Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**GTSR18110097-EDR**
FCC ID.....:	**2ARJURIMWBD**
Compiled by (position+printed name+signature)..:	File administrators Jimmy Wang
Supervised by (position+printed name+signature)..:	Test Engineer Aaron Tan
Approved by (position+printed name+signature)..:	Manager Jason Hu
Date of issue.....:	Nov. 8, 2018
Representative Laboratory Name.:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China
Applicant's name.....:	**Rimports, LLC**
Address .....:	201 East Bay Blvd Provo, UT 84606 United States
Test specification .....:	
Standard .....:	**FCC Part 15.247**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd.
Master TRF.....:	Dated 2014-12

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Test item description .....:	**AromaSpeaker-WoodGrain Diffuser**
Trade Mark .....:	ScentSationals, Better Homes & Gardens
Manufacturer .....:	Vitality Crafts Ltd.
Model/Type reference.....:	RIM-WBD
Listed Models .....:	BH19-059-099-53
Difference .....:	All models have same circuits diagram, PCB Layout, construction and rated power,only different is the model name.
Modulation Type .....:	GFSK, Π/4DQPSK, 8DPSK
Difference .....:	/
Operation Frequency.....:	From 2402MHz to 2480MHz
Hardware Version .....:	V12
Software Version .....:	V1.5
Rating .....:	DC 24V from Adapter
Result.....:	**PASS**

TEST REPORT

Test Report No. :	GTSR18110097-EDR	Nov. 8, 2018 Date of issue

Equipment under Test	:	AromaSpeaker-WoodGrain Diffuser
Model /Type	:	RIM-WBD
Listed Models	:	BH19-059-099-53
Applicant	:	**Rimports, LLC**
Address	:	201 East Bay Blvd Provo, UT 84606 United States
Manufacturer	:	**Vitality Crafts Ltd.**
Address	:	2-4th Floor, Light Industrial Build Yon Lian Electroinc (HuiZhou) Ltd Jiang Jun Road, Cha Yuan Village Qiu Chang Town, Hui Yang District

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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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
KDB 558074 V05 : GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Oct. 29, 2018
Testing commenced on	:	Nov. 1~8, 2018
Testing concluded on	:	Nov. 8, 2018

2.2. Product Description

Product Name:	AromaSpeaker-WoodGrain Diffuser
Trade Mark:	ScentSationals, Better Homes & Gardens
Model/Type reference:	RIM-WBD
Listed Models	BH19-059-099-53
Power Supply	DC 24V from Adapter Adapter Information： Model： GQ12-240065-AU Input: GQ12-240065-AU Output: DC 24V/650mA
BT	
Modulation Type	GFSK,π/4DQPSK,8DPSK
Operation frequency	2402-2480 MHz
Antenna Type:	PCB Antenna
Antenna Gain:	2.2dBi

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	●	120V / 60Hz
		○	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

2.4. Short description of the Equipment under Test (EUT)

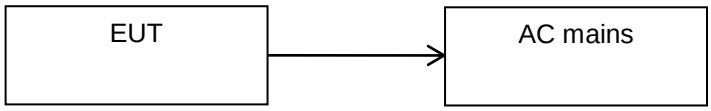
This is a **AromaSpeaker-WoodGrain Diffuser**.

2.5. EUT operation mode

The Applicant provides communication tools software（BK3266 RF Test_V1.5） to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT. Channel 00/38/78 was selected to test.

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**		

2.6. Block Diagram of Test Setup



2.7. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
TOSHIBA	Tablet PC	Satellite S40Dt-A	D26T	DOC

2.8. Related Submittal(s) / Grant (s)

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

2.9. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

3.2. Test Facility

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

FCC-Registration No.: 165725

Shenzhen Global Test Service 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.

A2LA-Lab Cert. No.: 4758.01

Shenzhen Global Test Service Co.,Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

CNAS-Lab Code: L8169

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2018.

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. Summary of measurement results

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Pre-test AC conducted emission at both voltage AC 120V/60Hz and AC 240V/50Hz, recorded worst case.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, which was determined to be TX(2402MHz Hopping Mode,GFSK).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(2402MHz Hopping Mode,GFSK).

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2018/09/20	2019/09/19
LISN	R&S	ESH2-Z5	893606/008	2018/09/20	2019/09/19
Bilog Antenna	Schwarzbeck	VULB9163	976	2016/09/20	2019/09/19
EMI Test Receiver	R&S	ESCI7	101102	2018/09/20	2019/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2018/09/20	2019/09/19
Spectrum Analyzer	R&S	FSP40	100019	2018/06/05	2019/06/04
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2016/09/20	2019/09/19
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2016/09/20	2019/09/19
Broadband Horn Antenna	SCHWARZBEC K	BBHA 9170	971	2016/09/20	2019/09/19
Amplifier	Schwarzbeck	BBV 9743	#202	2018/09/20	2019/09/19

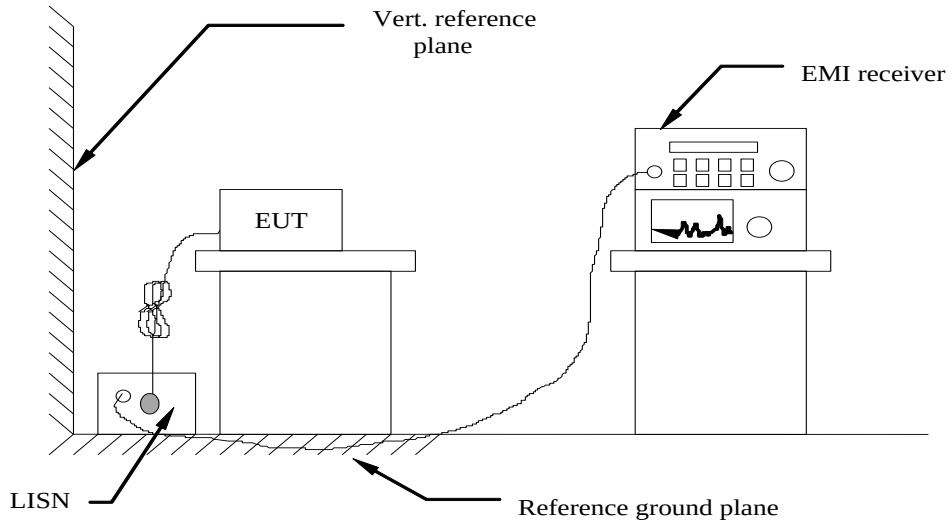
Amplifier	EMCI	EMC051845B	980355	2018/09/20	2019/09/19
Temperature/Humidity Meter	Gangxing	CTH-608	02	2018/09/20	2019/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2018/09/20	2019/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2018/09/20	2019/09/19
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2018/09/20	2019/09/19
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2018/09/20	2019/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2018/09/20	2019/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2018/09/20	2019/09/19
EMI Test Software	R&S	ES-K1	V1.7.1	2018/09/20	2019/09/19
EMI Test Software	JS Tonscend	JS32-RE	2.0.1.5	2018/09/20	2019/09/19
EMI Test Software	Audix	E3	2..1.1	2018/09/20	2019/09/19

Note: 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 The EUT received DC 5V power, the adapter received AC120V/60Hz or AC 240V/50Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 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.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

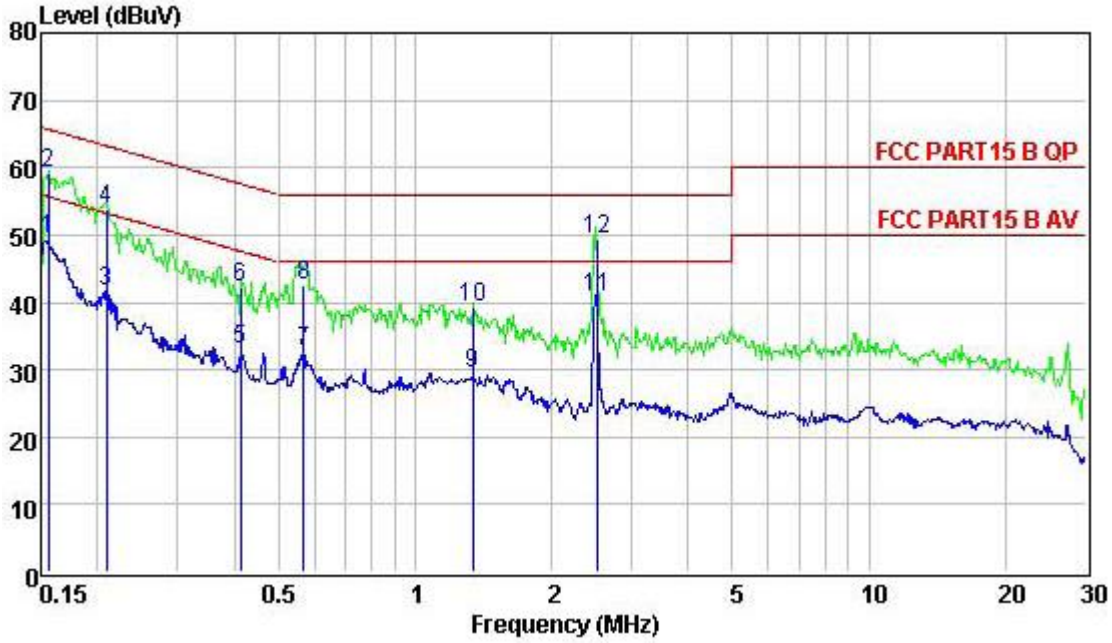
For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

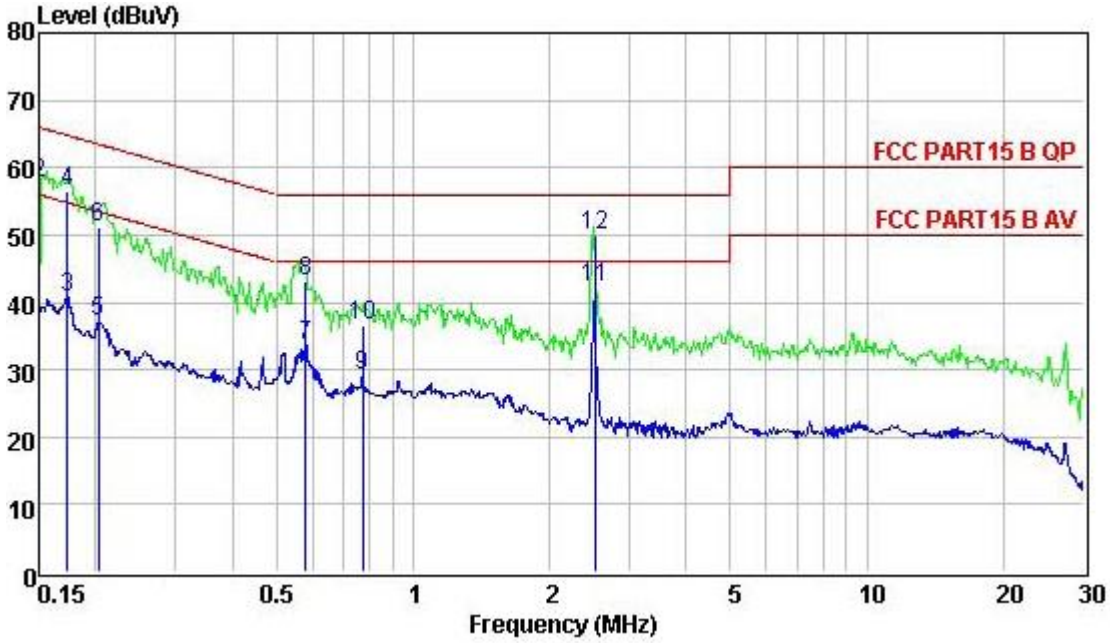
Remark: We measured Conducted Emission at GFSK, π/4 DQPSK and 8DPSK mode in DC 12V form adapter, the worst case was recorded .

Power supply:	AC 240V/50Hz(Adapter)	Polarization	L



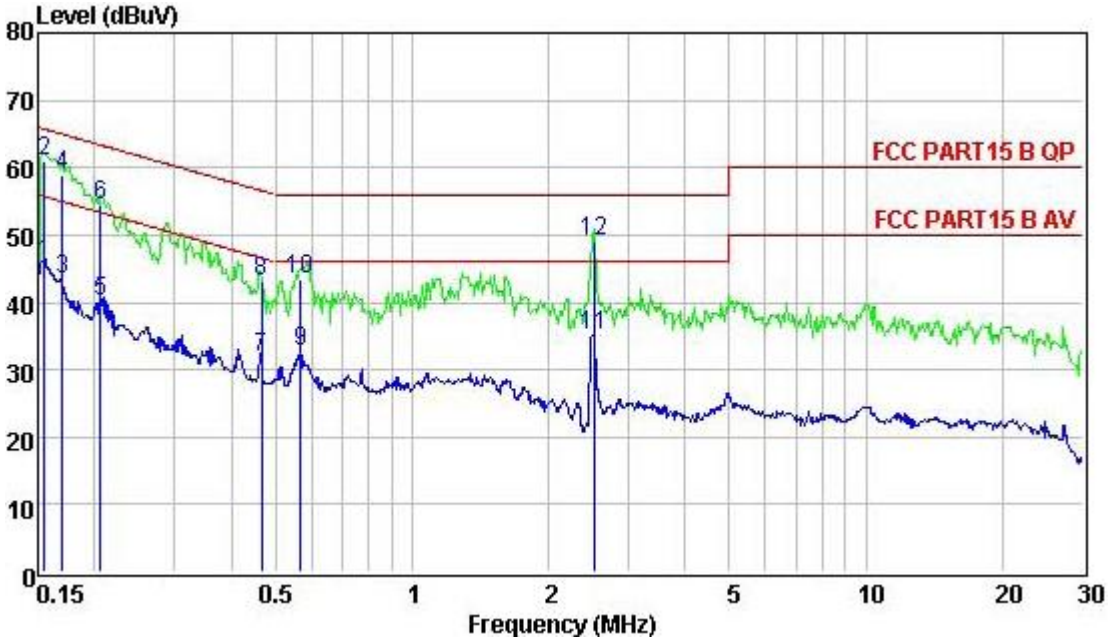
	Freq	Level	Cable Loss	LISN Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dB	
1	0.16	49.42	0.24	9.69	55.69	-6.27	Average
2	0.16	59.20	0.24	9.69	65.69	-6.49	QP
3	0.21	41.60	0.25	9.64	53.23	-11.63	Average
4	0.21	53.69	0.25	9.64	63.23	-9.54	QP
5	0.41	32.98	0.25	9.59	47.59	-14.61	Average
6	0.41	42.15	0.25	9.59	57.59	-15.44	QP
7	0.57	32.59	0.25	9.59	46.00	-13.41	Average
8	0.57	42.58	0.25	9.59	56.00	-13.42	QP
9	1.34	29.39	0.27	9.60	46.00	-16.61	Average
10	1.34	39.26	0.27	9.60	56.00	-16.74	QP
11	2.51	40.70	0.28	9.62	46.00	-5.30	Average
12	2.51	49.40	0.28	9.62	56.00	-6.60	QP

Power supply:	AC 240V/50Hz(Adapter)	Polarization	N



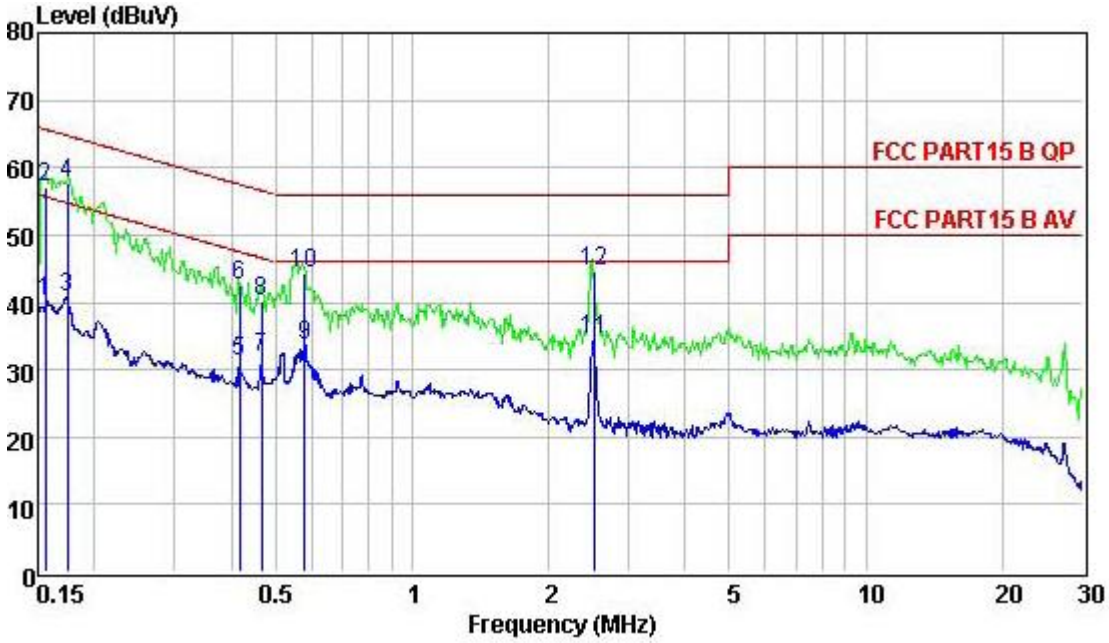
	Freq	Level	Cable Loss	LISN Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dB	
1	0.15	40.24	0.24	9.45	56.00	-15.76	Average
2	0.15	57.59	0.24	9.45	66.00	-8.41	QP
3	0.17	40.82	0.24	9.51	54.81	-13.99	Average
4	0.17	56.48	0.24	9.51	64.81	-8.33	QP
5	0.20	37.16	0.25	9.57	53.49	-16.33	Average
6	0.20	51.15	0.25	9.57	63.49	-12.34	QP
7	0.58	33.54	0.25	9.59	46.00	-12.46	Average
8	0.58	43.26	0.25	9.59	56.00	-12.74	QP
9	0.78	29.20	0.26	9.60	46.00	-16.80	Average
10	0.78	36.59	0.26	9.60	56.00	-19.41	QP
11	2.51	42.30	0.28	9.59	46.00	-3.70	Average
12	2.51	50.00	0.28	9.59	56.00	-6.00	QP

Power supply:	AC 120V/60Hz(Adapter)	Polarization	L



	Freq	Level	Cable Loss	LISN Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dB	
1	0.15	45.82	0.24	9.69	55.74	-9.92	Average
2	0.15	61.00	0.24	9.69	65.74	-4.74	QP
3	0.17	43.45	0.24	9.67	54.99	-11.54	Average
4	0.17	59.02	0.24	9.67	64.99	-5.97	QP
5	0.21	40.29	0.25	9.64	53.36	-13.07	Average
6	0.21	54.28	0.25	9.64	63.36	-9.08	QP
7	0.47	31.96	0.25	9.58	46.58	-14.62	Average
8	0.47	43.08	0.25	9.58	56.58	-13.50	QP
9	0.57	32.59	0.25	9.59	46.00	-13.41	Average
10	0.57	43.39	0.25	9.59	56.00	-12.61	QP
11	2.51	35.18	0.28	9.62	46.00	-10.82	Average
12	2.51	48.97	0.28	9.62	56.00	-7.03	QP

Power supply:	AC 120V/60Hz(Adapter)	Polarization	N

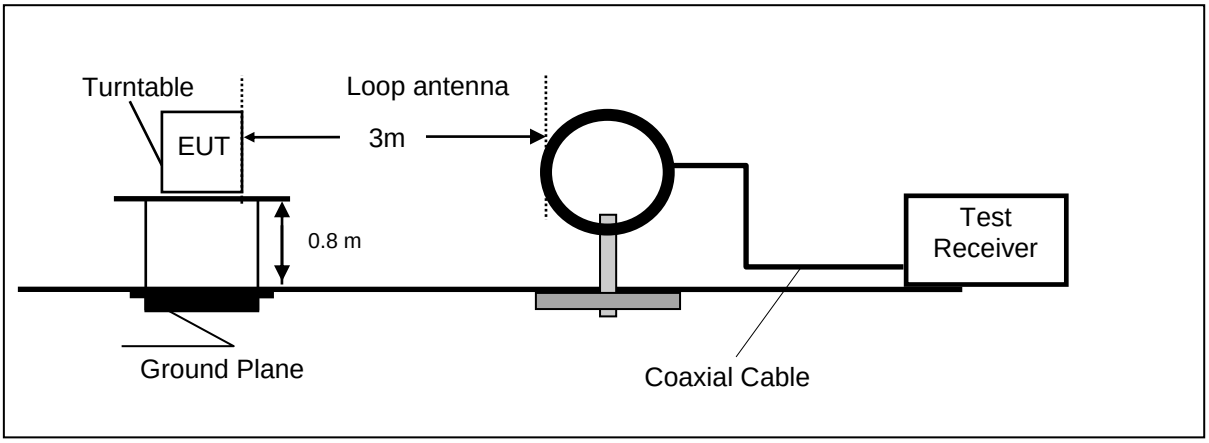


	Freq	Level	Cable Loss	LISN Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dB	
1	0.16	40.08	0.24	9.47	55.69	-15.61	Average
2	0.16	57.01	0.24	9.47	65.69	-8.68	QP
3	0.17	40.82	0.24	9.51	54.77	-13.95	Average
4	0.17	57.68	0.24	9.51	64.77	-7.09	QP
5	0.42	31.24	0.25	9.59	47.51	-16.27	Average
6	0.42	42.39	0.25	9.59	57.51	-15.12	QP
7	0.47	31.80	0.25	9.59	46.58	-14.78	Average
8	0.47	40.01	0.25	9.59	56.58	-16.57	QP
9	0.58	33.54	0.25	9.59	46.00	-12.46	Average
10	0.58	44.26	0.25	9.59	56.00	-11.74	QP
11	2.51	34.38	0.28	9.59	46.00	-11.62	Average
12	2.51	44.68	0.28	9.59	56.00	-11.32	QP

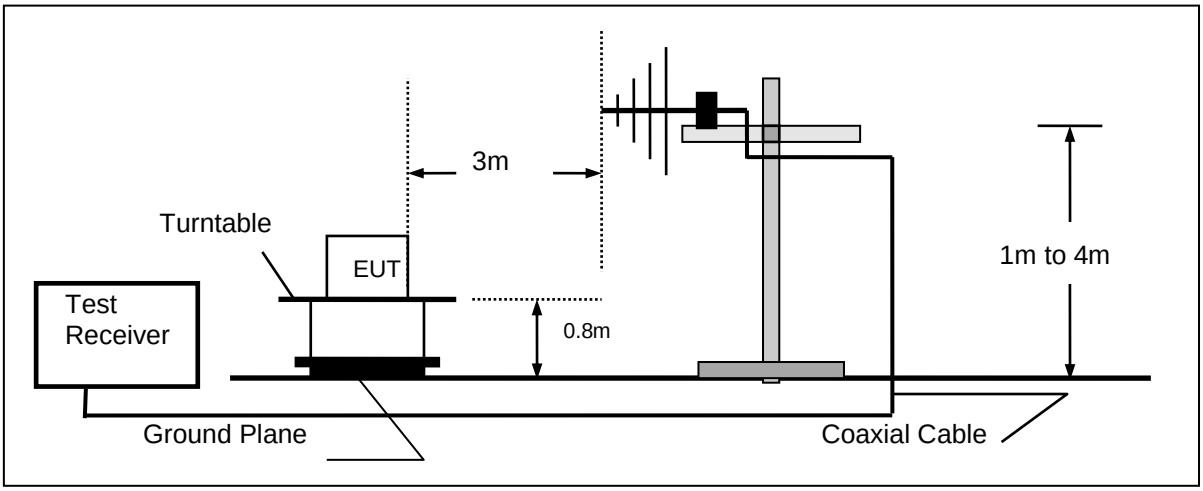
4.2. Radiated Emission

TEST CONFIGURATION

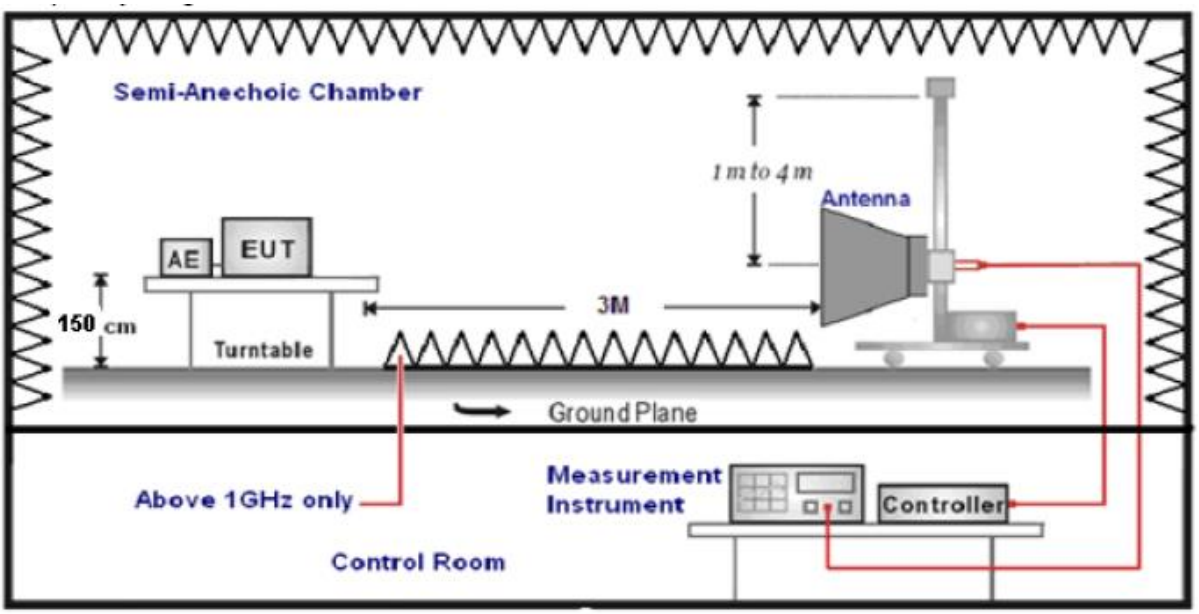
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
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 minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. 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	1

7. 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 Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

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	

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	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	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

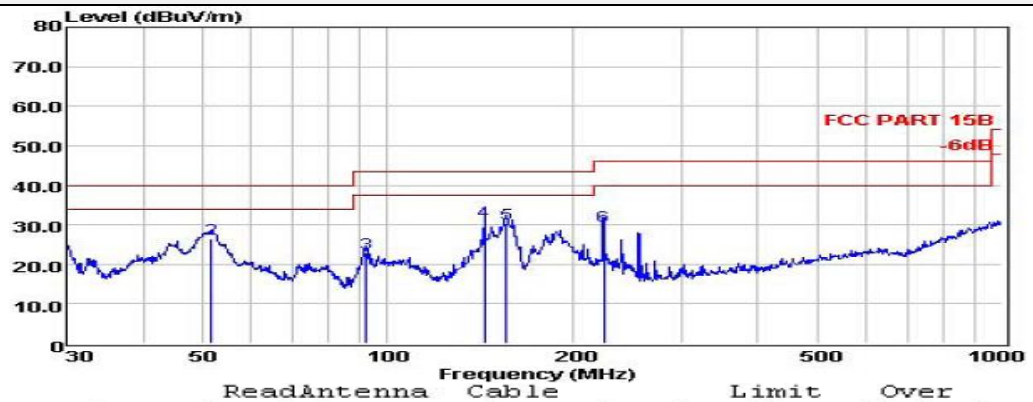
Remark: We measured Radiated Emission at GFSK, π/4 DQPSK and 8DPSK mode from 9 KHz to 25GHz and recorded worst case at GFSK mode.

For 9 KHz-30MHz

Remark:The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

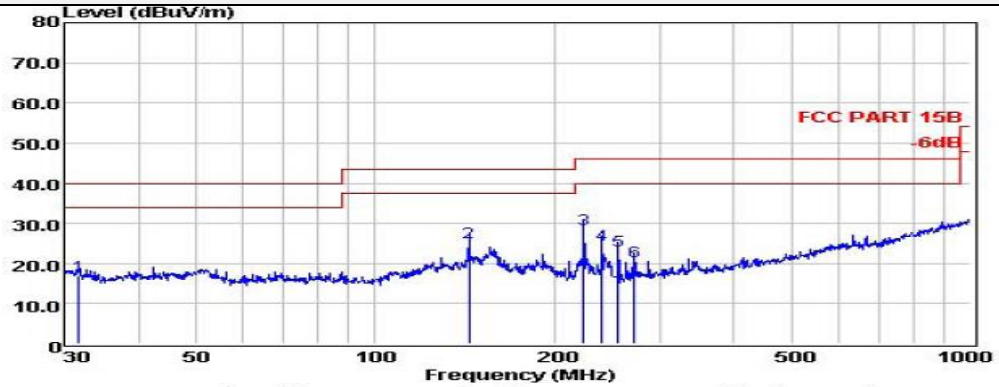
For 30MHz-1GHz

Vertical



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.11	8.57	14.75	0.34	23.66	40.00	-16.34	QP
2	51.66	13.52	12.81	0.12	26.45	40.00	-13.55	QP
3	92.46	11.32	11.35	0.16	22.83	43.50	-20.67	QP
4	143.83	15.38	15.31	0.23	30.92	43.50	-12.58	QP
5	155.91	14.62	15.61	0.23	30.46	43.50	-13.04	QP
6	224.52	17.76	11.72	0.40	29.88	46.00	-16.12	QP

Horizontal



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	31.73	2.62	14.07	0.30	16.99	40.00	-23.01	QP
2	143.83	9.85	15.31	0.23	25.39	43.50	-18.11	QP
3	223.73	16.55	11.68	0.40	28.63	46.00	-17.37	QP
4	239.99	11.88	12.40	0.40	24.68	46.00	-21.32	QP
5	255.62	10.89	11.85	0.40	23.14	46.00	-22.86	QP
6	272.28	7.84	12.26	0.56	20.66	46.00	-25.34	QP

Note:

1. Pre-scan all modes and recorded the worst case results in this report (TX(2402MHz Hopping Mode,GFSK)
2. Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor
3. Margin value = Emission level-Limits

For 1GHz to 25GHz

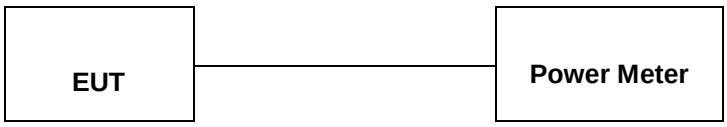
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	antenna Factor (dB)	cable loss (dB)	preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
2402									
Vertical	4804	41.28	30.26	6.98	26.63	51.05	74	-22.95	Pk
Horizonta	4804	42.13	30.26	6.98	26.63	52.41	74	-21.59	PK
Vertical	7206	36.07	36.55	8.87	27.02	54.89	74	-19.11	Pk
Horizontal	7206	35.14	36.55	8.87	27.02	53.67	74	-20.33	PK
2440									
Vertical	4880	39.98	30.34	7.58	26.67	51.11	74	-22.89	Pk
Horizonta	4880	40.59	30.34	7.58	26.67	51.99	74	-22.01	PK
Vertical	7320	34.26	36.69	8.56	27.18	52.62	74	-21.38	Pk
Horizontal	7320	33.37	36.69	8.56	27.18	51.74	74	-22.26	PK
2480									
Vertical	4960	39.47	30.58	7.81	26.73	51.99	74	-22.01	Pk
Horizonta	4960	40.51	30.58	7.81	26.73	52.02	74	-21.98	PK
Vertical	7440	33.82	37.31	8.72	27.23	52.19	74	-21.81	Pk
Horizontal	7440	34.56	37.31	8.72	27.23	53.47	74	-20.53	PK

REMARKS:

4. Emission level (dBuV/m) = Meter Reading+ antenna Factor+ cable loss- preamp factor
5. Margin value = Emission level-Limits
6. -- Mean the PK detector measured value is below average limit.
7. The other emission levels were very low against the limit.
8. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.
The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

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.

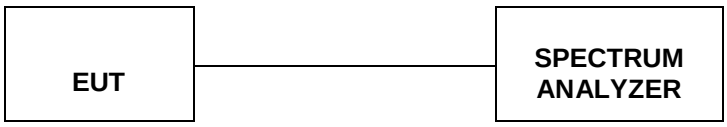
TEST RESULTS

Type	Channel	Peak Output power (dBm)	Limit (dBm)	Result
GFSK	Low	3.388	30	Pass
	Mid	3.540		
	High	**3.637**		
π/4DQPSK	Low	2.855	21	Pass
	Mid	3.062		
	High	2.924		
8DPSK	Low	3.160	21	Pass
	Mid	3.391		
	High	3.182		

Note: 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=30KHz and VBW=100KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

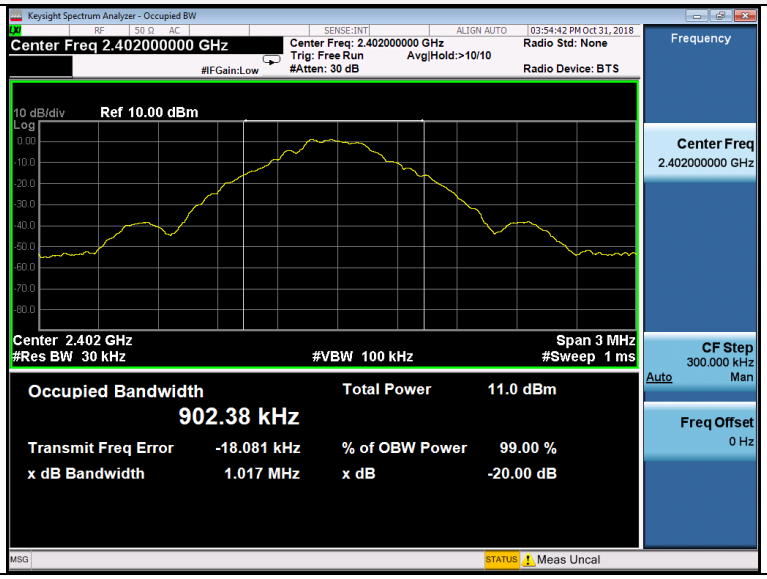
LIMIT

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

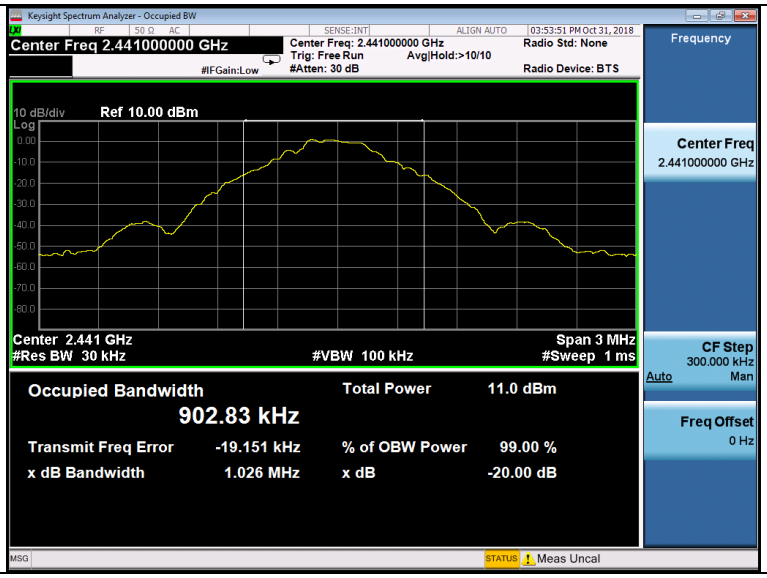
TEST RESULTS

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	Low	1.017	Pass
	Mid	1.026	
	High	1.021	
π/4DQPSK	Low	1.392	
	Mid	1.394	
	High	1.398	
8DPSK	Low	1.366	
	Mid	1.365	
	High	1.364	

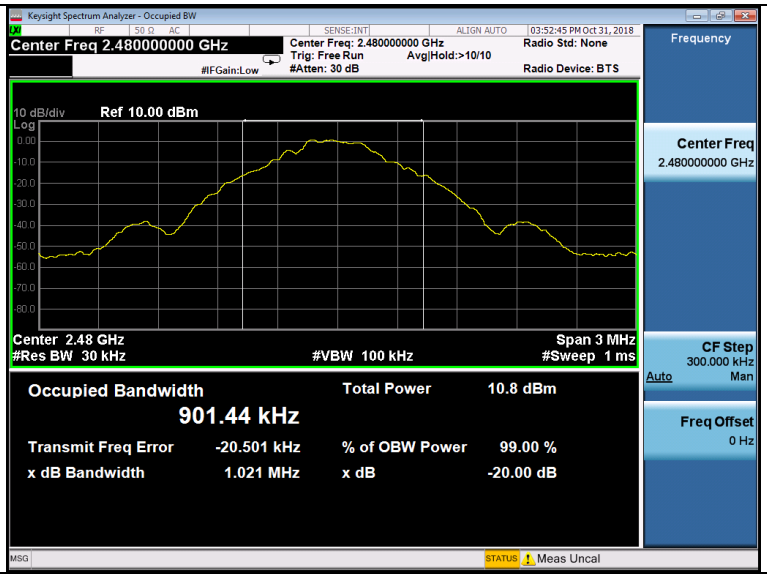
GFSK Modulation



Low

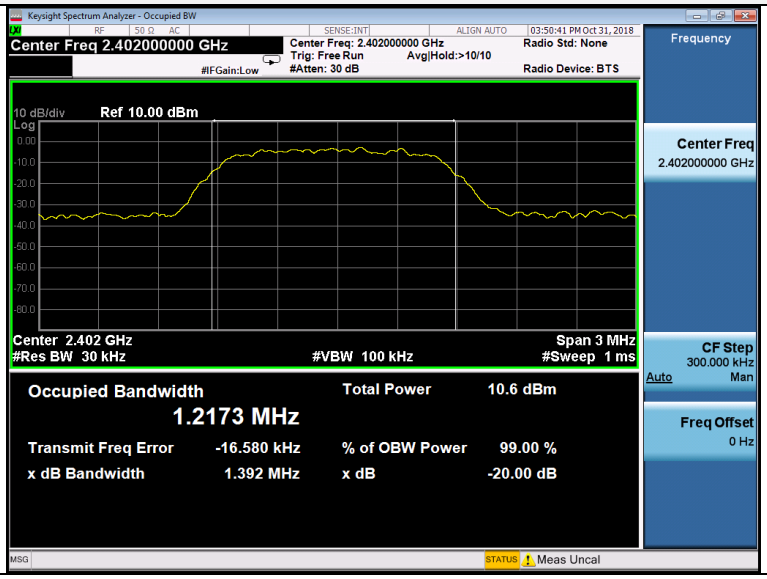


Mid

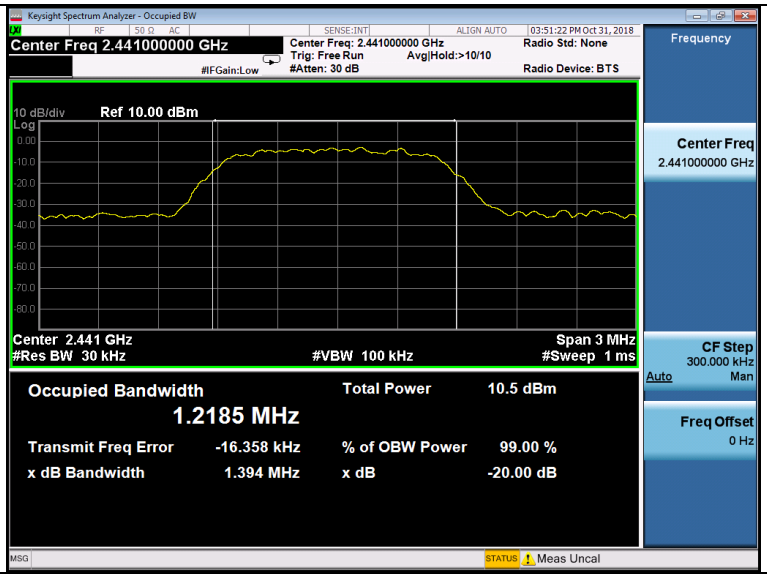


High

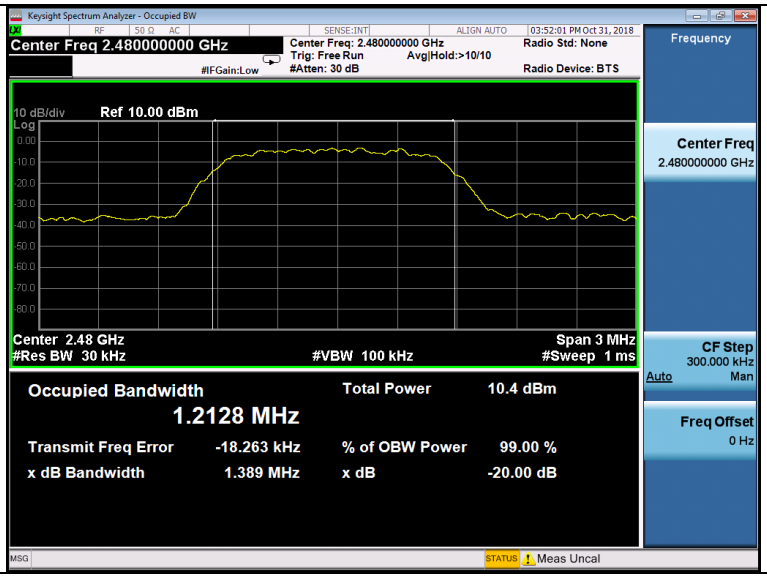
π/4DQPSK Modulation



Low

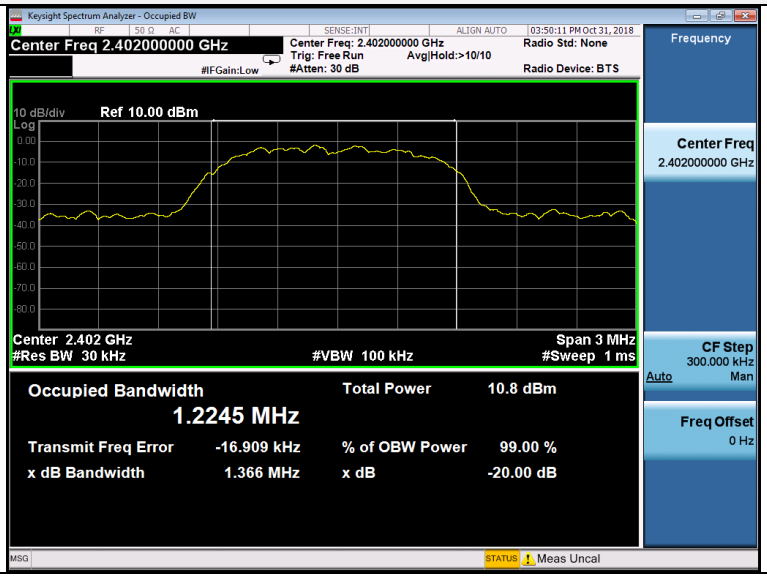


Mid

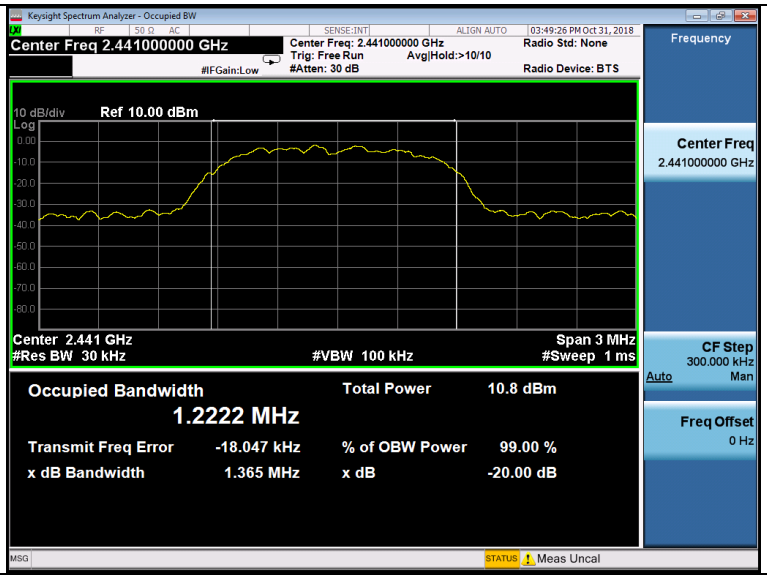


High

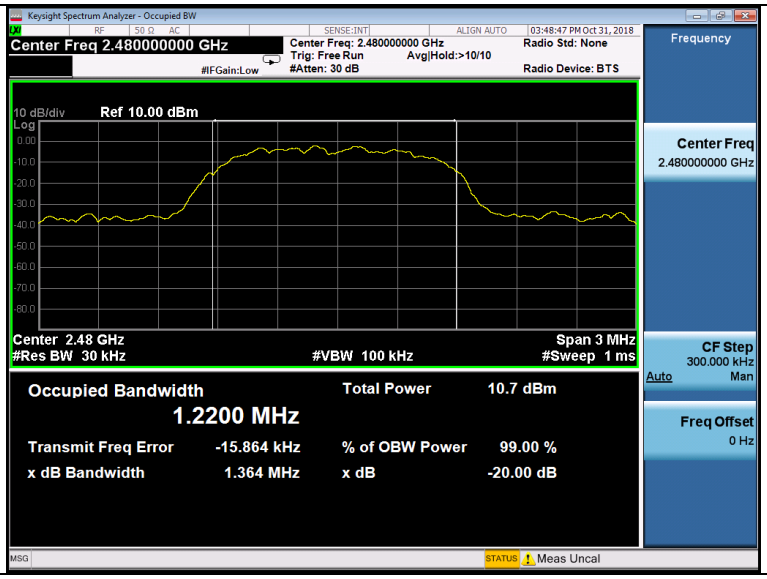
8DPSK Modulation



Low



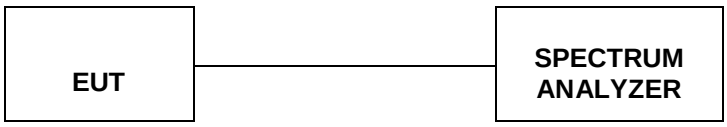
Mid



High

4.5. 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=30KHz 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

4.5.1 Test Data

Type/Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.000	1.017	pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.066	1.026	pass
	Adjacency Channel	2442			
	High Channel	2480	0.998	1.021	pass
	Adjacency Channel	2479			
CH Separation π/4DQPSK	Low Channel	2402	1.004	0.928	pass
	Adjacency Channel	2403			
	Mid Channel	2441	0.994	0.929	pass
	Adjacency Channel	2442			
	High Channel	2480	0.998	0.932	pass
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.018	0.910	pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.032	0.910	pass
	Adjacency Channel	2442			
	High Channel	2480	0.976	0.909	pass
	Adjacency Channel	2479			

Remark: We have tested all mode at high, middle and low channel, and recorded worst case at middle

GFSK - Low channel

GFSK - Middle channel

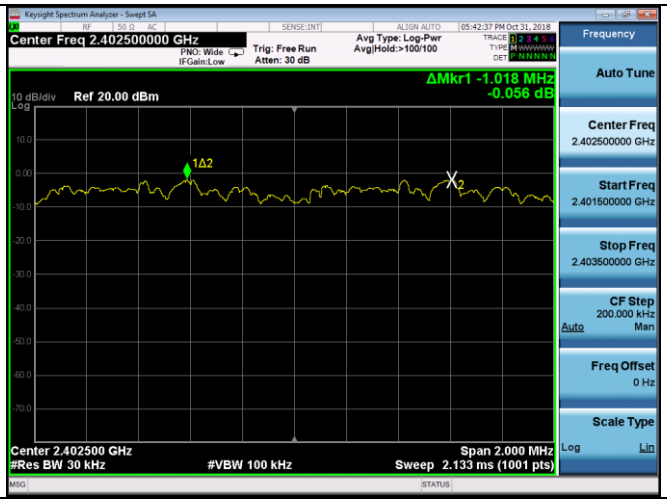
GFSK - High channel

π/4DQPSK - Low channel

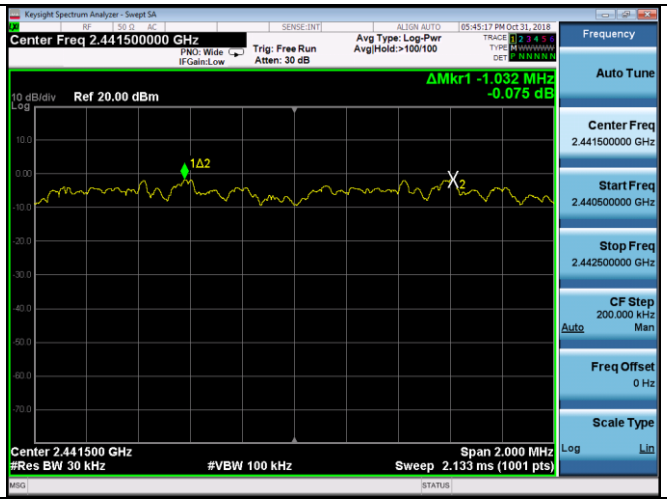
π/4DQPSK - Middle channel

π/4DQPSK - High channel

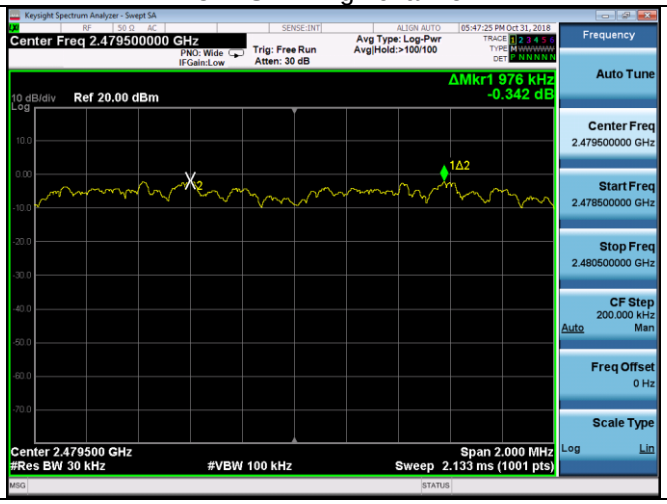
8DPSK - Low channel



8DPSK - Middle channel



8DPSK - High channel



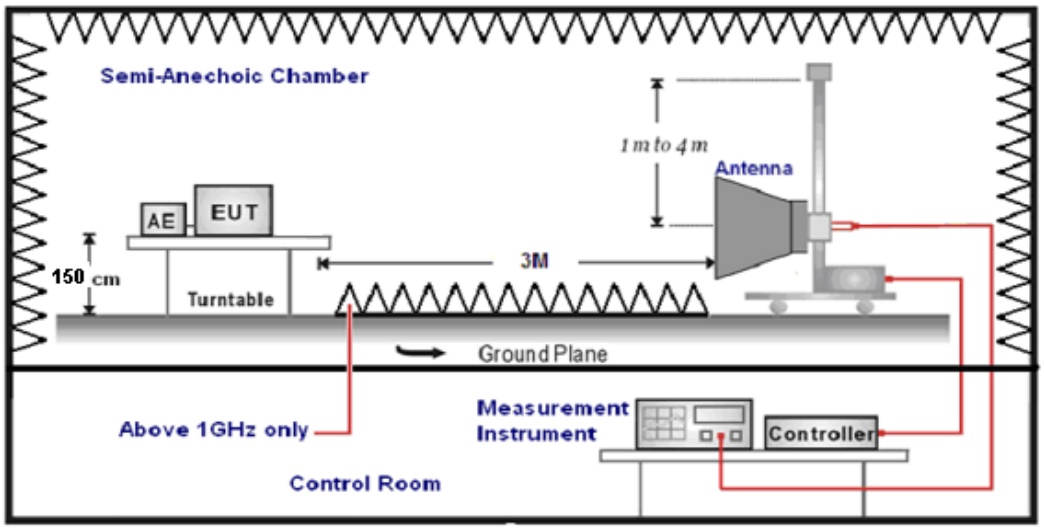
4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

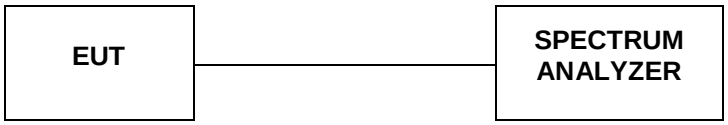
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

For Radiated



For Conducted



TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m 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 Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

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

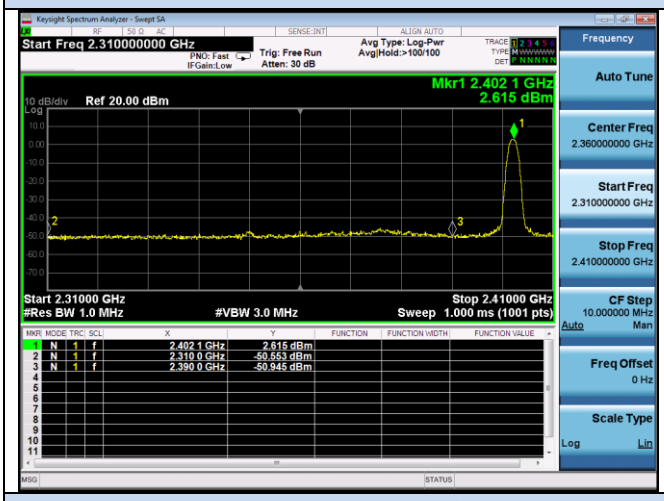
Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1.

4.6.1 For Radiated Bandedge Measurement

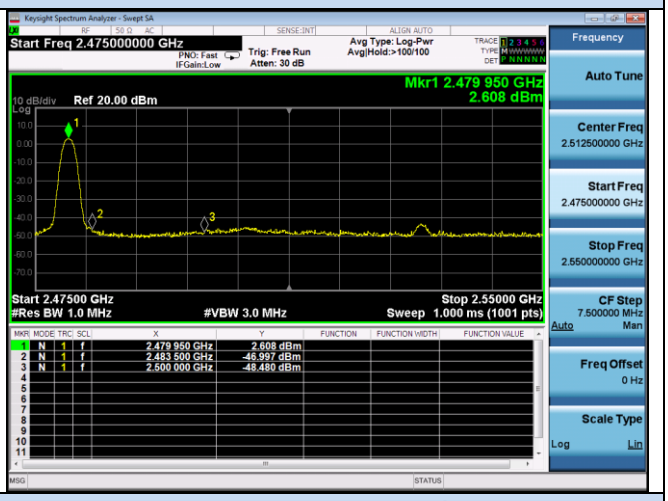
Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

GFSK								
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Over limit dB	Verdict
2310.000	-50.553	2.2	0	46.877	Peak	74	-27.123	PASS
2310.000	-62.289	2.2	0	35.141	AV	54	-18.859	PASS
2390.000	-50.945	2.2	0	46.485	Peak	74	-27.515	PASS
2390.000	-61.871	2.2	0	35.559	AV	54	-18.441	PASS
2483.500	-46.997	2.2	0	50.433	Peak	74	-23.567	PASS
2483.500	-58.581	2.2	0	38.849	AV	54	-15.151	PASS
2500.000	-48.480	2.2	0	48.95	Peak	74	-25.05	PASS
2500.000	-60.427	2.2	0	37.003	AV	54	-16.997	PASS

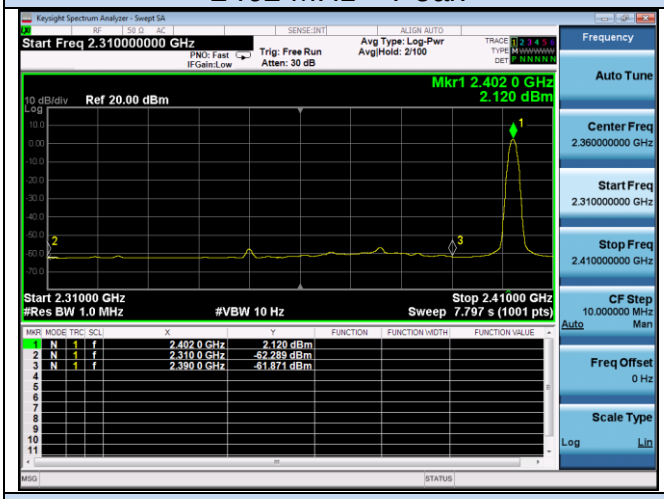
Band-edge measurements for radiated emissions



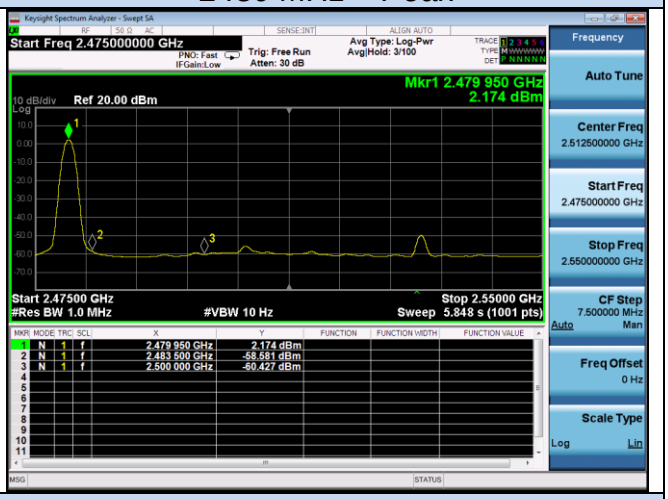
2402 MHz – Peak



2480 MHz – Peak



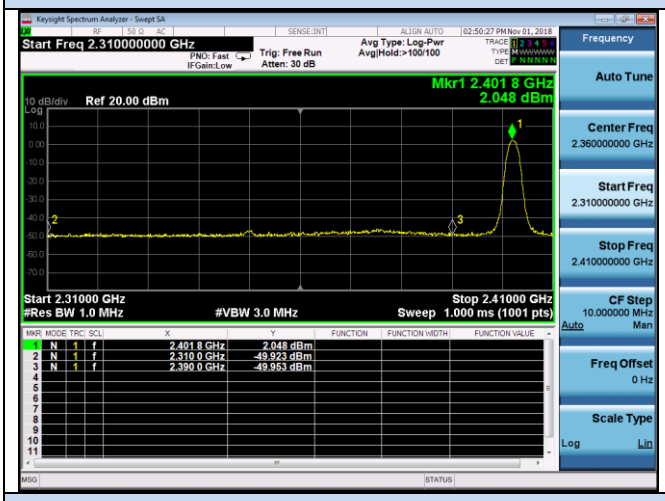
2402 MHz – Average



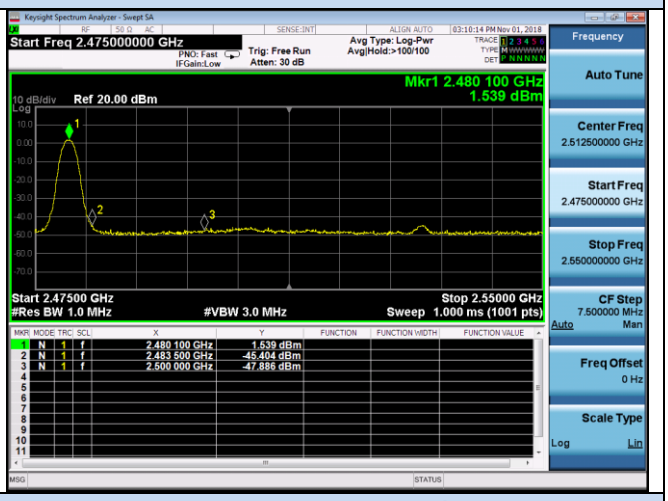
2480MHz –Average

π/4DQPSK								
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Over limit dB	Verdict
2310.000	-49.923	2.2	0	47.507	Peak	74	-26.493	PASS
2310.000	-62.471	2.2	0	34.959	AV	54	-19.041	PASS
2390.000	-49.953	2.2	0	47.477	Peak	74	-26.523	PASS
2390.000	-62.080	2.2	0	35.35	AV	54	-18.65	PASS
2483.500	-45.404	2.2	0	52.026	Peak	74	-21.974	PASS
2483.500	-59.196	2.2	0	38.234	AV	54	-15.766	PASS
2500.000	-47.886	2.2	0	49.544	Peak	74	-24.456	PASS
2500.000	-61.106	2.2	0	36.324	AV	54	-17.676	PASS

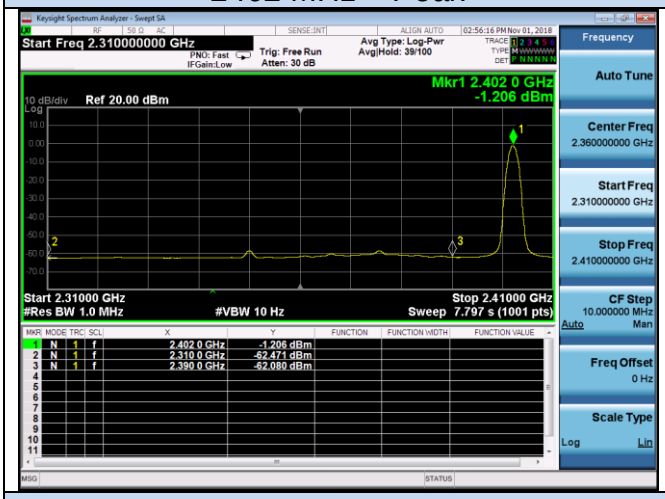
Band-edge measurements for radiated emissions



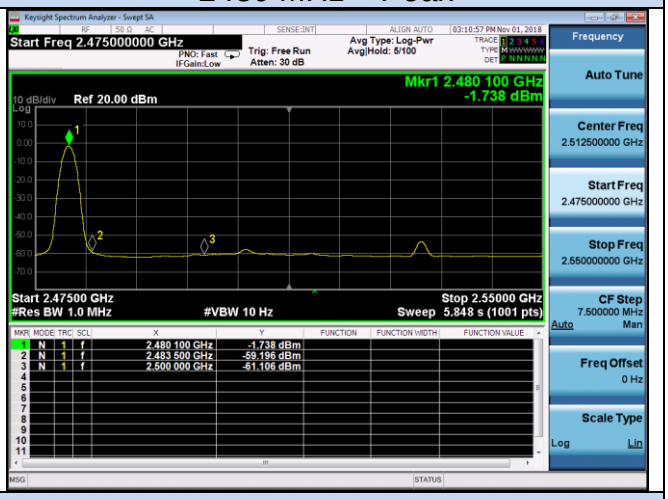
2402 MHz – Peak



2480 MHz – Peak



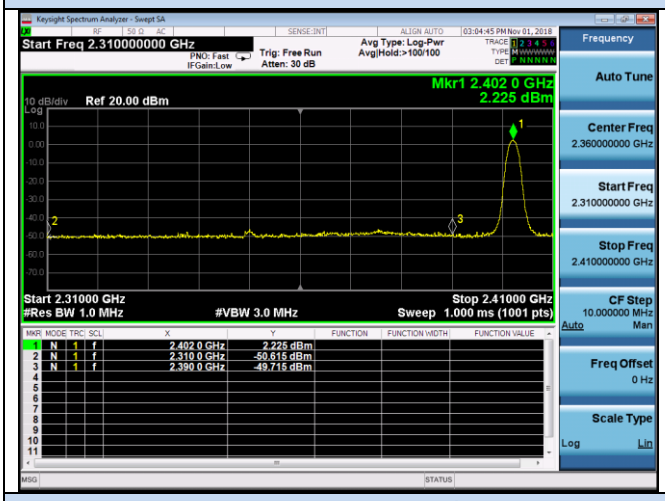
2402 MHz – Average



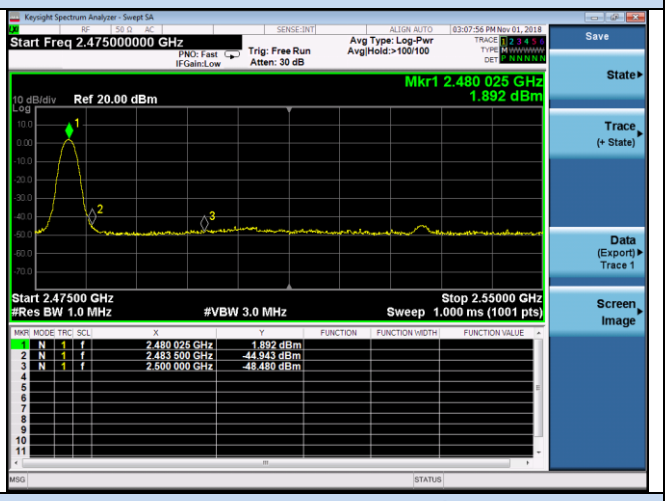
2480MHz –Average

8DPSK								
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Over limit dB	Verdict
2310.000	-50.615	2.2	0	46.815	Peak	74	-27.185	PASS
2310.000	-62.512	2.2	0	34.918	AV	54	-19.082	PASS
2390.000	-49.715	2.2	0	47.715	Peak	74	-26.285	PASS
2390.000	-62.111	2.2	0	35.319	AV	54	-18.681	PASS
2483.500	-44.943	2.2	0	52.487	Peak	74	-21.513	PASS
2483.500	-59.139	2.2	0	38.291	AV	54	-15.709	PASS
2500.000	-48.480	2.2	0	48.95	Peak	74	-25.05	PASS
2500.000	-61.141	2.2	0	36.289	AV	54	-17.711	PASS

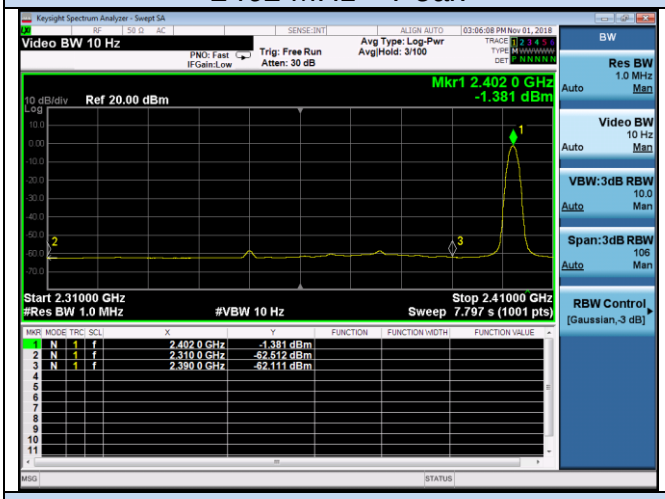
Band-edge measurements for radiated emissions



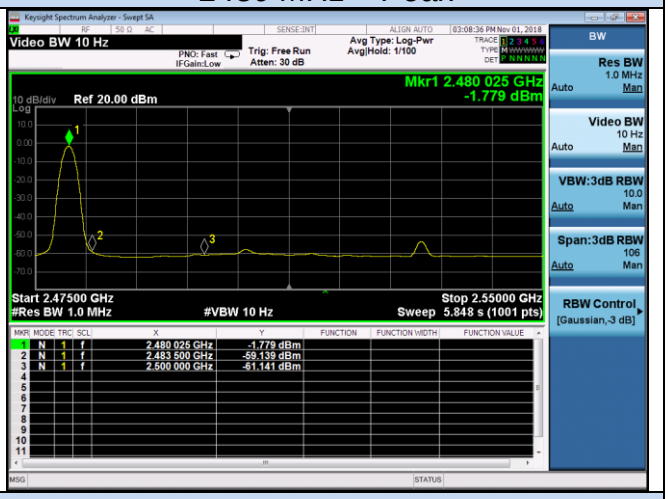
2402 MHz – Peak



2480 MHz – Peak



2402 MHz – Average

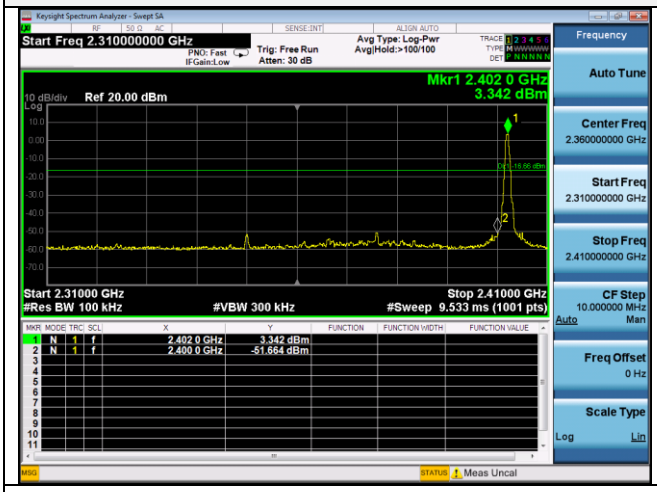
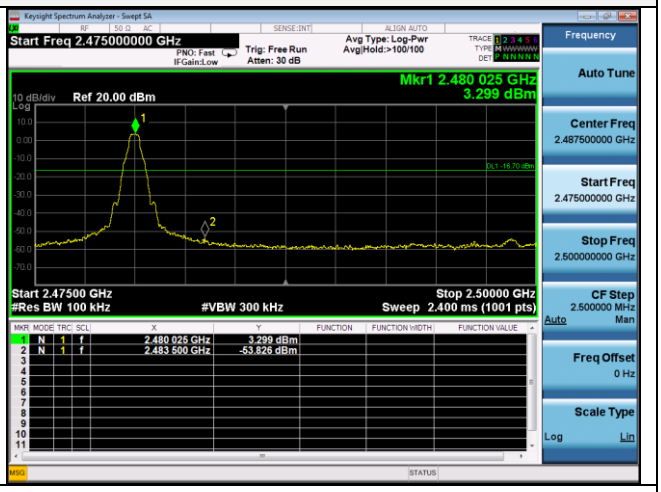
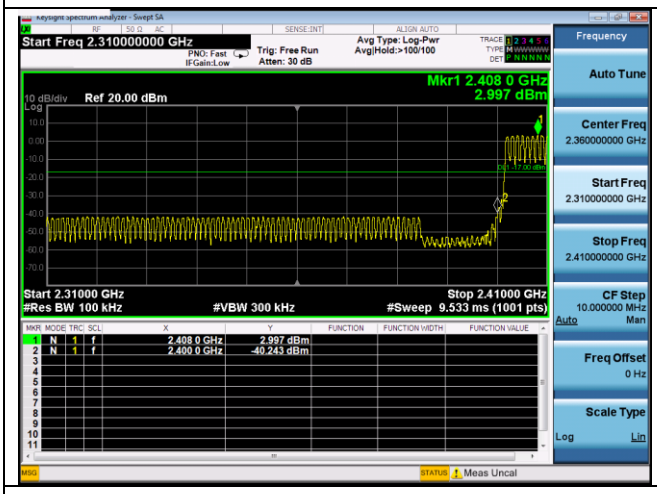
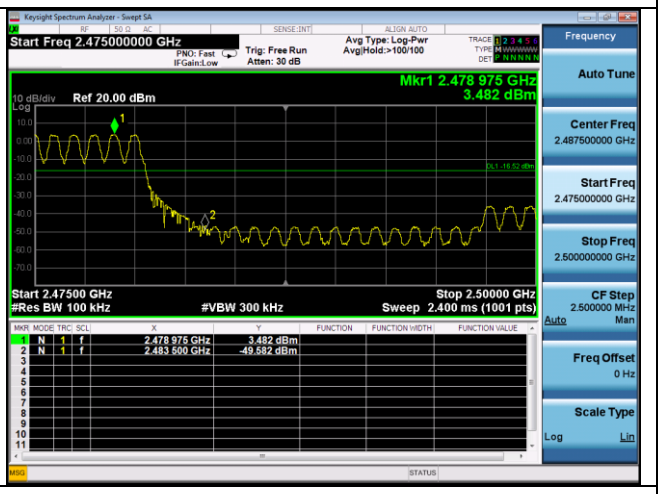


2480MHz –Average

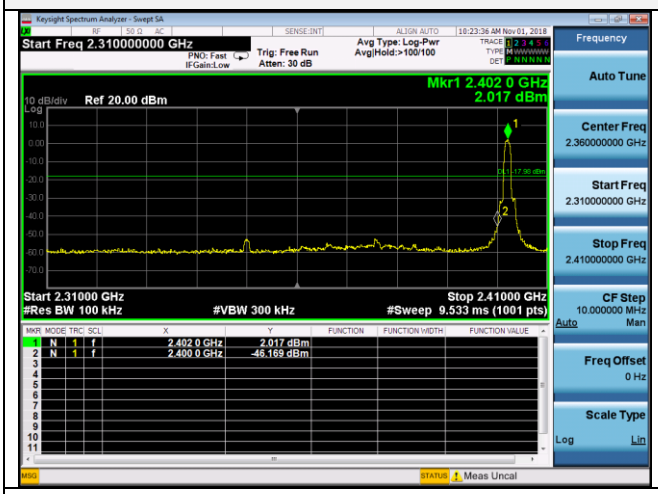
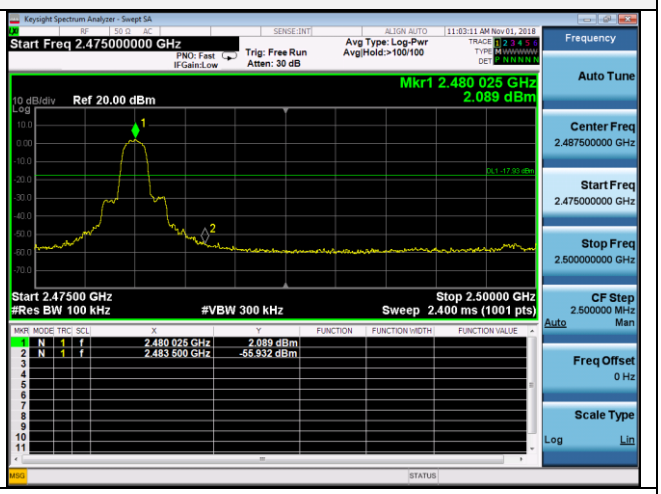
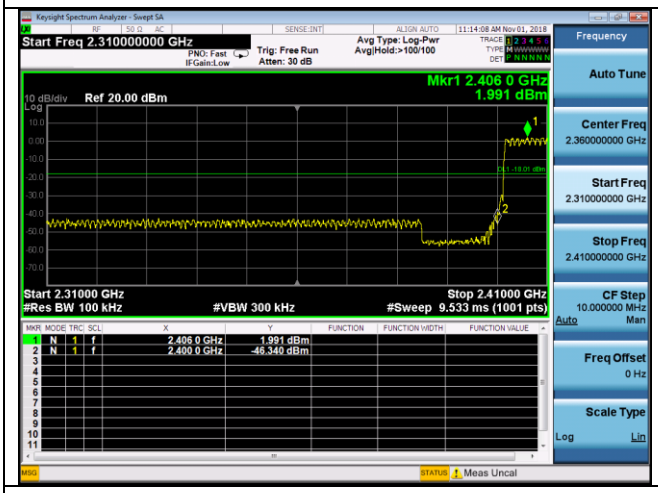
4.6.2 For Conducted Bandedge Measurement

Modulation		Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK	Non-hopping	Left Band	55.01	20	Pass
		Right Band	57.13	20	Pass
	hopping	Left Band	43.24	20	Pass
		Right Band	53.06	20	Pass
π/4DQPSK	Non-hopping	Left Band	48.19	20	Pass
		Right Band	58.02	20	Pass
	hopping	Left Band	48.33	20	Pass
		Right Band	56.41	20	Pass
8DPSK	Non-hopping	Left Band	47.74	20	Pass
		Right Band	56.69	20	Pass
	hopping	Left Band	38.07	20	Pass
		Right Band	49.06	20	Pass

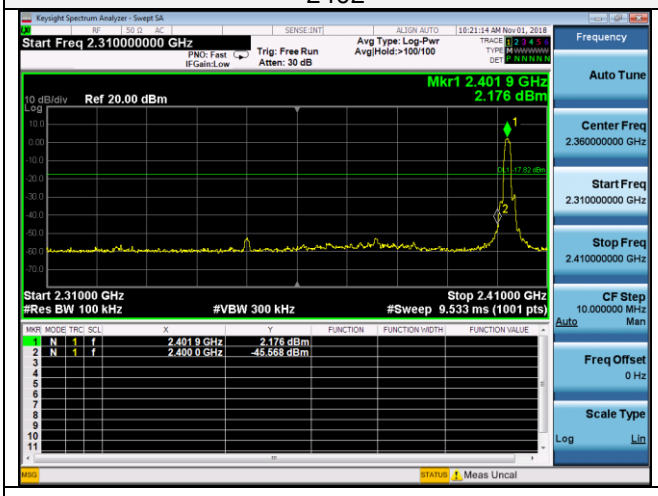
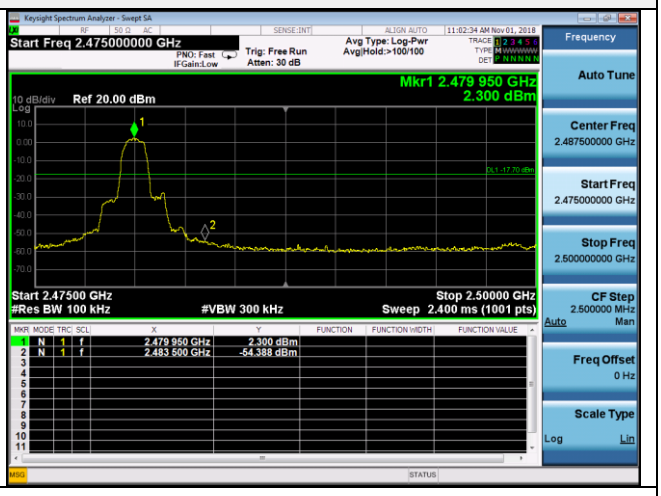
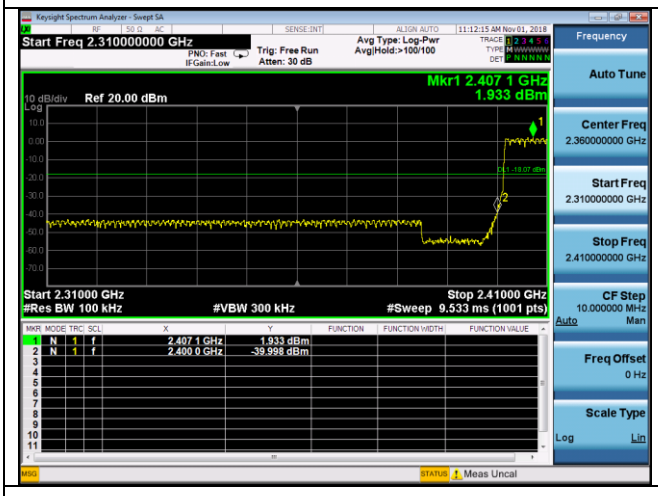
GFSK

2402	2480
	
Hoping Off	Hoping Off
	
Hoping On	Hoping On

π/4DQPSK

2402	2480
	
Hoping Off	Hoping Off
	
Hoping On	Hoping On

8DPSK

2402	2480
	
Hoping Off	Hoping Off
	
Hoping On	Hoping On