TEST REPORT

APPLICANT	:	Glory Horse Industries Limited
PRODUCT NAME	:	Hilti NCP Radio
MODEL NAME	:	R6-22
BRAND NAME	:	HILTI
FCC ID	:	2ABL5WSR1901R6-22
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2020-06-01
TEST DATE	:	2020-06-22 to 2020-06-30
ISSUE DATE	:	2020-10-29

Edited by: Chen Bilian (Rapporteur)

Approved by: Peng Huarui (Supervisor)

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DIRECTORY

1. Technical Information ····· 3
1.1. Applicant and Manufacturer Information ····· 3
1.2. Equipment Under Test (EUT) Description ····· 3
1.3. The Channel Number and Frequency ····· 4
1.4. Test Standards and Results ····· 5
1.5. Environmental Conditions ····· 6
2. 47 CFR Part 15C Requirements ····· 7
2.1. Antenna requirement ····· 7
2.2. Hopping Mechanism ····· 7
2.3. Number of Hopping Frequency ····· 8
2.4. Duty Cycle Of Test Signal ····· 11
2.5. Maximum Peak Conducted Output Power ····· 12
2.6. Maximum Average Conducted Output Power ····· 19
2.7. 20dB Bandwidth ····· 21
2.8. Carried Frequency Separation ····· 28
2.9. Time of Occupancy (Dwell time) ····· 31
2.10. Conducted Spurious Emissions ····· 38
2.11. Conducted Emission ····· 51
2.12. Restricted Frequency Bands ····· 53
2.13. Radiated Emission ····· 63
Annex A Test Uncertainty ····· 76
Annex B Testing Laboratory Information ····· 77

Change History		
Version	Date	Reason for change
1.0	2020-10-29	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Glory Horse Industries Limited
Applicant Address:	No.8,4/F, World-Wide IND Centre, 43-47 Shan Mei ST., Fotan Shatin,NT,HKG
Manufacturer:	Glory Horse Industries Limited
Manufacturer Address:	No.8,4/F, World-Wide IND Centre, 43-47 Shan Mei ST., Fotan Shatin,NT,HKG

1.2. Equipment Under Test (EUT) Description

Product Name:	Hilti NCP Radio
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	REV04
Software Version:	r6-22_id00de_0400_bl_app_param
Equipment Type:	Bluetooth classic
Modulation Type:	FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Operating Frequency Range:	2402MHz – 2480MHz
Bluetooth Version:	5.0
Antenna Type:	PCB Antenna
Antenna Gain:	3.51dBi

Note 1: We use the dedicated software to control the EUT continuous transmission.

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

1.3. The Channel Number and Frequency

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

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

1.4. Test Standards and Results

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

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

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

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.247(a)1 15.247(h)	Hopping Mechanism	N/A	N/A	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Jun 22, 2020	Lu Qiang	PASS	No deviation
4	N/A	Duty Cycle	Jun 22, 2020	Lu Qiang	PASS	No deviation
5	15.247(b)	Maximum Peak Conducted Output Power	Jun 29, 2020	Lu Qiang	PASS	No deviation
6	15.247(b)	Maximum Average Conducted Output Power	Jun 29, 2020	Lu Qiang	PASS	No deviation
7	15.247(a)	20dB Bandwidth	Jun 22, 2020	Lu Qiang	PASS	No deviation
8	15.247(a)	Carrier Frequency Separation	Jun 22, 2020	Lu Qiang	PASS	No deviation
9	15.247(a)	Time of Occupancy (Dwell time)	Jun 28, 2020	Lu Qiang	PASS	No deviation
10	15.247(d)	Conducted Spurious Emission	Jun 30, 2020	Lu Qiang	PASS	No deviation
11	15.207	Conducted Emission	N/A	N/A Note 1	N/A	N/A
12	15.247(d)	Restricted Frequency Bands	Jun 25, 2020	Gao Jianrou	PASS	No deviation

13	15.209, 15.247(d)	Radiated Emission	Jun 25, 2020	Gao Jianrou	PASS	No deviation

Note 1: Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.
Note 2: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013 and KDB558074 D01 v05r02.
Note 3: 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 4: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

1.5. Environmental Conditions

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

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

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

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

2.1.2. Result: Compliant

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

2.2. Hopping Mechanism

2.2.1. Requirement

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

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

2.2.2. Result: Compliant

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

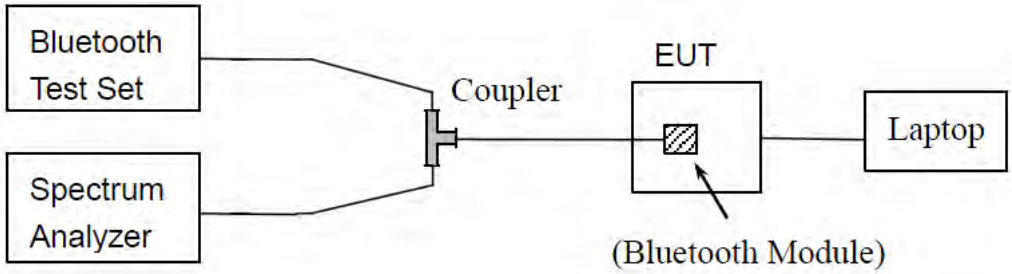
2.3. Number of Hopping Frequency

2.3.1. Requirement

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

2.3.2. Test Description

Test Setup:



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

2.3.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW: 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

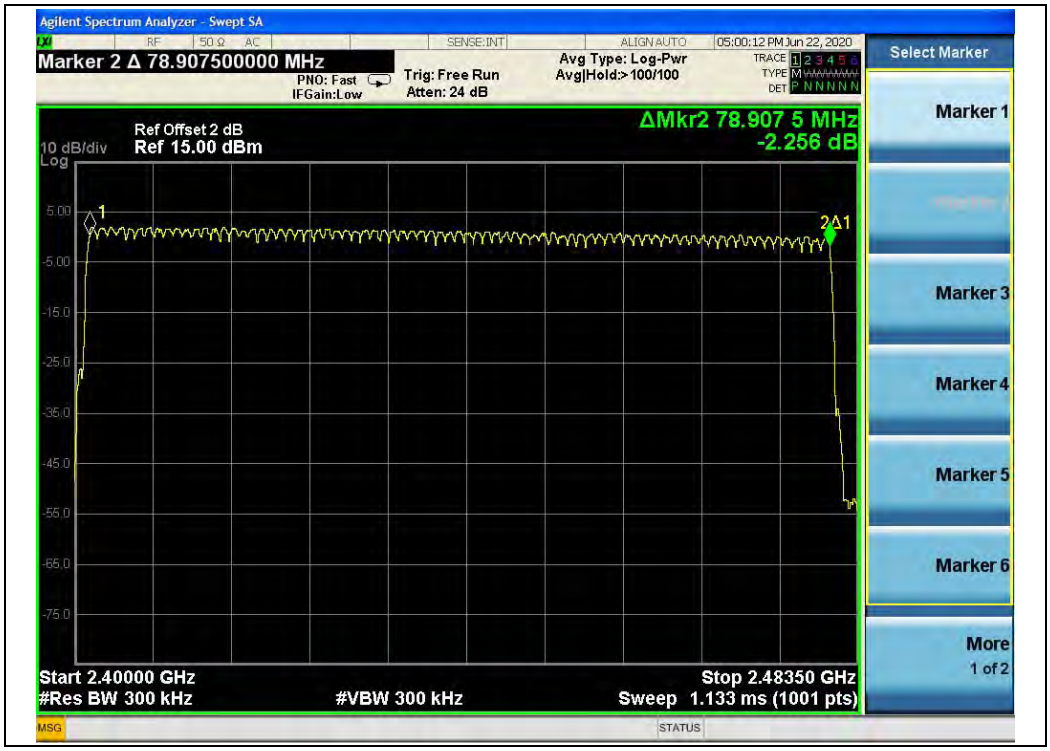
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

A. Test Verdict:

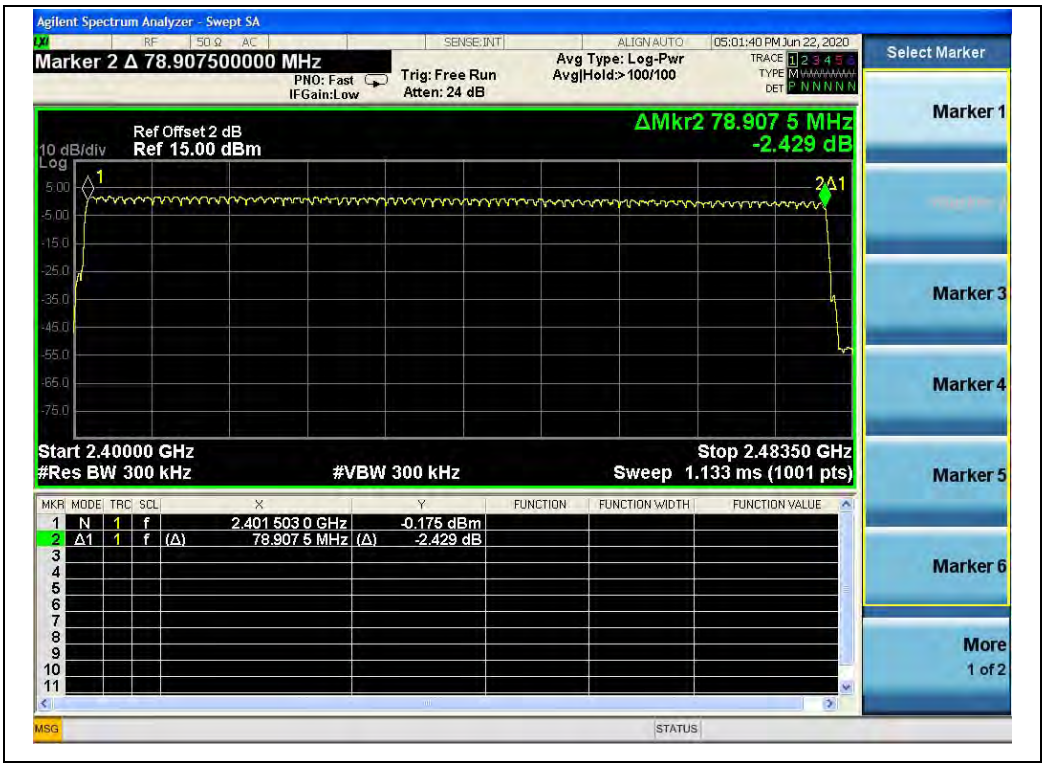
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
GFSK	2400 - 2483.5	79	15	PASS
π/4-DQPSK	2400 - 2483.5	79	15	PASS
8-DPSK	2400 - 2483.5	79	15	PASS

B. Test Plots:

(GFSK)



(π/4-DQPSK)



(8- DPSK)

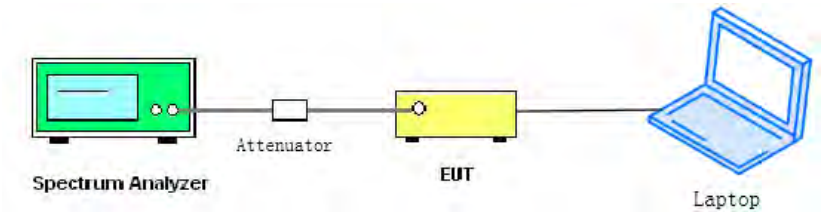
2.4. Duty Cycle Of Test Signal

2.4.1. Requirement

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

2.4.2. Test Description

Test Setup:



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

2.4.3. Test Result

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
GFSK	76.53	1.16
π/4-DQPSK	76.80	1.15
8-DPSK	76.53	1.16

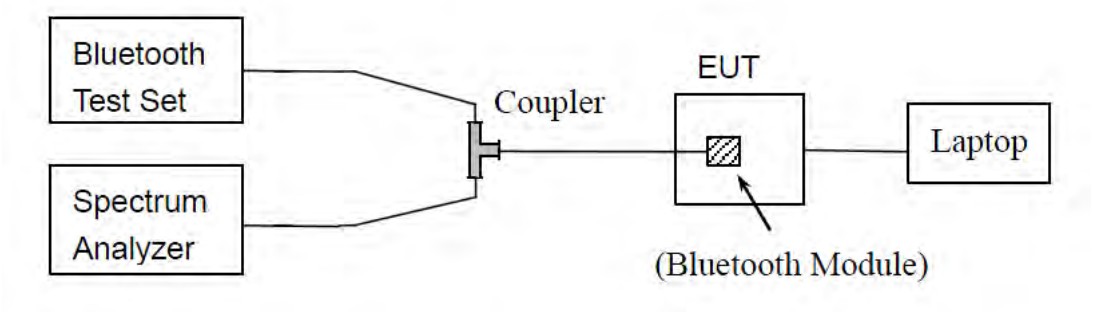
2.5. Maximum Peak Conducted Output Power

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

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	2.57	0.002	20.96	0.125	PASS
39	2441	1.61	0.001			PASS
78	2480	0.26	0.001			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	5.35	0.003	20.96	0.125	PASS
39	2441	4.25	0.003			PASS
78	2480	2.77	0.002			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	**6.04**	0.004	20.96	0.125	PASS
39	2441	4.94	0.003			PASS
78	2480	3.46	0.002			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

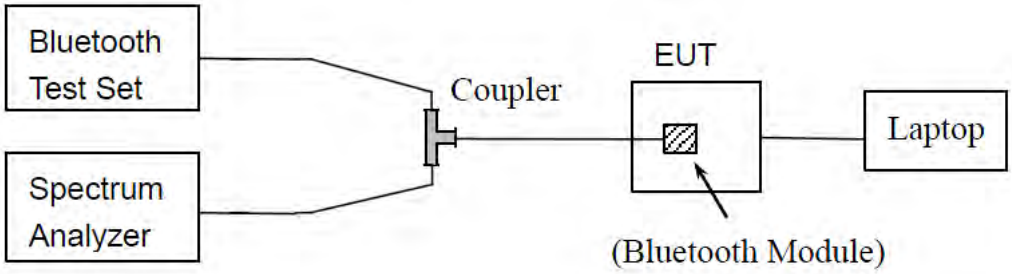
2.6.1. Requirement

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.

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	**1.39**	1.16	**2.55**	0.002	20.96	0.125	PASS
39	2441	0.38		1.54	0.001			PASS
78	2480	-1.00		0.16	0.001			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	0.89	1.15	2.04	0.002	20.96	0.125	PASS
39	2441	0.06		1.21	0.001			PASS
78	2480	-1.46		-0.31	0.001			PASS

8-DPSK Mode

Channel	Frequency (MHz)	Measured	Average Power			Limit		Verdict
			Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	0.99	1.16	2.15	0.002	20.96	0.125	PASS
39	2441	-0.04		1.12	0.001			PASS
78	2480	-1.39		-0.23	0.001			PASS

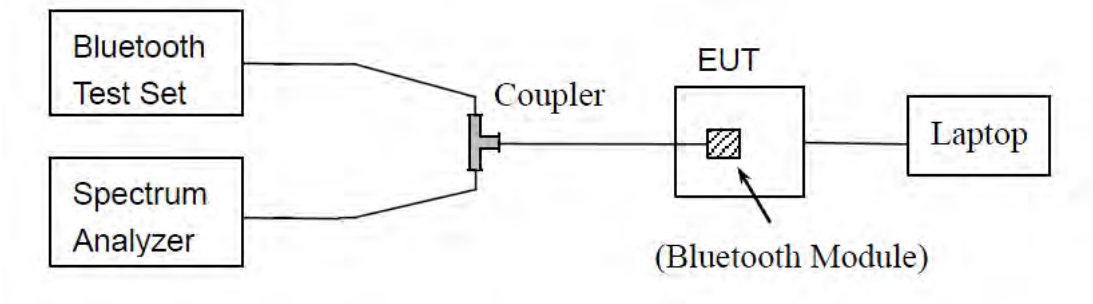
2.7. 20dB Bandwidth

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 = 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

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	0.949	PASS
39	2441	0.950	PASS
78	2480	0.949	PASS

B. Test Plots:

(GFSK, Channel 0, 2402MHz)

(GFSK, Channel 39, 2441MHz)

(GFSK, Channel 78, 2480MHz)

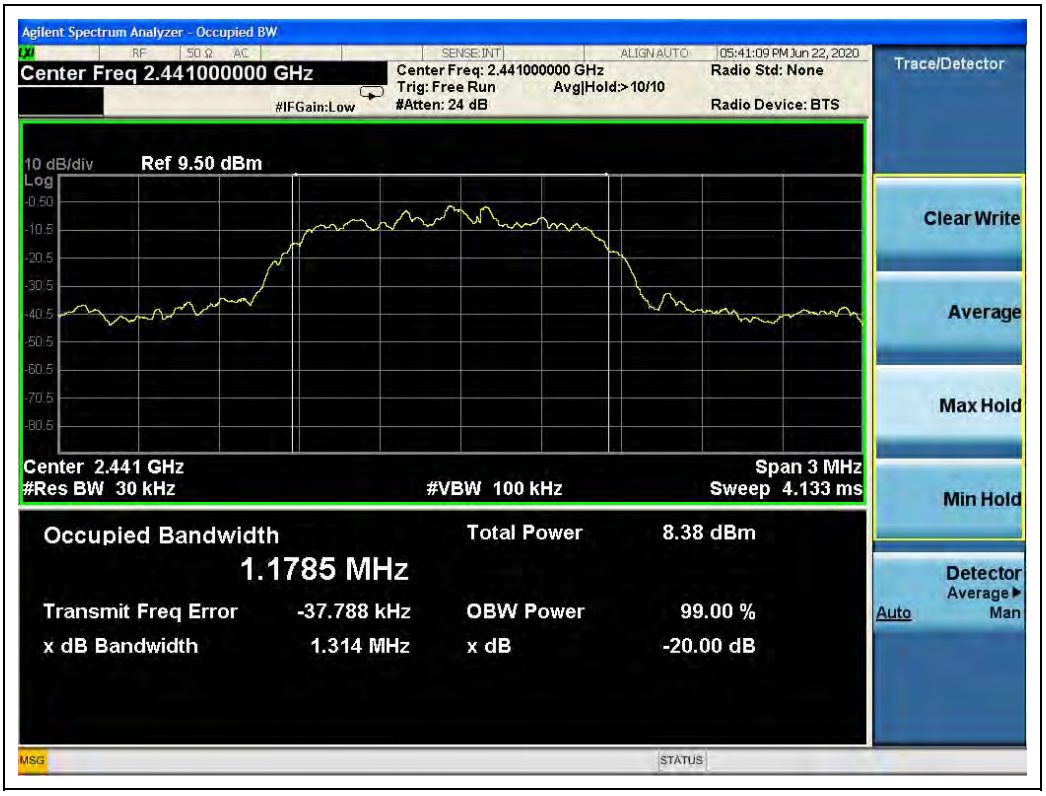
π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.308	PASS
39	2441	1.314	PASS
78	2480	1.315	PASS

B. Test Plots:

(π/4-DQPSK, Channel 0, 2402MHz)



(π/4-DQPSK, Channel 39, 2441MHz)

(π/4-DQPSK, Channel 78, 2480MHz)

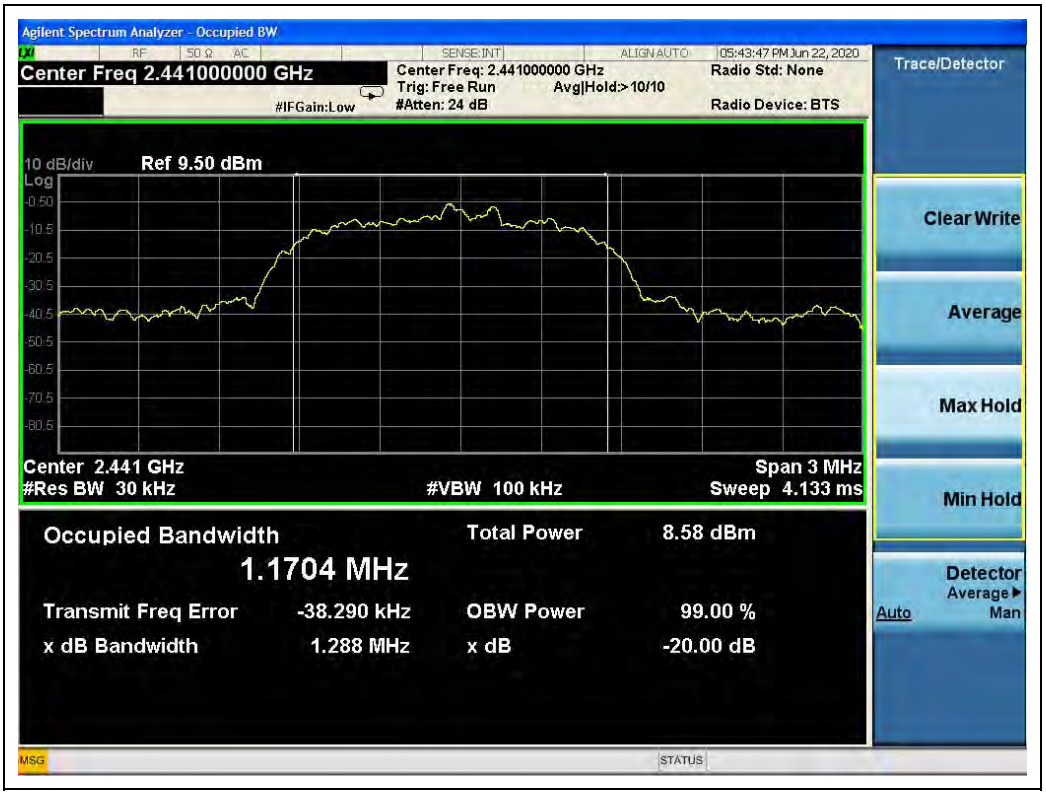
8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Result
0	2402	1.288	PASS
39	2441	1.288	PASS
78	2480	1.292	PASS

B. Test Plots:

(8-DPSK, Channel 0, 2402MHz)



(8-DPSK, Channel 39, 2441MHz)

(8-DPSK, Channel 78, 2480MHz)

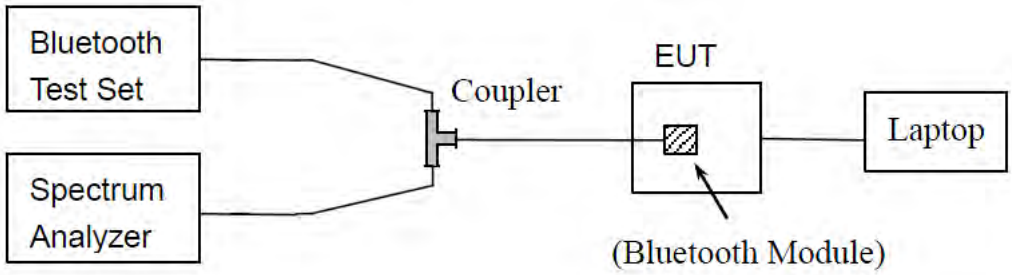
2.8. Carried Frequency Separation

2.8.1. Definition

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

2.8.2. Test Description

Test Setup:



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

2.8.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
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

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 (MHz)	20dB bandwidth (MHz)	Min. Limit	Verdict
GFSK	39 and 40	0.984	0.950	two-thirds of the 20dB bandwidth	PASS
π/4-DQPSK	39 and 40	1.038	1.315		PASS
8-DPSK	39 and 40	1.041	1.292		PASS

(GFSK)

(π/4-DQPSK)

(8-DPSK)

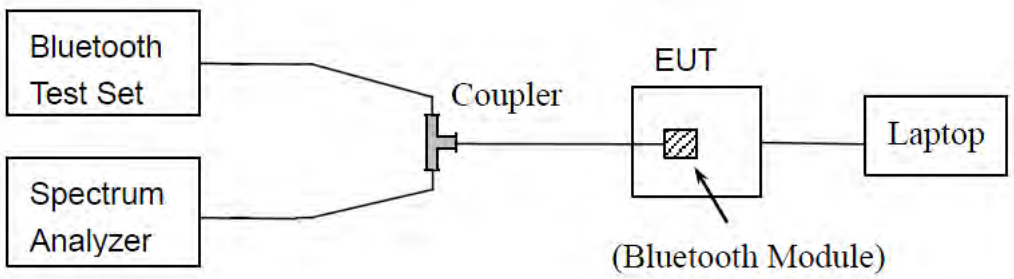
2.9. Time of Occupancy (Dwell time)

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

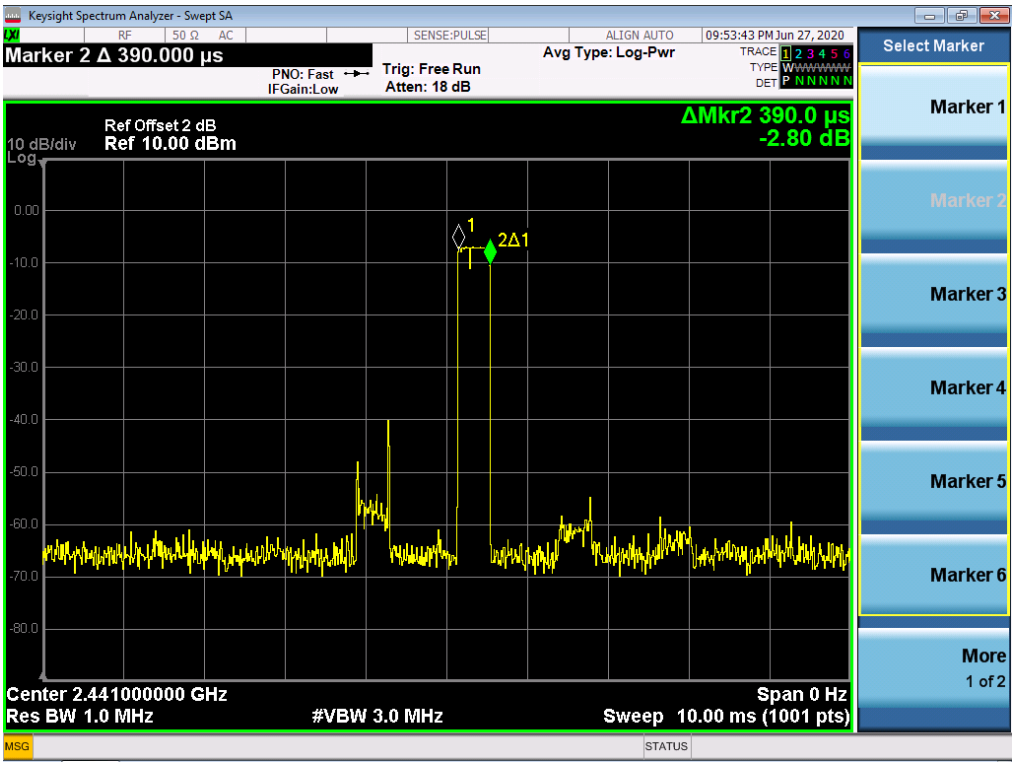
2.9.4. Test Result

GFSK Mode

A. Test Verdict:

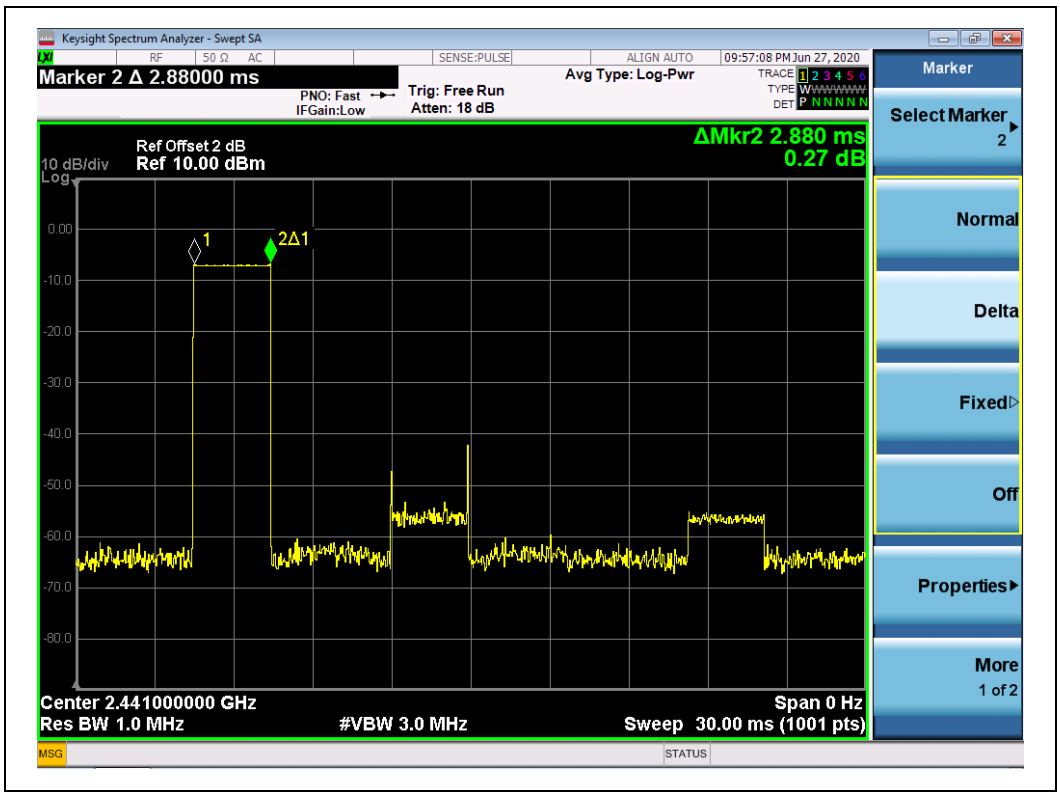
DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.39	124.80	62.40	0.4	PASS
DH3	1.65	264.00	132.00		PASS
DH5	2.88	307.20	153.60		PASS

B. Test Plots:



(DH1, GFSK)

(DH3, GFSK)



(DH5, GFSK)

π/4-DQPSK Mode

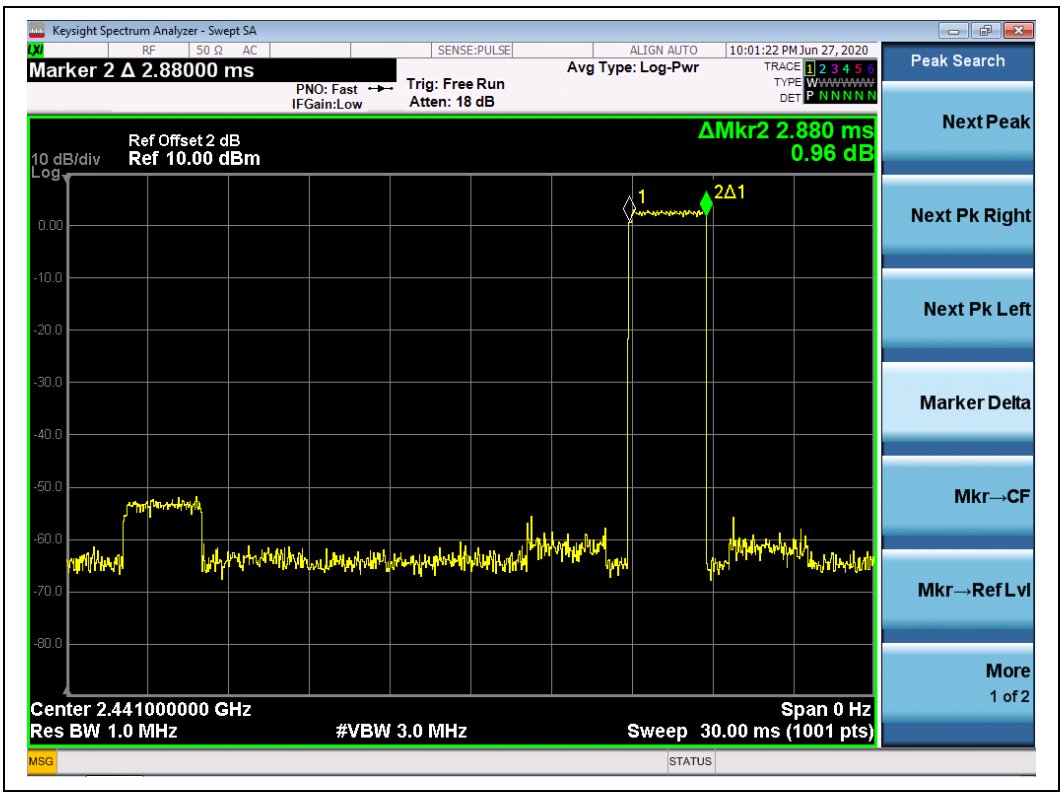
A. Test Verdict:

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	1.66	265.60	132.80		PASS
DH5	2.88	307.20	153.60		PASS

B. Test Plots:

(DH1, π/4-DQPSK)

(DH3, π/4-DQPSK)



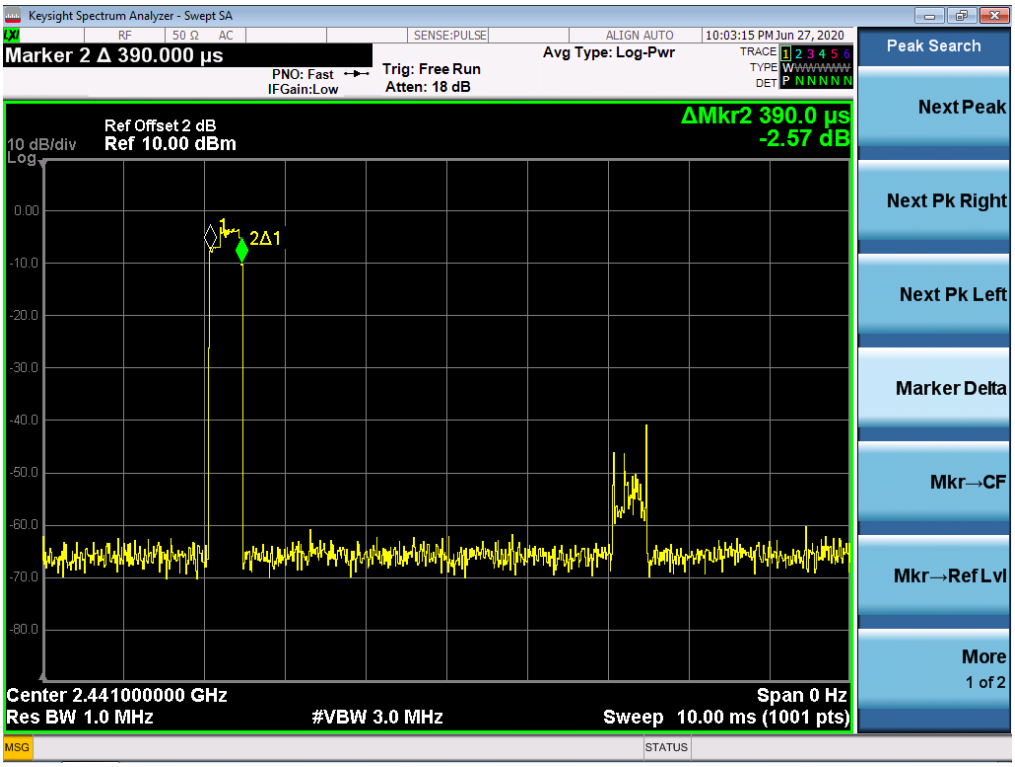
(DH5, π/4-DQPSK)

8-DPSK mode

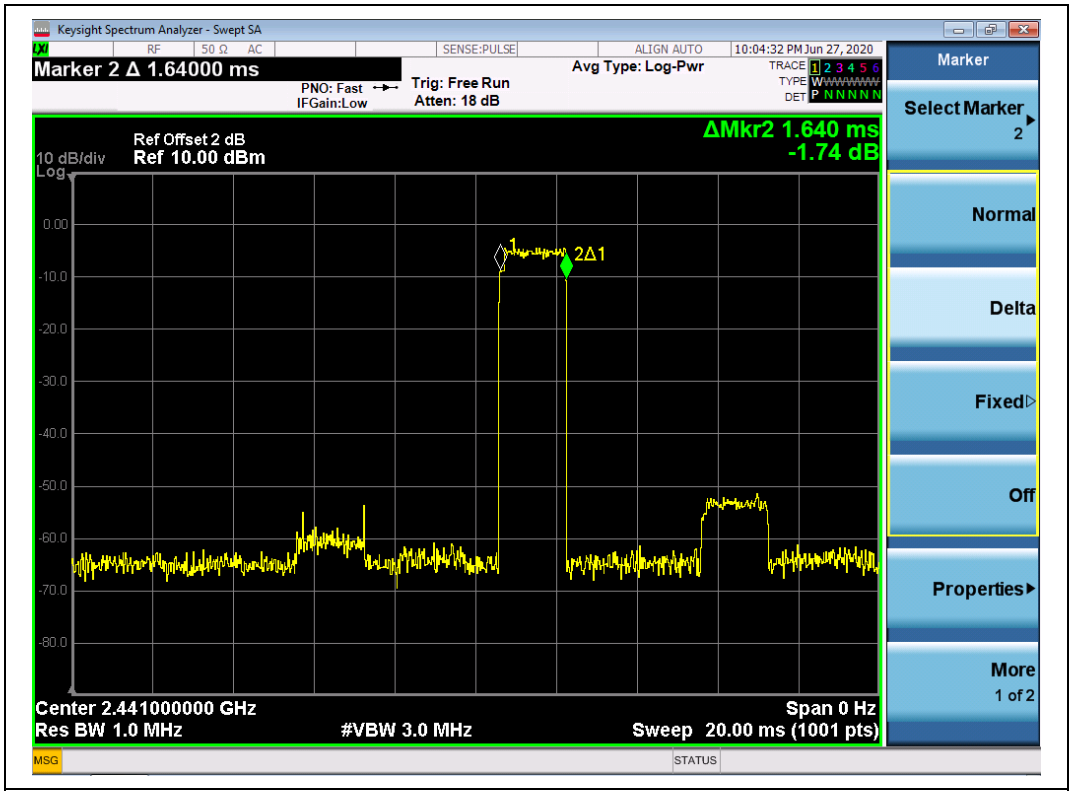
A. Test Verdict:

DH Packet	Pulse Width (ms)	Dwell Time (ms)		Limit (sec)	Verdict
		Normal Mode	AFH Mode		
DH1	0.39	124.8	62.40	0.4	PASS
DH3	1.64	262.4	131.20		PASS
DH5	2.91	310.4	155.20		PASS

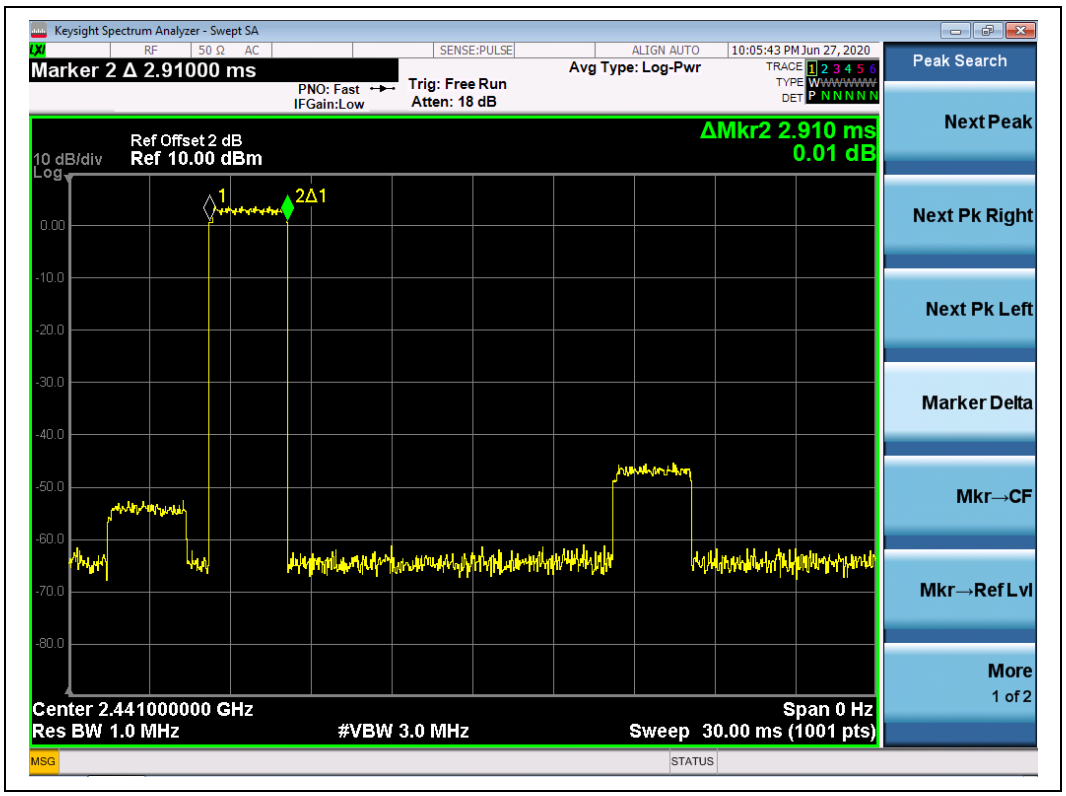
B. Test Plots:



(DH1, 8-DPSK)



(DH3, 8-DPSK)



(DH5, 8-DPSK)

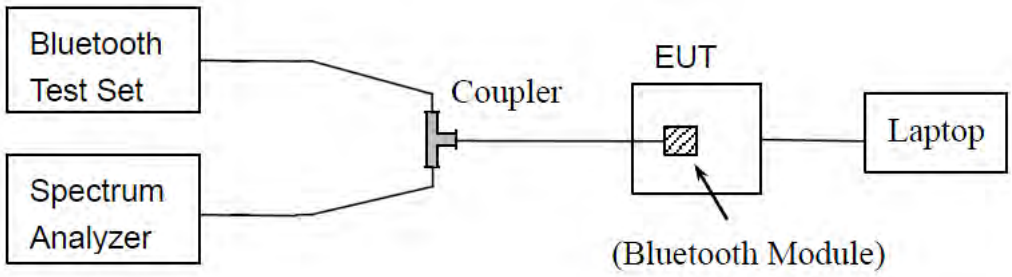
2.10. Conducted Spurious Emissions

2.10.1. Requirement

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

2.10.2. Test Description

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

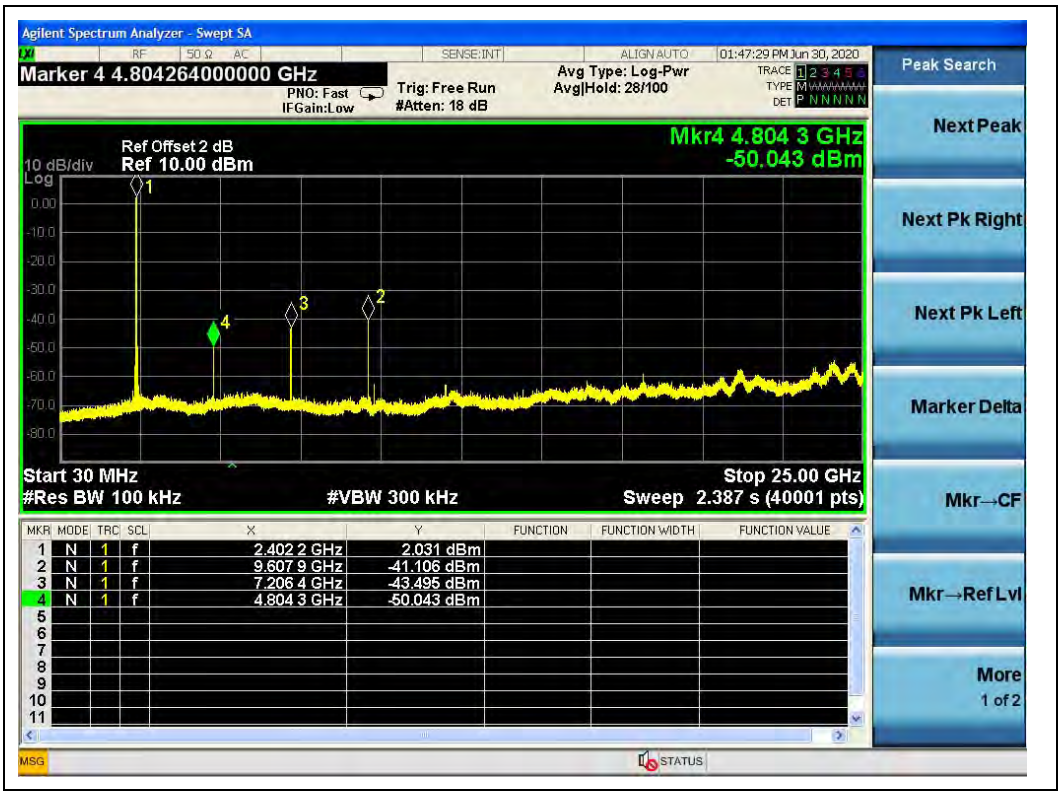
The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

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	-41.11	2.03	-17.97	PASS
39	2441	-41.94	1.07	-18.93	PASS
78	2480	-43.91	-0.69	-20.69	PASS

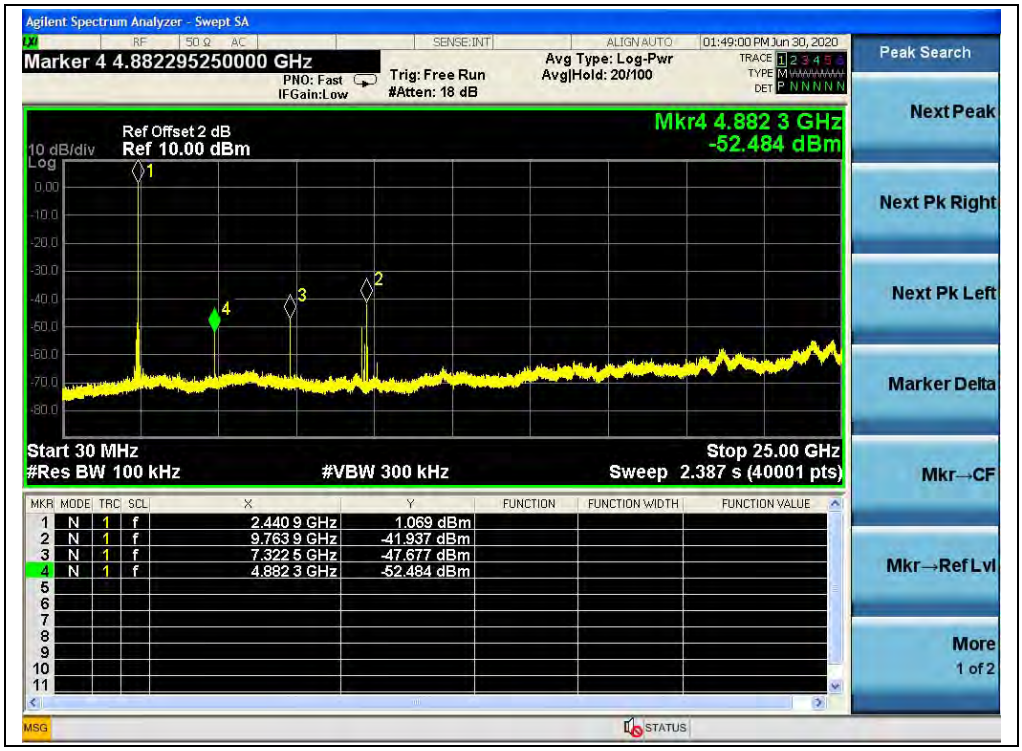
B. Test Plots:



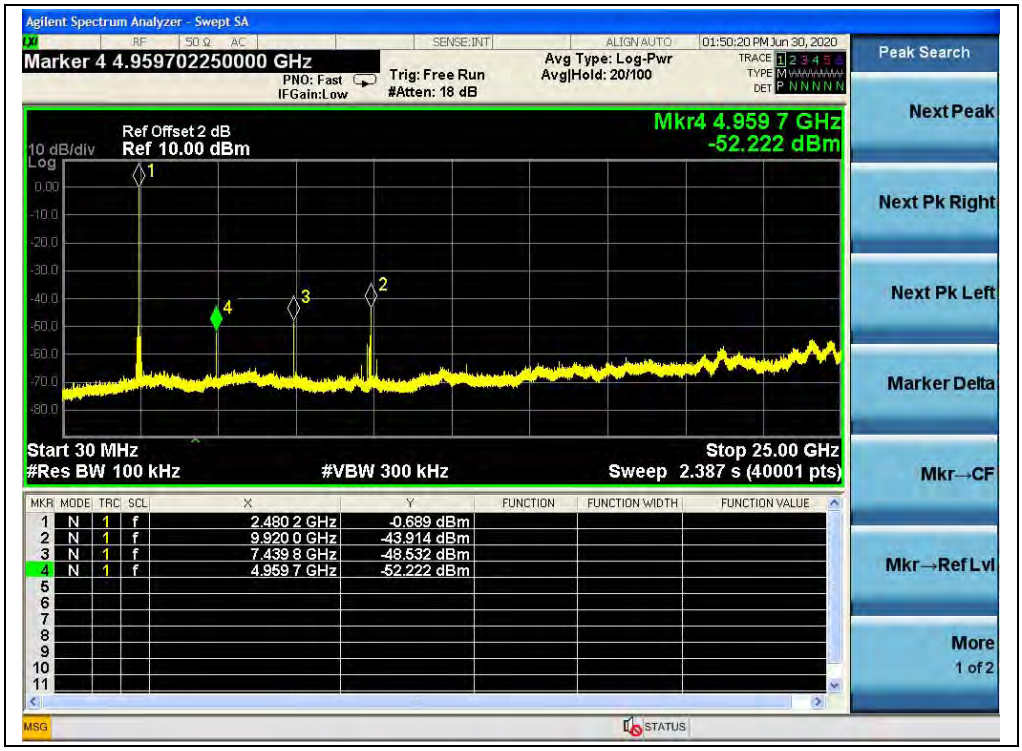
(Channel = 0, 30MHz to 25GHz, GFSK Mode)

(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)

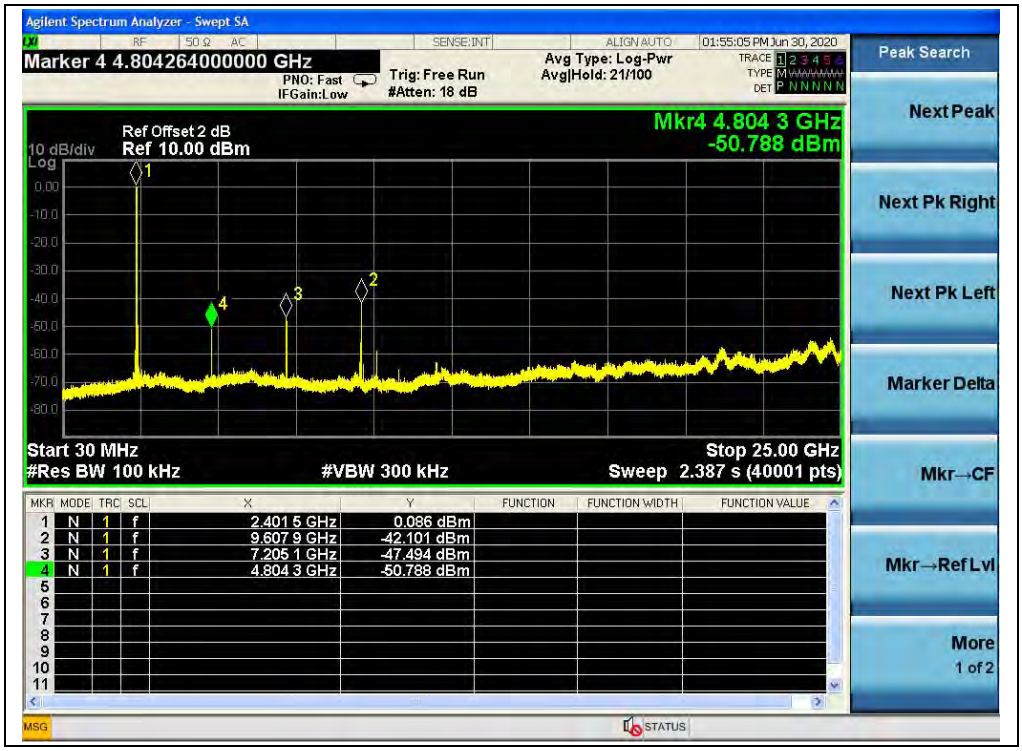
(Channel = 78, Band edge with hopping on, GFSK Mode)

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	-42.10	0.09	-19.91	PASS
39	2441	-42.86	0.69	-19.31	PASS
78	2480	-44.48	-2.30	-22.3	PASS

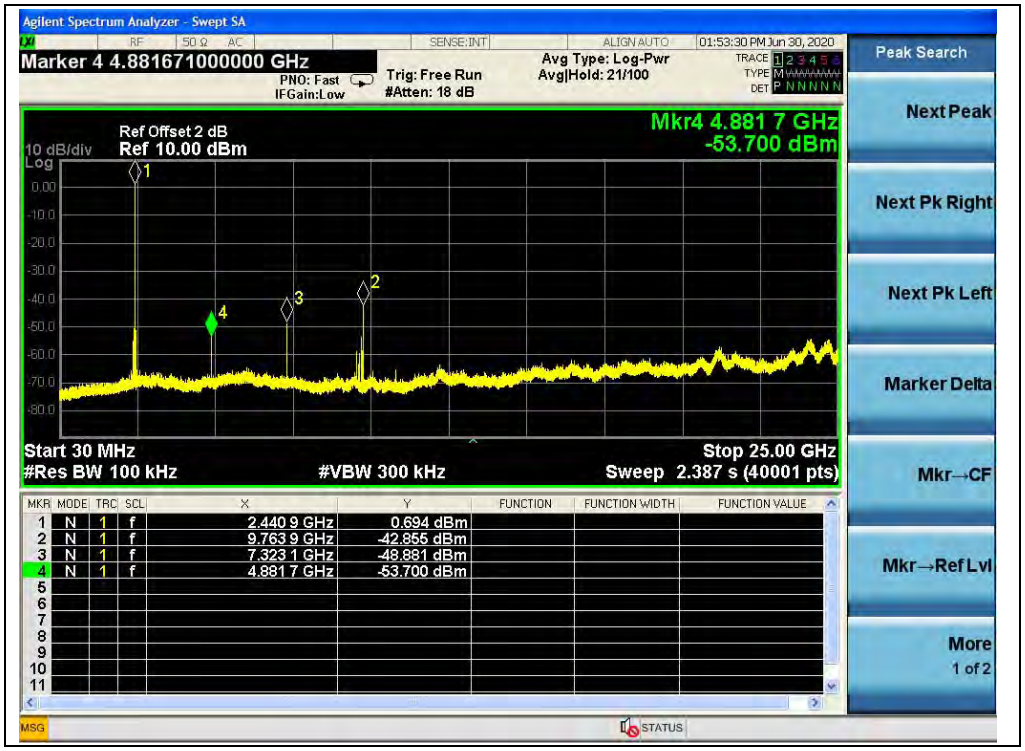
B. Test Plots:



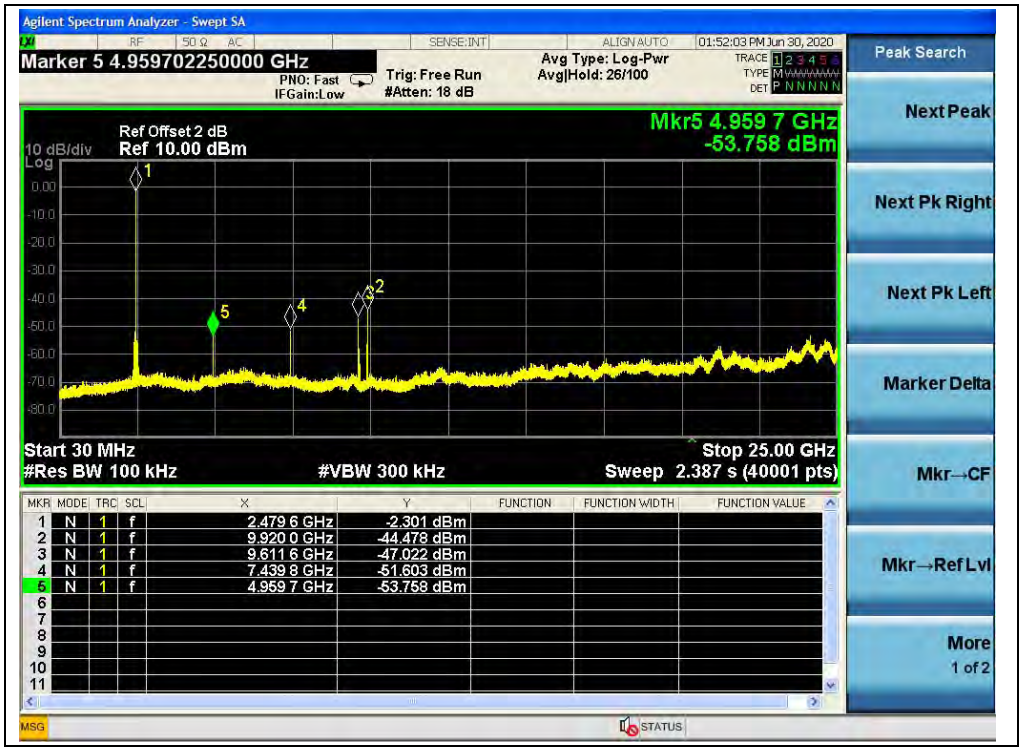
(Channel = 0, 30MHz to 25GHz, π/4-DQPSK)

(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)

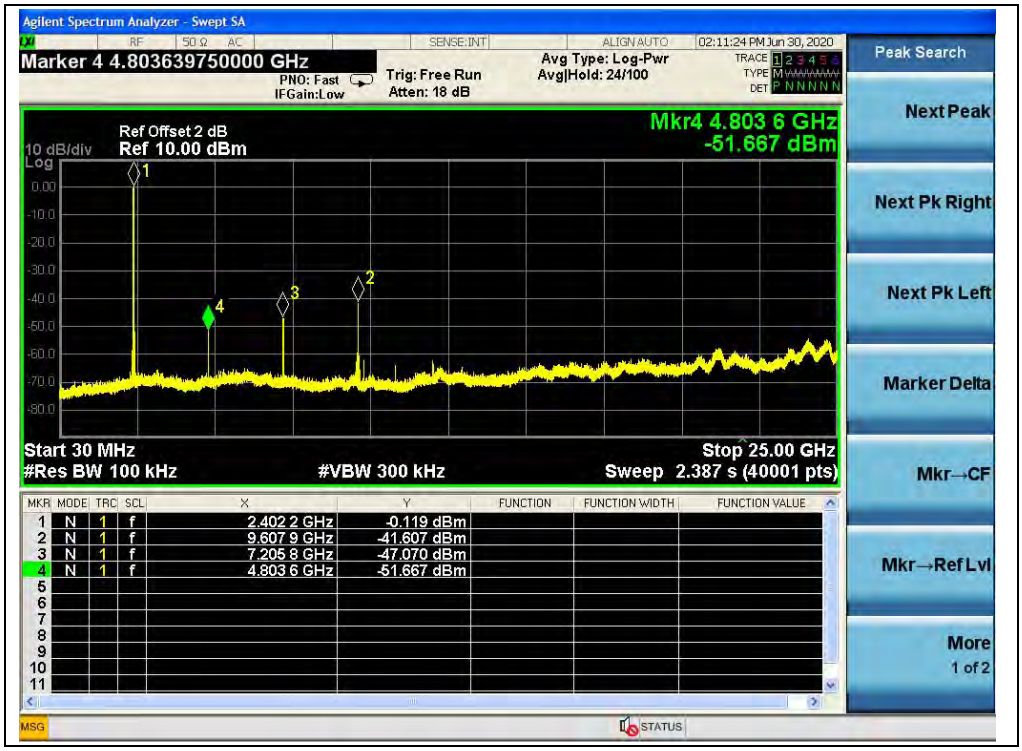
(Channel = 78, Band edge with hopping on, π/4-DQPSK)

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	-41.61	-0.12	-20.12	PASS
39	2441	-41.54	-0.78	-20.78	PASS
78	2480	-42.93	-2.25	-22.25	PASS

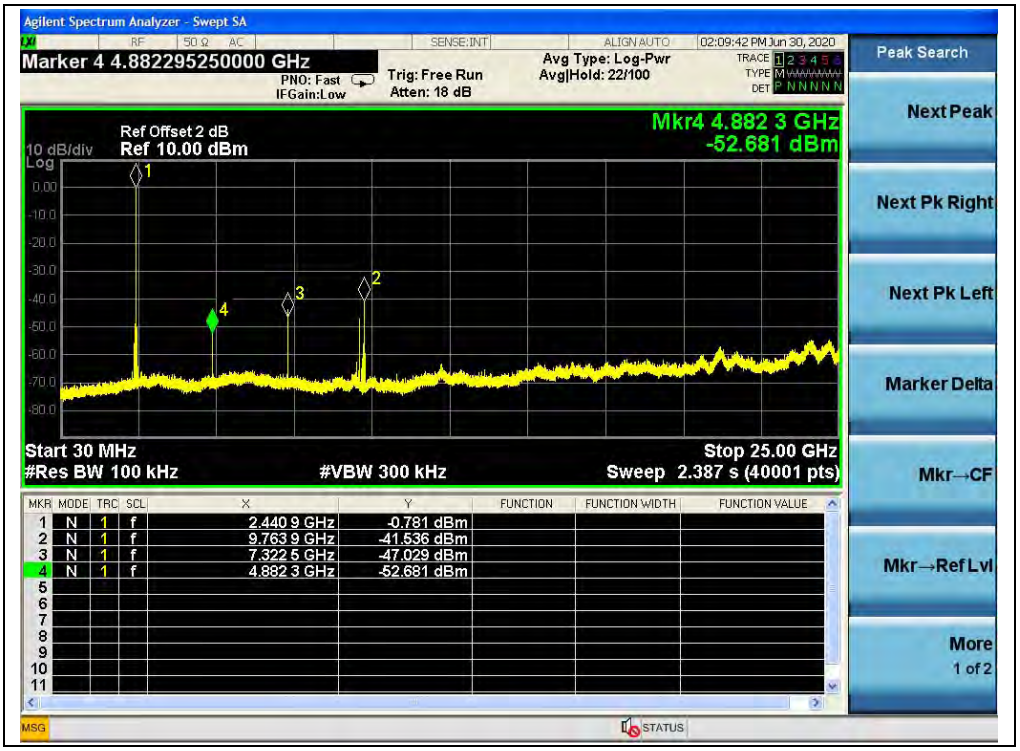
B. Test Plots:



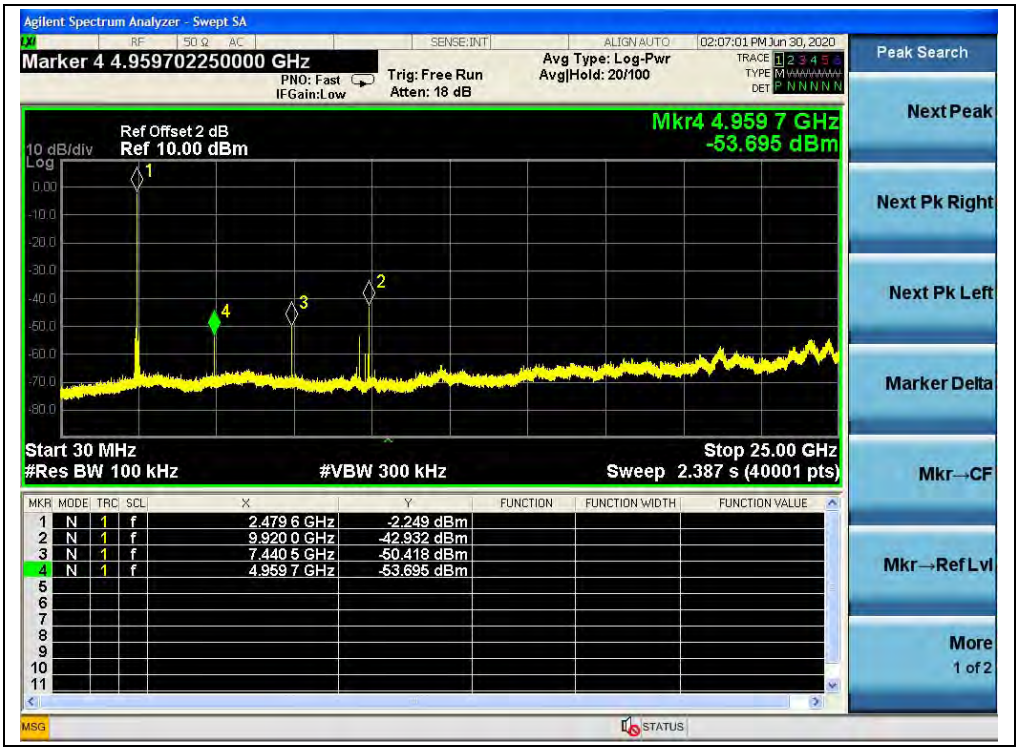
(Channel = 0, 30MHz to 25GH, 8-DPSK)

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

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



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



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

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

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

2.11. Conducted Emission

2.11.1. Requirement

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

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

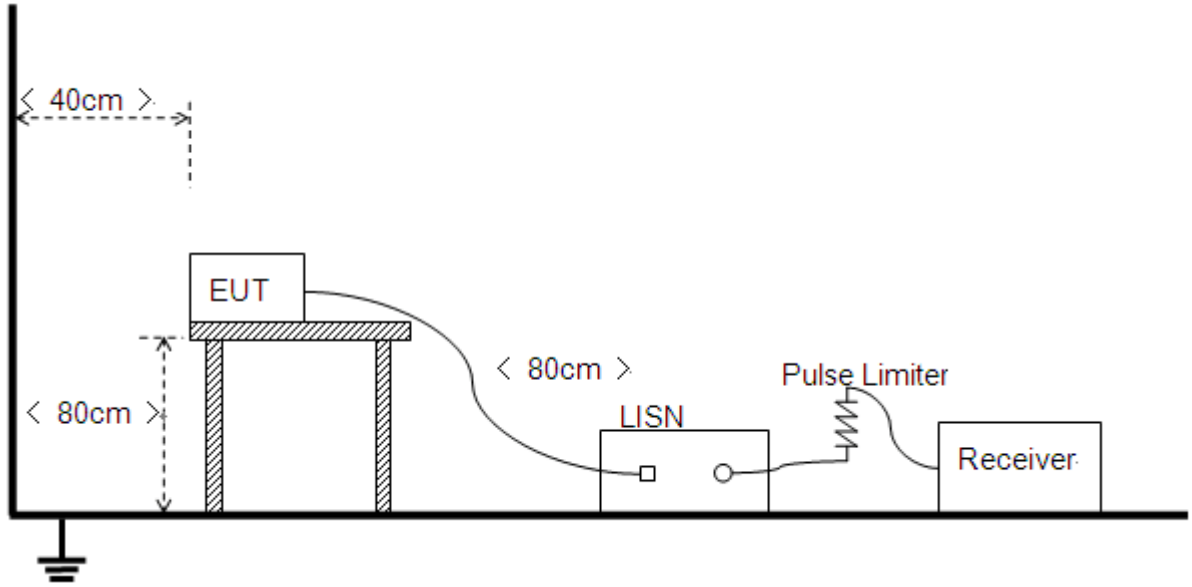
NOTE:

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

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

2.11.2. Test Description

Test Setup:



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

2.11.3. Test Result

This test case does not apply this kind of EUT.

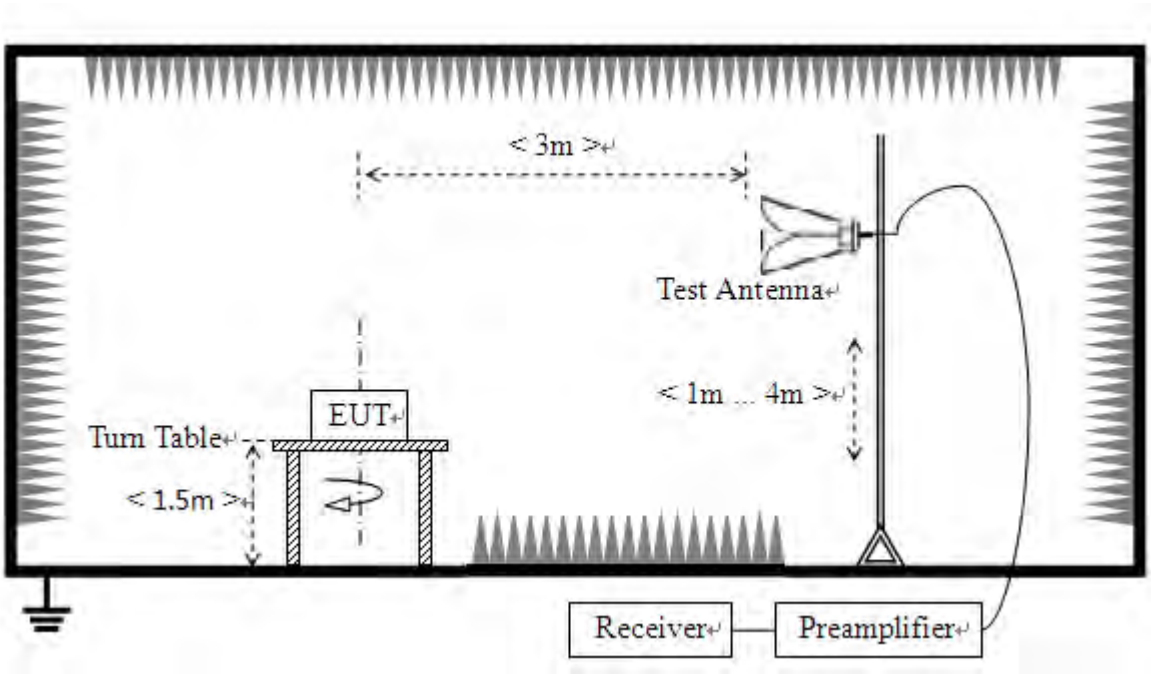
2.12. Restricted Frequency Bands

2.12.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

2.12.2. Test Description

Test Setup:



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

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

2.12.3. Test Procedure

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

2.12.4. Test Result

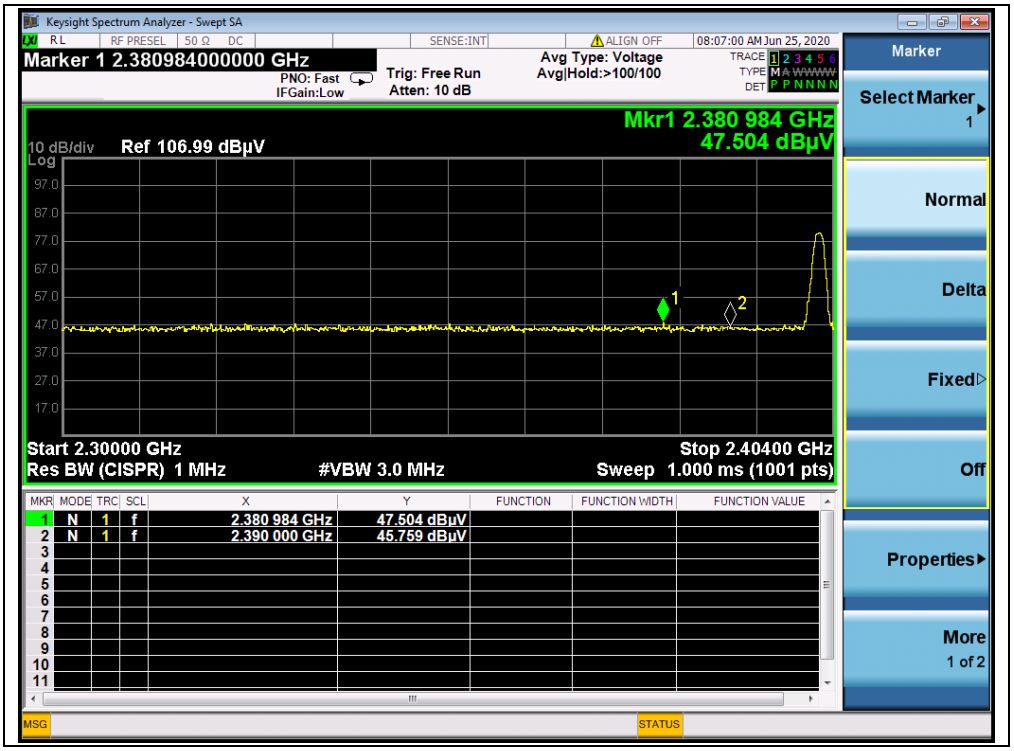
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; AT $=L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]
AT: Total correction Factor except Antenna
UR: Receiver Reading
Gpreamp: Preamplifier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

GFSK Mode

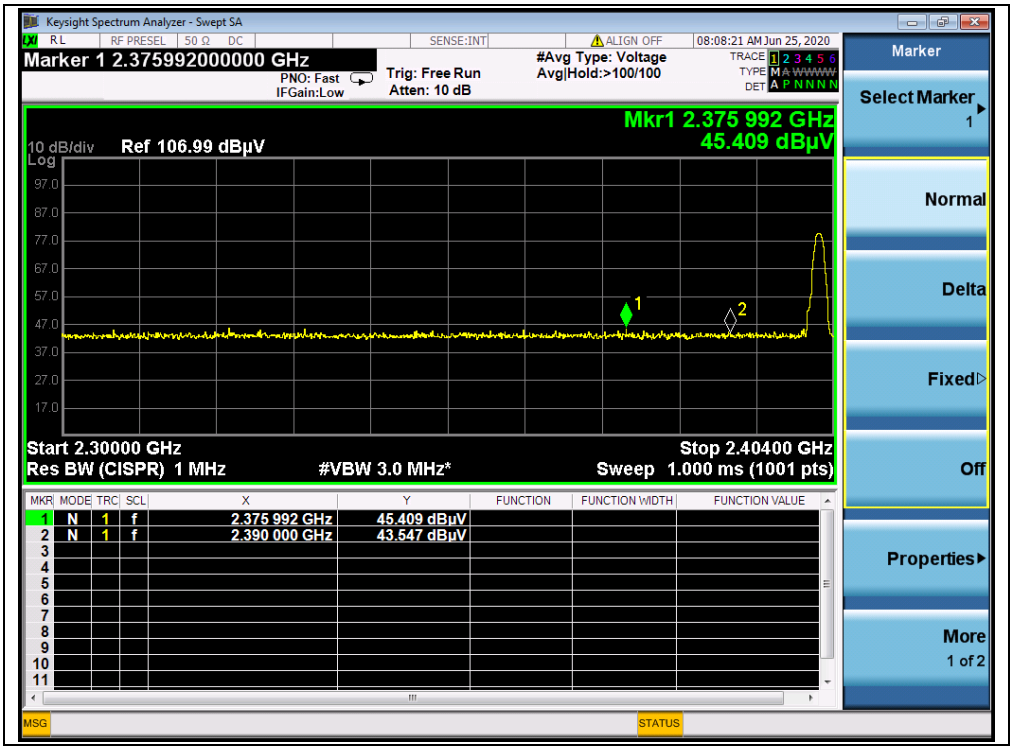
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2380.98	PK	47.50	-29.67	32.56	50.39	74	PASS
0	2375.99	AV	45.41	-29.67	32.56	48.30	54	PASS
78	2484.35	PK	46.70	-29.67	32.56	49.59	74	PASS
78	2485.19	AV	45.28	-29.67	32.56	48.17	54	PASS

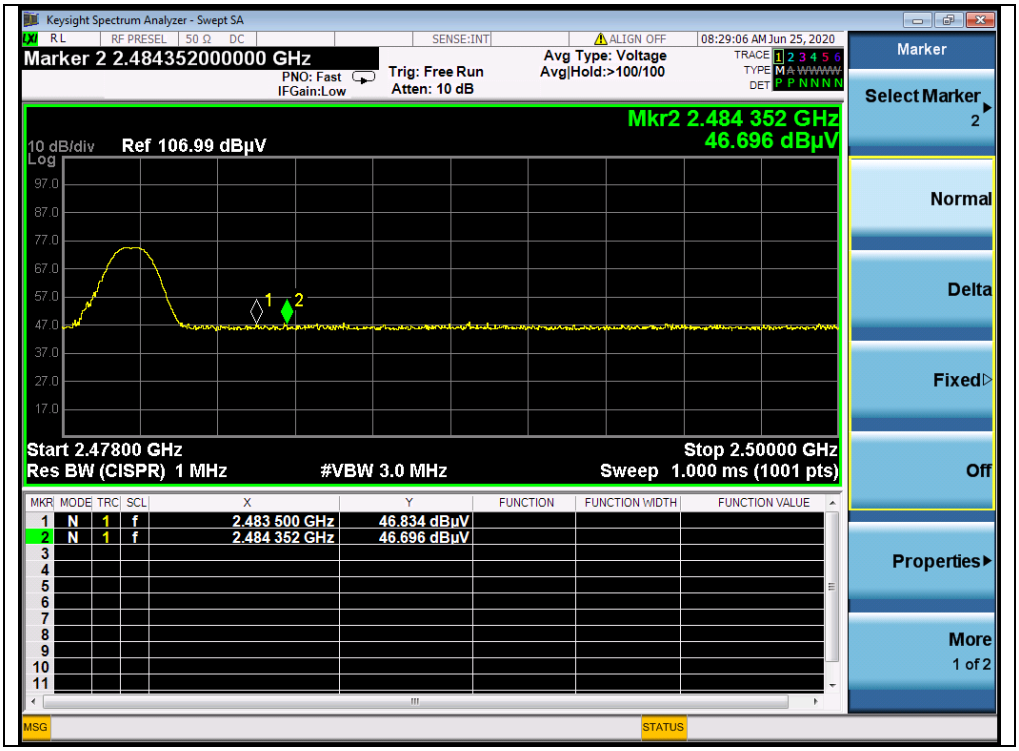
B. Test Plots:



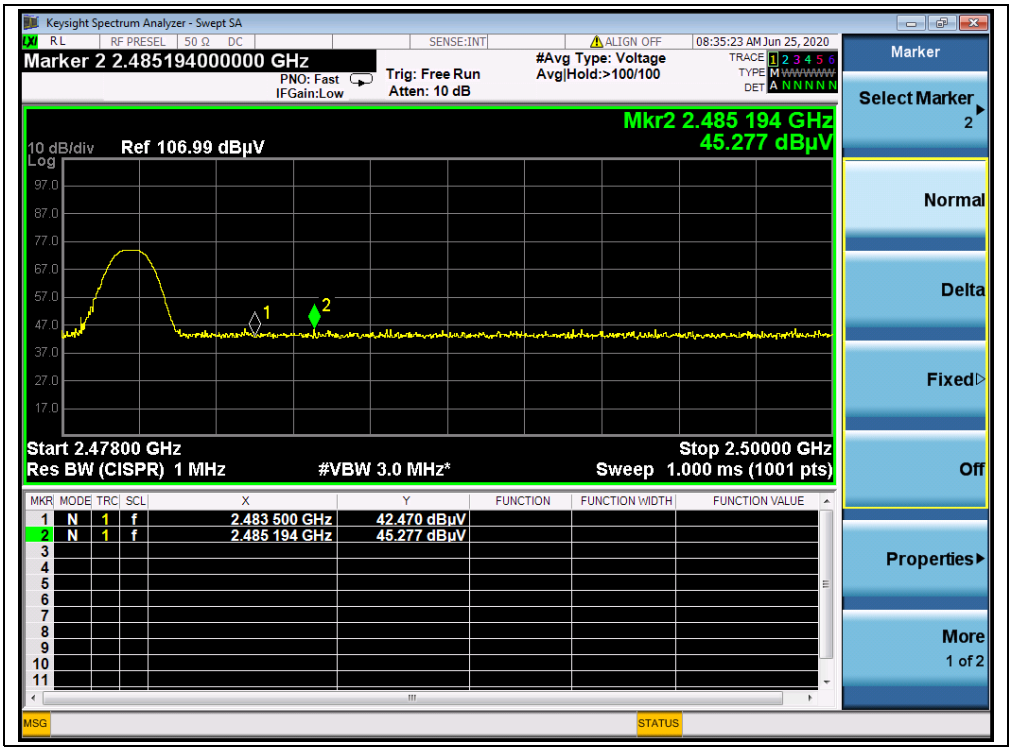
(PEAK, Channel = 0, GFSK)



(AVERAGE, Channel = 0, GFSK)



(PEAK, Channel = 78, GFSK)



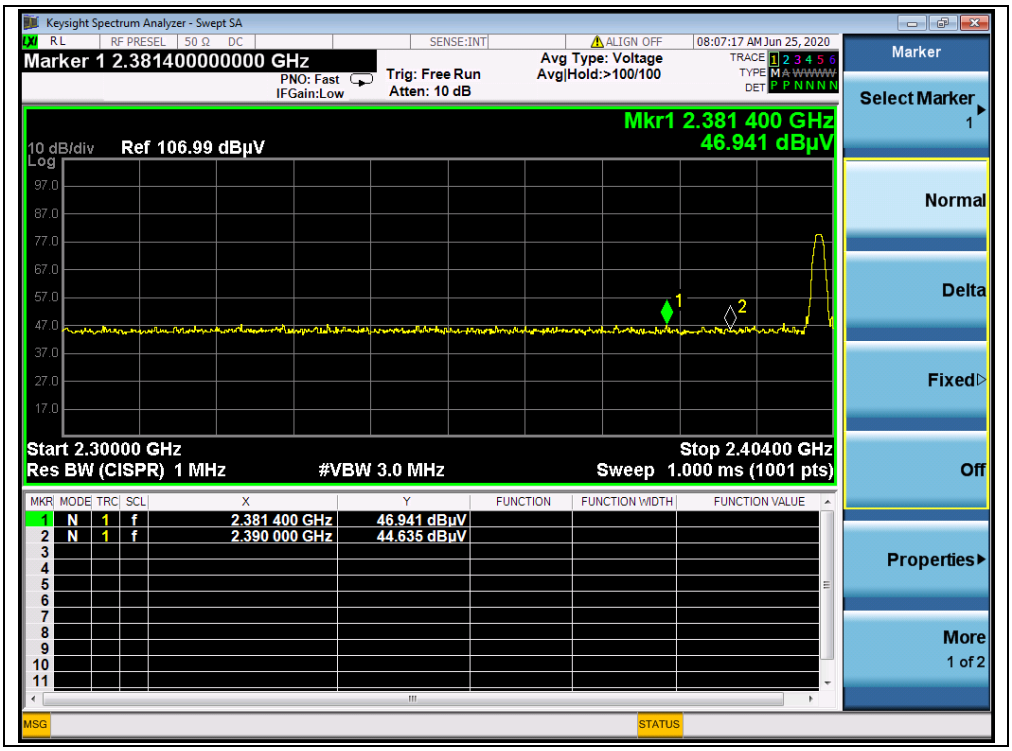
(AVERAGE, Channel = 78, GFSK)

π/4-DQPSK Mode

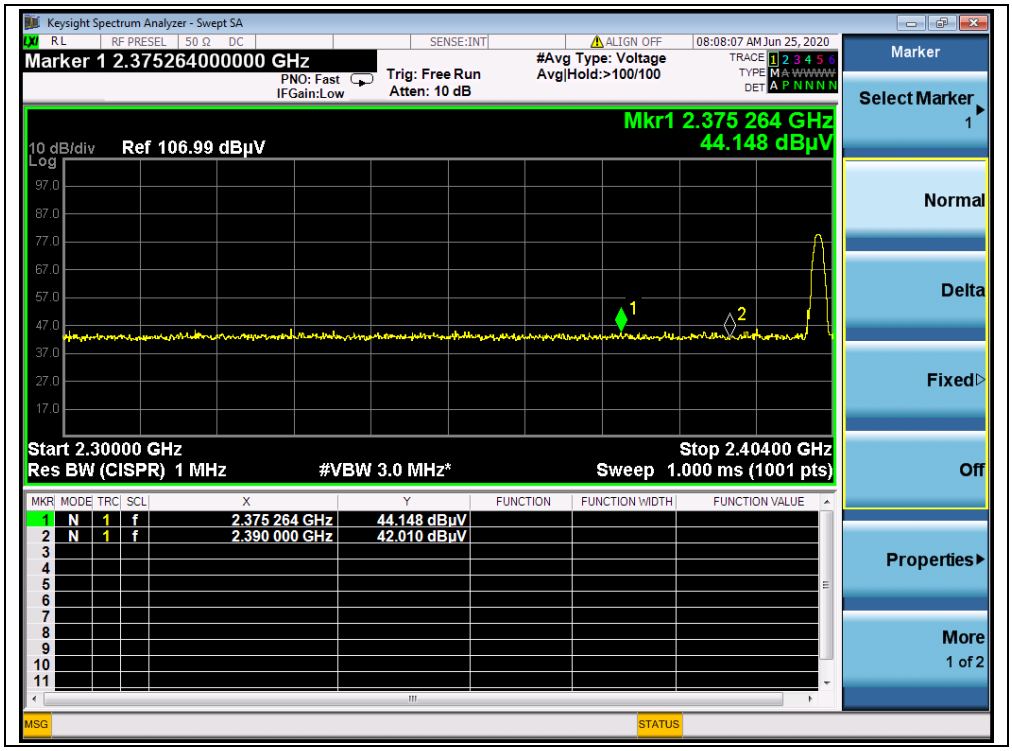
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2381.40	PK	46.94	-29.67	32.56	49.83	74	PASS
0	2375.26	AV	44.15	-29.67	32.56	47.04	54	PASS
78	2485.30	PK	46.52	-29.67	32.56	49.41	74	PASS
78	2486.27	AV	44.32	-29.67	32.56	47.21	54	PASS

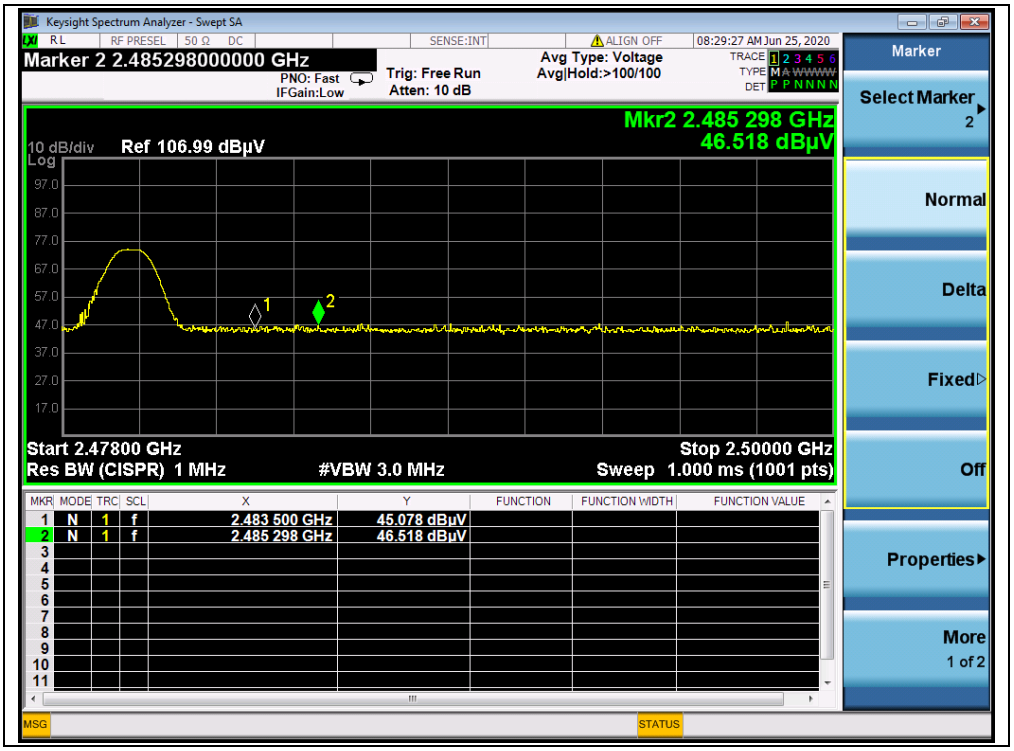
B. Test Plots:



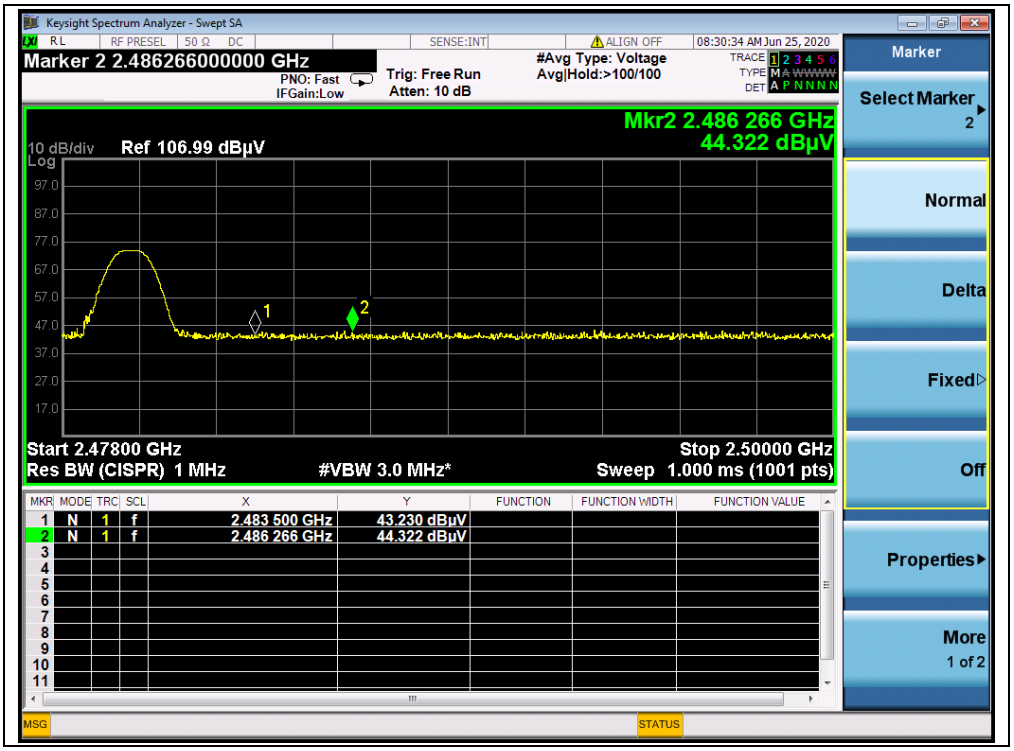
(PEAK, Channel = 0,π/4-DQPSK)



(AVERAGE, Channel = 0, π/4-DQPSK)



(PEAK, Channel = 78, π/4-DQPSK)



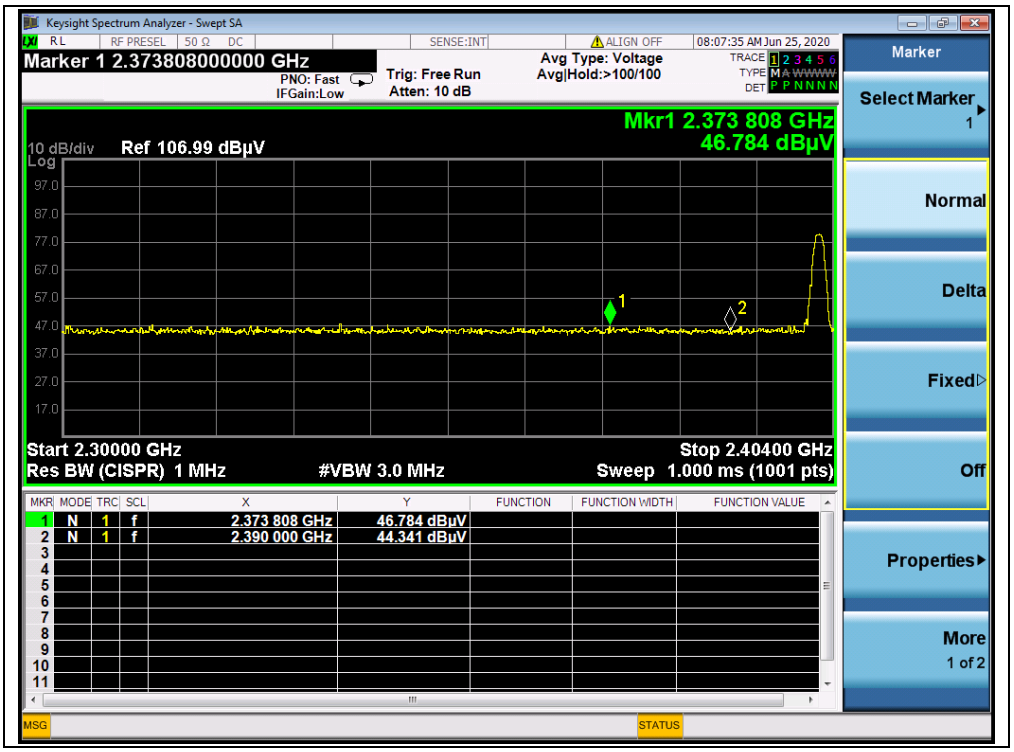
(AVERAGE, Channel = 78, π/4-DQPSK)

8-DPSK Mode

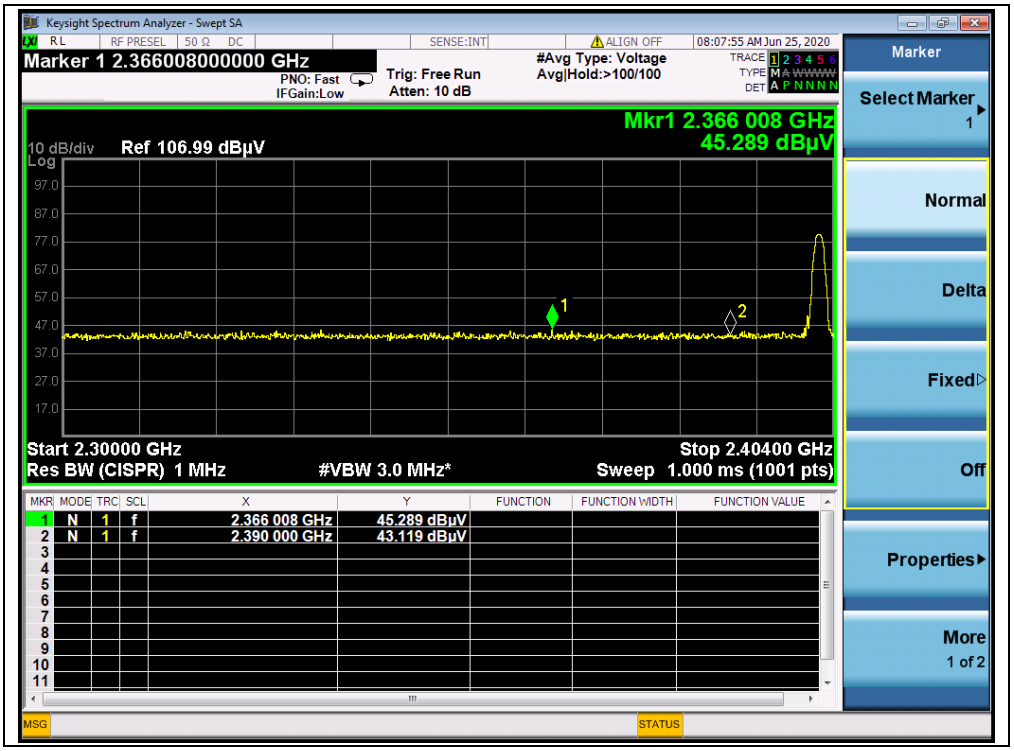
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2373.81	PK	46.78	-29.67	32.56	49.67	74	PASS
0	2366.01	AV	45.29	-29.67	32.56	48.18	54	PASS
78	2487.15	PK	46.93	-29.67	32.56	49.82	74	PASS
78	2484.51	AV	44.94	-29.67	32.56	47.83	54	PASS

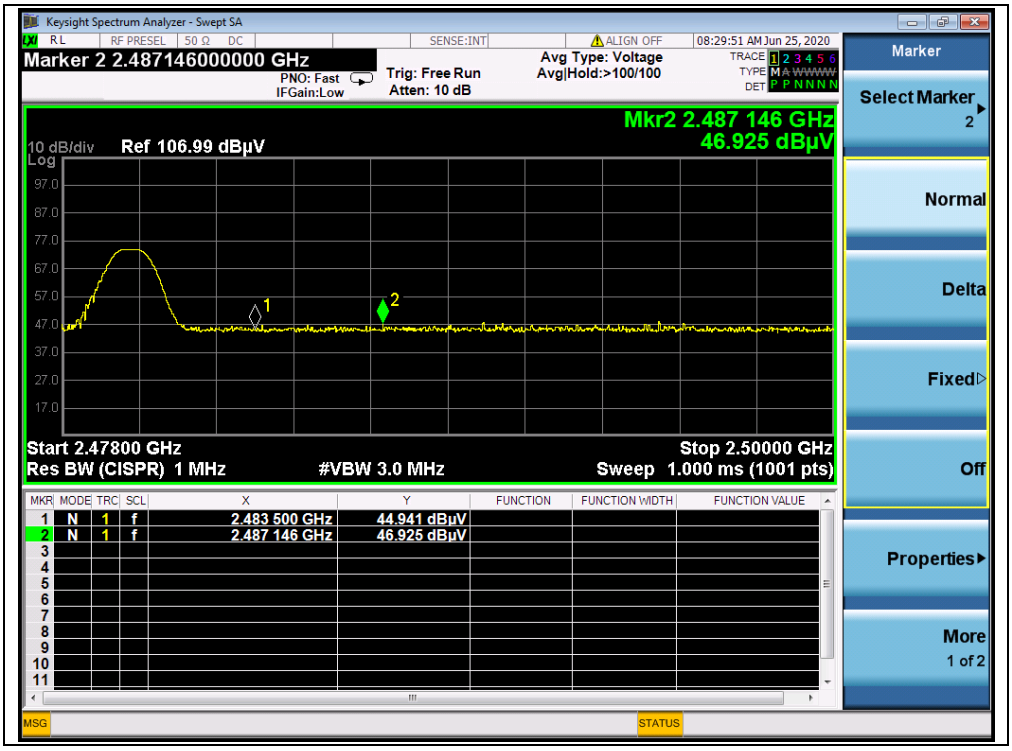
B. Test Plots:



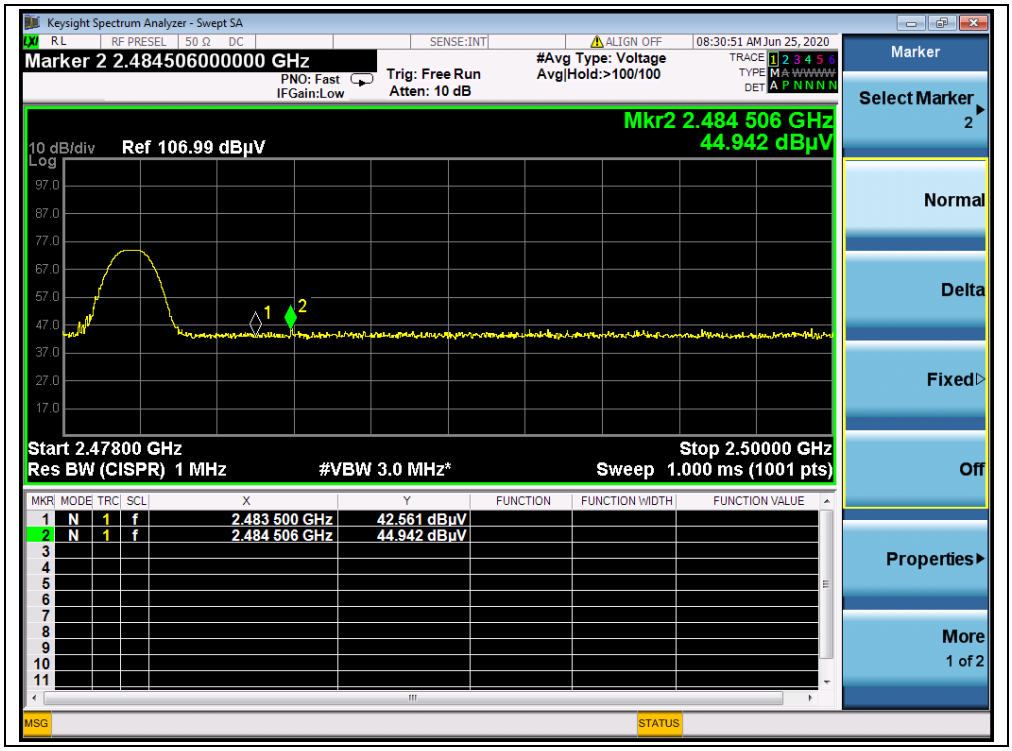
(PEAK, Channel = 0, 8-DPSK)



(AVERAGE, Channel = 0, 8-DPSK)



(PEAK, Channel = 78, 8-DPSK)



(AVERAGE, Channel = 78, 8-DPSK)

2.13. Radiated Emission

2.13.1. Requirement

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

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

Note:

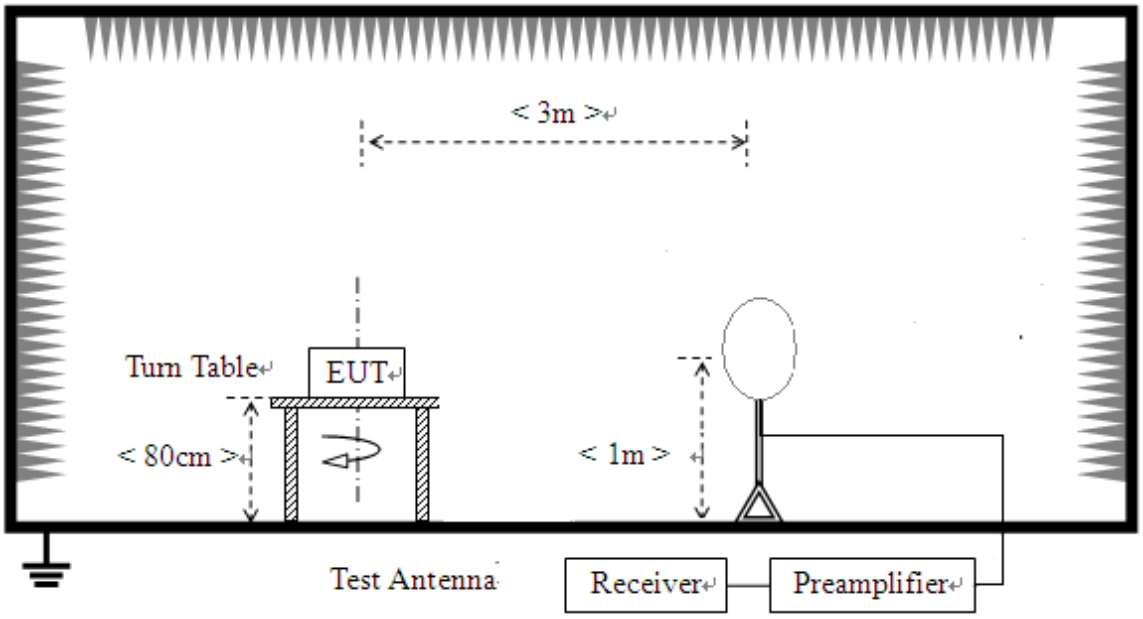
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength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

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

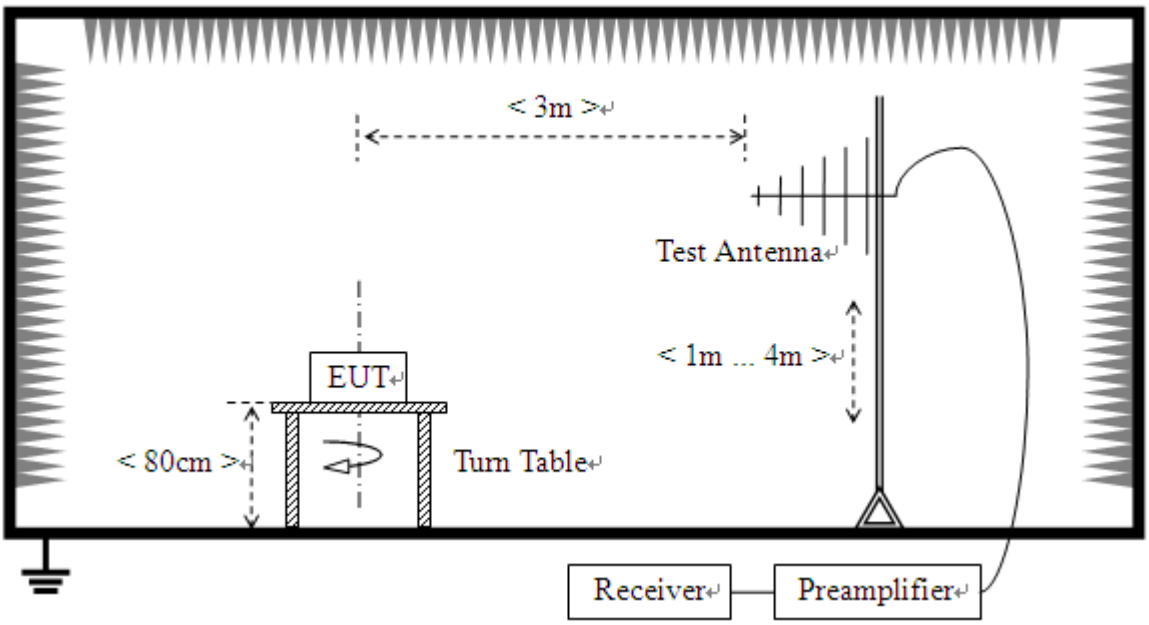
2.13.2. Test Description

Test Setup:

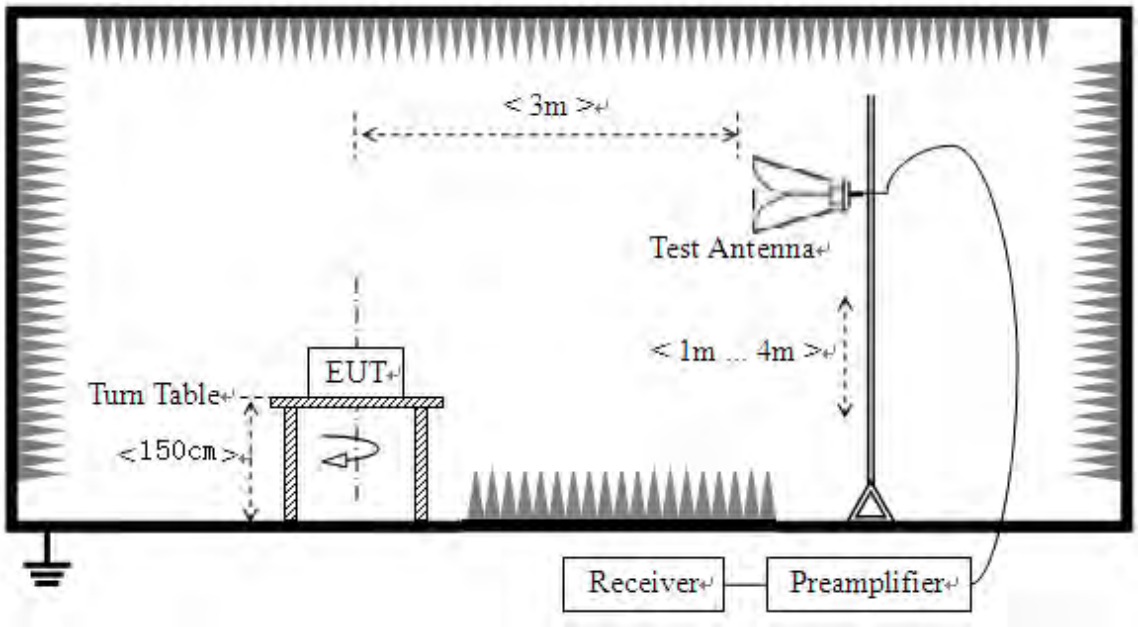
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



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

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

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

For the Test Antenna:

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

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

2.13.3. Test Procedure

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

2.13.4. Test Result

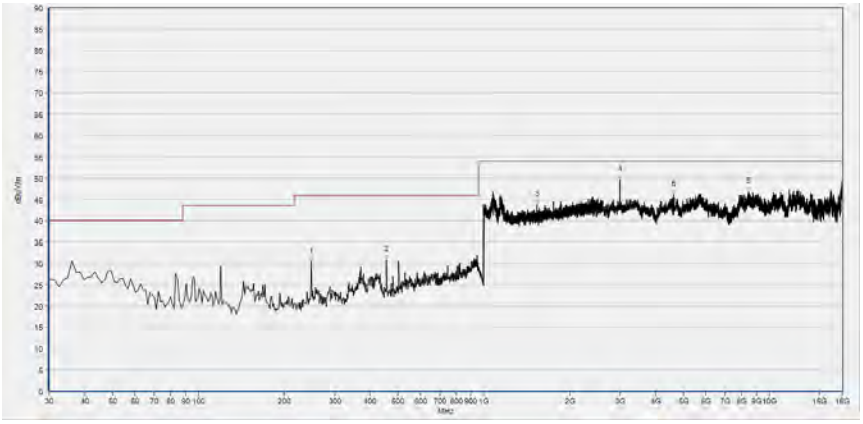
According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with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

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

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

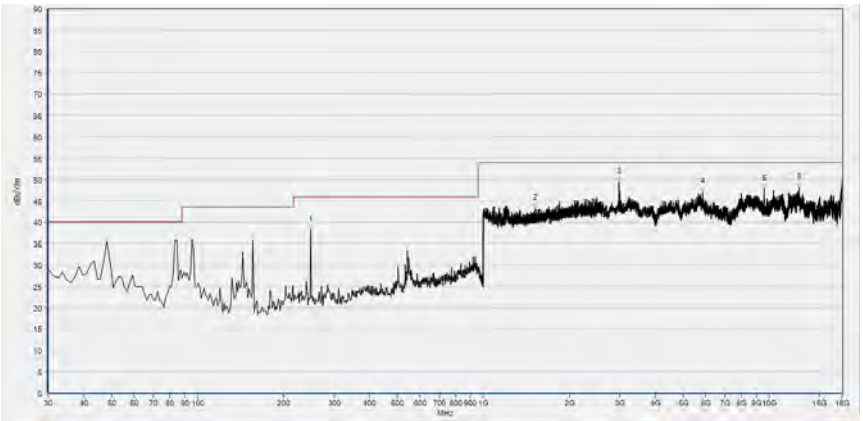
GFSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	30.39	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
456.120	30.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1532.693	43.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2997.672	49.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4621.968	46.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8450.264	46.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

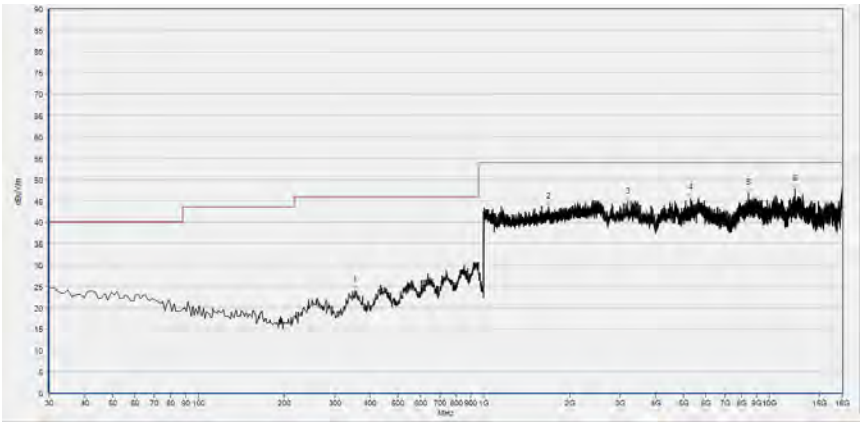
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	38.15	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1517.967	43.20	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2986.470	49.45	N/A	N/A	74.00	N/A	54.00	Vertica	PASS
5865.394	47.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9606.874	47.83	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12743.444	48.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

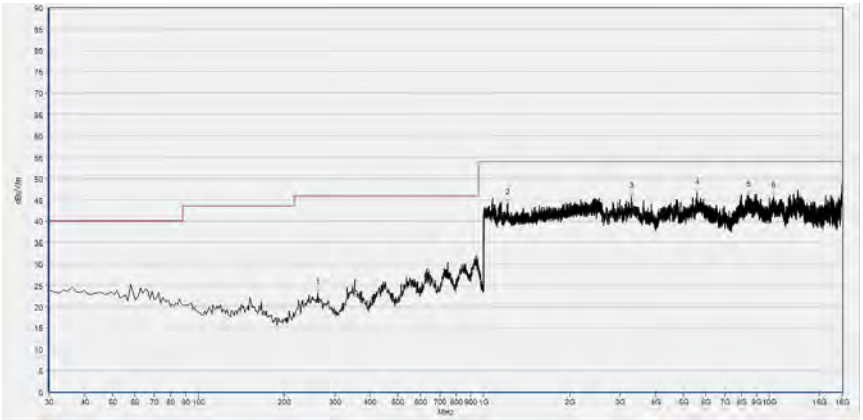
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
352.929	23.94	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1685.074	43.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3196.508	44.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5308.092	45.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8461.466	46.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12275.759	47.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

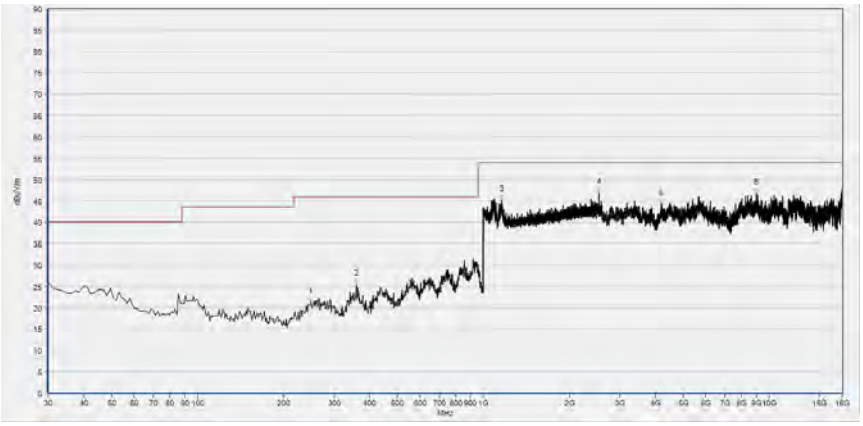
(30MHz to 18GHz, Antenna Horizontal, GFSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
261.877	23.06	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1211.285	44.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3283.324	45.82	N/A	N/A	74.00	N/A	54.00	Hori ontal	PASS
5585.343	46.58	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8447.463	46.16	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10368.612	45.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

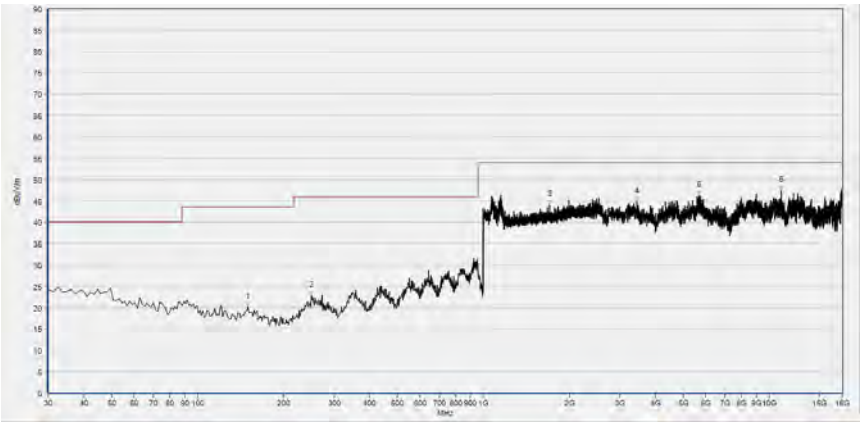
(30MHz to 18GHz, Antenna Vertical, GFSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	21.22	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
358.999	25.50	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1156.863	45.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2532.133	46.86	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4187.889	44.17	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9032.770	46.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

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

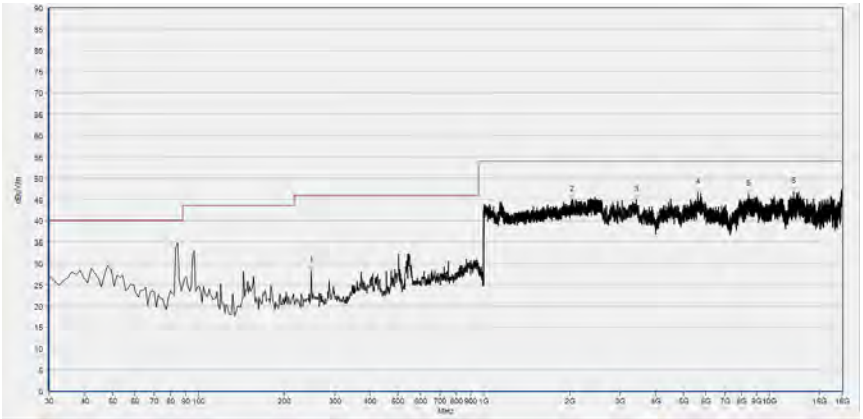


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
150.188	20.12	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	22.86	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1707.483	44.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3451.355	44.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5697.363	46.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
11004.328	47.51	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

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

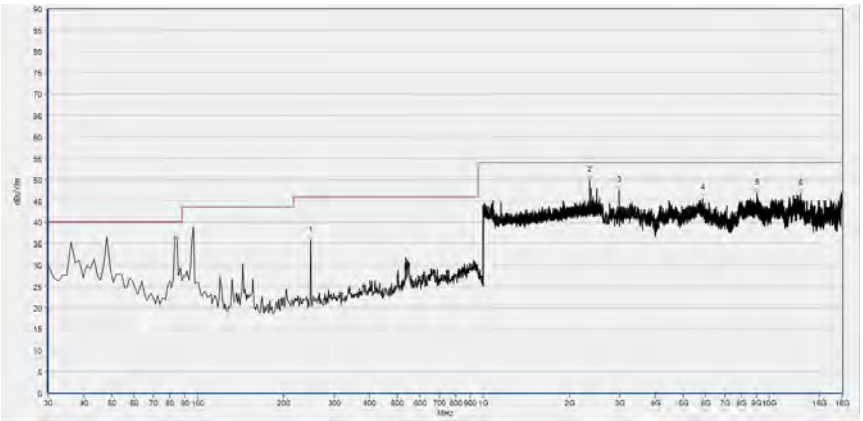
π/4-DQPSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	28.17	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2039.136	44.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3417.749	44.89	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5613.348	46.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8455.865	46.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12155.337	46.76	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

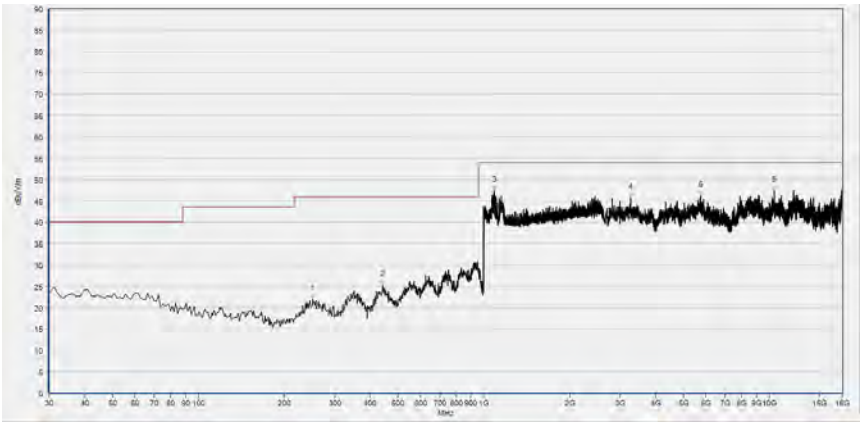
(30MHz to 18GHz, Antenna Horizontal, π/4-DQPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	35.68	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2350.300	49.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2989.271	47.48	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5862.593	45.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9063.575	46.70	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12922.677	46.61	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

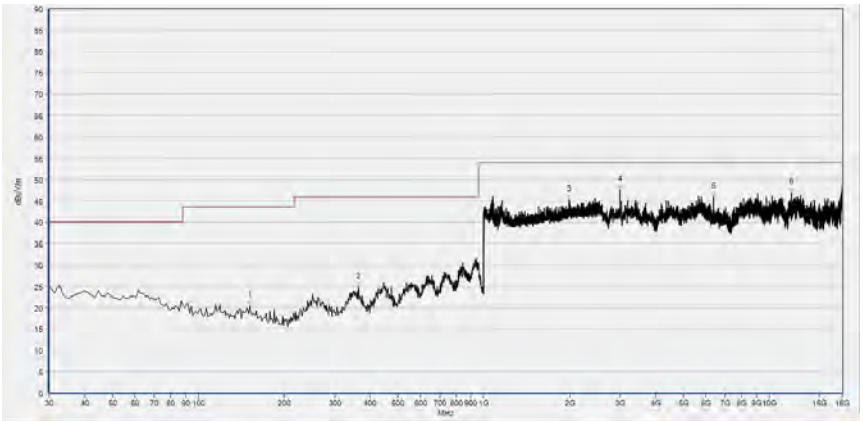
(30MHz to 18GHz, Antenna Vertical, π/4-DQPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
250.951	21.97	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
441.552	25.23	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1086.435	47.48	N A	N/A	74.00	N/A	54.00	Horizontal	PASS
3274.923	45.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5753.373	46.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10419.022	47.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

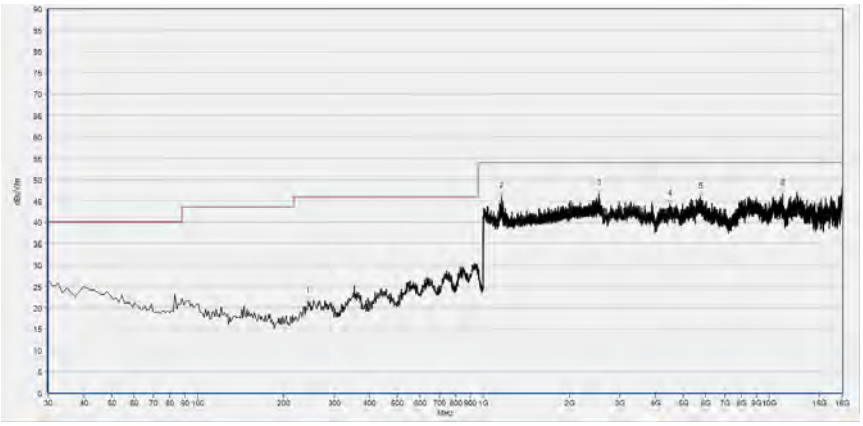
(30MHz to 18GHz, Antenna Horizontal, π/4-DQPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
151.402	20.45	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
363.855	24.86	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1993.677	45.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2994.872	47.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6394.690	46.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
11939.698	46.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

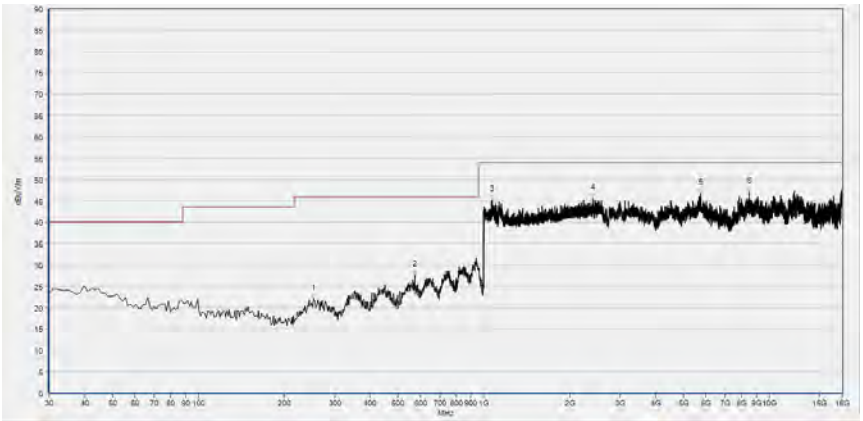
(30MHz to 18GHz, Antenna Vertical, π/4-DQPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
243.667	21.38	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1156.863	46.05	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2531.493	46.60	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4493.144	44.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5739.371	45.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11127.550	46.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

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

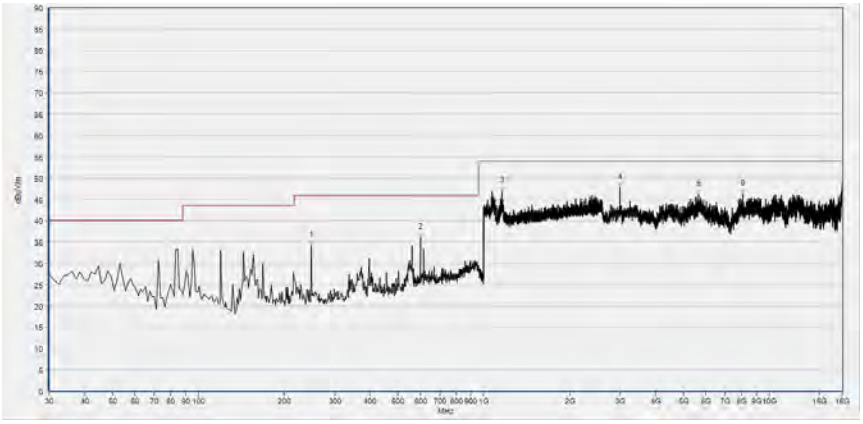


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
253.379	22.20	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
572.666	27.63	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1067.227	5.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2404.082	45.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5756.174	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8531.478	47.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

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

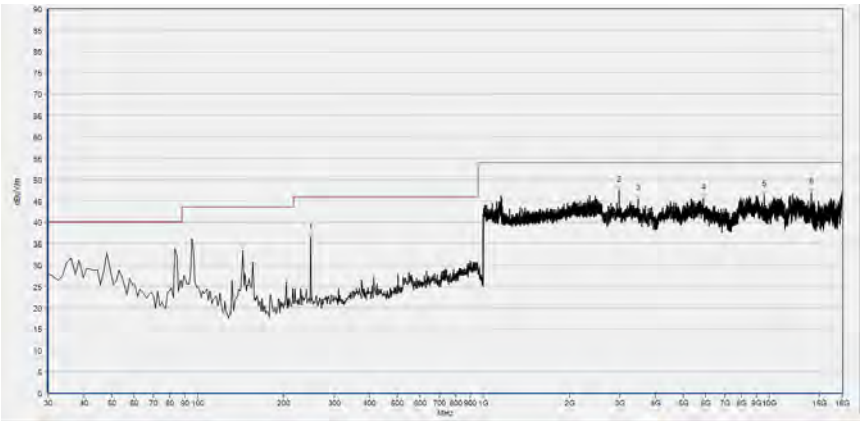
8-DPSK Mode

Plots for Channel = 0



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	34.21	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
599.374	36.09	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1158.784	46.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3000.473	47.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5649.755	46.01	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8069.394	46.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

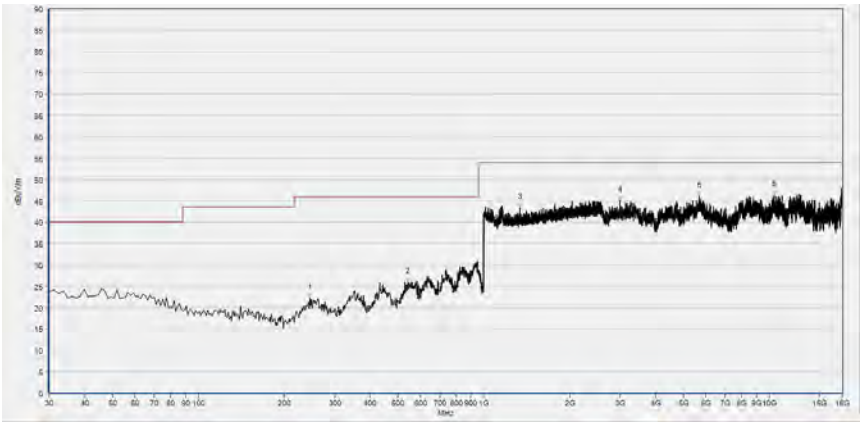
(30MHz to 18GHz, Antenna Horizontal, 8-DPSK, channel 0)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
248.523	36.41	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2989.271	47.35	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3473.759	45.49	N/A	N/A	74.00	N/A	54.00	Vertica	PASS
5876.596	45.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9606.874	46.44	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
14062.484	46.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

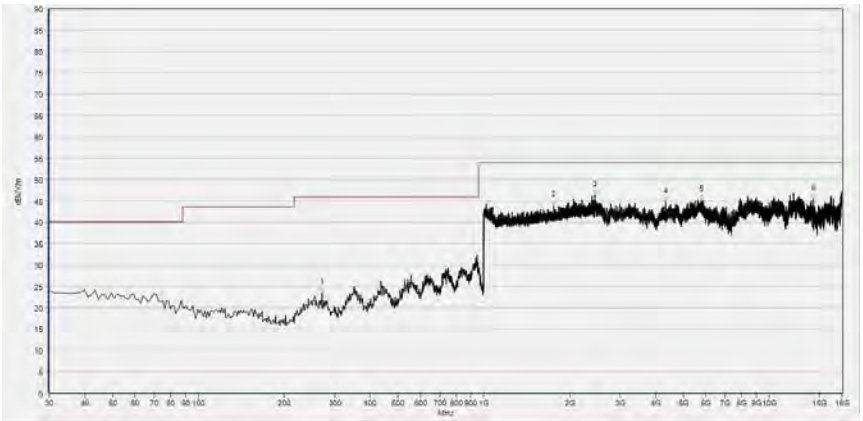
(30MHz to 18GHz, Antenna Vertical, 8-DPSK, channel 0)

Plot for Channel = 39



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
246.095	22.24	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
542.315	25.93	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1337.415	43.44	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3000.473	45.01	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5672.159	46.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10399.418	46.48	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

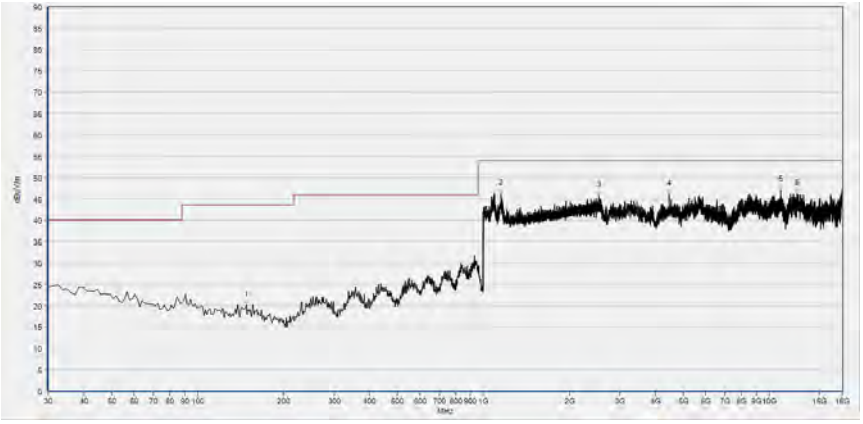
(30MHz to 18GHz, Antenna Horizontal, 8-DPSK, channel 39)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
271.589	23.51	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1759.344	43.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2446.339	46.41	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4330.715	44.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5770.176	45.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
14255.719	45.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

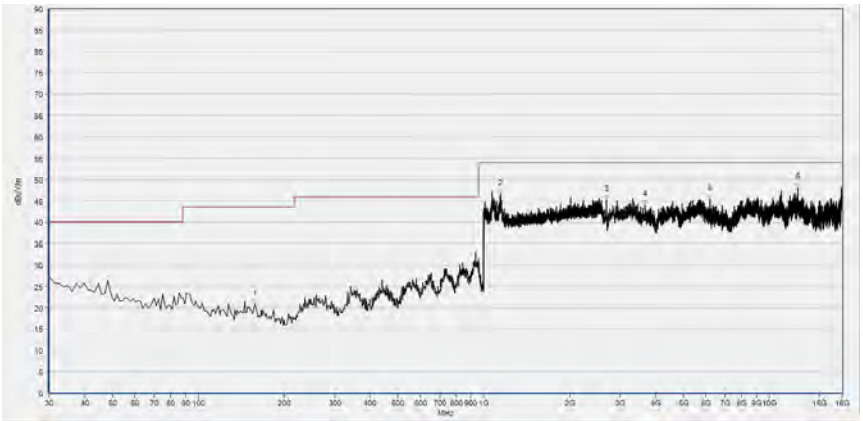
(30MHz to 18GHz, Antenna Vertical, 8-DPSK, channel 39)

Plot for Channel = 78



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
147.760	20.20	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1154.302	46.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2531.493	45.73	N/A	N/A	74.00	N/A	54.00	Hor zontal	PASS
4473.541	46.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10995.927	47.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12533.406	46.26	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

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



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
157.472	20.80	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1142.137	46.63	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2692.417	45.21	N/A	N/A	74.00	N/A	54.00	Vertica	PASS
3672.595	44.10	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6212.657	45.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12606.219	48.03	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

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

Annex A Test Uncertainty

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

Test items	Uncertainty
Number of Hopping Frequency	±5%
Peak Output Power	±2.22dB
20dB Bandwidth	±5%
Carrier Frequency Separation	±5%
Time of Occupancy (Dwell time)	±5%
Conducted Spurious Emission	±2.77dB
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	2020.04.01	2021.03.31
Directional coupler	17041703	DTO-5-30	ShangHai Huaxiang	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2020.04.01	2021.03.31
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2020.03.26	2021.03.25
LISN	8127449	NSLK 8127	Schwarzbeck	2020.03.26	2021.03.25
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2019.08.13	2020.08.12
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3 List of Software Used

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

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.29	2020.07.28
Test Antenna - Bi-Log	1267	VULB 9163	Schwarzbeck	2019.08.23	2022.08.22
Test Antenna - Loop	1519-022	FMZB 1519	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2022.07.25
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	S020180L3203	Tonscend	2019.07.29	2020.07.28
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2019.07.29	2020.07.28
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT