TEST REPORT

Applicant: **Address:**	**Dong Guan Qi You Zhi Neng Technology Co., Ltd.** **11F, Building 16B, Gold Town, No.7 Hetian Technology Avenue, Houjie Town, Dongguan City, Guangdong, P. R. China**		
Manufacturer: **Address:**	**Dong Guan Qi You Zhi Neng Technology Co., Ltd.** **11F, Building 16B, Gold Town, No.7 Hetian Technology Avenue, Houjie Town, Dongguan City, Guangdong, P. R. China**		
Factory: **Address:**	**Dong Guan Qi You Zhi Neng Technology Co., Ltd.** **11F, Building 16B, Gold Town, No.7 Hetian Technology Avenue, Houjie Town, Dongguan City, Guangdong, P. R. China**		
E.U.T.:	**Wireless Controller**		
Model Number:	**HS-PS4290, HS-PS4290W, HS-PS4290BK, HS-PS4290BU, HS-PS4290GD, HS-PS4290GY, HS-PS4290PK, HS-PS4290PU, HS-PS4290R**		
Trade mark:	**N/A**		
FCC ID:	**2BD8F-PS4290**		
Date of Receipt:	**Aug. 6, 2024**	**Date of Test:**	**Aug. 6 - 22, 2024**
Test Specification:	**FCC 47 CFR Part 15, Subpart C**		
Test Result:	**The equipment under test was found to be compliance with the requirements of the standards applied.**		

Prepared by:

Jerry Hu/ Engineer

Approved & Authorized Signer:

Frank Shen/ Manager

Issue Date: August 22, 2024

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Dongguan Lepont Service Co., Ltd.

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Revision History of This Test Report		
Report Number	Description	Issued Date
LP24080037C01-04	Initial Issue	2024-8-22

1. GENERAL PRODUCT INFORMATION

1.1. PRODUCT FUNCTION

Refer to Technical Construction Form and User Manual.

1.2. EUT TECHNICAL DESCRIPTION

Product Name:	Wireless Controller
Model No.:	HS-PS4290, HS-PS4290W, HS-PS4290BK, HS-PS4290BU, HS-PS4290GD, HS-PS4290GY, HS-PS4290PK, HS-PS4290PU, HS-PS4290R
Test Model No:	HS-PS4290
Difference:	All the models have the same circuit diagram and PCB layout, except for model name and colour.
Serial No.:	N/A
Test sample(s) ID:	LP24080037C01-S001
Sample(s) Status	Engineer sample
Hardware:	V 1.0
Software:	V 1.0
Operation Frequency:	2402MHz-2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	PCB Antenna
Antenna gain:	2.05dBi
Power supply:	☒ DC 5V form USB ☒ DC 3.7V form battery

1.3. INDEPENDENT OPERATION MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.
Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for GFSK modulation; 2Mbps for pi/4-DQPSK modulation; 3Mbps for 8DPSK modulation) were used for all test.
Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	…	…
1	2403	40	2442	76	2478
2	2404	41	2443	77	2479
…	…	…	…	78	2480
Note: fc=2402MHz+(k-1)×1MHz k=1 to 79					

Test Frequency and channel

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	78	2480

1.4. TEST SOFTWARE

Software		Description
BT_Tool.exe		Set the COM Port Test Tool to set the corresponding Test conditions

1.5. GENERAL CONDITION

	Temperature	Humidity
Ambient Condition:	24.1℃	53.6 %RH

1.6. SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Laptop computer	Lenovo	Xiaoxin Pro IA5HR	PF490VB0

Notes:

1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

2. TEST STANDARDS AND SITES

2.1. DESCRIPTION OF STANDARDS AND RESULTS

The EUT have been tested according to the applicable standards as referenced below.

FCC Part Clause	Test Parameter	Verdict	Remark
15.247(a)(1)	20 dB Bandwidth	PASS	
15.247(a)(1)	Carrier Frequency Separation	PASS	
15.247(a)(1)	Number of Hopping Frequencies	PASS	
15.247(a)(1)	Average Time of Occupancy (Dwell Time)	PASS	
15.247(b)(1)	Maximum Peak Conducted Output Power	PASS	
15.247(d)	Conducted Spurious Emissions	PASS	
15.247(d) 15.209	Radiated Spurious Emissions	PASS	
15.207	Conducted Emission	PASS	
15.203	Antenna Application	PASS	
15.247 (a) (1)/g/h	Frequency Hopping System	PASS	

NOTE1: N/A (Not Applicable)
NOTE2: According to FCC KDB 558074 D01 15.247 Meas Guidance v05r02, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.

2.2. LIST OF TEST AND MEASUREMENT INSTRUMENTS

For conducted emission at the mains terminals test(Shielded Room 1)							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESHS30	8290501003	Jan. 24, 2024	1 Year	LEP-E002	☑
Artificial Mains Network	Baluelec	LSN016	BL041122050121	Nov. 15, 2023	1 Year	LEP-E067	☑
Shielded Room 1	MR	MR-L05	LEP-E053	Nov. 17, 2022	3 Year	LEP-E053	☑
Test software	EZ-EMC	Fala	LEPONT-03A2	N/A	N/A	N/A	☑
For radiated(9K-30M) emission test(966 Chamber 1)							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESR 3	101849	Jan. 31, 2024	1 Year	LEP-E006	☑
Active Loop Antenna	Schwarzbeck	FMZB 1519C	00008	Jan. 24, 2024	3 Year	LEP-E068	☑
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	☑
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	☑
For radiated(30M-1G) emission test(966 Chamber 1)							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESR 3	101849	Jan. 31, 2024	1 Year	LEP-E006	☑
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	743	Nov. 20, 2022	3 Year	LEP-E005	☑
Signal Amplifier	HP	8447D	1726A01222	Jan. 24, 2024	1 Year	LEP-E007	☑
6dB Attenuator	RswTech	5W 6dB	LEP-E084	Jan. 24, 2024	1 Year	LEP-E084	☑
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	☑
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	☑
For radiated(1-18G) emission test(966 Chamber 1)							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	☑
Spectrum analyzer	Agilent	N9020A	MY49100060	Jan. 24, 2024	1 Year	LEP-E020	☑
Horn antenna	Schwarzbeck	BBHA 9120D	01875	Nov. 20, 2022	3 Year	LEP-E024	☑
Preamplifier	Schwarzbeck	BBN 9718B	00010	Jan. 24, 2024	1 Year	LEP-E025	☑
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	☑
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	☑
For radiated(18-40G) emission test(966 Chamber 1)							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	☑
Horn antenna+Preamplifier	COM-POWER	AH840	10100020	Sep. 05, 2022	3 Year	LEP-E075	☑
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	☑
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	☑
For RF test							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	☑
Spectrum analyzer	Agilent	N9020A	MY49100060	Jan. 24, 2024	1 Year	LEP-E020	☑
Vector source	Agilent	N5182A	MY47420382	Jan. 24, 2024	1 Year	LEP-E021	☑
Analog signal source	Agilent	N5171B	MY51350292	Jan. 24, 2024	1 Year	LEP-E022	☑
All instrument	Rohde & Schwarz	CMW 500	1201.002K50	Jan. 24, 2024	1 Year	LEP-E019	☑
High and low temperature chamber	Math-mart	MT-1202-40	LEP-E041	Jan. 24, 2024	1 Year	LEP-E041	☑
control unit	Tonscend	JS0806-2	10165	Jan. 24, 2024	1 Year	LEP-E034	☑
Testing software	Tonscend	JSTS1120-3	Ver 2.6.77.0518	N/A	N/A	N/A	☑

2.3. MEASUREMENT UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0%
Conducted Emissions Test	±3.08dB
Radiated Emission Test	±4.60dB
Power Density	±0.9%
Occupied Bandwidth Test	±2.3%
Band Edge Test	±1.2%
Antenna Port Emission	±3dB
Temperature	±3.2%
Humidity	±2.5%
Measurement Uncertainty for a level of Confidence of 95%	

2.4. TEST FACILITY

EMC Lab. : The Laboratory has been assessed and proved to be in compliance with CNAS/CL01
The Certificate Registration Number is L10100.
The Laboratory has been assessed and proved to be in compliance with A2LA
The Certificate Registration Number is 6901.01

FCC Designation No.: CN1351
Test Firm Registration No.: 397428

ISED CAB identifier: CN0151
Test Firm Registration No.: 20133

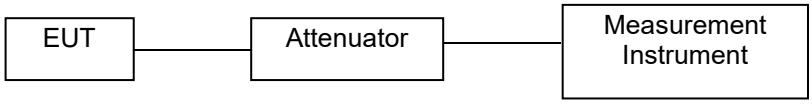
Test Location : Dongguan Lepont Testing Service Co., Ltd.

Address : Room 102, Building 11, No.7, Houjie Science And Technology Avenue, Houjie, Dongguan, Guangdong, China

3. SETUP OF EQUIPMENT UNDER TEST

3.1. RADIO FREQUENCY TEST SETUP 1

The component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



3.2. RADIO FREQUENCY TEST SETUP 2

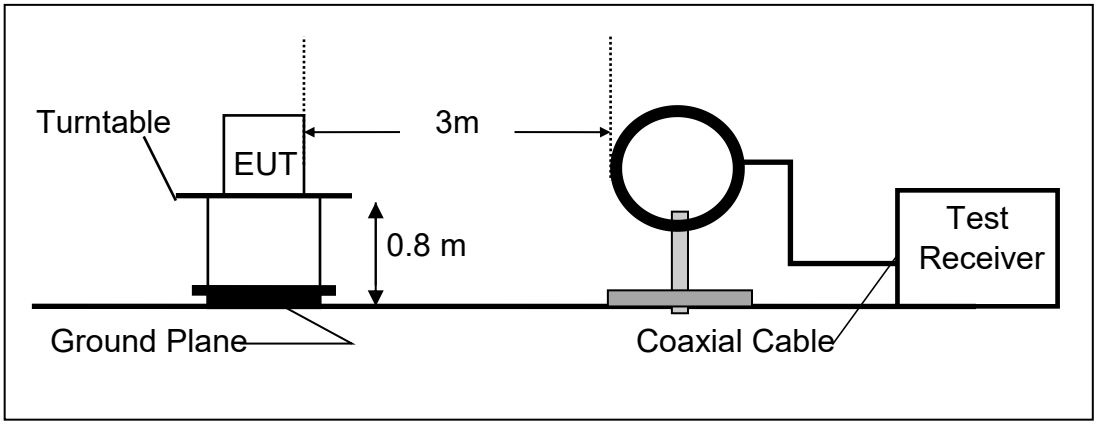
The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 32.

Below 30MHz：
The EUT is placed on a turntable 0.8meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

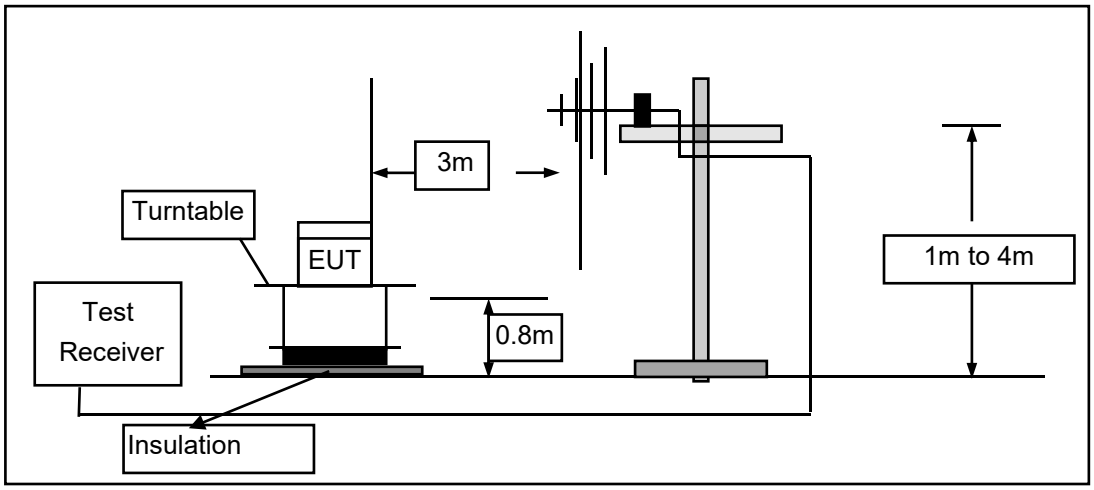
Above 30MHz：
The EUT is placed on a turntable 0.8meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)
The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

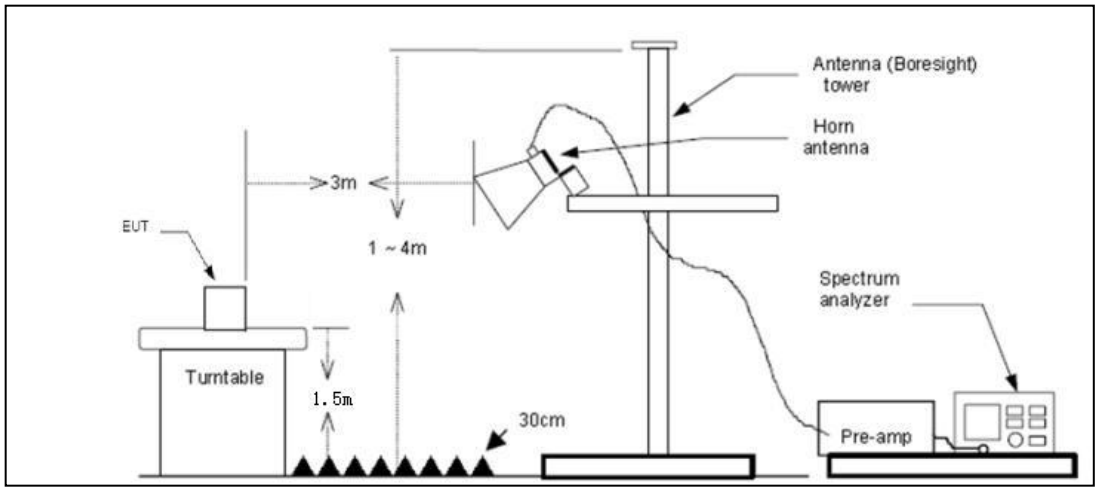
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz

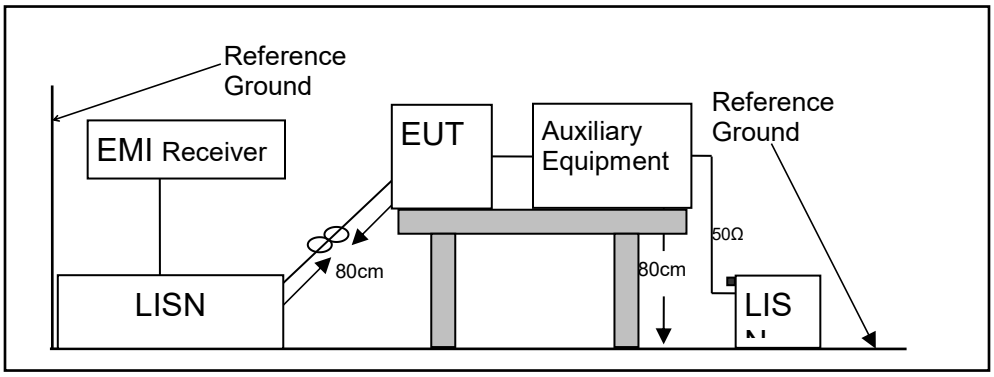


(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

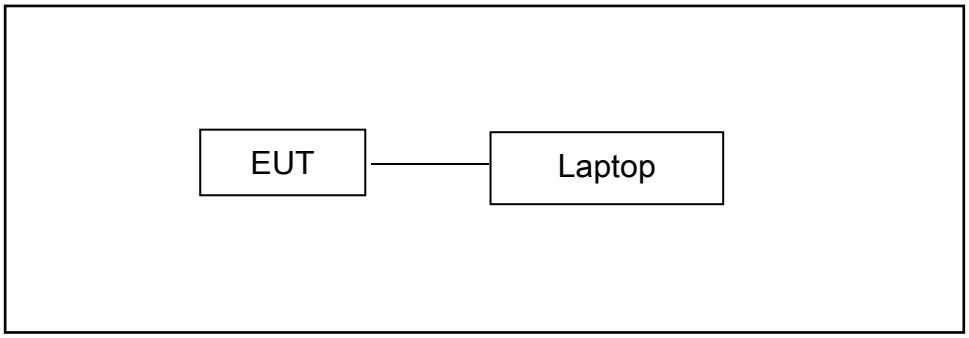


3.3. CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (Perfect Share Mini) must be connected to LISN. The LISN shall be placed 0.8m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.
Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.8m.
According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



3.4. BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



4. TEST RESULTS AND MEASUREMENT DATA

4.1. 20DB BANDWIDTH

4.1.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.1.2. Conformance Limit

No limit requirement.

4.1.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.1.4. Test Procedure

The EUT was operating in Bluetooth mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously
Set RBW = 30 kHz.
Set the video bandwidth (VBW) =100 kHz.
Set Span= approximately 2 to 3 times the 20 dB bandwidth
Set Detector = Peak.
Set Trace mode = max hold.
Set Sweep = auto couple.
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.
If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.
Measure and record the results in the test report.

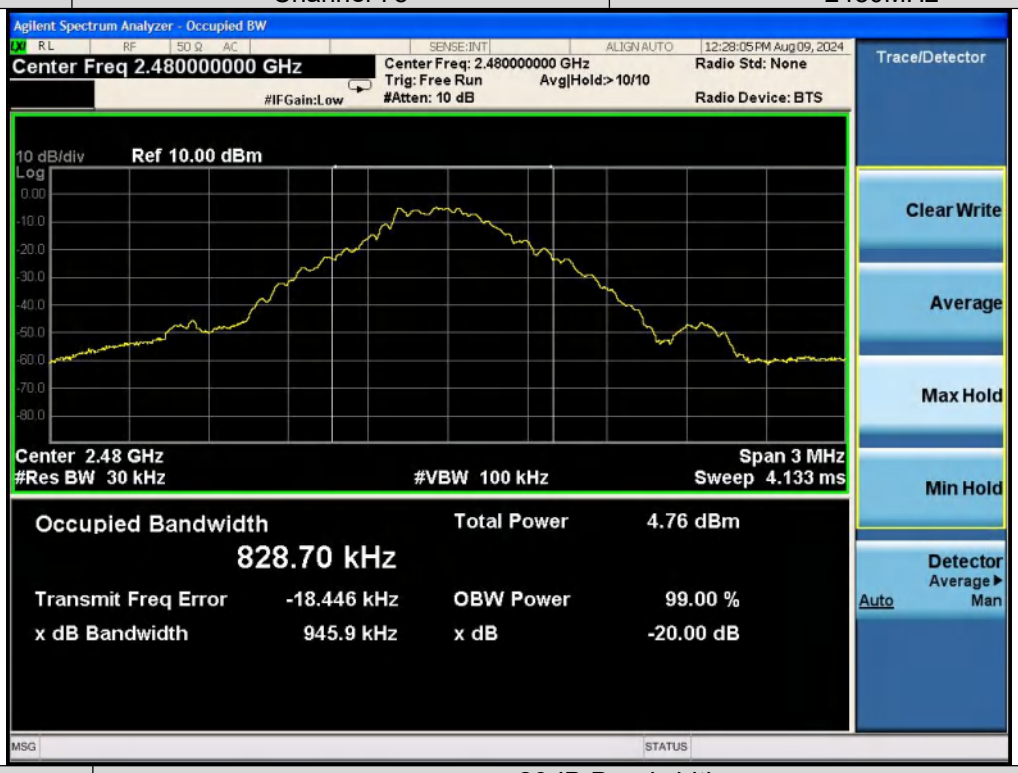
Test Results:

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth(MHz)	Limit (MHz)
GFSK	0	2402	0.9463	N/A
	39	2441	0.9468	N/A
	78	2480	0.9459	N/A
π/4-DQPSK	0	2402	1.319	N/A
	39	2441	1.318	N/A
	78	2480	1.319	N/A
8DPSK	0	2402	1.303	N/A
	39	2441	1.304	N/A
	78	2480	1.306	N/A
Note: N/A (Not Applicable)				

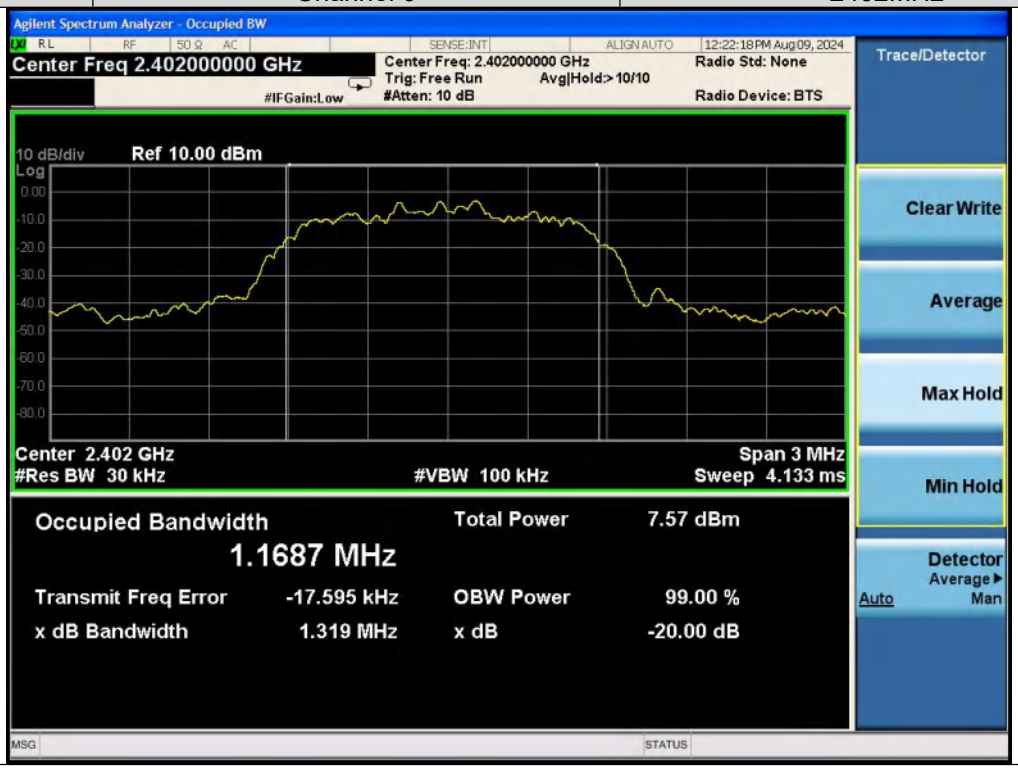
Test Model	20dB Bandwidth	
	GFSK	
	Channel 0	2402MHz

Test Model	20dB Bandwidth	
	GFSK	
	Channel 39	2441MHz

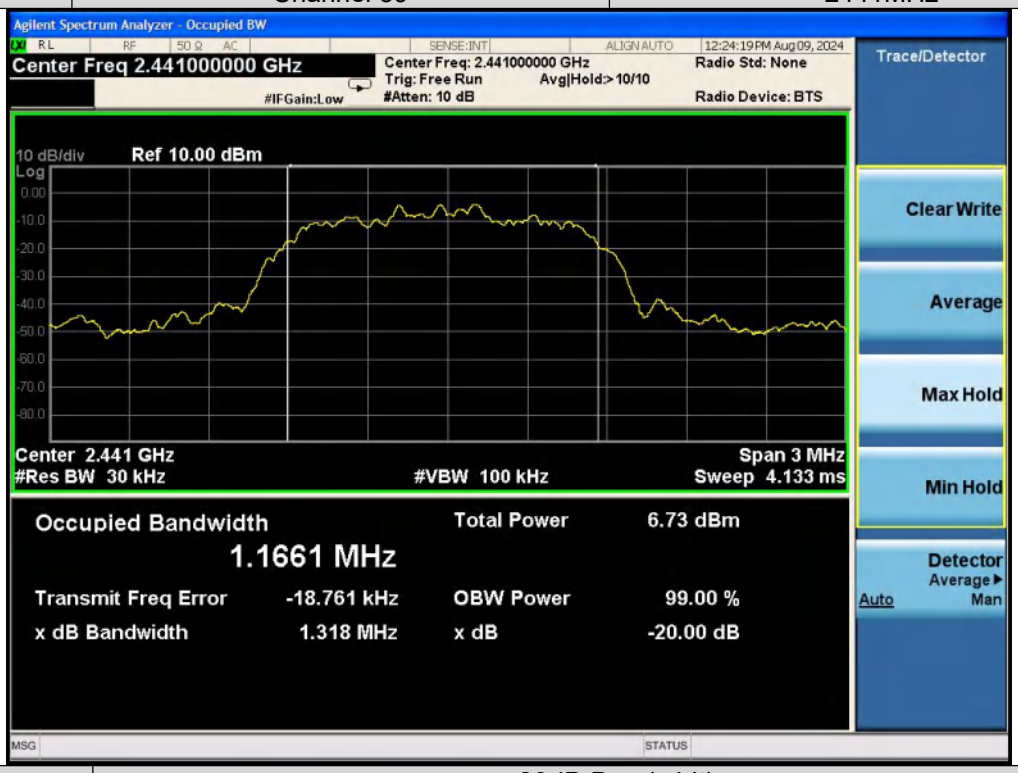
Test Model	20dB Bandwidth	
	GFSK	
	Channel 78	2480MHz



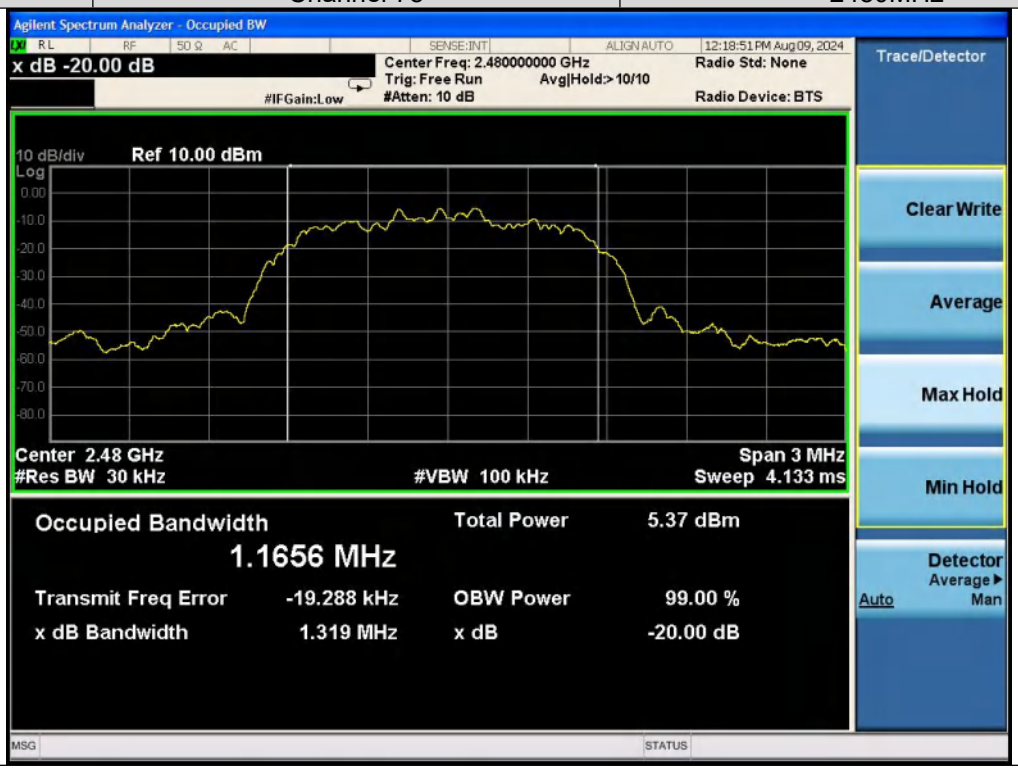
Test Model	20dB Bandwidth	
	π/4-DQPSK	
	Channel 0	2402MHz



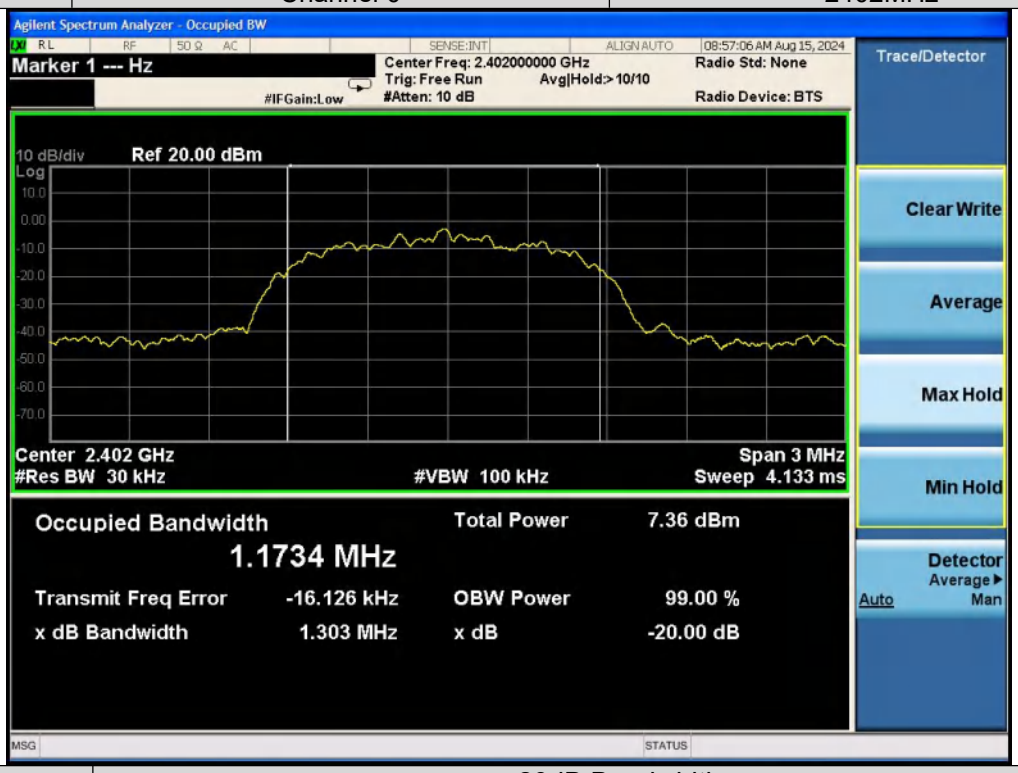
Test Model	20dB Bandwidth	
	π/4-DQPSK	
	Channel 39	2441MHz



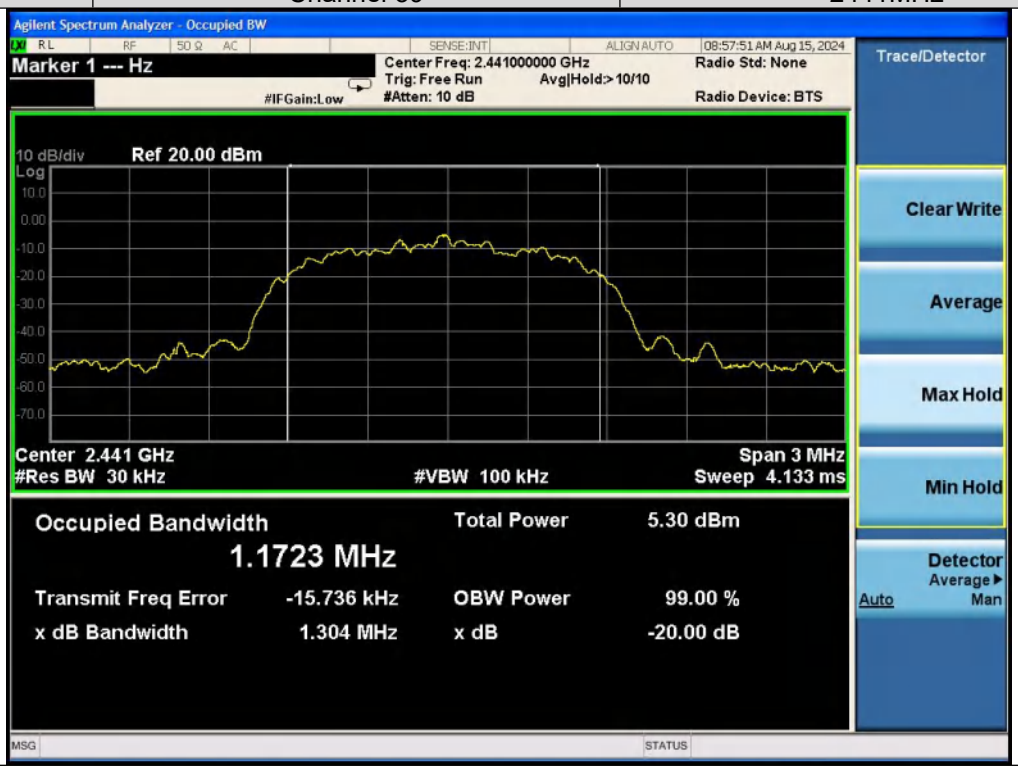
Test Model	20dB Bandwidth	
	π/4-DQPSK	
	Channel 78	2480MHz



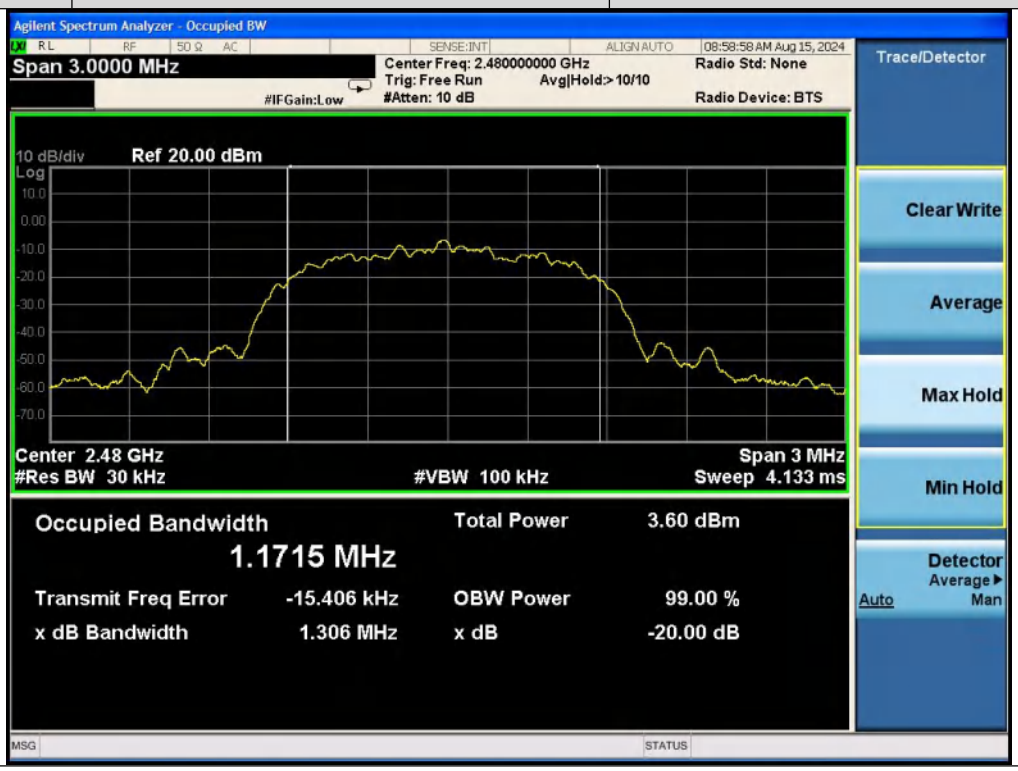
Test Model	20dB Bandwidth	
	8DPSK	
	Channel 0	2402MHz



Test Model	20dB Bandwidth	
	8DPSK	
	Channel 39	2441MHz



Test Model	20dB Bandwidth	
	8DPSK	
	Channel 78	2480MHz



4.2. CARRIER FREQUENCY SEPARATION

4.2.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.2.2. Conformance Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400 – 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

4.2.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.2.4. Test Procedure

■ According to FCC Part15.247(a)(1)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Set the RBW =30kHz.
Set VBW =100kHz.
Set the span = wide enough to capture the peaks of two adjacent channels
Set Sweep time = auto couple.
Set Detector = peak. Set Trace mode = max hold.
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test Results：

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth(kHz)	Limit(kHz)	Verdict
GFSK	0	2402	1032	>946	PASS
	39	2441	1158	>947	PASS
	78	2480	1002	>946	PASS
π/4-DQPSK	0	2402	1047	>879	PASS
	39	2441	984	>879	PASS
	78	2480	1227	>879	PASS
8DPSK	0	2402	1047	>869	PASS
	39	2441	984	>869	PASS
	78	2480	1227	>871	PASS
Note: Limit = GFSK: 20dB bandwidth π/4-DQPSK & 8DSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)					

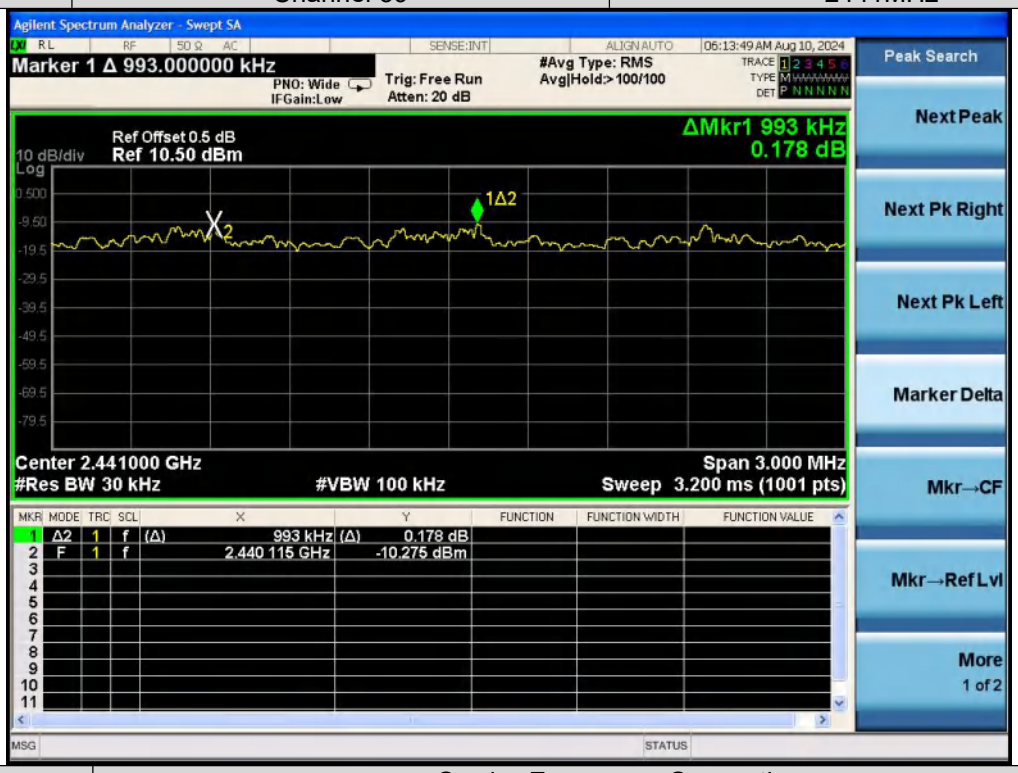
Test Model	Carrier Frequency Separation	
	GFSK	
	Channel 0	2402MHz

Test Model	Carrier Frequency Separation	
	GFSK	
	Channel 39	2441MHz

Test Model	Carrier Frequency Separation	
	GFSK	
	Channel:78	2480MHz

Test Model	Carrier Frequency Separation	
	π/4-DQPSK	
	Channel: 0	2402MHz

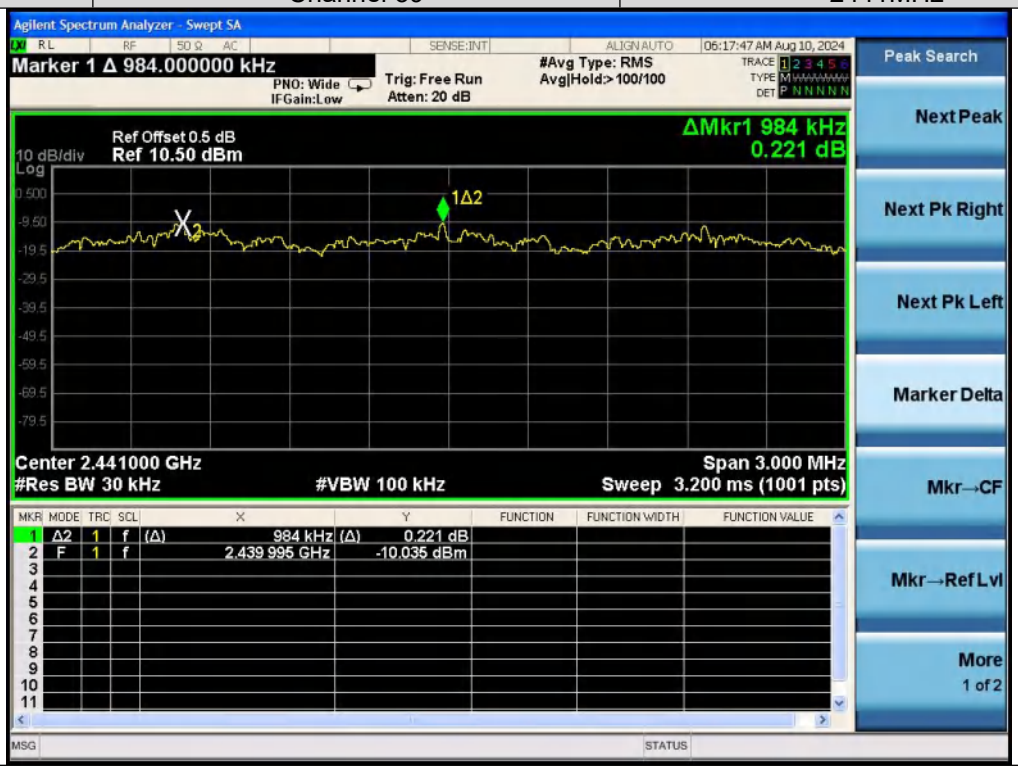
Test Model	Carrier Frequency Separation	
	π/4-DQPSK	
	Channel 39	2441MHz



Test Model	Carrier Frequency Separation	
	π/4-DQPSK	
	Channel 78	2480MHz

Test Model	Carrier Frequency Separation	
	8DPSK	
	Channel 0	2402MHz

Test Model	Carrier Frequency Separation	
	8DPSK	
	Channel 39	2441MHz



Test Model	Carrier Frequency Separation	
	8DPSK	
	Channel 78	2480MHz

4.3. NUMBER OF HOPPING FREQUENCIES

4.3.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.3.2. Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 channels.

4.3.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.3.4. Test Procedure

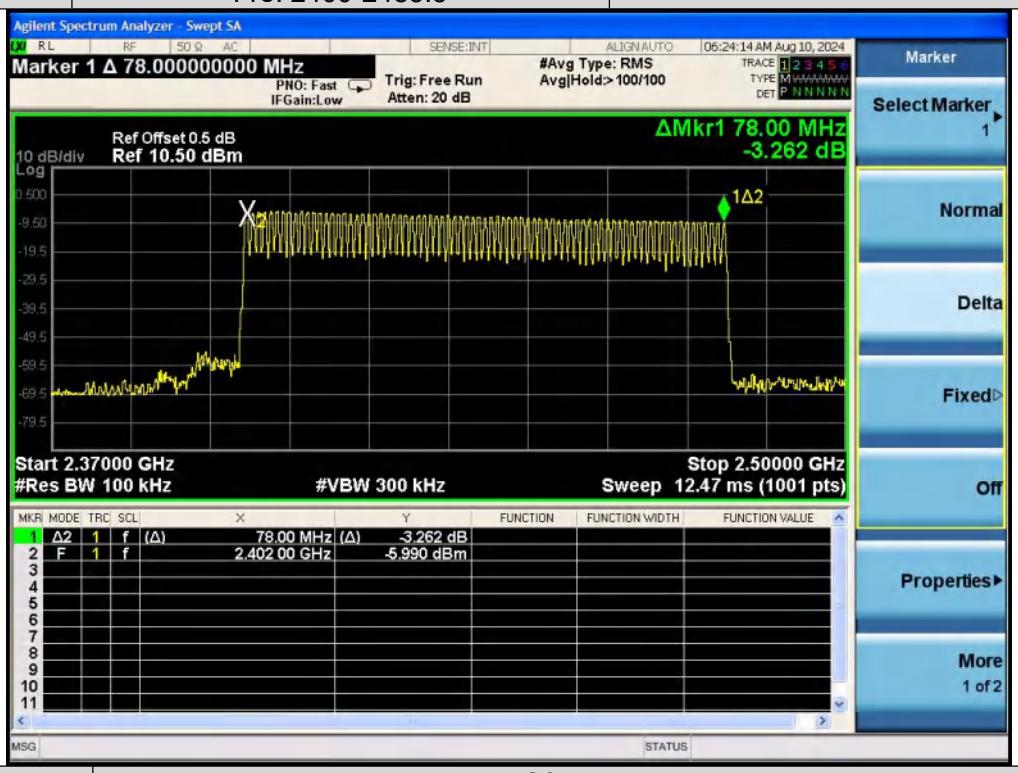
■ According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation (2400-2483.5MHz)
RBW ≥ 100KHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

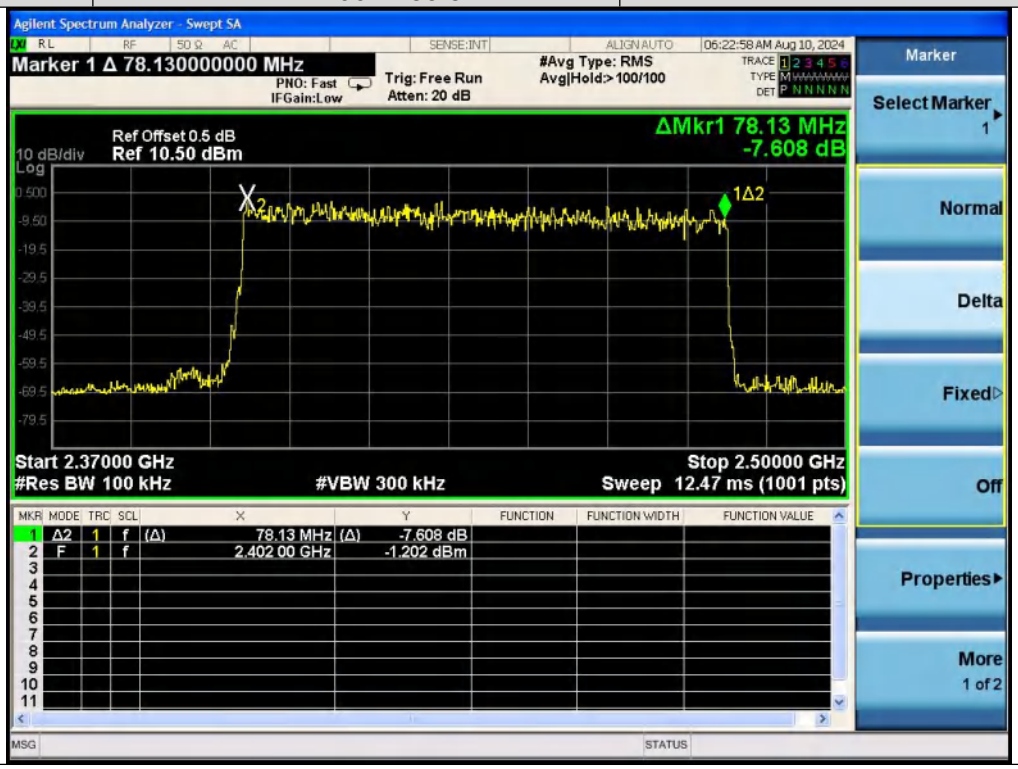
Test Results：

Modulation Mode	Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel limit
GFSK	2402-2480	79	＞15
π/4-DQPSK	2402-2480	79	＞15
8DPSK	2402-2480	79	＞15

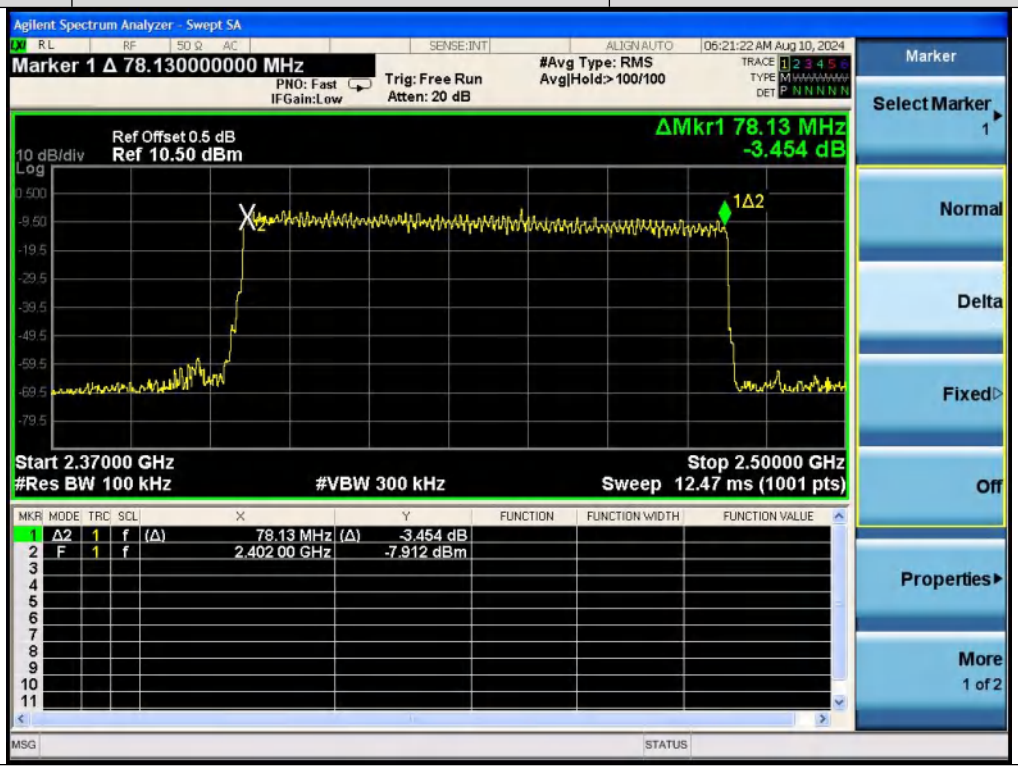
Test Model	Number Of Hopping Frequencies
	GFSK
	Fre: 2400-2483.5



Test Model	Number Of Hopping Frequencies
	π/4-DQPSK
	Fre: 2400-2483.5



Test Model	Number Of Hopping Frequencies	
	8DPSK	
	Fre: 2400-2483.5	



4.4. AVERAGE TIME OF OCCUPANCY (DWELL TIME)

4.4.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.4.2. Conformance Limit

For frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

4.4.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.4.4. Test Procedure

■ According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = zero span, centered on a hopping channel
RBW = 1 MHz
VBW ≥ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold
If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section.

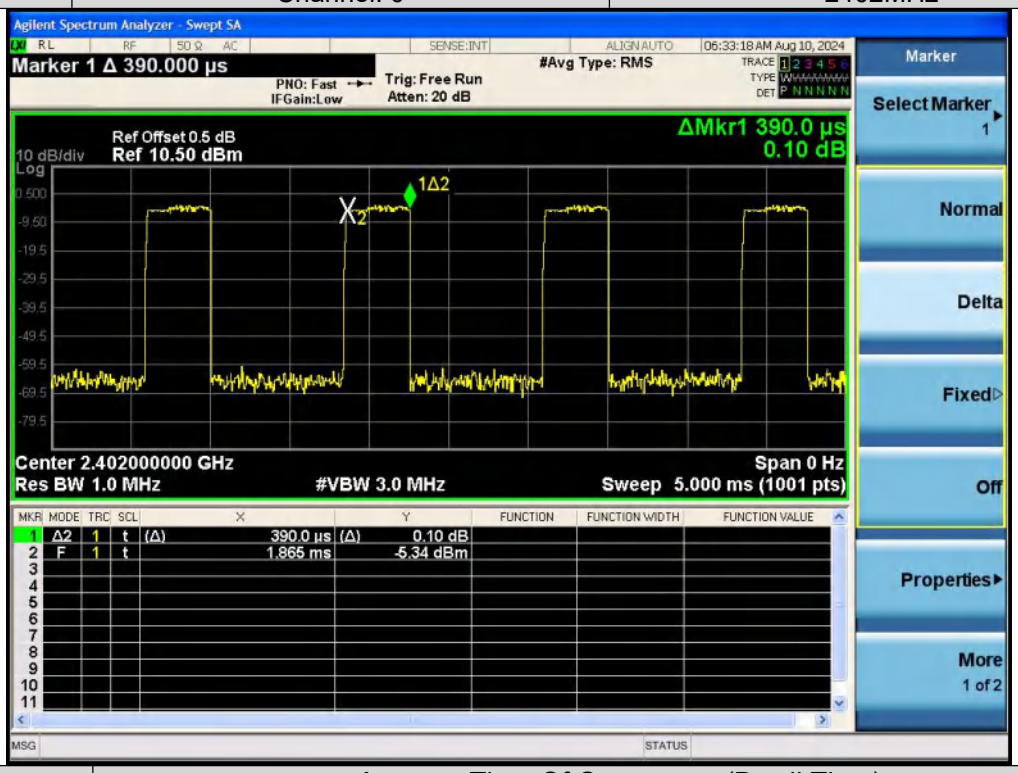
Test Results：

Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result was report as below:

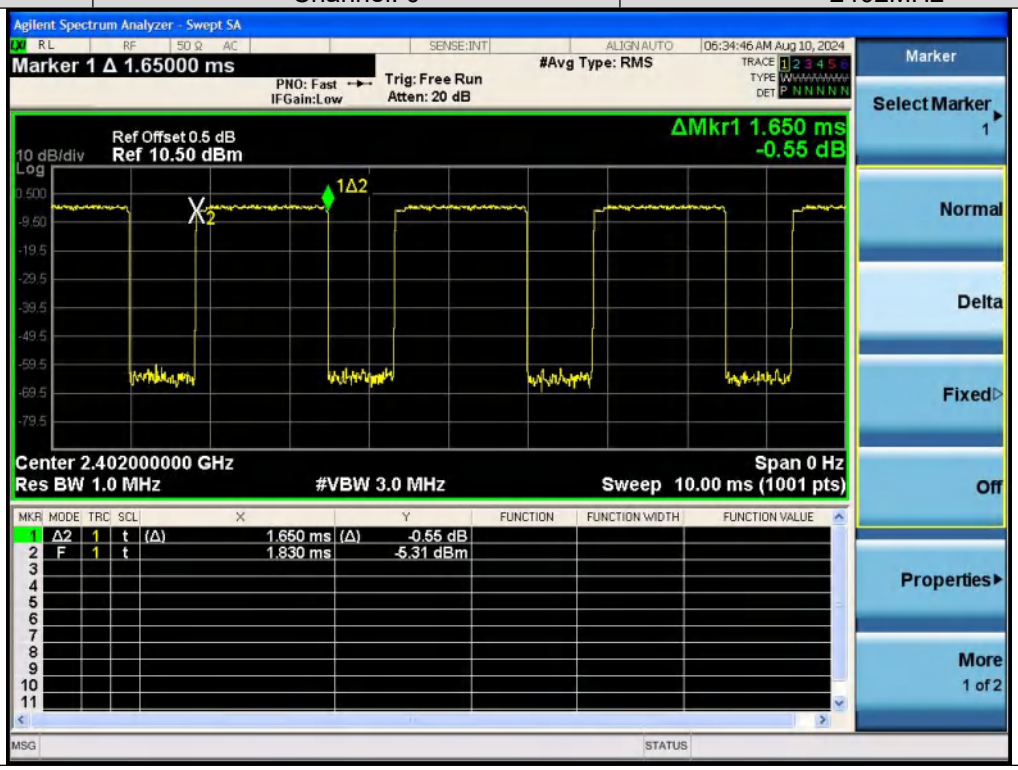
Modulation Mode	Channel Number	Packet type	Pluse width (ms)	Dwell Time (ms)	Limit (ms)	Verdict
8DPSK	0	3DH1	0.390	124.8	<400	PASS
	0	3DH3	1.650	264.0	<400	PASS
	0	3DH5	2.880	307.2	<400	PASS

Note:
Dwell Time(3DH1)=PW*(1600/2/79)*31.6
Dwell Time(3DH3)=PW*(1600/4/79)*31.6
Dwell Time(3DH5)=PW*(1600/6/79)*31.6

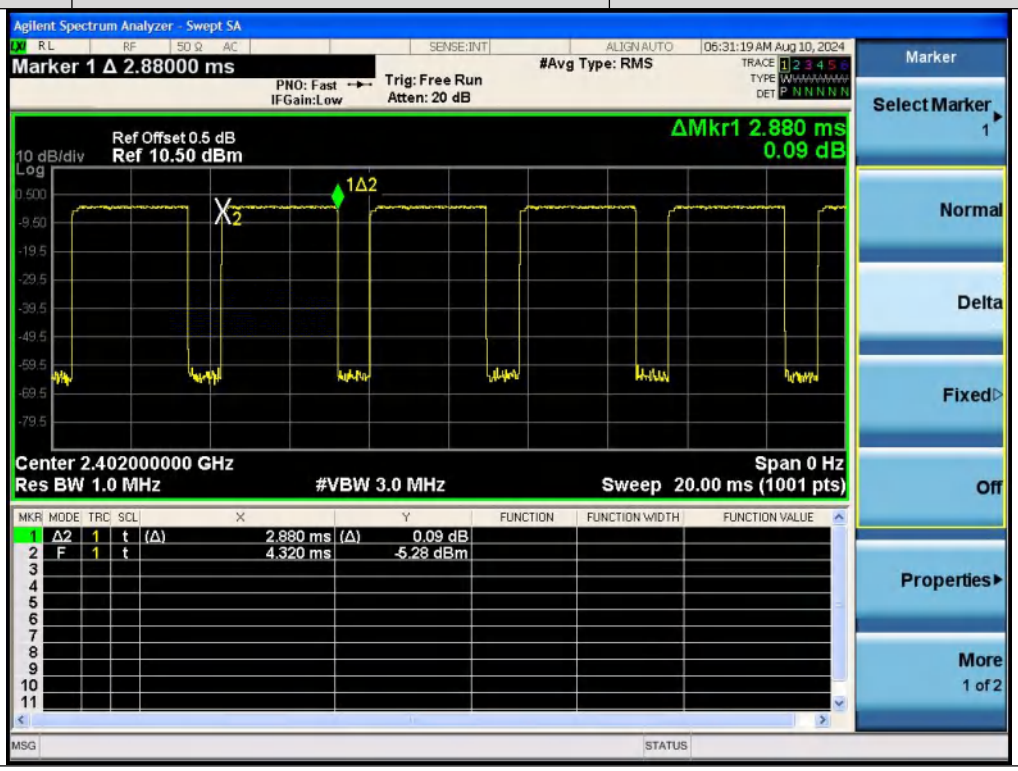
Test Model	Average Time Of Occupancy (Dwell Time)	
	8DPSK(3DH1)	
	Channel: 0	2402MHz



Test Model	Average Time Of Occupancy (Dwell Time)	
	8DPSK(3DH3)	
	Channel: 0	2402MHz



Test Model	Average Time Of Occupancy (Dwell Time)	
	8DPSK(3DH5)	
	Channel: 0	2402MHz



4.5. MAXIMUM PEAK CONDUCTED OUTPUT POWER

4.5.1. Applicable Standard

According to FCC Part 15.247(b)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.5.2. Conformance Limit

The max For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

4.5.3. Test Configuration

Test according to clause 4.5.4 radio frequency test setup 1

4.5.4. Test Procedure

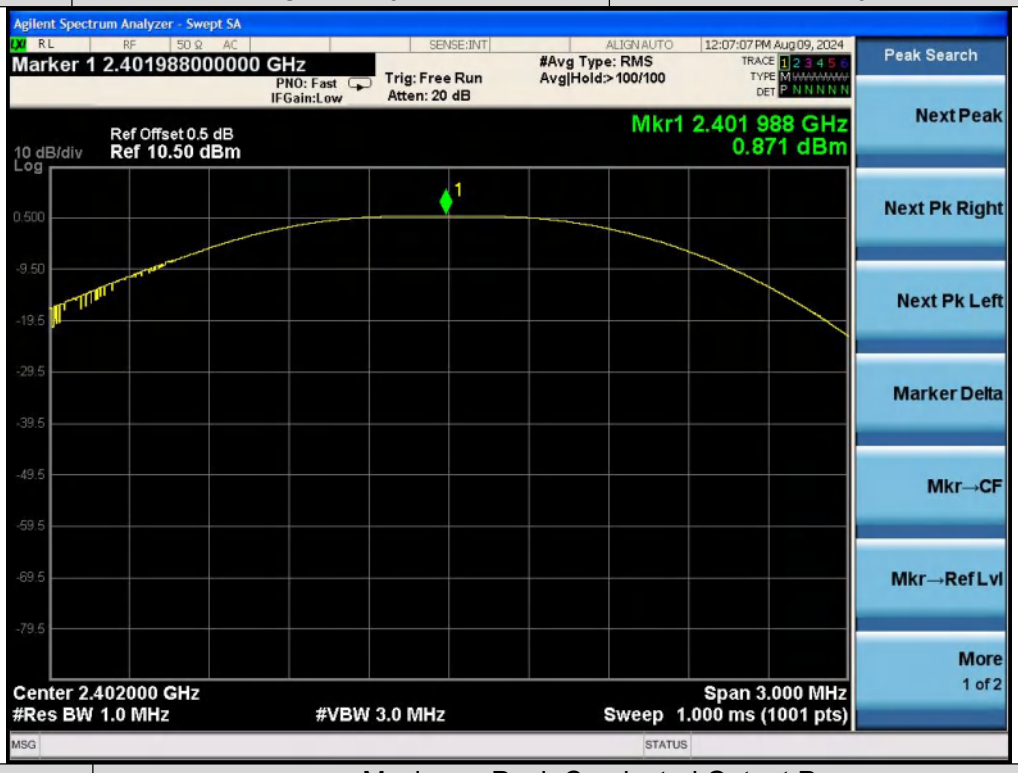
■ According to FCC Part15.247(b)(1)

As an alternative to a peak power measurement, compliance with the limit can be based on a measurement of the maximum conducted output power.
Use the following spectrum analyzer settings:
Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
Set RBW > the 20 dB bandwidth of the emission being measured
Set VBW ≥ RBW
Set Sweep = auto
Set Detector function = peak
Set Trace = max hold
Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission to determine the peak amplitude level.

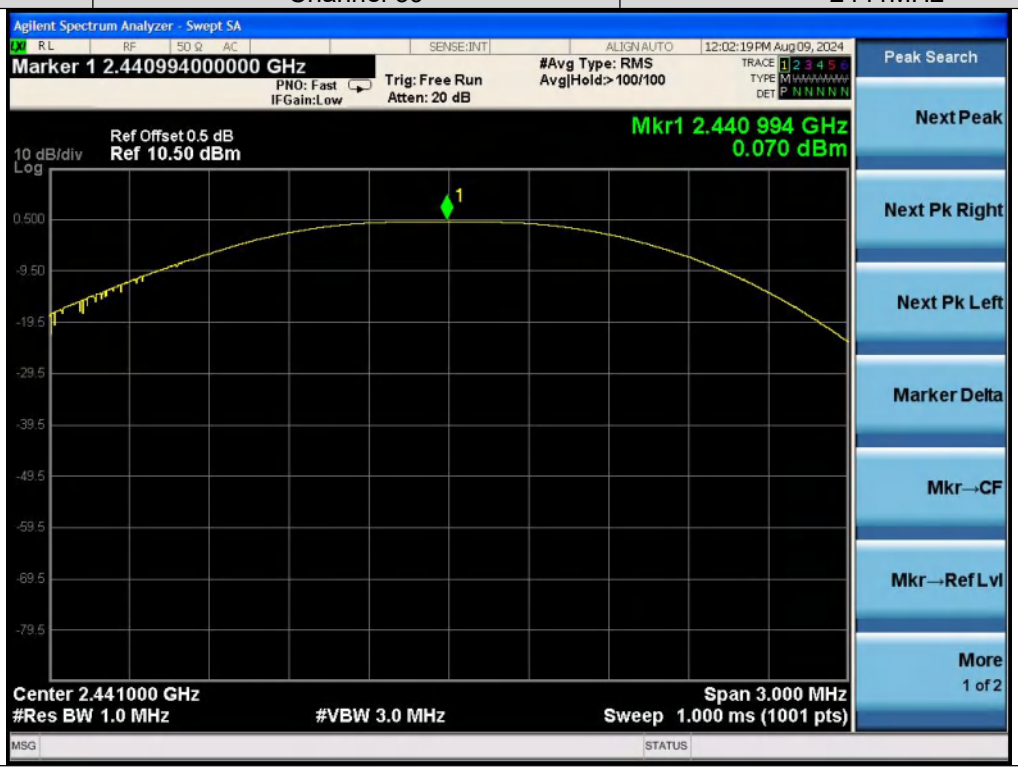
Test Results

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit(dBm)	Verdict
GFSK	0	2402	0.871	30	PASS
	39	2441	0.070	30	PASS
	78	2480	-1.309	30	PASS
π/4-DQPSK	0	2402	3.123	21	PASS
	39	2441	2.128	21	PASS
	78	2480	0.647	21	PASS
8DPSK	0	2402	3.583	21	PASS
	39	2441	2.567	21	PASS
	78	2480	1.035	21	PASS

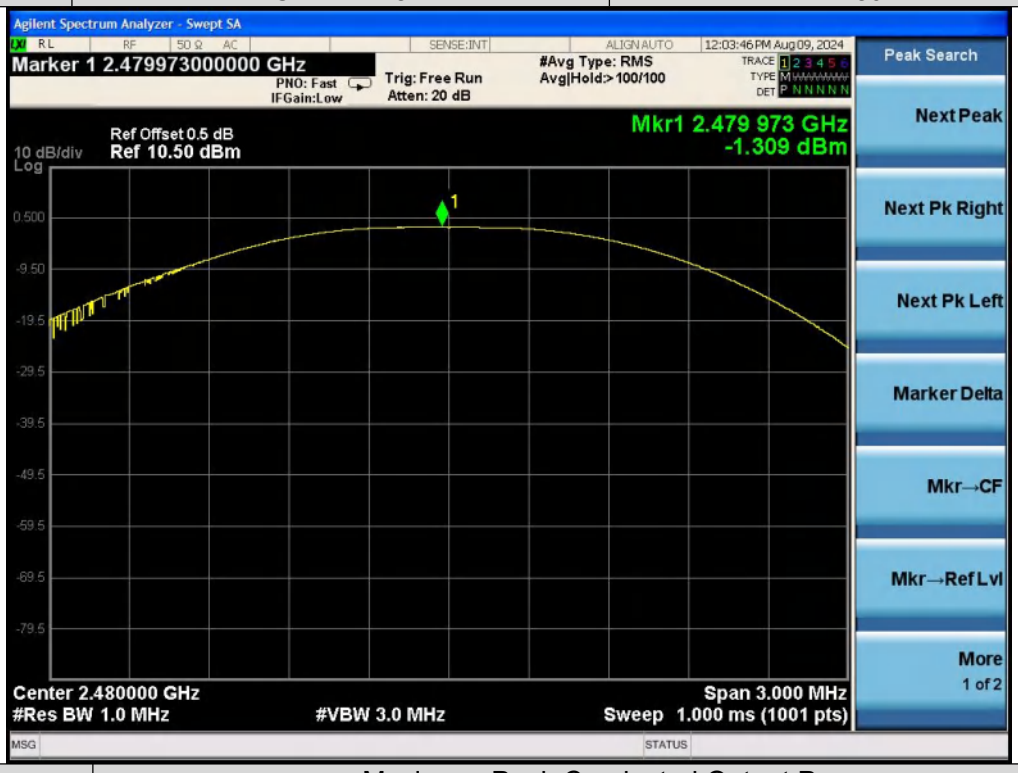
Test Model	Maximum Peak Conducted Output Power	
	GFSK	
	Channel 0	2402MHz



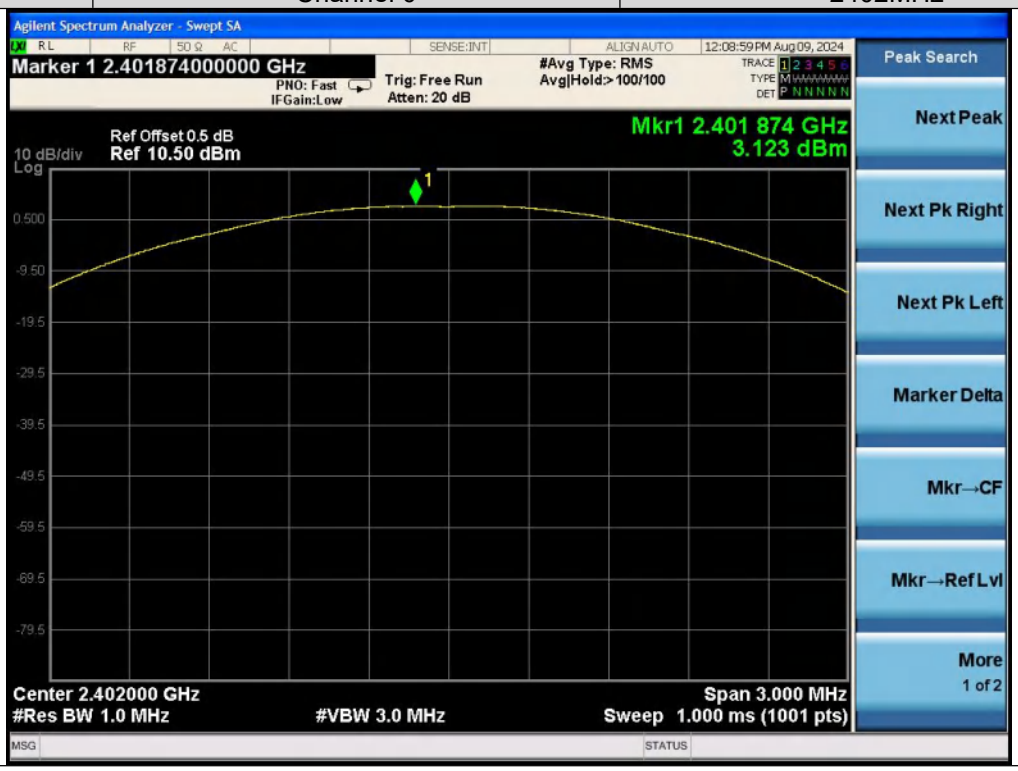
Test Model	Maximum Peak Conducted Output Power	
	GFSK	
	Channel 39	2441MHz



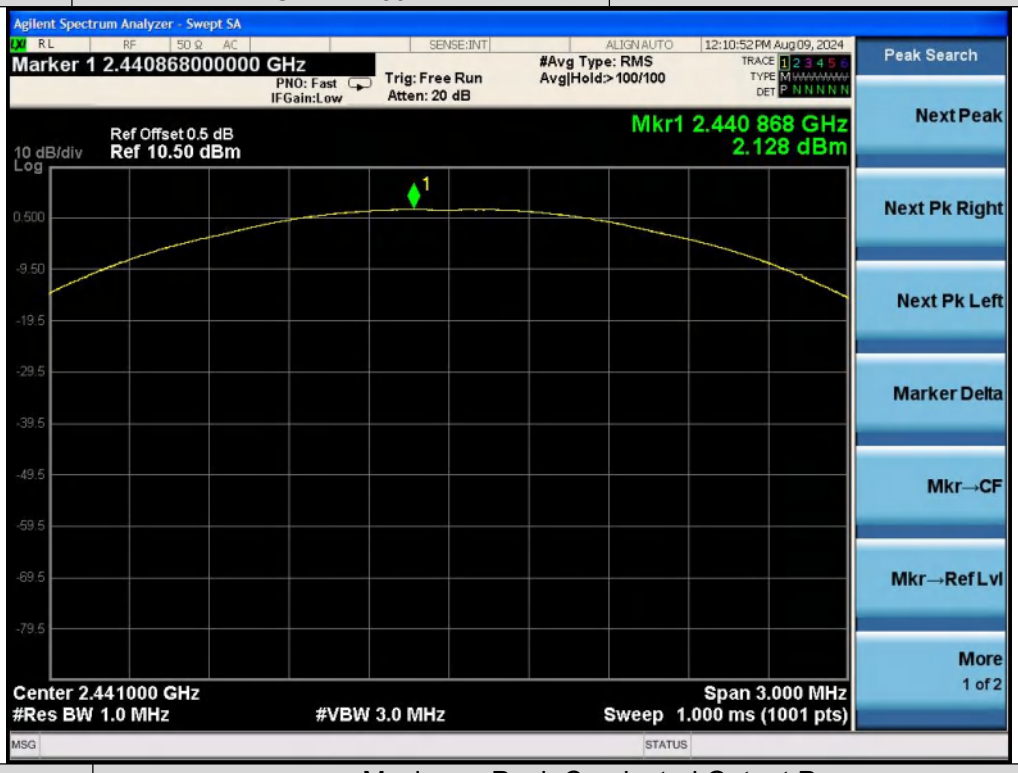
Test Model	Maximum Peak Conducted Output Power	
	GFSK	
	Channel 78	2480MHz



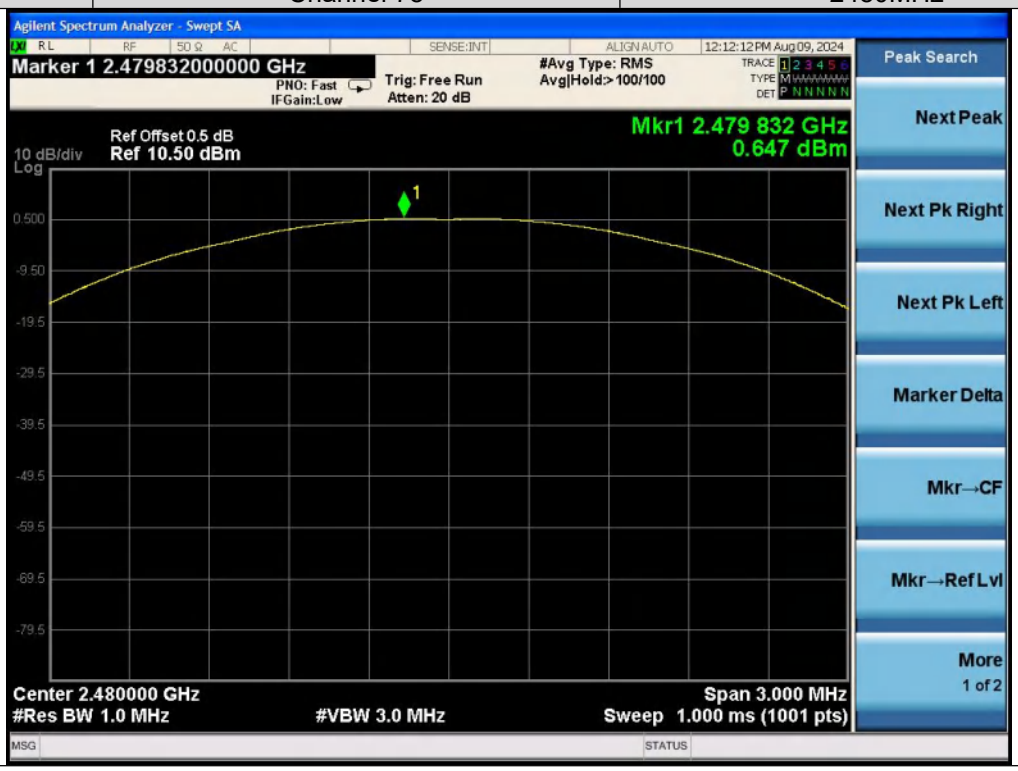
Test Model	Maximum Peak Conducted Output Power	
	π/4-DQPSK	
	Channel 0	2402MHz



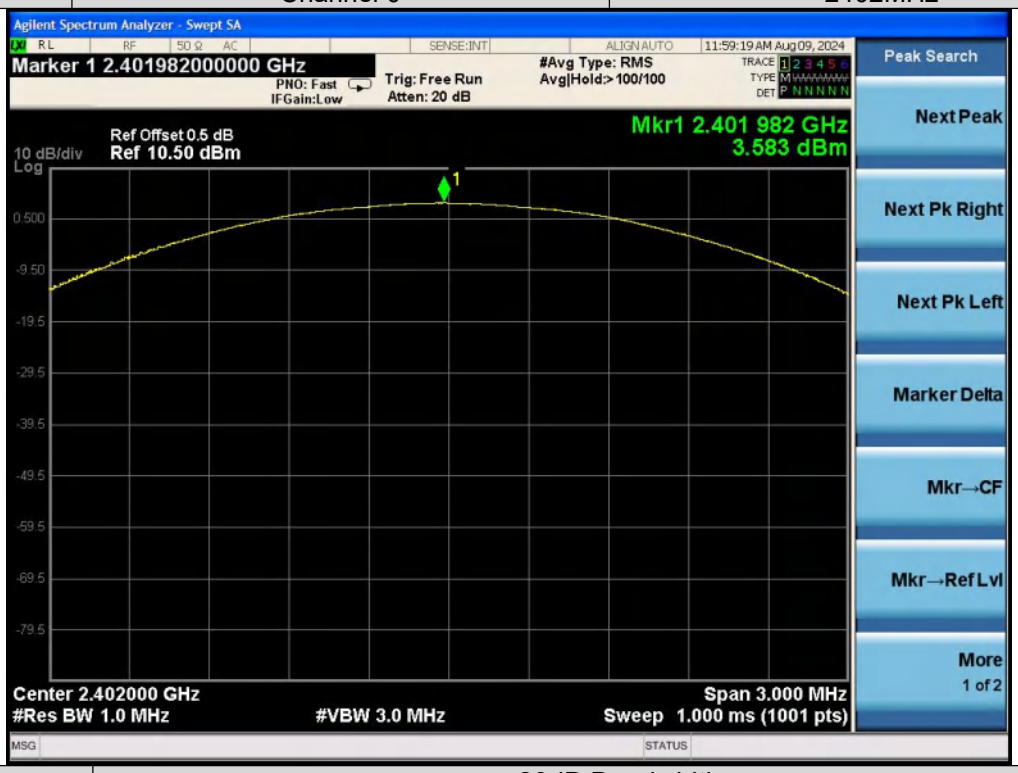
Test Model	Maximum Peak Conducted Output Power	
	π/4-DQPSK	
	Channel 39	2441MHz



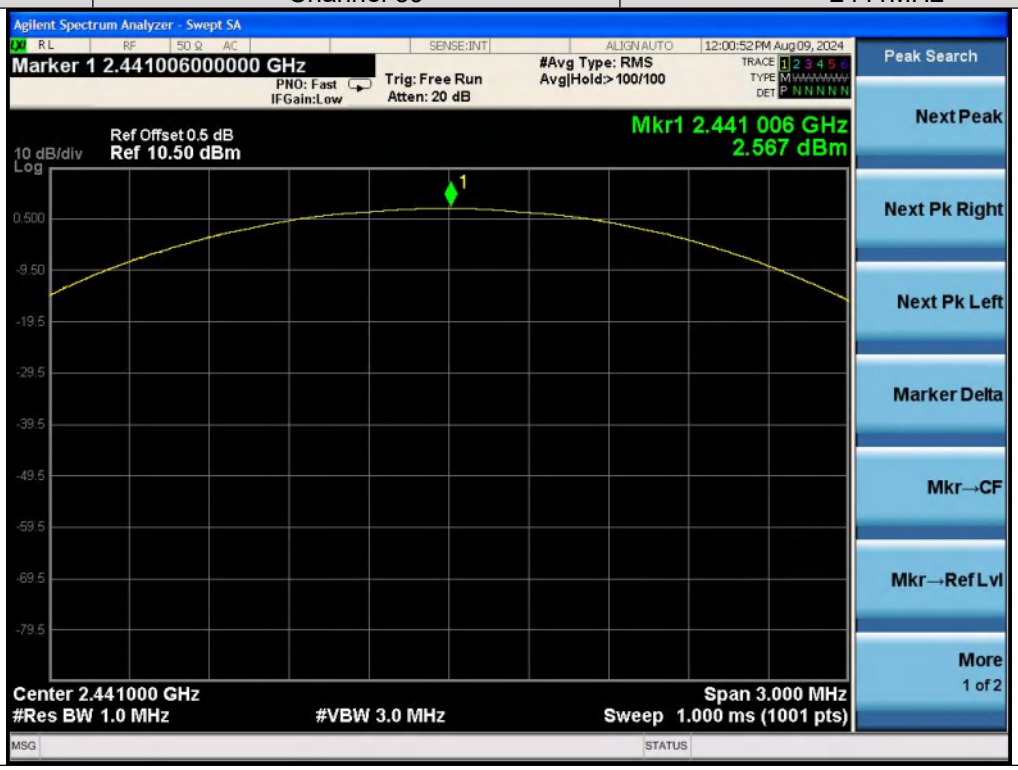
Test Model	Maximum Peak Conducted Output Power	
	π/4-DQPSK	
	Channel 78	2480MHz



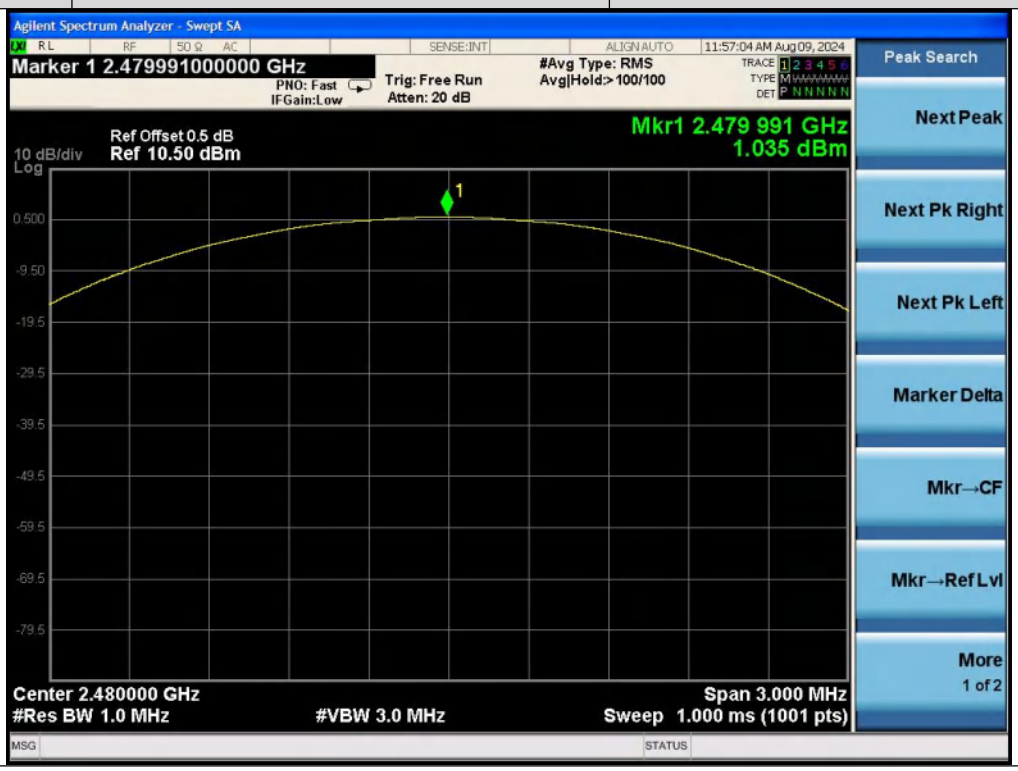
Test Model	Maximum Peak Conducted Output Power	
	8DPSK	
	Channel 0	2402MHz



Test Model	20dB Bandwidth	
	8DPSK	
	Channel 39	2441MHz



Test Model	Maximum Peak Conducted Output Power	
	8DPSK	
	Channel 78	2480MHz



4.6. CONDUCTED SUPRIOUS EMISSION

4.6.1. Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.6.2. Conformance Limit

According to FCC Part 15.247(d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted, provided the transmitter demonstrates compliance with the peak conducted power limits.

4.6.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.6.4. Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

- **Reference level measurement**

Establish a reference level by using the following procedure:
Set instrument center frequency to DSS channel center frequency.
Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.
Set the RBW = 100 kHz. Set the VBW ≥ 3 x RBW.
Set Detector = peak. Set Sweep time = auto couple.
Set Trace mode = max hold. Allow trace to fully stabilize.
Use the peak marker function to determine the maximum Maximum conduceted level.
Note that the channel found to contain the maximum conduceted level can be used to establish the reference level.

- **Band-edge Compliance of RF Conducted Emissions**

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation
Set RBW ≥ 1% of the span=100kHz Set VBW ≥ RBW
Set Sweep = auto Set Detector function = peak Set Trace = max hold
Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.
Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

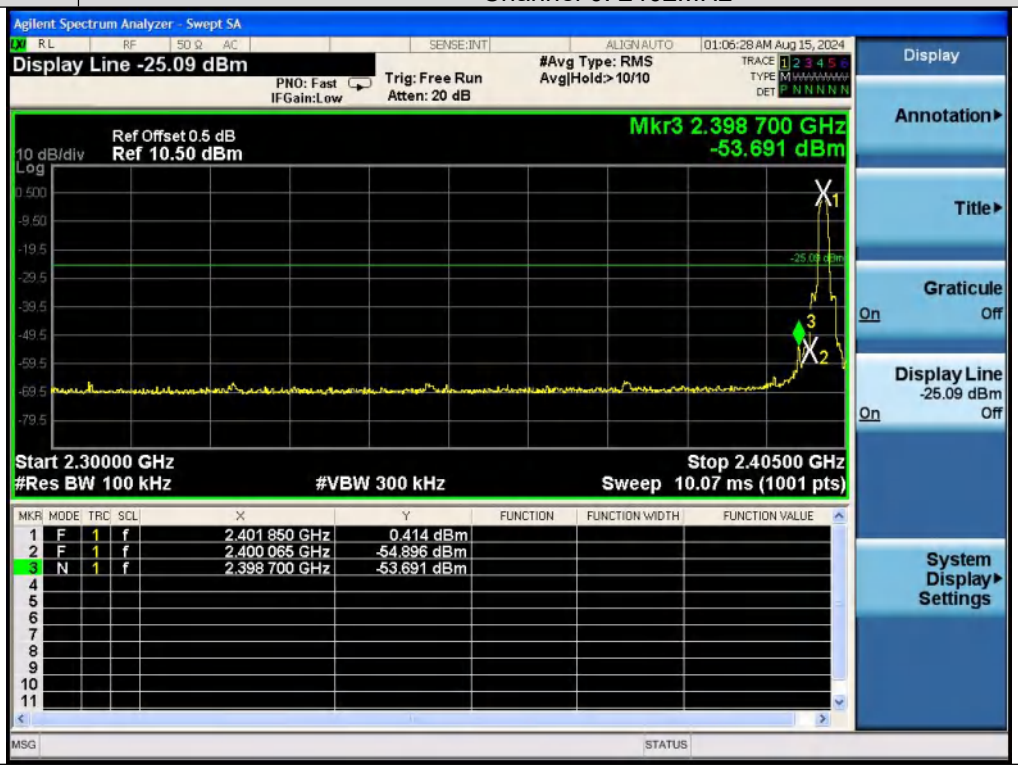
- **Conduceted Spurious RF Conducted Emission**

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.(30MHz to 26.5GHz). Set RBW = 100 kHz Set VBW ≥ RBW
Set Sweep = auto Set Detector function = peak Set Trace = max hold
Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

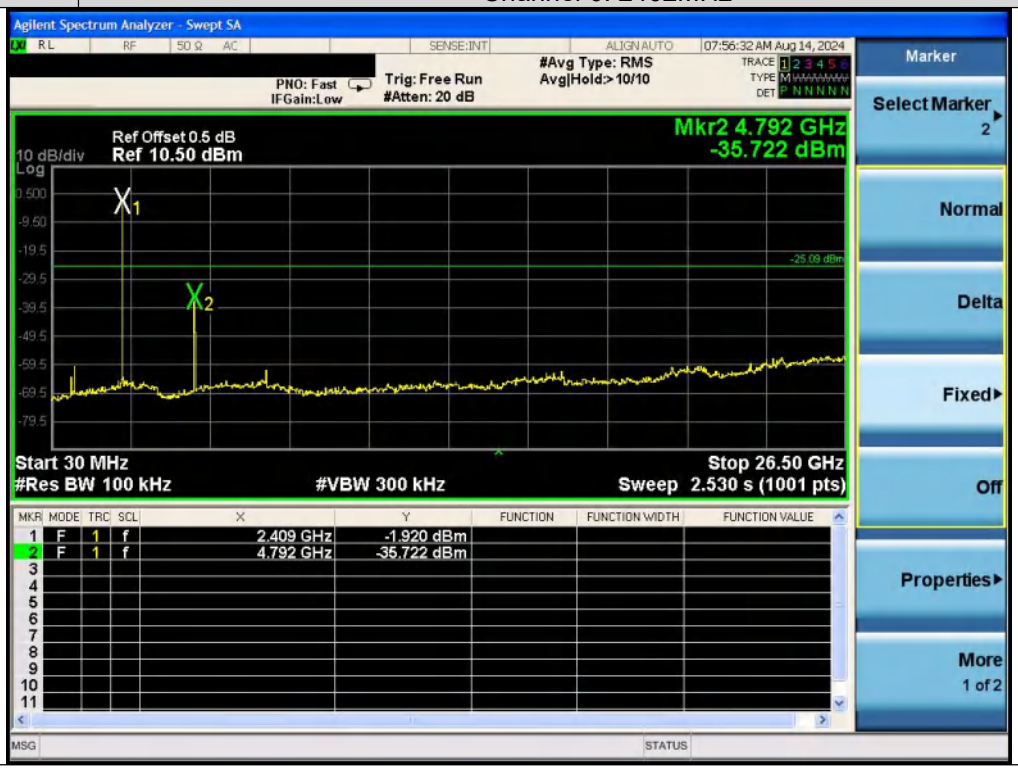
Test Results：

Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			

Test Model	Band edge			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			

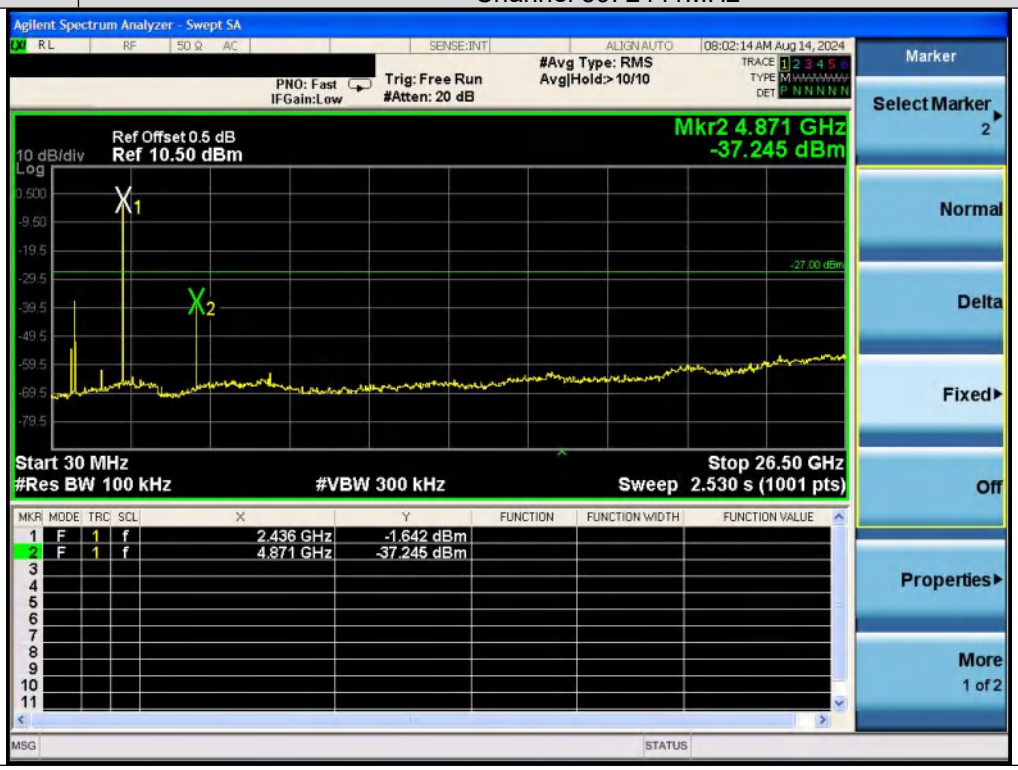


Test Model	Unwanted Emissions in non-restricted frequency bands			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			



Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 39: 2441MHz			

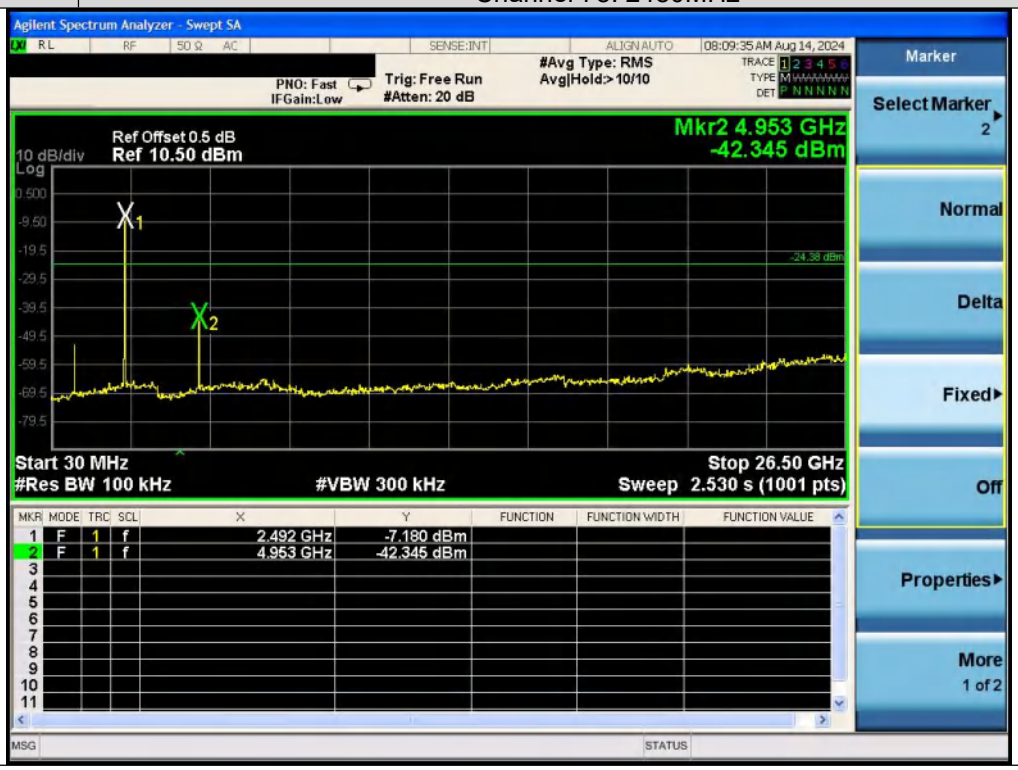
Test Model	Unwanted Emissions in non-restricted frequency bands			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 39: 2441MHz			



Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			

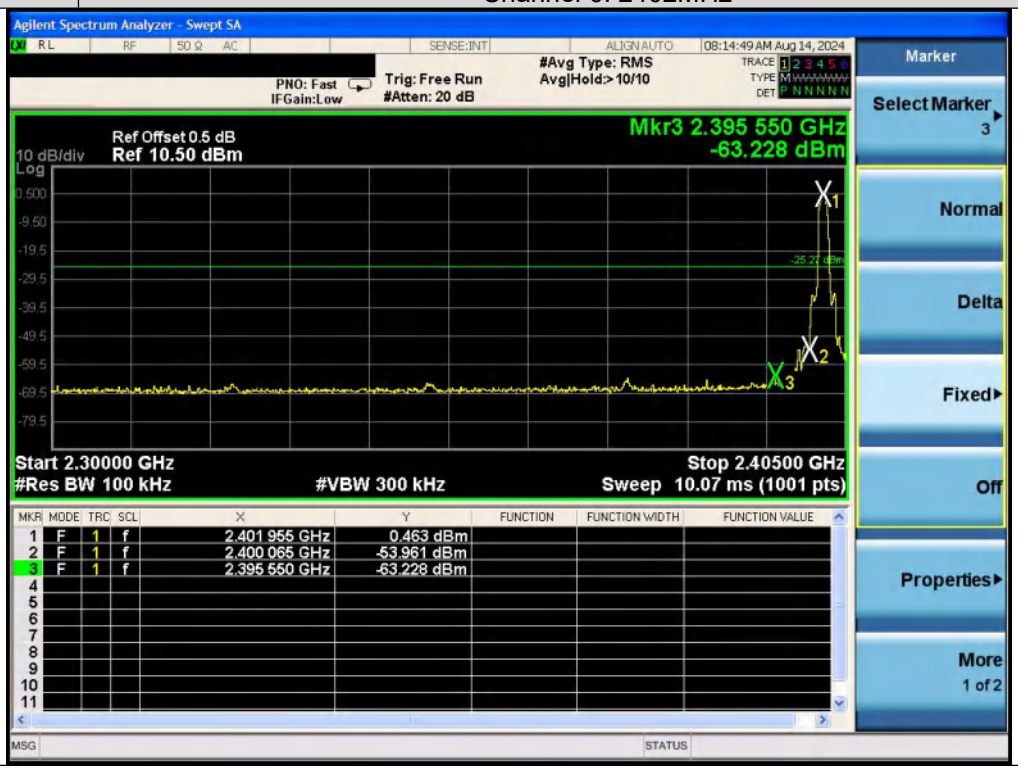
Test Model	Band edge			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			

Test Model	Unwanted Emissions in non-restricted frequency bands			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			

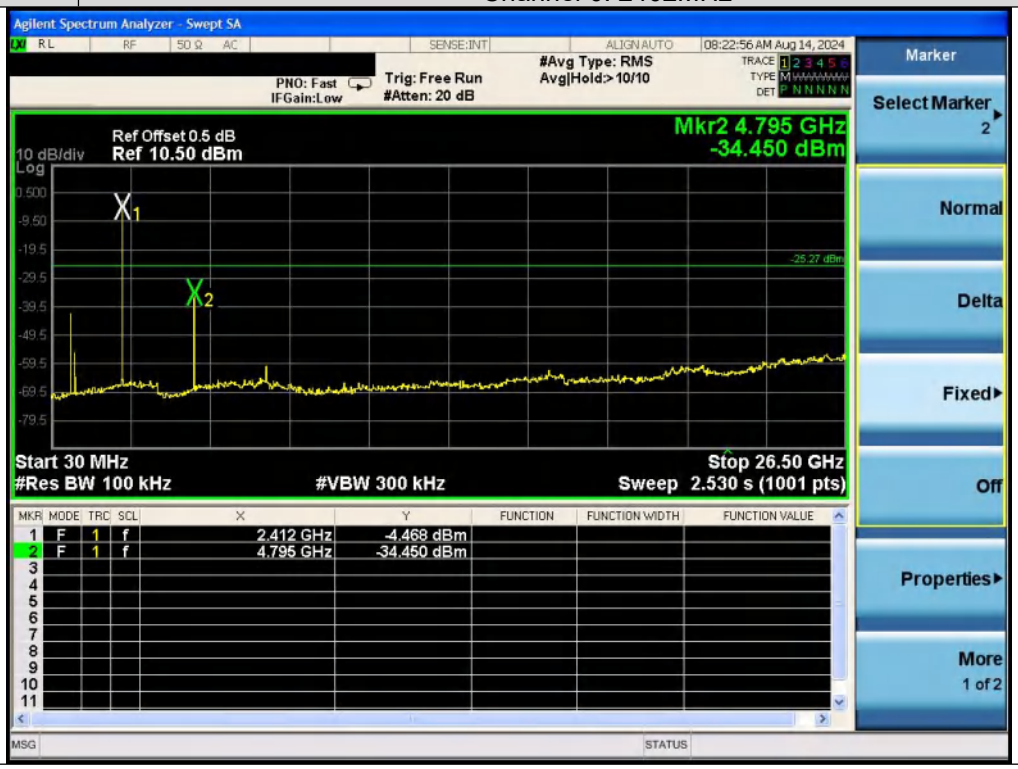


Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			

Test Model	Band edge			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			

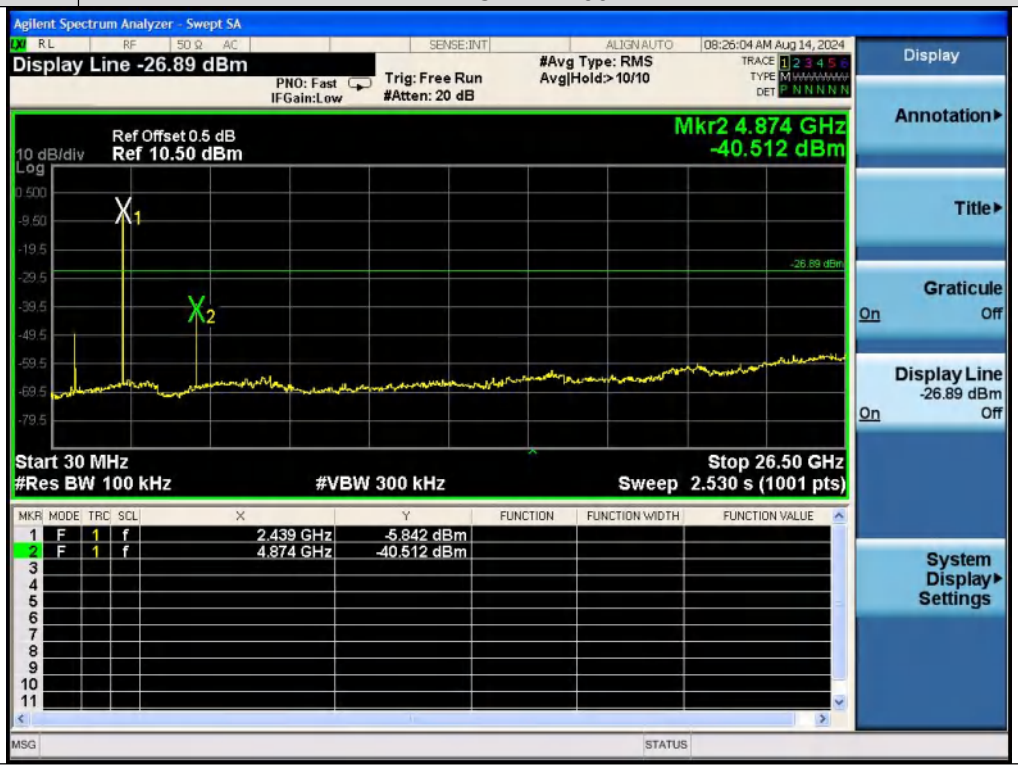


Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 0: 2402MHz			



Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 39: 2441MHz			

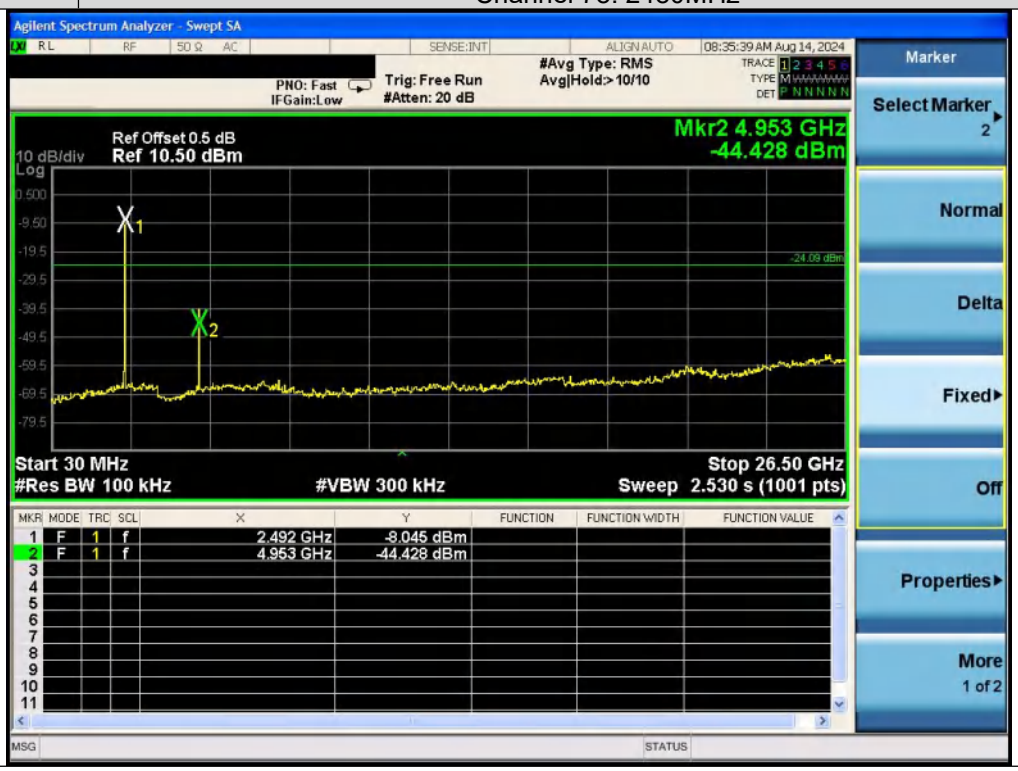
Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 39: 2441MHz			



Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			

Test Model	Band edge			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			

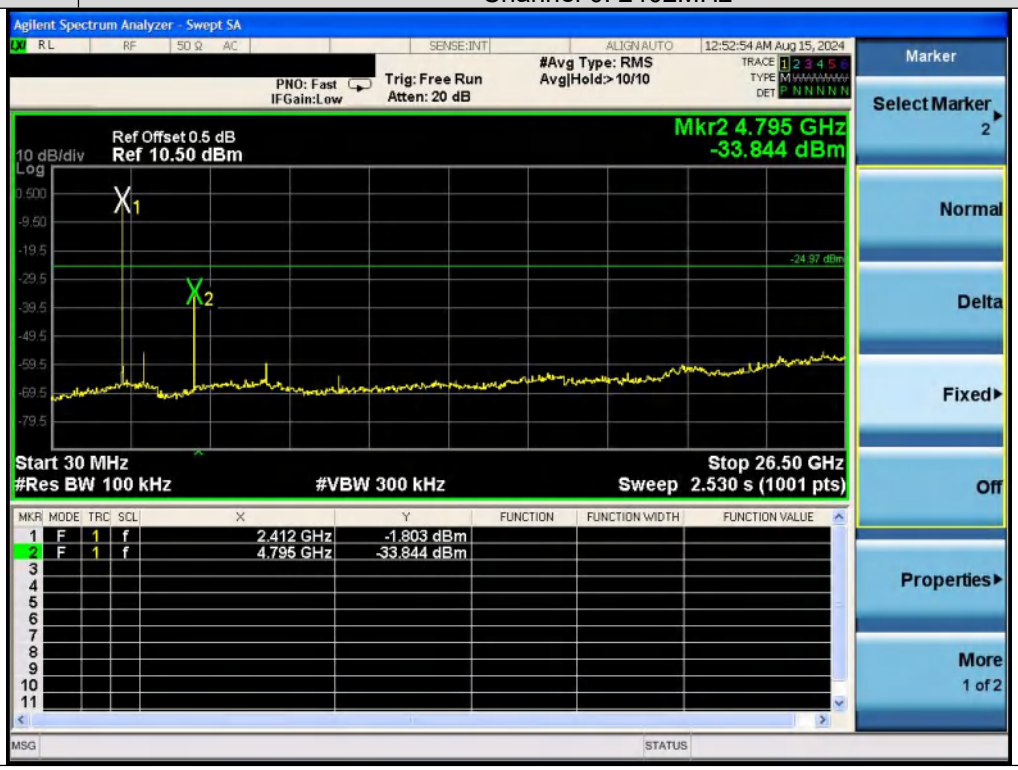
Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☐ _____
	Channel 78: 2480MHz			



Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 0: 2402MHz			

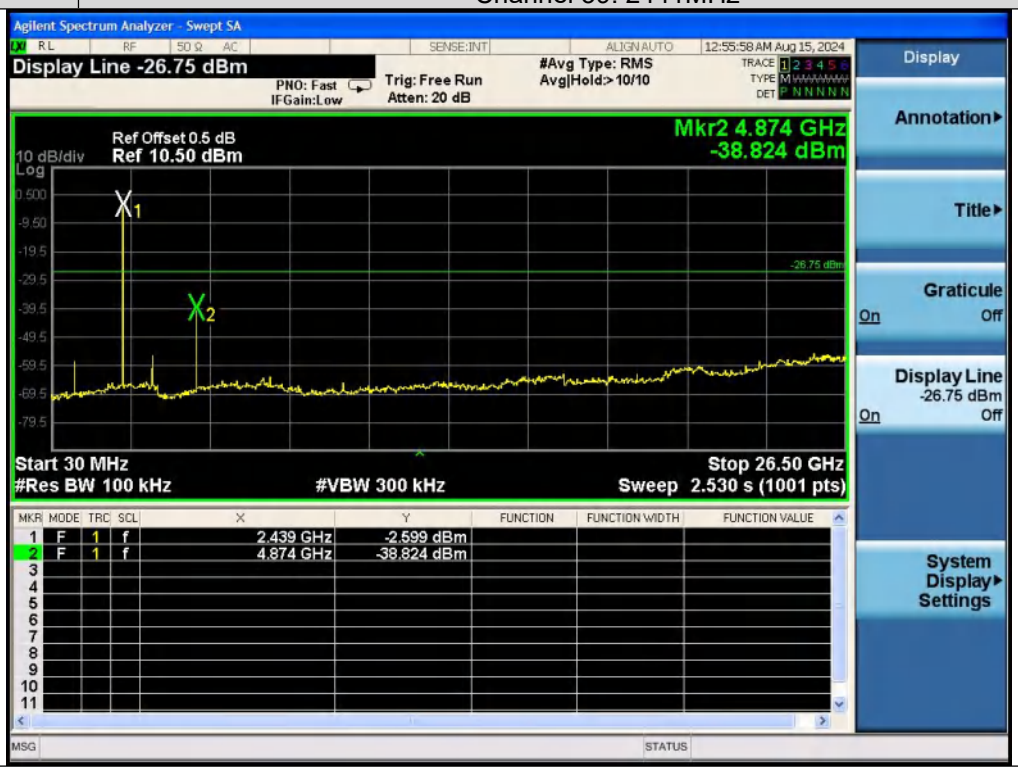
Test Model	Band edge			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 0: 2402MHz			

Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 0: 2402MHz			



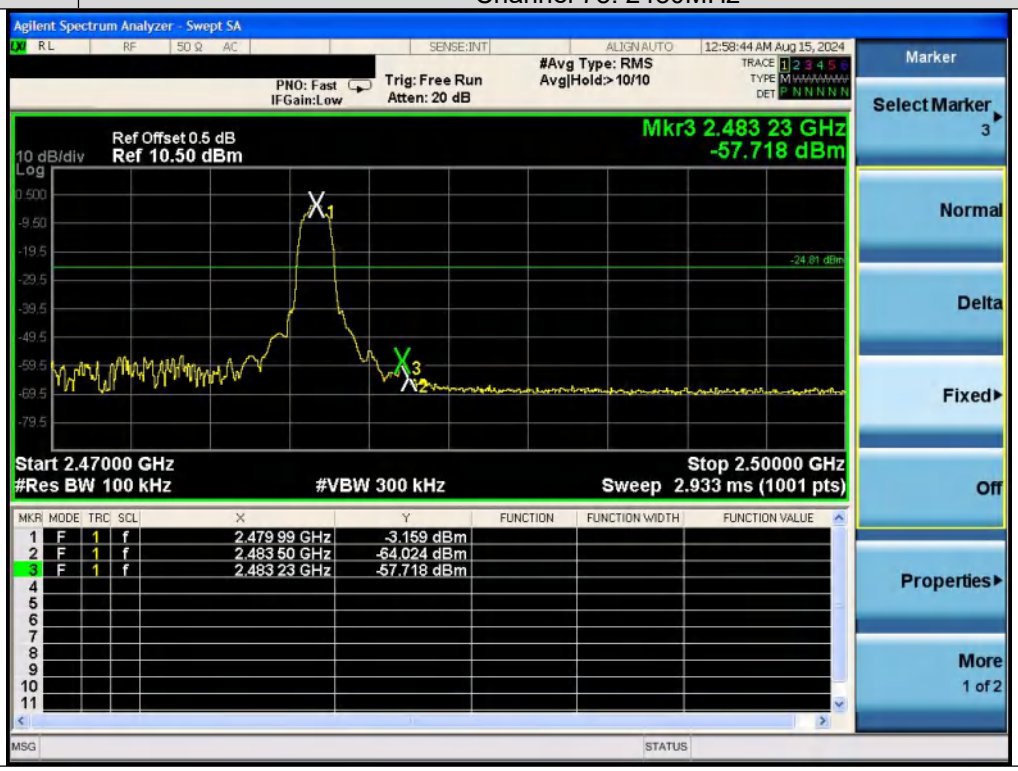
Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 39: 2441MHz			

Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 39: 2441MHz			

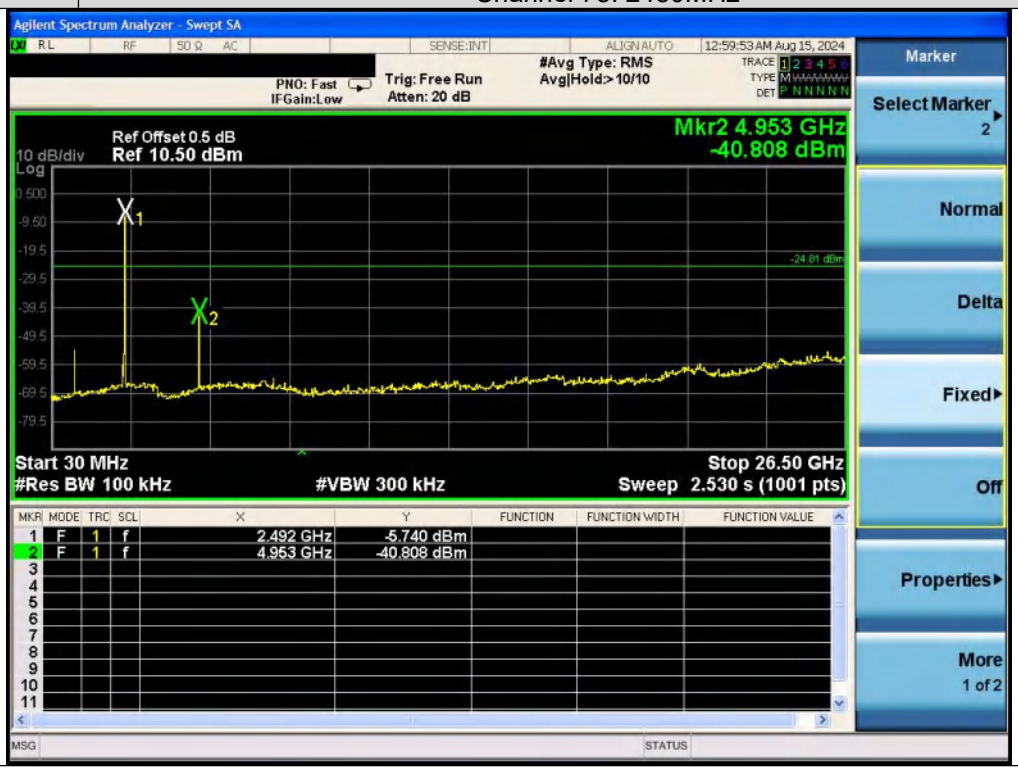


Test Model	PSD(Power Spectral Density) RBW=100kHz, VBW =300 kHz			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 78: 2480MHz			

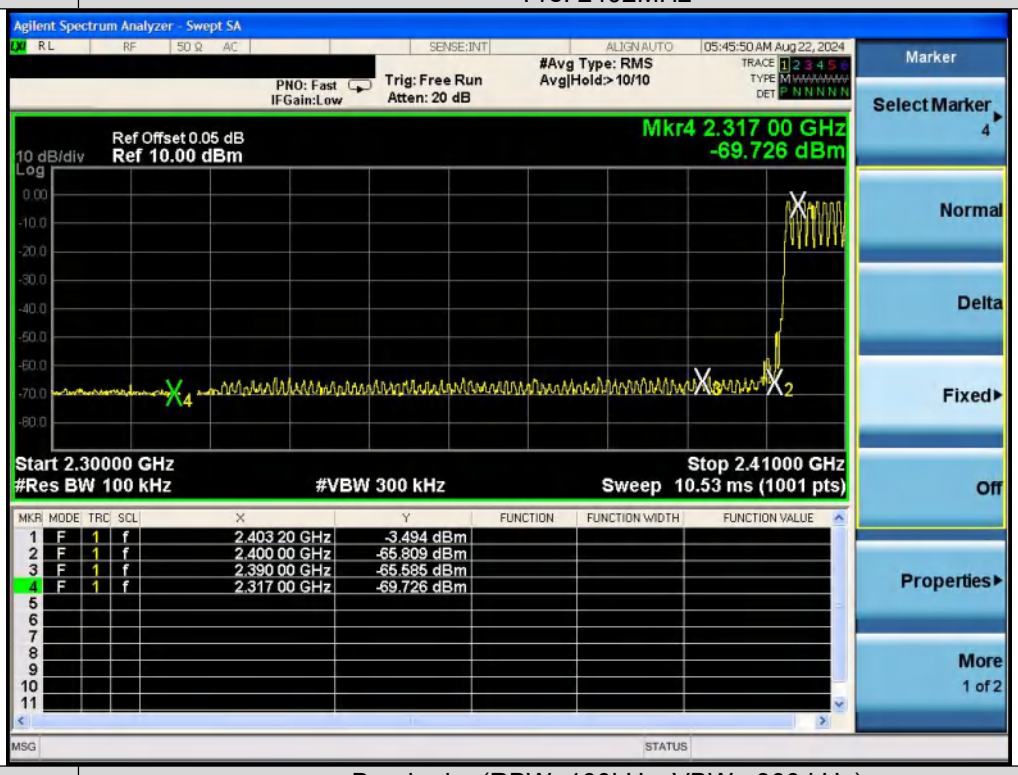
Test Model	Band edge			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 78: 2480MHz			



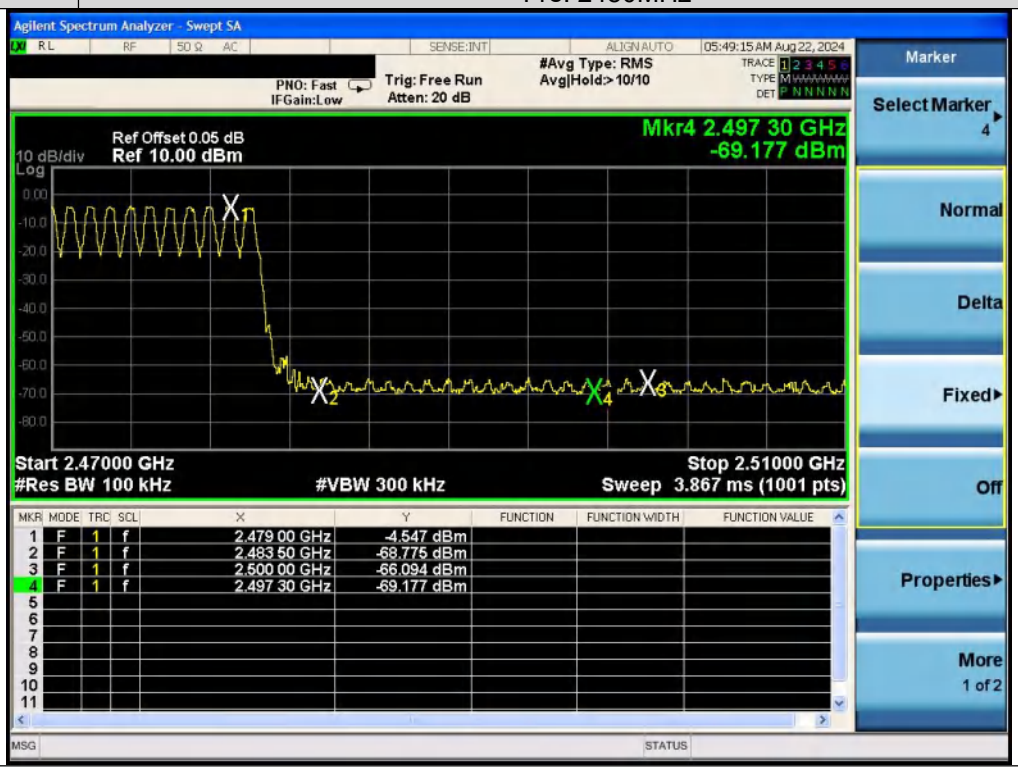
Test Model	Unwanted Emissions in non-restricted frequency bands			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☐ _____
	Channel 78: 2480MHz			



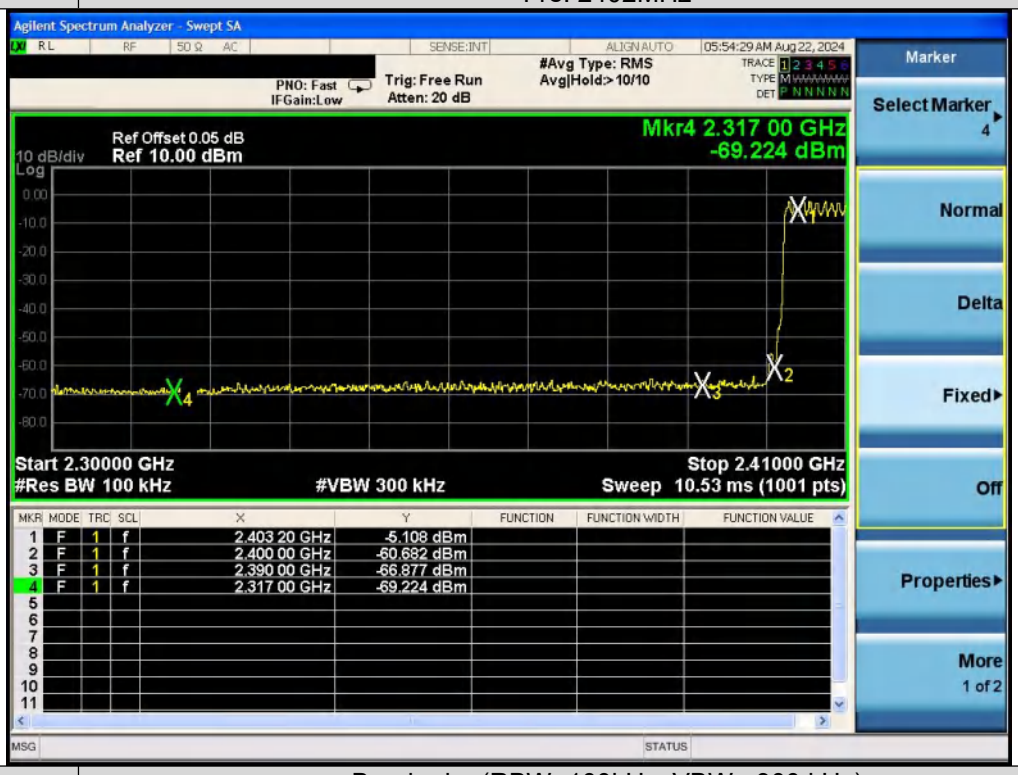
Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☒ _Hopping_____
	Fre: 2402MHz			



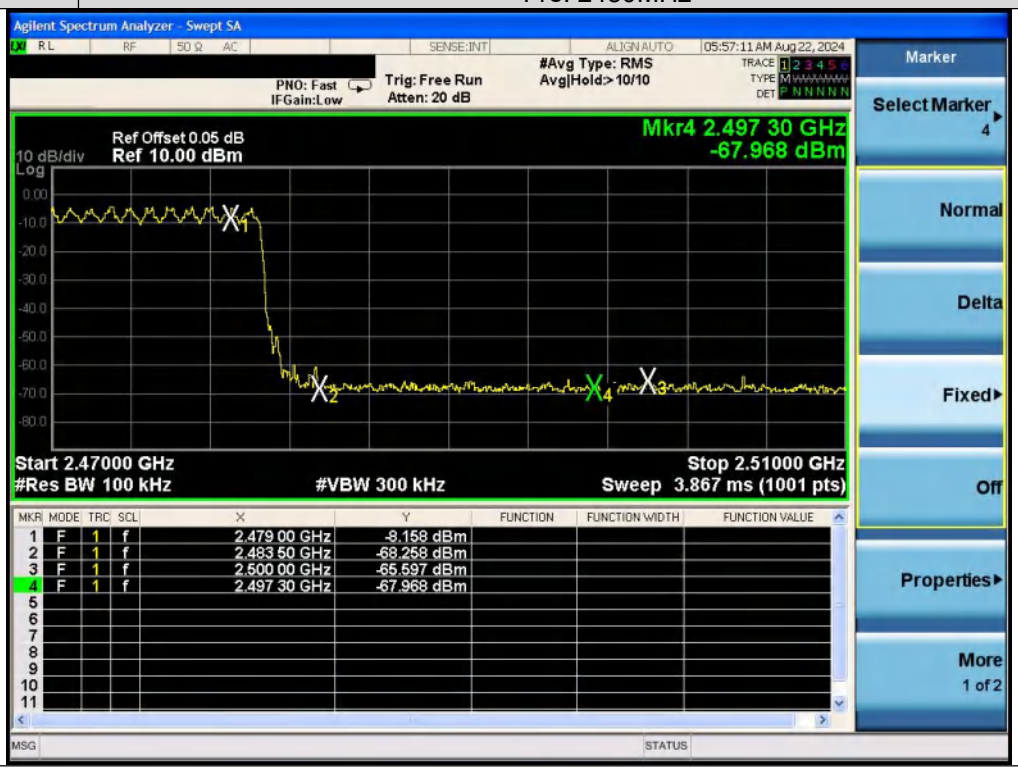
Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK	☒ _Hopping_____
	Fre: 2480MHz			



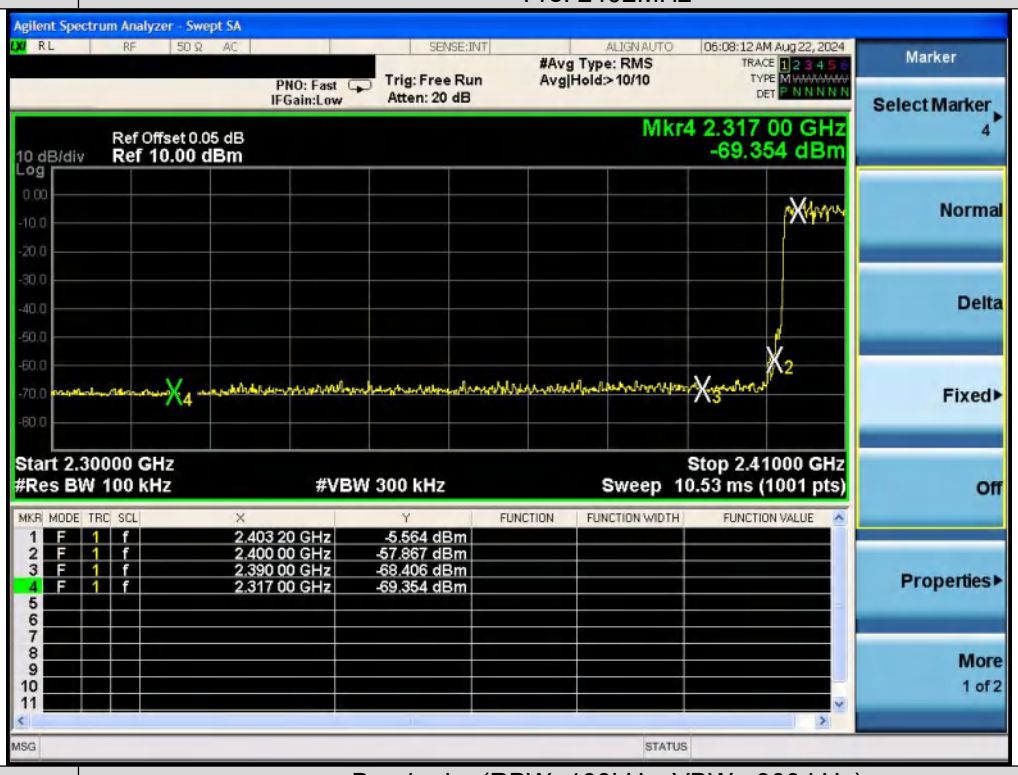
Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☒ _Hopping_____
	Fre: 2402MHz			



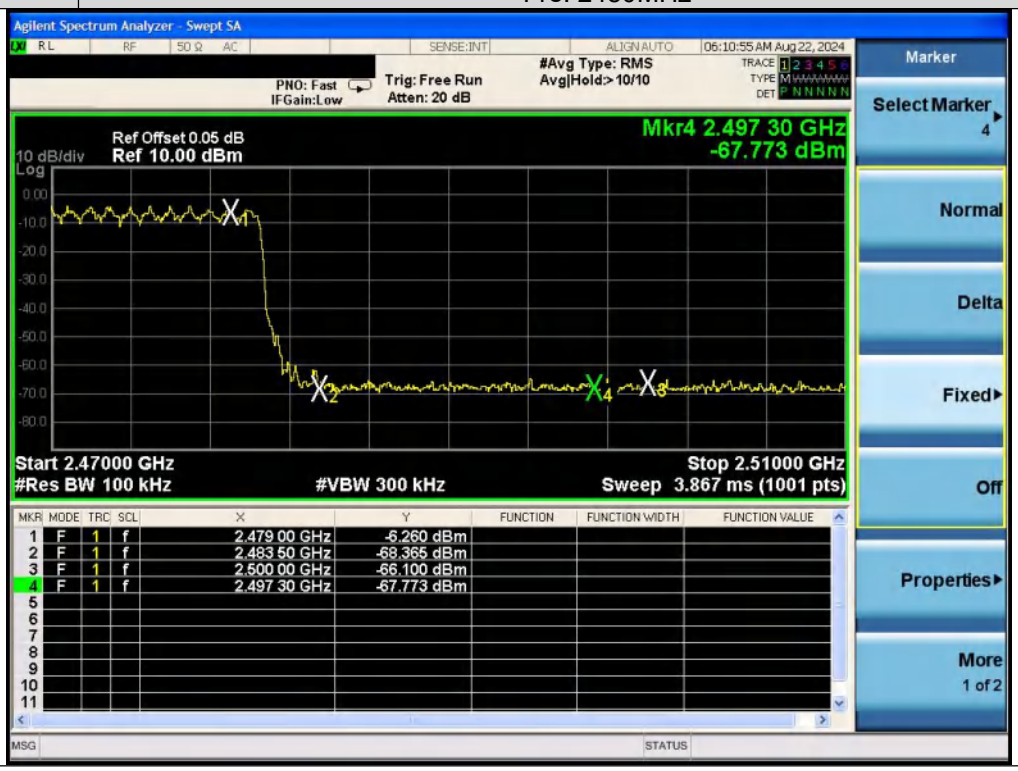
Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☐ GFSK	☒ π/4-DQPSK	☐ 8DPSK	☒ _Hopping_____
	Fre: 2480MHz			



Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☒ _Hopping_____
	Fre: 2402MHz			



Test Model	Band edge(RBW=100kHz, VBW =300 kHz)			
	☐ GFSK	☐ π/4-DQPSK	☒ 8DPSK	☒ _Hopping_____
	Fre: 2480MHz			



4.7. RADIATED SPURIOUS EMISSION

4.7.1. Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.7.2. Conformance Limit

According to FCC Part 15.247(d): 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) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

4.7.3. Test Configuration

Test according to clause 3.2 radio frequency test setup 2

4.7.4. Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
For Above 1GHz:
The EUT was placed on a turn table which is 1.5m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For Below 1GHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For Below 30MHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 9kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For Below 150KHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 200Hz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.
Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.
Repeat above procedures until all frequency measured was complete.

Test Results：

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test mode:	8DPSK	Frequency:	Channel 0: 2402MHz

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4043	46.16	1.14	47.3	74	-26.7	peak	V
4043	33.19	1.14	34.33	54	-19.67	AVG	V
4808	60.83	0.98	61.81	74	-12.19	peak	V
4808	45.25	0.98	46.23	54	-7.77	AVG	V
7206	38.16	7.68	45.84	74	-28.16	peak	V
7206	30.22	7.68	37.9	54	-16.1	AVG	V
3397	45.86	0.17	46.03	74	-27.97	peak	H
3414	30.96	0.21	31.17	54	-22.83	AVG	H
4808	51.07	0.98	52.05	74	-21.95	peak	H
4825	38.45	0.98	39.43	54	-14.57	AVG	H
7409	46.33	7.59	53.92	74	-20.08	peak	H
7426	37.6	7.59	45.19	54	-8.81	AVG	H

Test mode:	8DPSK	Frequency:	Channel 39: 2441MHz

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
3397	44.39	0.17	44.56	74	-29.44	peak	V
3414	31.18	0.21	31.39	54	-22.61	AVG	V
4876	51.53	0.99	52.52	74	-21.48	peak	V
4893	37.65	1	38.65	54	-15.35	AVG	V
7323	38.64	7.62	46.26	74	-27.74	peak	V
7323	28.71	7.62	36.33	54	-17.67	AVG	V
4876	48.3	0.99	49.29	74	-24.71	peak	H
4882	35.73	0.99	36.72	54	-17.28	AVG	H
7323	39.57	7.62	47.19	74	-26.81	peak	H
7323	29.88	7.62	37.5	54	-16.5	AVG	H
8174	42.05	7.47	49.52	74	-24.48	peak	H
8174	30.92	7.47	38.39	54	-15.61	AVG	H

Test mode:	8DPSK	Frequency:	Channel 78: 2480MHz

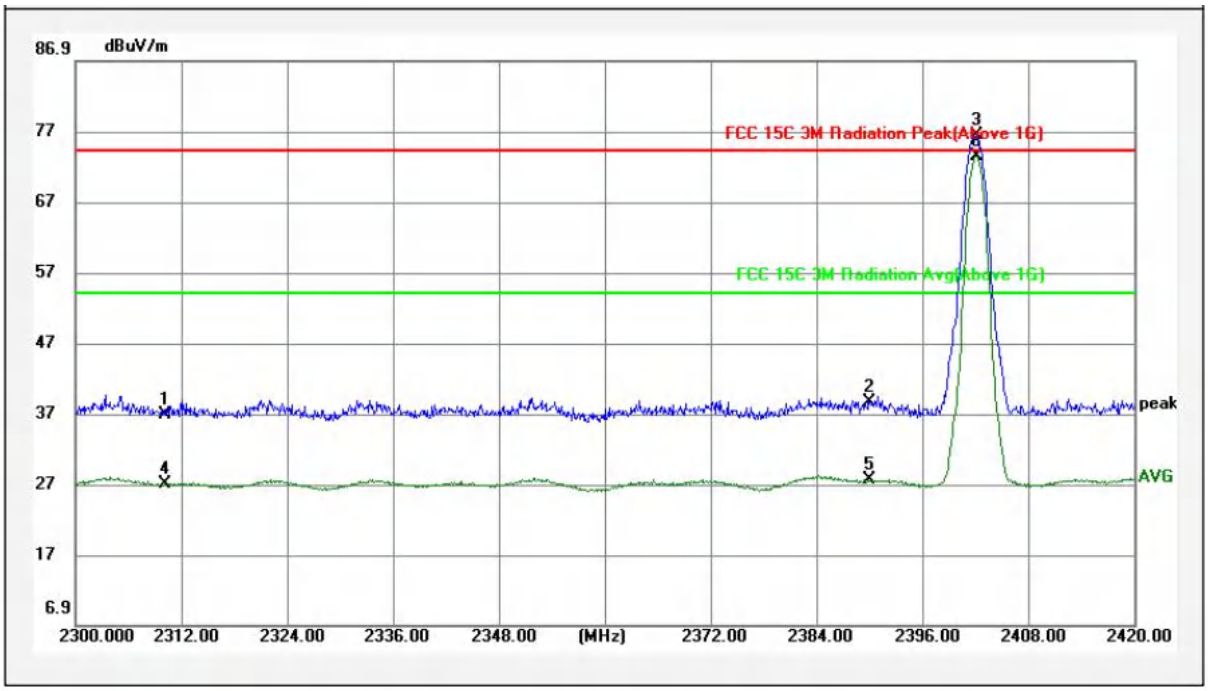
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
3397	53.58	0.17	53.75	74	-20.25	peak	V
3397	35.77	0.17	35.94	54	-18.06	AVG	V
4960	45.97	1	46.97	74	-27.03	peak	V
4960	32.31	1	33.31	54	-20.69	AVG	V
7440	39.22	7.58	46.8	74	-27.2	peak	V
7440	28.98	7.58	36.56	54	-17.44	AVG	V
4876	49.76	0.99	50.75	74	-23.25	peak	H
4960	36.99	1	37.99	54	-16.01	AVG	H
7018	41.05	7.76	48.81	74	-25.19	peak	H
7103	30.12	7.72	37.84	54	-16.16	AVG	H
7440	38.87	7.58	46.45	74	-27.55	peak	H
7440	28.98	7.58	36.56	54	-17.44	AVG	H

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) Data of measurement within this frequency range shown " -- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-23900MHz and 2483.5-2500MHz

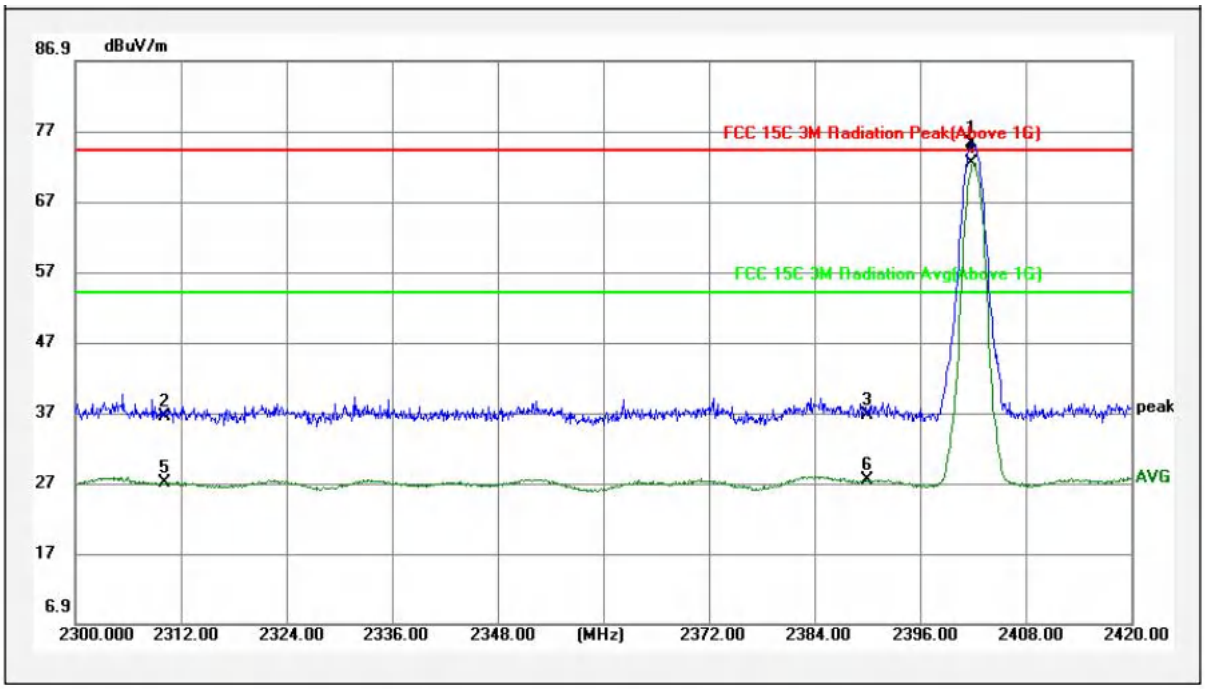
Bluetooth (GFSK, π/4-DQPSK, 8DPSK, Hopping) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2402MHz	Test Channel	Lowest
Temperature:	24.5℃		Phase:	Vertical
Relative Humidity:	56%		Pressure:	101.4KPa



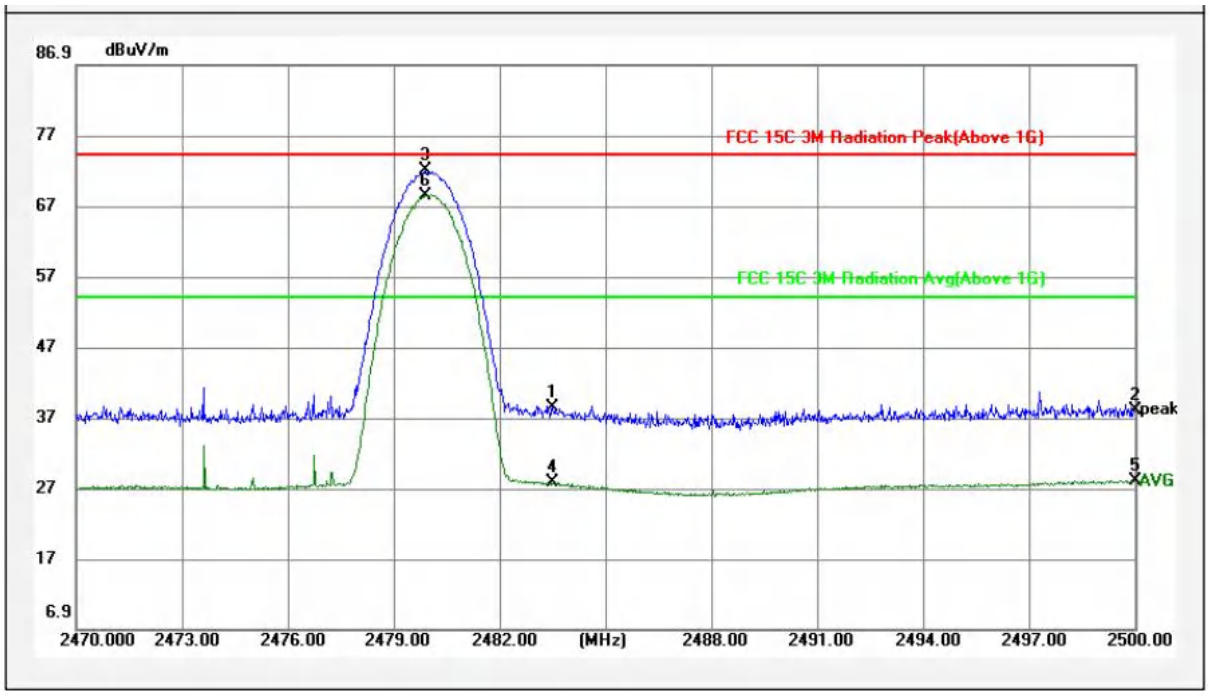
No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2310.000	-3.14	39.88	36.74	74.00	-37.26	peak		
2	2390.000	-2.85	41.36	38.51	74.00	-35.49	peak		
3	2402.120	-2.79	79.15	76.36	74.00	2.36	peak	X	
4	2310.000	-3.14	30.16	27.02	54.00	-26.98	AVG		
5	2390.000	-2.85	30.50	27.65	54.00	-26.35	AVG		
6	2402.120	-2.79	76.28	73.49	54.00	19.49	AVG	*	

Test Mode:	8DPSK	2402MHz	Test Channel	Lowest
Temperature:	24.5℃		Phase:	Horizontal
Relative Humidity:	56%		Pressure:	101.4KPa



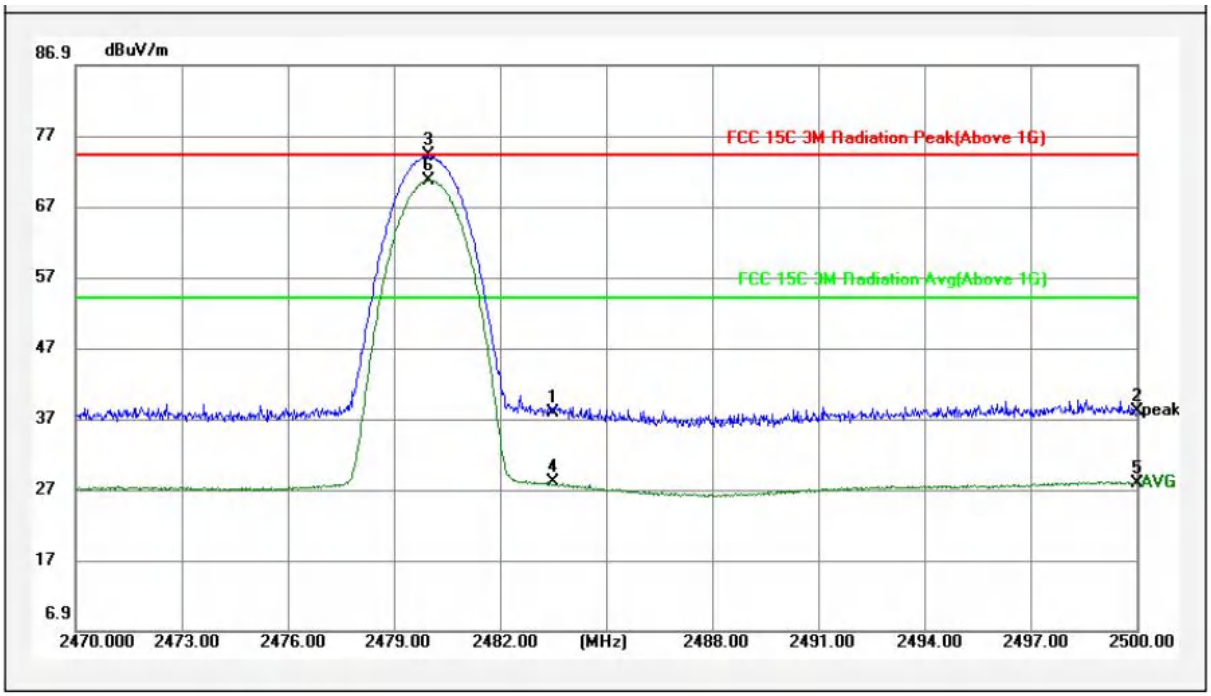
No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2401.880	-2.80	78.01	75.21	74.00	1.21	peak	X	
2	2310.000	-3.14	39.63	36.49	74.00	-37.51	peak		
3	2390.000	-2.85	39.40	36.55	74.00	-37.45	peak		
4	2401.880	-2.80	75.21	72.41	54.00	18.41	AVG	*	
5	2310.000	-3.14	30.14	27.00	54.00	-27.00	AVG		
6	2390.000	-2.85	30.34	27.49	54.00	-26.51	AVG		

Test Mode:	8DPSK	2480MHz	Test Channel	Highest
Temperature:	24.5℃		Phase:	Vertical
Relative Humidity:	56%		Pressure:	101.4KPa



No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2483.500	-2.48	40.93	38.45	74.00	-35.55	peak		
2	2500.000	-2.43	40.43	38.00	74.00	-36.00	peak		
3	2479.900	-2.50	74.44	71.94	74.00	-2.06	peak		
4	2483.500	-2.48	30.20	27.72	54.00	-26.28	AVG		
5	2500.000	-2.43	30.34	27.91	54.00	-26.09	AVG		
6	2479.900	-2.50	71.00	68.50	54.00	14.50	AVG	*	

Test Mode:	8DPSK	2480MHz	Test Channel	Highest
Temperature:	24.5℃		Phase:	Horizontal
Relative Humidity:	56%		Pressure:	101.4KPa



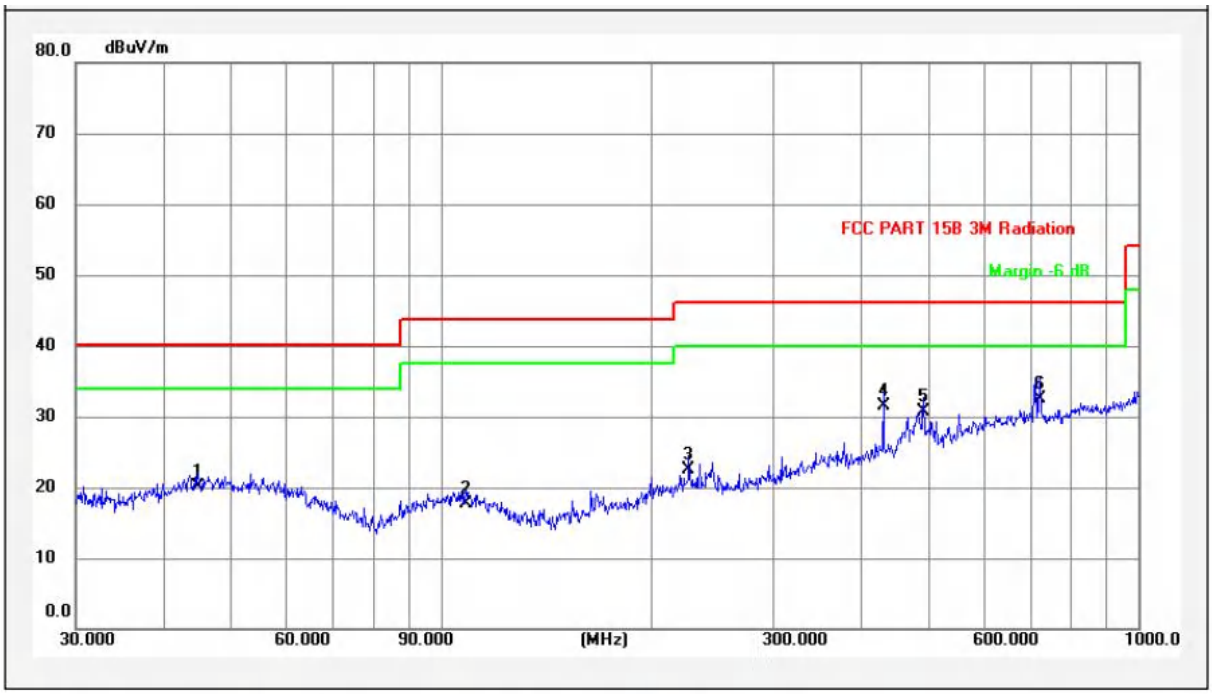
No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2483.500	-2.48	40.37	37.89	74.00	-36.11	peak		
2	2500.000	-2.43	40.39	37.96	74.00	-36.04	peak		
3	2479.960	-2.50	76.62	74.12	74.00	0.12	peak	X	
4	2483.500	-2.48	30.43	27.95	54.00	-26.05	AVG		
5	2500.000	-2.43	30.29	27.86	54.00	-26.14	AVG		
6	2479.960	-2.50	73.19	70.69	54.00	16.69	AVG	*	

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission below 1GHz (30MHz to 1GHz)

Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2402MHz	Test Voltage:	DC 5V
Temperature:	24.3℃		Phase:	Vertical
Relative Humidity:	50%		Pressure:	101.5KPa



No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	44.9004	12.74	7.37	20.11	40.00	-19.89	QP		
2	108.6470	10.04	7.71	17.75	43.50	-25.75	QP		
3	226.8934	11.02	11.39	22.41	46.00	-23.59	QP		
4	431.0314	15.30	16.17	31.47	46.00	-14.53	QP		
5	492.4685	15.87	14.81	30.68	46.00	-15.32	QP		
6	721.7258	20.15	12.40	32.55	46.00	-13.45	QP	*	

Test Mode:	8DPSK	2402MHz	Test Voltage:	DC 5V
Temperature:	24.3℃		Phase:	Horizontal
Relative Humidity:	50%		Pressure:	101.5KPa

No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	45.0583	12.78	7.34	20.12	40.00	-19.88	QP		
2	122.8336	8.82	9.13	17.95	43.50	-25.55	QP		
3	235.8163	11.10	13.38	24.48	46.00	-21.52	QP		
4	431.0314	15.30	20.46	35.76	46.00	-10.24	QP	*	
5	492.4685	15.87	16.19	32.06	46.00	-13.94	QP		
6	798.9796	20.68	12.23	32.91	46.00	-13.09	QP		

4.8. CONDUCTED EMISSION TEST

4.8.1. Applicable Standard

According to FCC Part 15.207(a)

4.8.2. Conformance Limit

Conducted Emission Limit		
Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50
Note: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.		

Remark: Test results were obtained from the following equation:
Measurement (dBμV) = LISN Factor (dB) + Cable Loss (dB) + Reading (dBμV)
Margin (dB) = Measurement (dBμV) - Limit (dBμV)

4.8.3. Test Configuration

Test according to clause 3.3 conducted emission test setup

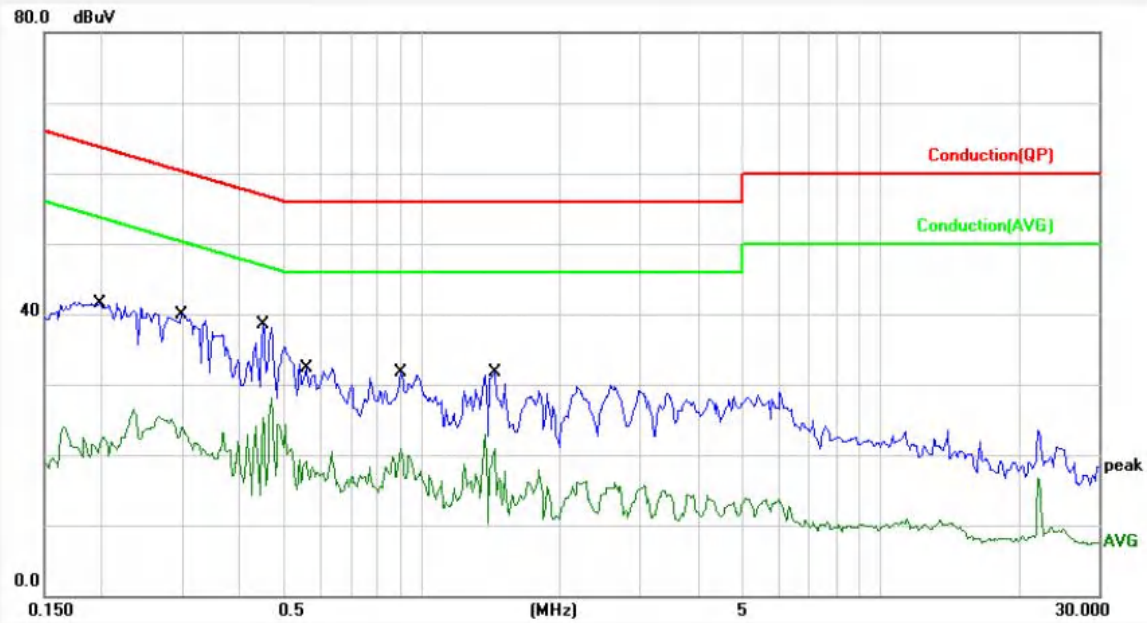
4.8.4. Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Repeat above procedures until all frequency measured were complete.

Test Results :PASS

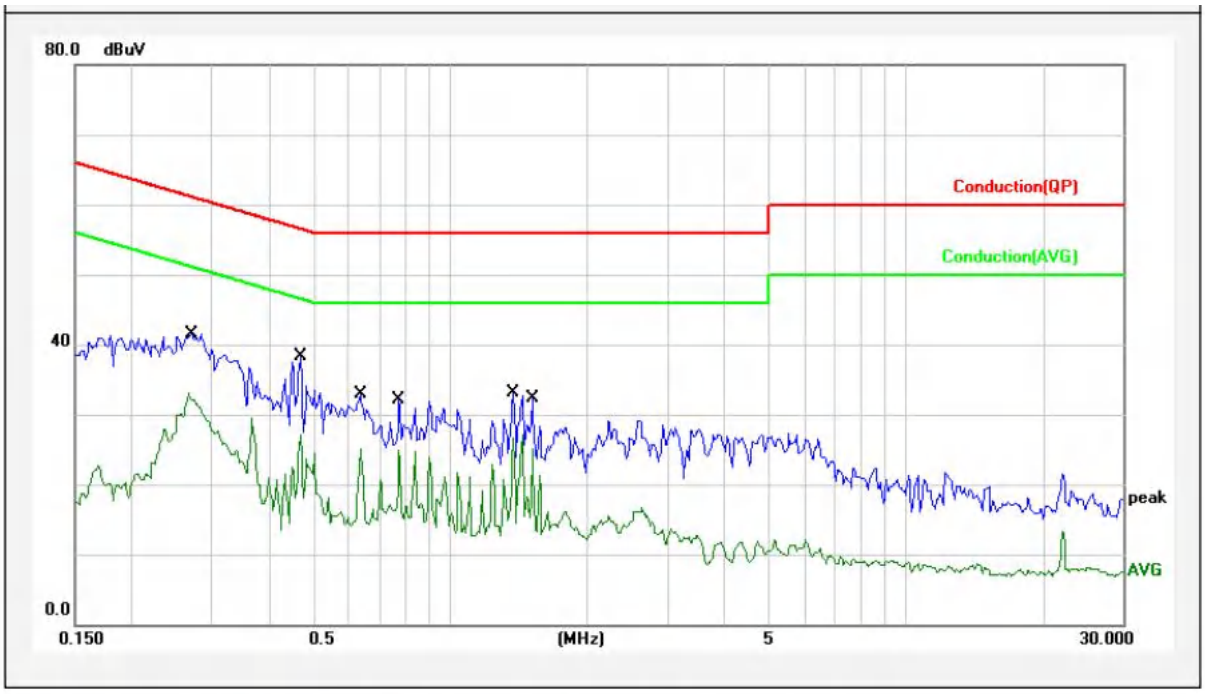
Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2402MHz	Test Voltage:	AC 120V/60Hz
Temperature:	22.2℃		Phase:	L1
Relative Humidity:	44%		Pressure:	101.5KPa



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1985	10.31	27.84	38.15	63.67	-25.52	QP	P	
2	0.1985	10.31	11.26	21.57	53.67	-32.10	AVG	P	
3	0.3000	10.34	25.88	36.22	60.24	-24.02	QP	P	
4	0.3000	10.34	13.53	23.87	50.24	-26.37	AVG	P	
5	0.4504	10.39	25.17	35.56	56.87	-21.31	QP	P	
6	0.4504	10.39	14.91	25.30	46.87	-21.57	AVG	P	
7	0.5584	10.42	19.04	29.46	56.00	-26.54	QP	P	
8	0.5584	10.42	8.76	19.18	46.00	-26.82	AVG	P	
9	0.9010	10.52	17.92	28.44	56.00	-27.56	QP	P	
10	0.9010	10.52	10.36	20.88	46.00	-25.12	AVG	P	
11	1.4415	10.57	17.90	28.47	56.00	-27.53	QP	P	
12	1.4415	10.57	10.40	20.97	46.00	-25.03	AVG	P	

Test Mode:	8DPSK	2402MHz	Test Voltage:	AC 120V/60Hz
Temperature:	22.2℃		Phase:	N
Relative Humidity:	44%		Pressure:	101.5KPa



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2671	10.37	28.14	38.51	61.21	-22.70	QP	P	
2	0.2671	10.37	22.46	32.83	51.21	-18.38	AVG	P	
3	0.4687	10.42	25.22	35.64	56.54	-20.90	QP	P	
4	0.4687	10.42	16.66	27.08	46.54	-19.46	AVG	P	
5	0.6344	10.46	19.28	29.74	56.00	-26.26	QP	P	
6	0.6344	10.46	14.57	25.03	46.00	-20.97	AVG	P	
7	0.7742	10.48	19.08	29.56	56.00	-26.44	QP	P	
8	0.7742	10.48	14.38	24.86	46.00	-21.14	AVG	P	
9	1.3744	10.56	19.56	30.12	56.00	-25.88	QP	P	
10	1.3744	10.56	16.10	26.66	46.00	-19.34	AVG	P	
11	1.5122	10.56	18.87	29.43	56.00	-26.57	QP	P	
12	1.5122	10.56	14.53	25.09	46.00	-20.91	AVG	P	

4.9. ANTENNA APPLICATION

4.9.1. Antenna Requirement

Standard	Requirement
FCC CRF Part 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.9.2. Result

PASS.

The EUT has 1 antenna: PCB Antenna for BT with classic mode, the gain is 2.05dBi;

☒ Antenna use a permanently attached antenna which is not replaceable.
☐ Not using a standard antenna jack or electrical connector for antenna replacement
☐ The antenna has to be professionally installed (please provide method of installation)

Note: which in accordance to section 15.203, please refer to the internal photos.

--------- END OF REPORT --------