TEST REPORT

APPLICANT	:	Powerstick.com Inc.
PRODUCT NAME	:	Concertino
MODEL NAME	:	803193
BRAND NAME	:	Powerstick.com Inc.
FCC ID		2AITNLUNA
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2019-08-28
TEST DATE	:	2019-09-19 to 2020-01-14
ISSUE DATE	:	2020-07-24

Edited by: Peng Mi (Rapporteur)

Approved by: Peng Huarui (Supervisor)

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Change History		
Version	Date	Reason for change
1.0	2020-07-24	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Powerstick.com Inc.
Applicant Address:	29 Camelot Drive Ottawa Canada K2G 5W6
Manufacturer:	Powerstick.com Inc.
Manufacturer Address:	29 Camelot Drive Ottawa Canada K2G 5W6

1.2. Equipment Under Test (EUT) Description

Product Name:	Concertino	
Serial No.:	(N/A, marked #1 by test site)	
Hardware Version:	Rev 5.0	
Software Version:	BW-Concertino-803193-V1.1	
Equipment Type:	Bluetooth classic	
Bluetooth Version:	4.2	
Modulation Type:	FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))	
Operating Frequency Range:	2402MHz – 2480MHz	
Antenna Type:	PCB Antenna	
Antenna Gain:	1.08dBi	
Accessory Information:	Battery	
	Brand Name:	Youli Juneng
	Model No.:	602535
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	600.00mAh
	Rated Voltage:	3.70V
	Charge Limit:	4.20V

Note 1: We use the dedicated software to control the EUT into the test mode, and then use MT8852B base station to control the EUT continuous transmission.

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. The Channel Number and Frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	**78**	**2480**
19	2421	**39**	**2441**	59	2461		

Note 1: The Lowest Channel 0, Middle 39 and Highest 78 were selected for test in the report.

1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No	Identity	Document Title
1	47 CFR Part 15	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.247(a)1 15.247(h)	Hopping Mechanism	N/A	N/A	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Jan 14, 2020	Zhou Chuang	PASS	No deviation
4	N/A	Duty Cycle	Jan 14, 2020	Zhou Chuang	PASS	No deviation
5	15.247(b)	Maximum Peak Conducted Output Power	Jan 14, 2020	Zhou Chuang	PASS	No deviation
6	15.247(b)	Maximum Average Conducted Output Power	Jan 14, 2020	Zhou Chuang	PASS	No deviation
7	15.247(a)	20dB Bandwidth	Jan 14, 2020	Zhou Chuang	PASS	No deviation
8	15.247(a)	Carrier Frequency Separation	Jan 14, 2020	Zhou Chuang	PASS	No deviation
9	15.247(a)	Time of Occupancy (Dwell time)	Jan 14, 2020	Zhou Chuang	PASS	No deviation
10	15.247(d)	Conducted Spurious Emission	Jan 14, 2020	Zhou Chuang	PASS	No deviation
11	15.207	Conducted Emission	Sep 21, 2019	Lin Jiayong	PASS	No deviation
12	15.247(d)	Restricted Frequency Bands	Sep 19, 2019	Peng Xuewei	PASS	No deviation

13	15.209, 15.247(d)	Radiated Emission	Sep 19, 2019	Peng Xuewei	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013 and KDB558074 D01 v05r02.
Note 2: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The Ref offset 2.0dB means the cable loss is 2.0dB.
Note 3: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

1.5. Environmental Conditions

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

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Hopping Mechanism

2.2.1. Requirement

According to FCC §15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to FCC §15.247(h), the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

2.2.2. Result: Compliant

The hopping mechanism of the EUT is in compliance with the document "***Bluetooth core specification v5.1***".

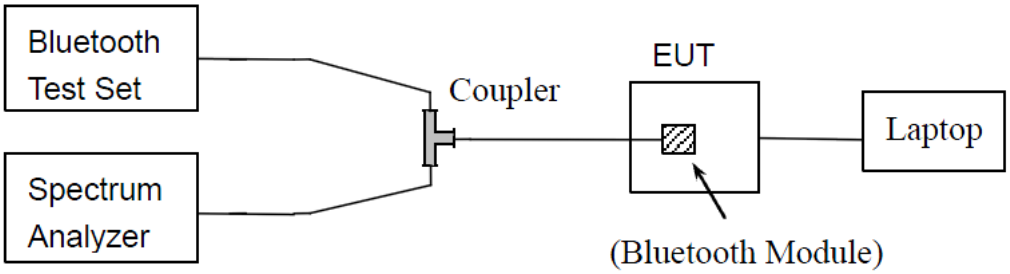
2.3. Number of Hopping Frequency

2.3.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.3.2. Test Description

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.3.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

2.3.4. Test Result

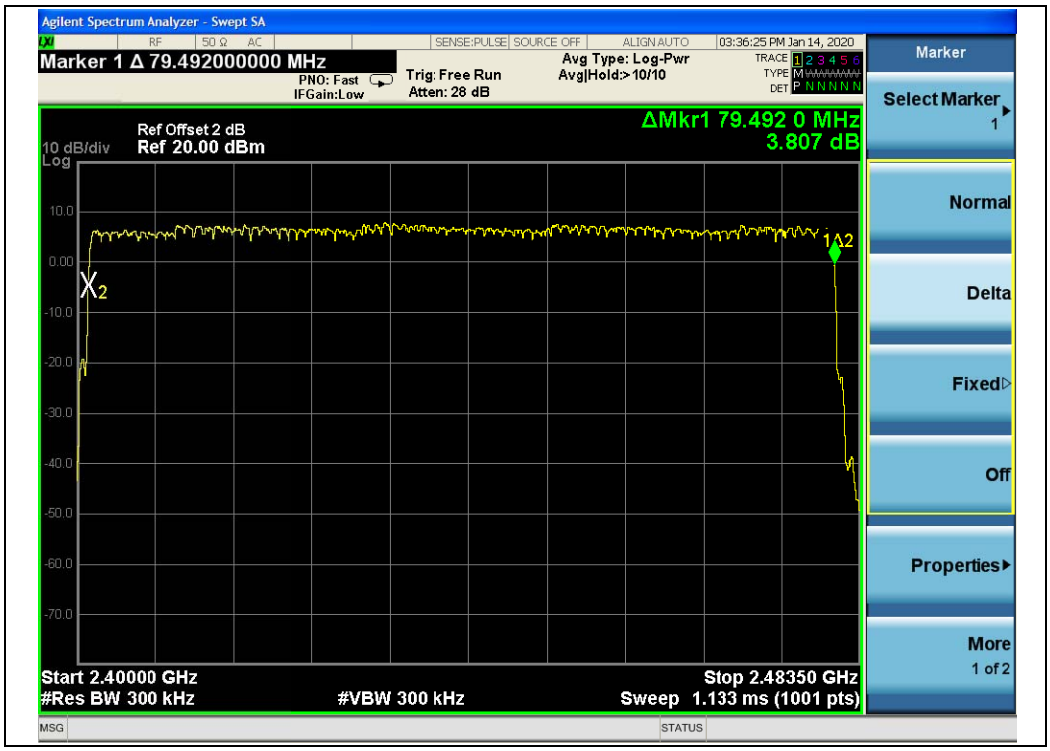
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

A. Test Verdict:

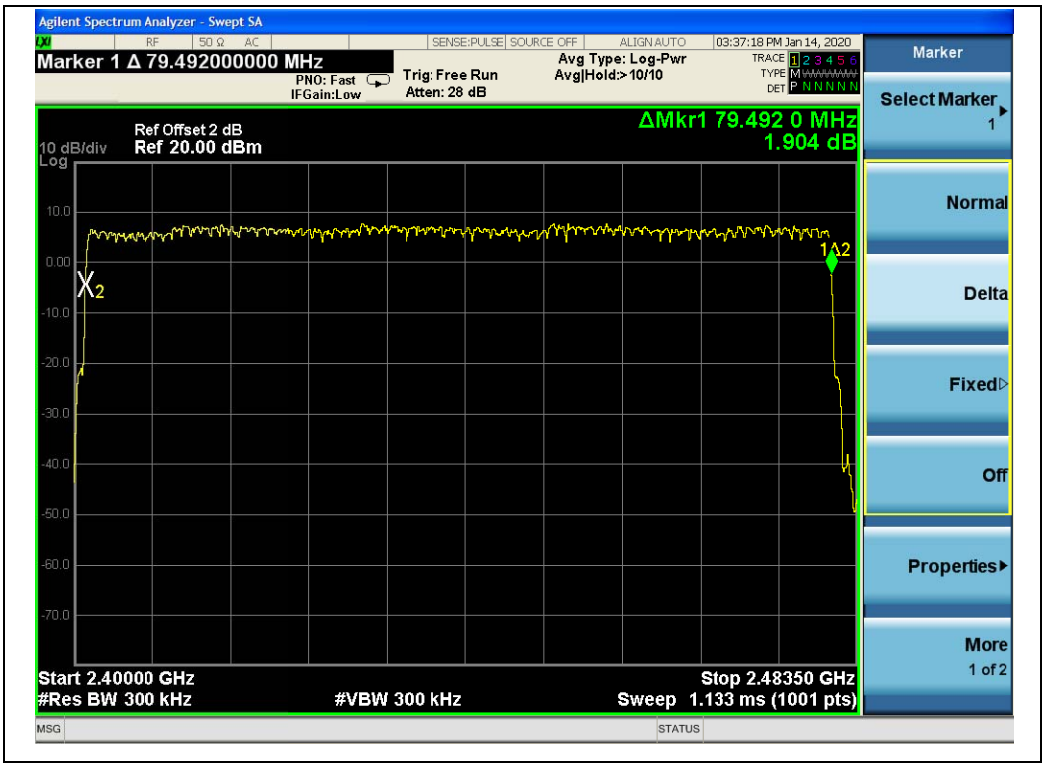
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	PASS
π/4-DQPSK	2400 - 2483.5	79	15	PASS
8-DPSK	2400 - 2483.5	79	15	PASS

B. Test Plots:

(GFSK)



(π/4-DQPSK)



(8- DPSK)

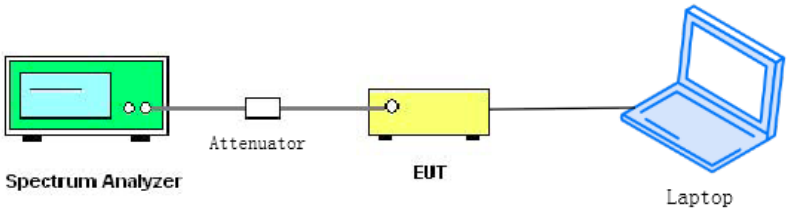
2.4. Duty Cycle of Test Signal

2.4.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this subclause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.4.2. Test Description

Test Setup:



ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.4.3. Test Result

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
GFSK	77.60	1.10
π/4-DQPSK	77.20	1.12
8-DPSK	77.33	1.12

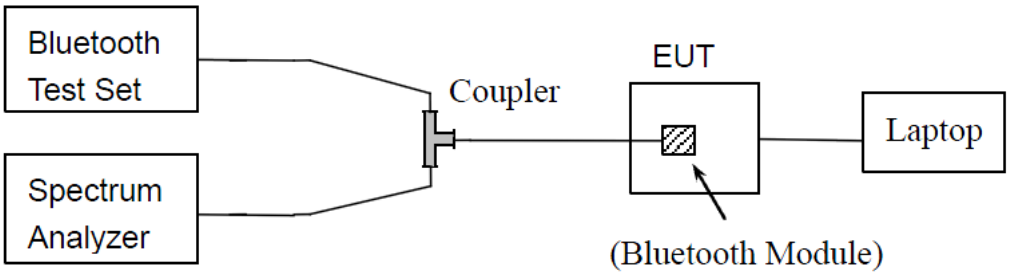
2.5. Maximum Peak Conducted Output Power

2.5.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.5.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.5.3. Test Result

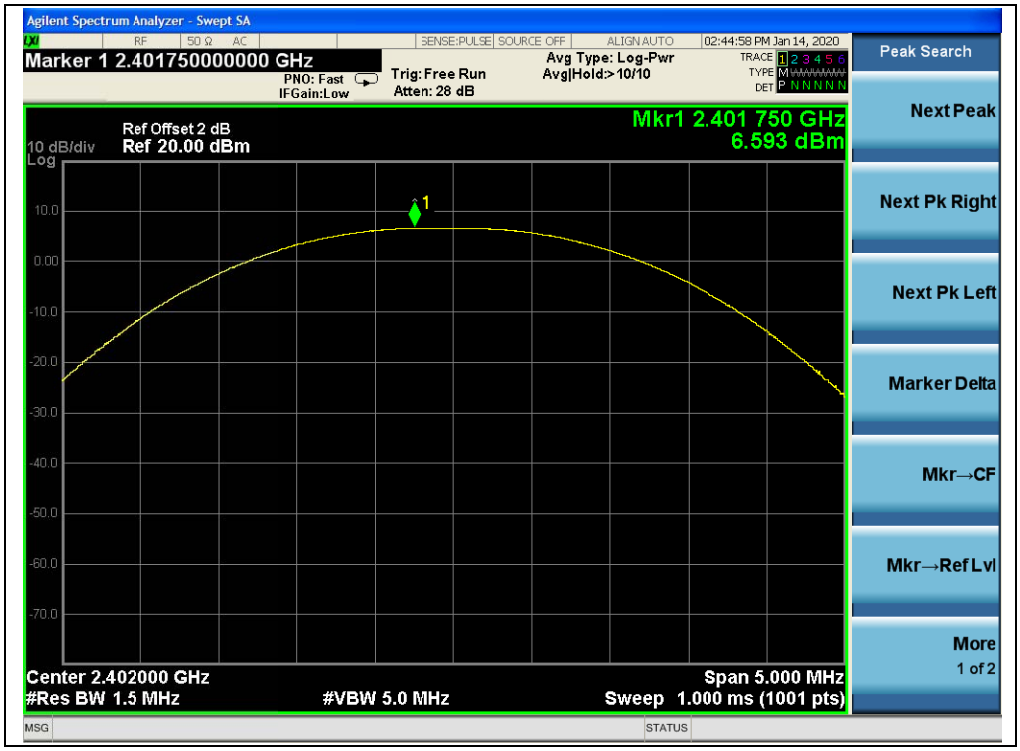
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module.

GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	6.59	0.005	20.96	0.125	PASS
39	2441	7.26	0.005			PASS
78	2480	6.82	0.005			PASS

B. Test Plots:



(GFSK, Channel 0, 2402MHz)

(GFSK, Channel 39, 2441MHz)

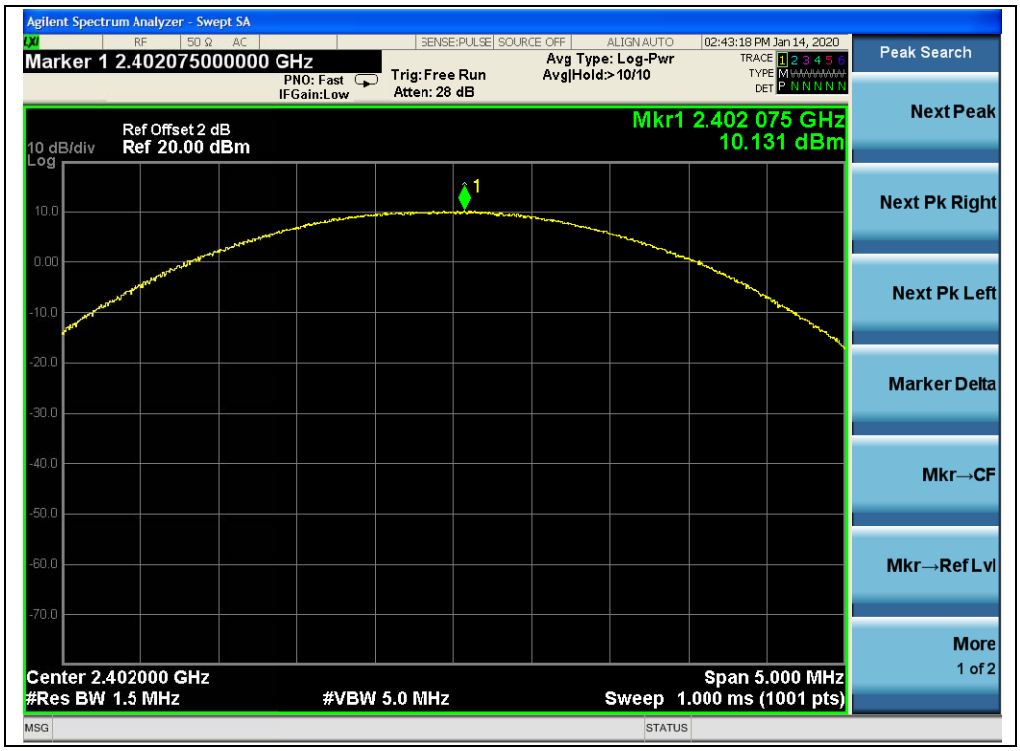
(GFSK, Channel 78, 2480MHz)

π/4-DQPSK Mode

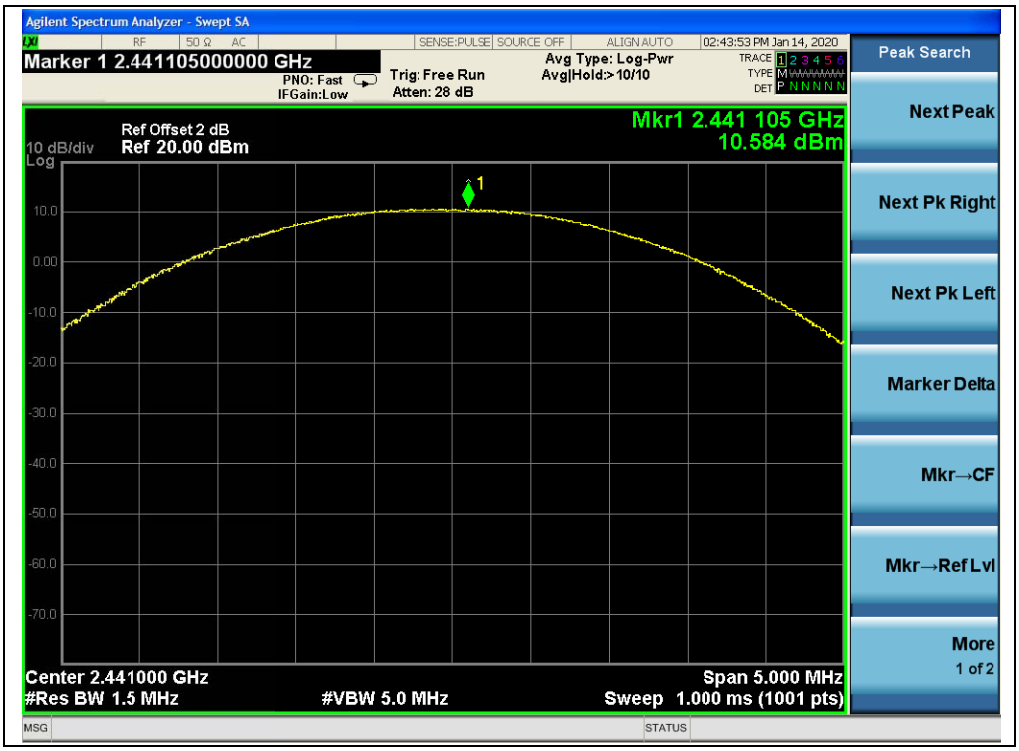
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	10.13	0.010	20.96	0.125	PASS
39	2441	10.58	0.011			PASS
78	2480	10.20	0.010			PASS

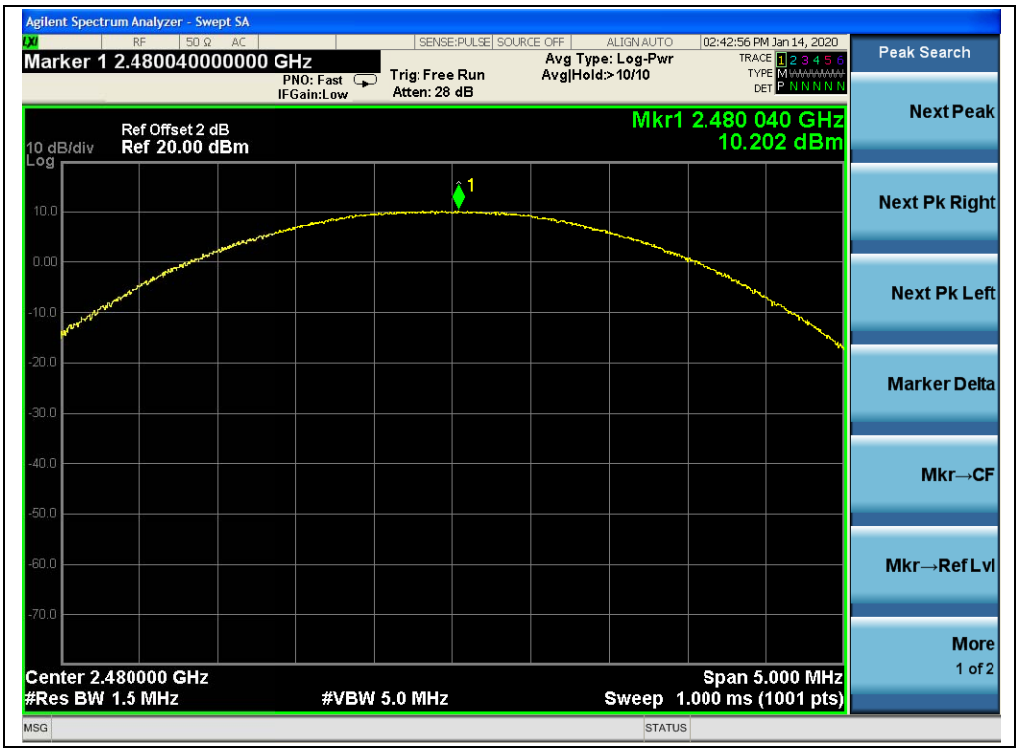
B. Test Plots:



(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)



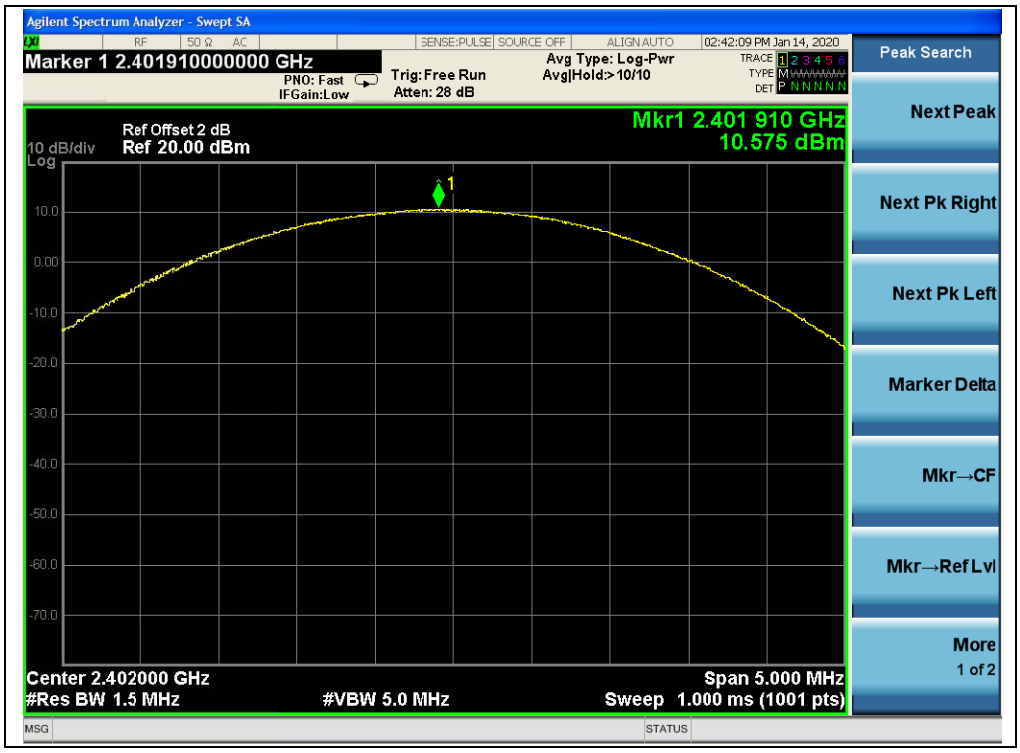
(π/4-DQPSK, Channel 78, 2480MHz)

8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	10.58	0.011	20.96	0.125	PASS
39	2441	**11.12**	**0.013**			PASS
78	2480	10.61	0.012			PASS

B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)

(8-DPSK, Channel 39, 2441MHz)

(8-DPSK, Channel 78, 2480MHz)

2.6. Maximum Average Conducted Output Power

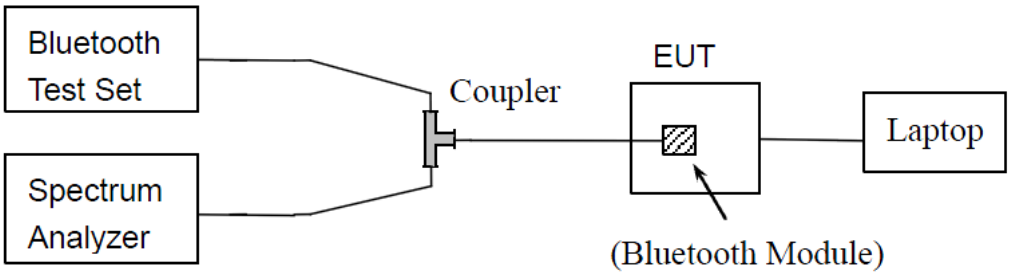
2.6.1. Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: The maximum average conducted output power of the intentional radiator shall not exceed 1 Watt.

2.6.2. Test Description

The measured output power was calculated by the reading of the USB Wideband Power Sensor and calibration.

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.6.3. Test procedure

KDB 558074 Section 8.3.2 was used in order to prove compliance.

2.6.4. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the module.

GFSK Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	5.01	1.10	6.11	0.004	20.96	0.125	PASS
39	2441	5.68		**6.78**	**0.005**			PASS
78	2480	5.43		6.53	0.004			PASS

π/4-DQPSK Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	4.92	1.12	6.04	0.004	20.96	0.125	PASS
39	2441	5.59		6.71	0.005			PASS
78	2480	5.29		6.41	0.004			PASS

8-DPSK Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	4.69	1.12	5.81	0.004	20.96	0.125	PASS
39	2441	5.30		6.42	0.004			PASS
78	2480	5.04		6.15	0.004			PASS

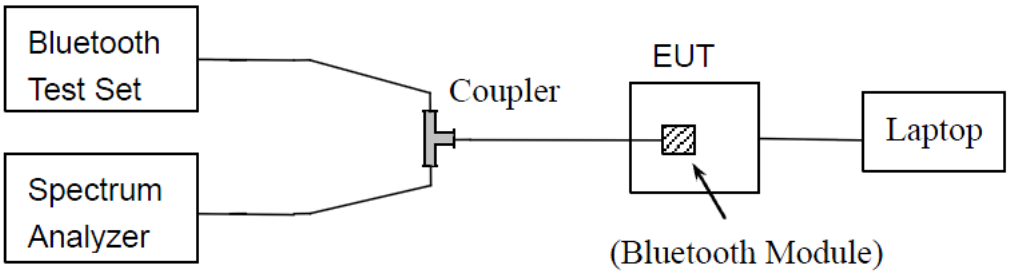
2.7. 20dB Bandwidth

2.7.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.7.2. Test Description

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.7.3. Test Procedure

Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.7.4. Test Result

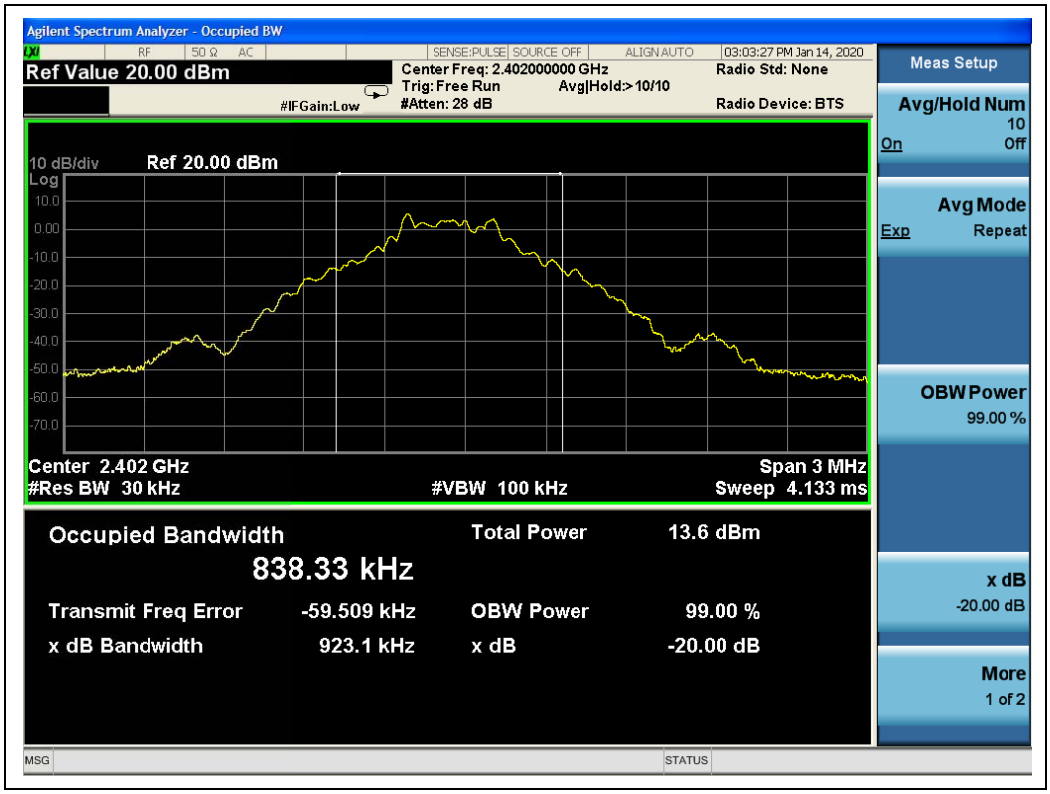
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

GFSK Mode

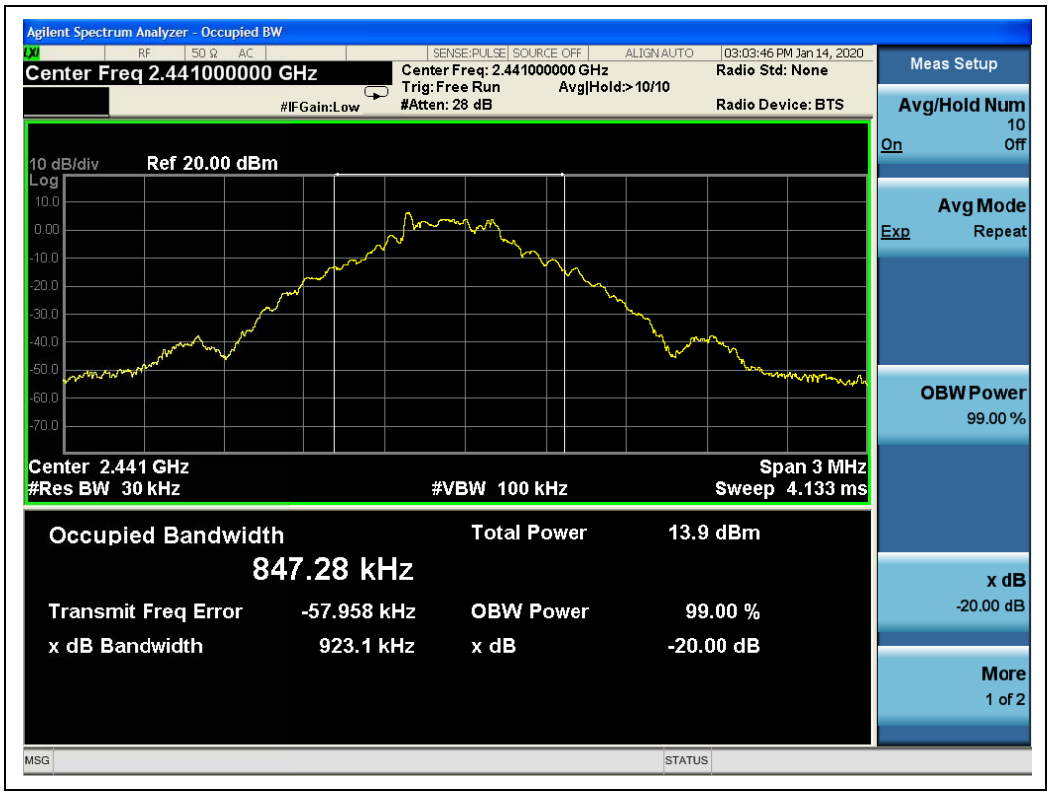
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	0.923	PASS
39	2441	0.923	PASS
78	2480	0.918	PASS

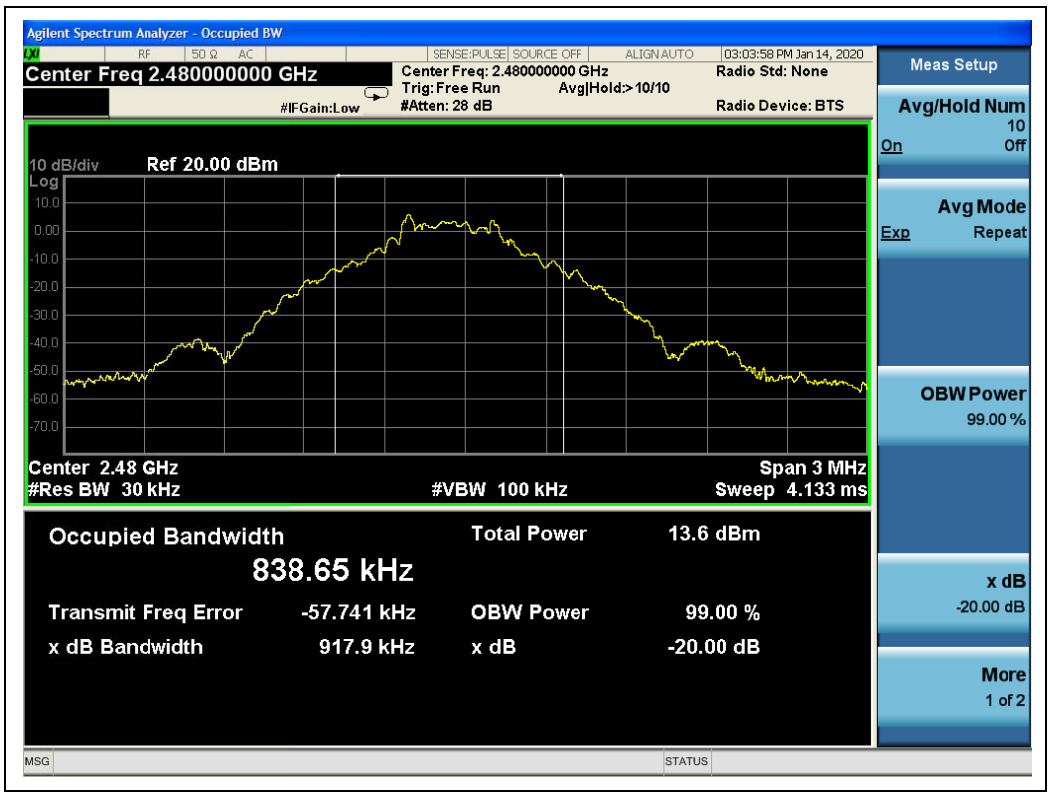
B. Test Plots:



(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 39, 2441MHz)



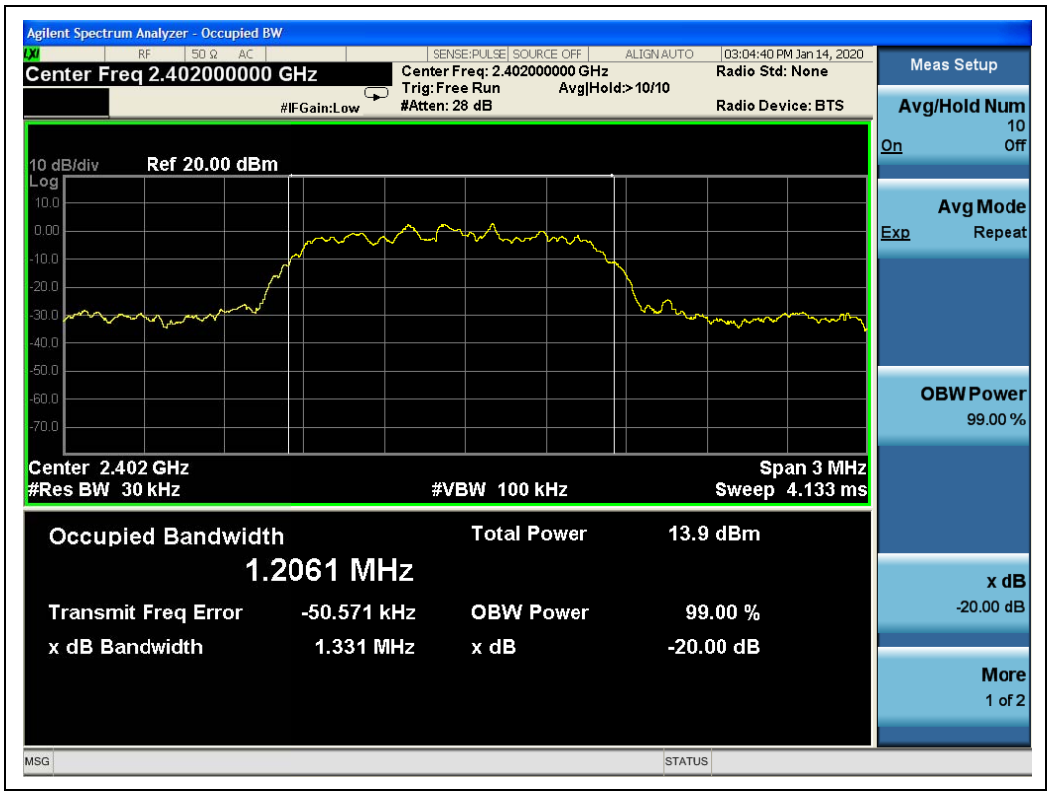
(GFSK, Channel 78, 2480MHz)

π/4-DQPSK Mode

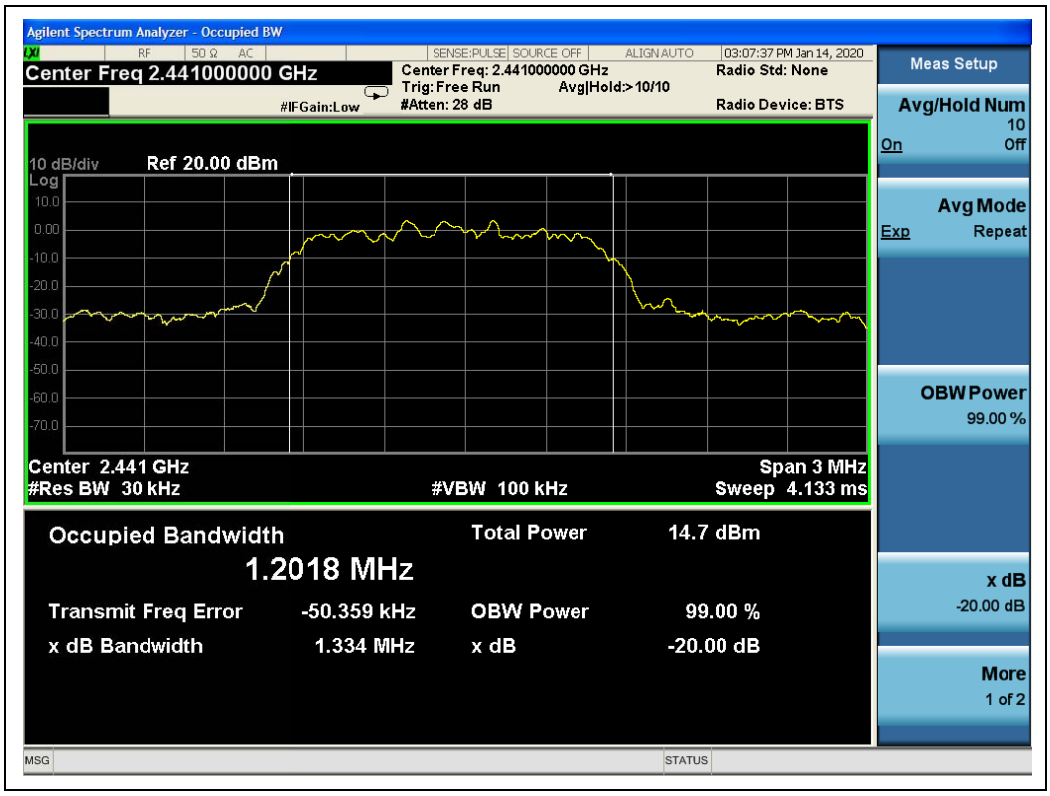
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.331	PASS
39	2441	1.334	PASS
78	2480	1.335	PASS

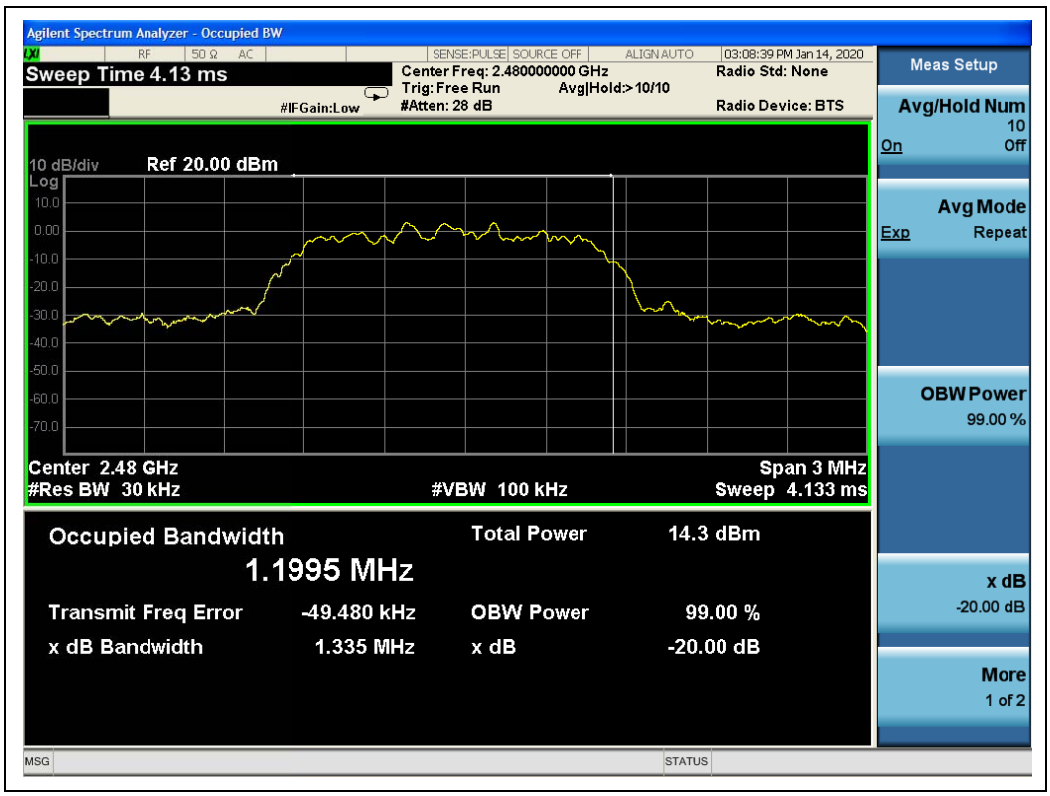
B. Test Plots:



(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)



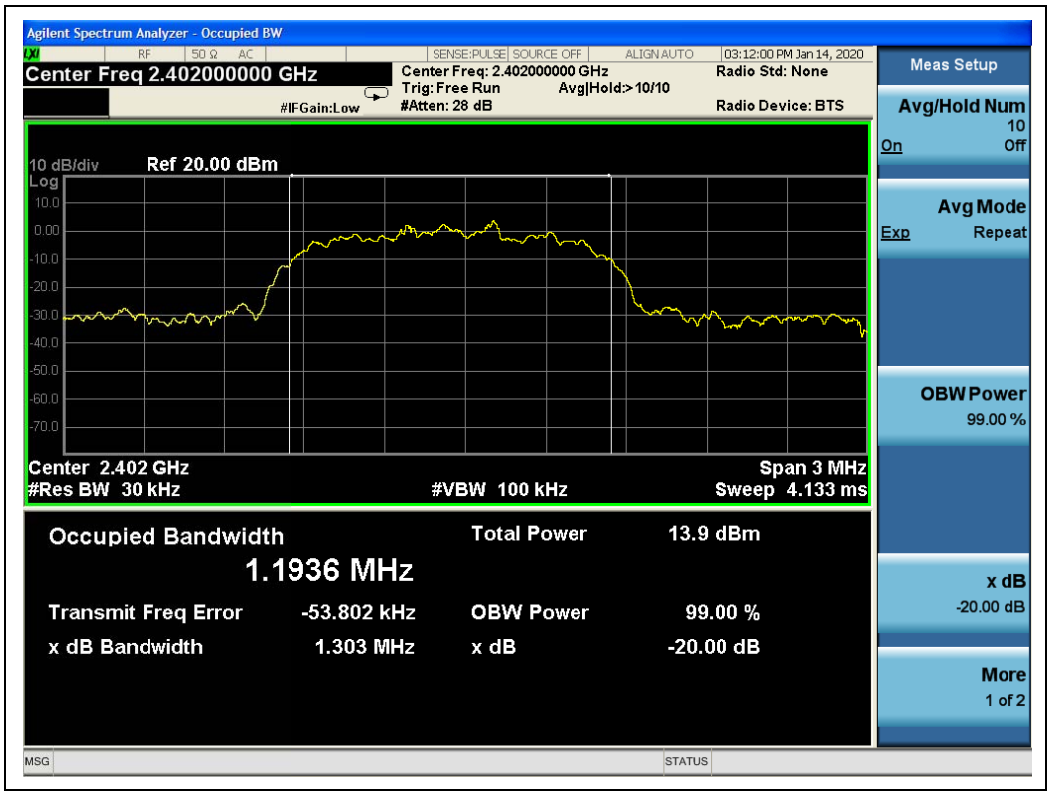
(π/4-DQPSK, Channel 78, 2480MHz)

8-DPSK Mode

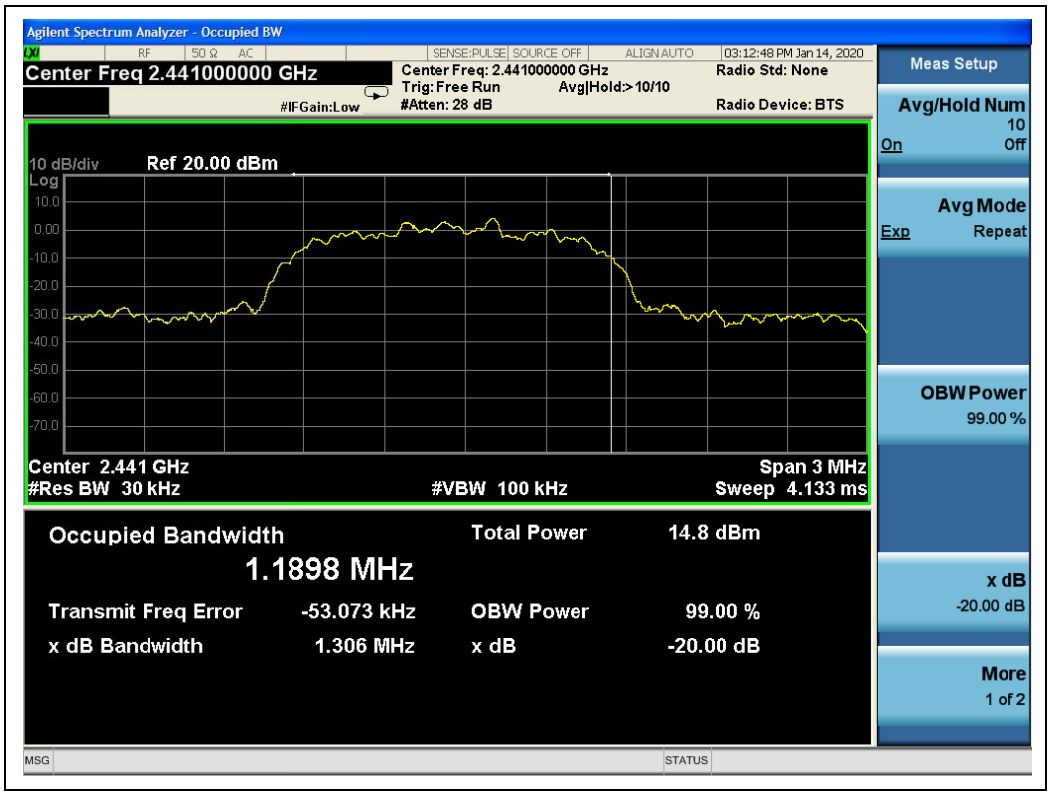
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.303	PASS
39	2441	1.306	PASS
78	2480	1.305	PASS

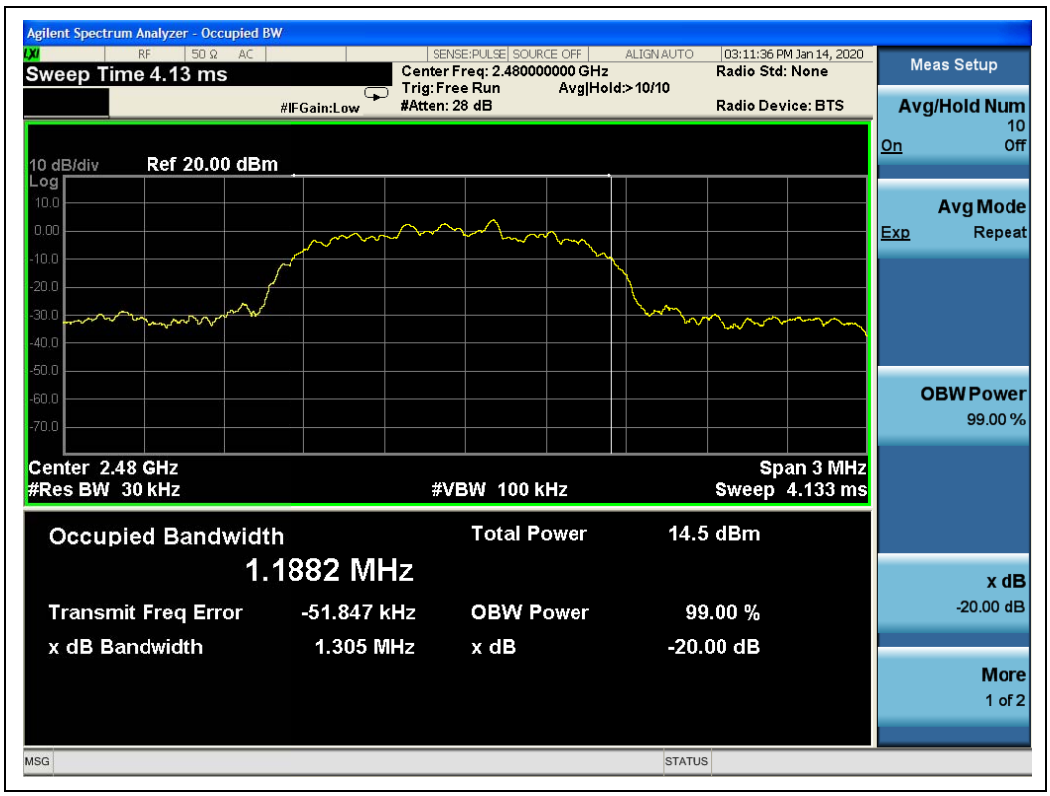
B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)



(8-DPSK, Channel 78, 2480MHz)

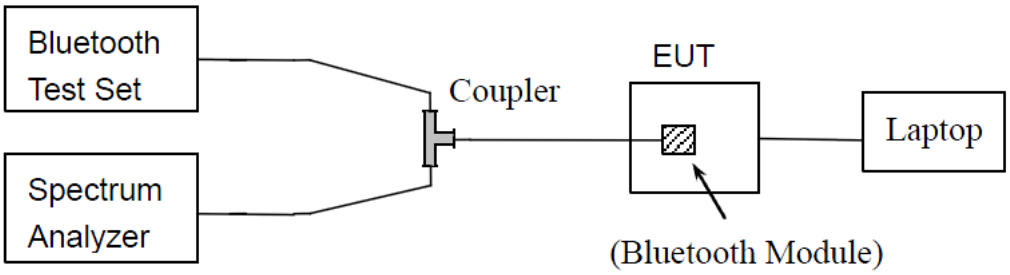
2.8. Carried Frequency Separation

2.8.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.8.2. Test Description

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.8.3. Test Procedure

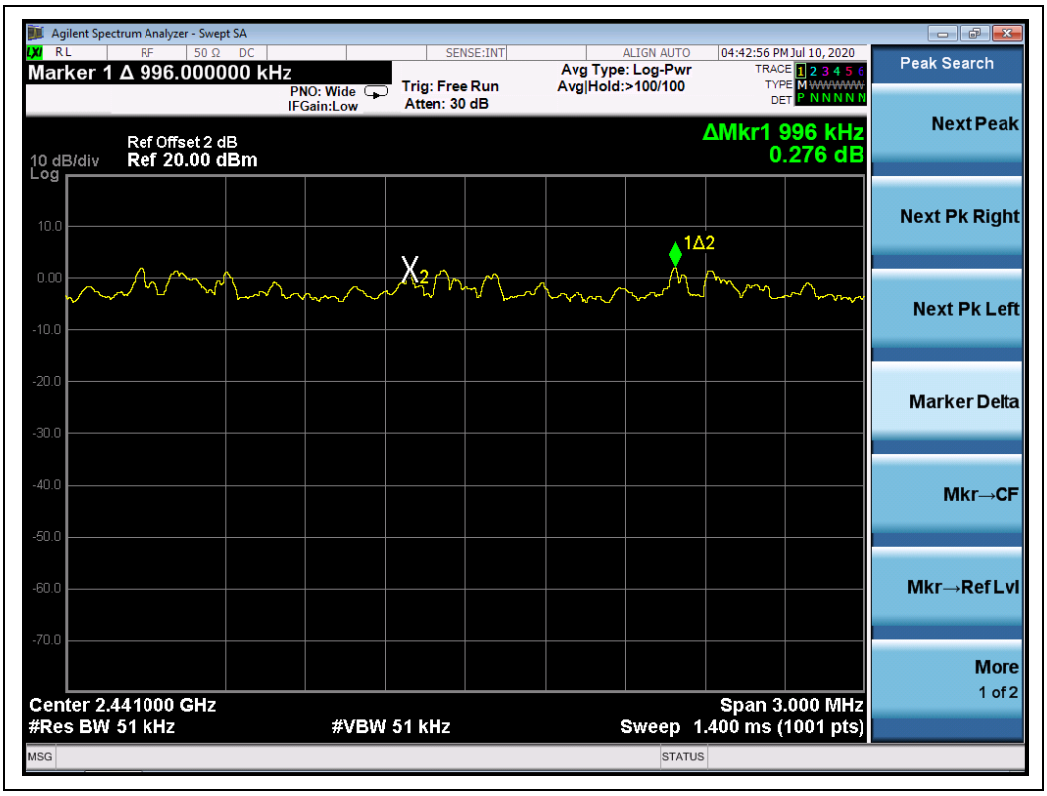
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

2.8.4. Test Result

The Bluetooth Module operates at hopping-on test mode. For any adjacent channels (e.g. the channel 39 and 40 as showed below), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 2.4.4), whichever is greater. So, the verdict is PASSING.

Test Mode	Measured Channel Numbers	Carried Frequency Separation	20dB bandwidth (MHz)	Min. Limit	Verdict
GFSK	39 and 40	1.176	0.923	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	0.996	1.335		PASS
8-DPSK	39 and 40	-0.906	1.306		PASS

(GFSK)



(π/4-DQPSK)

(8-DPSK)

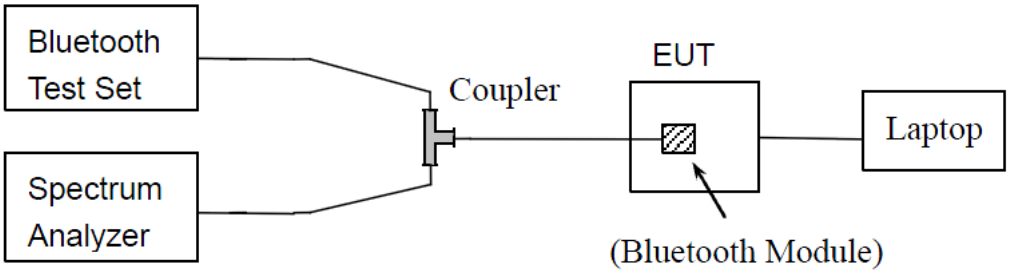
2.9. Time of Occupancy (Dwell time)

2.9.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.9.2. Test Description

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.9.3. Test Procedure

Option 1:
DH1: Dwell time equal to Pulse time (ms) *(1600 / 2 /79)*31.6 Millisecond DH3: Dwell time equal to Pulse time (ms) * (1600 /4 /79) *31.6 Millisecond DH5: Dwell time equal to Pulse Time (ms)* (1600 / 6 /79) *31.6 Millisecond
AFH Mode:
DH1: Dwell time equal to Pulse time (ms) *(800 / 2 /20)*(0.4*20) Millisecond DH3: Dwell time equal to Pulse time (ms) * (800 / 4 /20)*(0.4*20) Millisecond DH5: Dwell time equal to Pulse Time (ms)* (800 / 6 /20)*(0.4*20) Millisecond

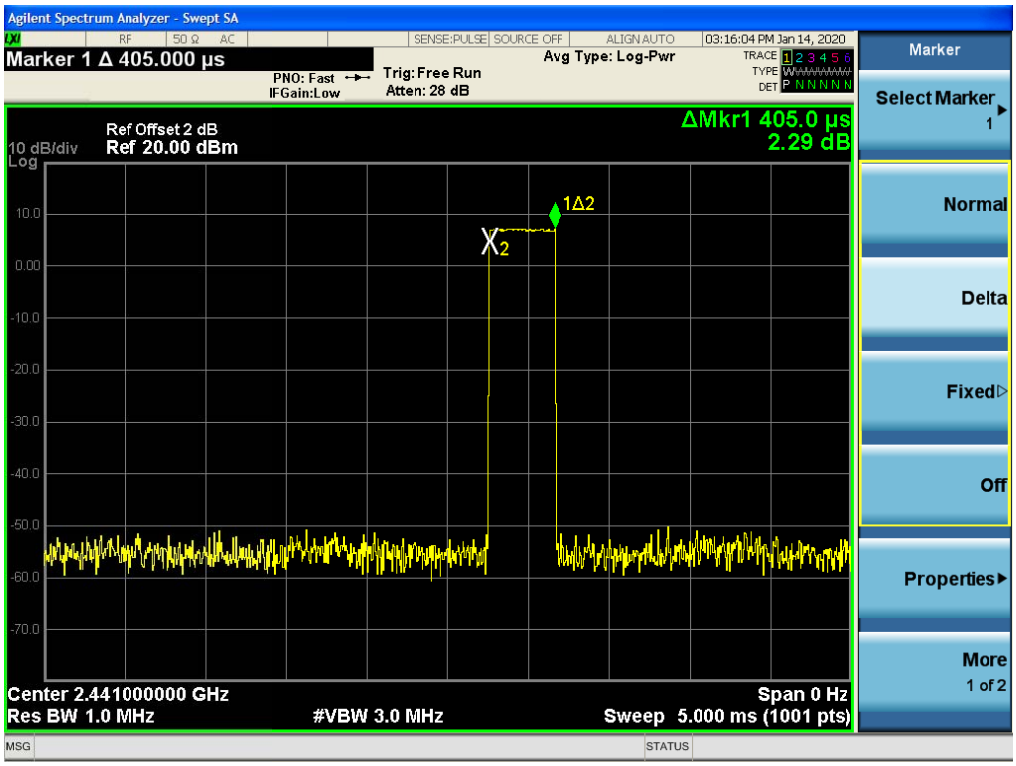
2.9.4. Test Result

GFSK Mode

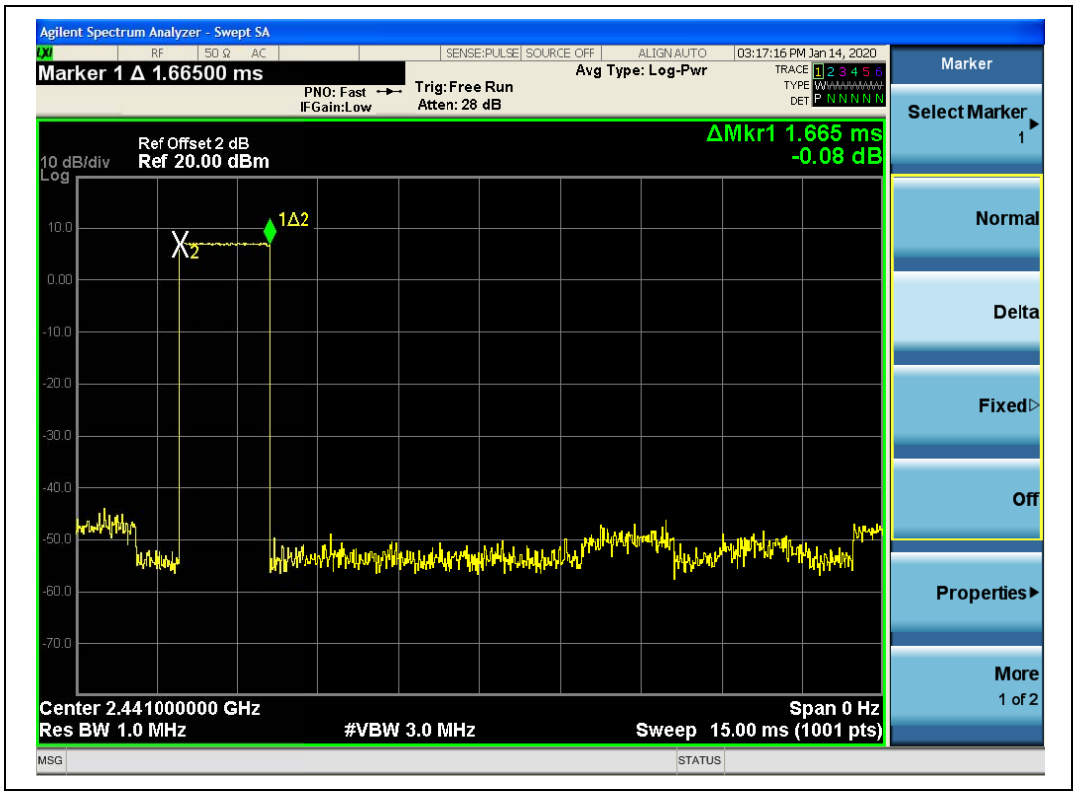
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.405	129.60	64.80	0.4	PASS
DH3	1.655	264.80	132.40		PASS
DH5	2.910	310.40	155.20		PASS

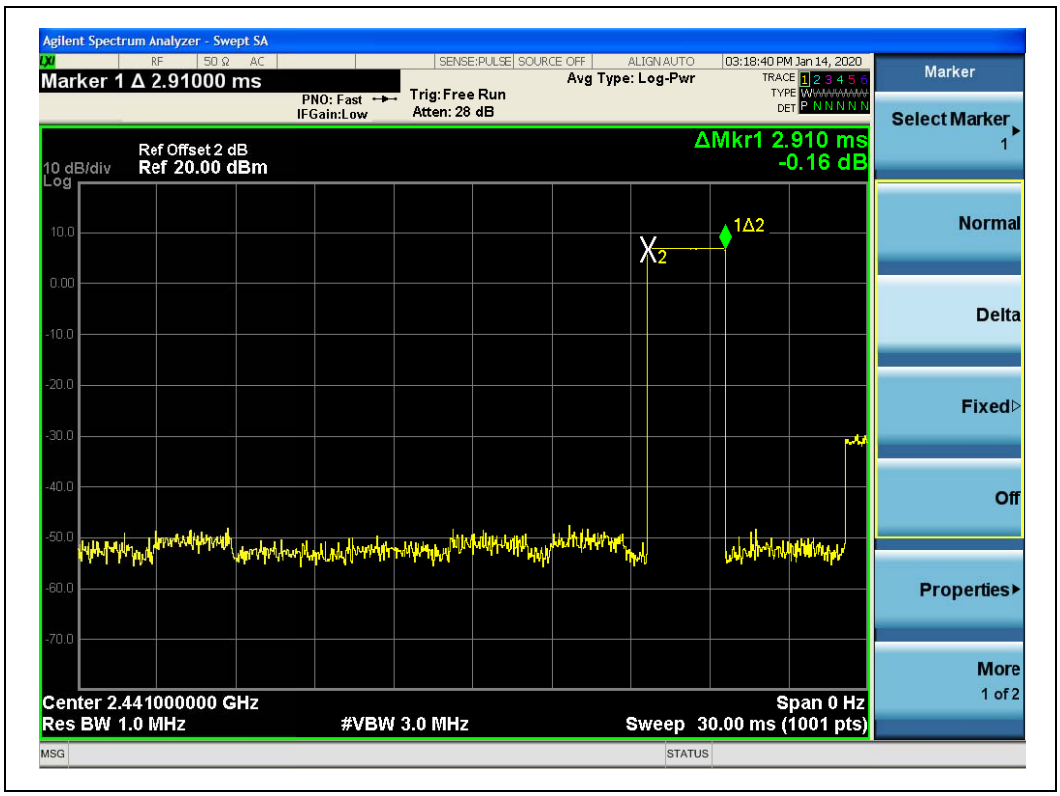
B. Test Plots:



(DH1, GFSK)



(DH3, GFSK)



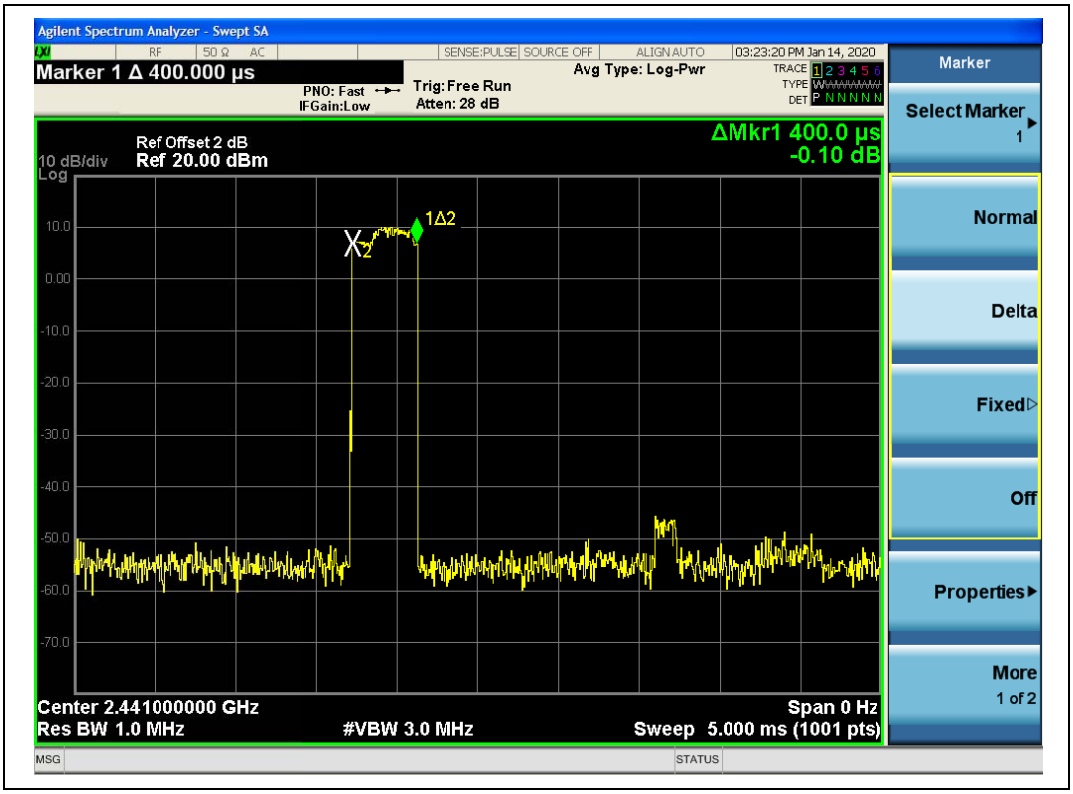
(DH5, GFSK)

π/4-DQPSK Mode

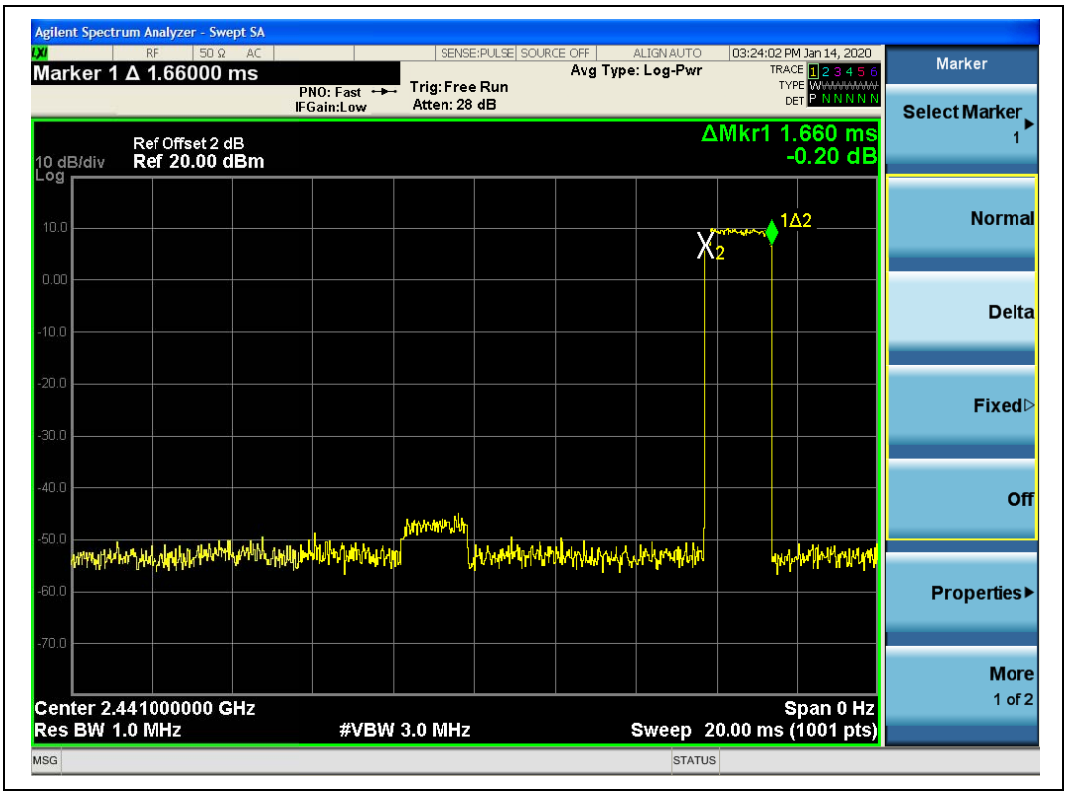
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.400	128.00	64.00	0.4	PASS
DH3	1.660	265.60	132.80		PASS
DH5	2.910	310.40	155.20		PASS

B. Test Plots:



(DH1, π/4-DQPSK)



(DH3, π/4-DQPSK)

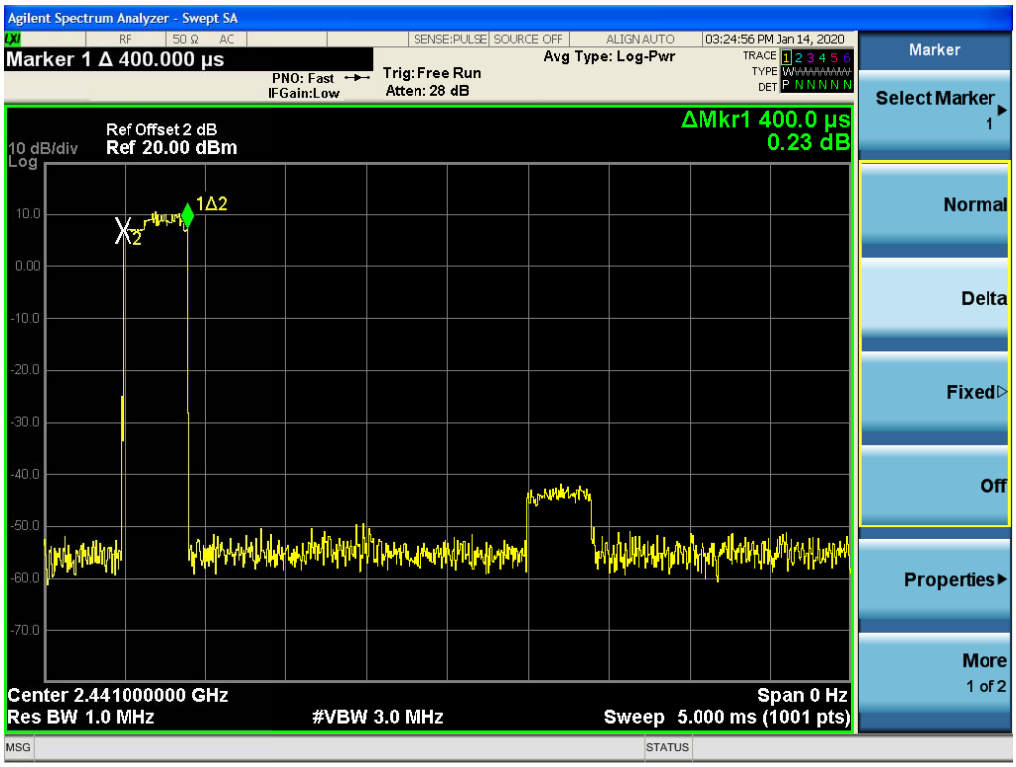
(DH5, π/4-DQPSK)

8-DPSK mode

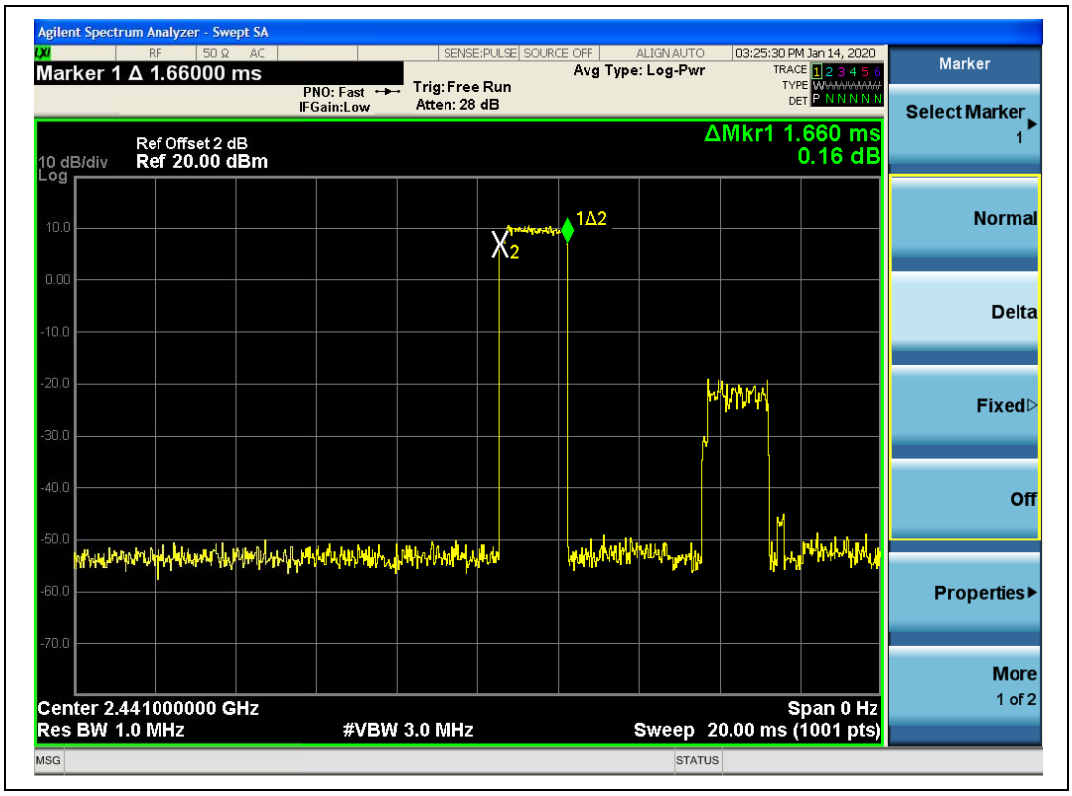
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.400	128.00	64.00	0.4	PASS
DH3	1.660	265.60	132.80		PASS
DH5	2.910	310.40	155.20		PASS

B. Test Plots:



(DH1, 8-DPSK)



(DH3, 8-DPSK)

(DH5, 8-DPSK)

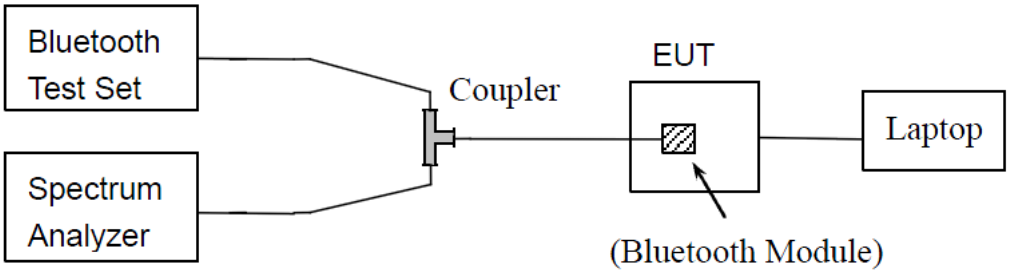
2.10. Conducted Spurious Emissions

2.10.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.10.2. Test Description

Test Setup:



The Bluetooth Module of the EUT is coupled to the Spectrum Analyzer (SA) and the Bluetooth Test Set through the coupler; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.10.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.10.4. Test Result

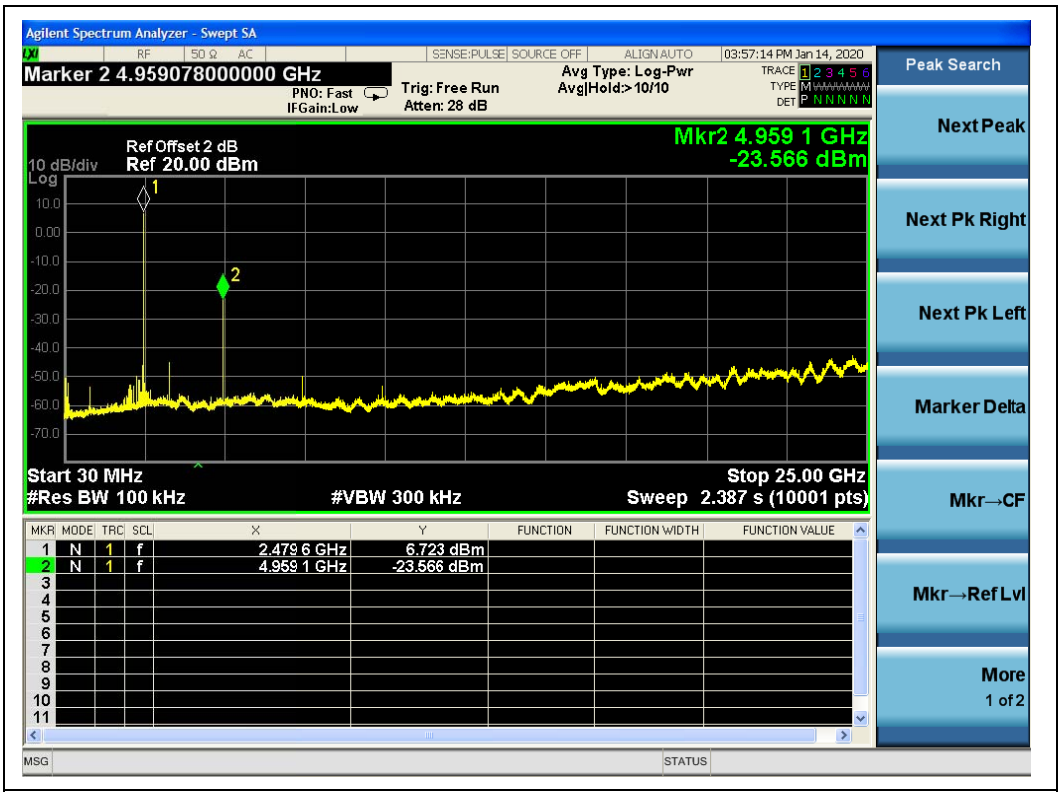
The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

GFSK Mode

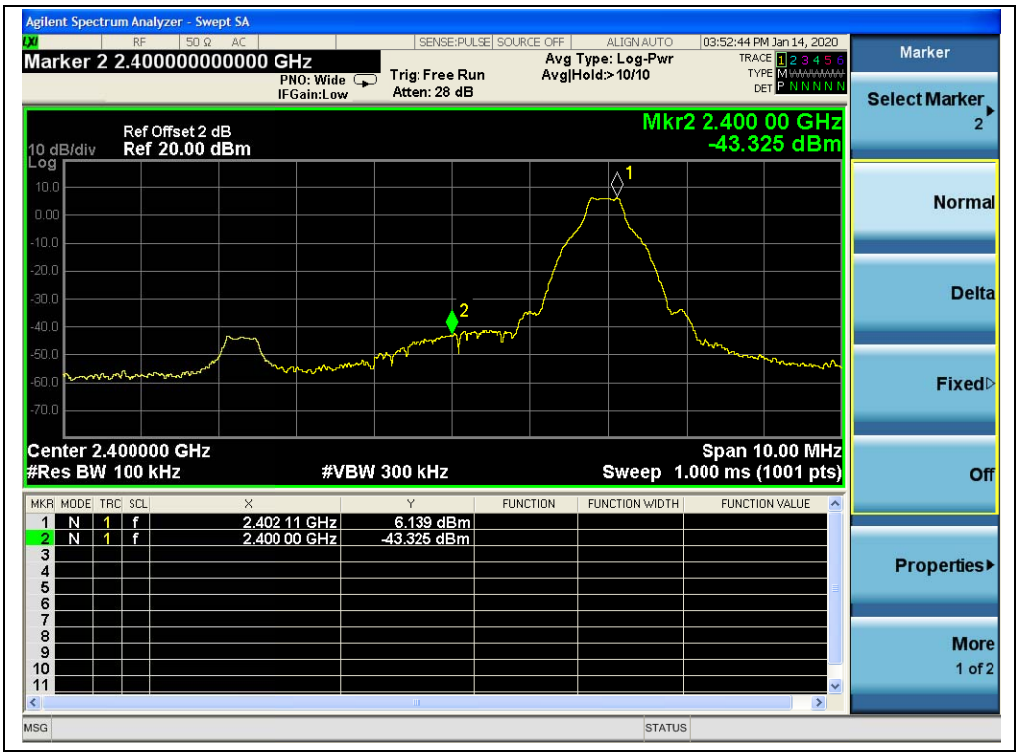
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-23.57	6.72	-13.28	PASS
39	2441	-24.48	6.68	-13.32	PASS
78	2480	-26.83	5.24	-14.76	PASS

B. Test Plots:

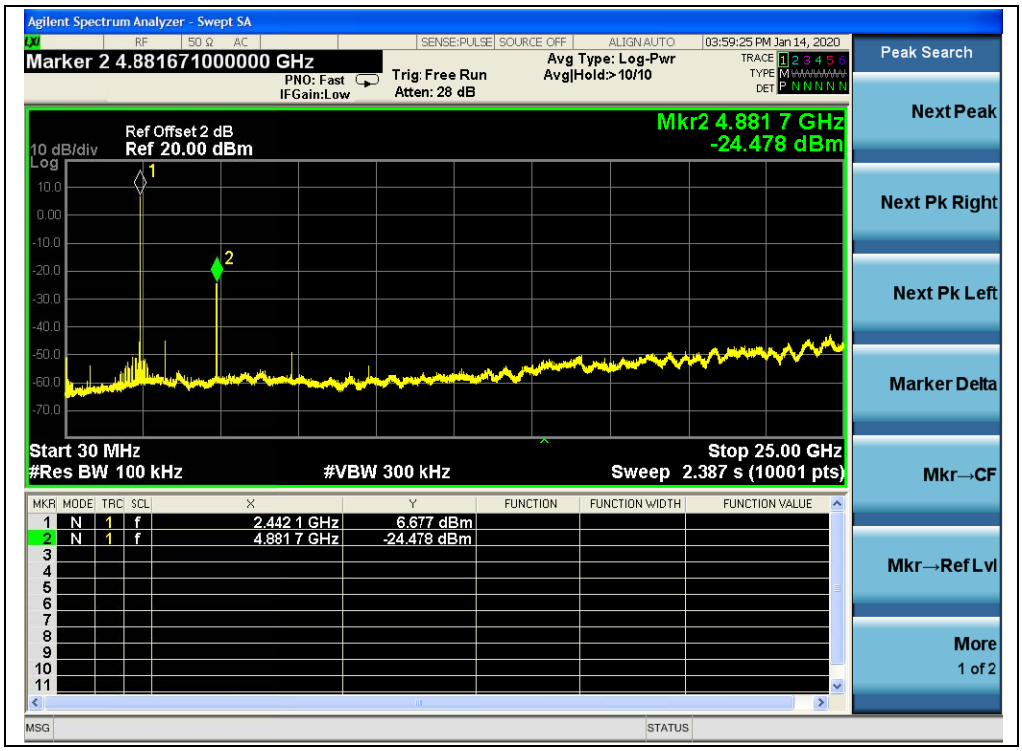


(Channel = 0, 30MHz to 25GHz, GFSK Mode)

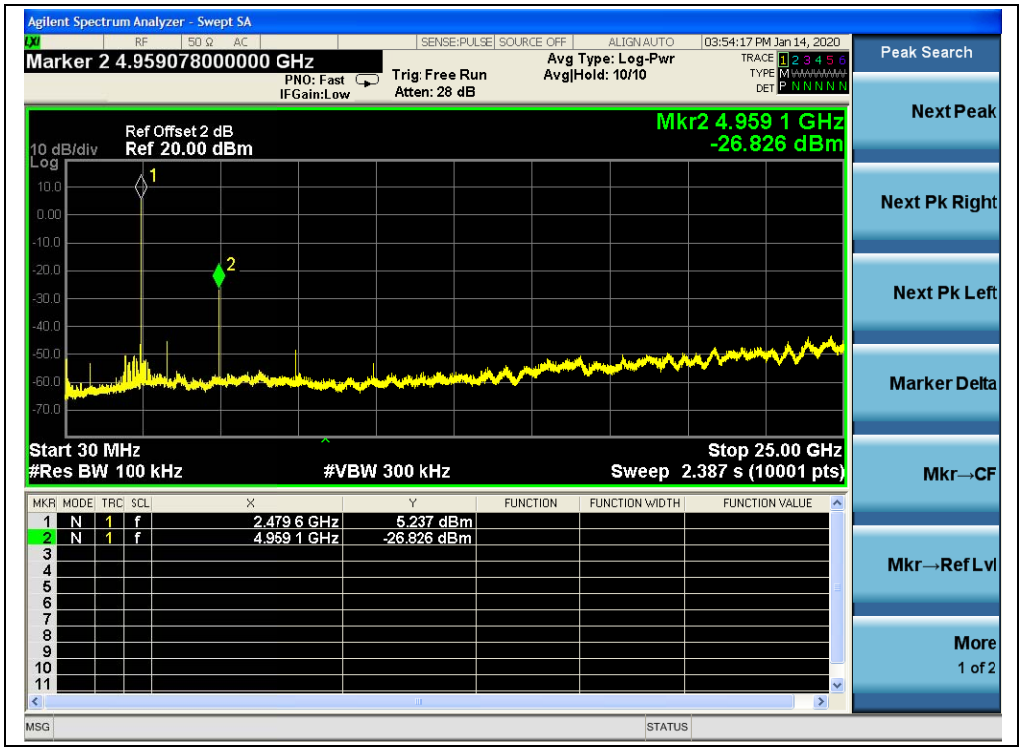


(Channel = 0, Band edge, GFSK Mode)

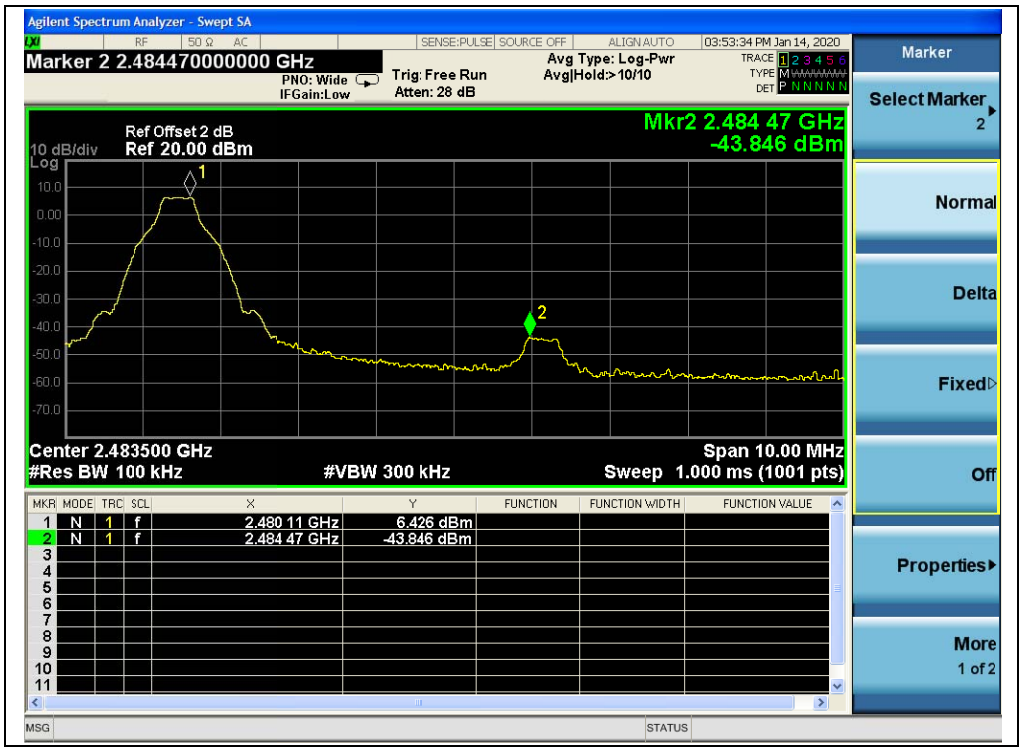
(Channel = 0, Band edge with hopping on, GFSK Mode)



(Channel = 39, 30MHz to 25GHz, GFSK Mode)



(Channel = 78, 30MHz to 25GHz, GFSK Mode)



(Channel = 78, Band edge, GFSK Mode)

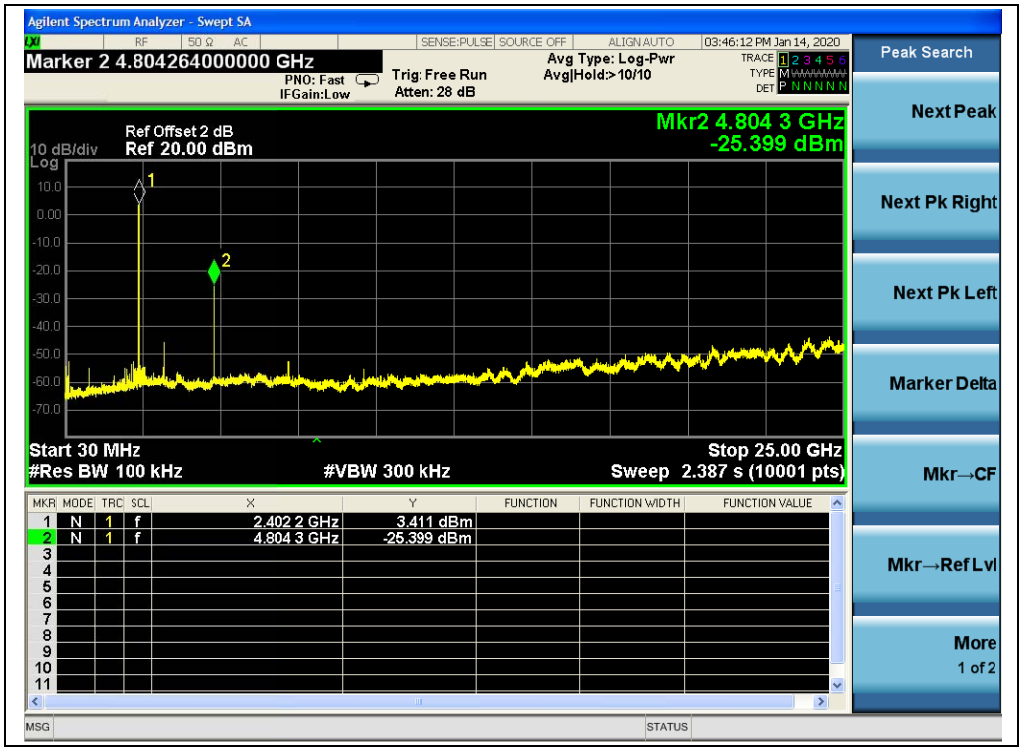
(Channel = 78, Band edge with hopping on, GFSK Mode)

π/4-DQPSK Mode

A. Test Verdict:

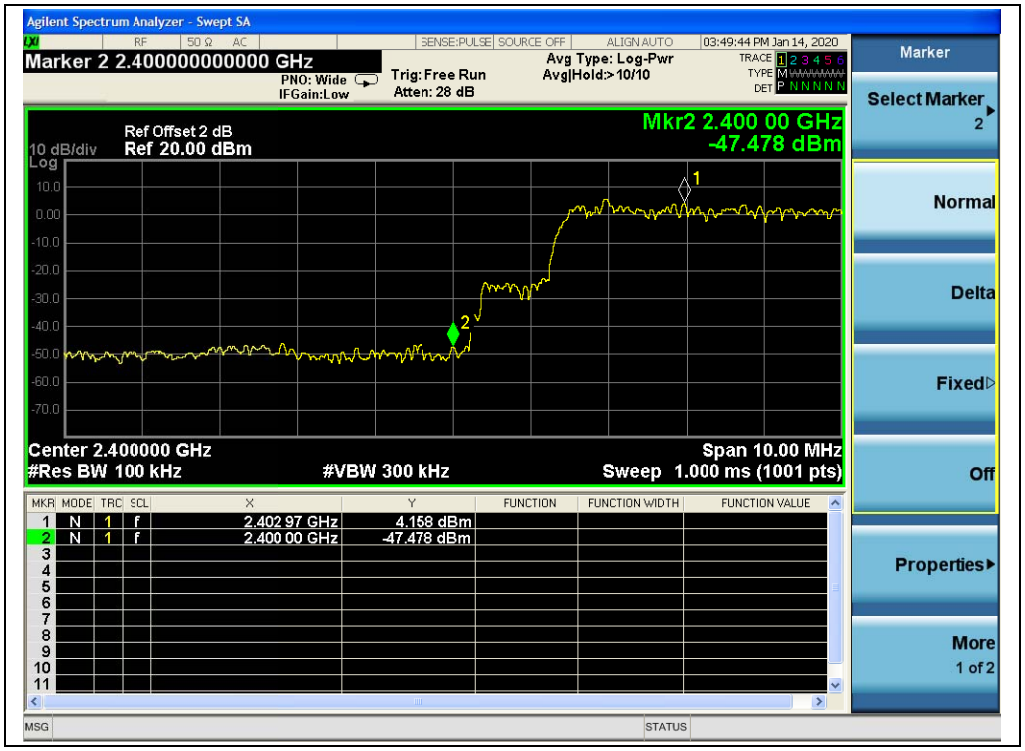
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-25.40	3.41	-16.59	PASS
39	2441	-25.76	3.03	-16.97	PASS
78	2480	24.52	5.87	-14.13	PASS

B. Test Plots:

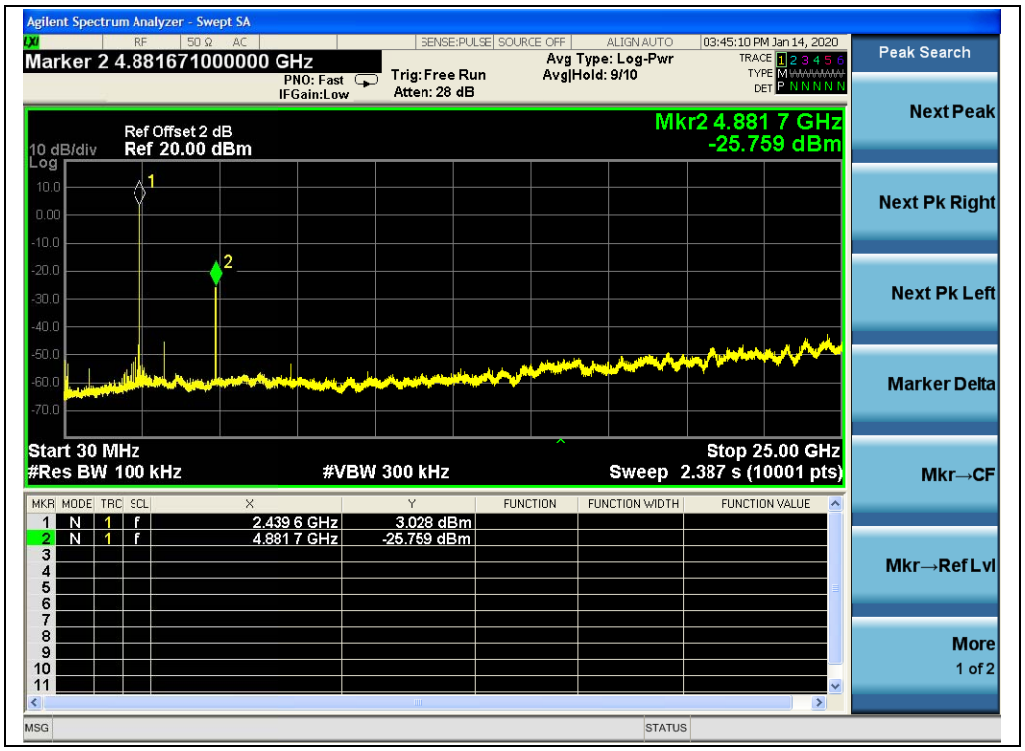


(Channel = 0, 30MHz to 25GHz, π/4-DQPSK)

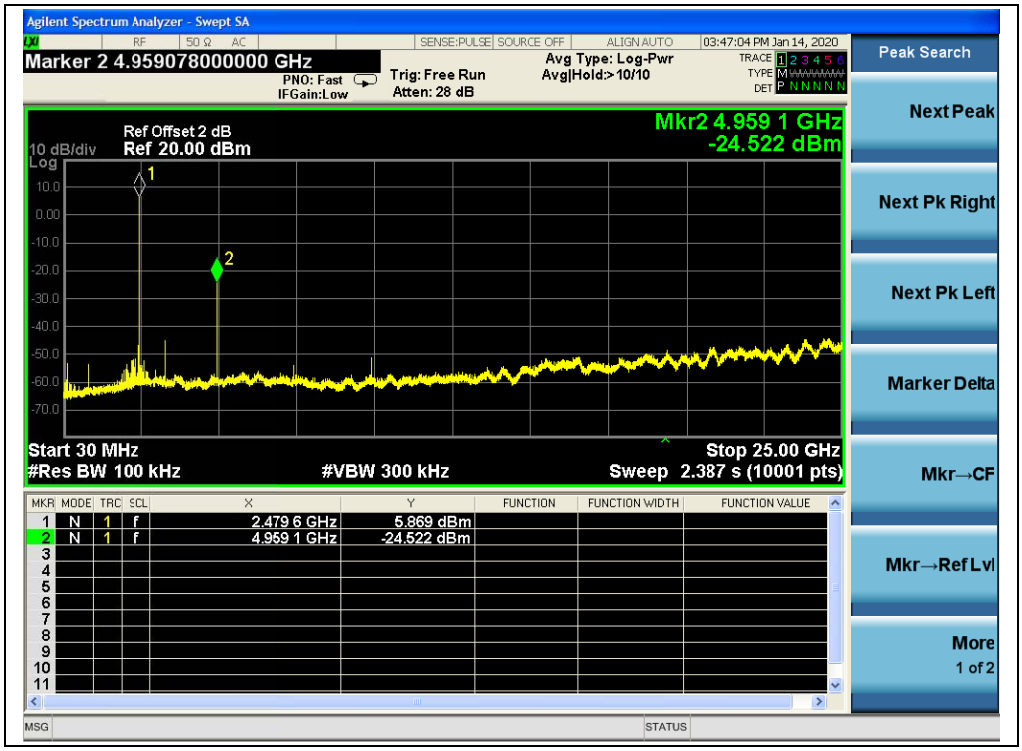
(Channel = 0, Band edge, π/4-DQPSK)



(Channel = 0, Band edge with hopping on, π/4-DQPSK)



(Channel = 39, 30MHz to 25GHz, π/4-DQPSK)



(Channel = 78, 30MHz to 25GHz, π/4-DQPSK)

(Channel = 78, Band edge, π/4-DQPSK)

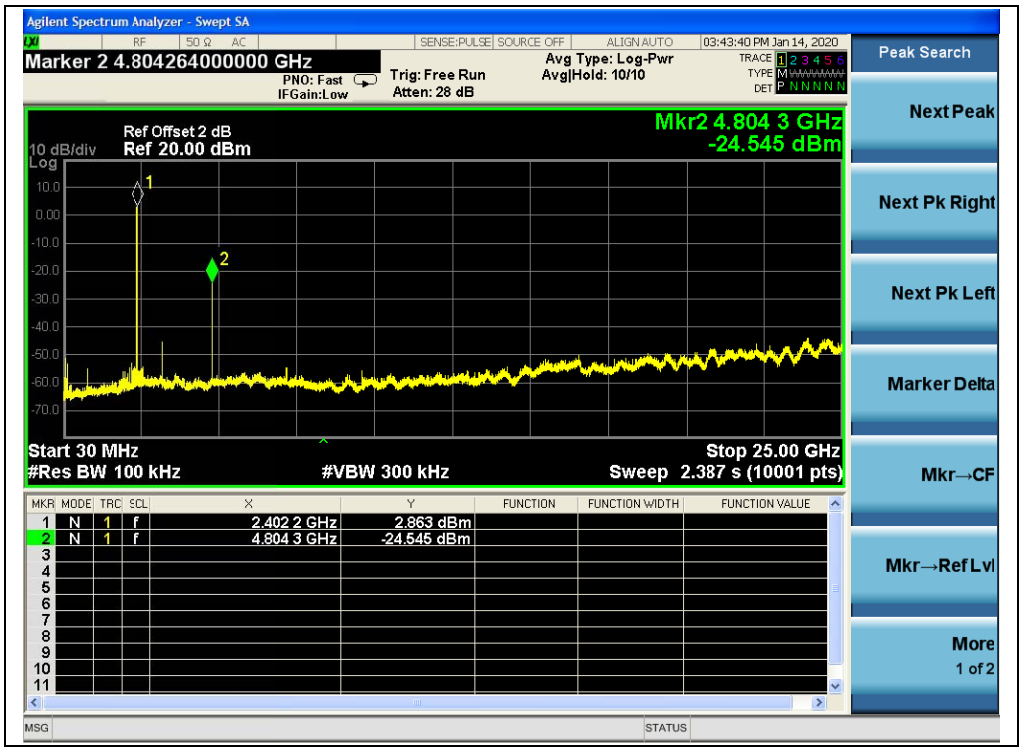
(Channel = 78, Band edge with hopping on, π/4-DQPSK)

8-DPSK Mode

A. Test Verdict:

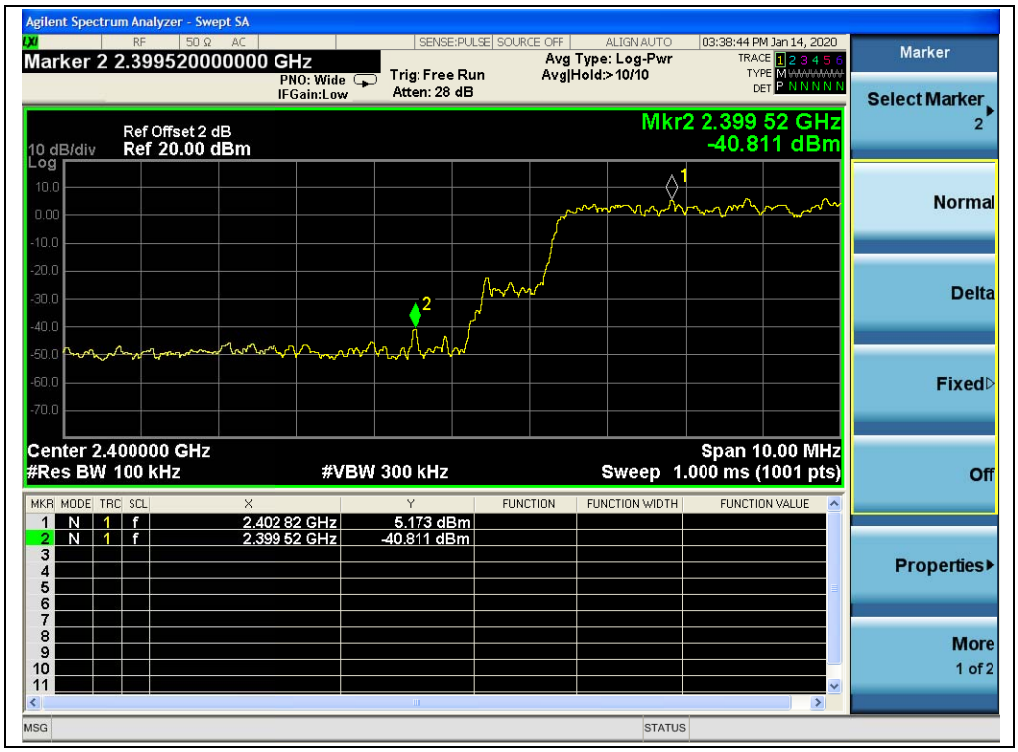
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-24.55	2.83	-17.17	PASS
39	2441	-23.66	4.15	-15.85	PASS
78	2480	-24.83	3.84	-16.16	PASS

B. Test Plots:

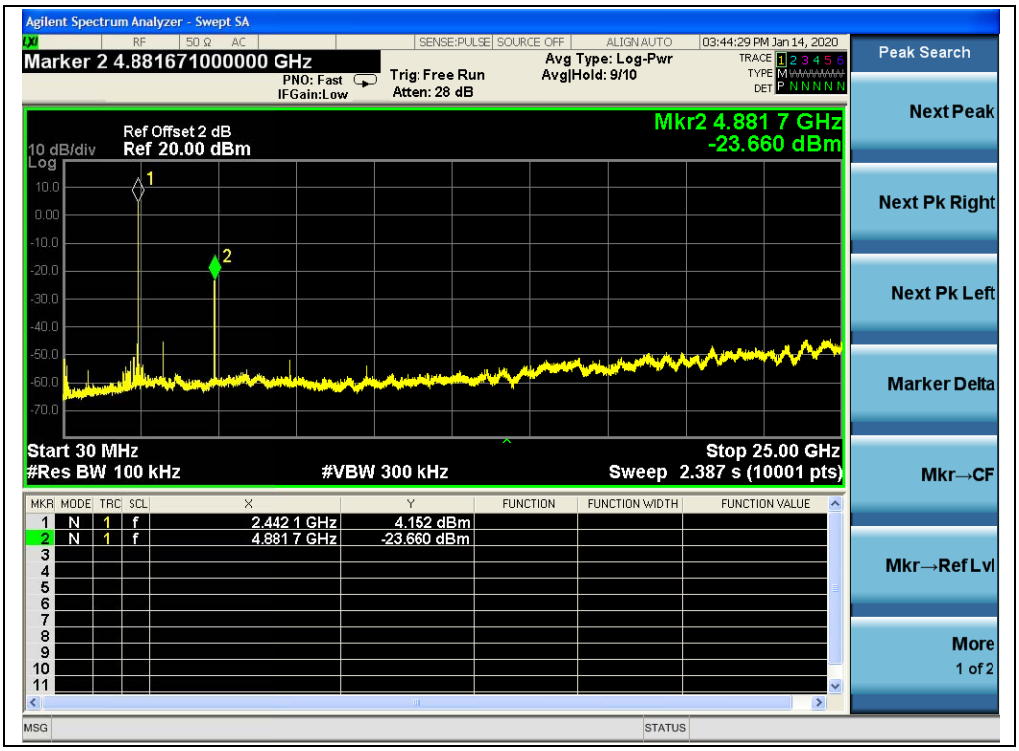


(Channel = 0, 30MHz to 25GH, 8-DPSK)

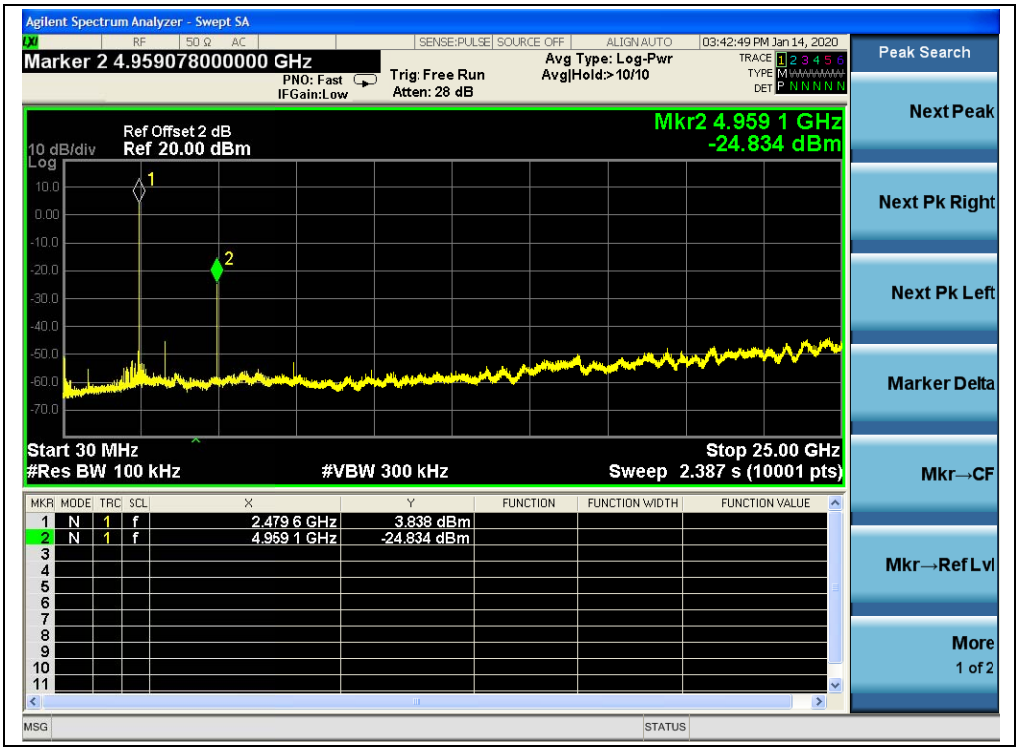
(Channel = 0, Band edge, 8-DPSK)



(Channel = 0, Band edge with hopping on, 8-DPSK)



(Channel = 39, 30MHz to 25GHz, 8-DPSK)



(Channel = 78, 30MHz to 25GH, 8-DPSK)

(Channel = 78, Band edge, 8-DPSK)

(Channel = 78, Band edge with hopping on, 8-DPSK)

2.11. Conducted Emission

2.11.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

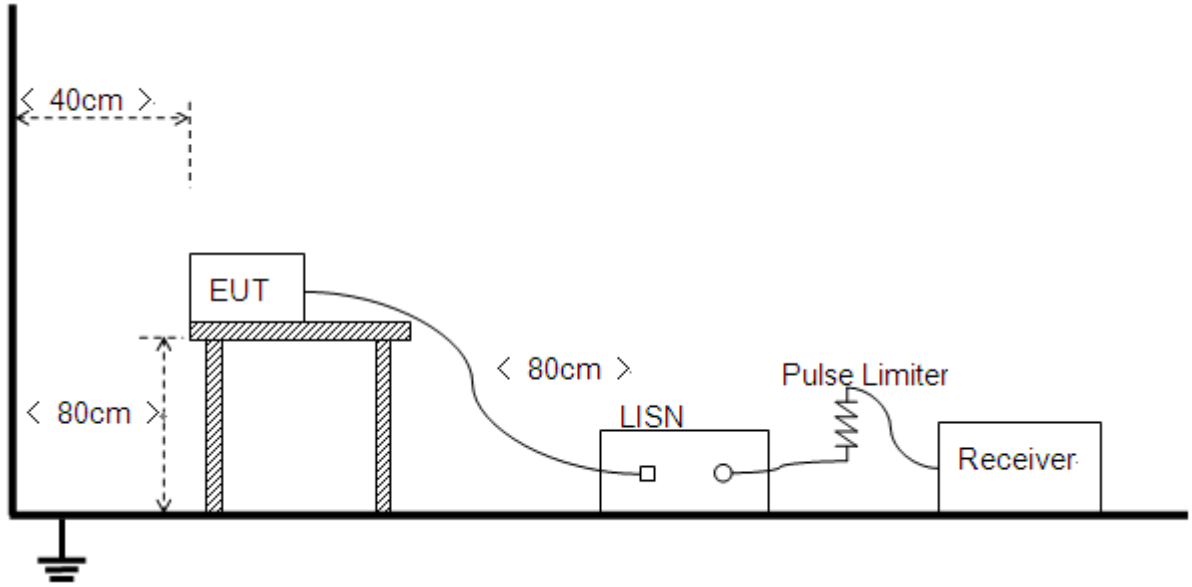
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.11.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.11.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test Setup:

Test Mode: EUT+ADAPTER + EDR TX

Test voltage: AC 120V/60Hz

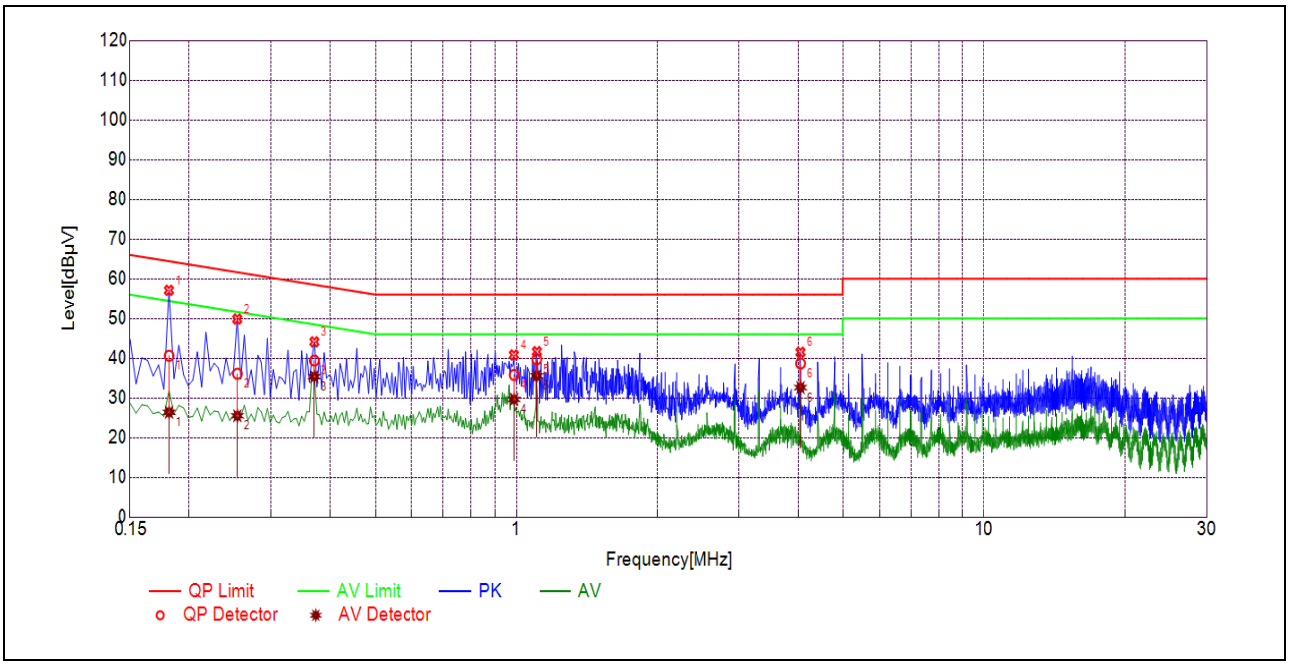
The measurement results are obtained as below:

E [dBμV] $=U_R + L_{Cable\ loss}$ [dB] + A_{Factor}

U_R: Receiver Reading

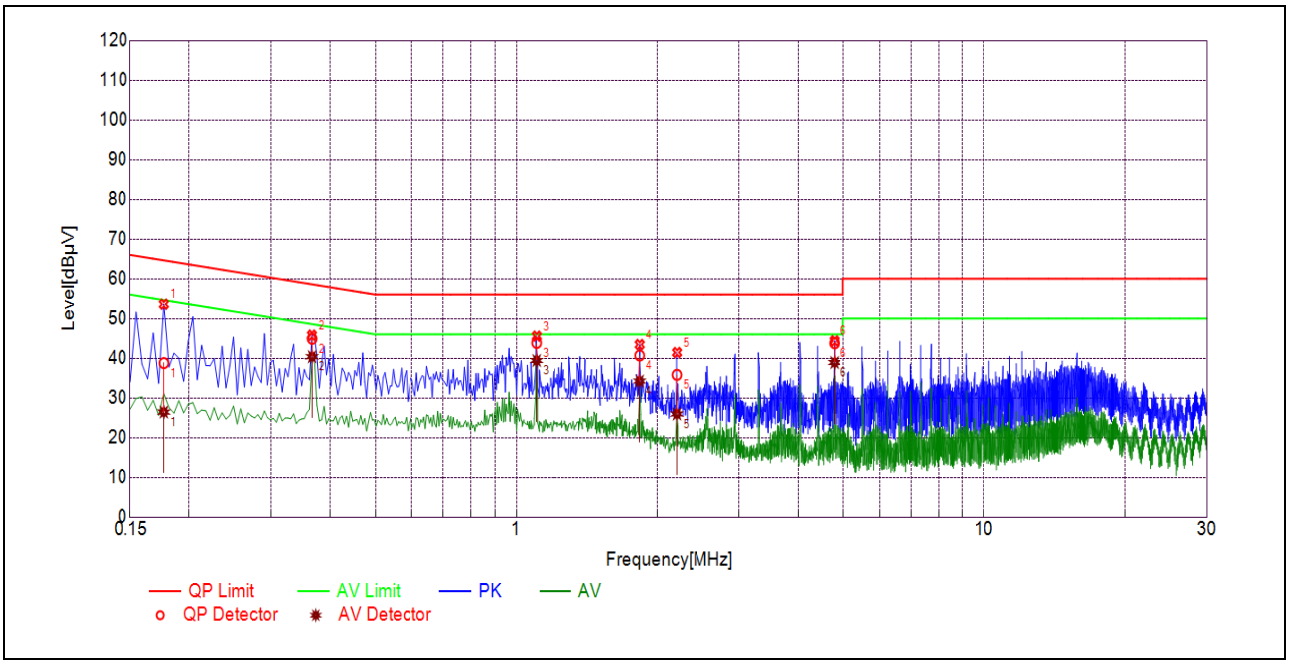
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1816	40.62	26.38	64.41	54.41	Line	PASS
2	0.2537	36.09	25.50	61.63	51.63		PASS
3	0.3703	39.40	35.35	58.49	48.49		PASS
4	0.9880	35.78	29.63	56.00	46.00		PASS
5	1.1031	39.75	35.55	56.00	46.00		PASS
6	4.0472	38.67	32.61	56.00	46.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1770	38.76	26.43	64.62	54.62	Neutral	PASS
2	0.3663	44.91	40.38	58.58	48.58		PASS
3	1.1029	43.86	39.42	56.00	46.00		PASS
4	1.8369	40.69	34.23	56.00	46.00		PASS
5	2.2050	35.80	25.95	56.00	46.00		PASS
6	4.7784	43.78	38.91	56.00	46.00		PASS

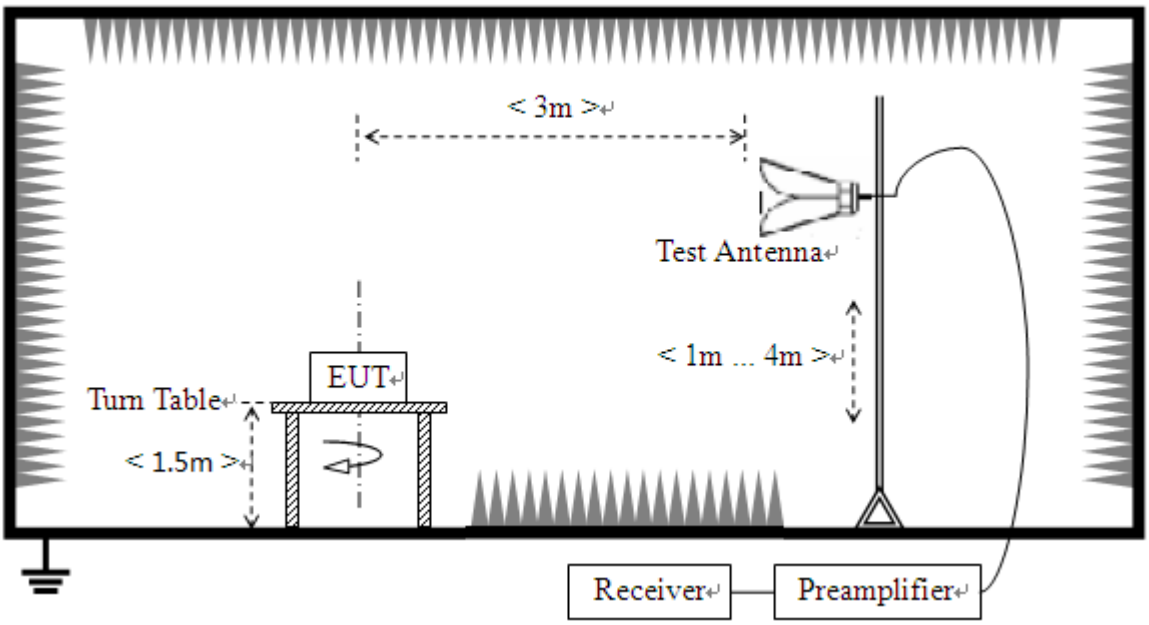
2.12. Restricted Frequency Bands

2.12.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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).

2.12.2. Test Description

Test Setup:



The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under non hopping-on test mode transmitting 339 bytes DH5, 679 bytes 2DH5 and 1021 bytes 3DH5 packages at maximum power.
For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

2.12.3. Test Procedure

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz, 100 KHz for f < 1GHz
VBW = 3 MHz for peak and 10Hz for average
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.12.4. Test Result

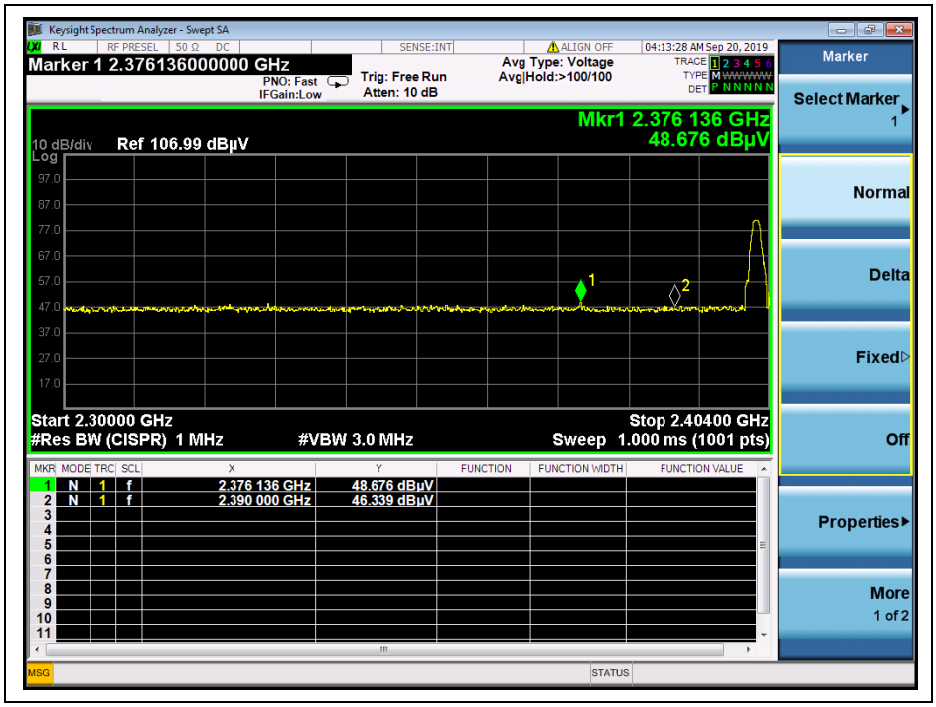
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; AT $=L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain
AFactor: Antenna Factor at 3m
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

GFSK Mode

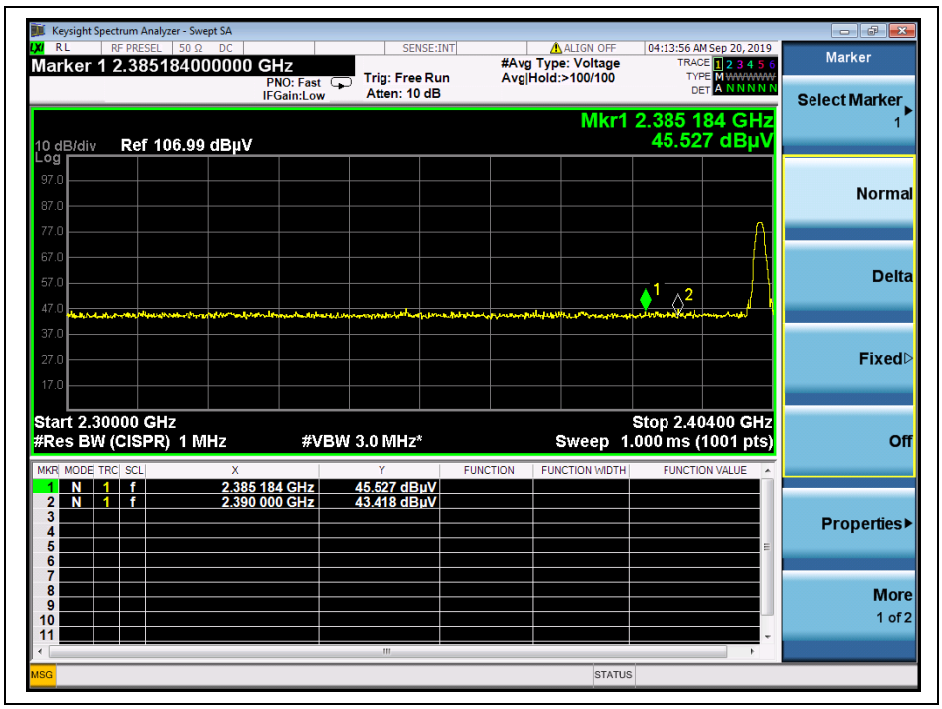
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2376.14	PK	48.68	-29.67	32.56	51.57	74	PASS
0	2385.18	AV	45.53	-29.67	32.56	48.42	54	PASS
78	2486.18	PK	47.80	-29.67	32.56	50.69	74	PASS
78	2485.13	AV	45.60	-29.67	32.56	48.49	54	PASS

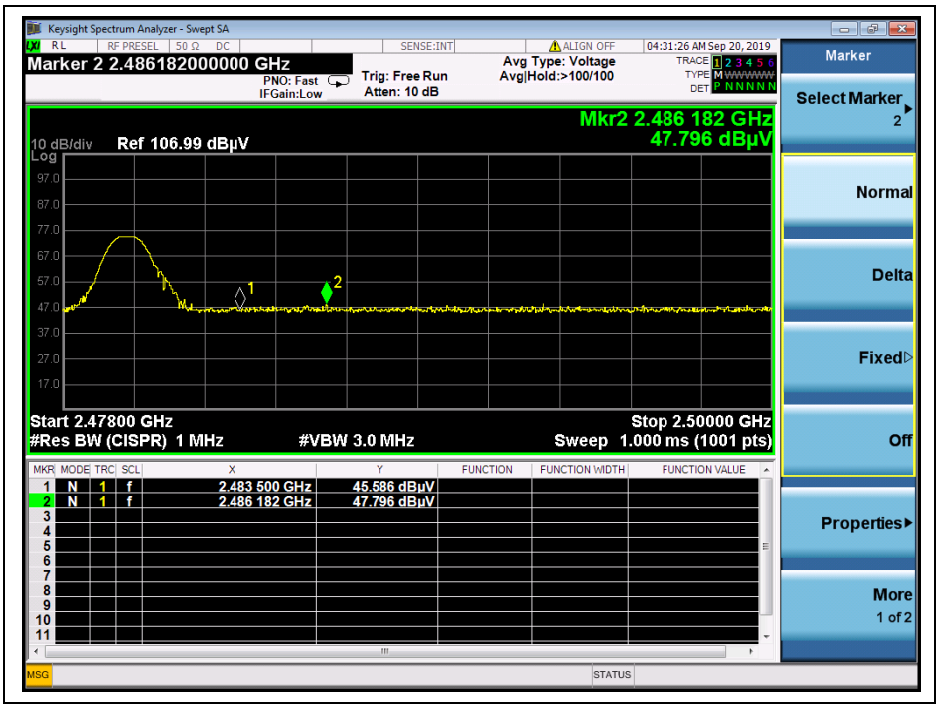
B. Test Plots:



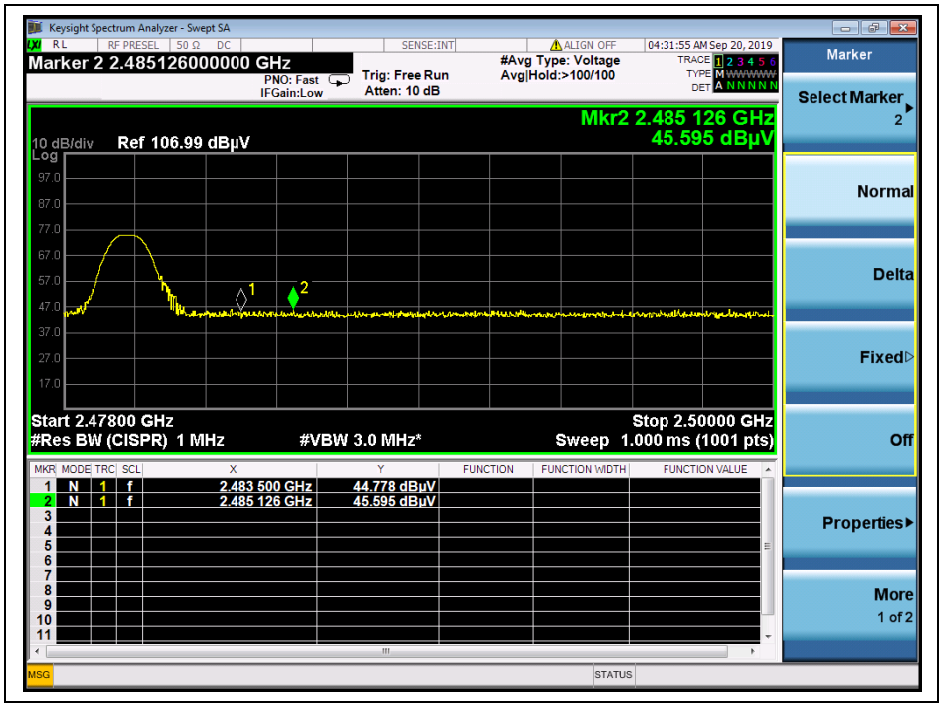
(PEAK, Channel = 0, GFSK)



(AVERAGE, Channel = 0, GFSK)



(PEAK, Channel = 78, GFSK)



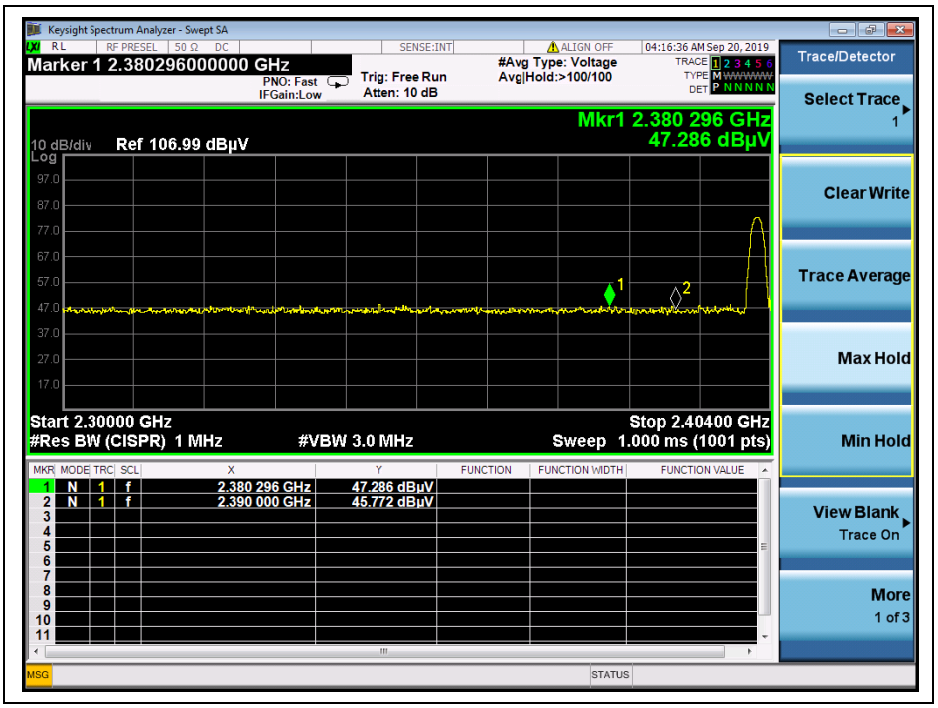
(AVERAGE, Channel = 78, GFSK)

π/4-DQPSK Mode

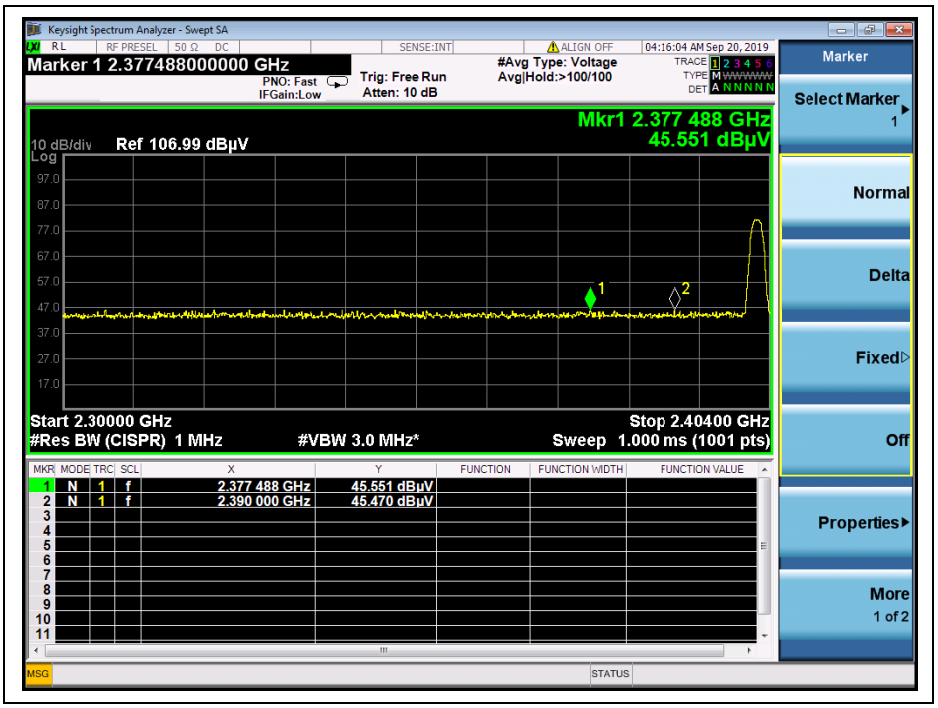
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2380.30	PK	47.29	-29.67	32.56	50.18	74	PASS
0	2377.49	AV	45.55	-29.67	32.56	48.44	54	PASS
78	2484.44	PK	47.09	-29.67	32.56	49.98	74	PASS
78	2484.51	AV	45.43	-29.67	32.56	48.32	54	PASS

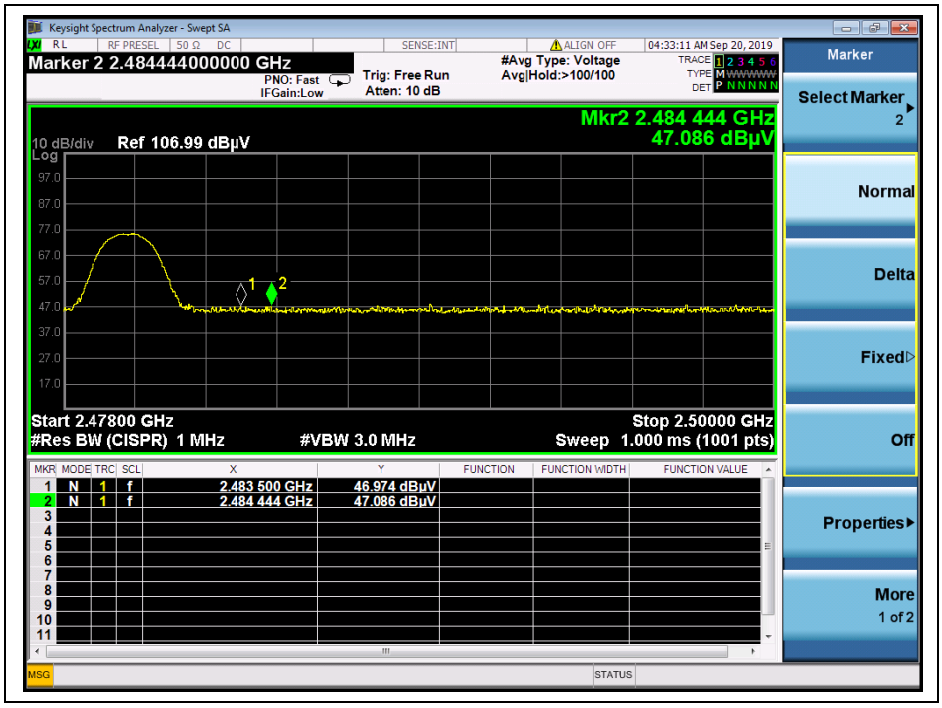
B. Test Plots:



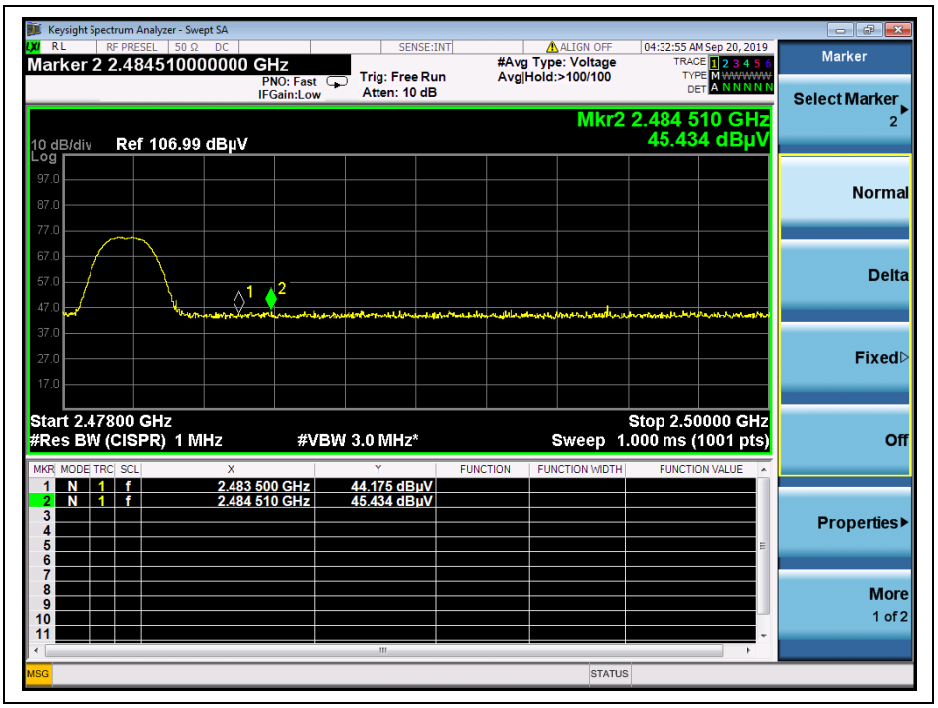
(PEAK, Channel = 0, π/4-DQPSK)



(AVERAGE, Channel = 0,π/4-DQPSK)



(PEAK, Channel = 78,π/4-DQPSK)



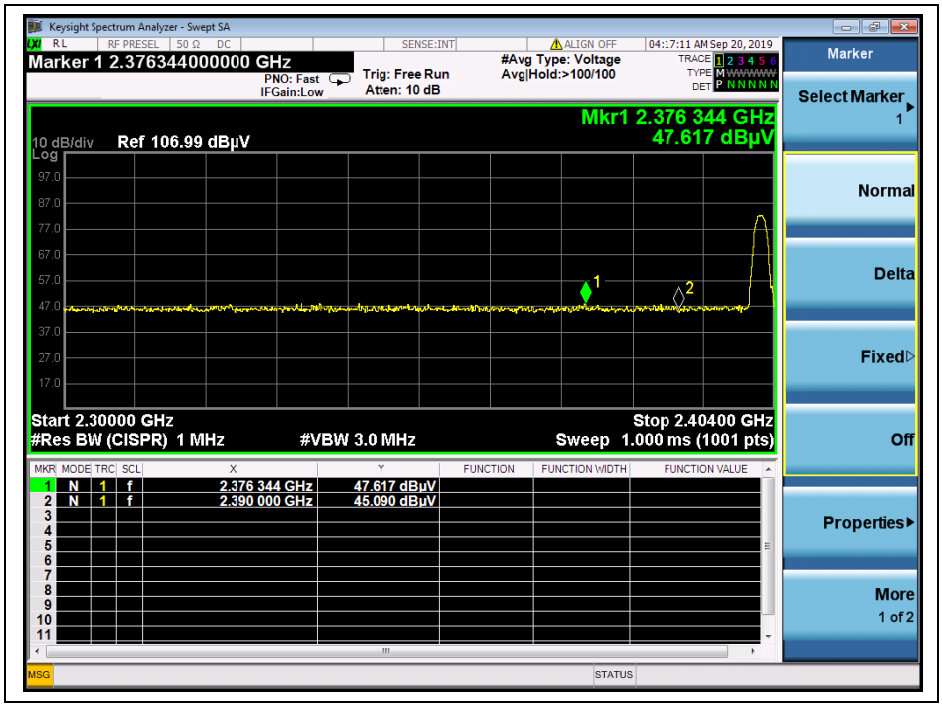
(AVERAGE, Channel = 78, π/4-DQPSK)

8-DPSK Mode

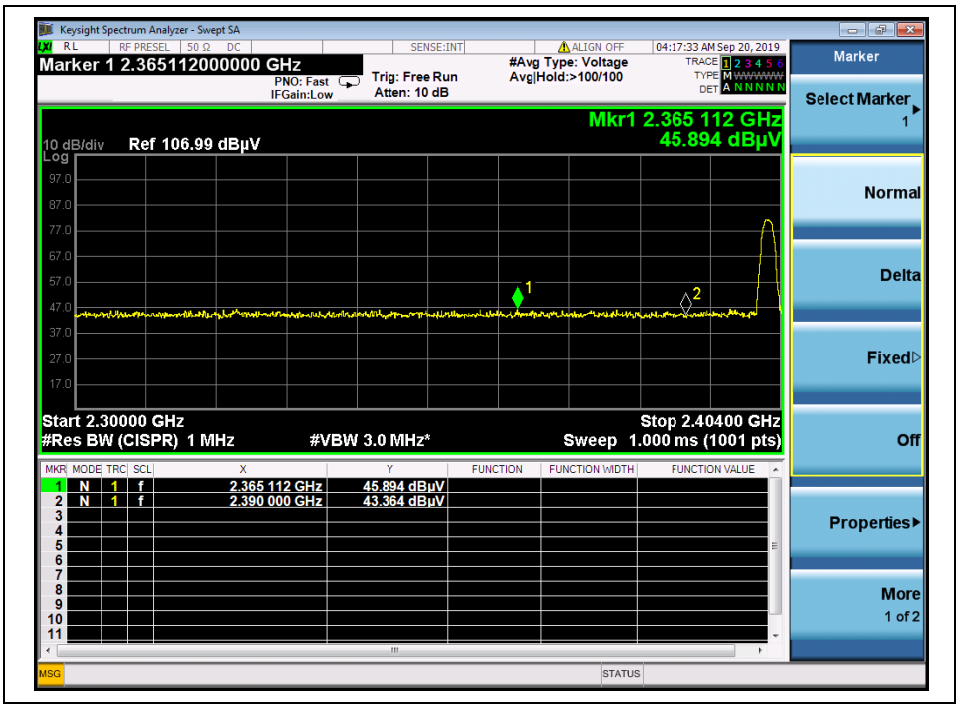
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2376.34	PK	47.62	-29.67	32.56	50.51	74	PASS
0	2365.11	AV	45.89	-29.67	32.56	48.78	54	PASS
78	2484.16	PK	47.22	-29.67	32.56	50.11	74	PASS
78	2483.50	AV	45.44	-29.67	32.56	48.33	54	PASS

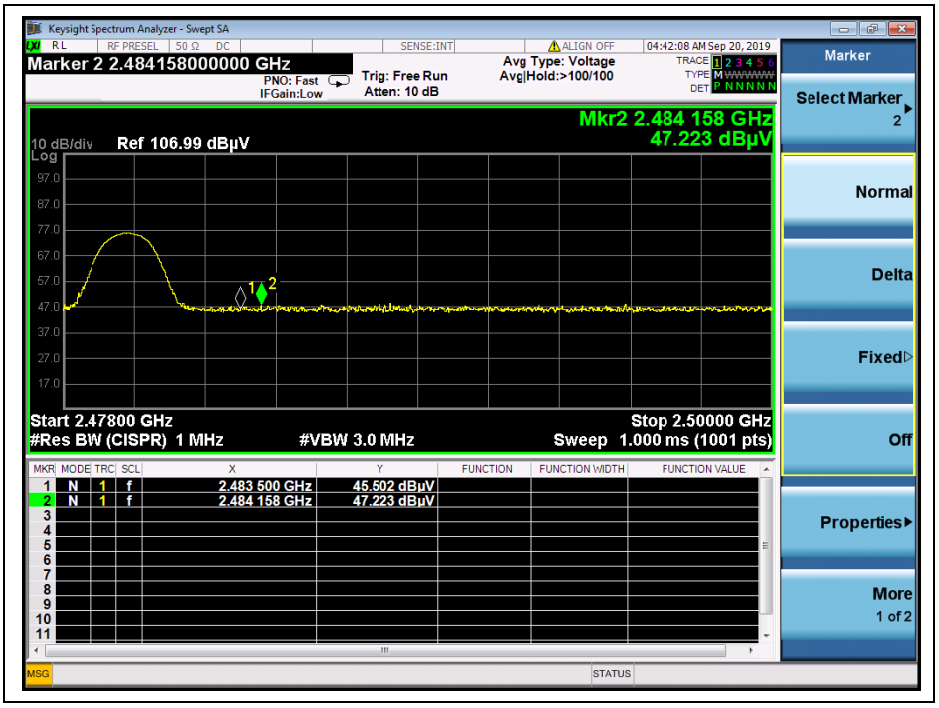
B. Test Plots:



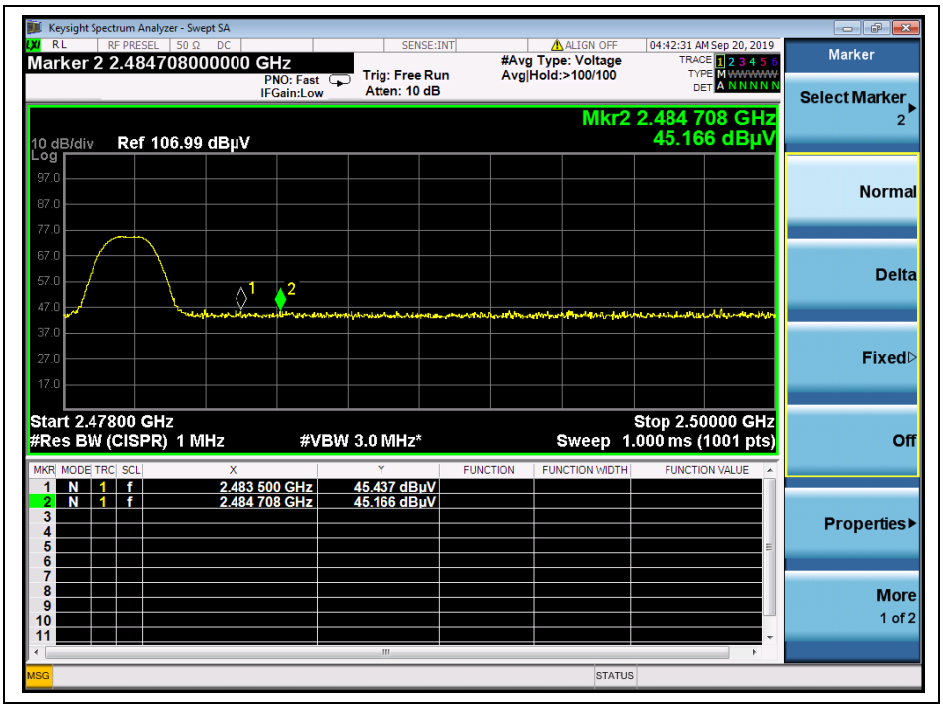
(PEAK, Channel = 0, 8-DPSK)



(AVERAGE, Channel = 0, 8-DPSK)



(PEAK, Channel = 78, 8-DPSK)



(AVERAGE, Channel = 78, 8-DPSK)

2.13. Radiated Emission

2.13.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

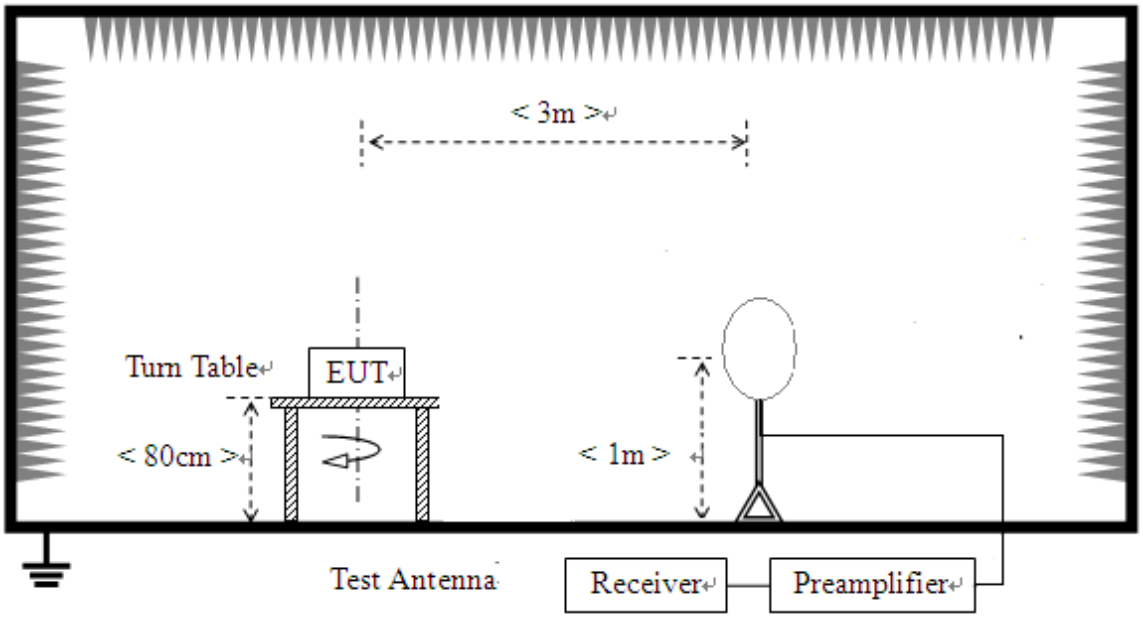
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

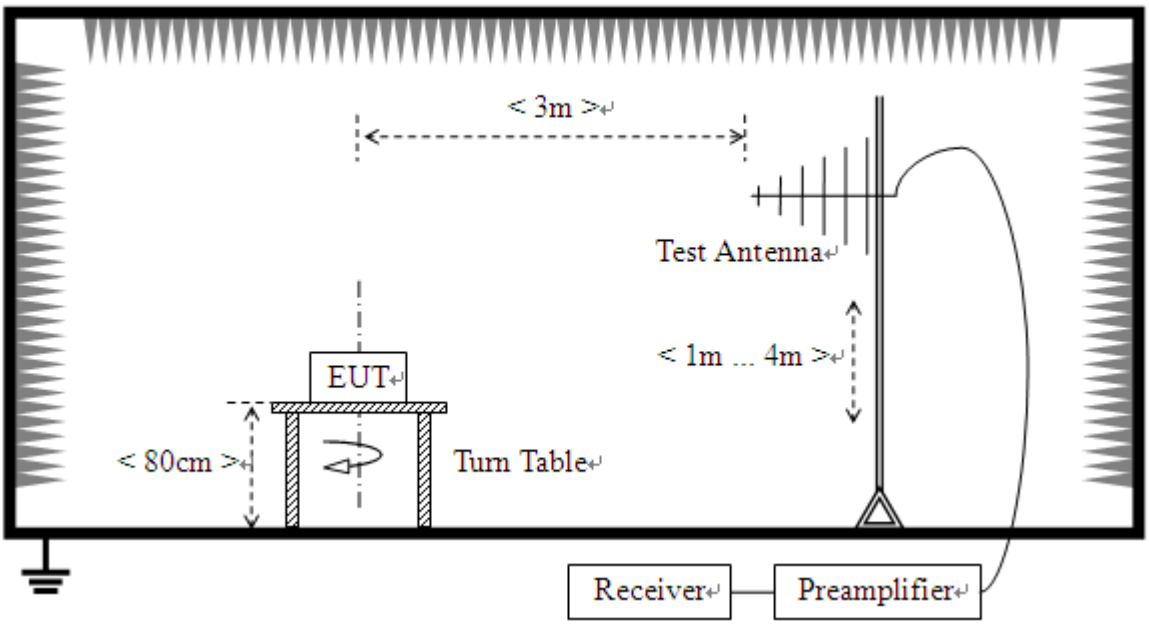
2.13.2. Test Description

Test Setup:

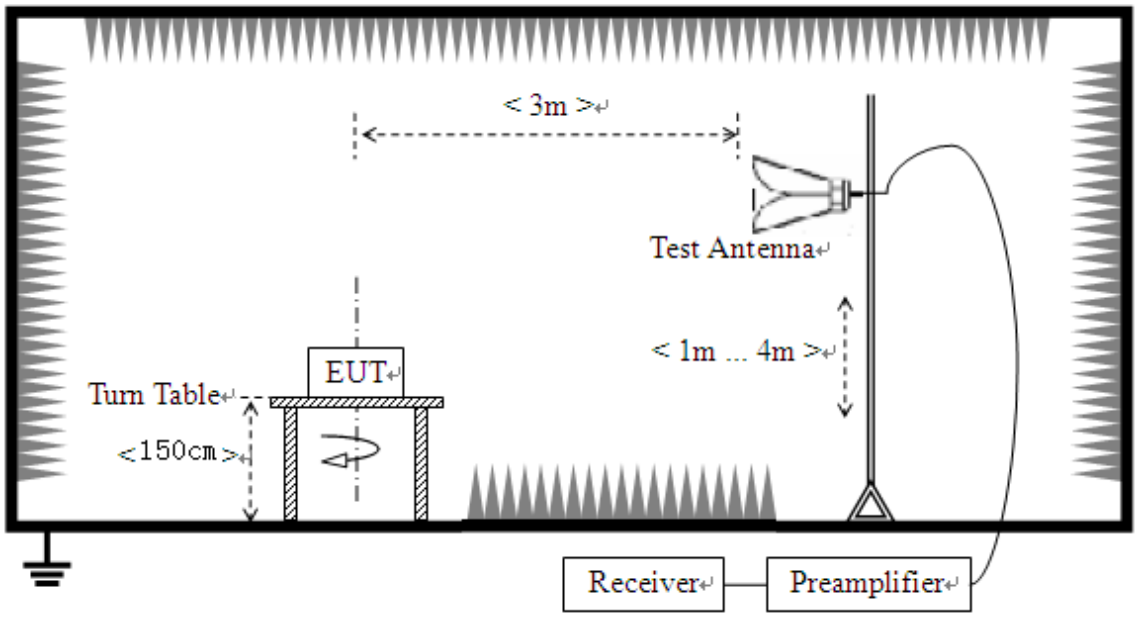
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be

higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

2.13.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.13.4. Test Result

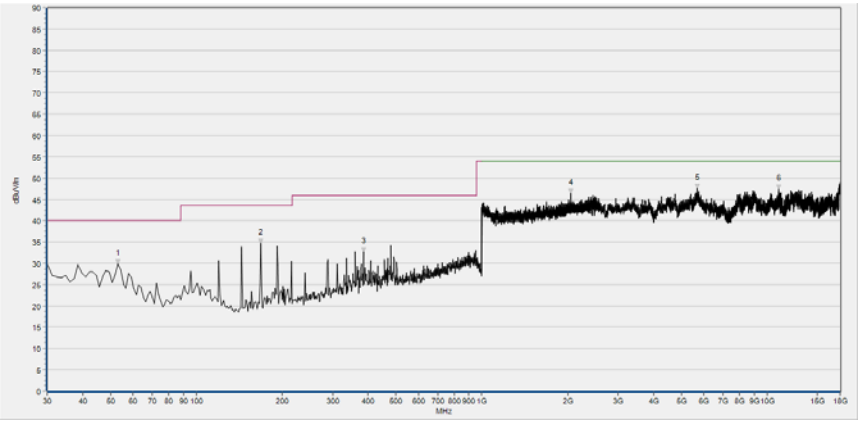
According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m
During the test, the total correction Factor AT and A_{Factor} were built in test software.

Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Note2: For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.
Note3: For the frequency, which started from 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

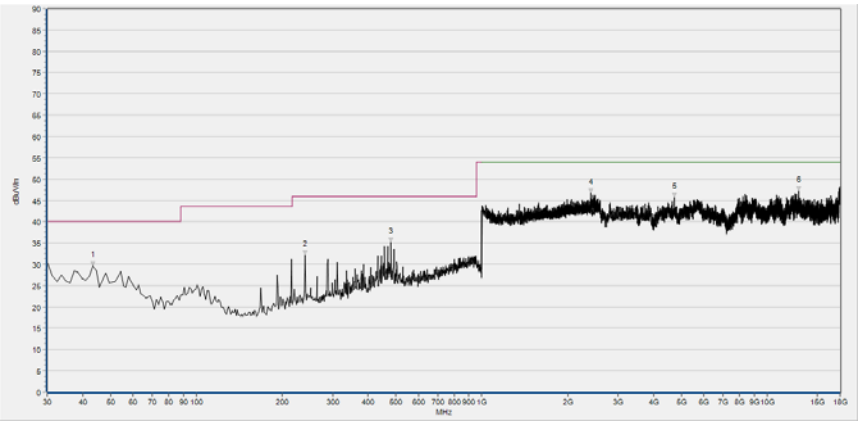
GFSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
53.066	29.79	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.398	34.70	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
384.493	32.62	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2050.660	46.42	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5683.361	47.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10965.121	47.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

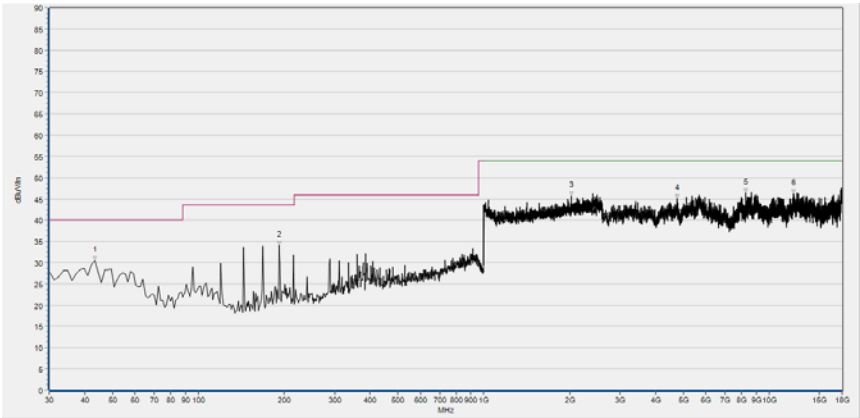
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	29.60	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.025	32.20	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
480.401	35.22	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2414.326	46.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4725.586	45.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12911.475	47.33	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

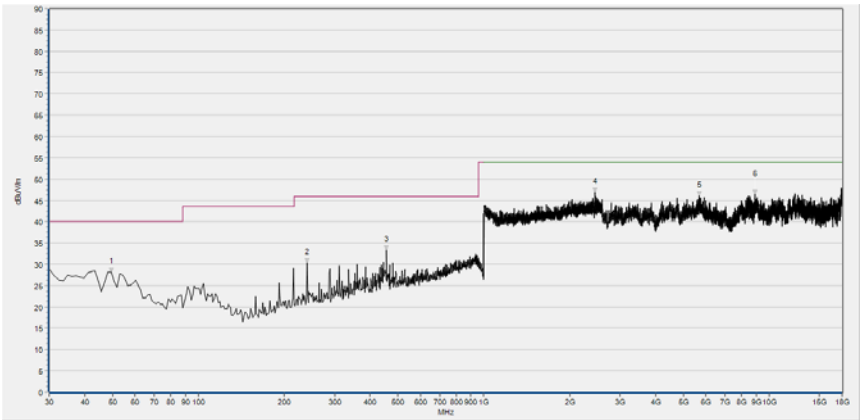
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	30.49	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
191.464	34.10	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2028.892	45.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4742.390	45.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8287.834	46.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12191.744	46.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

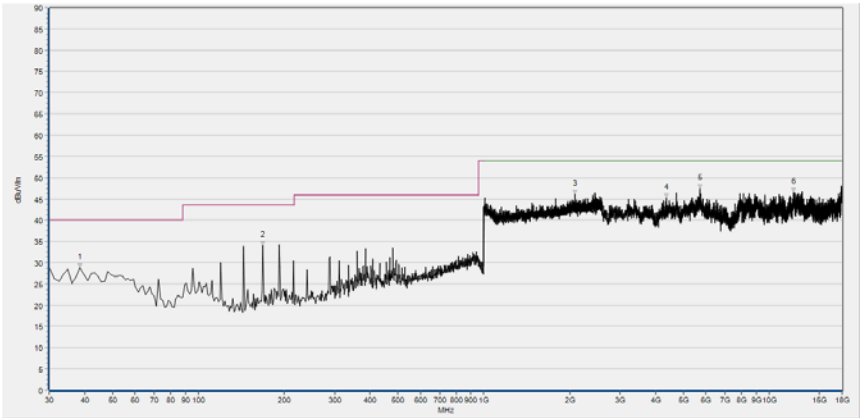
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
49.424	28.09	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.025	30.25	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
456.120	33.34	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2450.820	46.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5680.560	46.13	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8929.151	46.40	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

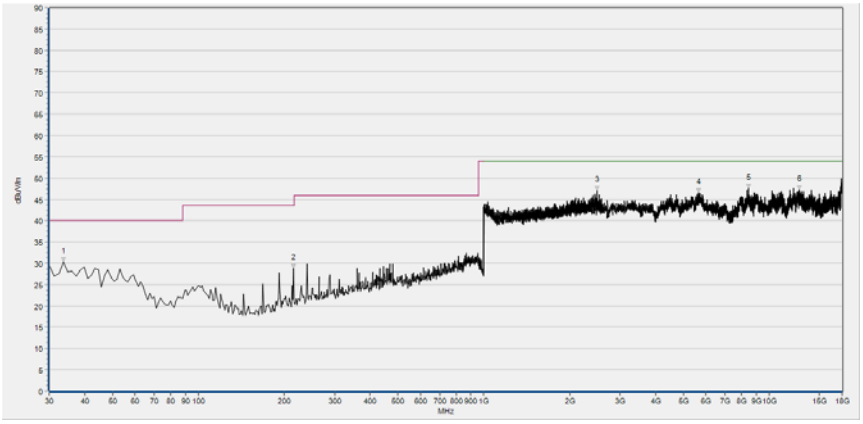
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
38.498	28.82	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.398	34.09	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2089.716	46.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4355.919	45.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5702.964	47.49	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12194.544	46.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 78)

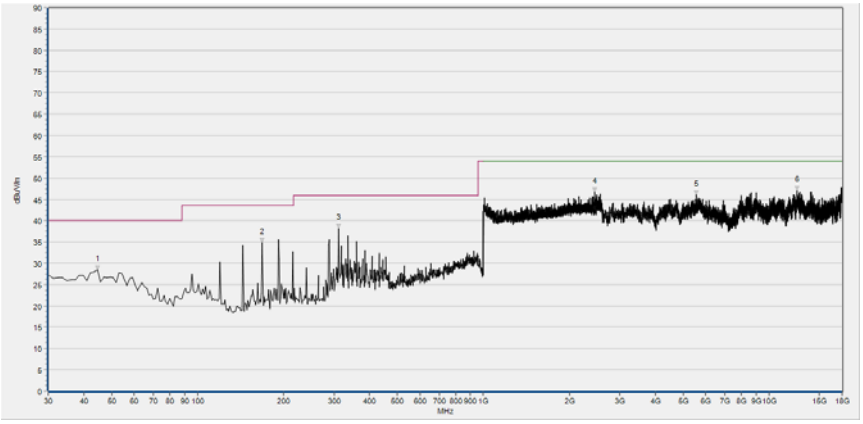


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
33.642	30.28	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
215.745	28.89	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2492.437	47.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5658.156	46.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8478.269	47.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12723.841	47.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 18GHz, Antenna Vertical, GFSK, channel 78)

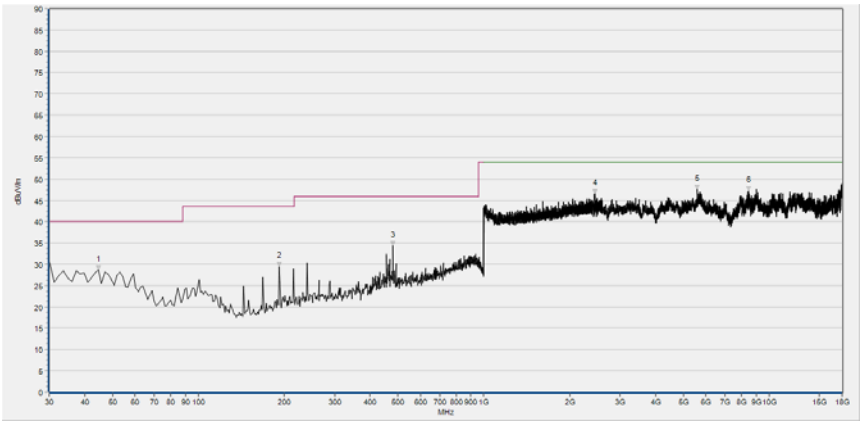
π/4-DQPSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
44.568	28.47	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.398	34.90	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
311.652	38.28	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2457.223	46.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5568.540	46.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12505.401	47.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

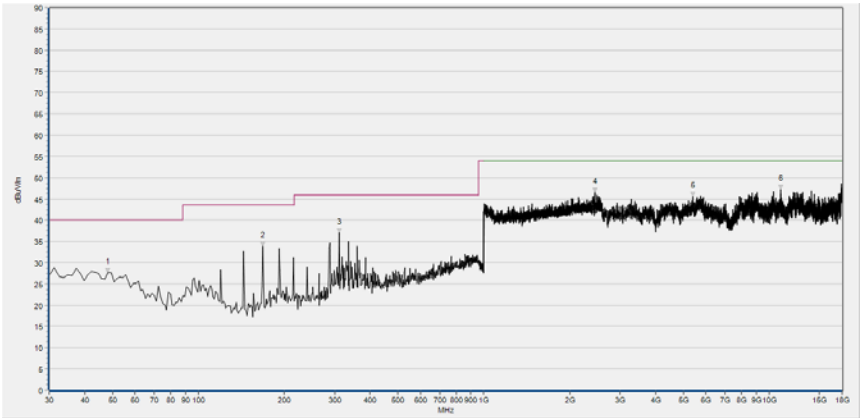
(30MHz to 18GHz, Antenna Horizontal, π/4-DQPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
44.568	28.73	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
191.464	29.57	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
480.401	34.28	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2454.662	46.60	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5602.146	47.53	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8439.062	47.20	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

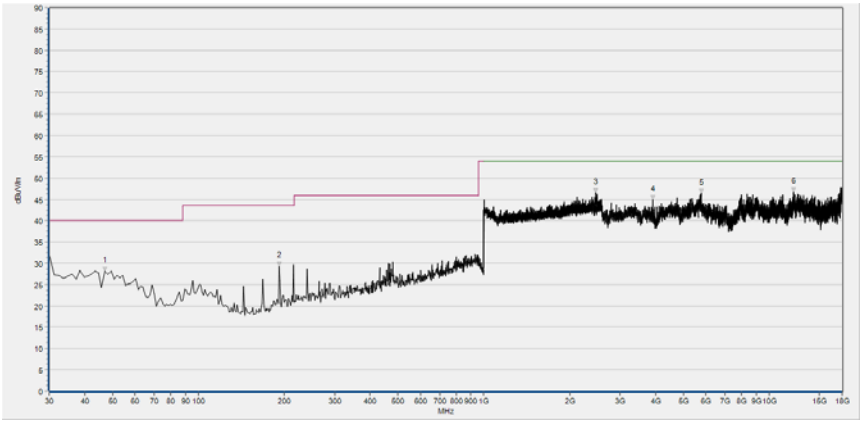
(30MHz to 18GHz, Antenna Vertical, π/4-DQPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	27.70	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.398	33.79	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
311.652	37.08	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2449.540	46.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5394.908	45.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10970.722	47.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

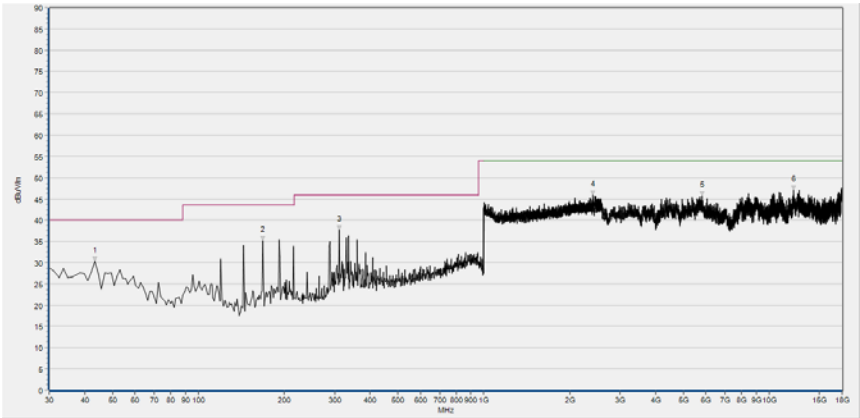
(30MHz to 18GHz, Antenna Horizontal, π/4-DQPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
46.996	28.23	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
191.464	29.33	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2457.863	46.51	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3902.237	44.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5767.376	46.44	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12180.542	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

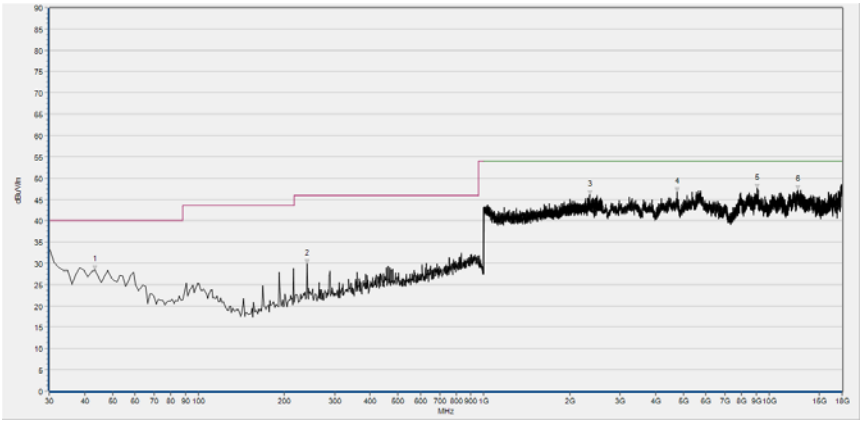
(30MHz to 18GHz, Antenna Vertical, π/4-DQPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	30.41	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.398	35.13	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
311.652	37.77	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2405.362	45.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5820.586	45.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12191.744	47.16	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 18GHz, Antenna Horizontal, π/4-DQPSK, channel 78)

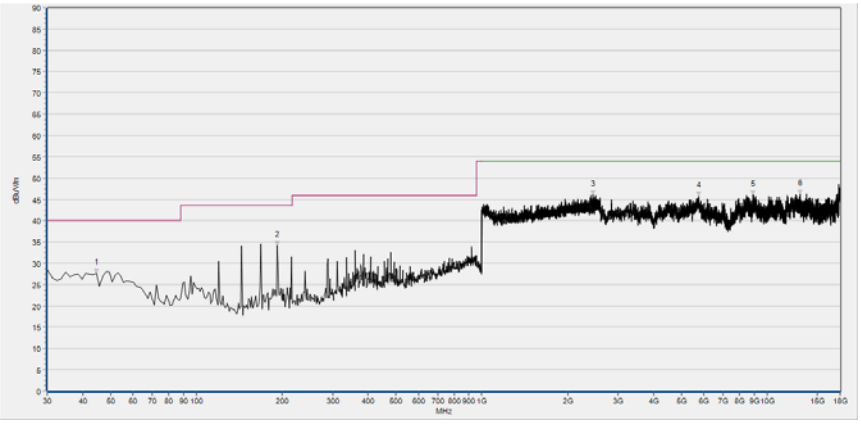


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	28.46	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.025	29.82	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2347.099	46.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4756.392	46.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9066.376	47.62	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12614.621	47.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 18GHz, Antenna Vertical, π/4-DQPSK, channel 78)

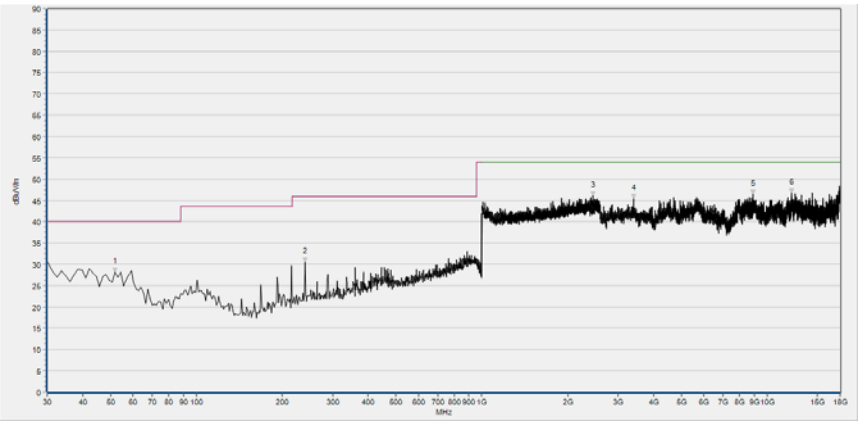
8-DPSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
44.568	27.65	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
191.464	34.19	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2450.820	46.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5742.171	45.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8931.951	46.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13071.104	46.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

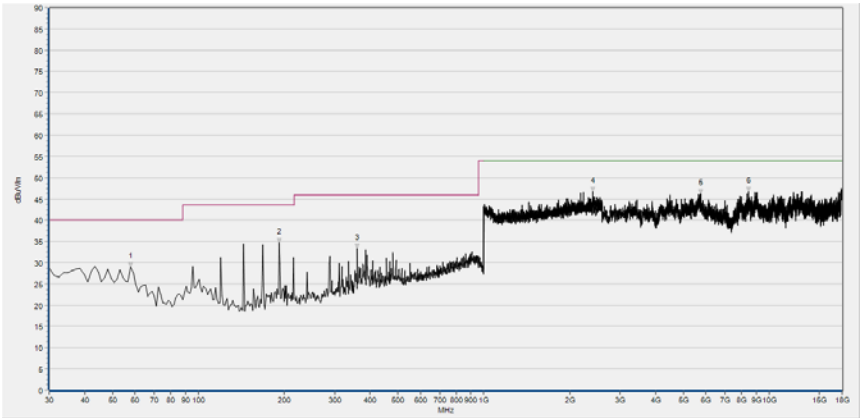
(30MHz to 18GHz, Antenna Horizontal, 8-DPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
51.852	28.16	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.025	30.50	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2450.820	46.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3395.345	45.37	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8926.350	46.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12152.537	46.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

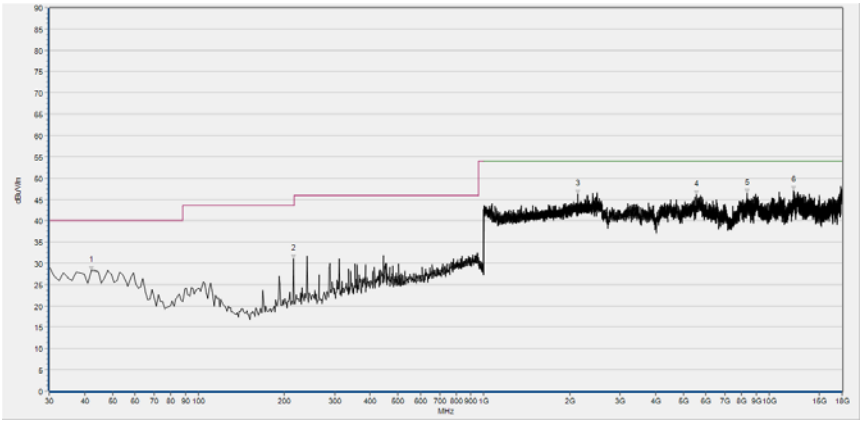
(30MHz to 18GHz, Antenna Vertical, 8-DPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
57.922	29.04	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
191.464	34.75	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
360.213	33.42	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2407.923	46.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5747.772	46.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8478.269	46.78	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

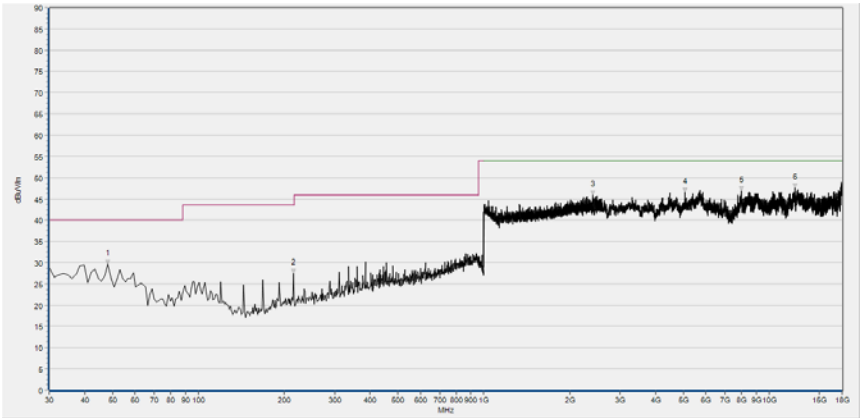
(30MHz to 18GHz, Antenna Horizontal, 8-DPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
42.140	28.26	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
215.745	30.98	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2131.973	46.29	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5565.739	46.10	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8369.049	46.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12158.138	47.08	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

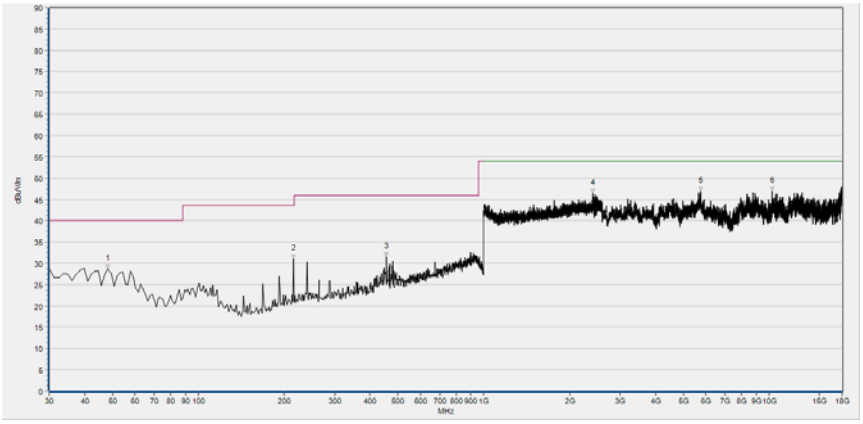
(30MHz to 18GHz, Antenna Vertical, 8-DPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	29.63	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
215.745	27.42	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2408.563	45.90	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5061.648	46.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7999.382	46.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12292.562	47.60	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 18GHz, Antenna Horizontal, 8-DPSK, channel 78)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	28.67	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
215.745	31.01	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
456.120	31.43	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2408.563	46.46	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5742.171	46.96	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10250.991	46.97	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 18GHz, Antenna Vertical, 8-DPSK, channel 78)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Number of Hopping Frequency	±5%
Peak Output Power	±2.22dB
20dB Bandwidth	±5%
Carrier Frequency Separation	±5%
Time of Occupancy (Dwell time)	±5%
Conducted Spurious Emission	±2.77dB

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

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Bluetooth Base Station	6K00006210	MT8852B	Anritsu	2020.04.01	2021.03.31
Directional coupler	17041703	DTO-5-30	ShangHai Huaxiang	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2020.04.01	2021.03.31
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2020.03.26	2021.03.25
LISN	812744	NSLK 8127	Schwarzbeck	2020.03.26	2021.03.25
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2019.08.13	2020.08.12
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
Adapter	N/A	HKC00550 10-3E	ViVo	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.29	2020.07.28
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2022.07.25
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	S020180L3203	Tonscend	2019.07.29	2020.07.28
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2019.07.29	2020.07.28
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2019.12.01	2020.12.01
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT