ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND INDUSTRY CANADA RSS 247 REQUIREMENT

OF

Applicant:	Euro-CB (Phils.) Inc. SFB No 2, MEZ 1, Lapu Lapu City, 6015 Cebu, Philippines
Product Name:	Interphone Edge
Brand Name:	Interphone
Model No.:	INTERPHONE BTF8
Model Difference:	N/A
FCC ID:	2AE5MBTF8
IC:	20468-BTF8
Report No.:	ER/2018/40078
FCC Rule Part:	§15.247, Cat: DSS
IC Rule Part:	RSS-247 issue 2 Feb. 2017
Issue Date:	May 18, 2018
Date of Test:	Apr. 19, 2018 ~ May 11, 2018
Date of EUT Received:	Apr. 19, 2018

We hereby certify that:
The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory
The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.
The test results of this report relate only to the tested sample identified in this report.

Tested By: Louis Chen

Louis Chen / Sr. Engineer

Approved By: Jim Chang

Jim Chang / Manager

Testing Laboratory
0513

Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/40078	Rev.00	Initial creation of document	All	May 18, 2018	Violetta Tang

Contents

1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	Interphone Edge	
Brand Name:	Interphone	
Model No.:	INTERPHONE BTF8	
Model difference:	N/A	
Product SW/HW version:	R157 (affects only user interface) / 1.0	
Radio SW/HW version:	26h + EDR / N/A	
Test SW Version:	N/A	
RF power setting in TEST SW:	N/A	
Data Cable (USB):	Model No.: N/A, Supplier: N/A	
Power Supply:	3.7V from Rechargeable Lithium Polymer Battery or 5Vdc from USB Port	
	Battery:	Model No.: 602055P, Supplier: Shenzhen BAK Technology Co., Ltd.

Bluetooth_BR+EDR:

Bluetooth Version:	BT V3.0
Channel number:	79 channels
Modulation type:	GFSK + π/4DQPSK + 8DPSK
Transmit Power:	9.13dBm
Frequency Range:	2.402GHz – 2.480GHz
Antenna Designation:	Printed PCB Antenna, Gain: 2.5dBi

1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

RSS-247 issue 2 Feb. 2017

RSS-Gen issue 5 Apr. 2018

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Numbers are: 509634 / TW0001

Canada Registration Number: 4620A-5.

1.4 Special Accessories

There is no special accessory used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plan. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated
emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss 1dB.

2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission

Fig. 2-2 AC Power Line Conducted Emission

Fig. 2-3 Conducted (Antenna Port) Emission

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	DELL	D505	34056609472	Shielded	Unshielded

3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	RSS-247 §5.4 (2)	Peak Output Power	Compliant
§15.247(a)(1)	RSS-247 §5.1 (1) RSS-Gen §6.6	20dB & 99% Bandwidth	Compliant
§15.247(d)	RSS-247 §5.5	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	RSS-247 §5.5	Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	RSS-247 §5.1 (2)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 (4)	Time of Occupancy	Compliant
§15.203 §15.247(b)	RSS- Gen §8.3	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY
0	2402 MHz	20	2422 MHz	40	2442 MHz	70	2462 MHz
1	2403 MHz	21	2423 MHz	41	2443 MHz	71	2463 MHz
2	2404 MHz	22	2424 MHz	42	2444 MHz	72	2464 MHz
3	2405 MHz	23	2425 MHz	43	2445 MHz	73	2465 MHz
4	2406 MHz	24	2426 MHz	44	2446 MHz	74	2466 MHz
5	2407 MHz	25	2427 MHz	45	2447 MHz	75	2467 MHz
6	2408 MHz	26	2428 MHz	46	2448 MHz	76	2468 MHz
7	2409 MHz	27	2429 MHz	47	2449 MHz	77	2469 MHz
8	2410 MHz	28	2430 MHz	48	2450 MHz	78	2470 MHz
9	2411 MHz	29	2431 MHz	49	2451 MHz	79	2471 MHz
10	2412 MHz	30	2432 MHz	50	2452 MHz	70	2472 MHz
11	2413 MHz	31	2433 MHz	51	2453 MHz	71	2473 MHz
12	2414 MHz	32	2434 MHz	52	2454 MHz	72	2474 MHz
13	2415 MHz	33	2435 MHz	53	2455 MHz	73	2475 MHz
14	2416 MHz	34	2436 MHz	54	2456 MHz	74	2476 MHz
15	2417 MHz	35	2437 MHz	55	2457 MHz	75	2477 MHz
16	2418 MHz	36	2438 MHz	56	2458 MHz	76	2478 MHz
17	2419 MHz	37	2439 MHz	57	2459 MHz	77	2479 MHz
18	2420 MHz	38	2440 MHz	58	2460 MHz	78	2480 MHz
19	2421 MHz	39	2441 MHz	59	2461 MHz		

4.2 The Worst Test Modes and Channel Details

1 The EUT has been tested under operating condition.
2 Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3 Investigation has been done on all the possible configurations for searching the worst case.

RADIATED TEST				
Radiated Emission Test (BELOW 1 GHz) (Worst case)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
Bluetooth	0 to 78	0,39,78	8-DPSK	3DH5
Radiated Emission Test (ABOVE 1 GHz) (Worst case)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
Bluetooth	0 to 78	0,39,78	8-DPSK	3DH5
Band Edge				
Bluetooth	0 to 78	0,78	GFSK	DH5
Bluetooth	0 to 78	0,78	8-DPSK	3DH5

Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth BR+EDR Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED TEST				
Peak Output Power, 20dB Band Width				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
Bluetooth	0 to 78	0,39,78	GFSK	DH5
	0 to 78	0,39,78	π/4-DQPSK	2DH5
	0 to 78	0,39,78	8-DPSK	3DH5
Band Edge & Conducted Emission				
Bluetooth	0 to 78	0,78	GFSK	DH5
Bluetooth	0 to 78	0,78	8-DPSK	3DH5
Frequency Separation				
Bluetooth	0 to 78	0,1,2	8-DPSK	3DH5
Number of hopping frequency				
Bluetooth	0 to 78	0 to 78	8-DPSK	3DH5
Time of Occupancy (Dwell time)				
Bluetooth	0 to 78	0,39,78	GFSK	DH1/DH3/DH5
Bluetooth	0 to 78	39	π/4-DQPSK	2DH1/2DH3/2DH5
Bluetooth	0 to 78	39	8-DPSK	3DH1/3DH3/3DH5

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : **Vertical**)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : **Horizontal**)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

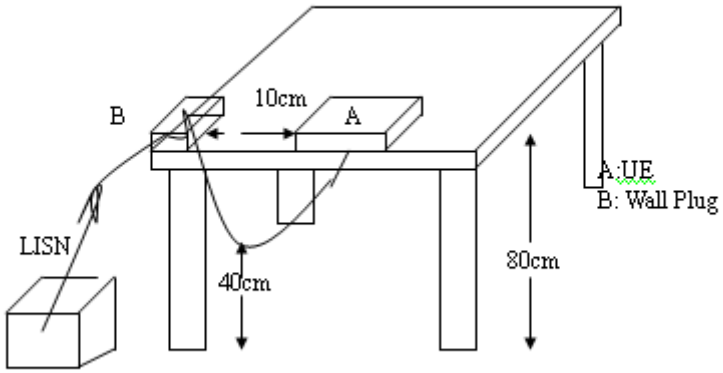
6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESCI7	100760	2017/06/06	2018/06/05
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/01/01
Notebook	DELL	D505	34056609472	N/A	N/A
LISN	SCHWARZBECK	NSLK 8127	8127-649	2017/05/22	2018/05/21

6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

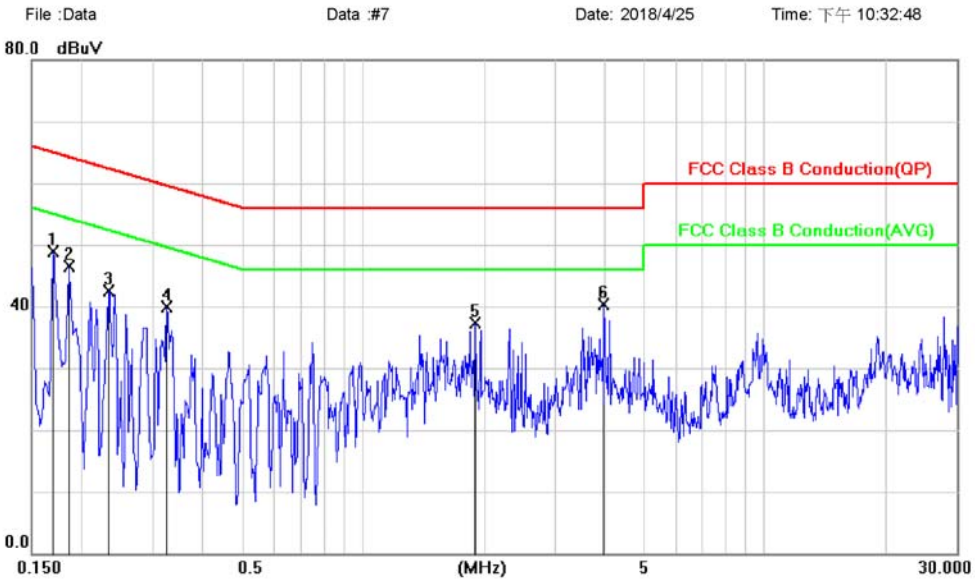
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode			Test Date:	Apr. 25, 2018
Temperature:	20 ℃	Humidity:	58 %	Test By:	Tin

Site Conduction Room
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note:

Phase: L1
Power: AC 120V/60Hz

Temperature: 20 ℃
Humidity: 58 %

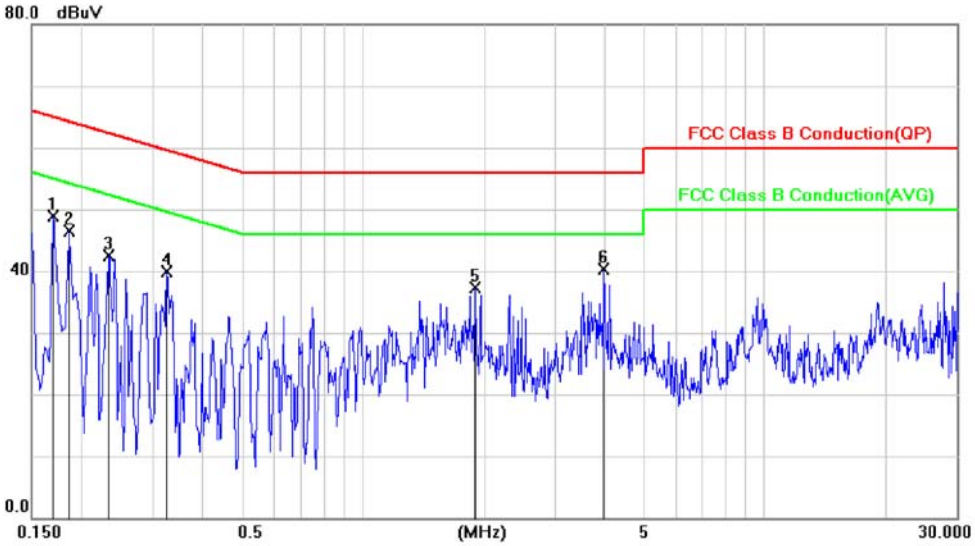


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1700	48.85	0.12	48.97	64.96	-15.99	peak	
2		0.1860	46.38	0.12	46.50	64.21	-17.71	peak	
3		0.2340	42.47	0.12	42.59	62.31	-19.72	peak	
4		0.3260	39.86	0.11	39.97	59.55	-19.58	peak	
5		1.9060	37.23	0.14	37.37	56.00	-18.63	peak	
6	*	3.9820	40.01	0.24	40.25	56.00	-15.75	peak	

Site Conduction Room	Phase: N	Temperature: 20 ℃
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note:		

Conducted Emission

File :Data Data :#9 Date: 2018/4/25 Time: 下午 10:32:48



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1700	48.85	0.07	48.92	64.96	-16.04	peak	
2		0.1860	46.38	0.07	46.45	64.21	-17.76	peak	
3		0.2340	42.47	0.07	42.54	62.31	-19.77	peak	
4		0.3260	39.86	0.08	39.94	59.55	-19.61	peak	
5		1.9060	37.23	0.11	37.34	56.00	-18.66	peak	
6	*	3.9820	40.01	0.21	40.22	56.00	-15.78	peak	

7 PEAK OUTPUT POWER MEASUREMENT

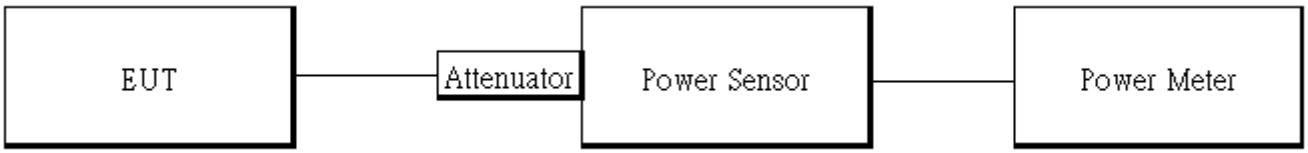
7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

7.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Power Meter	Anritsu	ML2496A	1242004	2017/10/16	2018/10/15
Notebook	DELL	D505	34056609472	N/A	N/A

7.3 Test Set-up:



7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

7.5 Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	**7.31**	5.383	1000
39	2441	6.92	4.920	1000
78	2480	6.55	4.519	1000

1M BR mode (Average):

CH	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	6.15	4.121	1000
39	2441	5.73	3.741	1000
78	2480	5.38	3.451	1000

2M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	**9.06**	8.054	125
39	2441	8.80	7.586	125
78	2480	8.28	6.730	125

2M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	4.60	2.884	125
39	2441	4.24	2.655	125
78	2480	3.92	2.466	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	**9.13**	8.185	125
39	2441	8.76	7.516	125
78	2480	8.49	7.063	125

NOTE: cable loss as 1dB that offsets in the spectrum

3M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	4.60	2.884	125
39	2441	4.22	2.642	125
78	2480	3.90	2.455	125

**Note: Max. Output include tune up tolerance Power measured by using average detector.*

EIRP

1M BR mode EIRP

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
0	2402	6.15	2.50	7.328	4000
39	2441	5.73	2.50	6.653	4000
78	2480	5.38	2.50	6.138	4000

2M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
0	2402	4.60	2.50	5.129	4000
39	2441	4.24	2.50	4.721	4000
78	2480	3.92	2.50	4.385	4000

3M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
0	2402	4.60	2.50	5.129	4000
39	2441	4.22	2.50	4.699	4000
78	2480	3.90	2.50	4.365	4000

***Note:** EIRP = Average Power + Gain

8 20DB & 99% BANDWIDTH MEASUREMENT

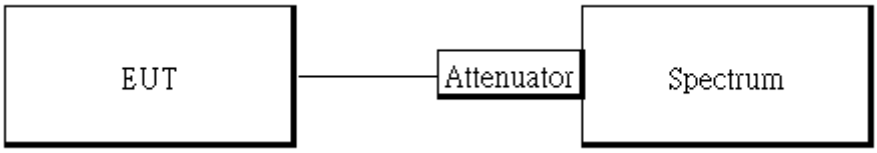
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08
Notebook	DELL	D505	34056609472	N/A	N/A

8.3 Test Set-up



8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as RBW=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
5. Mark the peak frequency and –20dB (upper and lower) frequency
6. Turn on the 99% bandwidth function, max reading.
7. Repeat above procedures until all test default channel is completed

NOTE:

1. For the plot of bandwidth measurement, the marker of the 20dB BW is arrow-mark.

8.5 Measurement Result

GFSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.924	0.62
Mid	0.931	0.62
High	0.925	0.62

π/4-DQPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.318	0.88
Mid	1.316	0.88
High	1.313	0.88

8-DPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.290	0.86
Mid	1.284	0.86
High	1.294	0.86

GFSK

CH	99% Bandwidth (MHz)
Low	0.85456
Mid	0.87691
High	0.86091

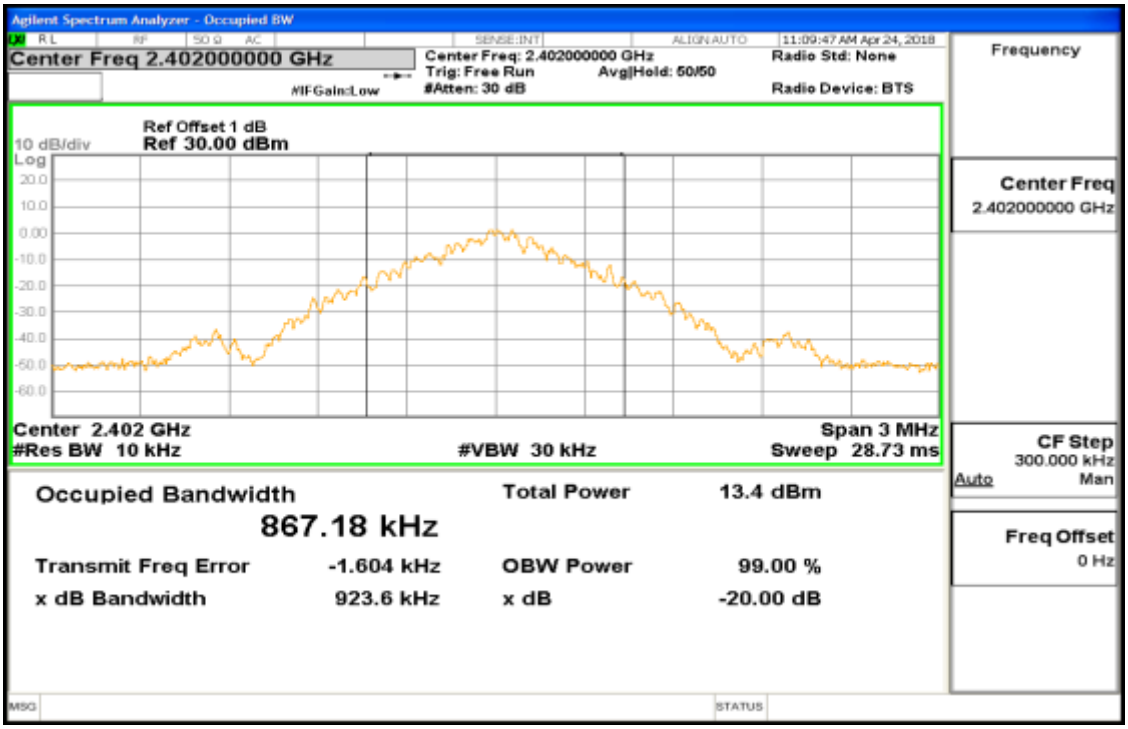
π/4-DQPSK

CH	99% Bandwidth (MHz)
Low	1.2427
Mid	1.2358
High	1.2376

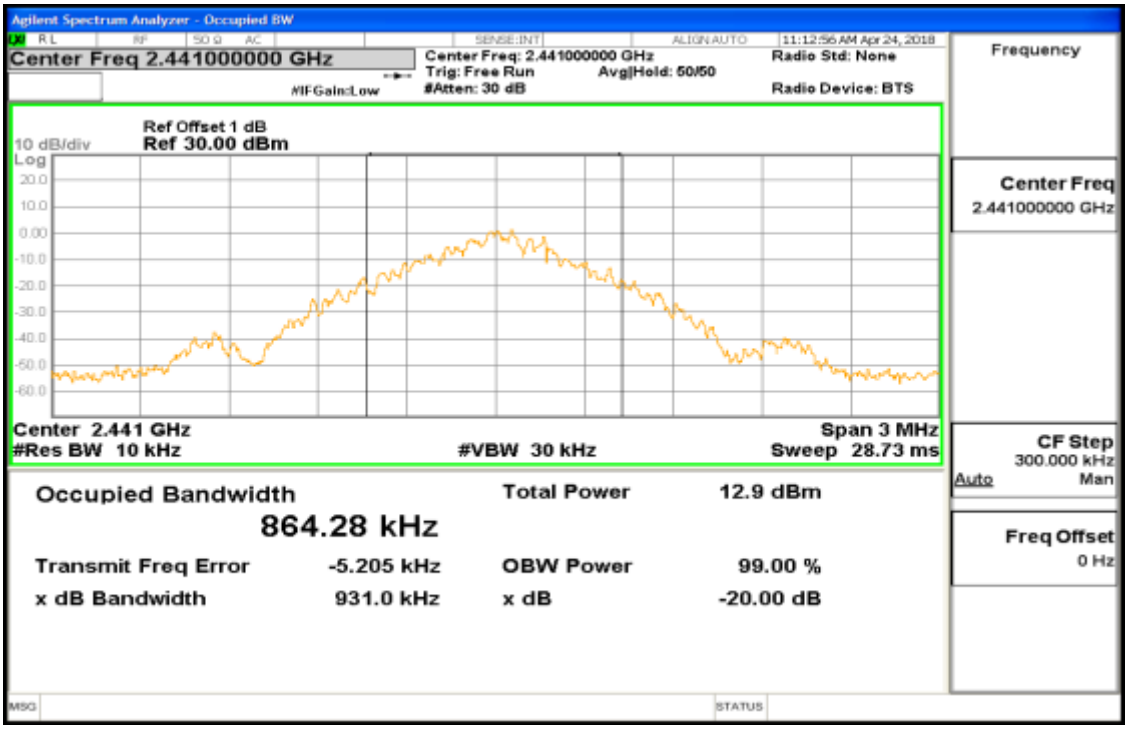
8-DPSK

CH	99% Bandwidth (MHz)
Low	1.2324
Mid	1.2375
High	1.2348

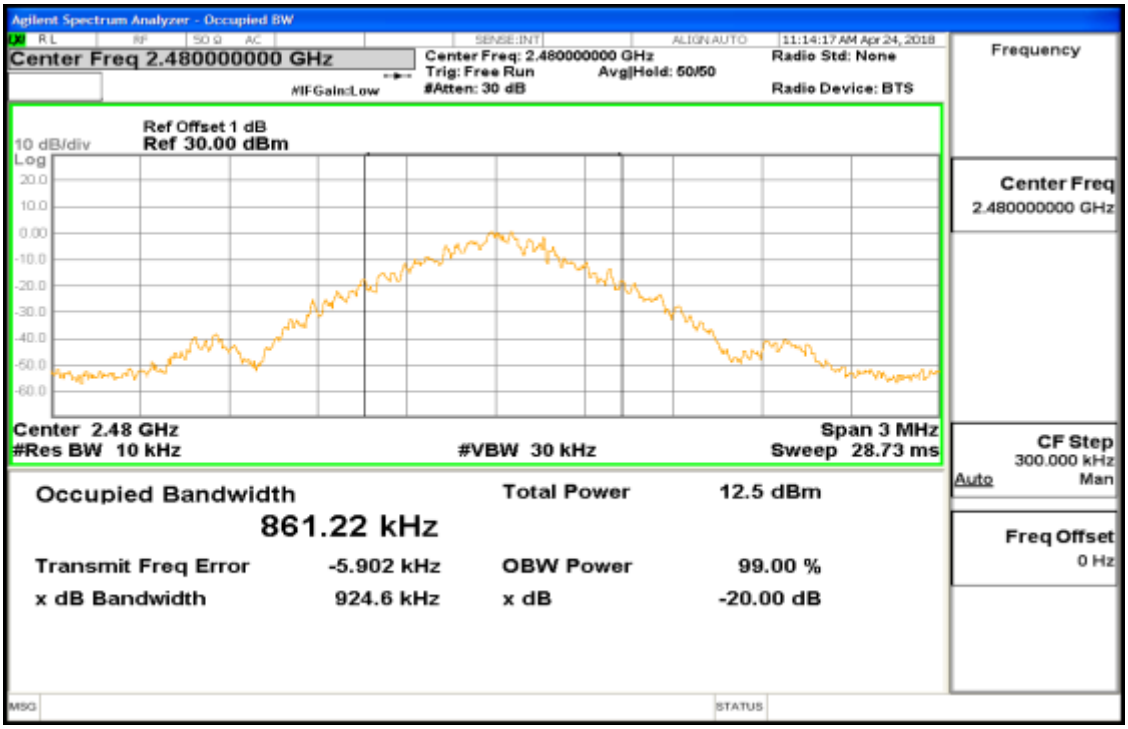
20dB Band Width Test Data CH-Low (GFSK mode)



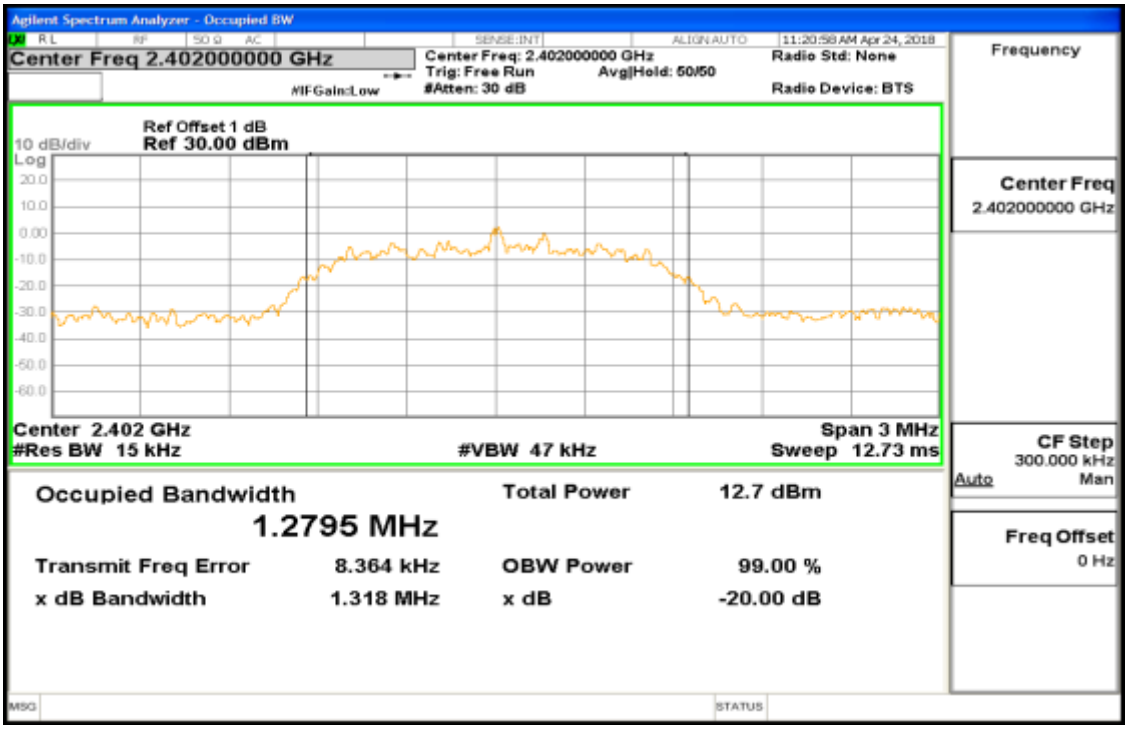
20dB Band Width Test Data CH-Mid (GFSK mode)



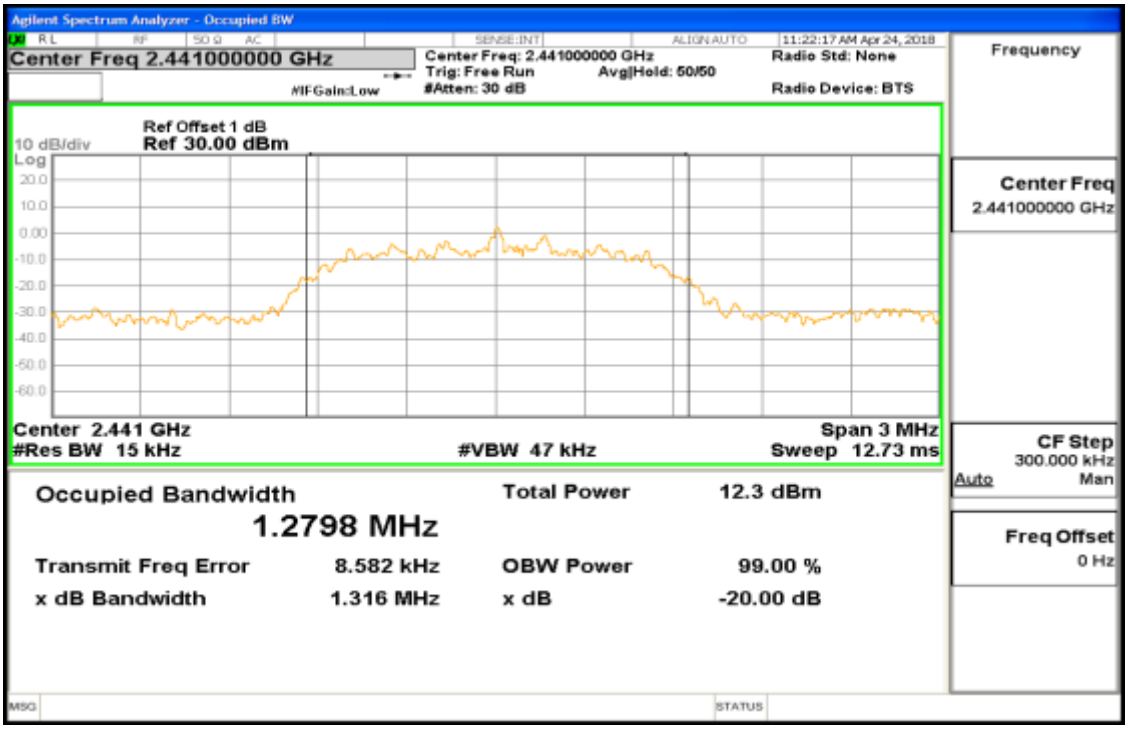
20dB Band Width Test Data CH-High (GFSK mode)



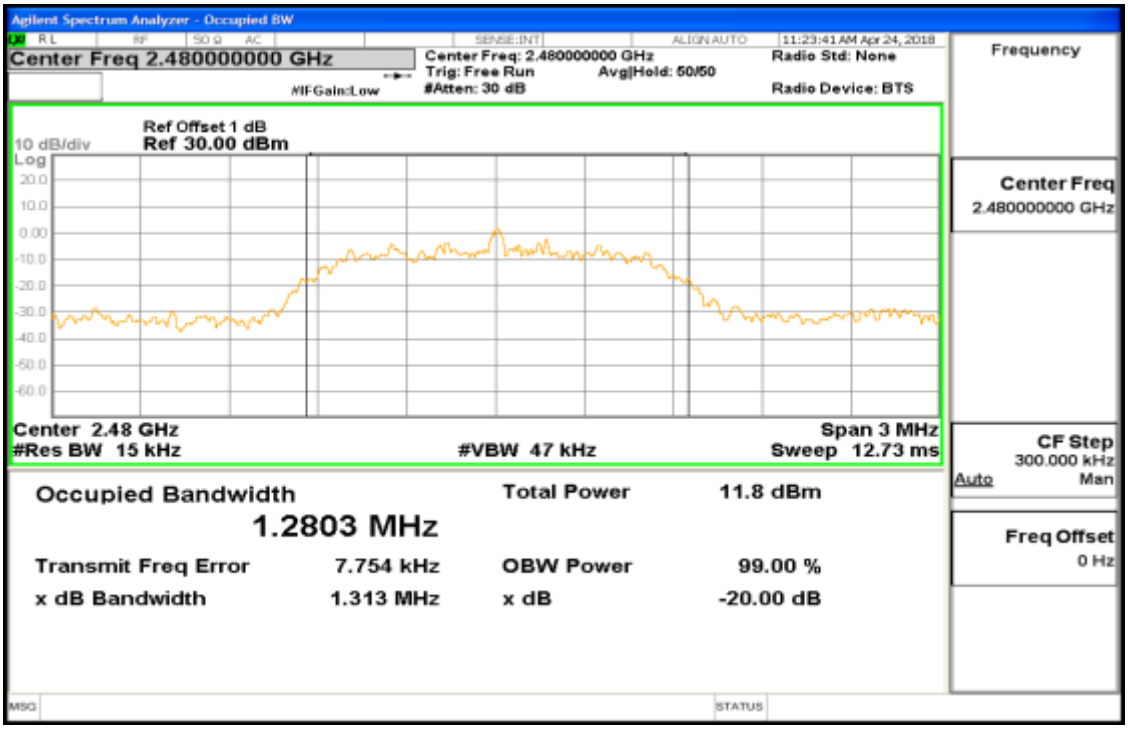
20dB Band Width Test Data CH-Low (π/4-DQPSK mode)



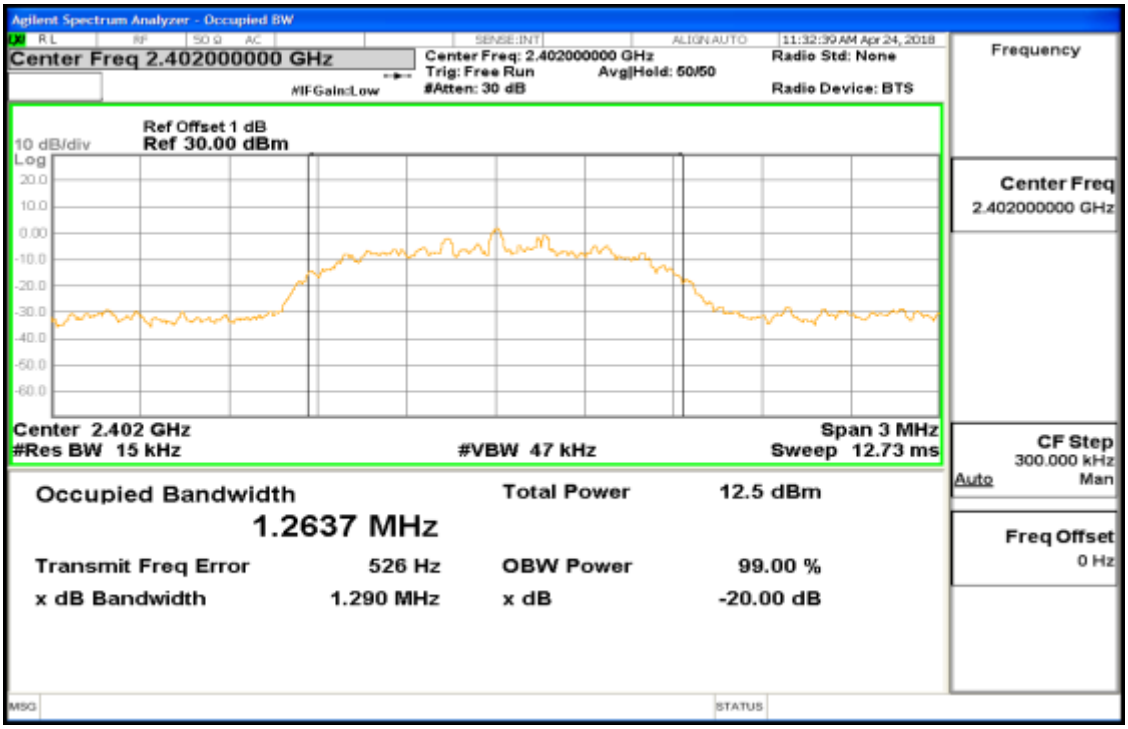
20dB Band Width Test Data CH-Mid (π/4-DQPSK mode)



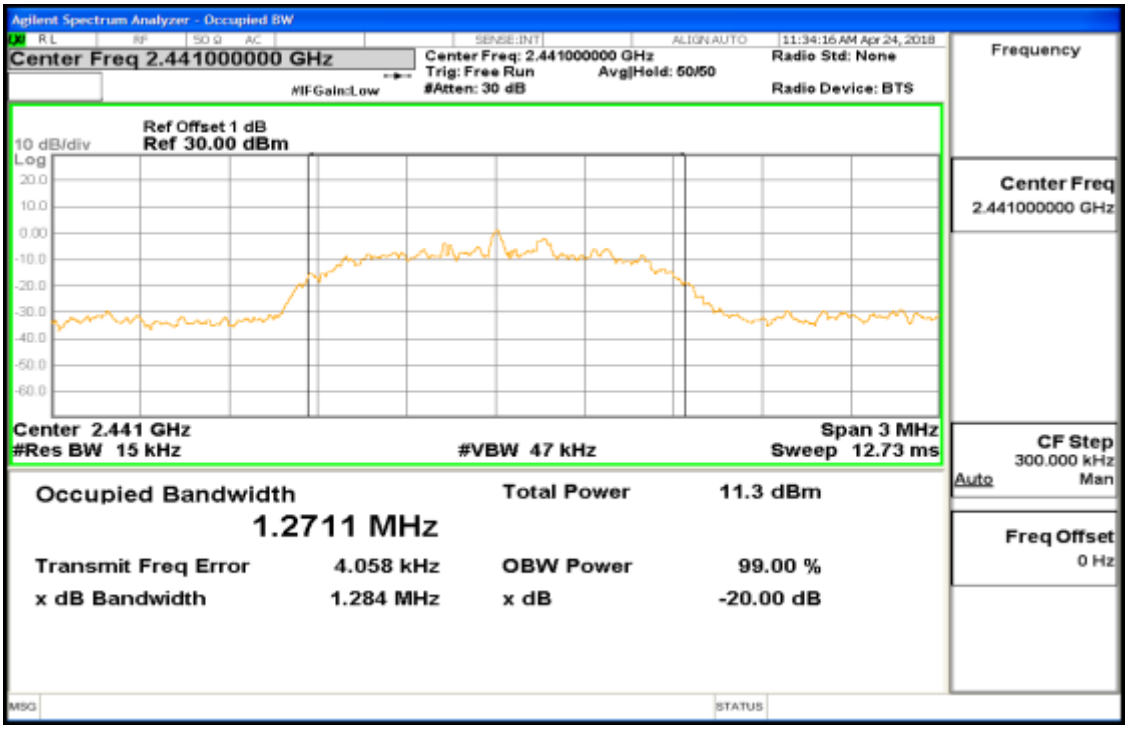
20dB Band Width Test Data CH-High (π/4-DQPSK mode)



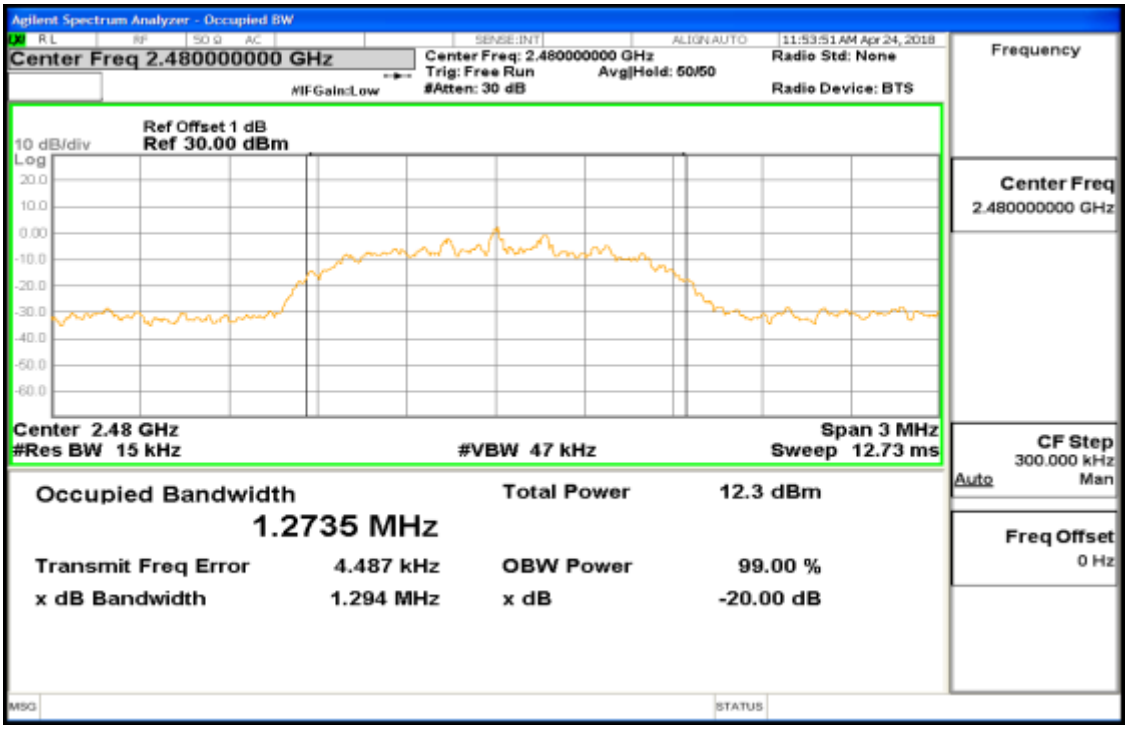
20dB Band Width Test Data CH-Low (8-DPSK mode)



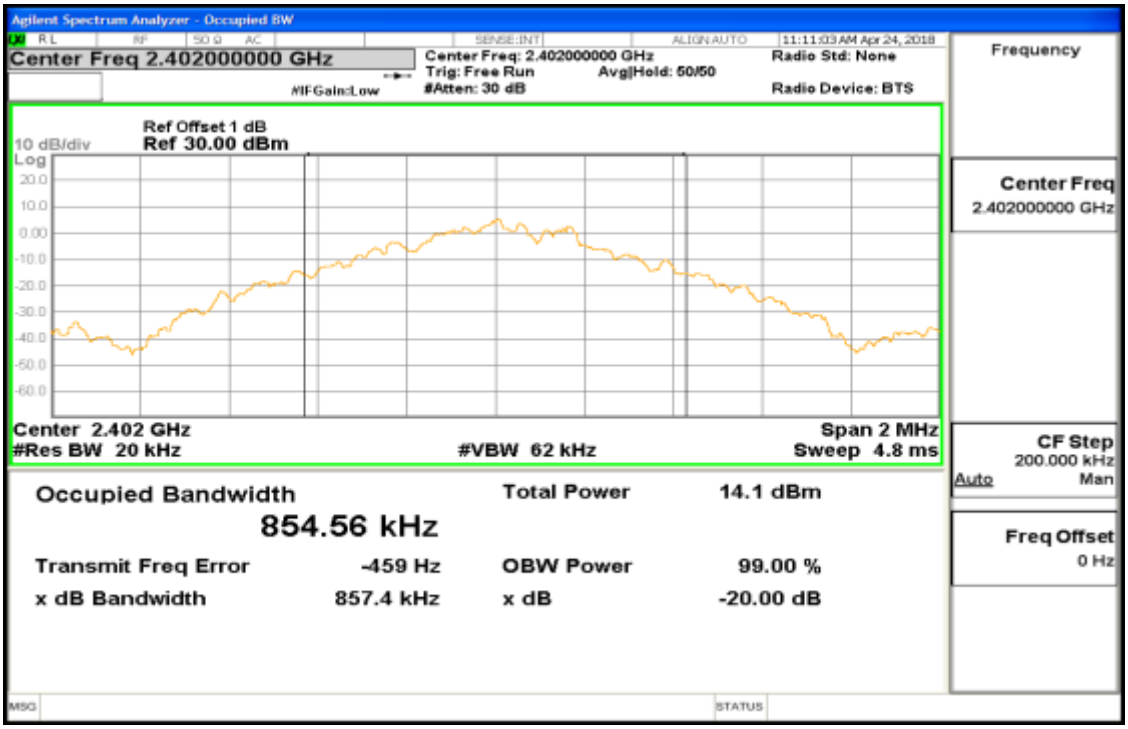
20dB Band Width Test Data CH-Mid (8-DPSK mode)



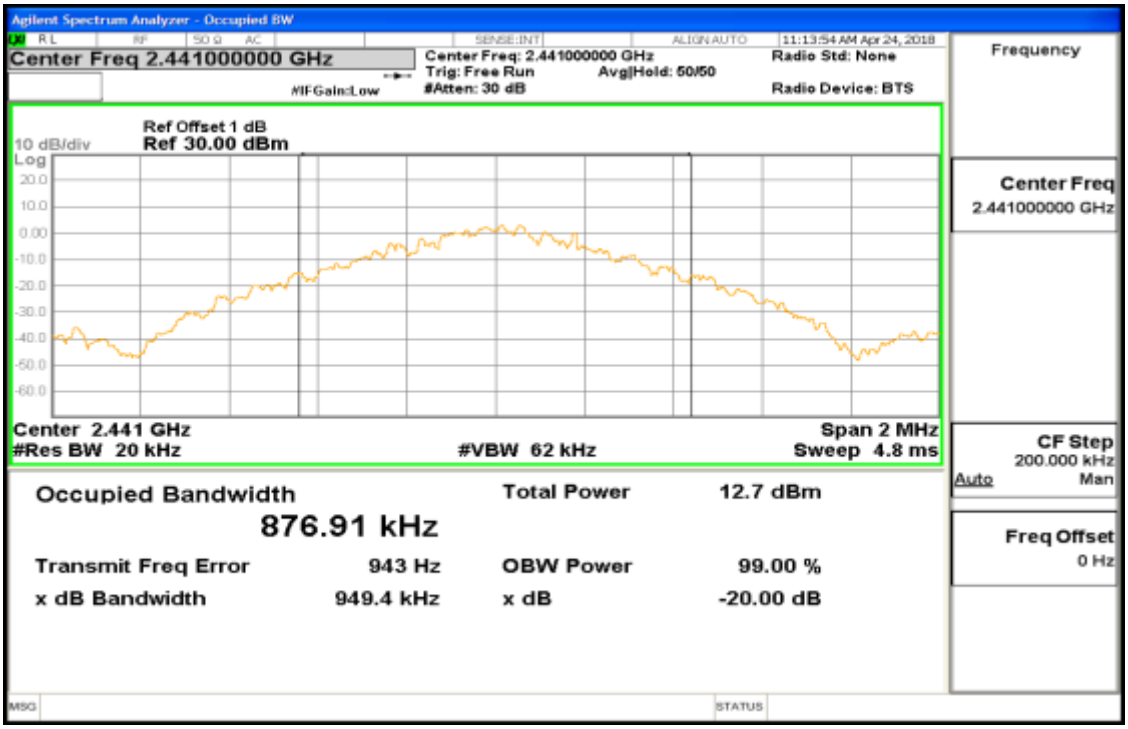
20dB Band Width Test Data CH-High (8-DPSK mode)



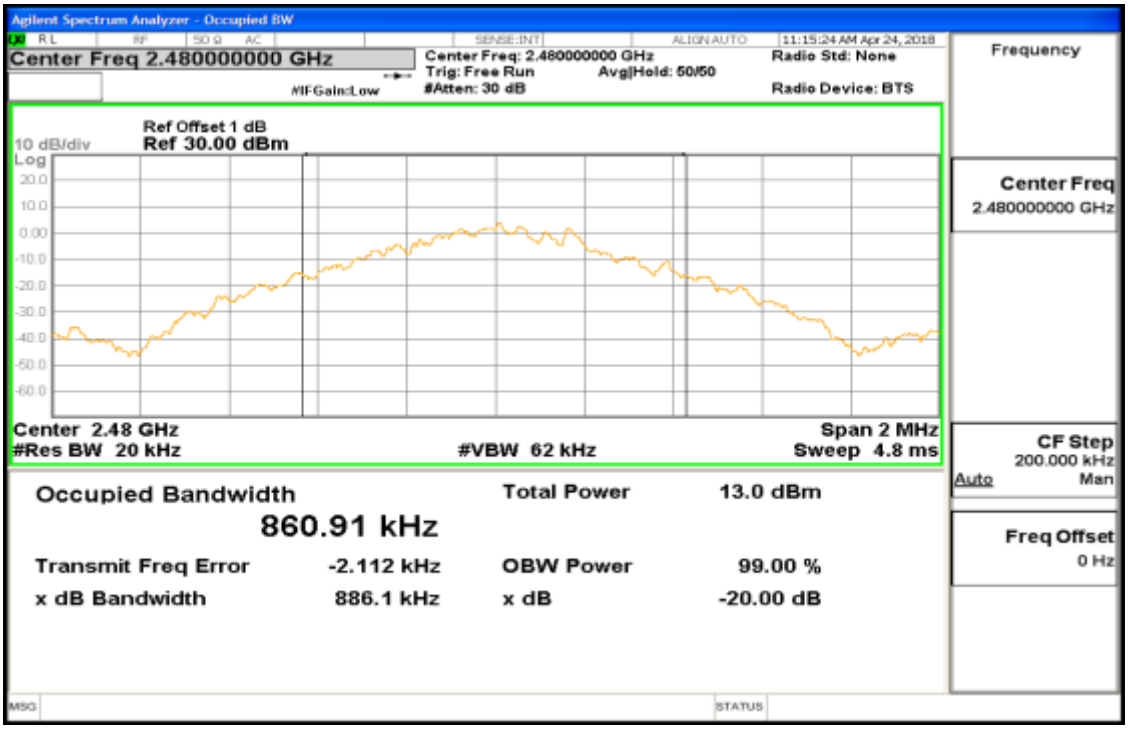
99% Band Width Test Data CH-Low (GFSK mode)



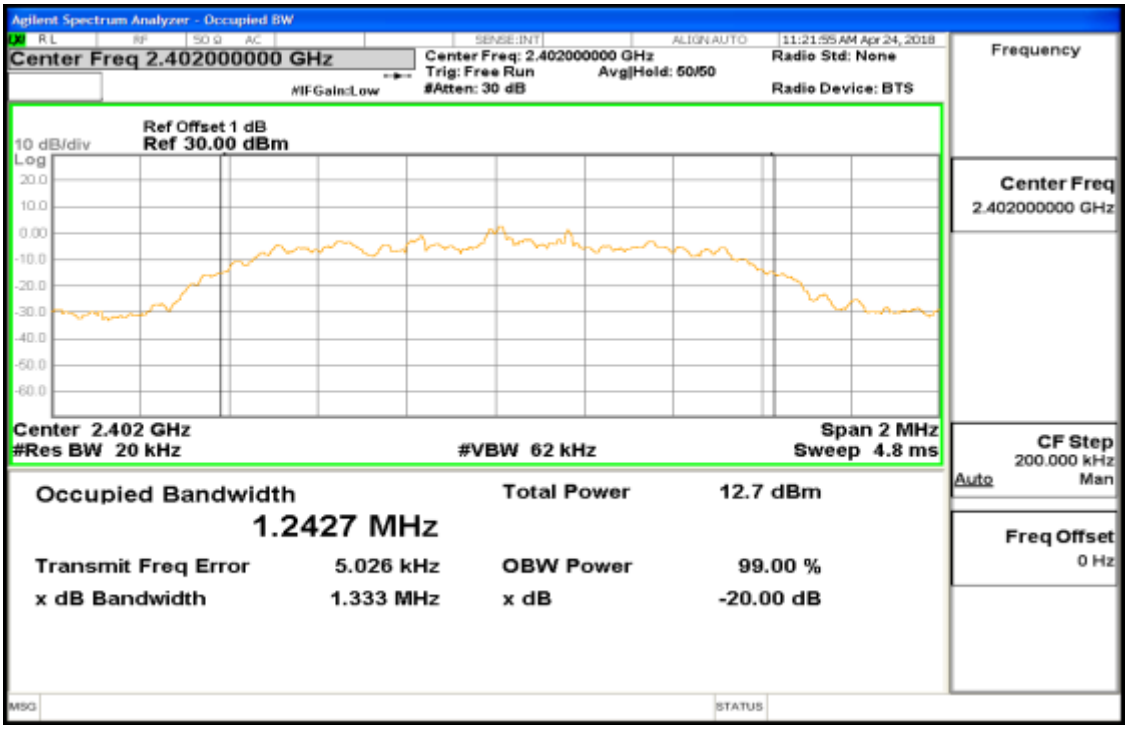
99% Band Width Test Data CH-Mid (GFSK mode)



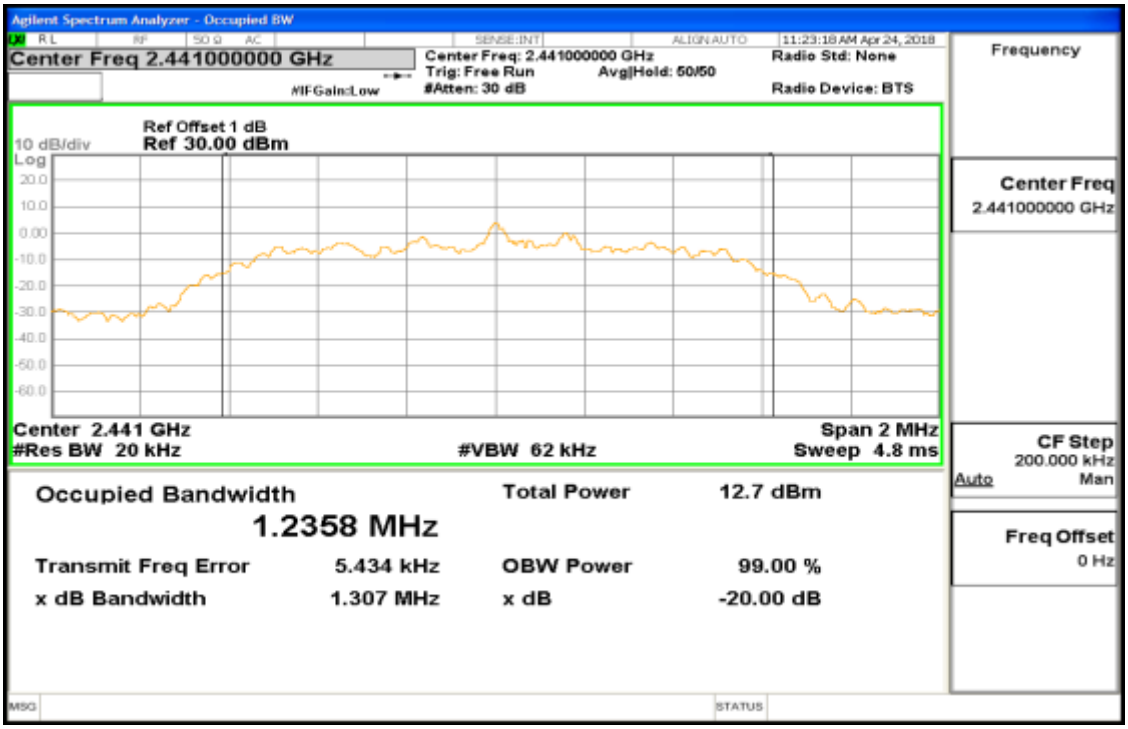
99% Band Width Test Data CH-High (GFSK mode)



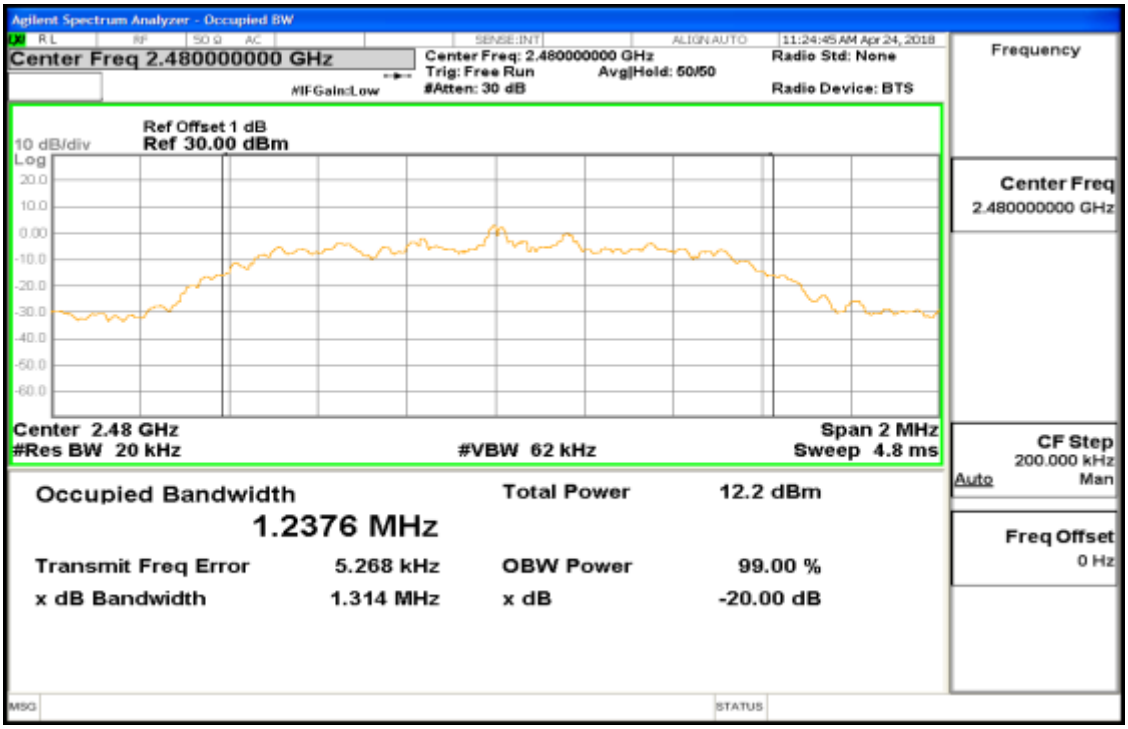
99% Band Width Test Data CH-Low (π/4-DQPSK mode)



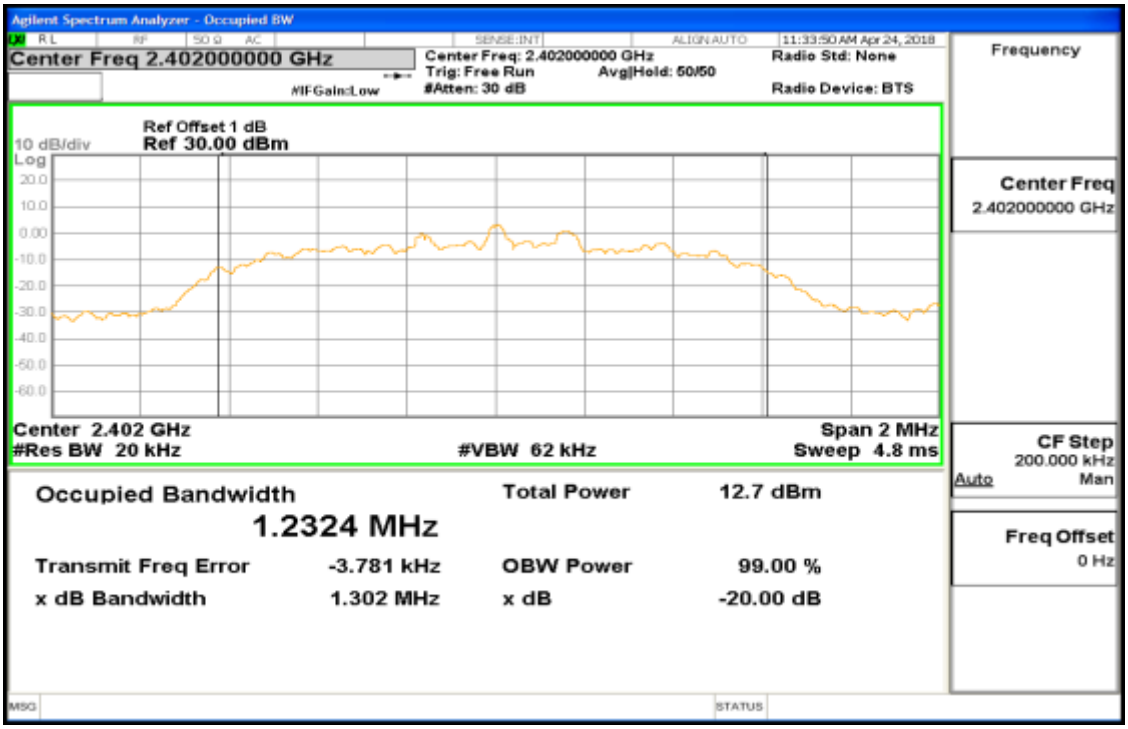
99% Band Width Test Data CH-Mid (π/4-DQPSK mode)



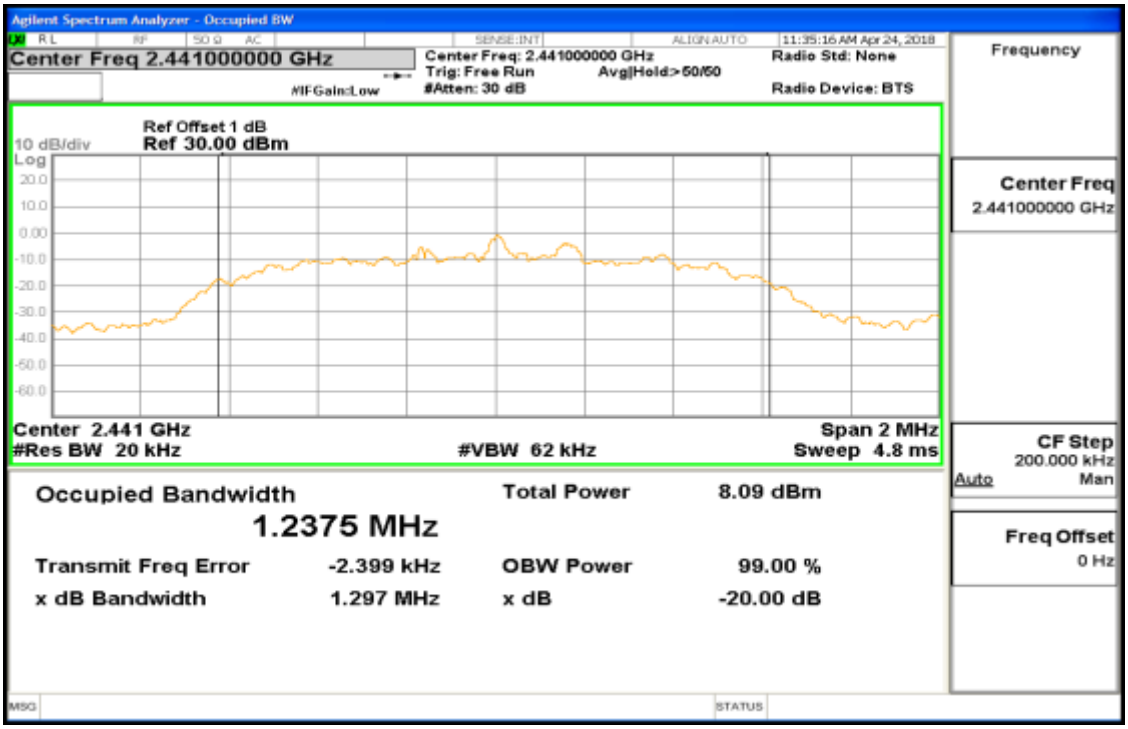
99% Band Width Test Data CH-High (π/4-DQPSK mode)



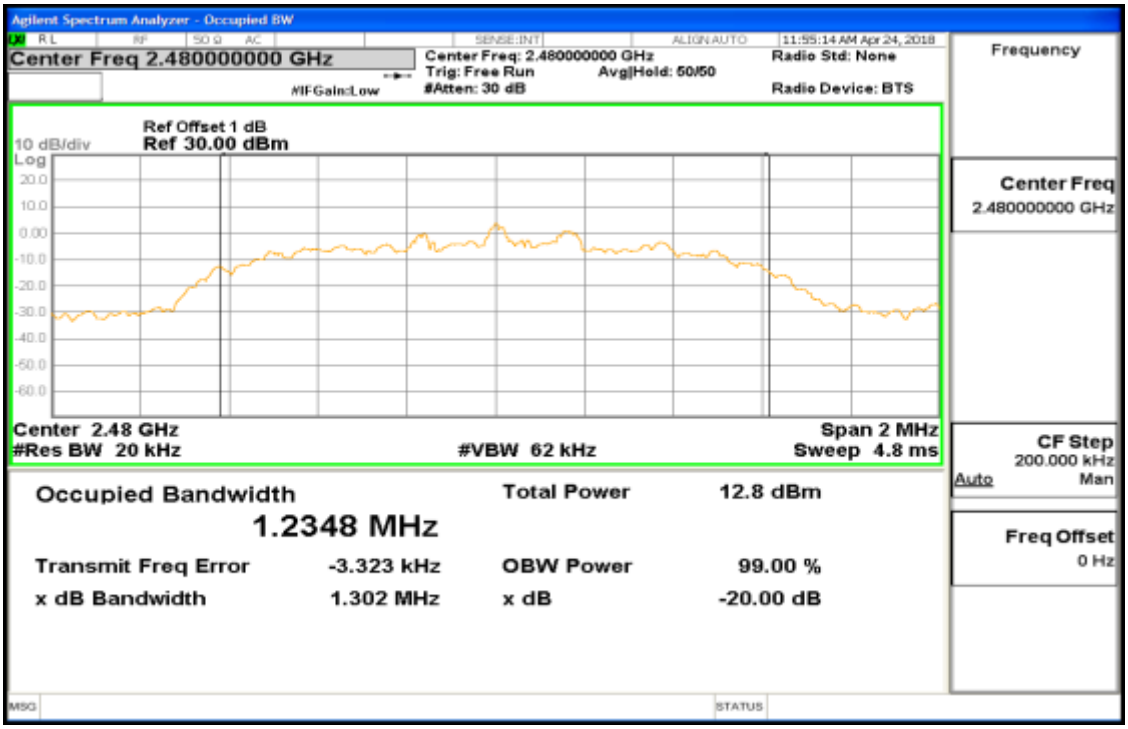
99% Band Width Test Data CH-Low (8-DPSK mode)



99% Band Width Test Data CH-Mid (8-DPSK mode)



99% Band Width Test Data CH-High (8-DPSK mode)



9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

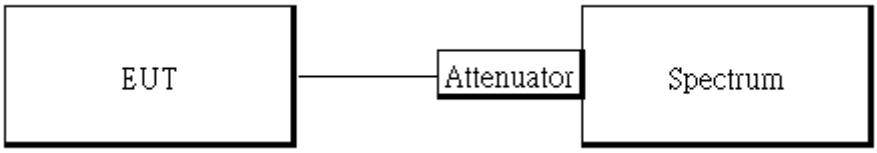
9.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digi-tally modulated intentional radiator is operating, the radio frequency power that is produced by the in-tentional 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 con-ducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) & RSS-Gen §8.9 limit.

9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08
Notebook	DELL	D505	34056609472	N/A	N/A

9.3 Test SET-UP



9.4 Measurement Procedure

Conducted Band Edge:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Set RBW = 100 kHz & VBW = 300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

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

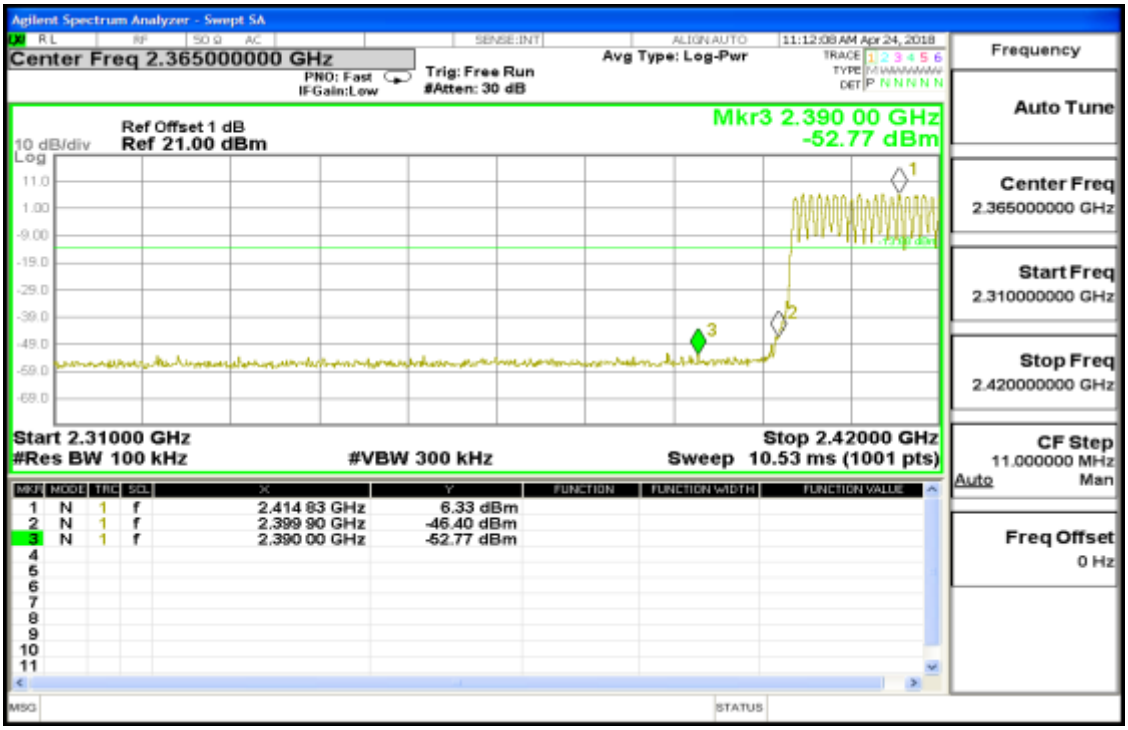
Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

9.5 Measurement Result

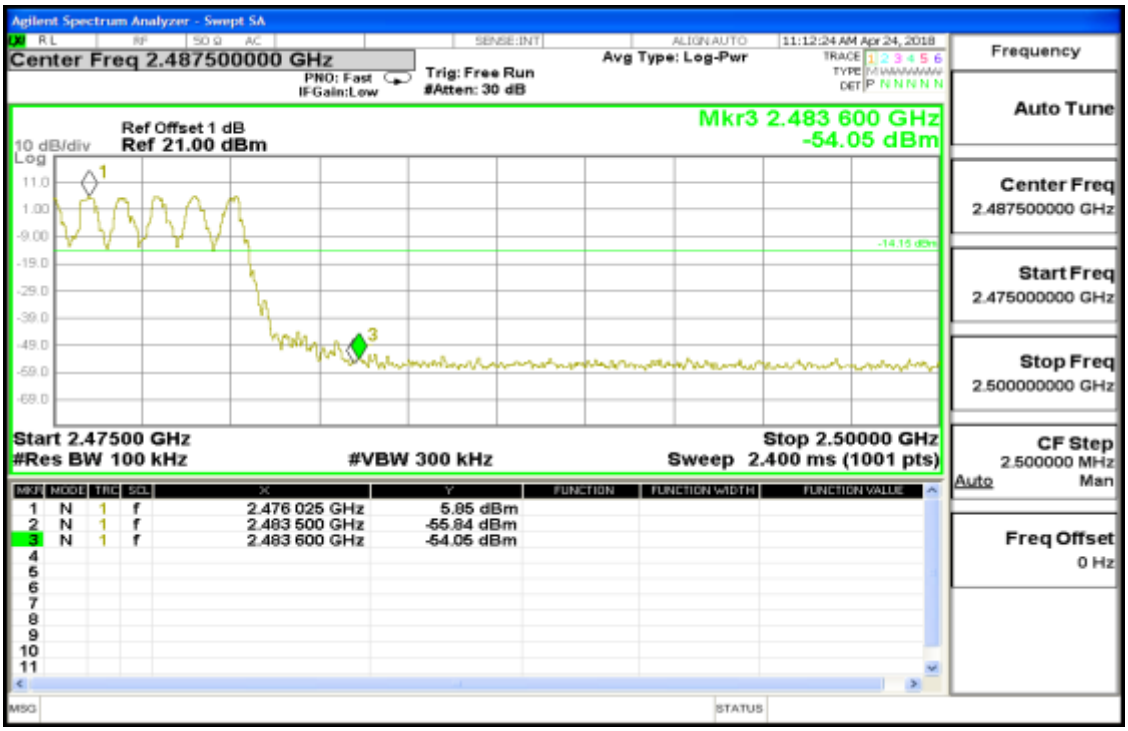
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

1. The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

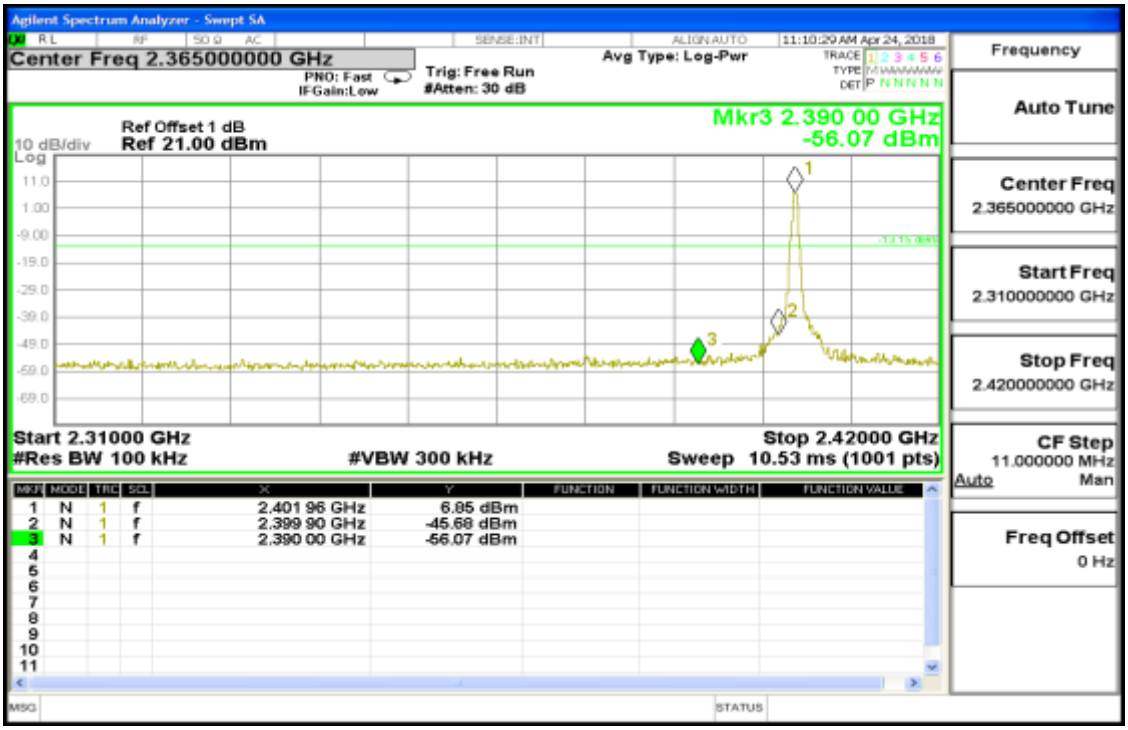
Band Edges Test Data CH-Low (Hopping mode) (GFSK mode)



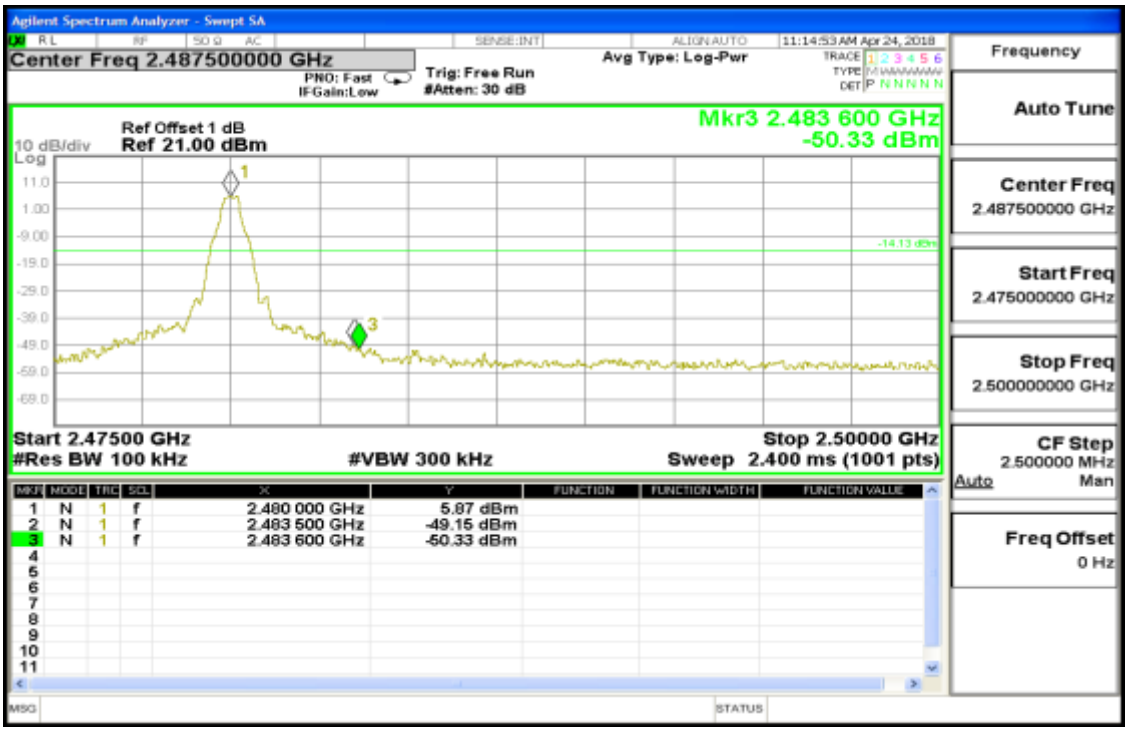
Band Edges Test Data CH-High



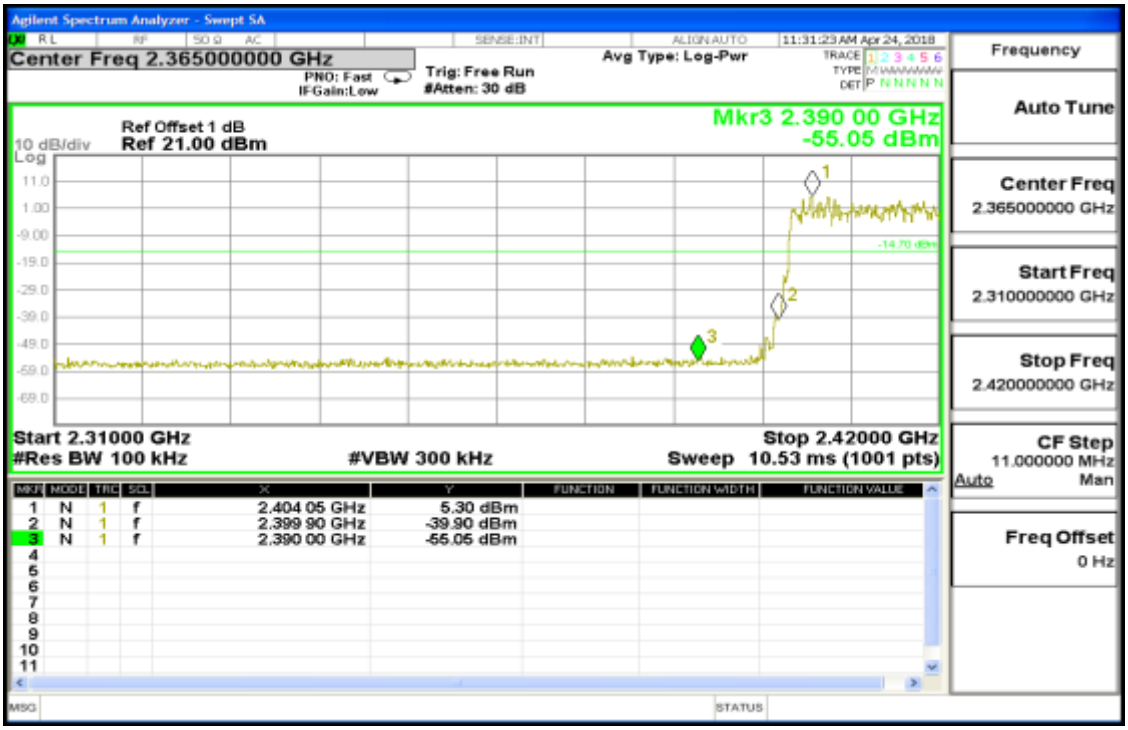
Band Edges Test Data CH-Low (Non-Hopping mode) (GFSK mode)



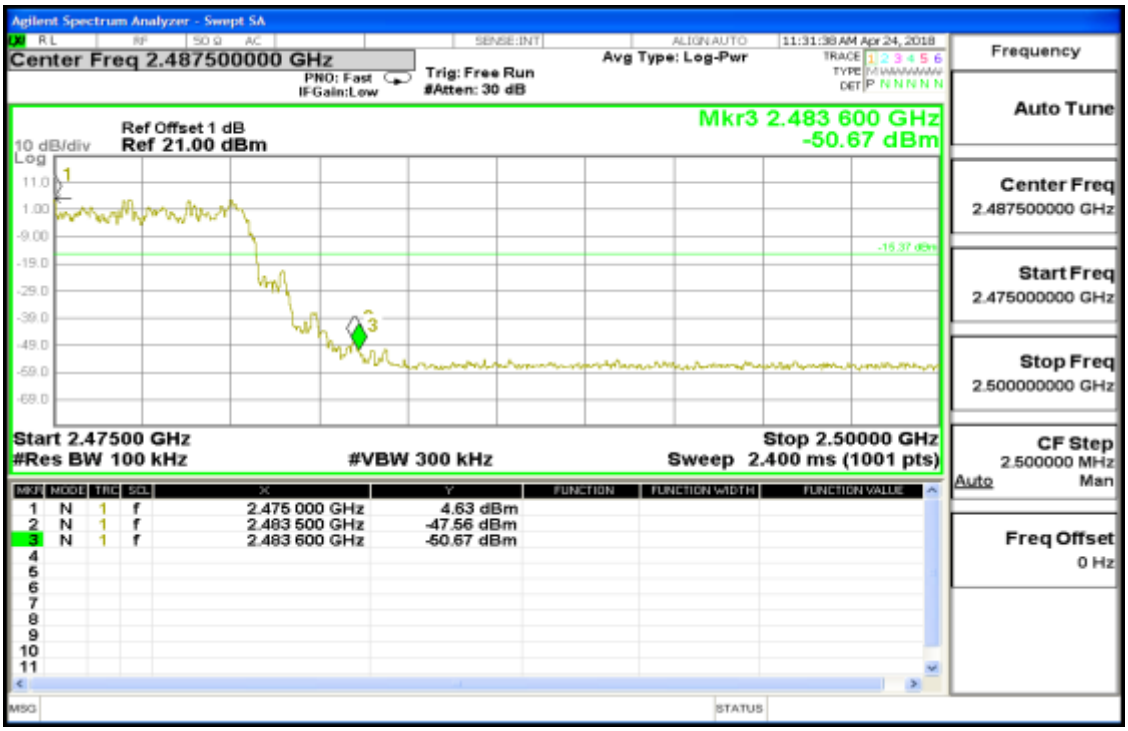
Band Edges Test Data CH-High



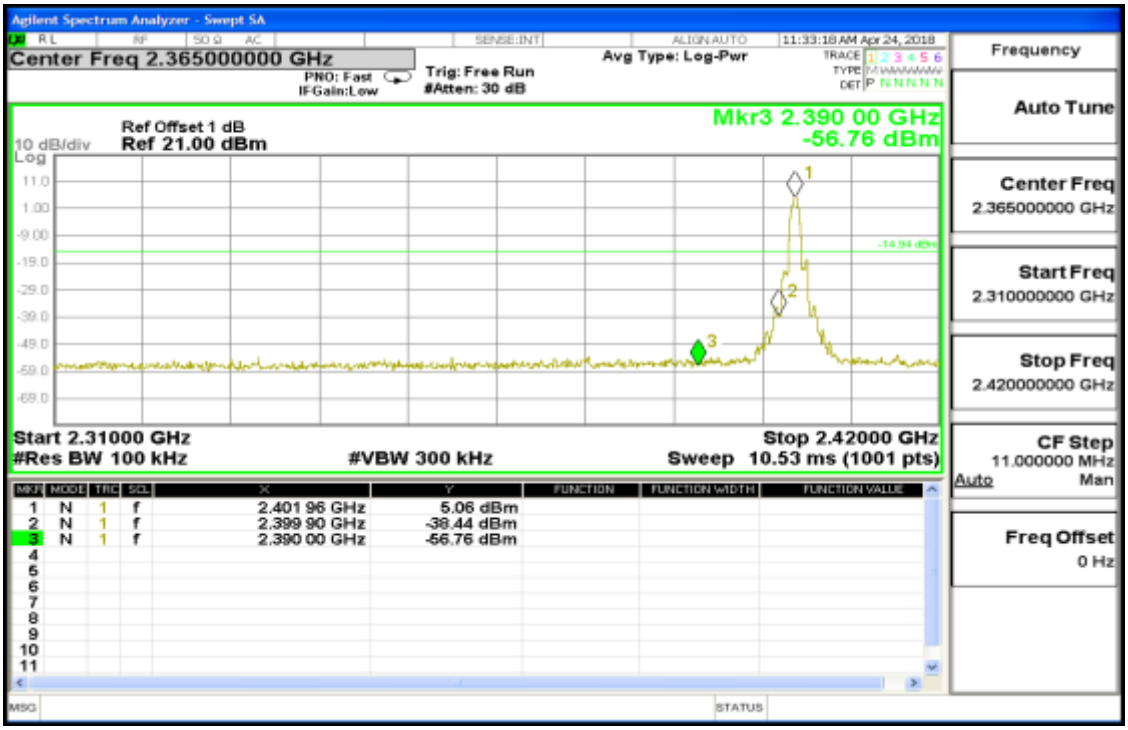
Band Edges Test Data CH-Low (Hopping mode) (8-DPSK mode)



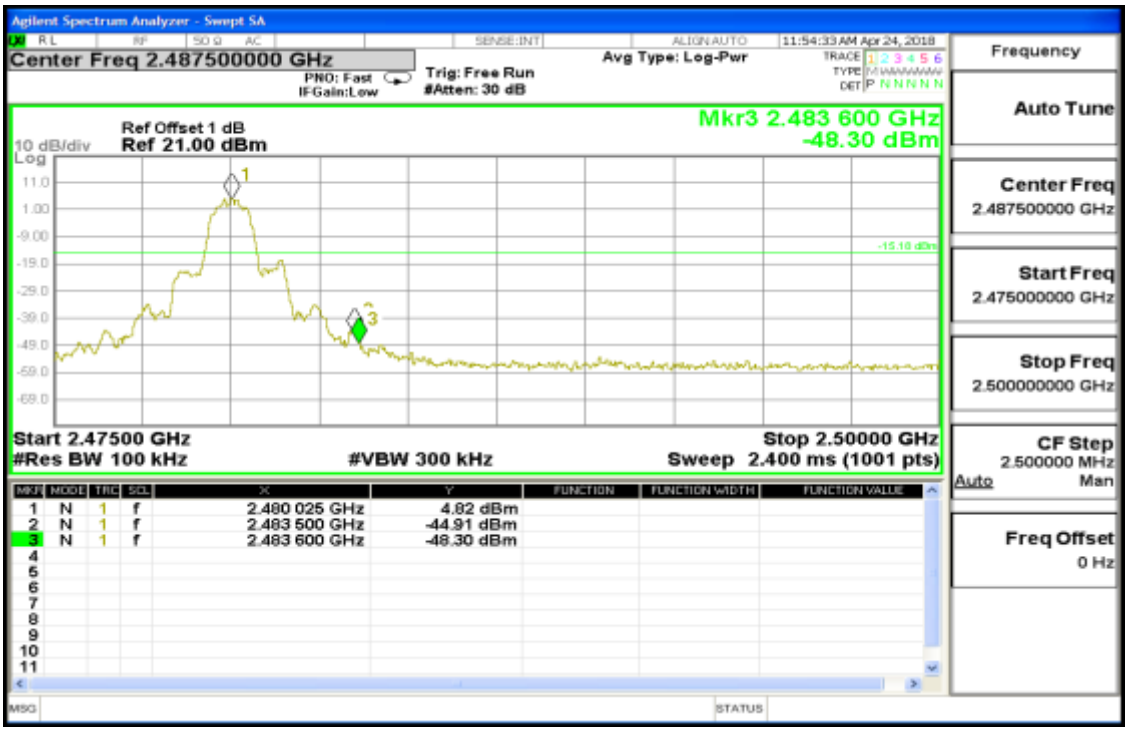
Band Edges Test Data CH-High



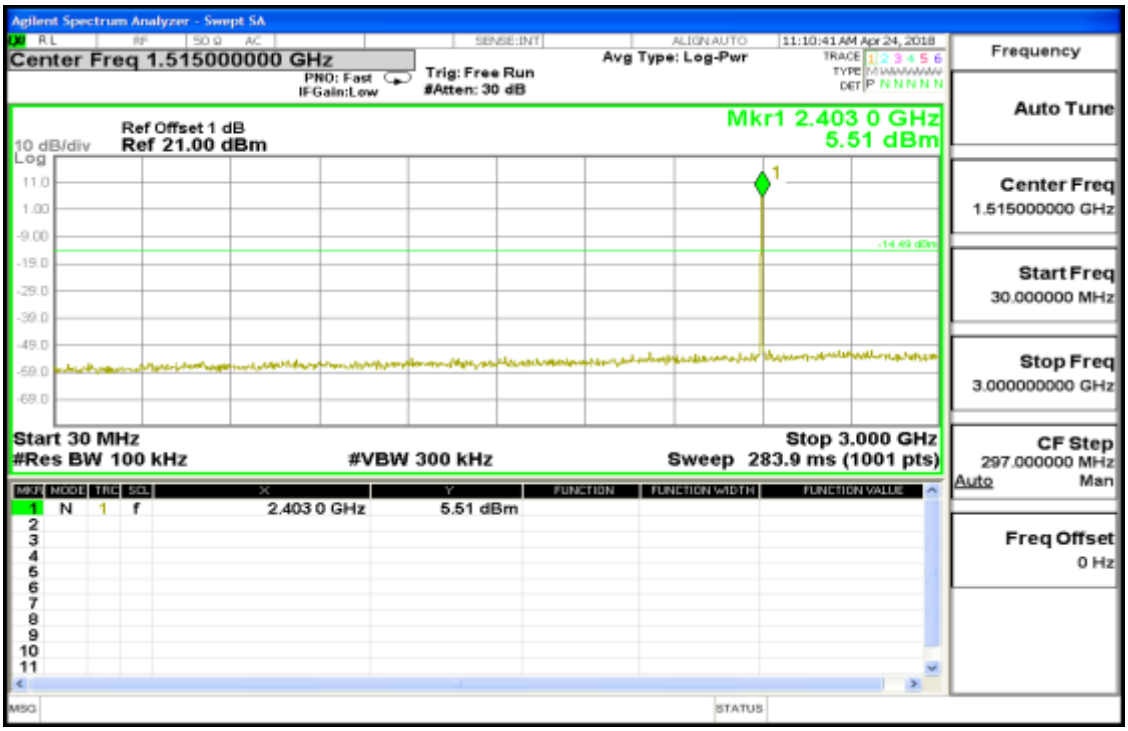
Band Edges Test Data CH-Low (Non-Hopping mode) (8-DPSK mode)



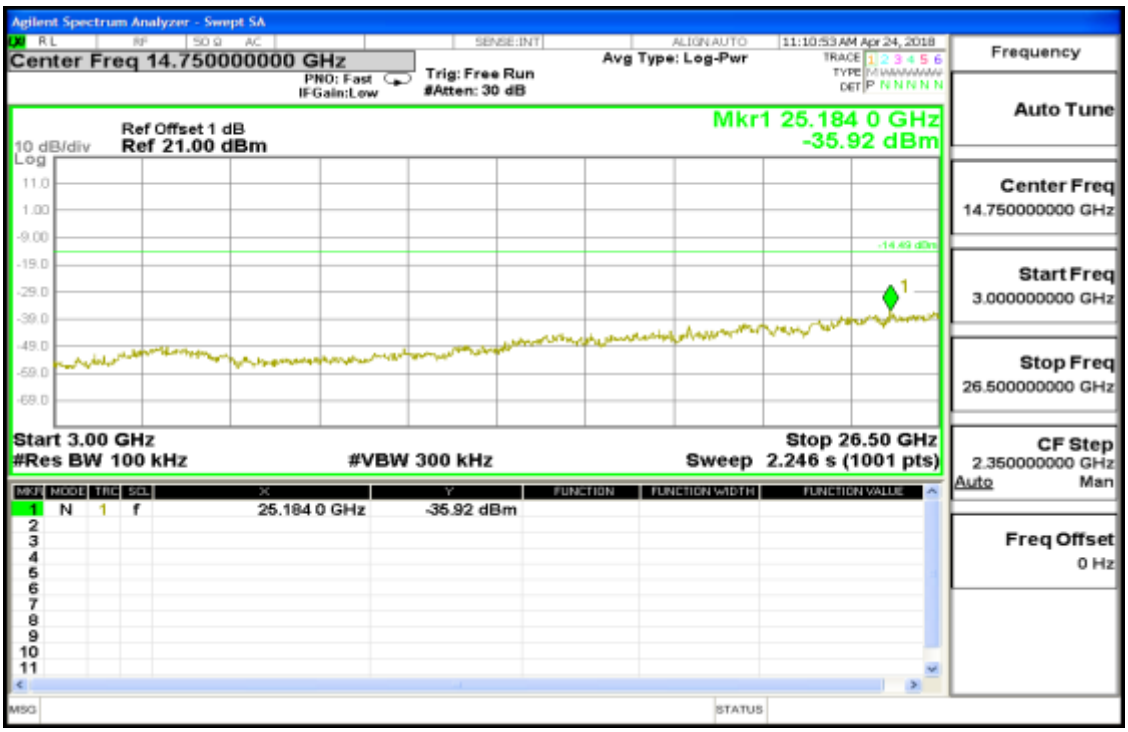
Band Edges Test Data CH-High



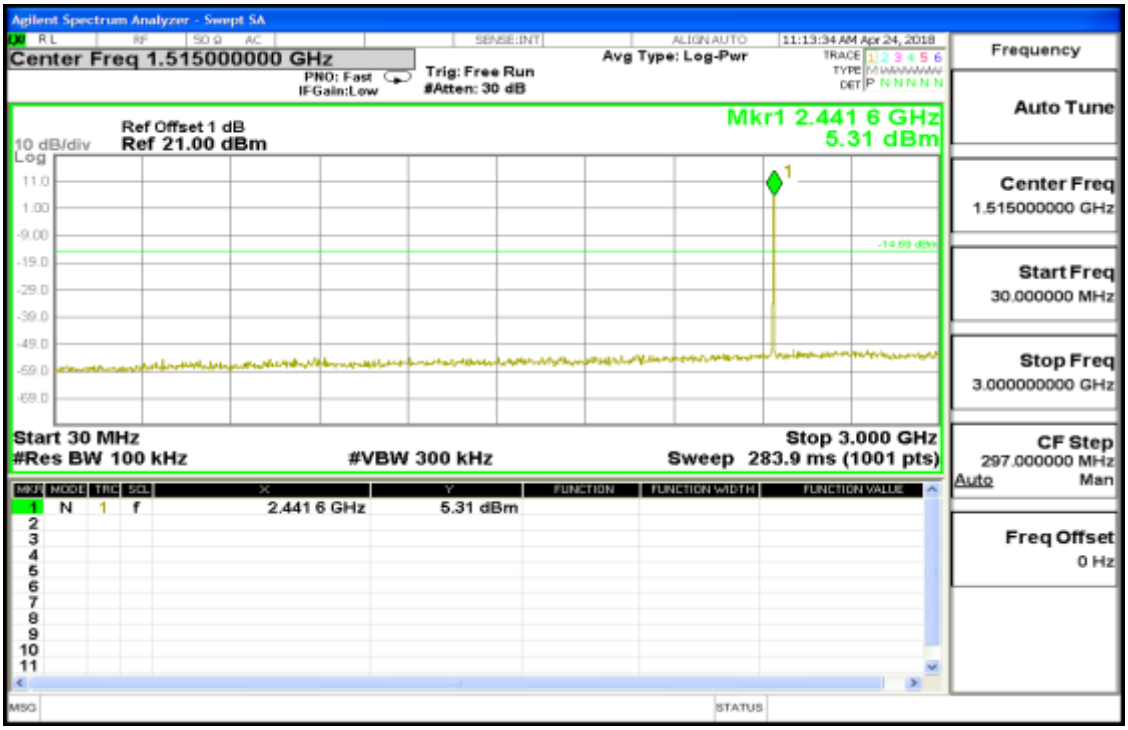
Conducted Spurious Emission Measurement Result (GFSK mode)
Ch Low 30MHz – 3GHz



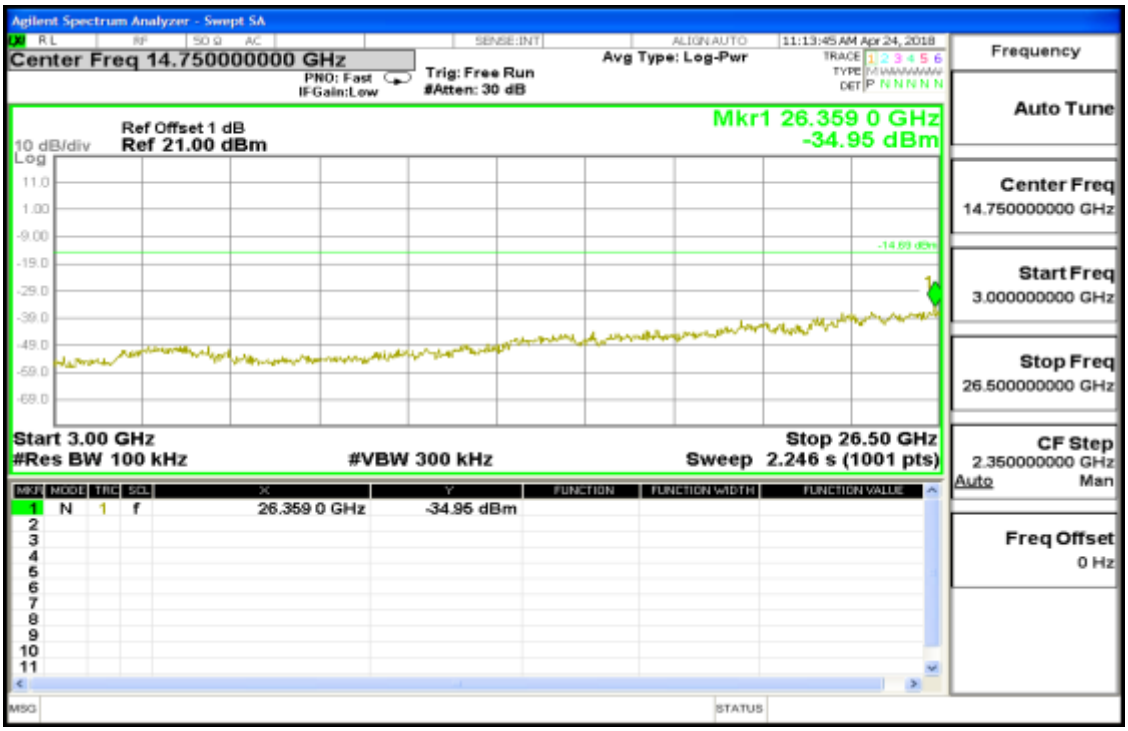
Ch Low 3GHz – 26.5GHz



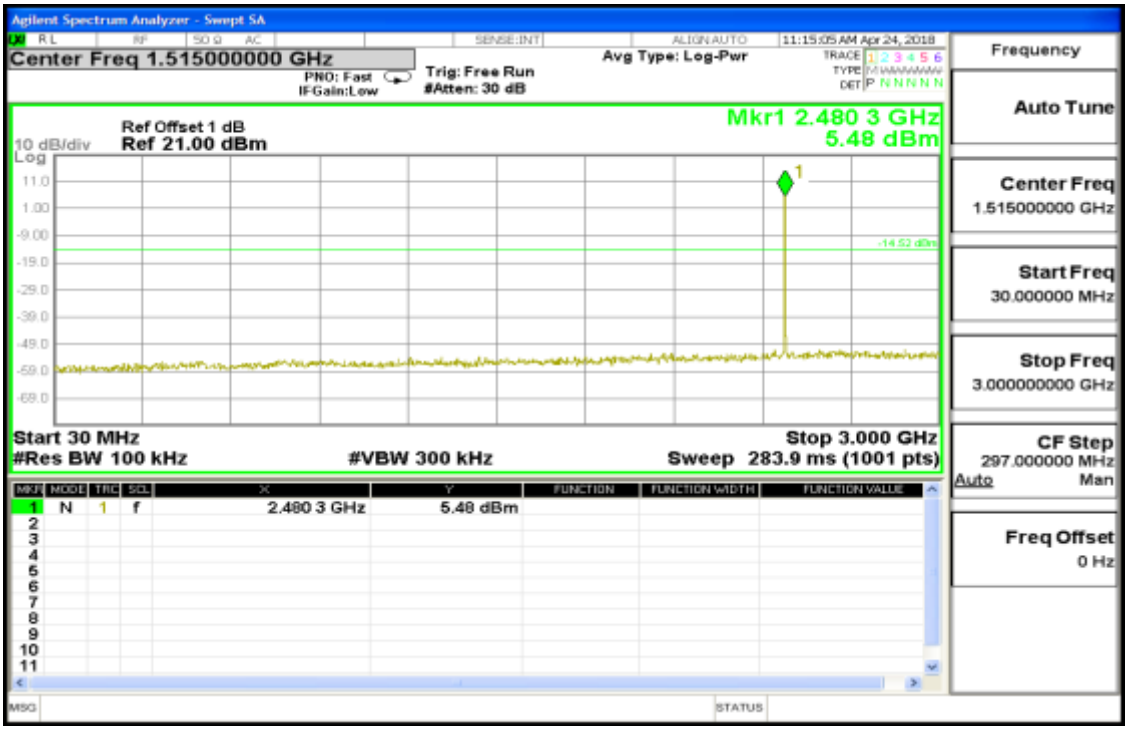
Ch Mid 30MHz – 3GHz



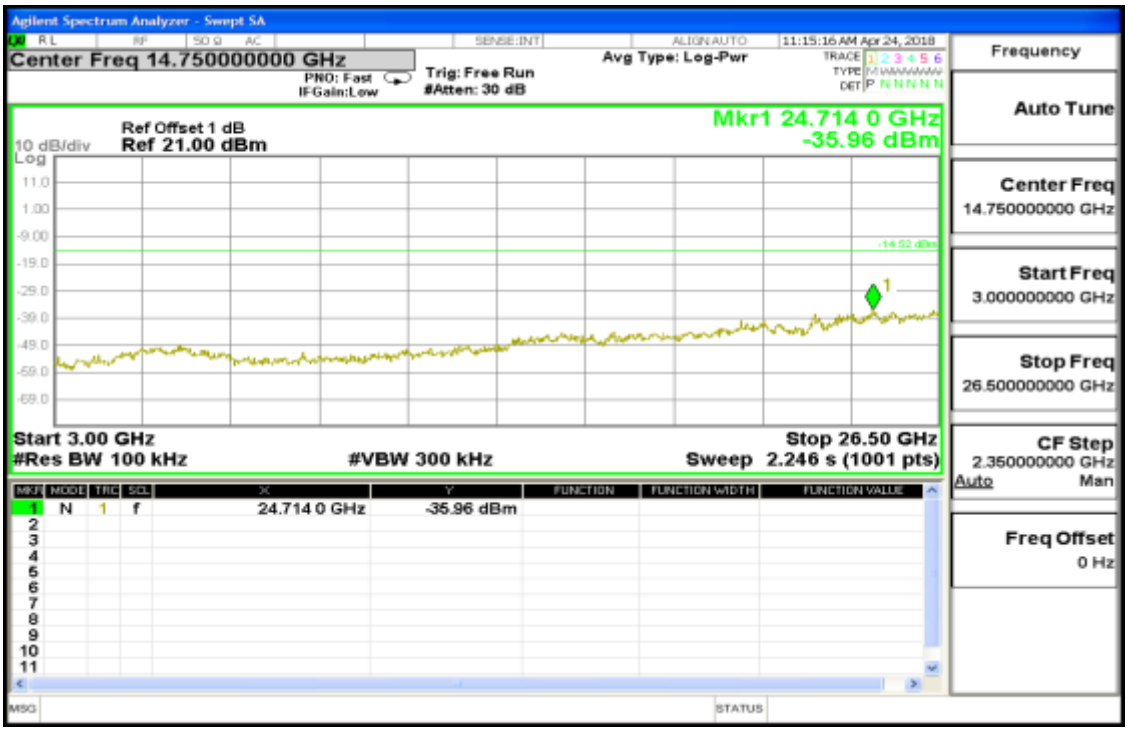
Ch Mid 3GHz – 26.5GHz



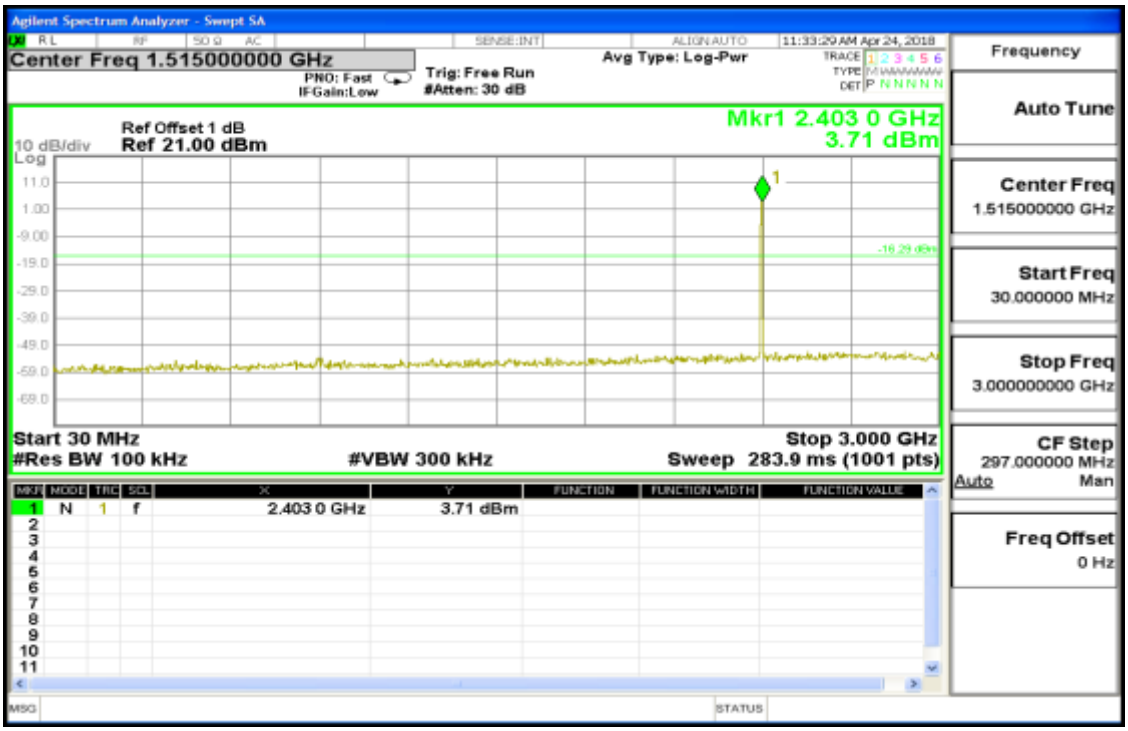
Ch High 30MHz – 3GHz

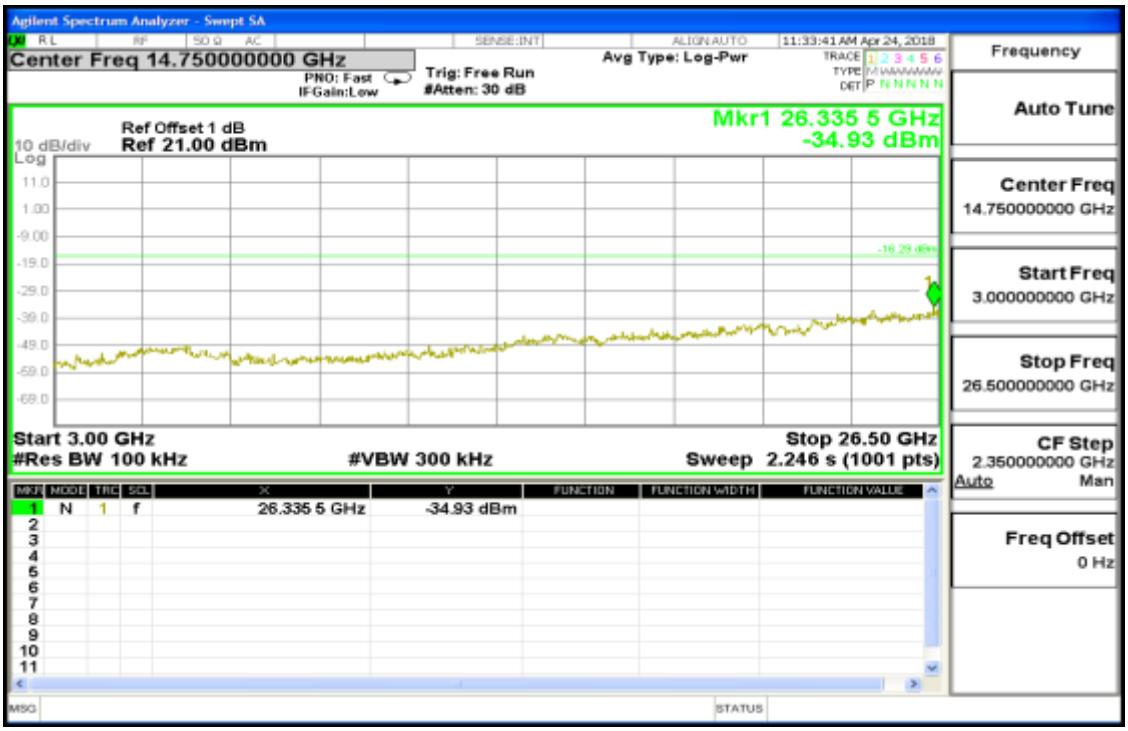


Ch High 3GHz – 26.5GHz

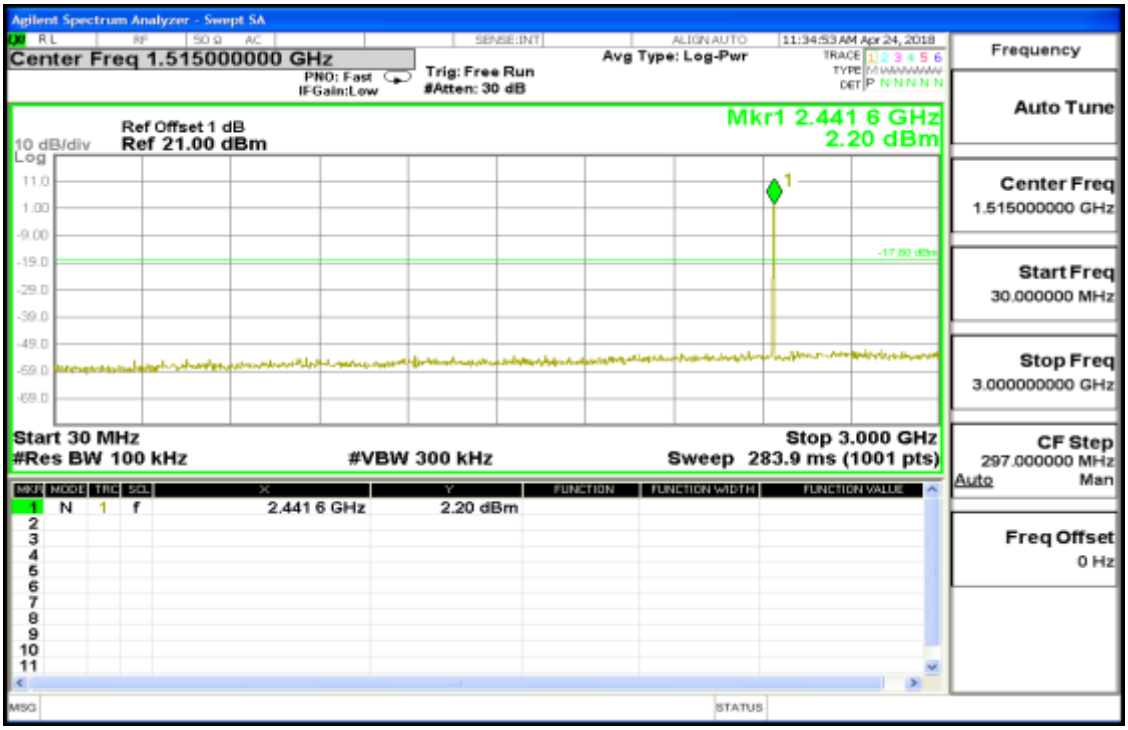


Conducted Spurious Emission Measurement Result (8DPSK mode)
Ch Low 30MHz – 3GHz

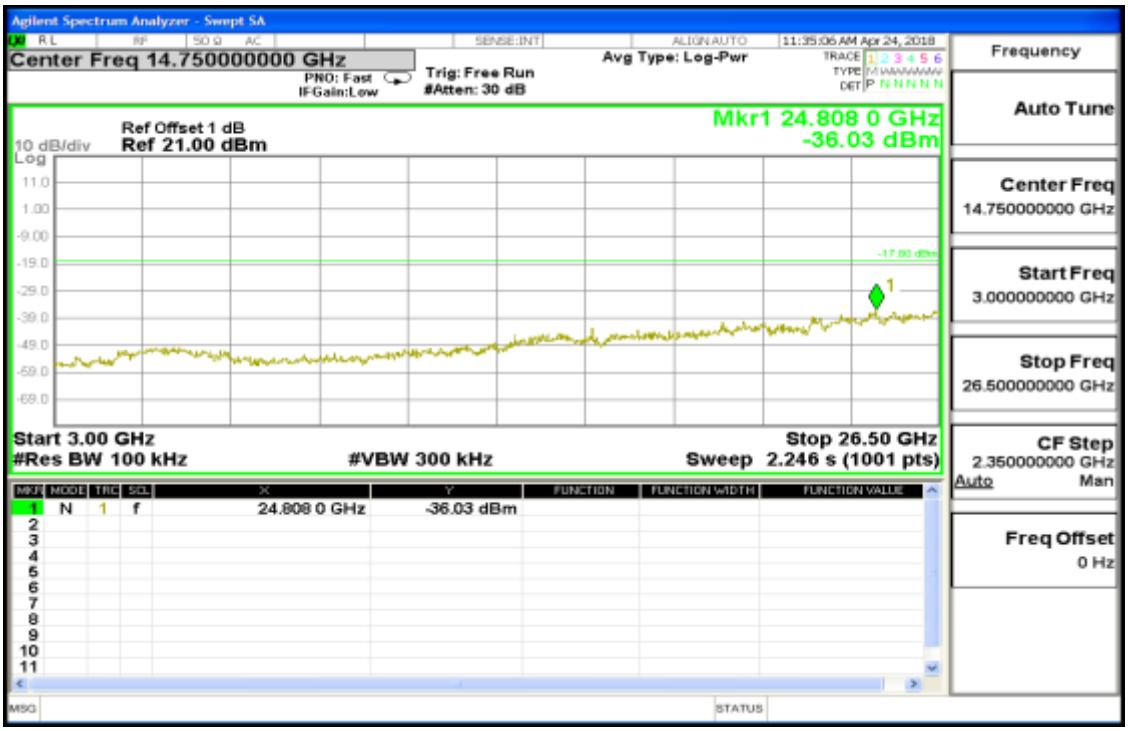




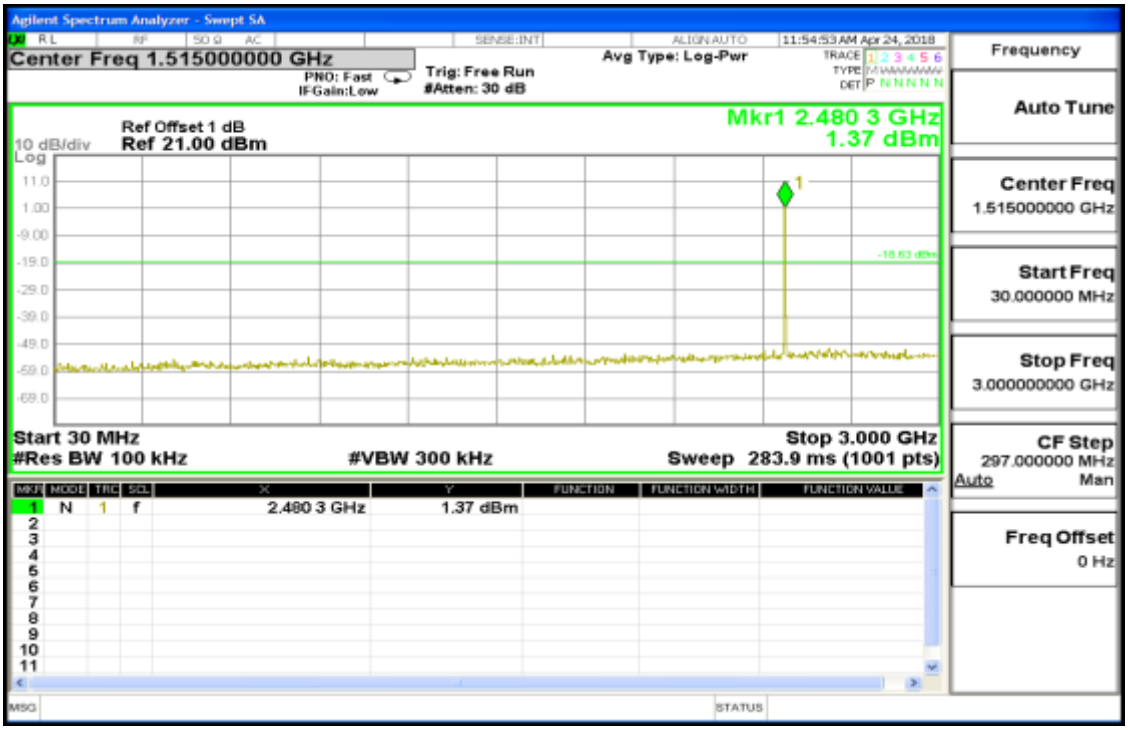
Ch Mid 30MHz – 3GHz



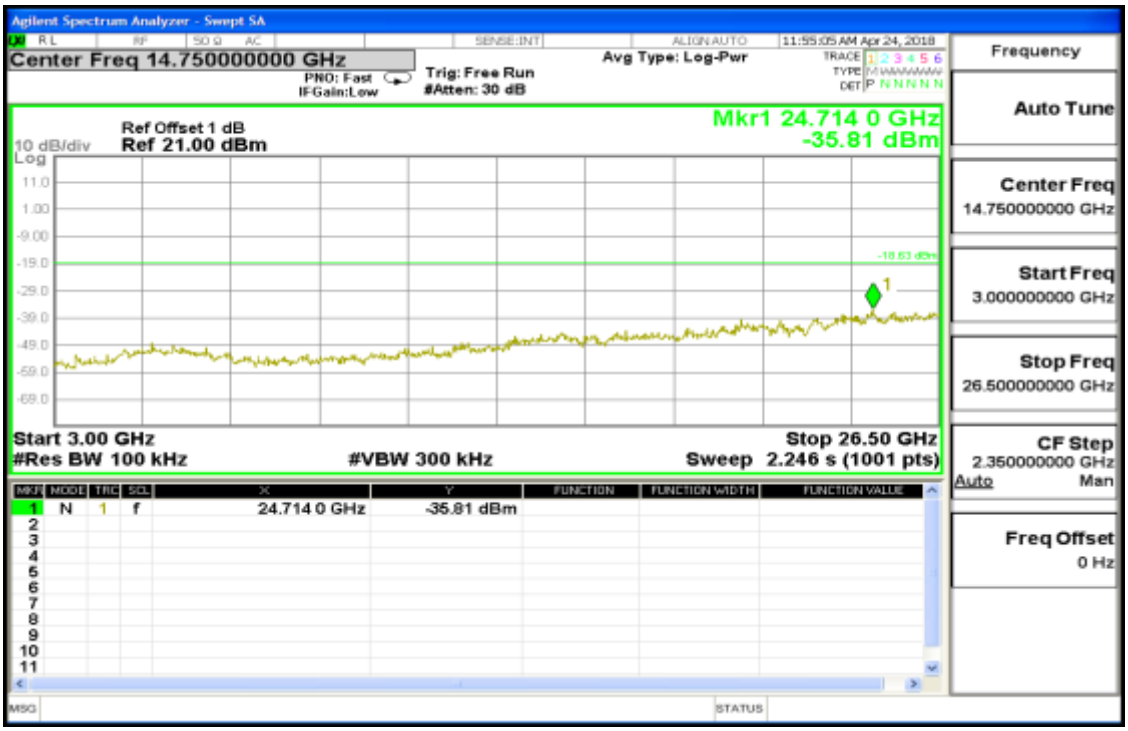
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digi-tally modulated intentional radiator is operating, the radio frequency power that is produced by the in-tentional 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 con-ducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, must also comply with the §15.209 & RSS-Gen §8.10 Table 6 limit.

And according to §15.33(a) (1) & RSS-Gen §8.9 Table 4 & 5, for an intentional radiator oper-ates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fun-damental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

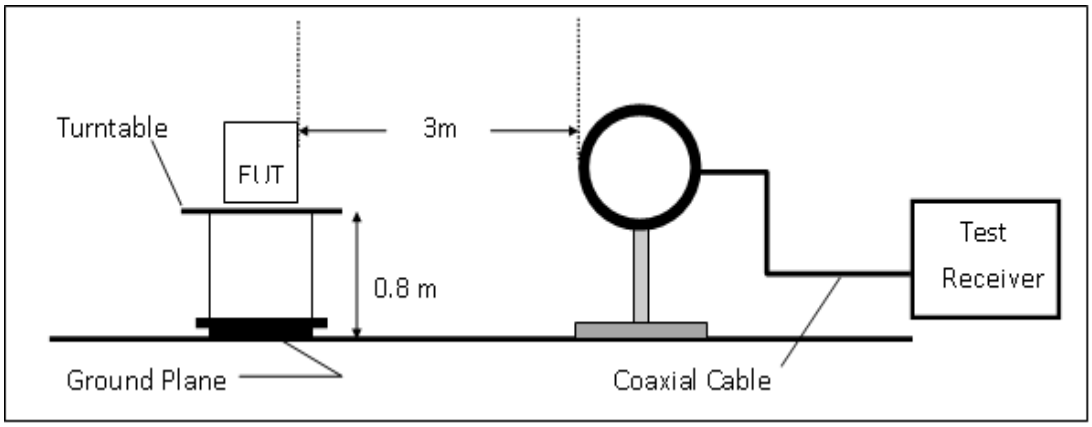
10.2 Measurement Equipment Used

SGS 966 Chamber No.C					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Bi-log Antenna	SCHWAZBECK	VULB9168	378	2017/12/29	2018/12/28
Horn Antenna	Schwarzbeck	BBHA9120D	1441	2017/08/04	2018/08/03
Horn Antenna	Schwarzbeck	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
Spectrum Analyzer	Agilent	E4446A	MY51100003	2017/05/10	2018/05/09
EMI Test Receiver	R&S	ESCI7	100760	2017/06/06	2018/06/05
Pre-Amplifier	HP	8449B	3008A00578	2018/01/02	2019/01/01
Pre-Amplifier	HP	8447D	2944A07676	2018/01/02	2019/01/01
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	2018/01/02	2019/01/01
Attenuator	Mini-Circuit	BW-S10W2+	N/A	2018/01/02	2019/01/01
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	2018/01/02	2019/01/01
Low Loss Cable	Huber Suhner	966_RX	9	2018/01/02	2019/01/01
Notebook	DELL	D505	34056609472	N/A	N/A

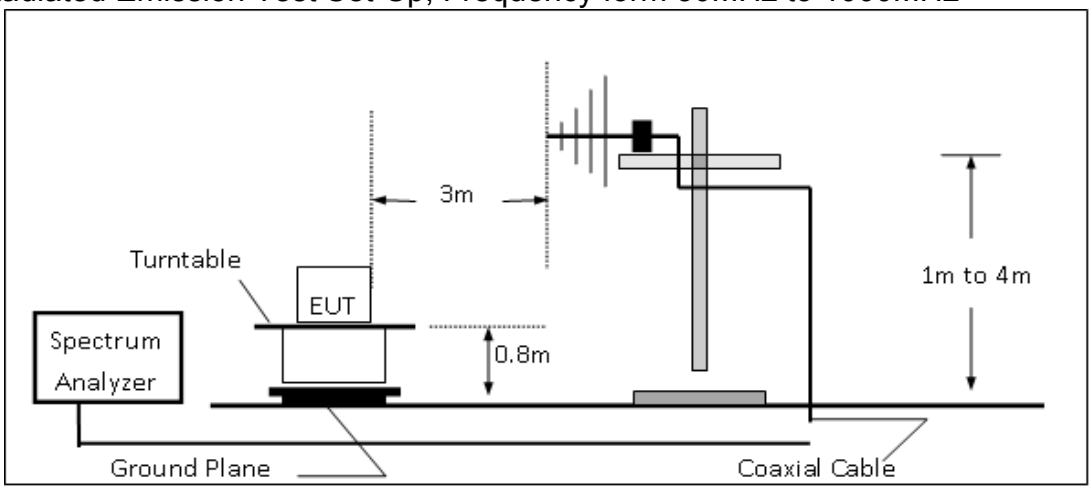
Note: N.C.R refers to Not Calibrated Required.

10.3 Test SET-UP

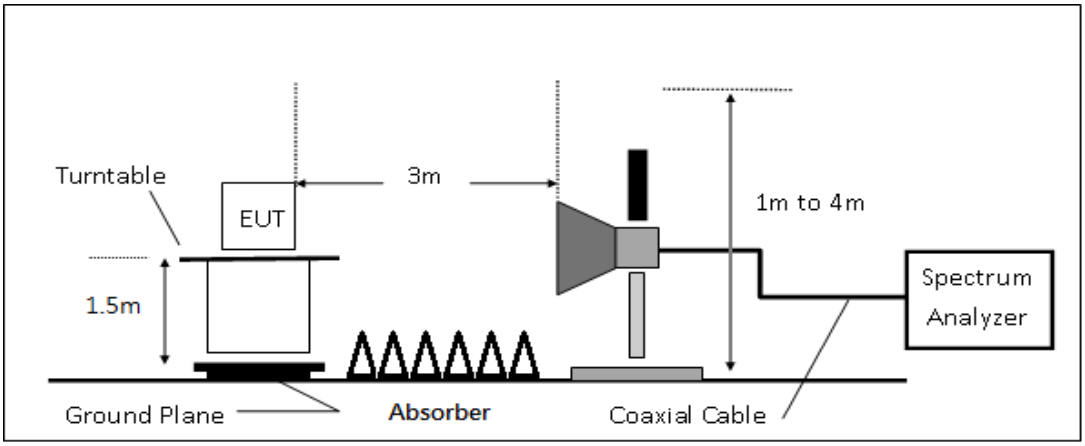
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



10.4 Measurement Procedure

Radiated Emission

1. The testing follows ANSI C63.10:2013. Measurement Guidelines.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 0.8m for frequency> 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Use the follow spectrum analyzer setting:
   (1) Span = wide enough to fully capture the emission being measured
   (2) RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
   (3) use duty cycle correction factor method per 15.35(c)
   Duty Cycle = On time/100 milliseconds
   On time = N1*L1=N2*L2+…+N(n-1)*LN(n-1)+N(n)*L(n)
   Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (duty Cycle)
6. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
7. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
8. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
9. Repeat above procedures until all frequency of the interest measured were complete.

10.5 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	

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note :

"**F**" : denotes Fundamental Frequency. ; "**H**" : denotes Harmonic Frequency.

"**E**" : denotes Band Edge Frequency. ; "**S**" : denotes Spurious Frequency.

10.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

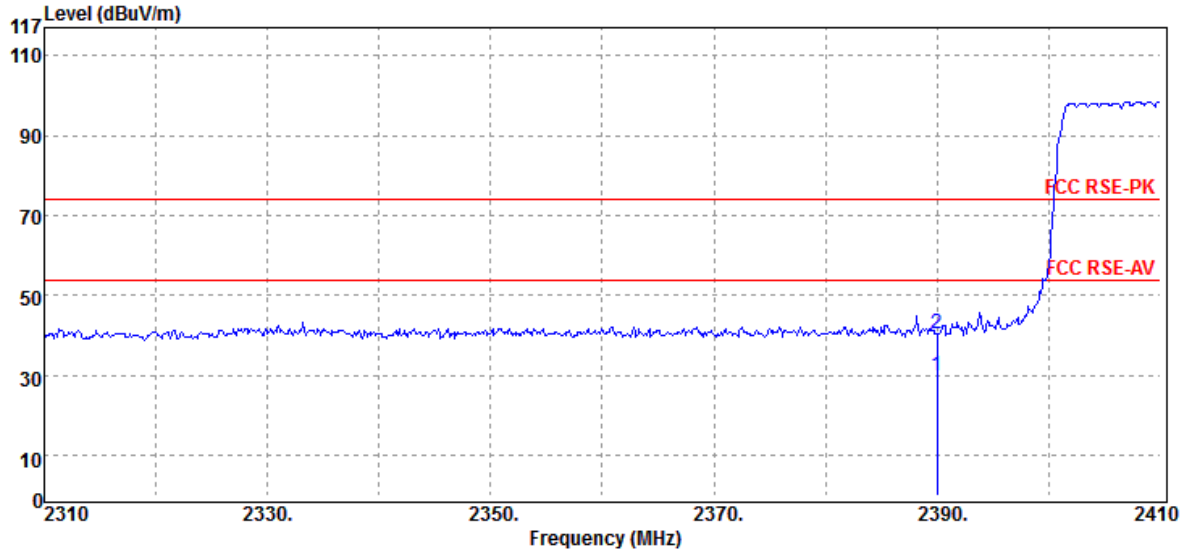
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

10.7 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

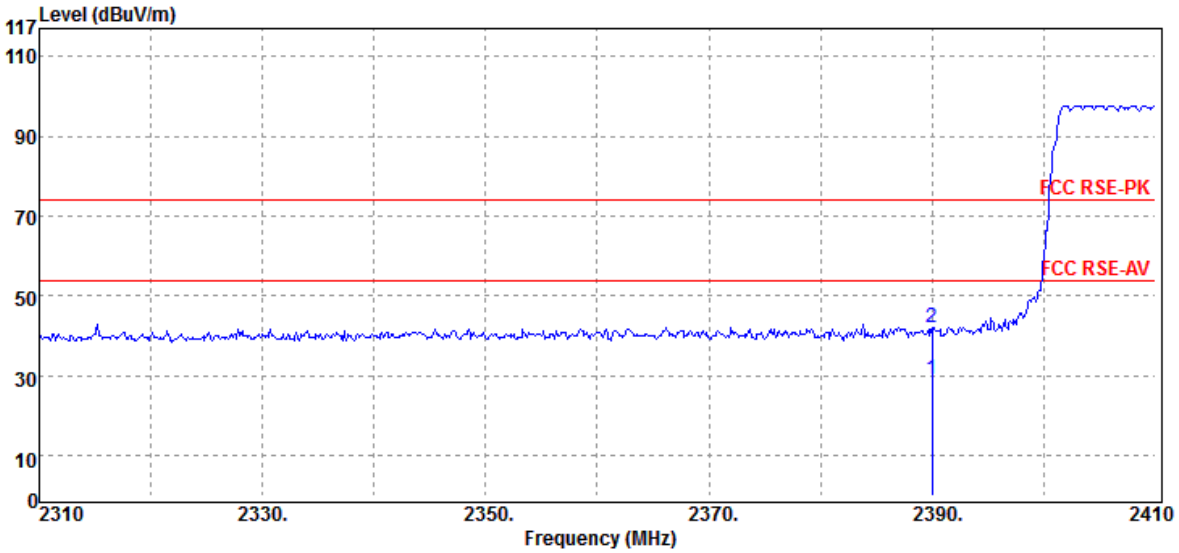
Radiated Band Edge Measurement Result: (Hopping Mode)

Operation Band	:BR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



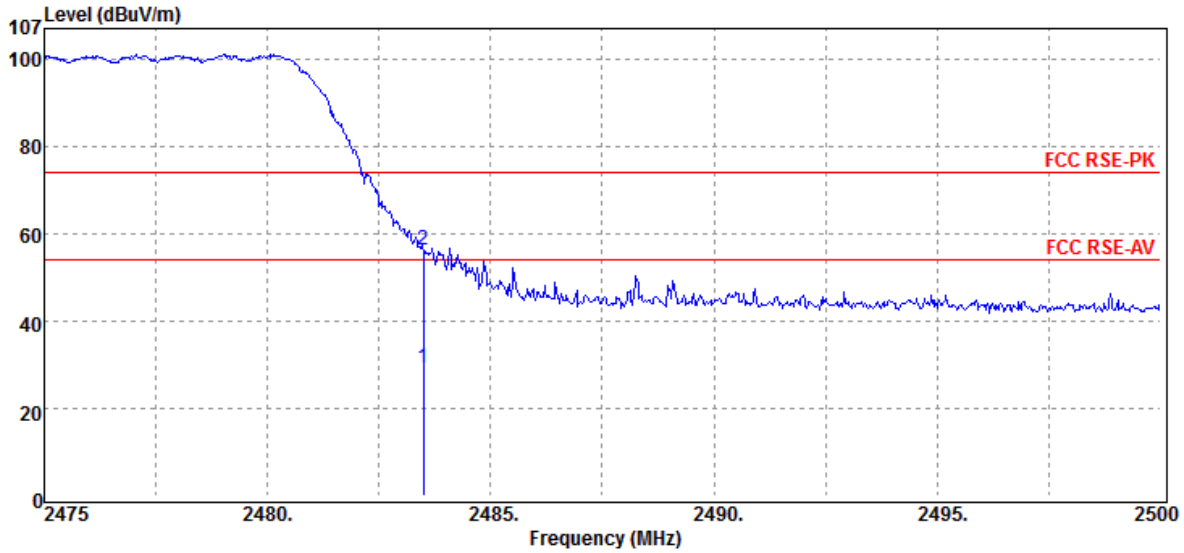
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	29.60	0.20	29.80	54.00	-24.20
2390.00	E	Peak	40.45	0.20	40.65	74.00	-33.35

Operation Band	:BR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



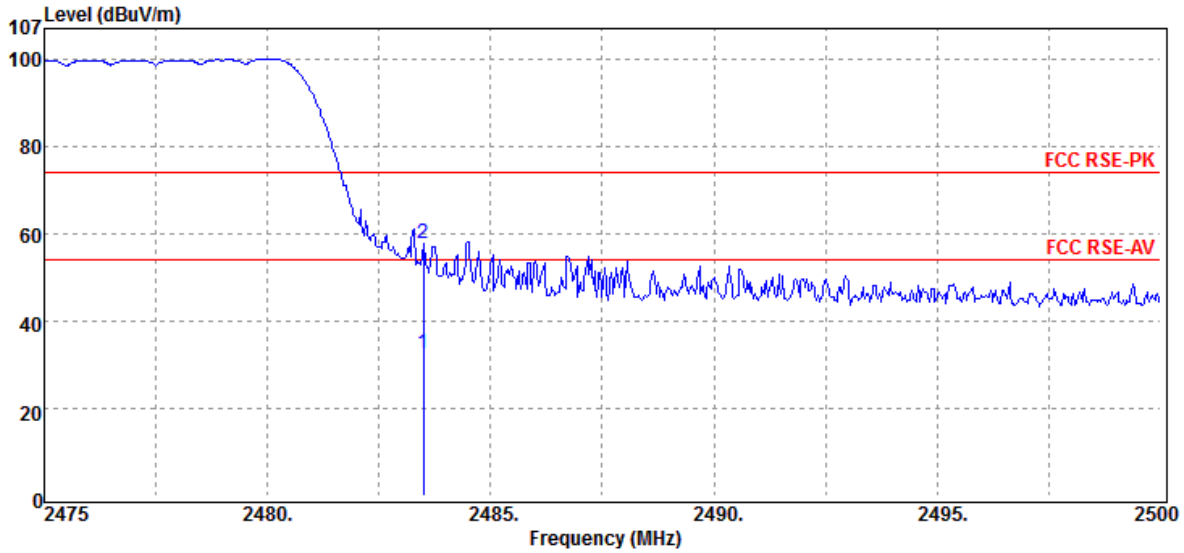
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	28.99	0.20	29.19	54.00	-24.81
2390.00	E	Peak	42.05	0.20	42.25	74.00	-31.75

Operation Band	:BR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



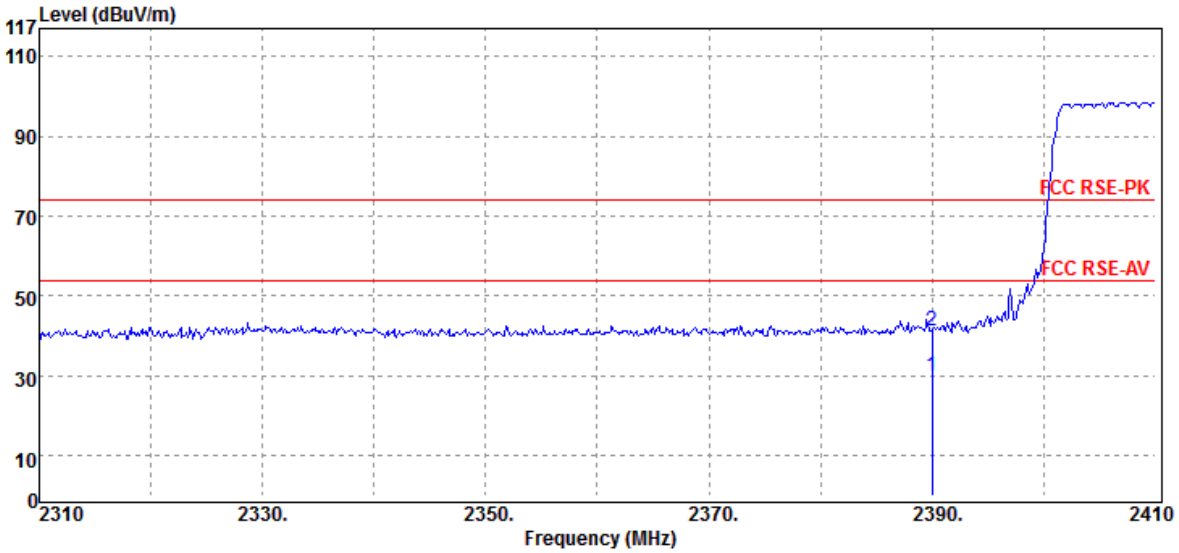
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	28.88	0.53	29.41	54.00	-24.59
2483.50	E	Peak	55.75	0.53	56.28	74.00	-17.72

Operation Band	:BR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



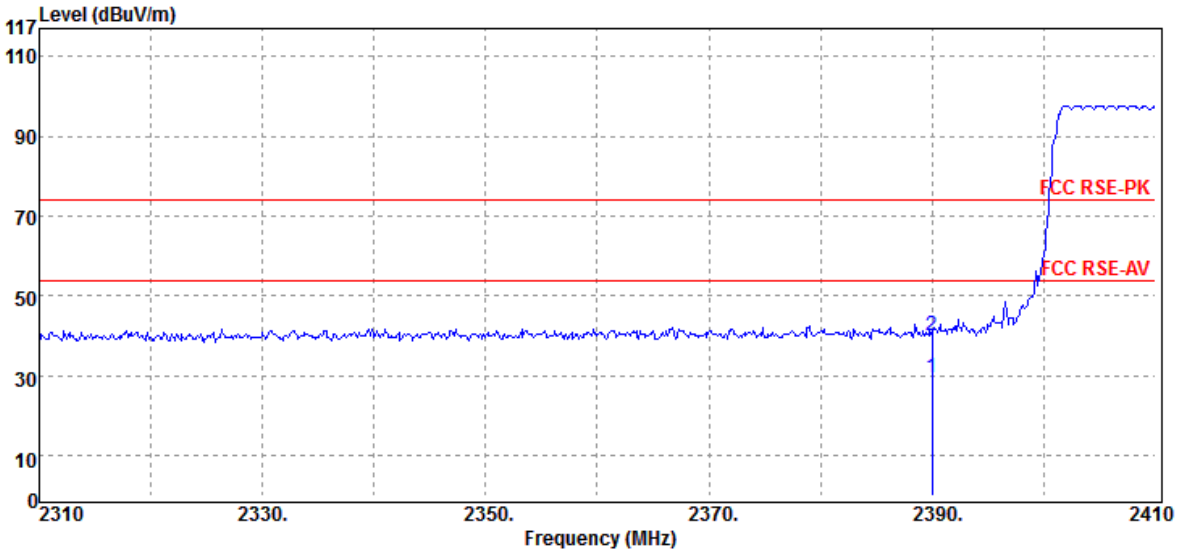
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	32.10	0.53	32.63	54.00	-21.37
2483.50	E	Peak	57.17	0.53	57.70	74.00	-16.30

Operation Band	:EDR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



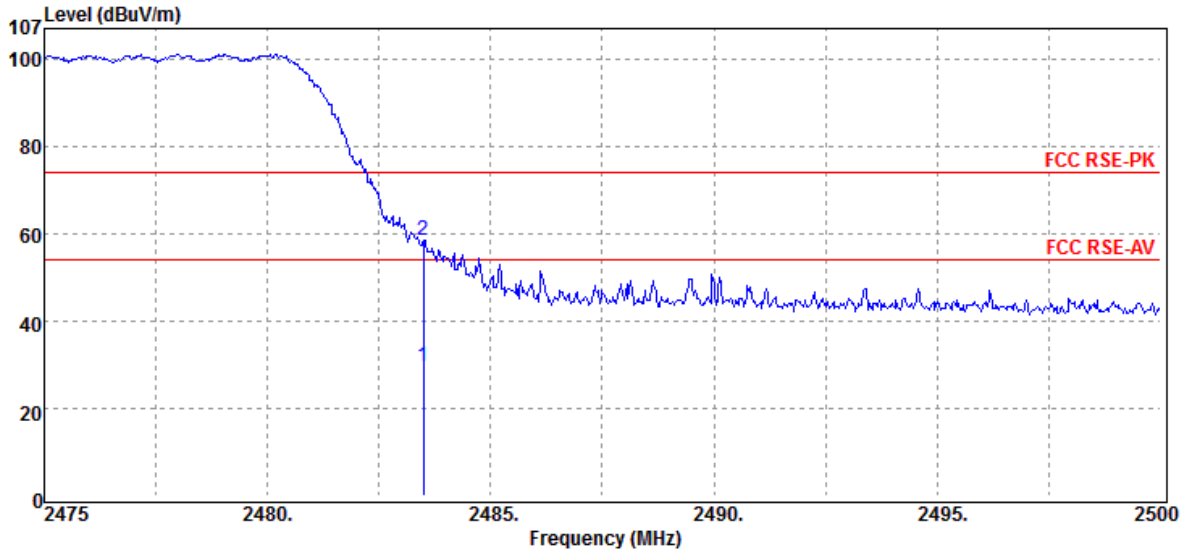
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	29.69	0.20	29.89	54.00	-24.11
2390.00	E	Peak	41.10	0.20	41.30	74.00	-32.70

Operation Band	:EDR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



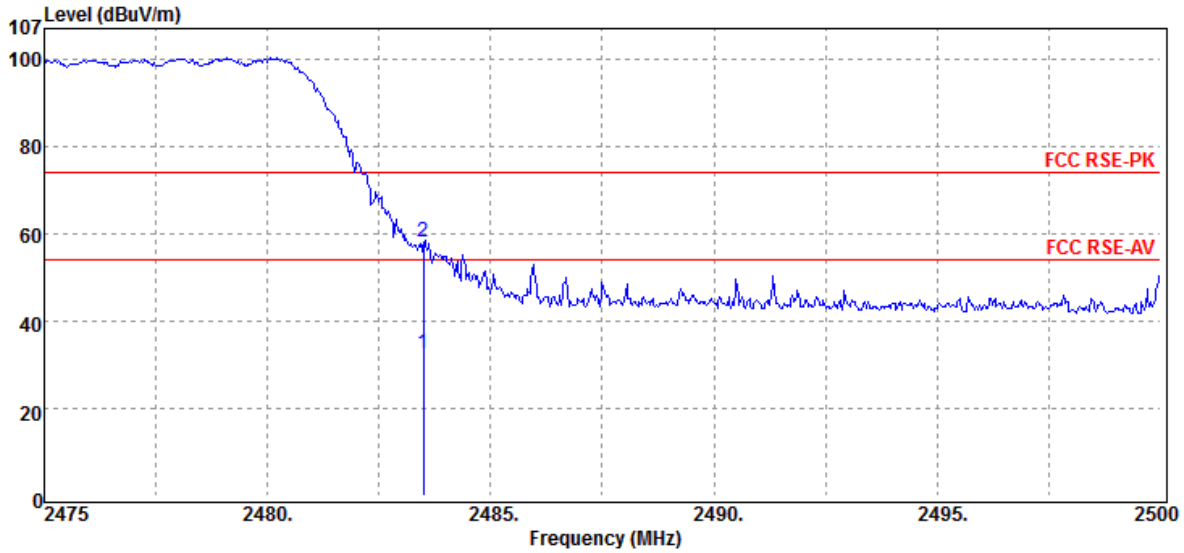
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	29.43	0.20	29.63	54.00	-24.37
2390.00	E	Peak	39.88	0.20	40.08	74.00	-33.92

Operation Band	:EDR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	29.07	0.53	29.60	54.00	-24.40
2483.50	E	Peak	58.11	0.53	58.64	74.00	-15.36

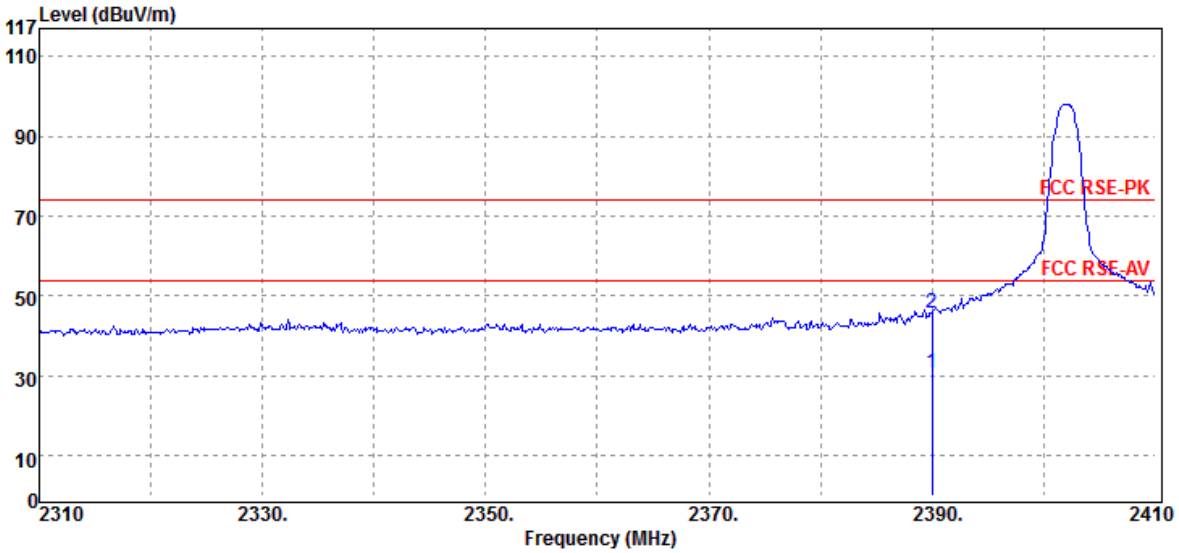
Operation Band	:EDR Hopping	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	32.00	0.53	32.53	54.00	-21.47
2483.50	E	Peak	57.57	0.53	58.10	74.00	-15.90

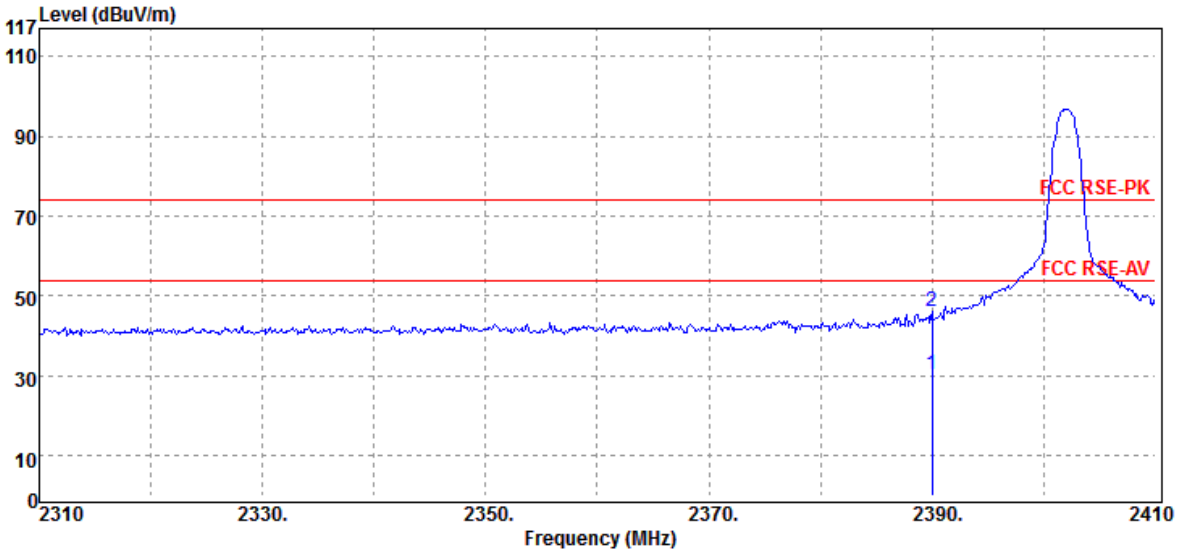
Radiated Band Edge Measurement Result: (Non-Hopping Mode)

Operation Band	:BR(1M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



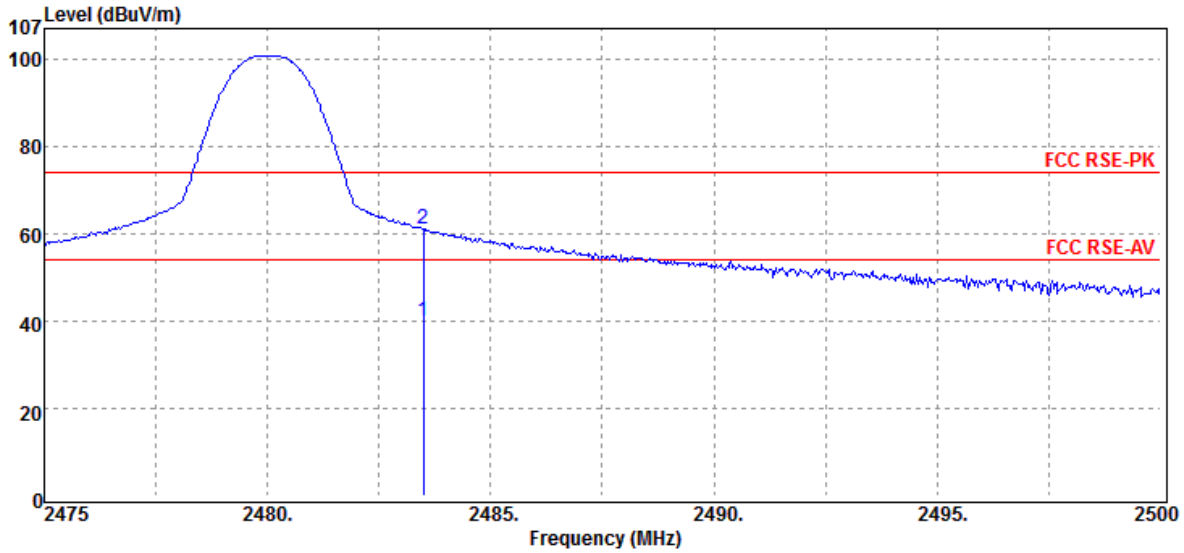
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	30.67	0.20	30.87	54.00	-23.13
2390.00	E	Peak	45.69	0.20	45.89	74.00	-28.11

Operation Band	:BR(1M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



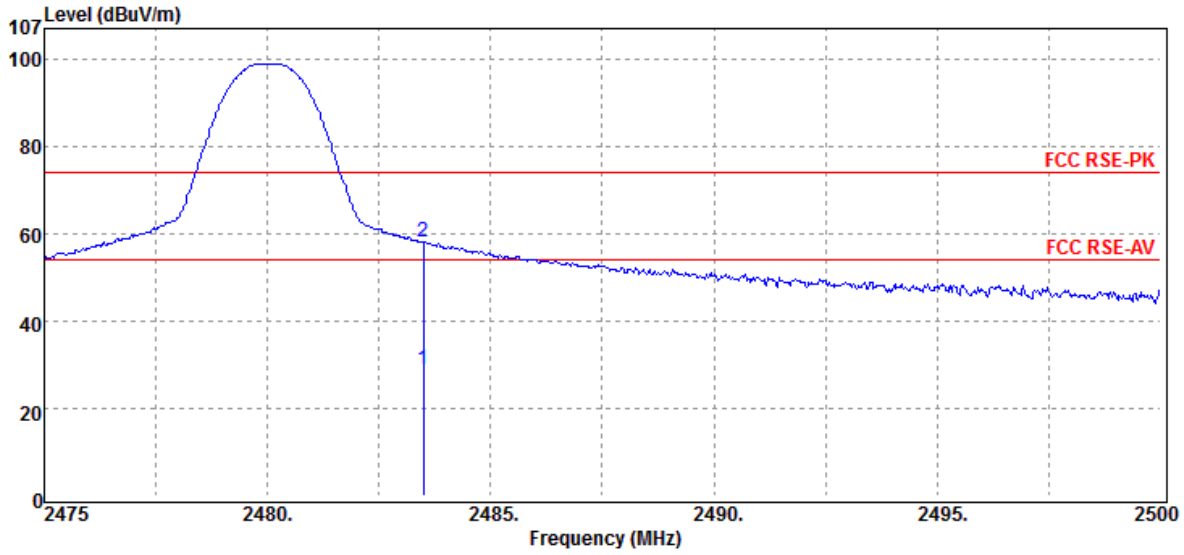
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	30.03	0.20	30.23	54.00	-23.77
2390.00	E	Peak	45.79	0.20	45.99	74.00	-28.01

Operation Band	:BR(1M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



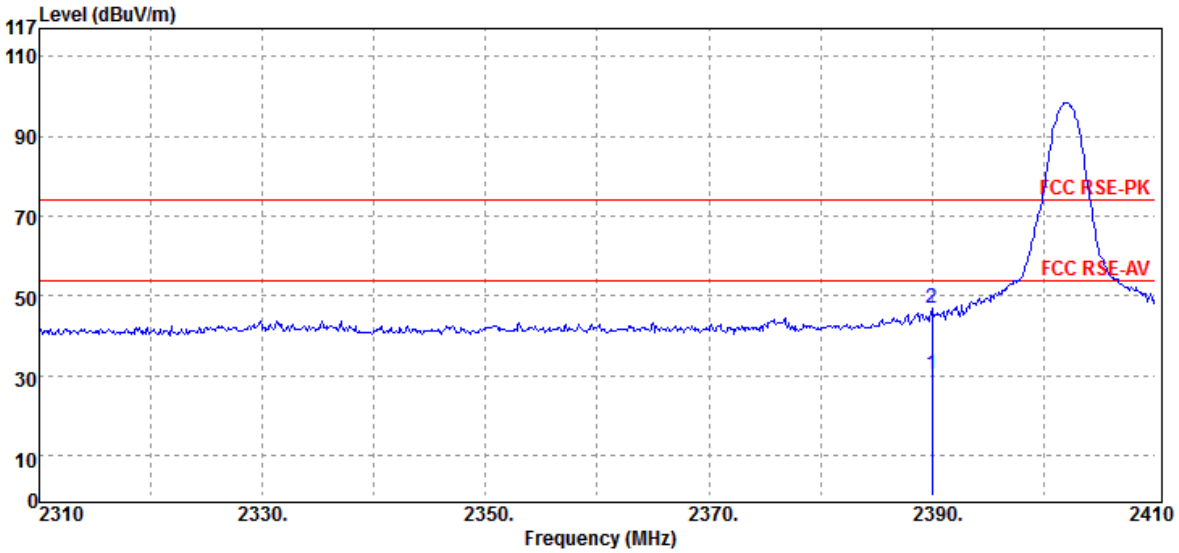
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	39.60	0.53	40.13	54.00	-13.87
2483.50	E	Peak	60.66	0.53	61.19	74.00	-12.81

Operation Band	:BR(1M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



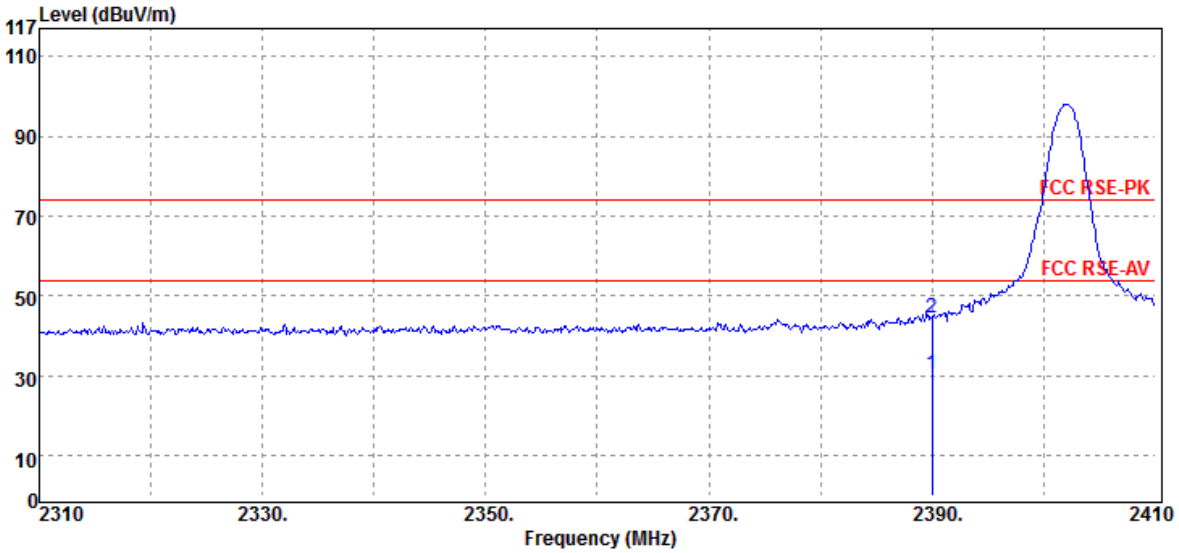
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	28.46	0.53	28.99	54.00	-25.01
2483.50	E	Peak	57.55	0.53	58.08	74.00	-15.92

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



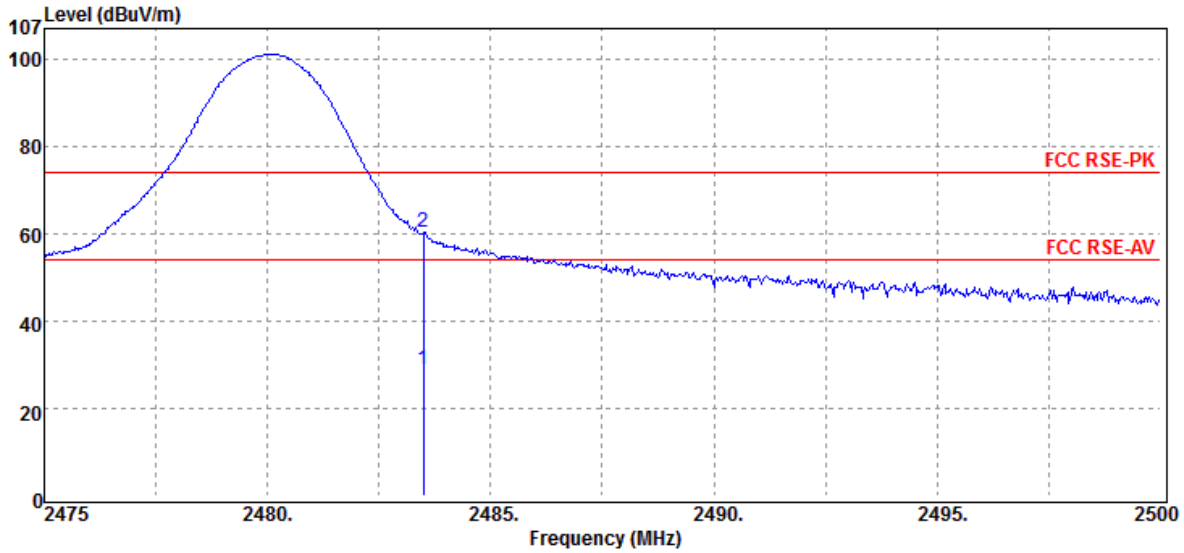
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	30.12	0.20	30.32	54.00	-23.68
2390.00	E	Peak	46.79	0.20	46.99	74.00	-27.01

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



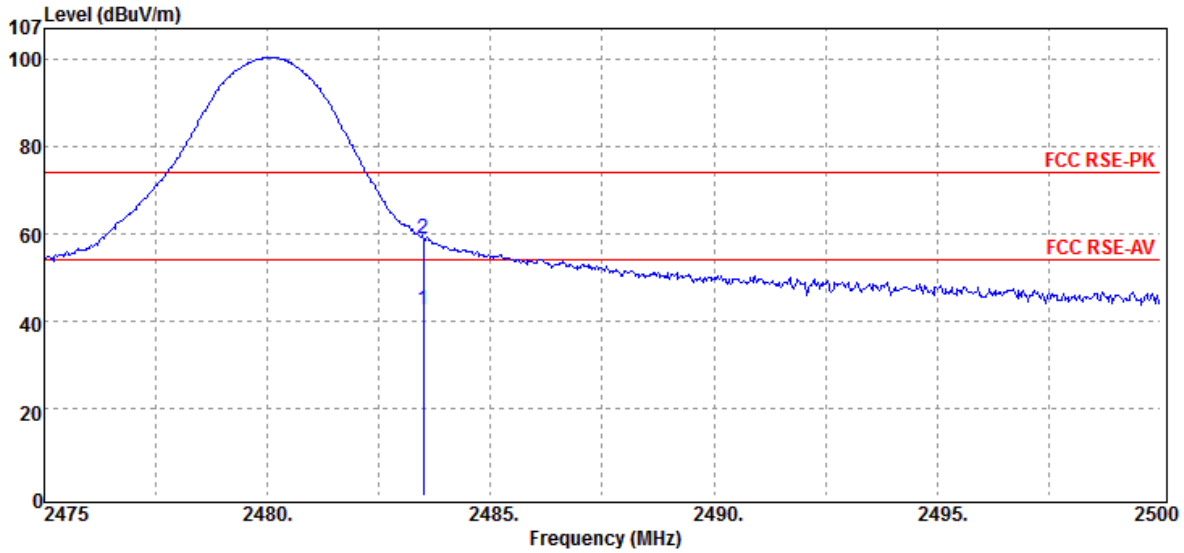
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	E	Average	30.04	0.20	30.24	54.00	-23.76
2390.00	E	Peak	44.28	0.20	44.48	74.00	-29.52

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	28.50	0.53	29.03	54.00	-24.97
2483.50	E	Peak	59.84	0.53	60.37	74.00	-13.63

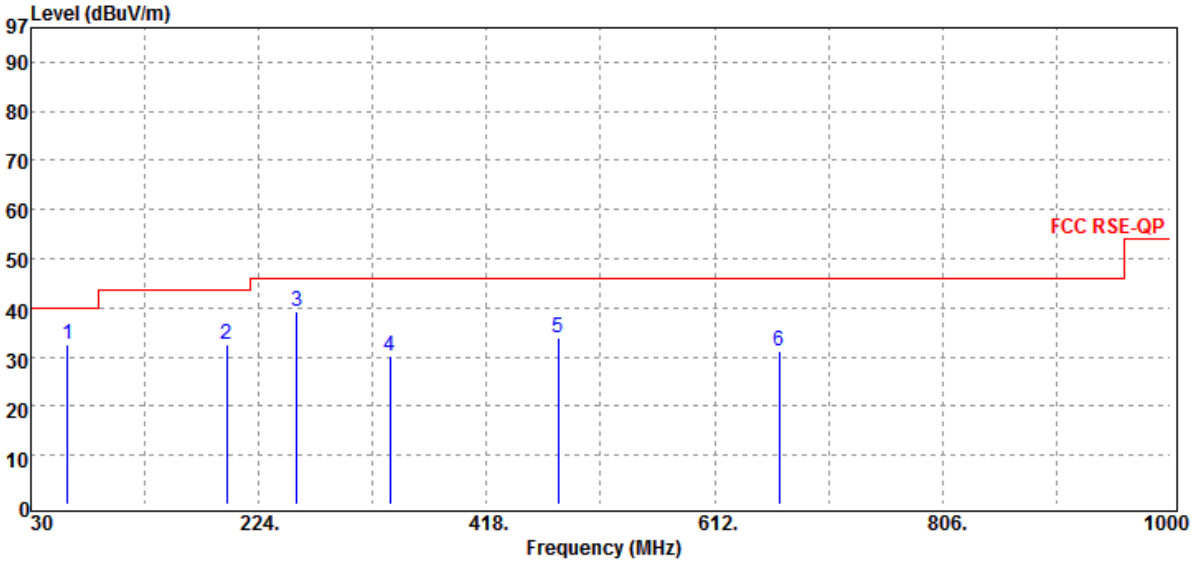
Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Bandedge CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.50	E	Average	42.04	0.53	42.57	54.00	-11.43
2483.50	E	Peak	58.19	0.53	58.72	74.00	-15.28

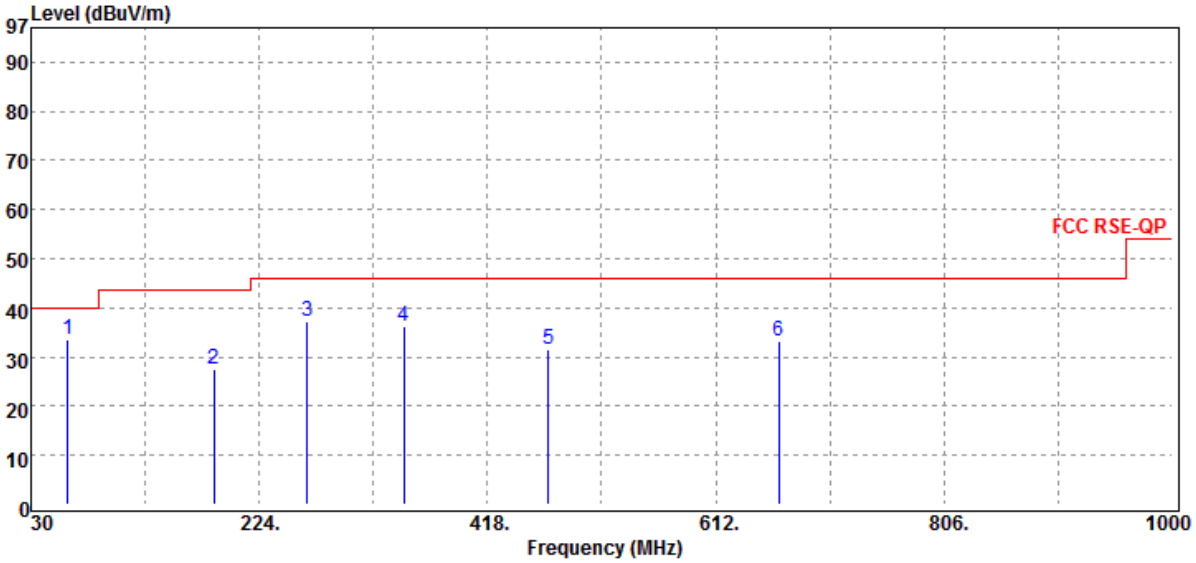
Radiated Spurious Emission Measurement Result: (Worst Case)

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
61.04	S	Peak	40.64	-8.05	32.59	40.00	-7.41
196.84	S	Peak	41.63	-9.19	32.44	43.50	-11.06
256.01	S	Peak	46.39	-7.13	39.26	46.00	-6.74
335.55	S	Peak	35.13	-4.89	30.24	46.00	-15.76
479.11	S	Peak	35.98	-2.10	33.88	46.00	-12.12
667.29	S	Peak	30.66	0.49	31.15	46.00	-14.85

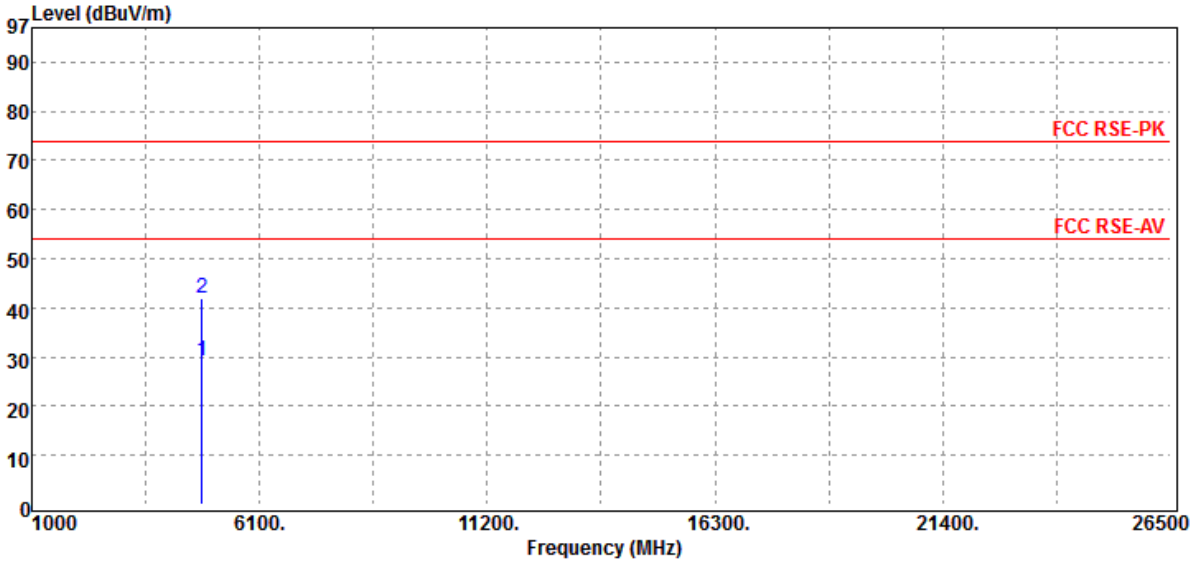
Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
61.04	S	Peak	41.62	-8.05	33.57	40.00	-6.43
185.20	S	Peak	36.21	-8.64	27.57	43.50	-15.93
264.74	S	Peak	44.07	-6.83	37.24	46.00	-8.76
347.19	S	Peak	40.81	-4.61	36.20	46.00	-9.80
469.41	S	Peak	33.84	-2.14	31.70	46.00	-14.30
665.35	S	Peak	32.95	0.34	33.29	46.00	-12.71

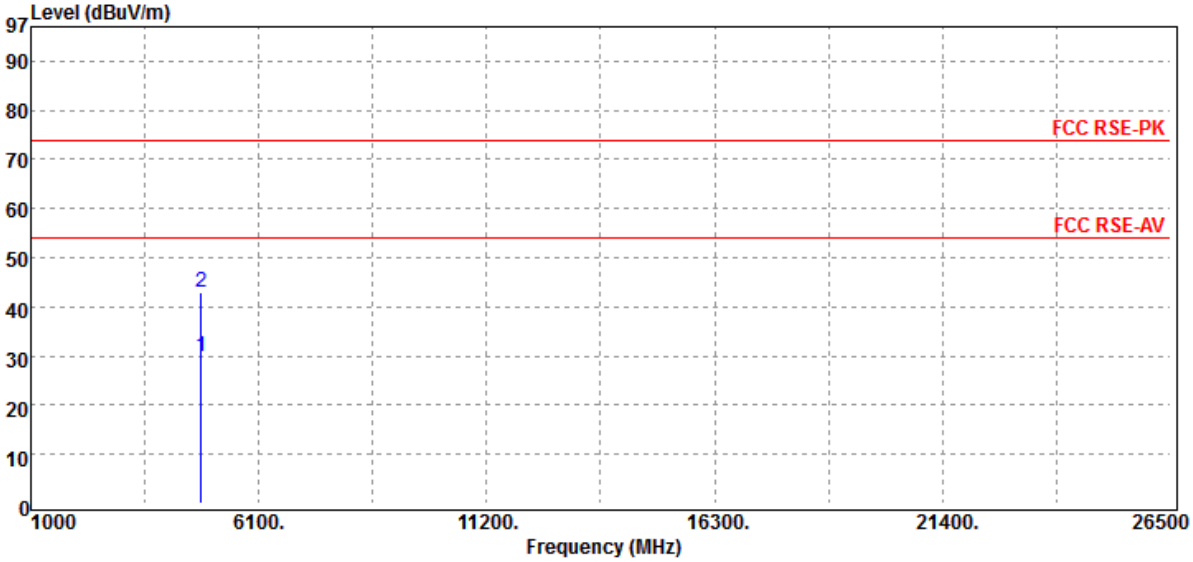
Radiated Spurious Emission Measurement Result: (Worst Case)
For Frequency above 1 GHz

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



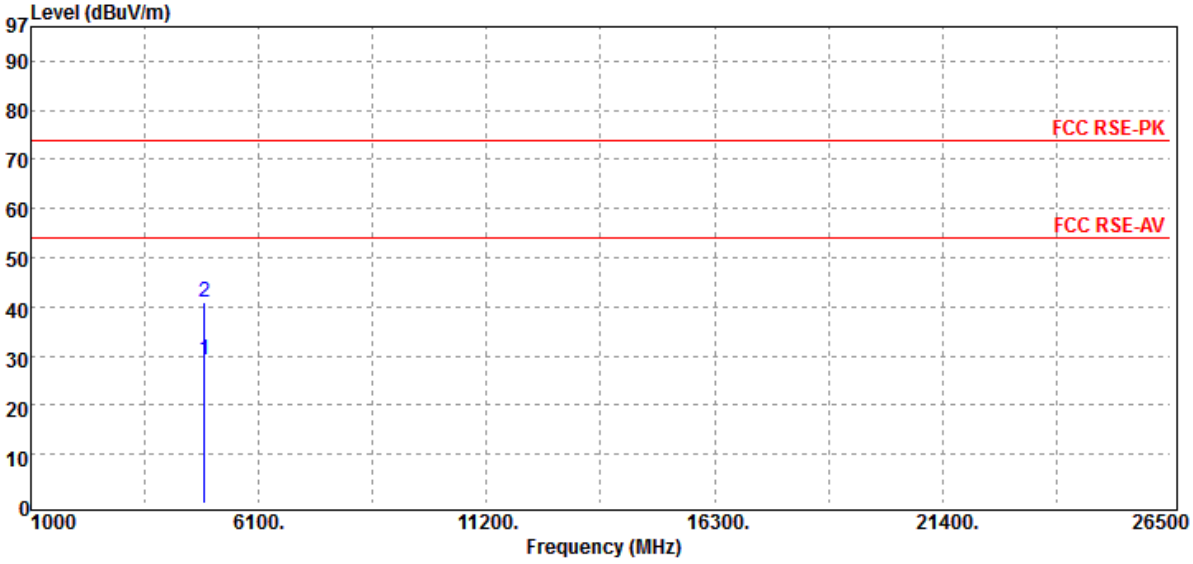
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	H	Average	21.78	7.38	29.16	54.00	-24.84
4804.00	H	Peak	34.46	7.38	41.84	74.00	-32.16

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



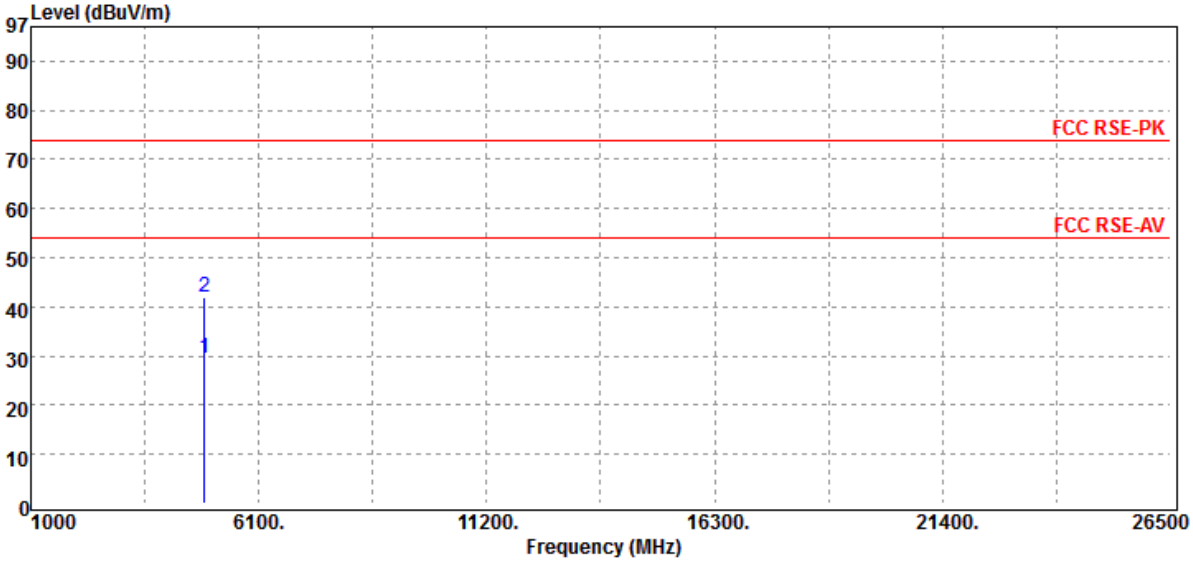
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	H	Average	22.40	7.38	29.78	54.00	-24.22
4804.00	H	Peak	35.49	7.38	42.87	74.00	-31.13

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



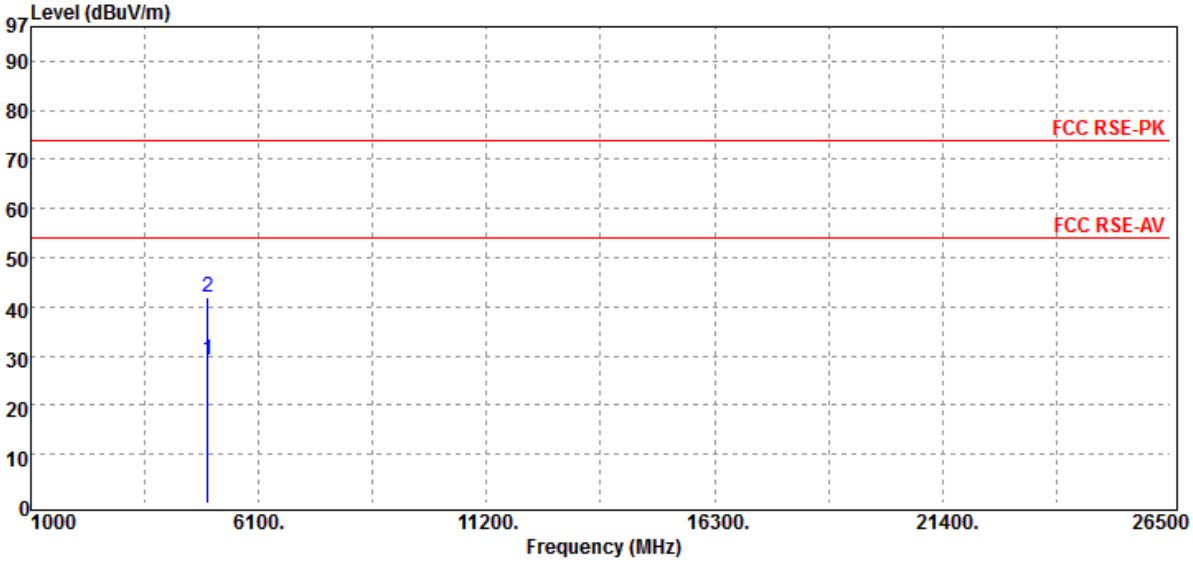
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4882.00	H	Average	21.63	7.67	29.30	54.00	-24.70
4882.00	H	Peak	33.17	7.67	40.84	74.00	-33.16

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2441 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



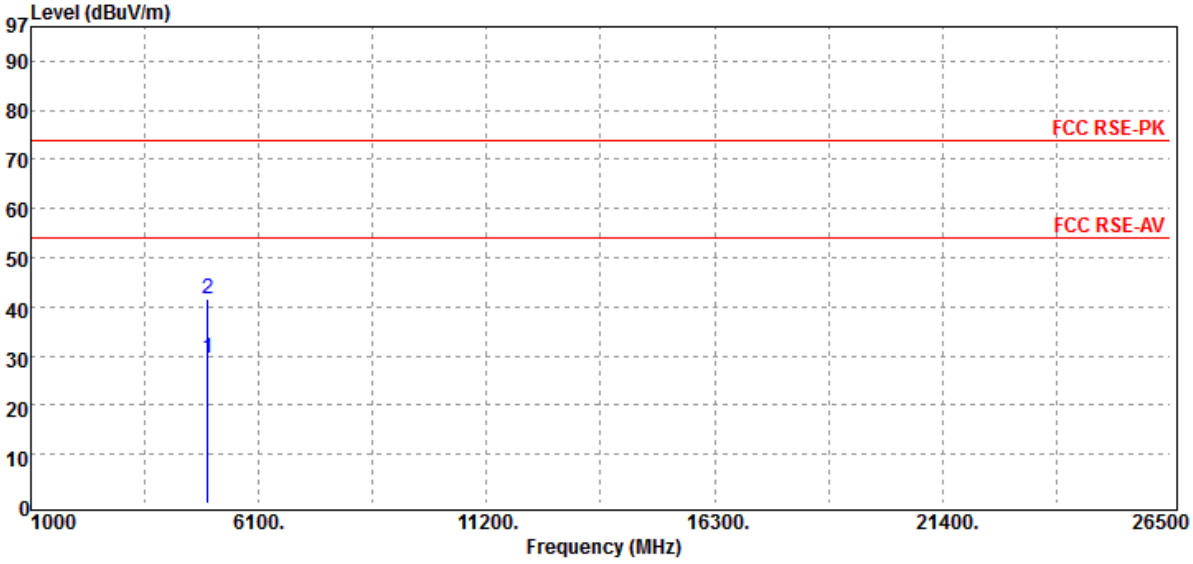
Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4882.00	H	Average	21.92	7.67	29.59	54.00	-24.41
4882.00	H	Peak	34.45	7.67	42.12	74.00	-31.88

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	H	Average	21.38	7.80	29.18	54.00	-24.82
4960.00	H	Peak	34.30	7.80	42.10	74.00	-31.90

Operation Band	:EDR(3M)	Test Date	:2018-04-23
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	H	Average	21.60	7.80	29.40	54.00	-24.60
4960.00	H	Peak	33.79	7.80	41.59	74.00	-32.41

11 FREQUENCY SEPARATION

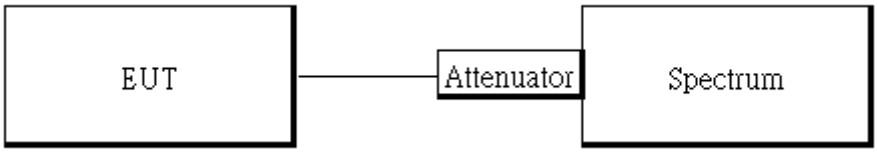
11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08
Notebook	DELL	D505	34056609472	N/A	N/A

11.3 Test Set-up



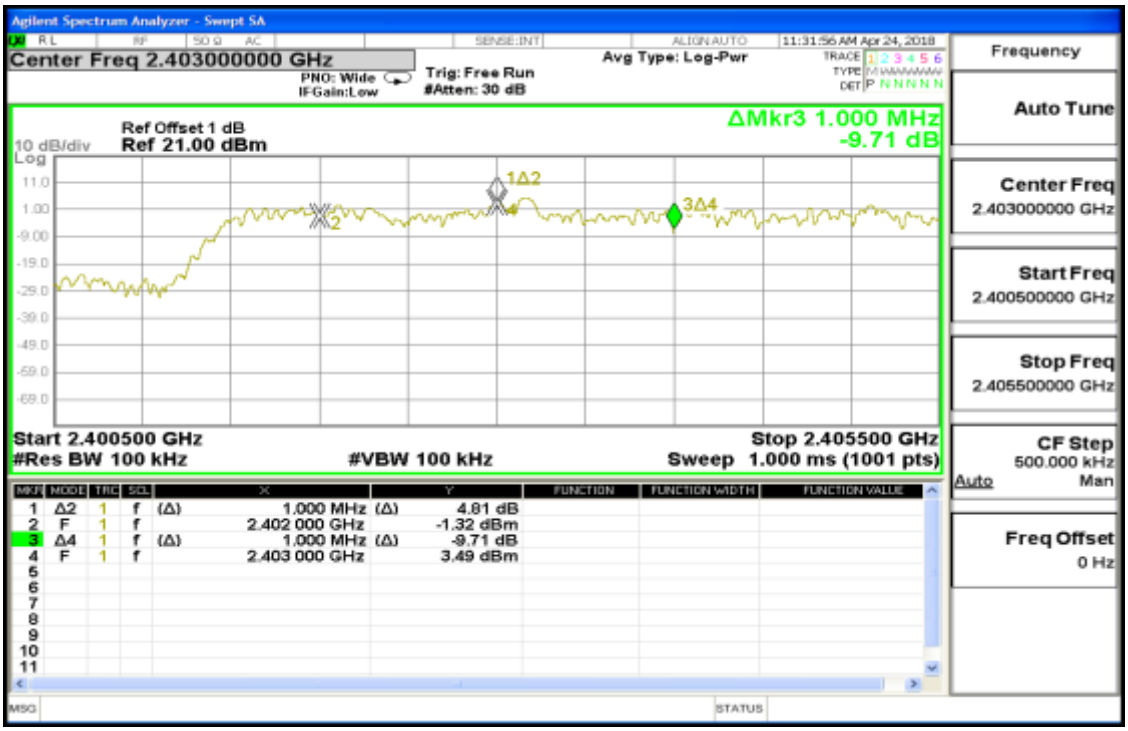
11.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows C63.10:2013 section 7.8.2.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = middle of hopping channel.
5. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

11.5 Measurement Result

Channel separation (MHz)	Limit	Result
1	>=25 kHz or 2/3 times 20dB bandwidth	PASS

Frequency Separation Test Data



12 NUMBER OF HOPPING FREQUENCY

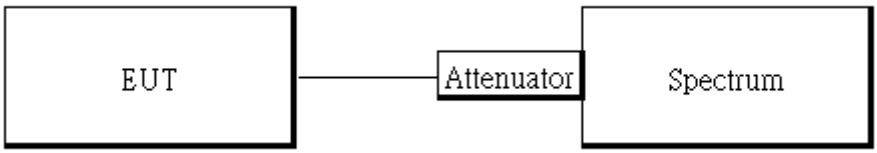
12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08
Notebook	DELL	D505	34056609472	N/A	N/A

12.3 Test Set-up



12.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW=430 kHz, VBW=1.5MHz., Detector = Peak
6. Max hold, view and count how many channel in the band.

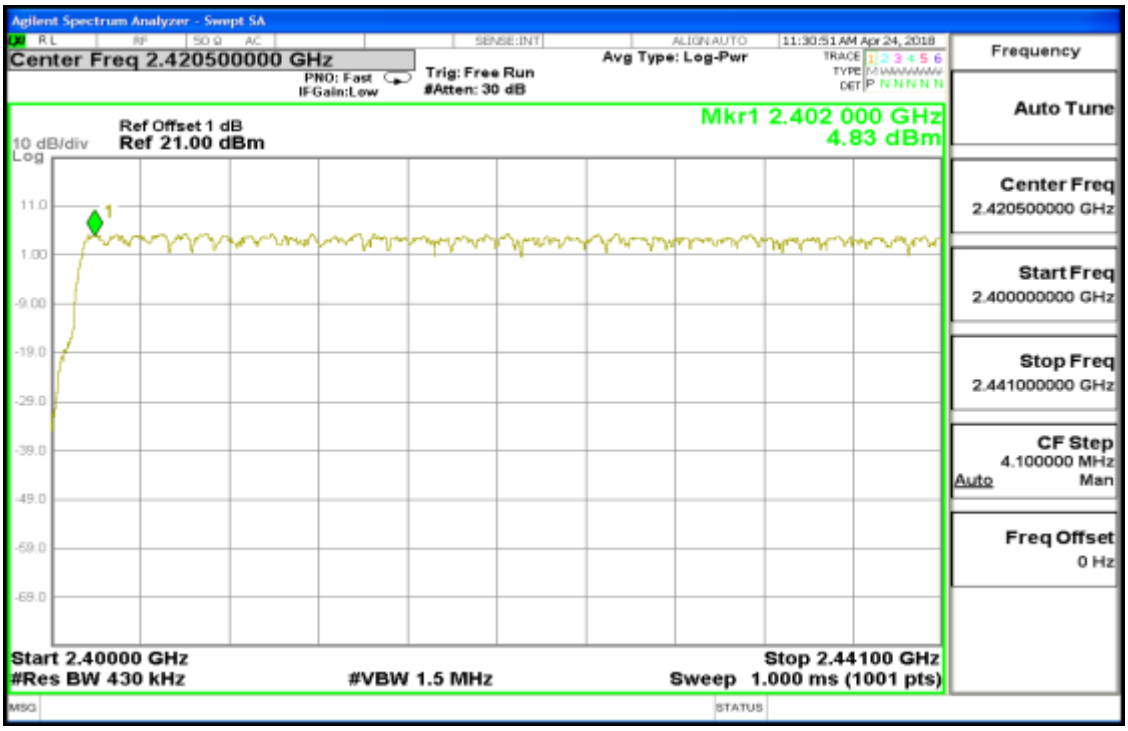
12.5 Measurement Result

Tabular Data of Total Channel Number

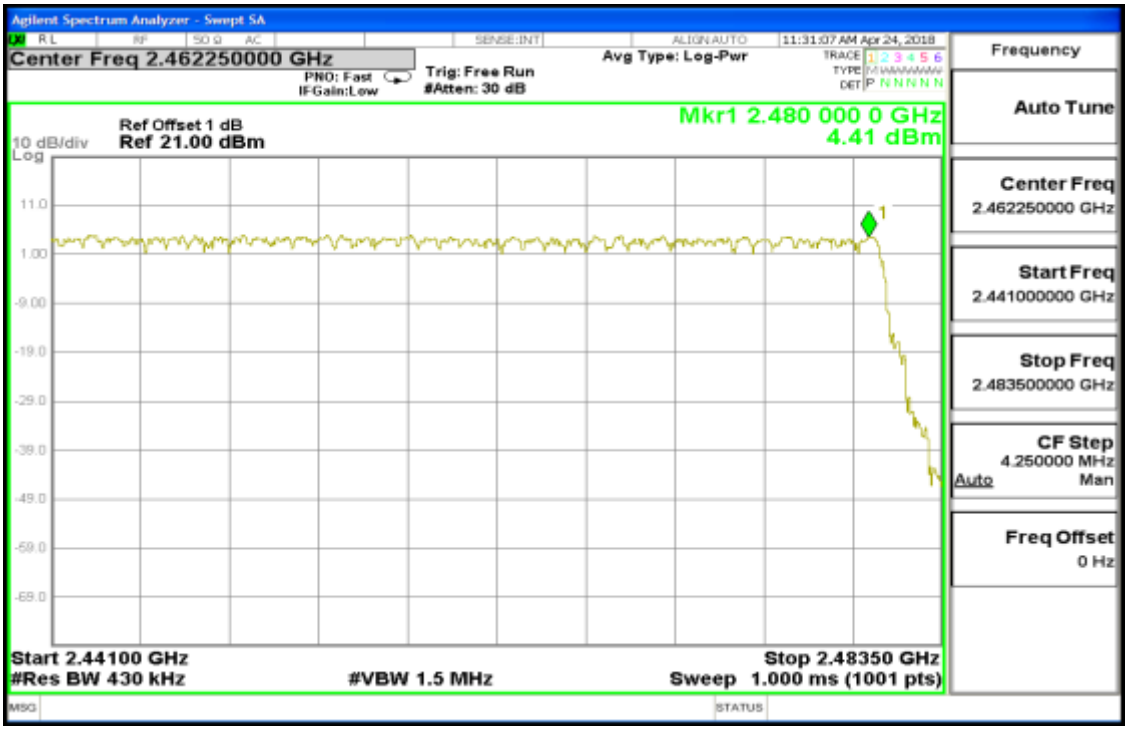
	Channel Number	**Limit**
2.4 GHz – 2.441GHz	**40**	**>15**
2.441 GHz – 2.4835GHz	**39**	
2.4GHz ~2.4835GHz	**(40+39) = 79**	

Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



13 TIME OF OCCUPANCY (DWELL TIME)

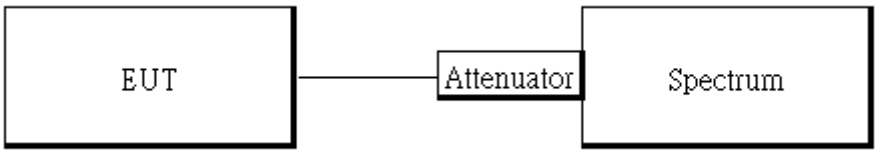
13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

13.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	2018/04/09	2019/04/08
Notebook	DELL	D505	34056609472	N/A	N/A

13.3 Test Set-up



13.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013. Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep = 2~8ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 * 20) (S), Hop Over Occupancy Time comes to (800 / 6 / 20)*(0.4 *20) =53.33

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

13.5 Tabular Result of the Measurement

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
0	DH1	157.70	400ms
	DH3	280.16	400ms
	DH5	320.85	400ms
39	DH1	159.10	400ms
	DH3	281.60	400ms
	DH5	319.36	400ms
78	DH1	161.92	400ms
	DH3	280.16	400ms
	DH5	320.85	400ms

π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
39	2DH1	164.74	400ms
	2DH3	282.24	400ms
	2DH5	320.85	400ms

8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
39	3DH1	163.33	400ms
	3DH3	281.60	400ms
	3DH5	320.85	400ms

A period time = 0.4 (s) * 79 = 31.6 (s)

GFSK (1Mbps):

CH Low	DH1 time slot =	0.493	*	(1600/2/79) *	31.6	=	157.70	(ms)
	DH3 time slot =	1.751	*	(1600/4/79) *	31.6	=	280.16	(ms)
	DH5 time slot =	3.008	*	(1600/6/79) *	31.6	=	320.85	(ms)
CH Mid	DH1 time slot =	0.497	*	(1600/2/79) *	31.6	=	159.10	(ms)
	DH3 time slot =	1.760	*	(1600/4/79) *	31.6	=	281.60	(ms)
	DH5 time slot =	2.994	*	(1600/6/79) *	31.6	=	319.36	(ms)
CH High	DH1 time slot =	0.506	*	(1600/2/79) *	31.6	=	161.92	(ms)
	DH3 time slot =	1.751	*	(1600/4/79) *	31.6	=	280.16	(ms)
	DH5 time slot =	3.008	*	(1600/6/79) *	31.6	=	320.85	(ms)

π/4 -DQPSK (2Mbps):

CH Mid	2DH1 time slo =	0.515	*	(1600/2/79) *	31.6	=	164.74	(ms)
	2DH3 time slo =	1.764	*	(1600/4/79) *	31.6	=	282.24	(ms)
	2DH5 time slo =	3.008	*	(1600/6/79) *	31.6	=	320.85	(ms)

8-DPSK (3Mbps):

CH Mid	3DH1 time slo =	0.510	*	(1600/2/79) *	31.6	=	163.33	(ms)
	3DH3 time slo =	1.760	*	(1600/4/79) *	31.6	=	281.60	(ms)
	3DH5 time slo =	3.008	*	(1600/6/79) *	31.6	=	320.85	(ms)

GFSK (1Mbps) for AFH Mode			
Hopping Channel Number	**PACKET TYPE**	**Measurement Result (ms)**	**Limit (ms)**
20	DH5	160.43	400ms
π/4 DQPSK (2Mbps) for AFH Mode			
Hopping Channel Number	**PACKET TYPE**	**Measurement Result (ms)**	**Limit (ms)**
20	2DH5	160.43	400ms
8-DPSK (3Mbps) for AFH Mode			
Hopping Channel Number	**PACKET TYPE**	**Measurement Result (ms)**	**Limit (ms)**
20	3DH5	160.43	400ms

GFSK (1Mbps):

DH5 time s = 3.008 (ms) * (800/6/20) * 8 = 160.43 (ms)

π/4 -DQPSK (2Mbps

2DH5 time = 3.008 (ms) * (800/6/20) * 8 = 160.43 (ms)

8-DPSK (3Mbps):

3DH5 time = 3.008 (ms) * (800/6/20) * 8 = 160.43 (ms)

13.6 Measurement Result

Note: Refer to next page for plots.

CH-Low
DH1

DH3

DH5

CH-Mid

DH1

DH3

DH5

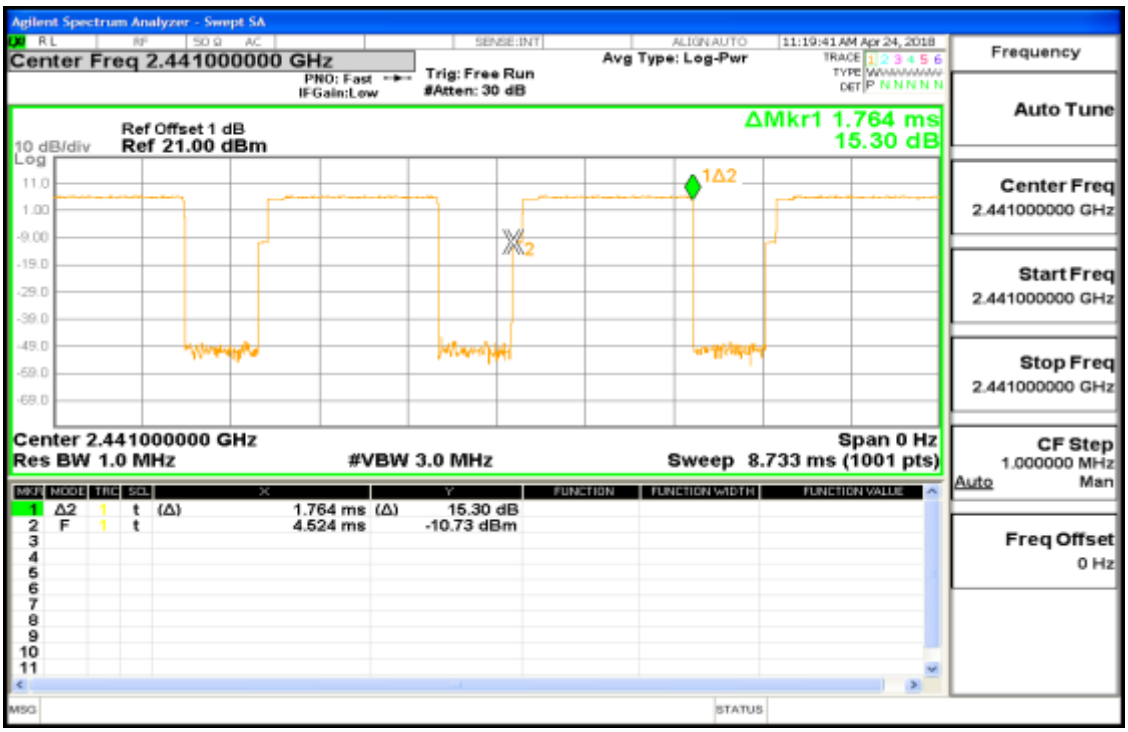
CH-High
DH1

DH3

DH5

CH-Mid
2DH1

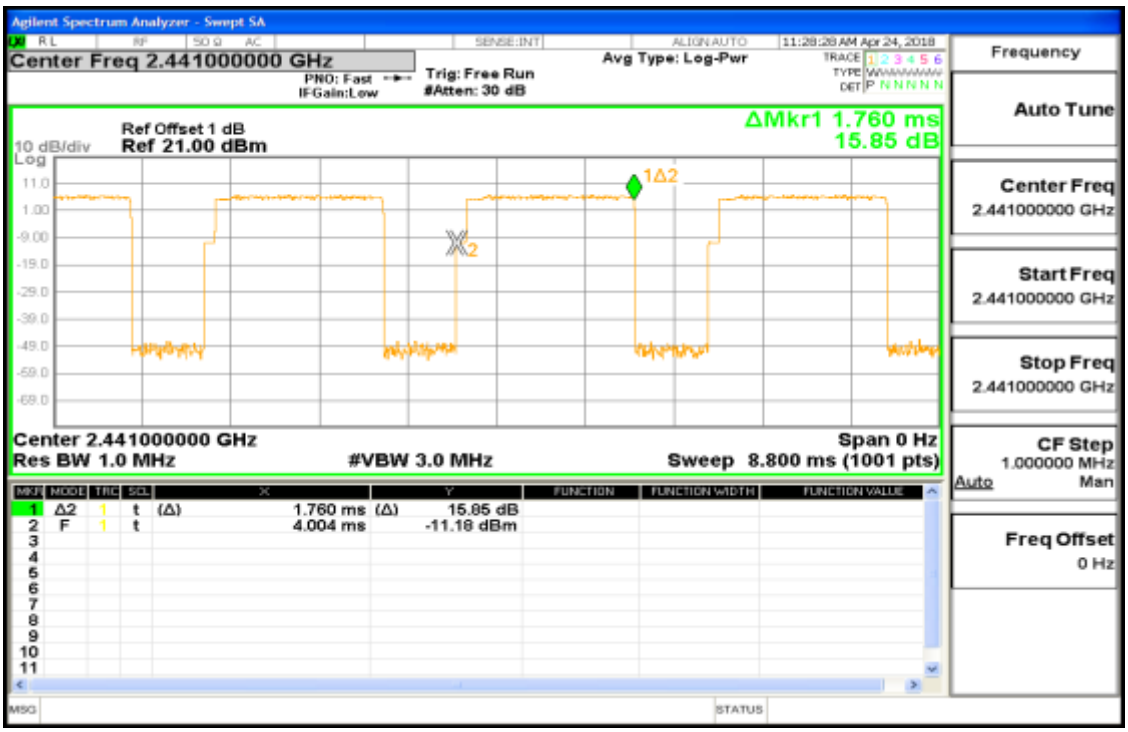
2DH3



2DH5

CH-Mid
3DH1

3DH3



3DH5

14 ANTENNA REQUIREMENT

14.1 Standard Applicable

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

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

According to RSS-GEN 8.3

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

14.2 Antenna Connected Construction

An embedded-in antenna design is used.

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

The antenna gain is less than 6dBi. Therefore, it is not necessary to reduce maximum output power limit.

~ End of Report ~