FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

FCC ID..... :	**2AAOTGGBSTYM**
Compiled by (position+printed name+signature)..:	File administrators Jack Yu
Supervised by (position+printed name+signature)..:	Technique principal Jerry You
Approved by (position+printed name+signature)..:	Manager Can Liu
Date of issue.....:	Apr. 05, 2017
Representative Laboratory Name .:	Shenzhen Asia Test Technology Co.,Ltd.
Address.....:	7 / F, Xinwei Building, Gushu Village, Xixiang Town, Baoan District, Shenzhen, China
Applicant's name.....:	AP Global Inc.
Address.....:	31352 Via Colinas,Westlake Village, CA 91362 United States
Test specification ..... **:**	
Standard .....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Shenzhen Asia Test Technology Co.,Ltd.

Test item description .....:	Alarm Clock
Trade Mark .....:	N/A
Manufacturer.....:	ANYSONIC ELECTRONICS CO., LIMITED
Model/Type reference.....:	GGBSTYM
Listed Models .....:	MU1228B
Modulation Type .....:	GFSK,8DPSK,π/4DQPSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating .....:	DC 5V
Result.....:	**PASS**

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Mar. 17, 2017
Testing commenced on	:	Mar. 18, 2017
Testing concluded on	:	Mar. 31, 2017

2.2 Product Description

The **ANYSONIC ELECTRONICS CO., LIMITED** 's Model: GGBSTYM or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Alarm Clock
Model Number	GGBSTYM
Listed Models	MU1228B
Model differences	All models are the same circuit and RF module, except model name.
Antenna Type	PCB
Antenna Gain	0.63dBi(Calculated)
BT FCC Operation frequency	2402MHz-2480MHz
BT Modulation Type	GFSK,8DPSK,π/4DQPSK(BT 2.1+EDR)
Hardware version	F-6188 V4.0 2014-7-16.P
Software version	V4.0
Bluetooth	Supported BT 2.1+EDR
Extreme temp. Tolerance	-10°C to +40°C
Extreme vol. Limits	4.5VDC to 5.5VDC (nominal: 5VDC)
adapter	M/N:BI24-050400-AdU Input:AC 100-240V, 50/60Hz, 0.8A OUTPUT: DC 5V, 4A

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 5V

2.4 EUT operation mode

The EUT has been tested under typical operating condition. There are EDR (Enhanced Data Rate) and BDR (Basic Data Rate) mode.The Applicant provides communication tools software to control the EUT for staying in continous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel . all test performed use fully-charged battery.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	**2402**	40	2442
01	2403	41	2443
02	2404	42	2444
03	2405	43	2445

04	2406	44	2446
05	2407	45	2447
06	2408	46	2448
07	2409	47	2449
08	2410	48	2450
09	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458
17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463
22	2424	62	2464
23	2425	63	2465
24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	**78**	**2480**
39	**2441**		

2.5 Internal Identification of AE used during the test

AE ID*	Description
AE1	Notebook(M/N:B50)
AE2	adapter

AE2
Model: HS05001000ES
INPUT: AC100-240V 50/60Hz 0.3A Max
OUTPUT: DC 5.0V 1.0A

*AE ID: is used to identify the test sample in the lab internally.

2.6 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AA9IGGBSTYM** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen Asia Test Technology Co.,Ltd.

7 / F, Xinwei Building, Gushu Village, Xixiang Town, Baoan District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 348715
Shenzhen Asia Test Technology Co.,Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
20dB Emission Bandwidth (EBW)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00,TM1_DH5_Ch39,TM1_DH5_Ch78, TM3_3DH5_Ch00,TM3_3DH5_Ch39,TM3_3DH5_Ch78,
Carrier Frequency Separation	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop, TM3_3DH5_Hop,
Number of Hopping Channel	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop ,TM3_3DH5_Hop,
Time of Occupancy (Dwell Time)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch39 ,TM3_3DH5_Ch39.
Maximum Peak Conducted Output Power	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH3_Ch00,TM1_DH3_Ch39,TM1_DH3_Ch78,TM2_2DH3_Ch00,TM2_2DH3_Ch39,TM2_2DH3_Ch78,TM3_3DH3_Ch00,TM3_3DH3_Ch39,TM3_3DH3_Ch78,
Bandedge spurious emission (Conducted)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH3_Ch00,TM1_DH3_Ch78, TM3_3DH3_Ch00,TM3_3DH3_Ch78,
Conducted RF Spurious Emission	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78,

		TM3_3DH5_Ch39, TM3_3DH5_Ch78.
Radiated Emissions in the Restricted Bands	Meas. Method	ANSI C63.10:2013 30 MHz to 1 GHz: Pre: RBW=100kHz; VBW=300kHz; Det. = Peak. Final: RBW=120kHz; Det. = CISPR Quasi-Peak. 1 GHz to 26.5GHz: Average: RBW=1 MHz; VBW= 10Hz; Det. = Peak; Sweep-time= Auto; Trace = Single. Peak: RBW=1 MHz; VBW= 3 MHz; Det. = Peak; Sweep-time= Auto; Trace≥ MaxHold * 100.
	Test Environment	NTNV
	EUT Conf.	30 MHz-1GHz TM1_DH5_Ch00 (Worst Conf.).
		1-18 GHz: TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78, (Worst Conf.).

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	EUT Configuration	TM1_DH5_Ch39. (Worst Conf.).

Note:
1. For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.
2. For π/4 QPSK its same modulation type with 8-DPSK, and based exploratory test, there is no significant difference of that two types test result, so except output power, all other items final test were only performed with the worse case 8-DPSK and GFSK.

3.5 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	-/-	-/-	-/-	-/-	☐	☐	☒	☐	Not applicable for FHSS
§15.247(a)(1)	Carrier Frequency separation	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Middle	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Number of Hopping channels	GFSK 8DPSK	☒ Full	GFSK 8DPSK	☒ Full	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Middle	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Spectrum bandwidth of a FHSS system 20dB bandwidth	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	GFSK 8DPSK	☒ Lowest ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies

§15.205	Band edge compliance radiated	GFSK 8DPSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions radiated	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☒	☐	☐	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report

3.6 Equipments Used during the Test

Equipment No.	Instrument	Manufacturer	Model Name	Serial Number	Specification	Cal. Data	calibration due dates
1	Semi-anechoic chamber	Changzhou Chengyu	EC3088	N/A	9*6*6m	10/25/2016	10/24/2017
2	Loop Antenna	ARA	PLA-1030/B	1029	9kHz-30 MHz	03/20/2017	03/19/2018
3	Broadband antenna	R&S	VULB 9160	VULB91 60-516	30MHz-1500 MHz	10/25/2016	10/24/2017
4	Horn antenna	R&S	BBHA 9120D	10087	1GHz-18GHz	06/05/2016	06/04/2016
5	SHF-EHF Horn	SCHWARZBECK	BBHA9170	BBHA9170367	15GHz-26.5GHz	12/03/2016	12/02/2017
6	Test receiver	R&S	ESCI	101686	9KHz-3GHz	10/25/2016	10/24/2017
7	EMI Measuring Receiver	R&S	ESR	101660	9KHz-40GHz	10/25/2016	10/24/2017
8	Multi-device controller	MF	MF-7868	MF786808762	N/A	10/25/2016	10/24/2017

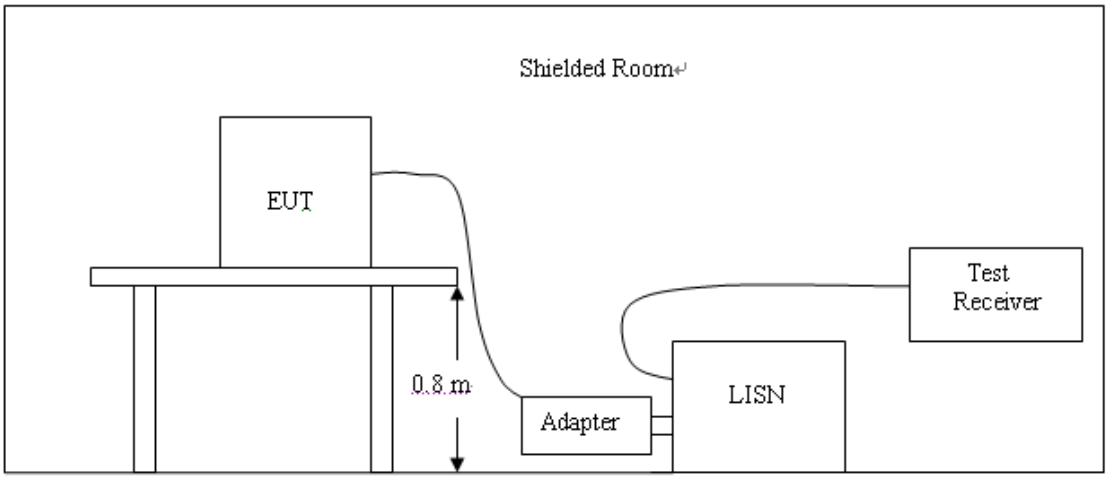
9	Amplifier	EM	EM-30180	060538	1GHz-18GHz	10/25/2016	10/24/2017
10	Amplifier	Schwarzbeck	BBV 9475	BBV 9475-663	1GHz-18GHz	06/05/2016	06/04/2017
11	Spectrum Analyzer	agilent	E4440B	US44300368	9kHz-26.5GH z	06/05/2016	06/04/2017
12	Test receiver	R&S	ESCI	101689	9KHz-3GHz	10/25/2016	10/24/2017
13	LISN	R&S	NSLK8126	8126466	9k-30MHz	10/25/2016	10/24/2017
14	LISN	Narda	L2-16B	5589756	9k-30MHz	10/25/2016	10/24/2017
15	Power Meter	Anritsu	ML2495A	N/A	40MHz	10/25/2016	10/24/2017
16	Power sensor	Anritsu	MA2411B	N/A	40MHz	10/25/2016	10/24/2017
17	Radiated Cable 1#	FUJIKURA	5D-2W	01	30MHz-1GHz	10/25/2016	10/24/2017
18	Radiated Cable 2#	FUJIKURA	10D2W	02	1GHz - 25GHz	10/25/2016	10/24/2017
19	Conducted Cable 1#	FUJIKURA	1D-2W	01	9KHz-30MHz	10/25/2016	10/24/2017
20	SMA Antenna connector	Dosin	Dosin-SMA	N/A	N/A	10/25/2016	10/24/2017

Note: The SMA antenna connector is soldered on the PCB board in order to perform conducted tests and this SMA antenna connector is listed in the equipment list.
The Cal.Interval was one year

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013
4. All support equipments received AC power from a second LISN, if any.
5. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
6. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
7. During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

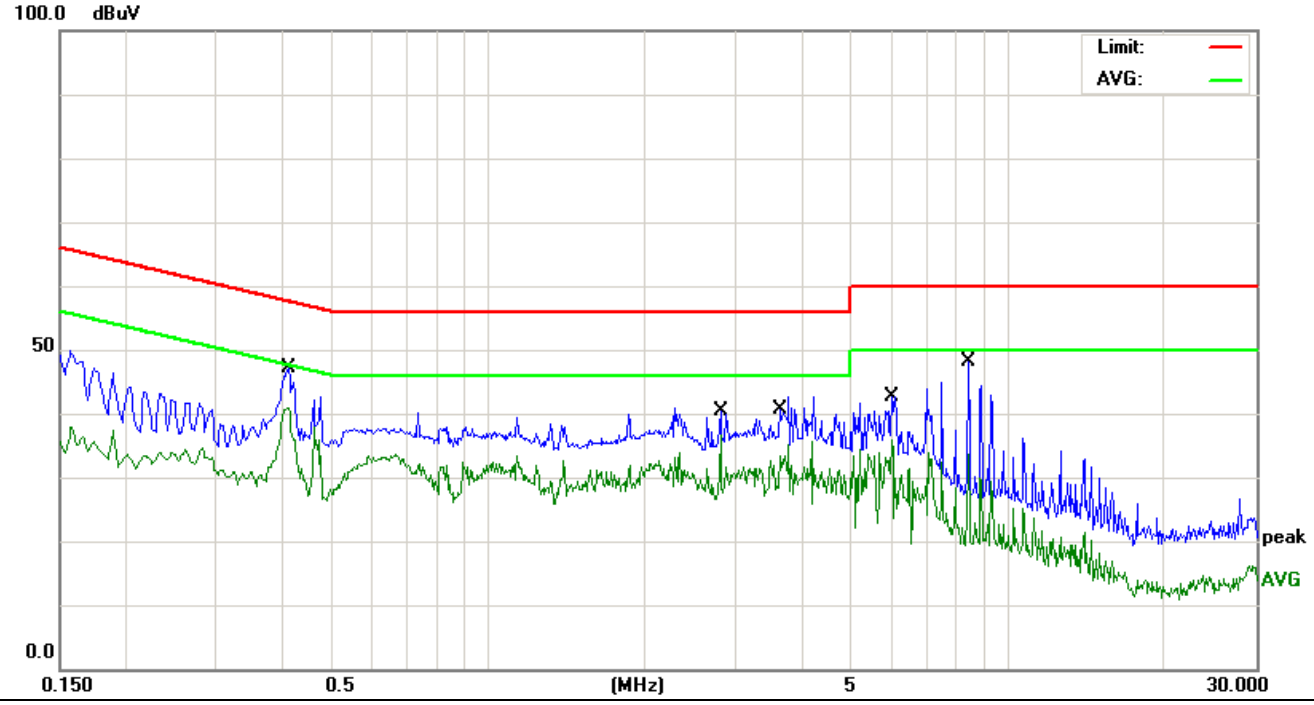
* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

Test Mode:	TM1_DH5_Ch39. (Worst Conf.)	Phase :	Line

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4138	37.11	10.12	47.23	57.57	-10.34	QP	
2	*	0.4138	30.87	10.12	40.99	47.57	-6.58	AVG	
3		2.7980	26.67	10.03	36.70	46.00	-9.30	AVG	
4		3.6539	30.61	10.04	40.65	56.00	-15.35	QP	
5		5.9858	25.87	10.12	35.99	50.00	-14.01	AVG	
6		8.3978	37.84	10.20	48.04	60.00	-11.96	QP	

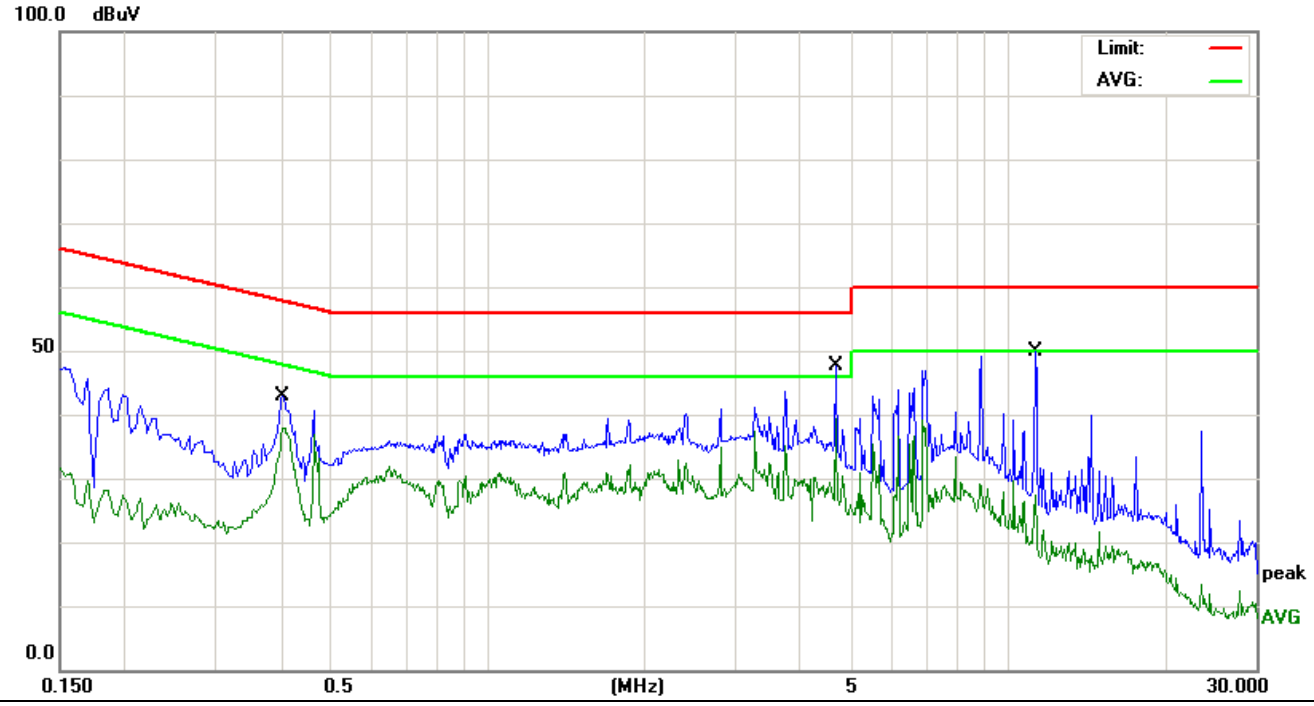
Remark: Factor = LISN Factor + Cable Loss+ Pulse limiter Factor.



Test Mode:	TM1_DH5_Ch39. (Worst Conf.).	Phase :	Neutral

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4020	32.74	10.12	42.86	57.81	-14.95	QP	
2		0.4020	27.80	10.12	37.92	47.81	-9.89	AVG	
3		4.6698	37.48	10.09	47.57	56.00	-8.43	QP	
4	*	4.6698	29.31	10.09	39.40	46.00	-6.60	AVG	
5		11.3099	39.62	10.30	49.92	60.00	-10.08	QP	
6		11.3099	17.16	10.30	27.46	50.00	-22.54	AVG	

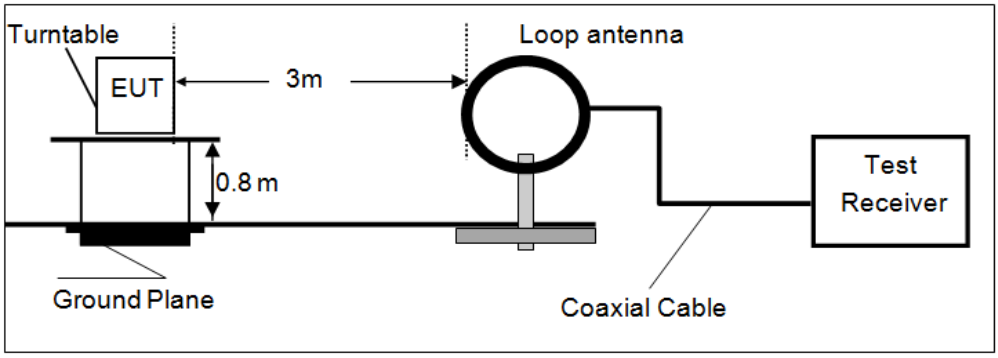
Remark: Factor = LISN Factor + Cable Loss+ Pulse limiter Factor.



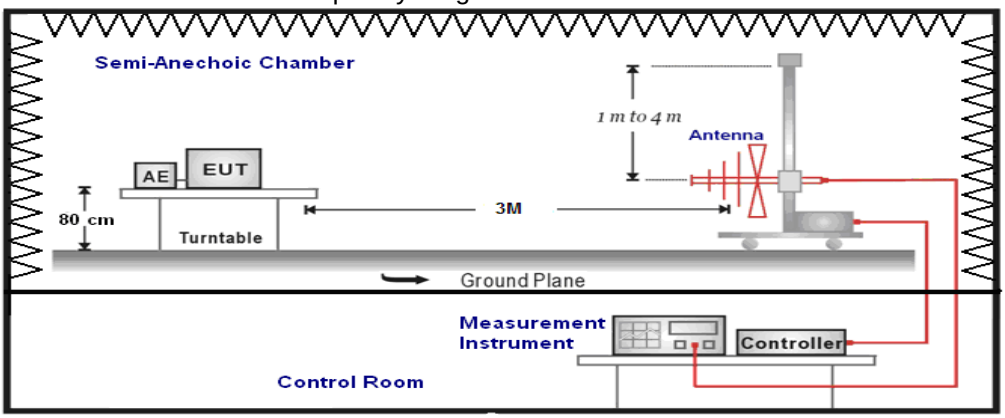
4.2 Radiated Emission

TEST CONFIGURATION

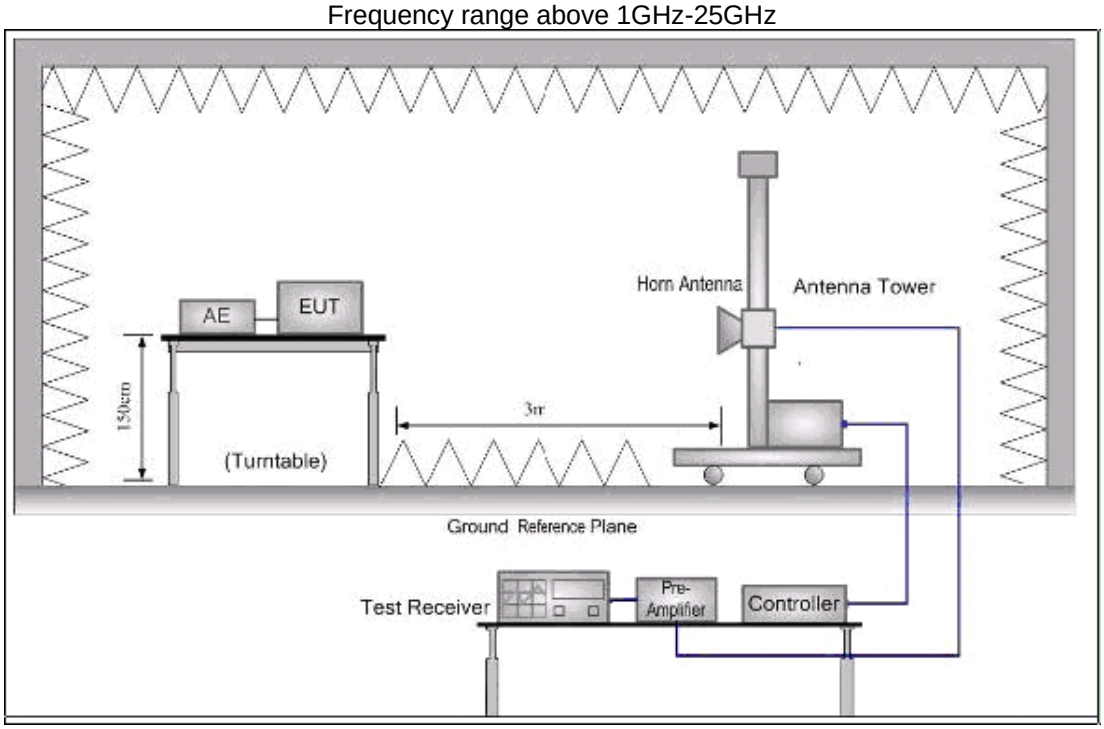
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m(1.5m above 1G) above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
6. For the radiated emission test above 1GHz:

   Place the measurement antenna away from 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 may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. 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.

7. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	3

8. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto	Peak (Receiver)
	Average Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto	Average (Receiver)

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.
The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

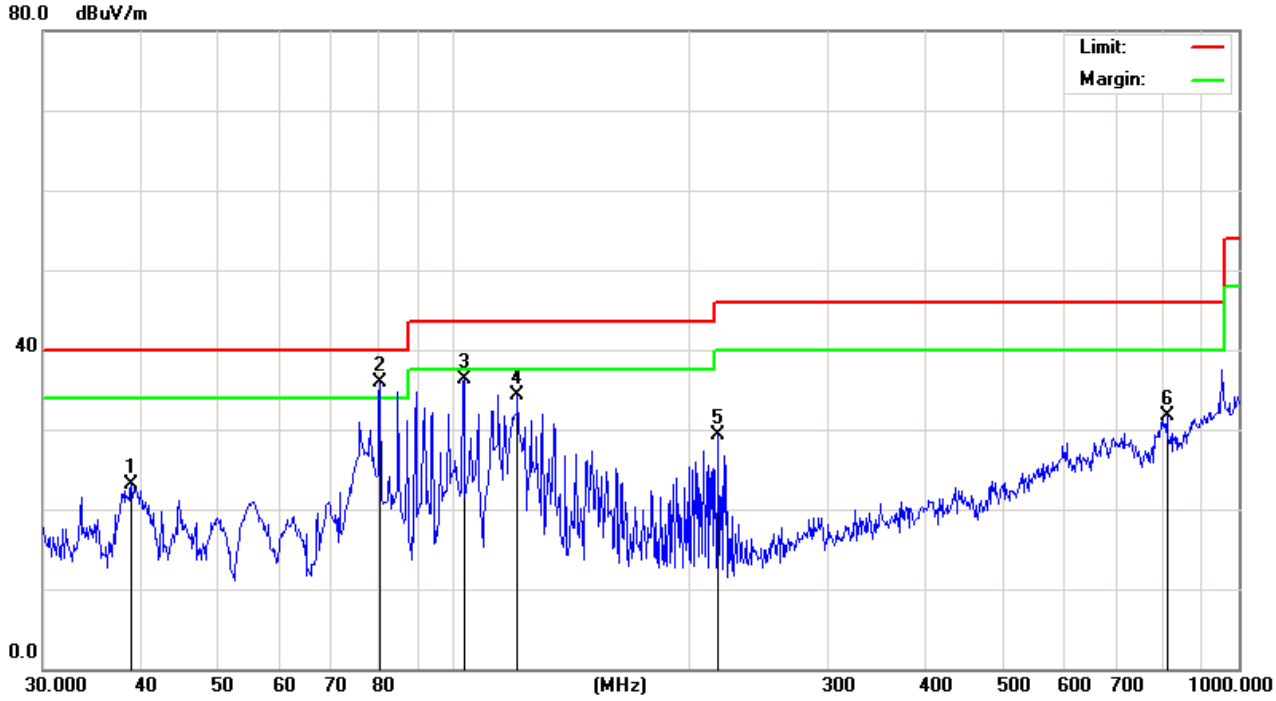
Remark:
1. The radiated measurement are performed the each channel (low/mid/high) at all Packet type (DH1, DH3 and DH5) also for difference modulation type (GFSK, 8DPSK), recorded worst case at GFSK_DH5_Low channel (Channel 00) for below 1GHz and GFSK_DH5_Low channel (Channel 00), GFSK_DH5_Middle channel (Channel 39), GFSK_DH5_High channel (Channel 78) for above 1G.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. “---” means not recorded as emission levels lower than limit.
5. Margin= Limit - Level

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
12.45	43.14	69.54	26.40	QP	PASS
24.41	42.68	69.54	26.86	QP	PASS

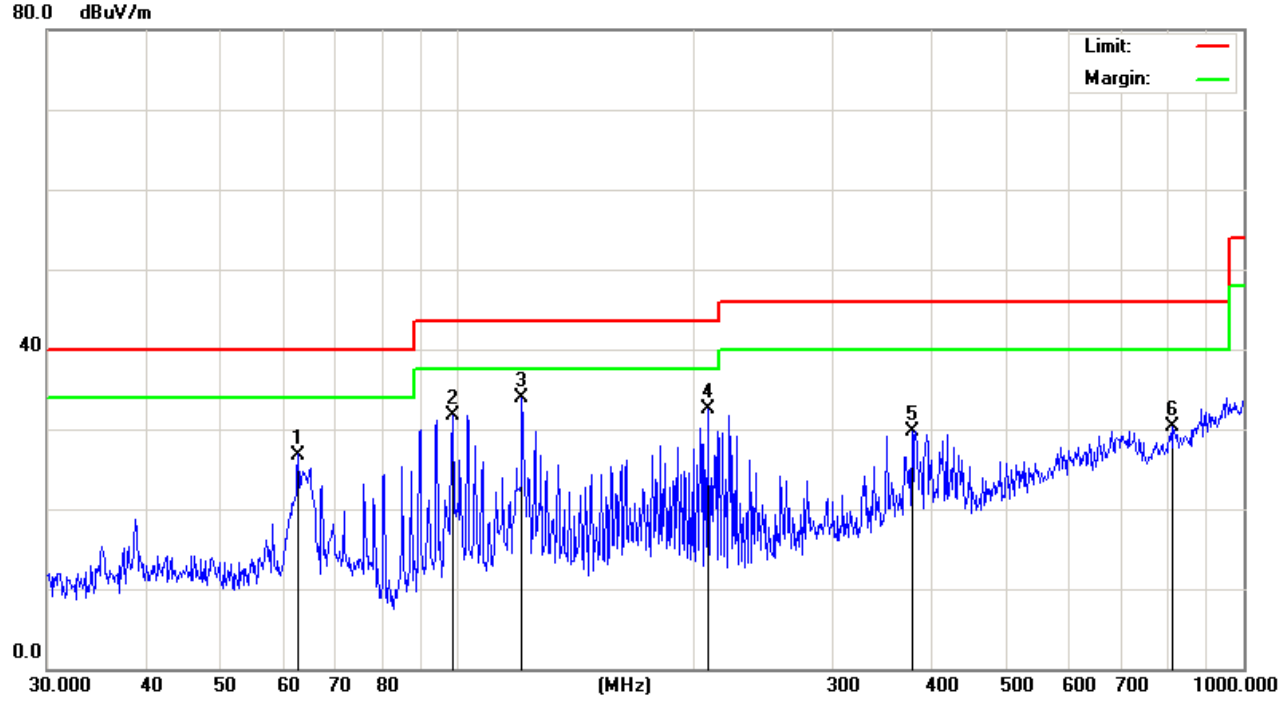
For 30MHz to 1000MHz

(a) Antenna polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		38.8878	39.76	-16.64	23.12	40.00	-16.88	QP			
2	*	80.6441	54.88	-19.04	35.84	40.00	-4.16	QP			
3		103.0799	49.94	-13.72	36.22	43.50	-7.28	QP			
4		120.6991	49.29	-14.94	34.35	43.50	-9.15	QP			
5		217.5442	45.59	-16.24	29.35	46.00	-16.65	QP			
6		810.2653	29.82	1.89	31.71	46.00	-14.29	QP			

(b) Antenna polarization: vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		62.6507	44.82	-18.02	26.80	40.00	-13.20	QP			
2		98.4866	47.90	-16.17	31.73	43.50	-11.77	QP			
3	*	120.6991	48.94	-14.94	34.00	43.50	-9.50	QP			
4		207.8501	49.16	-16.74	32.42	43.50	-11.08	QP			
5		378.5843	37.24	-7.54	29.70	46.00	-16.30	QP			
6		813.1115	29.50	0.83	30.33	46.00	-15.67	QP			

Note:

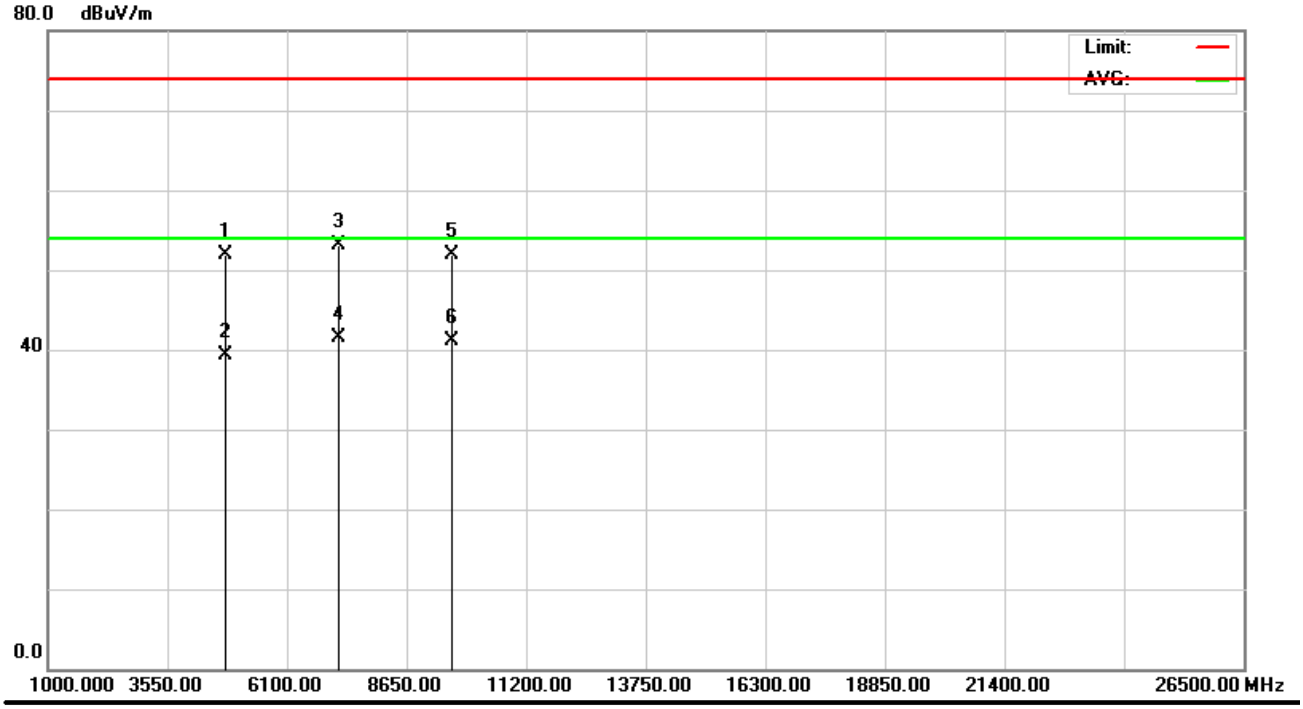
Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier

For 1GHz to 25GHz

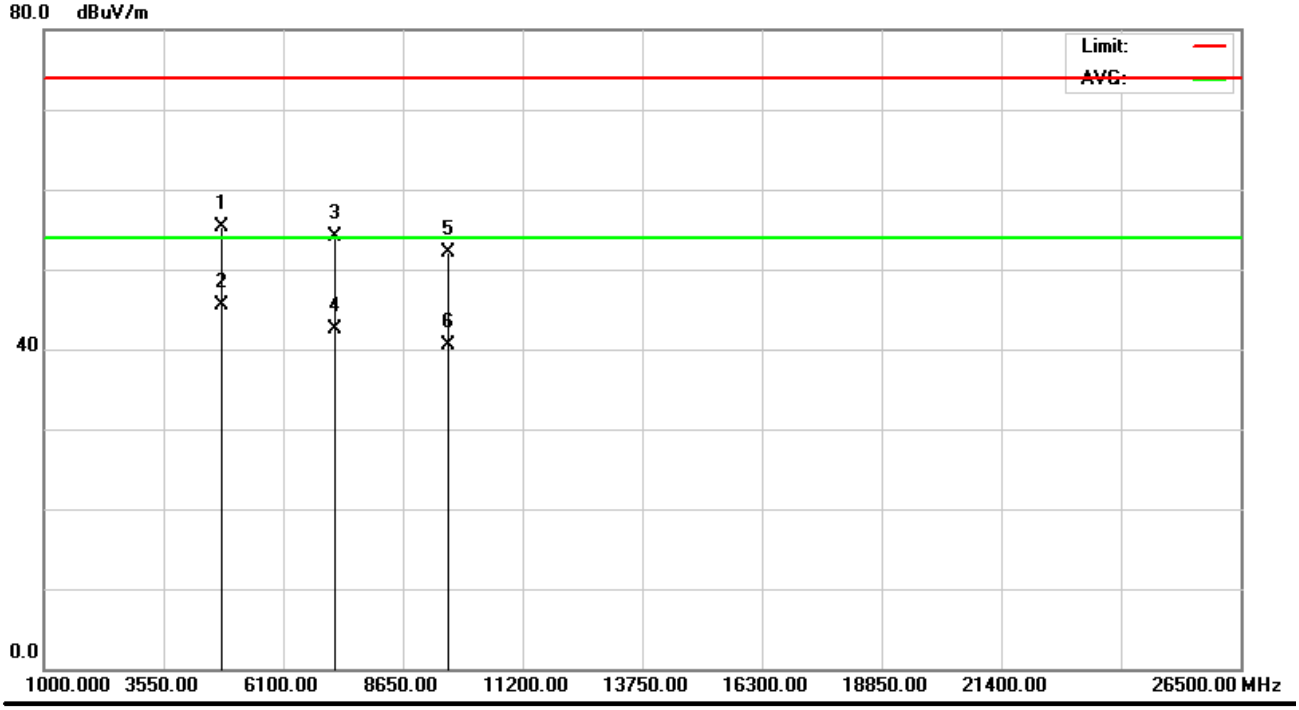
Note:We tested GFSK Mode and 8DPSK*, rcorded the worst case at the GFSK (DH5) Mode.*

(a) Antenna polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	56.72	-4.86	51.86	74.00	-22.14	peak
2		4804.000	44.15	-4.86	39.29	54.00	-14.71	AVG
3		7206.000	53.69	-0.58	53.11	74.00	-20.89	peak
4	*	7206.000	42.08	-0.58	41.50	54.00	-12.50	AVG
5		9608.000	47.14	4.81	51.95	74.00	-22.05	peak
6		9608.000	36.22	4.81	41.03	54.00	-12.97	AVG

(b) Antenna polarization: Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4804.000	60.12	-4.86	55.26	74.00	-18.74	peak
2	*	4804.000	50.37	-4.86	45.51	54.00	-8.49	AVG
3		7206.000	54.78	-0.58	54.20	74.00	-19.80	peak
4		7206.000	43.16	-0.58	42.58	54.00	-11.42	AVG
5		9608.000	47.22	4.81	52.03	74.00	-21.97	peak
6		9608.000	35.78	4.81	40.59	54.00	-13.41	AVG

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

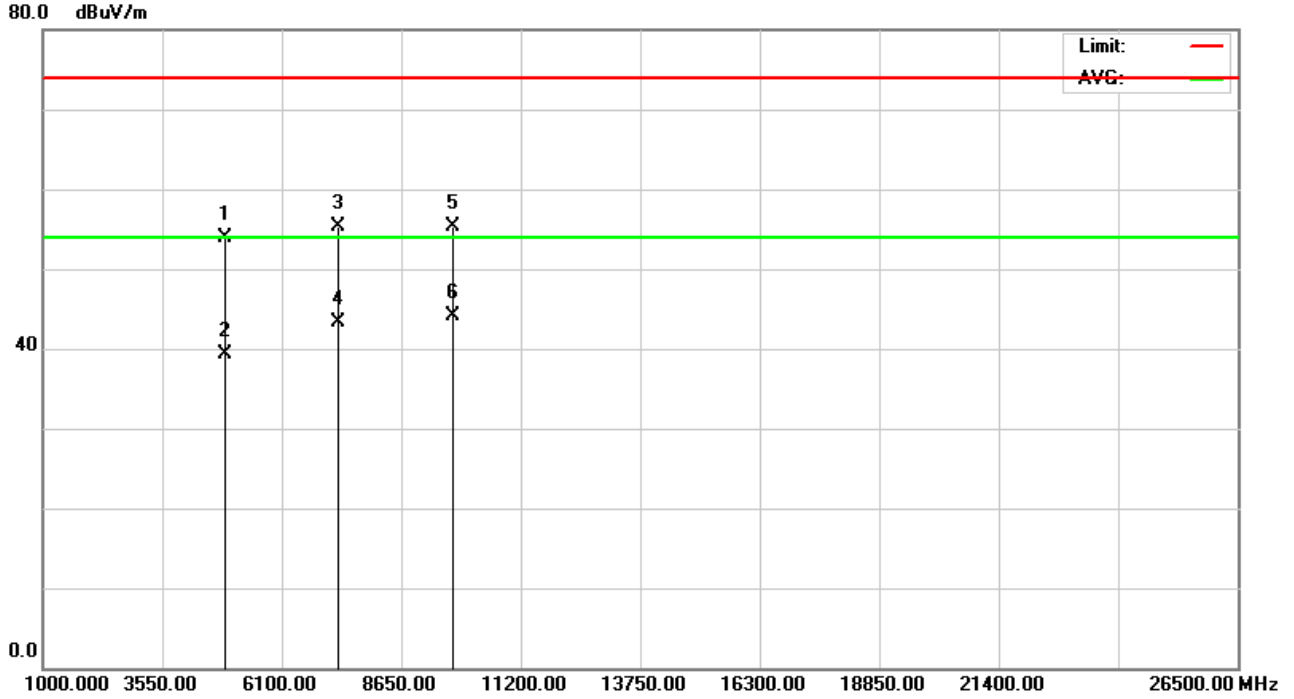
Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier

Lowest channel: 2402 MHz

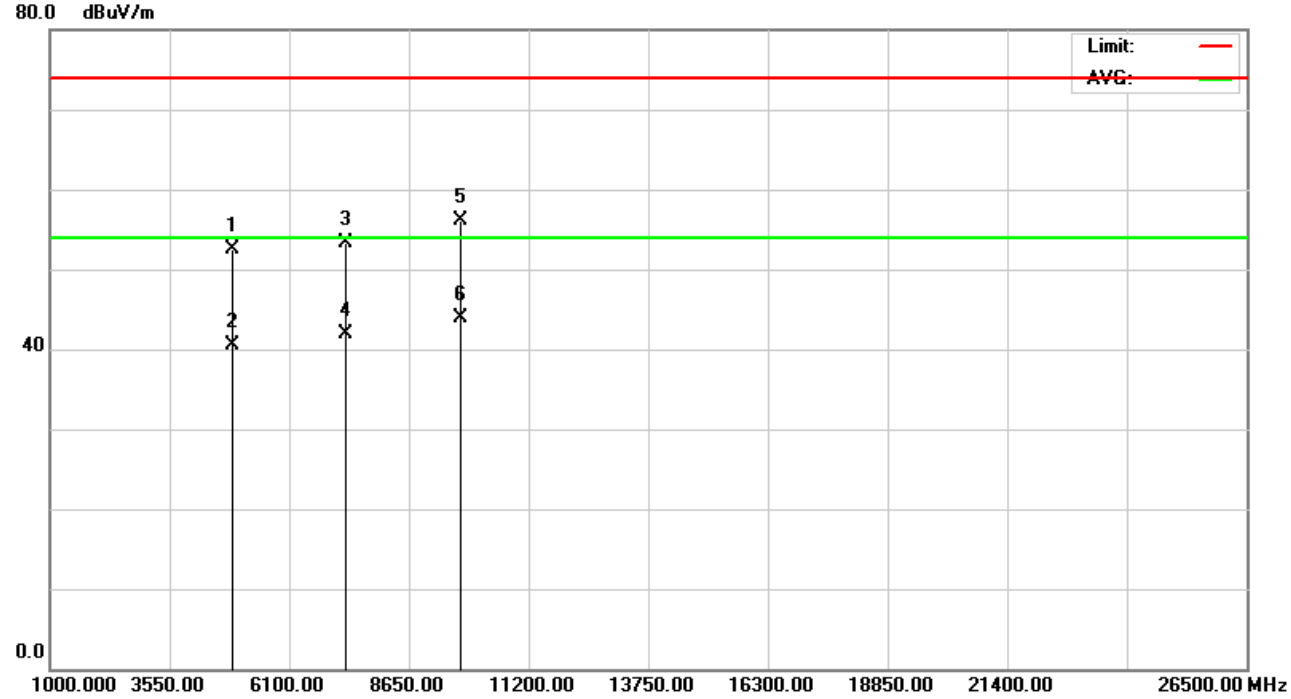
Data rate: 1Mbps

(a) Antenna polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	58.71	-4.73	53.98	74.00	-20.02	peak			
2		4882.000	44.12	-4.73	39.39	54.00	-14.61	AVG			
3		7323.000	55.63	-0.30	55.33	74.00	-18.67	peak			
4		7323.000	43.62	-0.30	43.32	54.00	-10.68	AVG			
5		9764.000	50.12	5.26	55.38	74.00	-18.62	peak			
6	*	9764.000	38.75	5.26	44.01	54.00	-9.99	AVG			

(b) Antenna polarization: Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	57.14	-4.73	52.41	74.00	-21.59	peak		0	
2		4882.000	45.25	-4.73	40.52	54.00	-13.48	AVG		0	
3		7323.000	53.68	-0.30	53.38	74.00	-20.62	peak		0	
4		7323.000	42.14	-0.30	41.84	54.00	-12.16	AVG		0	
5		9764.000	50.88	5.26	56.14	74.00	-17.86	peak		0	
6	*	9764.000	38.71	5.26	43.97	54.00	-10.03	AVG		0	

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

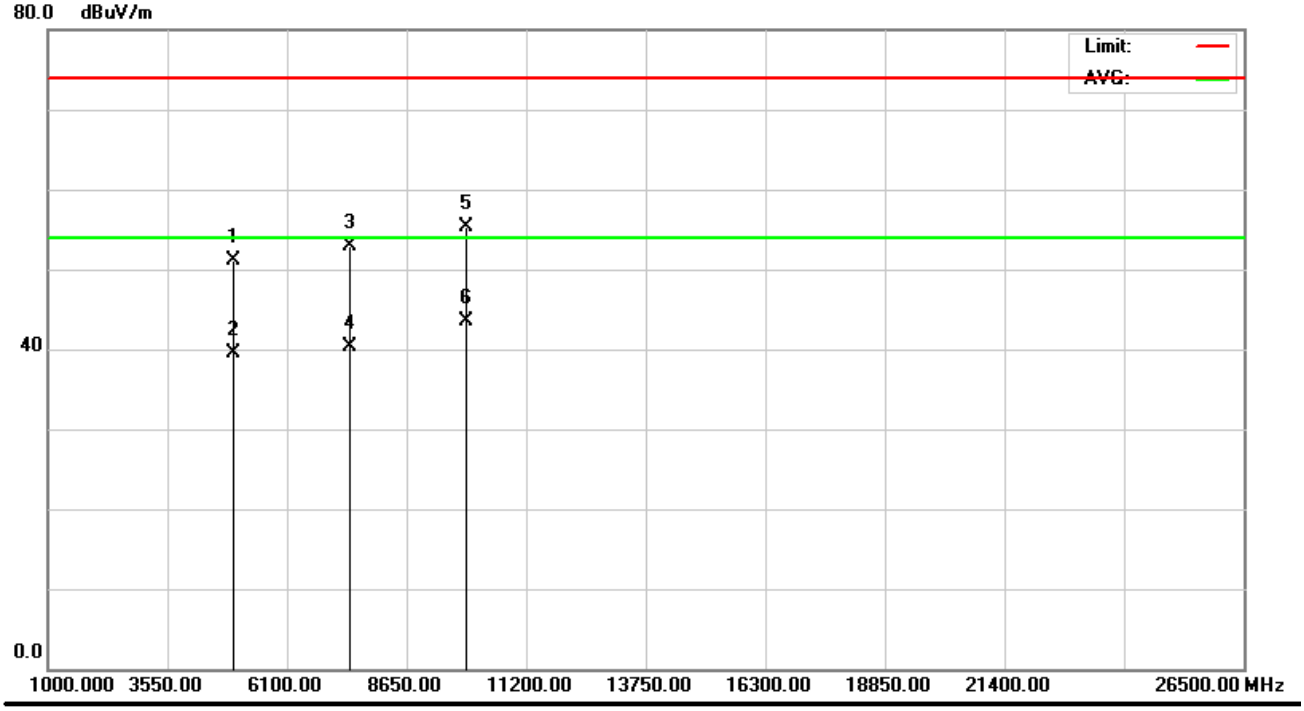
Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier

Middle Channel: 2441 MHz

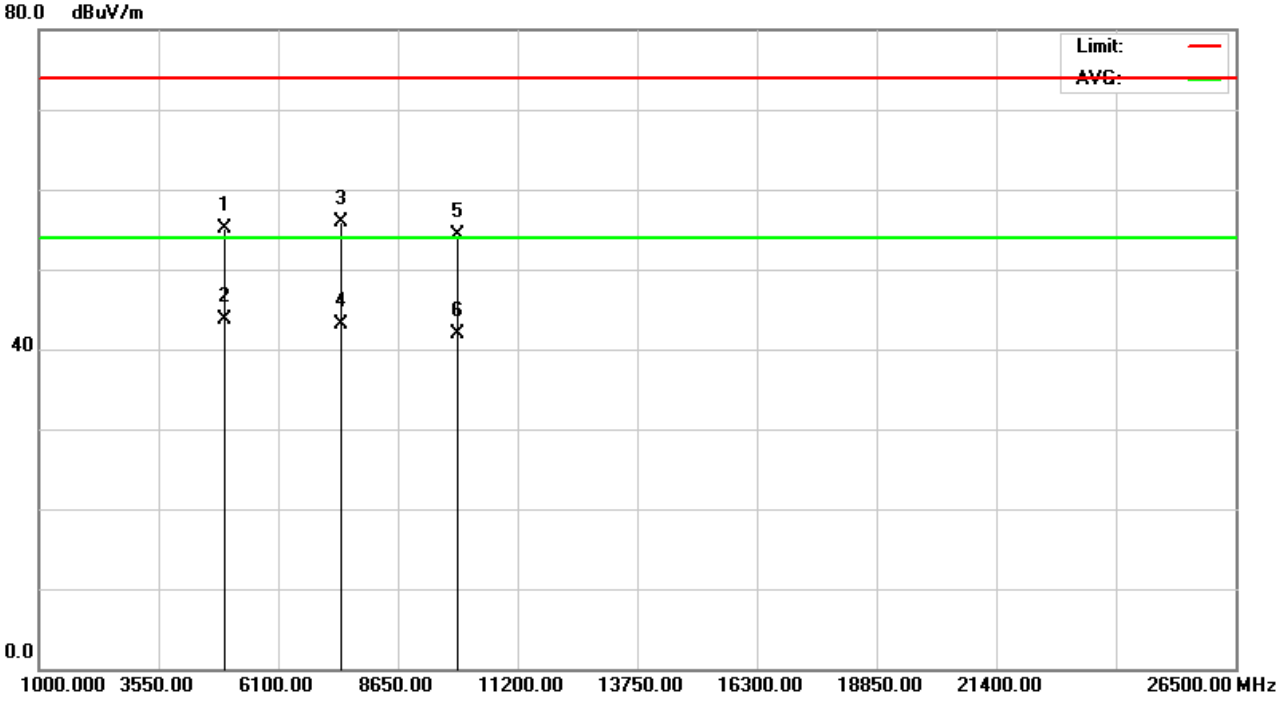
Data rate: 1Mbps

(a) Antenna polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	55.72	-4.60	51.12	74.00	-22.88	peak
2		4960.000	44.11	-4.60	39.51	54.00	-14.49	AVG
3		7440.000	52.93	-0.02	52.91	74.00	-21.09	peak
4		7440.000	40.38	-0.02	40.36	54.00	-13.64	AVG
5		9920.000	49.72	5.66	55.38	74.00	-18.62	peak
6	*	9920.000	37.82	5.66	43.48	54.00	-10.52	AVG

(b) Antenna polarization: Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		4960.000	59.72	-4.60	55.12	74.00	-18.88	peak
2	*	4960.000	48.37	-4.60	43.77	54.00	-10.23	AVG
3		7440.000	55.97	-0.02	55.95	74.00	-18.05	peak
4		7440.000	43.12	-0.02	43.10	54.00	-10.90	AVG
5		9920.000	48.67	5.66	54.33	74.00	-19.67	peak
6		9920.000	36.25	5.66	41.91	54.00	-12.09	AVG

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

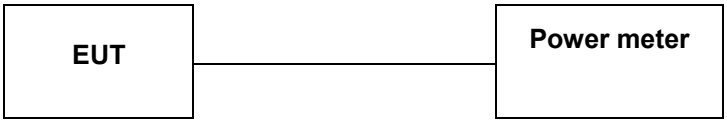
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier

Highest Channel: 2480 MHz

Data rate: 1Mbps

4.3 Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2013 Maximum peak conducted output power: Connent antenna port into power meter and reading Peak values.

LIMIT

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

TEST RESULTS

Remark: We test maximum peak output power at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5

4.3.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	3.89	21	PASS
39	2441	3.76	21	PASS
78	2480	3.95	21	PASS

Note:
1.The test results including the cable lose.

4.3.2 π/4 DQPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	3.35	21	PASS
39	2441	3.22	21	PASS
78	2480	3.19	21	PASS

Note:
1.The test results including the cable lose.

4.3.3 8DPSK Test Mode

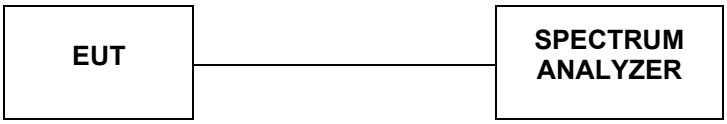
A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	2.78	21	PASS
39	2441	2.94	21	PASS
78	2480	2.69	21	PASS

Note:
1.The test results including the cable lose.

4.4 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwith.

TEST RESULTS

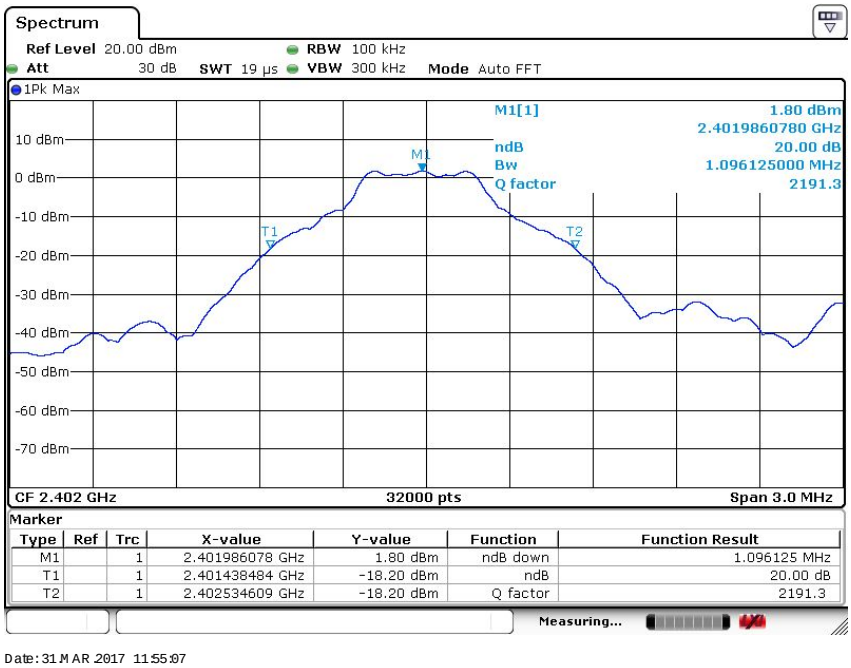
4.4.1 GFSK Test Mode

A. Test Verdict

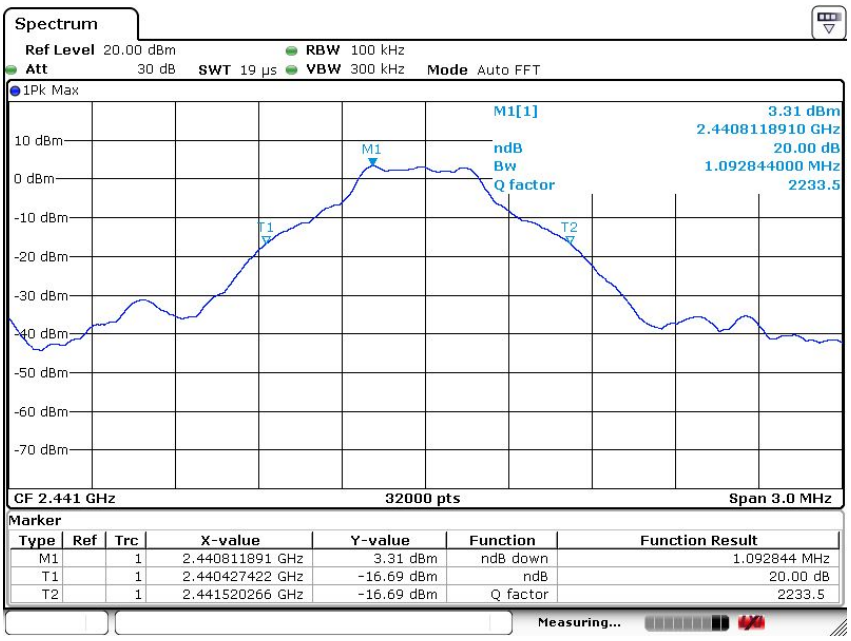
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.0961	Plot 4.4.1 A	/	PASS
39	2441	1.0928	Plot 4.4.1 B	/	PASS
78	2480	1.0936	Plot 4.4.1 C	/	PASS

Note: 1.The test results including the cable lose.

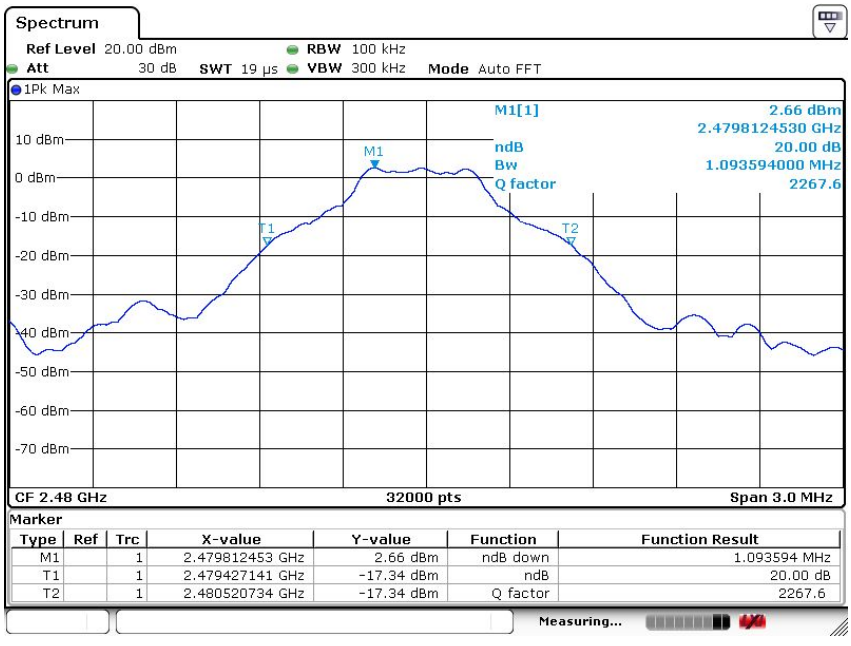
B. Test Plots



(Plot 4.4.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.4.1 B: Channel 39: 2441MHz @ GFSK)



(Plot 4.4.1 C: Channel 78: 2480MHz @ GFSK)

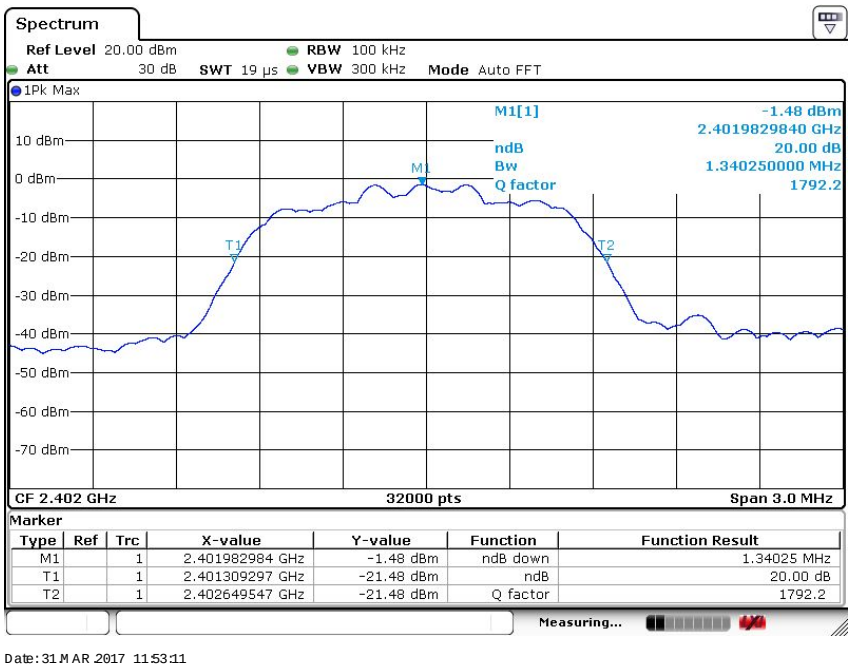
4.4.2 8DPSKTest Mode

A. Test Verdict

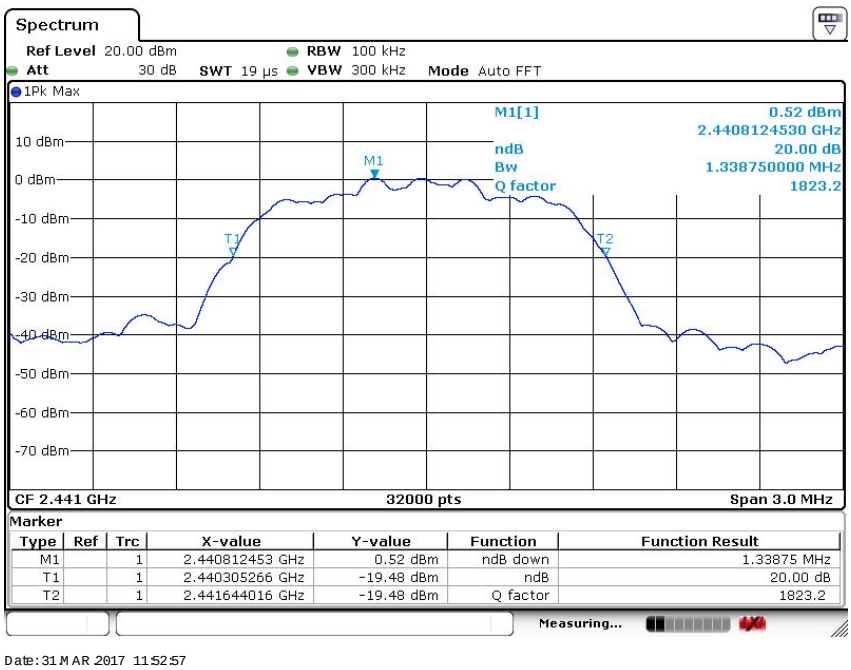
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.3402	Plot 4.4.2 A	/	PASS
39	2441	1.3383	Plot 4.4.2 B	/	PASS
78	2480	1.3405	Plot 4.4.2 C	/	PASS

Note: 1.The test results including the cable lose.

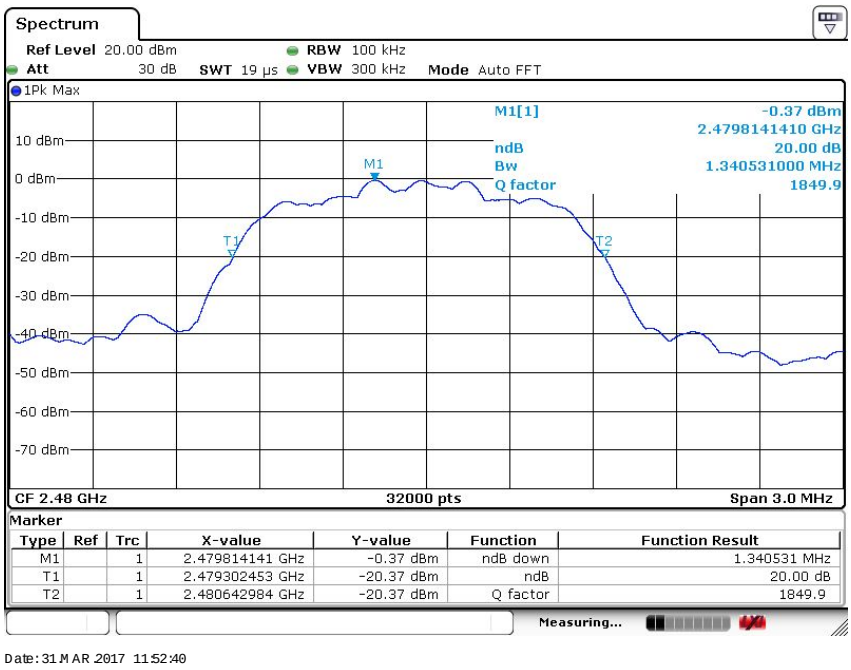
B. Test Plots



(Plot 4.4.2 A: Channel 00: 2402MHz @ 8DPSK)



(Plot 4.4.2 B: Channel 39: 2441MHz @ 8DPSK)



(Plot 4.4.2 C: Channel 78: 2480MHz @ 8DPSK)

4.5 Band Edge

Applicable Standard

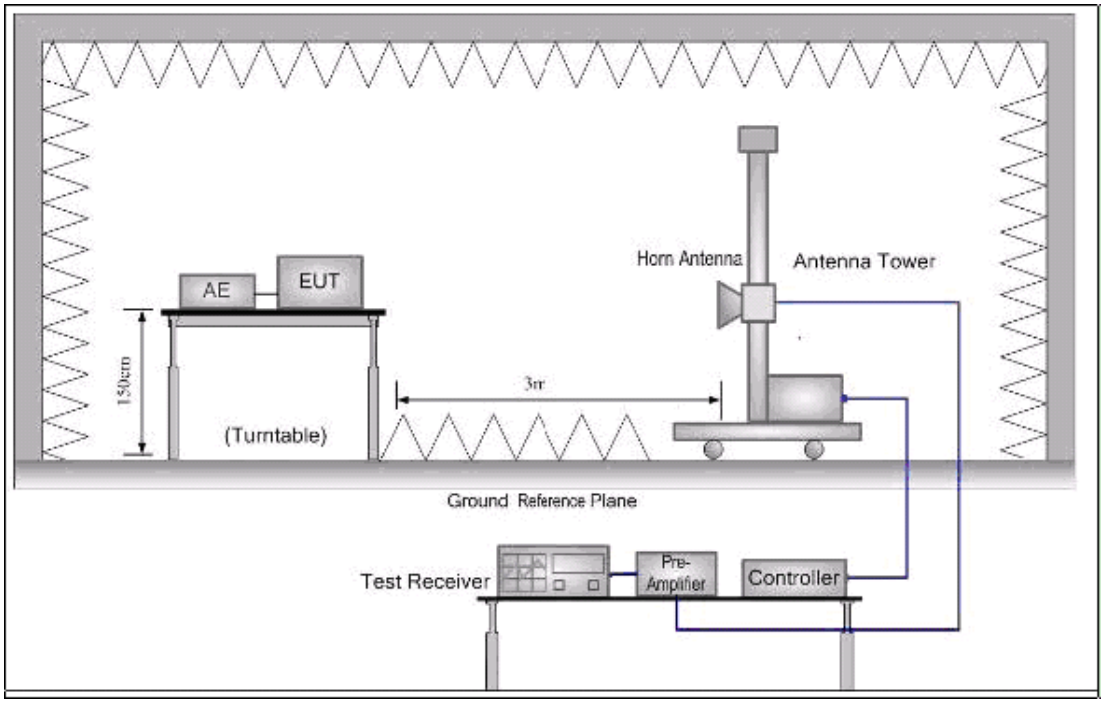
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 PROCEDURE

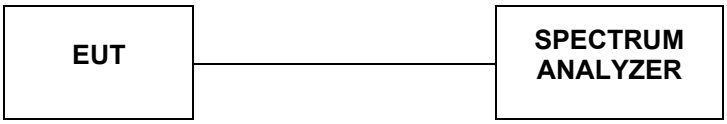
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

TEST CONFIGURATION

For Radiated



For Conducted



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m(1.5m above 1G) above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto	Peak (Receiver)
1GHz-40GHz	Average Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto	Average (Receiver)

LIMIT

Below -20dB of the highest emission level in operating band.
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)

TEST RESULTS

Remark:
1. We test Band Edge at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5.
2. "---" means not recorded as emission levels lower than limit.

4.5.1 For Radiated Bandedge Measurement

Remark: we tested radiated bandedge at both hopping and no-hopping modes, recorded worst case at no-hopping mode

4.5.1.1 Test data

Data rate	Test channel	Ant.Pol. H/V	Freq. (MHz)	Reading		Ant/CF CF(dB)	Act		Limit	
				Peak (dBuv)	AV (dBuv)		Peak (dBuv/m)	AV (dBuv/m)	Peak (dBuv/m)	AV (dBuv/m)
1Mbps	CH00	V	2390	41.56	30.27	-5.79	35.77	24.48	74	54
	CH00	H	2390	43.68	31.14	-5.79	37.89	25.35	74	54
	CH78	V	2483.5	46.77	33.25	-4.98	41.79	28.27	74	54
	CH78	H	2483.5	45.12	33.52	-4.98	40.14	28.54	74	54
3Mbps	CH00	V	2390	40.36	30.72	-5.79	34.57	24.93	74	54
	CH00	H	2390	42.88	31.16	-5.79	37.09	25.37	74	54
	CH78	V	2483.5	41.79	30.33	-4.98	36.81	25.35	74	54
	CH78	H	2483.5	40.38	29.93	-4.98	35.4	24.95	74	54

Remark：

(1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode.

(2) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna

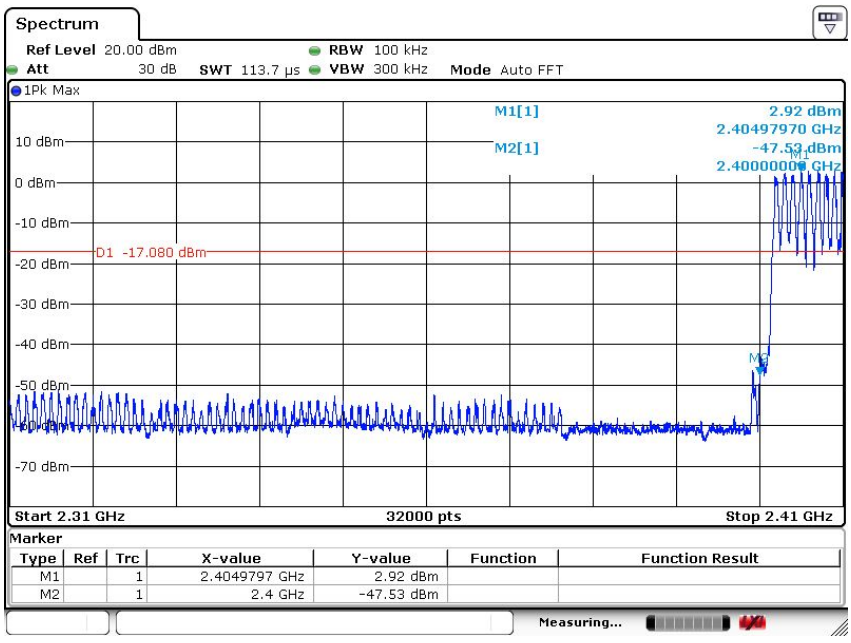
(3) Corr.Factor = Antenna Factor + Cable Loss – Pre-amplifier.

4.5.2 For Conducted Bandedge Measurement

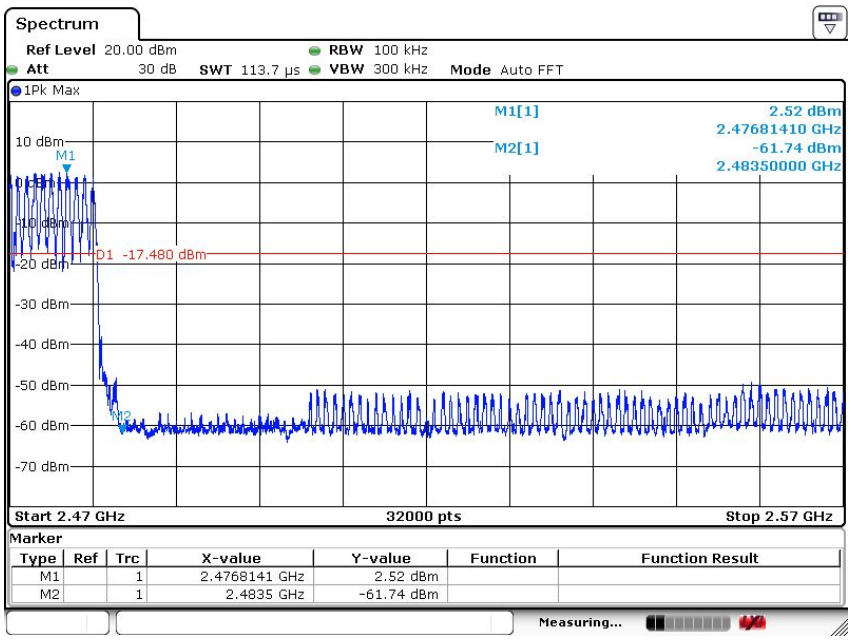
4.5.2.1 GFSK Test Mode

We tested hopping mode and non-hopping mode,and recorded the worst case at the hopping mode.

A. Test Plots



(Plot 4.5.2.1 A: Hopping Mode @ GFSK)

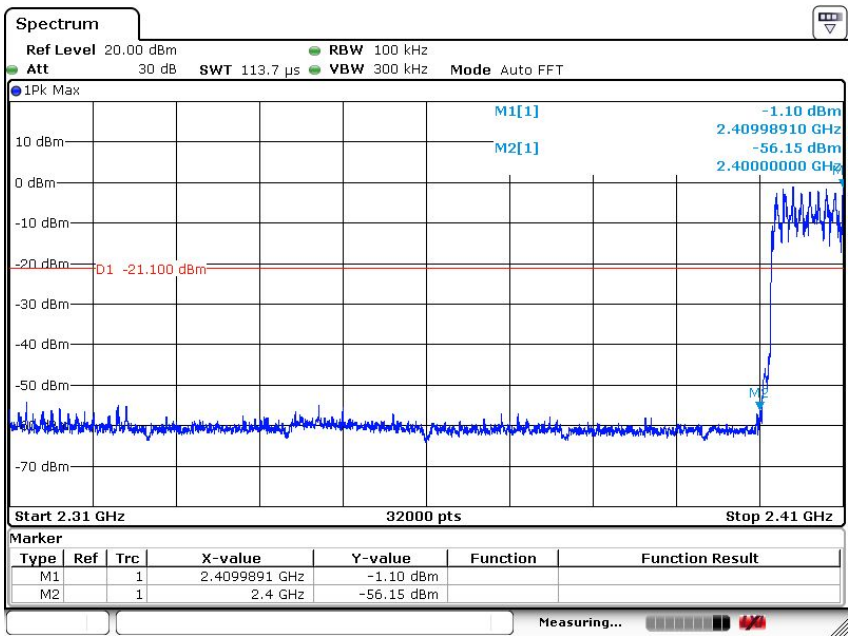


(Plot 4.5.2.1 B: Hopping Mode @ GFSK)

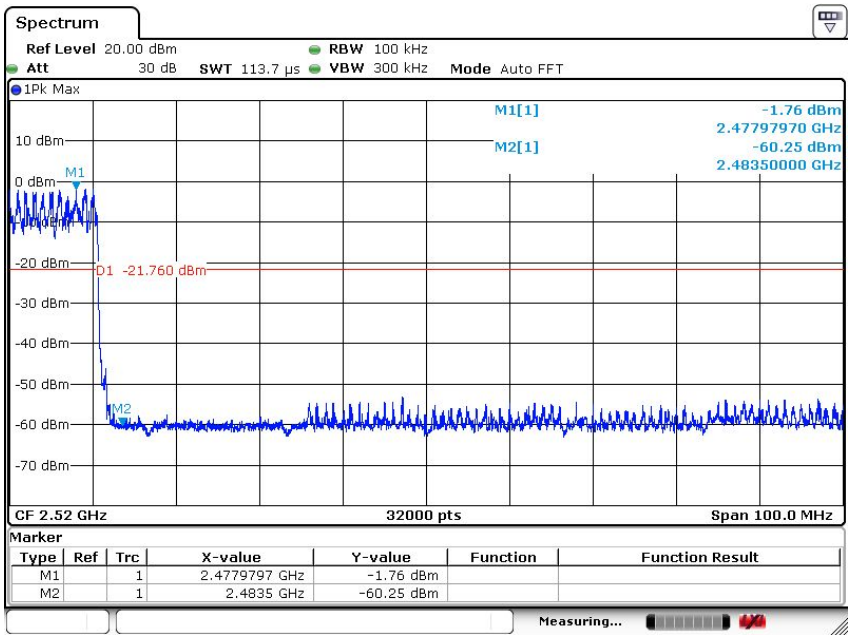
4.5.2.2 8DPSK Test Mode

We tested hopping mode and non-hopping mode,and recorded the worst case at the hopping mode.

A. Test Plots



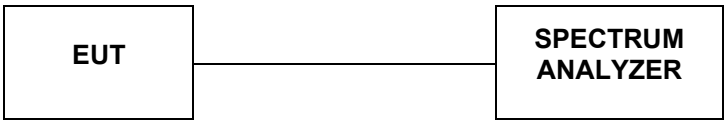
(Plot 4.5.2.2 A: Hopping Mode @ 8DPSK)



(Plot 4.5.2.2 B: Hopping Mode @ 8DPSK)

4.6 Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST RESULTS

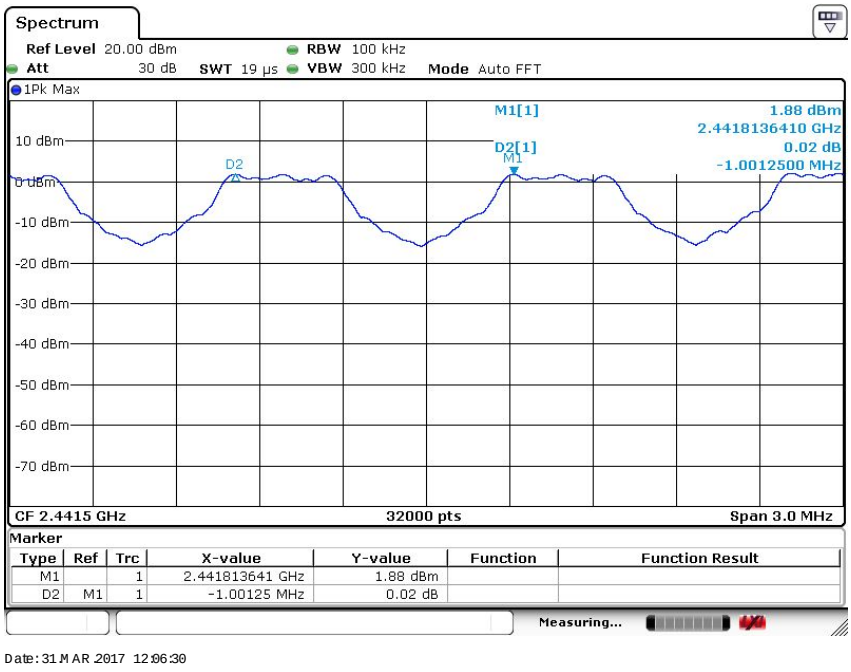
Remark: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5) and all test channels, recorded worst case at DH5 and middle channel.

4.6.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.0013	Plot 4.6.1 A	0.8702	PASS
39	2441				

B. Test Plots



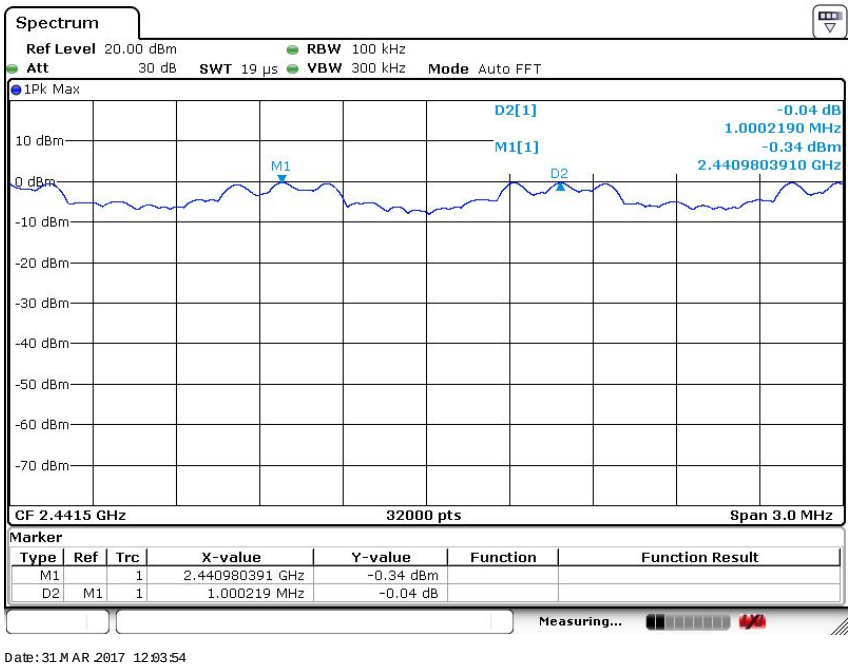
(Plot 4.6.1 A: Channel 39: 2441MHz @ GFSK)

4.6.2 8DPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.0002	Plot 4.6.2 A	0.84936	PASS
39	2441				

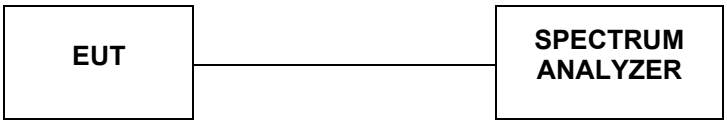
B. Test Plots



(Plot 4.6.2 A: Channel 39: 2441MHz @ 8DPSK)

4.7 Number of hopping frequency

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=100 KHz and VBW=300 KHz.

LIMIT

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

TEST RESULTS

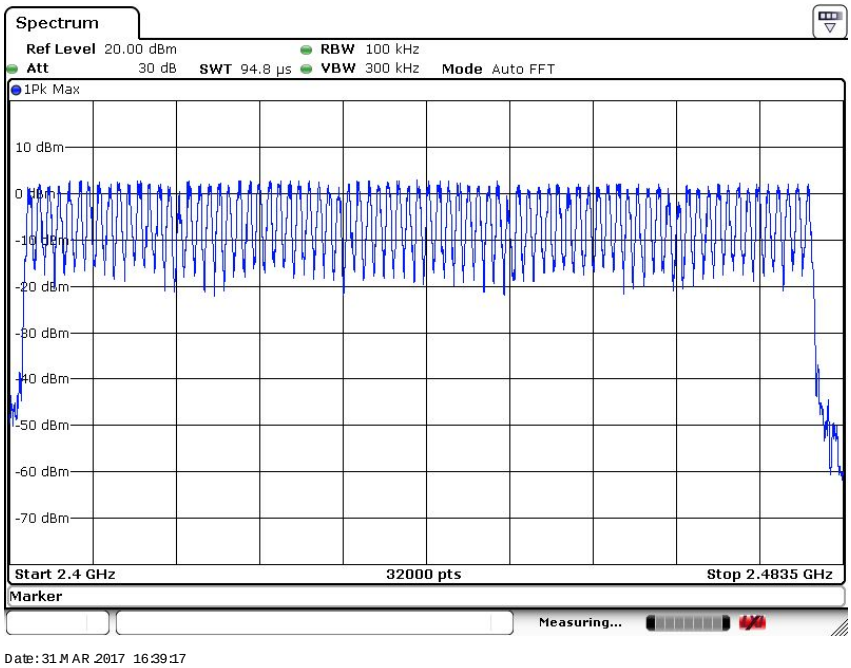
Remark: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5.

4.7.1 GFSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.7.1 A1	≥15	PASS

B. Test Plots



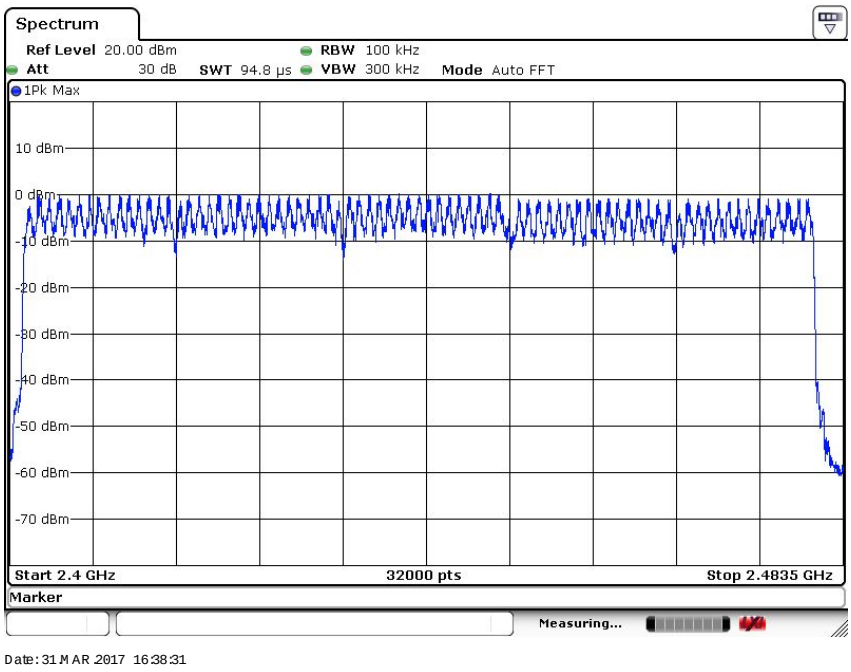
(Plot 4.7.1 A1: @ GFSK)

4.7.2 8DPSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.7.2 A1	≥15	PASS

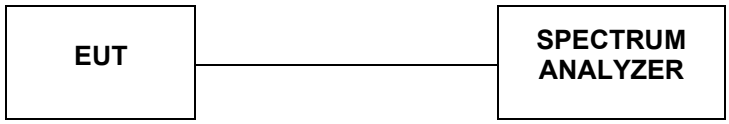
B. Test Plots



(Plot 4.7.2 A1: @ 8DPSK)

4.8 Time of Occupancy (Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=1MHz, Span=0Hz.

LIMIT

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

TEST RESULTS

The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation:0.4[s]*hopping number=0.4[s]*79[ch]=31.6[s*ch];
The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.
The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch*hop/s] for all channels. So the final hopping rate for all channels is 1600/6=266.67 [ch*hop/s]
The hops per second on one channel: 266.67 [ch*hops/s]/79 [ch]=3.38 [hop/s];
The total hops for all channels within the dwell time calculation duration: 3.38 [hop/s]*31.6[s*ch]=106.67 [hop*ch];
The dwell time for all channels hopping: 106.67 [hop*ch]*Burst Width [ms/hop/ch].

Remark: 1. We test Frequency Separation at all test channels, recorded worst case at middle channel.

A. Test Verdict

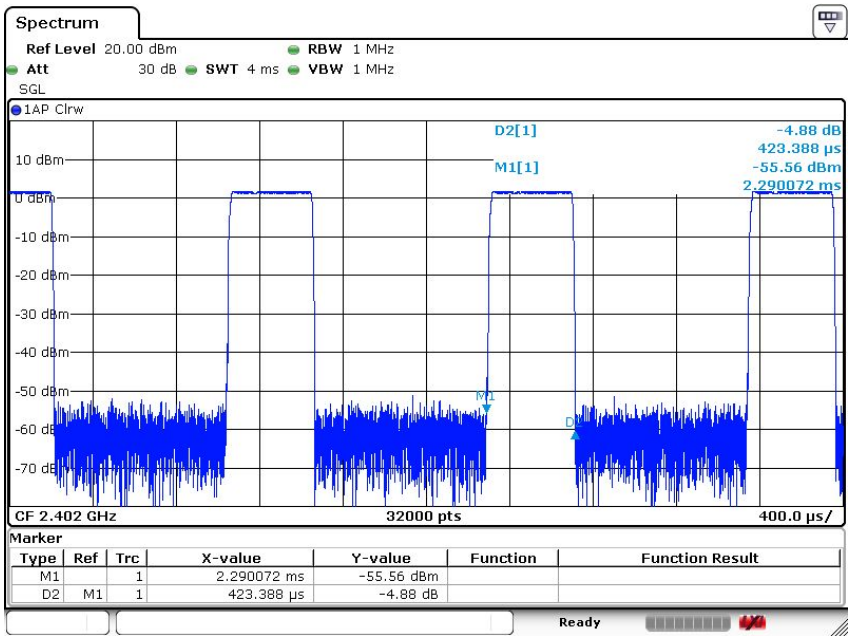
4.8.1 GFSK Test Mode

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH1	2402	0.423	0.135	0.4	Plot 4.8.1 A	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH3	2402	1.680	0.279	0.4	Plot 4.8.1 B	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH5	2402	2.928	0.312	0.4	Plot 4.8.1 C	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

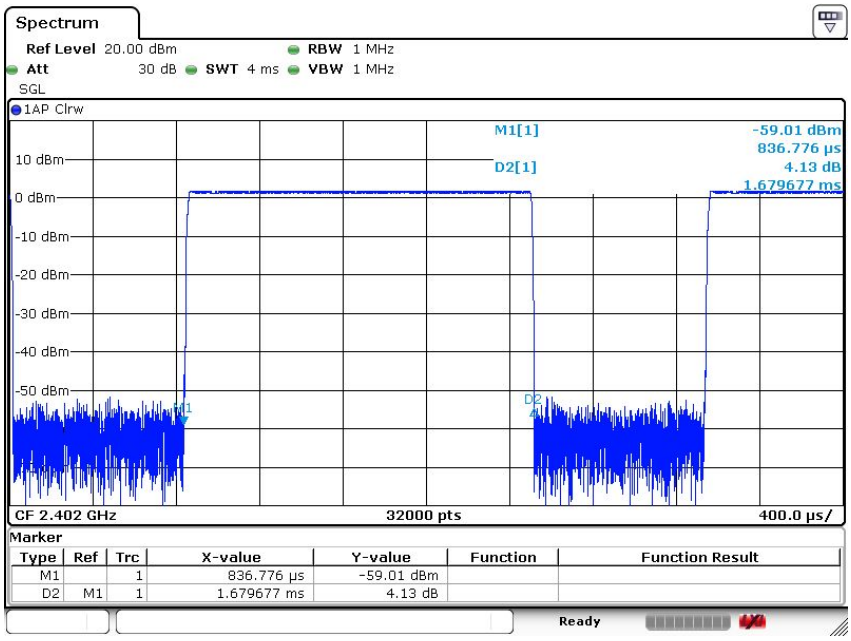
4.8.2 8DPSK Test Mode

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH1	2402	0.432	0.138	0.4	Plot 4.8.2 A	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH3	2402	1.685	0.280	0.4	Plot 4.8.2 B	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH5	2402	2.938	0.313	0.4	Plot 4.8.2 C	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

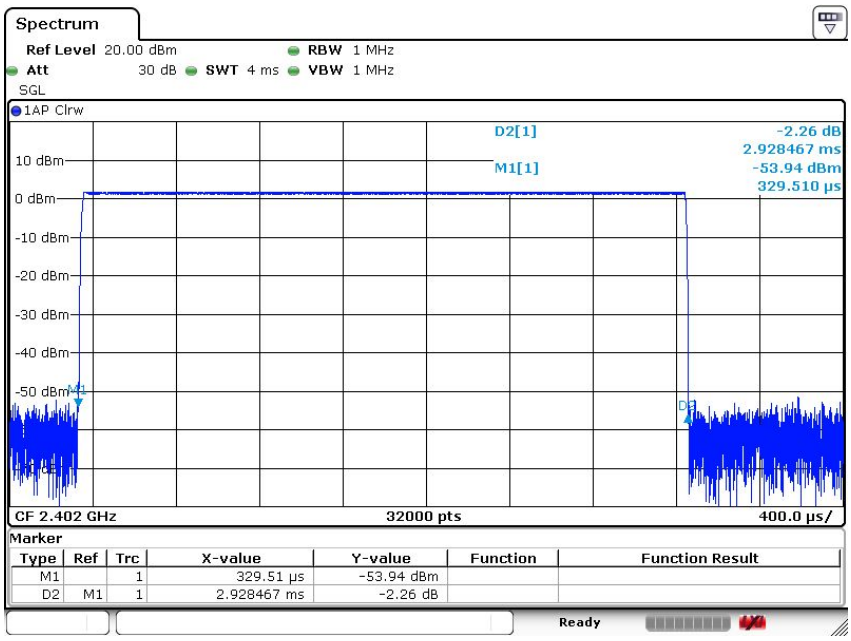
B. Test Plots



(Plot 4.8.1.A: Channel 00: 2402MHz @ GFSK @ DH1)

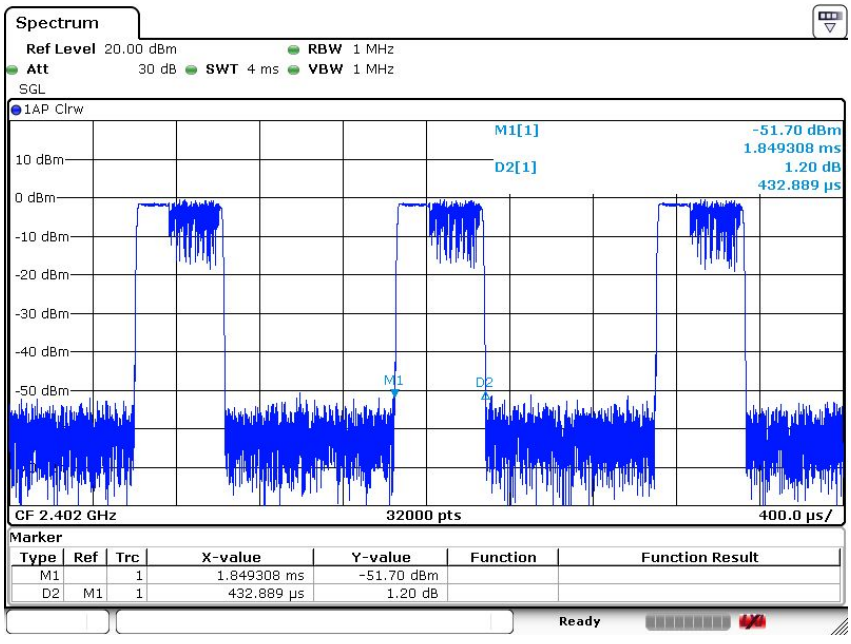


(Plot 4.8.1.B: Channel 00: 2402MHz @ GFSK @ DH3)



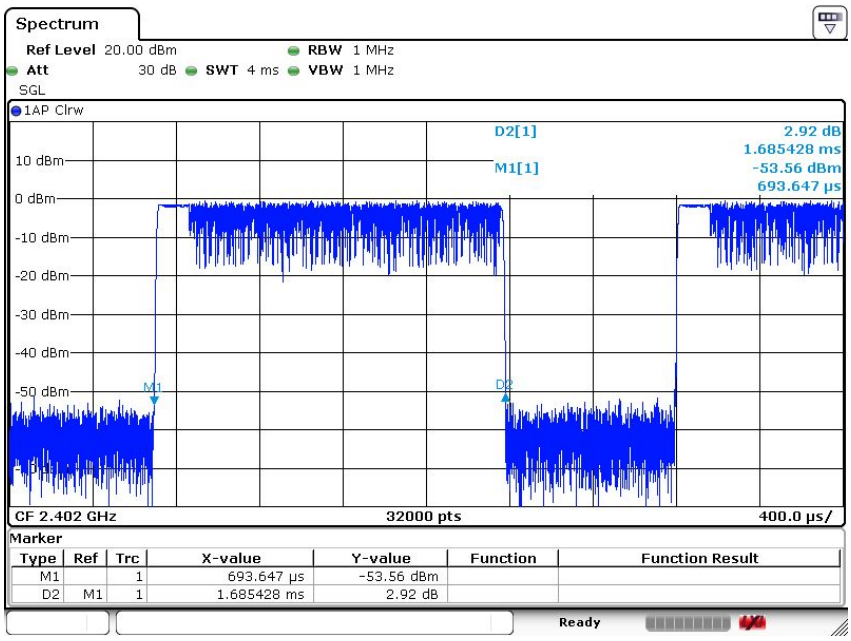
Date: 31.MAR.2017 16:41:24

(Plot 4.8.1.C: Channel 00: 2402MHz @ GFSK @ DH5)

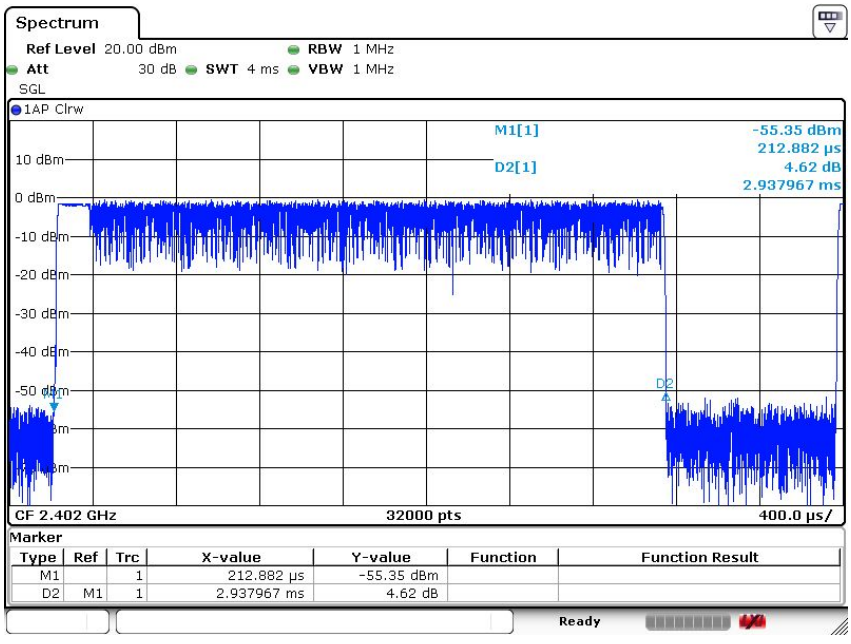


Date: 31.MAR.2017 16:43:58

(Plot 4.8.2.A: Channel 00: 2402MHz @ 8DPSK @ DH1)



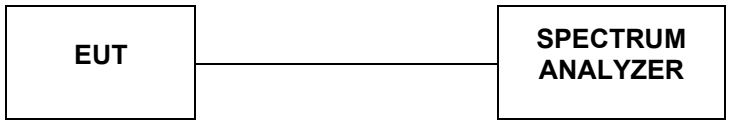
(Plot 4.8.2.B: Channel 00: 2402MHz @ 8DPSK @ DH3)



(Plot 4.8.2.C: Channel 00: 2402MHz @ 8DPSK @ DH5)

4.9 Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10:2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength , and measurement frequency range from 9KHz to 26.5GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Remark:
1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5.
2.For 9KHz -30MHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

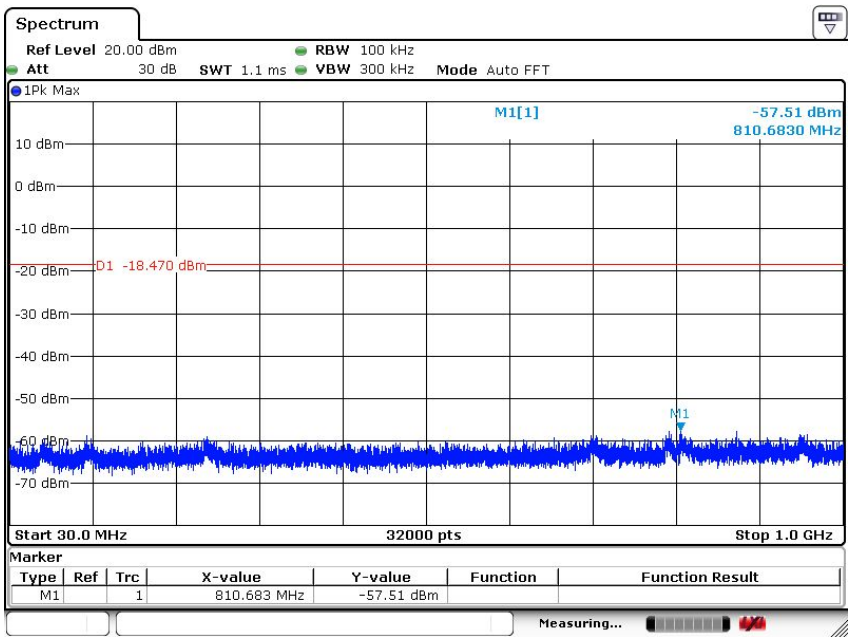
4.9.1 GFSK Test Mode

A. Test Verdict

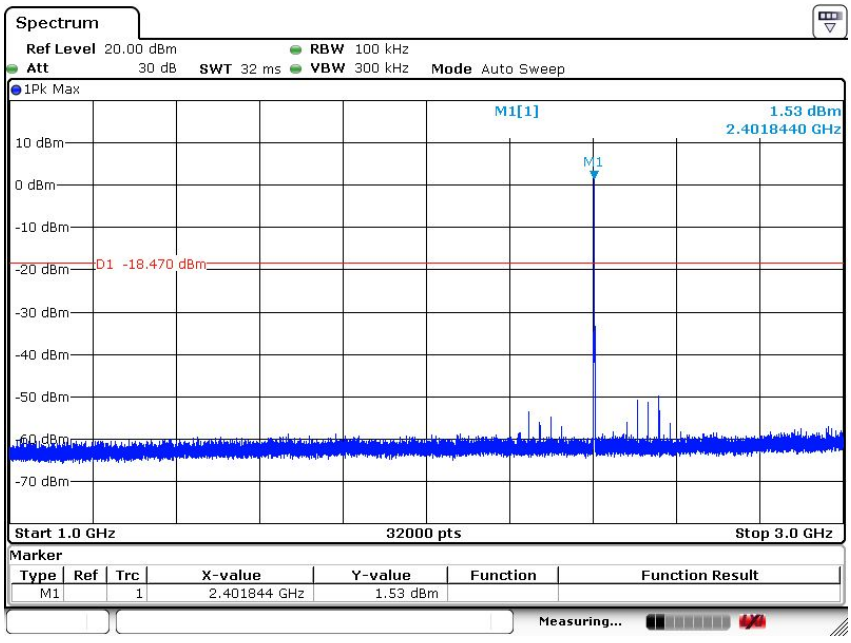
Channel	Frequency (MHz)	Frequency Range	Sweep Points	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-1GHz	9700	Plot 4.9.1 A1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.1 A2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.1 A3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.1 A4	-20	PASS
39	2441	30MHz-1GHz	9700	Plot 4.9.1 B1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.1 B2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.1 B3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.1 B4	-20	PASS
78	2480	30MHz-1GHz	9700	Plot 4.9.1 C1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.1 C2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.1 C3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.1 C4	-20	PASS

Note:
1. The test results including the cable lose.

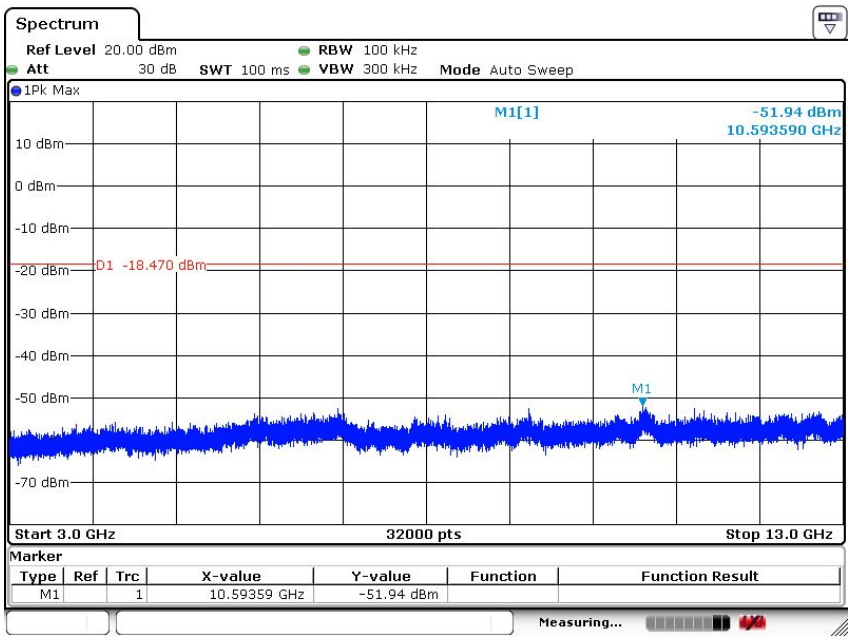
B. Test Plots



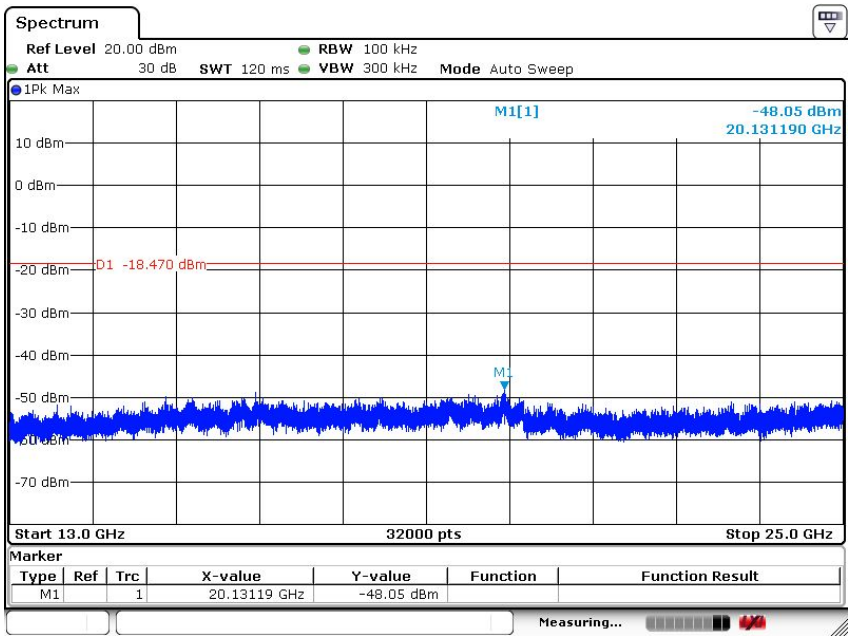
(Plot 4.9.1 A1: Channel 00: 2402MHz @ GFSK)



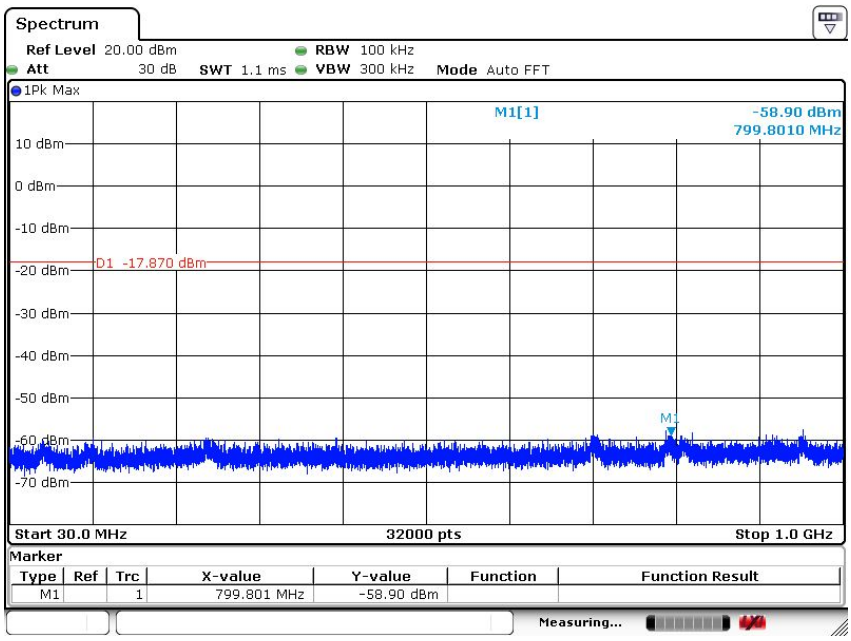
(Plot 4.9.1 A2: Channel 00: 2402MHz @ GFSK)



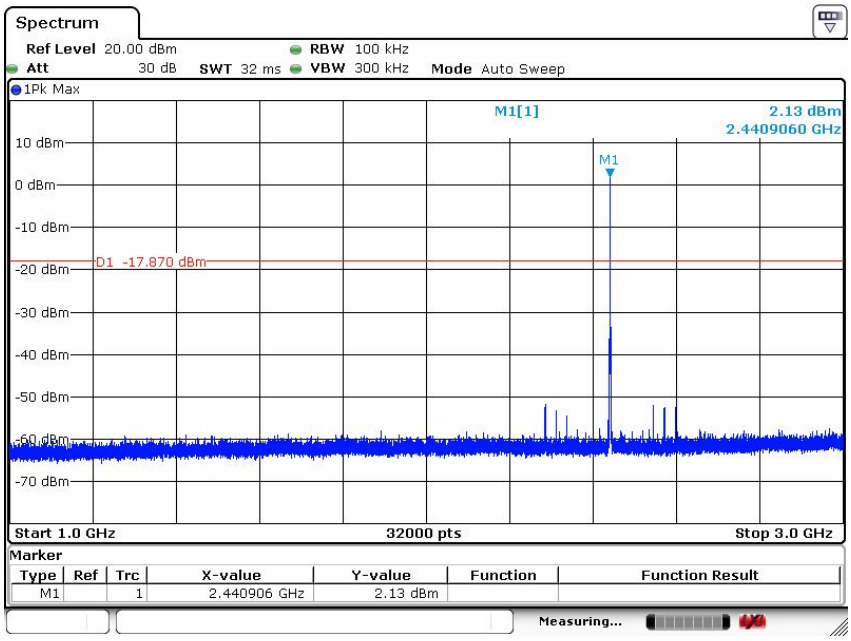
(Plot 4.9.1 A3: Channel 00: 2402MHz @ GFSK)



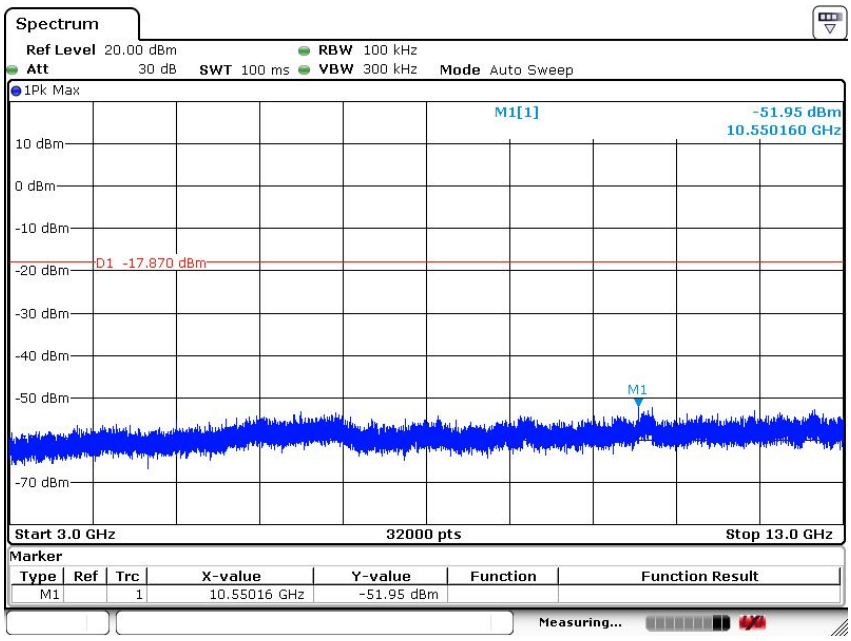
(Plot 4.9.1 A4: Channel 00: 2402MHz @ GFSK)



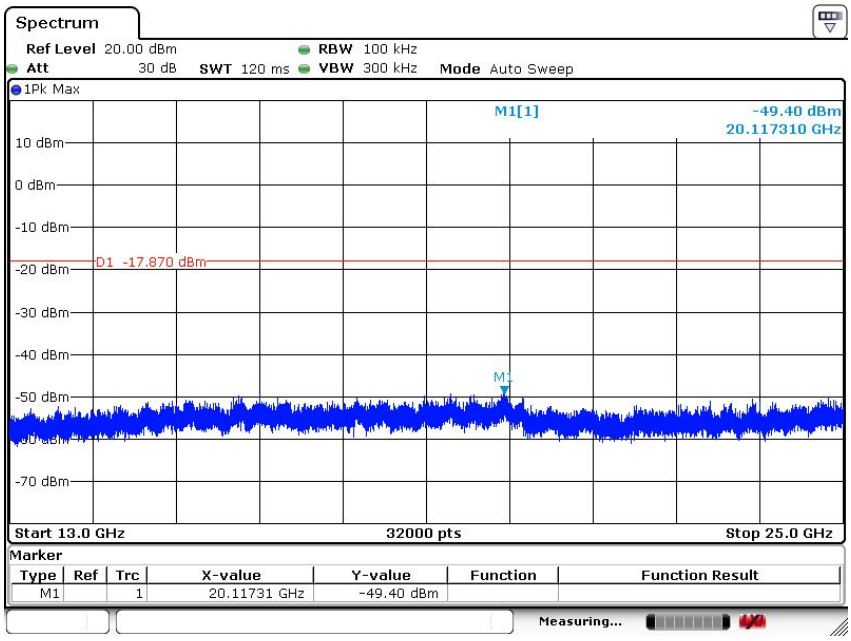
(Plot 4.9.1 B1: Channel 39: 2441MHz @ GFSK)



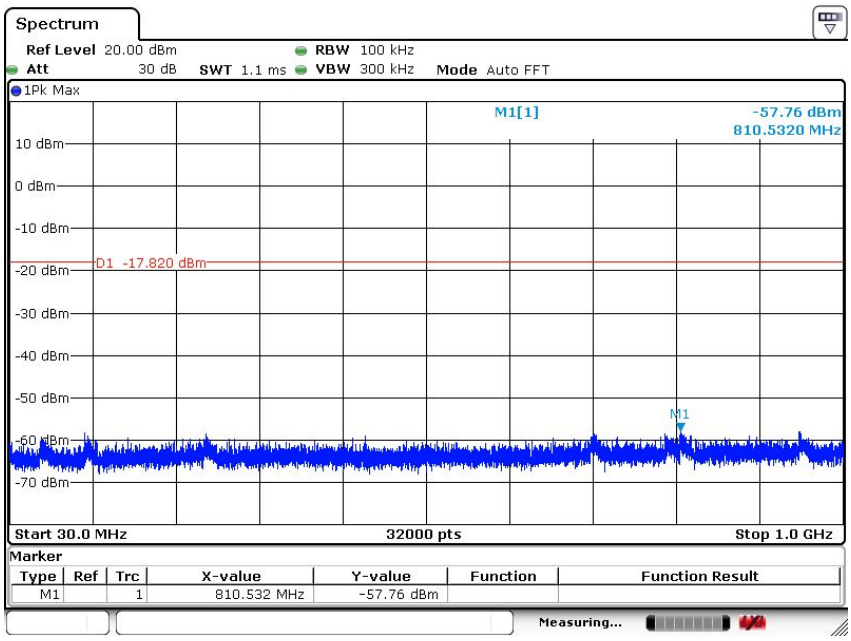
(Plot 4.9.1 B2: Channel 39: 2441MHz @ GFSK)



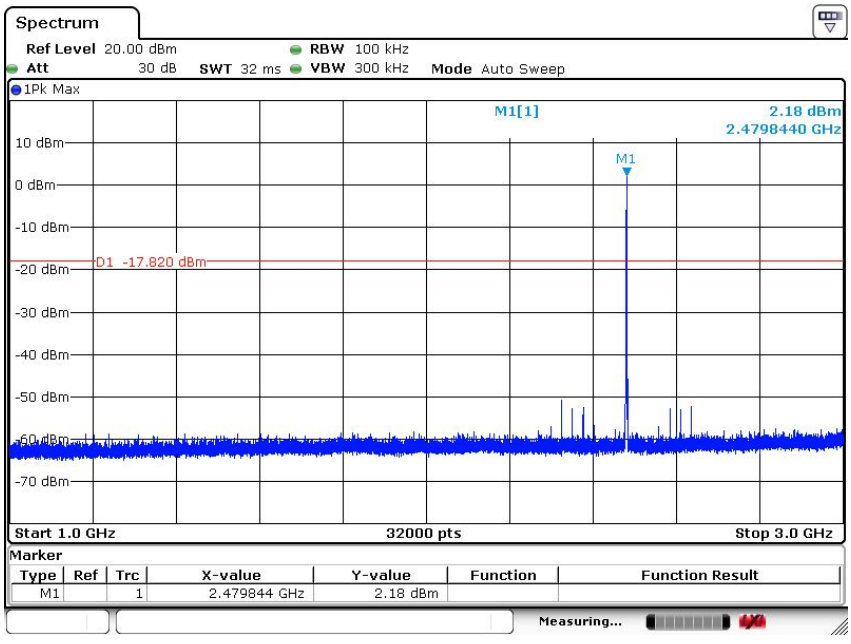
(Plot 4.9.1 B3: Channel 39: 2441MHz @ GFSK)



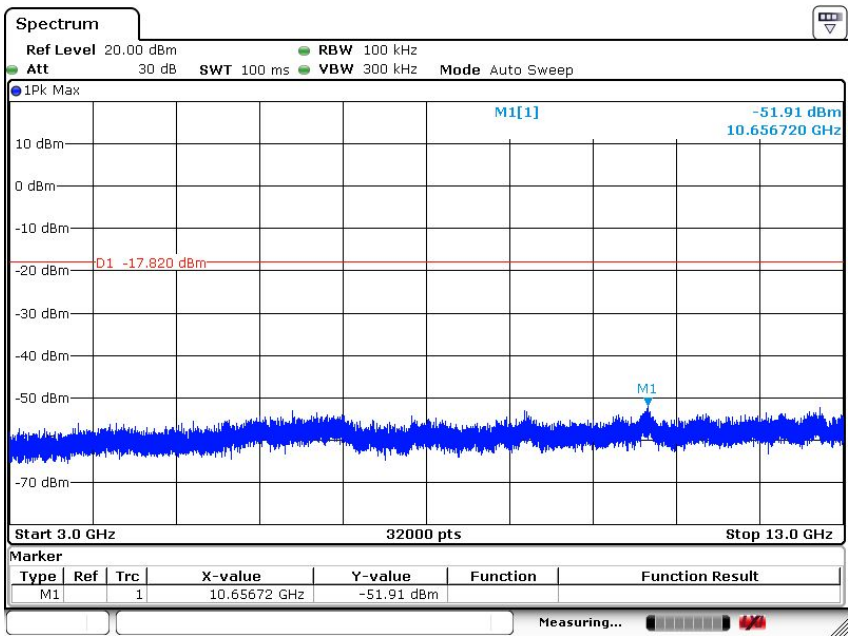
(Plot 4.9.1 B4: Channel 39: 2441MHz @ GFSK)



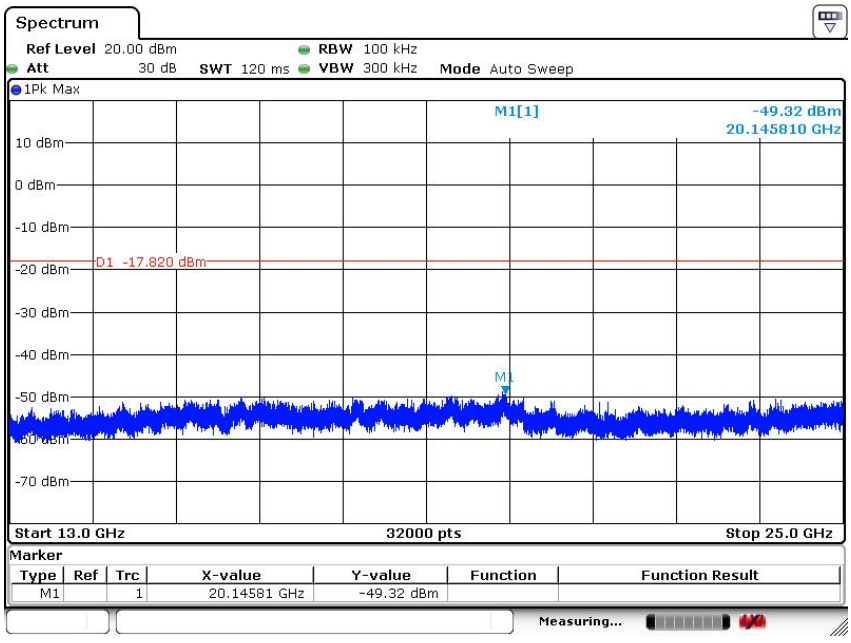
(Plot 4.9.1 C1: Channel 78: 2480MHz @ GFSK)



(Plot 4.9.1 C2: Channel 78: 2480MHz @ GFSK)



(Plot 4.9.1 C3: Channel 78: 2480MHz @ GFSK)



(Plot 4.9.1 C4: Channel 78: 2480MHz @ GFSK)

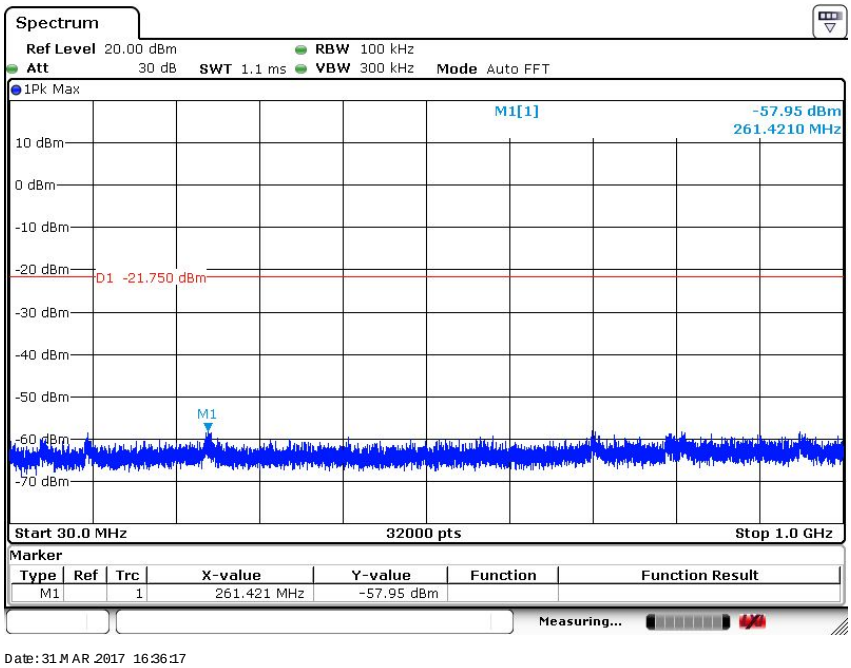
4.9.2 8DPSK Test Mode

A. Test Verdict

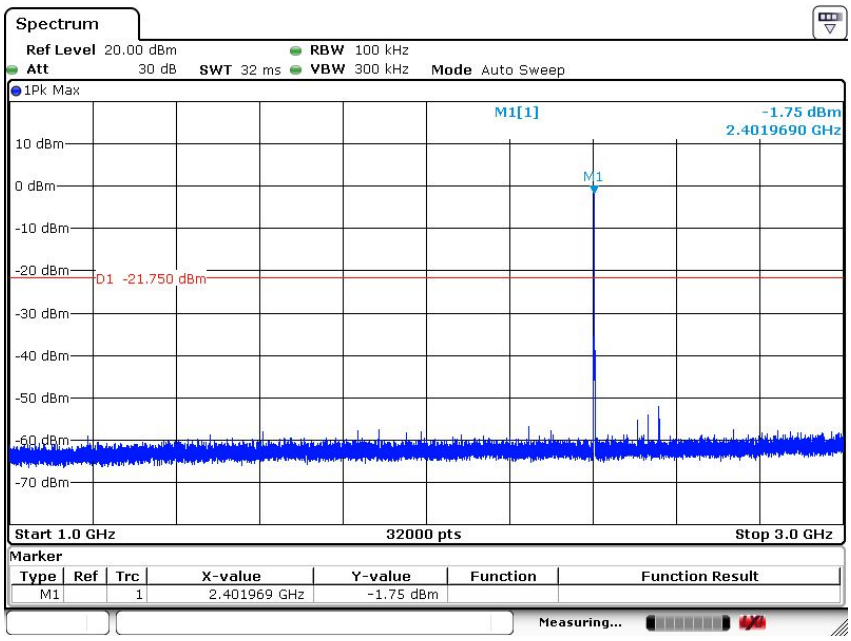
Channel	Frequency (MHz)	Frequency Range	Sweep Points	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-1GHz	9700	Plot 4.9.2 A1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.2 A2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.2 A3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.2 A4	-20	PASS
39	2441	30MHz-1GHz	9700	Plot 4.9.2 B1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.2 B2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.2 B3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.2 B4	-20	PASS
78	2480	30MHz-1GHz	9700	Plot 4.9.2 C1	-20	PASS
		1MHz-3GHz	20000	Plot 4.9.2 C2	-20	PASS
		3GHz-13GHz	100000	Plot 4.9.2 C3	-20	PASS
		13GHz-25GHz	120000	Plot 4.9.2 C4	-20	PASS

Note:
1. The test results including the cable lose.

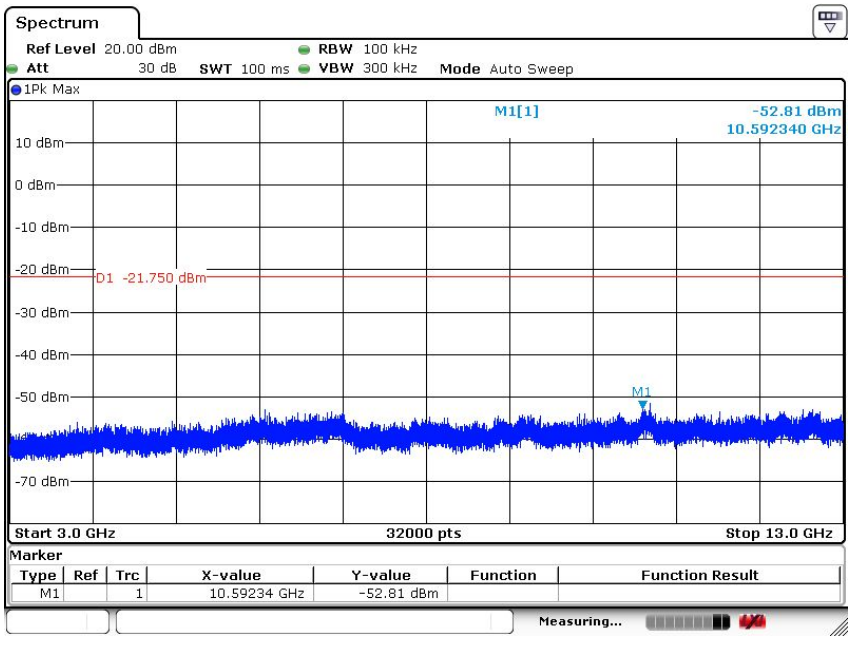
B. Test Plots



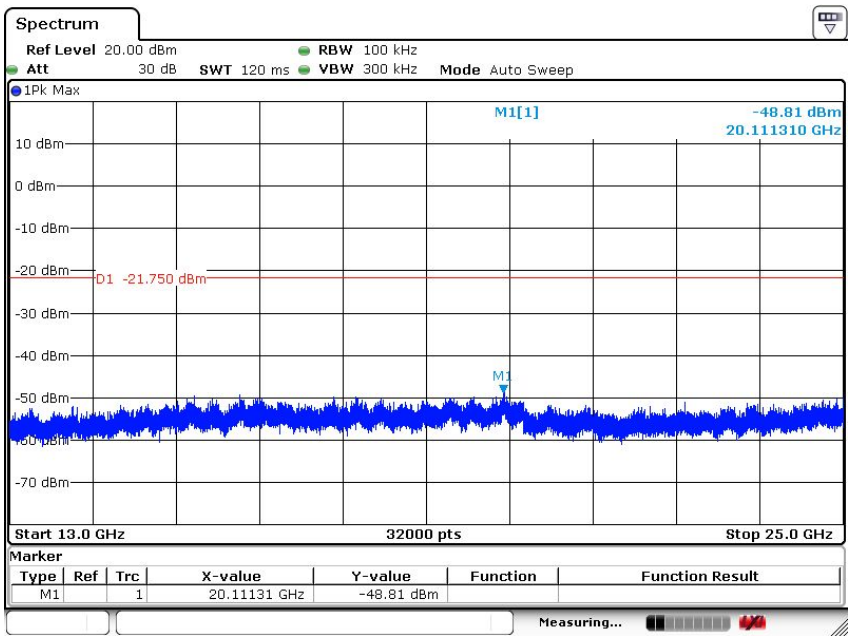
(Plot 4.9.2 A1: Channel 00: 2402MHz @ 8DPSK)



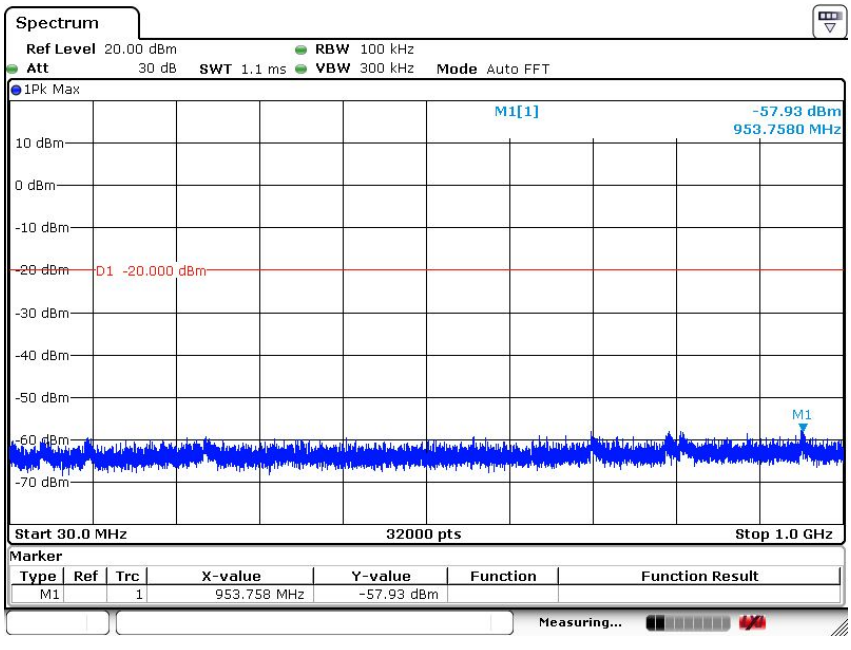
(Plot 4.9.2 A2: Channel 00: 2402MHz @ @ 8DPSK)



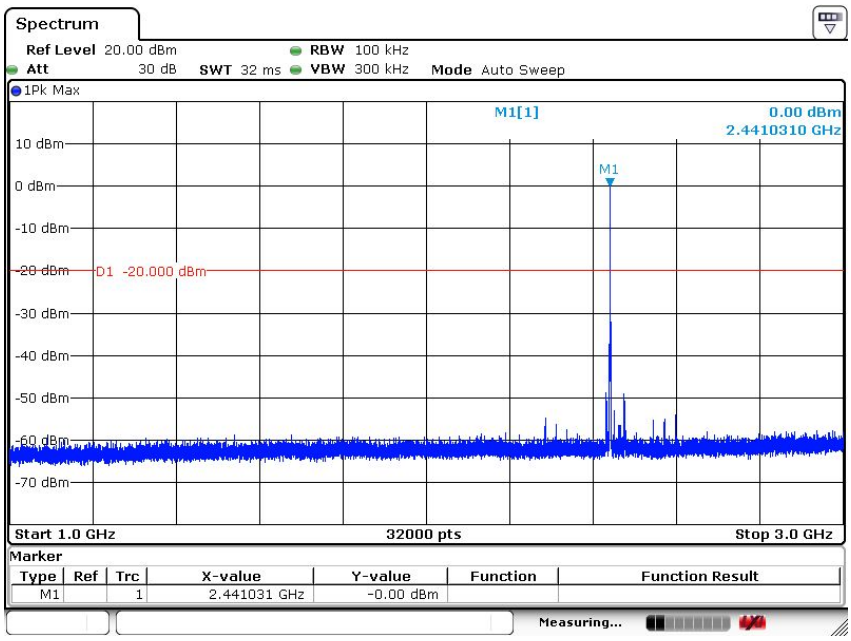
(Plot 4.9.2 A3: Channel 00: 2402MHz @ @ 8DPSK)



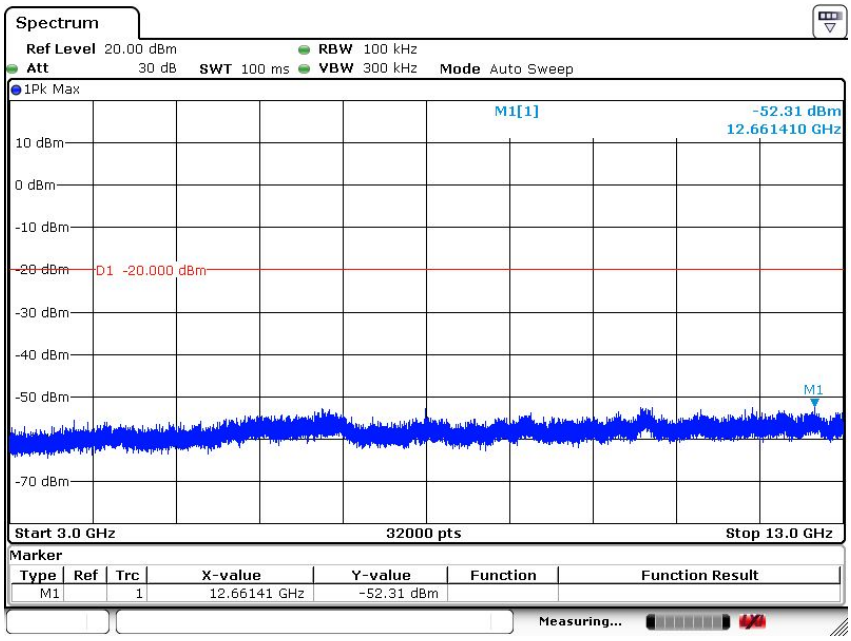
(Plot 4.9.2 A4: Channel 00: 2402MHz @ @ 8DPSK)



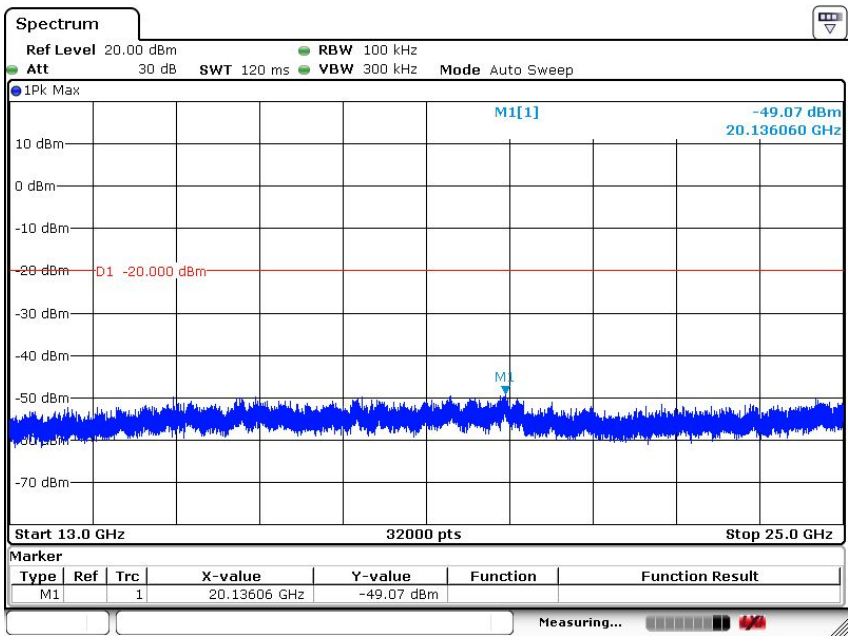
(Plot 4.9.2 B1: Channel 39: 2441MHz @ @ 8DPSK)



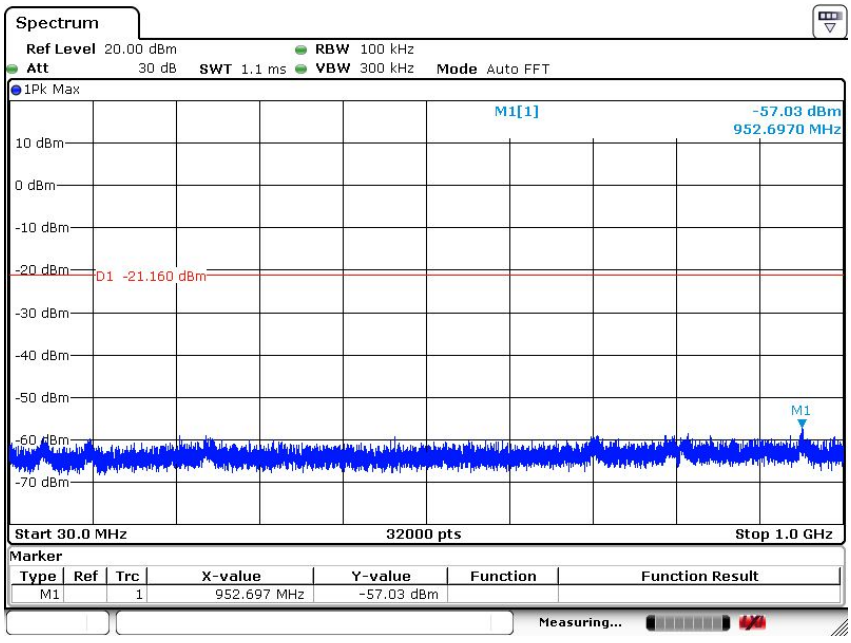
(Plot 4.9.2 B2: Channel 39: 2441MHz @ @ 8DPSK)



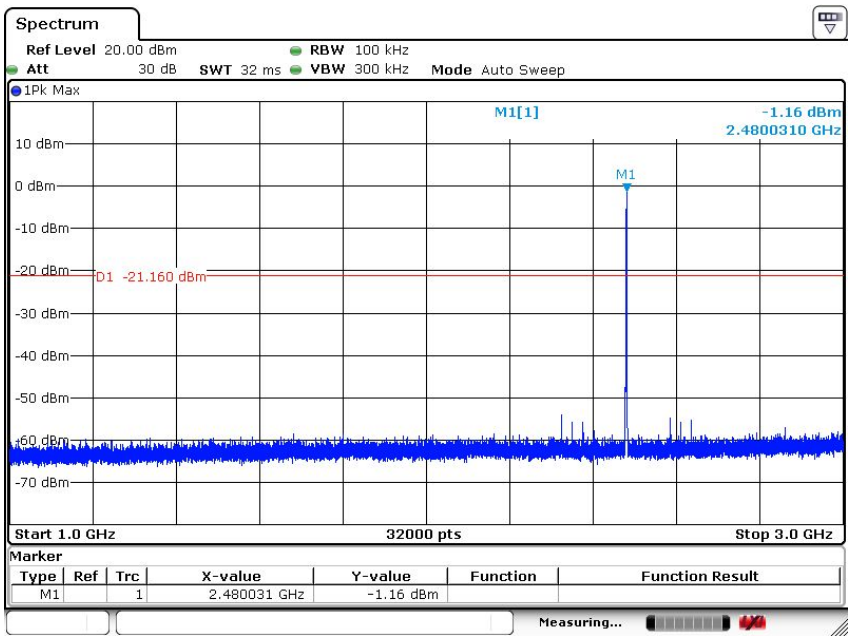
(Plot 4.9.2 B3: Channel 39: 2441MHz @ @ 8DPSK)



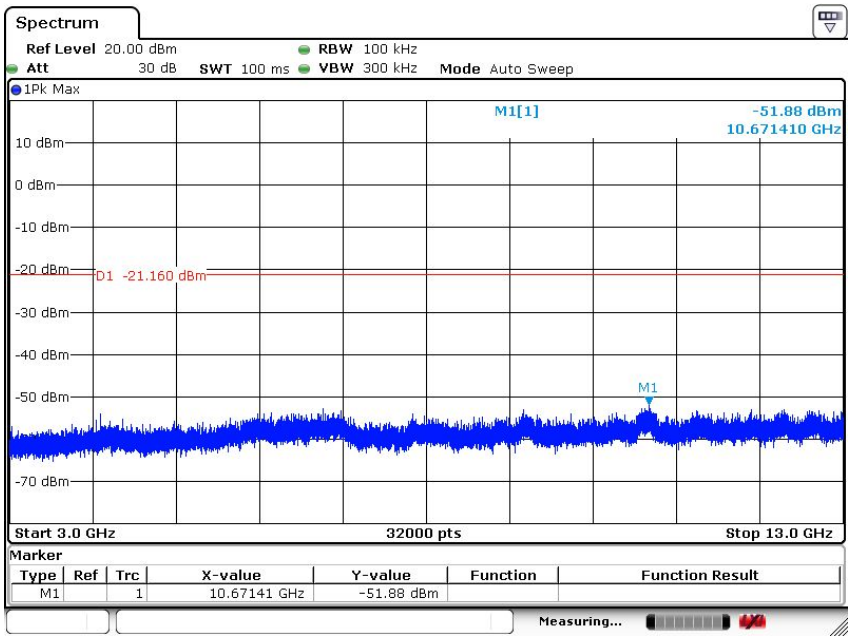
(Plot 4.9.2 B4: Channel 39: 2441MHz @ @ 8DPSK)



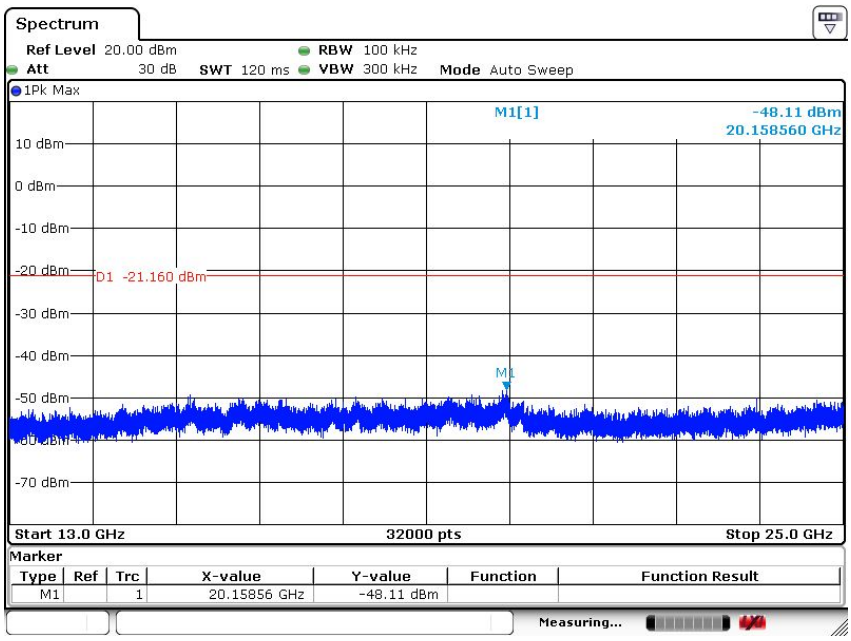
(Plot 4.9.2 C1: Channel 78: 2480MHz @ @ 8DPSK)



(Plot 4.9.2 C2: Channel 78: 2480MHz @ @ 8DPSK)



(Plot 4.9.2 C3: Channel 78: 2480MHz @ @ 8DPSK)



(Plot 4.9.2 C4: Channel 78: 2480MHz @ @ 8DPSK)

4.10 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

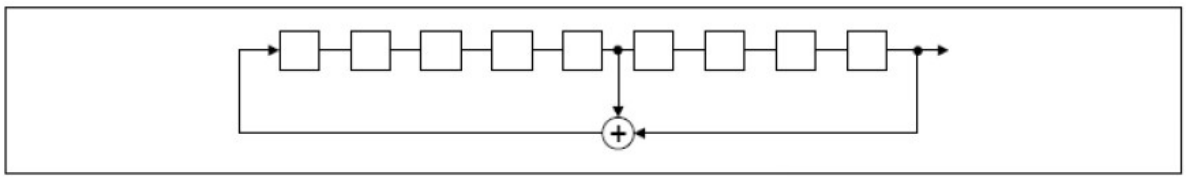
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 125 mW. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

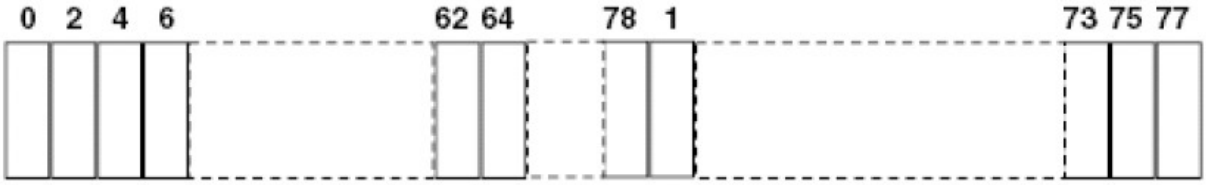
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.11 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.For normal BT devices, the GFSK mode is used.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

antena type:PCB antena

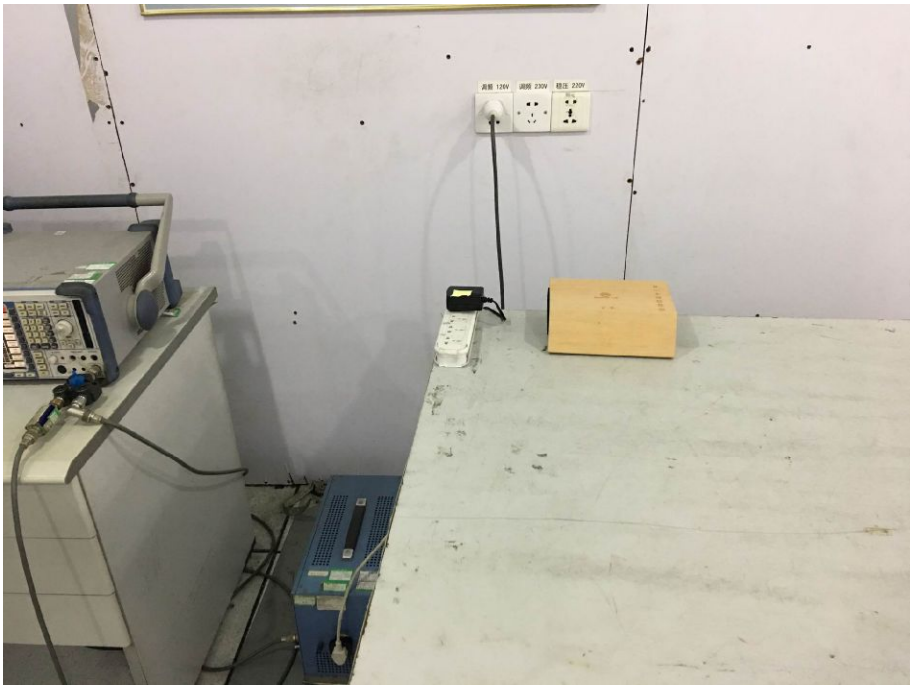
FCC	IC
Antenna Gain	
6 dBi	

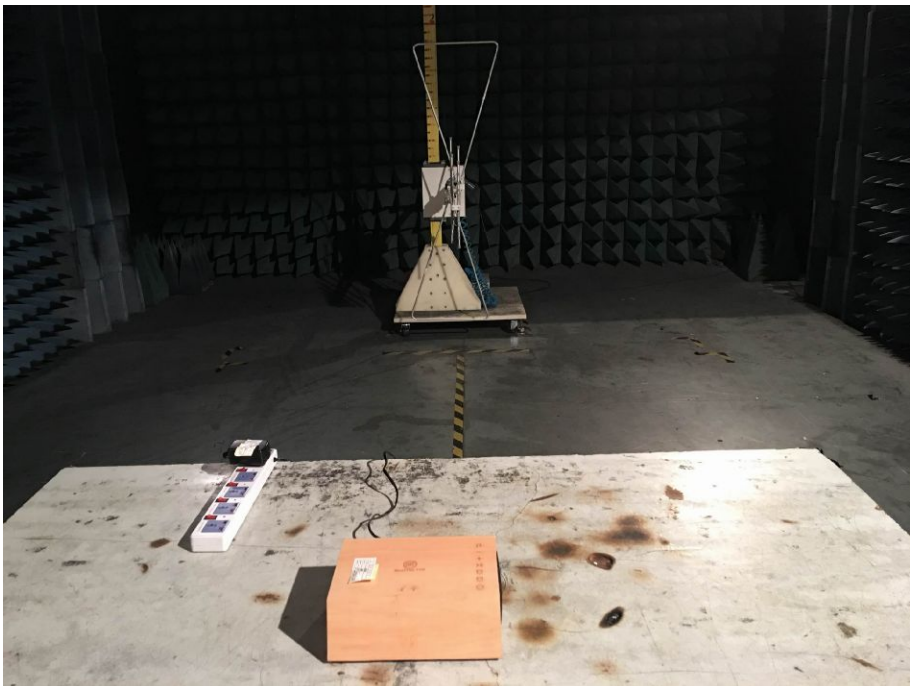
Results

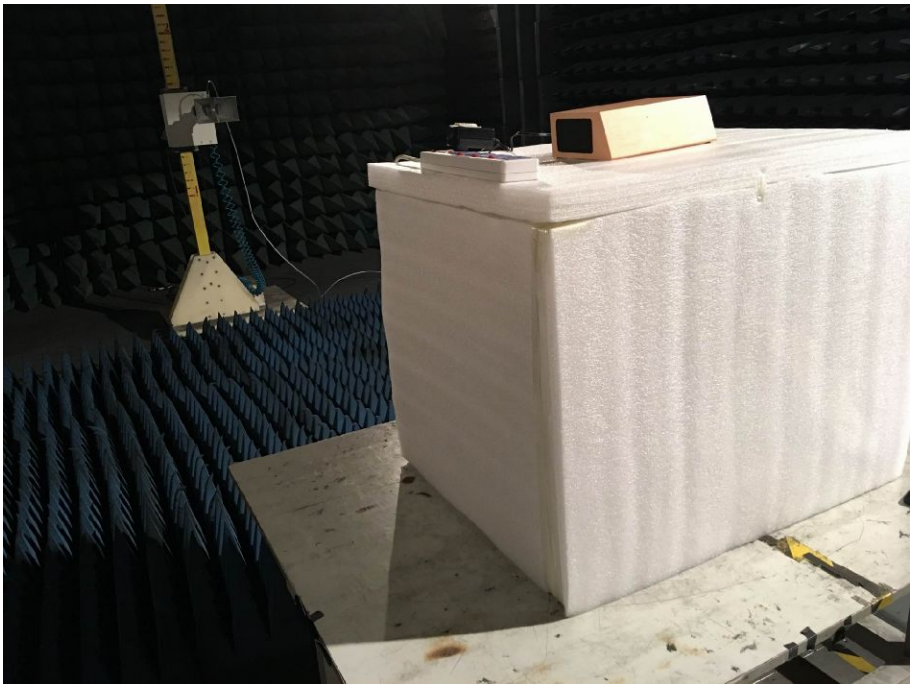
Antenna type:PCB antenna

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2441 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		3.89	3.76	3.95
Radiated power [dBm] Measured with GFSK modulation		4.52	4.37	4.42
Gain [dBi] Calculated		0.63	0.61	0.47
Measurement uncertainty		± 0.6 dB (cond.) / ± 2.56 dB (rad.)		

Setup photo







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