REPORT No. : SZ20100254W02

TEST REPORT

APPLICANT	:	Thundercomm Technology Co., Ltd
PRODUCT NAME	:	TurboX C450 SOM
MODEL NAME	:	TurboX C450
BRAND NAME	:	TurboX
FCC ID	:	2AOHHTURBOXC450
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2020-10-28
TEST DATE	:	2020-11-07 to 2021-03-12
ISSUE DATE	:	2021-05-08

Edited by: Peng Mi (Rapporteur)

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MORLAB

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DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2021-05-08	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Thundercomm Technology Co., Ltd
Applicant Address:	Building 4, No. 99, Data Valley Middle Road, Xiantao District, Yubei District, Chongqing, China
Manufacturer:	Thundercomm Technology Co., Ltd
Manufacturer Address:	Building 4, No. 99, Data Valley Middle Road, Xiantao District, Yubei District, Chongqing, China

1.2. Equipment Under Test (EUT) Description

Product Name:	TurboX C450 SOM
Serial No.:	(N/A, marked #1 by test site)
Hardware Version:	TURBOX-C450_SOM
Software Version:	2020.10.22
Equipment Type:	Bluetooth classic
Bluetooth Version:	4.0
Modulation Type:	FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Operating Frequency Range:	2402MHz–2480MHz
Antenna Type:	Dipole Antenna
Antenna Gain:	3dBi

Note 1: The EUT will not sell with antenna.

Note 2: We use the dedicated software to control the EUT into the test mode, and then use bluetooth base station 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 black bold channels were selected for test.

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) 15.247(h)	Hopping Mechanism	N/A	N/A	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Nov 26, 2020	Liu Bo	PASS	No deviation
4	ANSI C63.10	Duty Cycle	Nov 26, 2020	Liu Bo	PASS	No deviation
5	15.247(b)	Maximum Peak Conducted Output Power	Nov 26, 2020	Liu Bo	PASS	No deviation
6	15.247(b)	Maximum Average Conducted Output Power	Nov 26, 2020	Liu Bo	PASS	No deviation
7	15.247(a)	20dB Bandwidth	Nov 26, 2020	Liu Bo	PASS	No deviation
8	15.247(a)	Carrier Frequency Separation	Nov 26, 2020	Liu Bo	PASS	No deviation
9	15.247(a)	Time of Occupancy (Dwell time)	Nov 26, 2020	Liu Bo	PASS	No deviation
10	15.247(d)	Conducted Spurious Emission	Nov 26, 2020	Liu Bo	PASS	No deviation
11	15.207	Conducted Emission	Nov 07, 2020	Huang Zhiye	PASS	No deviation
12	15.247(d)	Restricted Frequency Bands	Mar 11&12, 2021	Lin Jiayong	PASS	No deviation
13	15.209, 15.247(d)	Radiated Emission	Mar 10, 2021	Lin Jiayong	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 1.5dB means the cable loss is 1.5dB.
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.
Note 4: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

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.Test 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 hop sets 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***".

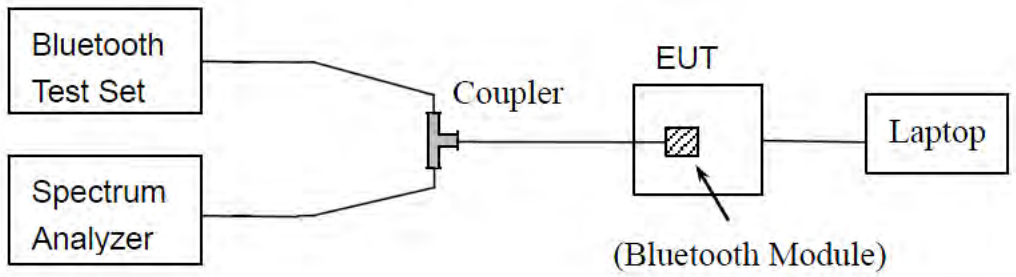
2.3.Number of Hopping Frequency

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

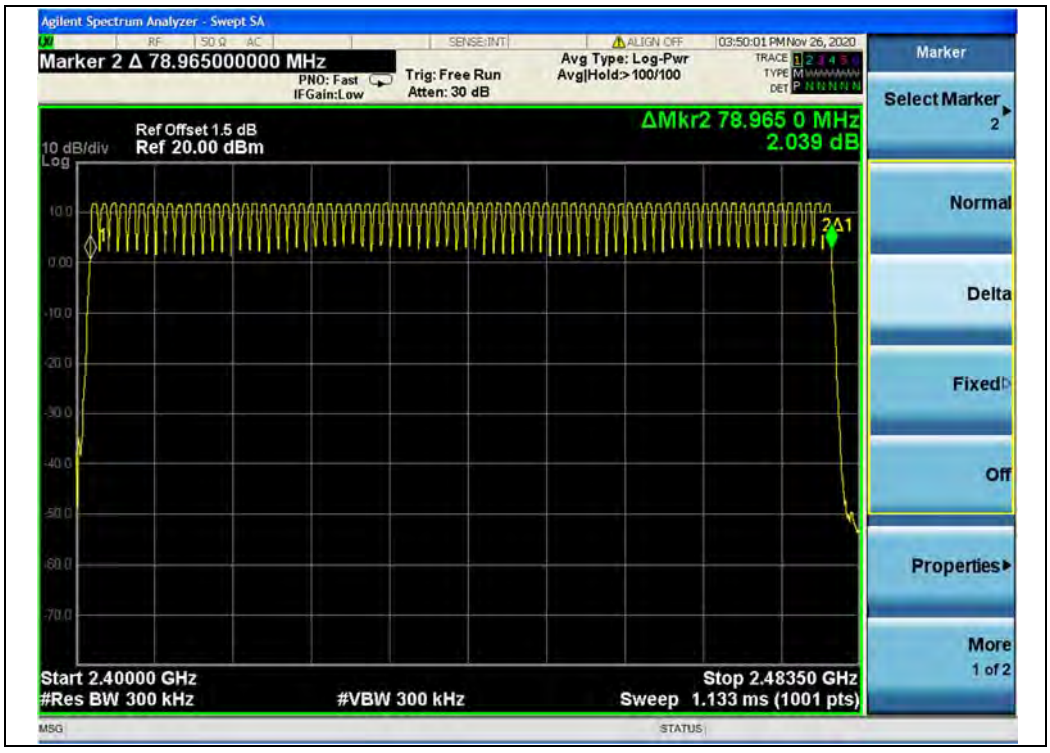
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

2.3.4.Test Result

A.Test Verdict:

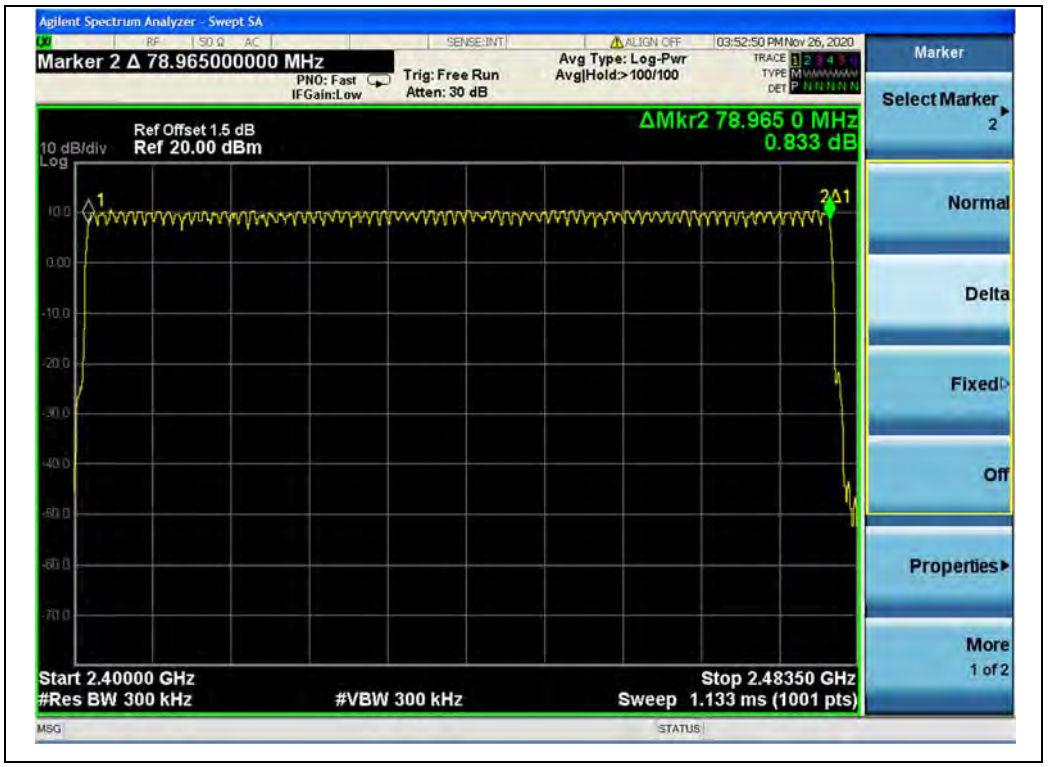
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	PASS
π/4-DQPSK	2400 - 2483.5	79	15	PASS
8-DPSK	2400 - 2483.5	79	15	PASS

B.Test Plots:



(GFSK)

(π/4-DQPSK)



(8-DPSK)

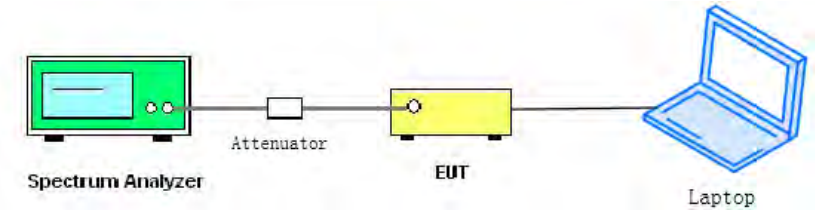
2.4.Duty Cycle of Test Signal

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 sub clause, 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	77.07	1.13
π/4-DQPSK	77.07	1.13
8-DPSK	77.07	1.13

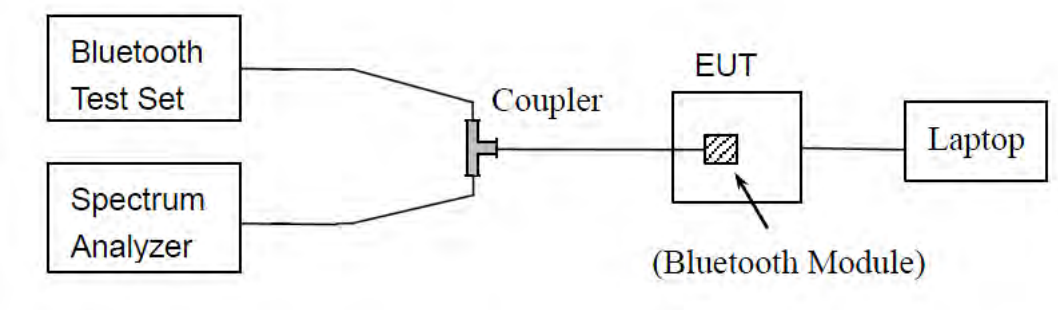
2.5.Maximum Peak Conducted Output Power

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

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.

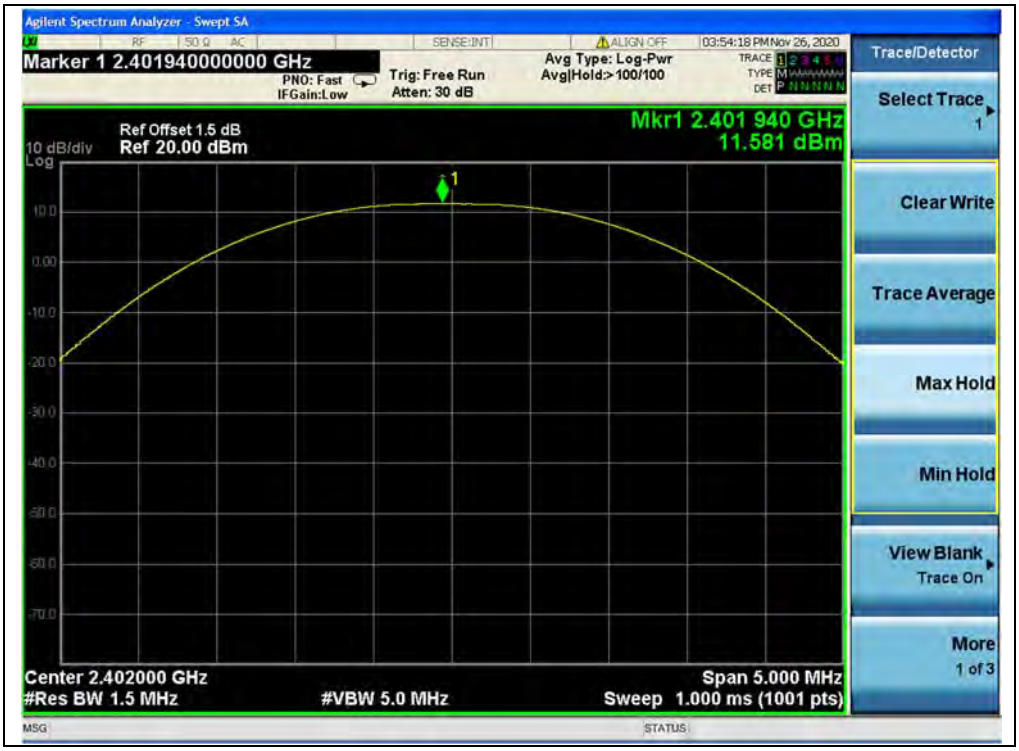
2.5.3.Test Result

GFSK Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	11.58	0.014	20.96	0.125	PASS
39	2441	11.67	0.015			PASS
78	2480	11.66	0.015			PASS

B.Test Plot:



(Channel 0, GFSK)

(Channel 39, GFSK)

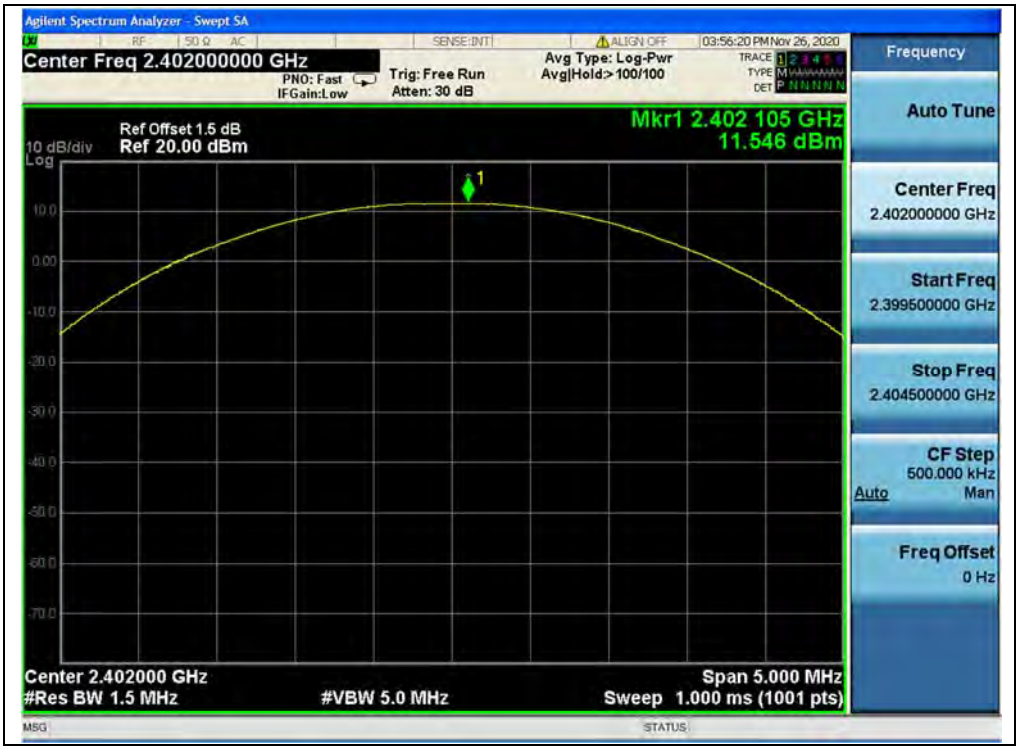
(Channel 78, GFSK)

π/4-DQPSK Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	11.55	0.014	20.96	0.125	PASS
39	2441	11.62	0.015			PASS
78	2480	11.61	0.014			PASS

B.Test Plot:



(Channel 0, π/4-DQPSK)

(Channel 39, π/4-DQPSK)

(Channel 78, π/4-DQPSK)

8-DPSK Mode

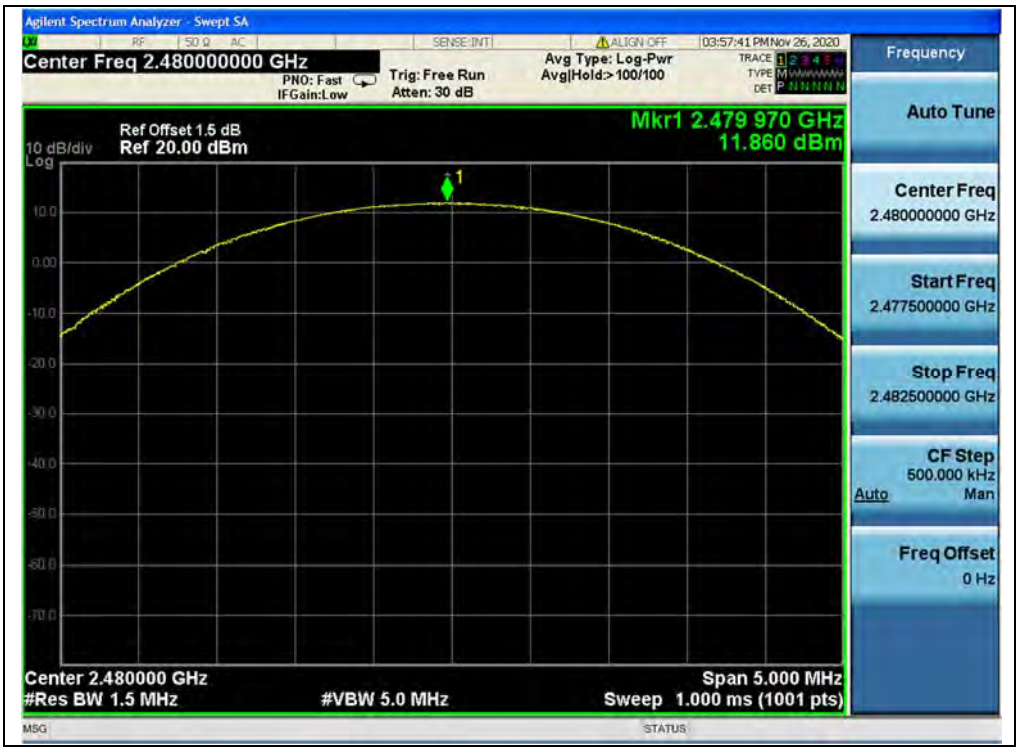
A.Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	11.81	0.015	20.96	0.125	PASS
39	2441	**11.87**	**0.015**			PASS
78	2480	11.86	0.015			PASS

B.Test Plot:

(Channel 0, 8-DPSK)

(Channel 39, 8-DPSK)



(Channel 39, 8-DPSK)

2.6.Maximum Average Conducted Output Power

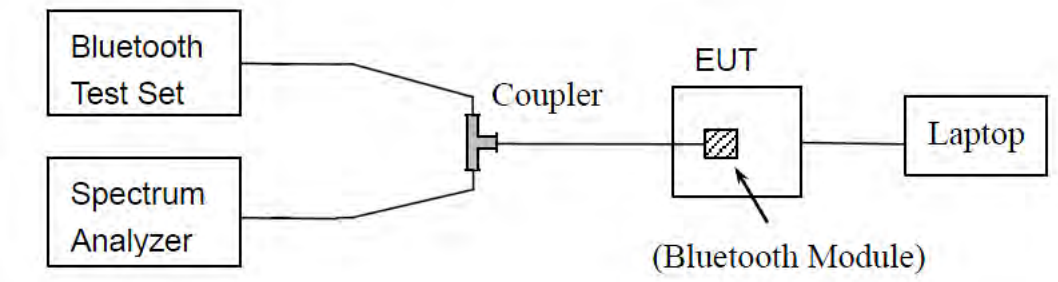
2.6.1.Requirement

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.

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

GFSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	10.19	1.13	11.32	0.014	20.96	0.125	PASS
39	2441	10.36		11.49	0.014			PASS
78	2480	10.50		**11.63**	**0.015**			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	7.85	1.13	8.98	0.008	20.96	0.125	PASS
39	2441	8.00		9.13	0.008			PASS
78	2480	8.21		9.34	0.009			PASS

8-DPSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	7.95	1.13	9.08	0.008	20.96	0.125	PASS
39	2441	7.94		9.07	0.008			PASS
78	2480	8.09		9.22	0.008			PASS

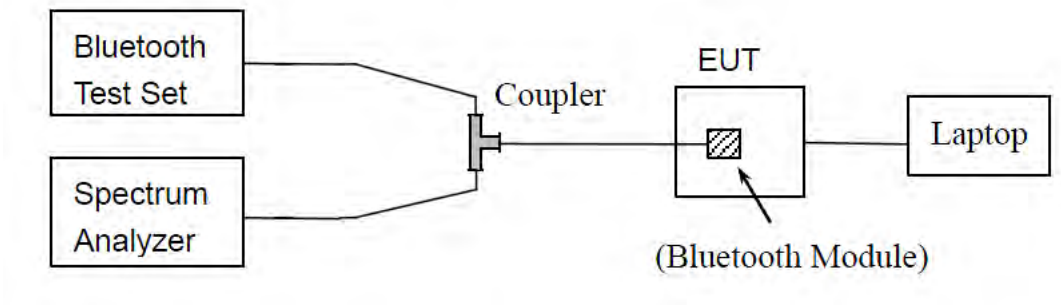
2.7.20dB Bandwidth

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 = between 2 to 5 times the OBW, centered on the test channel
RBW= 1% to 5% of the OBW
VBW ≥ 3 x RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.7.4.Test Result

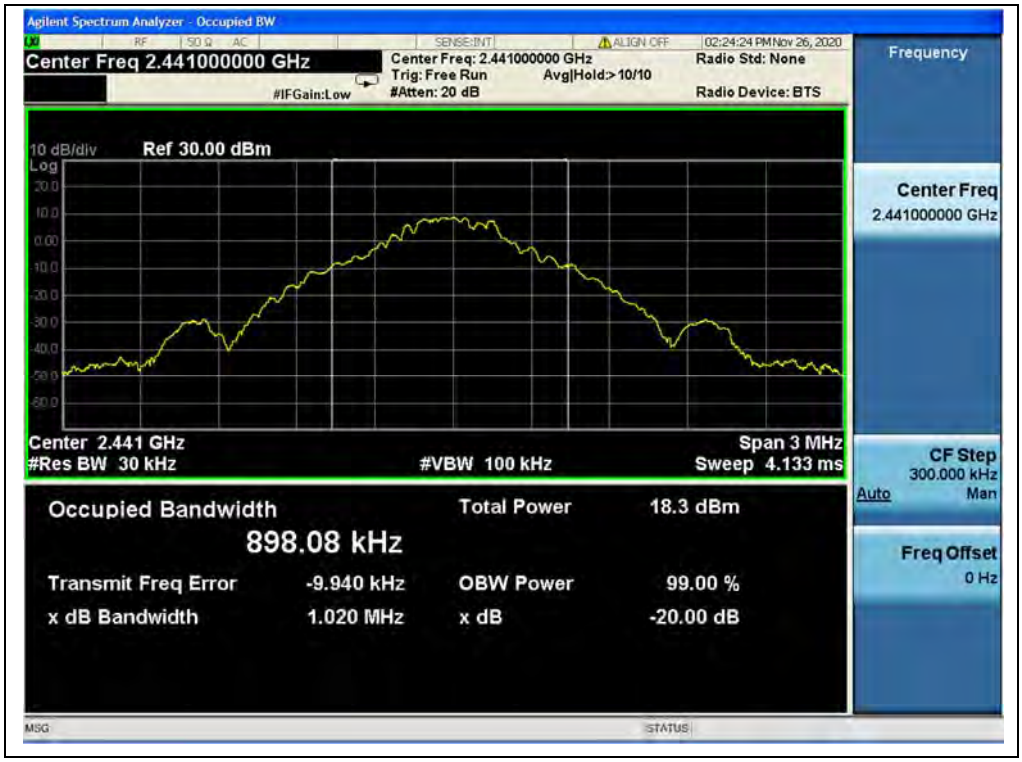
GFSK Mode

A.Test Verdict:

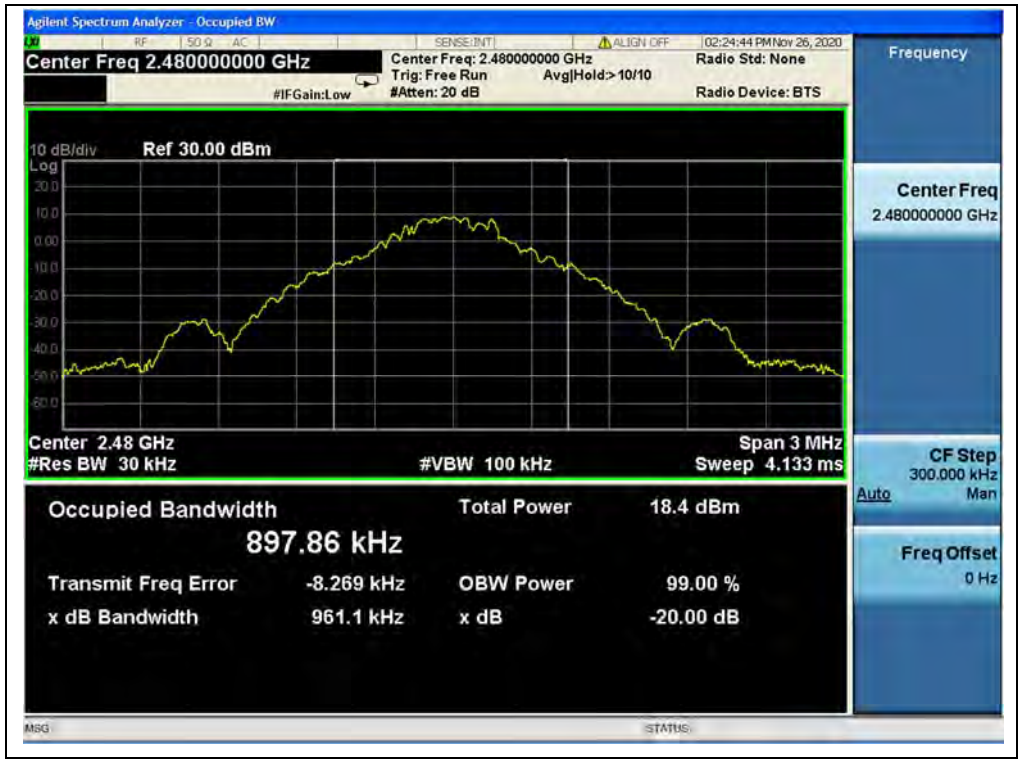
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.015	PASS
39	2441	1.020	PASS
78	2480	0.961	PASS

B.Test Plot:

(Channel 0, GFSK)



(Channel 39, GFSK)



(Channel 78, GFSK)

π/4-DQPSK Mode

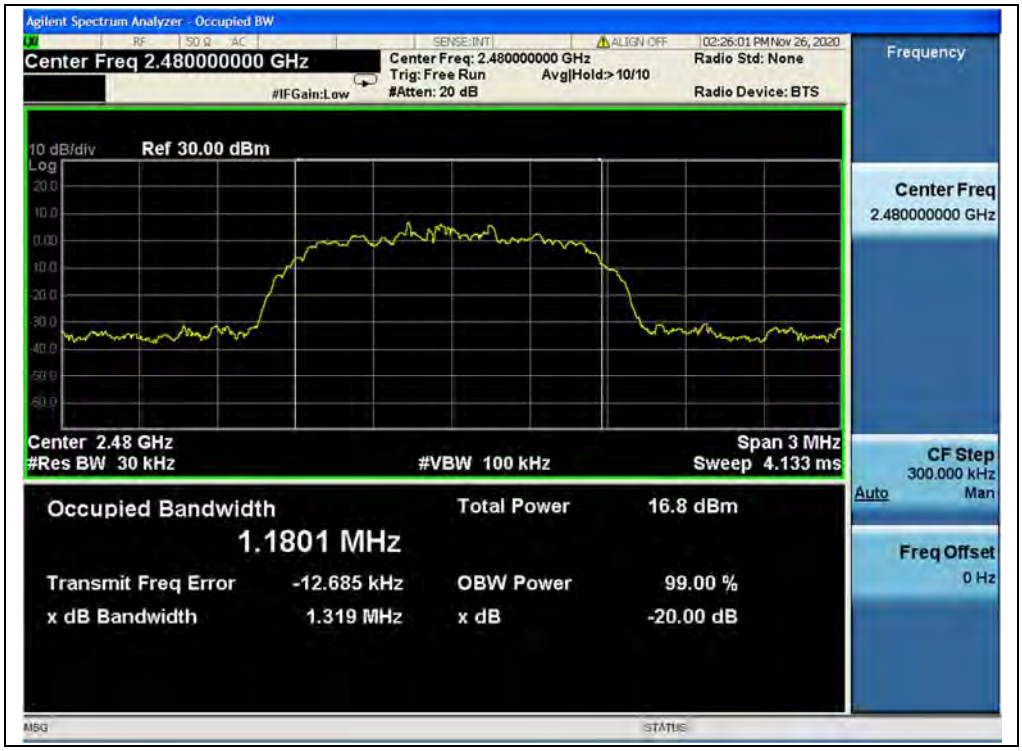
A.Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.314	PASS
39	2441	1.305	PASS
78	2480	1.319	PASS

B.Test Plot:

(Channel 0, π/4-DQPSK)

(Channel 39, π/4-DQPSK)



(Channel 78, π/4-DQPSK)

8-DPSK Mode

A.Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.300	PASS
39	2441	1.301	PASS
78	2480	1.299	PASS

B.Test Plot:

(Channel 0, 8-DPSK)

(Channel 39, 8-DPSK)

(Channel 78, 8-DPSK)

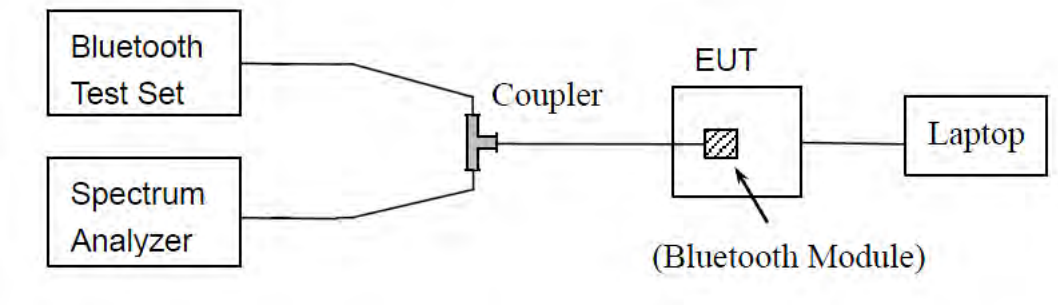
2.8.Carried Frequency Separation

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
RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
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

A.Test Verdict:

Test Mode	Measured Channel Numbers	Carried Frequency Separation (MHz)	20dBband width (MHz)	Min. Limit	Verdict
GFSK	39 and 40	0.999	1.020	two-thirds of the 20dBbandwidth	PASS
π/4-DQPSK	39 and 40	0.999	1.319		PASS
8-DPSK	39 and 40	0.990	1.301		PASS

B.Test Plot:

(GFSK)

(π/4-DQPSK)

(8-DPSK)

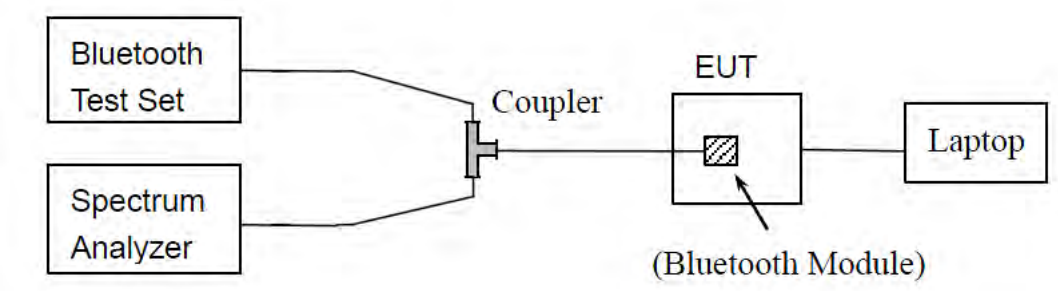
2.9.Time of Occupancy (Dwell time)

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

Normal Mode:
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.

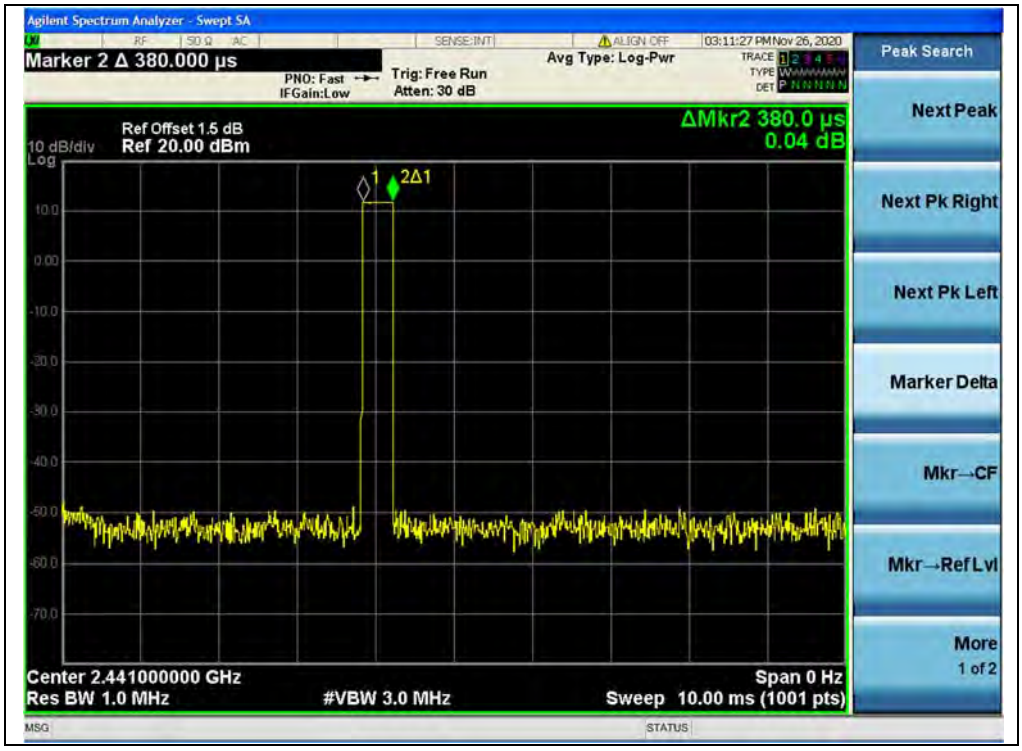
2.9.4.Test Result

GFSK Mode

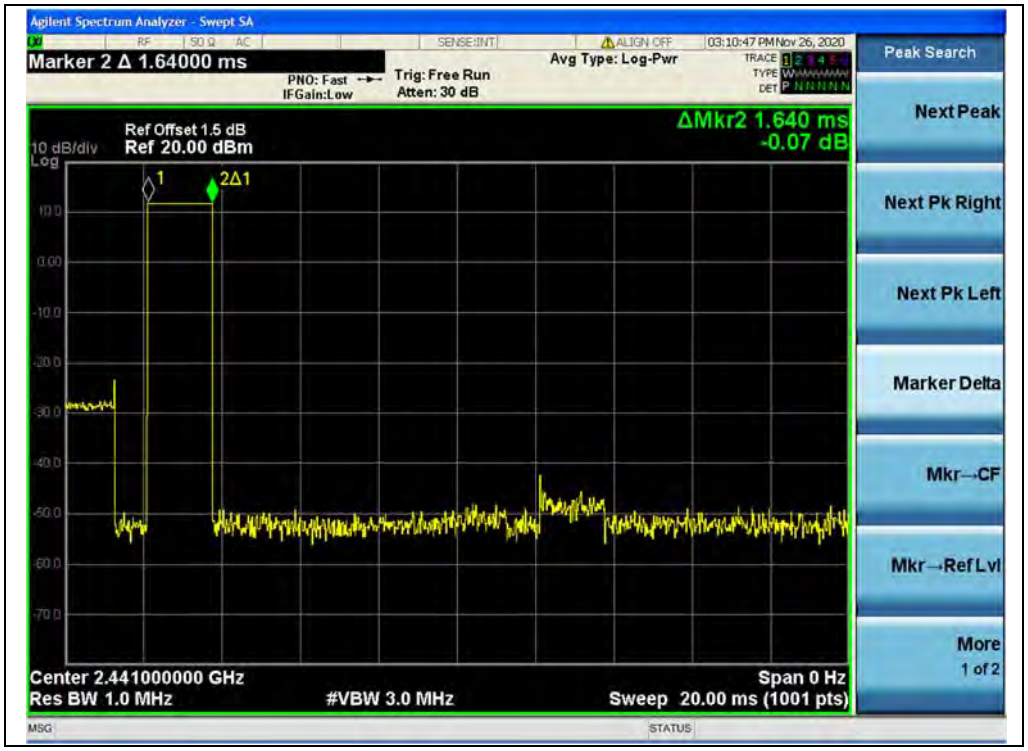
A.Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.38	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 Plot:



(DH1, GFSK)



(DH3, GFSK)

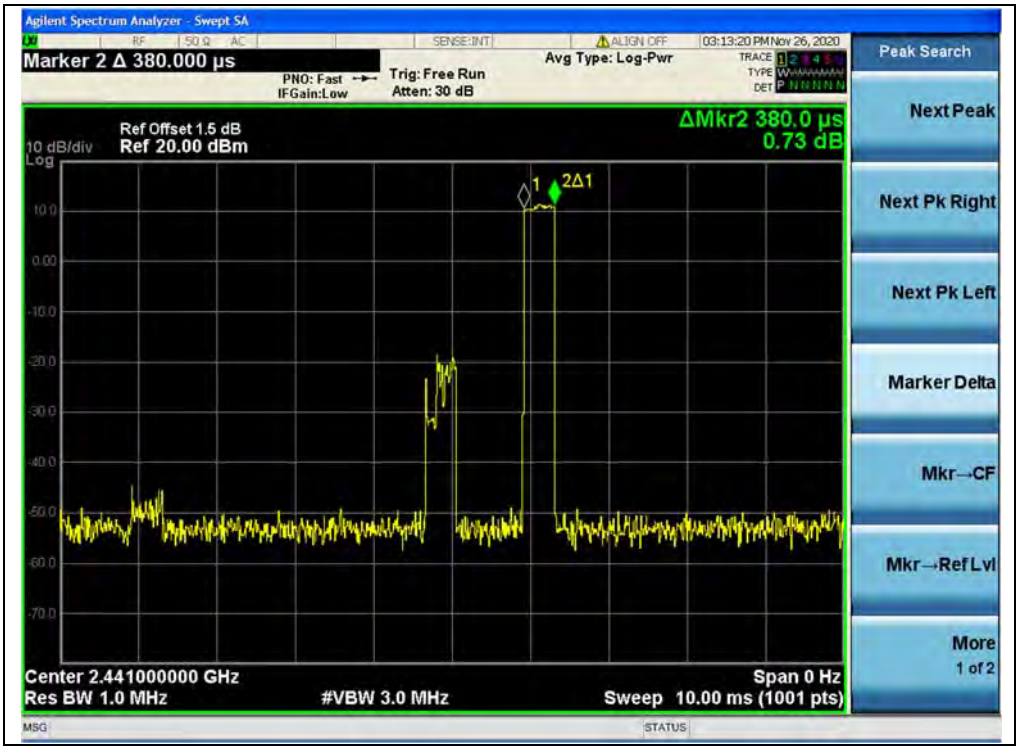
(DH5, GFSK)

π/4-DQPSK Mode

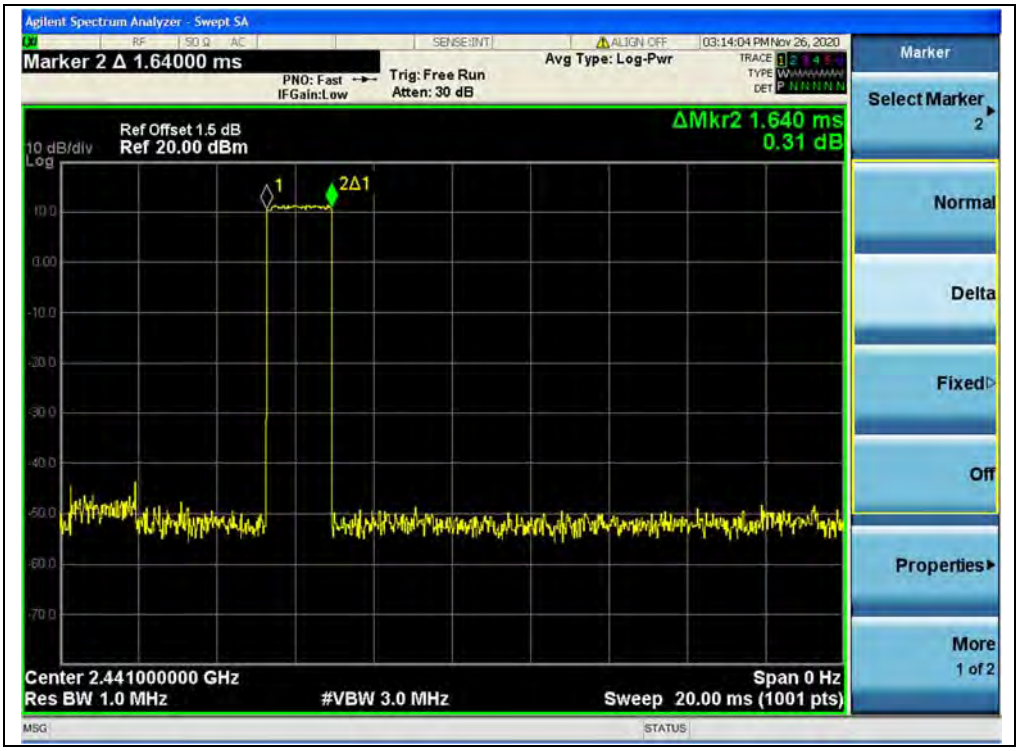
A.Test Verdict:

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

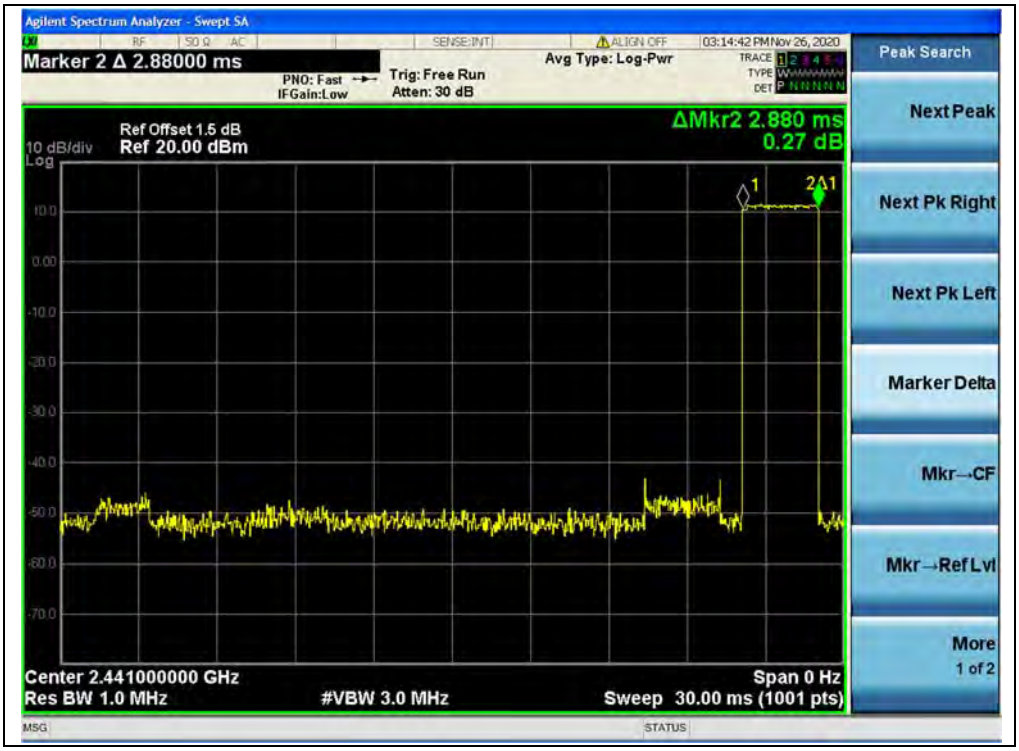
B.Test Plot:



(DH1, π/4-DQPSK)



(DH3, π/4-DQPSK)



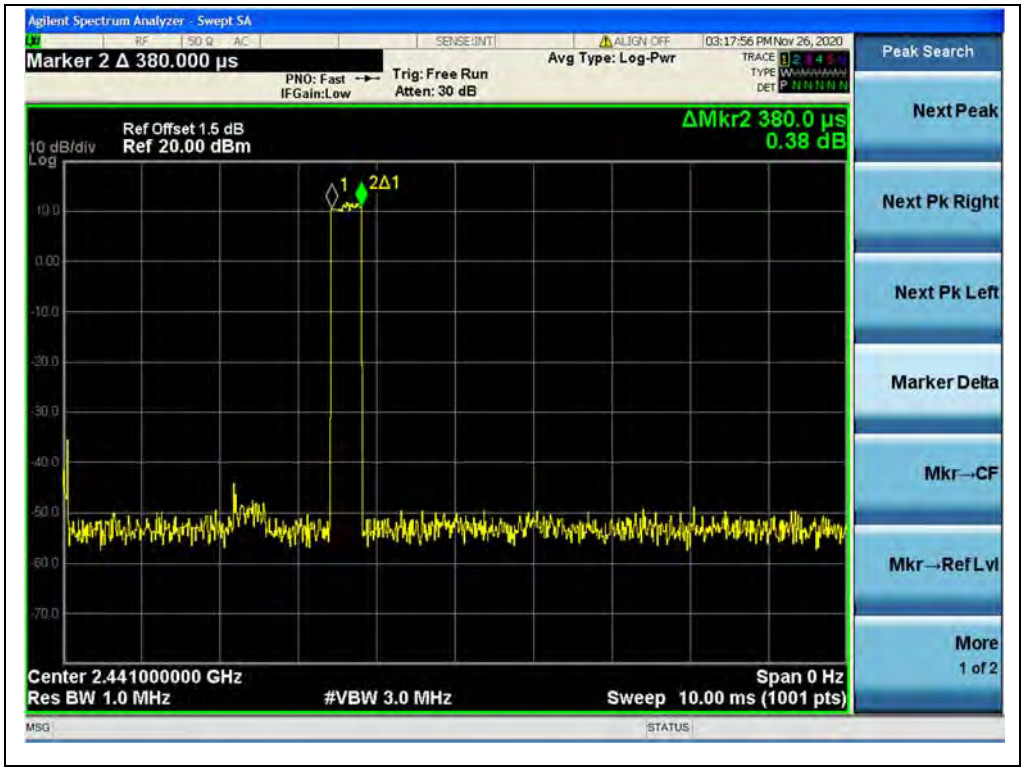
(DH5, π/4-DQPSK)

8-DPSK mode

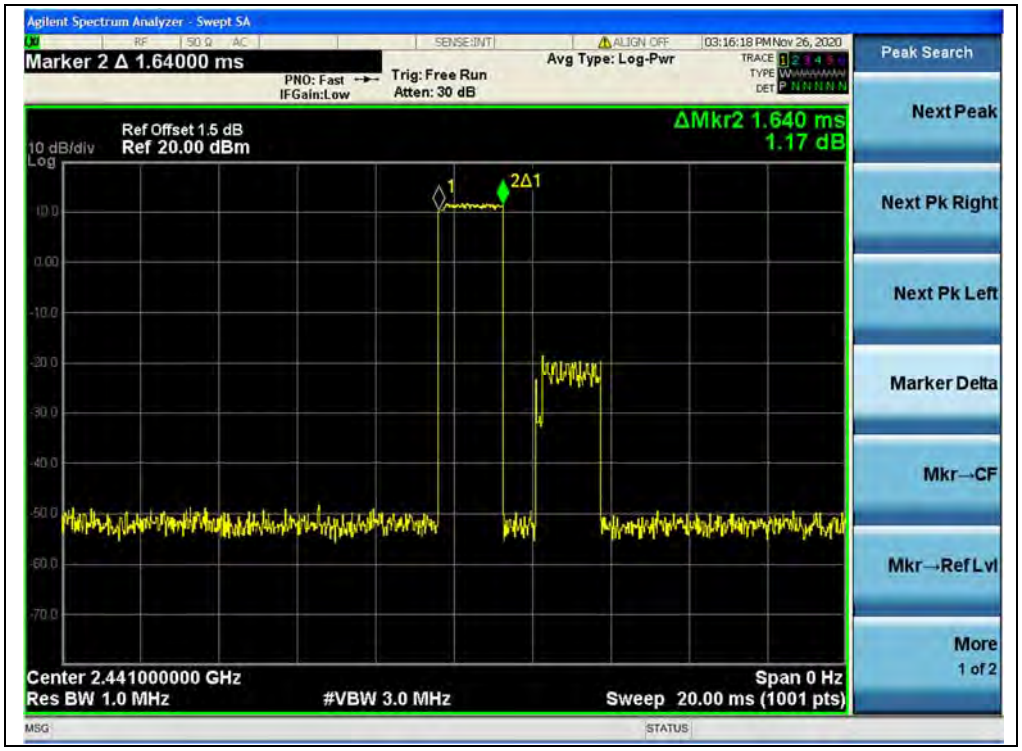
A.Test Verdict:

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	1.64	262.40	131.20		PASS
DH5	2.88	307.20	153.60		PASS

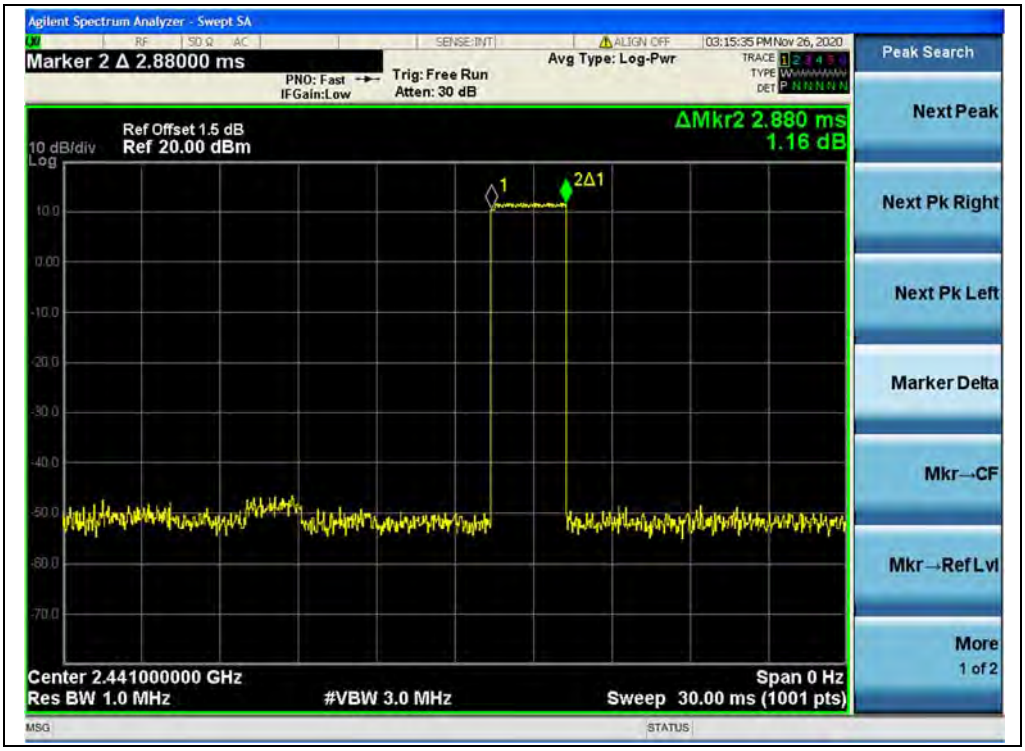
B.Test Plot:



(DH1, 8-DPSK)



(DH3, 8-DPSK)



(DH5, 8-DPSK)

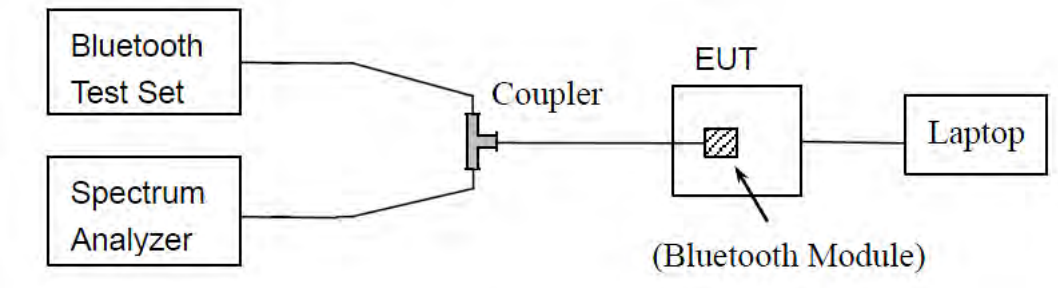
2.10.Conducted Spurious Emissions

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 20 dB 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.

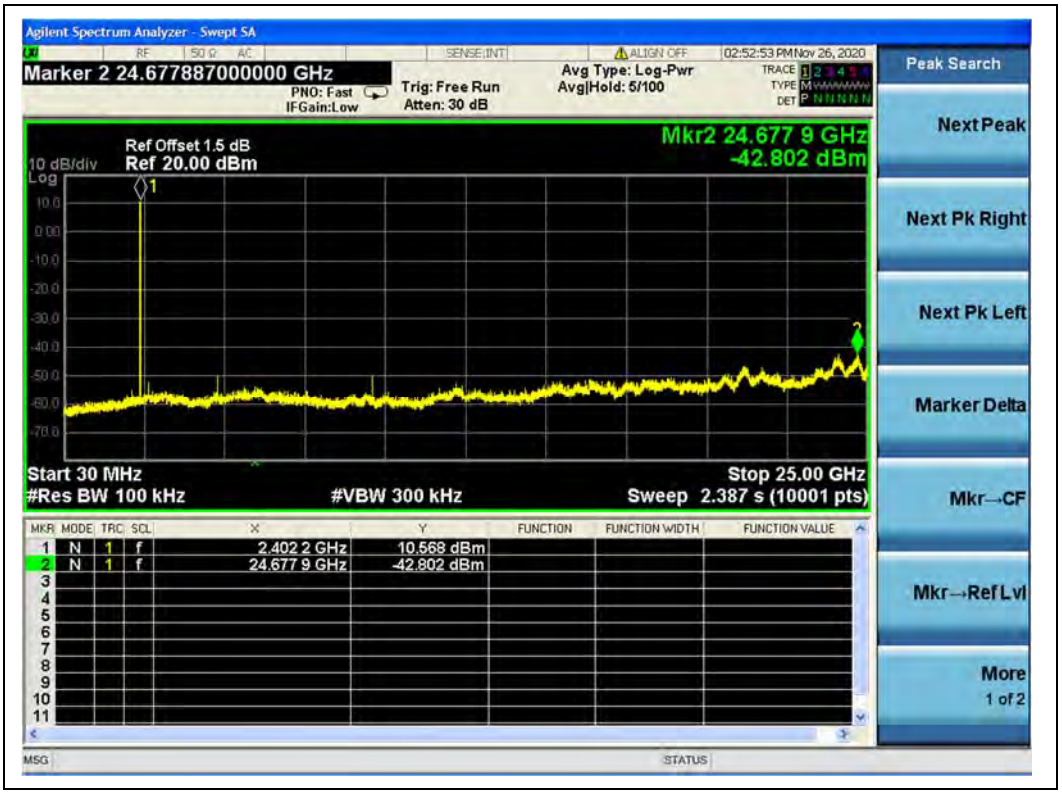
2.10.4.Test Result

GFSK Mode

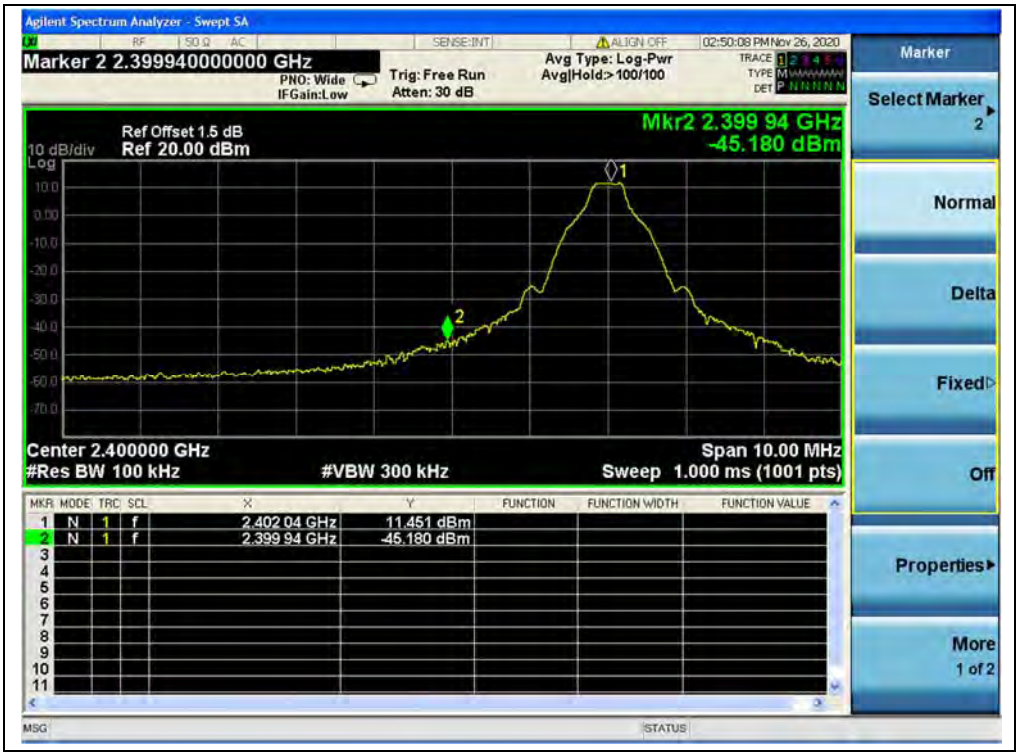
A.Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-42.80	10.57	-9.43	PASS
39	2441	-43.67	10.78	-9.22	PASS
78	2480	-44.04	10.93	-9.07	PASS

B.Test Plot:

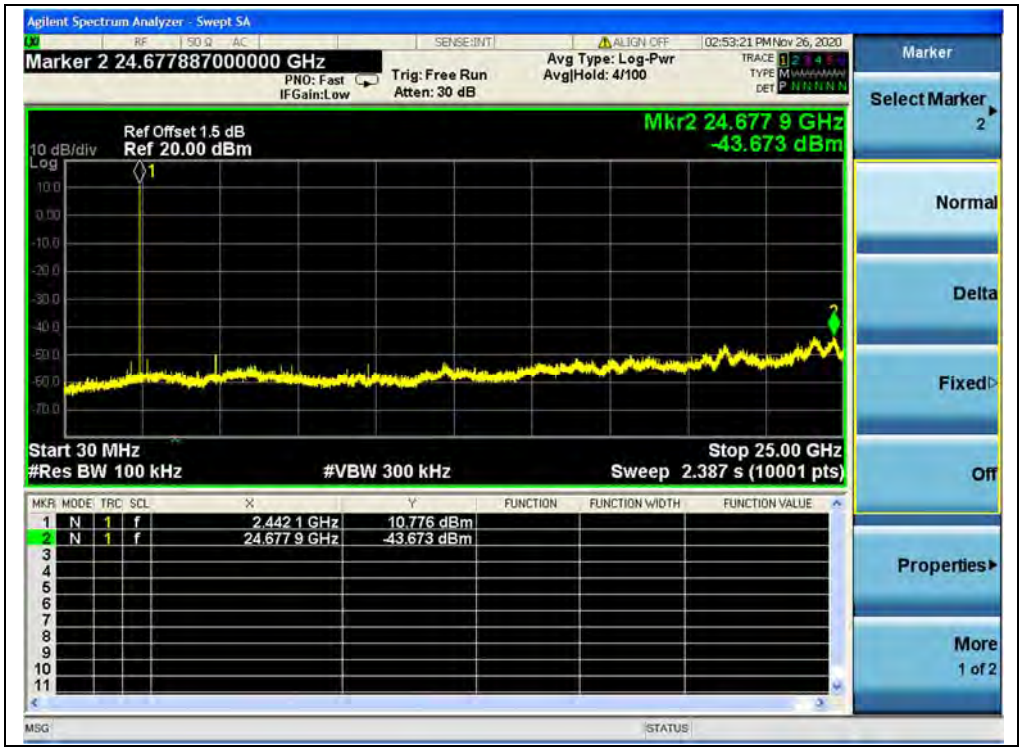


(30MHz to 25GHz, Channel 0, GFSK)

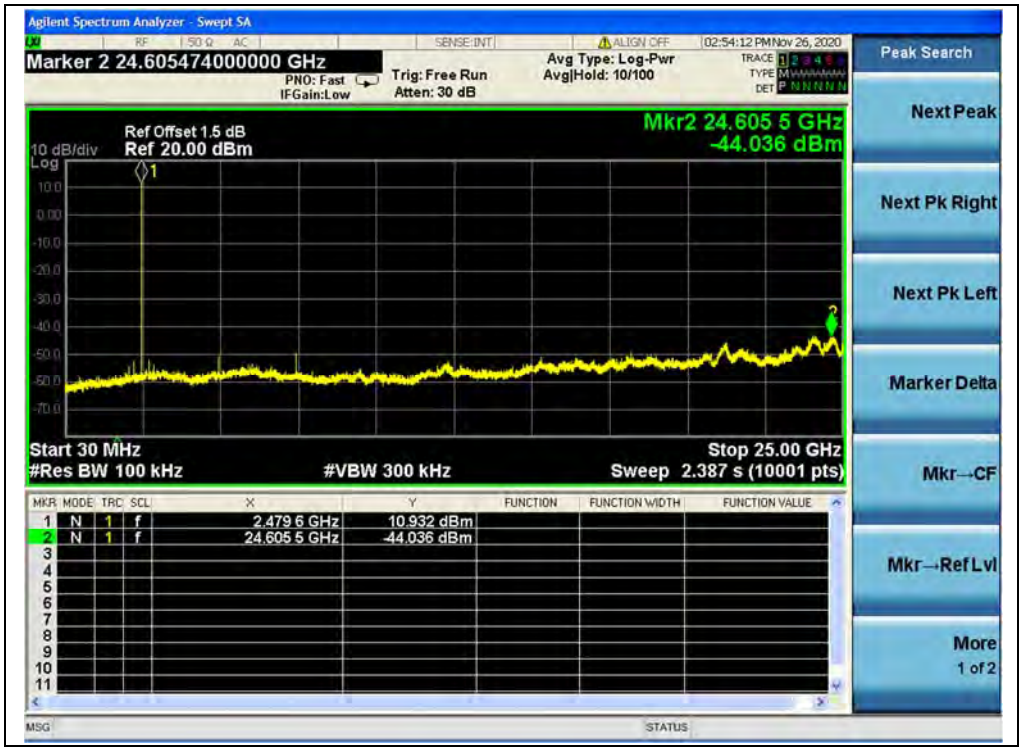


(Band edge, Channel 0, GFSK)

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

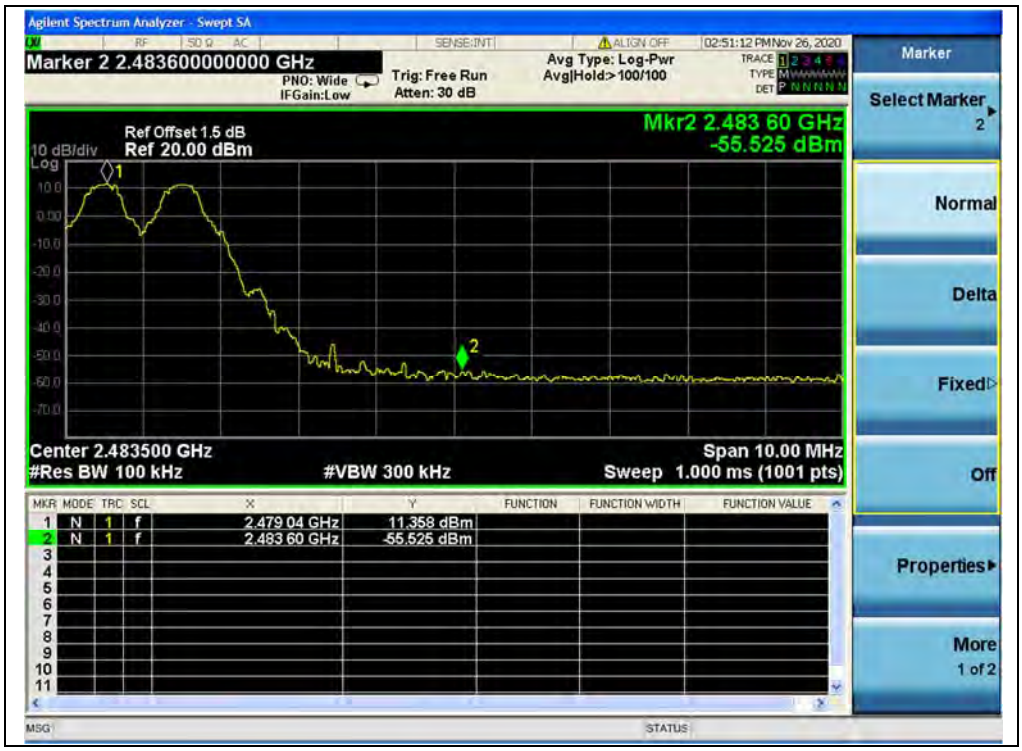


(30MHz to 25GHz, Channel 39, GFSK)



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

(Band edge, Channel 78, GFSK)



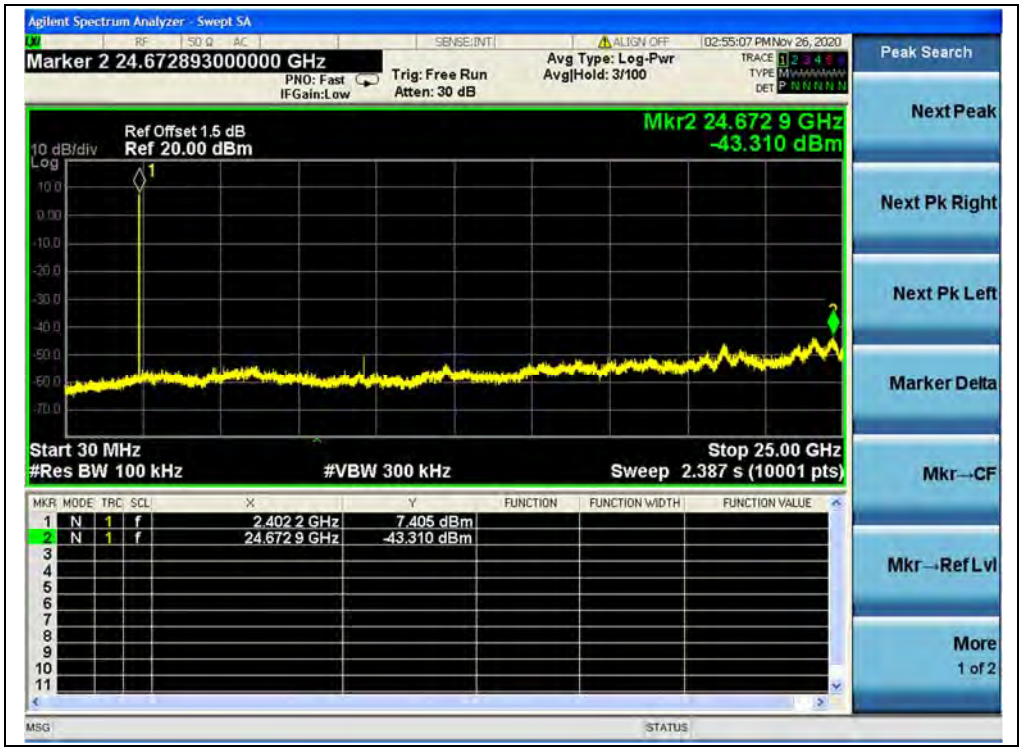
(Band edge with hopping on, Channel 78, GFSK)

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	-43.31	7.41	-12.59	PASS
39	2441	-43.31	5.34	-14.66	PASS
78	2480	-42.67	5.67	-14.33	PASS

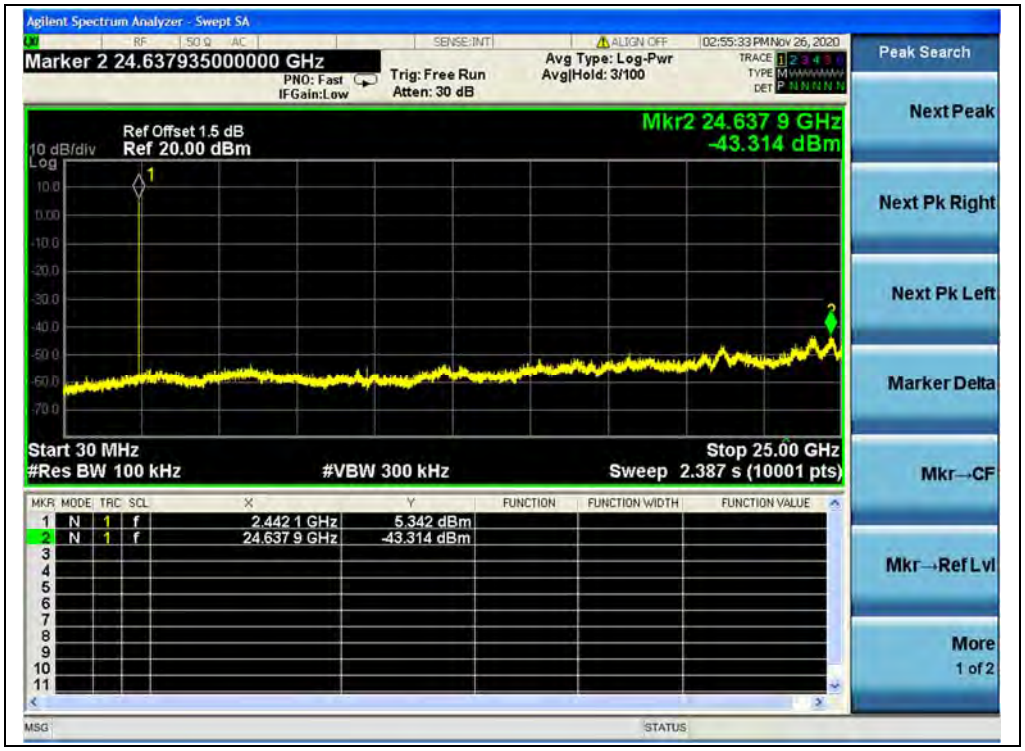
B.Test Plot:



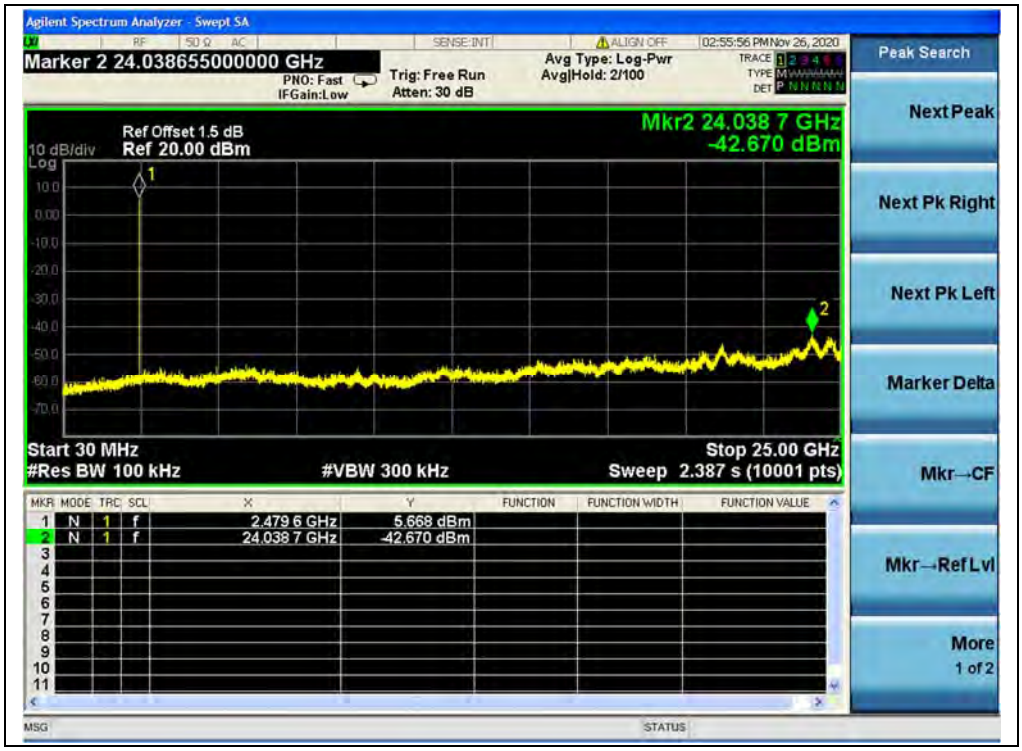
(30MHz to 25GHz, Channel 0, π/4-DQPSK)

(Band edge, Channel 0, π/4-DQPSK)

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

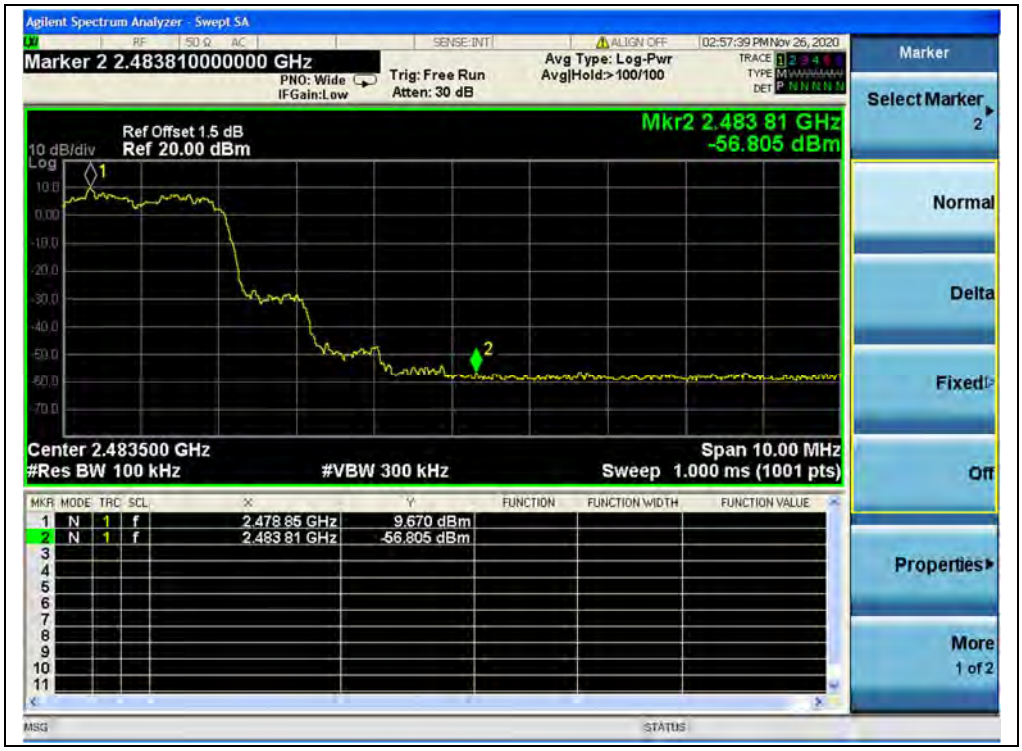


(30MHz to 25GHz, Channel 39, π/4-DQPSK)



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

(Band edge, Channel 78, π/4-DQPSK)



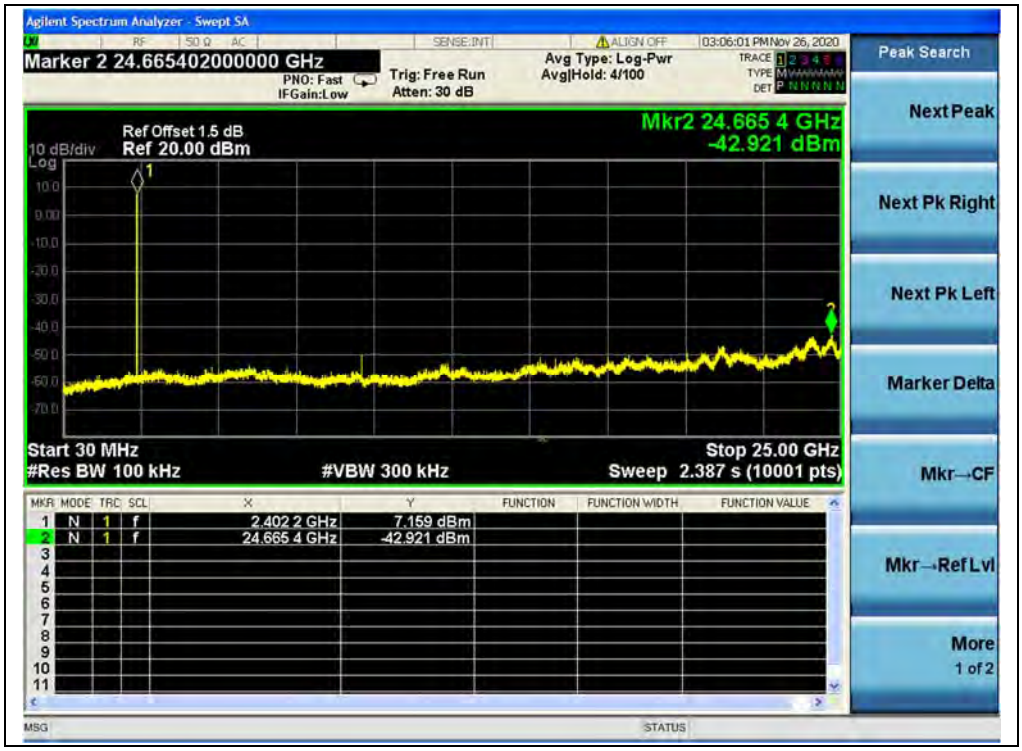
(Band edge with hopping on, Channel 78, π/4-DQPSK)

8-DPSK Mode

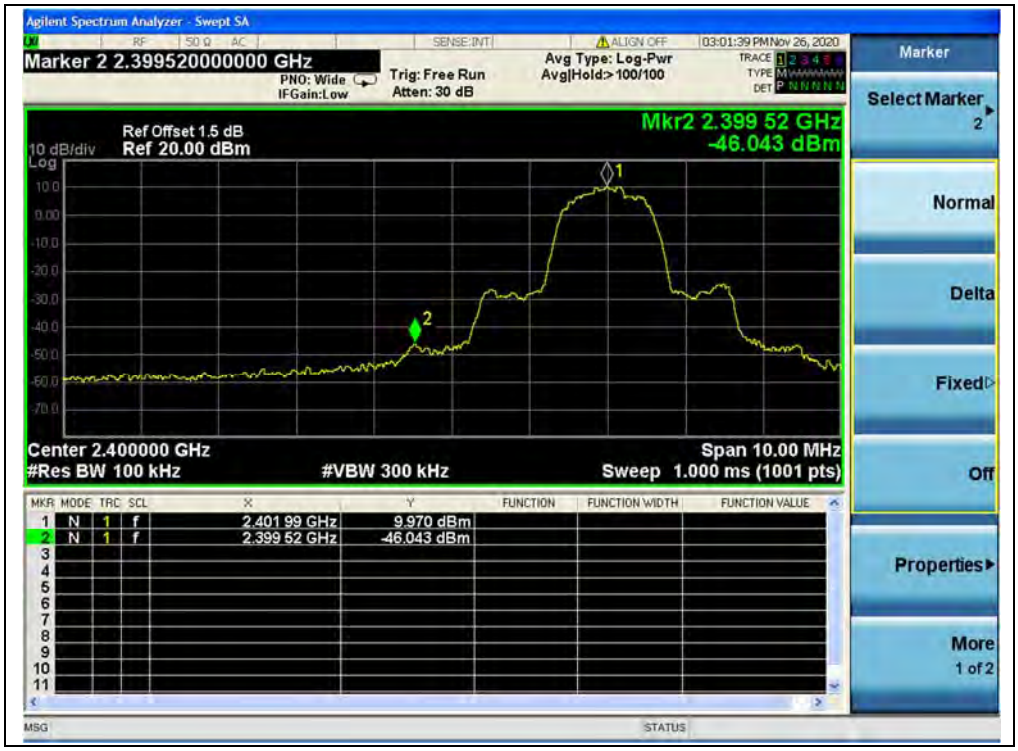
A.Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-42.92	7.16	-12.84	PASS
39	2441	-43.19	6.52	-13.48	PASS
78	2480	-43.20	5.81	-14.19	PASS

B.Test Plot:

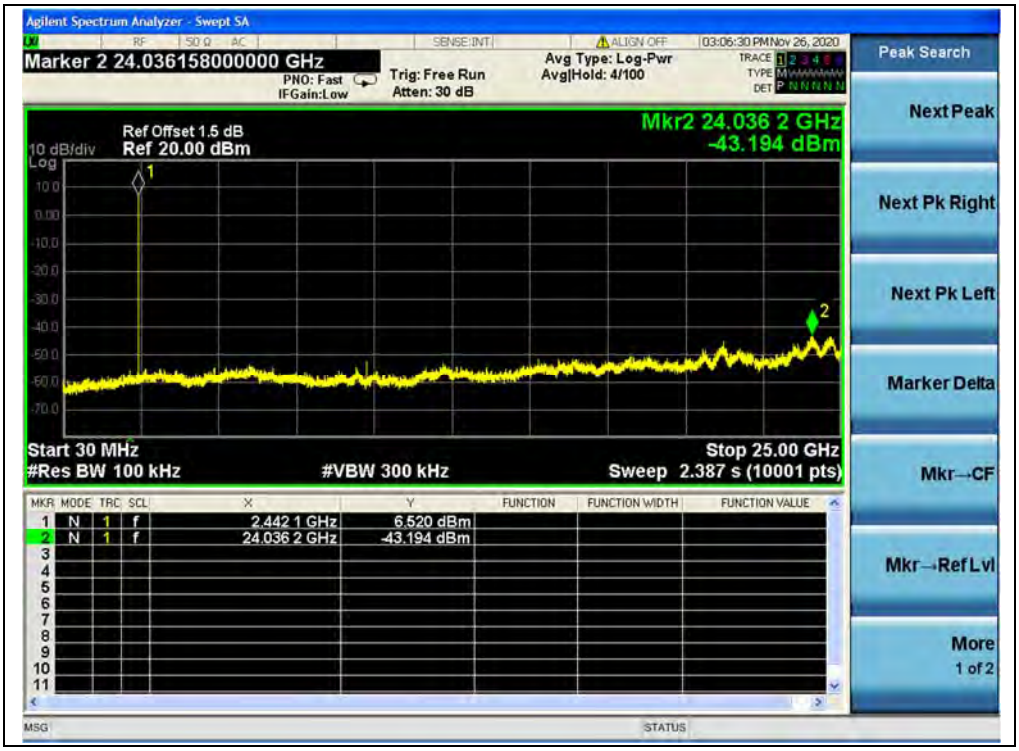


(30MHz to 25GHz, Channel 0, 8-DPSK)

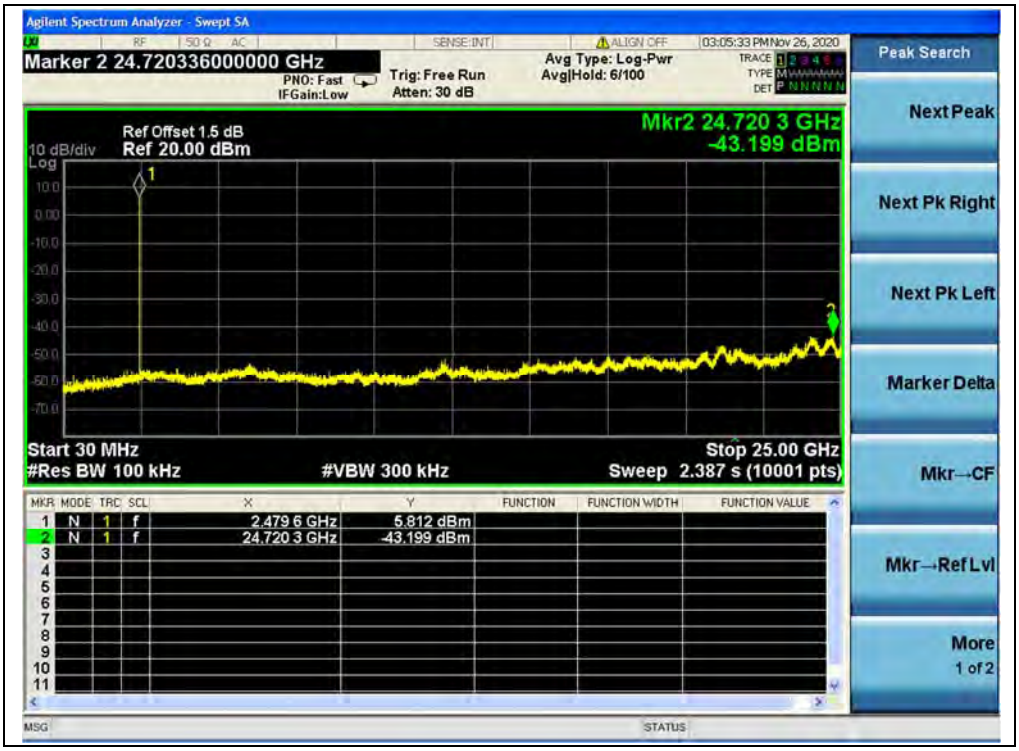


(Band edge, Channel 0, 8-DPSK)

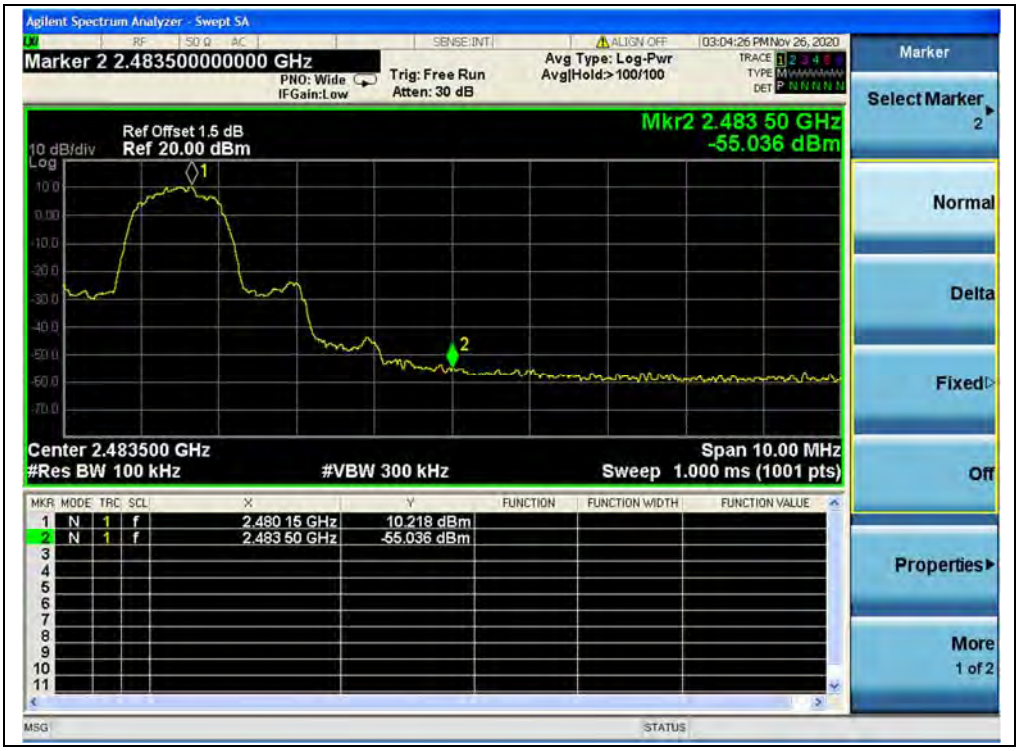
(Band edge with hopping on, Channel 0, 8-DPSK)



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



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



(Band edge, Channel 78, 8-DPSK)

(Band edge with hopping on, Channel 78, 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

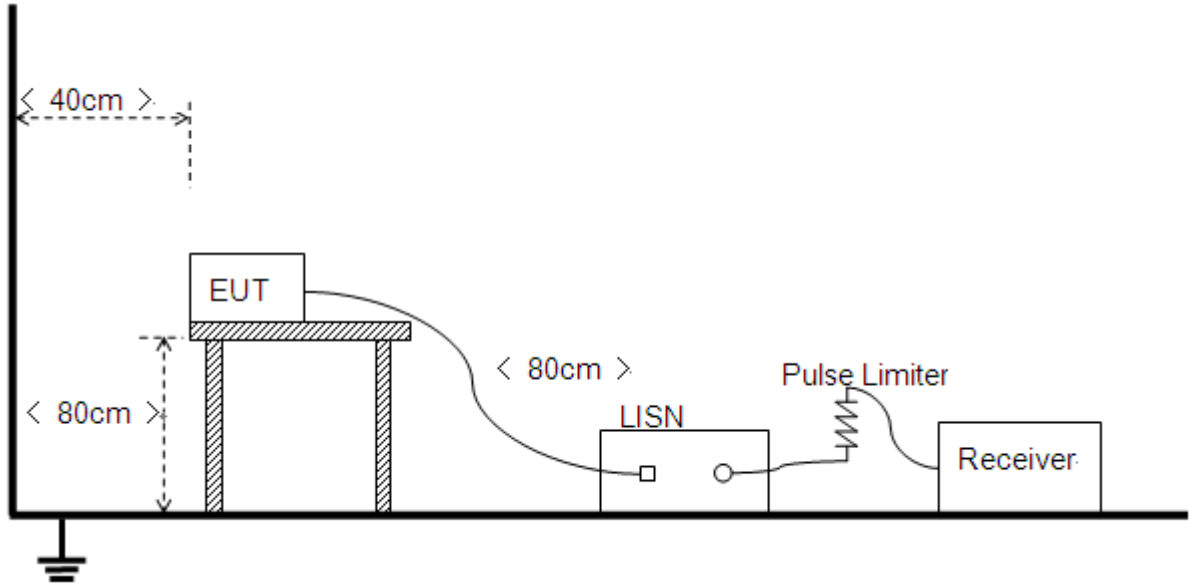
NOTE:

(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. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hzwere 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+ camera + display + adapter + BT TX

Test Voltage: AC 120V/60Hz

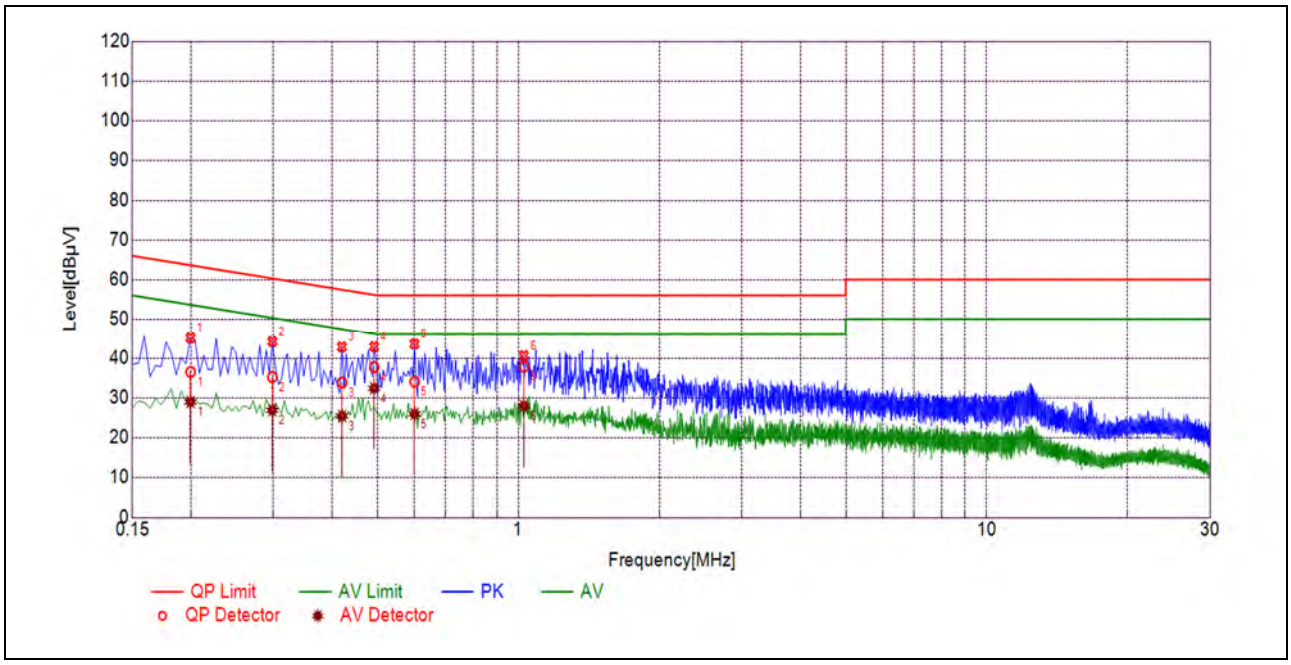
The measurement results are obtained as below:

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

U_R: Receiver Reading

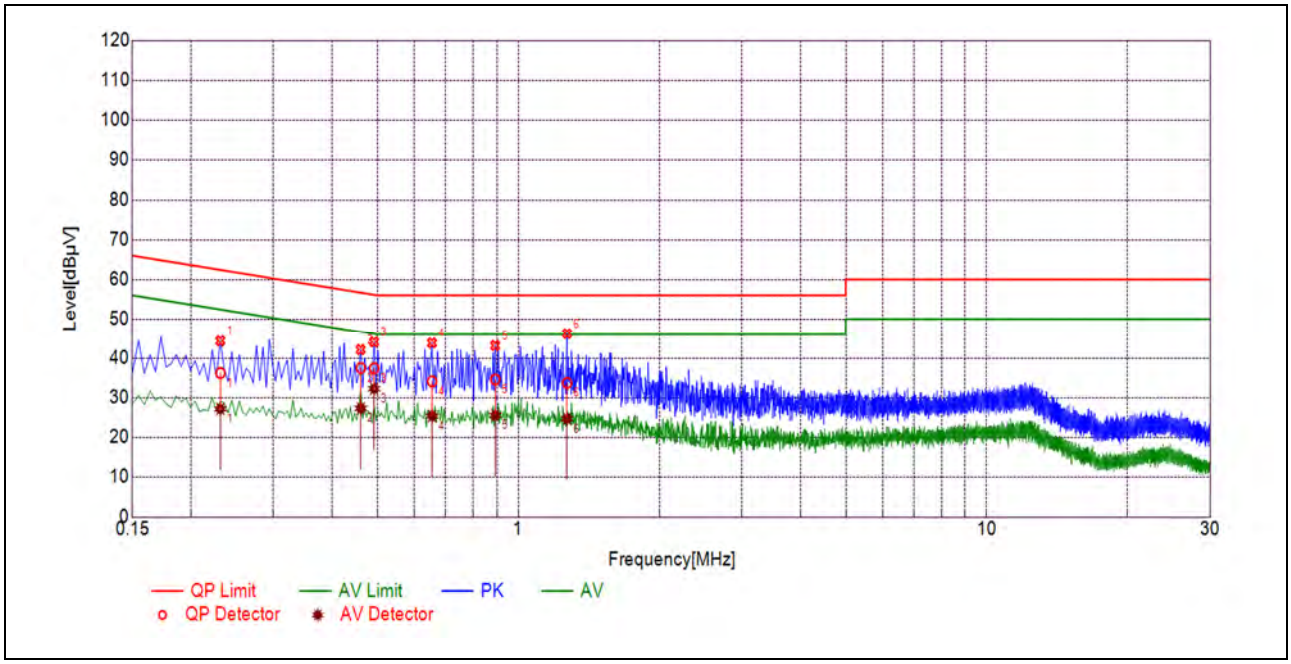
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1996	36.47	28.95	63.63	53.63	Line	PASS
2	0.2983	35.19	26.85	60.29	50.29		PASS
3	0.4204	33.83	25.40	57.44	47.44		PASS
4	0.4921	37.69	32.38	56.13	46.13		PASS
5	0.6004	34.00	25.92	56.00	46.00		PASS
6	1.0272	37.82	27.94	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	0.2311	36.20	27.13	62.41	52.41	Neutral	PASS
2	0.4608	37.47	27.28	56.68	46.68		PASS
3	0.4921	37.40	32.24	56.13	46.13		PASS
4	0.6543	34.08	25.34	56.00	46.00		PASS
5	0.8928	34.55	25.53	56.00	46.00		PASS
6	1.2707	33.70	24.66	56.00	46.00		PASS

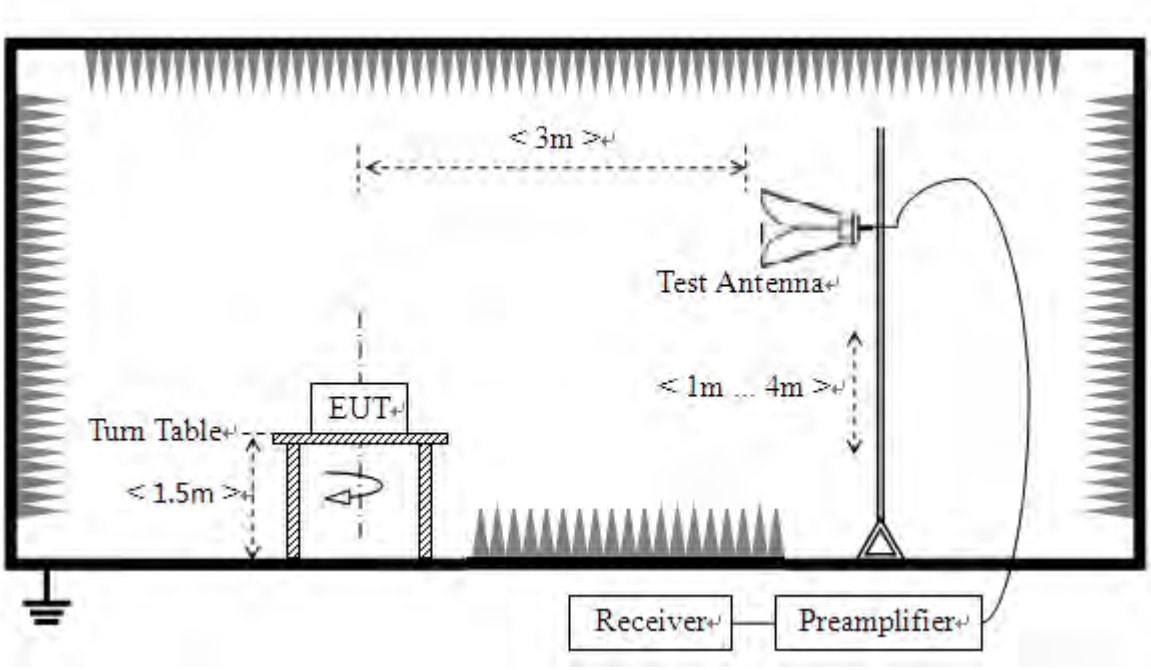
2.12.Restricted Frequency Bands

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.

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
Sweep = auto
Detector function = peak/average
Trace = max hold
Allow the trace to stabilize

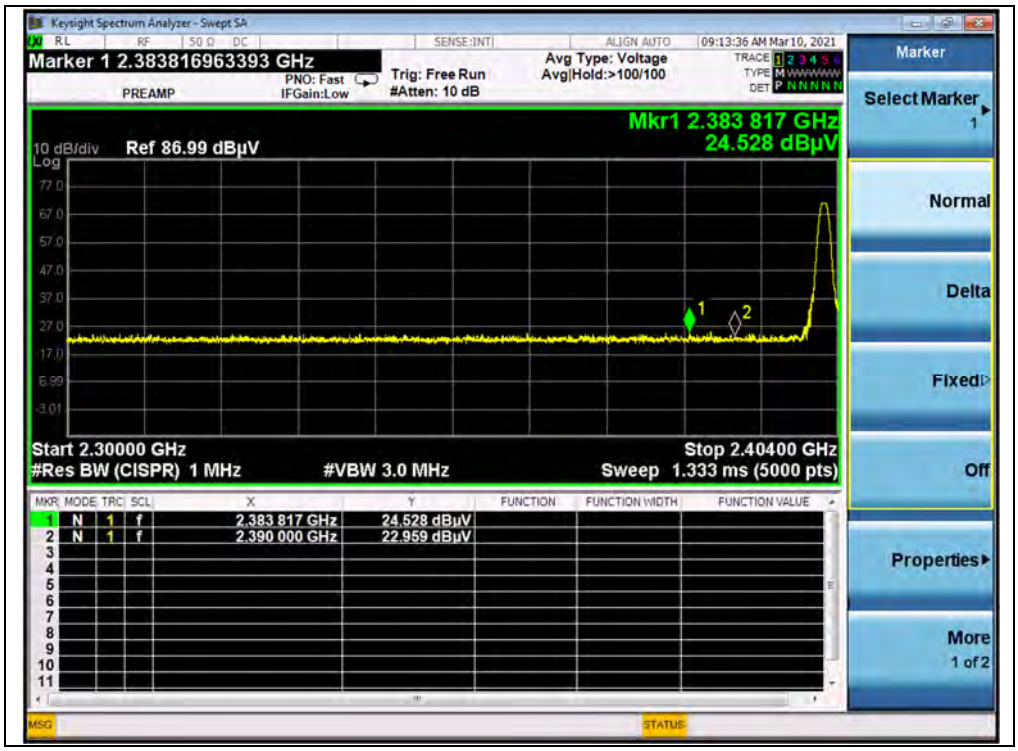
2.12.4.Test Result

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
G_{preamp}: Preamplifier Gain
A_{Factor}: 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

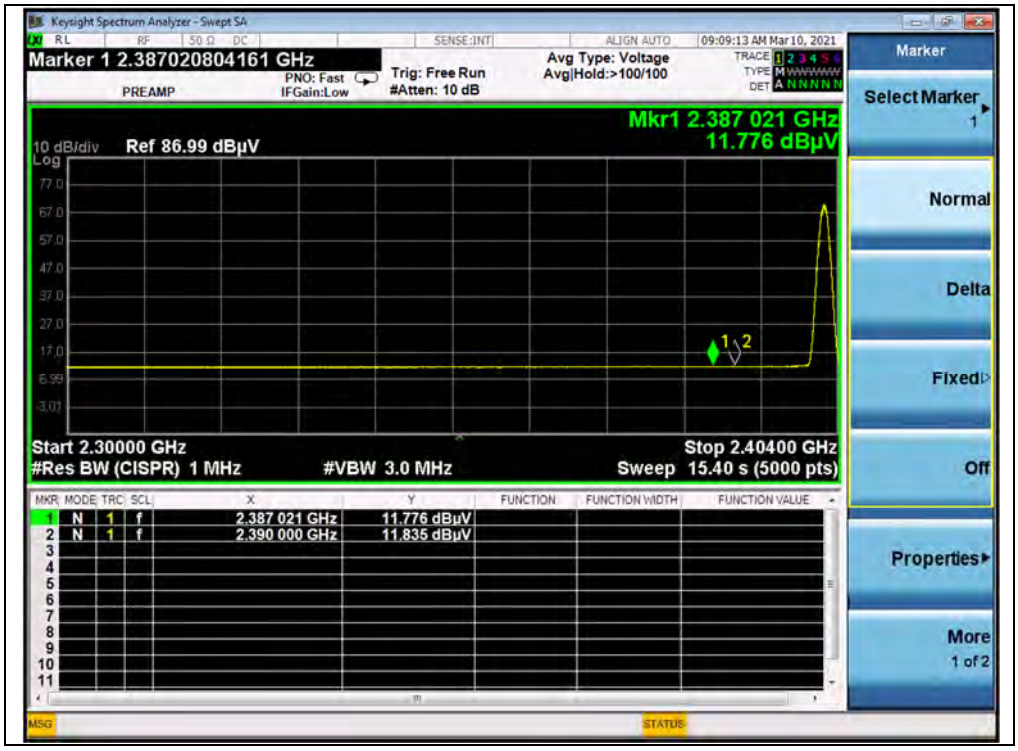
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2383.82	PK	24.53	6.74	27.20	58.47	74	PASS
0	2390.00	AV	11.84	6.74	27.20	45.78	54	PASS
78	2483.90	PK	23.98	6.74	27.20	57.92	74	PASS
78	2483.92	AV	12.48	6.74	27.20	46.42	54	PASS

B.Test Plot:

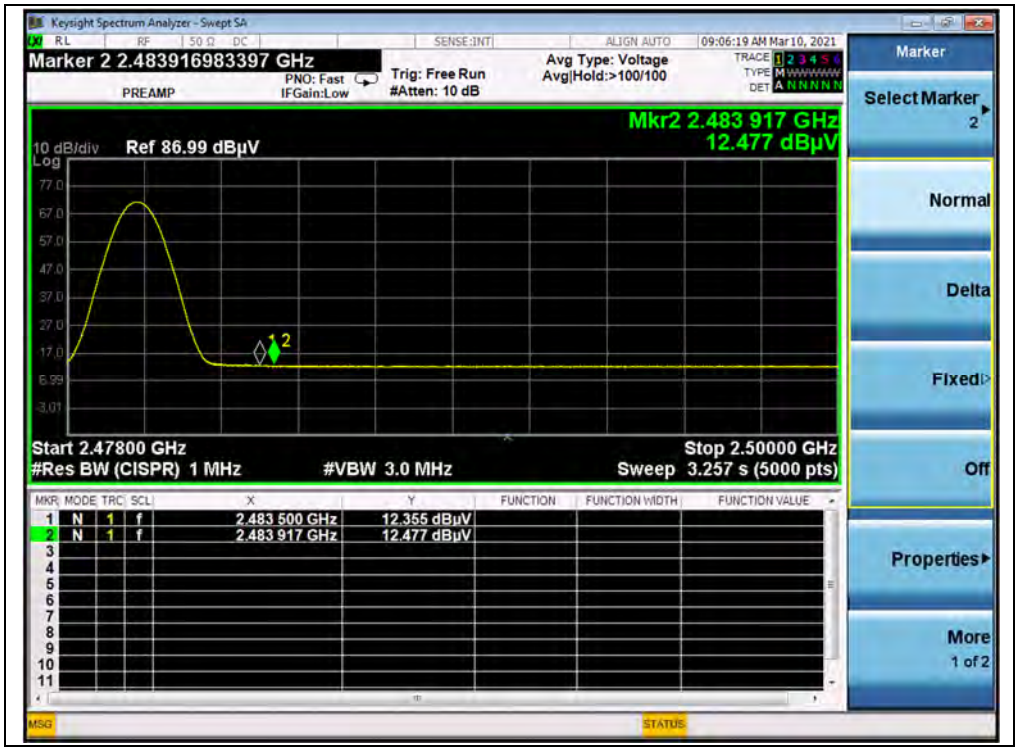


(PEAK, Channel 0, GFSK)



(AVERAGE, Channel 0, GFSK)

(PEAK, Channel 78, GFSK)



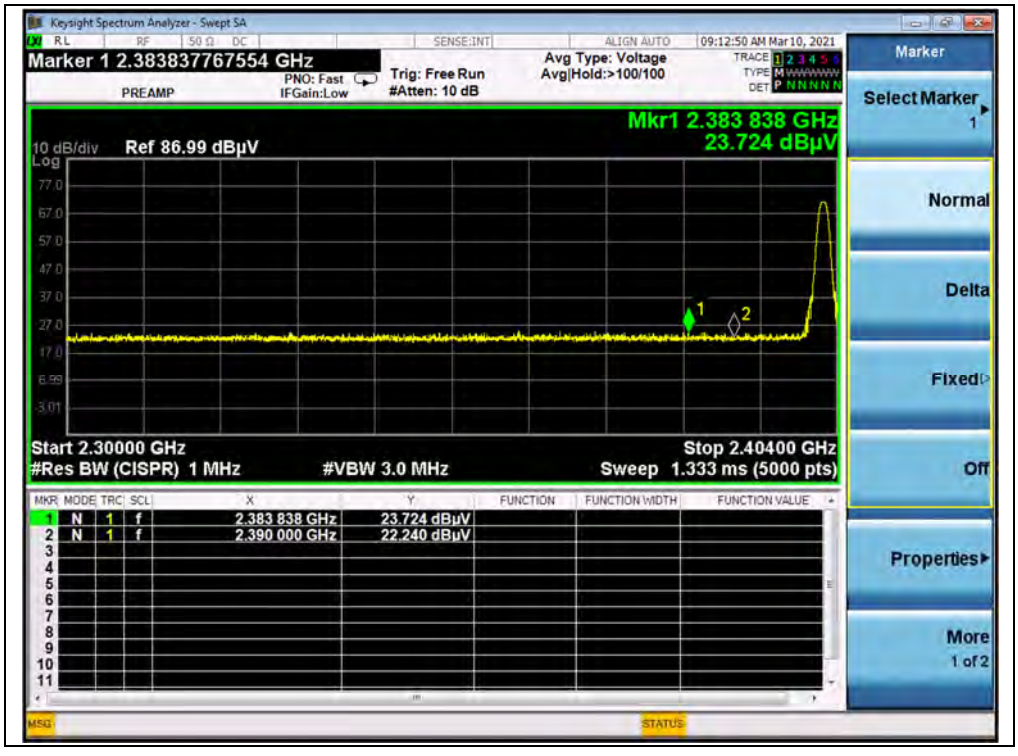
(AVERAGE, Channel 78, GFSK)

π/4-DQPSK Mode

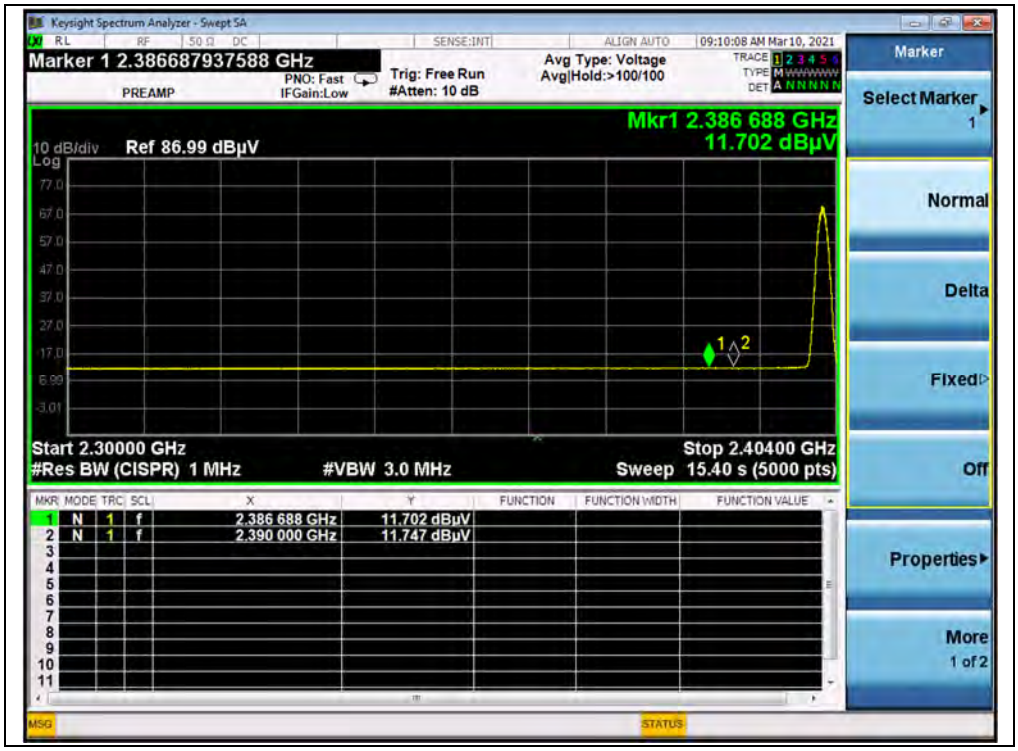
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2383.84	PK	23.72	6.74	27.20	57.66	74	PASS
0	2390.00	AV	11.75	6.74	27.20	45.69	54	PASS
78	2484.50	PK	24.62	6.74	27.20	58.56	74	PASS
78	2483.50	AV	12.43	6.74	27.20	46.37	54	PASS

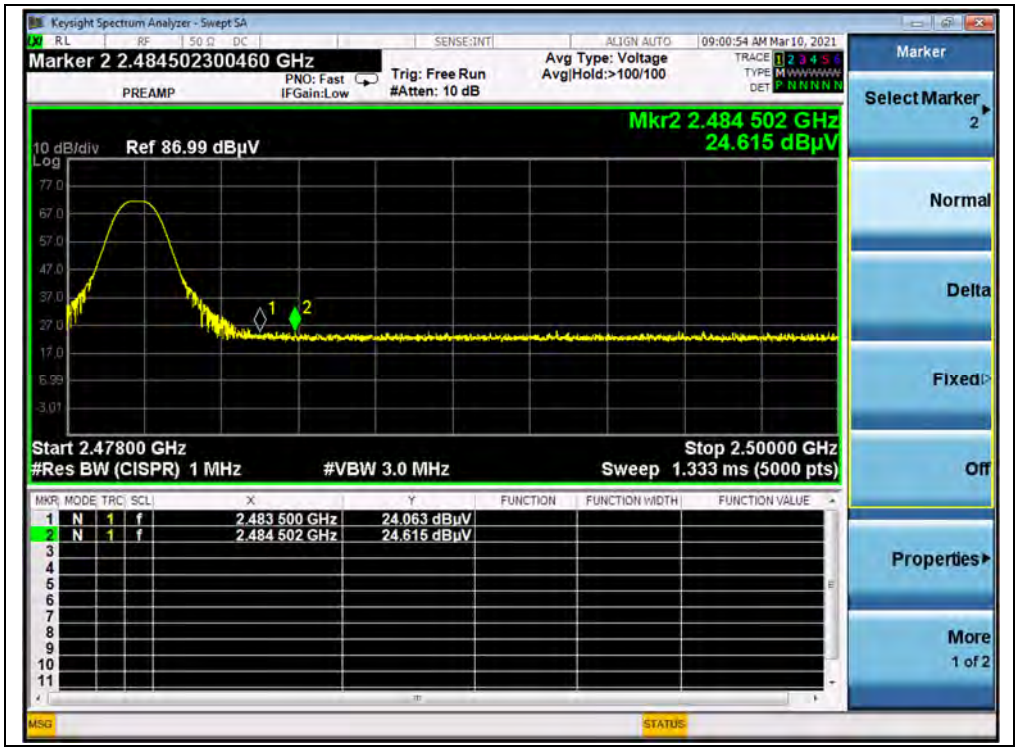
B.Test Plot:



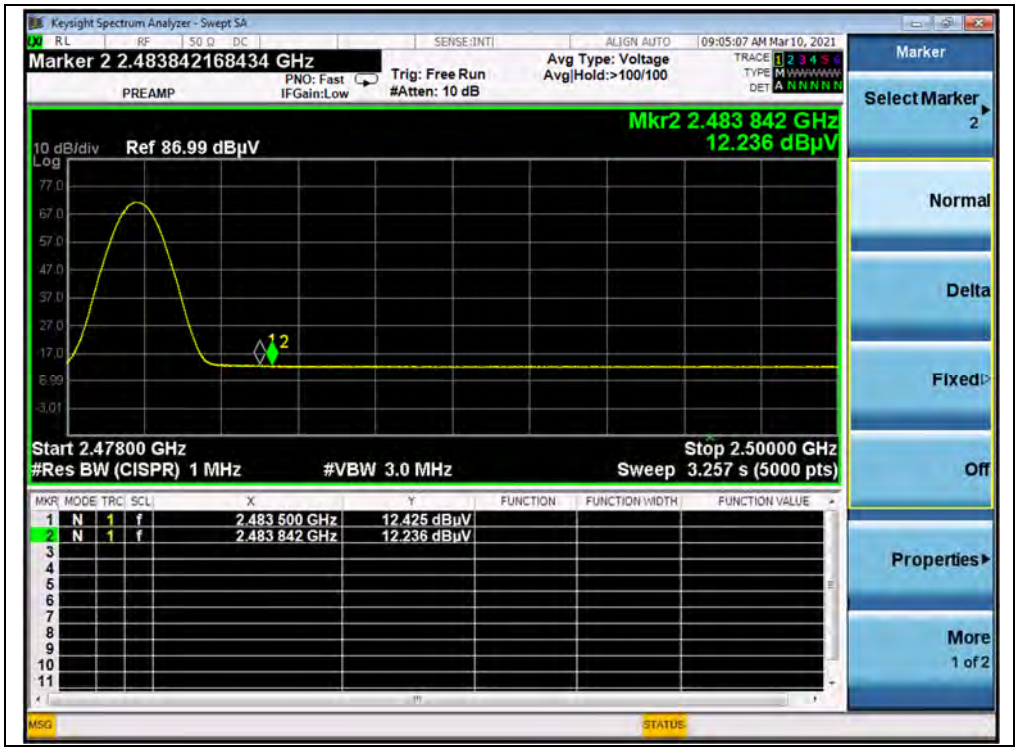
(PEAK, Channel 0,π/4-DQPSK)



(AVERAGE, Channel 0, π/4-DQPSK)



(PEAK, Channel 78, π/4-DQPSK)



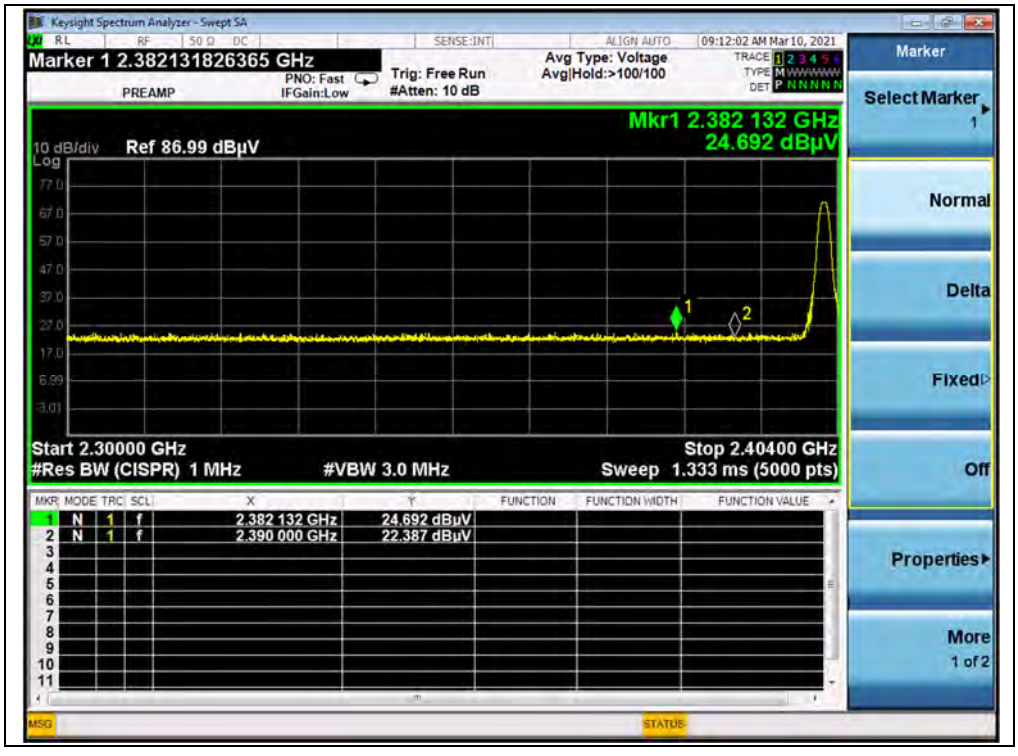
(AVERAGE, Channel 78, π/4-DQPSK)

8-DPSK Mode

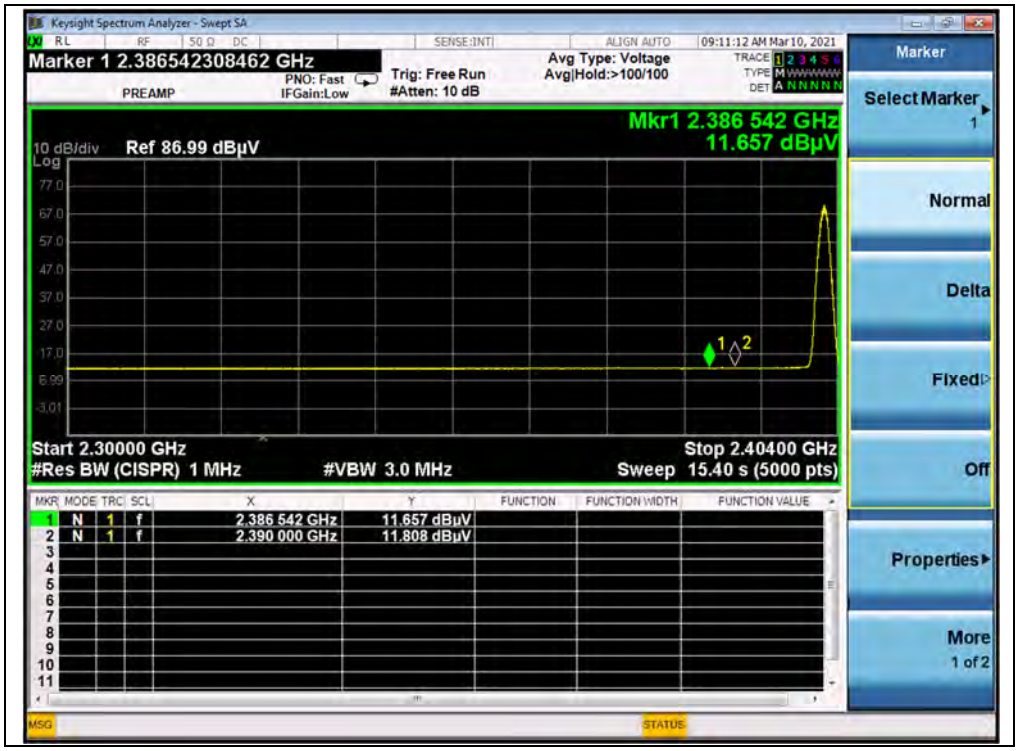
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2382.13	PK	24.69	6.74	27.20	58.63	74	PASS
0	2390.00	AV	11.81	6.74	27.20	45.75	54	PASS
78	2483.73	PK	24.29	6.74	27.20	58.23	74	PASS
78	2483.72	AV	12.35	6.74	27.20	46.29	54	PASS

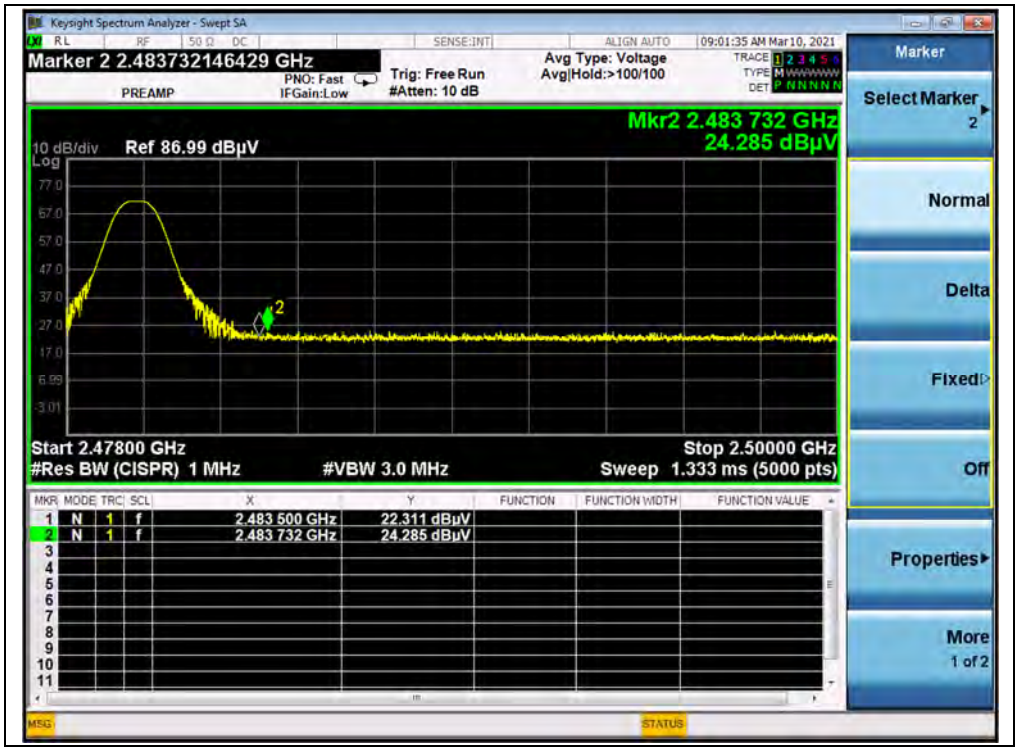
B.Test Plot:



(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:

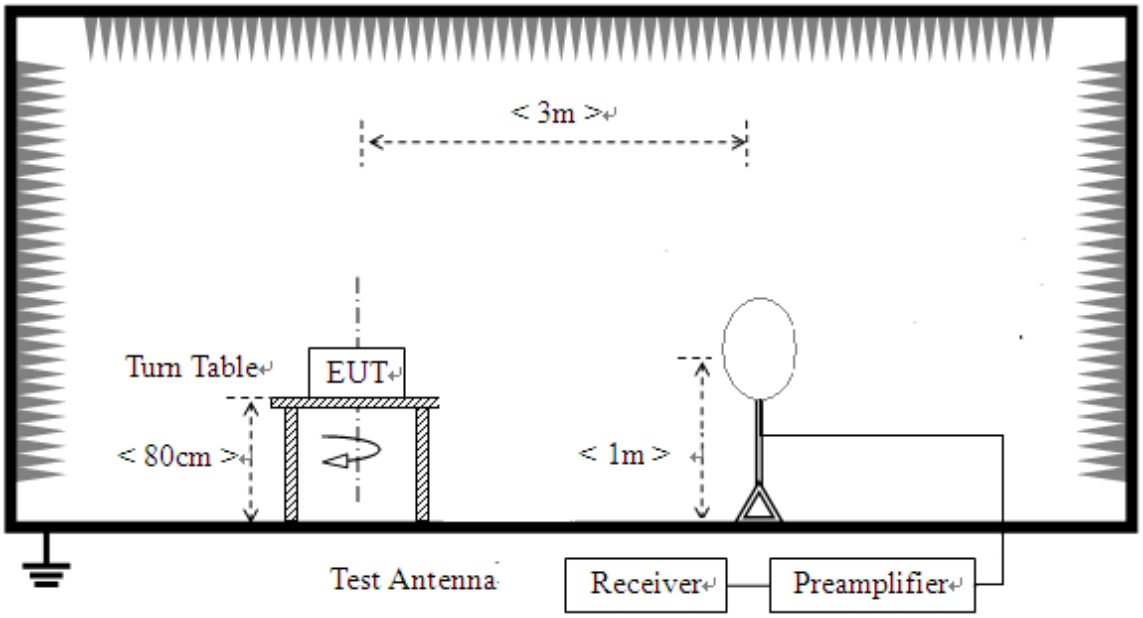
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note1: 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.
Note2: 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).

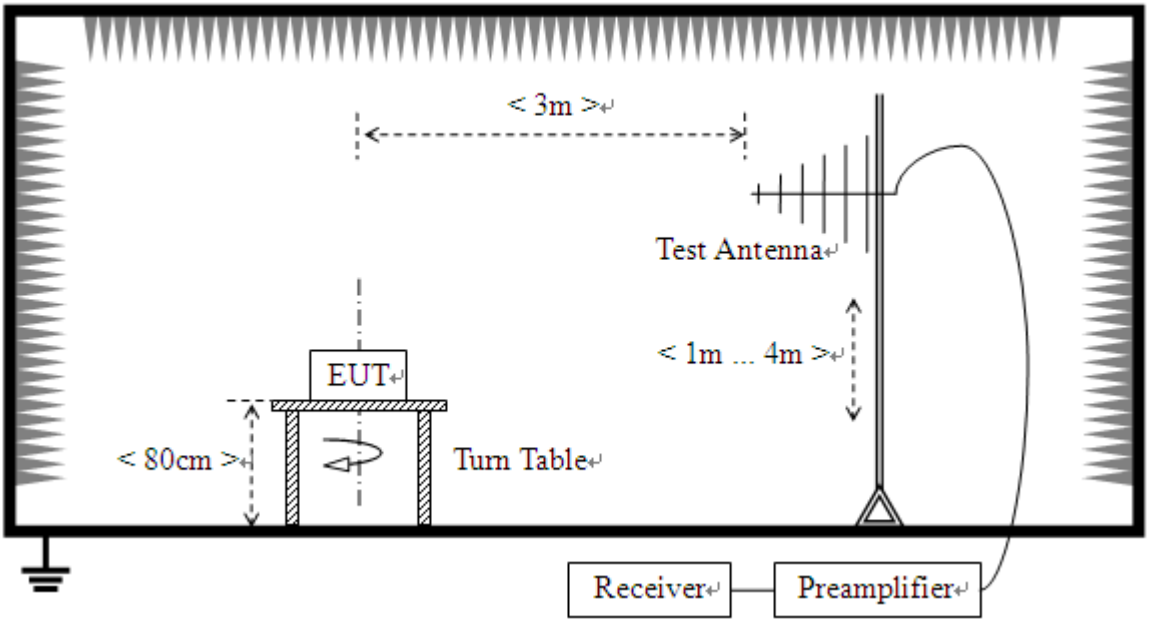
2.13.2.Test Description

Test Setup:

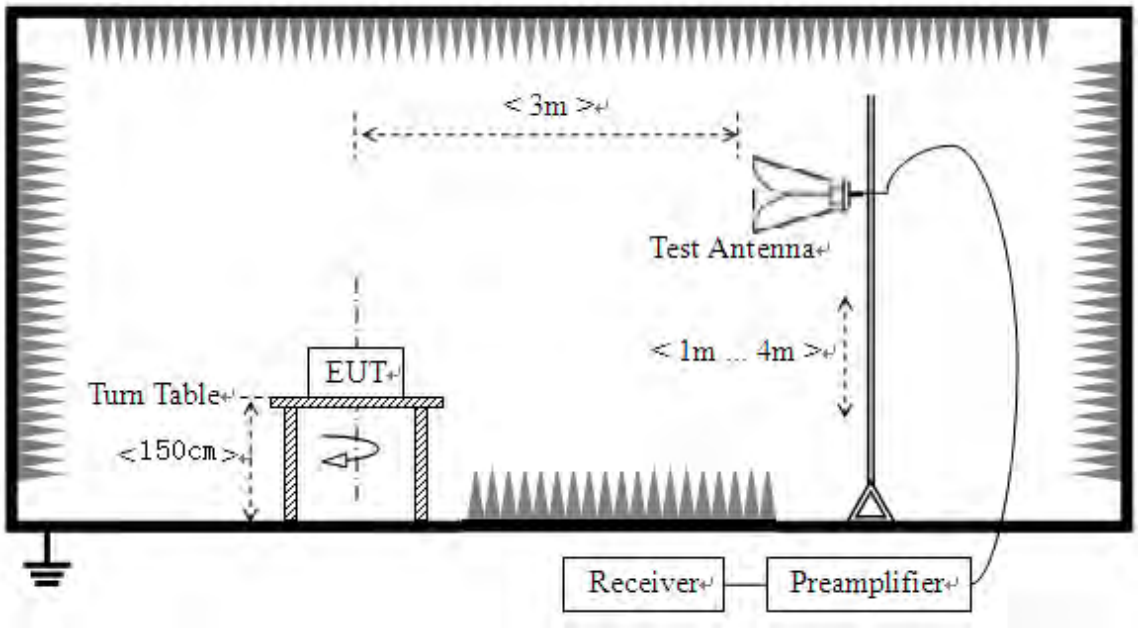
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz.The antenna to EUT distance is 3meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

2.13.3.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 (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

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.

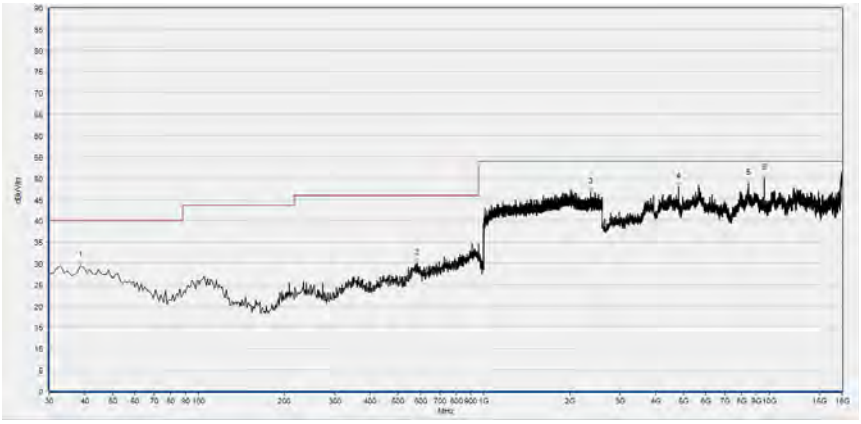
Note 1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note 2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note 3: 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.

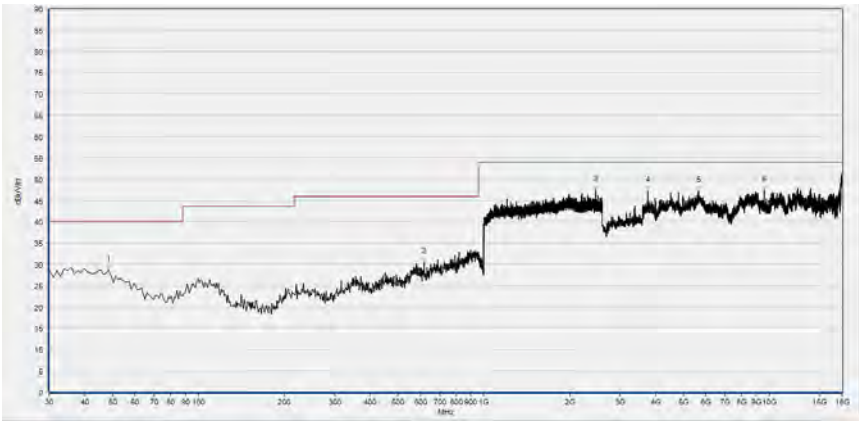
GFSK Mode

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
38.730	29.43	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
582.900	30.01	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2364.800	46.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4805.280	47.93	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8448.920	48.78	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9607.000	49.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

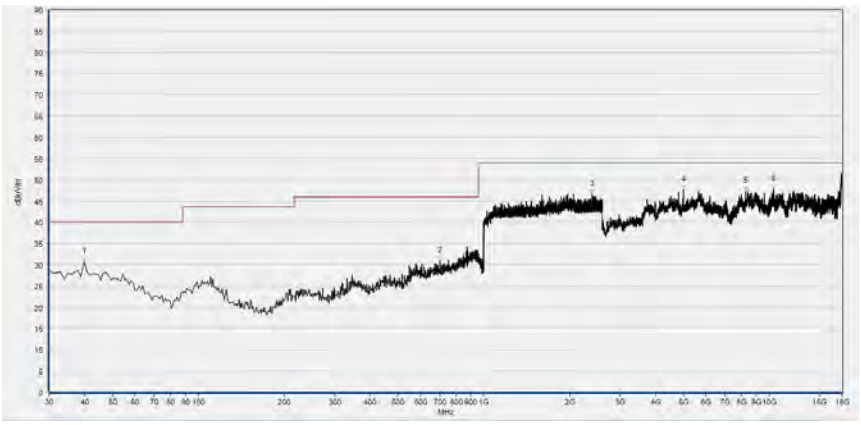
(Antenna Horizontal, 30MHz to 18GHz)



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
48.430	28.58	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
618.790	30.53	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2466.667	47.50	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3748.840	47.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5636.880	47.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9607.000	47.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

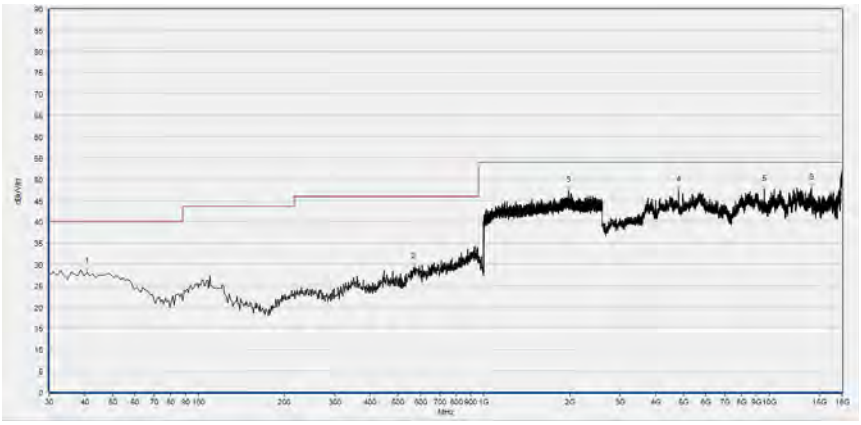
(Antenna Vertical, 30MHz to 18GHz)

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
39.700	30.67	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
700.270	30.82	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2401.600	46.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4996.240	47.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8267.200	47.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10349.280	47.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

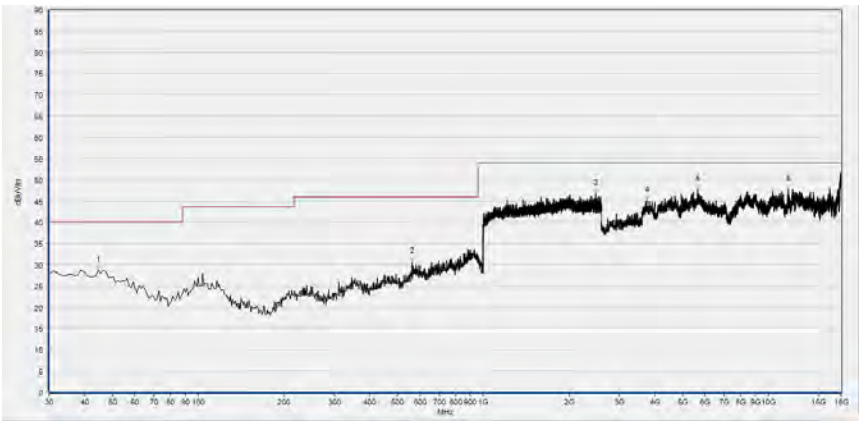
(Antenna Horizontal, 30MHz to 18GHz)



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
40.670	28.23	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
567.380	29.30	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1974.933	47.22	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4802.200	47.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9607.000	47.66	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14017.560	47.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

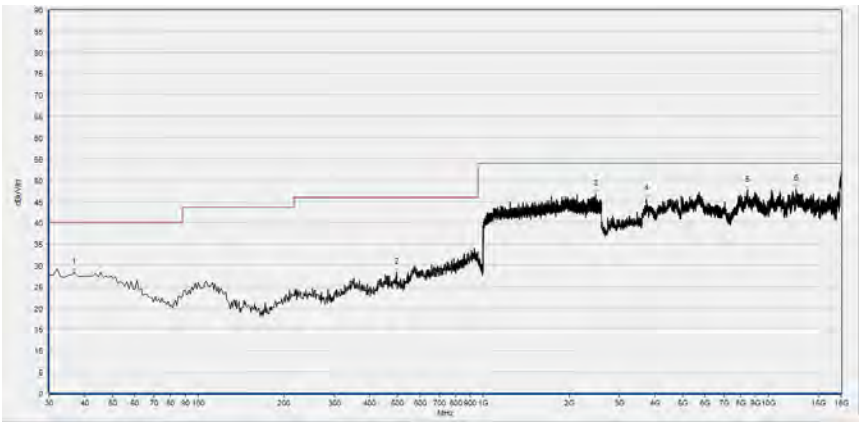
(Antenna Vertical, 30MHz to 18GHz)

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
44.550	28.62	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
562.530	30.64	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2479.467	46.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3745.760	45.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5655.360	47.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11738.360	47.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

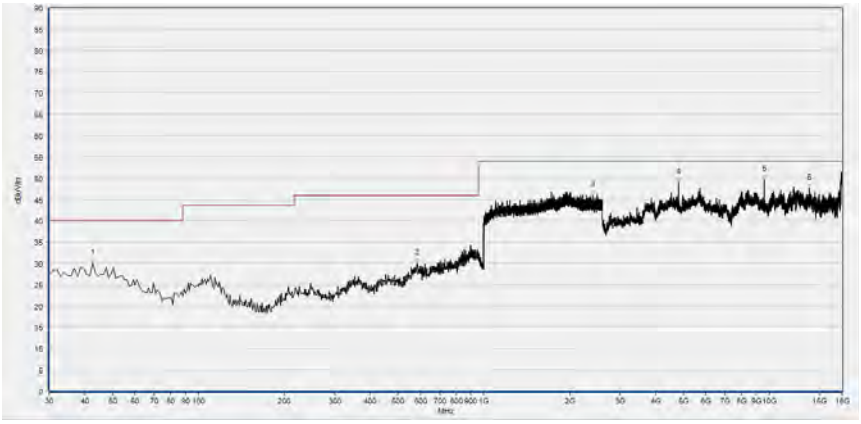


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
36.790	28.38	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
497.540	28.33	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2480.000	46.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3742.680	45.64	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8439.680	47.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12542.240	47.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

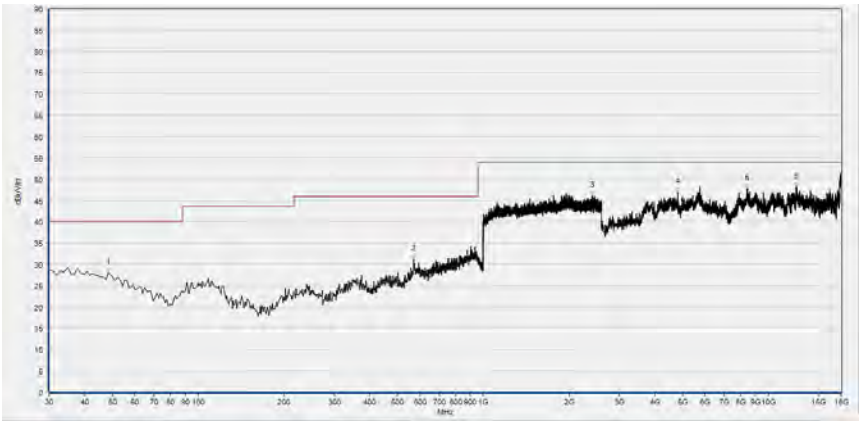
π/4-DQPSK Mode

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
42.610	29.93	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
583.870	30.02	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2403.200	45.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4805.280	48.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9607.000	49.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13848.160	47.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

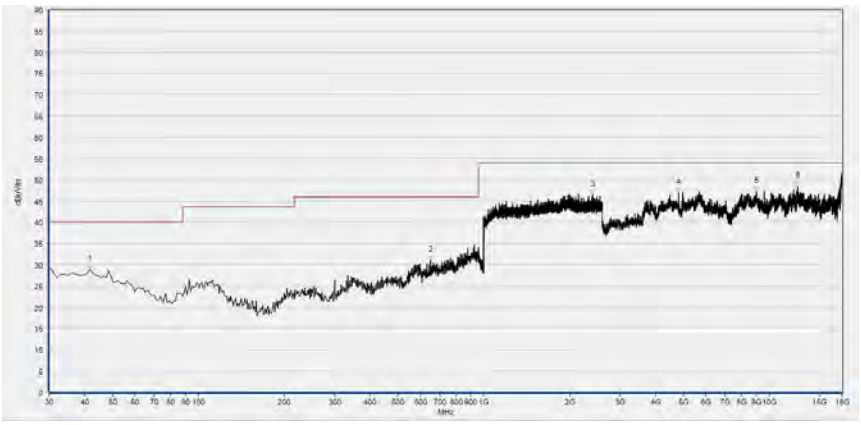
(Antenna Horizontal, 30MHz to 18GHz)



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
48.430	27.97	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
570.290	31.11	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2404.800	46.08	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4802.200	46.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8421.200	47.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12496.040	48.10	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

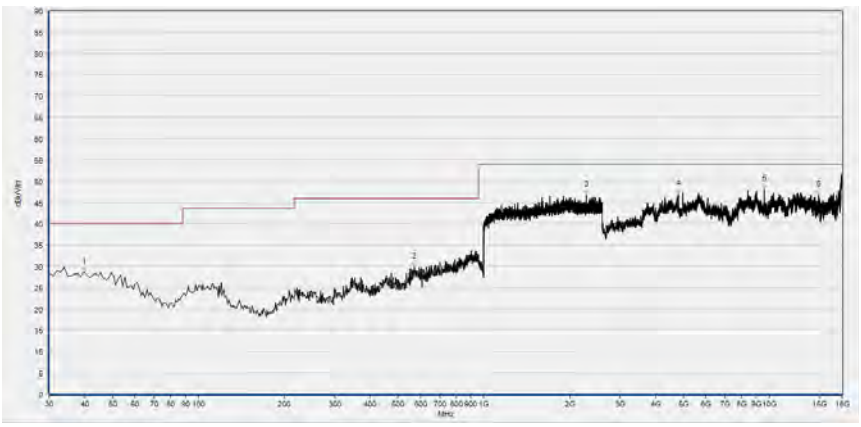
(Antenna Vertical, 30MHz to 18GHz)

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
41.640	28.77	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
651.770	30.98	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2410.667	46.46	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4805.280	46.88	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8997.160	47.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12588.440	48.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

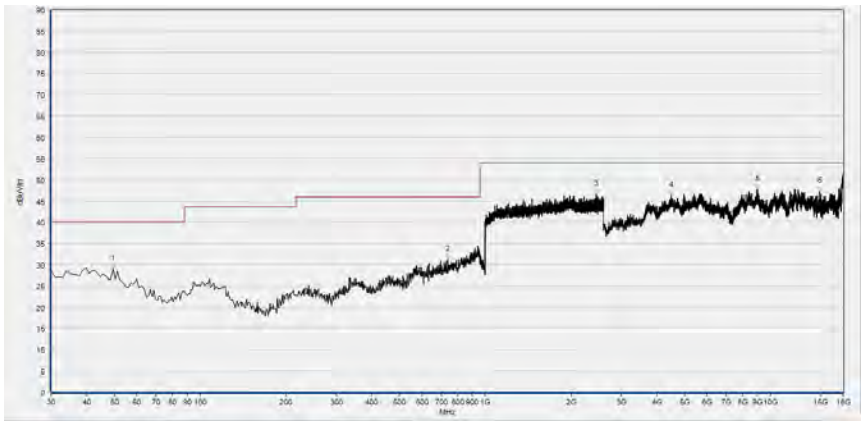
(Antenna Horizontal, 30MHz to 18GHz)



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
39.700	28.63	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
571.260	29.84	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2282.667	46.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4805.280	46.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9607.000	48.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
14873.800	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

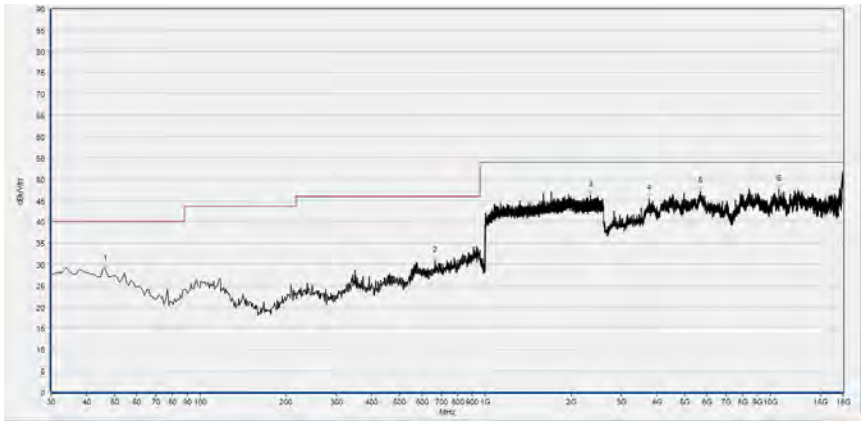
(Antenna Vertical, 30MHz to 18GHz)

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
49.400	28.99	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
740.040	31.18	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2448.533	46.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4491.120	46.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9012.560	47.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14879.960	47.29	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

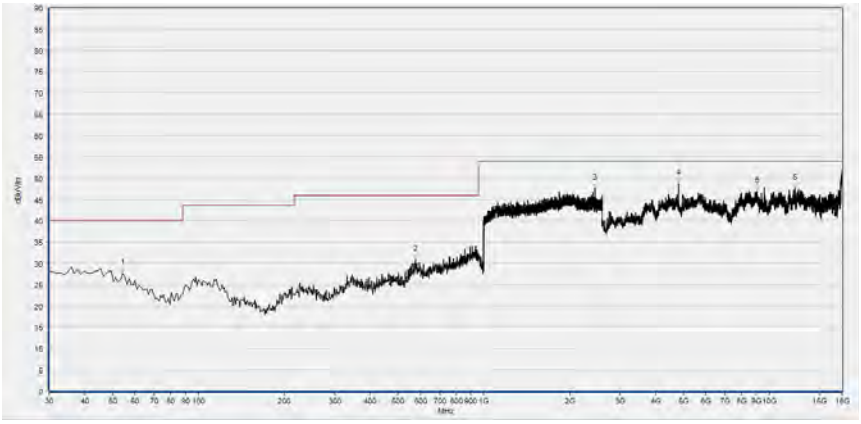


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
46.490	28.79	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
666.320	30.76	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2341.333	46.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3748.840	45.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5689.240	47.17	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10718.880	47.59	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

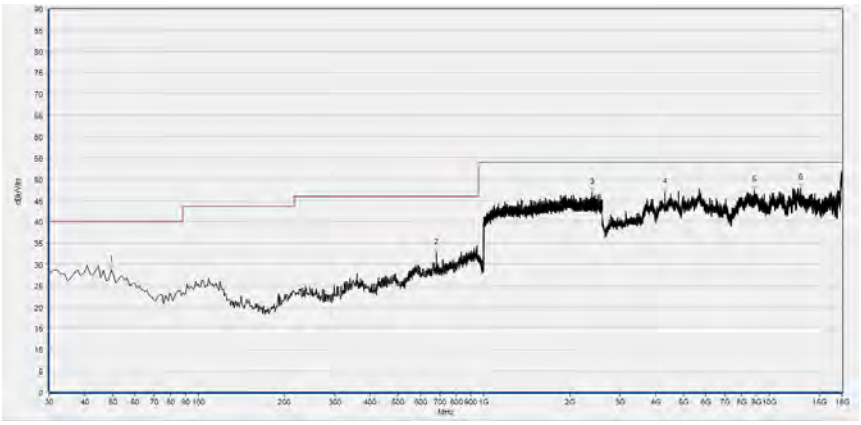
8-DPSK Mode

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
54.250	27.65	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
576.110	30.83	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2447.467	47.66	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4805.280	48.72	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9064.920	46.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12323.560	47.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

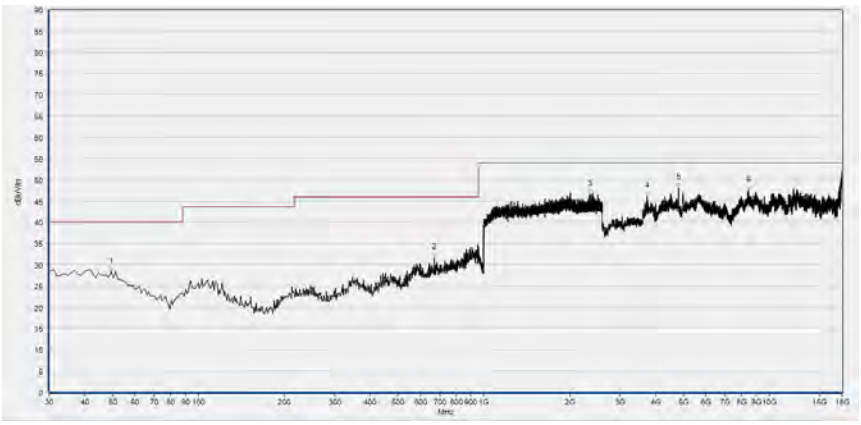
(Antenna Horizontal, 30MHz to 18GHz)



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
49.400	28.73	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
682.810	32.63	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2389.333	46.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4306.320	46.96	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8873.960	47.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12893.360	48.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

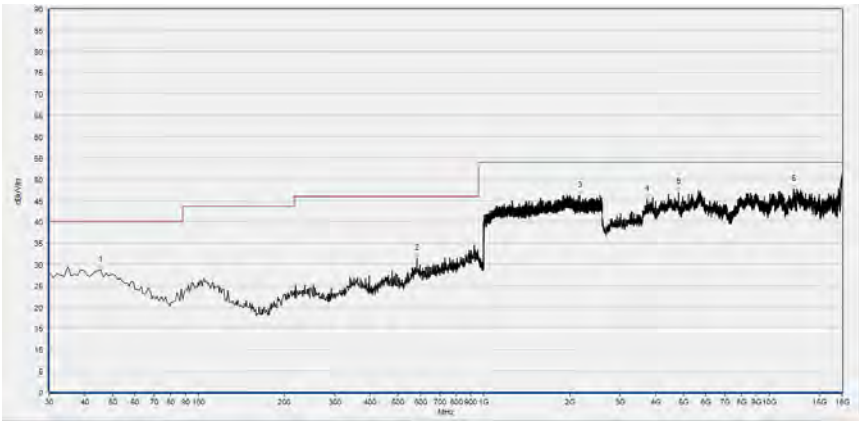
(Antenna Vertical, 30MHz to 18GHz)

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
49.400	28.25	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
671.170	31.61	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2350.933	46.62	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3736.520	46.15	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4802.200	48.05	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8436.600	47.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

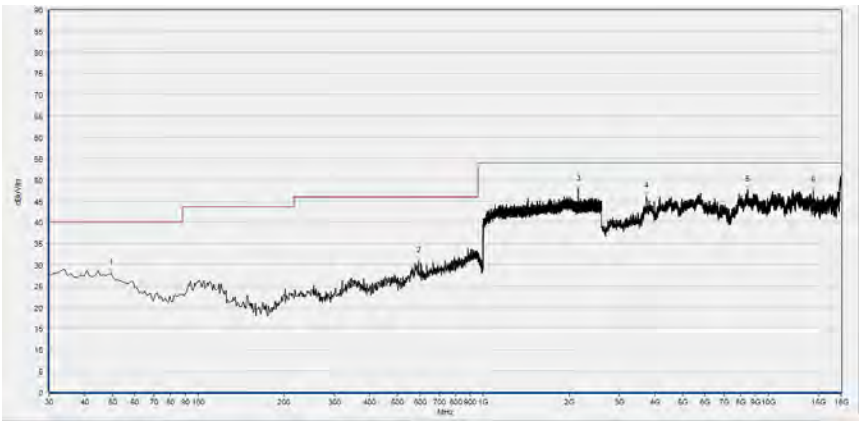
(Antenna Horizontal, 30MHz to 18GHz)



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
45.520	28.72	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
581.930	31.41	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2176.000	46.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3742.680	45.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4805.280	46.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12154.160	47.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

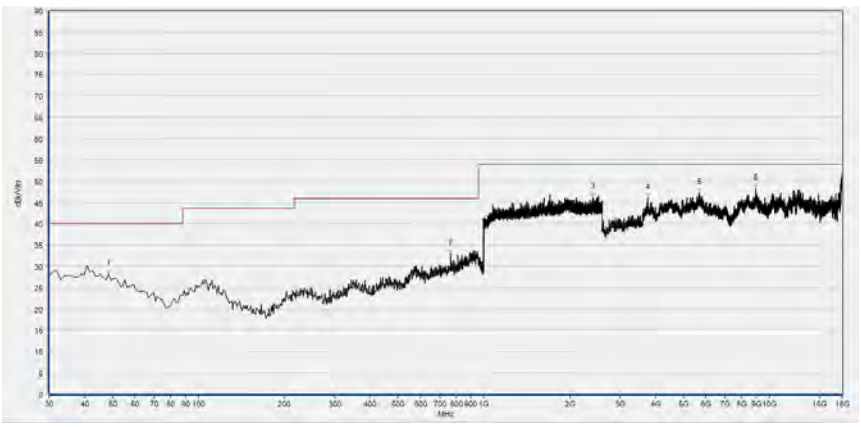
(Antenna Vertical, 30MHz to 18GHz)

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
49.400	28.02	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
592.600	30.87	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2153.067	47.83	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3736.520	46.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8445.840	47.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
14405.640	47.50	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



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
48.430	28.13	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
766.230	33.05	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2407.467	46.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3748.840	46.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5689.240	47.26	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8984.840	48.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

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
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. MorlabLaboratory
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 C63.10-2013and 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	Due Date
Bluetooth Base Station	6K00006210	MT8852B	Anritsu	2020.04.01	2021.03.31
Directional coupler	17041703	DTO-5-30	ShangHaiHuaxiang	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

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
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	2020.07.24	2021.07.23
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
Computer	DF2DR A01 DPC	VOSTRO 5370	DELL	N/A	N/A
PC Adapter	N/A	LA45NM140	LITEON	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
TS+ -[JS32-CE]	Tonscend	V2.5.0.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2020.07.21	2021.07.20
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1519-022	FMZB1519	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
Coaxial cable (N male) (30MHz-40GHz)	CB05	EMC05	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	S020180L3203	Tonscend	2020.07.21	2021.07.20
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2020.07.21	2021.07.20
26-40GHz pre-Amplifier	56774	S40M400L4002	Tonscend	2020.07.21	2021.07.20
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2020.07.21	2021.07.20
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT