TEST REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Soundbar-Fire TV Edition
MODEL NAME	:	D3000
BRAND NAME	:	NEBULA
FCC ID	:	2AOKB-D3000
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2019-07-31
TEST DATE	:	2019-08-23 to 2019-09-24
ISSUE DATE	:	2019-09-25

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Peng Huarui (Supervisor)

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Change History		
Version	**Date**	**Reason for change**
1.0	2019-09-25	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Nebula Soundbar-Fire TV Edition
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	V0.3
Software Version:	V1.1.13
Equipment Type:	Bluetooth classic
Modulation Type:	FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Operating Frequency Range:	2402MHz – 2480MHz
Antenna Type:	Fixed Internal Antenna
Antenna Gain:	1.1 dBi

Note 1: The EUT contains two modules, and the information of two modules are shown as below. This report recorded the results of BT classic for the module 2.

Module	Model name
Module 1	ActionsBlue Stack Dual 5.0
Module 2	E9L29Y

Note 2: We use the dedicated software to control the EUT continuous transmission.

Note 3: 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	N/A
2	15.247(a)1 15.247(h)	Hopping Mechanism	Sep 24, 2019	Wang Meng	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Sep 24, 2019	Wang Meng	PASS	No deviation
4	N/A	Duty Cycle	Sep 24, 2019	Wang Meng	PASS	No deviation
5	15.247(b)	Maximum Peak Conducted Output Power	Sep 24, 2019	Wang Meng	PASS	No deviation
6	15.247(b)	Maximum Average Conducted Output Power	Sep 24, 2019	Wang Meng	PASS	No deviation
7	15.247(a)	20dB Bandwidth	Sep 24, 2019	Wang Meng	PASS	No deviation
8	15.247(a)	Carrier Frequency Separation	Sep 24, 2019	Wang Meng	PASS	No deviation
9	15.247(a)	Time of Occupancy (Dwell time)	Sep 24, 2019	Wang Meng	PASS	No deviation
10	15.247(d)	Conducted Spurious Emission	Sep 24, 2019	Wang Meng	PASS	No deviation
11	15.207	Conducted Emission	Aug 27, 2019	Lin Jiayong	PASS	No deviation
12	15.247(d)	Restricted Frequency Bands	Aug 23, 2019	Peng Xuewei	PASS	No deviation
13	15.209, 15.247(d)	Radiated Emission	Aug 23, 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 should be judged in the "method determination" column of add, deviate or exclude from the specific method should 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***".

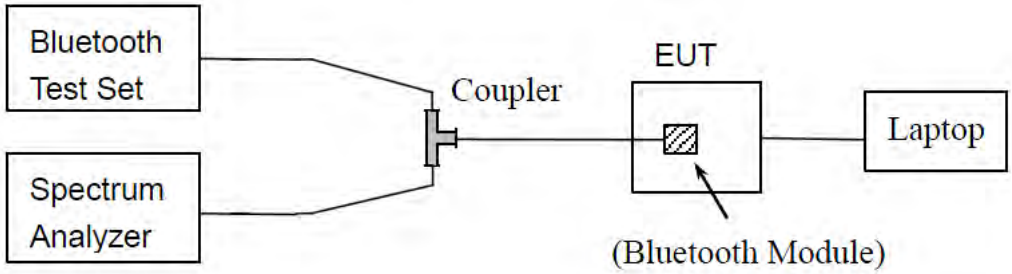
2.3. Number of Hopping Frequency

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

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.

2.3.3. Test Procedure

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

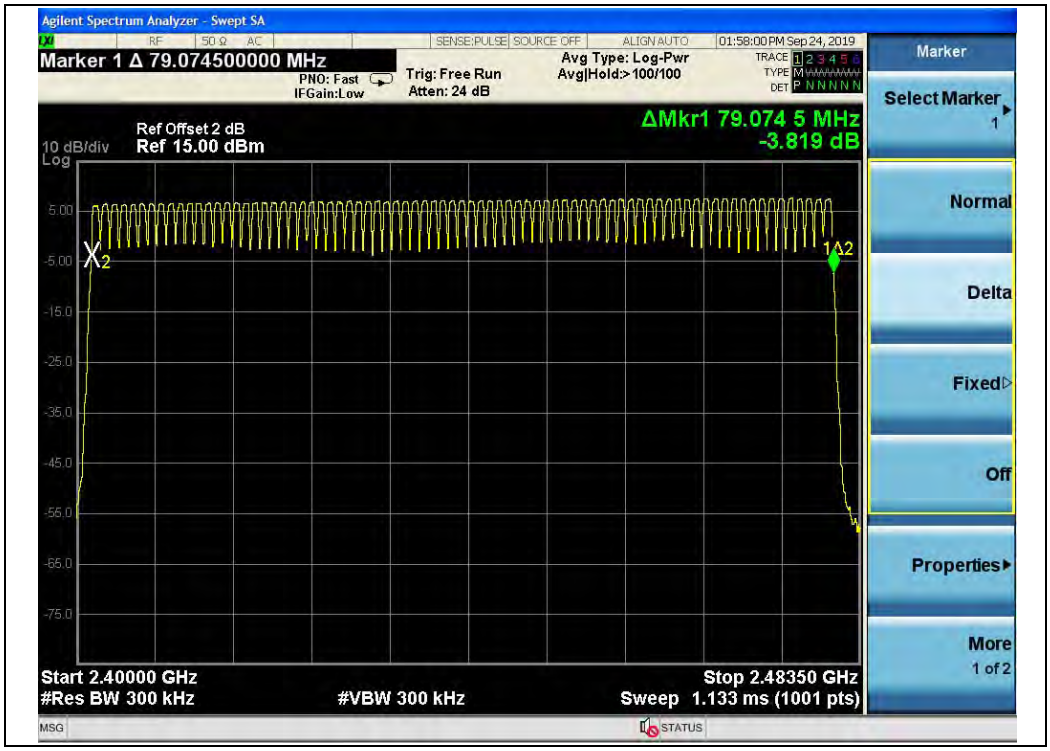
2.3.4. Test Result

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.

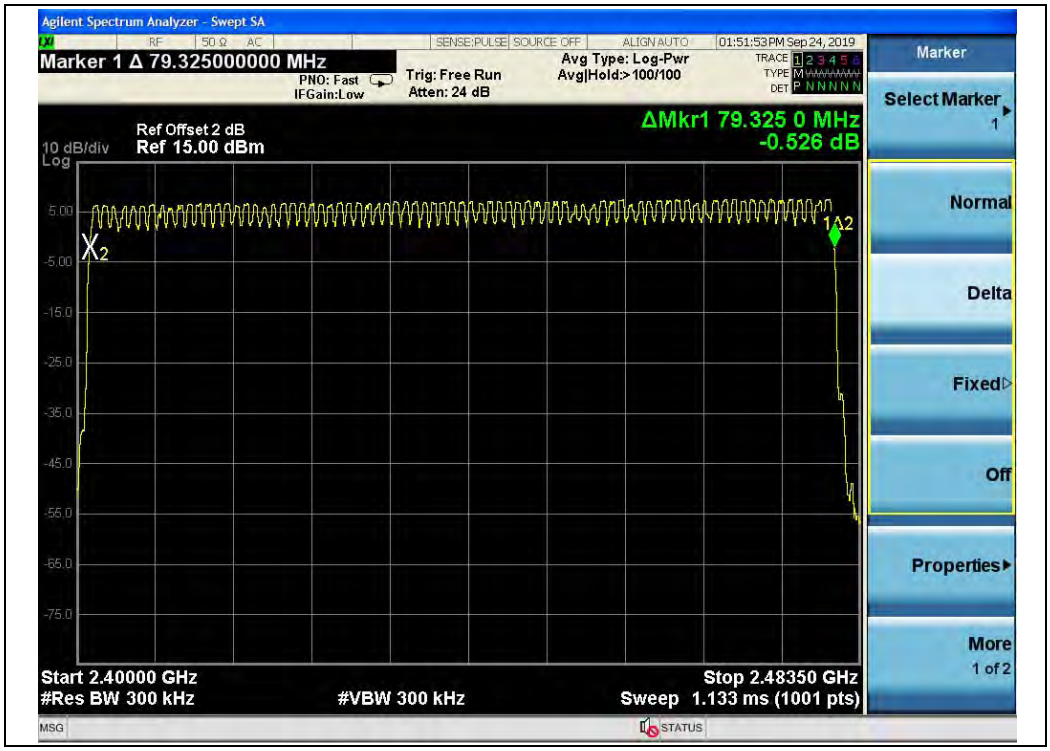
A. Test Verdict:

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)

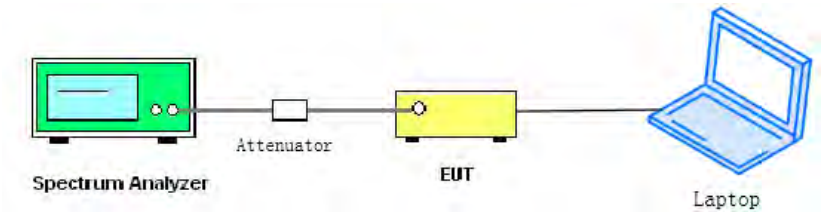
2.4. Duty Cycle Of Test Signal

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

A. Test Set:



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	57.66	2.39
π/4-DQPSK	57.49	2.40
8-DPSK	57.66	2.39

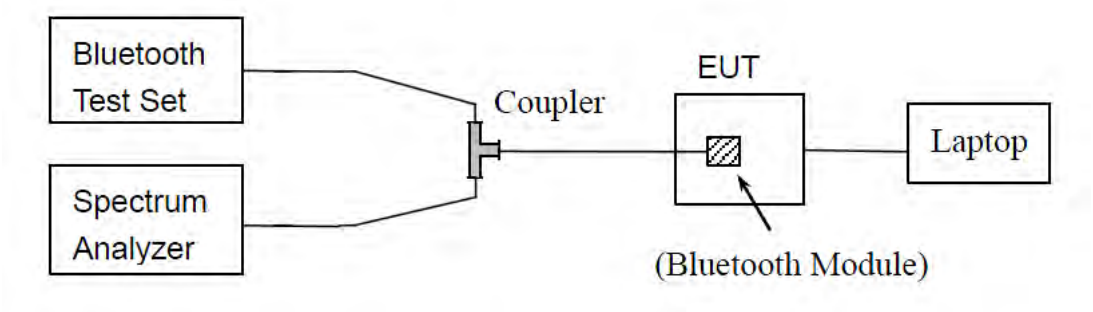
2.5. Maximum Peak Conducted Output Power

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.

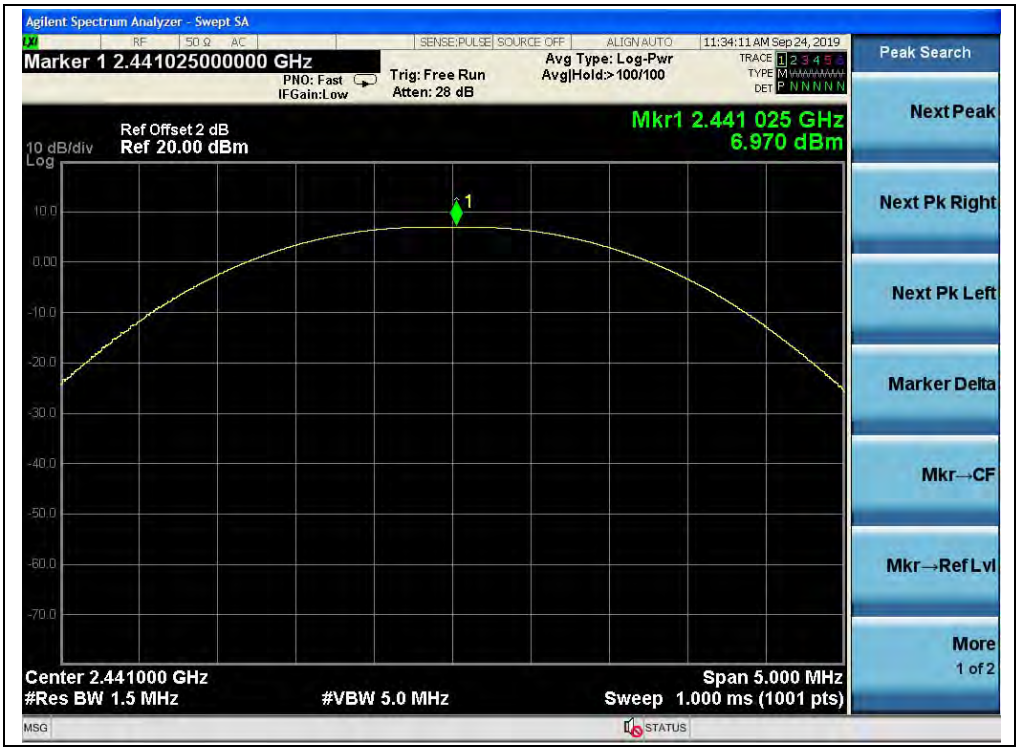
GFSK Mode

A. Test Verdict:

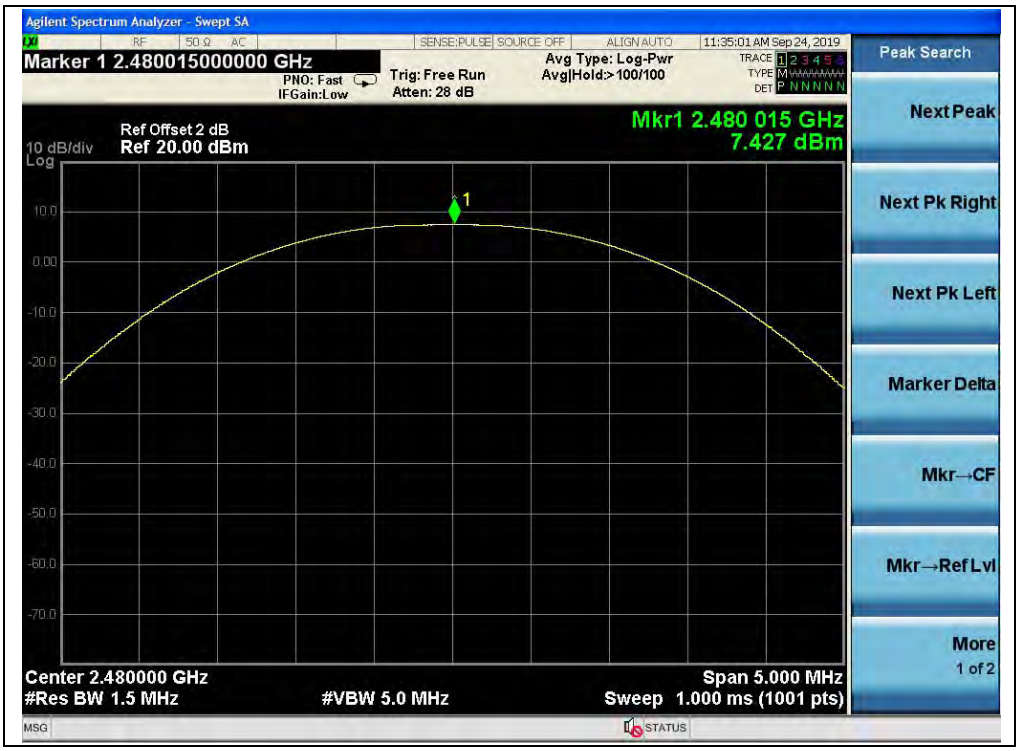
Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	6.23	0.004	20.96	0.125	PASS
39	2441	6.97	0.005			PASS
78	2480	7.43	0.006			PASS

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	6.25	0.004	20.96	0.125	PASS
39	2441	6.98	0.005			PASS
78	2480	7.43	0.006			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	6.24	0.004	20.96	0.125	PASS
39	2441	6.97	0.005			PASS
78	2480	**7.44**	**0.006**			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

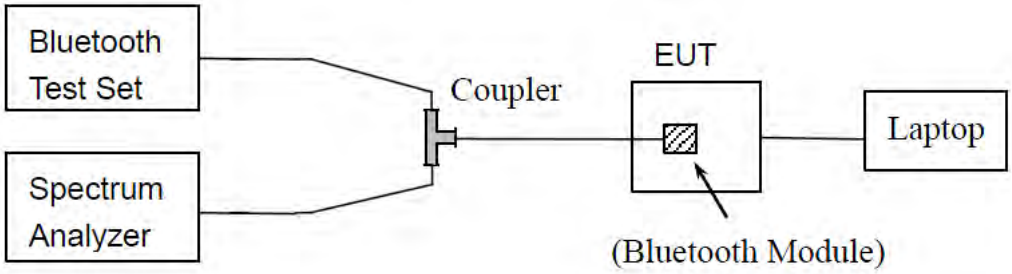
2.6.1. Requirement

According to FCC §15.247(b), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum average 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.

2.6.2. Test Description

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

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.

2.6.3. 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 average power of the module.

GFSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	3.45	2.39	5.84	0.004	20.96	0.125	PASS
39	2441	4.30		6.70	0.005			PASS
78	2480	4.77		**7.16**	**0.005**			PASS

π/4-DQPSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	0.41	2.40	2.82	0.002	20.96	0.125	PASS
39	2441	1.28		3.68	0.002			PASS
78	2480	1.72		4.12	0.003			PASS

8-DPSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	0.48	2.39	2.87	0.002	20.96	0.125	PASS
39	2441	1.26		3.65	0.002			PASS
78	2480	1.73		4.12	0.003			PASS

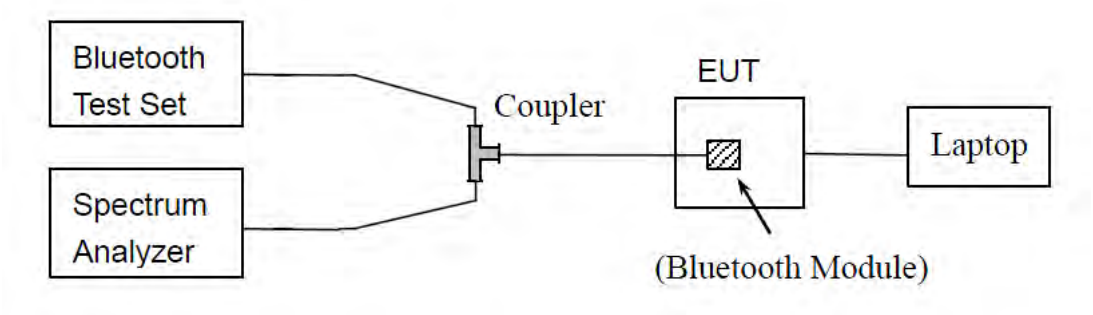
2.7. 20dB Bandwidth

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

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.

2.7.3. 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.

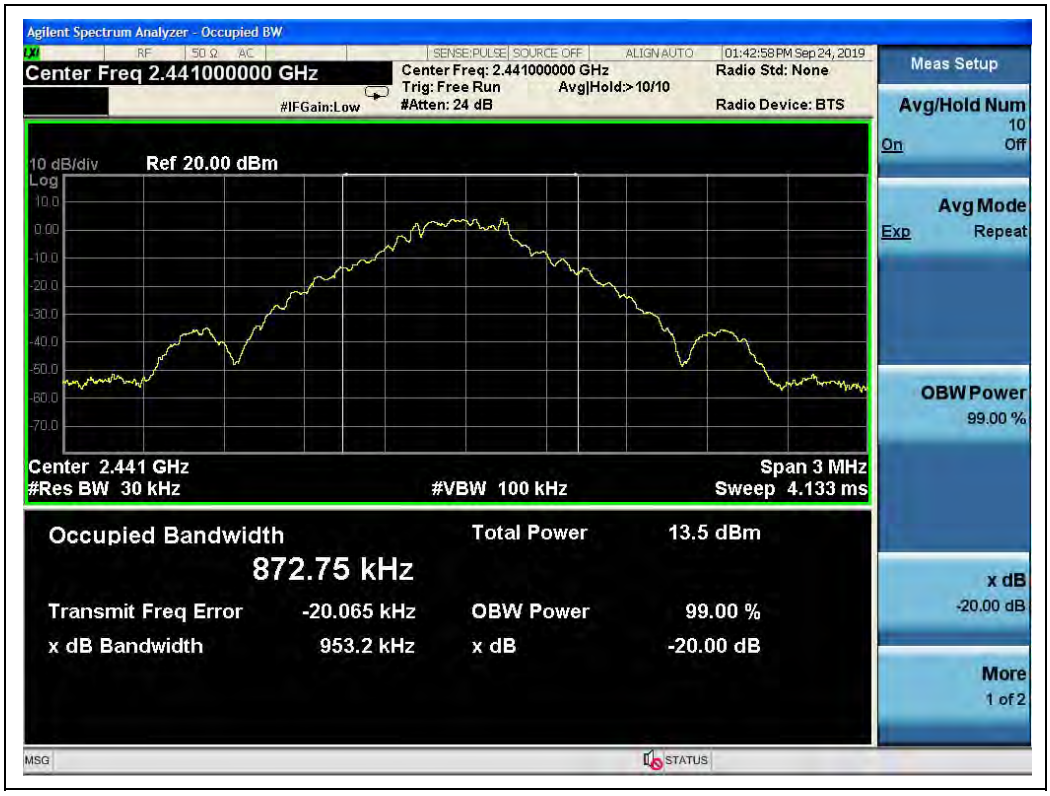
GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	0.959	PASS
39	2441	0.953	PASS
78	2480	0.961	PASS

B. Test Plots:

(GFSK, Channel 0, 2402MHz)



(GFSK, Channel 39, 2441MHz)

(GFSK, Channel 78, 2480MHz)

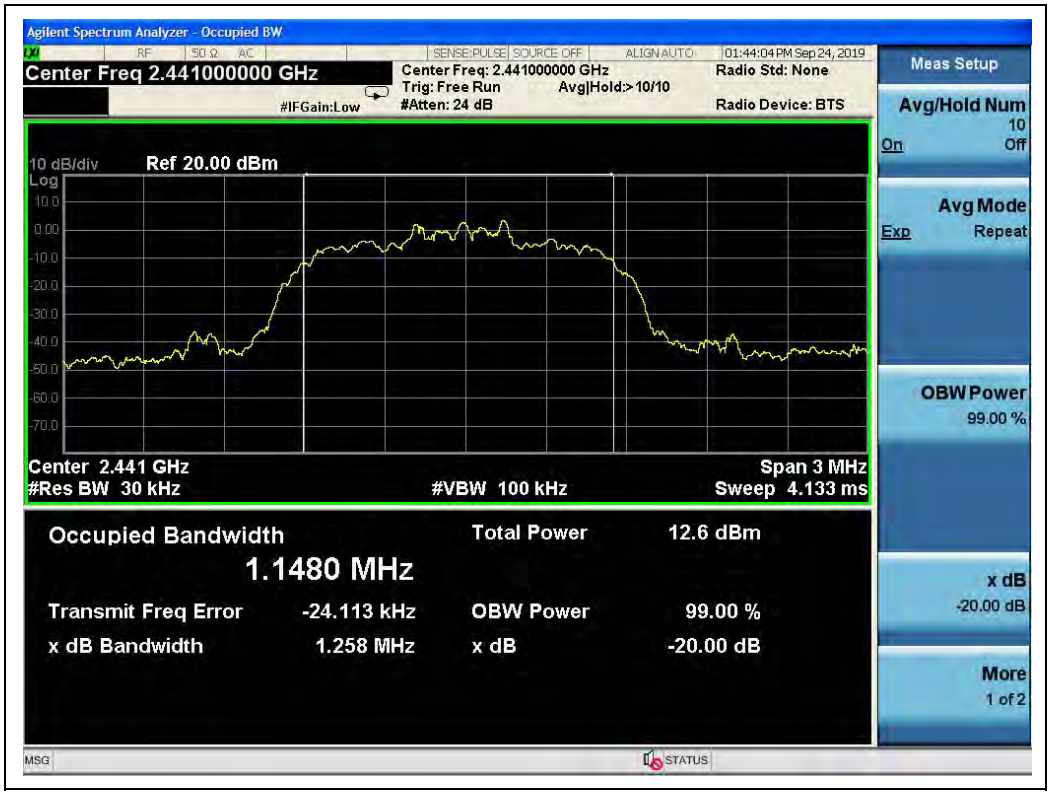
π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.259	PASS
39	2441	1.258	PASS
78	2480	1.265	PASS

B. Test Plots:

(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)

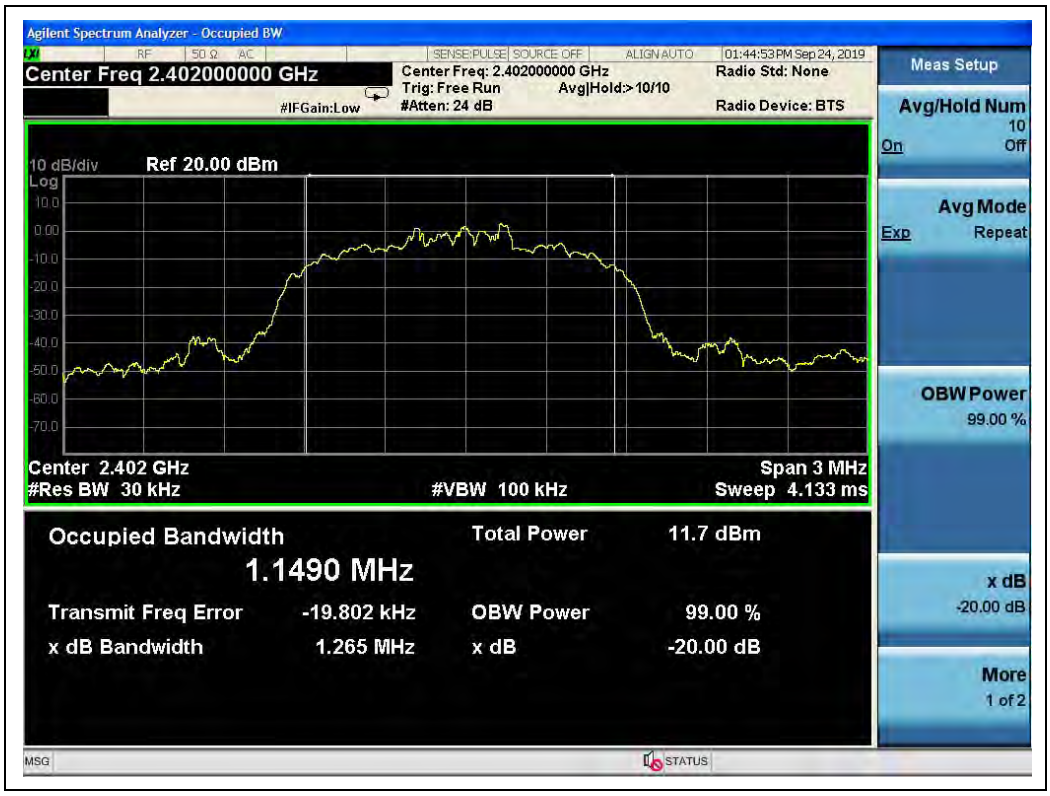
(π/4-DQPSK, Channel 78, 2480MHz)

8-DPSK Mode

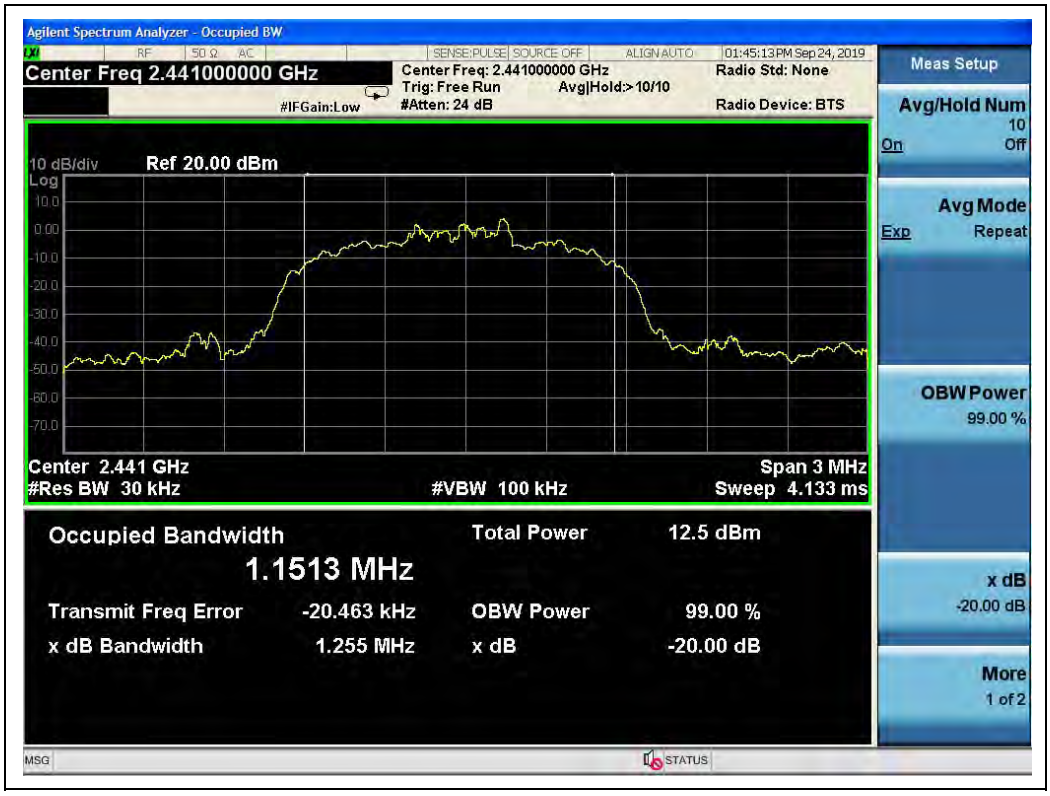
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.265	PASS
39	2441	1.255	PASS
78	2480	1.277	PASS

B. Test Plots:



(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)

(8-DPSK, Channel 78, 2480MHz)

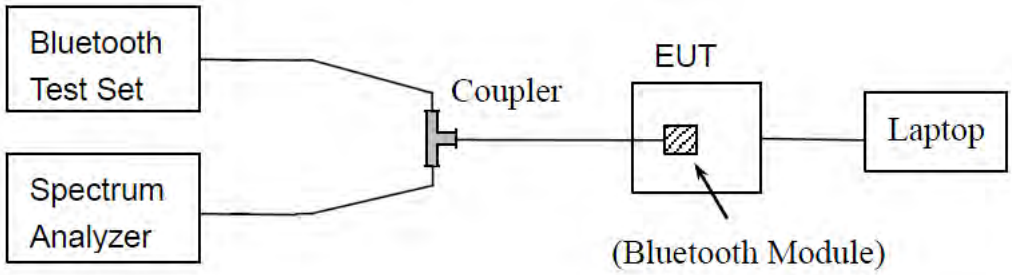
2.8. Carried Frequency Separation

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

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.

2.8.3. 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
RBW = the value can identify clearly the center of each individual channels
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	1.002	0.961	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.002	1.265		PASS
8-DPSK	39 and 40	0.993	1.277		PASS

(GFSK)

(π/4-DQPSK)

(8-DPSK)

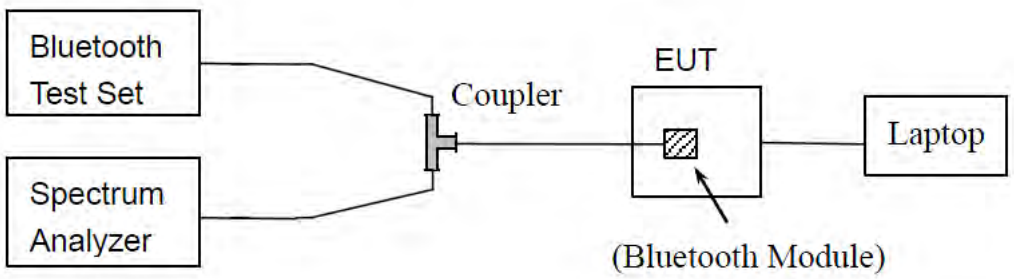
2.9. Time of Occupancy (Dwell time)

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

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.

2.9.3. 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

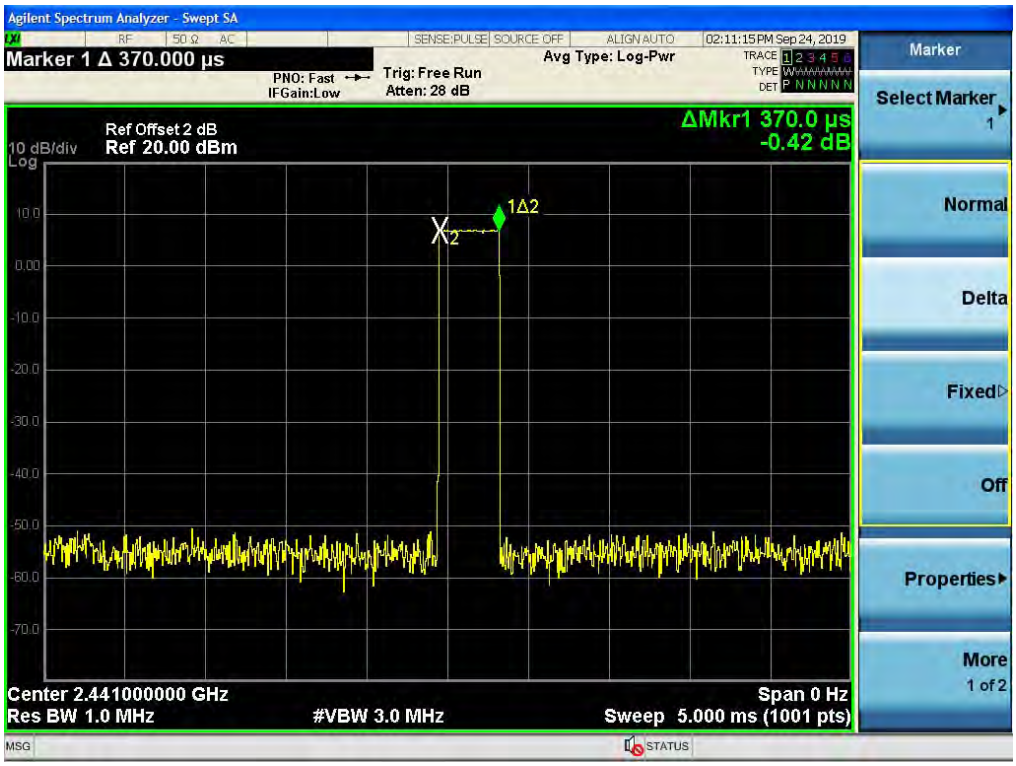
2.9.4. Test Result

GFSK Mode

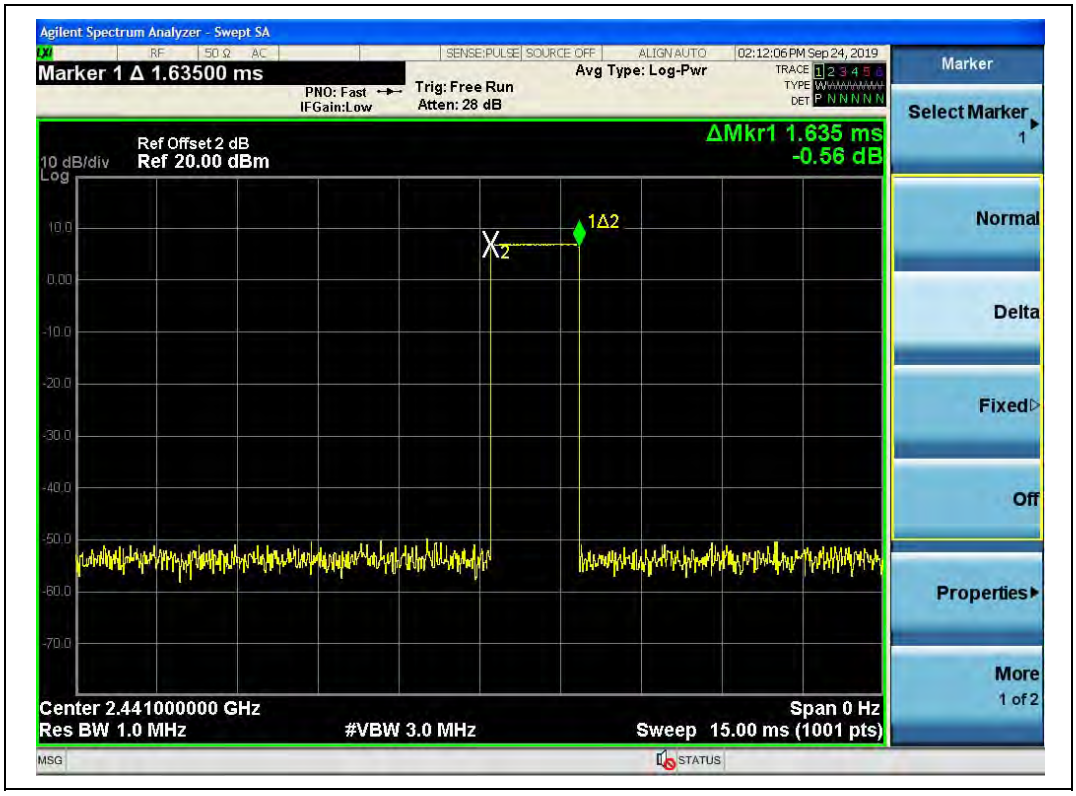
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.37	118.40	59.20	0.4	PASS
DH3	1.64	262.40	131.20		PASS
DH5	2.88	307.20	153.60		PASS

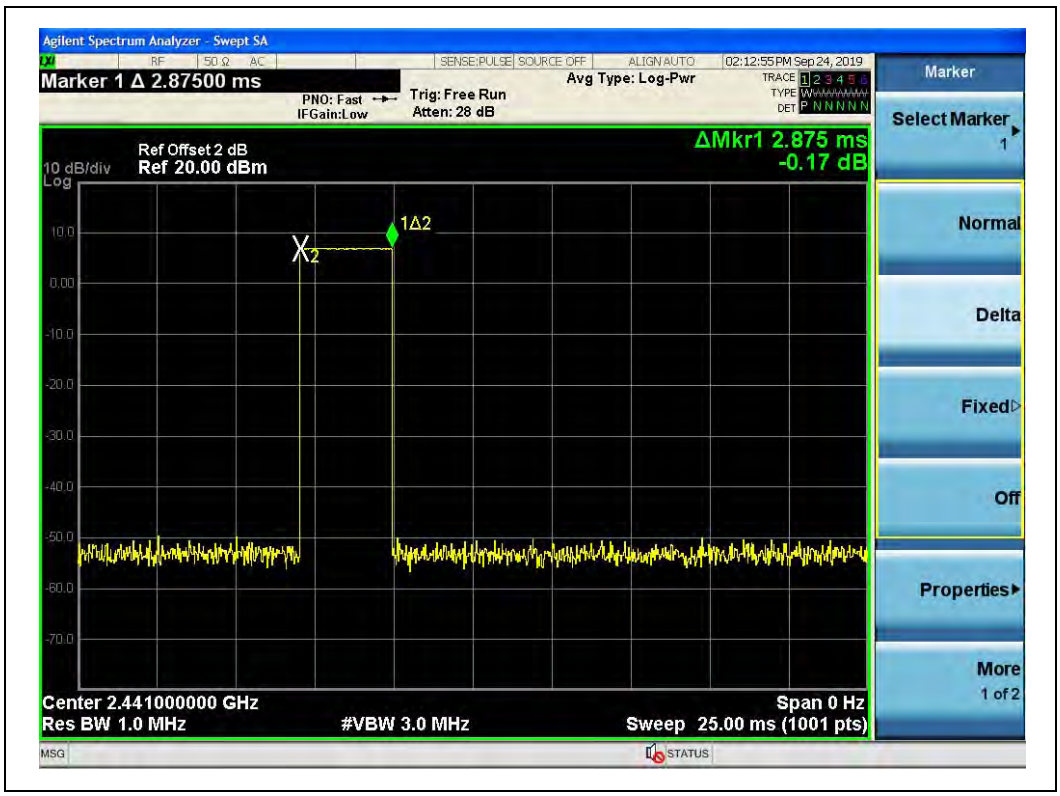
B. Test Plots:



(DH1, GFSK)



(DH3, GFSK)



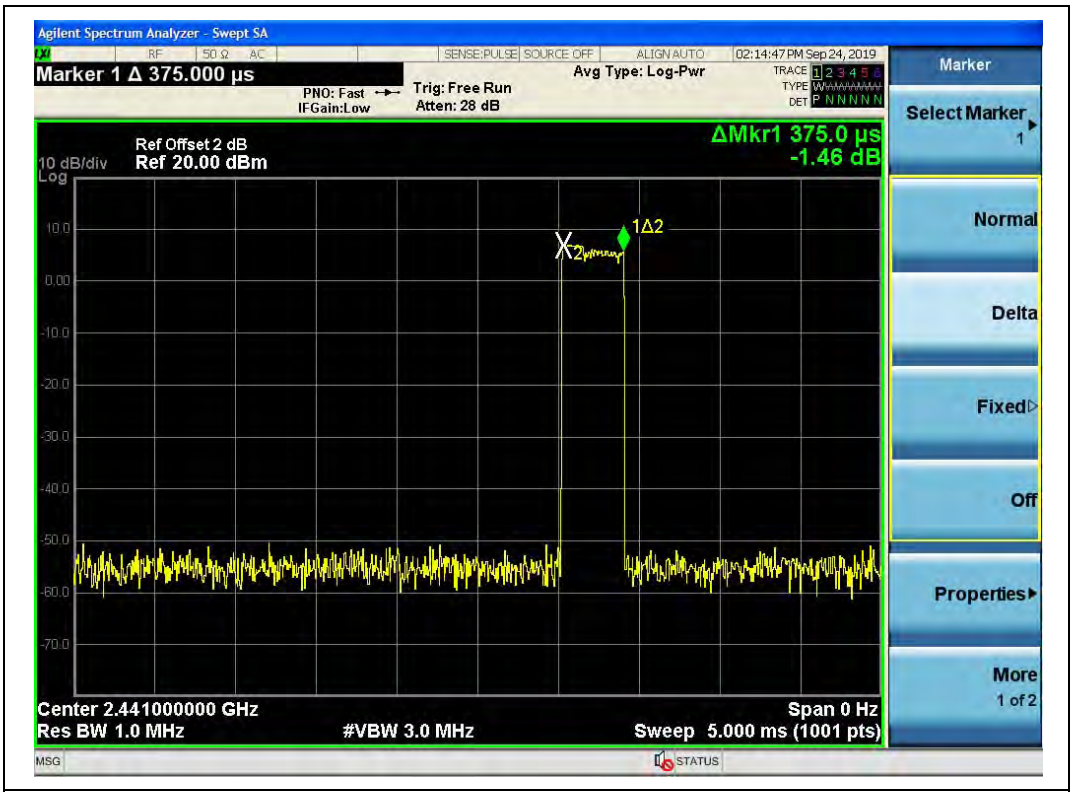
(DH5, GFSK)

π/4-DQPSK Mode

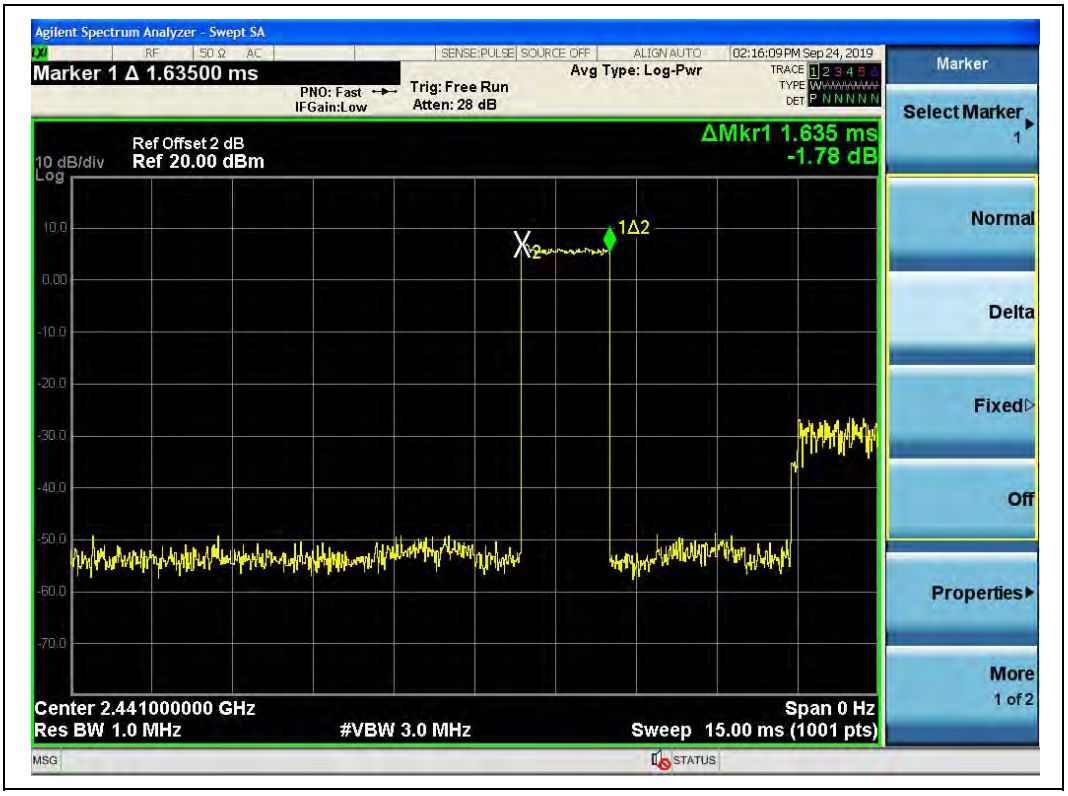
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.38	121.60	60.80	0.4	PASS
DH3	1.64	262.40	131.20		PASS
DH5	2.88	307.20	153.60		PASS

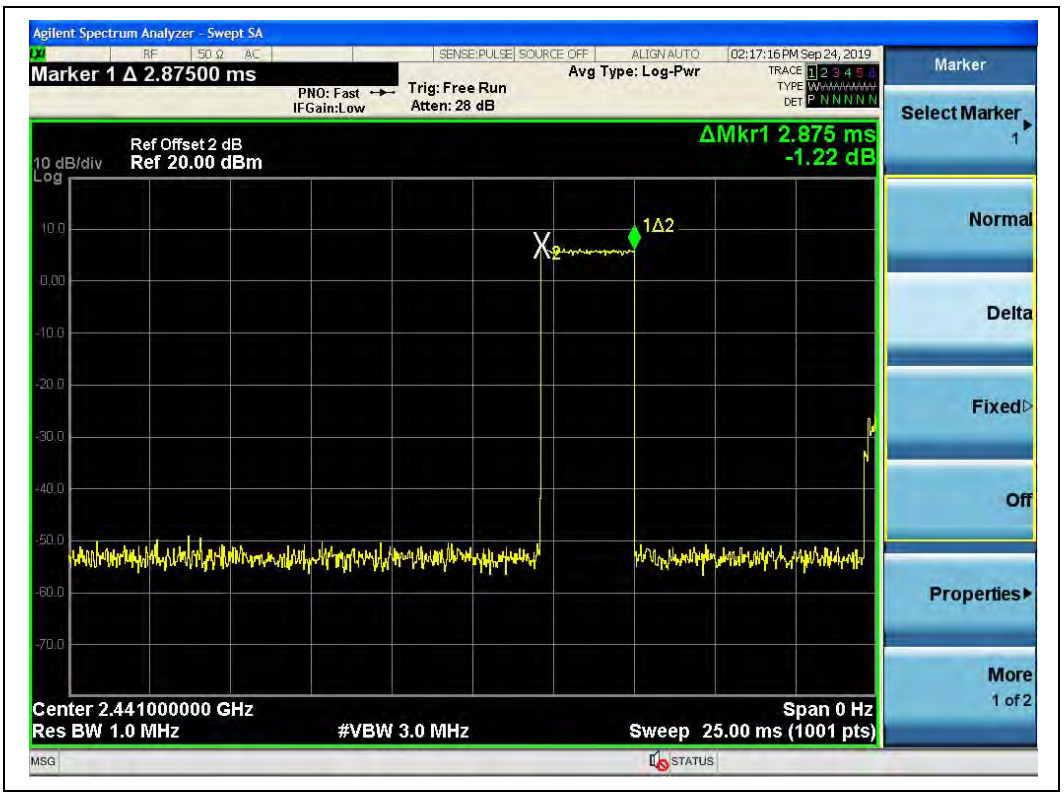
B. Test Plots:



(DH1, π/4-DQPSK)



(DH3, π/4-DQPSK)



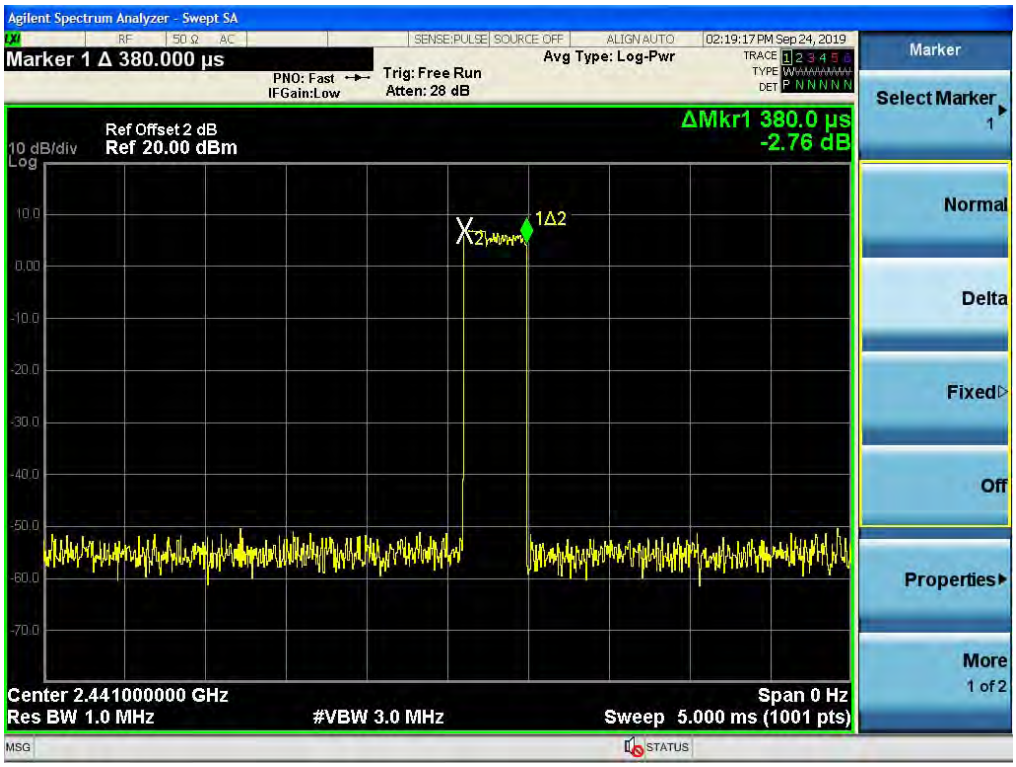
(DH5, π/4-DQPSK)

8-DPSK mode

A. Test Verdict:

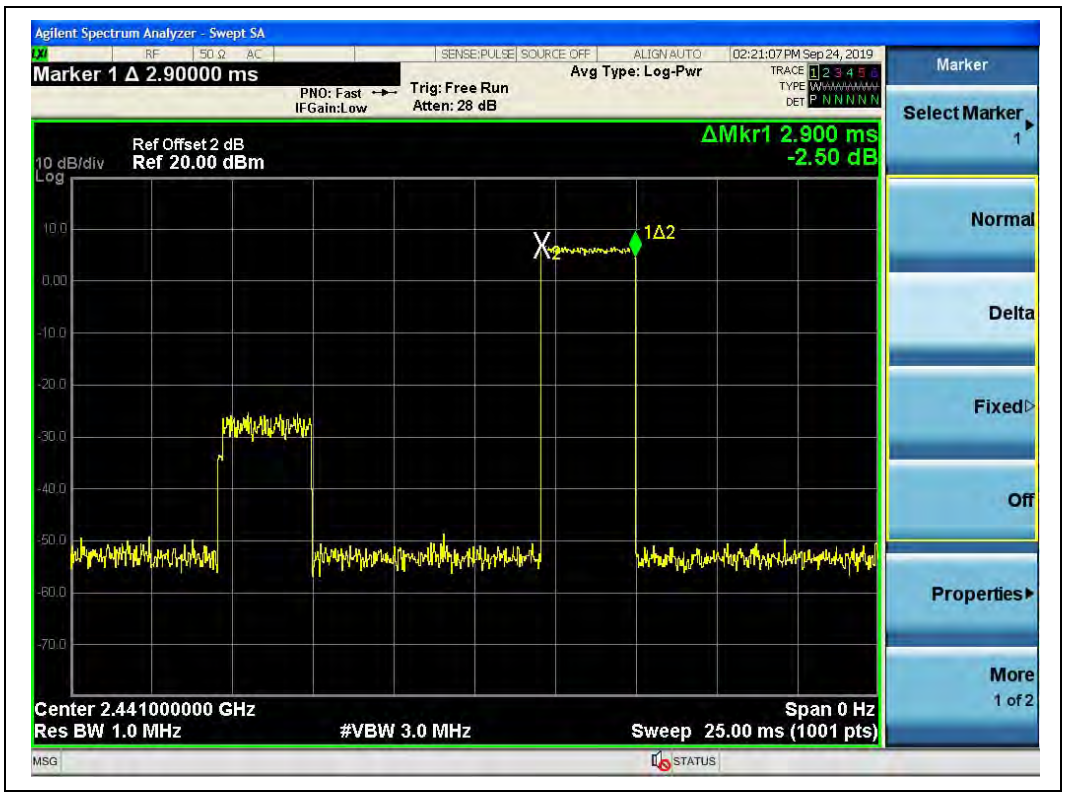
DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.38	121.60	60.80	0.4	PASS
DH3	1.62	259.20	129.60		PASS
DH5	2.90	309.33	154.67		PASS

B. Test Plots:



(DH1, 8-DPSK)

(DH3, 8-DPSK)



(DH5, 8-DPSK)

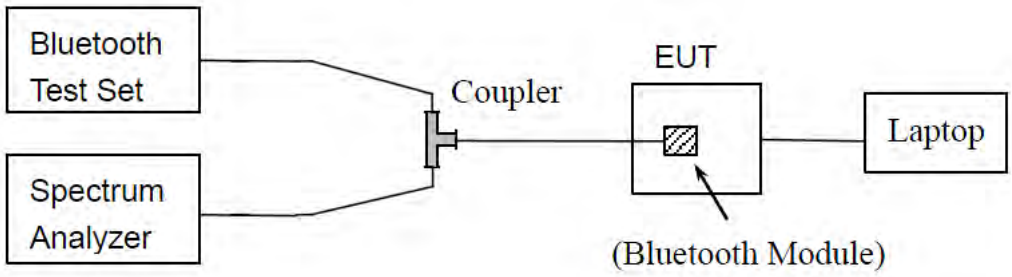
2.10. Conducted Spurious Emissions

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

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.

2.10.3. 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.

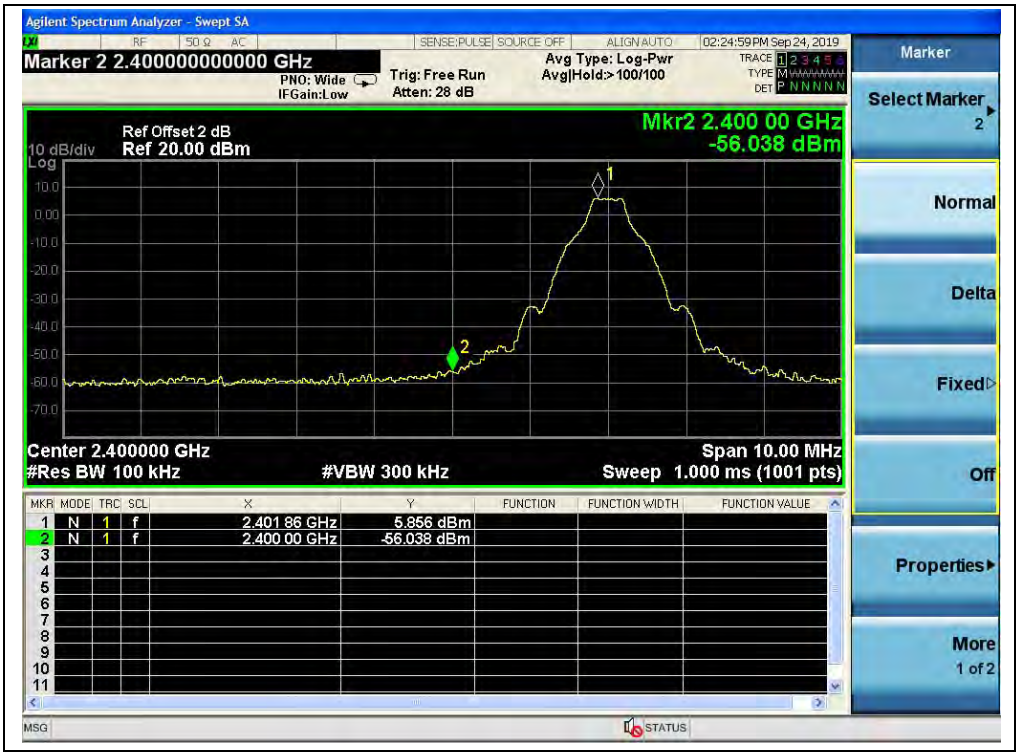
GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-44.63	5.57	-14.43	PASS
39	2441	-44.74	6.51	-13.49	PASS
78	2480	-44.35	7.03	-12.97	PASS

B. Test Plots:

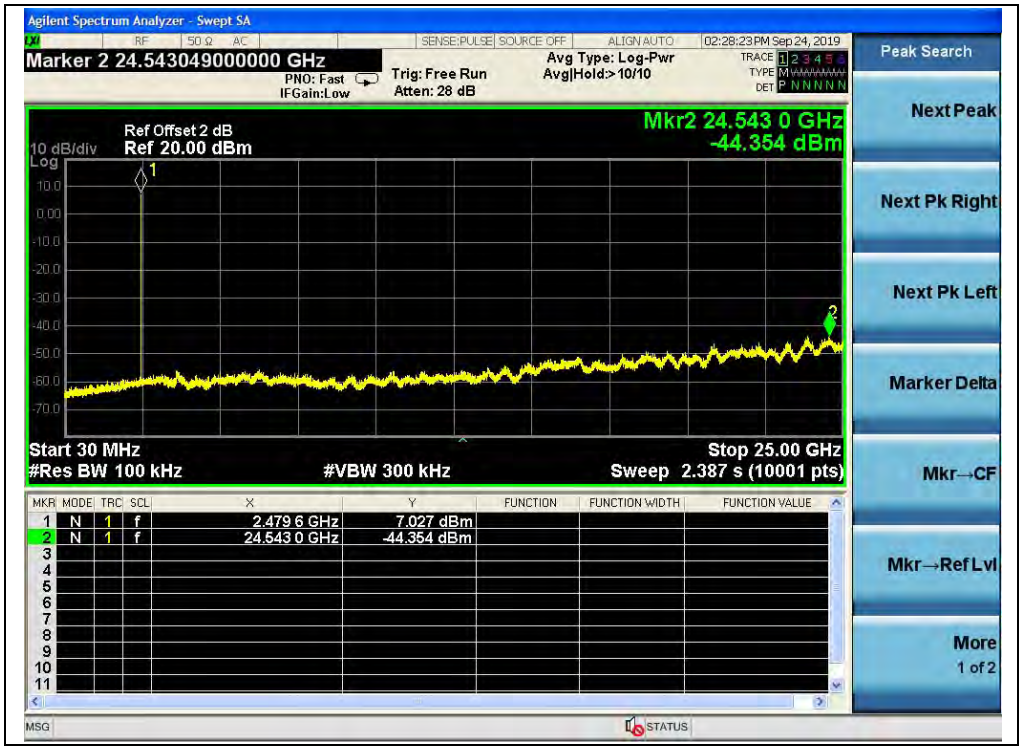
(Channel = 0, 30MHz to 25GHz, GFSK Mode)



(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)

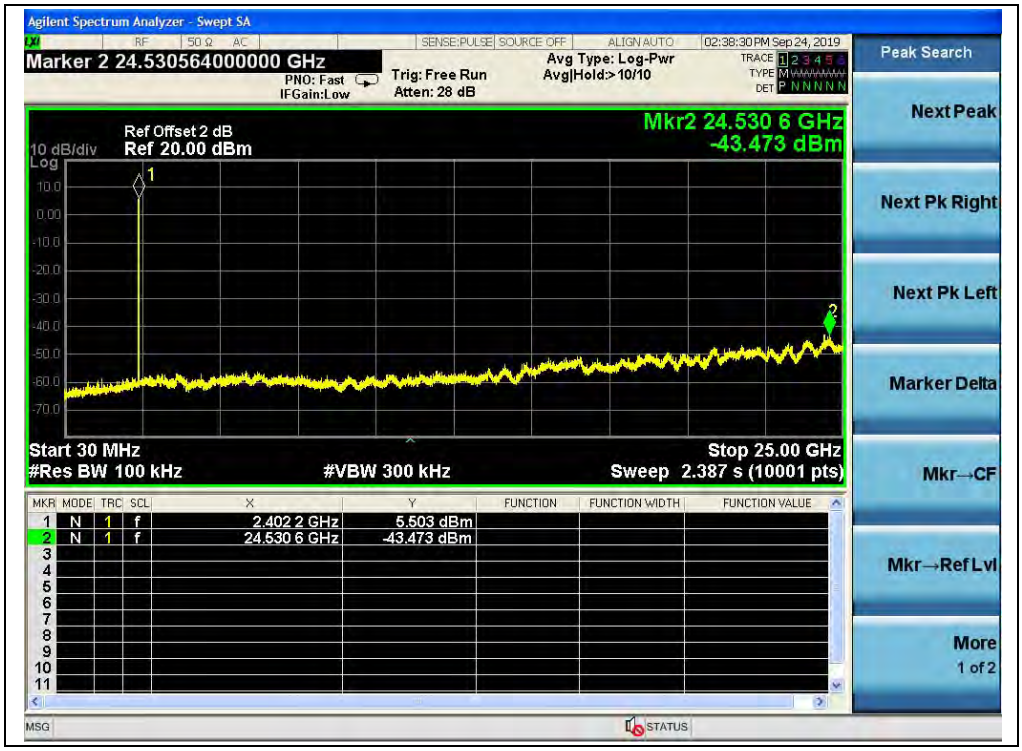
(Channel = 78, Band edge with hopping on, GFSK Mode)

π/4-DQPSK Mode

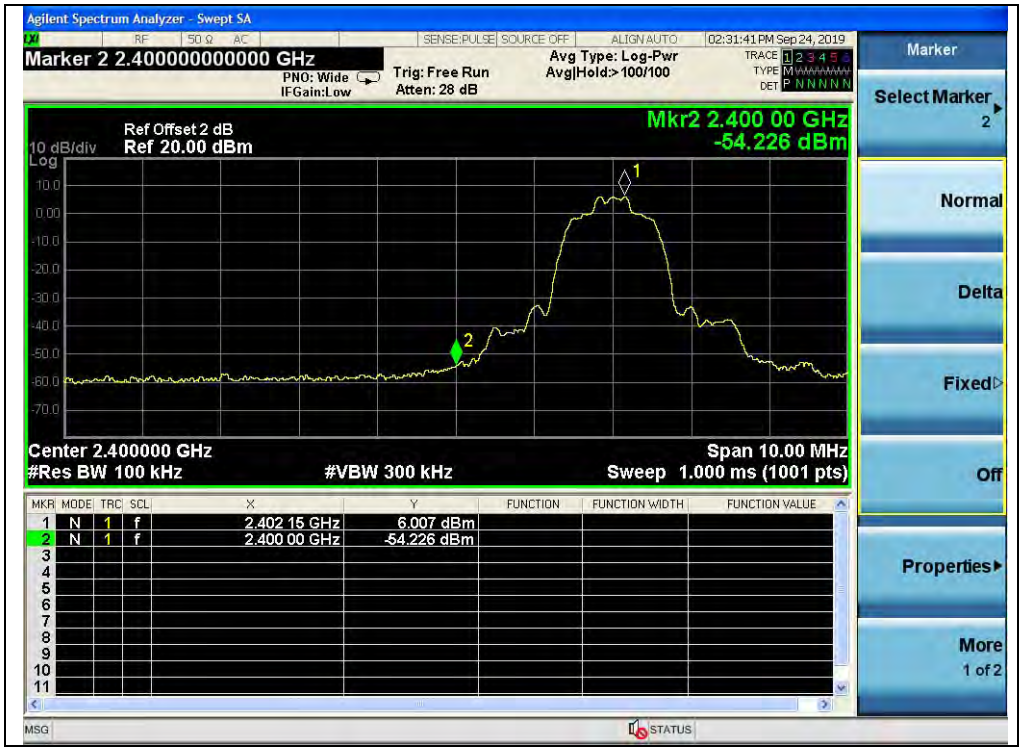
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-43.47	5.50	-14.50	PASS
39	2441	-43.05	1.49	-18.51	PASS
78	2480	-43.91	1.22	-18.78	PASS

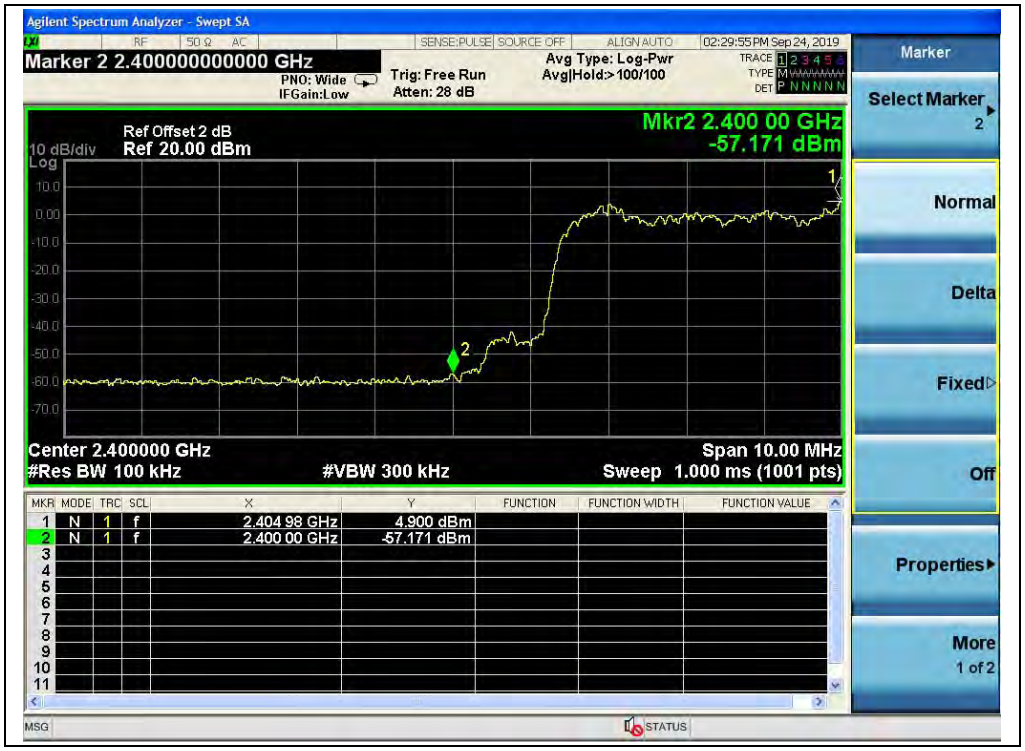
B. Test Plots:



(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	-43.86	2.59	-17.41	PASS
39	2441	-42.91	6.15	-13.85	PASS
78	2480	-43.80	2.13	-17.87	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

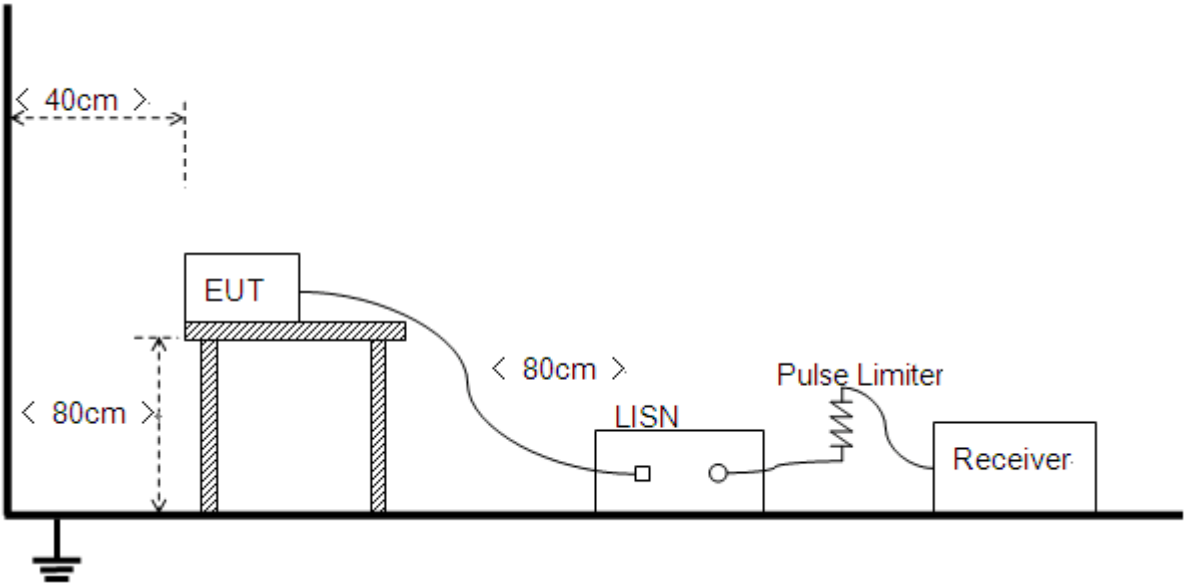
NOTE:

(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

A. 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+ADAPTOR+BT TX

Test voltage: AC 120V/60Hz

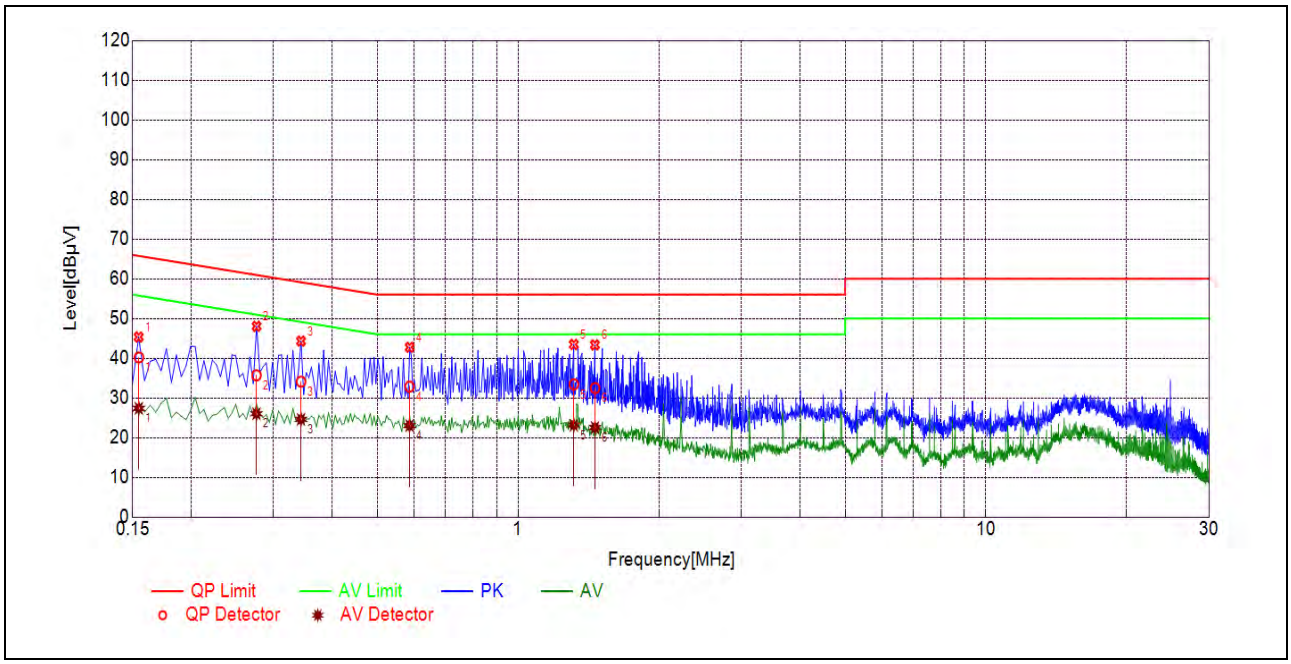
The measurement results are obtained as below:

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

U_R: Receiver Reading

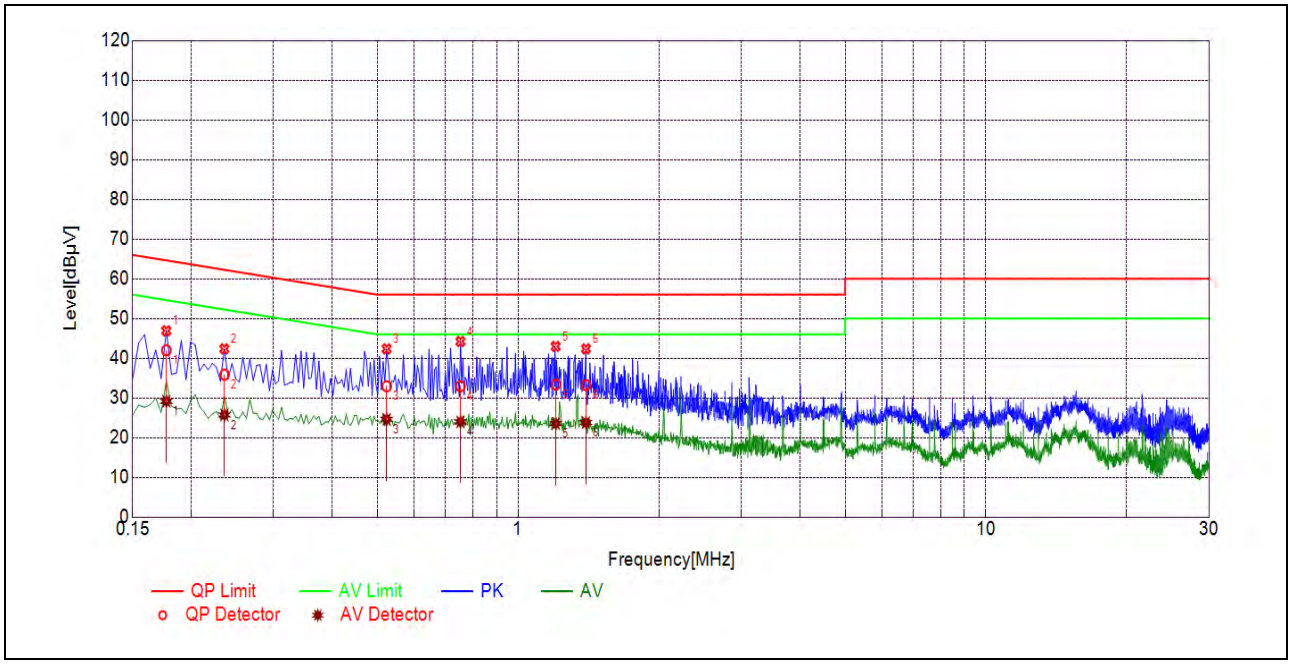
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1546	40.20	27.39	65.75	55.75	Line	PASS
2	0.2758	35.67	26.02	60.94	50.94		PASS
3	0.3434	34.10	24.60	59.12	49.12		PASS
4	0.5859	32.85	23.02	56.00	46.00		PASS
5	1.3156	33.41	23.14	56.00	46.00		PASS
6	1.4602	32.49	22.54	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	42.01	29.18	64.63	54.63	Neutral	PASS
2	0.2356	35.83	25.72	62.25	52.25		PASS
3	0.5236	32.93	24.60	56.00	46.00		PASS
4	0.7529	32.94	23.95	56.00	46.00		PASS
5	1.2039	33.36	23.55	56.00	46.00		PASS
6	1.3964	33.23	23.78	56.00	46.00		PASS

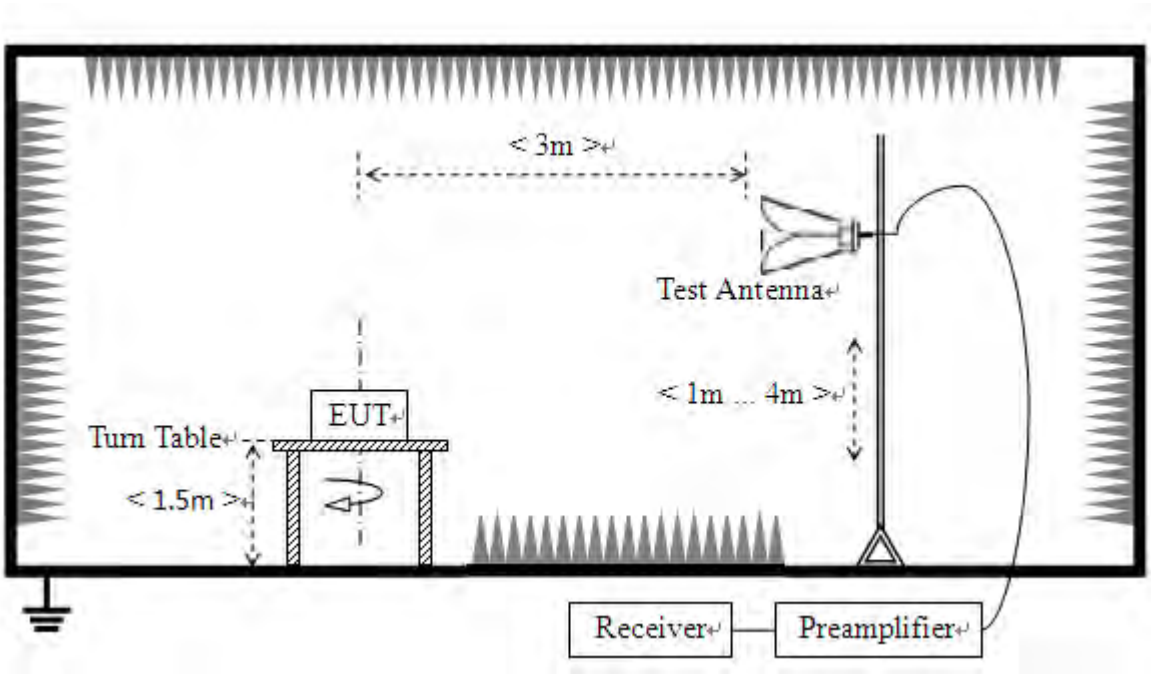
2.12. Restricted Frequency Bands

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

A. 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

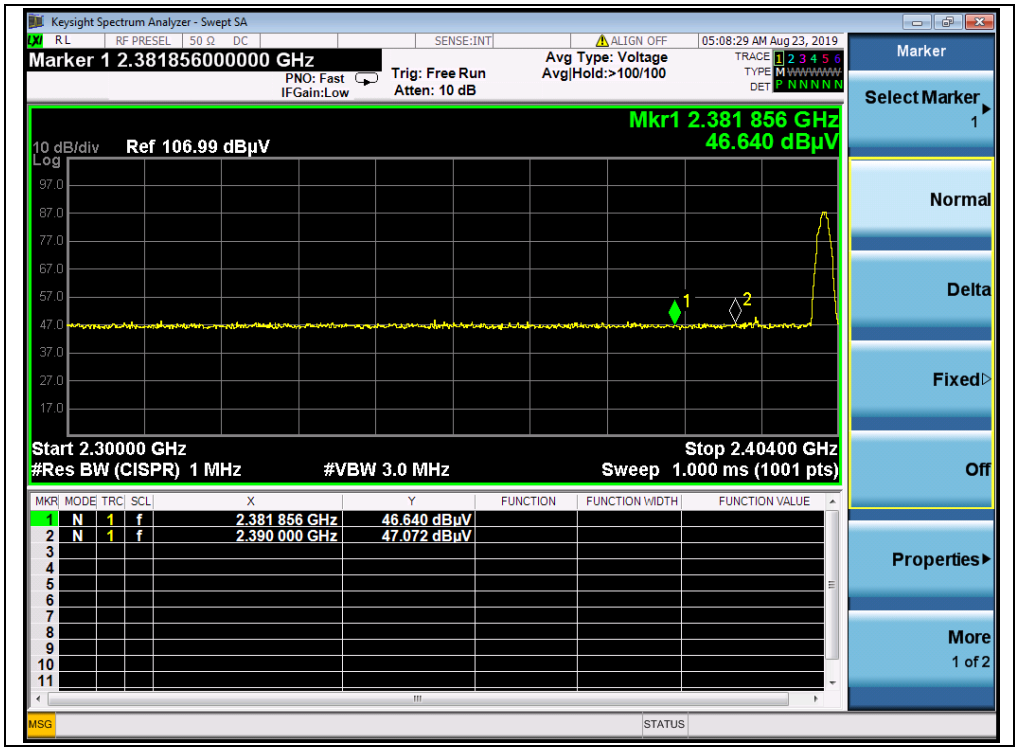
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; AT =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier Gain
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

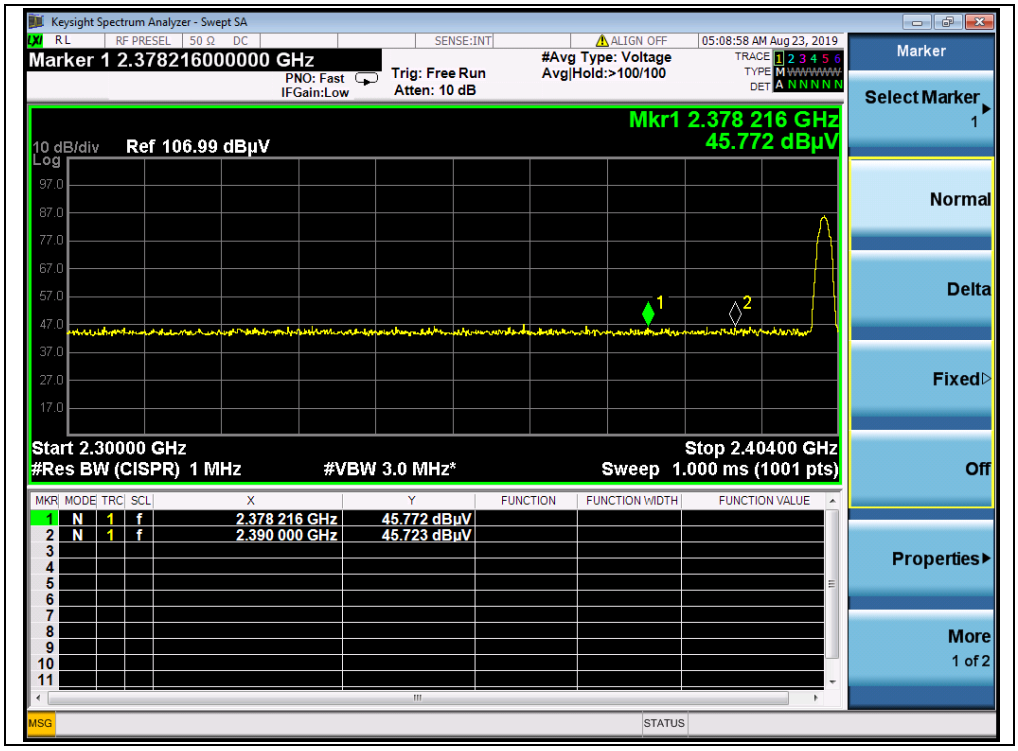
A. Test Verdict:

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	2390.00	PK	47.07	-29.67	32.56	49.96	74	PASS
0	2378.22	AV	45.77	-29.67	32.56	48.66	54	PASS
78	2485.13	PK	46.89	-29.67	32.56	49.78	74	PASS
78	2484.93	AV	46.33	-29.67	32.56	49.22	54	PASS

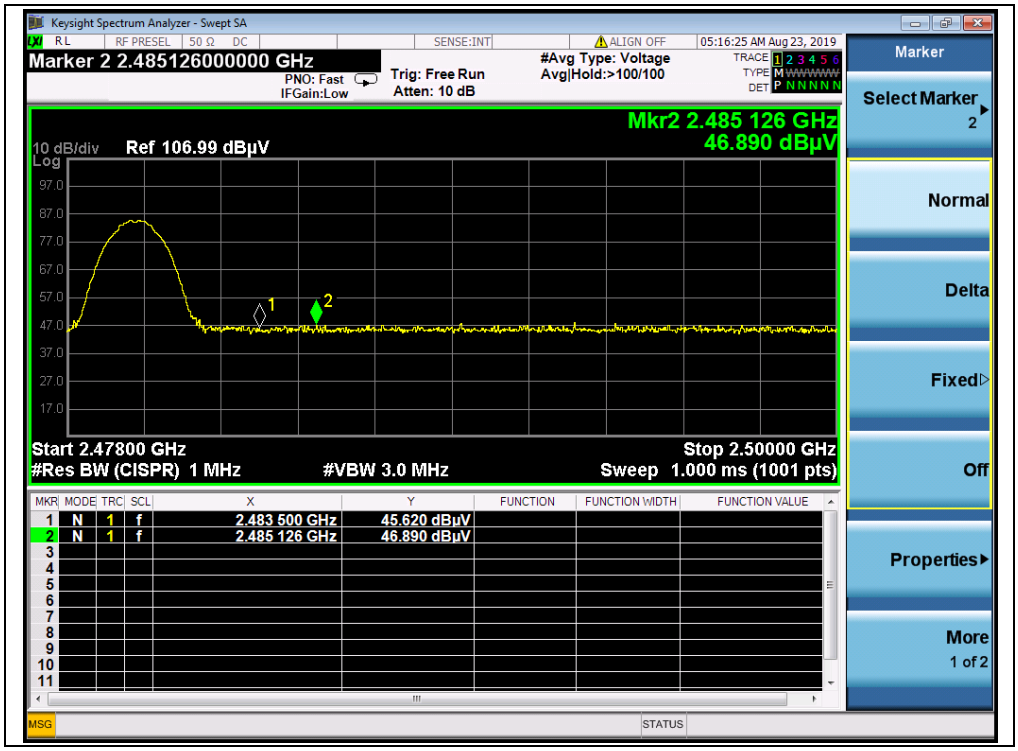
B. Test Plots:



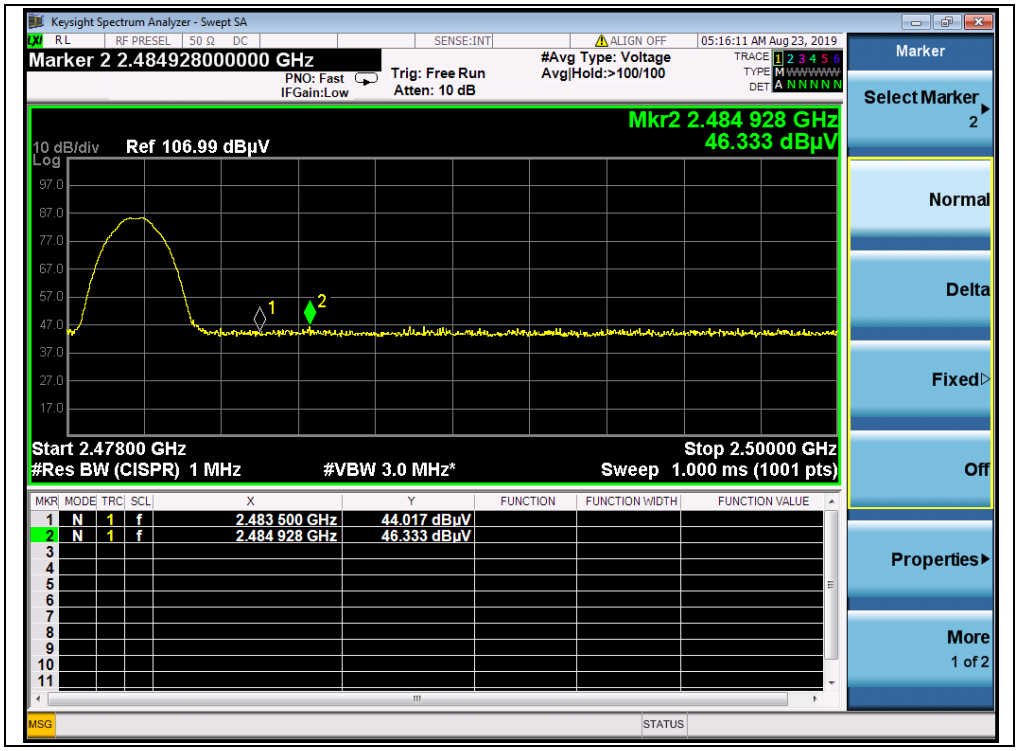
(Channel = 0, PEAK, GFSK)



(Channel = 0, AVERAGE, GFSK)



(Channel = 78, PEAK, GFSK)



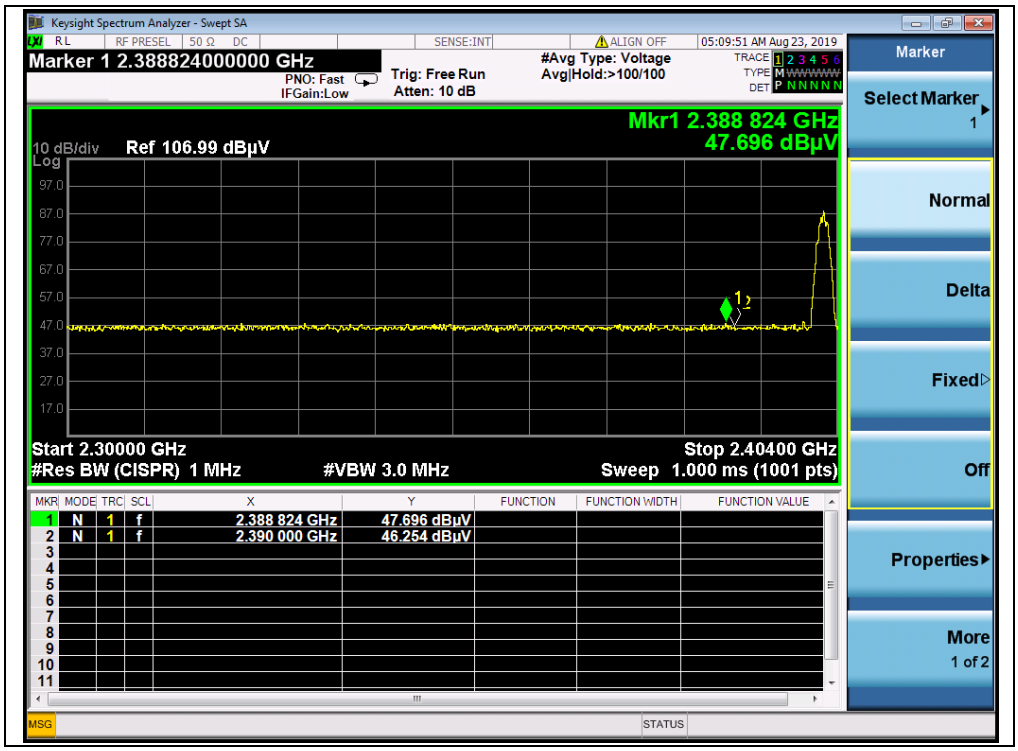
(Channel = 78, AVERAGE, GFSK)

π/4-DQPSK Mode

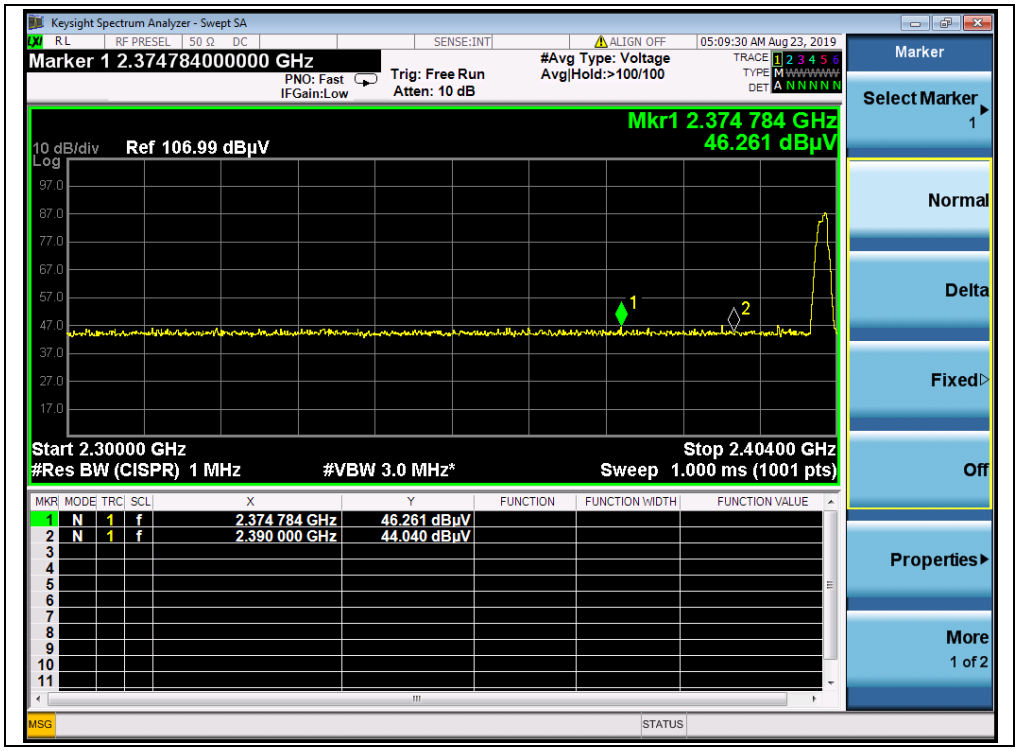
A. Test Verdict:

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	2388.82	PK	47.70	-29.67	32.56	50.59	74	PASS
0	2374.78	AV	46.26	-29.67	32.56	49.15	54	PASS
78	2486.53	PK	48.07	-29.67	32.56	50.96	74	PASS
78	2485.02	AV	45.63	-29.67	32.56	48.52	54	PASS

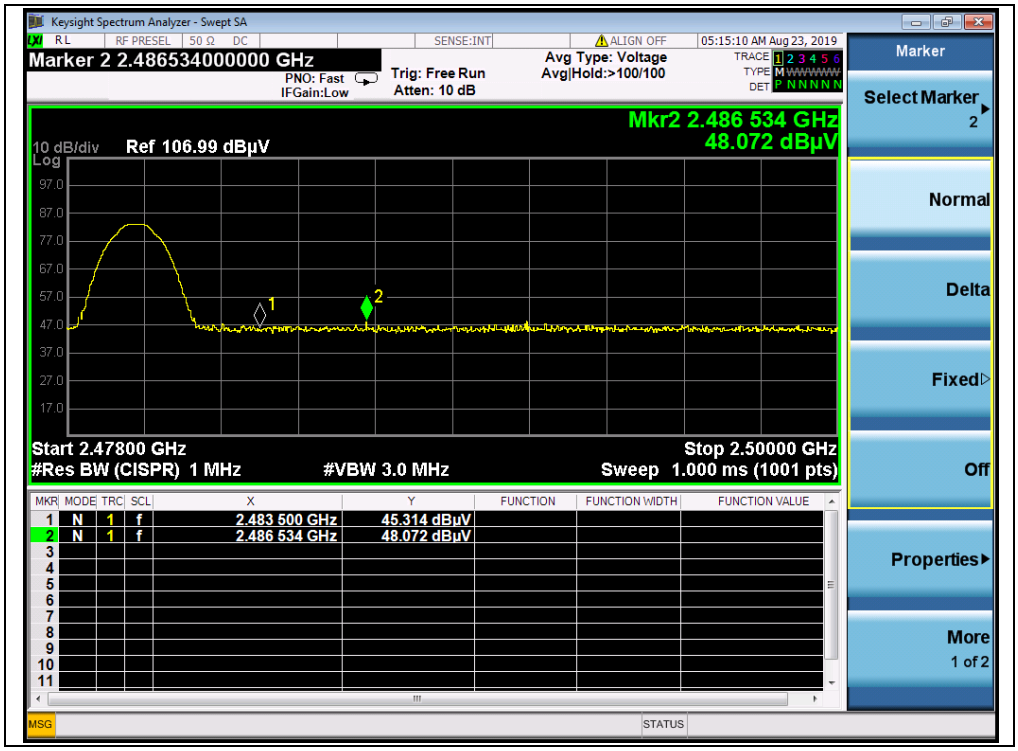
B. Test Plots:



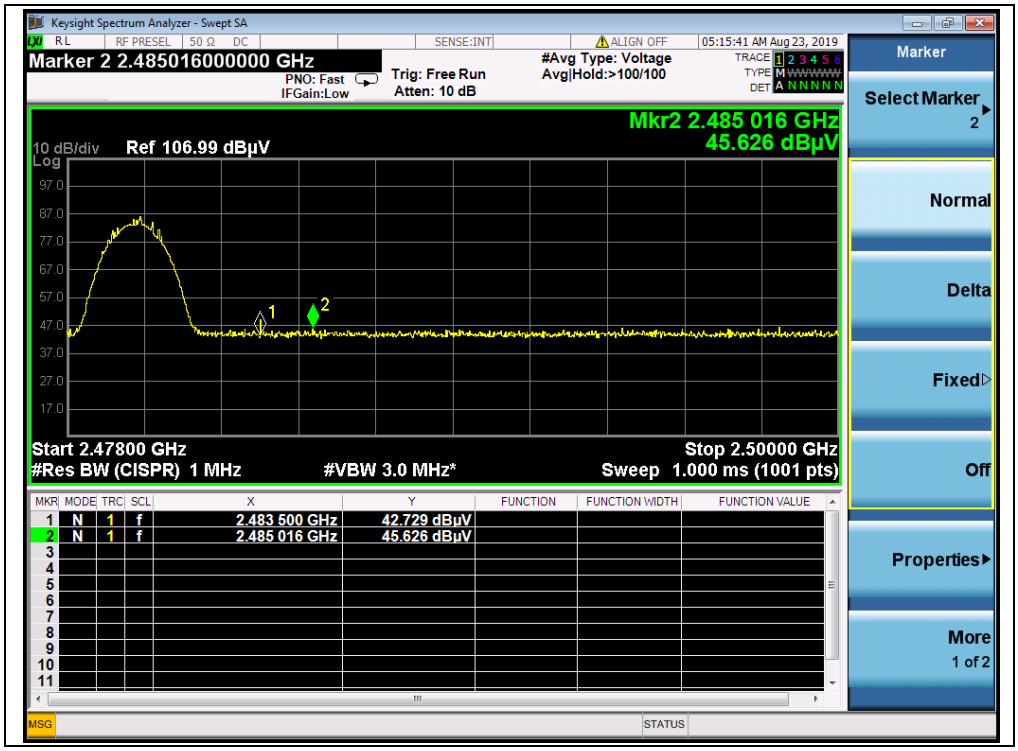
(Channel = 0, PEAK, π/4-DQPSK)



(Channel = 0, AVERAGE, π/4-DQPSK)



(Channel = 78, PEAK, π/4-DQPSK)



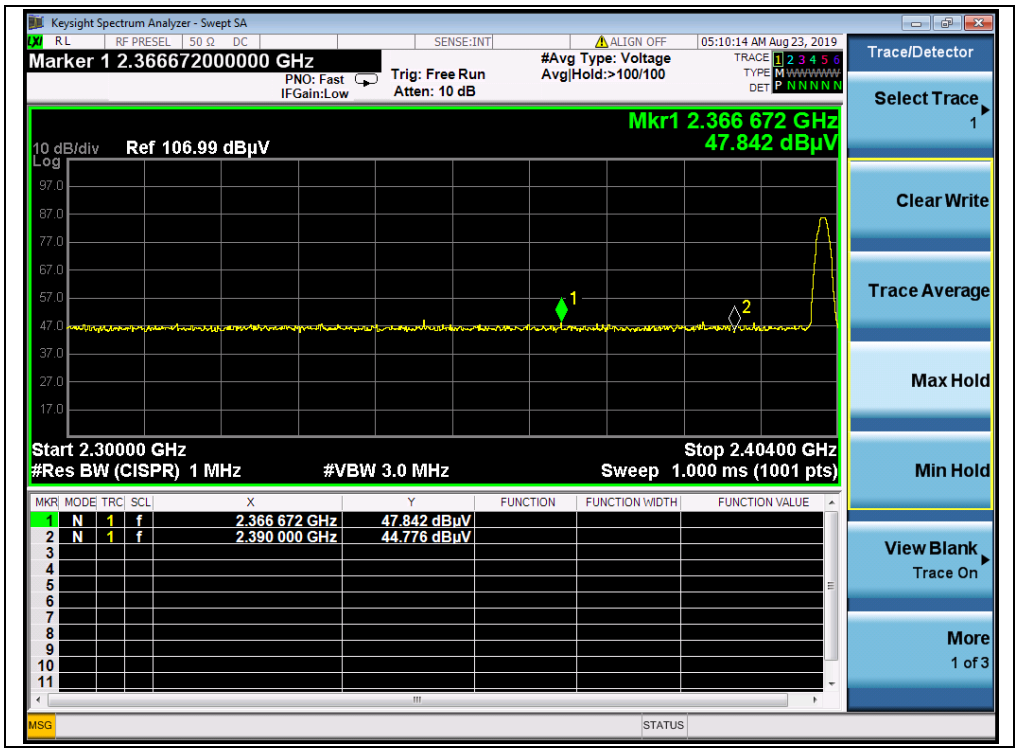
(Channel = 78, AVERAGE, π/4-DQPSK)

8-DPSK Mode

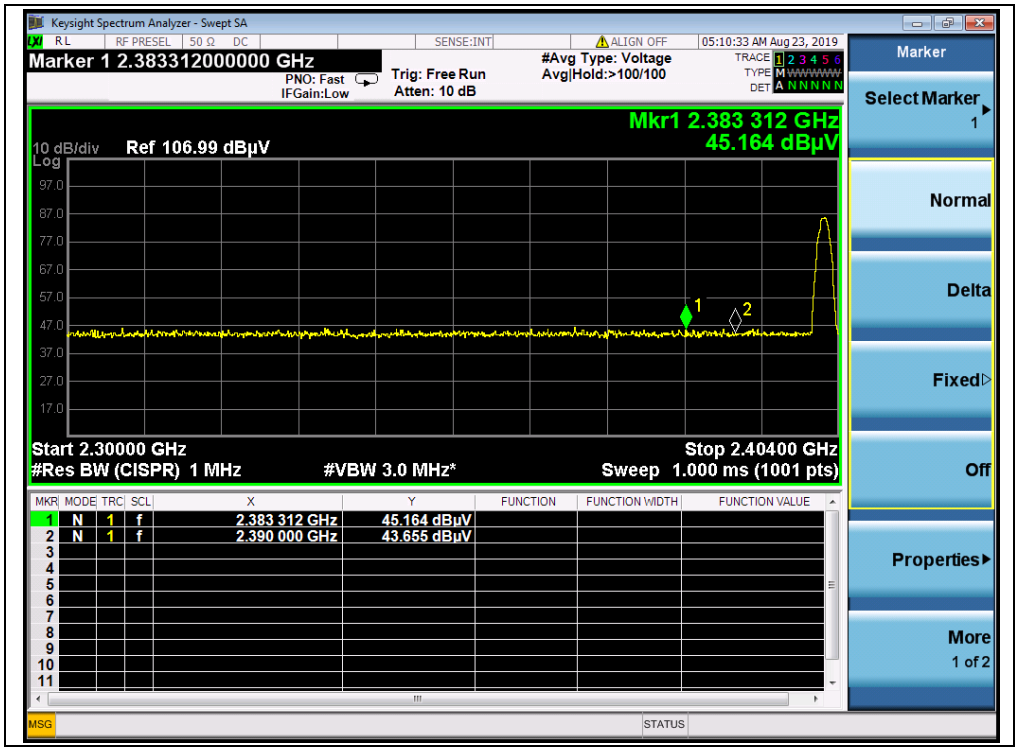
A. Test Verdict:

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	2366.67	PK	47.84	-29.67	32.56	50.73	74	PASS
0	2383.31	AV	45.16	-29.67	32.56	48.05	54	PASS
78	24876.07	PK	49.82	-29.67	32.56	52.71	74	PASS
78	2483.96	AV	45.65	-29.67	32.56	48.54	54	PASS

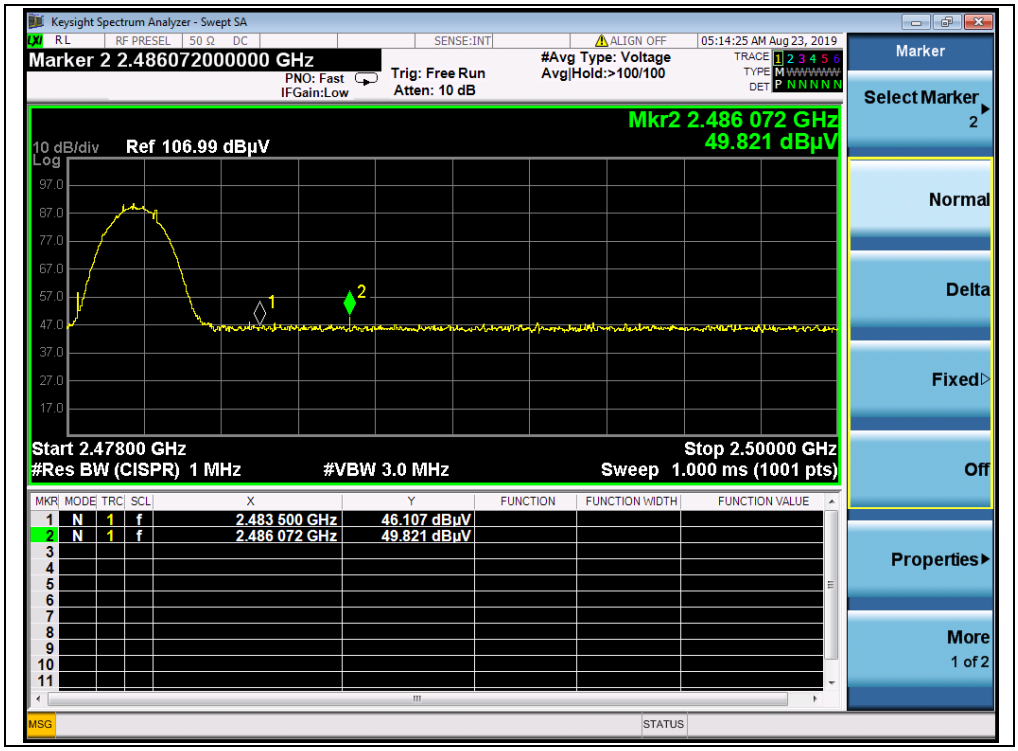
B. Test Plots:



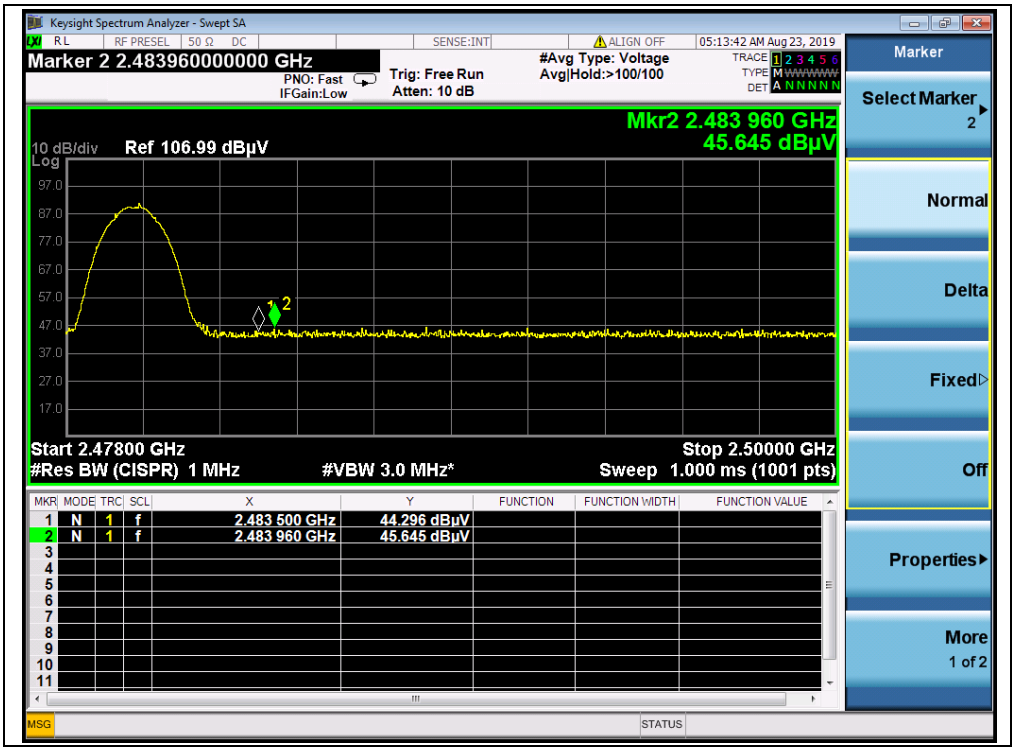
(Channel = 0, PEAK, 8-DPSK)



(Channel = 0, AVERAGE, 8-DPSK)



(Channel = 78, PEAK, 8-DPSK)



(Channel = 78, AVERAGE, 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:

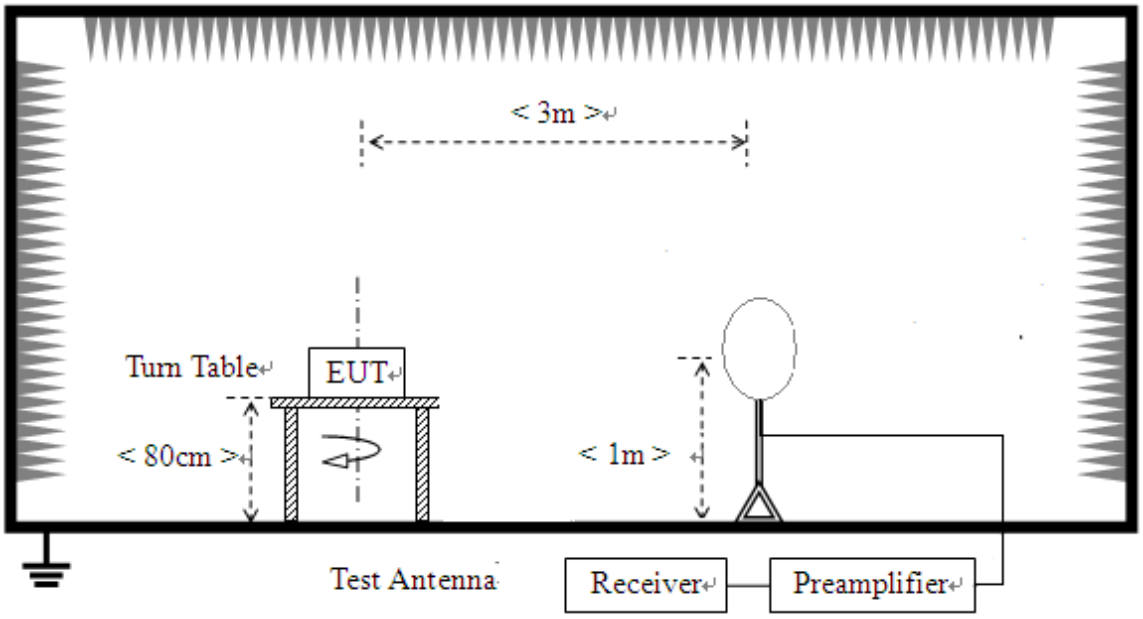
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength 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)

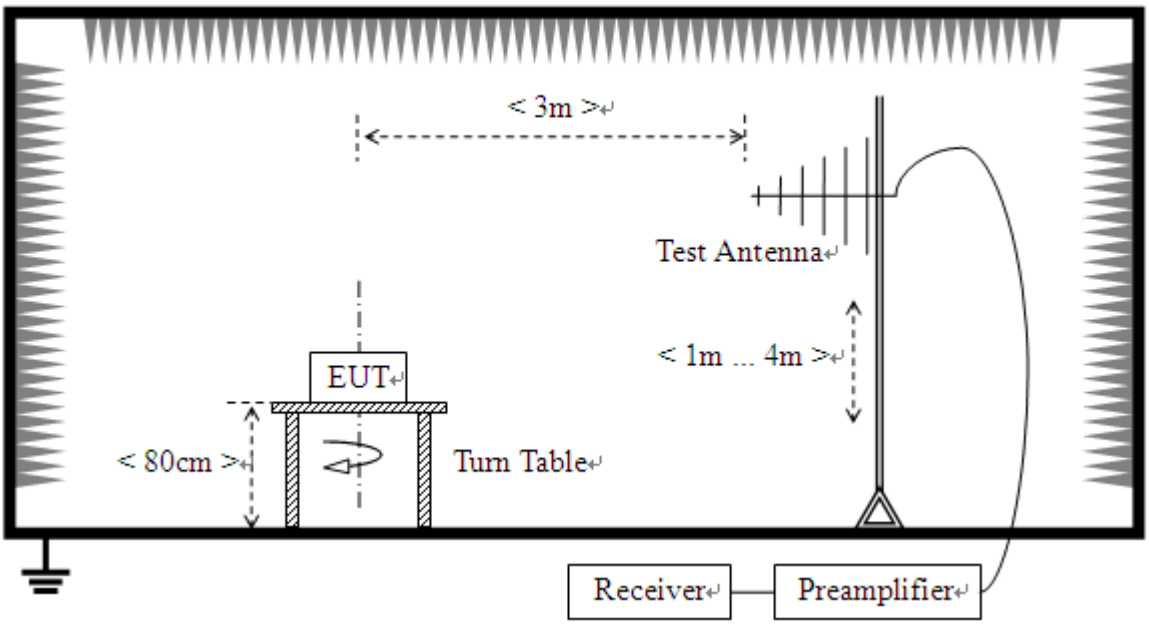
2.13.2. Test Description

A. Test Setup:

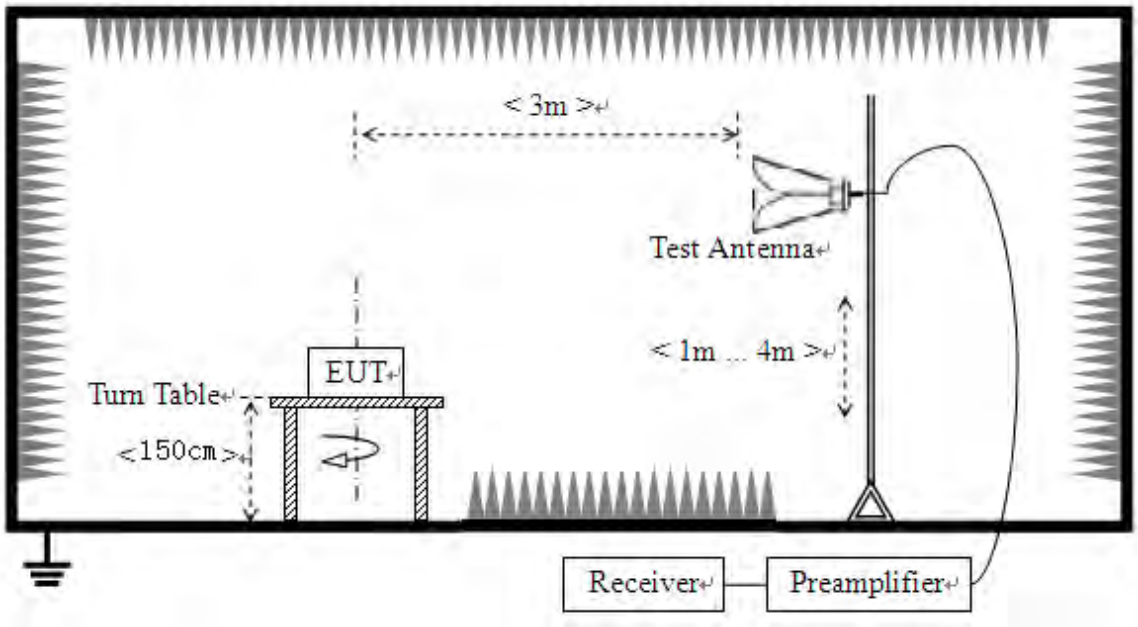
1) For radiated emissions from 9kHz to 30MHz



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

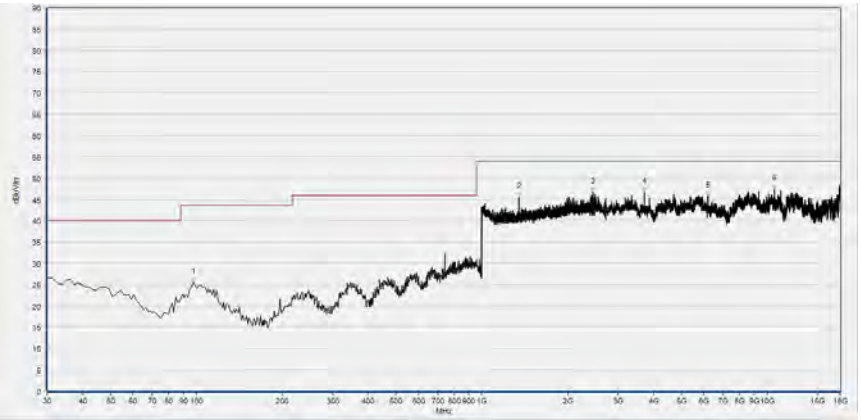
According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with 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 25GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

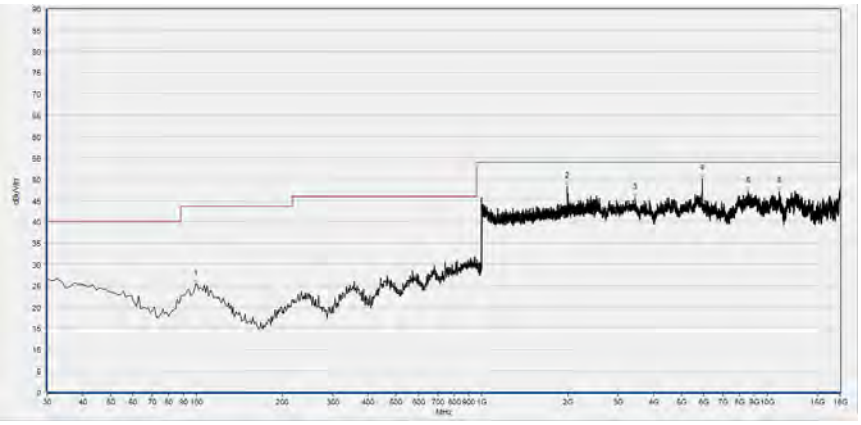
GFSK Mode

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
97.985	25.40	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1350.220	45.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2452.741	46.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3709.002	46.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6195.854	45.72	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10567.449	47.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

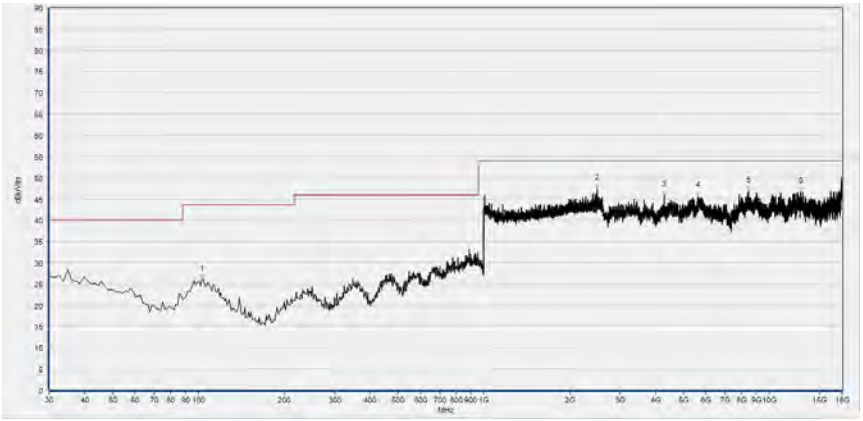
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 0)



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
99.199	25.27	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1996.238	48.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3448.554	45.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	50.13	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8581.888	47.15	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
11046.336	47.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

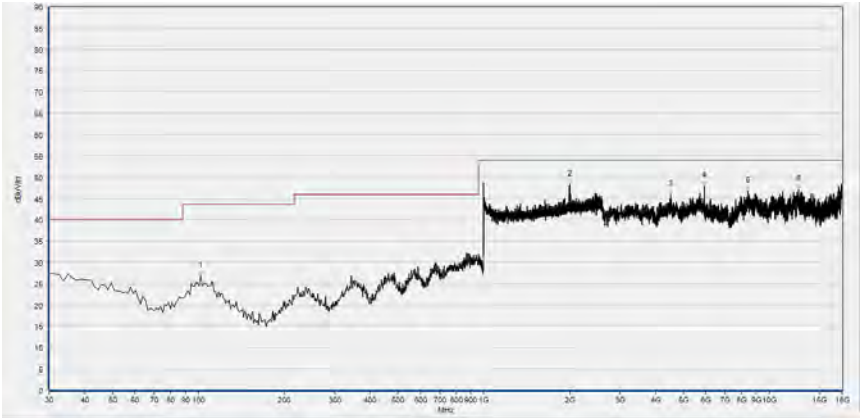
(30MHz to 25GHz, Antenna Vertical, GFSK, channel 0)

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
102.841	26.14	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2500.120	47.40	N/A	N/A	74.00	N/A	74.00	Horizontal	PASS
4280.306	45.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5624.550	45.83	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8439.062	46.90	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12891.871	46.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

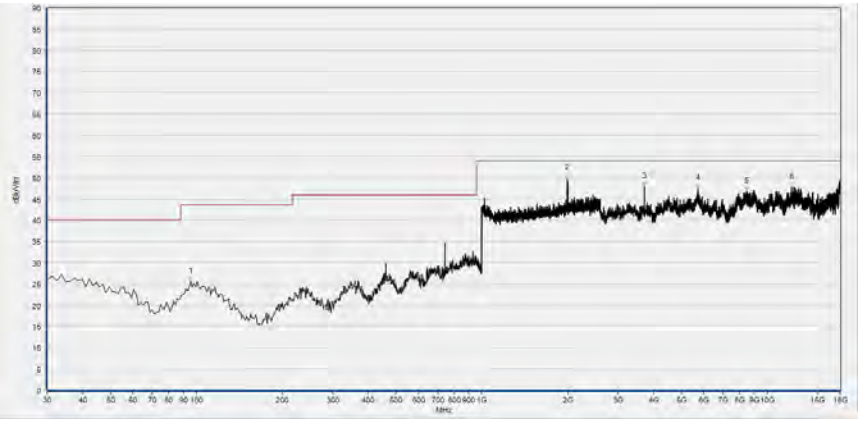
(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 39)



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
101.627	26.88	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1998.159	48.27	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4523.950	46.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	47.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8427.860	46.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12684.634	47.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

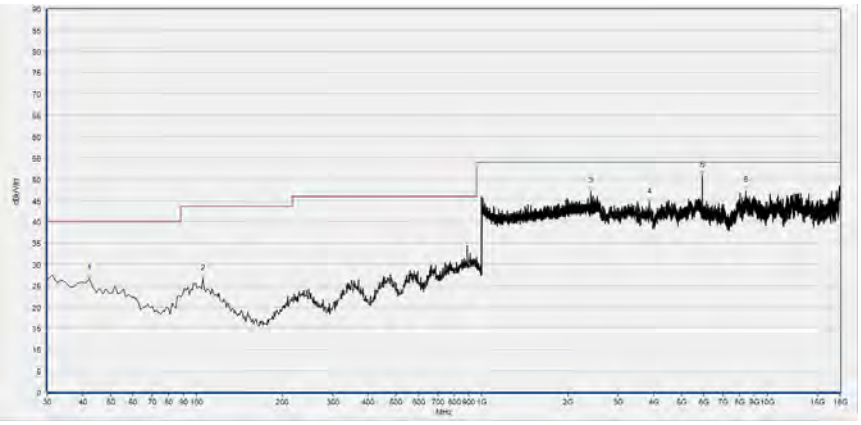
(30MHz to 25GHz, Antenna Vertical, GFSK, channel 39)

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
95.557	25.41	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1994.958	49.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3709.002	47.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5730.969	47.36	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8481.069	46.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12146.936	47.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal, GFSK, channel 78)

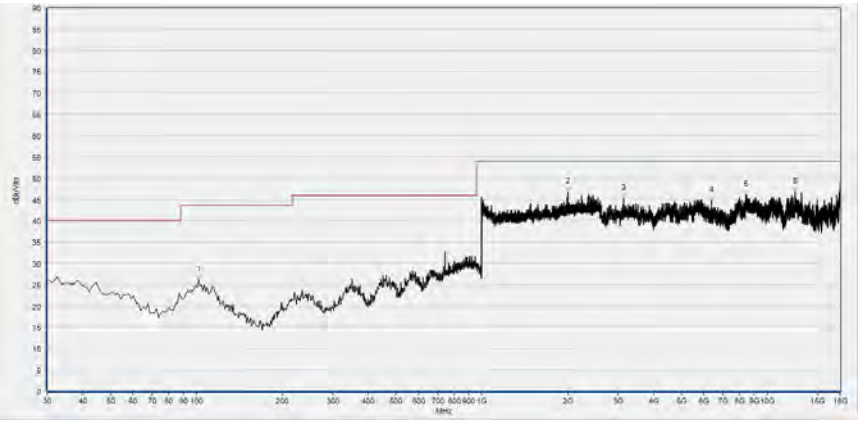


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
42.140	26.60	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
105.269	26.64	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2407.283	47.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3854.628	44.60	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	50.80	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8394.254	47.33	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical, GFSK, channel 78)

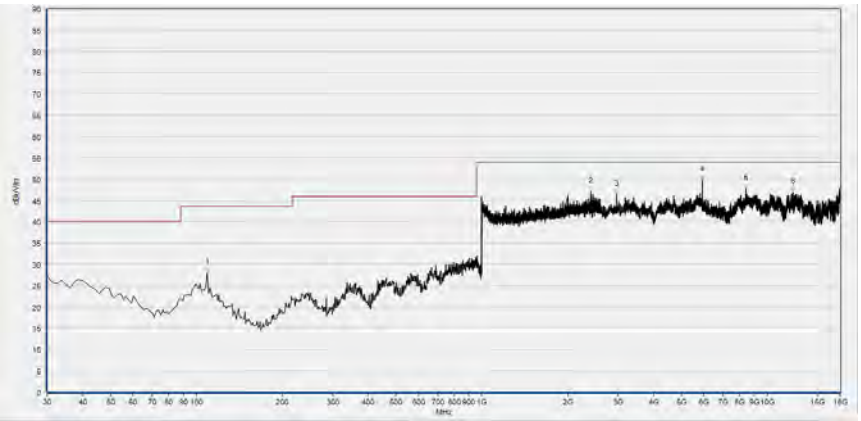
π/4-DQPSK Mode

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
101.627	26.22	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1998.800	46.76	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3143.299	45.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6389.089	44.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8419.458	46.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12516.603	46.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

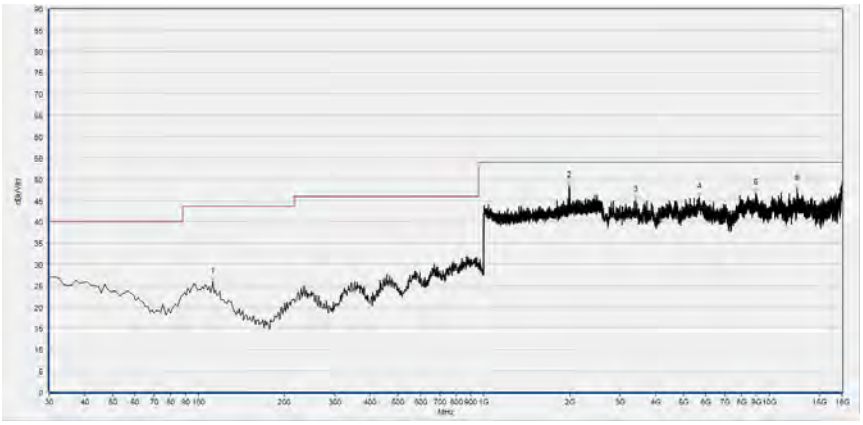
(30MHz to 25GHz, Antenna Horizontal, π/4-DQPSK, channel 0)



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
108.911	27.94	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2411.765	47.15	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2966.867	46.34	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	49.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8427.860	47.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12281.360	46.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

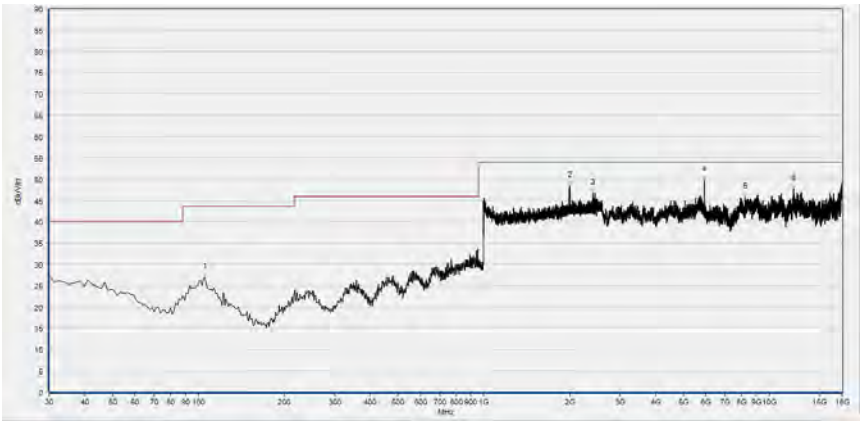
(30MHz to 25GHz, Antenna Vertical, π/4-DQPSK, channel 0)

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
112.553	25.97	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1991.116	48.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3403.746	45.07	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5669.358	45.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8959.956	46.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12508.201	47.78	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

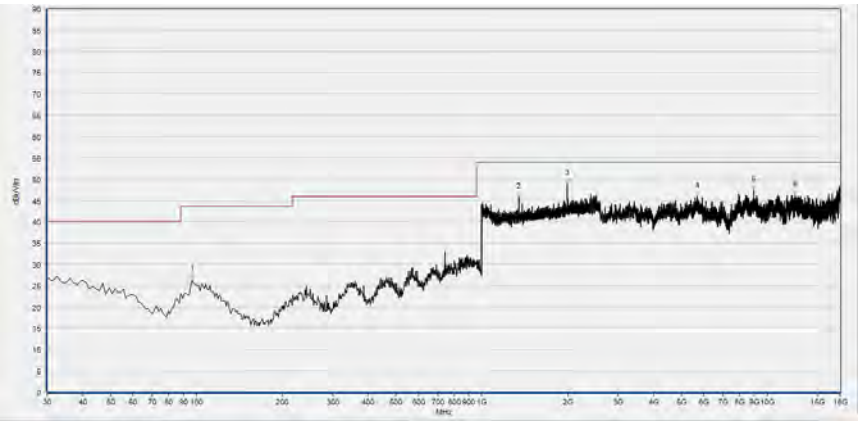
(30MHz to 25GHz, Antenna Horizontal, π/4-DQPSK, channel 39)



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
105.269	26.92	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1998.159	48.37	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2411.124	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5935.406	49.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8217.821	45.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12146.936	47.81	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

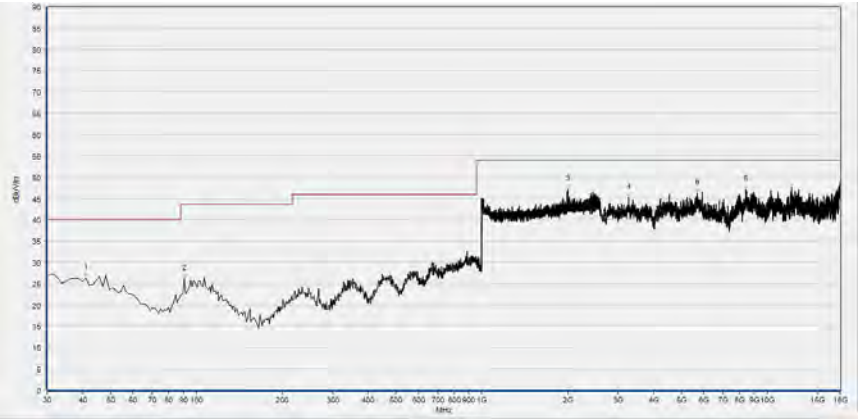
(30MHz to 25GHz, Antenna Vertical, π/4-DQPSK, channel 39)

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
96.771	26.24	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1349.580	45.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
1994.318	48.90	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5672.159	45.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8973.959	47.50	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12508.201	46.22	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal, π/4-DQPSK, channel 78)

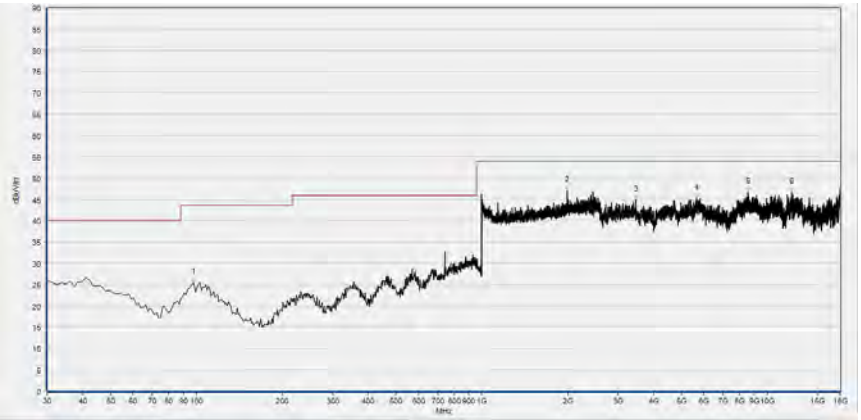


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
40.926	26.30	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
90.701	26.19	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1998.800	47.06	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3269.322	45.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5677.760	46.33	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8413.857	47.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical, π/4-DQPSK, channel 78)

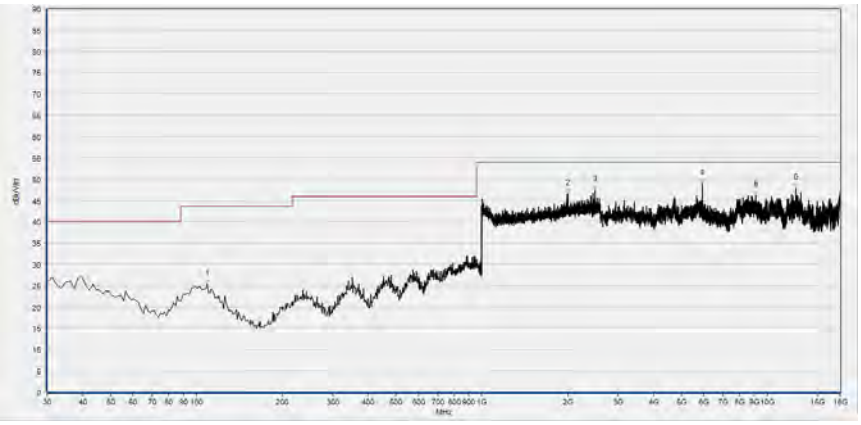
8-DPSK Mode

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
97.985	25.44	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1993.037	47.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3470.958	44.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5646.954	45.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8576.287	46.71	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12160.938	46.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

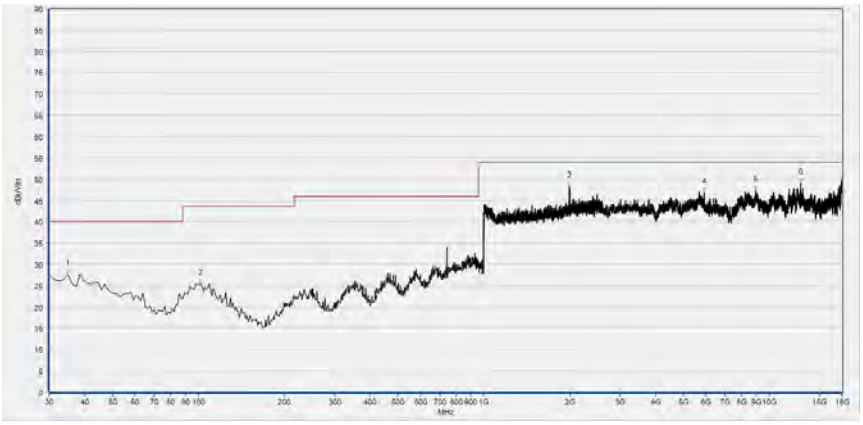
(30MHz to 25GHz, Antenna Horizontal, 8-DPSK, channel 0)



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
108.911	25.27	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1997.519	46.63	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2495.638	47.50	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	48.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9097.181	46.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12614.621	47.97	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

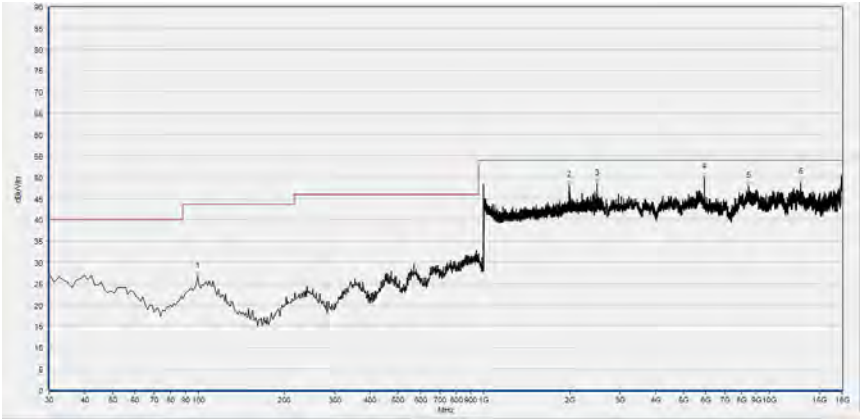
(30MHz to 25GHz, Antenna Vertical, 8-DPSK, channel 0)

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
34.856	27.63	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
101.627	25.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1995.598	48.42	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5932.606	46.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8987.961	47.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12886.270	49.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

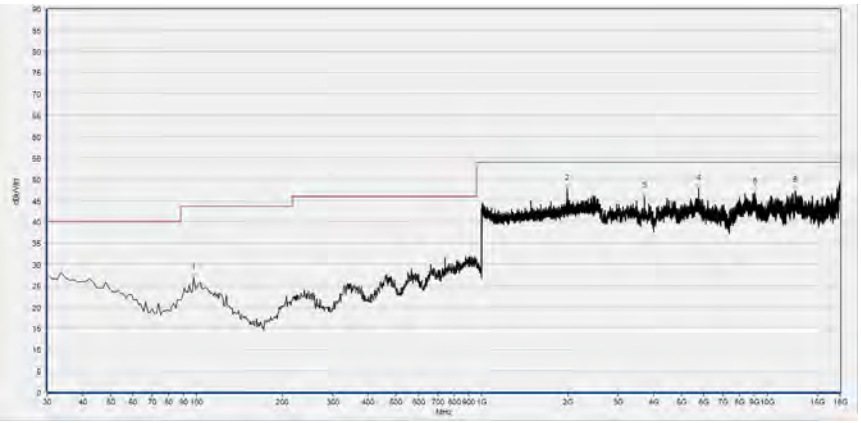
(30MHz to 25GHz, Antenna Horizontal, 8-DPSK, channel 39)



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
99.199	26.62	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1996.879	48.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2490.516	48.45	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	49.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8461.466	47.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12897.472	48.83	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

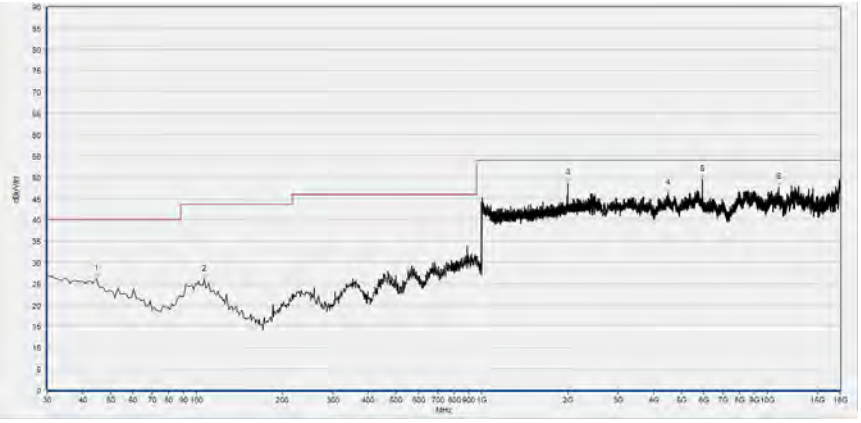
(30MHz to 25GHz, Antenna Vertical, 8-DPSK, channel 39)

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
97.985	26.78	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1994.958	47.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3709.002	45.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5756.174	47.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9088.780	46.88	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12533.406	47.27	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(30MHz to 25GHz, 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
44.568	26.23	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
106.483	25.91	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1997.519	48.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4476.341	46.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5932.606	49.51	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10959.520	47.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(30MHz to 25GHz, 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	±2.77 dB
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

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	2019.04.09	2020.04.08
Directional coupler	17041703	DTO-5-30	ShangHai Huaxiang	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2019.04.09	2020.04.08
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	2019.05.08	2020.05.09
LISN	812744	NSLK 8127	Schwarzbeck	2019.05.08	2020.05.09
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
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	V 1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.26	2020.07.25
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.08	2020.05.09
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.15	2020.02.14
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2020.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2020.07.25
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	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2018.12.01	2019.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT