TEST REPORT

Product Name	:	E-drum monitor speaker
Model Number	:	SK-50
FCC ID	:	2BKFZ-SK-50

Prepared for	:	NINGBO HAMPBACK CULTURE TECHNOLOGY CO.,LTD.
Address	:	No. 335, Jingu Middle Road, Yinzhou District, Ningbo, China
Prepared by	:	EMTEK (NINGBO) CO., LTD.
Address	:	No. 8, Building 8, Lane 216, Qingyi Road, Ningbo Hi-Tech Zone, Ningbo, Zhejiang, China Tel: +86-574-27907998 Fax: +86-574-27721538

Report Number	:	ENB2407240027W00201R
Date(s) of Tests	:	July 24, 2024 to August 13, 2024
Date of issue	:	August 19, 2024

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1 TEST RESULT CERTIFICATION

Applicant	:	NINGBO HAMPBACK CULTURE TECHNOLOGY CO.,LTD.
Address	:	No. 335, Jingu Middle Road, Yinzhou District, Ningbo, China
Manufacturer	:	NINGBO HAMPBACK CULTURE TECHNOLOGY CO.,LTD.
Address	:	No. 335, Jingu Middle Road, Yinzhou District, Ningbo, China
EUT	:	E-drum monitor speaker
Model Name	:	SK-50
Trademark	:	N/A

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C	PASS

The above equipment was tested by EMTEK (NINGBO) CO., LTD.The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Date of Test : July 24, 2024 to August 13, 2024

Prepared by : June Gao /Engineer

Reviewer : Lucas Xu /Supervisor

Approve & Authorized Signer : Tony wei/Manager

Modified History

Version	Report No.	Revision Date	Summary
/	ENB2407240027W00201R	/	Original report

2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Product Name	E-drum monitor speaker
Model number	SK-50
Sample number	ENB2407240027W002-1-1
Device Type	Bluetooth V5.0
Data Rate	1Mbps for GFSK modulation 2Mbps for pi/4-DQPSK modulation 3Mbps for 8DPSK modulation
Modulation	GFSK pi/4-DQPSK 8DPSK
Operating Frequency Range	2402-2480MHz
Number of Channels	79 channels
Max Transmit Power	1.53 dBm
Antenna Type	PCB Antenna
Gain	1.67 dBi
Test Voltage	AC 120V, 60Hz
Temperature Range	-10℃ to +45℃
Date of Received	July 24, 2024

Note: for more details, please refer to the User's manual of the EUT.

3 SUMMARY OF TEST RESULT

FCC PartClause	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(c)	Conducted Spurious Emissions	PASS	
15.247(d) 15.209	Radiated Spurious Emissions	PASS	
15.207	Conducted Emission	PASS	
15.203	Antenna Application	PASS	
NOTE1:N/A (Not Applicable)			

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2BKFZ-SK-50 filing to comply with Section 15.247 of the FCC Part 15, Subpart C.

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:
FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C
FCC KDB 558074 D01 15.247 Meas Guidance v05r02

4.2 MEASUREMENT EQUIPMENT USED

4.2.1 Conducted Emission Test Equipment

Equ.No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-001	EMI Test Receiver	R & S	ESCI	101108	Dec 14, 2023	1 Year
ENE-158	L.I.S.N	Schwarzbeck	NNLK 8129	0373	Nov 17, 2023	1 Year
ENE-004	L.I.S.N	Schwarzbeck	NSLK 8126	8126-462	July 02, 2024	1 Year
ENE-006	Pulse Limiter	MTS-systemtechnik	IMP-136	2611115-001-0033	July 02, 2024	1 Year
ENE-278	RF Switching Unit	HTEC	HRSU	222101	July 02, 2024	1 Year
ENE-083	RF Cable	Hubber Suhner/Swiss	CBL-RE-3	/	May 30, 2024	1 Year
ENE-162-2	RF Cable	TIMES	2M(N-N)	605236-0002	May 30, 2024	1 Year
ENE-149	Conduction Test Room 1#	SKET	11.5*5*4m	/	Dec 17, 2021	3 Year

4.2.2 Radiated Emission Test Equipment

Equ. No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-185	EMI Test Receiver	R&S	ESR7	102480	Apr 25, 2024	1 Year
ENE-190	Antenna Multiple	Schwarzbeck	VULB 9163	01499	May 18, 2024	2 Year
ENE-195	Pre-Amplifier	JS Denki	PA09K03-40	JSPA21019	Apr 25, 2024	1 Year
ENE-204	Low Frequency Notch Filter RF Switching	JS Denki	JSDSW-F	JSDSW2211D02	Apr 25, 2024	1 Year
ENE-251	6dB Attenuator	Mini-Circuits	UNAT-6+	11542	July 02, 2024	1 Year
ENE-279-1	RF Cable	Rosenberger	L17-C001-7000	/	May 30, 2024	1 Year
ENE-279-2	RF Cable	Rosenberger	L17-C001-3500	/	May 30, 2024	1 Year
ENE-279-3	RF Cable	Rosenberger	L17-C001-1500	/	May 30, 2024	1 Year
ENE-279-4	RF Cable	Rosenberger	/	/	May 30, 2024	1 Year
ENE-279-5	RF Cable	Rosenberger	/	/	May 30, 2024	1 Year
ENE-279-6	RF Cable	Rosenberger	L08-C446-1500	/	May 30, 2024	1 Year

ENE-171	EXA Signal Analyzer	KEYSIGHT	N9010B	MY60242467	Dec 14, 2023	1 Year
ENE-191	Horn Antenna	Schwarzbeck	BBHA 9120 D	02588	May 18, 2024	2 Year
ENE-198	Pre-Amplifier	JS Denki	PA0118-50	JSPA21022	Apr 25, 2024	1 Year
ENE-281-1	RF Cable	Rosenberger	LA2-C125-3500	/	May 30, 2024	1 Year
ENE-281-2	RF Cable	Rosenberger	LA2-C125-1500	/	May 30, 2024	1 Year
ENE-281-3	RF Cable	Rosenberger	LU7-C1511-1200	/	May 30, 2024	1 Year
ENE-285-1	RF Cable	Rosenberger	LA2-C199-6500	/	May 30, 2024	1 Year
ENE-206	High Frequency Notch FilterRf Switching	JS Denki	JSDSW-F	202083582	Apr 25, 2024	1 Year
ENE-144	3-Meter Anechoic Chamber 2#	SKET	9*6*6m	/	June 19, 2022	3 Year

4.2.3 Radio Frequency Test Equipment

Equ. No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ENE-256	EXA Signal Anaalyzer	Keysight	N9010B	MY62060219	July 02, 2024	1 Year
ENE-172	RF Control Unit	Tonscend	JS0806-2(V.6E)	21L8060521	February 27, 2024	1 Year

4.3 DESCRIPTION OF TEST 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 Bluetooth GFSK modulation; 2Mbps for Bluetooth pi/4-DQPSK modulation; 3Mbps for Bluetooth 8DPSK) 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 for Bluetooth V5.0

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 for Bluetooth V5.0

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

4.4 TEST SOFTWARE

Item	Software
Radiated Emission:	FCC (V2.23)
Conducted Emission	FCC (V2.23)

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No. 8, Building 8, Lane 216, Qingyi Road, Ningbo Hi-Tech Zone, Ningbo, Zhejiang, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 32.

5.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

EMC Lab. : **Accredited by CNAS**
The Certificate Registration Number is L6666.
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2018 (identical to ISO/IEC 17025:2017)

Designation by FCC
Designation Number: CN1354
Test Firm Registration Number: 427606

Accredited by A2LA
The certificate is valid until May 31, 2025

Accredited by Industry Canada
The Conformity Assessment Body Identifier is CN0114
Test Firm Registration Number: 9469A

Name of Firm : EMTEK (NINGBO) CO., LTD.
Site Location : No. 8, Building 8, Lane 216, Qingyi Road, Ningbo Hi-Tech Zone, Ningbo, Zhejiang, China

6 TEST SYSTEM UNCERTAINTY

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

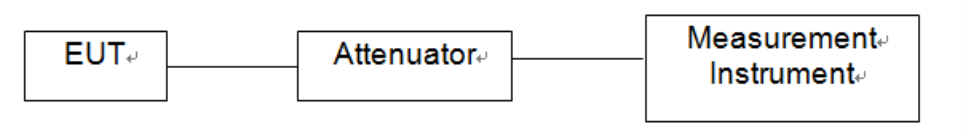
Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0dB
Conducted Emissions Test	±2.0dB
Radiated Emission Test	±2.0dB
Occupied Bandwidth Test	±1.0dB
Band Edge Test	±3dB
All emission, radiated	±3dB
Antenna Port Emission	±3dB
Temperature	±0.5℃
Humidity	±3%

Measurement Uncertainty for a level of Confidence of 95%

7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP 1

The Bluetooth 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.



7.2 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 C63.10-2014 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz：

The EUT is placed on a turntable 0.8 meters 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 androtated about its vertical axis formaximum response at each azimuth about the EUT. The center of the loopshall be 1 m above the ground.For certain applications, the loop antennaplane may also need to be positioned horizontally at the specified distance from the EUT.

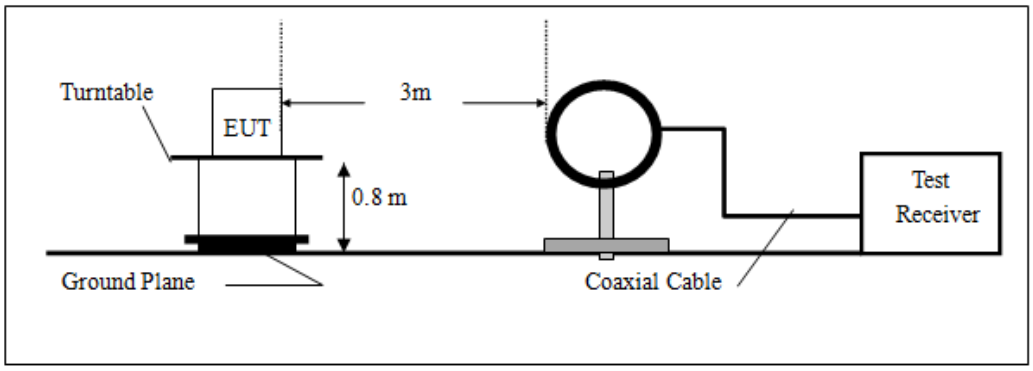
30MHz-1GHz：

The EUT is placed on a turntable 0.8 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).

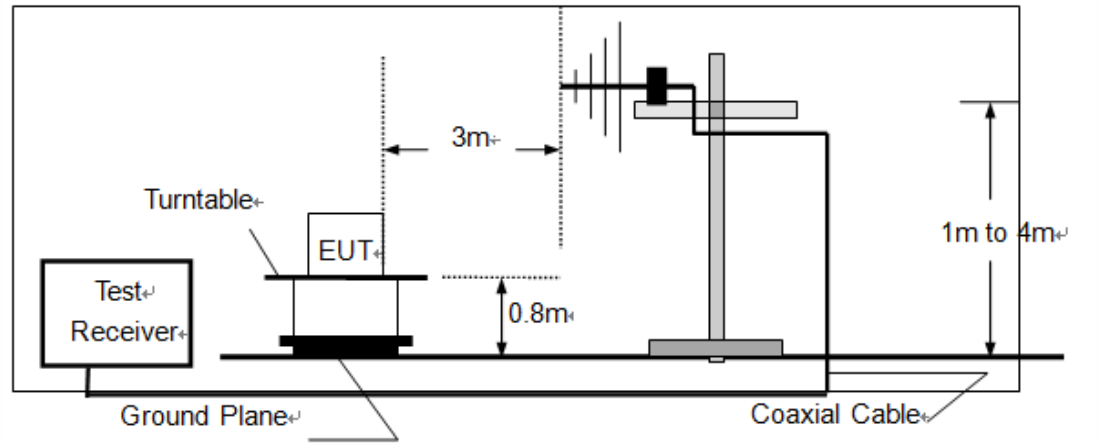
Above 1GHz：

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).

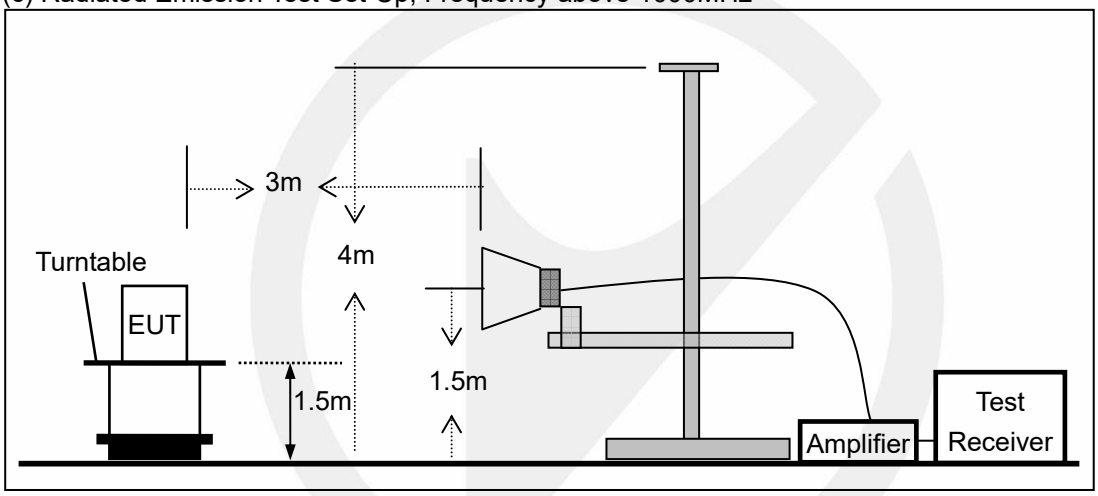
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



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

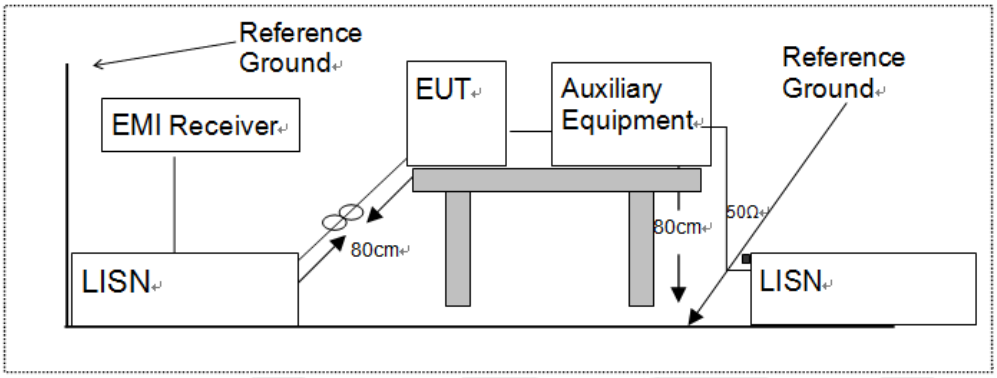


(c) Radiated Emission Test Set-Up, Frequency above 1000MHz



7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (Game fitness board) must be connected to LISN. The LISN shall be placed 0.8 m 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 0.1 m.
According to the requirements in Section 13.1.4.1 of ANSI C63.10-2014 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.



7.4 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
/	/	/	/

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.*

8 FREQUENCY HOPPING SYSTEM REQUIREMENTS

8.1 Standard Applicable

According to FCC Part 15.247(a)(1), The 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.

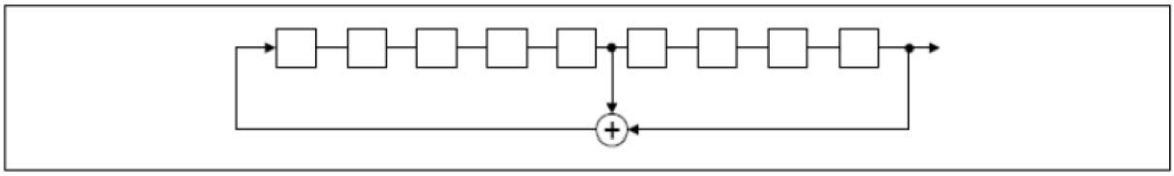
(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(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.

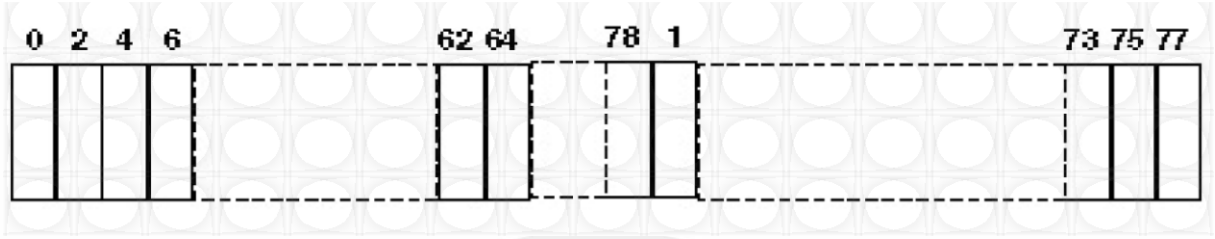
8.2 EUT Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels.
The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; thephase in the hopping sequence is determined by the Bluetooth clock of the master.The channel is divide into time slots where each slot corresponds to an RF hop frequency. Consecutive hopscorrespond to different RF hop frequencies. The normal hop is 1 600 hops/s.

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9
Length of pseudo-random sequence: 29-1 = 524 bits
Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence



Each frequency used equally on the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

8.3 Equal Hopping Frequency Use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

Example of a 79 hopping sequence in data mode:
35, 27, 6, 44, 14, 61, 74, 32, 1, 11, 23, 2, 55, 65, 29, 3, 9, 52, 78, 58, 40, 25, 0, 7, 18, 26, 76, 60, 47, 50, 2, 5, 16, 37, 70, 63, 66, 54, 20, 13, 4, 8, 15, 21, 26, 10, 73, 77, 67, 69, 43, 24, 57, 39, 46, 72, 48, 33, 17, 31, 75, 19, 41, 62, 68, 28, 51, 66, 30, 56, 34, 59, 71, 22, 49, 64, 38, 45, 36, 42, 53
Each Frequency used equally on the average by each transmitter

8.4 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH- enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

9 TEST REQUIREMENTS

9.1 20DB BANDWIDTH

Applicable Standard

According to FCC Part 15.247(a)(1) and 558074 D01 15.247 Meas Guidance V05r02

Conformance Limit

No limit requirement.

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

Test Procedure

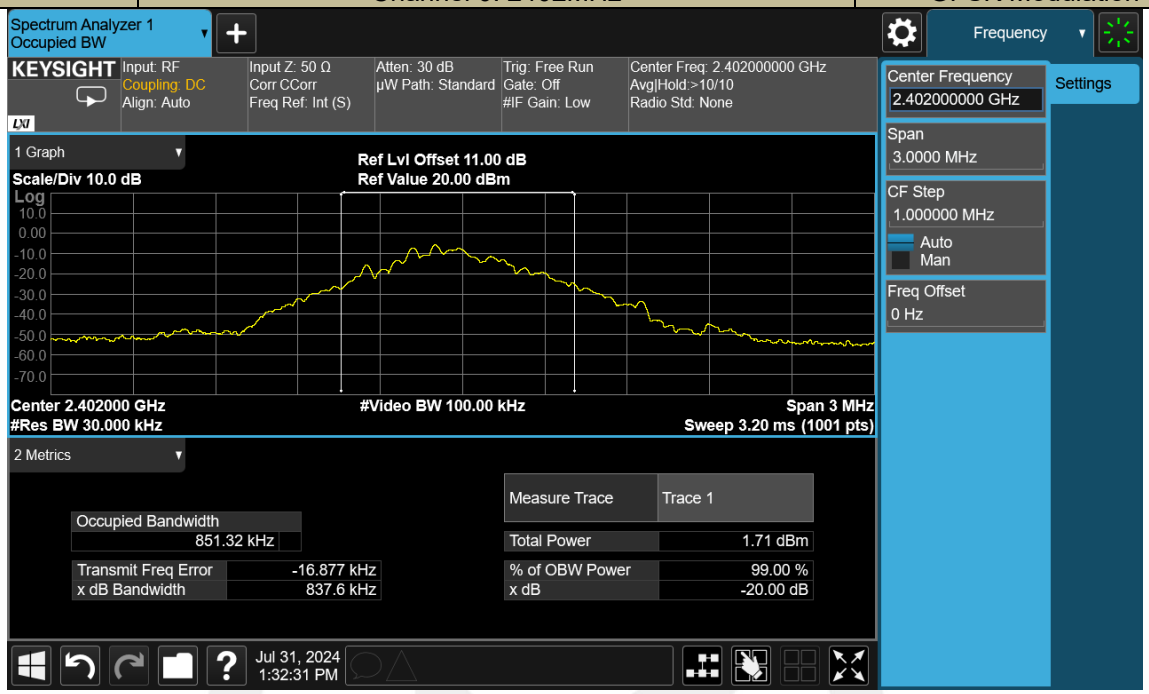
The EUT was operating in Bluetooth V5.0 and controlled its channel. Printed out the test result from the spectrum by hard copy function.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously
Set RBW = 30 kHz.
Set the video bandwidth (VBW) =100kHz.
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 themarker-delta function to measure 20 dB down one side of the emission. Reset the markerdeltafunction, and move the marker to the other side of the emission, until it is (asclose as possible to) even with the reference marker level. The marker-delta reading atthis point is the 20 dB bandwidth of the emission.
If this value varies with differentmodes of operation (e.g., data rate, modulation format, etc.), repeat this test for eachvariation.
Measure and record the results in the test report.

Test Results

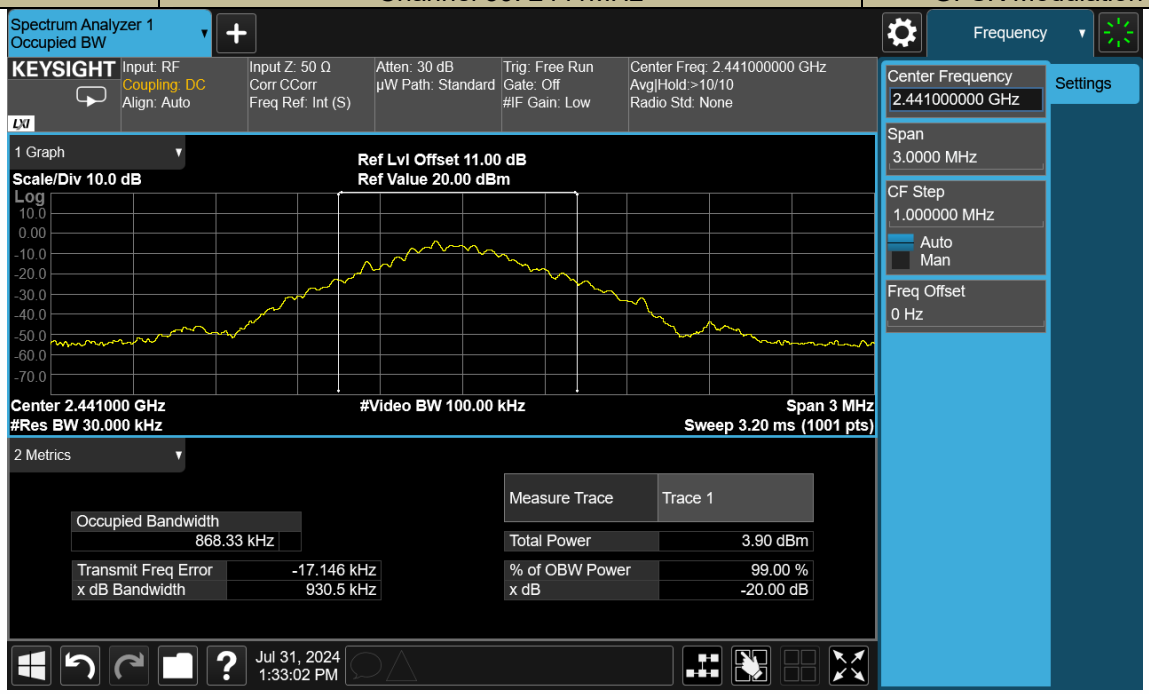
Temperature:	26 ℃	Test Date:	July 31, 2024
Humidity:	60%	Test By:	Lucas Xu

Modulation Mode	Channel Number	Channel Frequency (MHz)	20dB Bandwidth (MHz)
GFSK	0	2402	0.8376
	39	2441	0.9305
	78	2480	0.9260
pi/4-DQPSK	0	2402	1.2620
	39	2441	1.2800
	78	2480	1.2760
8DPSK	0	2402	1.2260
	39	2441	1.2760
	78	2480	1.2770

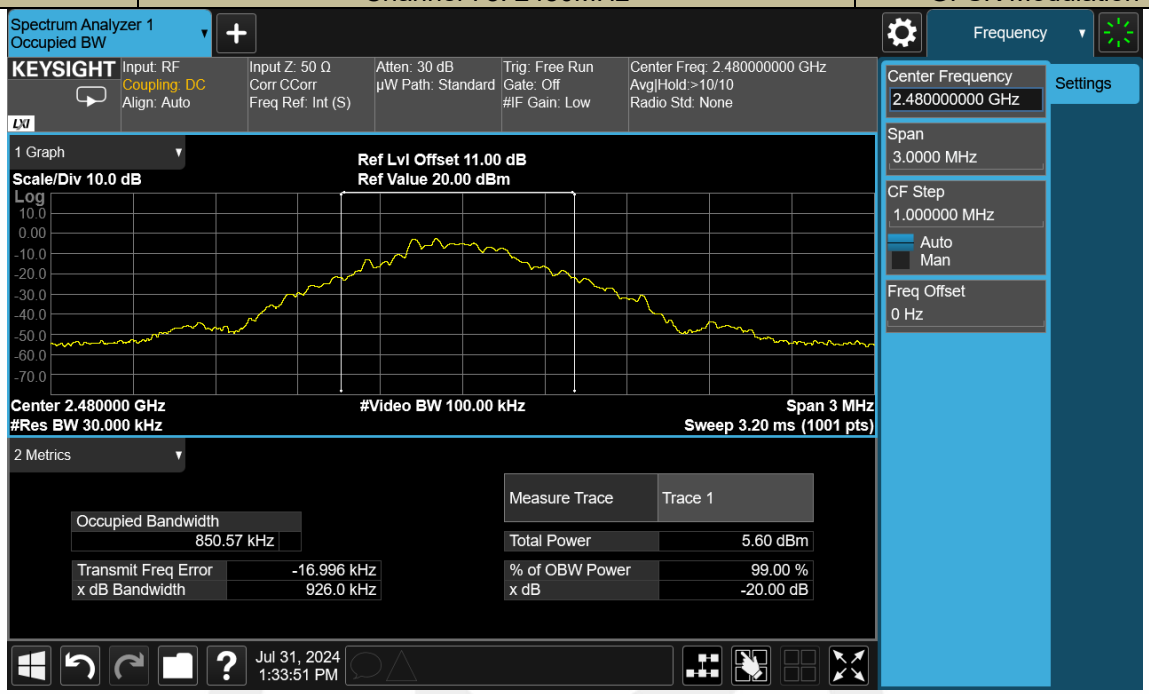
Test Model	20dB Bandwidth	
	Channel 0: 2402MHz	GFSK Modulation



Test Model	20dB Bandwidth	
	Channel 39: 2441MHz	GFSK Modulation



Test Model	20dB Bandwidth	
	Channel 78: 2480MHz	GFSK Modulation



Test Model	20dB Bandwidth	
	Channel 0: 2402MHz	pi/4-DQPSK Modulation

Test Model	20dB Bandwidth	
	Channel 39: 2441MHz	pi/4-DQPSK Modulation

Test Model	20dB Bandwidth	
	Channel 78: 2480MHz	pi/4-DQPSK Modulation

Test Model	20dB Bandwidth	
	Channel 0: 2402MHz	8DPSK Modulation

Test Model	20dB Bandwidth	
	Channel 39: 2441MHz	8DPSK Modulation

Test Model	20dB Bandwidth	
	Channel 78: 2480MHz	8DPSK Modulation

9.2 CARRIER FREQUENCY SEPARATION

Applicable Standard

According to FCC Part 15.247(a)(1) and 558074 D01 15.247 Meas Guidance V05r02

Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall have hoppingchannel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth ofthe hopping channel, whichever is greater.
In case of an output power less than 125mW,the frequency hopping system may have channels separated by a minimum of 25kHz ortwo-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

Test Procedure

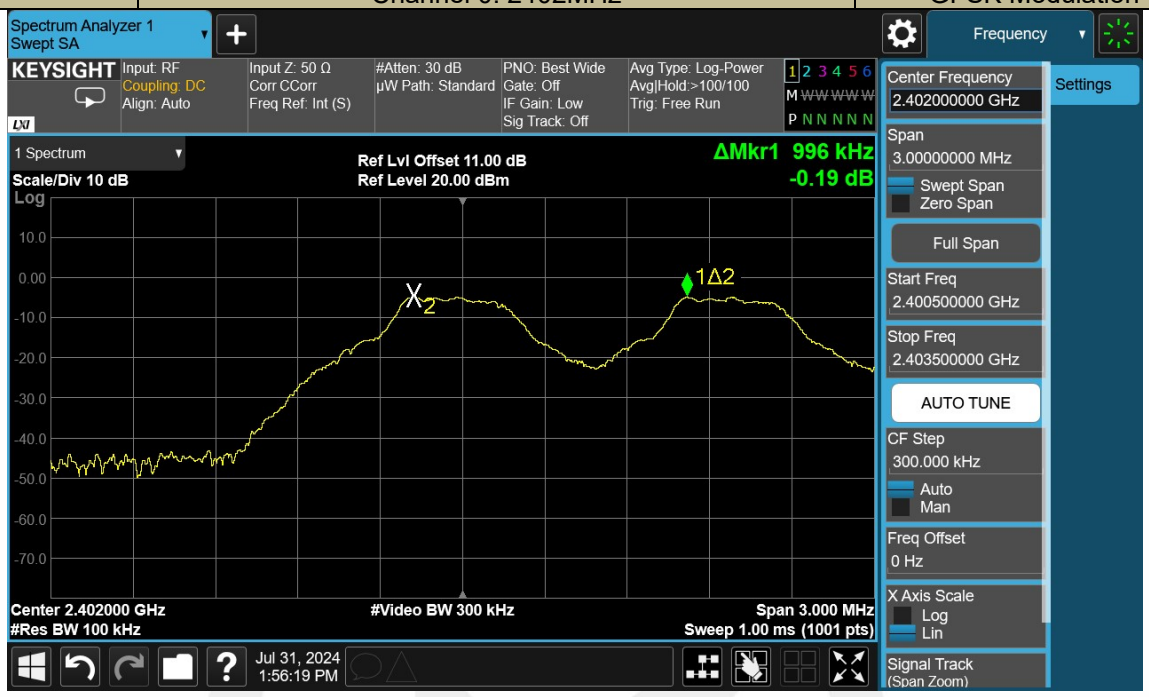
■ According to FCC Part15.247(a)(1)
The EUT must have its hopping function enabled. Use the following spectrum analyzersettings:
Set the RBW =100kHz. Set VBW =300kHz.
Set the span = wide enough to capture the peaks of two adjacent channels
Set Sweep time = auto couple.
Set Detector = peak. Set Trace 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

Temperature:	25 ℃	Test Date:	July 31, 2024
Humidity:	60%	Test By:	Lucas Xu

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	0	2402	0.996	＞0.56	PASS
	39	2441	1.014	＞0.62	PASS
	78	2480	0.999	＞0.62	PASS
pi/4-DQPSK	0	2402	0.999	＞0.84	PASS
	39	2441	0.993	＞0.85	PASS
	78	2480	1.002	＞0.86	PASS
8DPSK	0	2402	1.005	＞0.82	PASS
	39	2441	0.990	＞0.86	PASS
	78	2480	1.005	＞0.85	PASS
Note: Limit = 20dB bandwidth * 2/3, if it is greater than 25kHz and the output power is less than 125mW (21dBm).					

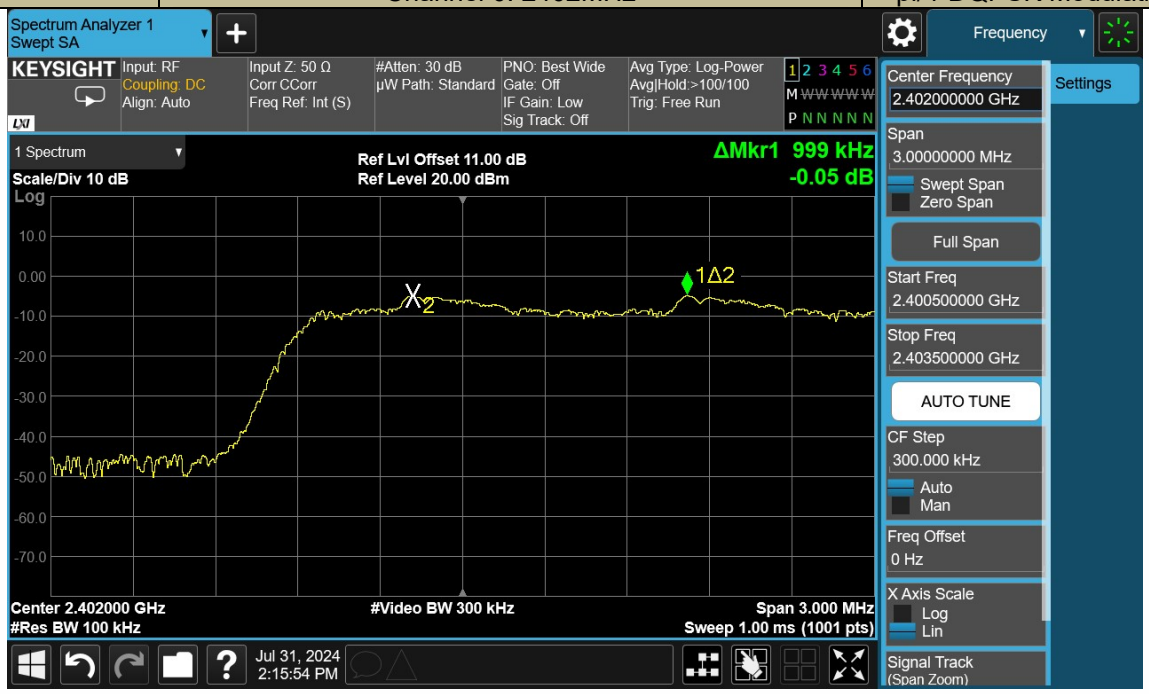
Test Model	Carrier Frequency Separation	
	Channel 0: 2402MHz	GFSK Modulation



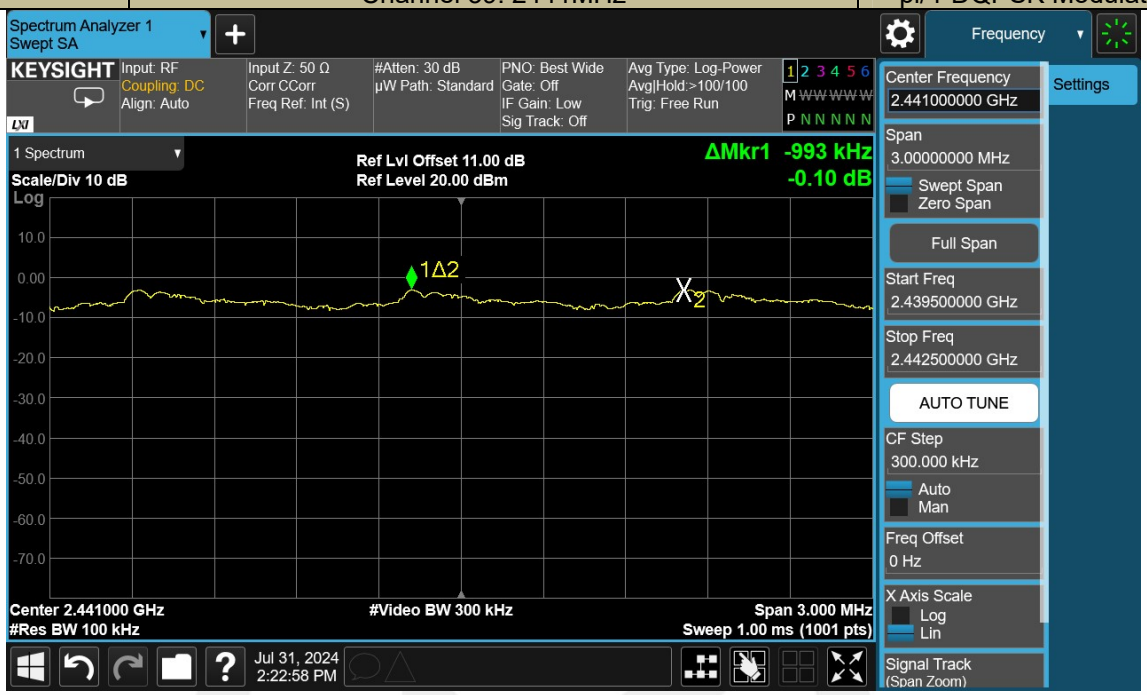
Test Model	Carrier Frequency Separation	
	Channel 39: 2441MHz	GFSK Modulation

Test Model	Carrier Frequency Separation	
	Channel 78: 2480MHz	GFSK Modulation

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

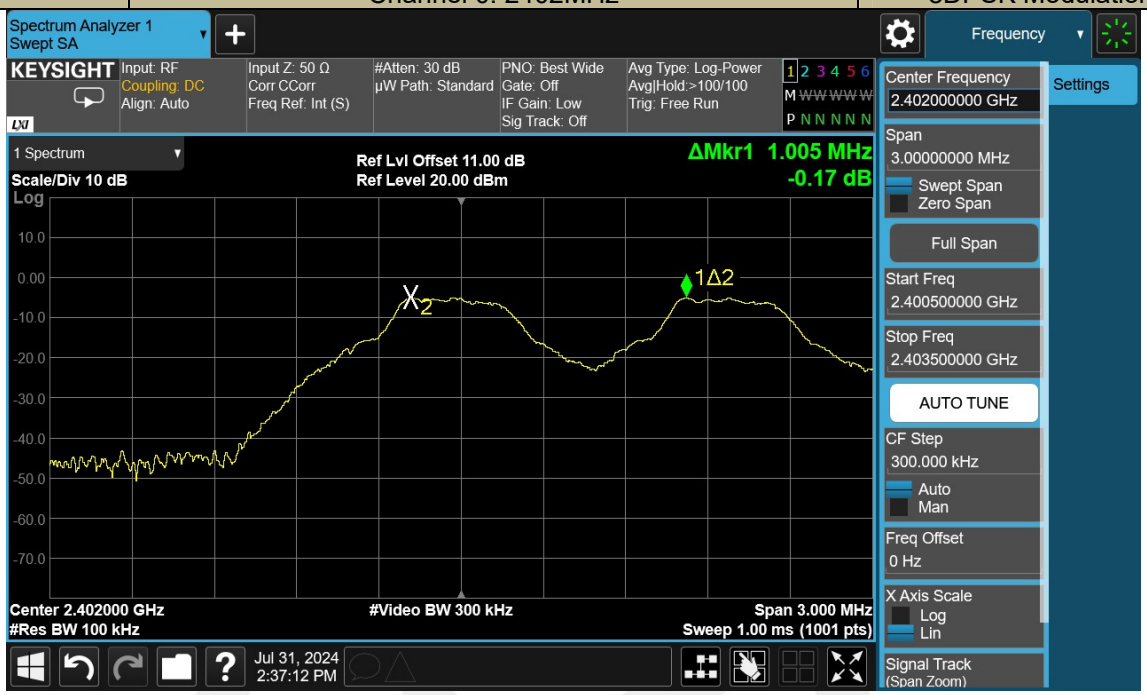


Test Model	Carrier Frequency Separation	
	Channel 39: 2441MHz	pi/4-DQPSK Modulation

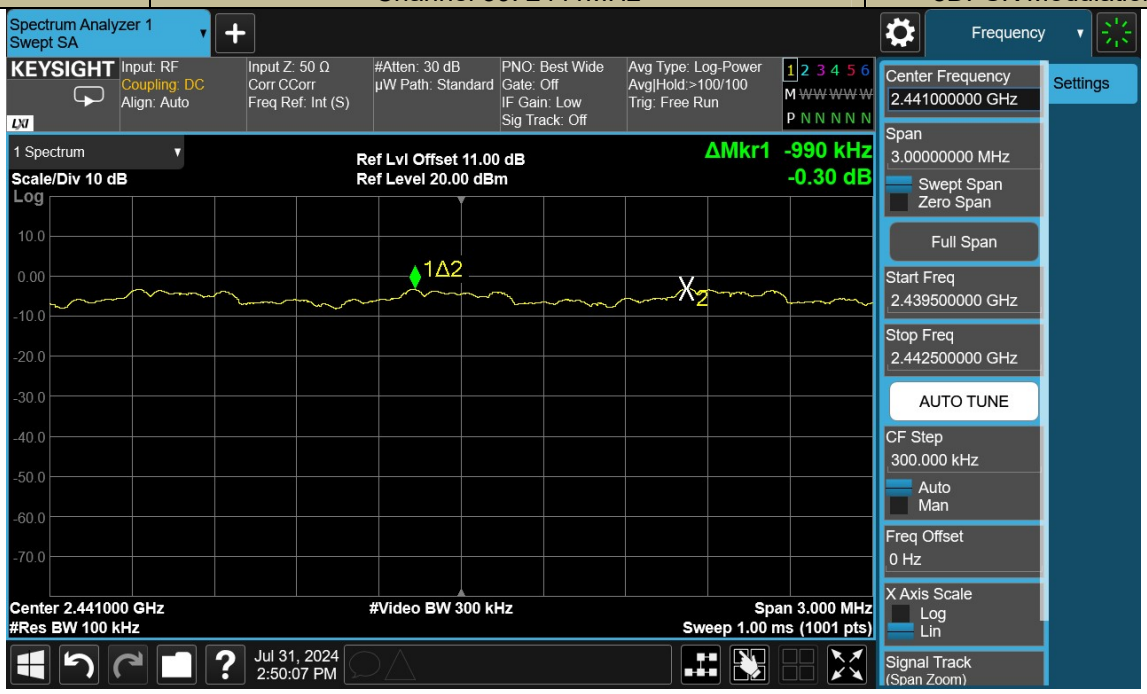


Test Model	Carrier Frequency Separation	
	Channel 78: 2480MHz	pi/4-DQPSK Modulation

Test Model	Carrier Frequency Separation	
	Channel 0: 2402MHz	8DPSK Modulation



Test Model	Carrier Frequency Separation	
	Channel 39: 2441MHz	8DPSK Modulation



Test Model	Carrier Frequency Separation	
	Channel 78: 2480MHz	8DPSK Modulation

9.3 NUMBER OF HOPPING FREQUENCIES

Applicable Standard

According to FCC Part 15.247(a)(1) (iii)and 558074 D01 15.247 Meas Guidance V05r02

Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall use at least15 channels.

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

Test Procedure

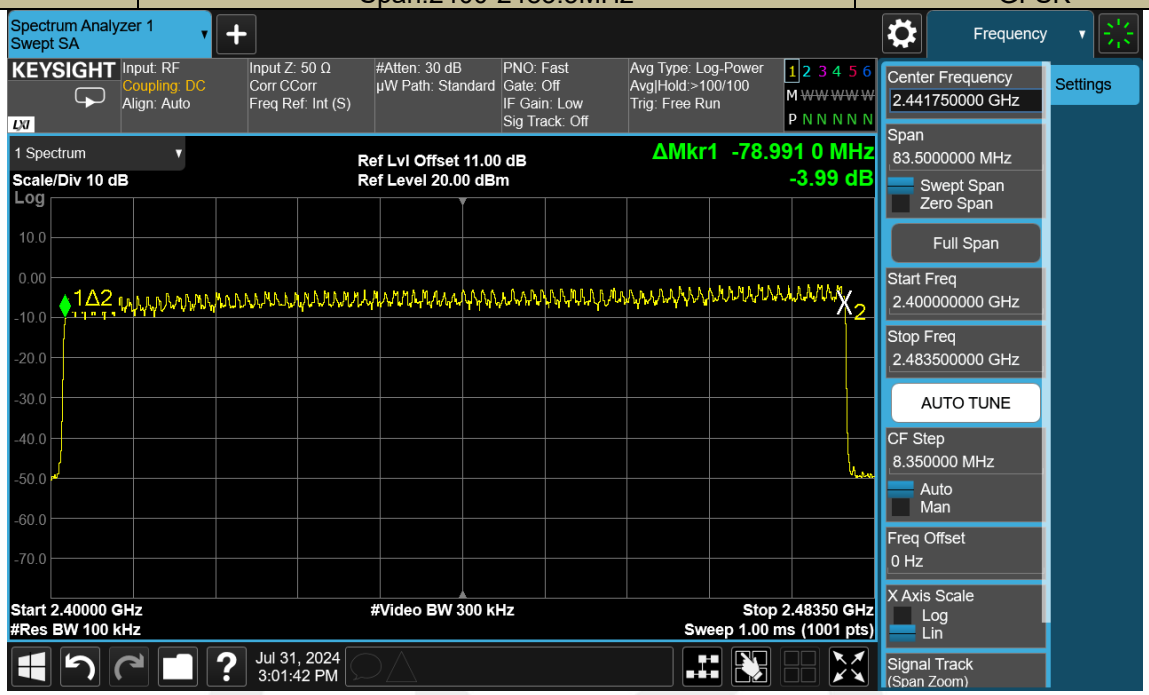
■ According to FCC Part15.247(a)(1)(iii)
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW = 100kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. It may prove necessary to break the span up to sections, inorder to clearly show all of the hopping frequencies.

Test Results

Temperature:	25 ℃	Test Date:	July 31, 2024
Humidity:	60%	Test By:	Lucas Xu

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel limit
2402-2480 (GFSK)	79	＞15
Note: Both BR & EDR mode has same result .		

Test Model	Number Of Hopping Frequencies	
	Span:2400-2483.5MHz	GFSK



9.4 AVERAGE TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

According to FCC Part 15.247(a)(1)(iii) and 558074 D01 15.247 Meas Guidance V05r02

Conformance Limit

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

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

Test Procedure

■ According to FCC Part15.247(a)(1)(iii)
The EUT must have its hopping function enabled. Use the following spectrum analyzersettings:
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 subparagraphsof this Section.

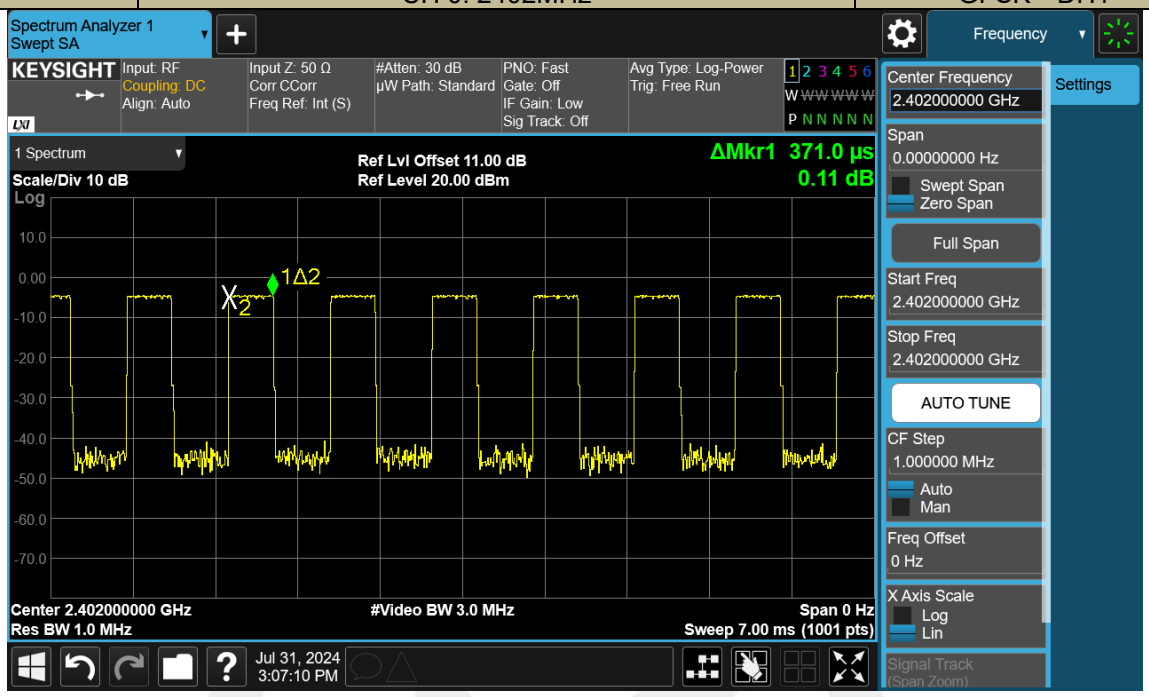
Test Results

Temperature:	25 ℃	Test Date:	July 31, 2024
Humidity:	60%	Test By:	Lucas Xu

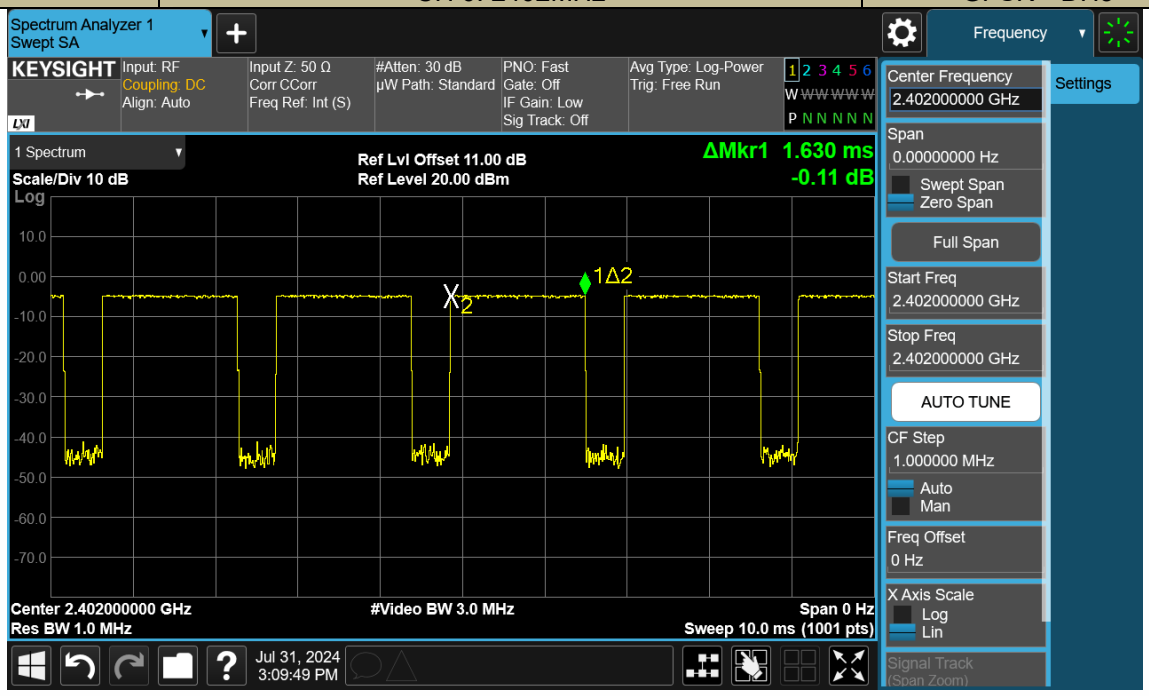
Modulation Mode	Channel Number	Packet type	Pluse width (ms)	DwellTime (ms)	Limit (ms)	Verdict
GFSK	0	DH1	0.371	118.72	<400	PASS
	0	DH3	1.630	260.80	<400	PASS
	0	DH5	2.880	307.20	<400	PASS

Note1: DwellTime(DH1)=PW*(1600/2/79)*31.6
DwellTime(DH3)=PW*(1600/4/79)*31.6
DwellTime(DH5)=PW*(1600/6/79)*31.6
Note2: Bluetooth (GFSK, pi/4-DQPSK, 8DPSK)mode have been tested, and the worst results has been recorded on the follow page.

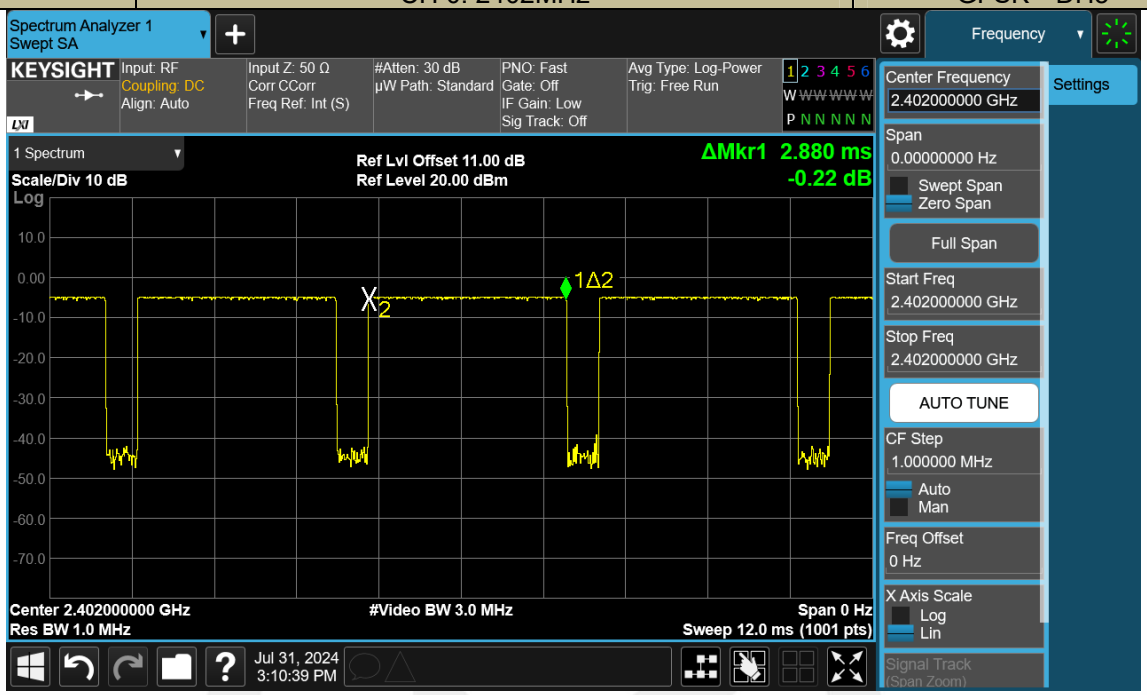
Test Model	Average Time Of Occupancy (Dwell Time)	
	CH 0: 2402MHz	GFSK DH1



Test Model	Average Time Of Occupancy (Dwell Time)	
	CH 0: 2402MHz	GFSK DH3



Test Model	Average Time Of Occupancy (Dwell Time)	
	CH 0: 2402MHz	GFSK DH5



9.5 MAXIMUM PEAK CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC Part 15.247(b)(1) and 558074 D01 15.247 Meas Guidance V05r02

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.

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

Test Procedure

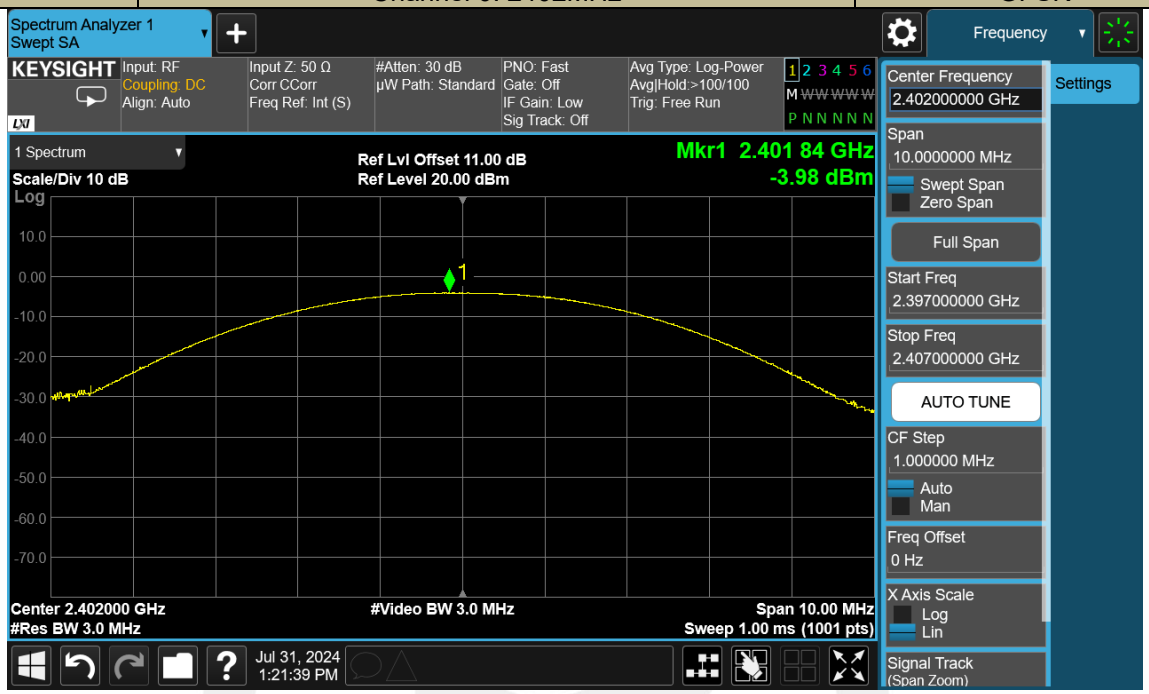
■ According to FCC Part15.247(b)(1)
As an alternative to a peak power measurement, compliance with the limit can be based on a measurement of the maximum conducted output power.
Use the following spectrum analyzer settings:
Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel(about 10MHz)
Set RBW > the 20 dB bandwidth of the emission being measured(about 3MHz)
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 emissionto determine the peak amplitude level.

Test Results

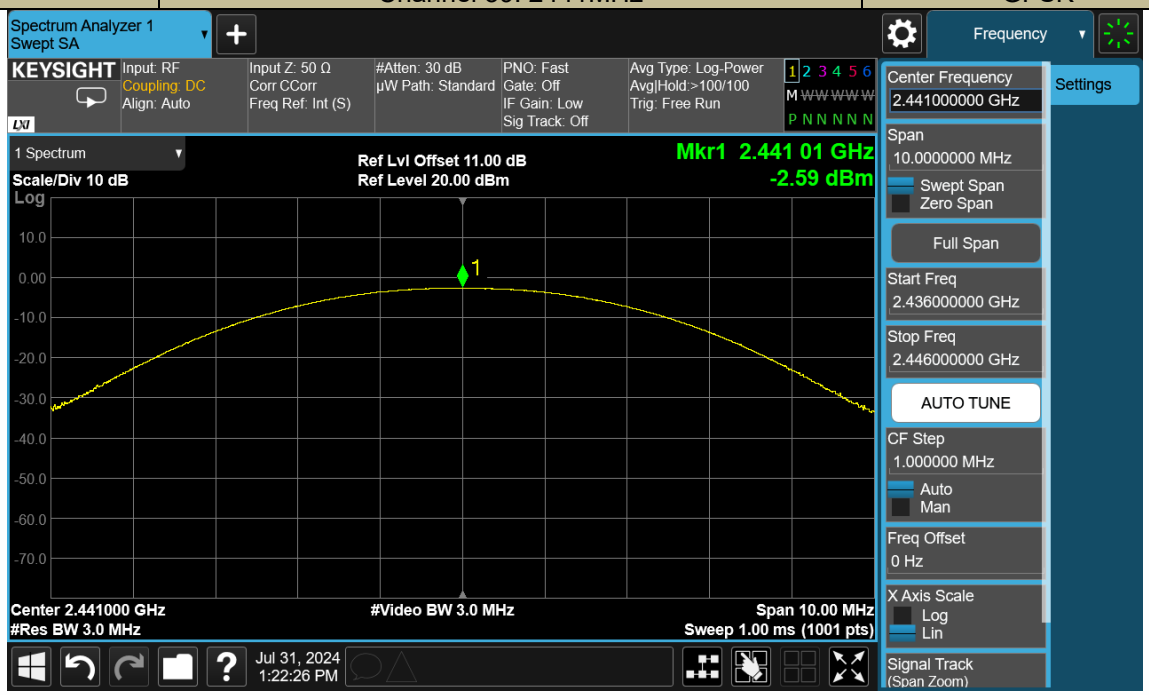
Temperature:	25 ℃	Test Date:	July 31, 2024
Humidity:	60%	Test By:	Lucas Xu

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
GFSK	0	2402	-3.98	21	PASS
	39	2441	-2.59	21	PASS
	78	2480	-1.26	21	PASS
pi/4-DQPSK	0	2402	-1.76	21	PASS
	39	2441	0.07	21	PASS
	78	2480	1.06	21	PASS
8DPSK	0	2402	-1.52	21	PASS
	39	2441	0.42	21	PASS
	78	2480	1.53	21	PASS
Note:N/A					

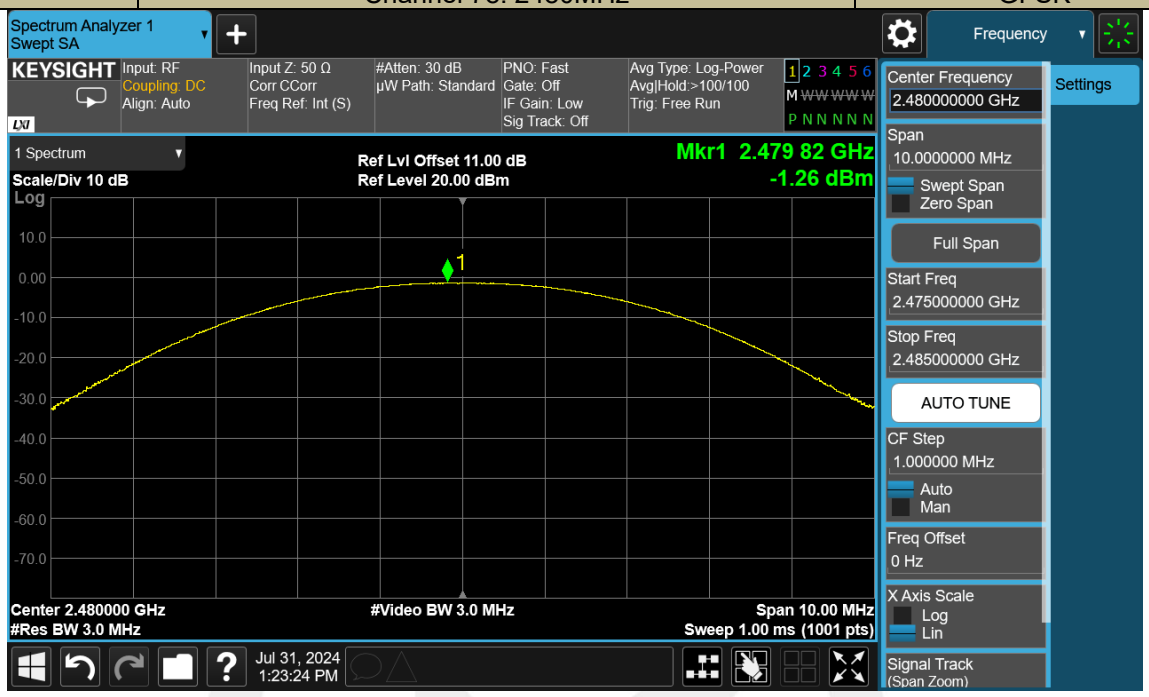
Test Model	Maximum PeakConducted Output Power	
	Channel 0: 2402MHz	GFSK



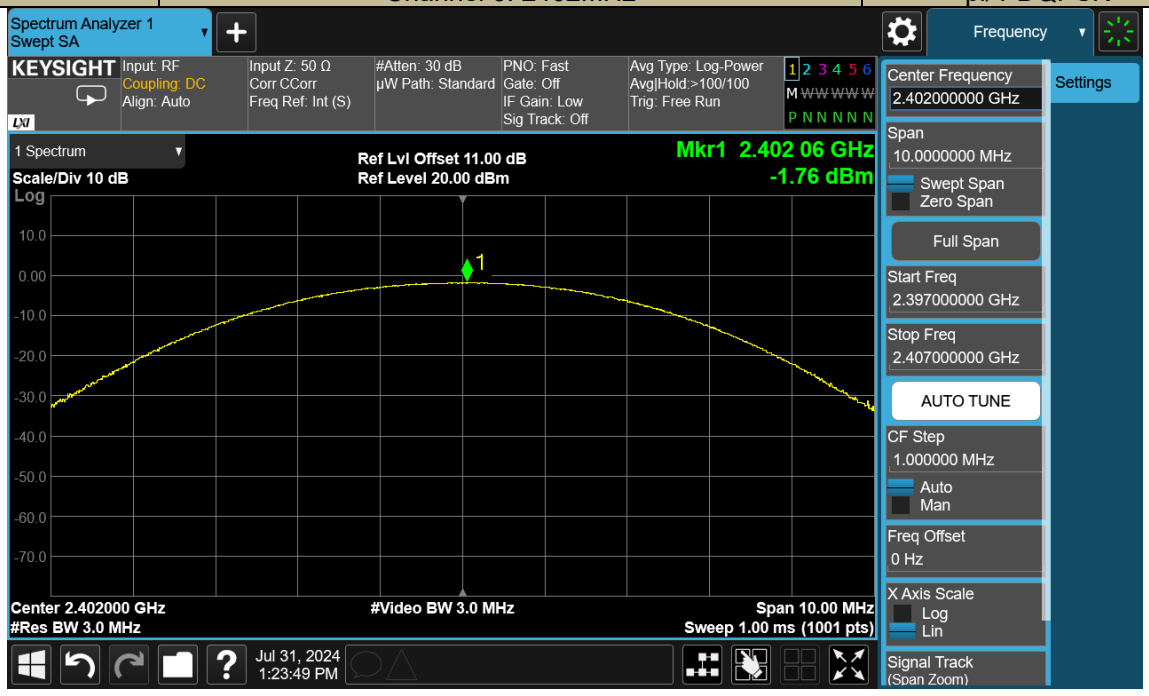
Test Model	Maximum PeakConducted Output Power	
	Channel 39: 2441MHz	GFSK



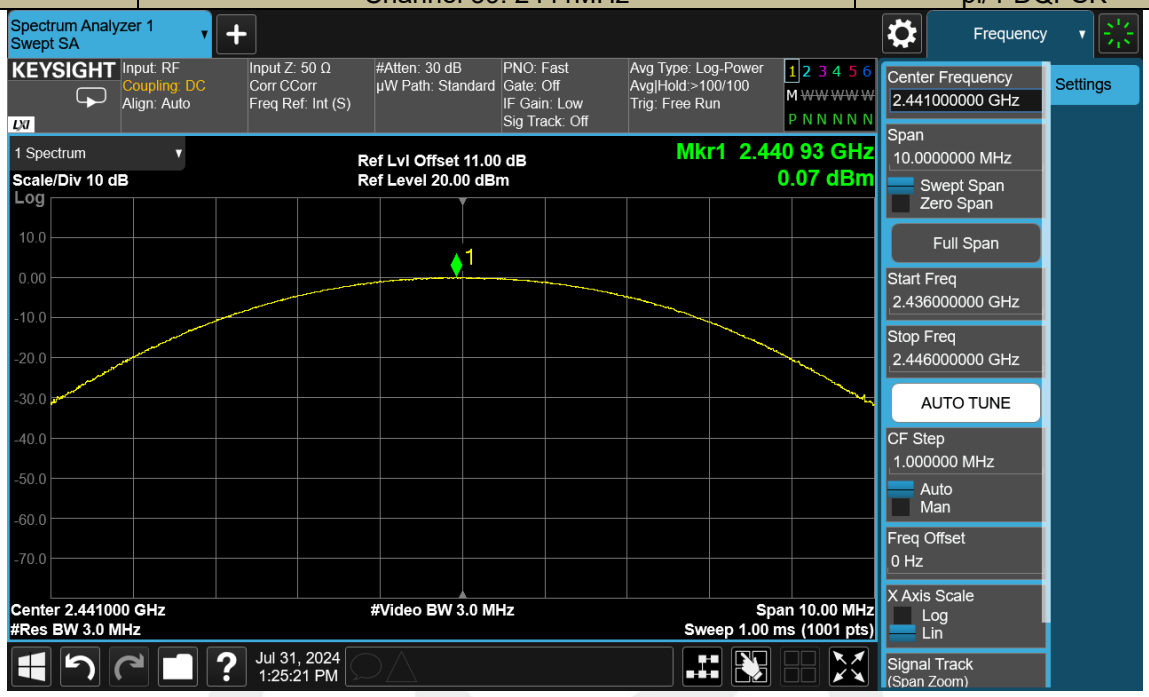
Test Model	Maximum PeakConducted Output Power	
	Channel 78: 2480MHz	GFSK



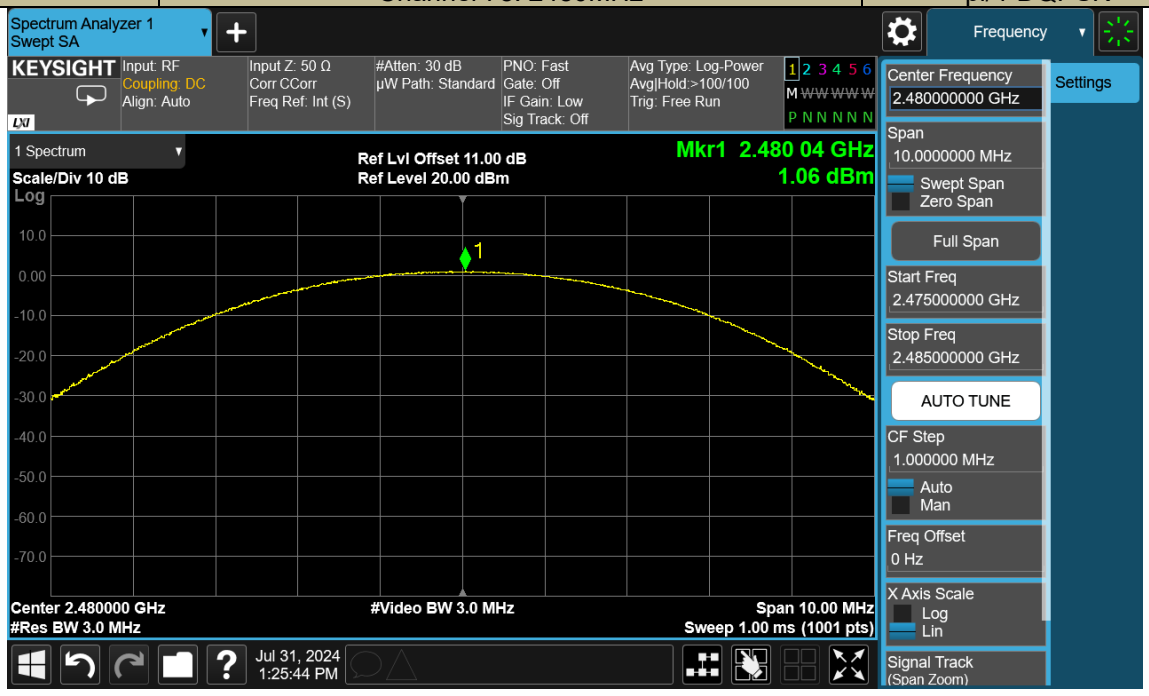
Test Model	Maximum PeakConducted Output Power	
	Channel 0: 2402MHz	pi/4-DQPSK



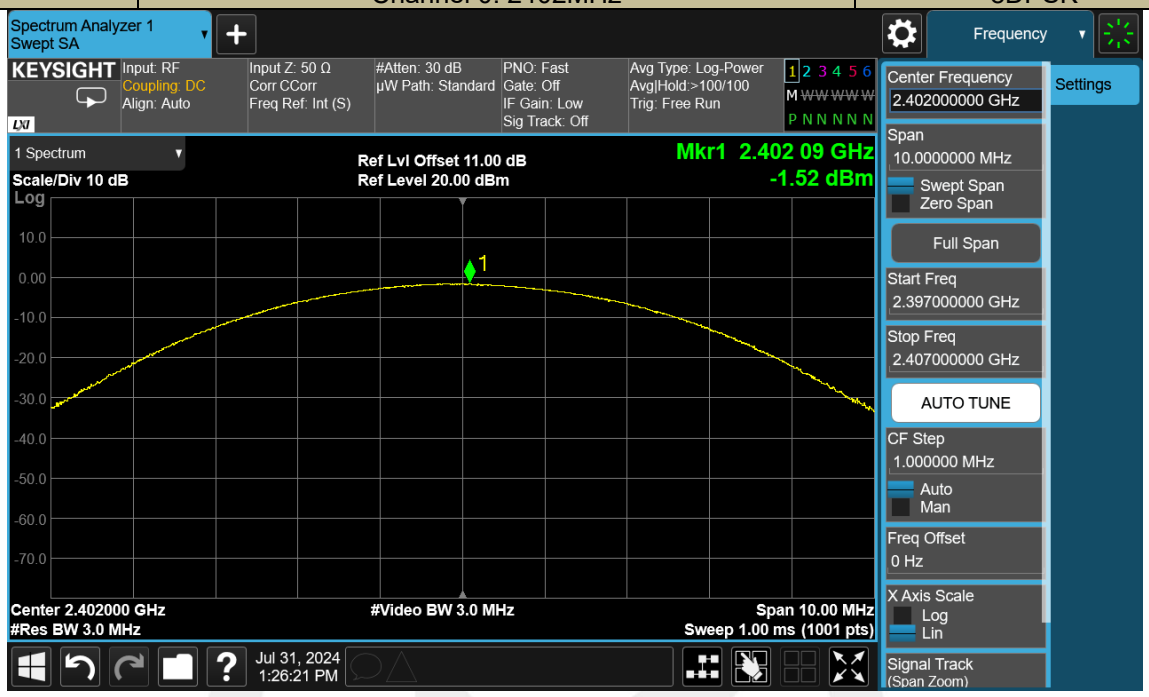
Test Model	Maximum PeakConducted Output Power	
	Channel 39: 2441MHz	pi/4-DQPSK



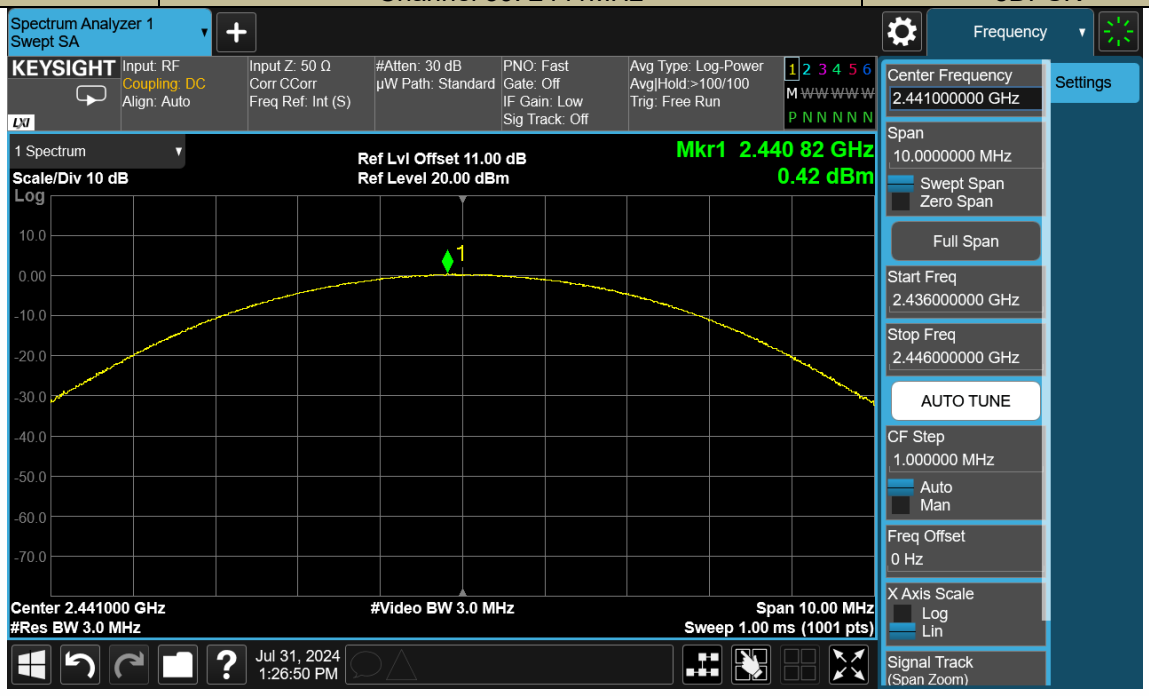
Test Model	Maximum PeakConducted Output Power	
	Channel 78: 2480MHz	pi/4-DQPSK



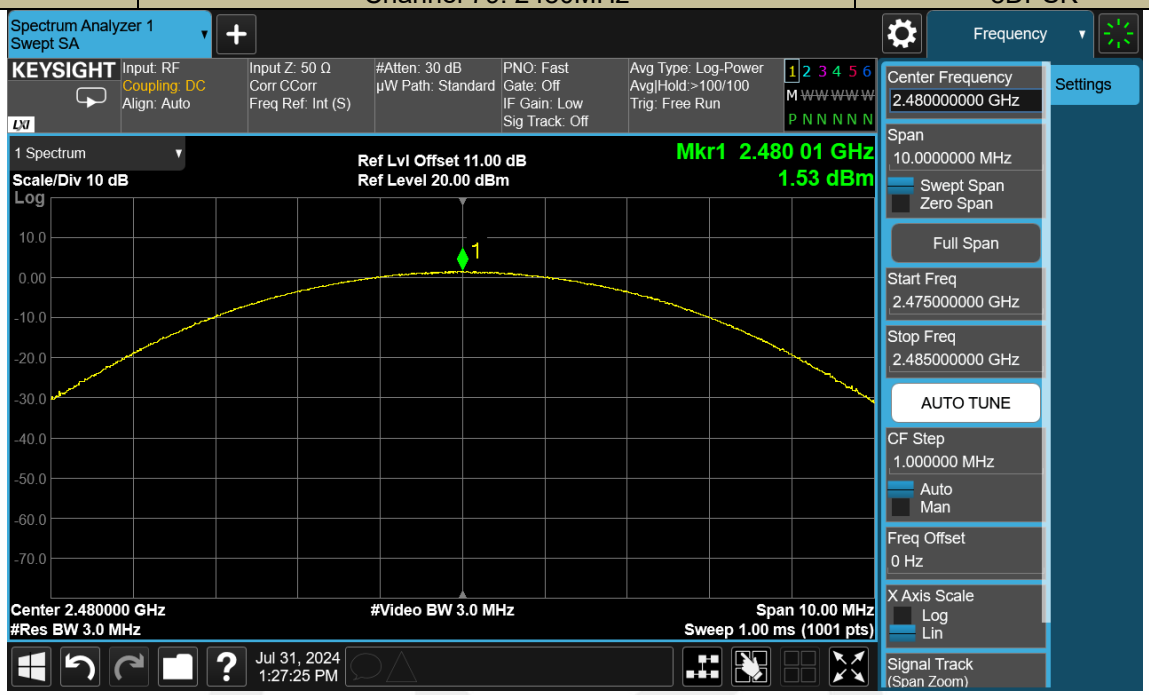
Test Model	Maximum PeakConducted Output Power	
	Channel 0: 2402MHz	8DPSK



Test Model	Maximum PeakConducted Output Power	
	Channel 39: 2441MHz	8DPSK



Test Model	Maximum PeakConducted Output Power	
	Channel 79: 2480MHz	8DPSK



9.6 CONDUCTED SUPRIOUS EMISSION

Applicable Standard

According to FCC Part 15.247(d) and 558074 D01 15.247 Meas Guidance V05r02

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.

Test Configuration

Test according to clause 7.1 radio frequency test setup 1

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 Maximumconducetedlevel.
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=100kHzSet VBW ≥ RBW
Set Sweep = autoSetDetector function = peakSetTrace = 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.

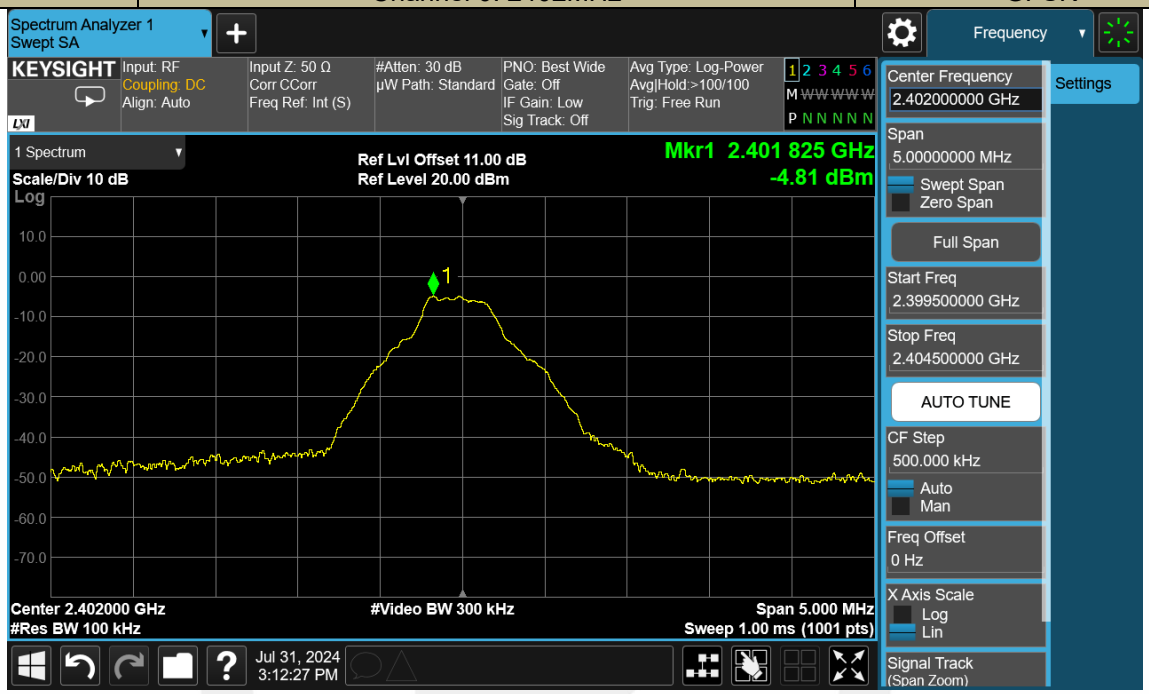
- **ConducetedSpurious RF Conducted Emission**

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 25GHz).Set RBW = 100 kHzSetVBW≥ RBW
Set Sweep = autoSetDetector function = peakSetTrace = 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.

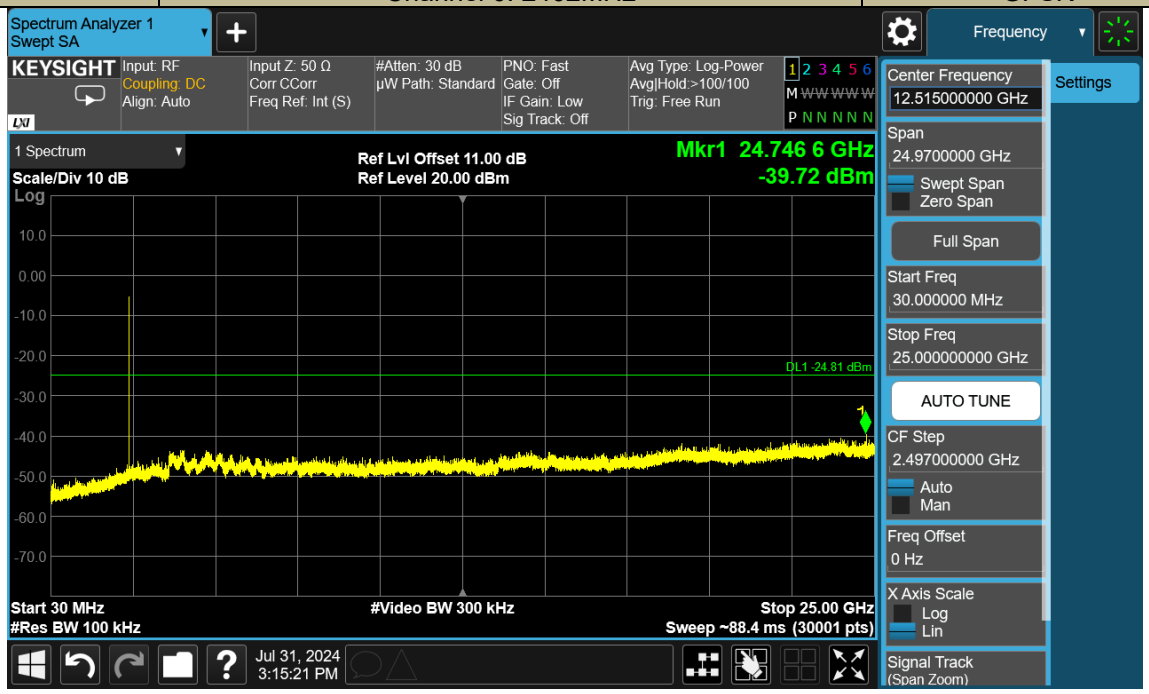
Test Results

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

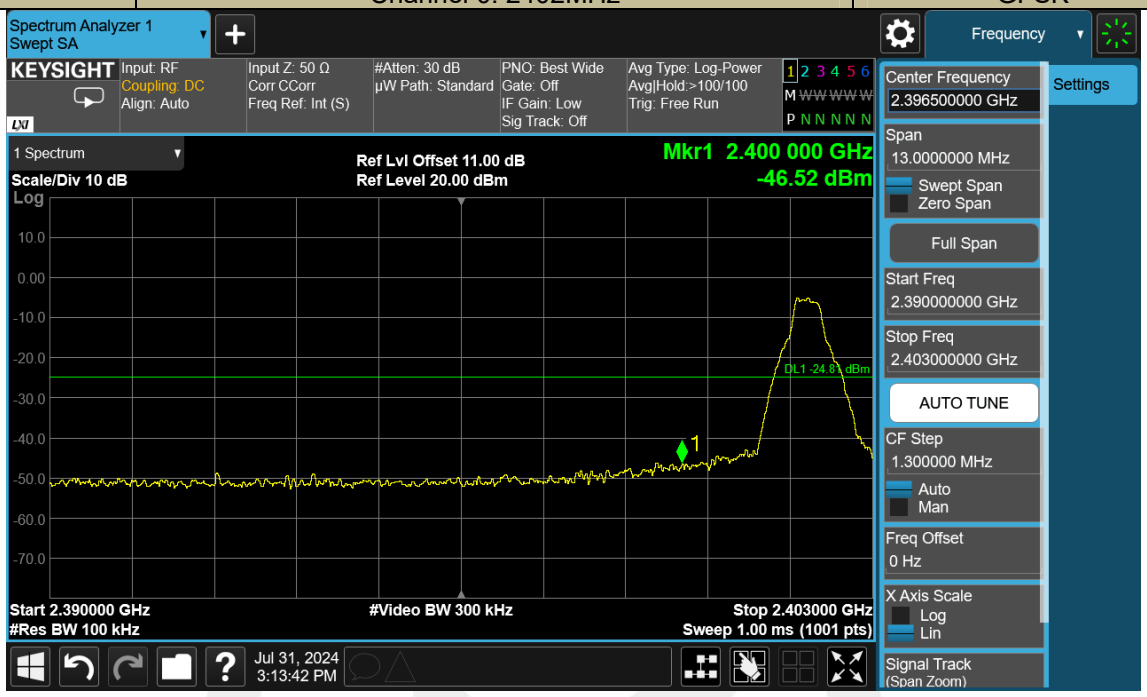
Test Model	Maximum Conduceted Level RBW=100kHz	
	Channel 0: 2402MHz	GFSK



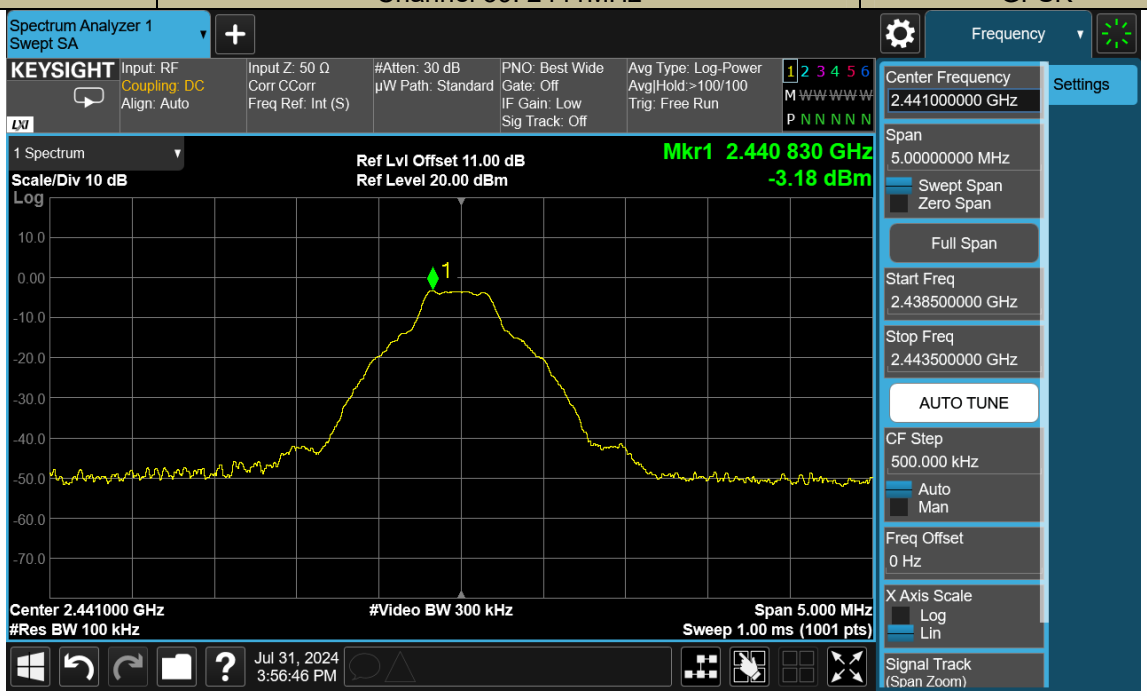
Test Model	ConducetedSpurious RF Conducted Emission(30 MHz-25GHz)	
	Channel 0: 2402MHz	GFSK



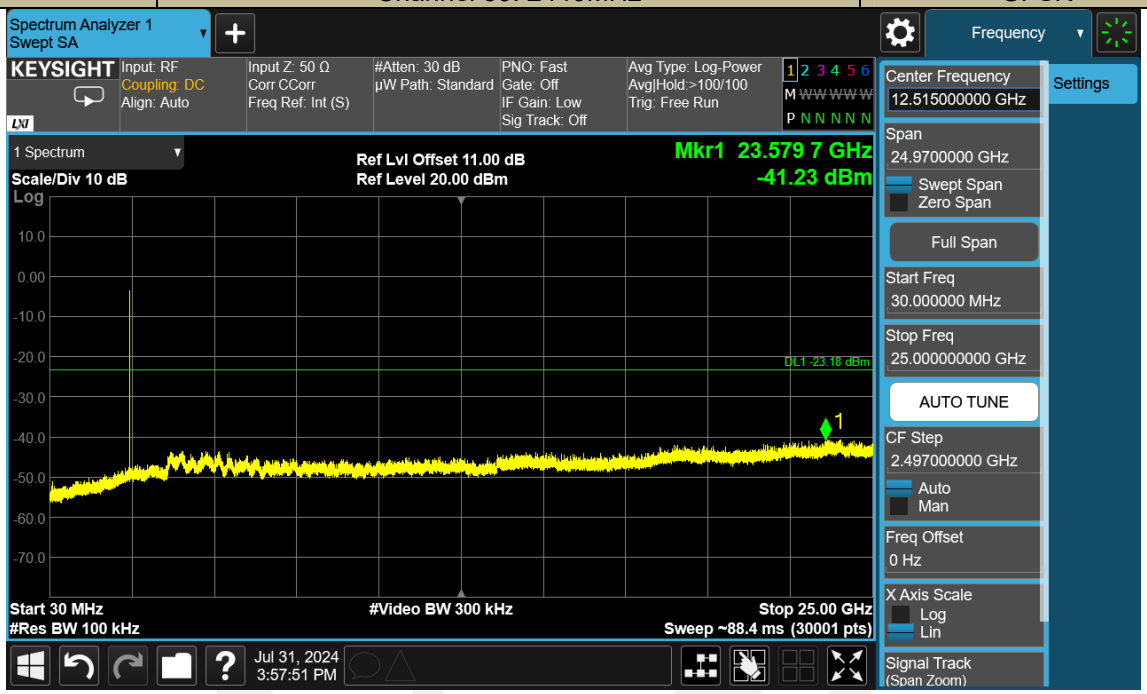
Test Model	Band-edge Conducted Emissions	
	Channel 0: 2402MHz	GFSK



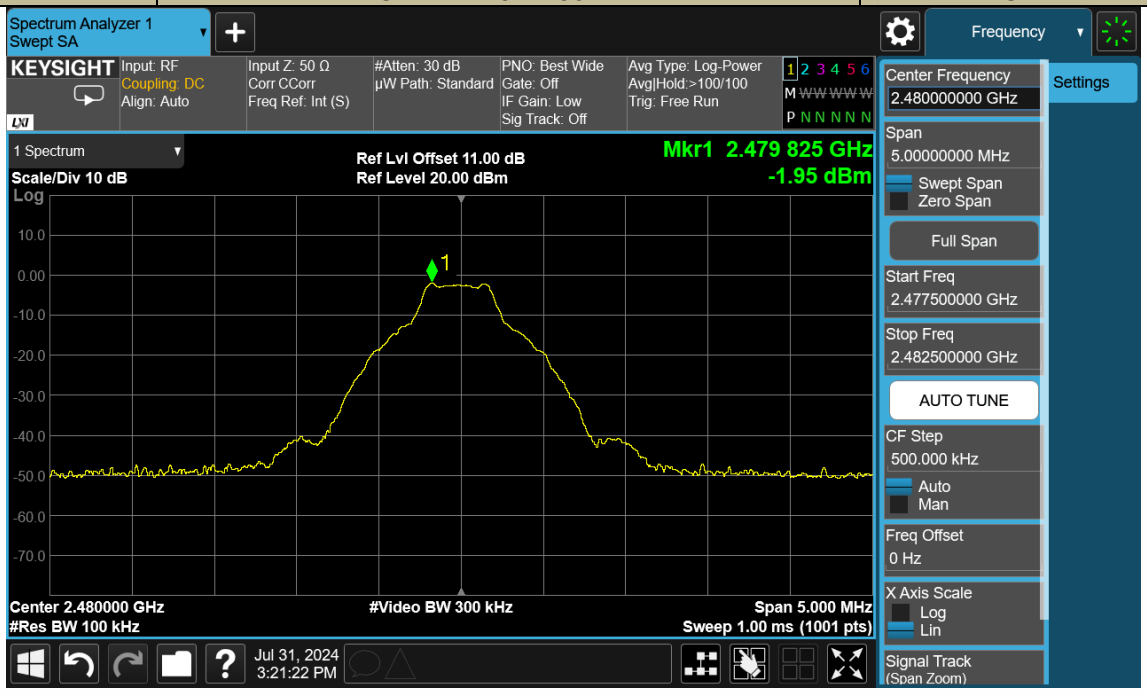
Test Model	Maximum Conduceted Level RBW=100kHz	
	Channel 39: 2441MHz	GFSK



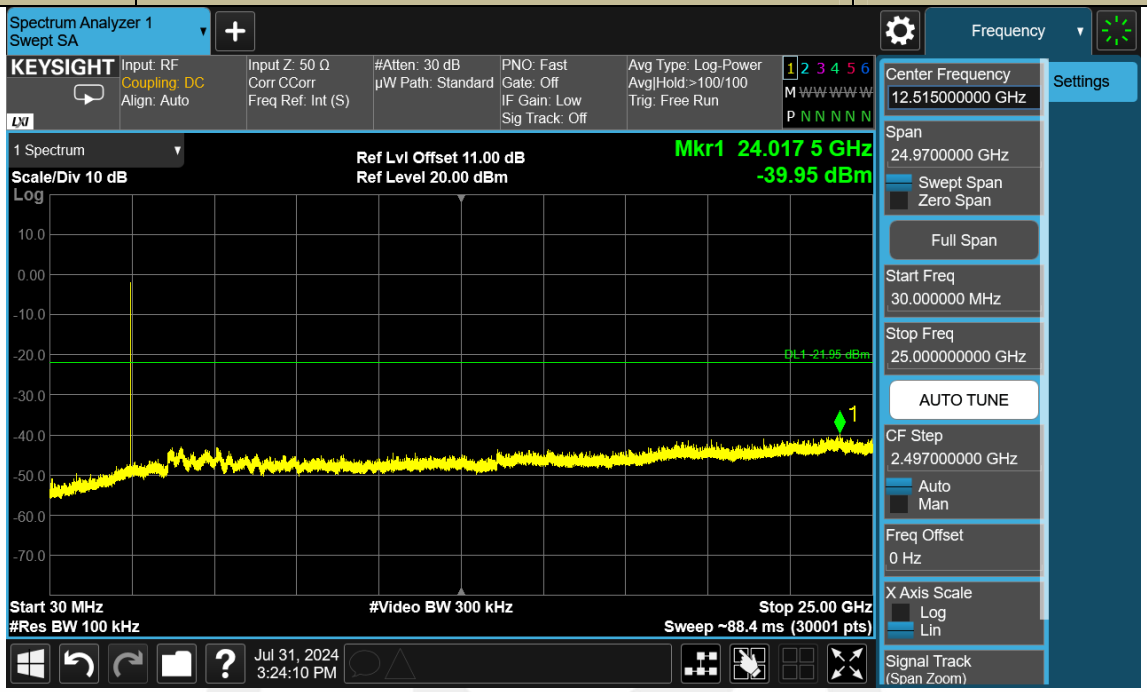
Test Model	ConducetedSpurious RF Conducted Emission(30 MHz-25GHz)	
	Channel 39: 2440MHz	GFSK



Test Model	Maximum Conduceted Level RBW=100kHz	
	Channel 78: 2480MHz	GFSK

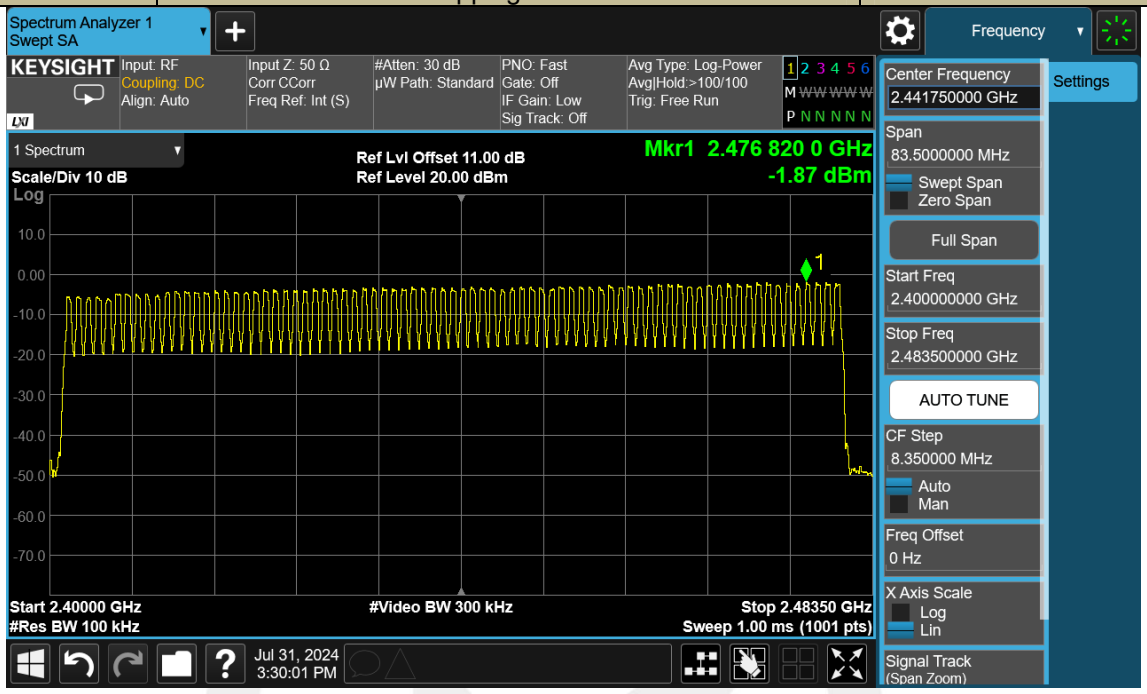


Test Model	ConducetedSpurious RF Conducted Emission(30 MHz-25 GHz)	
	Channel 78: 2480MHz	GFSK

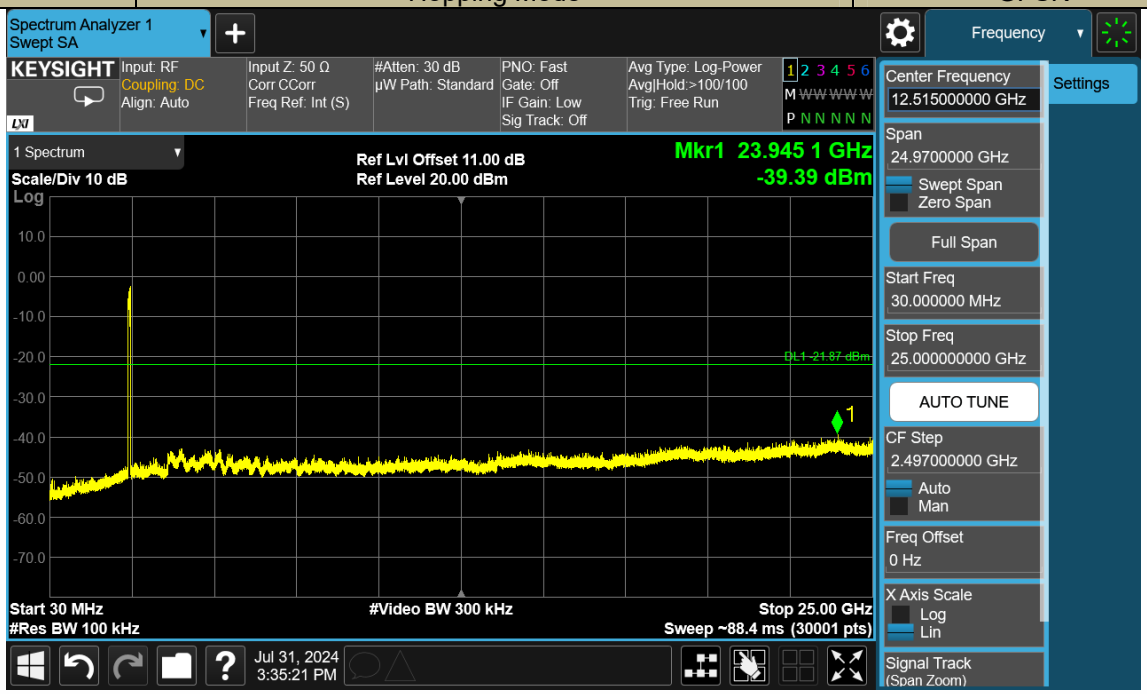


Test Model	Band-edge Conducted Emissions	
	Channel 78: 2480MHz	GFSK

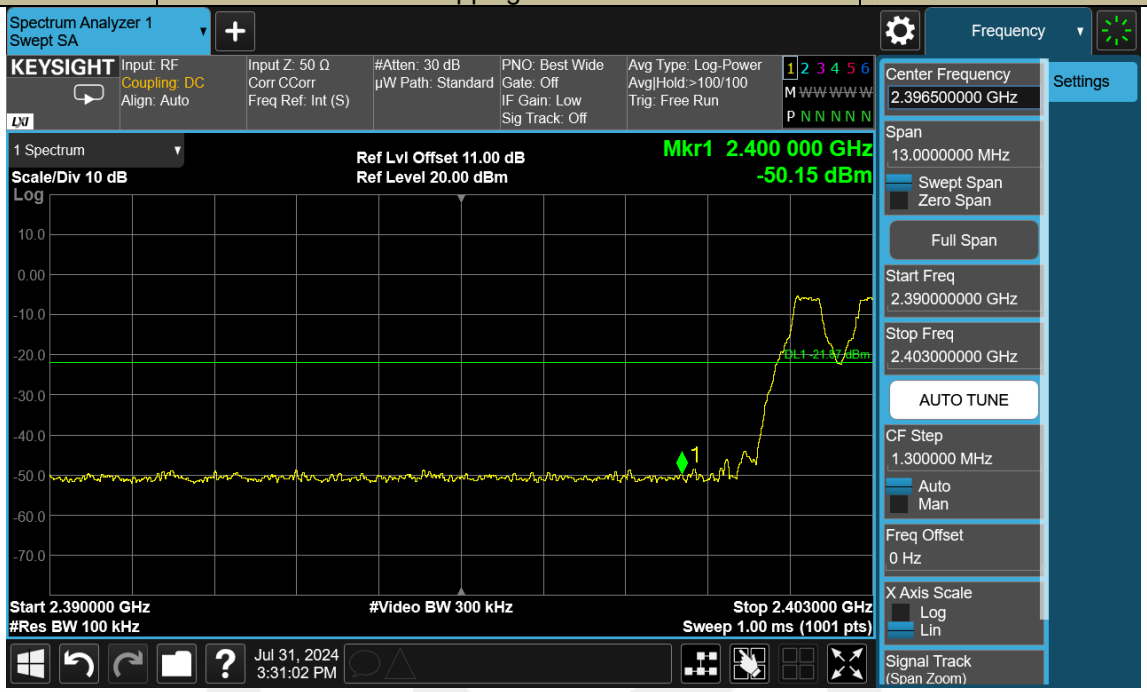
Test Model	Maximum Conduceted Level RBW=100kHz	
	Hopping Mode	GFSK

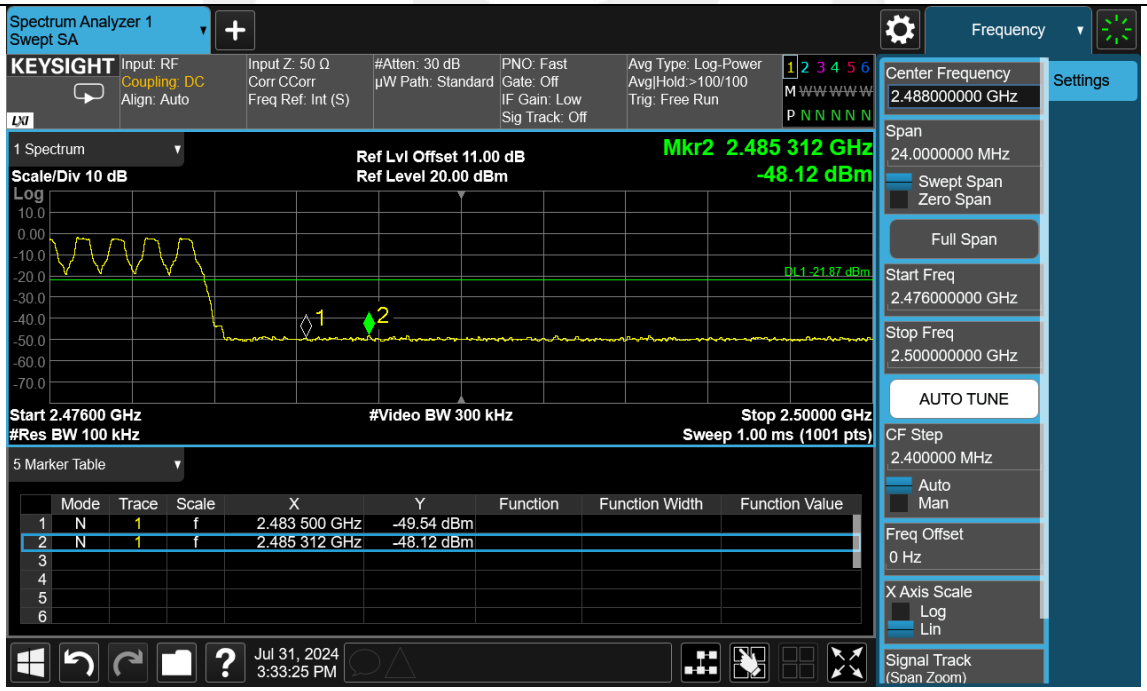


Test Model	ConducetedSpurious RF Conducted Emission(30 MHz-25GHz)	
	Hopping Mode	GFSK



Test Model	Band-edge Conducted Emissions	
	Hopping Mode	GFSK





9.7 RADIATED SPURIOUS EMISSION

Applicable Standard

According to FCC Part 15.247(d) and 15.209 and 558074 D01 15.247 Meas Guidance V05r02

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 Part15.209,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

Test Configuration

Test according to clause 7.2 radio frequency test setup 2

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:
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 = 1 MHz for f ≥ 1 GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz)
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

Follow the guidelines in ANSI C63.10-2014 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)

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	TX Mode		

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

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

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Channel 0: 2402MHz

Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4804.000	52.58	-8.8	43.78	74.00	30.22	PK+	V	PASS
4804.000	37.27	-8.8	28.47	54.00	25.53	AVG	V	PASS
11011.000	44.71	6.67	51.38	74.00	22.62	PK+	V	PASS
11011.000	30.58	6.67	37.25	54.00	16.75	AVG	V	PASS
17982.000	40.95	13.44	54.39	74.00	19.61	PK+	V	PASS
17982.000	26.85	13.44	40.29	54.00	13.71	AVG	V	PASS
Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4804.000	51.31	-8.8	42.51	74.00	31.49	PK+	H	PASS
4804.000	36.44	-8.8	27.64	54.00	26.36	AVG	H	PASS
9608.000	48.50	2.53	51.03	74.00	22.97	PK+	H	PASS
9608.000	31.86	2.53	34.39	54.00	19.61	AVG	H	PASS
17905.500	42.81	12.51	55.32	74.00	18.68	PK+	H	PASS
17905.500	27.60	12.51	40.11	54.00	13.89	AVG	H	PASS

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Channel 39: 2441MHz

Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4881.900	51.43	-8.22	43.21	74.00	30.79	PK+	V	PASS
4881.900	37.43	-8.22	29.21	54.00	24.79	AVG	V	PASS
14247.000	43.41	8.99	52.40	74.00	21.60	PK+	V	PASS
14247.000	28.47	8.99	37.46	54.00	16.54	AVG	V	PASS
17929.500	41.32	12.8	54.12	74.00	19.88	PK+	V	PASS
17929.500	28.52	12.8	41.32	54.00	12.68	AVG	V	PASS
Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4881.900	52.55	-8.22	44.33	74.00	29.67	PK+	H	PASS
4881.900	38.45	-8.22	30.23	54.00	23.77	AVG	H	PASS
13965.000	43.19	9.16	52.35	74.00	21.65	PK+	H	PASS
13965.000	28.32	9.16	37.48	54.00	16.52	AVG	H	PASS
17970.000	41.25	13.3	54.55	74.00	19.45	PK+	H	PASS
17970.000	27.39	13.3	40.69	54.00	13.31	AVG	H	PASS

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Channel 78: 2480MHz

Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4960.000	51.10	-7.41	43.69	74.00	30.31	PK+	V	PASS
4960.000	36.90	-7.41	29.49	54.00	24.51	AVG	V	PASS
7787.500	47.53	0.86	48.39	74.00	25.61	PK+	V	PASS
7787.500	32.75	0.86	33.61	54.00	20.39	AVG	V	PASS
17983.500	41.00	13.46	54.46	74.00	19.54	PK+	V	PASS
17983.500	27.69	13.46	41.15	54.00	12.85	AVG	V	PASS
Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.	Verdict
4960.000	53.71	-7.41	46.30	74.00	27.70	PK+	H	PASS
4960.000	38.46	-7.41	31.05	54.00	22.95	AVG	H	PASS
14100.500	44.00	9.07	53.07	74.00	20.93	PK+	H	PASS
14100.500	31.21	9.07	40.28	54.00	13.72	AVG	H	PASS
17980.000	41.11	13.42	54.53	74.00	19.47	PK+	H	PASS
17980.000	28.15	13.42	41.57	54.00	12.43	AVG	H	PASS

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(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 in Restricted Band 2310-2390MHz and 2483.5-2500MHz

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

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Channel 0: 2402MHz

Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)	Over (dB)
2329.080	H	57.68	74.00	-16.32	44.98	54.00	-9.02
2385.600	V	58.19	74.00	-15.81	43.67	54.00	-10.33

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Channel 78: 2480MHz

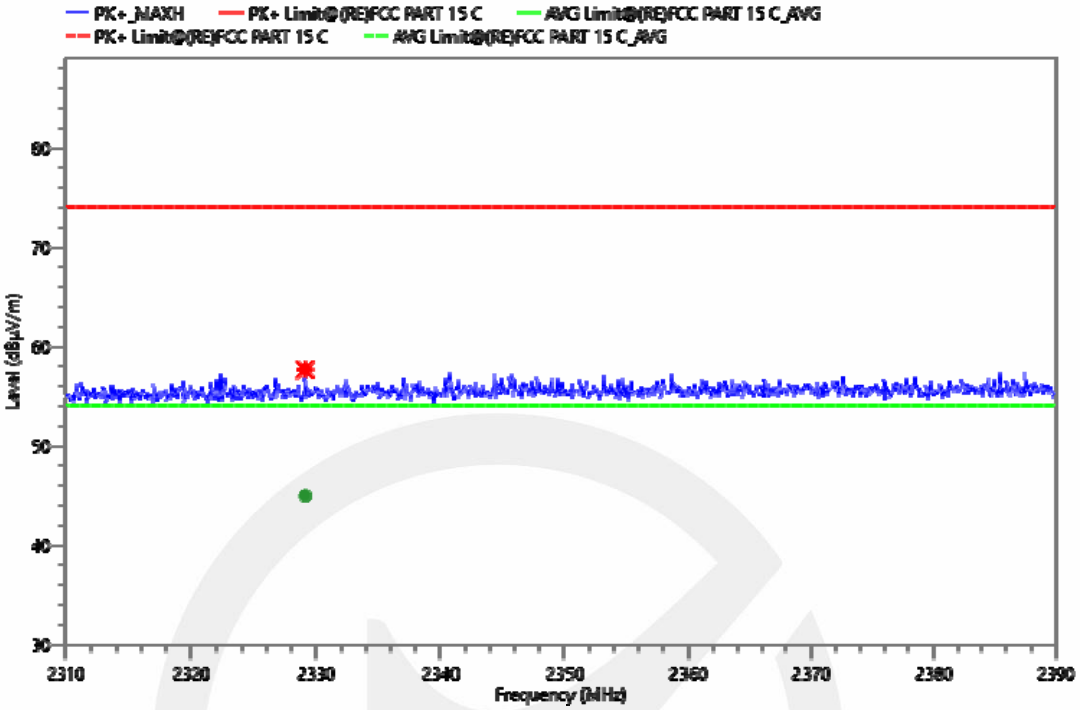
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)	Over (dB)
2496.321	H	57.76	74.00	-16.24	43.57	54.00	-10.43
2493.334	V	58.93	74.00	-15.07	43.28	54.00	-10.72

Temperature:	21 ℃	Test Date:	August 02, 2024
Humidity:	66%	Test By:	Lucas Xu
Test mode:	GFSK	Frequency:	Hopping

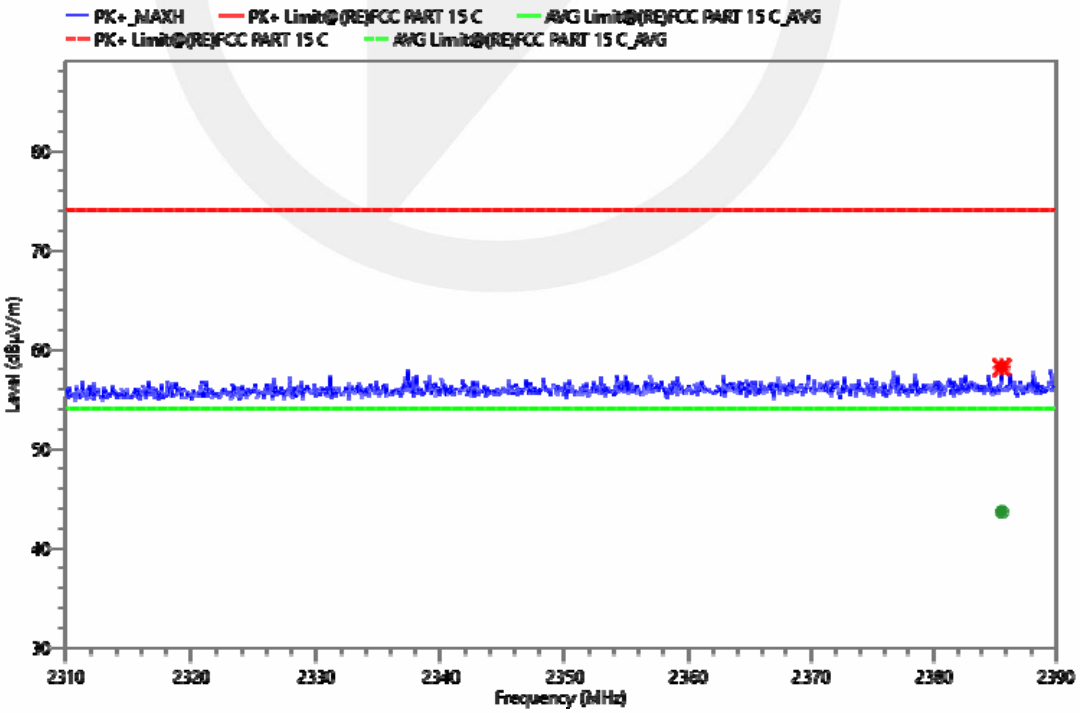
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)	Over (dB)
2400.000	H	55.65	74.00	-18.35	42.95	54.00	-11.05
2483.500	H	55.67	74.00	-18.33	41.33	54.00	-12.67
2400.000	V	56.09	74.00	-17.91	43.37	54.00	-10.63
2483.500	V	55.77	74.00	-18.23	42.64	54.00	-11.36

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(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.

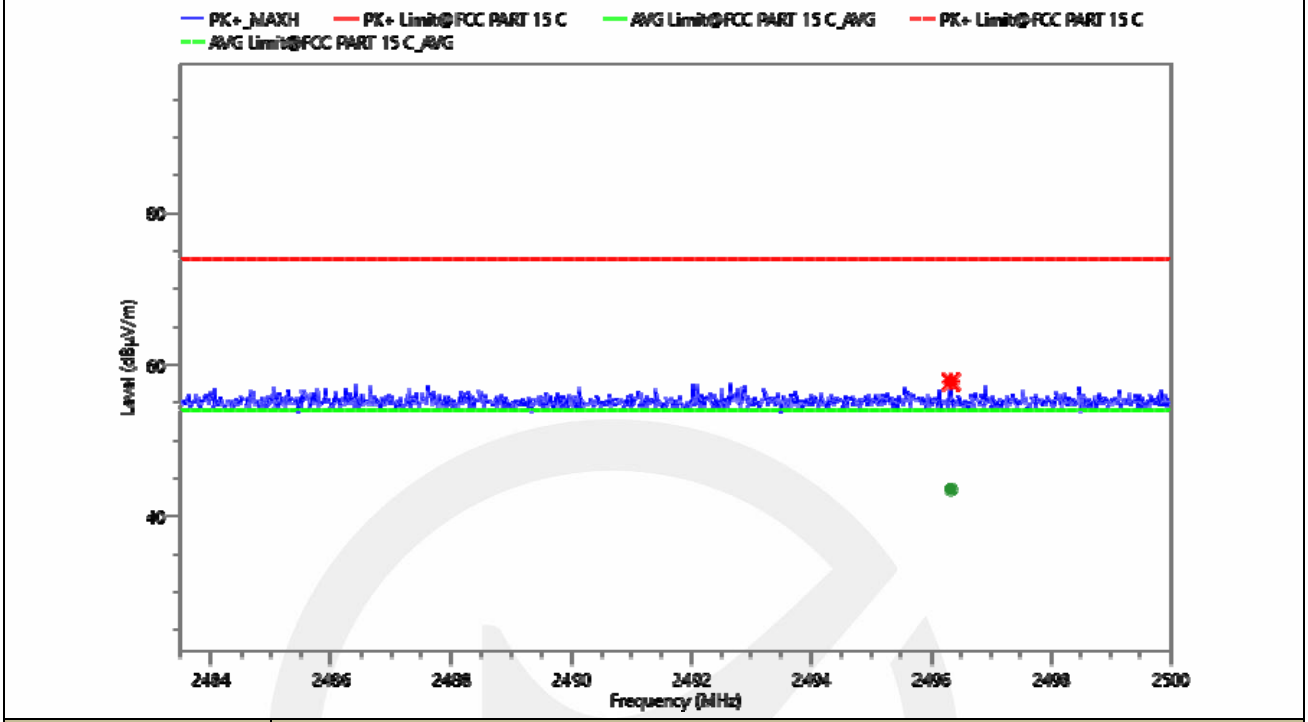
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	Channel 0: 2402MHz	GFSK	H



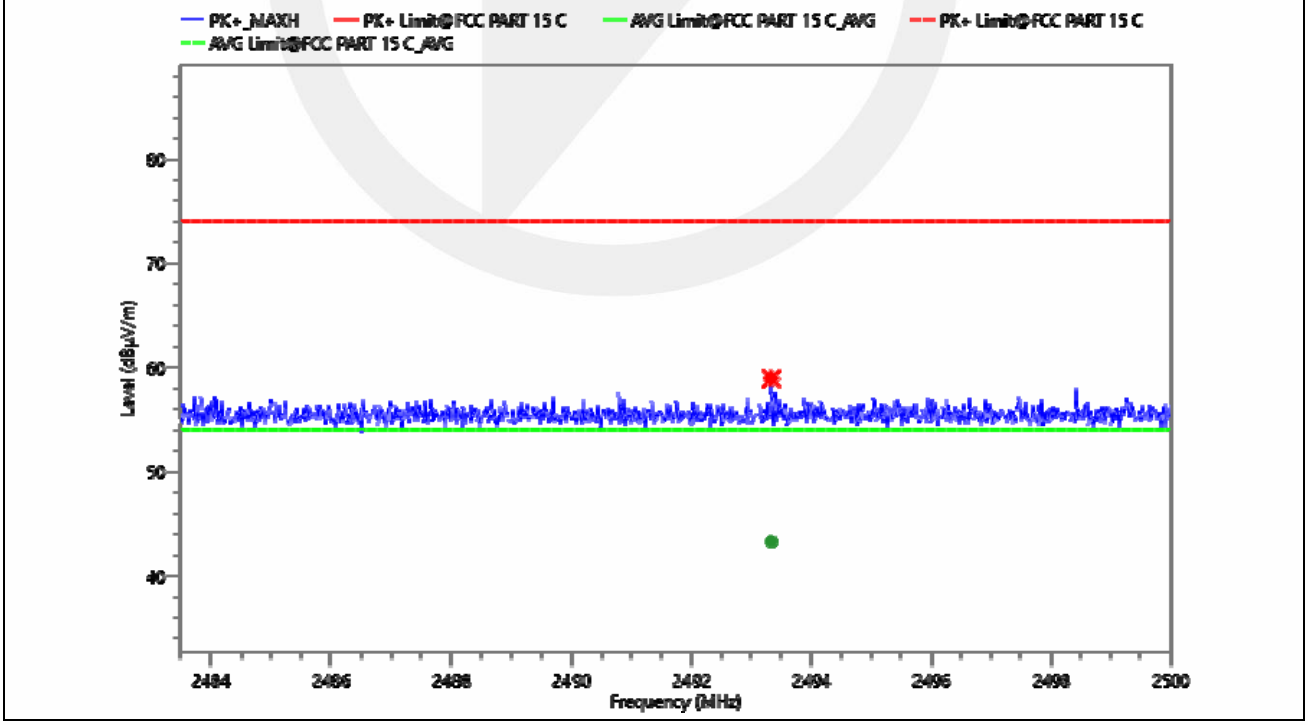
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	Channel 0: 2402MHz	GFSK	V



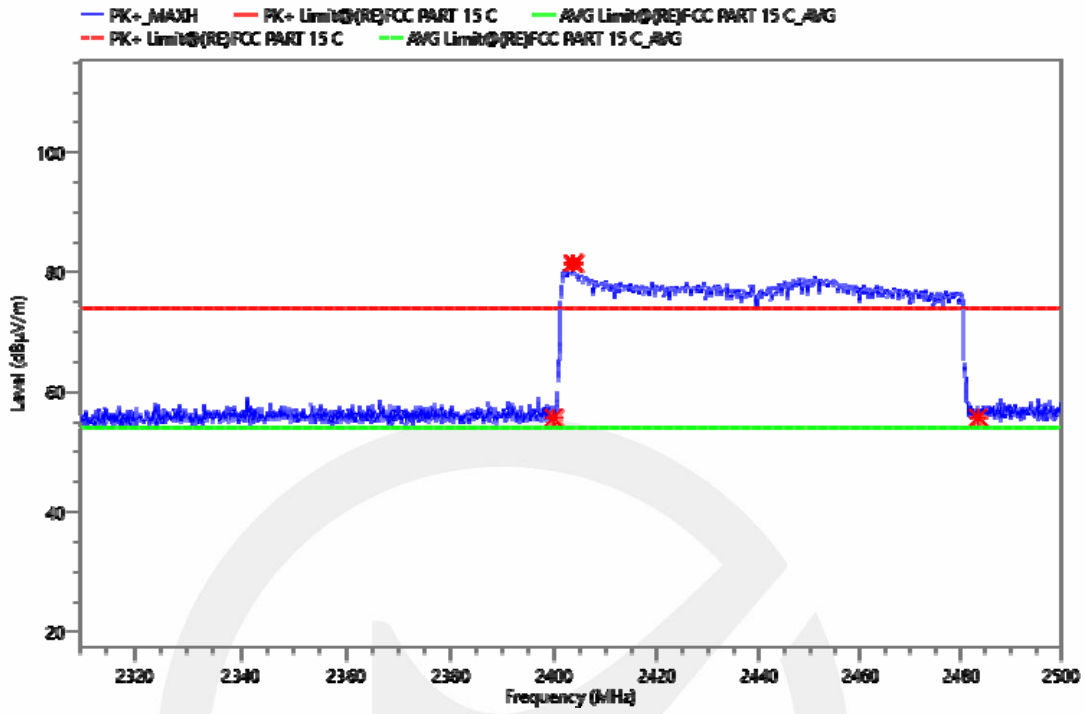
Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz		
	Channel 78: 2480MHz	GFSK	H



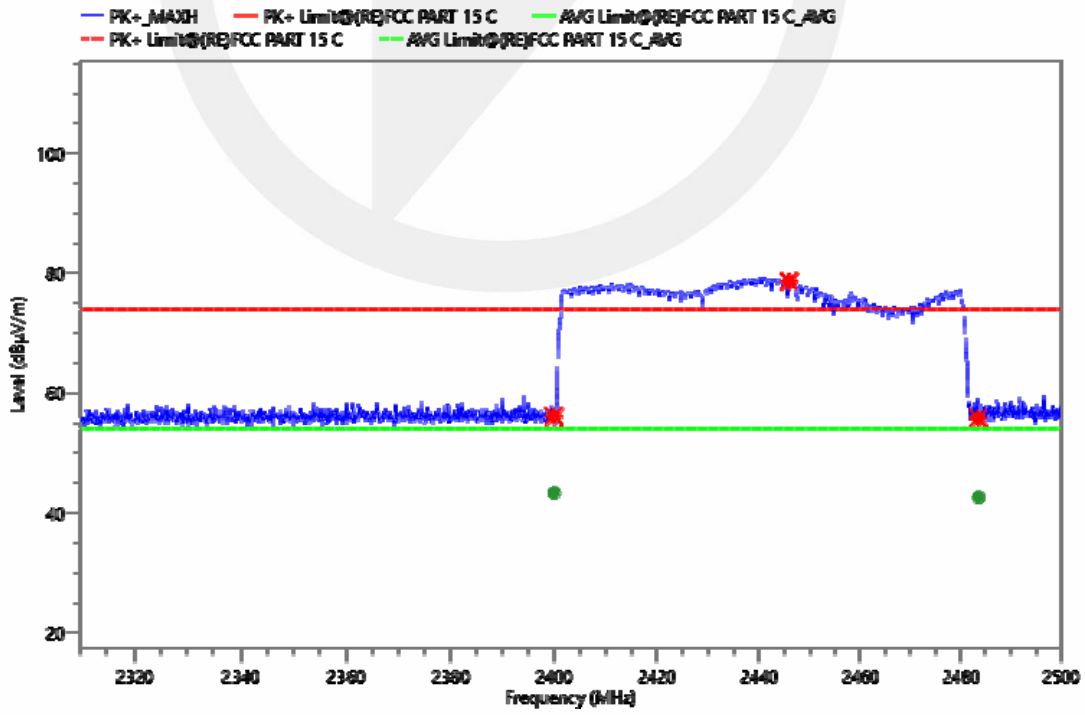
Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz		
	Channel 78: 2480MHz	GFSK	V



Test Model	Spurious Emission in Restricted Band 2310-2390&2483.5-2500MHz		
	Hopping	GFSK	H



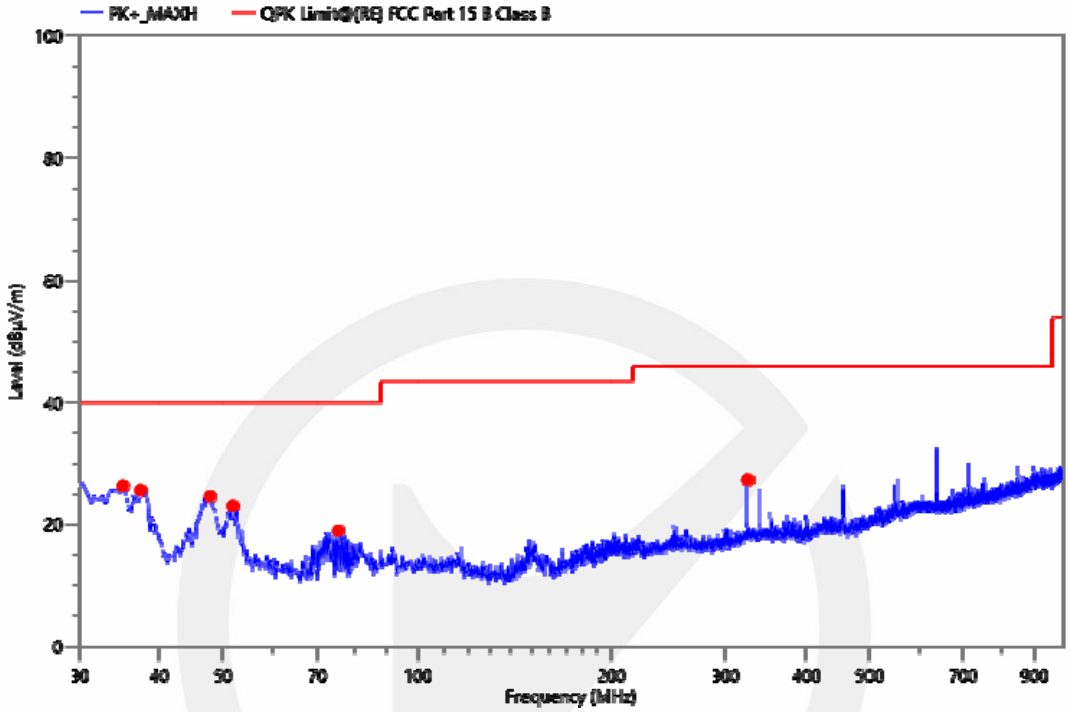
Test Model	Spurious Emission in Restricted Band2310-2390&2483.5-2500MHz		
	Hopping	GFSK	V



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

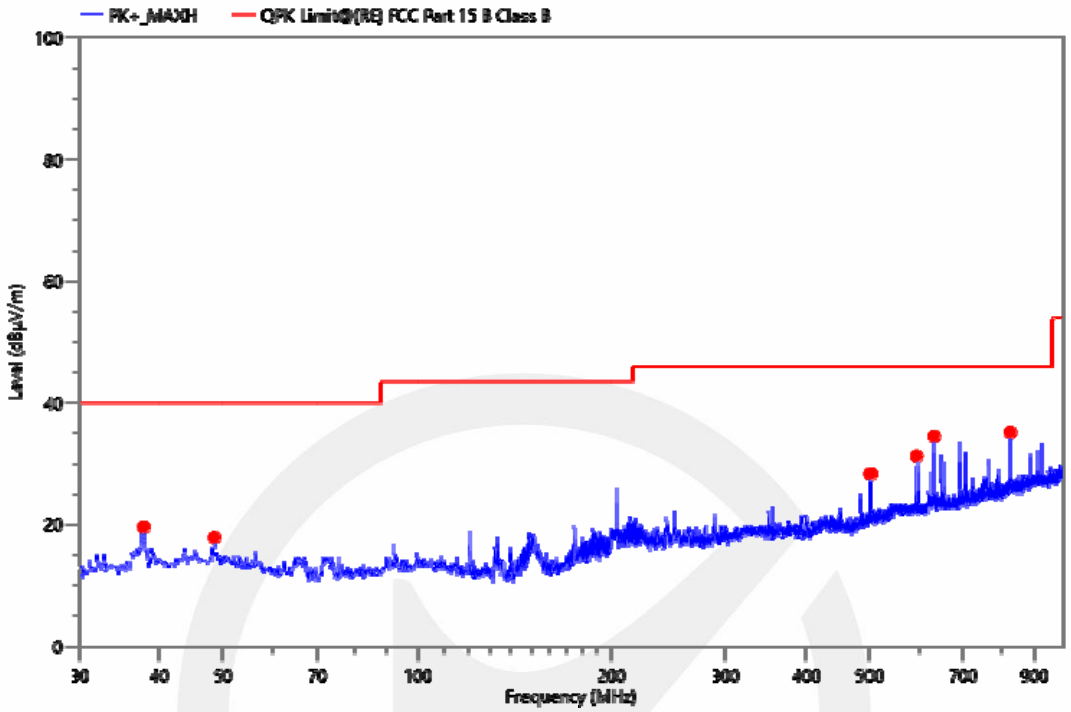
Bluetooth (GFSK, pi/4-DQPSK, 8DPSK)mode have been tested, and the worst result was report as below:

Project Information			
Mode:	TX2402	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



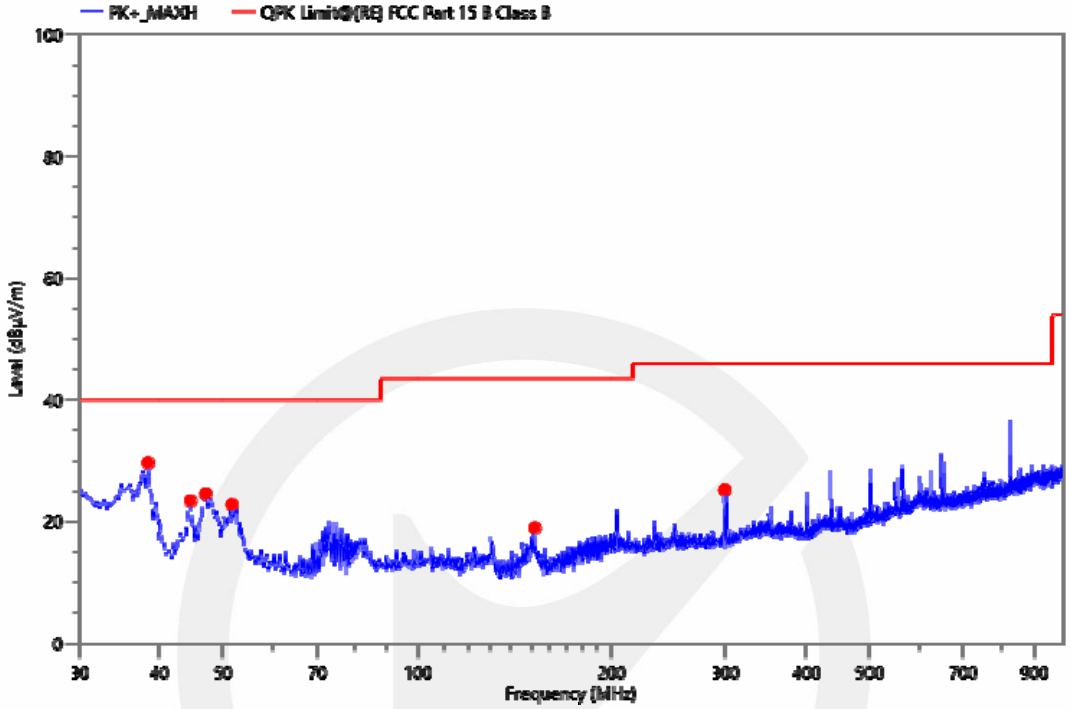
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	35.044	51.25	-24.96	26.29	40.00	13.71	QPK	100	V	74.5	PASS
2	37.372	50.35	-24.77	25.58	40.00	14.42	QPK	100	V	209.0	PASS
3	47.751	48.69	-24.11	24.58	40.00	15.42	QPK	100	V	152.0	PASS
4	51.825	47.49	-24.47	23.02	40.00	16.98	QPK	100	V	191.0	PASS
5	75.493	45.90	-26.98	18.92	40.00	21.08	QPK	200	V	353.0	PASS
6	324.686	48.28	-20.97	27.31	46.00	18.69	QPK	100	V	39.0	PASS

Project Information			
Mode:	TX2402	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



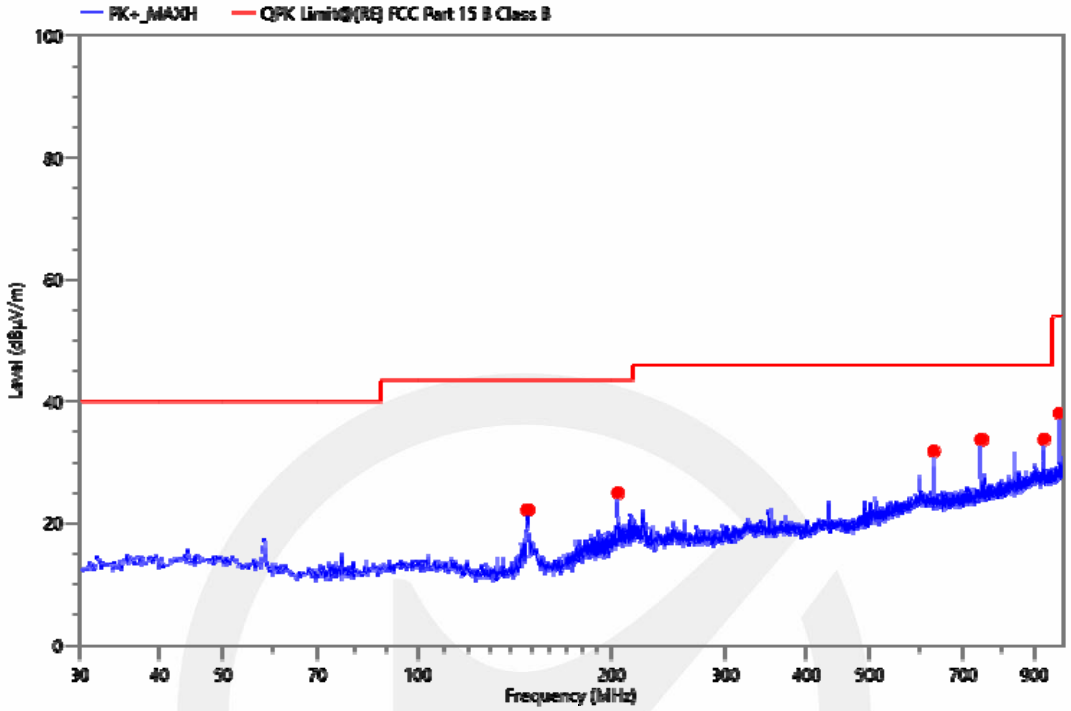
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	37.760	44.34	-24.74	19.60	40.00	20.40	QPK	200	H	142.4	PASS
2	48.430	42.02	-24.13	17.89	40.00	22.11	QPK	200	H	135.9	PASS
3	502.099	45.96	-17.6	28.36	46.00	17.64	QPK	200	H	215.4	PASS
4	590.951	46.29	-15.03	31.26	46.00	14.74	QPK	200	H	120.4	PASS
5	629.557	49.59	-15.07	34.52	46.00	11.48	QPK	200	H	123.4	PASS
6	825.012	47.93	-12.77	35.16	46.00	10.84	QPK	200	H	142.9	PASS

Project Information			
Mode:	TX2441	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



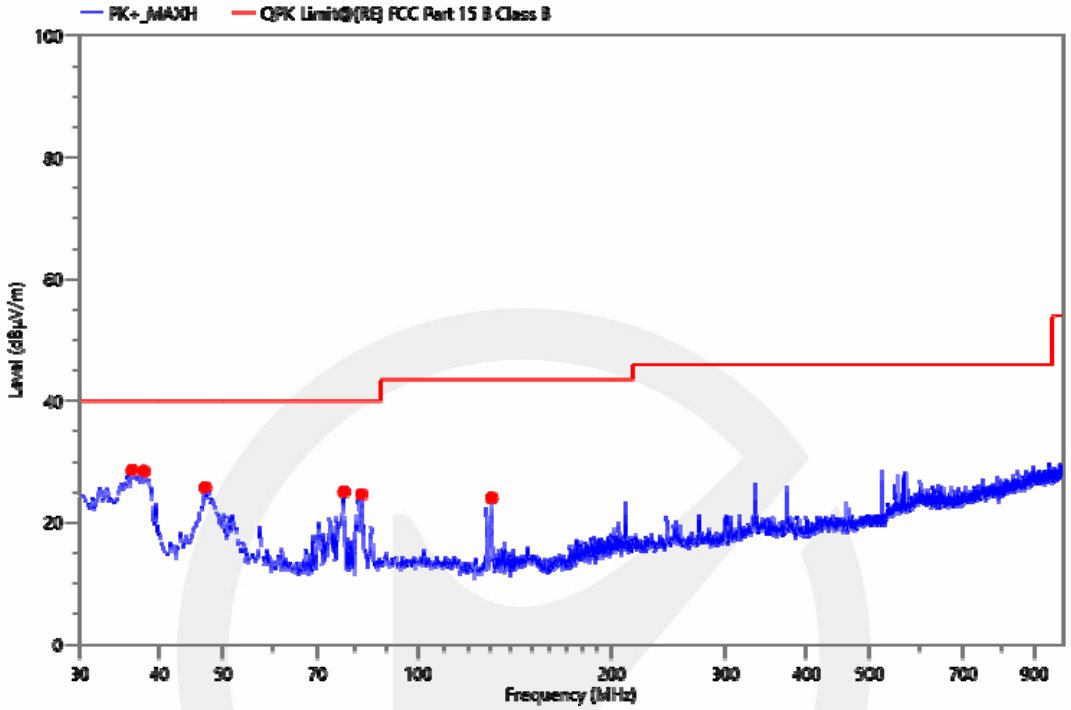
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	38.342	54.35	-24.69	29.66	40.00	10.34	QPK	100	V	216.2	PASS
2	44.453	47.54	-24.11	23.43	40.00	16.57	QPK	200	V	314.7	PASS
3	46.975	48.66	-24.1	24.56	40.00	15.44	QPK	200	V	26.7	PASS
4	51.631	47.24	-24.44	22.80	40.00	17.20	QPK	100	V	181.2	PASS
5	151.541	45.89	-26.92	18.97	43.50	24.53	QPK	100	V	193.2	PASS
6	298.884	47.54	-22.32	25.22	46.00	20.78	QPK	100	V	212.2	PASS

Project Information			
Mode:	TX2441	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



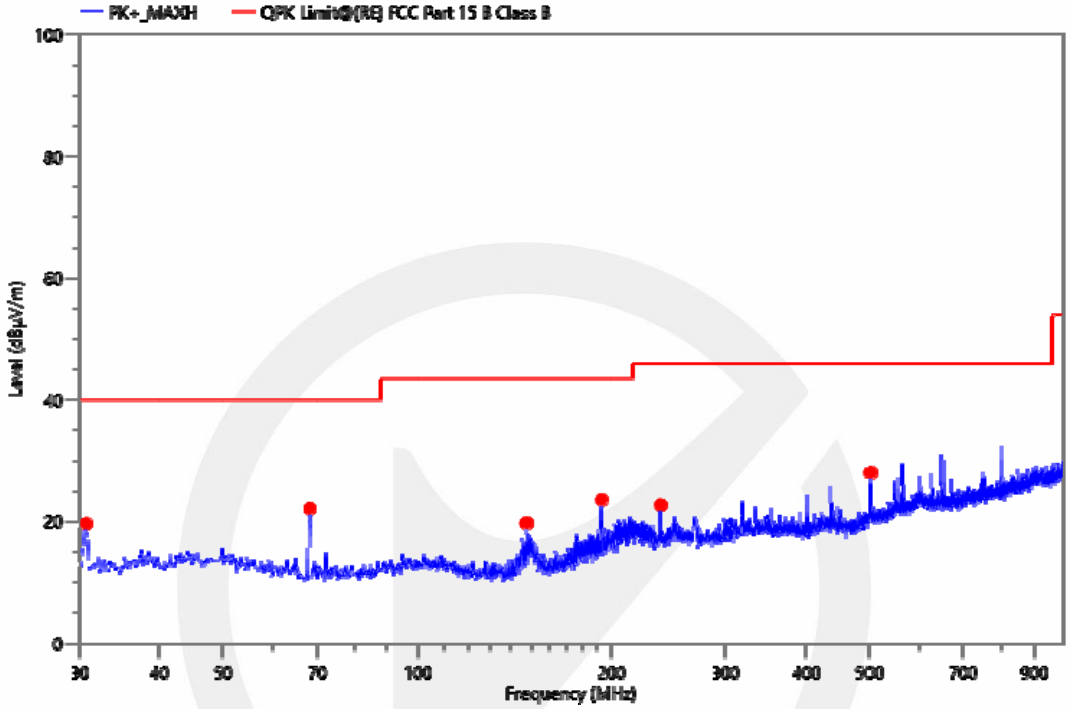
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	148.049	49.38	-27.14	22.24	43.50	21.26	QPK	200	H	191.3	PASS
2	204.503	49.54	-24.55	24.99	43.50	18.51	QPK	200	H	183.8	PASS
3	629.169	46.91	-15.06	31.85	46.00	14.15	QPK	200	H	190.3	PASS
4	745.472	48.08	-14.34	33.74	46.00	12.26	QPK	200	H	184.3	PASS
5	931.518	45.27	-11.49	33.78	46.00	12.22	QPK	200	H	190.3	PASS
6	983.995	49.13	-11.08	38.05	54.00	15.95	QPK	200	H	185.3	PASS

Project Information			
Mode:	TX2480	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	36.208	53.46	-24.87	28.59	40.00	11.41	QPK	100	V	340.9	PASS
2	37.760	53.19	-24.74	28.45	40.00	11.55	QPK	100	V	176.9	PASS
3	46.878	49.85	-24.1	25.75	40.00	14.25	QPK	100	V	159.4	PASS
4	76.948	52.03	-26.96	25.07	40.00	14.93	QPK	100	V	178.9	PASS
5	81.992	51.39	-26.76	24.63	40.00	15.37	QPK	100	V	173.9	PASS
6	130.298	51.77	-27.67	24.10	43.50	19.40	QPK	200	V	358.1	PASS

Project Information			
Mode:	TX2480	Voltage:	AC 120V/60Hz
Environment:	Temp: 21 ℃; Humi:66%	Engineer:	Elvis Xia



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
1	30.679	45.01	-25.31	19.70	40.00	20.30	QPK	100	H	358.4	PASS
2	68.024	48.96	-26.81	22.15	40.00	17.85	QPK	100	H	248.6	PASS
3	147.467	46.98	-27.21	19.77	43.50	23.73	QPK	100	H	44.6	PASS
4	192.960	48.85	-25.26	23.59	43.50	19.91	QPK	100	H	358.4	PASS
5	237.483	46.12	-23.39	22.73	46.00	23.27	QPK	100	H	358.4	PASS
6	502.099	45.64	-17.6	28.04	46.00	17.96	QPK	100	H	235.6	PASS

9.8 CONDUCTED EMISSION TEST

Applicable Standard

According to FCC Part 15.207(a)

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.

Test Configuration

Test according to clause 7.3 conducted emission test setup

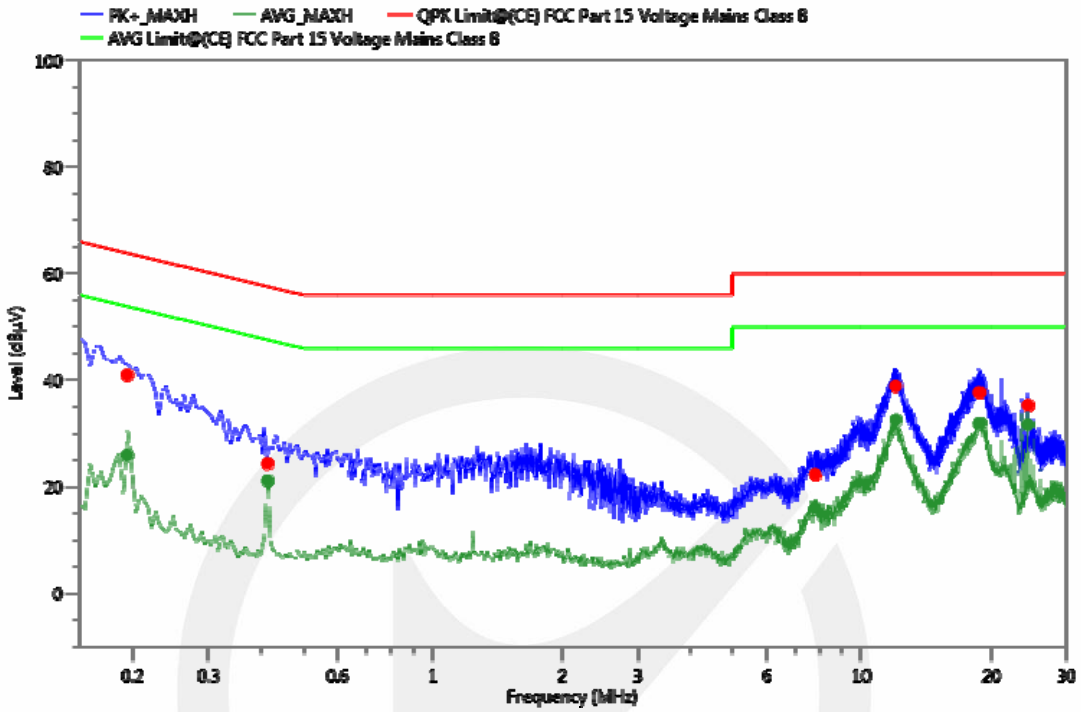
Test Procedure

The EUT was placed on a table which is 0.1m 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

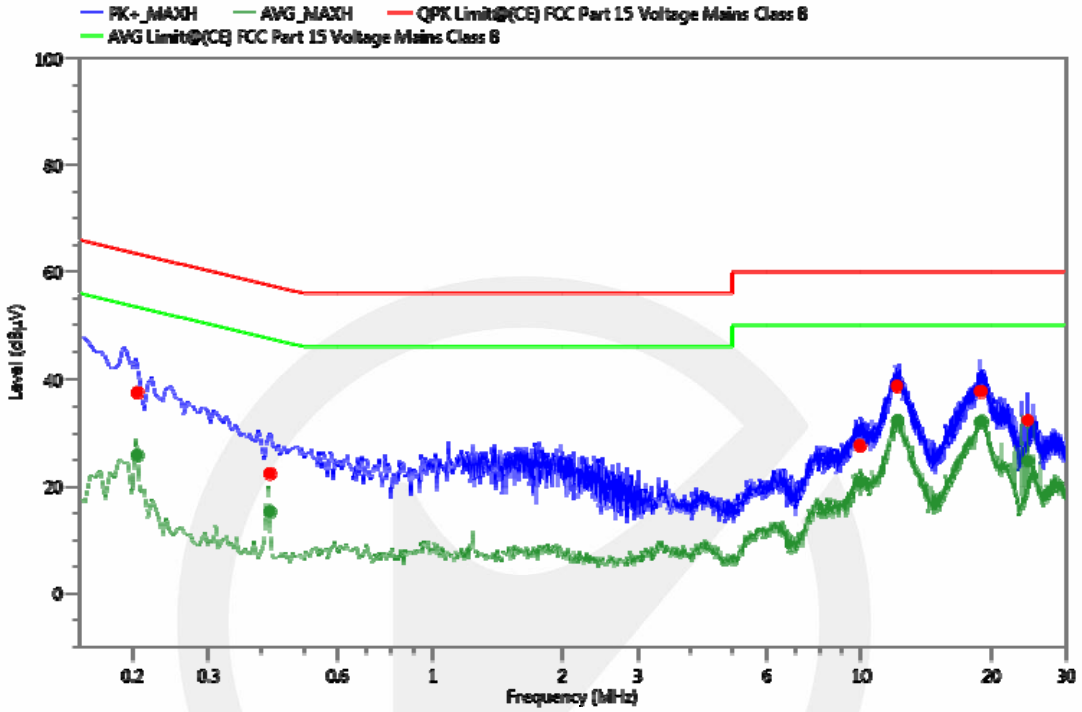
Pass.
Bluetooth (GFSK, pi/4-DQPSK, 8DPSK)mode have been tested, and the worst result was report as below:

Project Information			
Mode:	TX2402	Voltage:	AC 120V/60Hz
Environment:	Temp: 24 ℃; Humi:69%	Engineer:	Ace Li



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV)	Limit (dBµV)	Margin (dB)	Det.	Line	PE	Verdict
1	0.194	30.85	10.1	40.95	63.86	22.91	QPK	L1	GND	PASS
2	0.194	15.75	10.1	25.85	53.86	28.01	AVG	L1	GND	PASS
3	0.413	14.26	10.06	24.32	57.59	33.27	QPK	L1	GND	PASS
4	0.413	11.07	10.06	21.13	47.59	26.46	AVG	L1	GND	PASS
5	7.793	12.20	10.05	22.25	60.00	37.75	QPK	L1	GND	PASS
6	7.793	5.89	10.05	15.94	50.00	34.06	AVG	L1	GND	PASS
7	11.973	28.71	10.11	38.82	60.00	21.18	QPK	L1	GND	PASS
8	11.973	22.37	10.11	32.48	50.00	17.52	AVG	L1	GND	PASS
9	18.821	27.44	10.17	37.61	60.00	22.39	QPK	L1	GND	PASS
10	18.821	21.69	10.17	31.86	50.00	18.14	AVG	L1	GND	PASS
11	24.364	24.96	10.27	35.23	60.00	24.77	QPK	L1	GND	PASS
12	24.364	21.28	10.27	31.55	50.00	18.45	AVG	L1	GND	PASS

Project Information			
Mode:	TX2402	Voltage:	AC 120V/60Hz
Environment:	Temp: 24 ℃; Humi:69c%	Engineer:	Ace Li



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV)	Limit (dBµV)	Margin (dB)	Det.	Line	PE	Verdict
1	0.205	27.51	10.1	37.61	63.41	25.80	QPK	N	GND	PASS
2	0.205	15.73	10.1	25.83	53.41	27.58	AVG	N	GND	PASS
3	0.418	12.35	10.06	22.41	57.49	35.08	QPK	N	GND	PASS
4	0.418	5.18	10.06	15.24	47.49	32.25	AVG	N	GND	PASS
5	9.928	17.58	10.09	27.67	60.00	32.33	QPK	N	GND	PASS
6	9.928	10.75	10.09	20.84	50.00	29.16	AVG	N	GND	PASS
7	12.064	28.67	10.12	38.79	60.00	21.21	QPK	N	GND	PASS
8	12.064	22.20	10.12	32.32	50.00	17.68	AVG	N	GND	PASS
9	18.955	27.60	10.19	37.79	60.00	22.21	QPK	N	GND	PASS
10	18.955	21.86	10.19	32.05	50.00	17.95	AVG	N	GND	PASS
11	24.369	22.03	10.32	32.35	60.00	27.65	QPK	N	GND	PASS
12	24.369	14.37	10.32	24.69	50.00	25.31	AVG	N	GND	PASS

9.9 ANTENNA APPLICATION

Antenna Requirement

Standard	Requirement
FCC CRF Part15.203	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 intentionalradiators 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.

Result

Pass.

The EUT has 1 PCB Antenna: The PCB Antenna Gain is 1.67 dBi;

Note: ☒ 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)

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

*** End of Report ***

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Statement

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