FCC RADIO TEST REPORT

FCC ID: 2AWVB-AQS1

Product: Wireless Earphone

Trade Name: N/A

Model Name: AQS1

Serial Model: AQS2, AQS3, AQS4, LA-S2, LA-HAC1

Report No.: PTC20070302736E-FC01

Prepared for

Shenzhen Lavanda Technology Co.,Ltd

Room 2101 West Tower Digital Cultural Industry Base, Nanshan Dist., Shenzhen, China

Prepared by

DongGuan Precise testing &Certification Corp. Ltd

Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China

TEST RESULT CERTIFICATION

Applicant's name..... : Shenzhen Lavanda Technology Co.,Ltd

Address..... : Room 2101 West Tower Digital Cultural Industry Base, Nanshan Dist., Shenzhen, China

Manufacture's Name..... : Shenzhen Lavanda Technology Co.,Ltd

Address..... : Room 2101 West Tower Digital Cultural Industry Base, Nanshan Dist., Shenzhen, China

Product description

Product name..... : Wireless Earphone

Trade Mark..... : N/A

Model and/or type reference . : AQS1, AQS2, AQS3, AQS4, LA-S2, LA-HAC1

Standards..... : FCC Rules and Regulations Part 15 Subpart C Section 15.247
ANSI C63.10: 2013

This device described above has been tested by DongGuan Precise testing &Certification Corp. Ltd and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test..... :

Date (s) of performance of tests..... : Jul. 03 ~ 10, 2020

Date of Issue..... : Jun. 13, 2020

Test Result..... : Pass

Prepared by: Leo Yang

Leo Yang / Engineer

Reviewer:

Chris Du / Manager

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1. TEST SUMMARY

TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT
CONDUCTED EMISSIONS TEST	COMPLIANT
RADIATED EMISSION TEST	COMPLIANT
BAND EDGE	COMPLIANT
OCCUPIED BANDWIDTH MEASUREMENT	COMPLIANT
MAXIMUM PEAK OUTPUT POWER	COMPLIANT
FREQUENCY SEPARATION	COMPLIANT
CONDUCTED BANDEGE MEASUREMENT	COMPLIANT
SPURIOUS RF CONDUCTED EMISSION	COMPLIANT
NUMBER OF HOPPING FREQUENCY	COMPLIANT
TIME OF OCCUPANCY(DWELL TIME)	COMPLIANT
ANTENNA REQUIREMENT	COMPLIANT

TEST FACILITY

Test Firm : DongGuan Precise testing &Certification Corp. Ltd

Address : Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, Chinaa

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless Earphone
Trade Mark	N/A
Model Name	AQS1
Serial No.	AQS2, AQS3, AQS4, LA-S2, LA-HAC1
Model Difference	All models have the same circuit diagram, printed circuit board layout, structure and rated power, only different is the model name and appearance color.
FCC ID	2AWVB-AQS1
Antenna Type	Internal Antenna
Antenna Gain	0dBi
Frequency Range	2402-2480MHz
Number of Channels	79 channels for BR+EDR
Modulation Type	GFSK, Pi/4 QPSK, 8DPSK for BR+EDR
Power Source	DC 5V from Host or 3.7V from battery

Table for auxiliary equipment:

Equipment Description	Manufacturer	Model	Calibration Due Date	Remark
Notebook	Lenovo	Lenovo G475	GB14477457	N/A
Adapter	BI	BI05-050100U	N/A	DC 5V/1A

2.2 Carrier Frequency of Channels

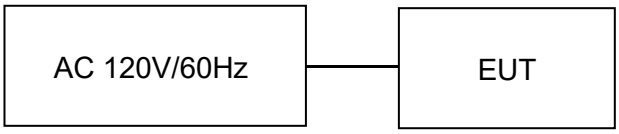
Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	21	2423	42	2444	63	2465
01	2403	22	2424	43	2445	64	2466
02	2404	23	2425	44	2446	65	2467
03	2405	24	2426	45	2447	66	2468
04	2406	25	2427	46	2448	67	2469
05	2407	26	2428	47	2449	68	2470
06	2408	27	2429	48	2450	69	2471
07	2409	28	2430	49	2451	70	2472
08	2410	29	2431	50	2452	71	2473
09	2411	30	2432	51	2453	72	2474
10	2412	31	2433	52	2454	73	2475
11	2413	32	2434	53	2455	74	2476
12	2414	33	2435	54	2456	75	2477
13	2415	34	2436	55	2457	76	2478
14	2416	35	2437	56	2458	77	2479
15	2417	36	2438	57	2459	78	2480
16	2418	37	2439	58	2460		
17	2419	38	2440	59	2461		
18	2420	39	2441	60	2462		
19	2421	40	2442	61	2463		
20	2422	41	2443	62	2464		

2.3 Operation of EUT during testing

Operating Mode
The mode is used: Transmitting mode
Low Channel: 2402MHz
Middle Channel: 2441MHz
High Channel: 2480MHz
Test SW Version: Airoha_Tool_Kit

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT during Radiation testing:

2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
CONDUCTED EMISSIONS TEST					
1	AMN	Schwarzbeck	NNLK8121	8121370	2020.9.9
2	AMN	ETS	3810/2	00020199	2020.9.9
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2020.9.9
4	AAN	TESEQ	T8-Cat6	38888	2020.9.9
RADIATED EMISSION TEST					
1	Horn Antenna	Sunol	DRH-118	A101415	2020.9.29
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2020.9.29
3	PREAMP	HP	8449B	3008A00160	2020.9.9
4	PREAMP	HP	8447D	2944A07999	2020.9.9
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.9.9
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.9.28
7	Signal Generator	Agilent	E4421B	MY4335105	2020.9.28
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.9.28
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2020.9.9
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2020.9.28
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2020.9.9
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2020.9.9
13	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2021.3.20
14	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2021.3.20
15	RF power divider	Anritsu	K241B	992289	2020.9.28
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.9.28
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2020.9.8
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2020.9.8
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2020.9.8
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2021.3.20
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2020.11.02
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2021.3.20
23	Microwave Broadband PreWireless Earphone	Schwarzbeck	BBV 9721	100472	2020.10.24
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2020.9.8
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.9.8
26	Frequency Meter	VICTOR	VC2000	997406086	2020.9.8
27	DC Power Source	HYELEC	HY5020E	055161818	2020.9.8
Test software					
1	E3	Audix	6.101223a	N/A	N/A

3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

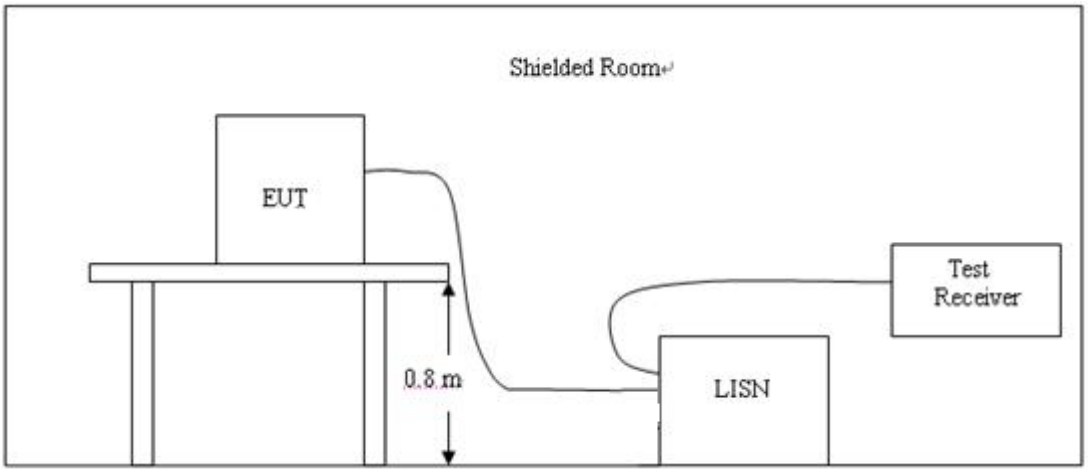
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

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

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 Test Setup



3.3 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.
2, Support equipment, if needed, was placed as per ANSI C63.10.
3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz 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.

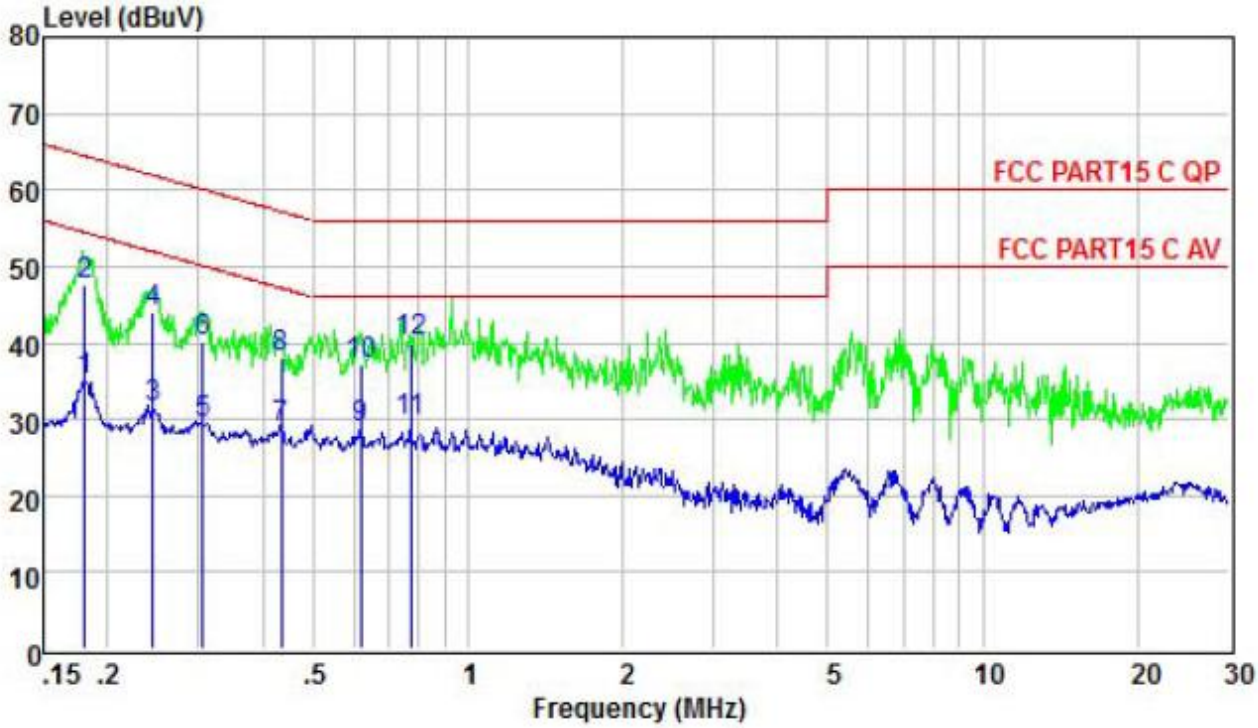
3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below:

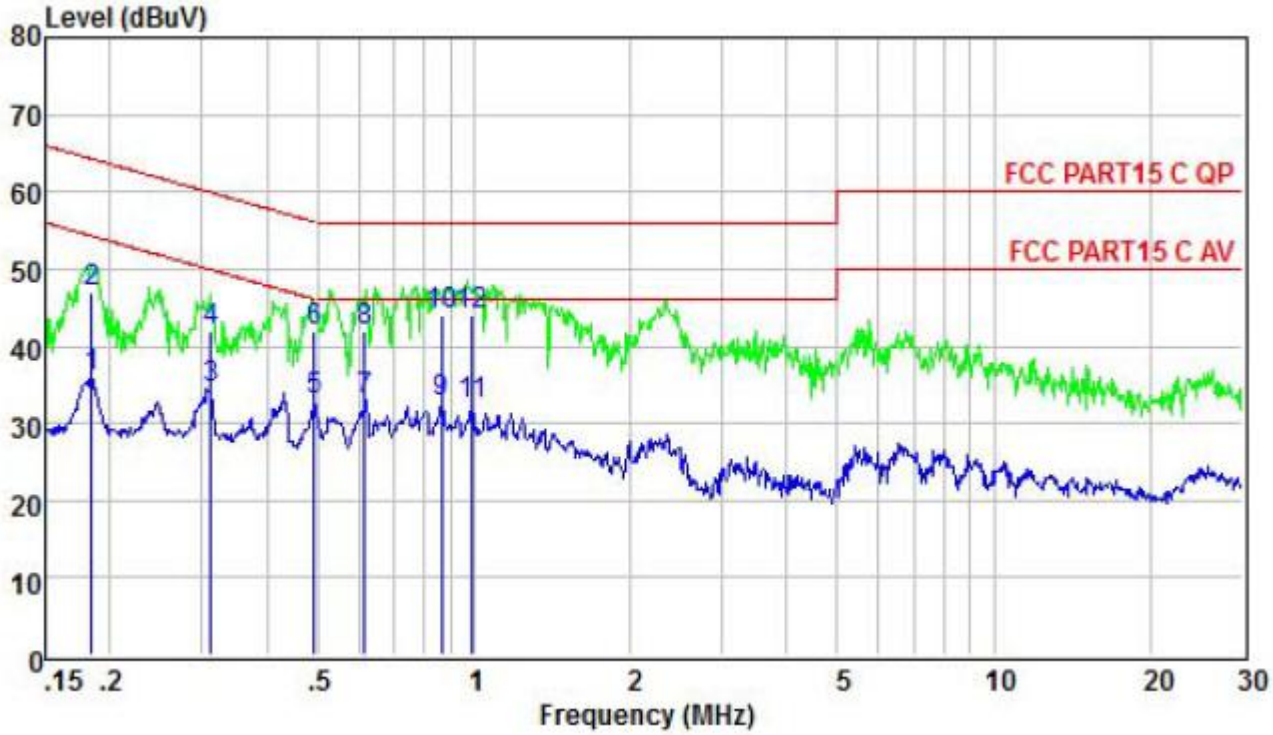
Temperature:	25℃	Relative Humidity:	49%
Test Date:	Jul. 03, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	Transmitting mode of GFSK 2480MHz		



	Freq	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dB	
1	0.181	9.55	0.05	35.03	54.46	-19.43	Average
2	0.181	9.55	0.05	47.53	64.46	-16.93	QP
3	0.244	9.53	0.05	31.52	51.95	-20.43	Average
4	0.244	9.53	0.05	44.03	61.95	-17.92	QP
5	0.307	9.56	0.05	29.48	50.06	-20.58	Average
6	0.307	9.56	0.05	40.02	60.06	-20.04	QP
7	0.435	9.62	0.05	28.73	47.15	-18.42	Average
8	0.435	9.62	0.05	38.02	57.15	-19.13	QP
9	0.621	9.63	0.05	28.73	46.00	-17.27	Average
10	0.621	9.63	0.05	37.04	56.00	-18.96	QP
11	0.775	9.63	0.05	29.60	46.00	-16.40	Average
12	0.775	9.63	0.05	40.00	56.00	-16.00	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

Temperature:	25℃	Relative Humidity:	49%
Test Date:	Jul. 03, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Neutral
Test Mode:	Transmitting mode of GFSK 2480MHz		



	Freq	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dB	
1	0.184	9.64	0.05	35.84	64.28	-28.44	Average
2	0.184	9.64	0.05	47.02	64.28	-17.26	QP
3	0.312	9.63	0.05	34.57	59.93	-25.36	Average
4	0.312	9.63	0.05	42.03	59.93	-17.90	QP
5	0.494	9.69	0.05	33.09	56.10	-23.01	Average
6	0.494	9.69	0.05	41.98	56.10	-14.12	QP
7	0.617	9.66	0.05	33.06	56.00	-22.94	Average
8	0.617	9.66	0.05	42.06	56.00	-13.94	QP
9	0.866	9.62	0.05	32.69	56.00	-23.31	Average
10	0.866	9.62	0.05	44.03	56.00	-11.97	QP
11	0.994	9.61	0.05	32.56	56.00	-23.44	Average
12	0.994	9.61	0.05	43.96	56.00	-12.04	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

4. RADIATED EMISSION TEST

4.1 Radiation Limit

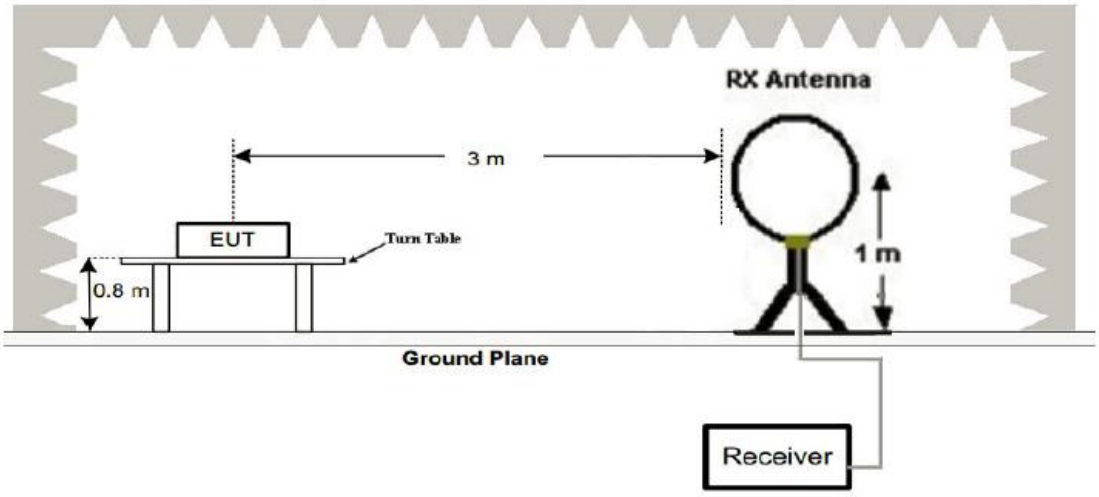
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
30-88	3	40	100
88-216	3	43.5	150
216-960	3	46	200
Above 960	3	54	500

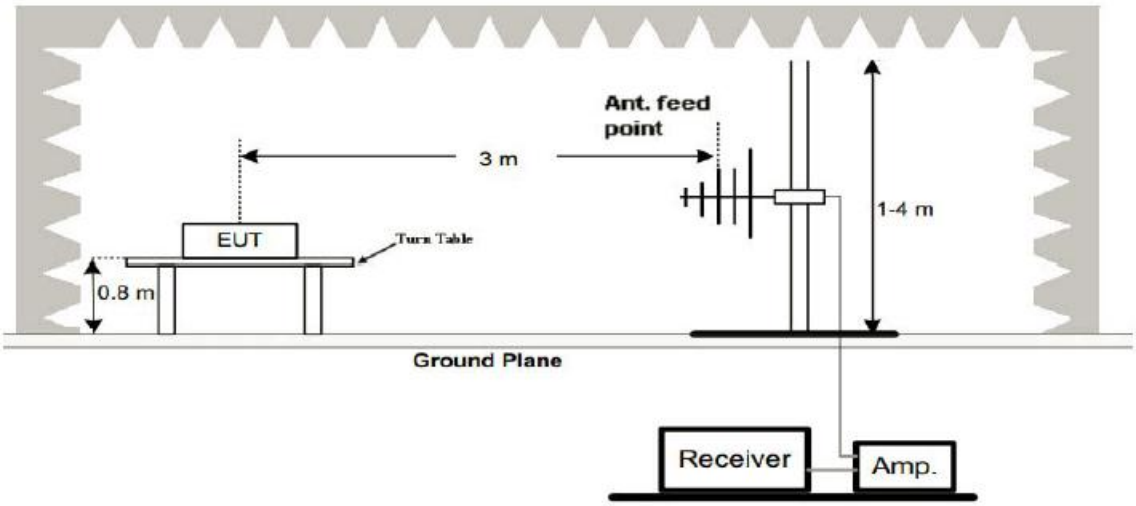
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

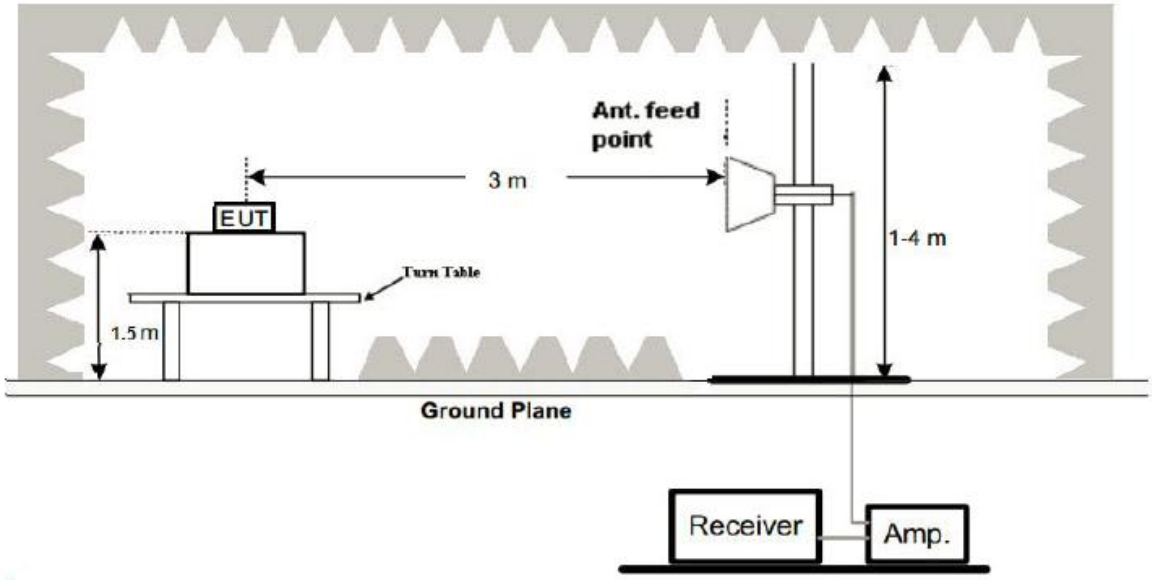
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).
8. 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	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

Note:
For battery operated equipment, the equipment tests shall be performed using a new battery.

4.4 Test Result

PASS

Remark:

1. All modes of GFSK, π/4 DQPSK, 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK High Channel was reported for below 1GHz test.
2. For BT3.0 above 1GHz test all modes of GFSK, π/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.
3. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
4. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

Temperature:	25℃	Relative Humidity:	49%
Test Date:	Jul. 03, 2020	Pressure:	1010hPa
Test Voltage:	DC 3.7V	Polarization:	Horizontal
Test Mode:	Transmitting mode of GFSK 2480MHz		

Below 30MHz

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F
--	--	--	--	P
--	--	--	--	P

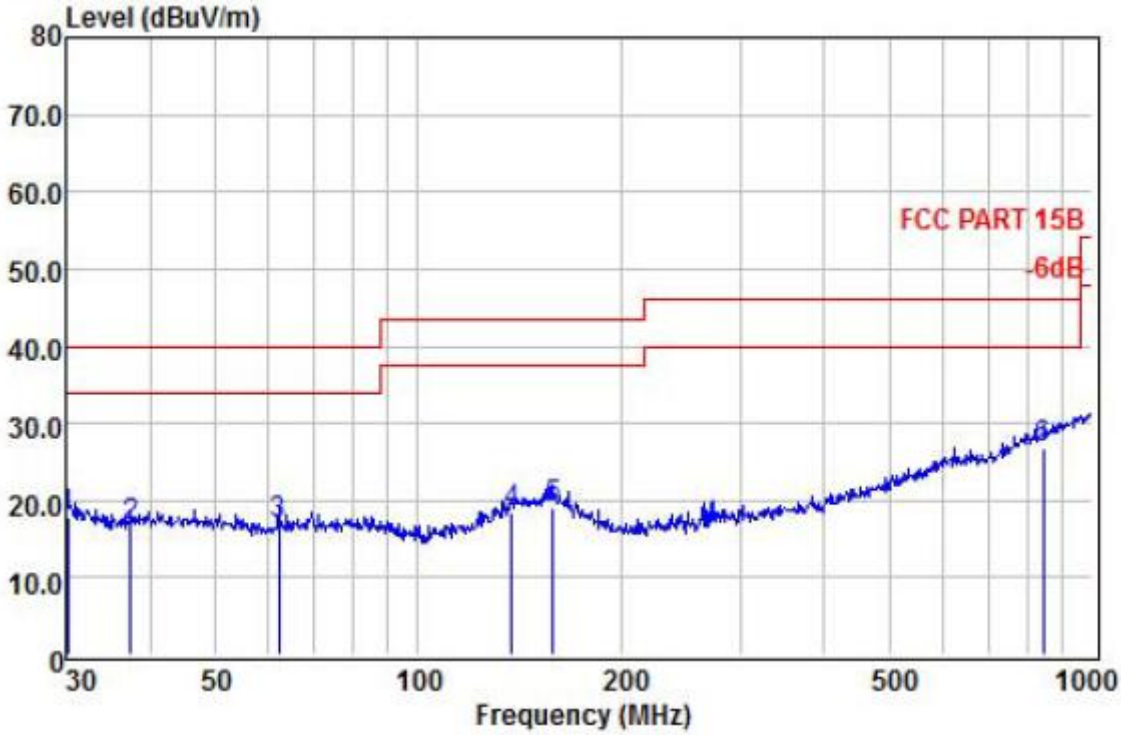
Note:

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.

Below 1GHz Test Results:

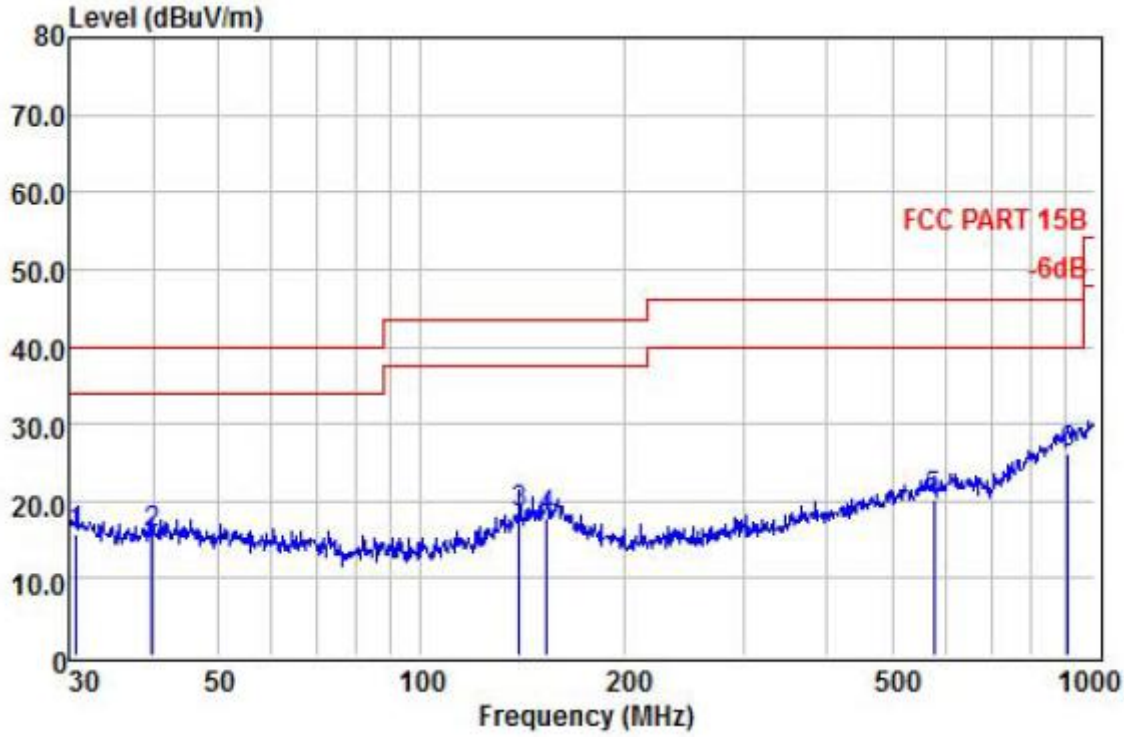
Temperature:	25℃	Relative Humidity:	49%
Test Date:	Jul. 03, 2020	Pressure:	1010hPa
Test Voltage:	DC 3.7V	Polarization:	Horizontal
Test Mode:	Transmitting mode of GFSK 2402MHz		



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.21	2.80	14.71	0.34	17.85	40.00	-22.15	QP
2	37.42	3.26	13.15	0.18	16.59	40.00	-23.41	QP
3	62.00	4.77	12.08	0.13	16.98	40.00	-23.02	QP
4	137.90	3.19	14.94	0.23	18.36	43.50	-25.14	QP
5	158.67	3.00	15.67	0.23	18.90	43.50	-24.60	QP
6	848.06	3.38	21.85	1.52	26.75	46.00	-19.25	QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

Temperature:	25℃	Relative Humidity:	49%
Test Date:	Jul. 03, 2020	Pressure:	1010hPa
Test Voltage:	DC 3.7V	Polarization:	Vertical
Test Mode:	Transmitting mode of GFSK 2480MHz		



	Freq	Read Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.75	0.95	14.48	0.32	15.75	40.00	-24.25	QP
2	39.85	2.11	13.48	0.13	15.72	40.00	-24.28	QP
3	139.85	2.89	15.20	0.23	18.32	43.50	-25.18	QP
4	153.74	2.13	15.56	0.23	17.92	43.50	-25.58	QP
5	576.64	1.65	17.33	1.14	20.12	46.00	-25.88	QP
6	912.86	1.95	22.71	1.64	26.30	46.00	-19.70	QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss

Remark:
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results (GFSK Worst Case):
CH Middle (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.99	-5.84	103.15	114	-10.85	PK
2402	81.04	-5.84	75.20	94	-18.80	AV
4804	61.31	-3.64	57.67	74	-16.33	PK
4804	49.06	-3.64	45.42	54	-8.58	AV
7206	54.55	-0.95	53.60	74	-20.40	PK
7206	46.04	-0.95	45.09	54	-8.91	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.55	-5.84	102.71	114	-11.29	PK
2402	79.17	-5.84	73.33	94	-20.67	AV
4804	57.96	-3.64	54.32	74	-19.68	PK
4804	49.26	-3.64	45.62	54	-8.38	AV
7206	52.62	-0.95	51.67	74	-22.33	PK
7206	45.61	-0.95	44.66	54	-9.34	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

CH Middle (2441MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	107.81	-5.71	102.10	114	-11.90	PK
2441	78.90	-5.71	73.19	94	-20.81	AV
4882	58.79	-3.51	55.28	74	-18.72	PK
4882	47.66	-3.51	44.15	54	-9.85	AV
7323	54.41	-0.82	53.59	74	-20.41	PK
7323	42.55	-0.82	41.73	54	-12.27	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2441	108.19	-5.71	102.48	114	-11.52	PK
2441	79.35	-5.71	73.64	94	-20.36	AV
4882	59.55	-3.51	56.04	74	-17.96	PK
4882	49.51	-3.51	46.00	54	-8.00	AV
7323	53.51	-0.82	52.69	74	-21.31	PK
7323	44.85	-0.82	44.03	54	-9.97	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

CH High (2480MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	109.48	-5.65	103.83	114	-10.17	PK
2480	79.76	-5.65	74.11	94	-19.89	AV
4960	58.49	-3.43	55.06	74	-18.94	PK
4960	49.77	-3.43	46.34	54	-7.66	AV
7440	54.85	-0.75	54.10	74	-19.90	PK
7440	45.47	-0.75	44.72	54	-9.28	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	111.05	-5.65	105.40	114	-8.60	PK
2480	80.09	-5.65	74.44	94	-19.56	AV
4960	60.69	-3.43	57.26	74	-16.74	PK
4960	48.94	-3.43	45.51	54	-8.49	AV
7440	56.89	-0.75	56.14	74	-17.86	PK
7440	47.55	-0.75	46.80	54	-7.20	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp. Margin = Absolute Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions are reported.

5. BAND EDGE

5.1 Limits

FCC PART 15.247 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10kHz to measure the average radiated field strength. The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

5.3 Test Result

PASS

Remark: All modes of GFSK, π/4 DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:

Radiated Band Edge Test:

Worst case on GFSK

Operation Mode: TX CH Low (2402MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	53.34	-5.81	47.53	74	-26.47	PK
2310	/	-5.81	/	54	/	AV
2390	53.57	-5.84	47.73	74	-26.27	PK
2390	/	-5.84	/	54	/	AV
2400	53.39	-5.84	47.55	74	-26.45	PK
2400	/	-5.84	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	52.89	-5.81	47.08	74	-26.92	PK
2310	/	-5.81	/	54	/	AV
2390	52.68	-5.84	46.84	74	-27.16	PK
2390	/	-5.84	/	54	/	AV
2400	52.75	-5.84	46.91	74	-27.09	PK
2400	/	-5.84	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp.						

Operation Mode: TX CH High (2480MHz)

Horizontal :

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	54.16	-5.65	48.51	74	-25.49	PK
2483.5	/	-5.65	/	54	/	AV
2500	53.94	-5.72	48.22	74	-25.78	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp.						

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	53.78	-5.65	48.13	74	-25.87	PK
2483.5	/	-5.65	/	54	/	AV
2500	53.53	-5.72	47.81	74	-26.19	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amp.						

6. OCCUPIED BANDWIDTH MEASUREMENT

6.1 Test Setup

Same as Radiated Emission Measurement

6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on ANSI C63.10 section 6.9.2: RBW=30KHz, VBW=100KHz, Span=3MHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

6.3 Measurement Equipment Used

Same as Radiated Emission Measurement

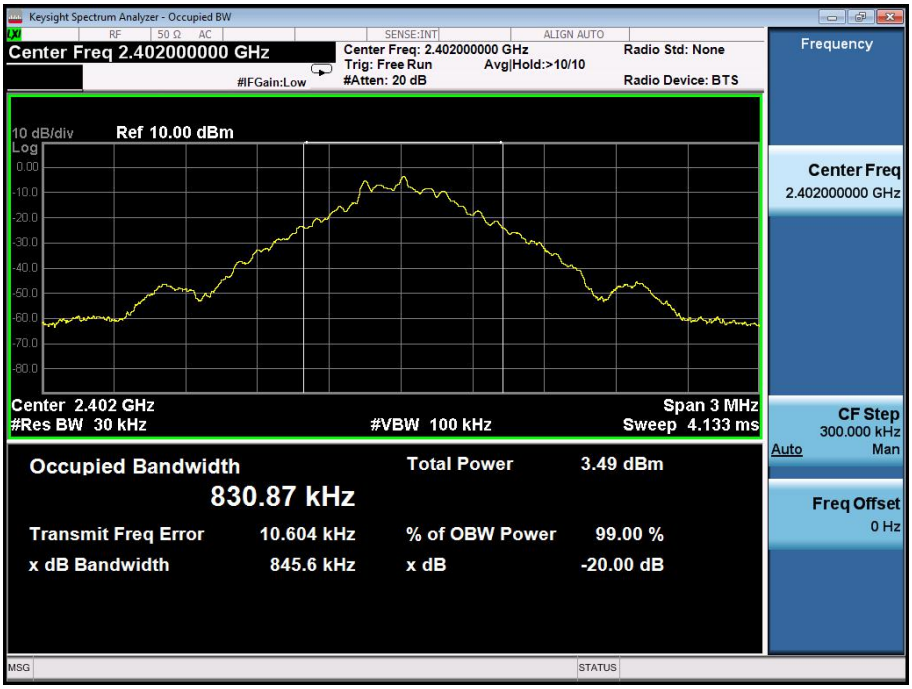
6.4 Test Result

PASS

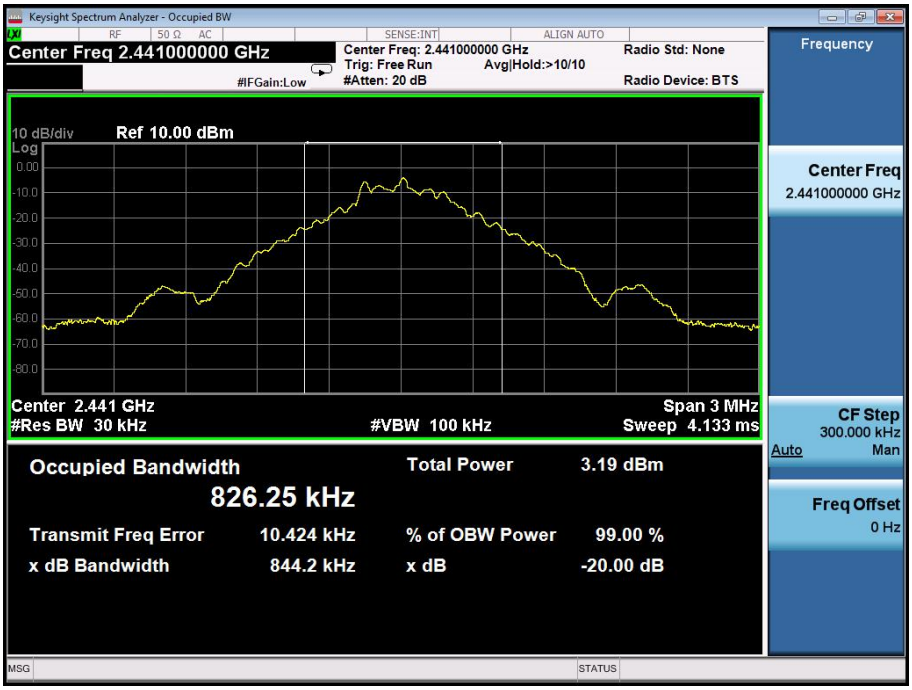
GFSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	0.846	PASS
2441	0.844	PASS
2480	0.846	PASS

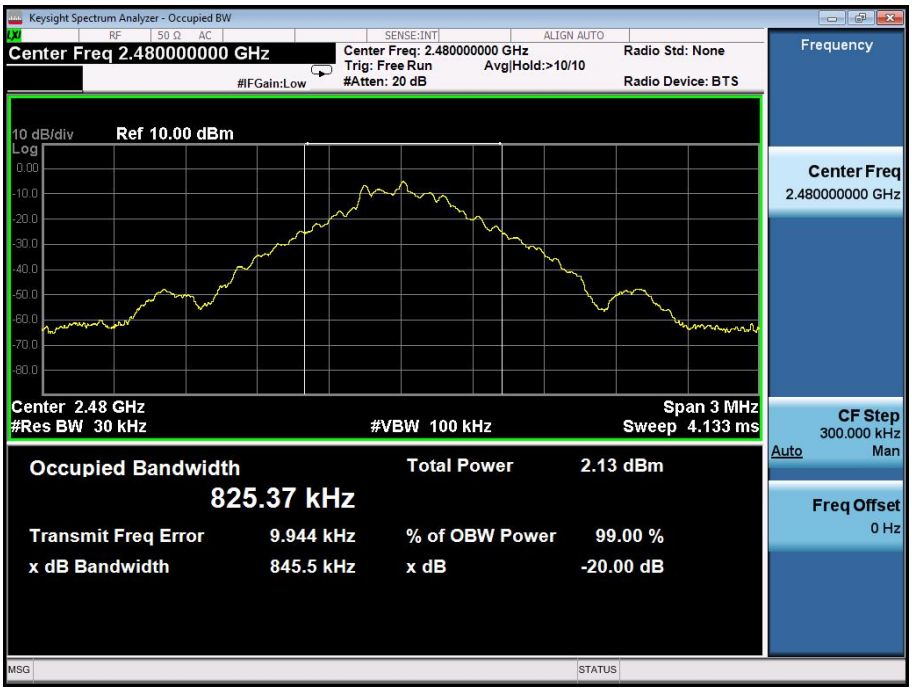
CH: 2402MHz



CH: 2441MHz



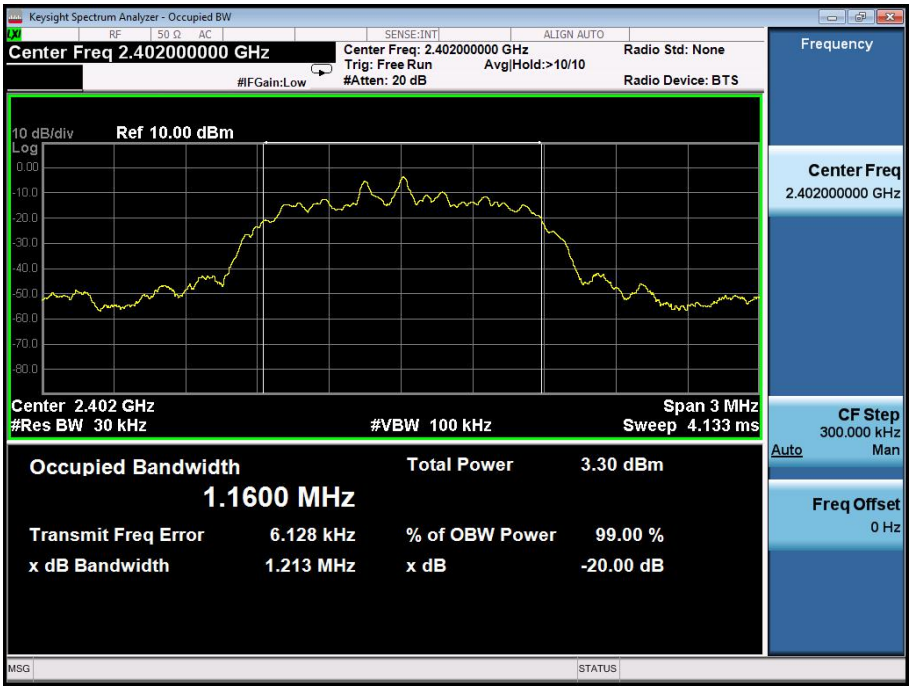
CH: 2480MHz



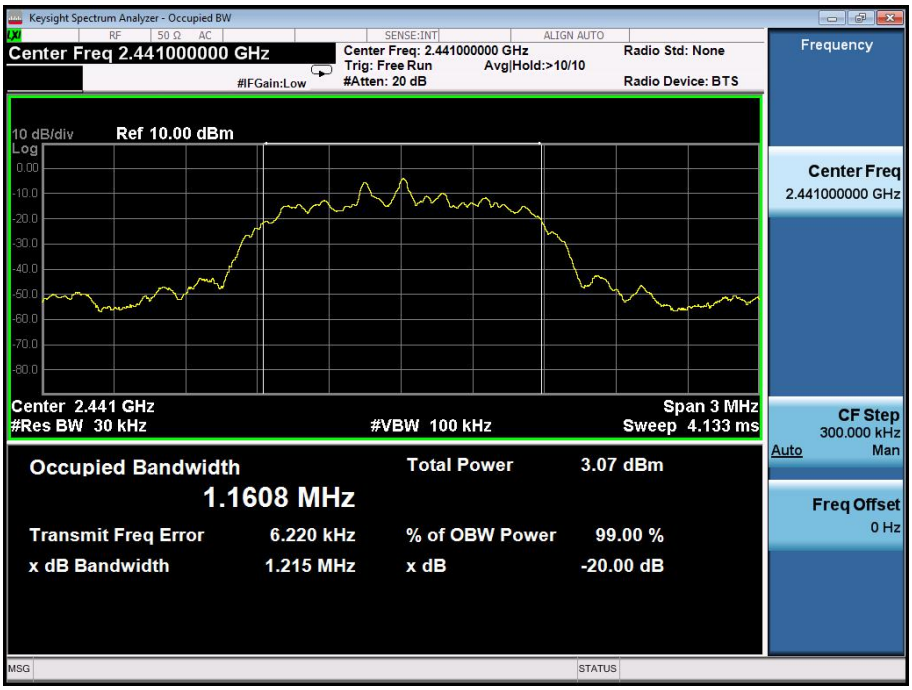
π/4 DQPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.213	PASS
2441	1.215	PASS
2480	1.215	PASS

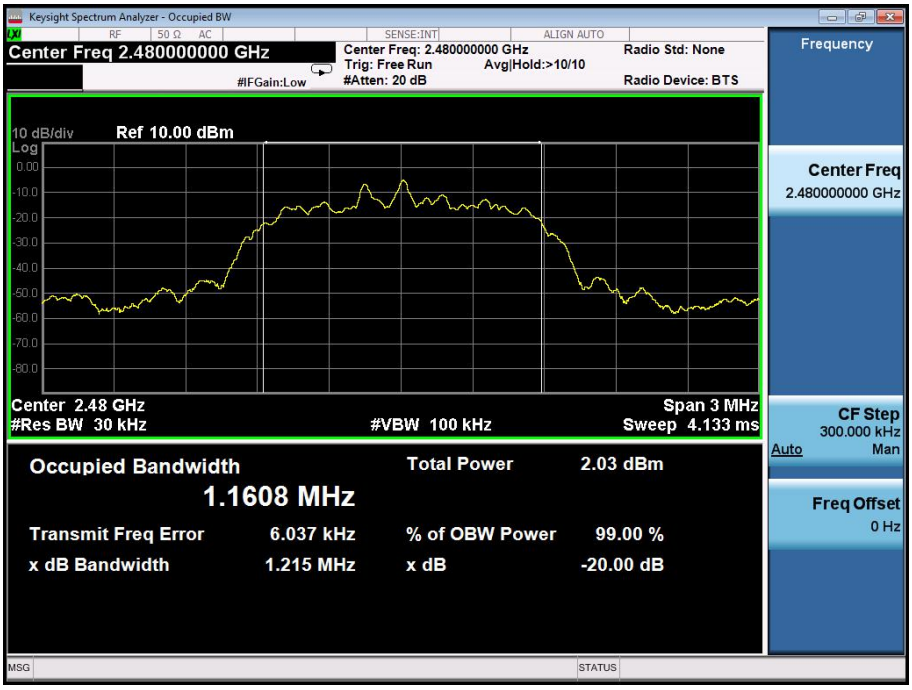
CH: 2402MHz



CH: 2441MHz



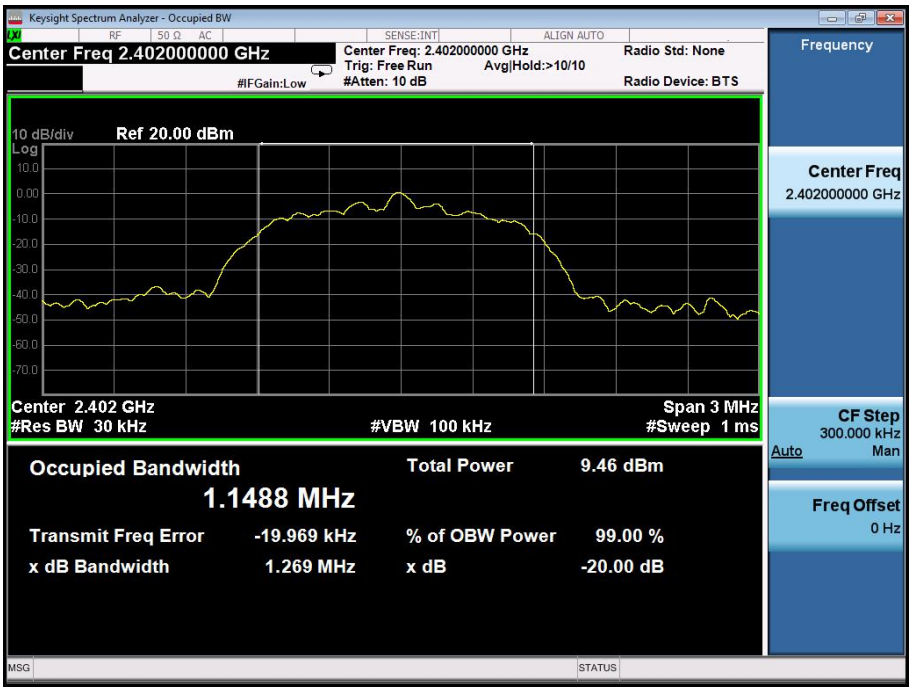
CH: 2480MHz



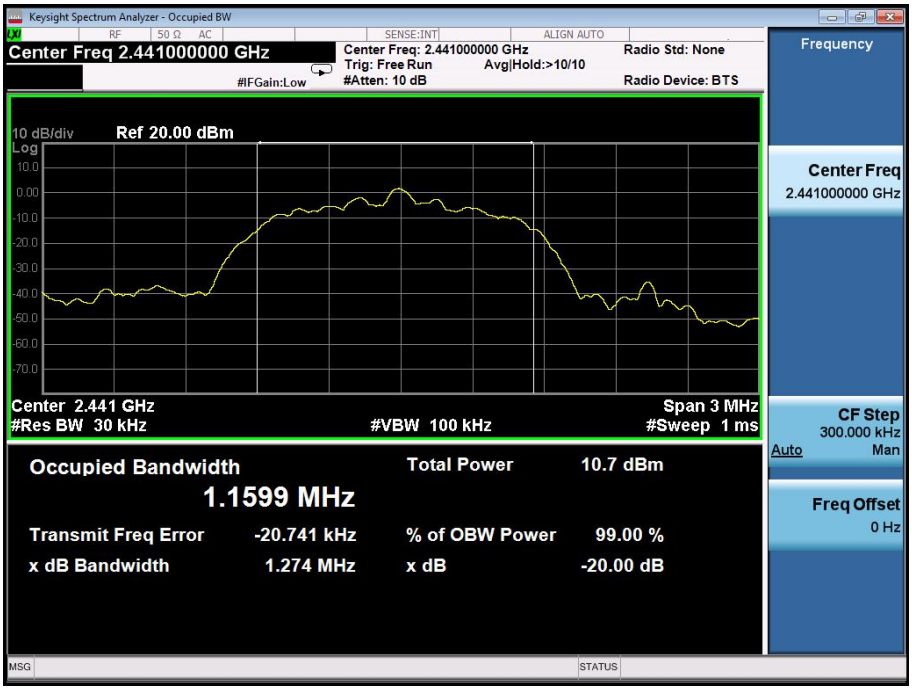
8DPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.269	PASS
2441	1.274	PASS
2480	1.264	PASS

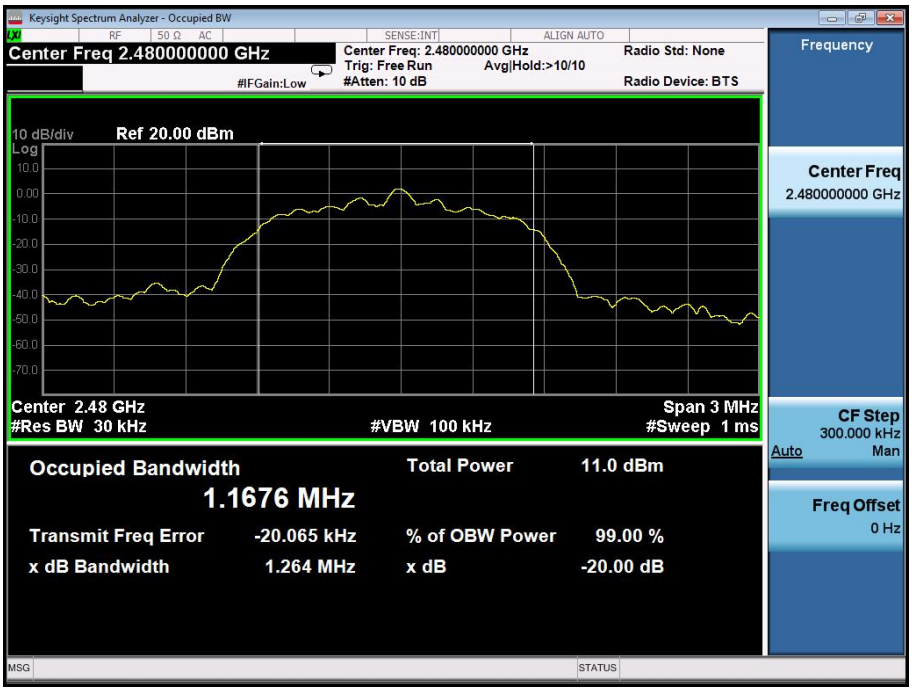
CH: 2402MHz



CH: 2441MHz



CH: 2480MHz



7. MAXIMUM PEAK OUTPUT POWER

7.1 Test Setup

7.2 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.

7.3 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.

7.4 Test Result

PASS

Type	Channel	Peak Output power (dBm)	Limit (dBm)	Result
GFSK	Low	-0.127	21	Pass
	Mid	-0.008		
	High	**0.146**		
π/4DQPSK	Low	-0.881	21	Pass
	Mid	-0.664		
	High	-0.263		
8DPSK	Low	-1.244	21	Pass
	Mid	-1.108		
	High	-0.966		

8. FREQUENCY SEPARATION

8.1 Test Setup

8.2 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.

8.3 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.

8.4 Test Result

PASS

Type/Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.002	0.880	pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.000	0.890	pass
	Adjacency Channel	2442			
	High Channel	2480	1.000	0.897	pass
	Adjacency Channel	2479			

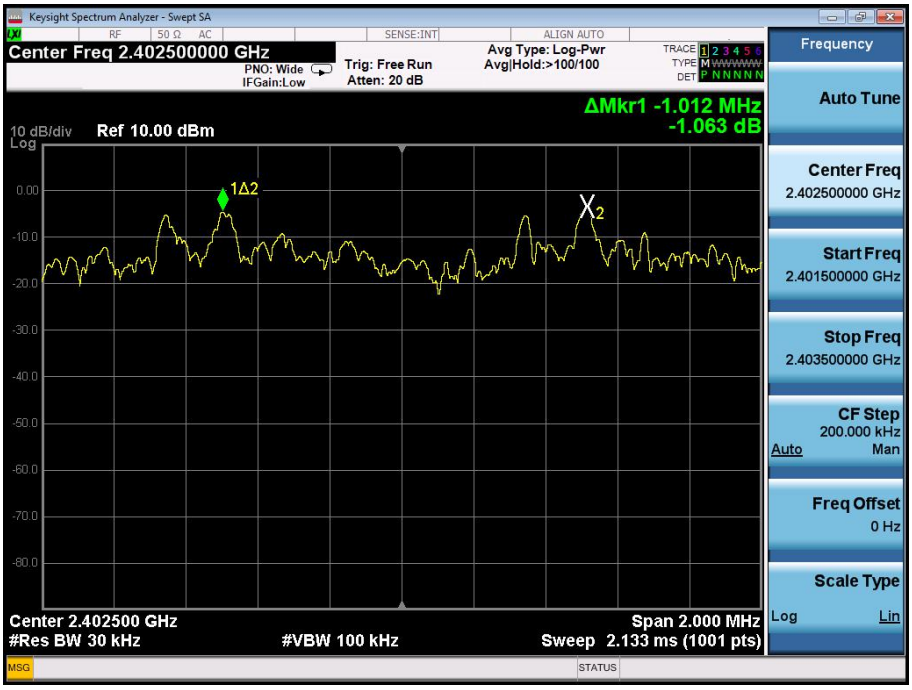
CH: 2402MHz

CH: 2441MHz

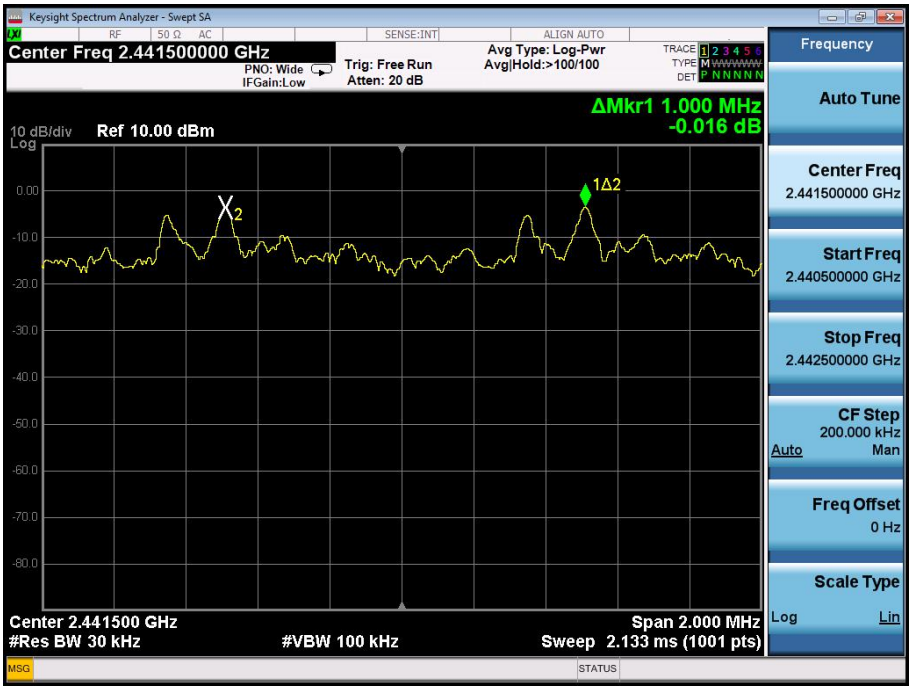
CH: 2480MHz

Type/Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation π/4DQPSK	Low Channel	2402	1.012	0.809	pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.000	0.810	pass
	Adjacency Channel	2442			
	High Channel	2480	1.0002	0.810	pass
	Adjacency Channel	2479			

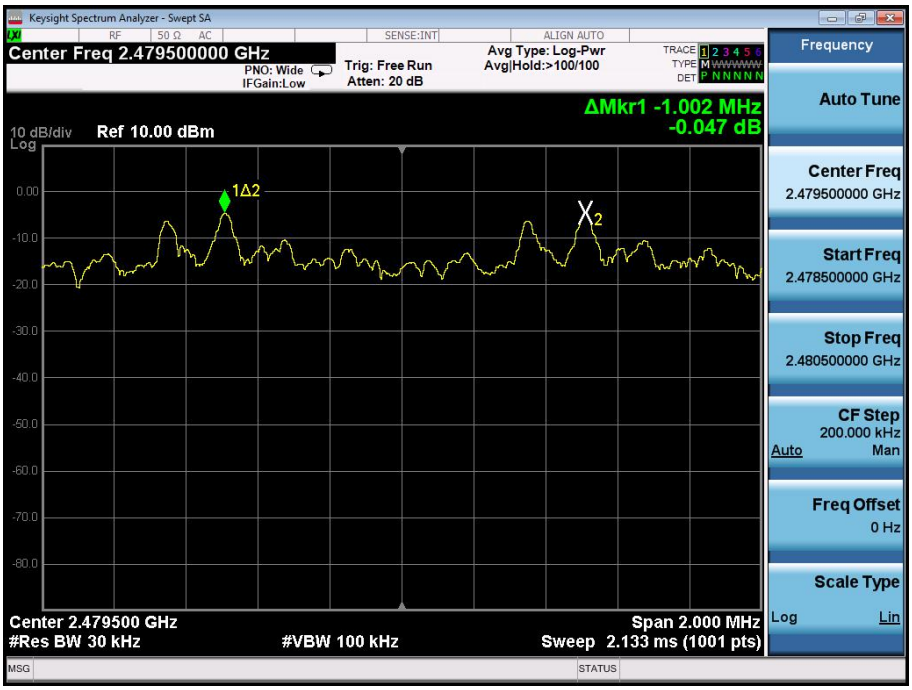
CH: 2402MHz



CH: 2441MHz



CH: 2480MHz



Type/Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation 8DPSK	Low Channel	2402	1.000	0.846	pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.006	0.849	pass
	Adjacency Channel	2442			
	High Channel	2480	1.004	0.843	pass
	Adjacency Channel	2479			

CH: 2402MHz

CH: 2441MHz

CH: 2480MHz