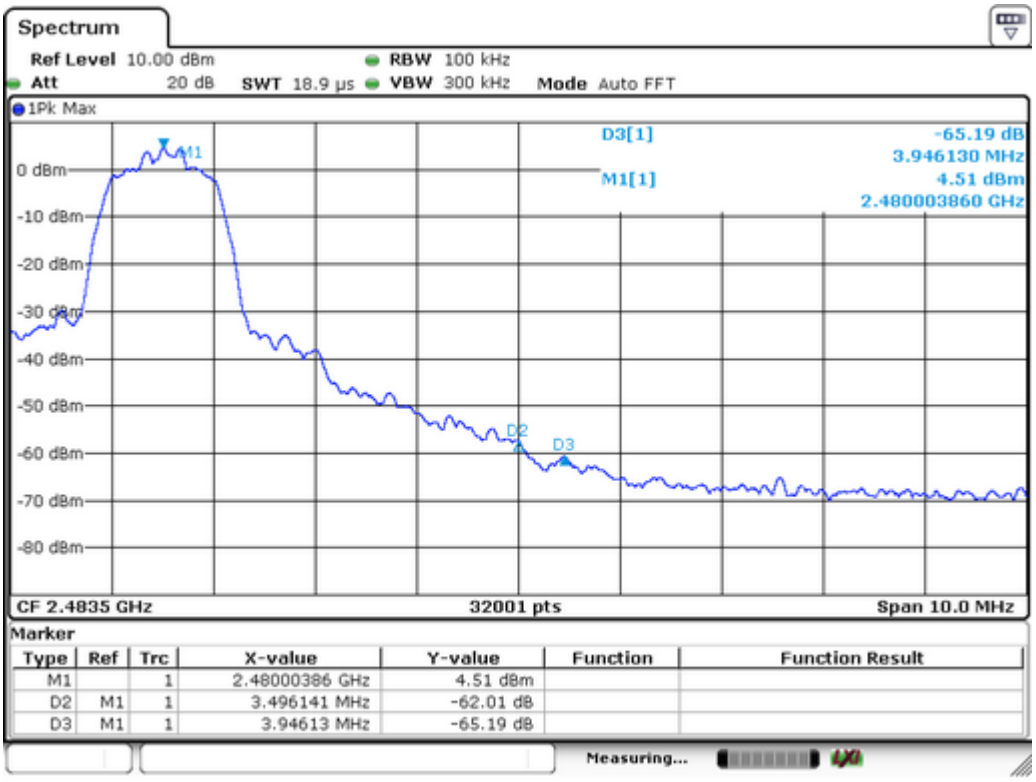
GFSK



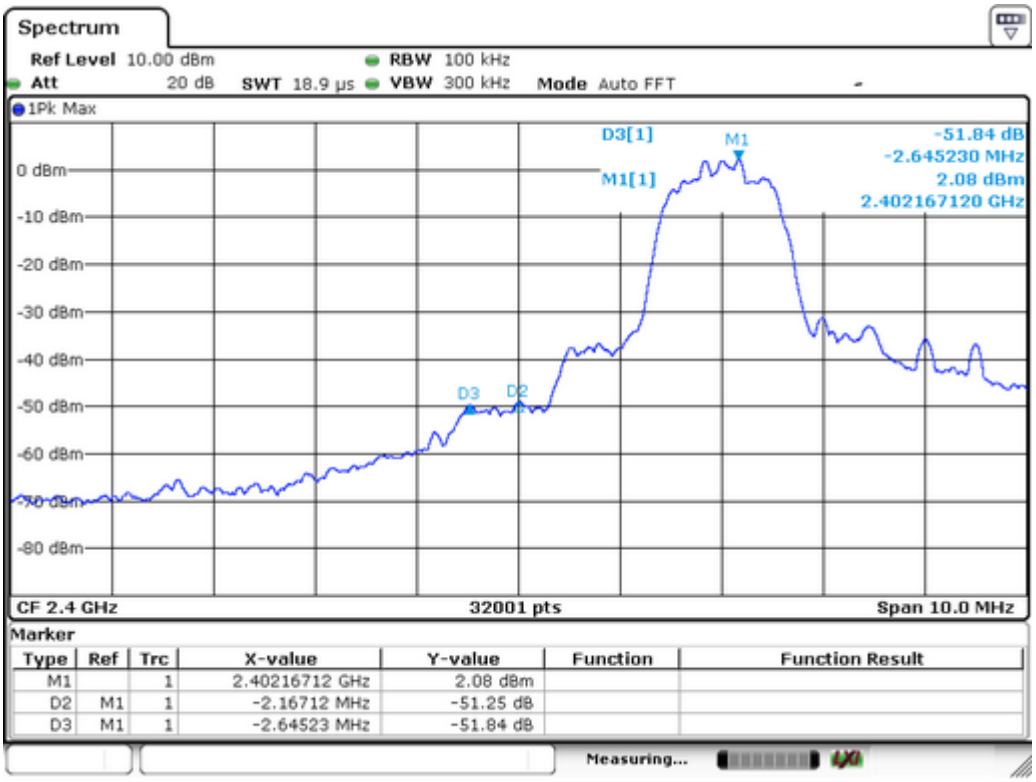


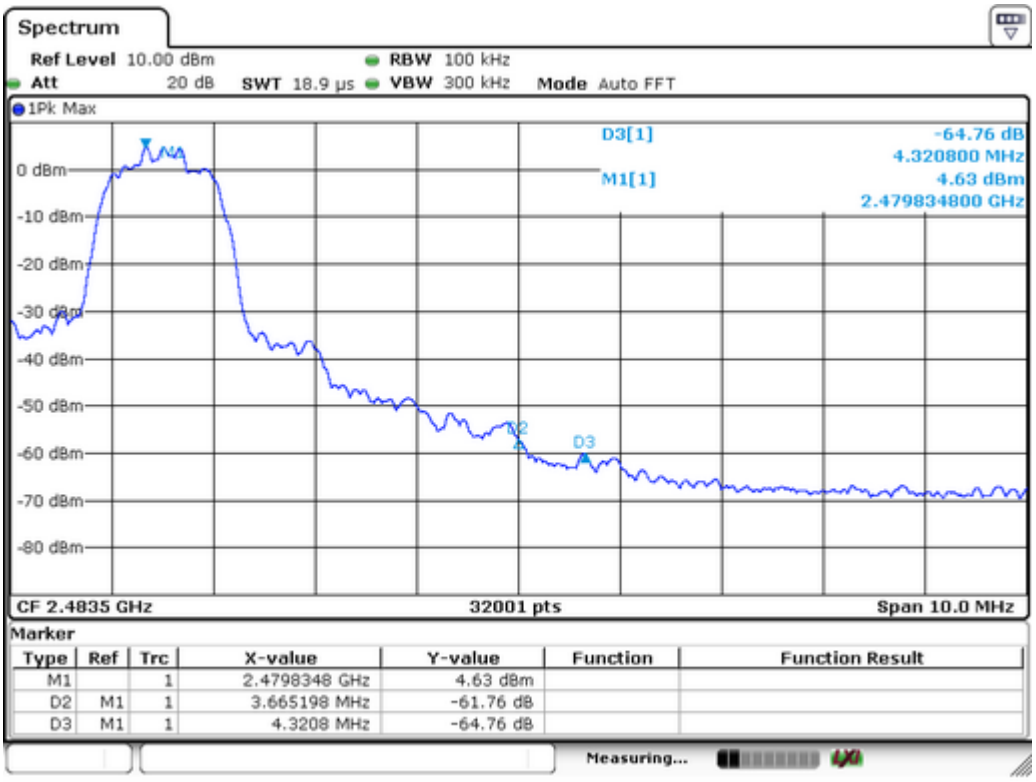
π/4-DQPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-52.49 dB
-2.480230 MHz
M1[1]
1.95 dBm
2.402003690 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.40200369 GHz 1.95 dBm
D2 M1 1 -2.003687 MHz -53.23 dB
D3 M1 1 -2.48023 MHz -52.49 dB
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-65.19 dB
3.946130 MHz
M1[1]
4.51 dBm
2.480003860 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.48000386 GHz 4.51 dBm
D2 M1 1 3.496141 MHz -62.01 dB
D3 M1 1 3.94613 MHz -65.19 dB
Measuring...

8DPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-51.84 dB
-2.645230 MHz
M1[1]
2.08 dBm
2.402167120 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.40216712 GHz 2.08 dBm
D2 M1 1 -2.16712 MHz -51.25 dB
D3 M1 1 -2.64523 MHz -51.84 dB
Measuring...

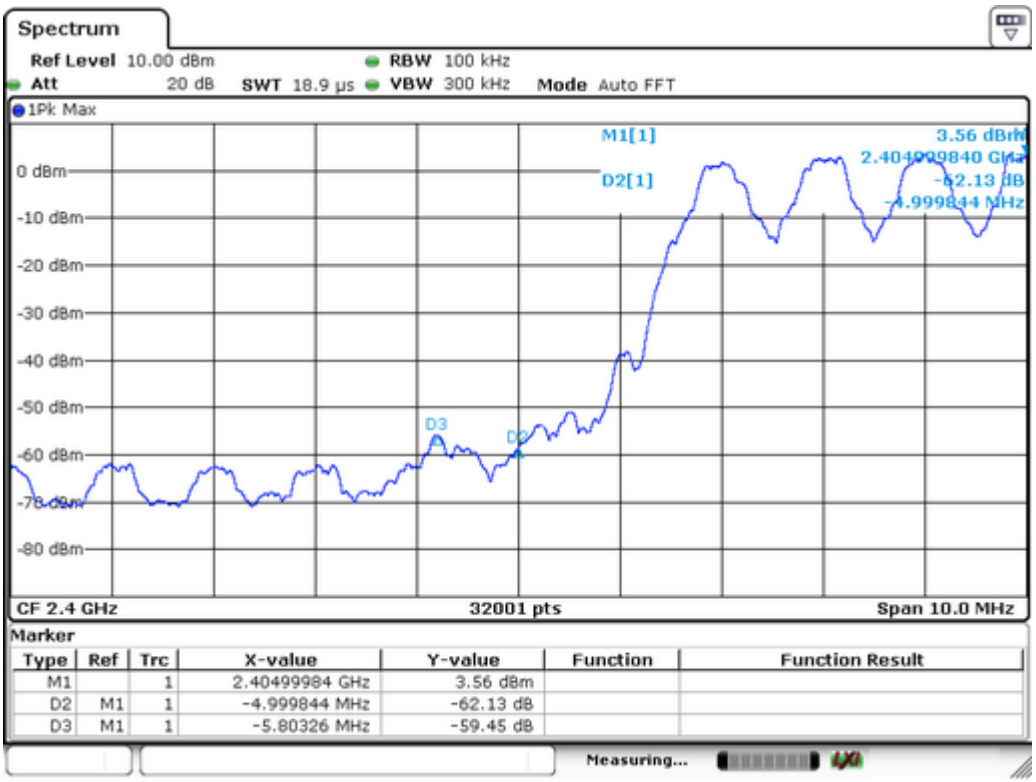

Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-64.76 dB
4.320800 MHz
M1[1]
4.63 dBm
2.479834800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4798348 GHz 4.63 dBm
D2 M1 1 3.665198 MHz -61.76 dB
D3 M1 1 4.3208 MHz -64.76 dB
Measuring...

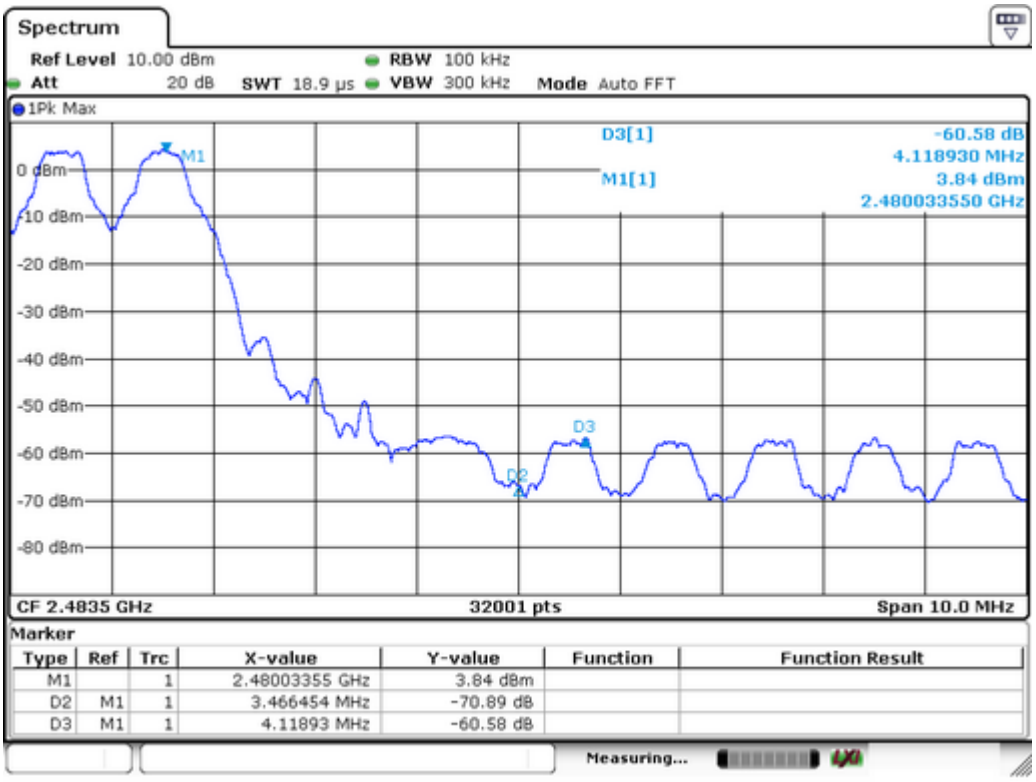
For Hopping Mode:

Frequency(MHz)	Modulation	Peak Power Output (dBm)	Emission Read Value (dBm)	Result of Band edge (dBc)	Band Edge Limit (dBc)
2404.09	GFSK	3.56	-62.13	65.69	>20dBc
2404.16	π/4-DQPSK	1.43	-55.43	56.86	>20dBc
2404.99	8DPSK	3.32	-54.61	57.93	>20dBc
2480.03	GFSK	3.84	-60.58	64.42	>20dBc
2480.01	π/4-DQPSK	4.14	-61.48	65.62	>20dBc
2480.01	8DPSK	3.11	-60.78	63.89	>20dBc

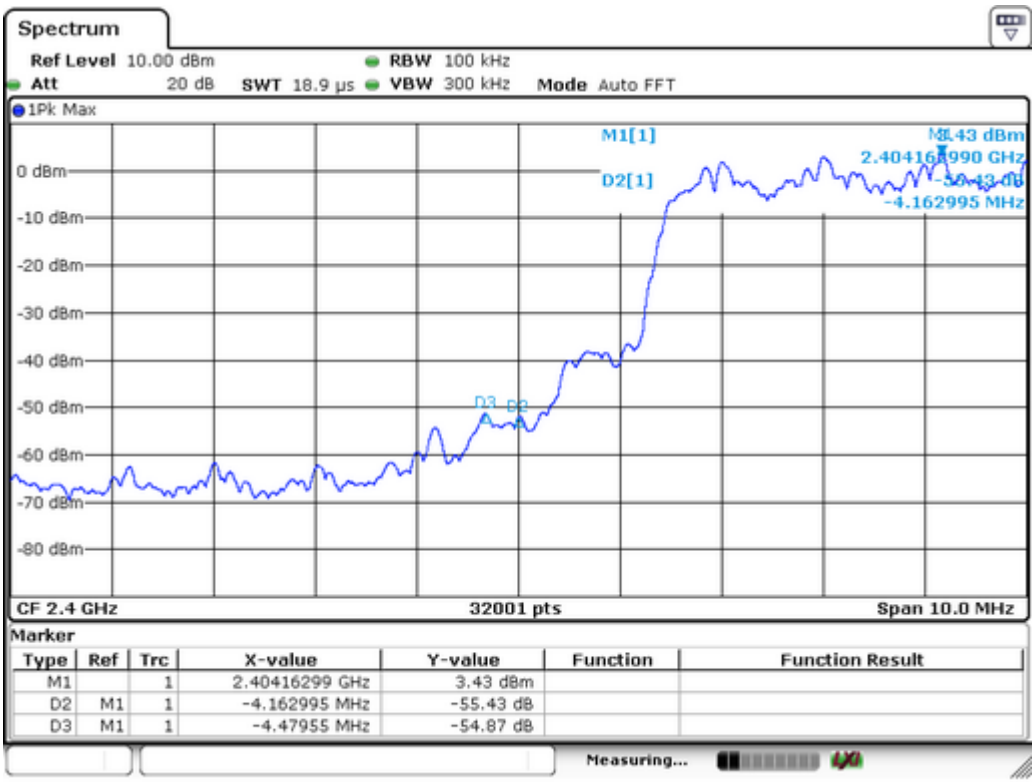
Test Plot:

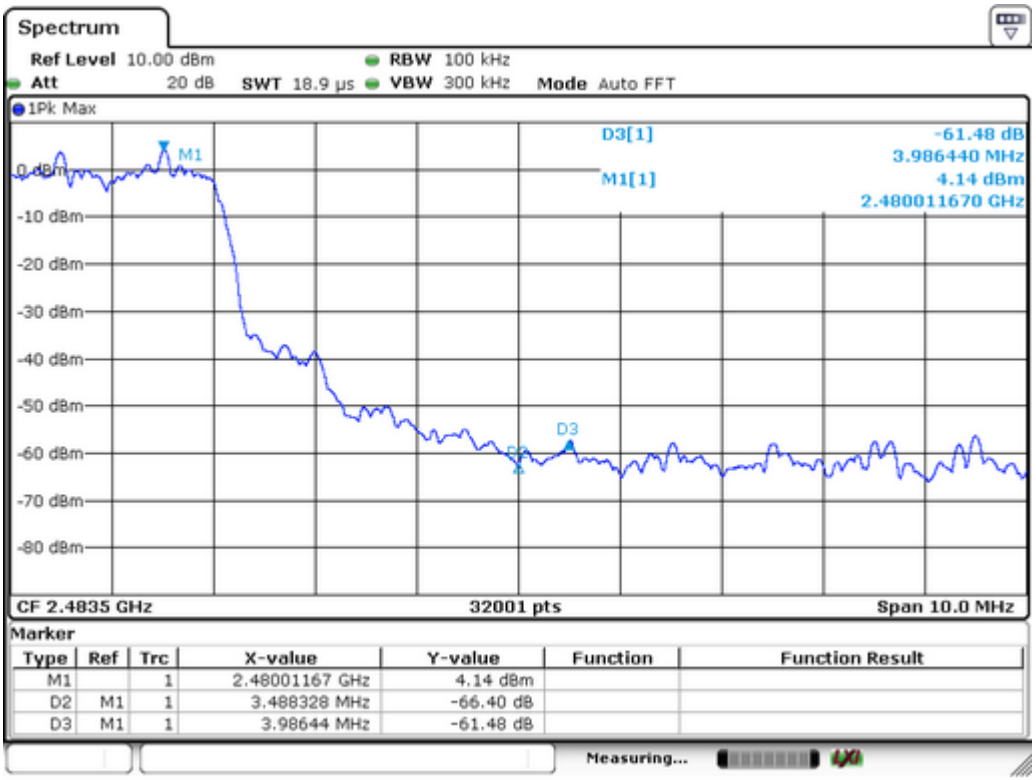
GFSK



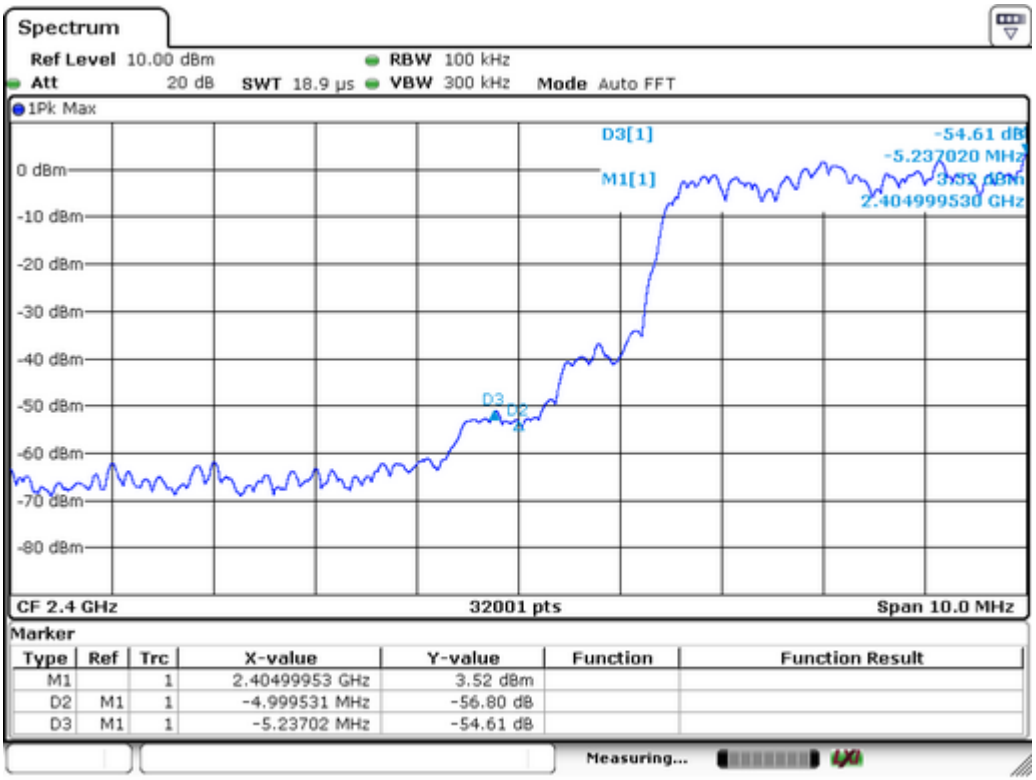


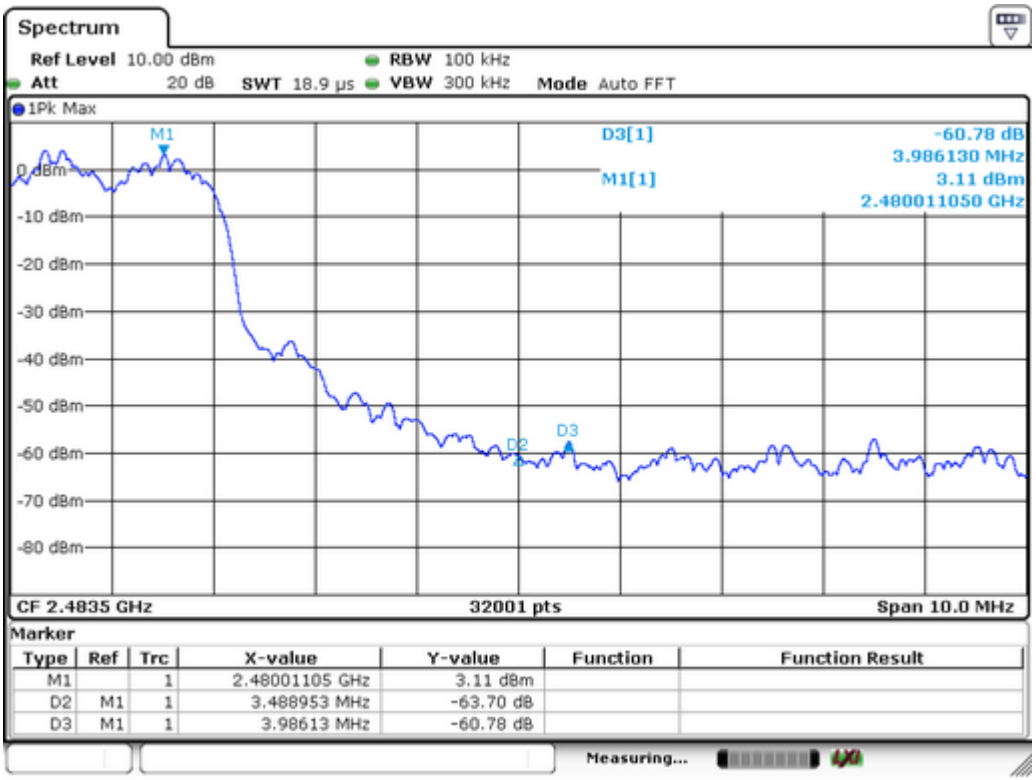
π /4-DQPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
M1[1]
3.43 dBm
2.40416299 GHz
D2[1]
-55.43 dB
-4.162995 MHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.40416299 GHz 3.43 dBm
D2 M1 1 -4.162995 MHz -55.43 dB
D3 M1 1 -4.47955 MHz -54.87 dB
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-61.48 dB
3.986440 MHz
M1[1]
4.14 dBm
2.480011670 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.48001167 GHz 4.14 dBm
D2 M1 1 3.488328 MHz -66.40 dB
D3 M1 1 3.98644 MHz -61.48 dB
Measuring...

8DPSK


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
D3[1]
-54.61 dB
-5.237020 MHz
M1[1]
2.404999530 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.40499953 GHz 3.52 dBm
D2 M1 1 -4.999531 MHz -56.80 dB
D3 M1 1 -5.23702 MHz -54.61 dB
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 100 kHz
Att 20 dB
SWT 18.9 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
M1
D3[1]
-60.78 dB
3.986130 MHz
M1[1]
3.11 dBm
2.480011050 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.4835 GHz
32001 pts
Span 10.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.48001105 GHz 3.11 dBm
D2 M1 1 3.488953 MHz -63.70 dB
D3 M1 1 3.98613 MHz -60.78 dB
Measuring...

7 20 dB Bandwidth Measurement

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

7.1 Test Procedure

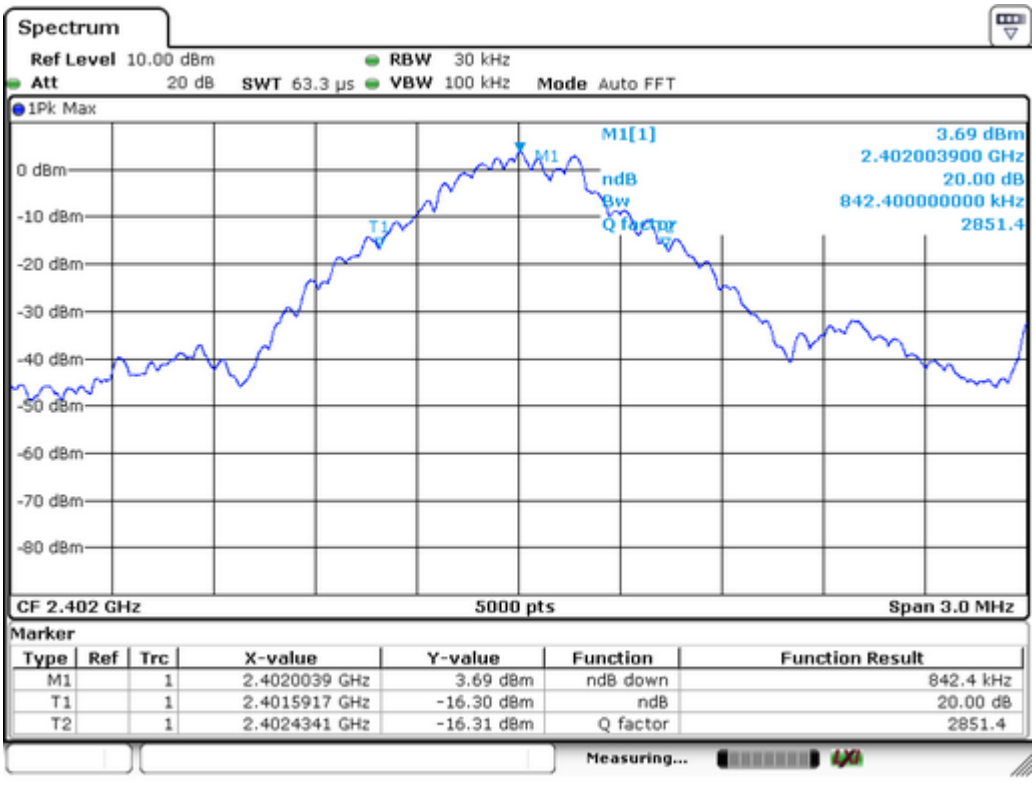
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

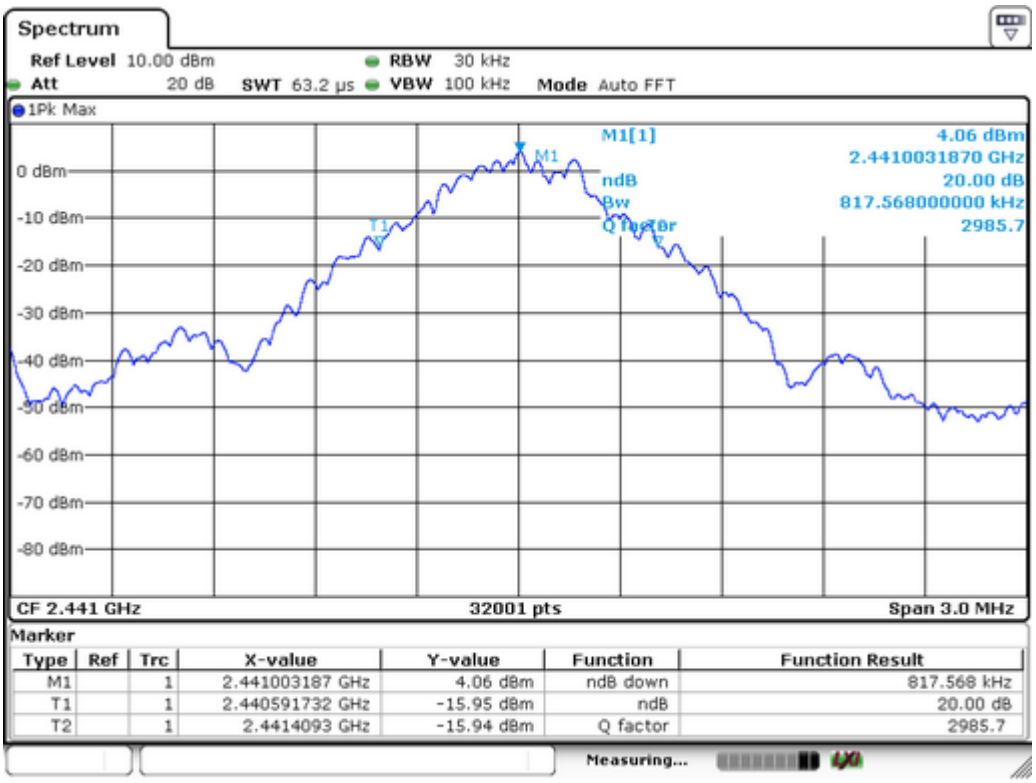
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

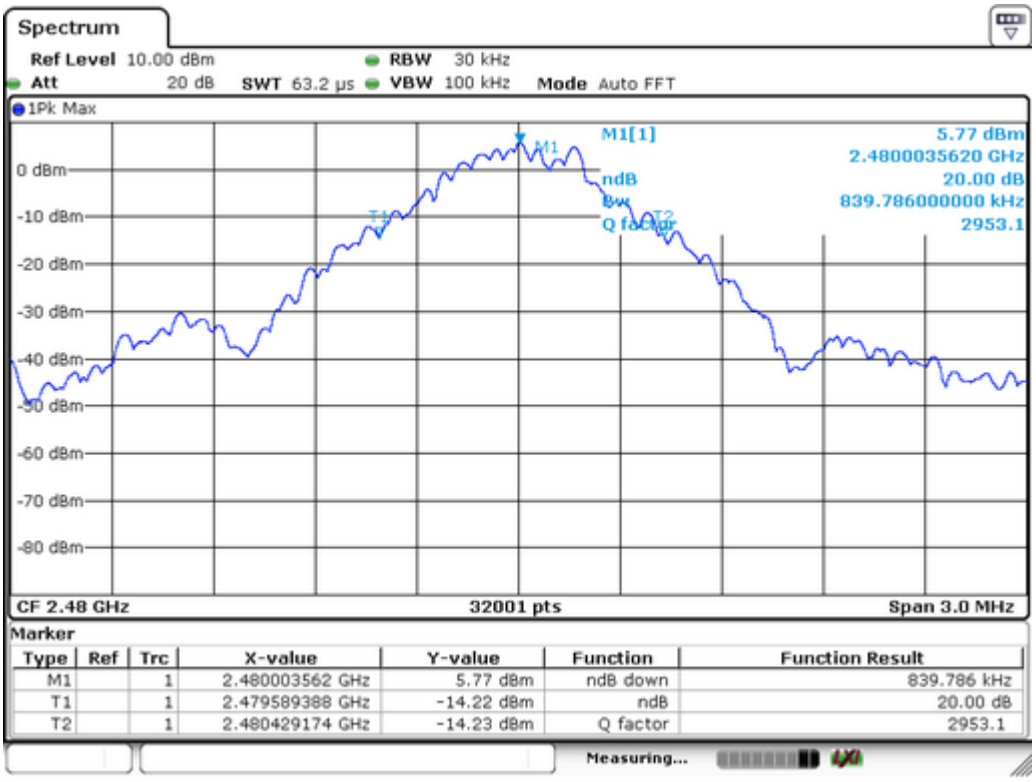
7.2 Test Result

Test Mode: CH00 / CH39 / CH78 (GFSK/(1Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	842
39	2441	818
78	2480	840

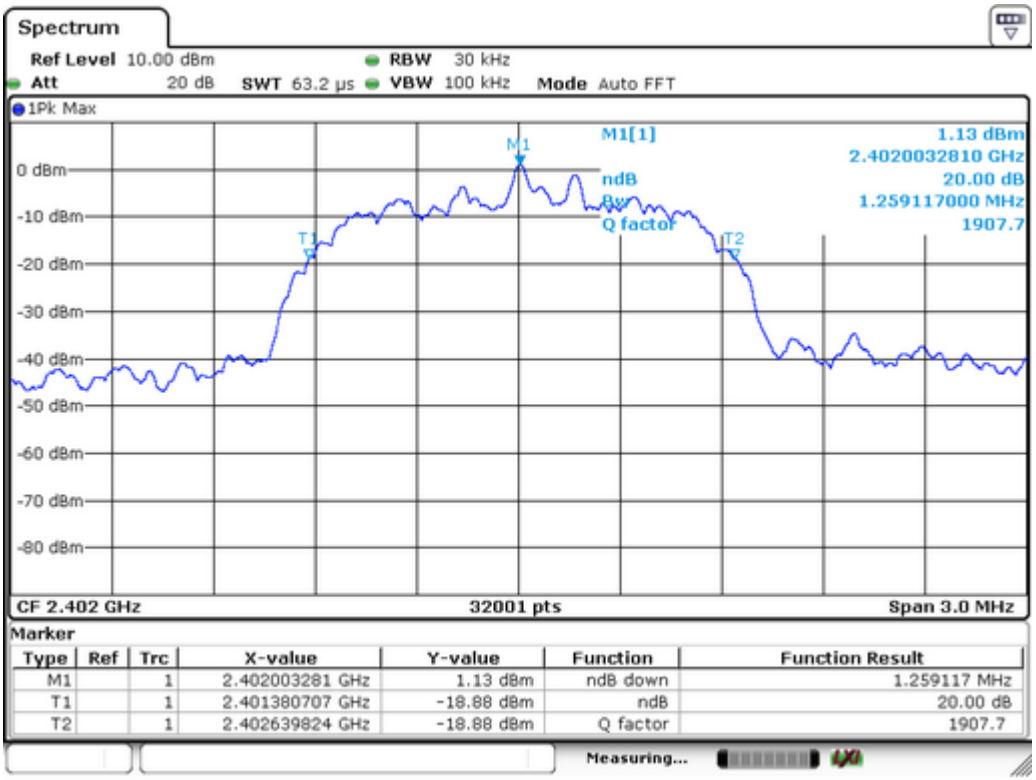


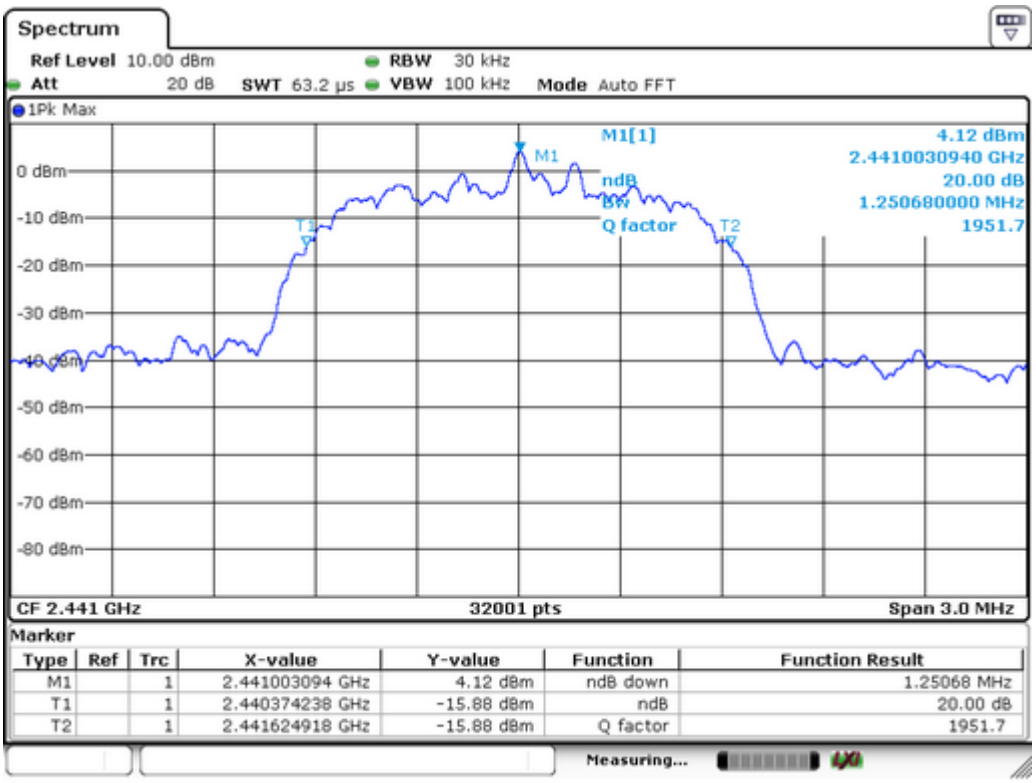

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
4.06 dBm
2.4410031870 GHz
ndB 20.00 dB
Bw 817.568000000 kHz
Q factor 2985.7
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441003187 GHz 4.06 dBm ndB down 817.568 kHz
T1 1 2.440591732 GHz -15.95 dBm ndB 20.00 dB
T2 1 2.4414093 GHz -15.94 dBm Q factor 2985.7
Measuring...

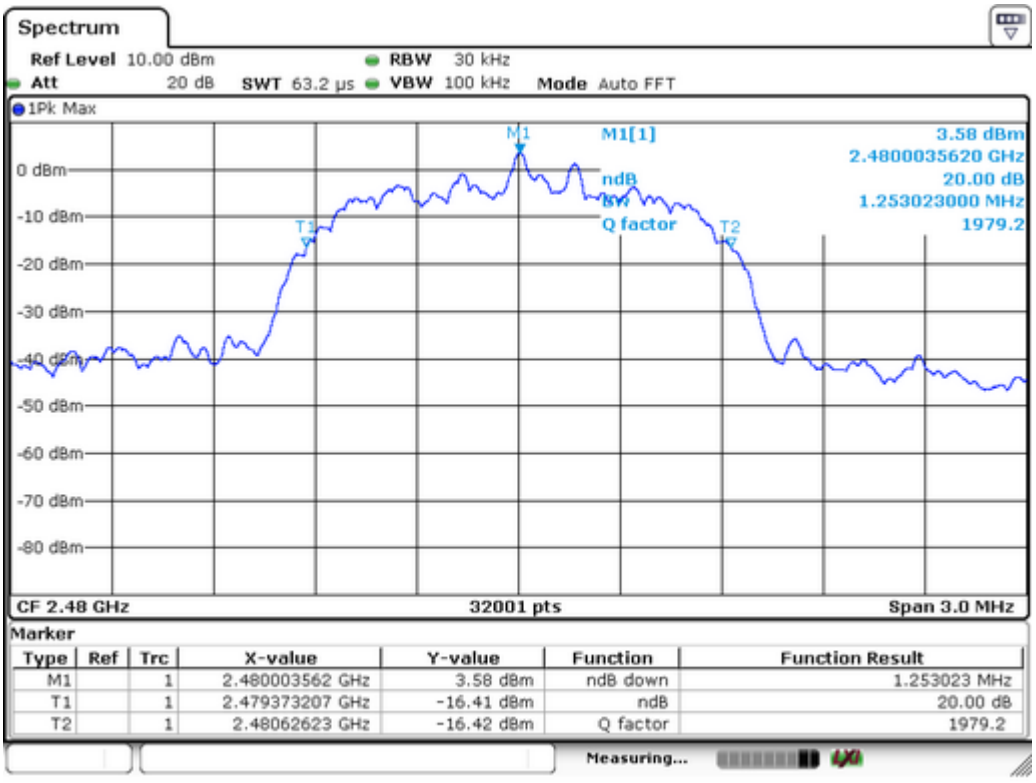

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
5.77 dBm
2.4800035620 GHz
ndB 20.00 dB
Bw 839.786000000 kHz
Q factor 2953.1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.480003562 GHz 5.77 dBm ndB down 839.786 kHz
T1 1 2.479589388 GHz -14.22 dBm ndB 20.00 dB
T2 1 2.480429174 GHz -14.23 dBm Q factor 2953.1
Measuring...

Test Mode: CH00 / CH39 / CH78 (π/4-DQPSK /(2Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1259
39	2441	1251
78	2480	1253

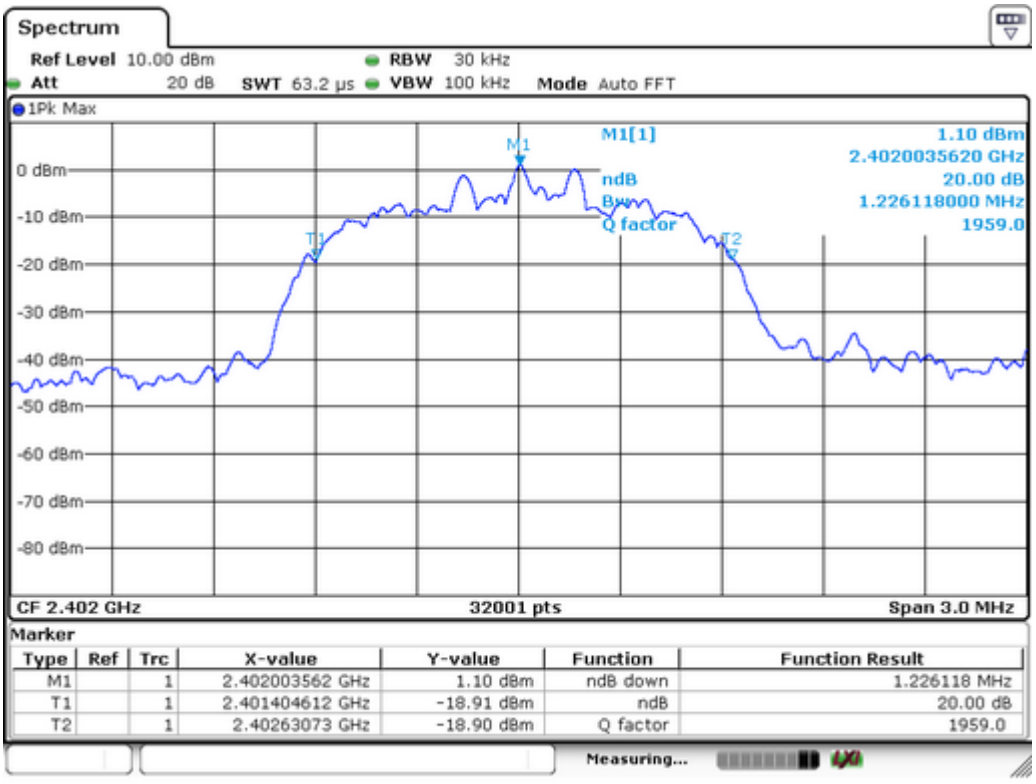


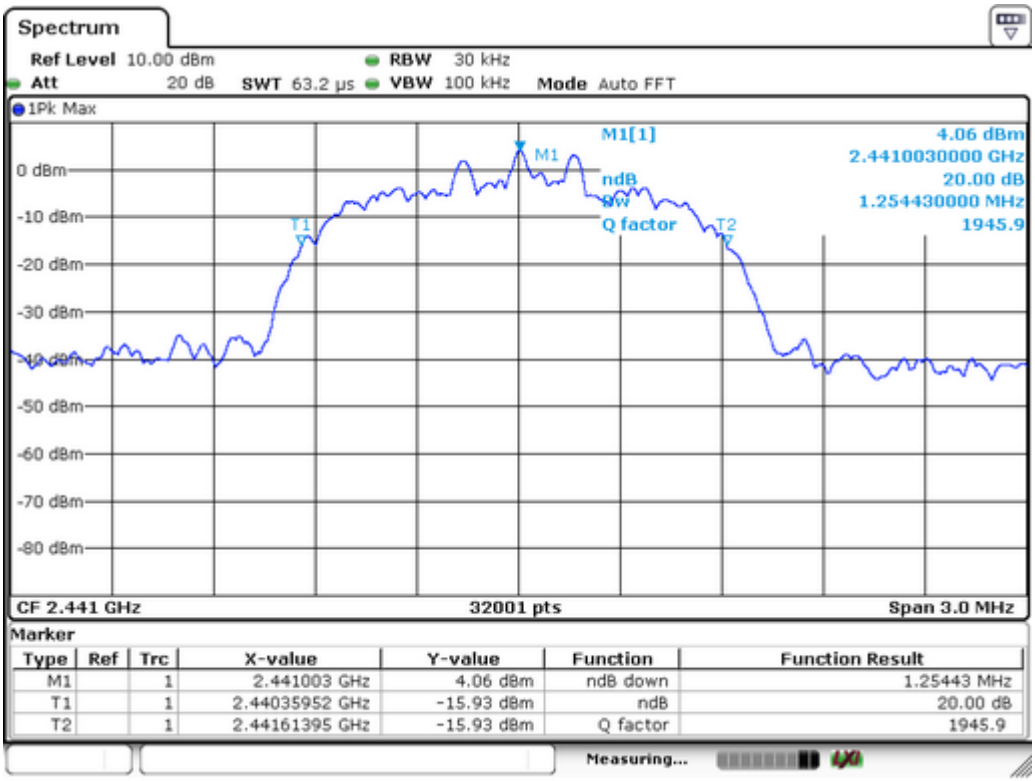

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
4.12 dBm
2.4410030940 GHz
ndB 20.00 dB
BW 1.250680000 MHz
Q factor 1951.7
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441003094 GHz 4.12 dBm ndB down 1.25068 MHz
T1 1 2.440374238 GHz -15.88 dBm ndB 20.00 dB
T2 1 2.441624918 GHz -15.88 dBm Q factor 1951.7
Measuring...

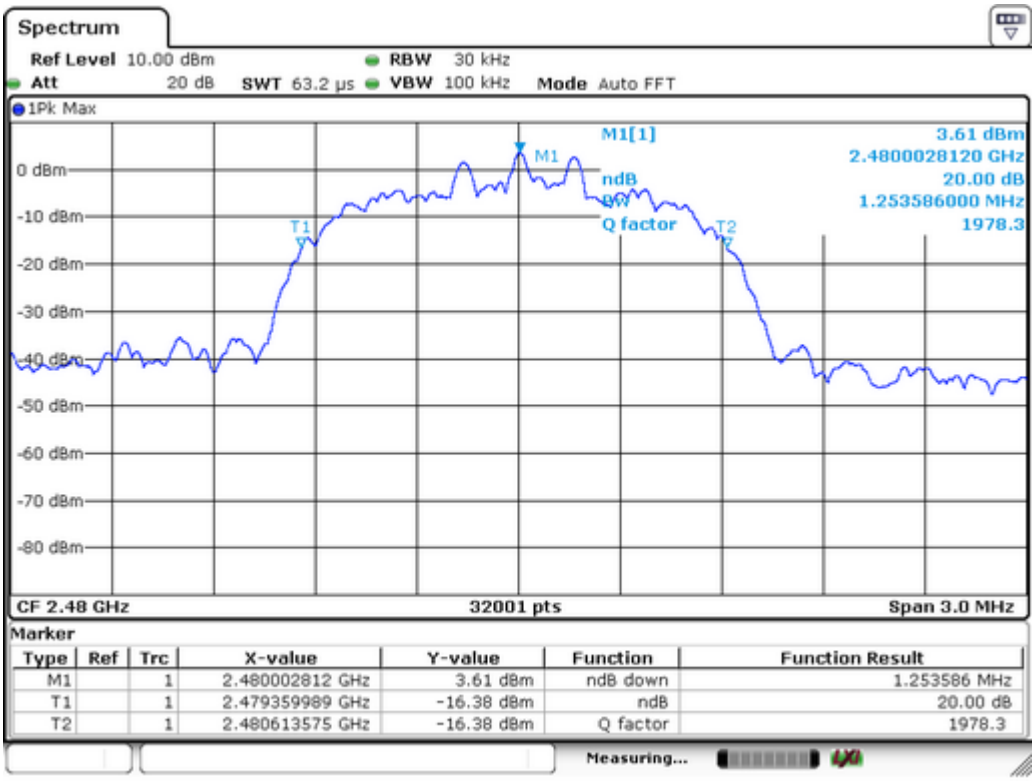

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
3.58 dBm
2.4800035620 GHz
ndB 20.00 dB
BW 1.253023000 MHz
Q factor 1979.2
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.480003562 GHz 3.58 dBm ndB down 1.253023 MHz
T1 1 2.479373207 GHz -16.41 dBm ndB 20.00 dB
T2 1 2.48062623 GHz -16.42 dBm Q factor 1979.2
Measuring...

Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1226
39	2441	1254
78	2480	1254




Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
4.06 dBm
2.4410030000 GHz
ndB 20.00 dB
BW 1.254430000 MHz
Q factor 1945.9
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441003 GHz 4.06 dBm ndB down 1.25443 MHz
T1 1 2.44035952 GHz -15.93 dBm ndB 20.00 dB
T2 1 2.44161395 GHz -15.93 dBm Q factor 1945.9
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
3.61 dBm
2.4800028120 GHz
ndB 20.00 dB
BW 1.253586000 MHz
Q factor 1978.3
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.480002812 GHz 3.61 dBm ndB down 1.253586 MHz
T1 1 2.479359989 GHz -16.38 dBm ndB 20.00 dB
T2 1 2.480613575 GHz -16.38 dBm Q factor 1978.3
Measuring...

8 Maximum Peak Output Power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

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 (30dBm). 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

8.1 Test Procedure

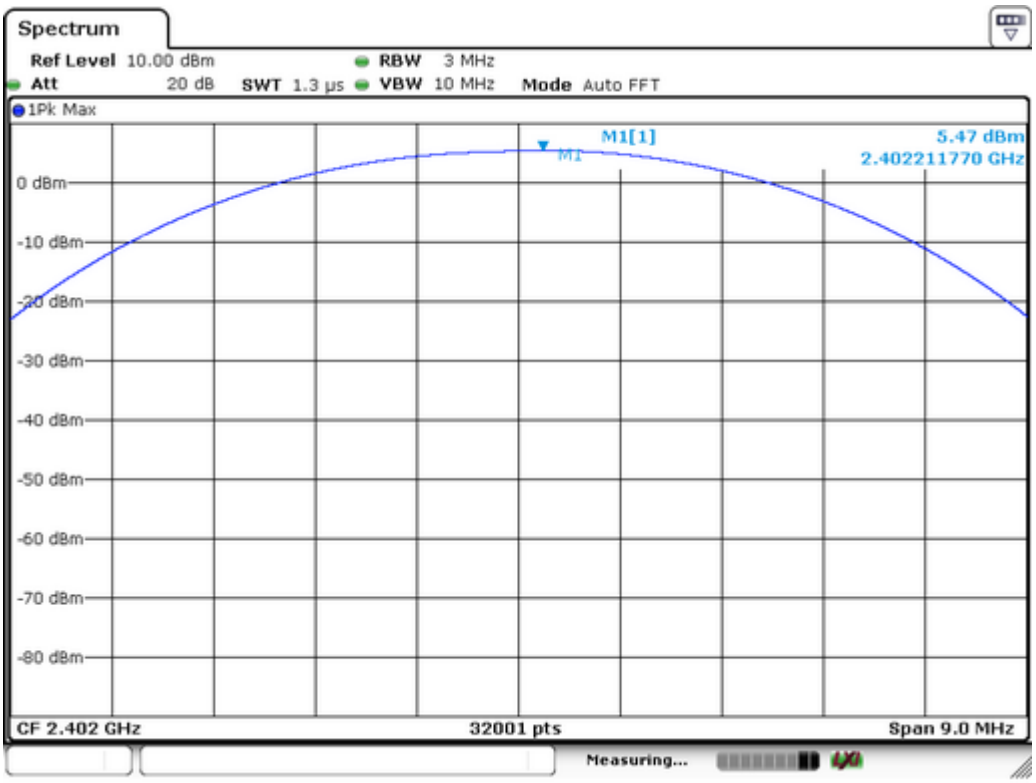
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

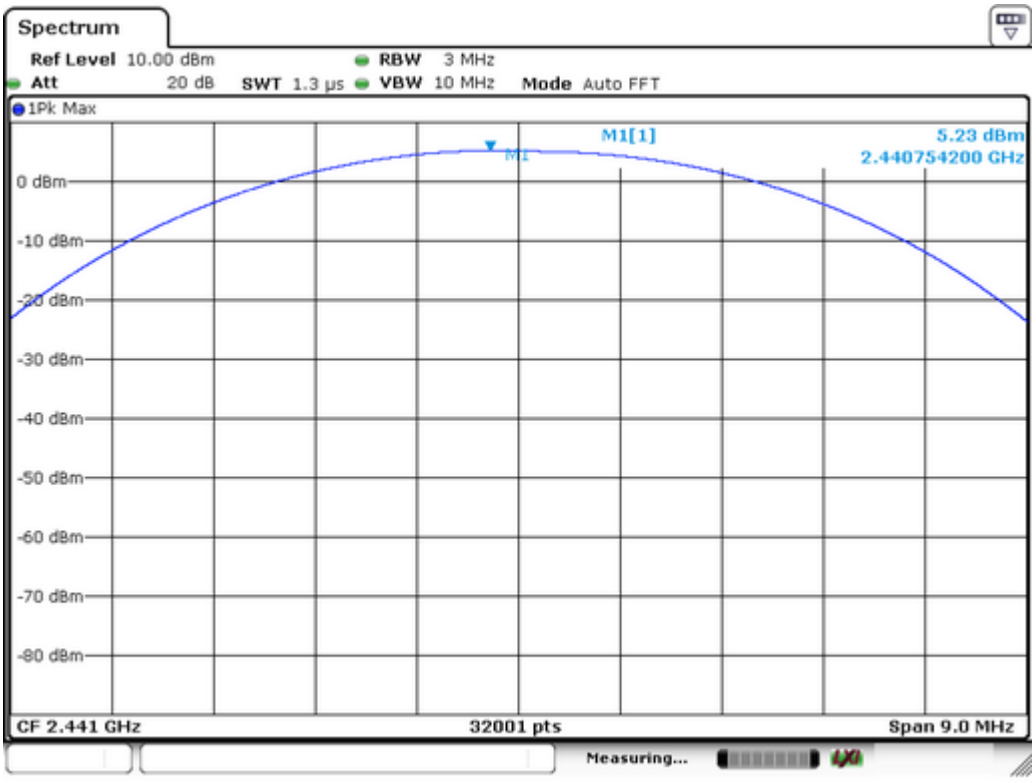
2. Set the spectrum analyser: RBW = 3 MHz. VBW =10 MHz. Sweep = auto; Detector Function = Peak.

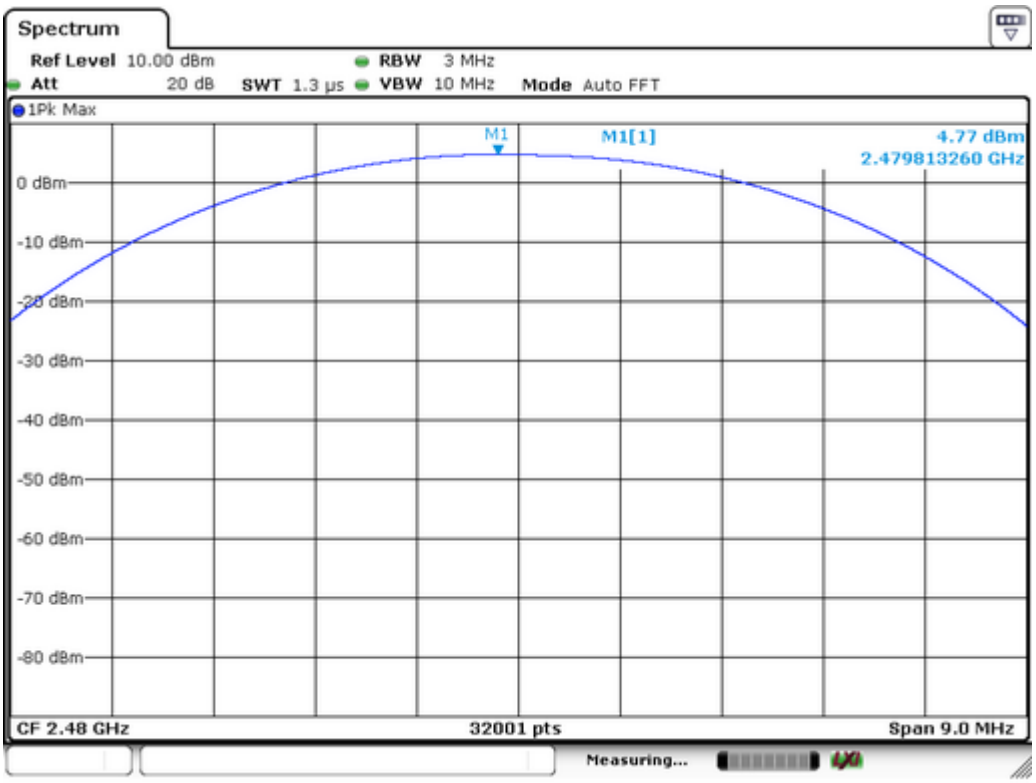
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.2 Test Result

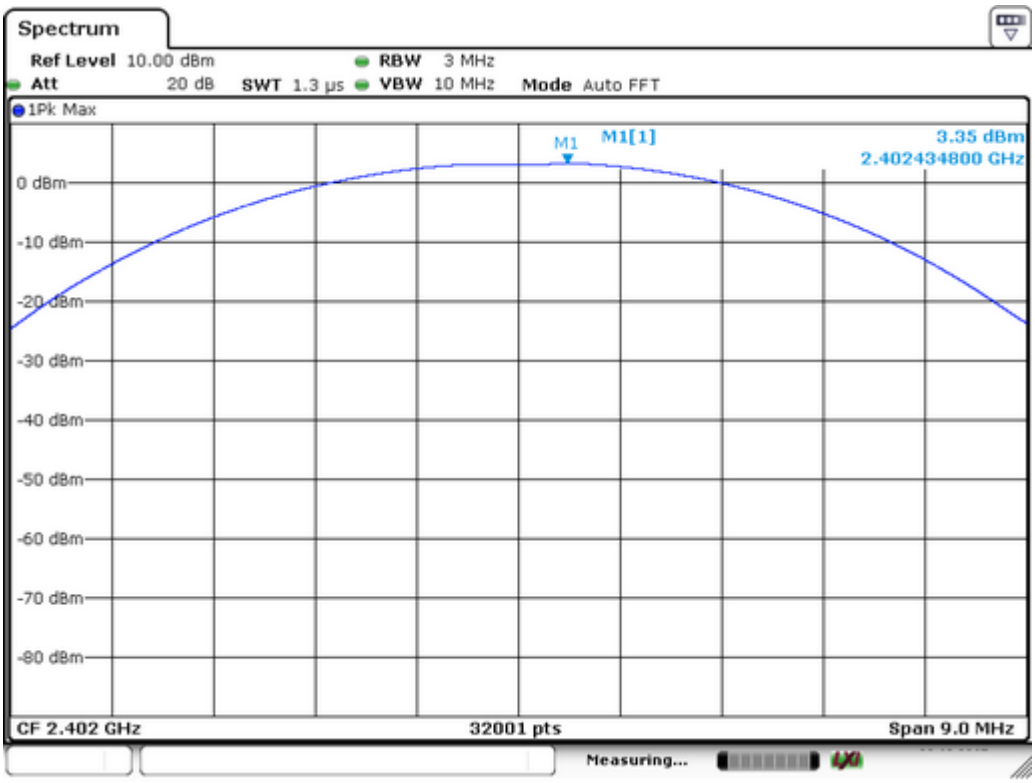
GFSK(1Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	5.47	3.52	1000	Pass
CH39	2441	5.23	3.33	1000	Pass
CH78	2480	4.77	3.00	1000	Pass

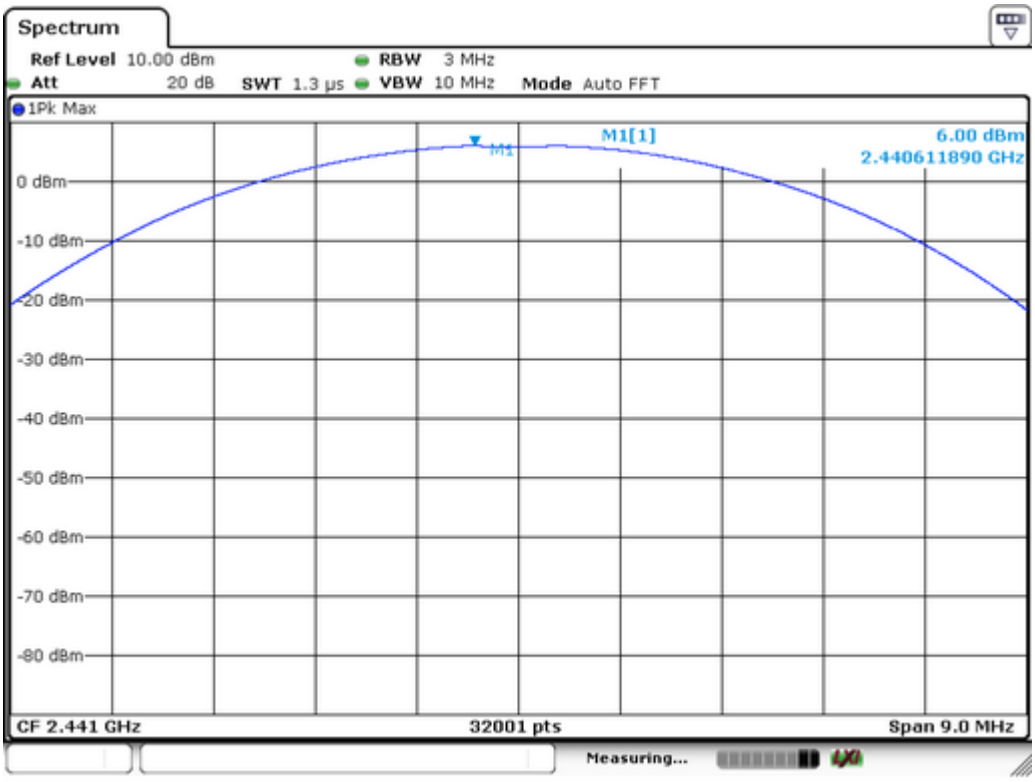

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
5.47 dBm
2.402211770 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz
Measuring...

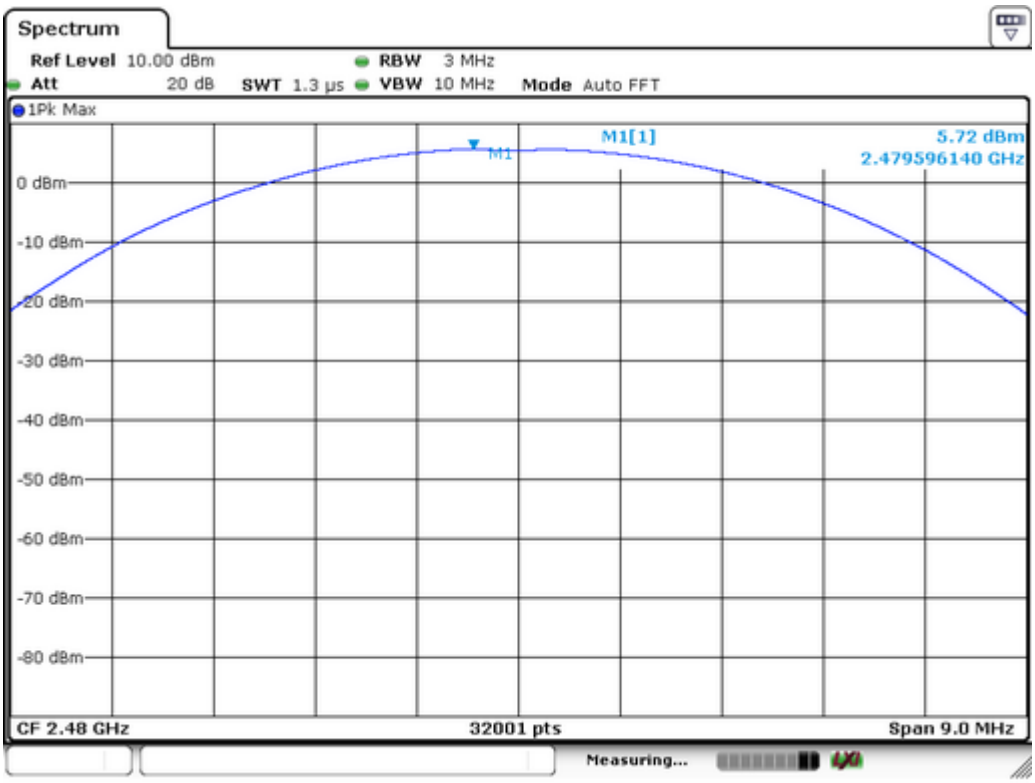

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
5.23 dBm
2.440754200 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz
Measuring...



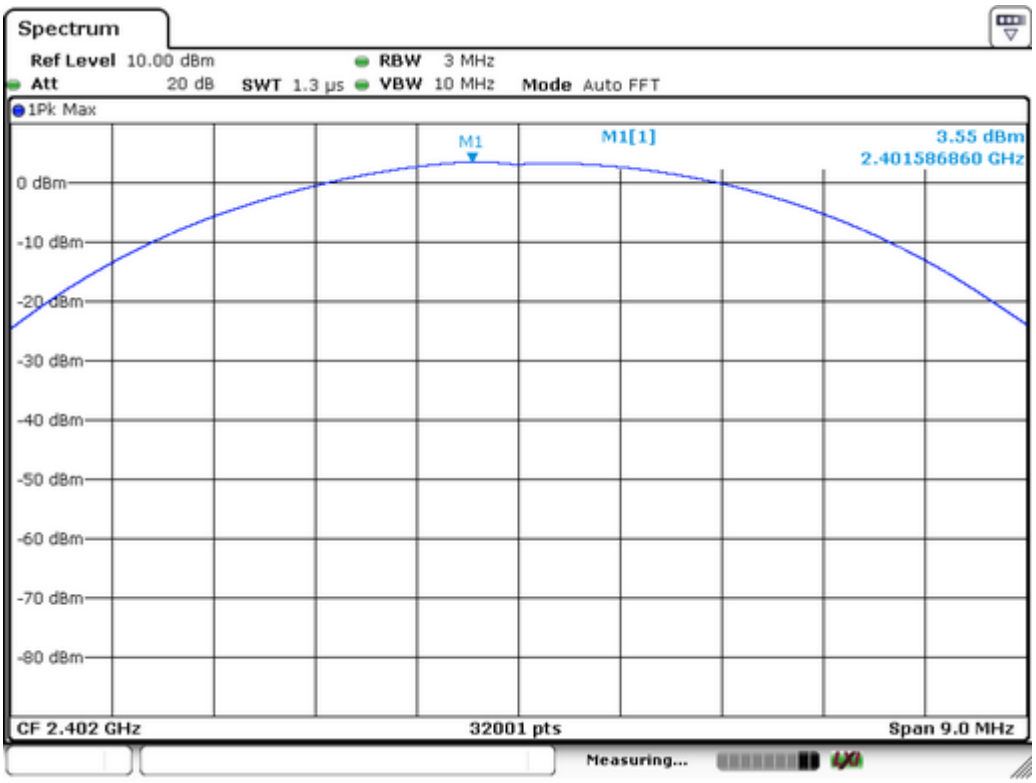
π /4-DQPSK(2Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	3.35	2.16	125	Pass
CH39	2441	6.00	3.98	125	Pass
CH78	2480	5.72	3.73	125	Pass

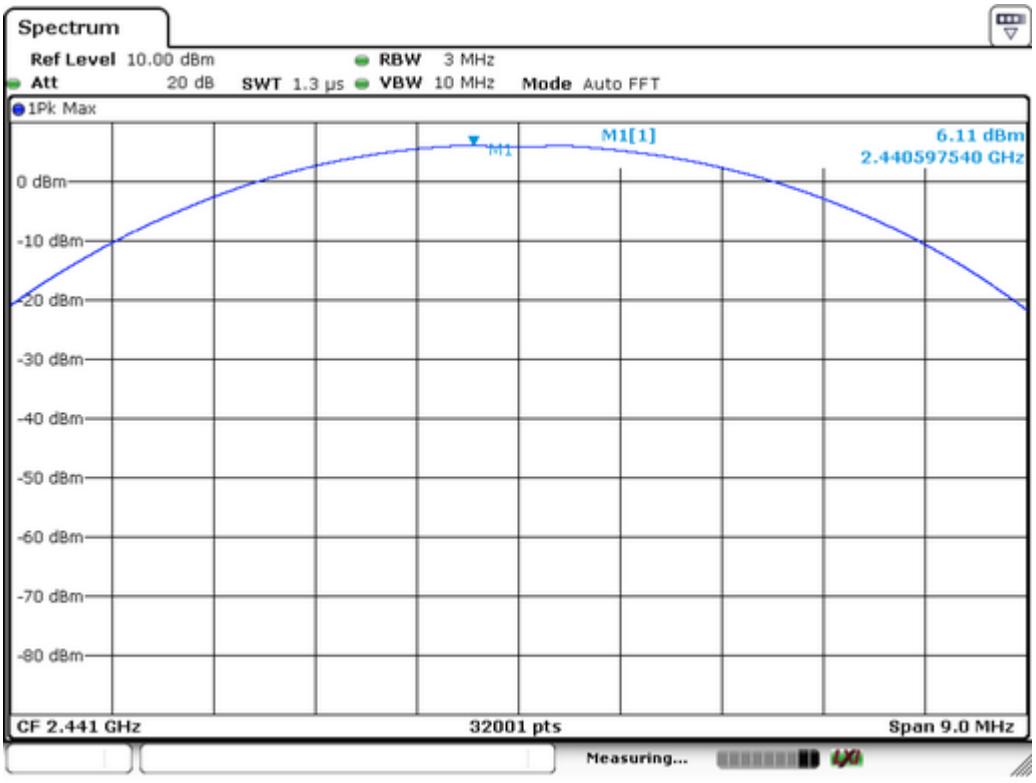

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1
M1[1]
3.35 dBm
2.402434800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz
Measuring...

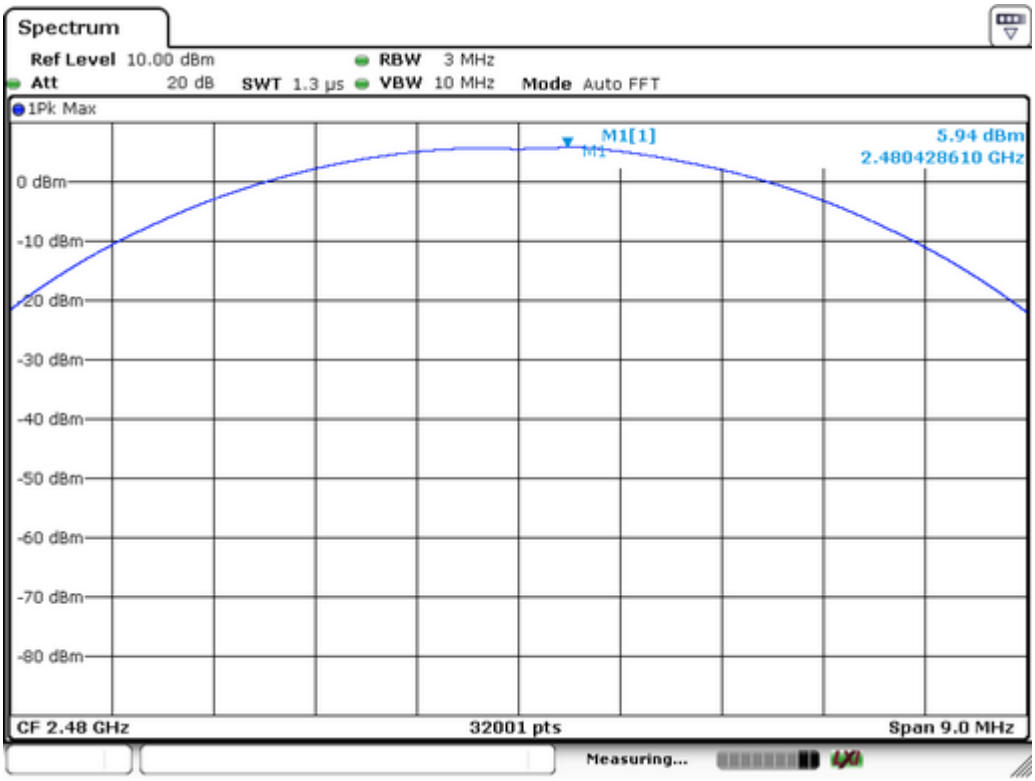

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1
M1[1]
6.00 dBm
2.440611890 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz
Measuring...



8DPSK(3Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	3.55	2.26	125	Pass
CH39	2441	6.11	4.08	125	Pass
CH78	2480	5.94	3.93	125	Pass


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1
M1[1]
3.55 dBm
2.401586860 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 9.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1
M1[1]
6.11 dBm
2.440597540 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 9.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 10 MHz
Mode Auto FFT
1Pk Max
M1[1]
5.94 dBm
2.480428610 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 9.0 MHz
Measuring...

9 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 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode	:	Hopping

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.

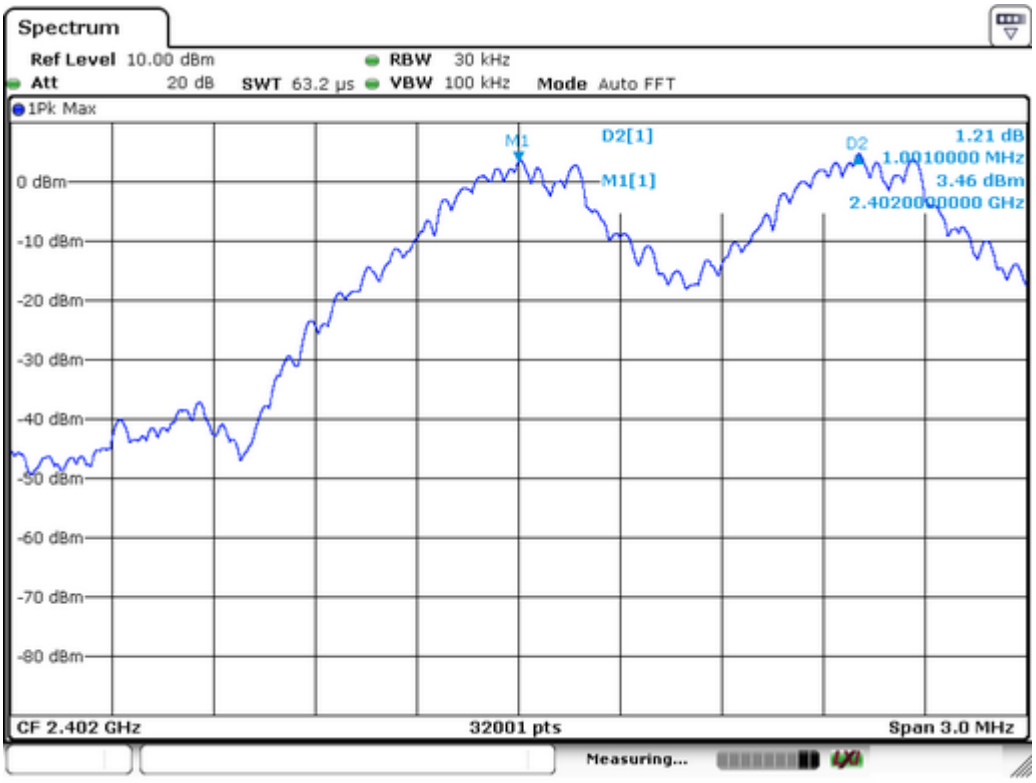
2. Set the spectrum analyzer: RBW = 30KHz. VBW = 100KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

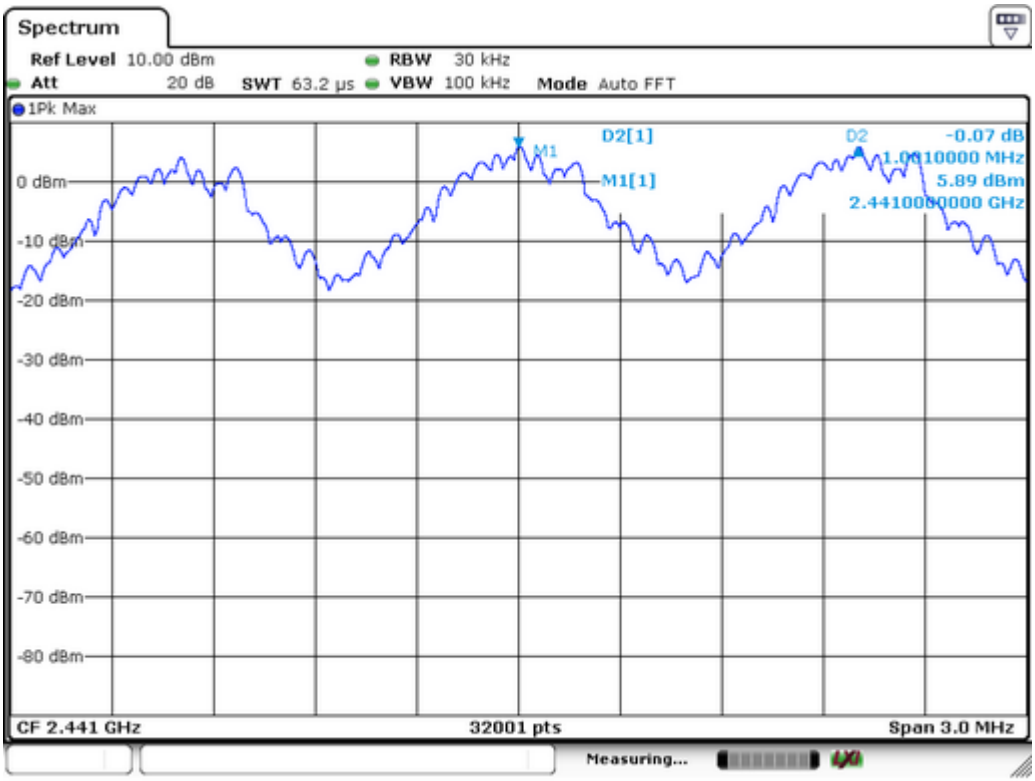
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

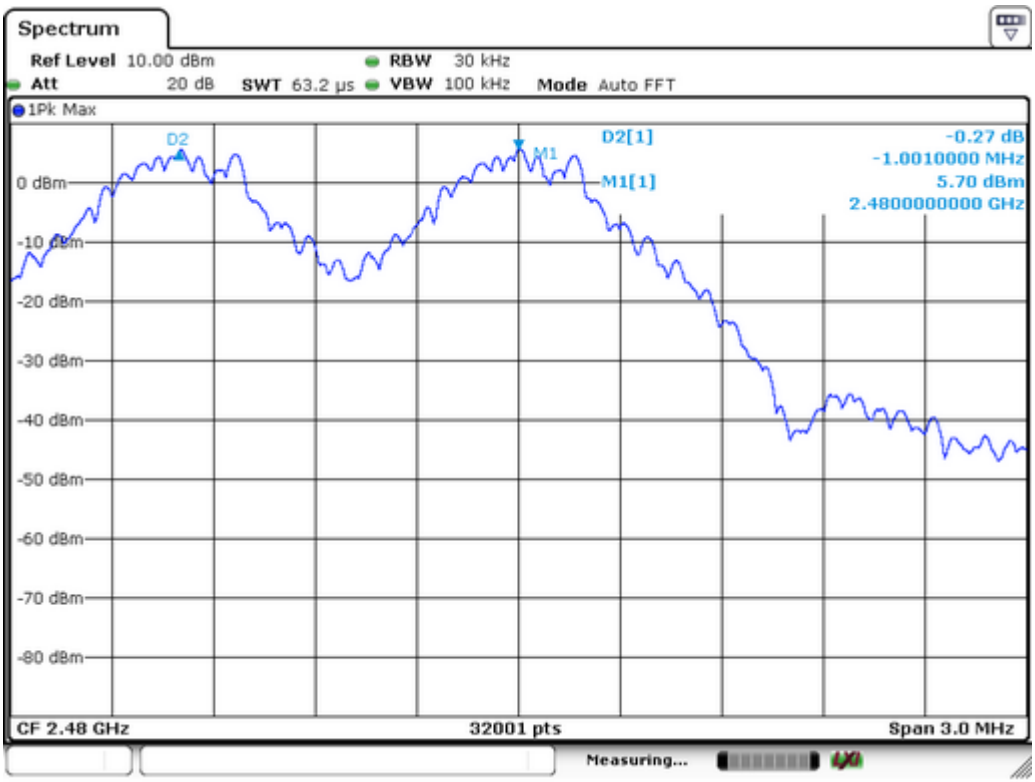
9.2 Test Result

Test Mode:	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
00	2402	1001	842
39	2441	1001	818
78	2480	1001	840

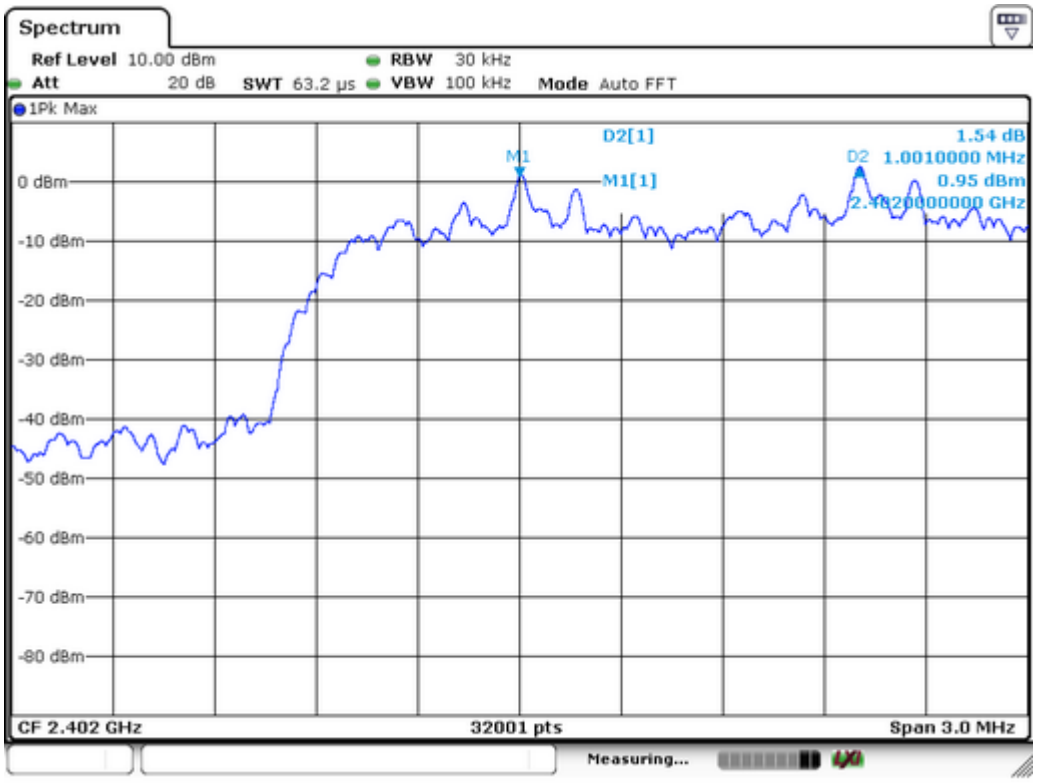


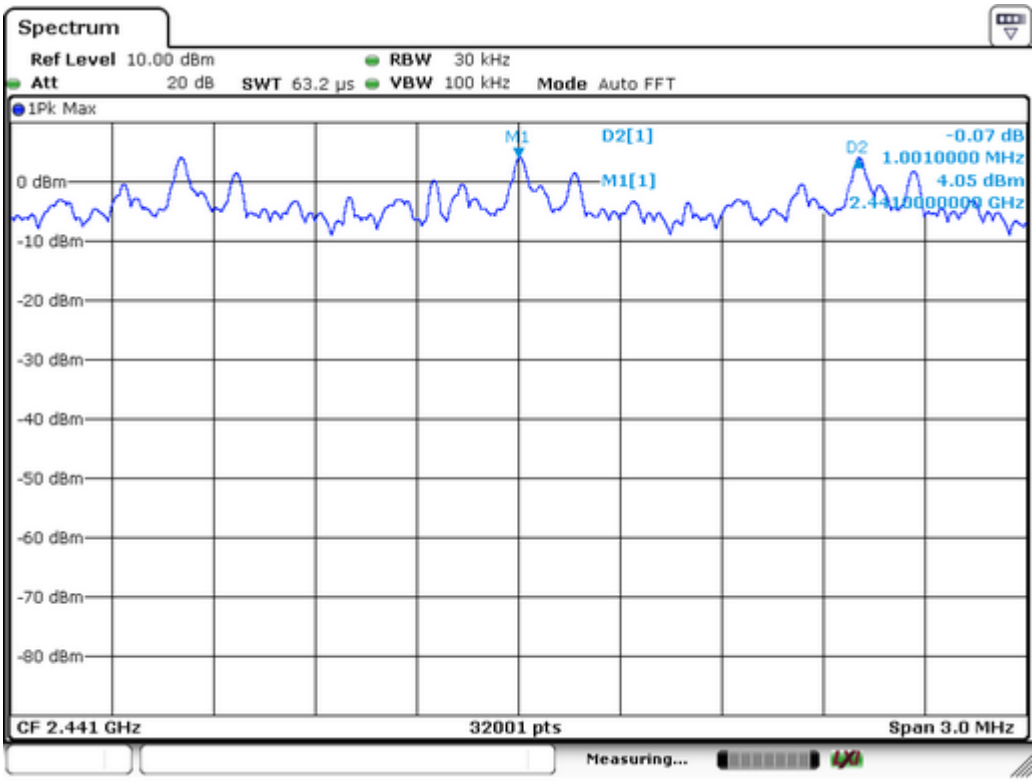

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2[1]
-0.07 dB
1.0010000 MHz
5.89 dBm
2.4410000000 GHz
M1[1]
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...

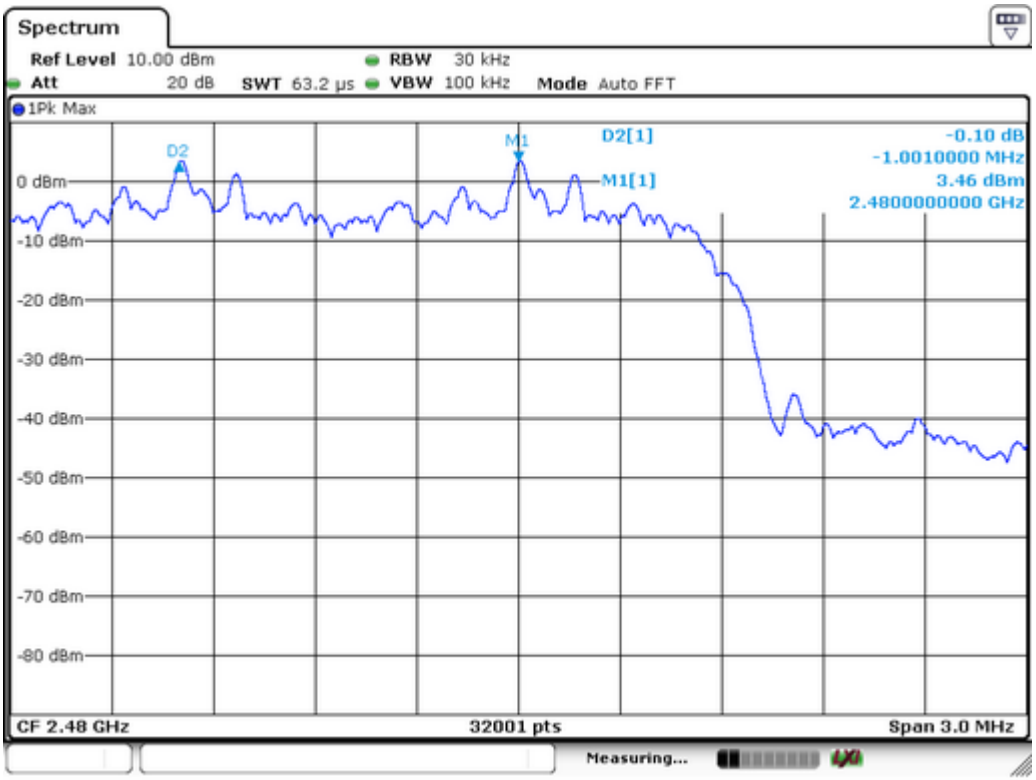

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2
D2[1]
-0.27 dB
-1.0010000 MHz
5.70 dBm
2.4800000000 GHz
M1[1]
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Measuring...

Test Mode:	CH00 / CH39 / CH78 (π/4-DQPSK (2Mbps) Mode)

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
00	2402	1001	>839
39	2441	1001	>834
78	2480	1001	>835

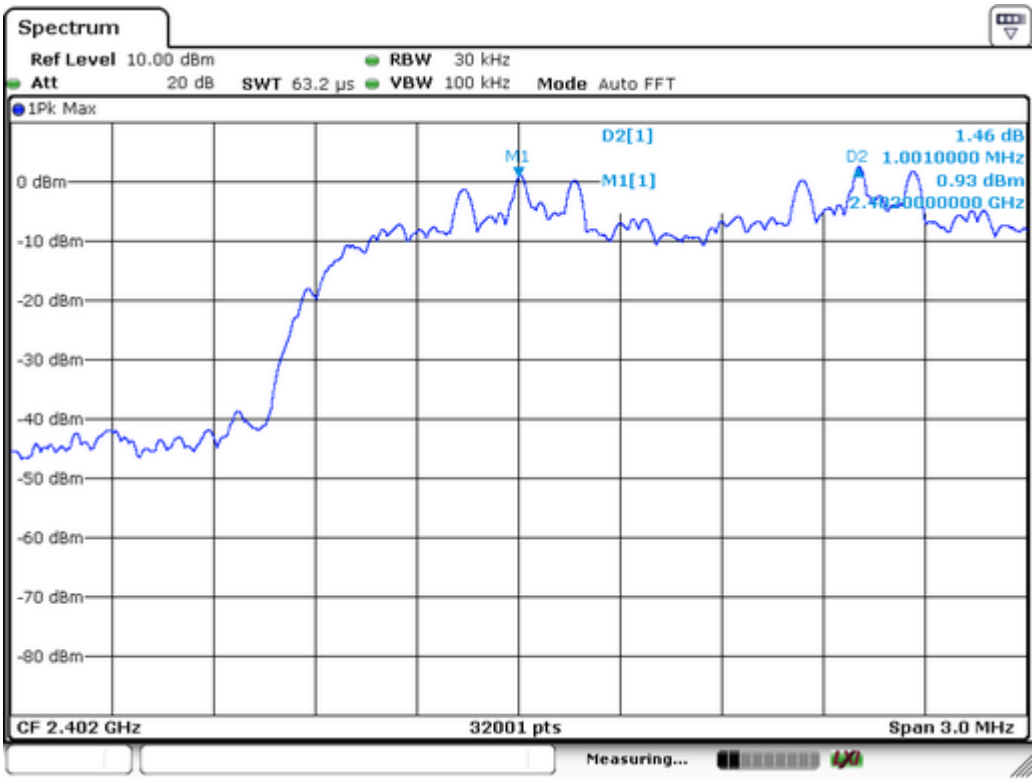


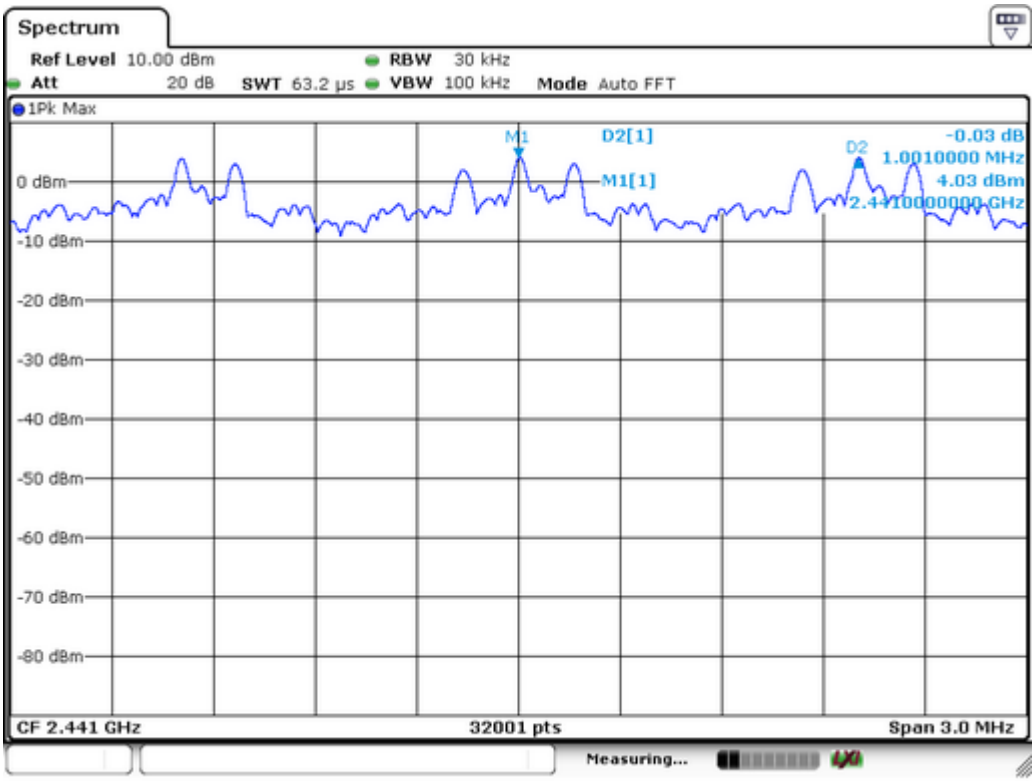

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1
D2[1]
M1[1]
D2
-0.07 dB
1.0010000 MHz
4.05 dBm
2.4410000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...

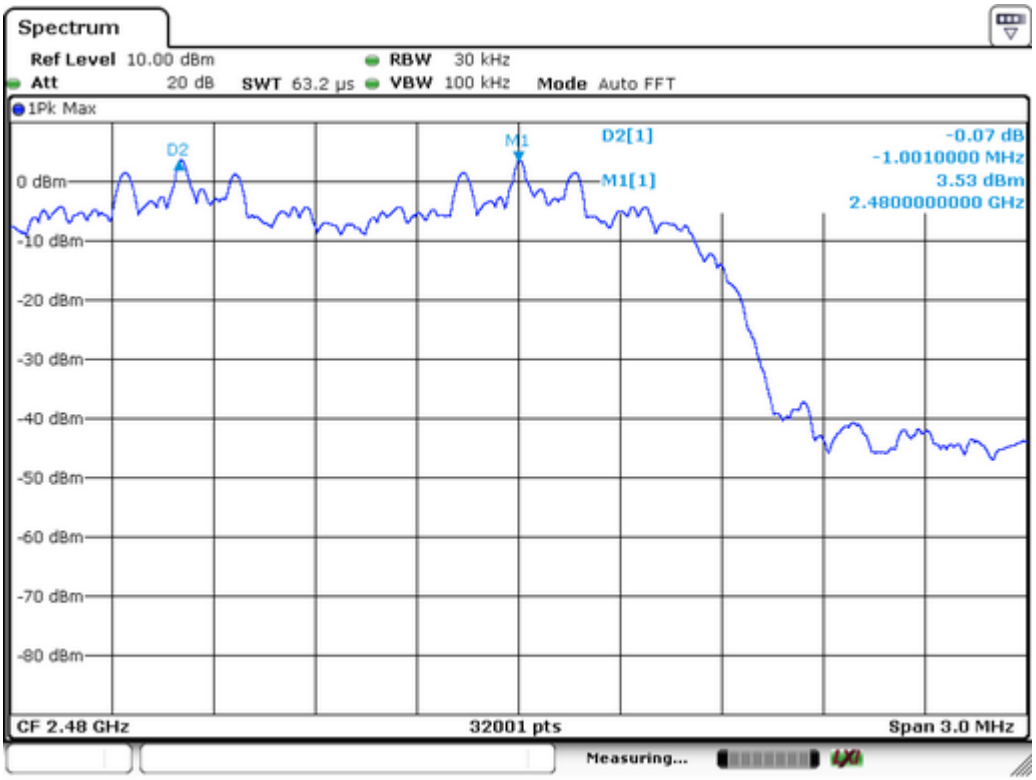

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2
M1
D2[1]
M1[1]
-0.10 dB
-1.0010000 MHz
3.46 dBm
2.4800000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Measuring...

Test Mode:	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
00	2402	1001	>815
39	2441	1001	>836
78	2480	1001	>836




Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1
D2[1]
M1[1]
D2
-0.03 dB
1.0010000 MHz
4.03 dBm
2.4410000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D2
M1
D2[1]
M1[1]
-0.07 dB
-1.0010000 MHz
3.53 dBm
2.4800000000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Measuring...

10 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	:	Hopping(GFSK)

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.

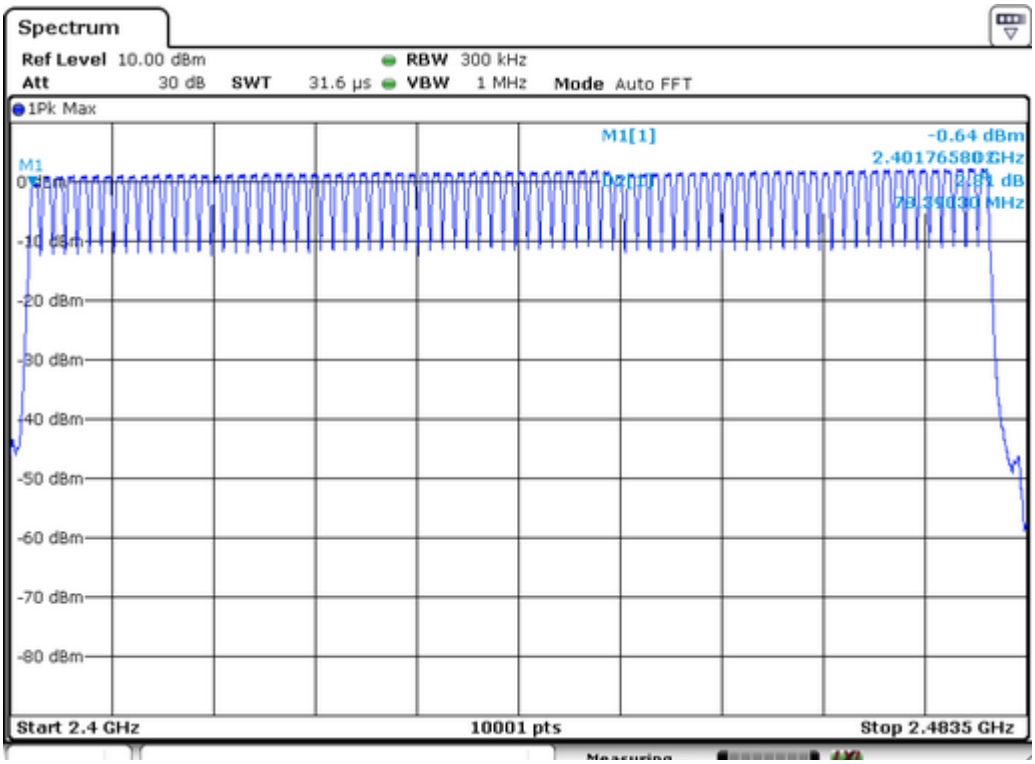
2. Set the spectrum analyzer: RBW = 300KHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

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;

10.2 Test Result

Channel Number	Limit
79	≥15



11 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.
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 spectrum analyzer span = 0. Centred on a hopping channel;

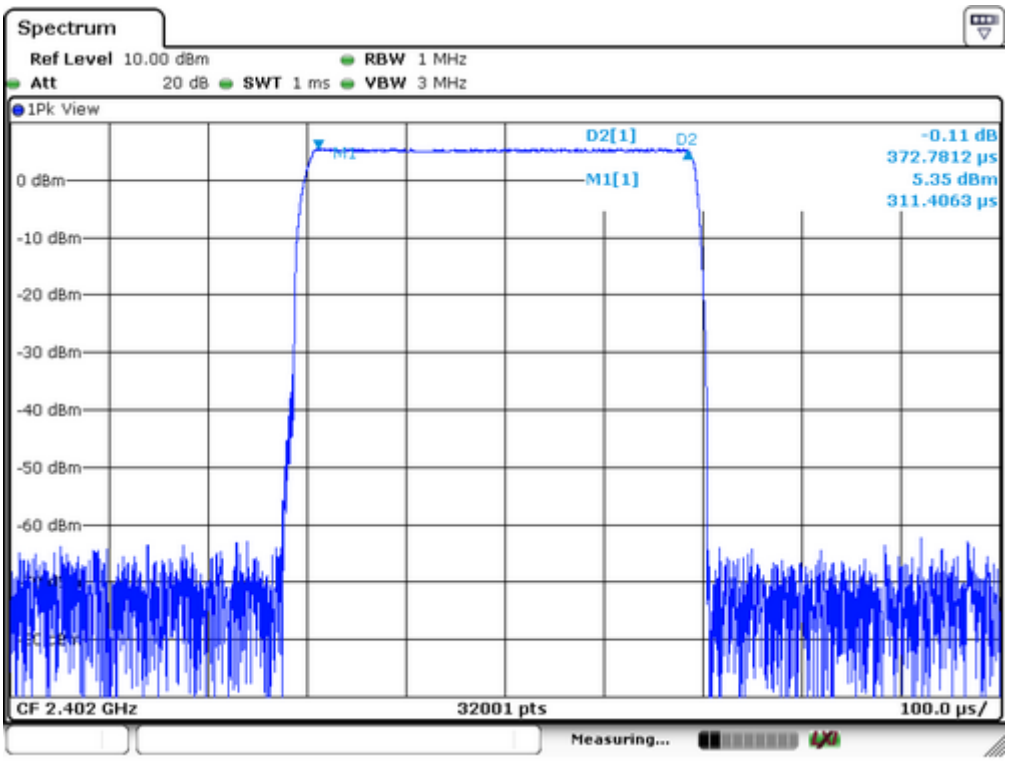
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

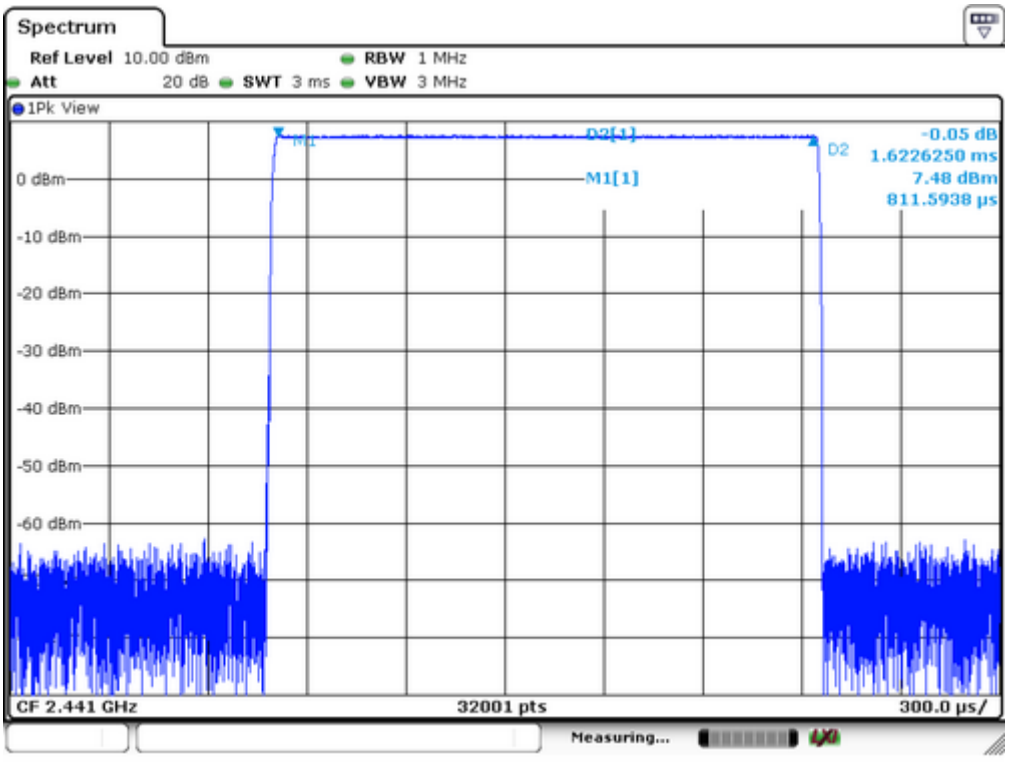
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

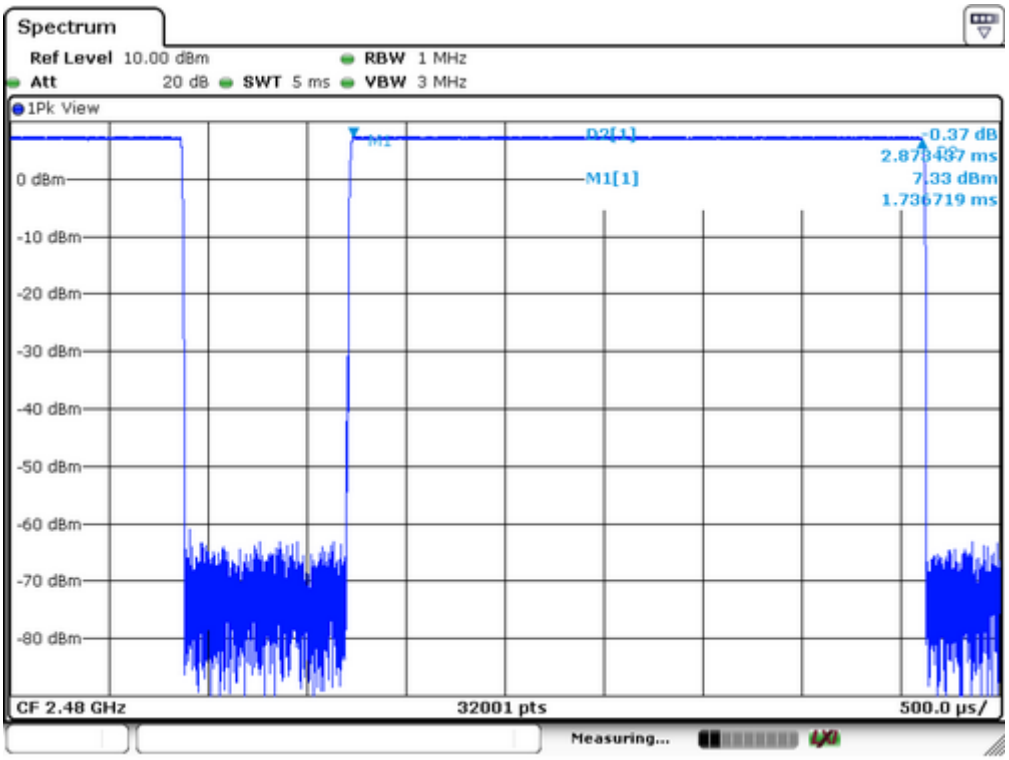
11.2 Test Result

Test Mode:	GFSK (Mbps) –DH1/DH3/DH5

Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	1600/(2*79) x 31.6 = 320	0.372	119.04	400
DH3	1600/(4*79) x 31.6 =160	1.623	259.68	400
DH5	1600/(6*79) x 31.6 =106.67	2.873	306.46	400

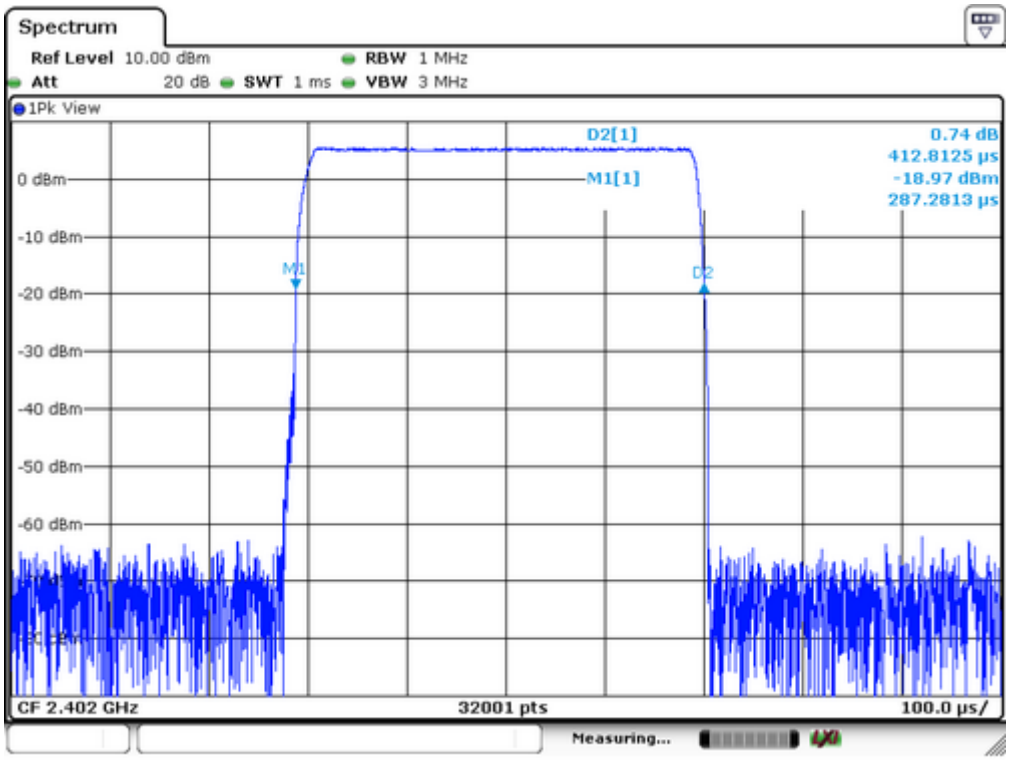

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 1 ms VBW 3 MHz
1Pk View
D2[1] -0.11 dB
372.7812 µs
M1[1] 5.35 dBm
311.4063 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.402 GHz
32001 pts
100.0 µs/
Measuring...

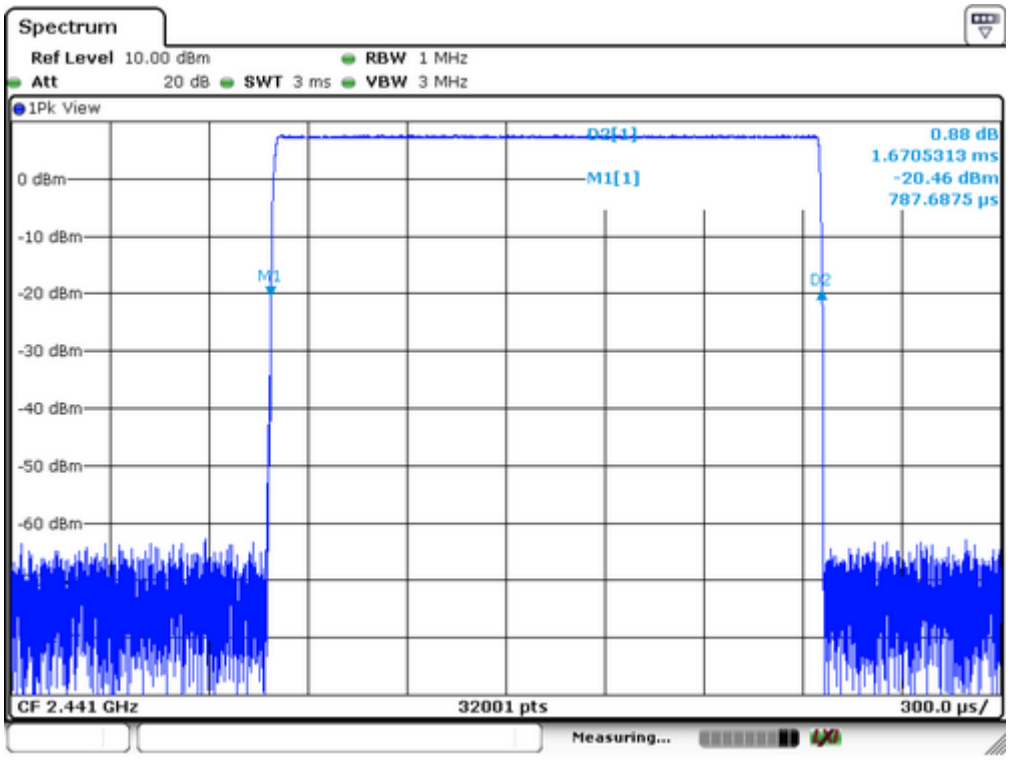

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 3 ms VBW 3 MHz
1Pk View
D2[1] -0.05 dB
1.6226250 ms
M1[1] 7.48 dBm
811.5938 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.441 GHz
32001 pts
300.0 µs/
Measuring...

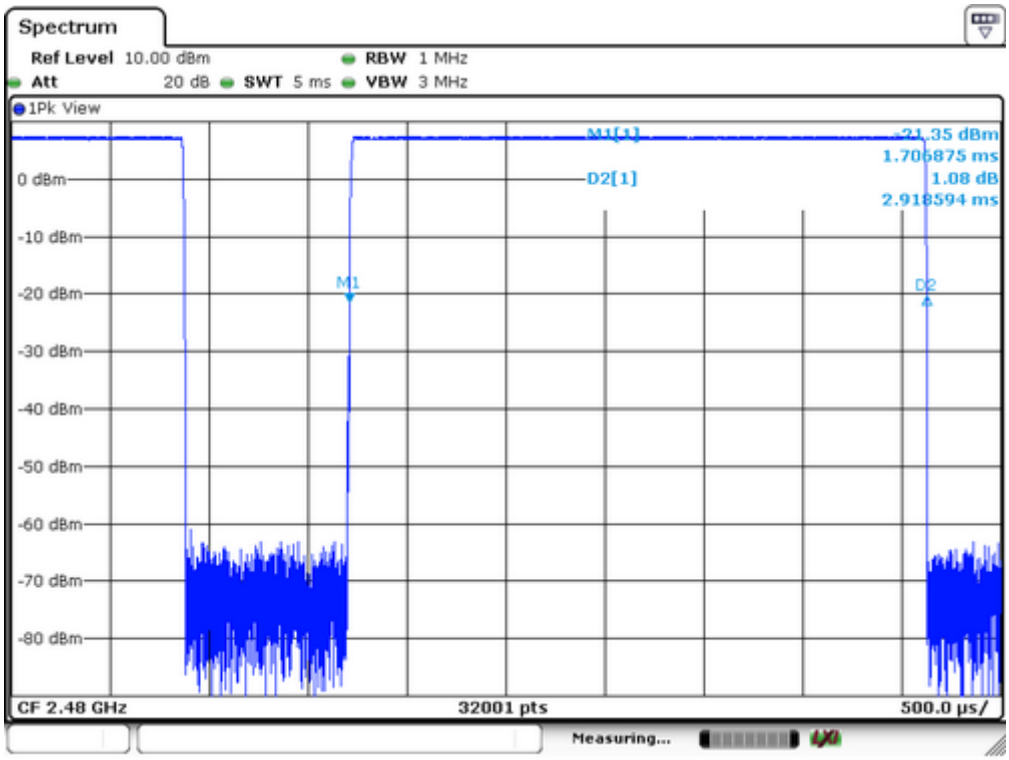


Test Mode:	π/4-DQPSK(2Mbps) –2DH1/2DH3/2DH5

Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
2DH1	1600/(2*79) x 31.6 = 320	0.412	131.84	400
2DH3	1600/(4*79) x 31.6 =160	1.671	267.36	400
2DH5	1600/(6*79) x 31.6 =106.67	2.910	310.41	400

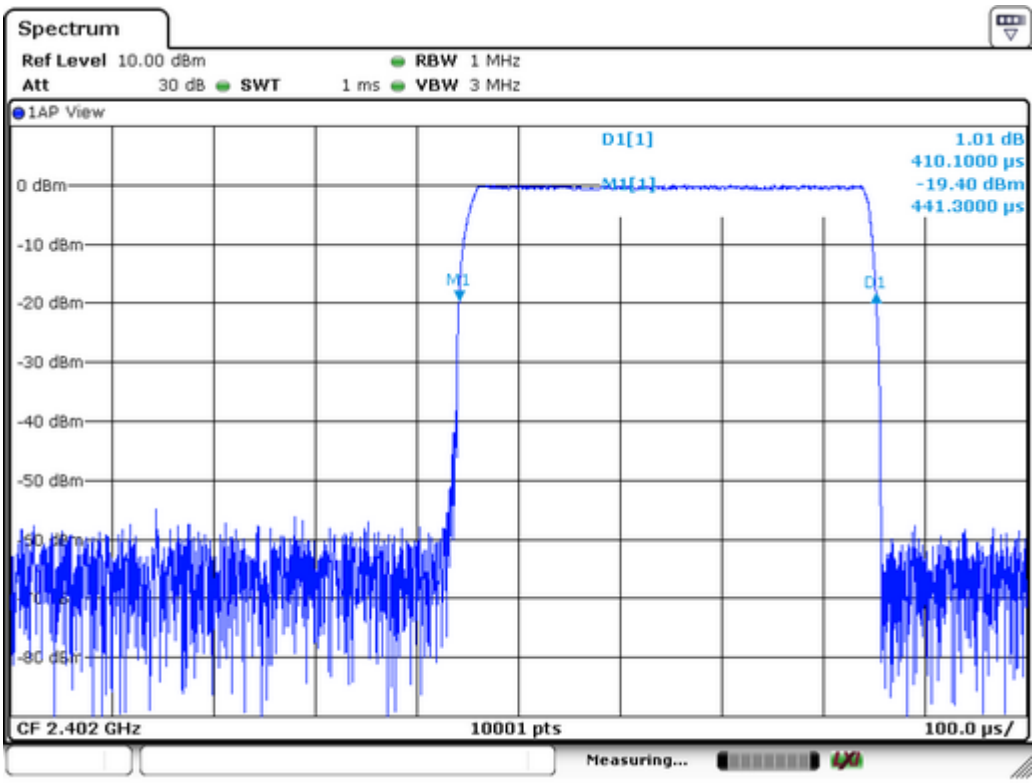

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 1 ms VBW 3 MHz
1Pk View
D2[1] 0.74 dB
412.8125 µs
M1[1] -18.97 dBm
287.2813 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D2
CF 2.402 GHz
32001 pts
100.0 µs/
Measuring...

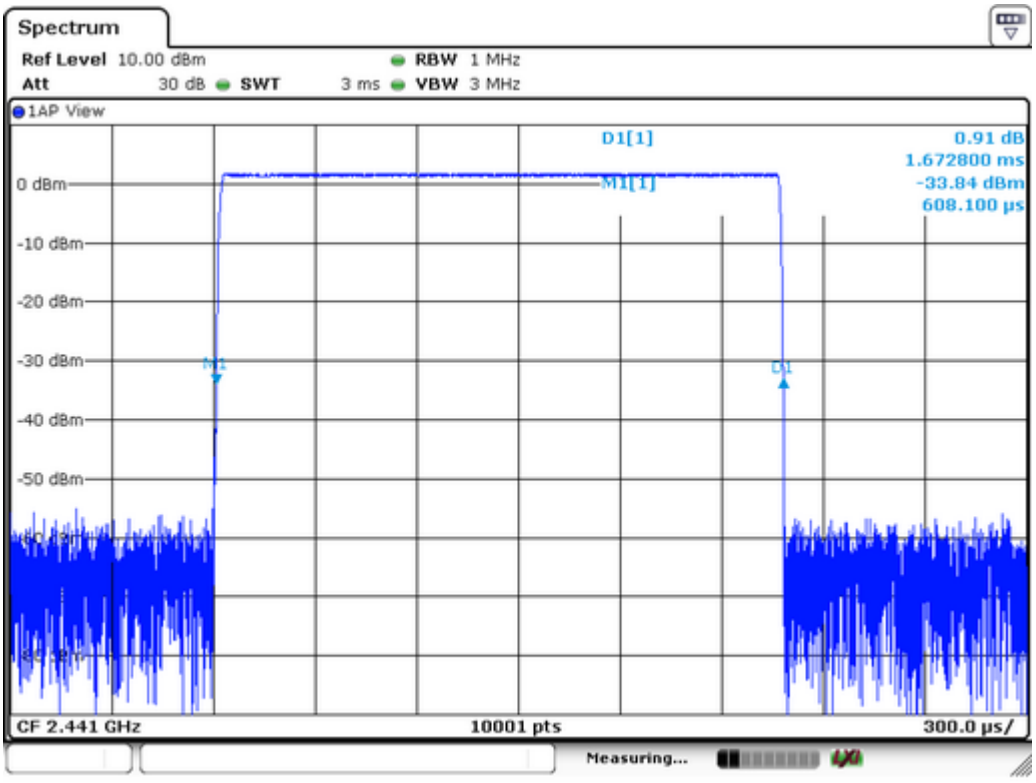

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 3 ms VBW 3 MHz
1Pk View
D2[1] 0.88 dB
1.6705313 ms
M1[1] -20.46 dBm
787.6875 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D2
CF 2.441 GHz
32001 pts
300.0 µs/
Measuring...

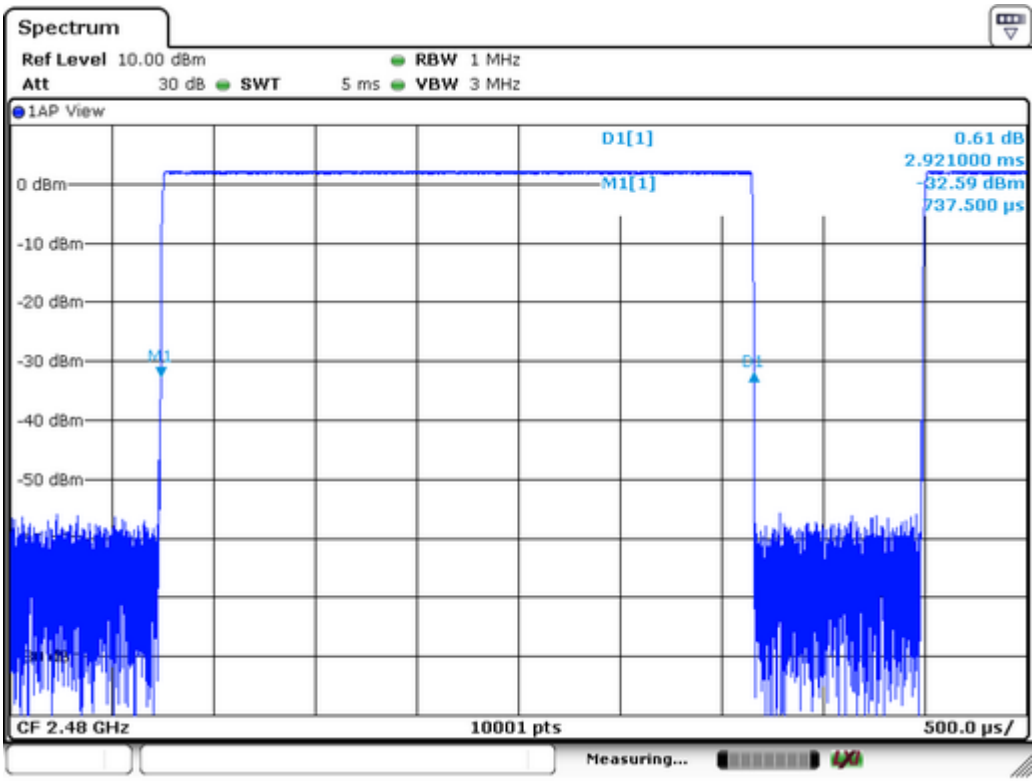


Test Mode:	8DPSK(3Mbps) –3DH1/3DH3/3DH5

Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
3DH1	1600/(2*79) x 31.6 = 320	0.410	131.2	400
3DH3	1600/(4*79) x 31.6 =160	1.672	267.52	400
3DH5	1600/(6*79) x 31.6 =106.67	2.921	311.58	400


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 30 dB SWT 1 ms VBW 3 MHz
1AP View
D1[1] 1.01 dB
410.1000 µs
M1[1] -19.40 dBm
441.3000 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
M1
D1
CF 2.402 GHz
10001 pts
100.0 µs/
Measuring...

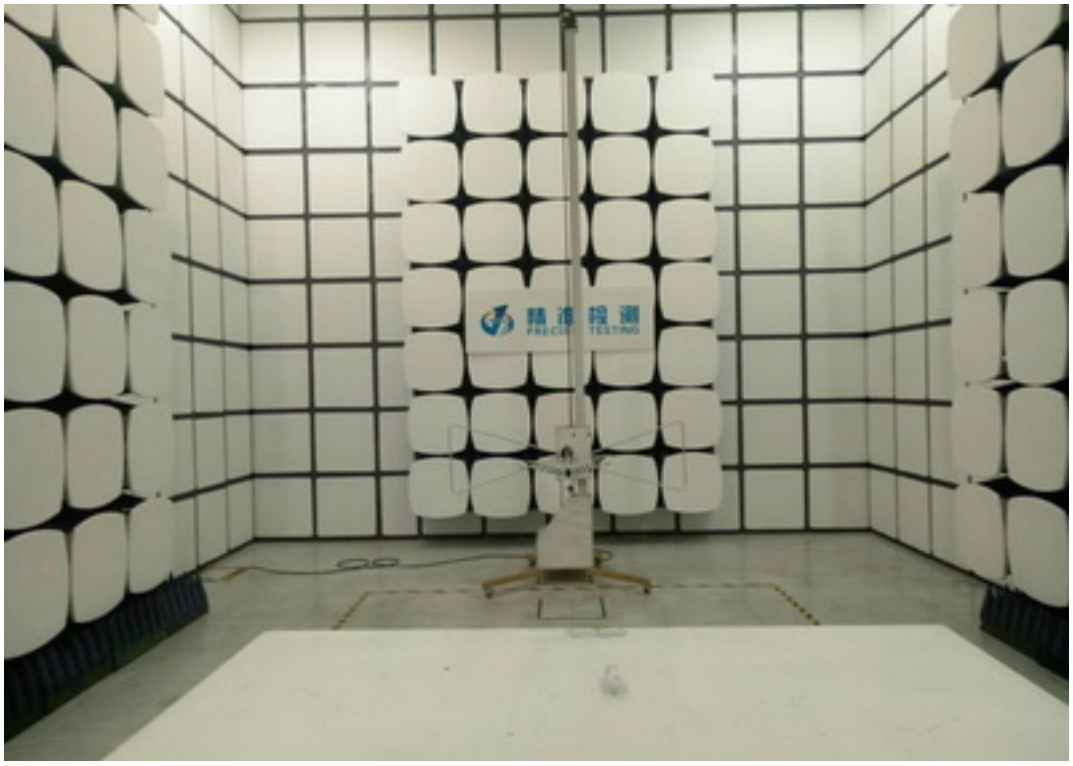

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 30 dB SWT 3 ms VBW 3 MHz
1AP View
D1[1] 0.91 dB
1.672800 ms
M1[1] -33.84 dBm
608.100 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
M1
D1
CF 2.441 GHz
10001 pts
300.0 µs/
Measuring...

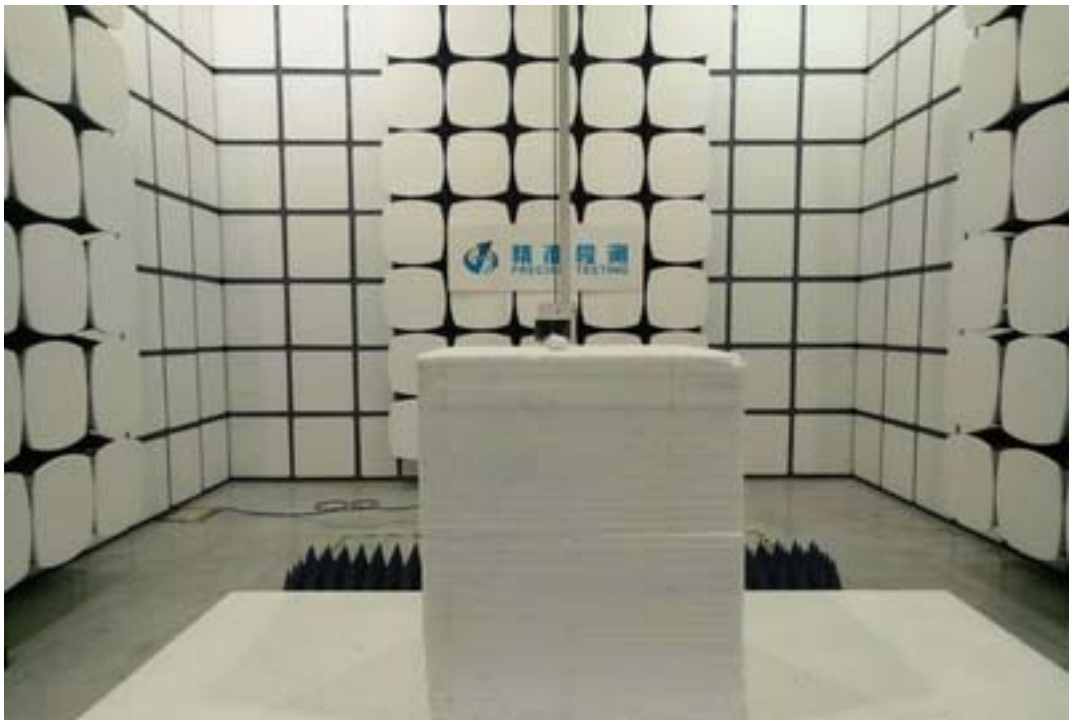

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 30 dB SWT 5 ms VBW 3 MHz
1AP View
D1[1]
0.61 dB
2.921000 ms
M1[1]
-32.59 dBm
737.500 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
M1
D1
CF 2.48 GHz
10001 pts
500.0 µs/
Measuring...

12 Antenna Requirement

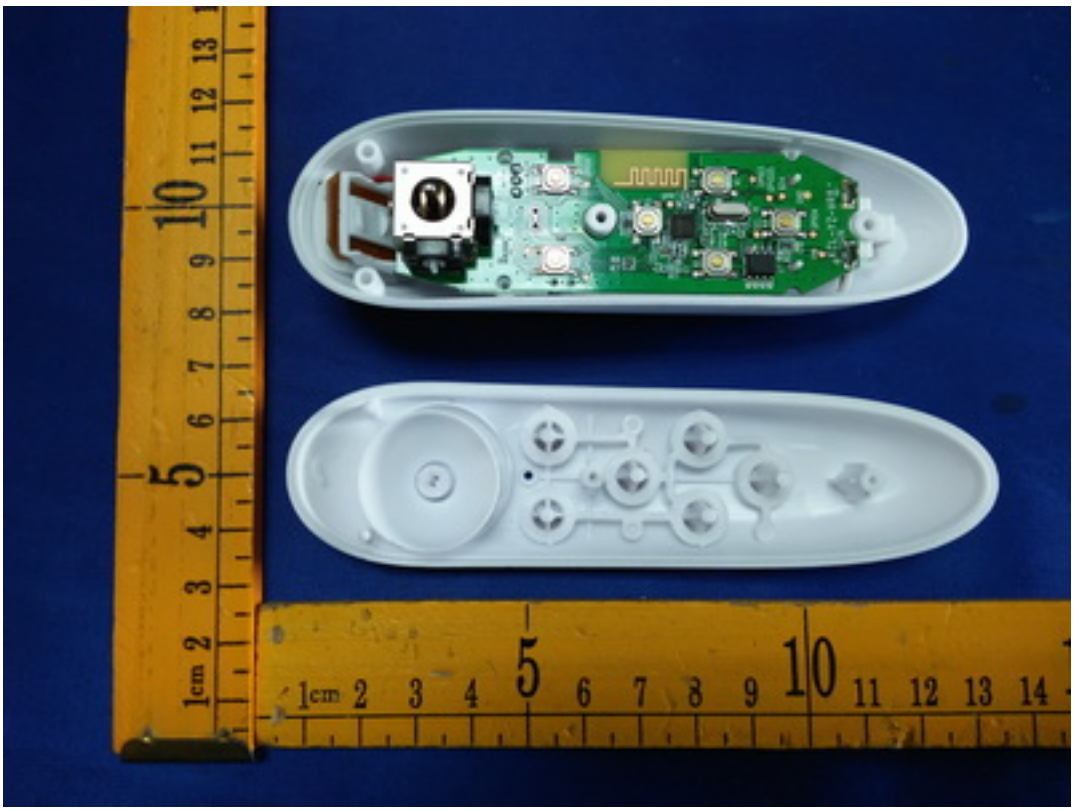
According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an internal PCB Antenna, it meet the requirement of this section.

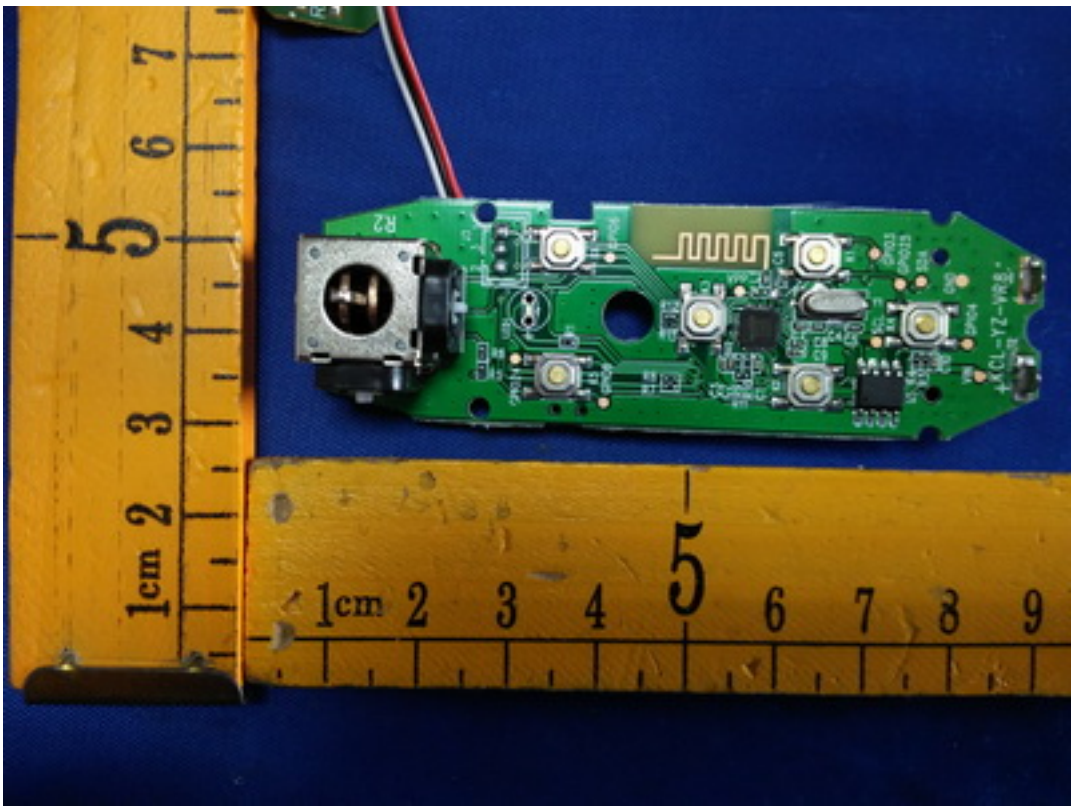
13 TEST PHOTOS

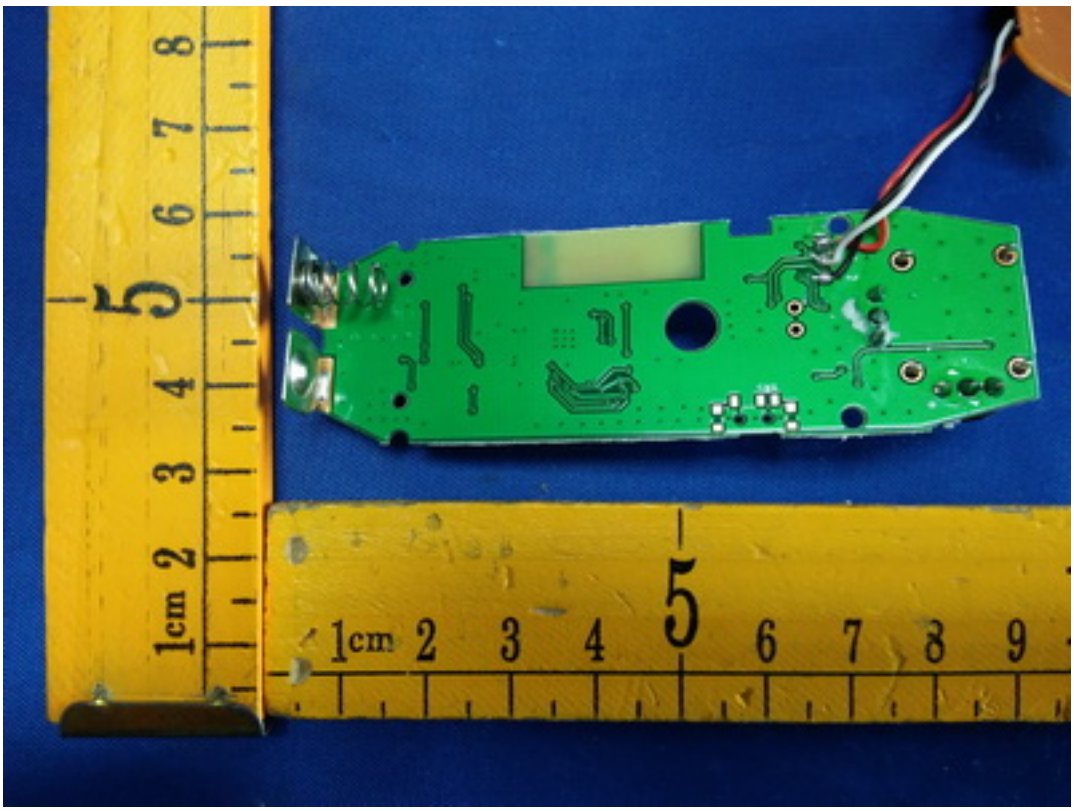


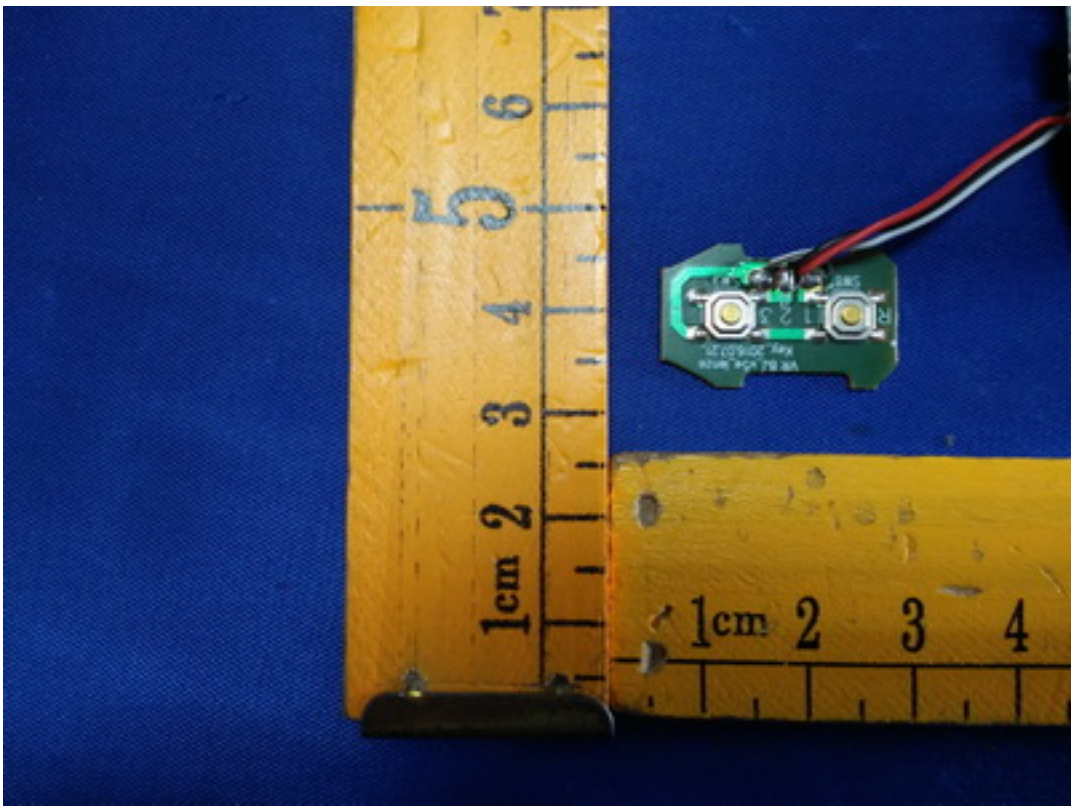


14 EUT PHOTOS









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