

FCC TEST REPORT

FCC ID: 2AIGHA9

Product Name : Bluetooth digital speaker
Model Name : A9, A9pro, A2, A2pro, A2metal, A2plus, A2mini, G2, G2pro, Q2, Q2pro
Brand Name : N/A
Report No. : PTCDQ02170522301-FC01

Prepared for

DONGGUAN LOYFUN INDUSTRY CO.,LTD
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Prepared by

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1TEST RESULT CERTIFICATION

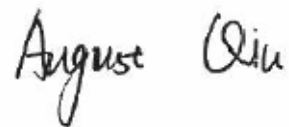
Applicant's name : DONGGUAN LOYFUN INDUSTRY CO.,LTD
Address : no.1, Xikeng road, Puxin village, Shipai town,Dongguan,
Guangdong, China
Manufacture's name : DONGGUAN LOYFUN INDUSTRY CO.,LTD
Address : no.1, Xikeng road, Puxin village, Shipai town,Dongguan,
Guangdong, China
Product name : Bluetooth digital speaker
Model name : A9, A9pro, A2, A2pro, A2metal, A2plus, A2mini, G2, G2pro, Q2,
Q2pro
Brand Name : All samples are the same except model number, the color of
appearance.
Standards : FCC CFR47 Part 15 Section 15.247
Test procedure : ANSI C63.10:2013
Test Date : June 08, 2017 to June 20, 2017
Date of Issue : July 10, 2017
Test Result : Pass

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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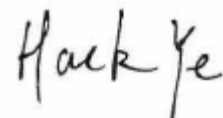
Testing Engineer

August Qiu



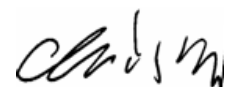
Technical Manager

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
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: The product was full-charged when was testing.

N/A: Not Applicable

3 TEST FACILITY

Site	Dongguan Precise Testing & Certification Corp., Ltd.
Location	Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China
FCC Registration No.	371540

4 General Information

4.1 General Description of E.U.T.

Product Name	: Bluetooth digital speaker
Model Name	: A9
Bluetooth Version	: BT4.1+EDR
Operating frequency	: 2402-2480MHz
Numbers of Channel	: 79 channels
Antenna Type:	: PCB Print Antenna
Antenna Gain:	: 1.3 dBi
Type of Modulation	: GFSK, Pi/4DQPSK, 8DPSK
Power supply for Test	: DC 3.7V, 800mA power by battery
Hardware Version	: A2.PCB
Software Version	: LF.A2.B_BK3254

4.2 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	-	-

4.3 Test Mode

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, $\pi/4$ -DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel	Frequency(MHz)
00	2402
39	2441
78	2480

4.4 Supported Equipment

Supported Equipment	Model	FCC ID
Adapter	Model: PS65B050Y3000S Input: AC100-240V, 50/60Hz, 1.5A Output: DC 5V, 3000mA	N/A

5 Equipment During Test

5.1 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
6	Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	October 10, 2016	October 09, 2017	1 year
7	Coaxial Cable	CDS	79254	46107086	October 10, 2016	October 09, 2017	1 year

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

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	Loop Antenna	Schwarzbeck	FMZB 1519	012	July 15, 2016	July 14, 2017	1 year
3	Trilog Broadband Antenna	SCHWARZECK	VULB9160	9160-3355	July 15, 2016	July 14, 2017	1 year
4	Amplifier	EM	EM-30180	060538	July 15, 2016	July 14, 2017	1 year
5	Horn Antenna	SCHWARZECK	BBHA9120D	1246	July 15, 2016	July 14, 2017	1 year
6	Horn Antenna	SCHWARZECK	BBHA9170D	1412	July 15, 2016	July 14, 2017	1 year
7	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	July 15, 2016	July 14, 2017	1 year
8	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	SCHWARZB ECK	NSLK 8128	8128-289	July 15, 2016	July 14, 2017	1 year
3	Cable	LARGE	RF300	-	July 15, 2016	July 14, 2017	1 year

5.2 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
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

6 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:	:	66-56 dB μ V between 0.15MHz & 0.5MHz
	:	56 dB μ V between 0.5MHz & 5MHz
	:	60 dB μ V between 5MHz & 30MHz
Detector:	:	Peak for pre-scan (9kHz Resolution Bandwidth)

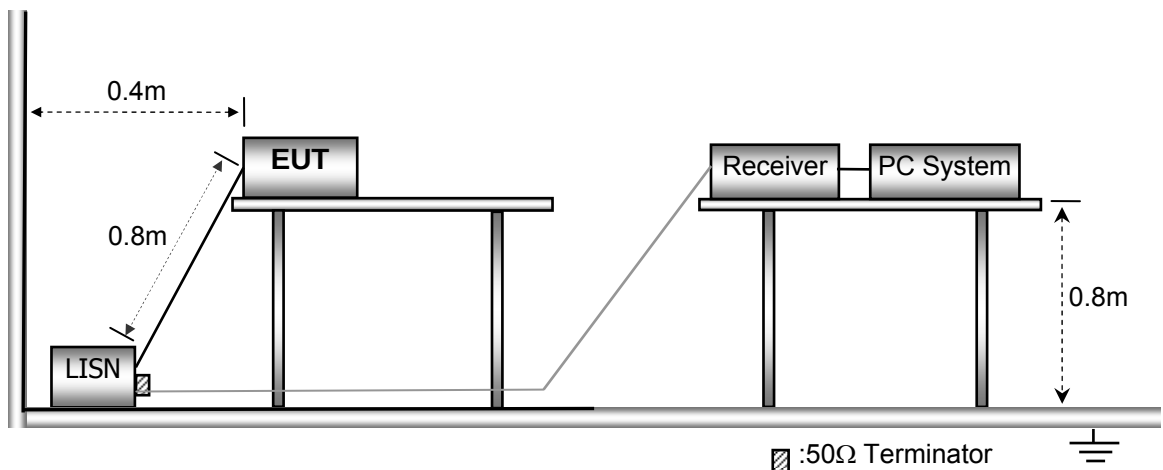
6.1 E.U.T. Operation

Operating Environment :

Temperature:	:	25.5 °C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.2kPa
EUT Operation :	:	Refer to section 3.3
Test Voltage	:	AC 120V/60Hz&AC 240V/60Hz

6.2 EUT Setup

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

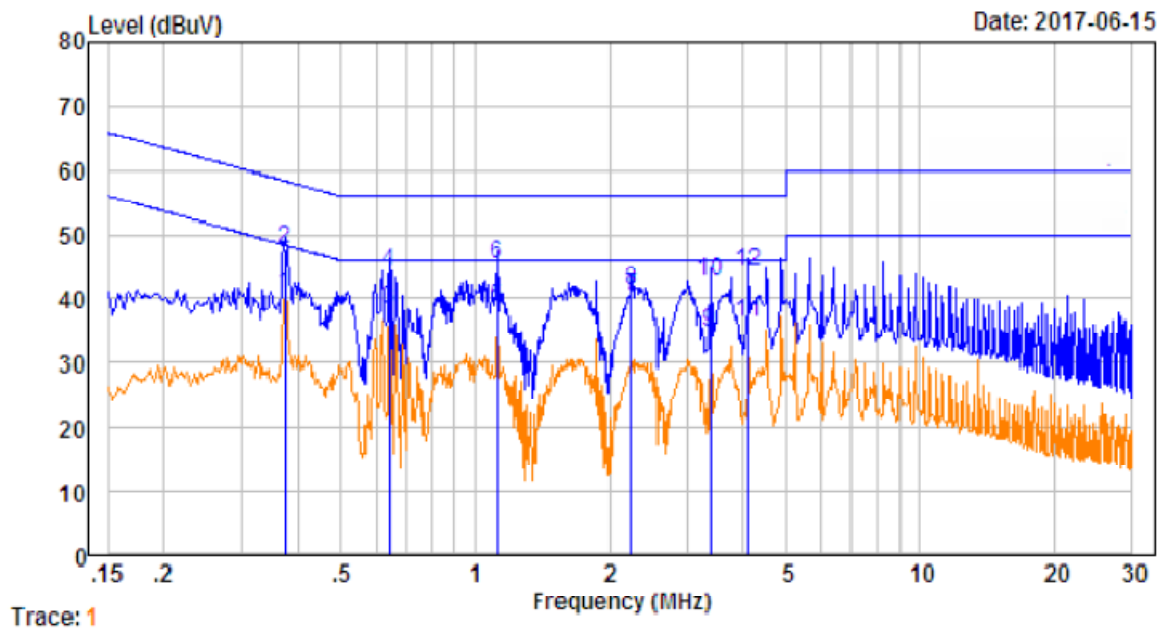


6.3 Measurement Description

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

6.4 Conducted Emission Test Result

Line-AC120V/60Hz:

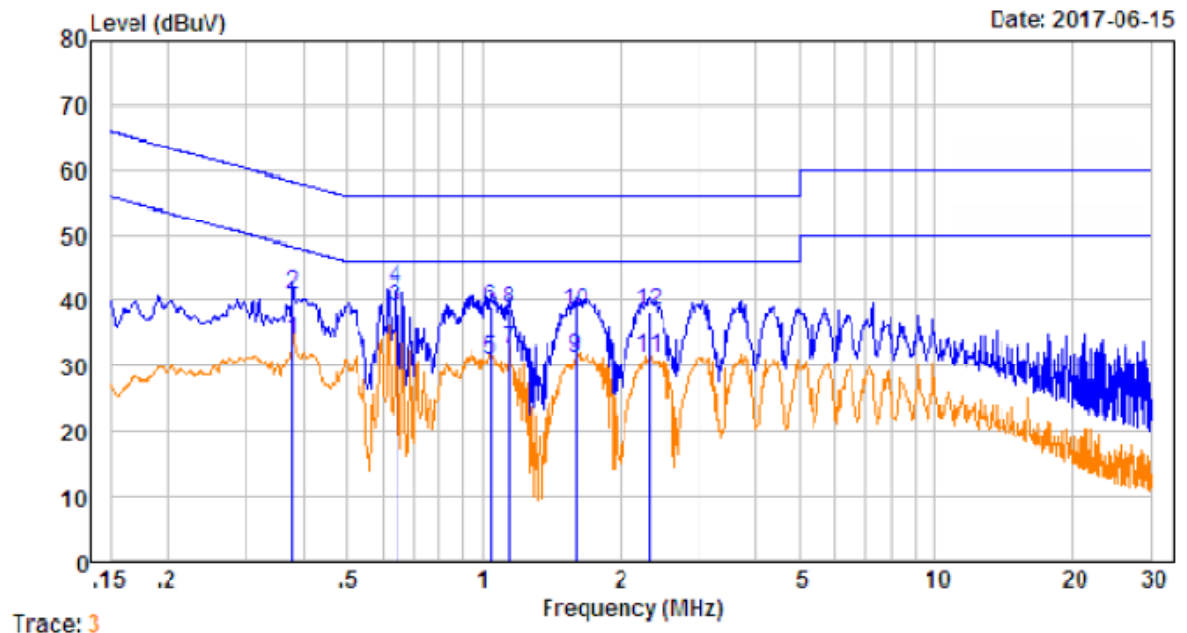


Trace: 1

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.373	10.63	0.60	29.50	40.73	48.43	-7.70	Average
2.	0.373	10.63	0.60	36.50	47.73	58.43	-10.70	QP
3.	0.641	10.66	0.60	27.03	38.29	46.00	-7.71	Average
4.	0.641	10.66	0.60	33.03	44.29	56.00	-11.71	QP
5.	1.123	10.68	0.60	27.33	38.61	46.00	-7.39	Average
6.	1.123	10.68	0.60	34.33	45.61	56.00	-10.39	QP
7.	2.249	10.70	0.60	29.17	40.47	46.00	-5.53	Average
8.	2.249	10.70	0.60	30.17	41.47	56.00	-14.53	QP
9.	3.381	10.72	0.60	23.53	34.85	46.00	-11.15	Average
10.	3.381	10.72	0.60	31.53	42.85	56.00	-13.15	QP
11.	4.136	10.72	0.60	24.92	36.24	46.00	-9.76	Average
12.	4.136	10.72	0.60	32.92	44.24	56.00	-11.76	QP



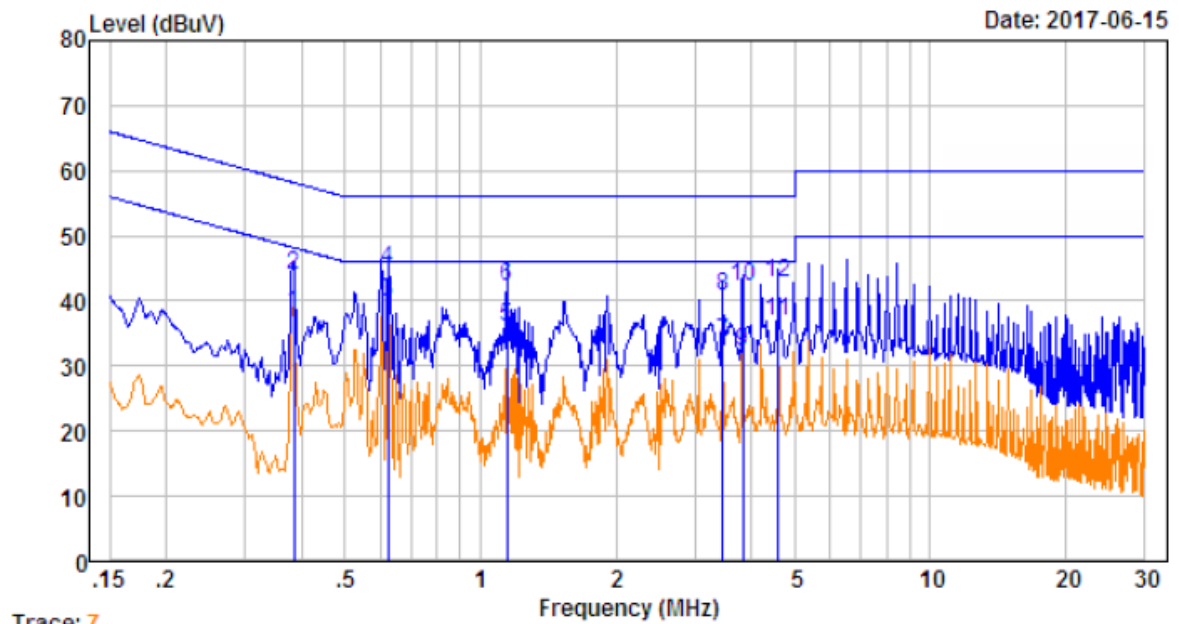
Neutral-AC 120V/60Hz:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.379	10.64	0.60	22.85	34.09	48.30	-14.21	Average
2.	0.379	10.64	0.60	29.85	41.09	58.30	-17.21	QP
3.	0.641	10.66	0.60	27.64	38.90	46.00	-7.10	Average
4.	0.641	10.66	0.60	30.64	41.90	56.00	-14.10	QP
5.	1.037	10.67	0.60	19.63	30.90	46.00	-15.10	Average
6.	1.037	10.67	0.60	27.63	38.90	56.00	-17.10	QP
7.	1.141	10.68	0.60	21.30	32.58	46.00	-13.42	Average
8.	1.141	10.68	0.60	27.30	38.58	56.00	-17.42	QP
9.	1.602	10.69	0.60	20.11	31.40	46.00	-14.60	Average
10.	1.602	10.69	0.60	27.11	38.40	56.00	-17.60	QP
11.	2.321	10.70	0.60	20.10	31.40	46.00	-14.60	Average
12.	2.321	10.70	0.60	27.10	38.40	56.00	-17.60	QP

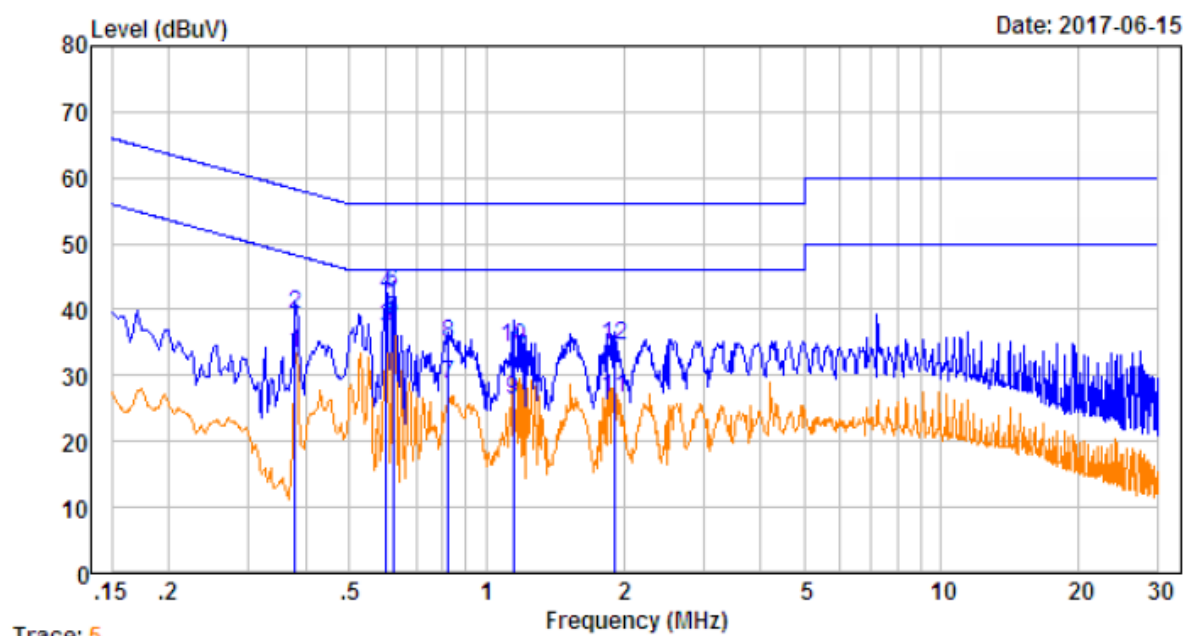


Line –AC 240V/60Hz:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.385	10.64	0.60	26.80	38.04	48.17	-10.13	Average
2.	0.385	10.64	0.60	32.80	44.04	58.17	-14.13	QP
3.	0.624	10.66	0.60	28.65	39.91	46.00	-6.09	Average
4.	0.624	10.66	0.60	33.65	44.91	56.00	-11.09	QP
5.	1.147	10.68	0.60	24.85	36.13	46.00	-9.87	Average
6.	1.147	10.68	0.60	30.85	42.13	56.00	-13.87	QP
7.	3.454	10.72	0.60	22.36	33.68	46.00	-12.32	Average
8.	3.454	10.72	0.60	29.36	40.68	56.00	-15.32	QP
9.	3.840	10.72	0.60	20.77	32.09	46.00	-13.91	Average
10.	3.840	10.72	0.60	30.77	42.09	56.00	-13.91	QP
11.	4.598	10.73	0.60	25.56	36.89	46.00	-9.11	Average
12.	4.598	10.73	0.60	31.56	42.89	56.00	-13.11	QP

Neutral –AC 240V/60Hz:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBUV	Emission Level dBUV	Limit dBUV	Over Limit dB	Remark
1.	0.379	10.64	0.60	22.07	33.31	48.30	-14.99	Average
2.	0.379	10.64	0.60	28.07	39.31	58.30	-18.99	QP
3.	0.601	10.66	0.60	26.08	37.34	46.00	-8.66	Average
4.	0.601	10.66	0.60	31.08	42.34	56.00	-13.66	QP
5.	0.624	10.66	0.60	27.13	38.39	46.00	-7.61	Average
6.	0.624	10.66	0.60	31.13	42.39	56.00	-13.61	QP
7.	0.826	10.66	0.60	17.48	28.74	46.00	-17.26	Average
8.	0.826	10.66	0.60	23.48	34.74	56.00	-21.26	QP
9.	1.147	10.68	0.60	15.04	26.32	46.00	-19.68	Average
10.	1.147	10.68	0.60	23.04	34.32	56.00	-21.68	QP
11.	1.908	10.70	0.60	15.22	26.52	46.00	-19.48	Average
12.	1.908	10.70	0.60	23.22	34.52	56.00	-21.48	QP

7 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	$2400/F(\text{kHz})$	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	$20\log^{(500)}$

7.1 EUT Operation

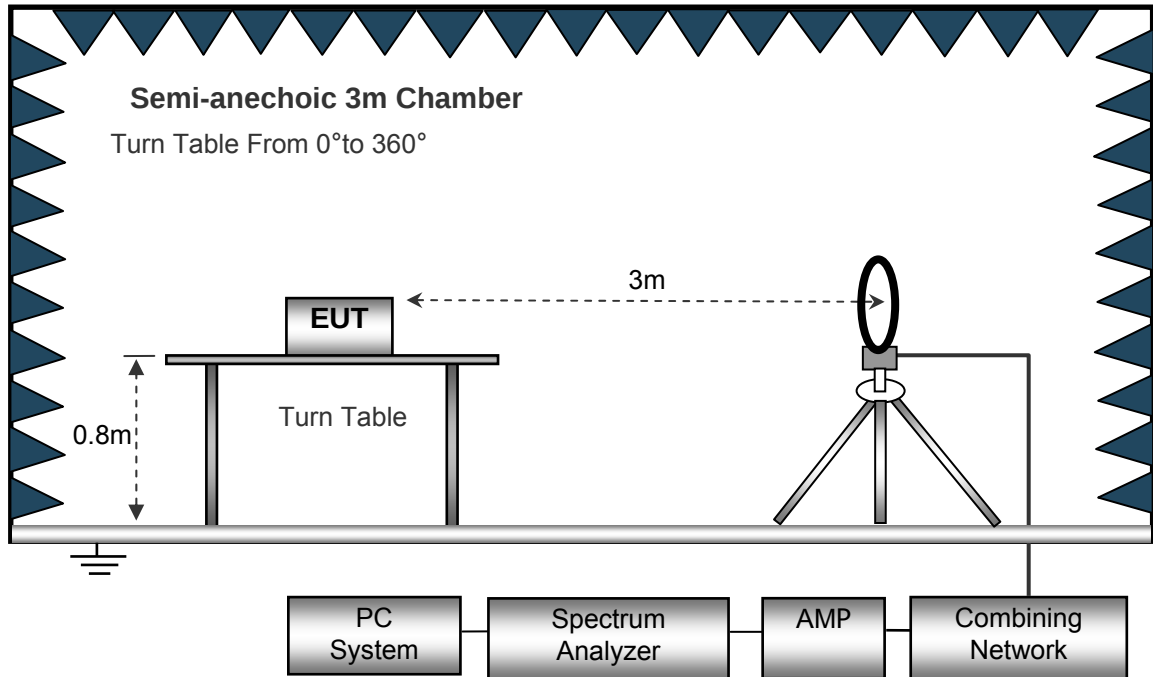
Operating Environment :

Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3
 Test Voltage : : DC 3.7V from Battery

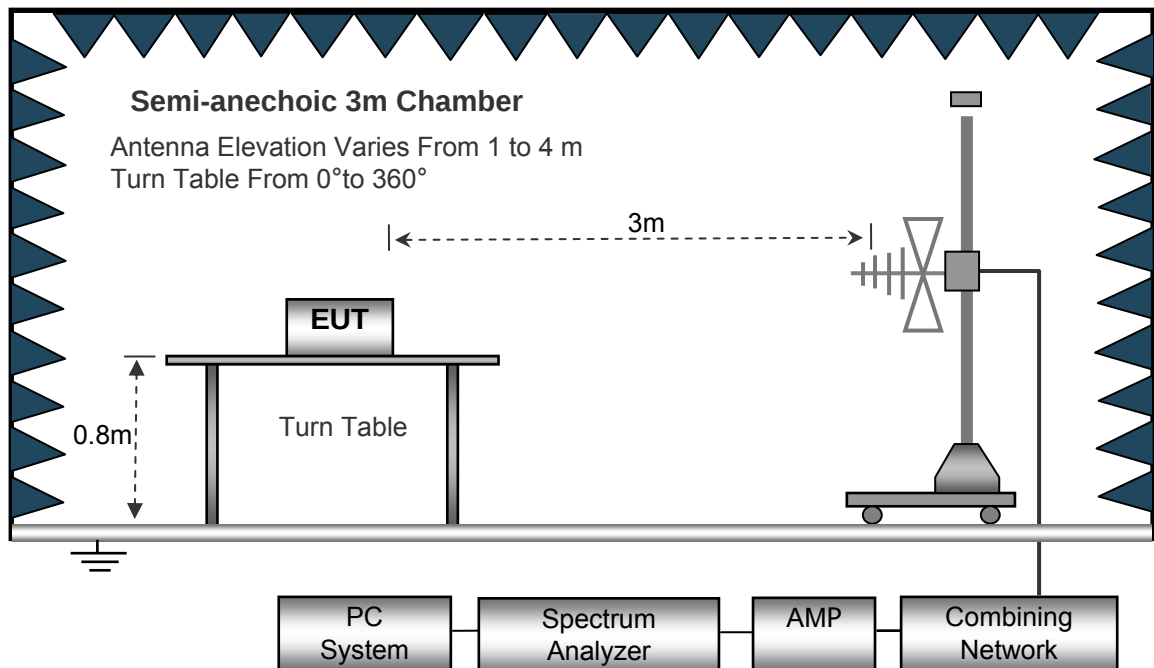
7.2 Test Setup

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

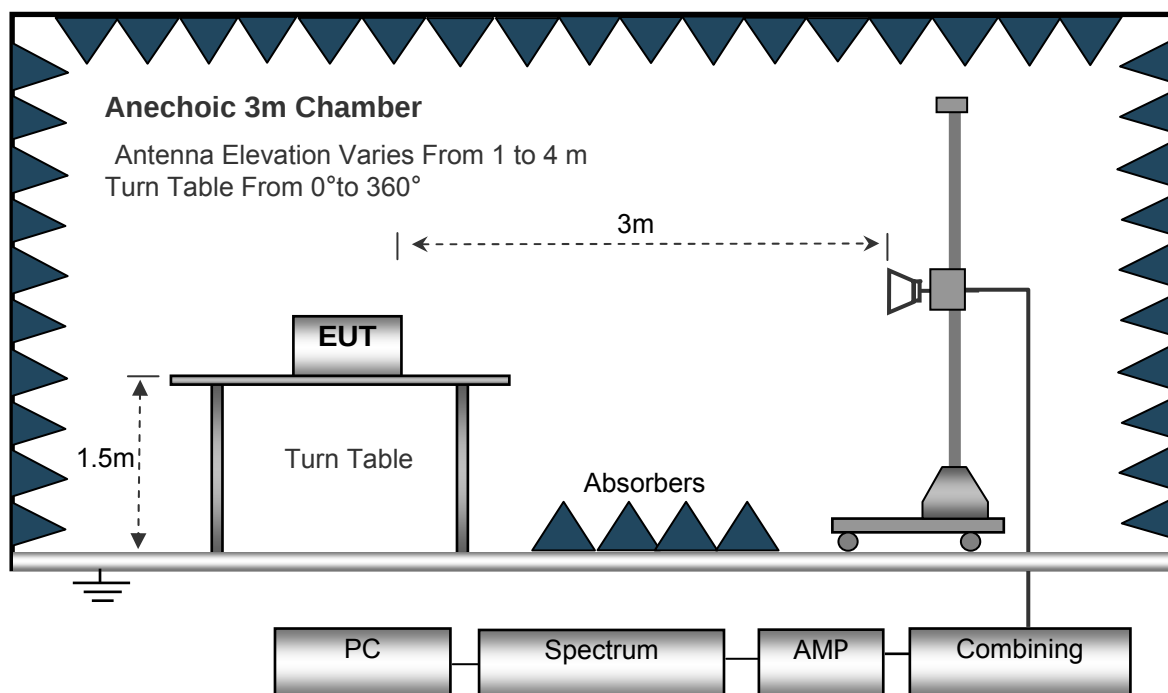
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 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

7.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m 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.

7.5 Summary of Test Results

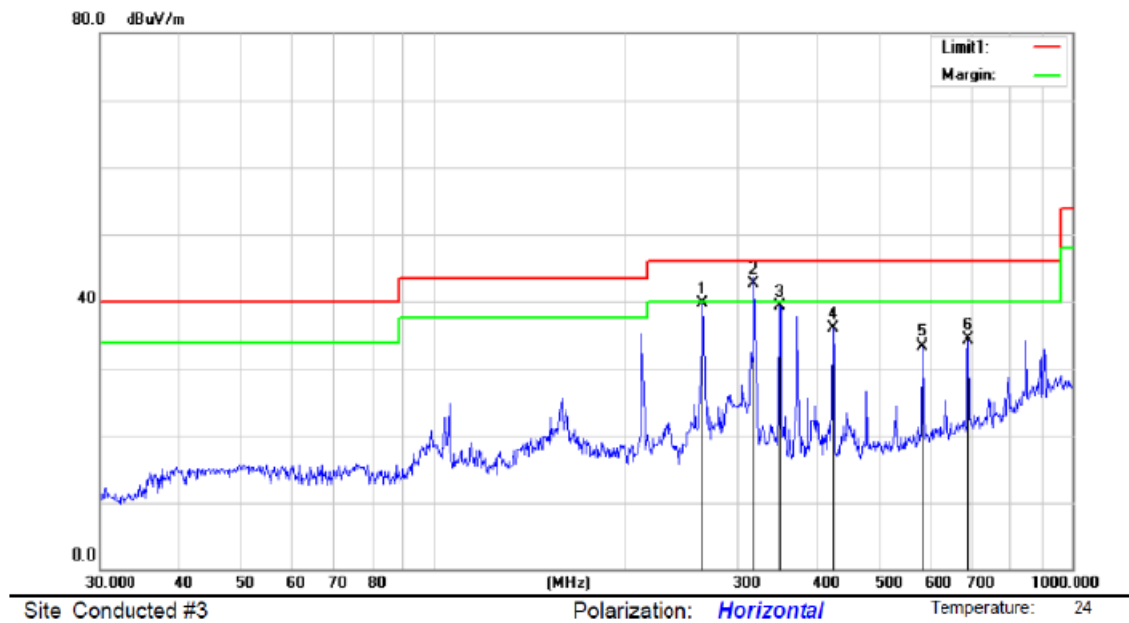
Test Frequency: Below 30MHz

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.

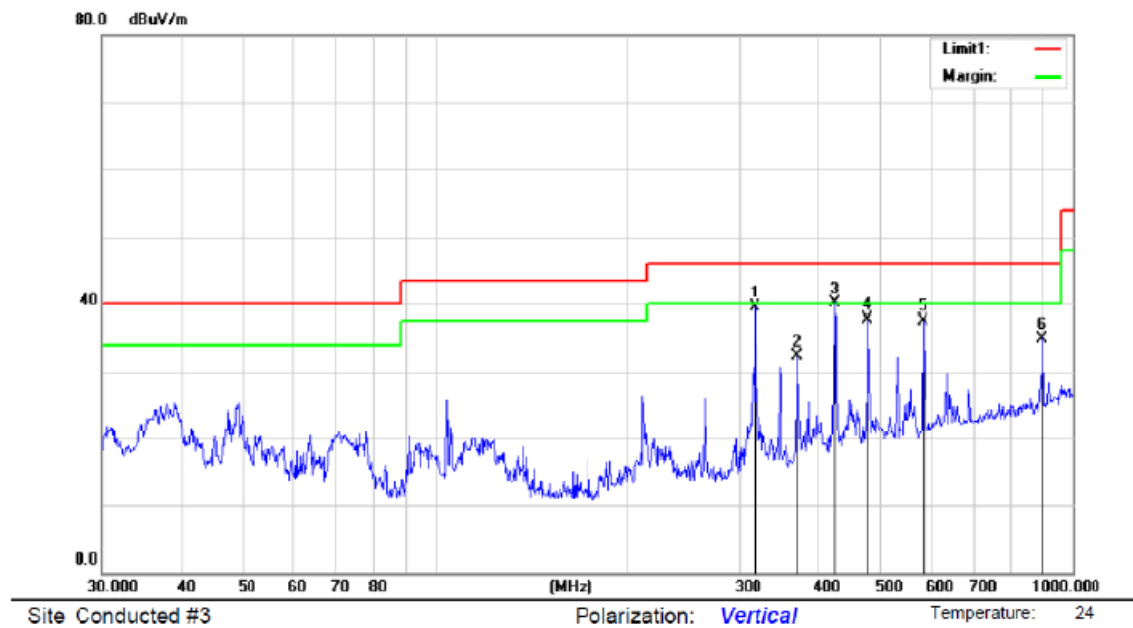
Test plot for Horizontal: GFSK(2402MHz)



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

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	264.7456	52.52	-12.88	39.64	46.00	-6.36	QP	0	
2 *	317.7010	54.15	-11.37	42.78	46.00	-3.22	QP	0	
3	348.0274	49.80	-10.42	39.38	46.00	-6.62	QP	0	
4	423.5402	45.12	-9.25	35.87	46.00	-10.13	QP	0	
5	582.7423	39.34	-6.13	33.21	46.00	-12.79	QP	0	
6	689.5643	38.72	-4.40	34.32	46.00	-11.68	QP	0	

Test plot for Vertical: GFSK(2402MHz)

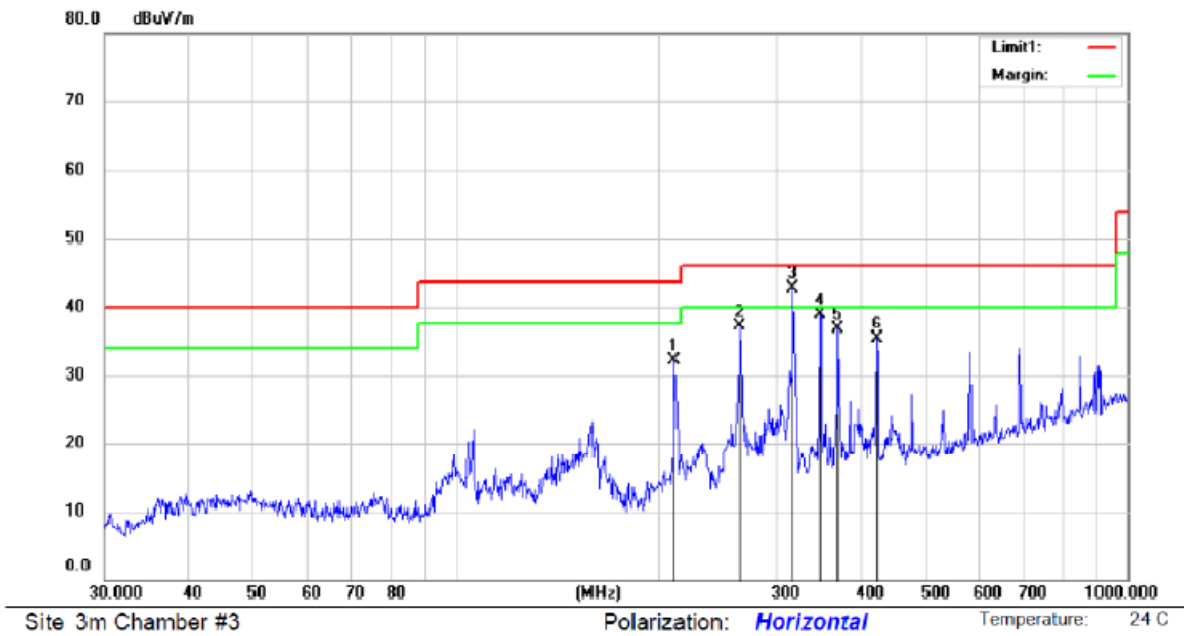


Remark:

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

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	317.7010	50.85	-11.37	39.48	46.00	-6.52	QP	0	
2	370.7022	42.65	-10.39	32.26	46.00	-13.74	QP	0	
3 *	423.5402	49.43	-9.25	40.18	46.00	-5.82	QP	0	
4	477.1693	45.75	-7.95	37.80	46.00	-8.20	QP	0	
5	582.7423	43.66	-6.13	37.53	46.00	-8.47	QP	0	
6	896.9963	36.59	-1.59	35.00	46.00	-11.00	QP	0	

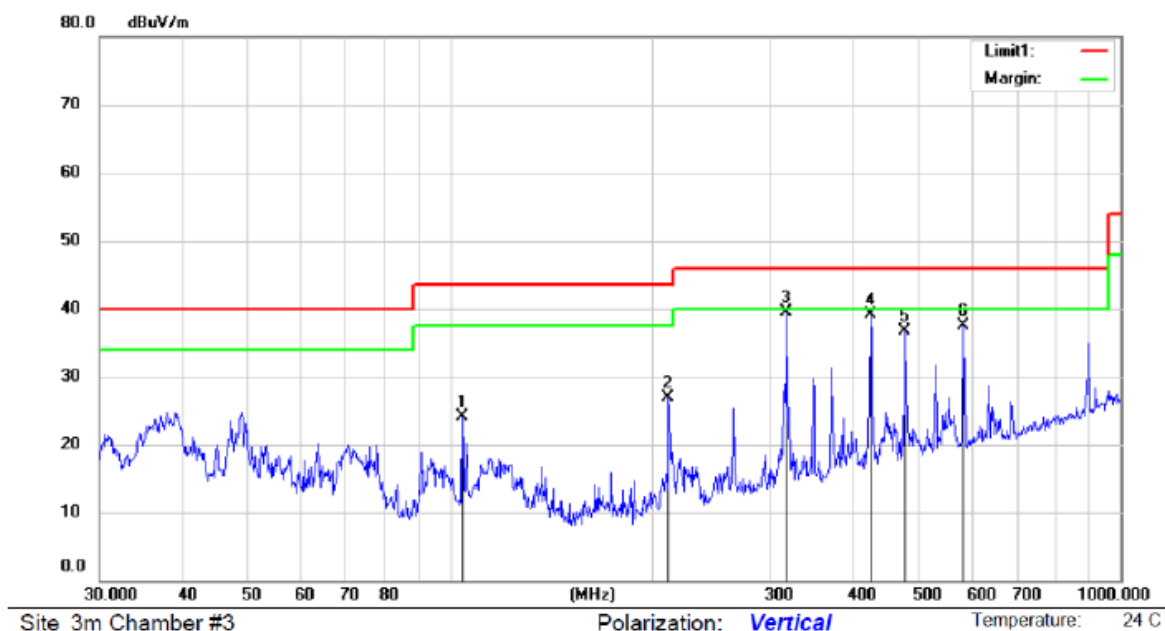
Test plot for Horizontal: GFSK(2441MHz)



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

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	211.5265	47.14	-14.94	32.20	43.50	-11.30	QP		
2	264.7457	50.02	-12.88	37.14	46.00	-8.86	QP		
3 *	317.7011	54.15	-11.37	42.78	46.00	-3.22	QP		
4	348.0274	49.30	-10.42	38.88	46.00	-7.12	QP		
5	370.7023	47.02	-10.39	36.63	46.00	-9.37	QP		
6	423.5403	44.62	-9.25	35.37	46.00	-10.63	QP		

Test plot for Vertical: GFSK(2441MHz)

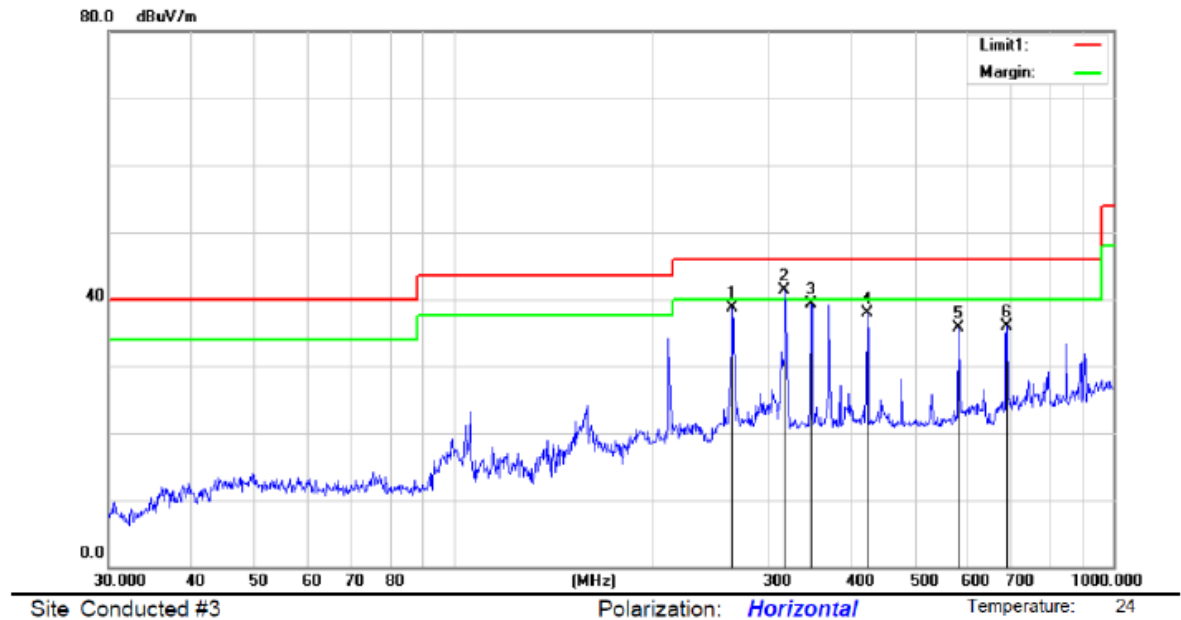


Remark:

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

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		104.1701	39.42	-15.31	24.11	43.50	-19.39	QP		
2		211.5265	41.75	-14.94	26.81	43.50	-16.69	QP		
3	*	317.7011	50.85	-11.37	39.48	46.00	-6.52	QP		
4		423.5403	48.43	-9.25	39.18	46.00	-6.82	QP		
5		477.1694	44.75	-7.95	36.80	46.00	-9.20	QP		
6		582.7425	43.66	-6.13	37.53	46.00	-8.47	QP		

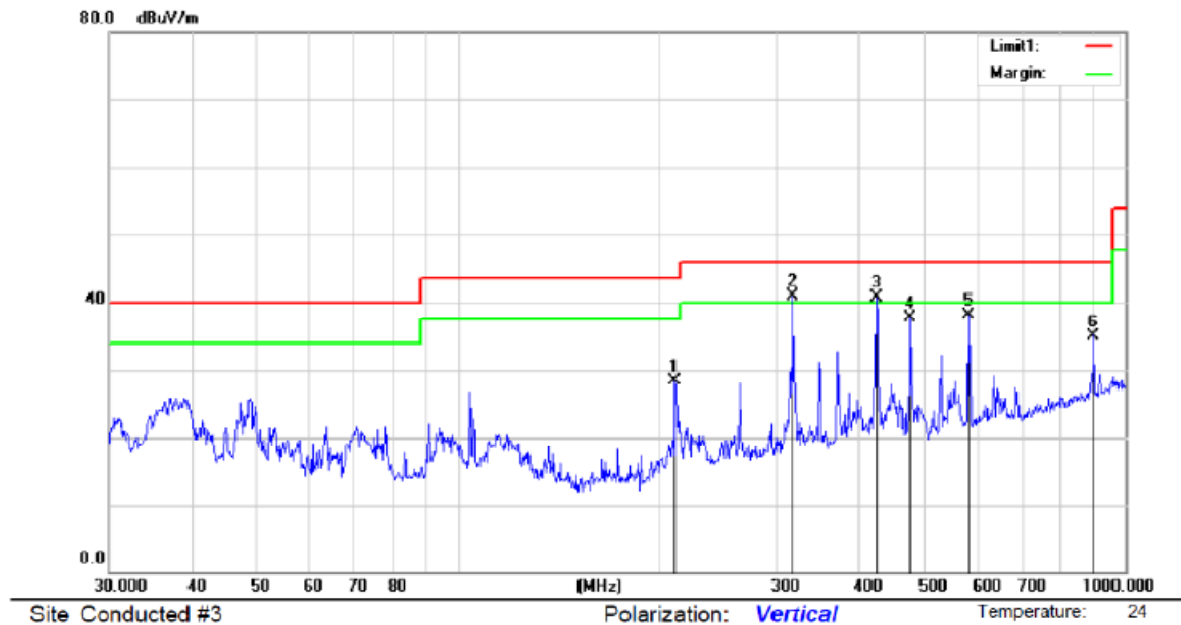
Test plot for Horizontal: GFSK(2480MHz)



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

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	264.7456	51.52	-12.88	38.64	46.00	-7.36	QP		0
2 *	317.7010	52.65	-11.37	41.28	46.00	-4.72	QP		0
3	348.0274	49.80	-10.42	39.38	46.00	-6.62	QP		0
4	423.5402	47.12	-9.25	37.87	46.00	-8.13	QP		0
5	582.7423	41.84	-6.13	35.71	46.00	-10.29	QP		0
6	689.5643	40.22	-4.40	35.82	46.00	-10.18	QP		0

Test plot for Vertical: GFSK(2480MHz)



Remark:

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

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	211.5261	43.25	-14.94	28.31	43.50	-15.19	QP	0	
2 *	317.7010	52.35	-11.37	40.98	46.00	-5.02	QP	0	
3 !	423.5402	49.93	-9.25	40.68	46.00	-5.32	QP	0	
4	477.1693	45.75	-7.95	37.80	46.00	-8.20	QP	0	
5	582.7423	44.16	-6.13	38.03	46.00	-7.97	QP	0	
6	896.9963	36.59	-1.59	35.00	46.00	-11.00	QP	0	

Test Frequency: Above 1000MHz~10th Harmonics:

Operation Mode: GFSK (CH00: 2402MHz) Test Date : 2017-06-08

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4804	H	64.85	43.62	74	54	-9.15	-10.38
7206	H	63.25	42.15	74	54	-10.75	-11.85
9608	H	62.15	41.9	74	54	-11.85	-12.1
12010	H	61.04	40.82	74	54	-12.96	-13.18
14412	H	60.36	39.55	74	54	-13.64	-14.45
16814	H	59.34	38.45	74	54	-14.66	-15.55
4804	V	64.83	44.62	74	54	-9.17	-9.38
7206	V	63.26	43.62	74	54	-10.74	-10.38
9608	V	62.14	42.16	74	54	-11.86	-11.84
12010	V	61.41	41.05	74	54	-12.59	-12.95
14412	V	60.95	40.92	74	54	-13.05	-13.08
16814	V	59.37	39.55	74	54	-14.63	-14.45

Operation Mode: GFSK (CH39: 2441MHz) Test Date : 2017-06-08

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4882	H	65.33	45.14	74	54	-8.67	-8.86
7323	H	64.15	44.05	74	54	-9.85	-9.95
9764	H	63.28	43.62	74	54	-10.72	-10.38
12205	H	61.04	42.15	74	54	-12.96	-11.85
14646	H	60.69	41.04	74	54	-13.31	-12.96
17087	H	59.47	40.69	74	54	-14.53	-13.31
4882	V	64.35	45.62	74	54	-9.65	-8.38
7323	V	63.15	44.15	74	54	-10.85	-9.85
9764	V	62.05	43.62	74	54	-11.95	-10.38
12205	V	61.47	42.04	74	54	-12.53	-11.96
14646	V	60.62	41.57	74	54	-13.38	-12.43
17087	V	59.34	40.69	74	54	-14.66	-13.31

Operation Mode: GFSK (CH78: 2480MHz) Test Date : 2017-06-08

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4960	H	65.96	44.35	74	54	-8.04	-9.65
7440	H	64.15	43.62	74	54	-9.85	-10.38
9920	H	63.05	42.15	74	54	-10.95	-11.85
12400	H	62.14	41.04	74	54	-11.86	-12.96
14880	H	61	40.69	74	54	-13	-13.31
17360	H	60.25	39.85	74	54	-13.75	-14.15
4960	V	64.69	45.16	74	54	-9.31	-8.84
7440	V	63.15	44.22	74	54	-10.85	-9.78
9920	V	62.05	43.62	74	54	-11.95	-10.38
12400	V	61.85	42.15	74	54	-12.15	-11.85
14880	V	60.33	41.07	74	54	-13.67	-12.93
17360	V	59.4	40.58	74	54	-14.6	-13.42

Note:

- 1) Scan with GFSK, $\pi/4$ -DQPSK, 8DPSK, the worst case is GFSK Mode
- 2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor

8 CONDUCTED BAND EDGE EMISSION

8.1 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.

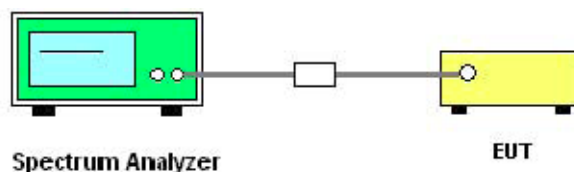
8.2 TEST PROCEDURE

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

8.3 TEST SETUP



1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

8.4 EUT OPERATION CONDITIONS

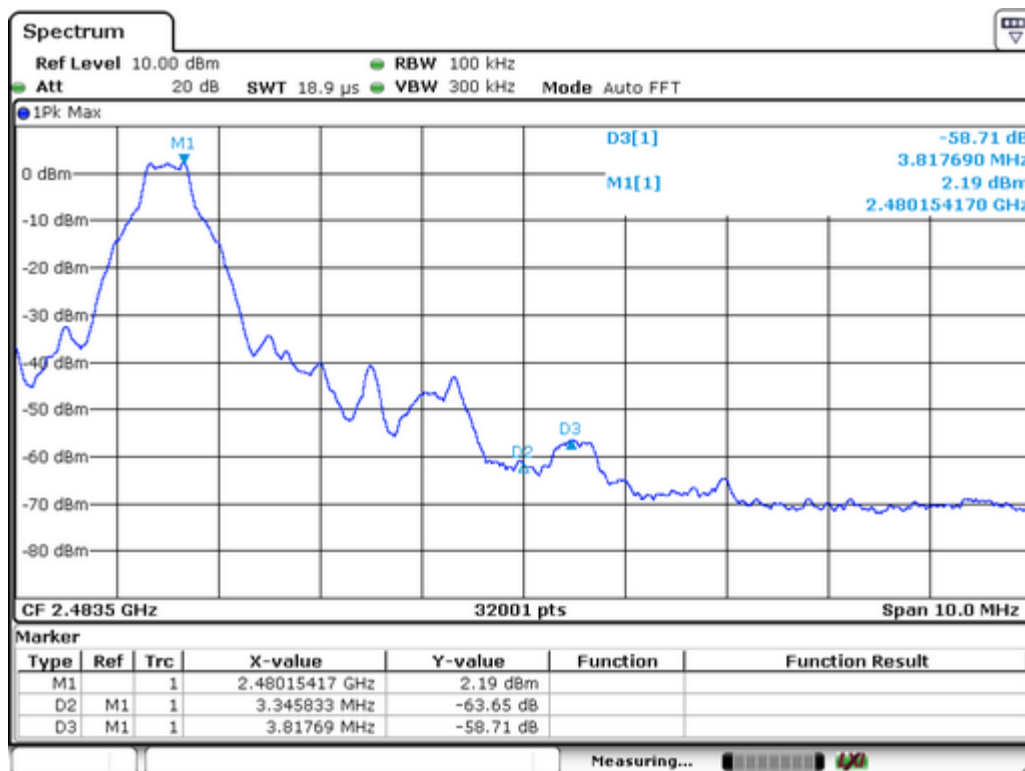
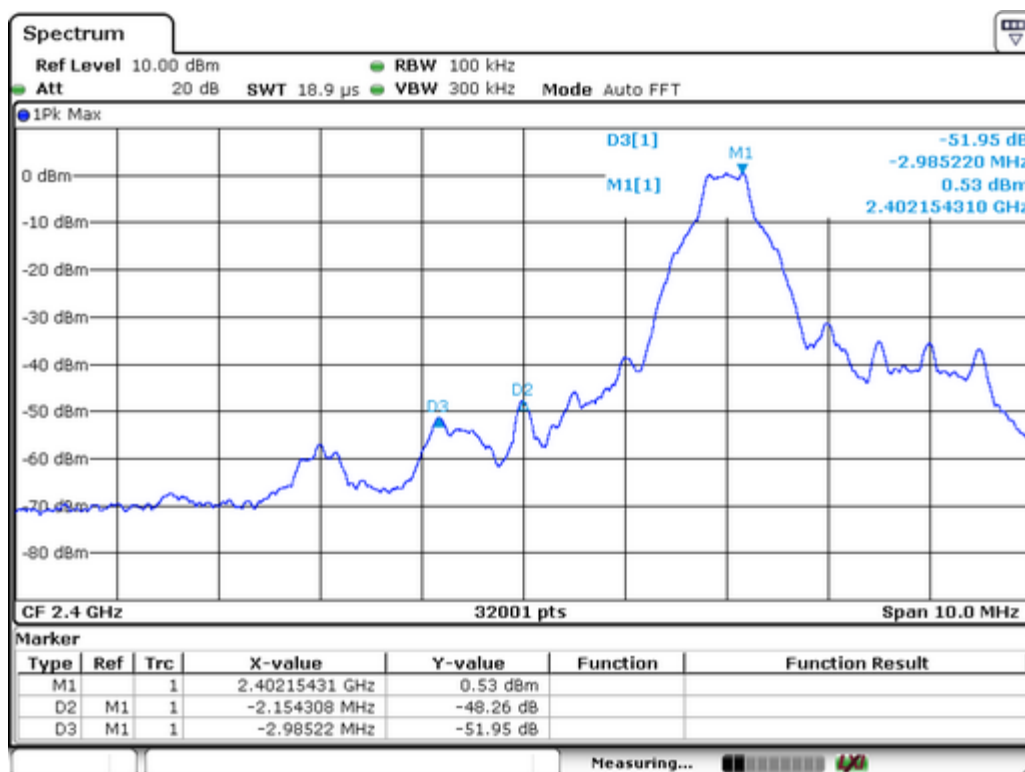
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

8.5 TEST RESULTS

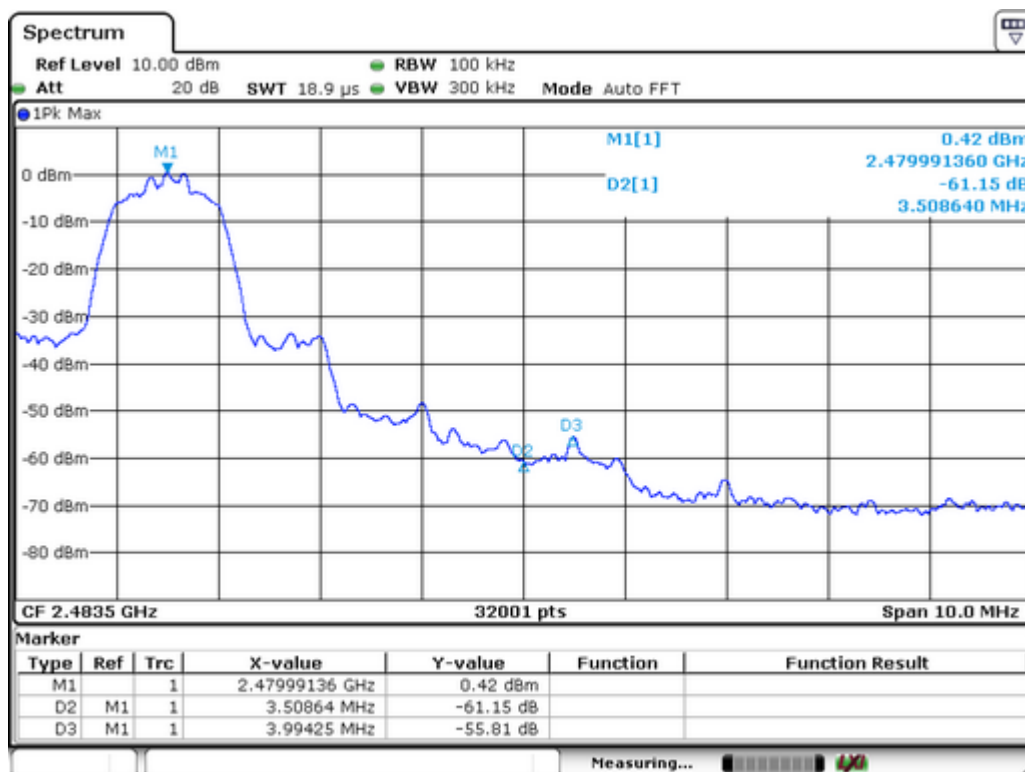
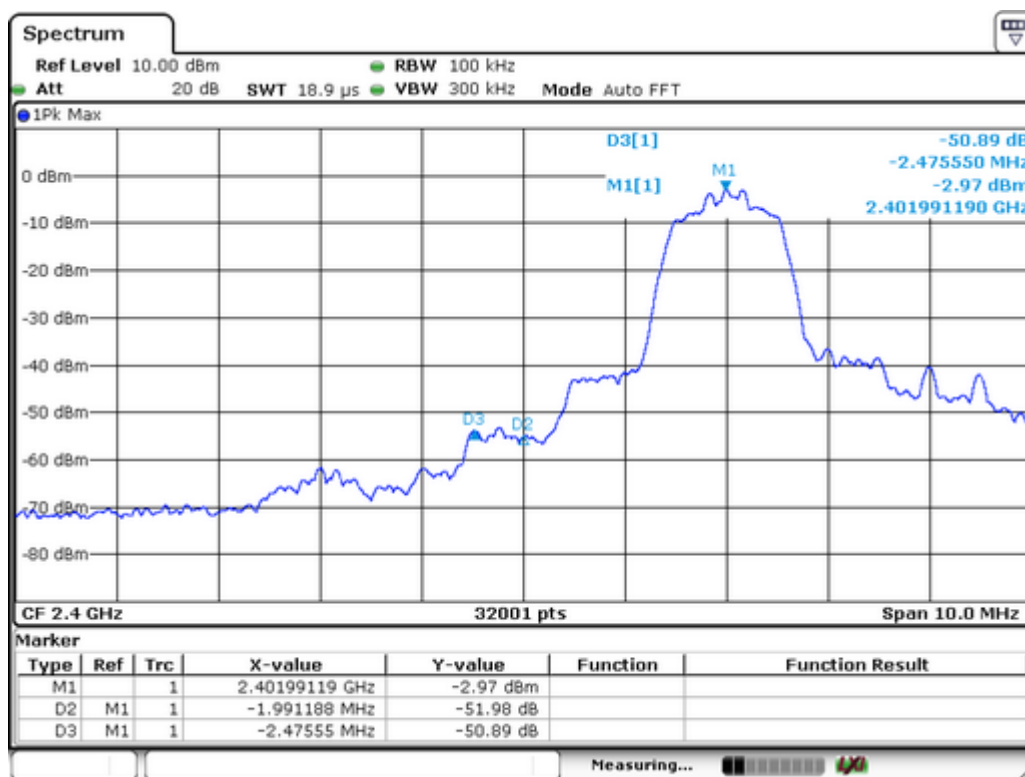
For Non-Hopping Mode:

Frequency(MHz)	Modulation	Peak Power Output (dBm)	Emission Read Value (dBm)	Result of Band edge (dBc)	Band Edge Limit (dBc)
2399.169	GFSK	0.53	-51.42	51.95	>20dBc
2399.516	$\pi/4$ -DQPSK	-2.97	-53.86	50.89	>20dBc
2399.534	8DPSK	-2.87	-54.96	52.09	>20dBc
2483.971	GFSK	2.19	-56.52	58.71	>20dBc
2483.499	$\pi/4$ -DQPSK	0.42	-60.73	61.15	>20dBc
2483.499	8DPSK	0.5	-59.81	60.31	>20dBc

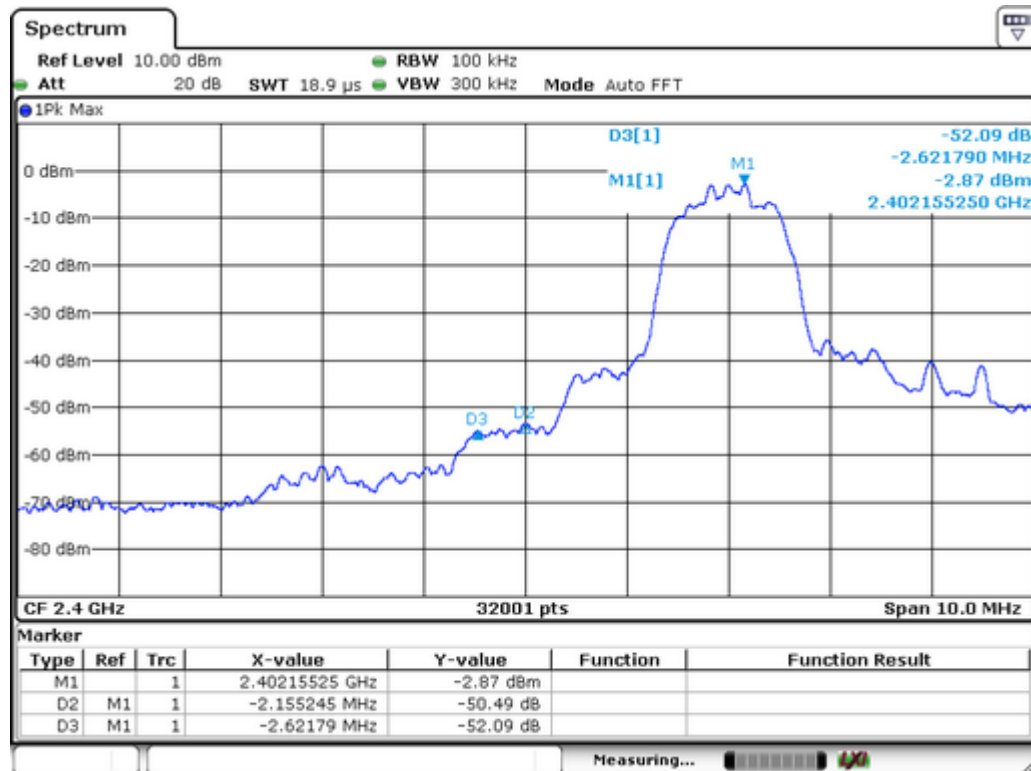
GFSK



$\pi/4$ -DQPSK



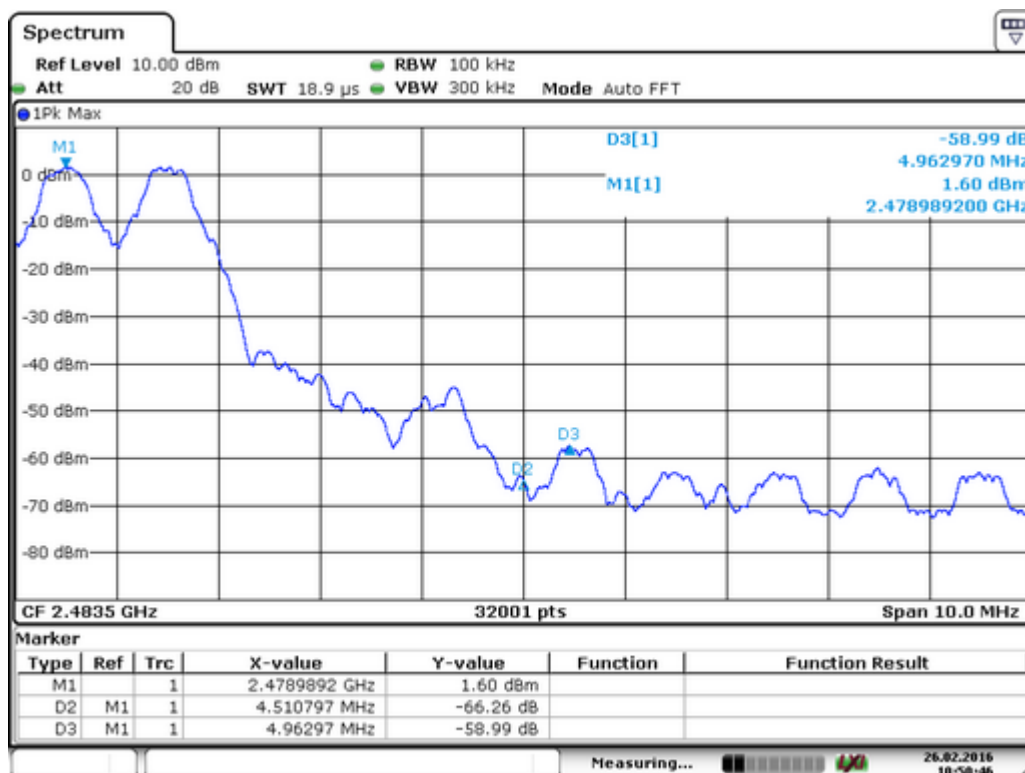
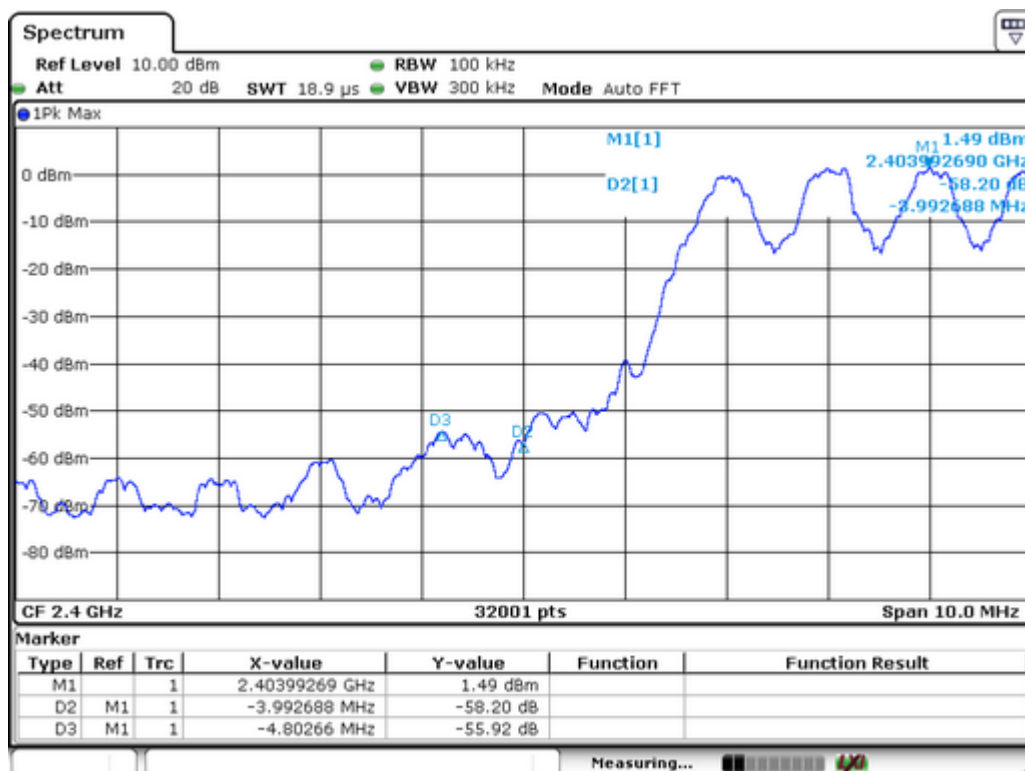
8DPSK



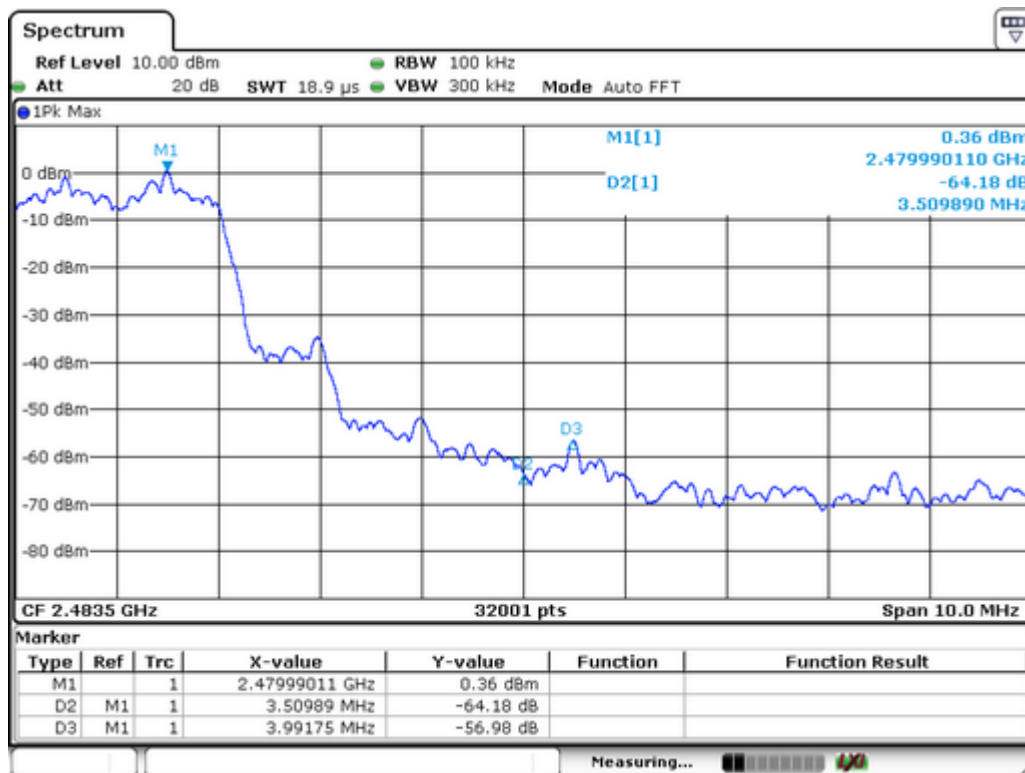
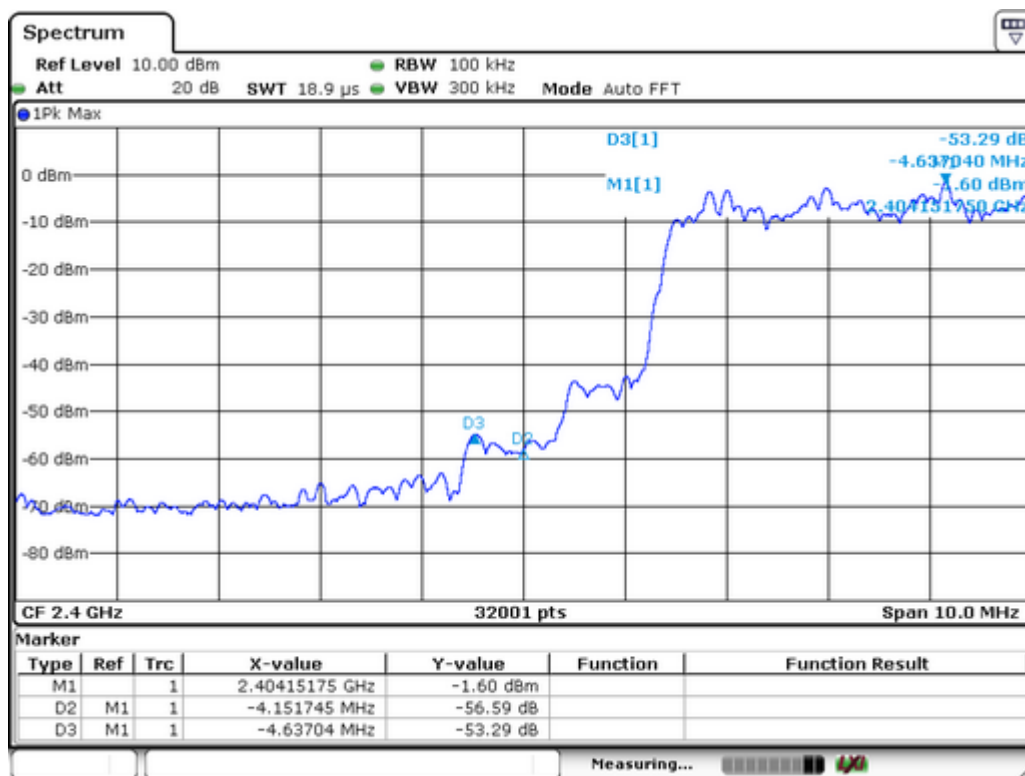
For Hopping Mode:

Frequency(MHz)	Modulation	Peak Power Output (dBm)	Emission Read Value (dBm)	Result of Band edge (dBc)	Band Edge Limit (dBc)
2400	GFSK	1.49	-56.71	58.2	>20dBc
2399.52	$\pi/4$ -DQPSK	-1.60	-54.89	53.29	>20dBc
2399.675	8DPSK	-2.90	-55.19	52.29	>20dBc
2483.951	GFSK	1.60	-57.39	58.99	>20dBc
2483.499	$\pi/4$ -DQPSK	0.36	-63.82	64.18	>20dBc
2484.407	8DPSK	0.17	-57.71	57.88	>20dBc

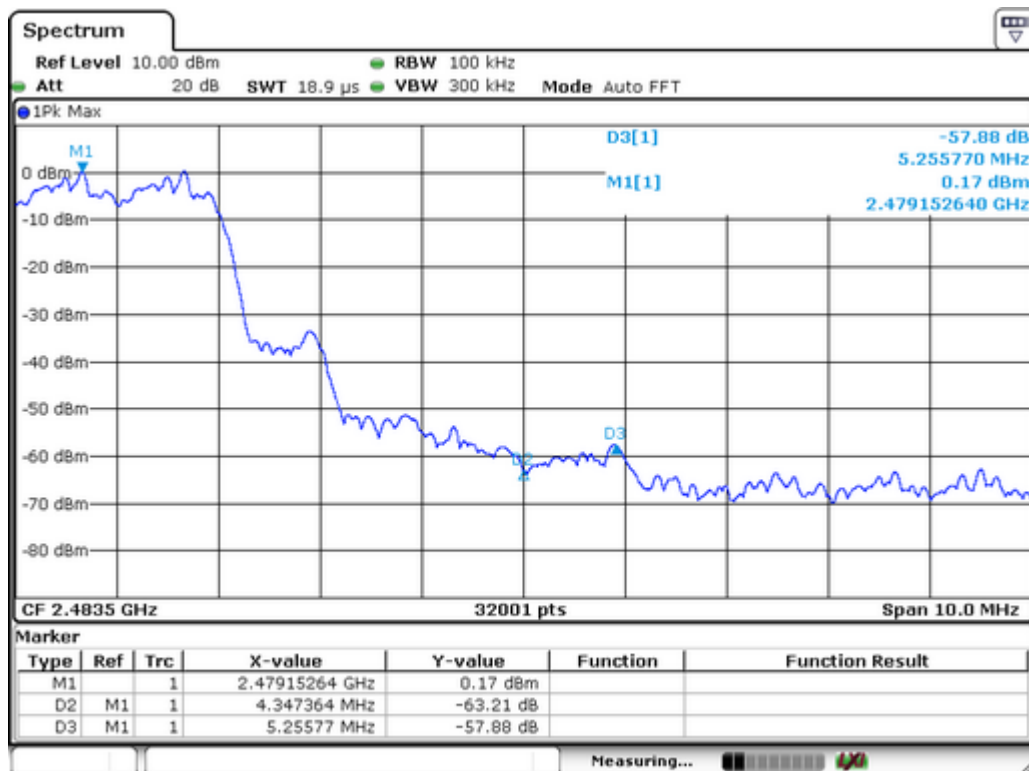
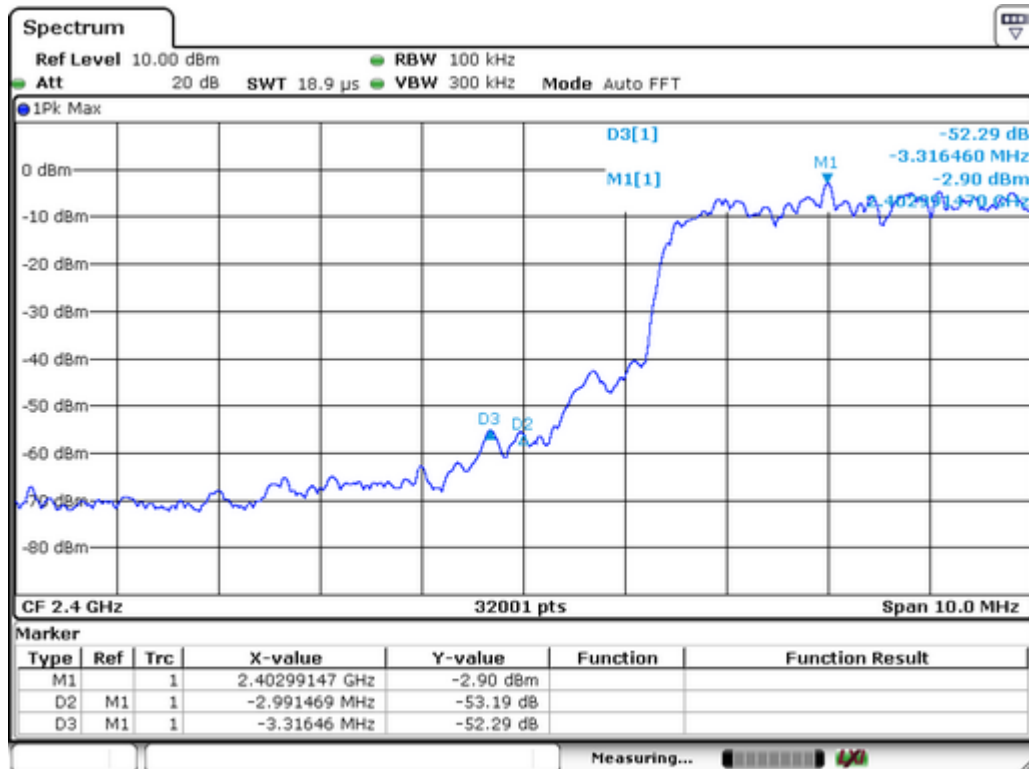
GFSK



$\pi/4$ -DQPSK



8DPSK



9 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

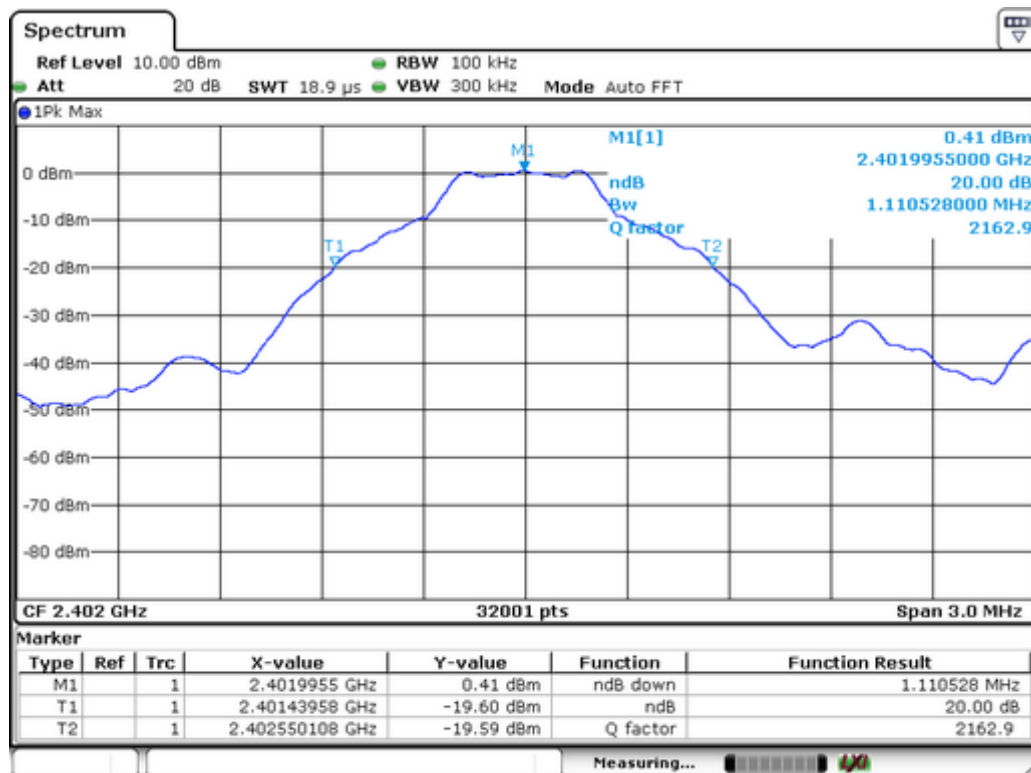
9.1 Test Procedure

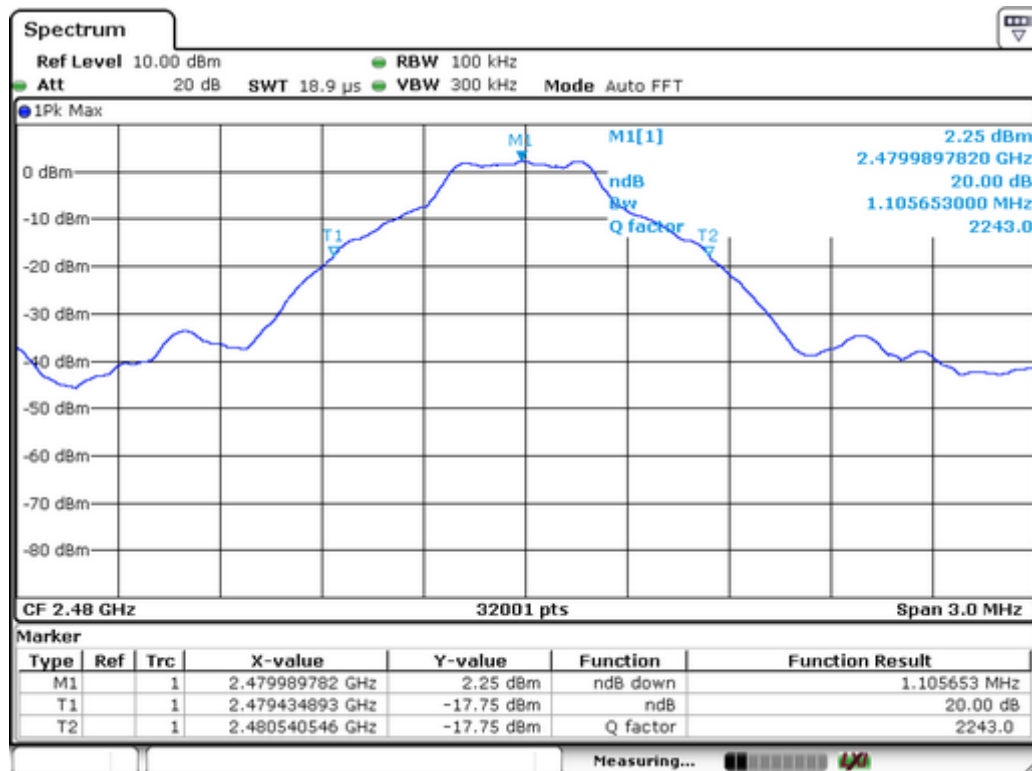
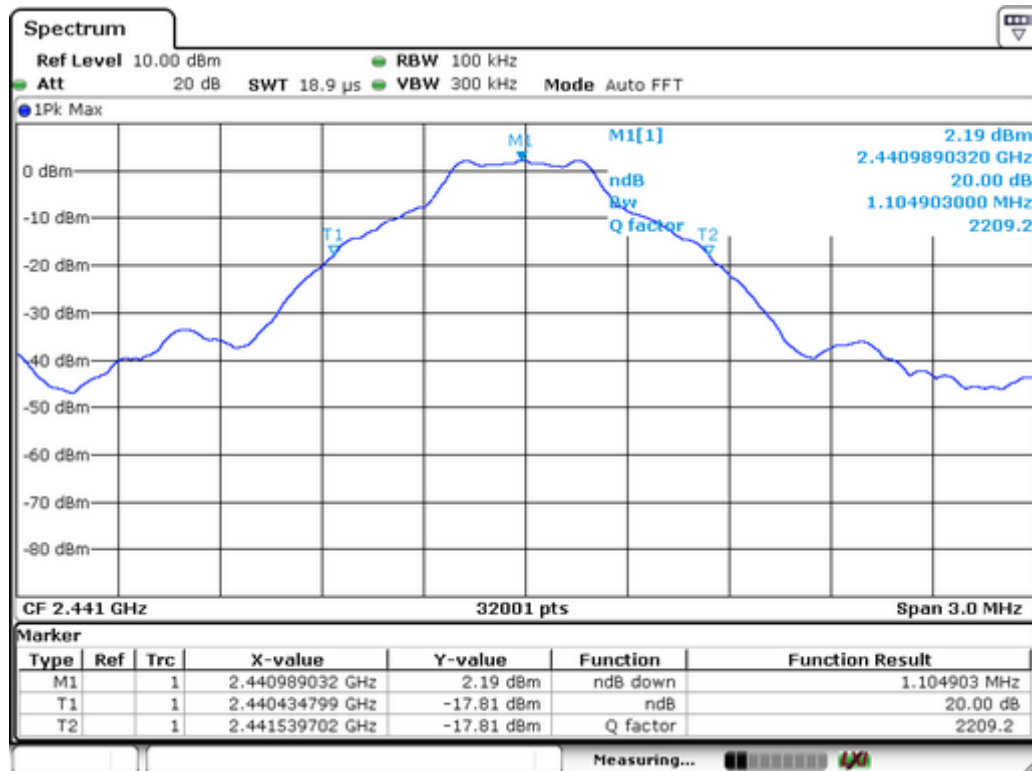
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

9.2 Test Result

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

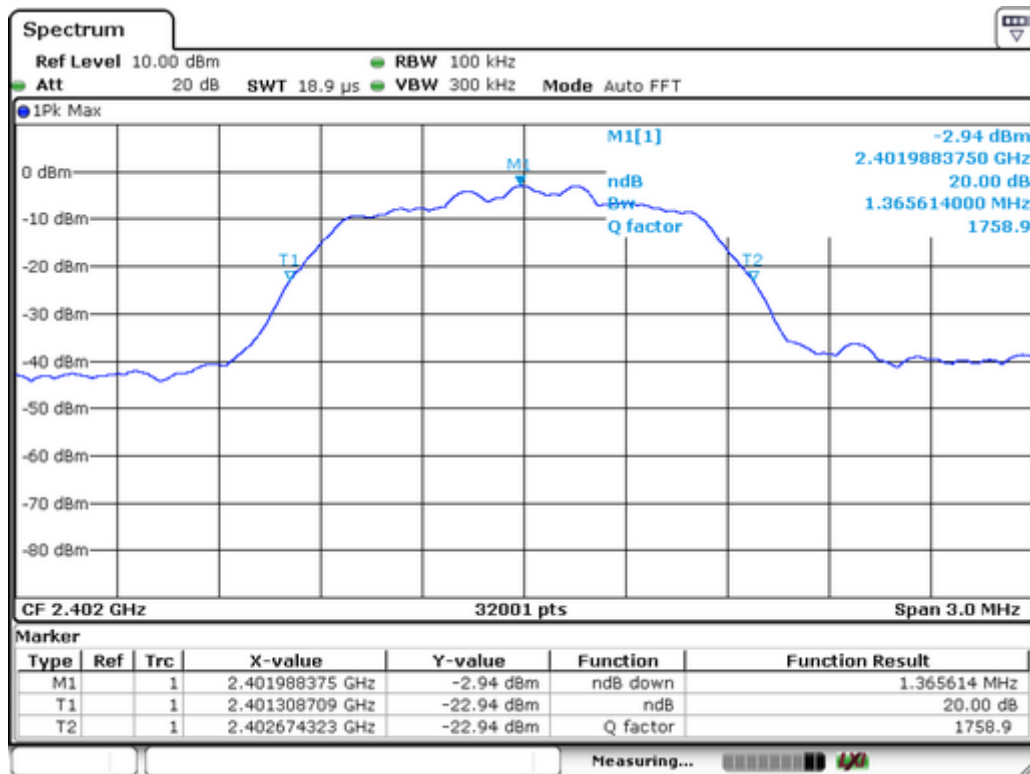
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1111
39	2441	1105
78	2480	1106

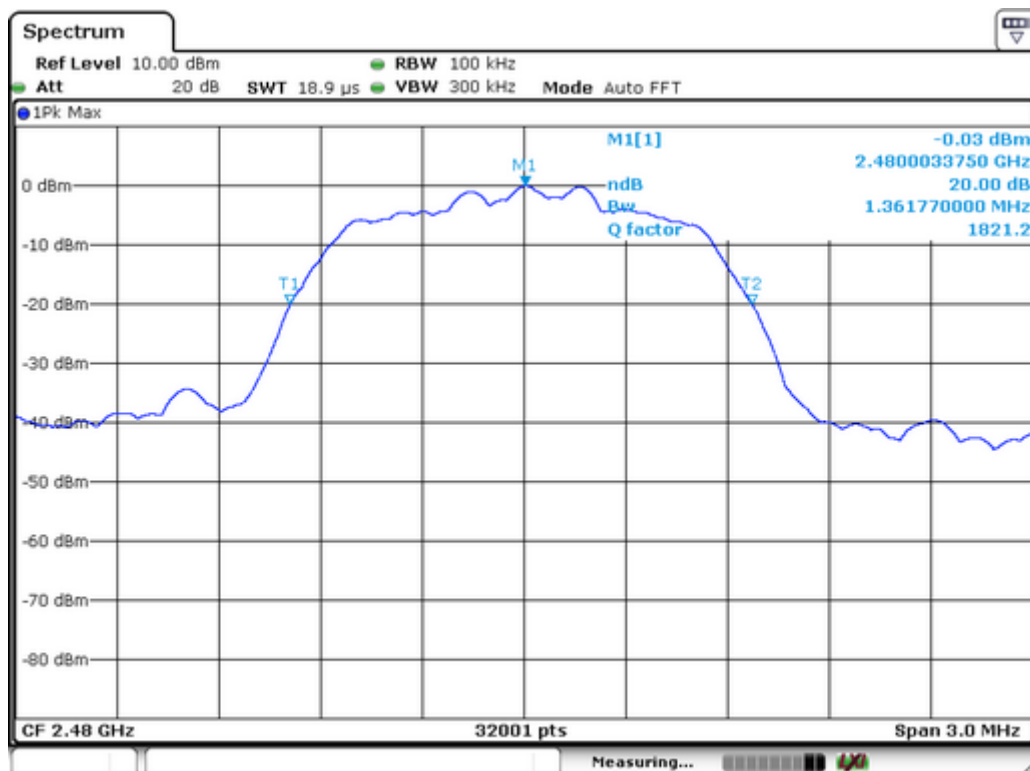
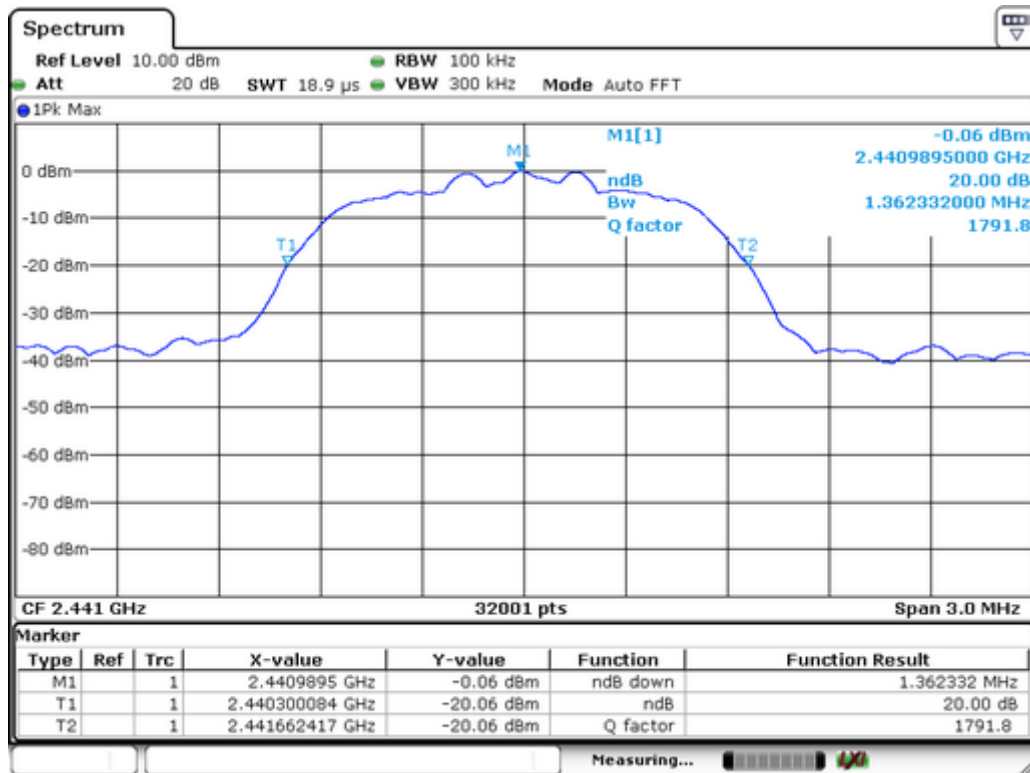




Test Mode: CH00 / CH39 / CH78 ($\pi/4$ -DQPSK / (2Mbps)Mode)

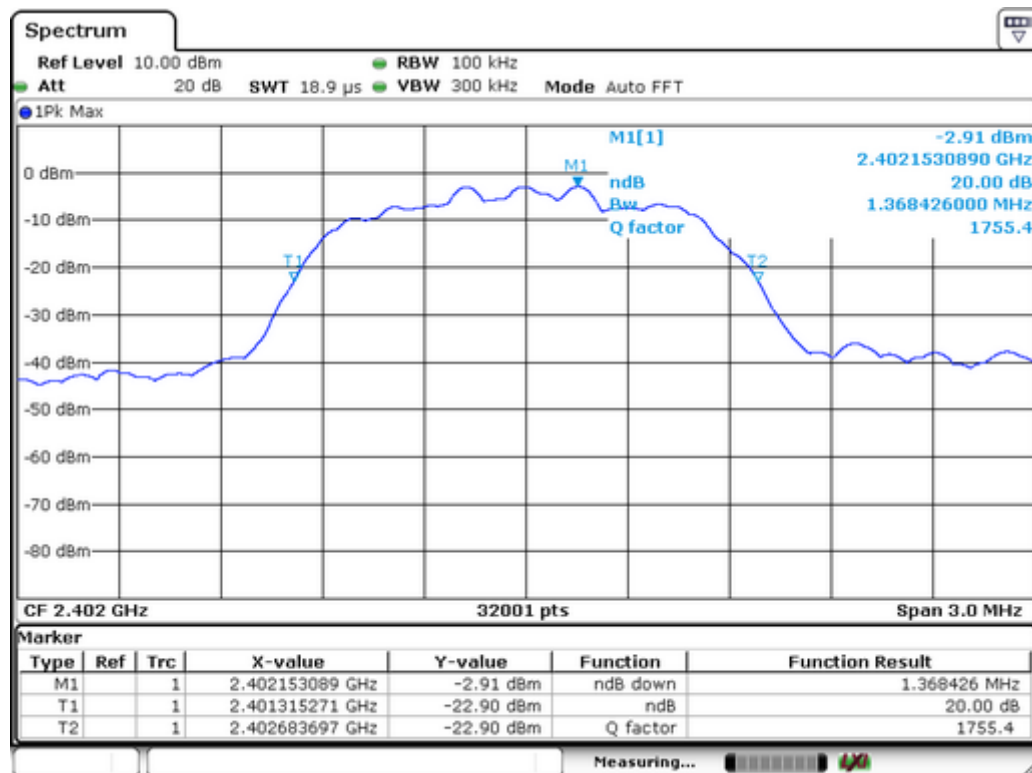
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1366
39	2441	1362
78	2480	1362

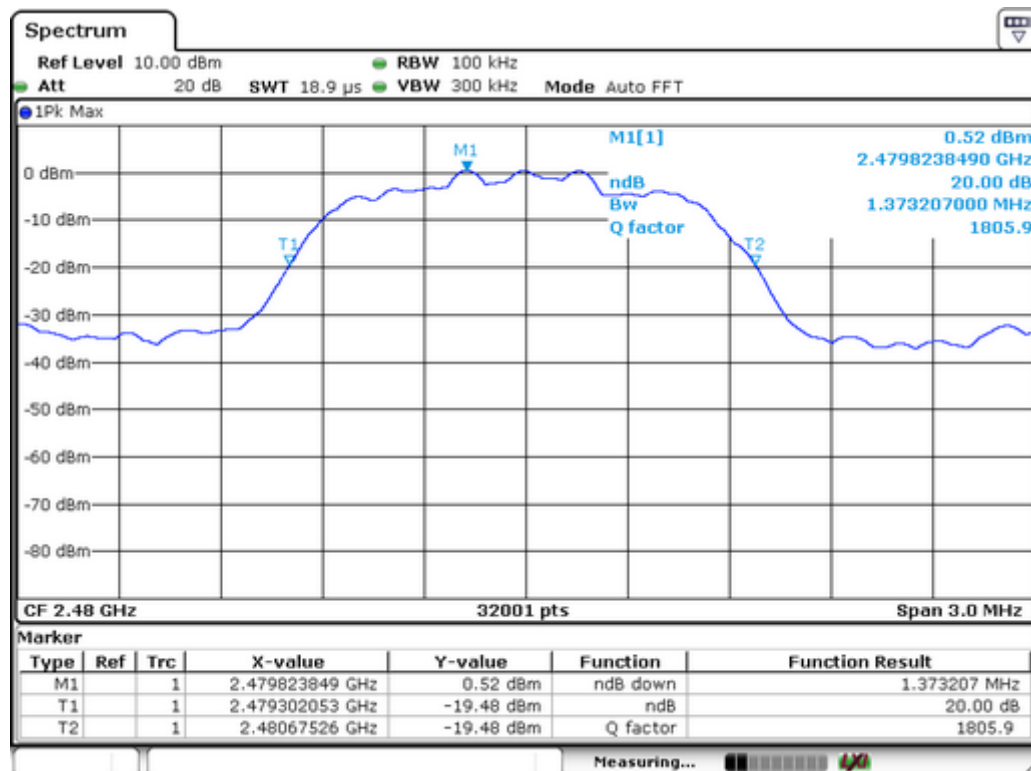
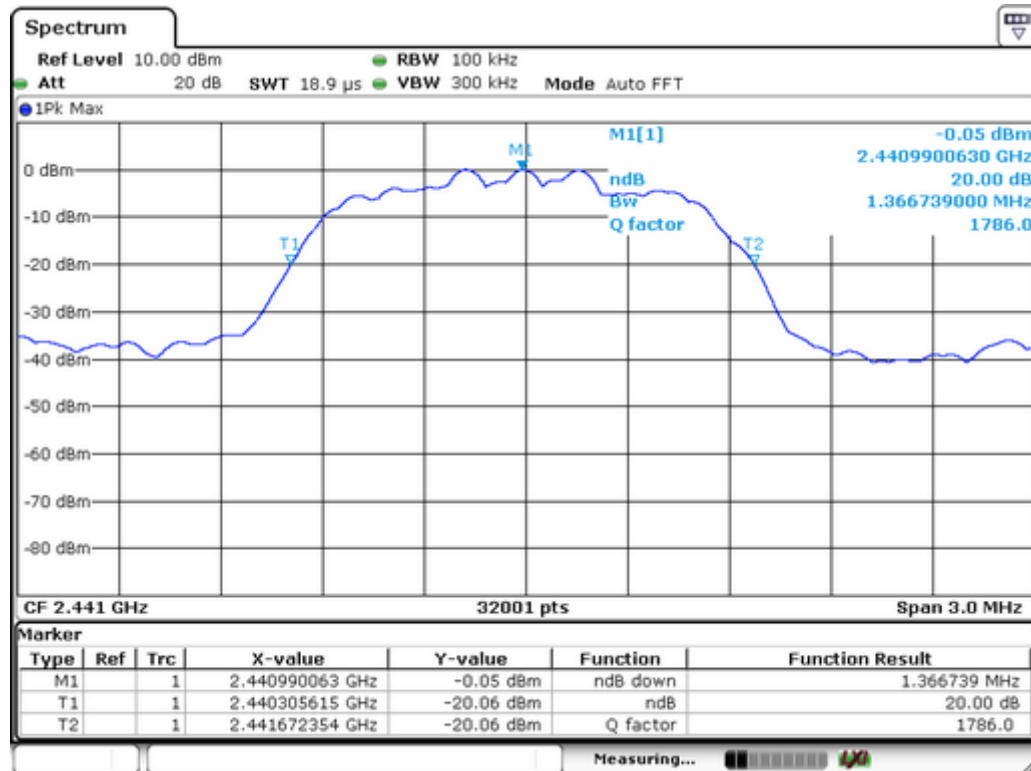




Test Mode: CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2402	1368
39	2441	1367
78	2480	1373





10 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

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

GFSK(1Mbps)					
Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	0.74	1.19	1000	Pass
CH39	2441	2.25	1.68	1000	Pass
CH78	2480	2.29	1.69	1000	Pass

$\pi/4$ QPSK(2Mbps)

Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	-1.69	0.68	125	Pass
CH39	2441	0.94	1.24	125	Pass
CH78	2480	1.21	1.32	125	Pass

8DPSK(3Mbps)

Test Channel	Frequency	Conducted Output Peak Power	Conducted Output Peak Power	LIMIT	Pass/Fail
	(MHz)	(dBm)	(mW)	(mW)	
CH00	2402	-1.19	0.76	125	Pass
CH39	2441	1.17	1.31	125	Pass
CH78	2480	1.36	1.37	125	Pass

11 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

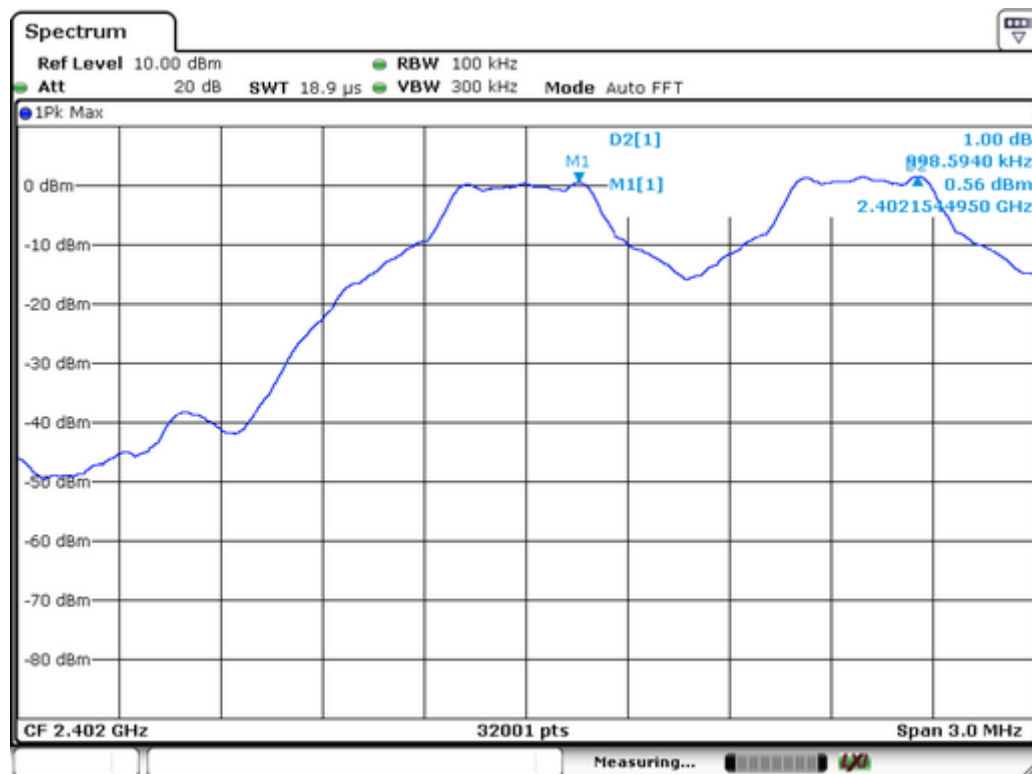
11.1 Test Procedure

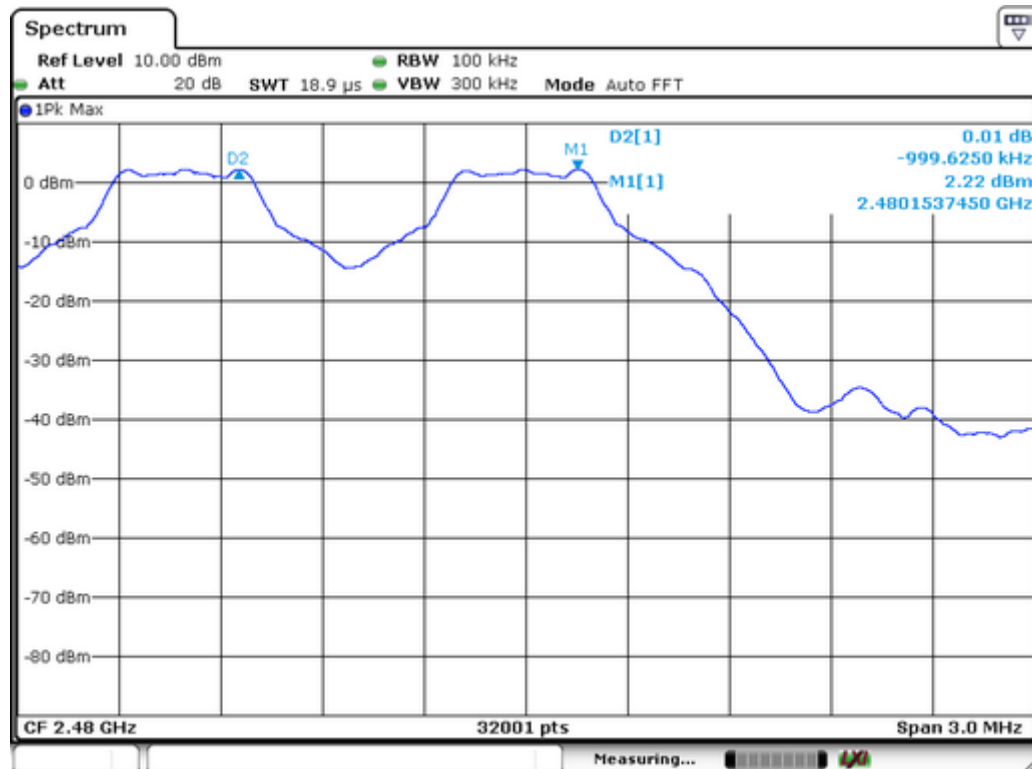
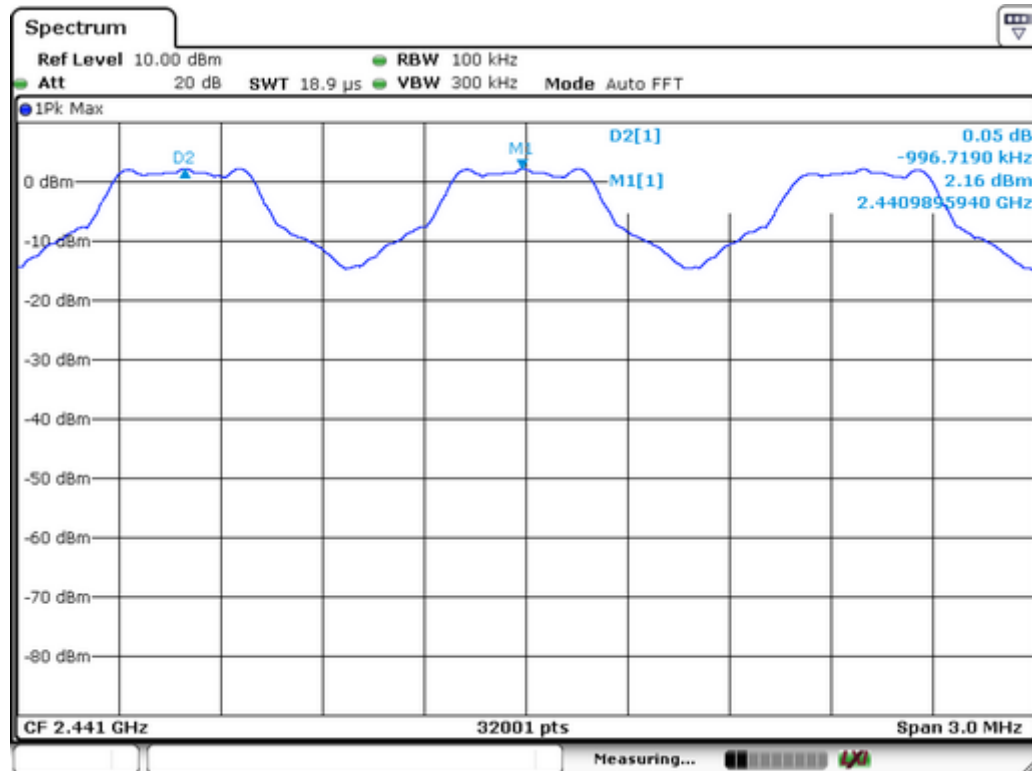
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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

Test Mode:	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)
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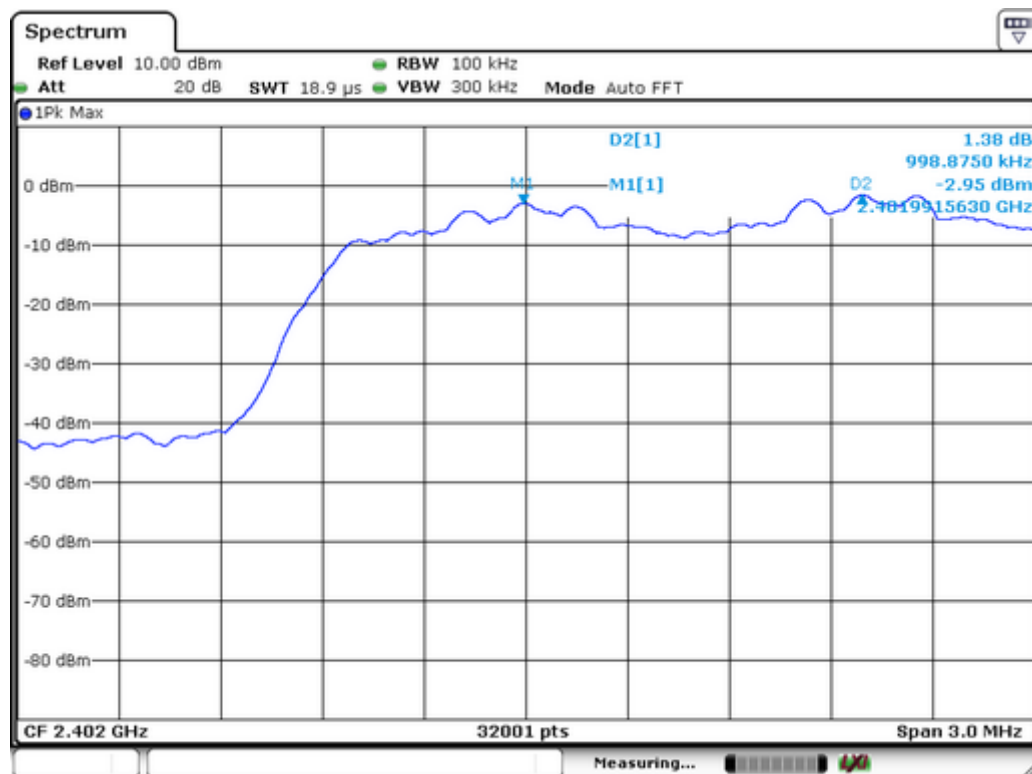
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
1	2402	899	>740
40	2441	997	>736
79	2480	1000	>737

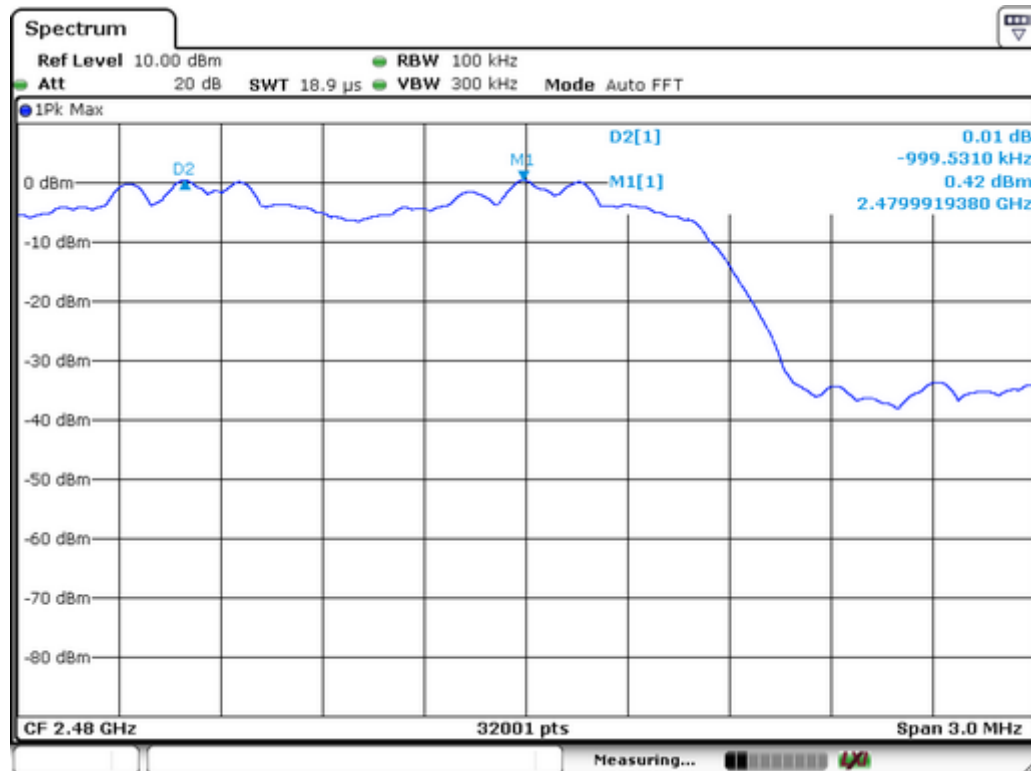
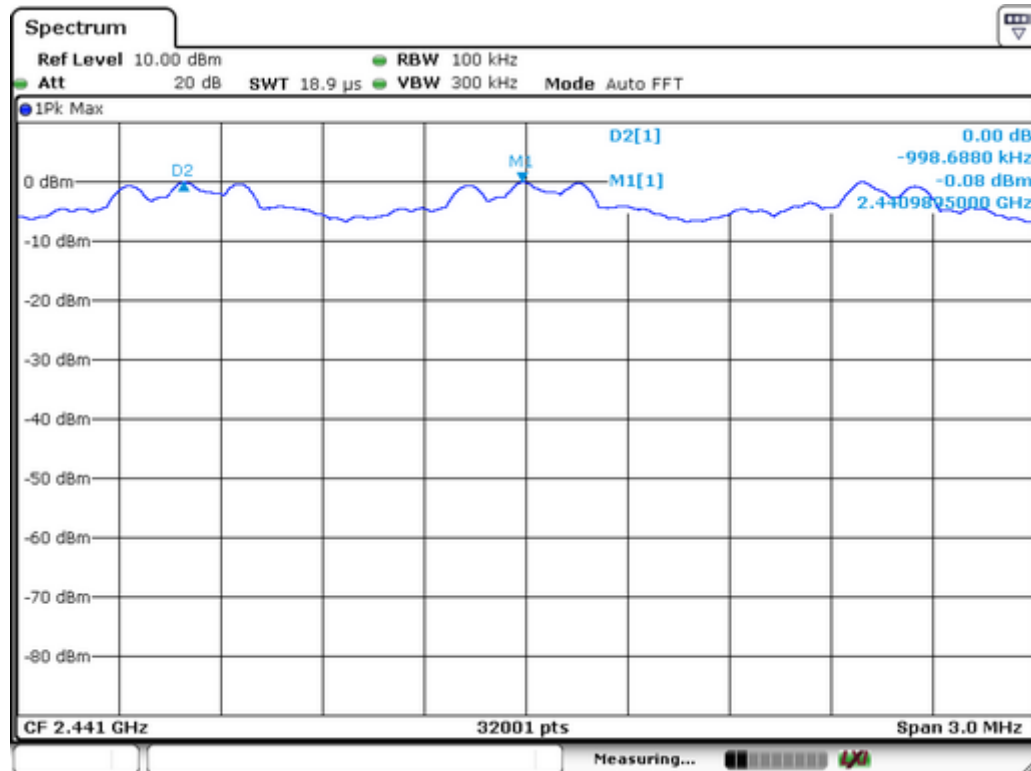




Test Mode:	CH00 / CH39 / CH78 ($\pi/4$ -DQPSK(2Mbps) Mode)
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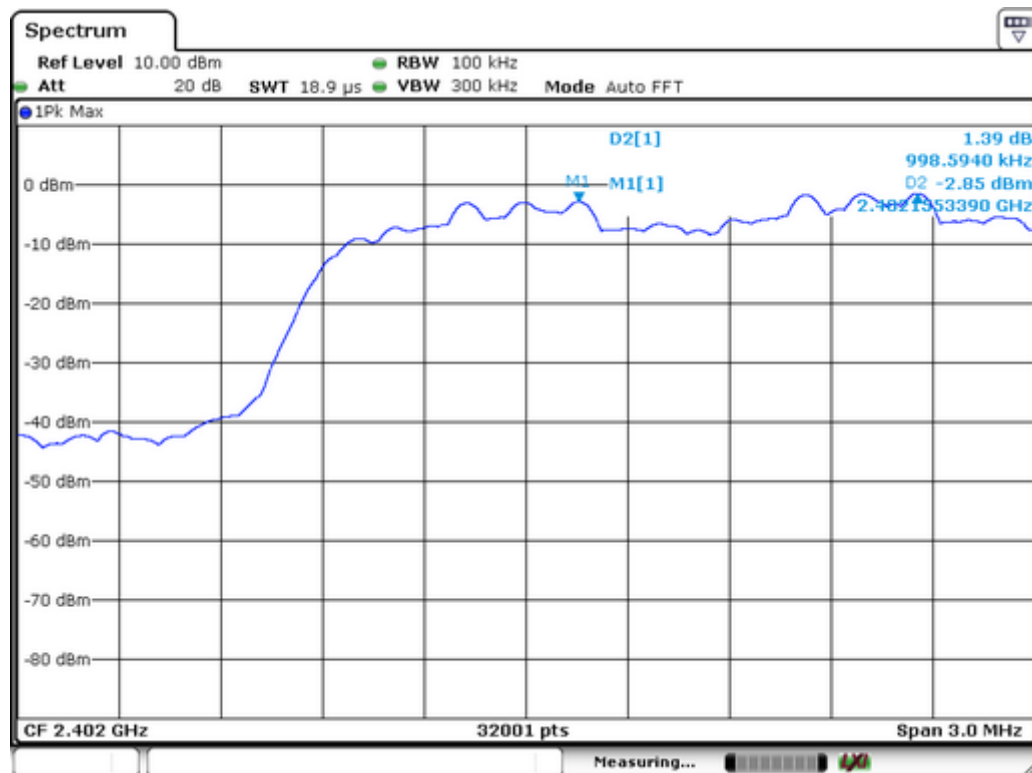
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	999	>910
40	2441	999	>907
79	2480	1000	>908

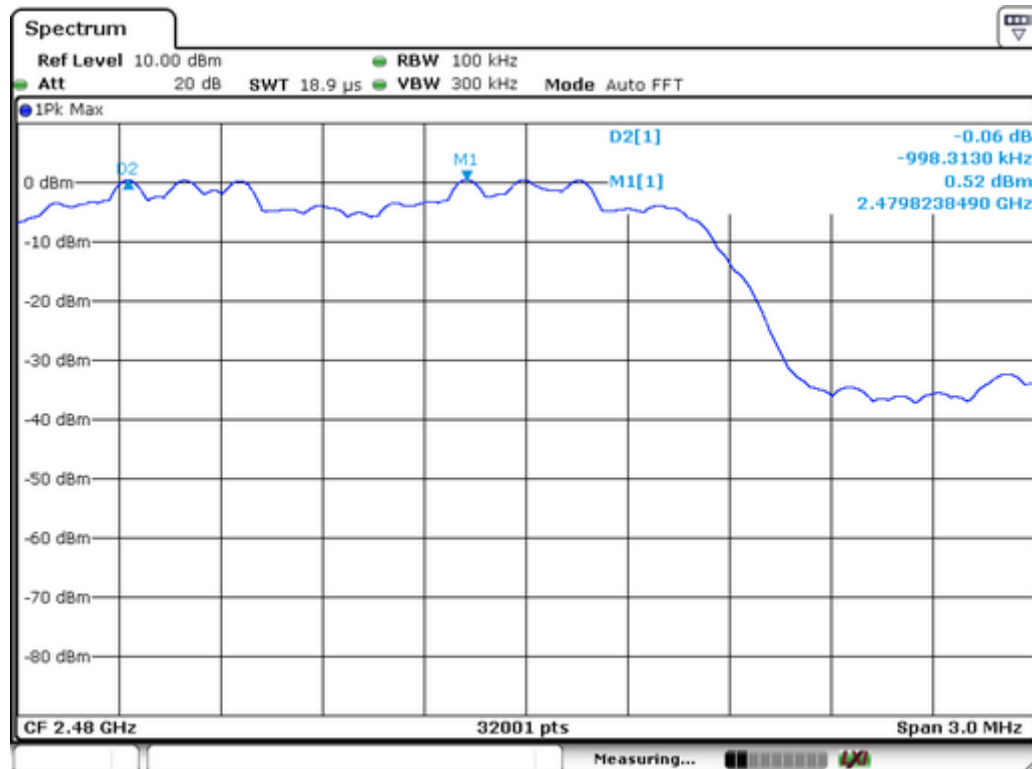
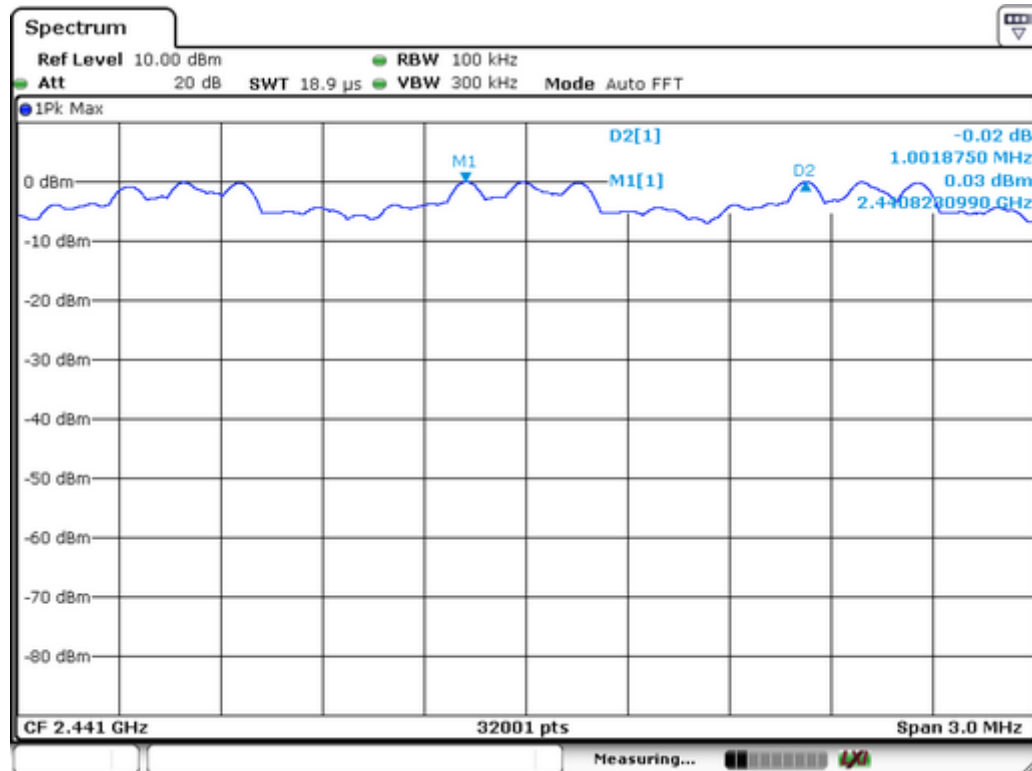




Test Mode:	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)
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Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	999	>912
40	2441	1002	>911
79	2480	998	>915





12 Number of Hopping Frequency

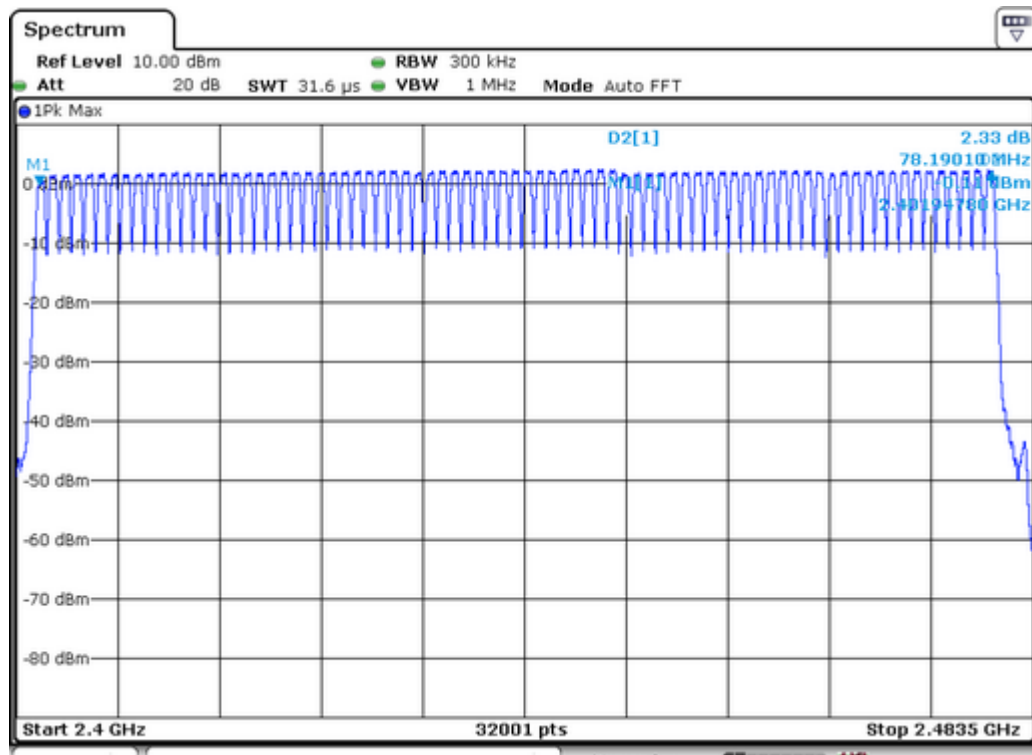
Test Requirement : FCC CFR47 Part 15 Section 15.247
 Test Method : ANSI C63.10:2013
 Test Limit : Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
 Test Mode : Hopping(GFSK)

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 = 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;

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
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	: The worst case(GFSK) was recorded

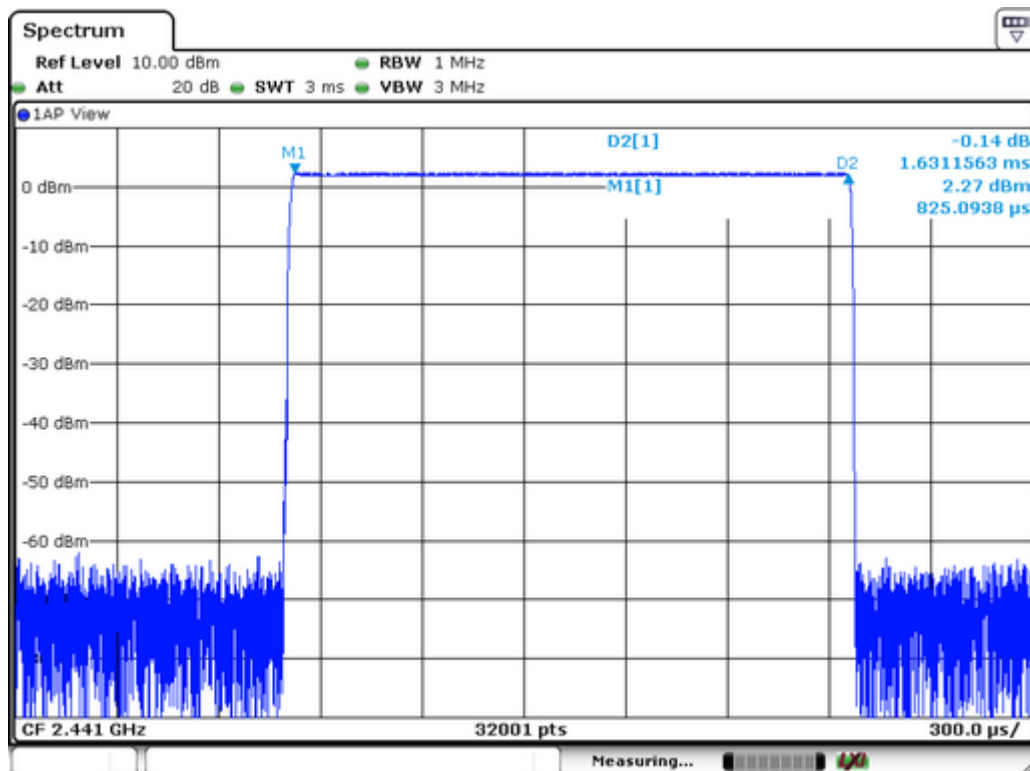
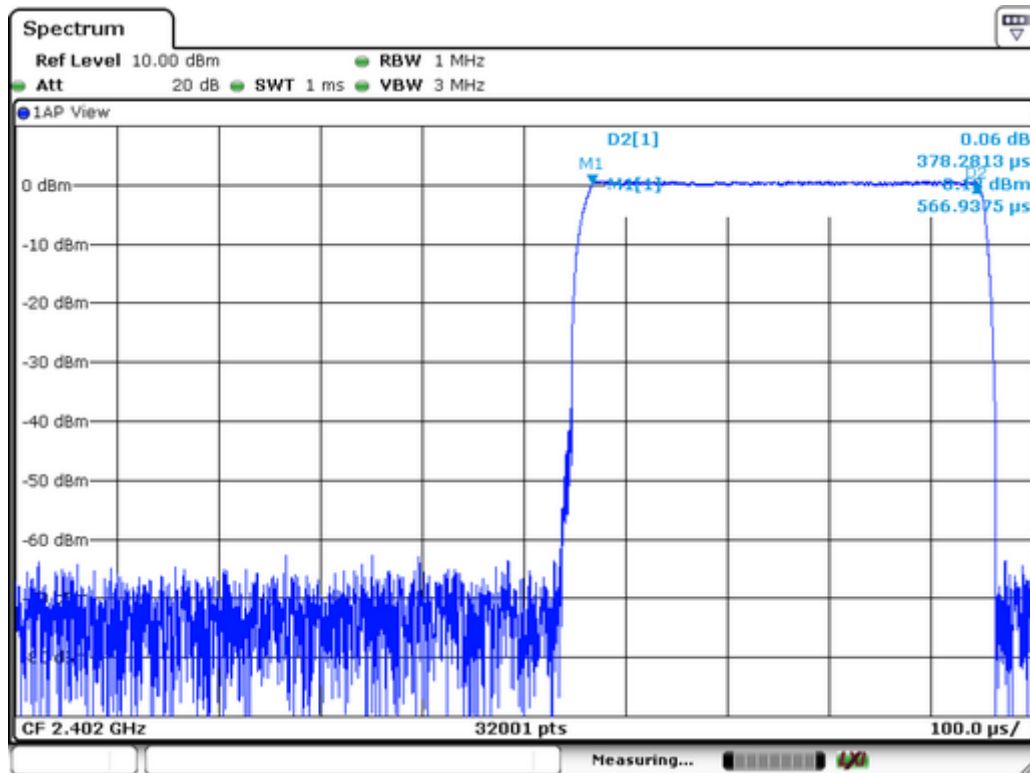
13.1 Test Procedure

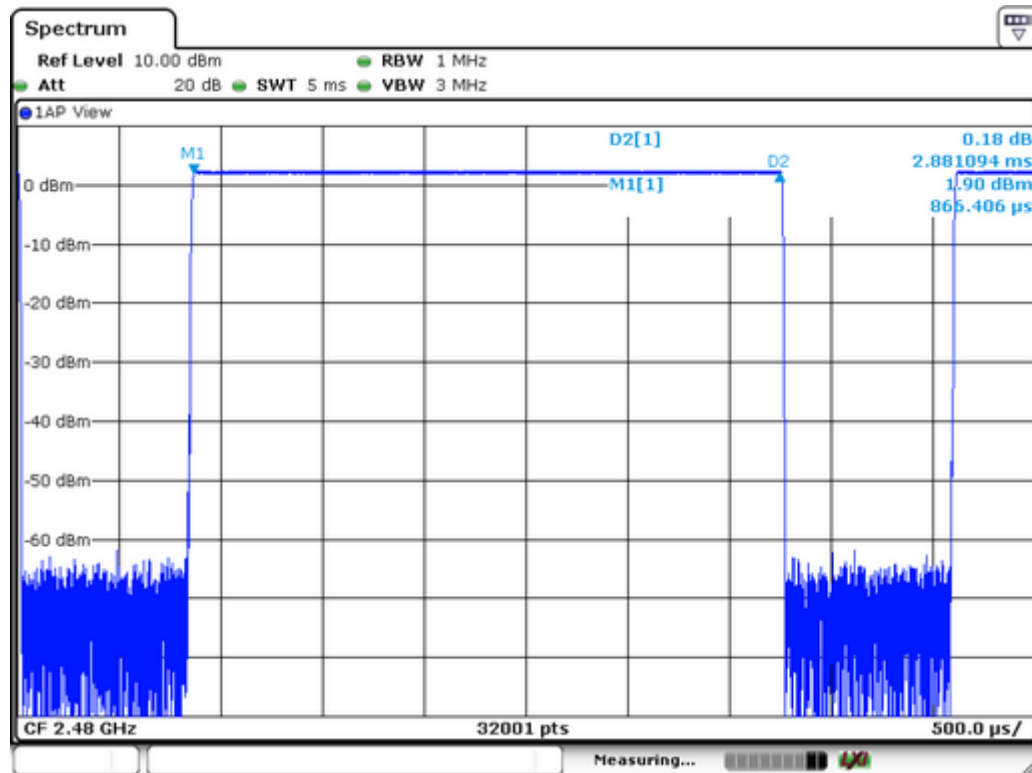
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 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

Test Mode:	GFSK(1Mbps) –DH1/DH3/DH5
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Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	$1600/(2*79) \times 31.6 = 320$	0.378	120.96	400
DH3	$1600/(4*79) \times 31.6 = 160$	1.631	260.96	400
DH5	$1600/(6*79) \times 31.6 = 106.67$	2.881	307.31	400





14 Antenna Requirement

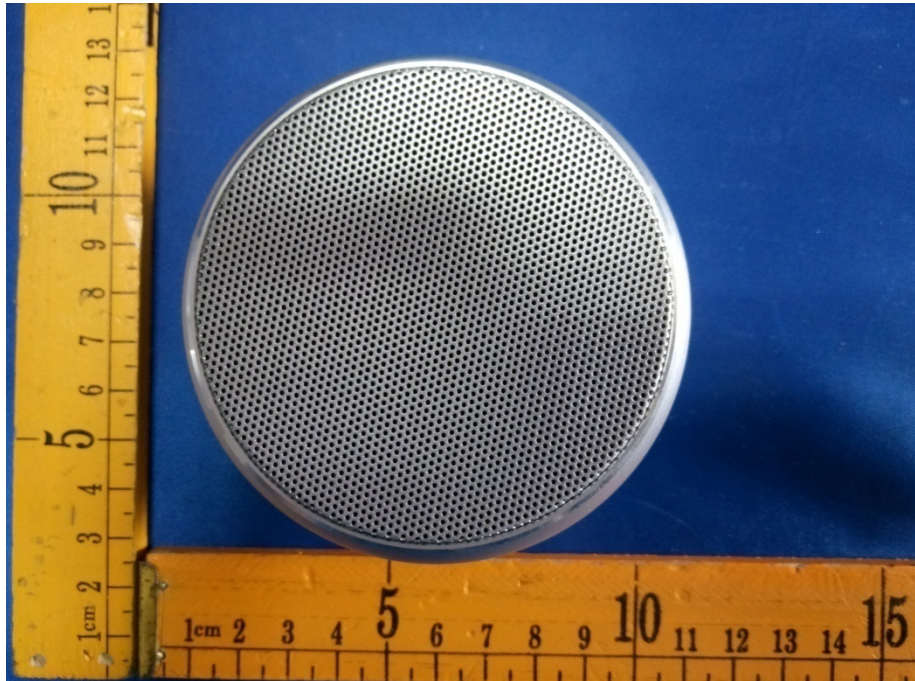
According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an internal PCB Antenna, it meet the requirement of this section.

15 TEST PHOTOS

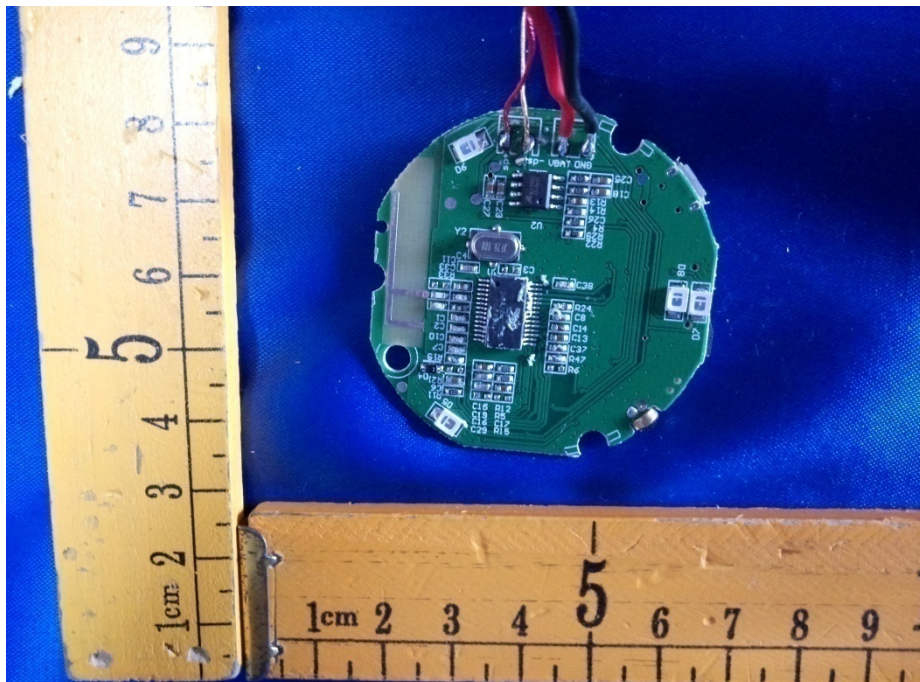


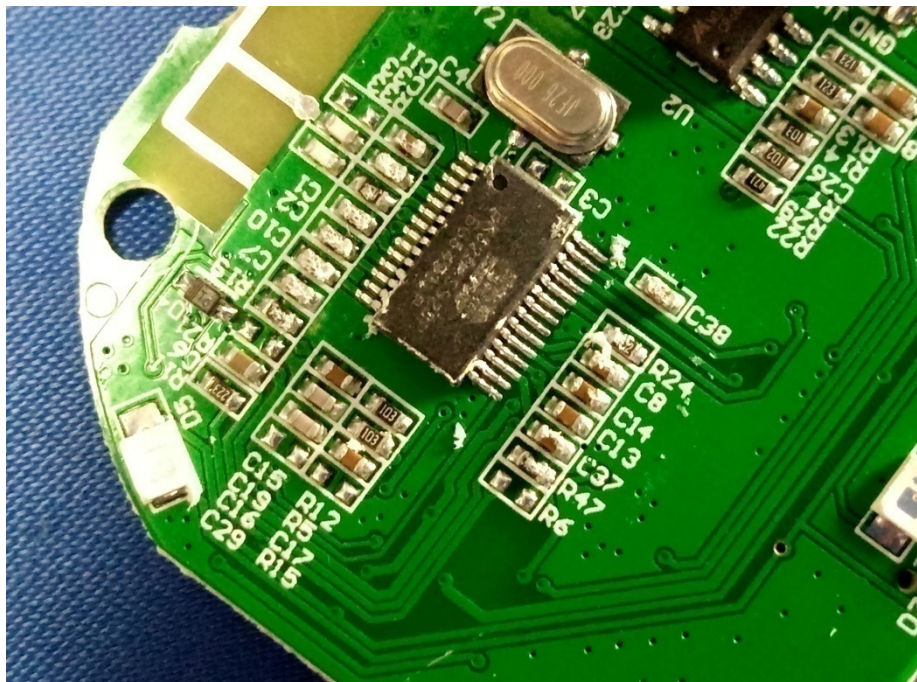
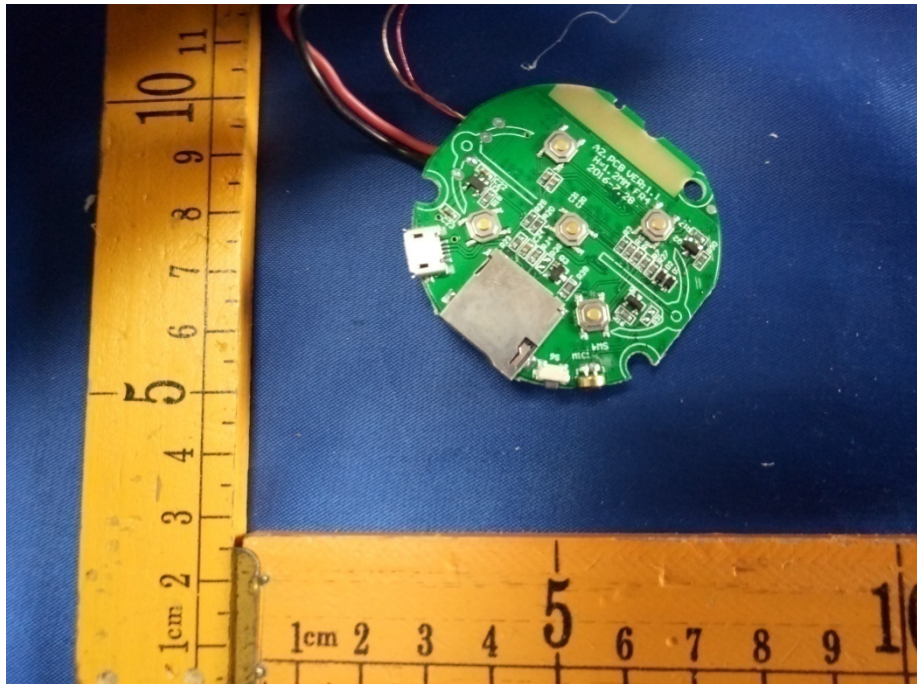


16 EUT PHOTOS











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