FCC TEST REPORT

FCC ID: 2BDJI-1249

On Behalf of

Shenzhen Avane Industrial Co.,Ltd

Bluetooth speaker

Model No.: 1249

Prepared for	:	Shenzhen Avane Industrial Co.,Ltd
Address	:	Rm702, NO.330, Golf Road, Guangpei Community, Guanlan Street, Longhua District, Shenzhen

Prepared By	:	Shenzhen PSI Testing Co., Ltd.
Address	:	1-2F, Building 5, Yudafu Industrial Park, No. 10, Xingye West Road, Shajing Street, Bao'an District, Shenzhen, Guangdong, China 518104

Report Number	:	psi2310052-C01-R09
Date of Receipt	:	October 25, 2023
Date of Test	:	October 25–November 05, 2023
Date of Report	:	November 06, 2023
Version Number	:	V0

TABLE OF CONTENTS

Description Page

1. Summary Of Standards And Results 6
1.1. Description of Standards and Results 6
2. General Information 7
2.1. Description of Device (EUT) 7
2.2. Accessories of Device (EUT) 8
2.3. Tested Supporting System Details 8
2.4. Block Diagram of connection between EUT and simulators 8
2.5. Test Mode Description 8
2.6. Test Conditions 9
2.7. Test Facility 9
2.8. Measurement Uncertainty 9
2.9. Test Equipment List 10
3. Maximum Peak Output Power 11
3.1. Limit 11
3.2. Test Procedure 11
3.3. Test Setup 11
3.4. Test Result 11
4. Bandwidth 12
4.1. Limit 12
4.2. Test Procedure 12
4.3. Test Result 12
5. Carrier Frequency Separation 16
5.1. Limit 16
5.2. Test Procedure 16
5.3. Test Result 16
6. Number Of Hopping Channel 18
6.1. Limit 18
6.2. Test Procedure 18
6.3. Test Result 18
7. Dwell Time 20
7.1. Test limit 20
7.2. Test Procedure 20
7.3. Test Result 20
8. Out-of-band Emissions 30
8.1. Test Limits 30
8.2. Test Procedure 30
8.3. Test Setup 30
8.4. Test Results 30
9. Radiated Emissions 34

9.1. Limit 34
9.2. Block Diagram of Test setup 35
9.3. Test Procedure 36
9.4. Test Results 36
10. Band Edge Test 44
10.1. Block Diagram of Test Setup 44
10.2. Test Limit 44
10.3. Test Procedure 44
10.4. Test Results 45
11. Power Line Conducted Emissions 48
11.1. Block Diagram of Test Setup 48
11.2. Limit 48
11.3. Test Procedure 48
11.4. Test Results 49
12. Antenna Requirements 52
12.1. Limit 52
12.2. Result 52
13. Photos of test setup 53
14. Photos of EUT 53

TEST REPORT DECLARATION

Applicant	:	Shenzhen Avane Industrial Co.,Ltd
Address	:	Rm702, NO.330, Golf Road, Guangpei Community, Guanlan Street, Longhua District, Shenzhen
Manufacturer	:	Shenzhen Avane Industrial Co.,Ltd
Address	:	Rm702, NO.330, Golf Road, Guangpei Community, Guanlan Street, Longhua District, Shenzhen
EUT Description	:	Bluetooth speaker
		(A) Model No. : 1249
		(B) Trademark : N/A

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247,

ANSI C63.10-2013

The device described above is tested by Shenzhen PSI Testing Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Shenzhen PSI Testing Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. Also, this report shows that the EUT is technically compliant with the FCC Part15 requirements.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen PSI Testing Co., Ltd.

Tested by (name + signature).....:	Jensen Wang Project Engineer	Jensen Wang
Approved by (name + signature)…....:	Simple Guan Project Manager	
Date of issue…… ……..:	November 06, 2023	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	November 06, 2023	Initial released Issue	Jensen Wang

1. Summary Of Standards And Results

1.1. Description of Standards and Results

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

Test Item	Standards Paragraph	Result
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1)	P
Bandwidth	FCC Part 15:15.247(a)(1)	P
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1)	P
Number Of Hopping Channel	FCC Part 15: 15.247(a)(1)	P
Dwell Time	FCC Part 15: 15.247(a)(1)	P
Radiated Spurious Emission	FCC Part 15: 15.209 FCC Part 15: 15.205	P
Out-of-band Emissions	FCC Part 15: 15.247(d)	P
Radiated Band Edge Emission	FCC Part 15: 15.247(d)	P
Power Line Conducted Emissions	FCC Part 15: 15.207	P
Antenna requirement	FCC Part 15: 15.203	P

Note:
1. P is an abbreviation for Pass.
2. F is an abbreviation for Fail.
3. N/A is an abbreviation for Not Applicable.
4. Conclusion determination rules of this report: Unless there are clear provisions on measurement uncertainty in the standard or customer requirements, decision by actual test data without considering measurement uncertainty.
5. Measurement method usage KDB 558074 D01 15.247 Meas Guidance v05r02.

2. General Information

2.1. Description of Device (EUT)

Description/PMN	:	Bluetooth speaker
Model Number/HVIN(s)	:	1249
Diff.	:	N/A
Trademark	:	N/A
Test Voltage	:	DC 3.7V from battery OR DC 5V from Type C port
Radio Technology	:	Bluetooth5.0 EDR
Operation frequency	:	2402MHz-2480MHz
Modulation	:	GFSK, π/4-DQPSK, 8DPSK
Channel No.	:	79 Channels
Channel Separation	:	1MHz
Antenna Type	:	Internal Antenna, max gain 1.68dBi.
Software version	:	V1.0
Hardware version	:	V1.0
Note	:	Antenna information is provided by applicant. Testing lab is not responsible for the accuracy of the information.

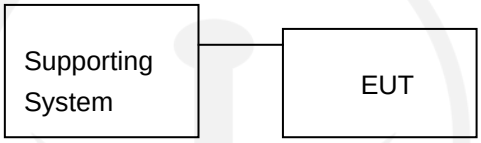
2.2. Accessories of Device (EUT)

Accessories	:	/
Manufacturer	:	/
Model	:	/
Input	:	/
Output	:	/

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number
1	Adapter	RUIDIR	Q2W24-1U-C	N/A
2	/	/.	/	/

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

The test software “RFTestTool.app” was used to control EUT work in Continuous TX mode, and select test channel, wireless mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
GFSK / Pi/4-DQPSK/8DPSK Carrier Tx Mode	CH0	2402
	CH39	2441
	CH78	2480
GFSK / Pi/4-DQPSK/8DPSK hopping on Tx Mode	CH0 to CH78	2402 to 2480
GFSK / Pi/4-DQPSK/8DPSK hopping off Tx Mode	CH0	2402
	CH39	2441
	CH78	2480

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	25℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.7. Test Facility

Shenzhen PSI Testing Co., Ltd.

1-2F, Building 5, Yudafu Industrial Park, No. 10, Xingye West Road, Shajing Street, Bao'an District, Shenzhen, Guangdong, China 518104

September 13, 2023 File on Federal Communication Commission
Registration Number: 916281

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	**Uncertainty**
Uncertainty for Power point Conducted Emissions Test	2.17dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	3.5dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	2.74dB(Polarize: V)
	2.76dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 18GHz)	4.29dB(Polarize: V)
	4.82dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (18GHz to 40GHz)	4.31 dB(Polarize: V)
	4.30 dB(Polarize: H)
Uncertainty for radio frequency	48.24KHz
Uncertainty for conducted RF Power	0.41dB

2.9. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Firmware Version	Last Cal.	Cal. Interval
1.	9*6*6 anechoic chamber	SKET	9*6*6	N/A	/	2022.12.20	3 Year
2.	Test Receiver	Rohde&Schwarz	ESCI 7	101032/003	4.42 SP3	2022.12.30	1 Year
3.	L.I.S.N.#1	Rohde&Schwarz	ENV216	102282	/	2022.12.30	1 Year
4.	L.I.S.N.#2	RFT	NNB111	13835240	/	2023.05.04	1 Year
5.	Loop Antenna	Schwarz beck	FMZB 1519B	00128	/	2023.04.03	2 Year
6.	Bilog Antenna	Schwarz beck	VULB 9168	01448	/	2022.12.26	2 Year
7.	Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101648	3.70	2022.12.30	1 Year
8.	Horn Antenna	Schwarz beck	BBHA 9120 D	02706	/	2022.12.26	2 Year
9.	Amplifier	SKET	LAPA_01G18G-45dB	SK2022032901	/	2022.12.29	1 Yea
10.	Horn Antenna	Schwarz beck	BBHA 9170	00946	/	2022.12.25	2 Year
11.	Amplifier	SKET	LNPA_0118G-45	SK2020010801	/	2022.12.30	1 Yea
12	RF Power Probe	Rohde&Schwarz	NRP-Z11	1138.3004.02-1111533-Fz	/	2023.03.30	1 Yea

For Test Software Information

Item	Software Name	Manufacturer	Version
RE	EMC-I	SKET	V1.5.0.3
CE	EMC-I	SKET	V1.5.0.3
RF	RTS	TACHOY	V1.0.0

3. Maximum Peak Output Power

3.1. Limit

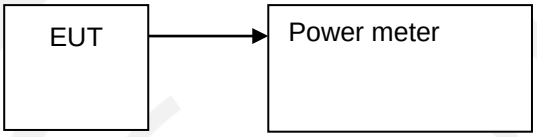
Please refer FCC part 15.247 & RSS-247..

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2. Test Procedure

The transmitter output is connected to the RF Power meter. The Power meter is set to the peak power detection.

3.3. Test Setup



3.4. Test Result

Mode	Freq (MHz)	Output Power (dBm)	Limit (dBm)	Result
GFSK	2402	1.04	21	Pass
	2441	2.25	21	Pass
	2480	**2.83**	21	Pass
π/4 DQPSK	2402	-0.13	21	Pass
	2441	1.06	21	Pass
	2480	1.79	21	Pass
8DPSK	2402	0.34	21	Pass
	2441	0.28	21	Pass
	2480	-0.97	21	Pass
Conclusion: PASS				

4. Bandwidth

4.1. Limit

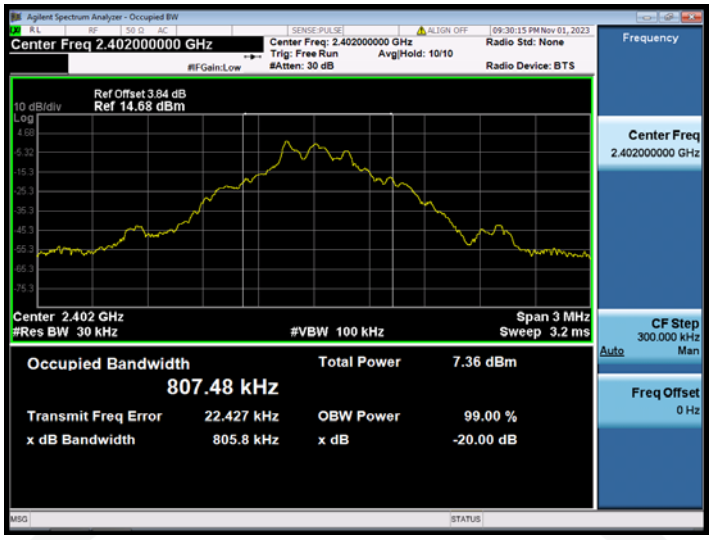
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in RSS-GEN, FCC Section 15.247(a)(1), must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2. Test Procedure

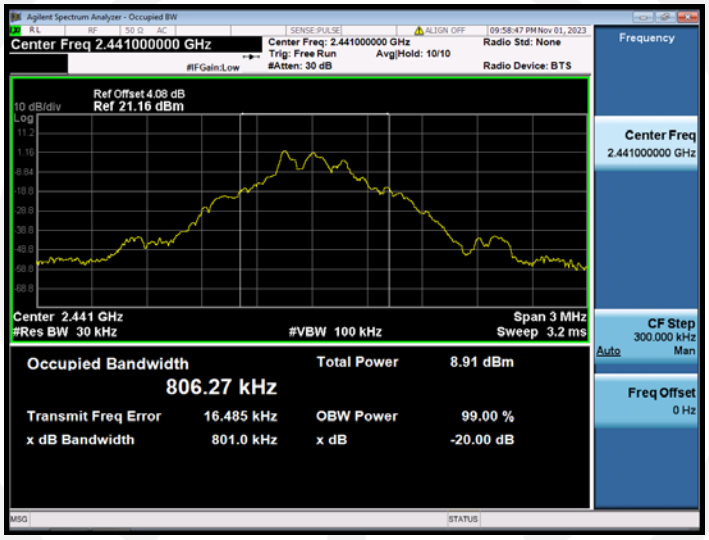
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3. Test Result

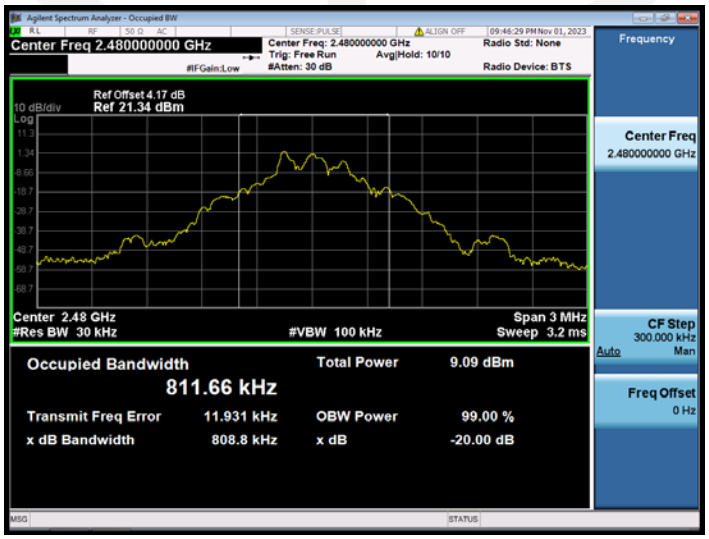
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-20 dB Bandwidth (MHz)	Limit -20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	Ant 1	0.807	0.806	/	Pass
NVNT	1-DH1	2441	Ant 1	0.806	0.801	/	Pass
NVNT	1-DH1	2480	Ant 1	0.812	0.809	/	Pass
NVNT	2-DH1	2402	Ant 1	1.078	1.144	/	Pass
NVNT	2-DH1	2441	Ant 1	1.078	1.147	/	Pass
NVNT	2-DH1	2480	Ant 1	1.077	1.142	/	Pass
NVNT	3-DH1	2402	Ant1	1.173	1.239	/	Pass
NVNT	3-DH1	2441	Ant1	1.175	1.289	/	Pass
NVNT	3-DH1	2480	Ant1	1.176	1.247	/	Pass



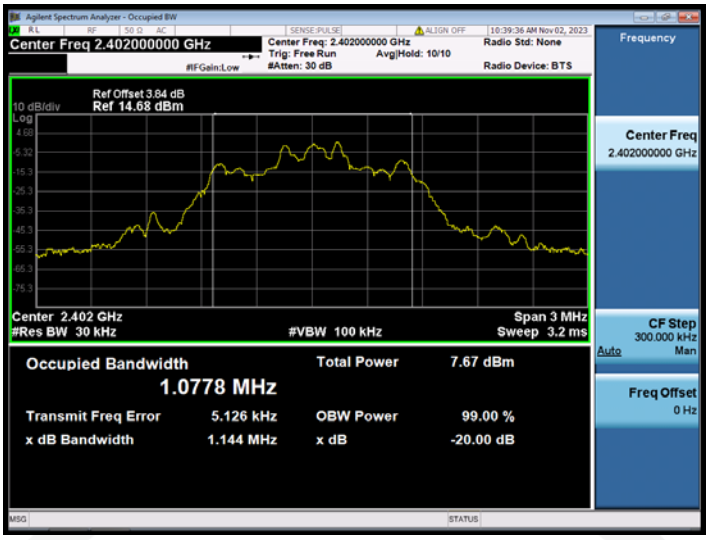
GFSK(1-DH1) 2402MHz



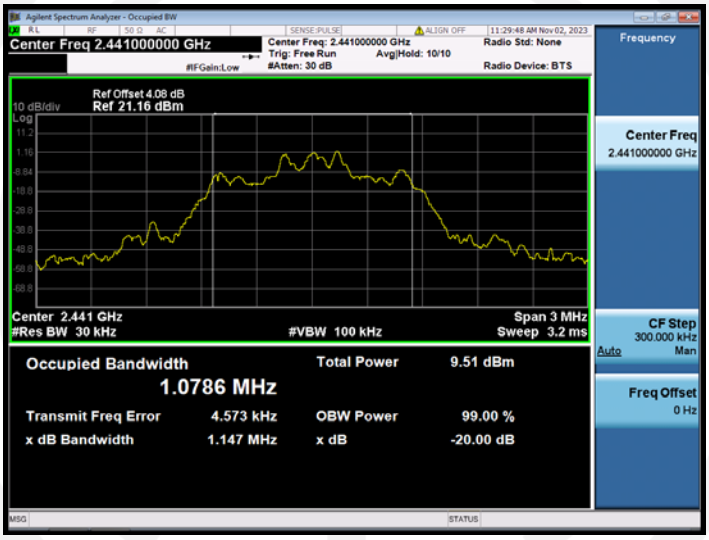
GFSK(1-DH1) 2441MHz



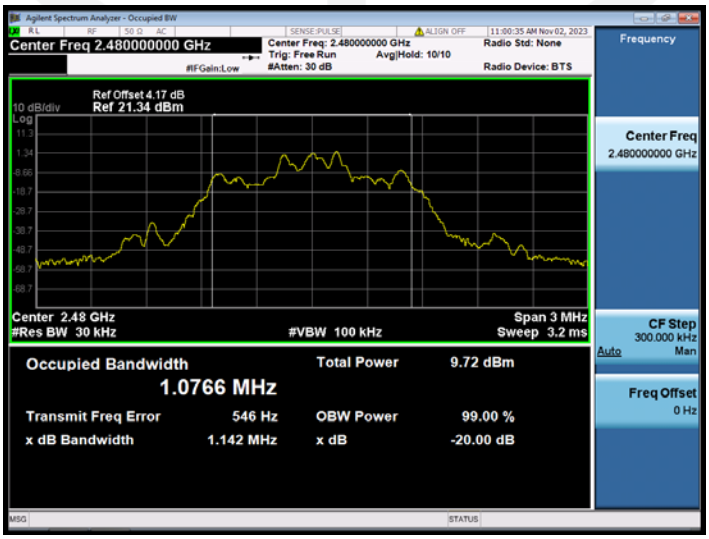
GFSK(1-DH1) 2480MHz



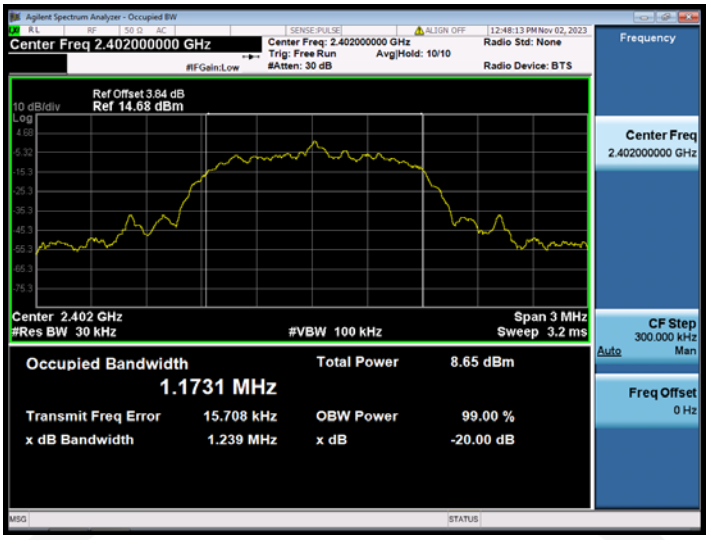
π/4-DQPSK (2-DH1) 2402MHz



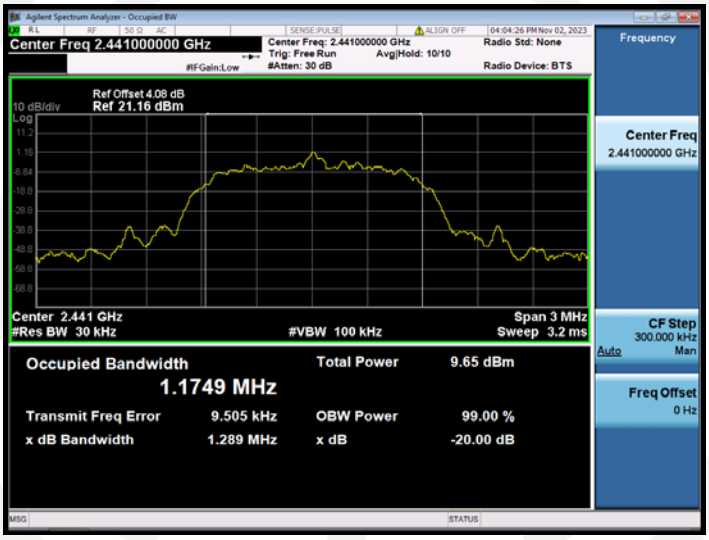
π/4-DQPSK (2-DH1) 2441MHz



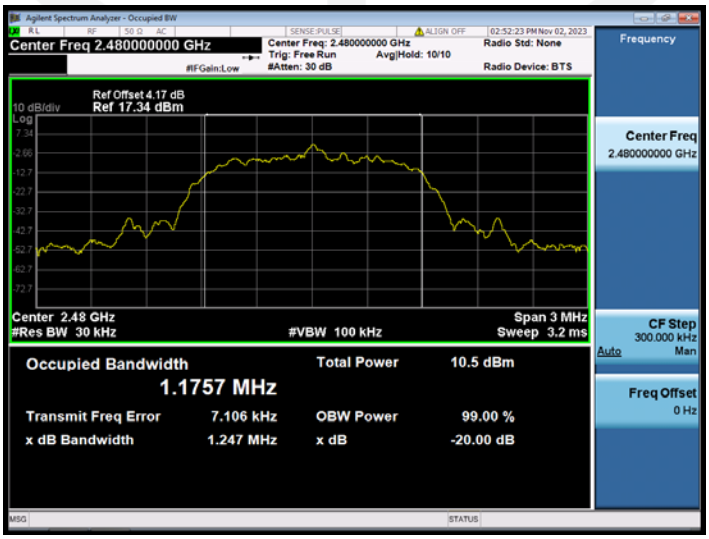
π/4-DQPSK (2-DH1) 2480MHz



8DPSK (3-DH1) 2402MHz



8DPSK (3-DH1) 2441MHz



8DPSK (3-DH1) 2480MHz

5. Carrier Frequency Separation

5.1. 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

5.2. Test Procedure

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The carrier frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW.

5.3. Test Result

Condition	Mode	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH1	2440.852	2441.854	1.002	0.801	Pass
NVNT	2-DH1	2441.014	2442.013	0.999	0.765	Pass
NVNT	3-DH1	2441.011	2442.010	0.999	0.859	Pass

GFSK (1-DH1) 2441MHz

π/4-DQPSK (2-DH1) 2441MHz

8DPSK (3-DH1) 2441MHz

6. Number Of Hopping Channel

6.1. Limit

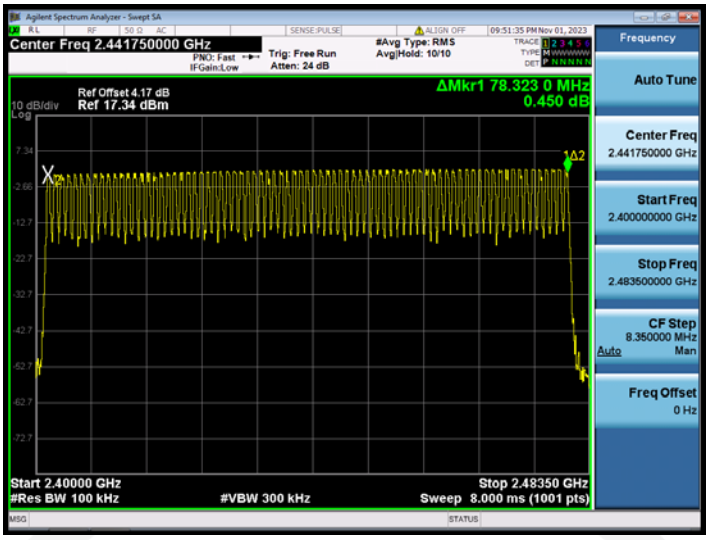
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

6.2. Test Procedure

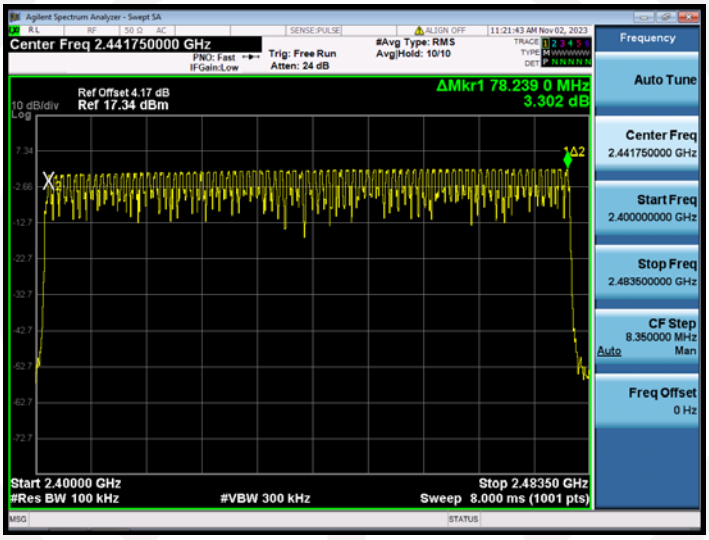
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The number of hopping channel was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW.

6.3. Test Result

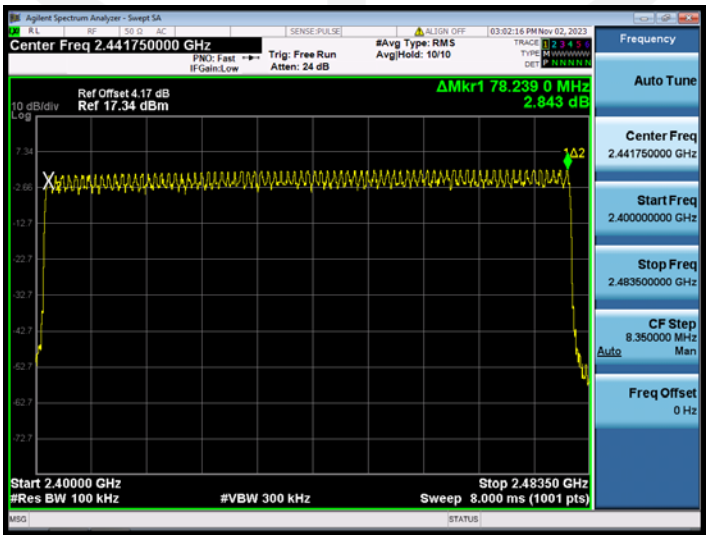
Condition	Mode	Hopping Number	Limit	Verdict
NVNT	1-DH1	79	15	Pass
NVNT	2-DH1	79	15	Pass
NVNT	3-DH1	79	15	Pass



GFSK (1-DH1) 2441MHz



π/4-DQPSK (2-DH1) 2441MHz



8DPSK (3-DH1) 2441MHz

7. Dwell Time

7.1. Test limit

Please refer FCC part 15.247 & RSS-247.

Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 sec- onds multiplied by the number of hopping channel employed.

7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.

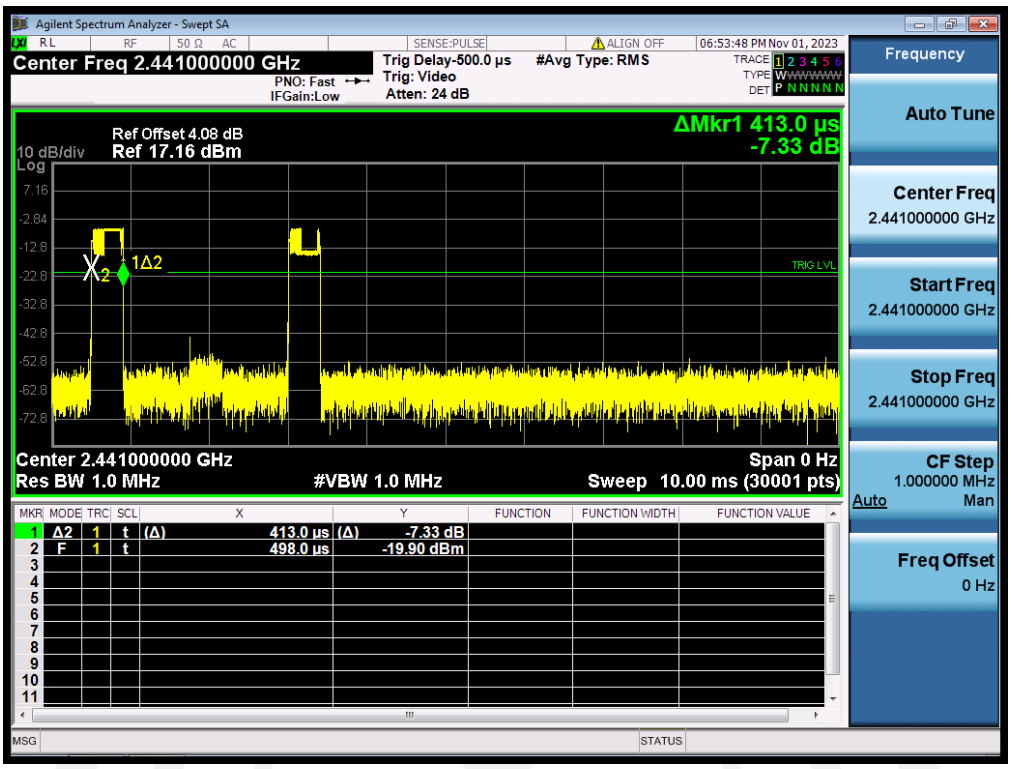
7.2.5. Repeat above procedures until all frequency measured were complete.

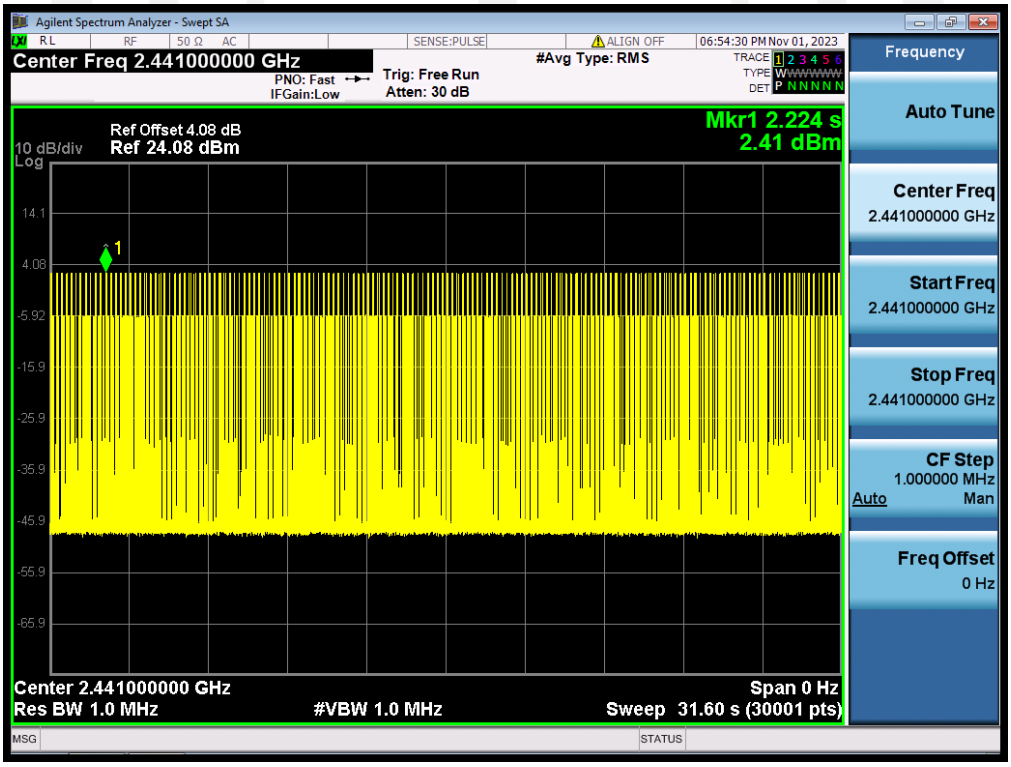
7.3. Test Result

PASS.

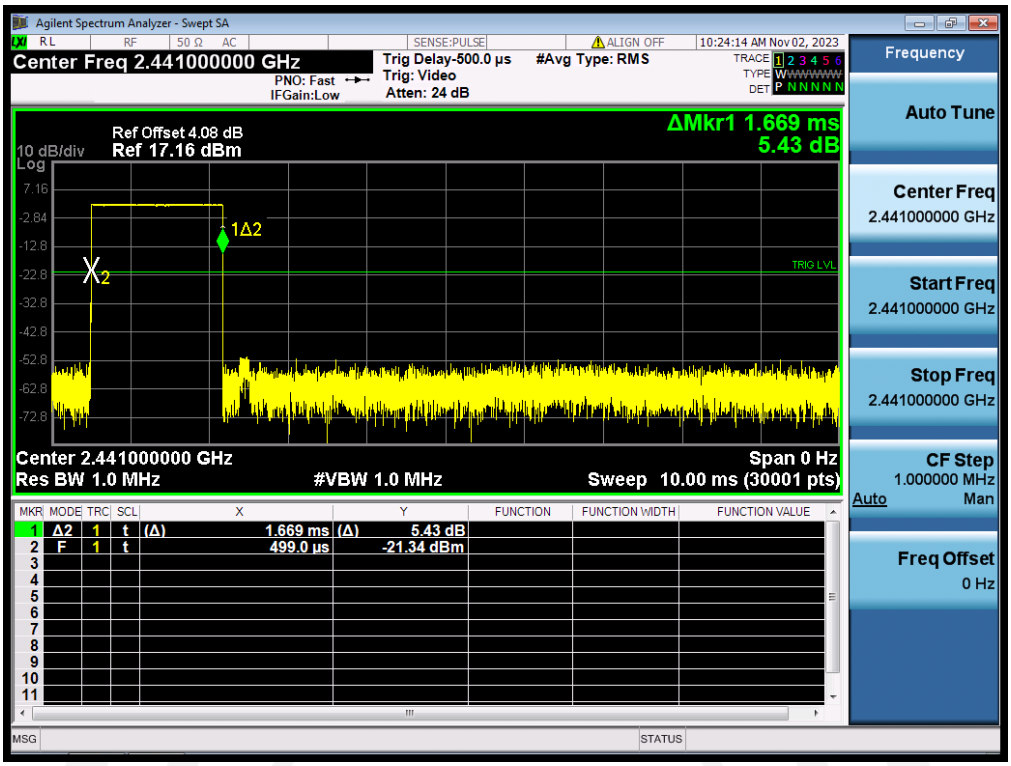
Detailed information please see the following page.

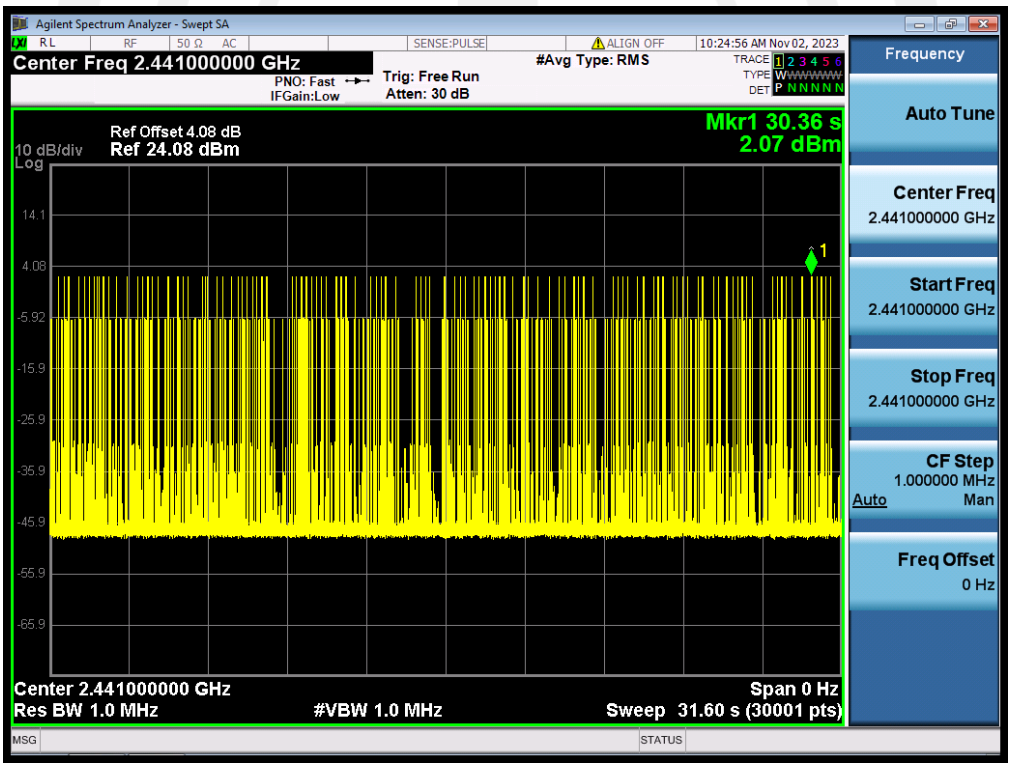
Mode	Frequency (MHz)	Pulse Time(ms)	Hops Number	Dwell Time(ms)	Limit(s)	Result
1-DH1	2441	0.413	320.00	132.160	0.40	Pass
1-DH3	2441	1.669	146.00	243.674	0.40	Pass
1-DH5	2441	2.917	105.00	306.285	0.40	Pass
2-DH1	2441	0.422	320.00	135.040	0.40	Pass
2-DH3	2441	1.675	156.00	261.300	0.40	Pass
2-DH5	2441	2.922	107.00	312.654	0.40	Pass
3-DH1	2441	0.425	320.00	136.000	0.40	Pass
3-DH3	2441	1.675	156.00	261.300	0.40	Pass
3-DH5	2441	2.926	103.00	301.378	0.40	Pass
Note:	1. The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s 2. Dwell Time=Pulse Time* Hops Number/ T					



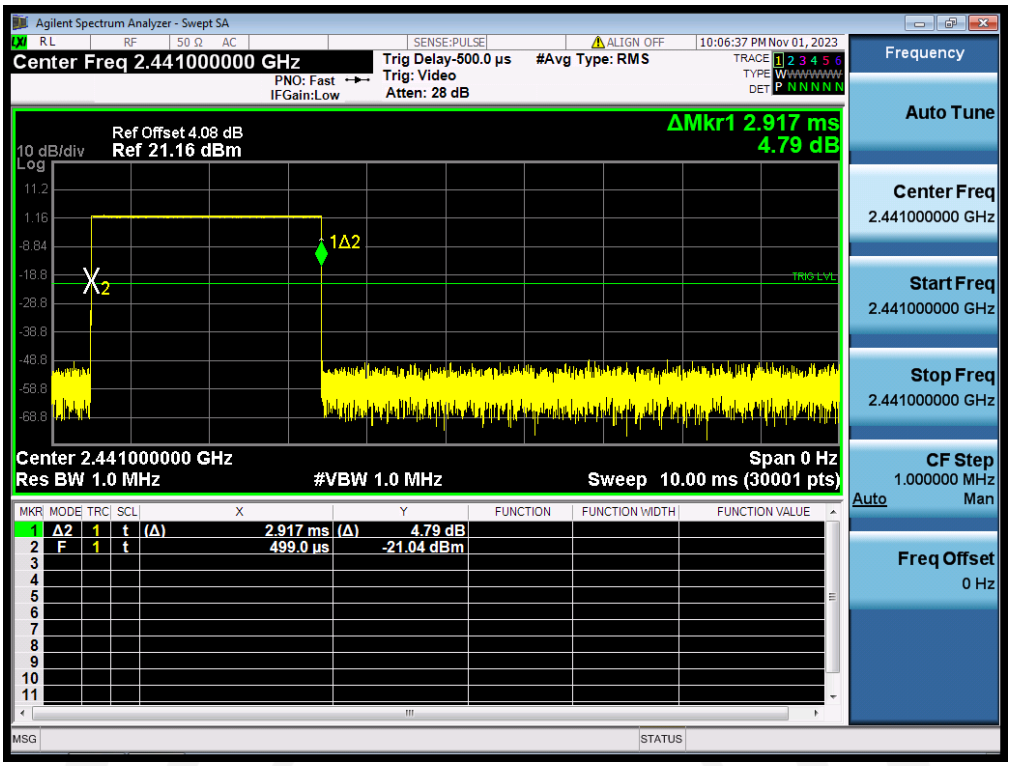


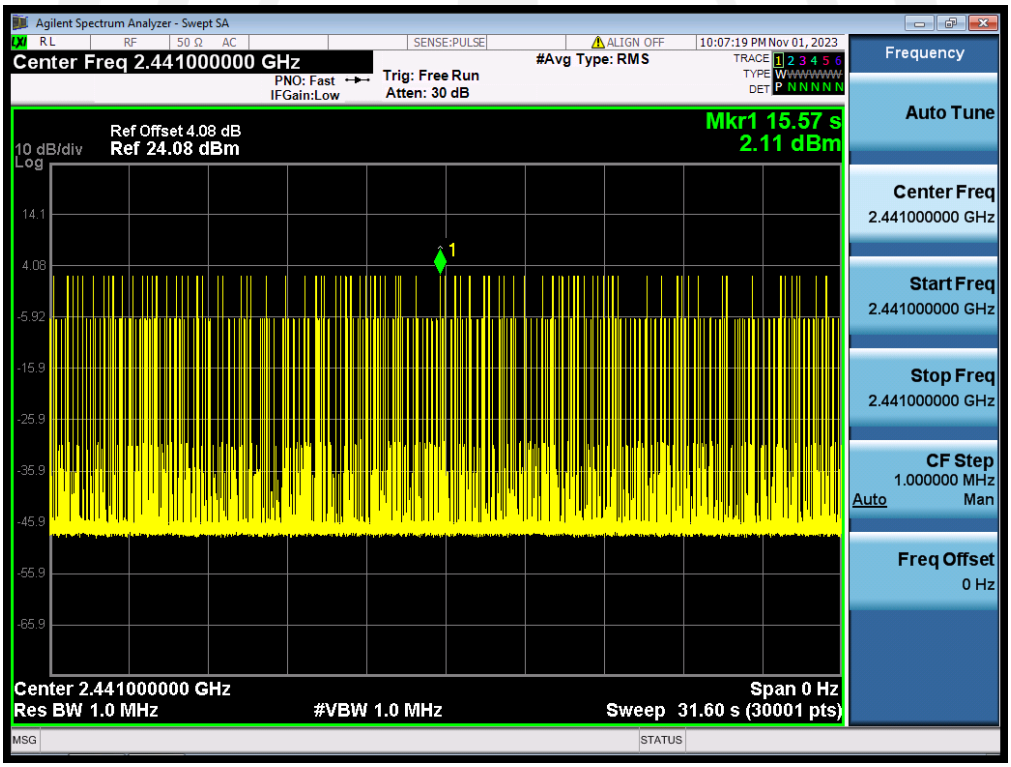
GFSK (1-DH1) 2441MHz



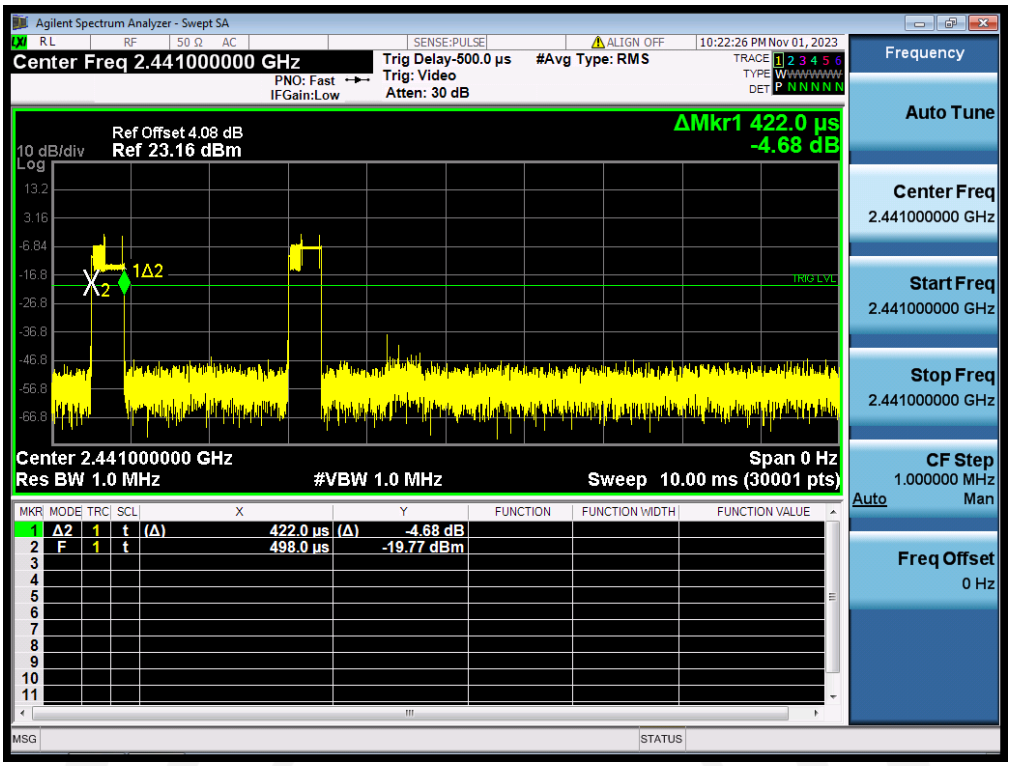


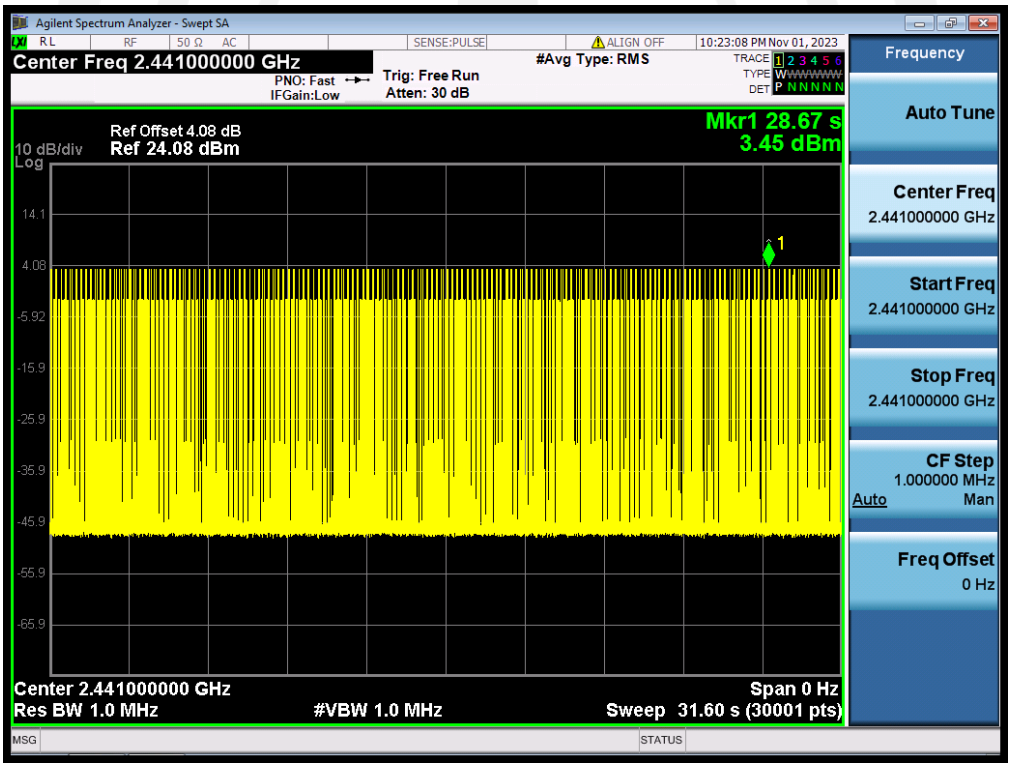
GFSK (1-DH3) 2441MHz



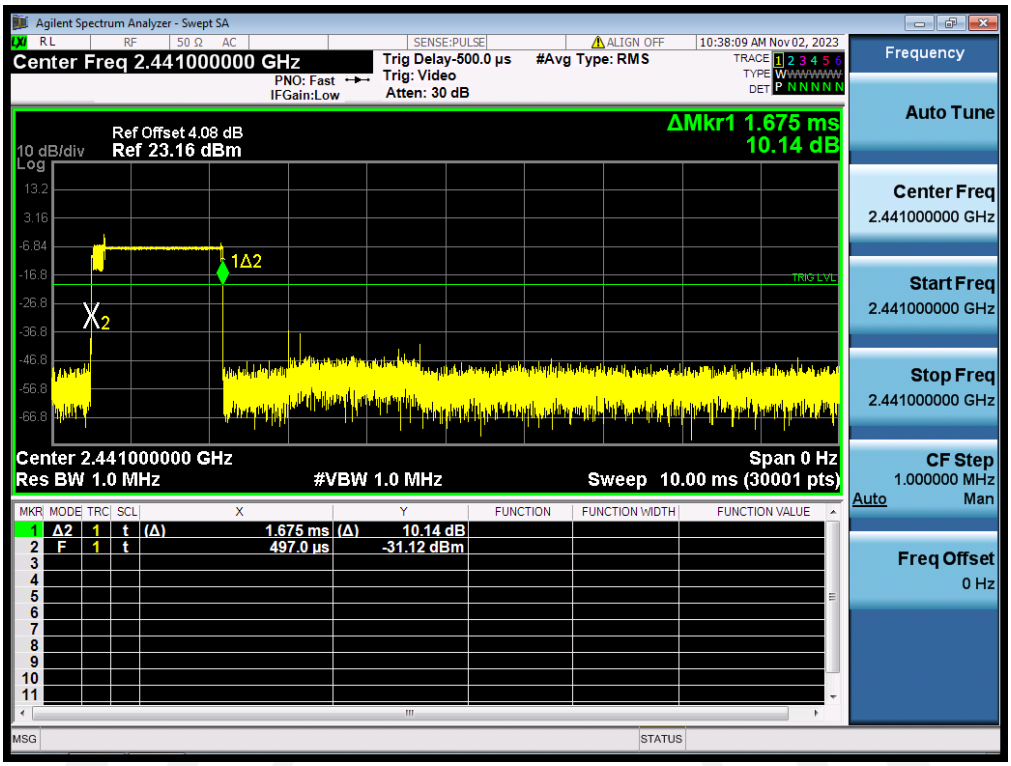


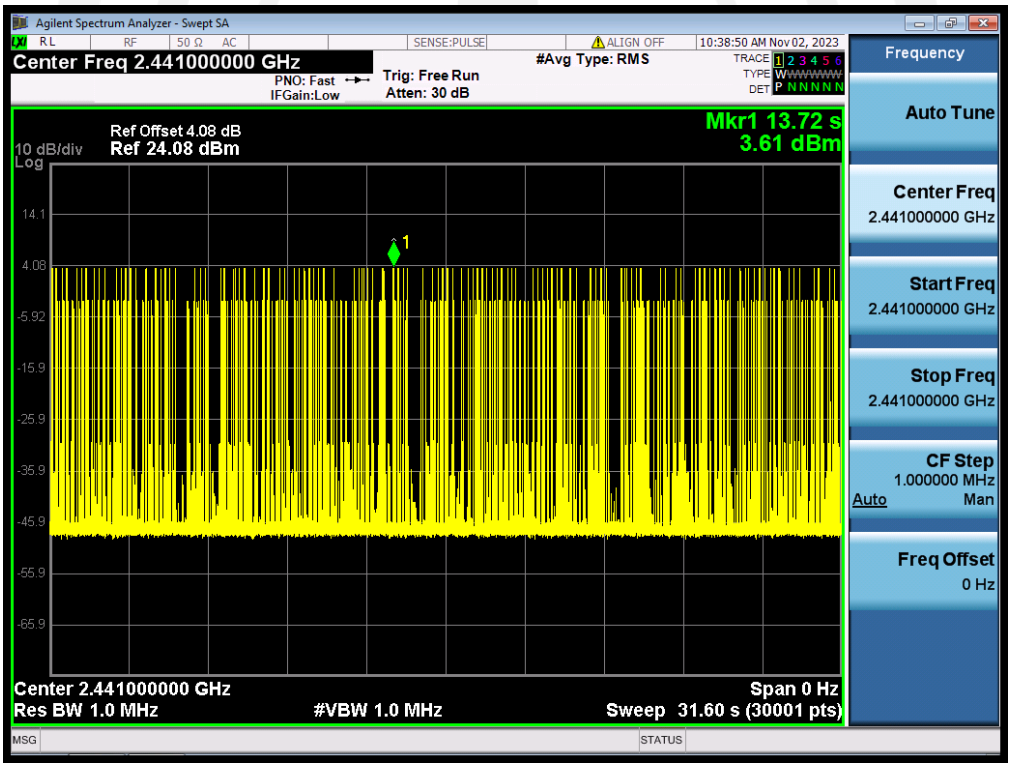
GFSK (1-DH5) 2441MHz



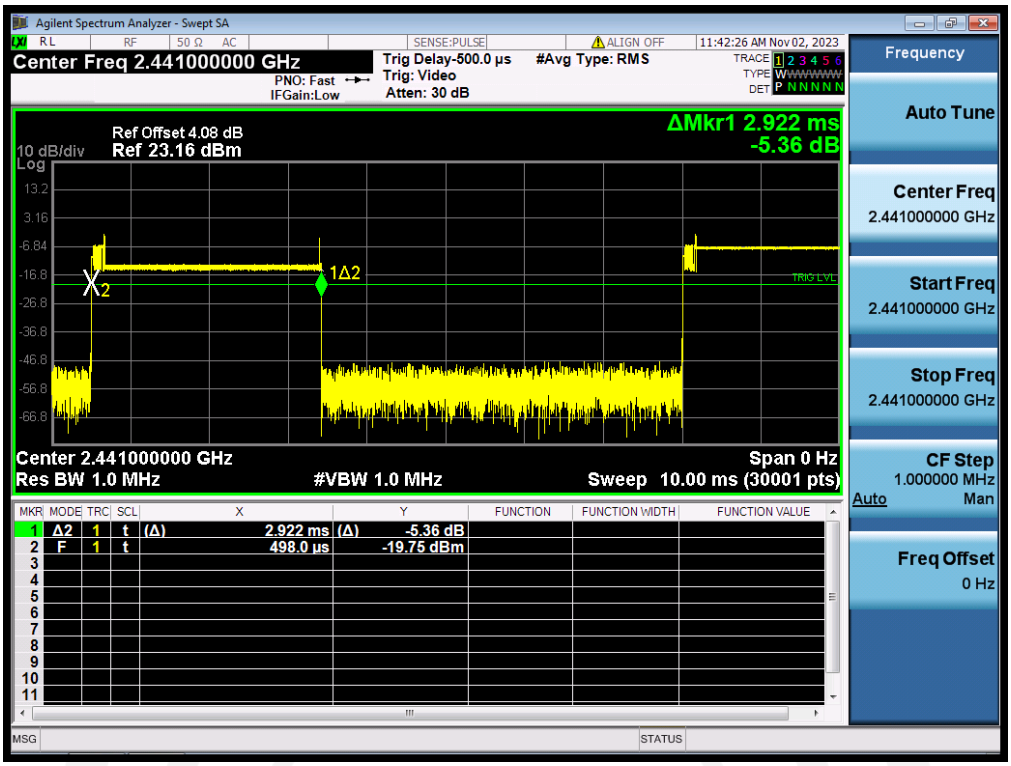


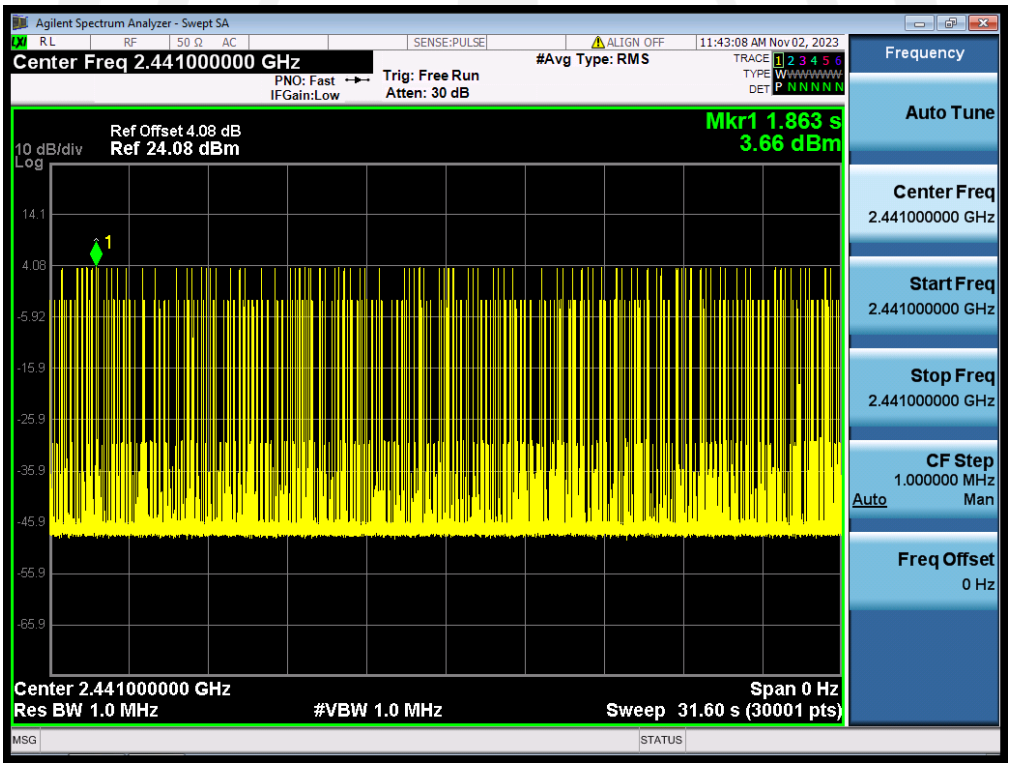
π/4-DQPSK (2-DH1) 2441MHz



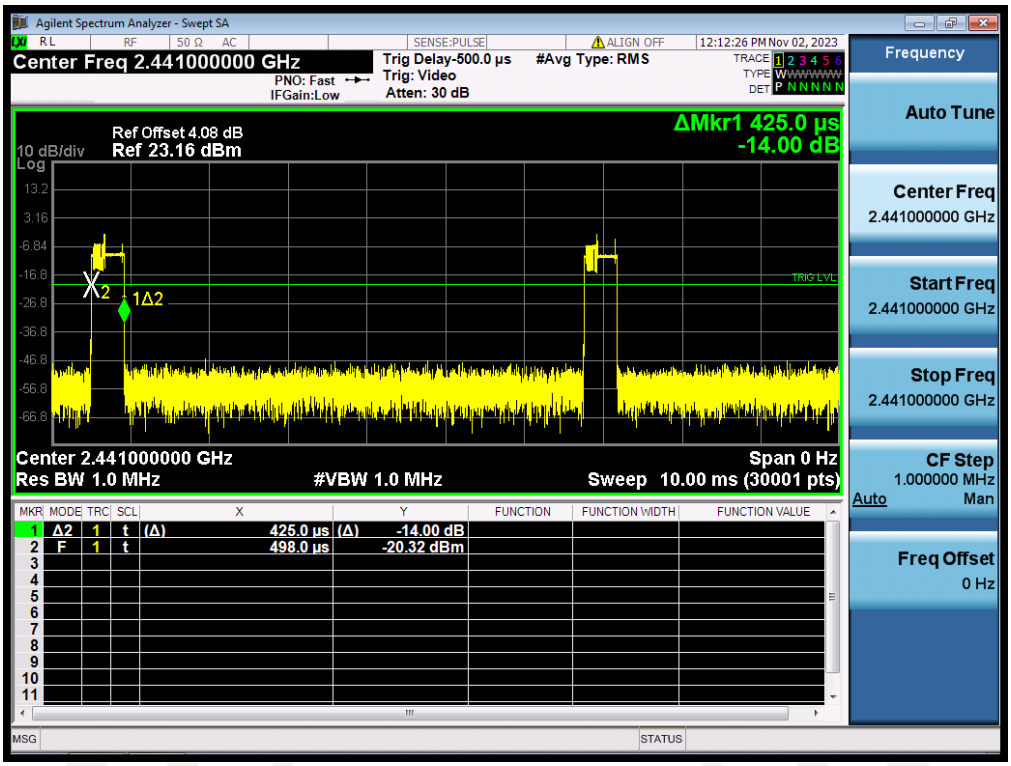


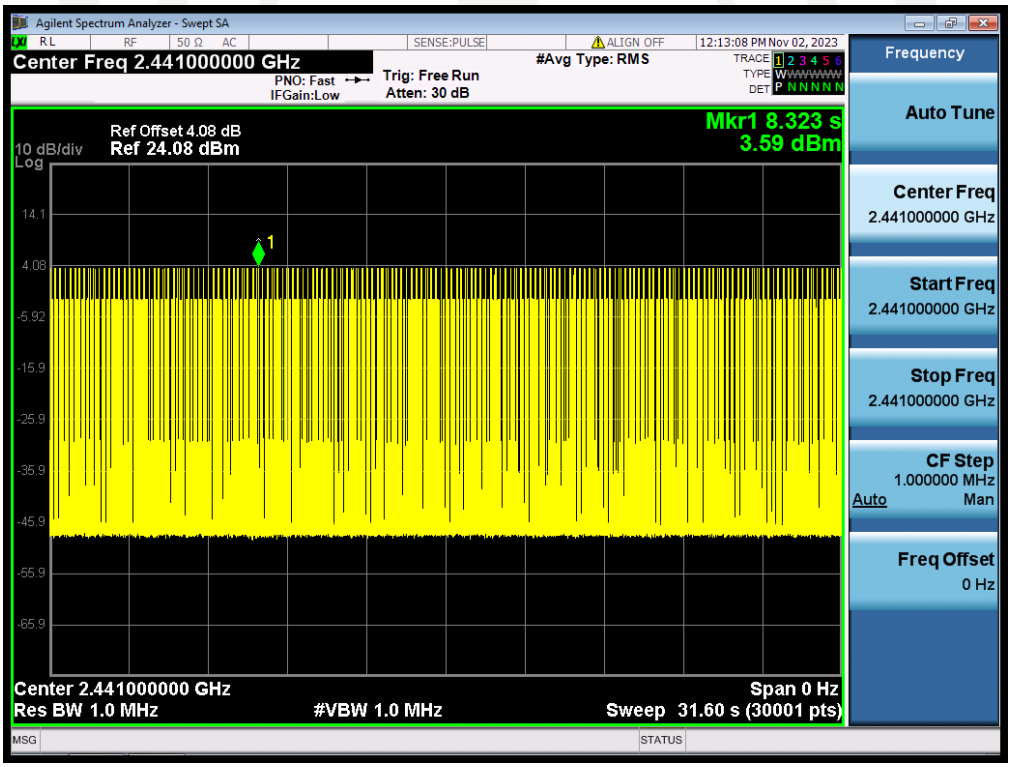
π/4-DQPSK (2-DH3) 2441MHz



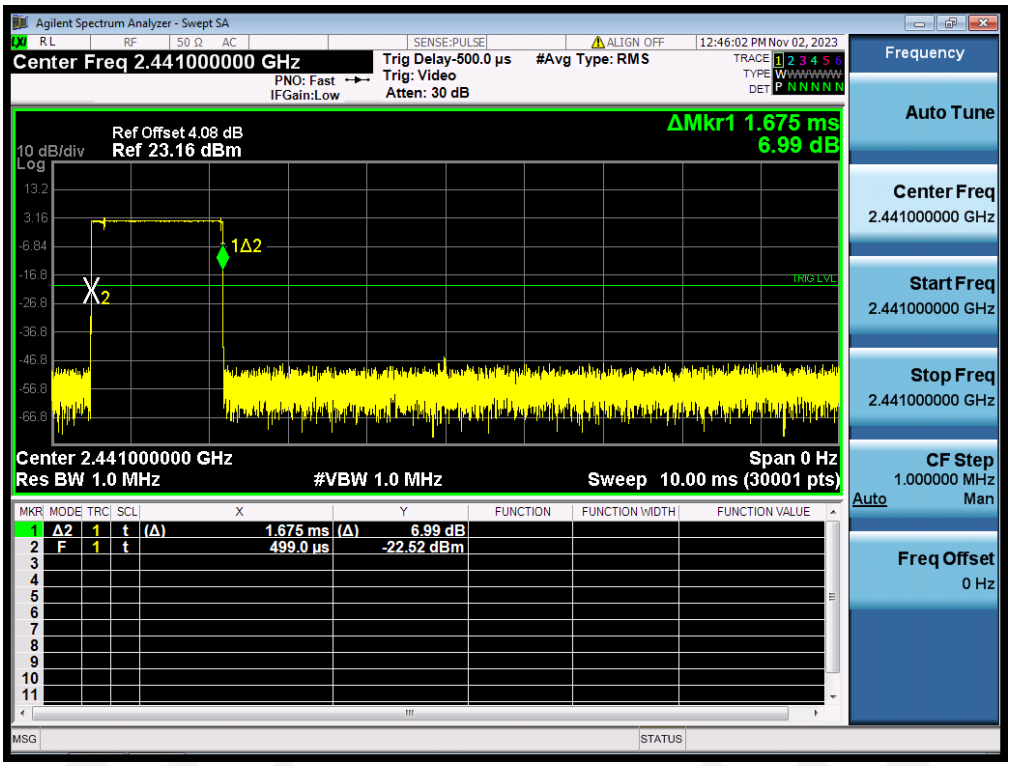


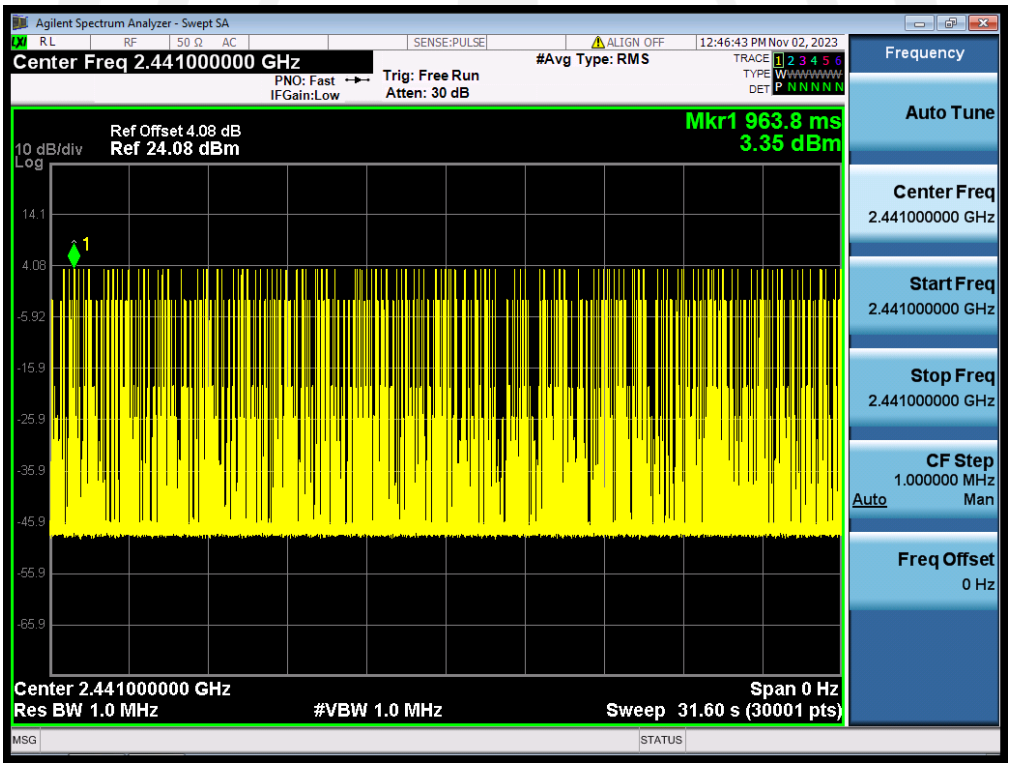
π/4-DQPSK (2-DH5) 2441MHz



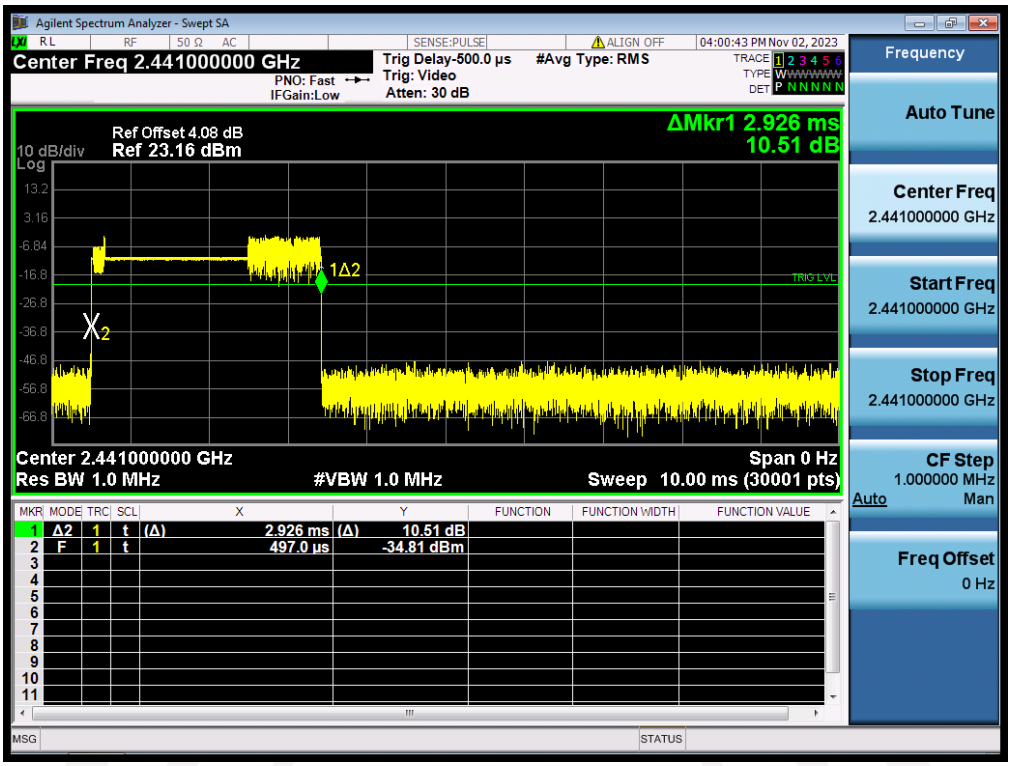


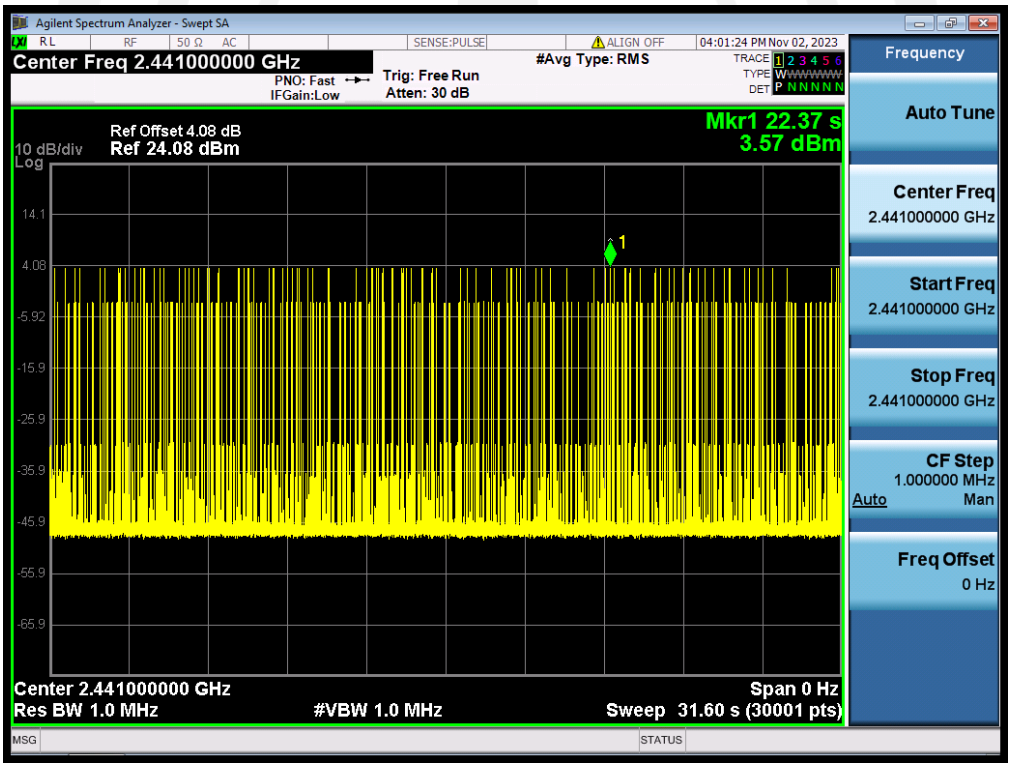
8DPSK (3-DH1) 2441MHz





8DPSK (3-DH3) 2441MHz





8DPSK (3-DH5) 2441MHz

8. Out-of-band Emissions

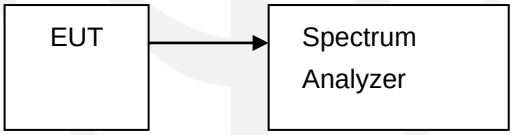
8.1. Test Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC Part15.209(a) is not required.

8.2. Test Procedure

Connect the transmitter ouput to spectrum analvzer using a low loss RF cable, and set the spectrum analvzerto RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these setting aremade of the in-band reference level, bandedge and out-of-band emissions.

8.3. Test Setup

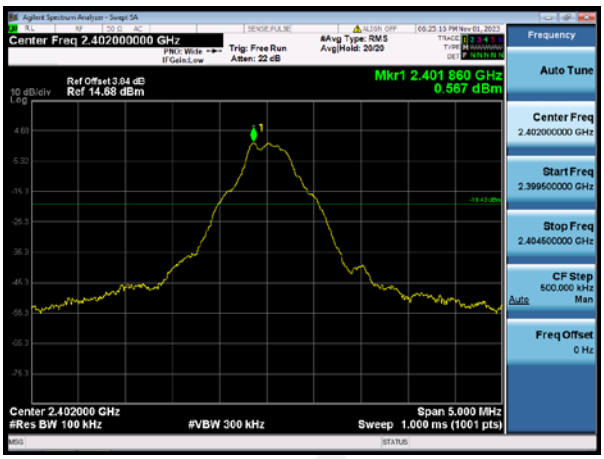


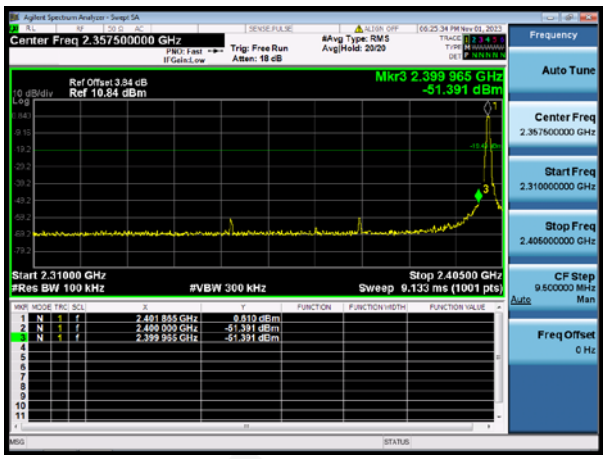
8.4. Test Results

PASS.

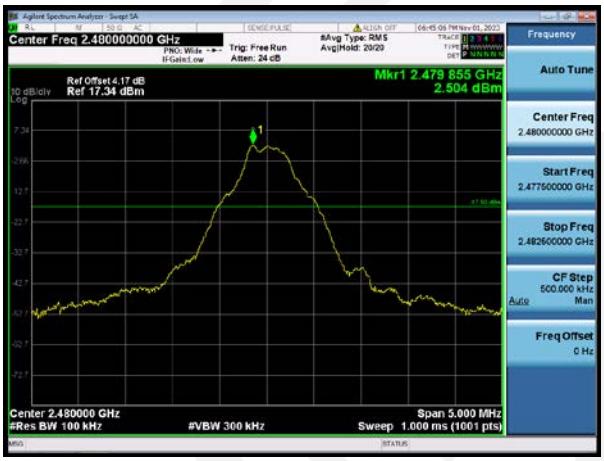
All modes have been tested, and only worst data of GFSK mode, GFSK was listed in this report.The test results are listed in next pages.

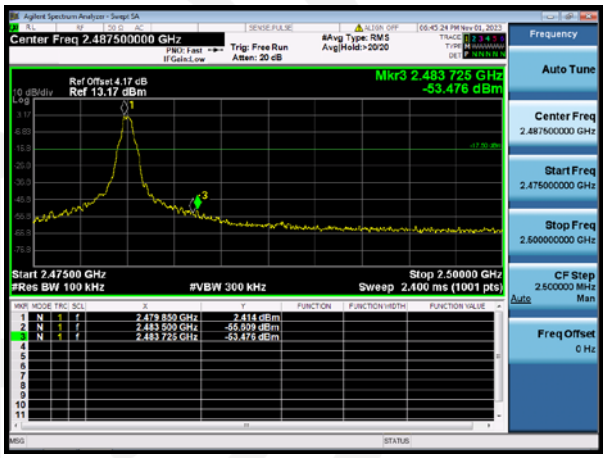
For Band Edge:



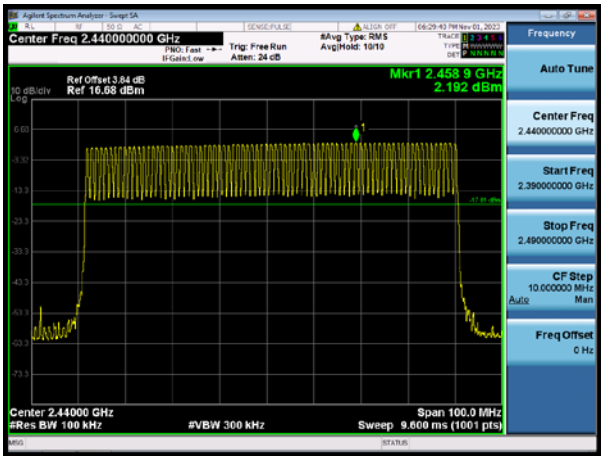


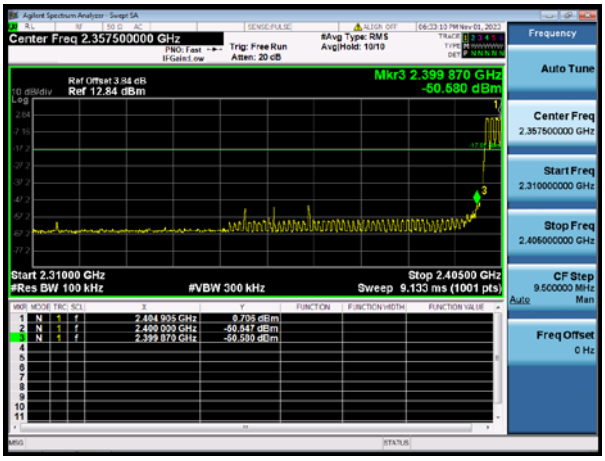
GFSK 2402MHz



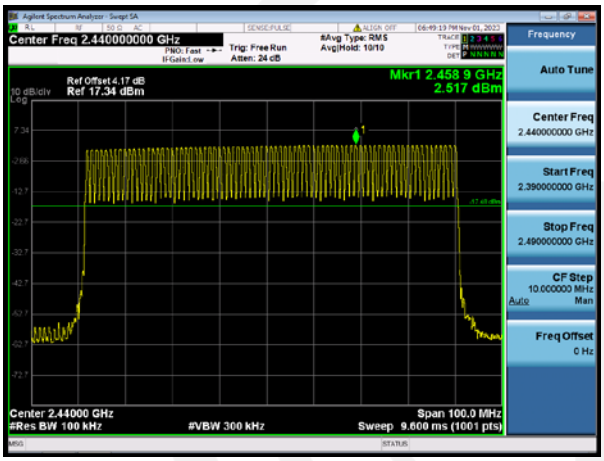


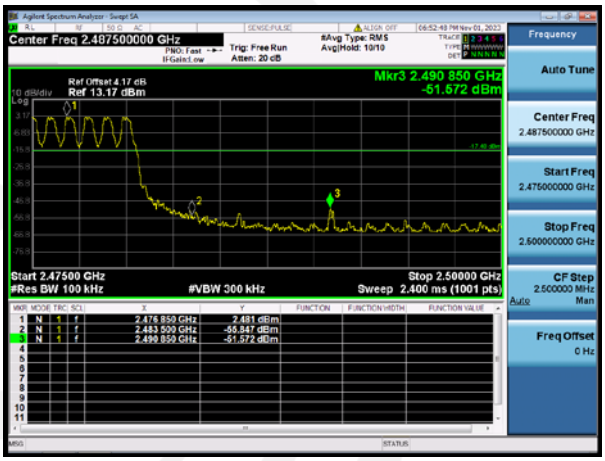
GFSK 2480MHz





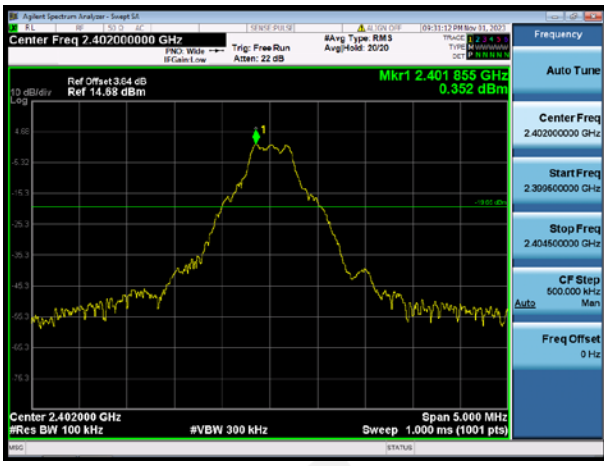
GFSK Hopping

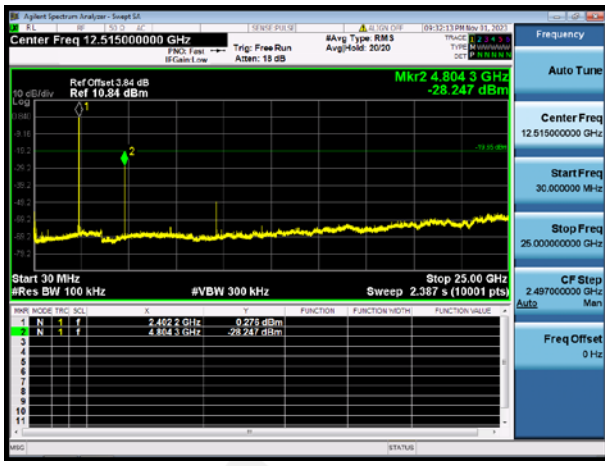




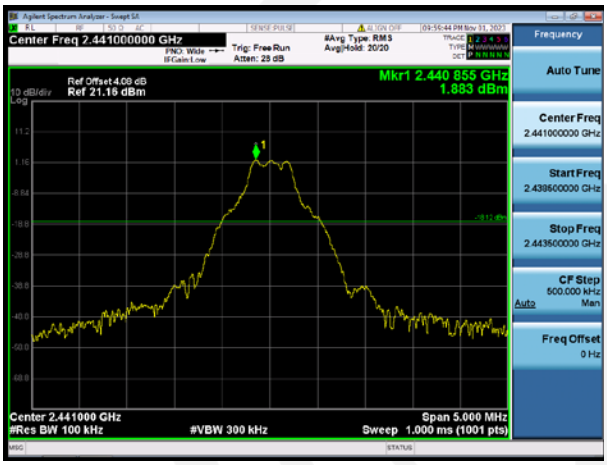
GFSK Hopping

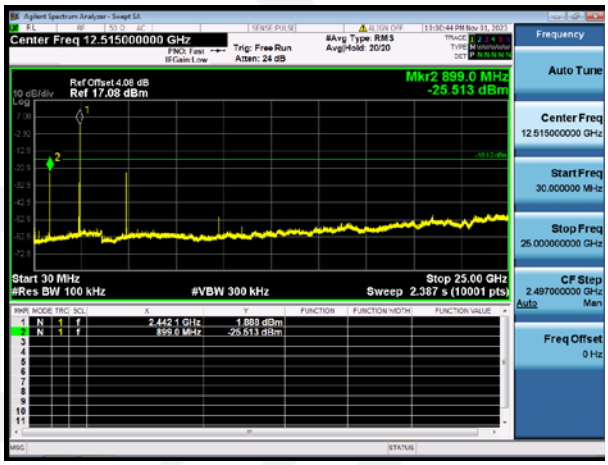
For Connected Spurious Emission:



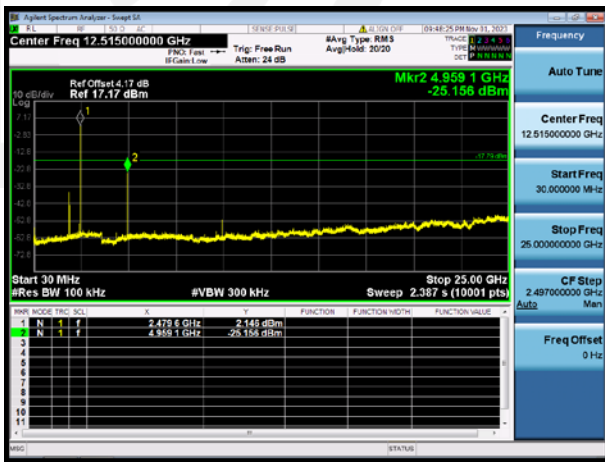


GFSK 2402MHz





GFSK 2441MHz



GFSK 2480MHz

9. Radiated Emissions

9.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 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	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	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])

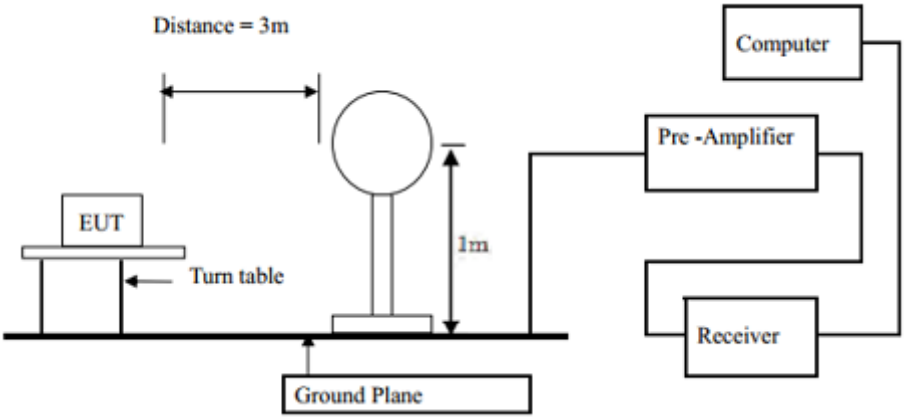
15.209 Limit

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

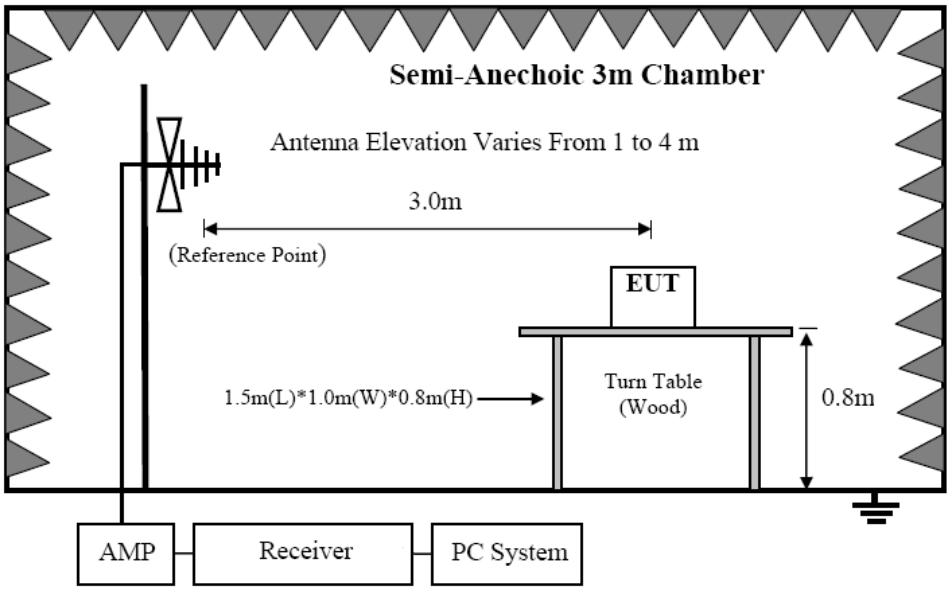
Note: The peak limit is 20 dB higher than the average limit

9.2. Block Diagram of Test setup

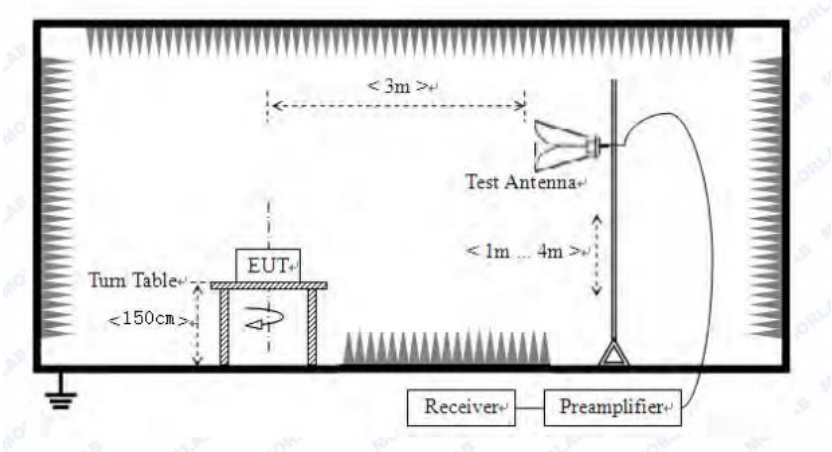
8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

9.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and simulator

(3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.

(a) Change work frequency or channel of device if practicable.

(b) Change modulation type of device if practicable.

(c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

(4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated

(5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013on Radiated Emission test.

(6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

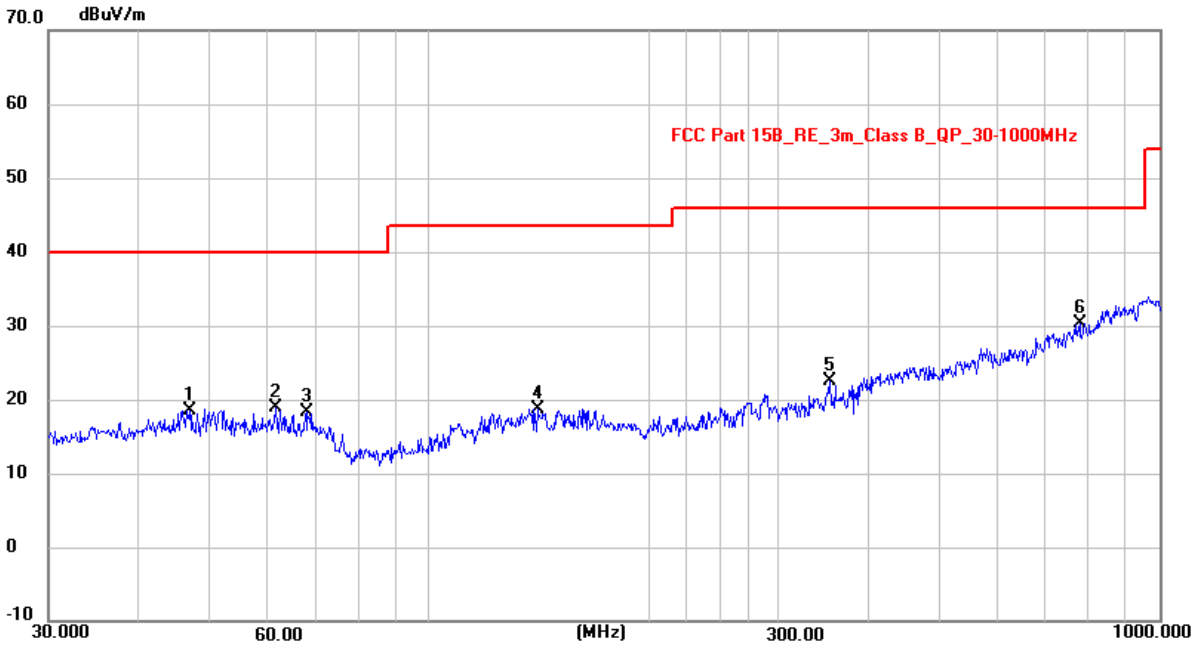
9.4. Test Results

We have scanned from 9kHz to the 10th harmonic of the EUT's highest frequency.
Detailed information please see the following page.

From 9KHz to 30MHz:					
Test Date	:	2023.11.03	Temperature	:	24℃
Test Engineer	:	Jensen Wang	Humidity	:	56%
Test Mode	:	GFSK mode			
Test Results	:	**PASS**			
Note:	The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.				

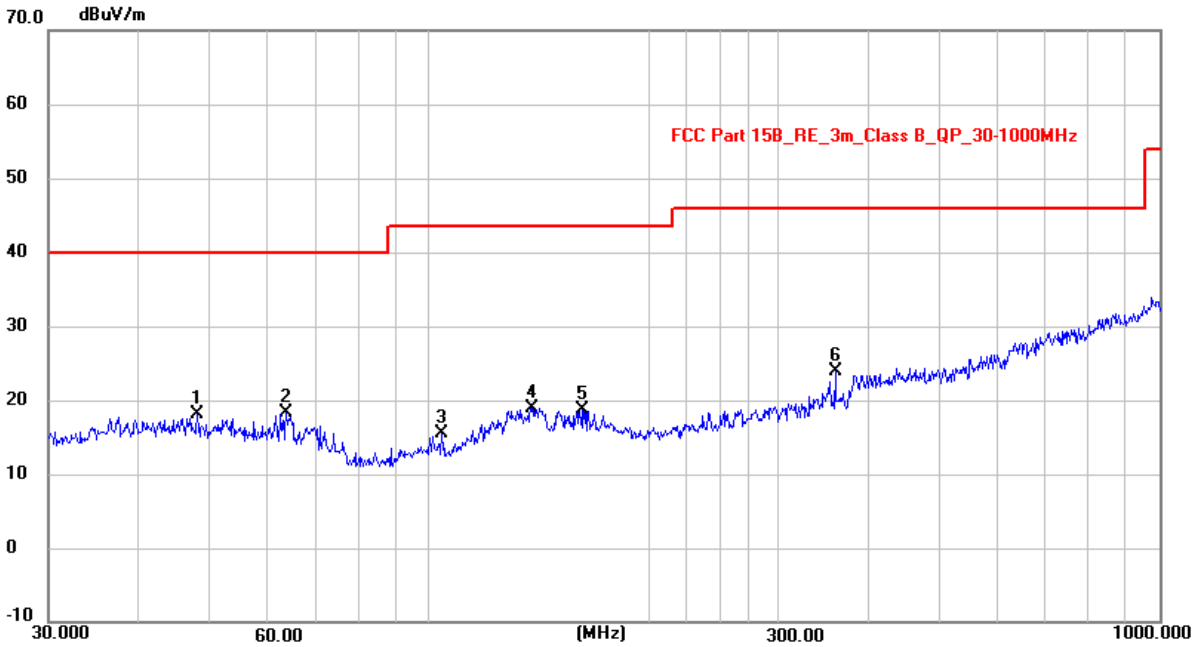
From 30MHz to 1000MHz:					
Test Date	:	2023.11.03	Temperature	:	24℃
Test Engineer	:	Jensen Wang	Humidity	:	56%
Test Mode	:	GFSK mode			
Test Results	:	**PASS**			
Note:	1. The test results are listed in next pages. 2. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector and quasi-peak detector need not be carried out. 3. All modes have been tested, and only worst data of GFSK mode, Channel 2441MHz (AC 120V/ 60Hz) was listed in this report.				

Polarization: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.9947	5.20	13.33	18.53	40.00	-21.47	peak
2	61.6968	6.84	11.97	18.81	40.00	-21.19	peak
3	68.0022	7.01	11.31	18.32	40.00	-21.68	peak
4	140.7116	5.93	12.83	18.76	43.50	-24.74	peak
5	353.5627	7.48	15.02	22.50	46.00	-23.50	peak
6 *	777.9000	7.17	23.13	30.30	46.00	-15.70	peak

Polarization: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	48.0150	4.87	13.29	18.16	40.00	-21.84	peak
2 *	63.5356	6.51	11.77	18.28	40.00	-21.72	peak
3	104.0788	5.49	9.94	15.43	43.50	-28.07	peak
4	137.9030	6.21	12.68	18.89	43.50	-24.61	peak
5	161.4740	5.62	13.11	18.73	43.50	-24.77	peak
6	360.1317	8.67	15.18	23.85	46.00	-22.15	peak

From 1GHz to 25GHz:					
Test Date	:	2023.11.03	Temperature	:	24℃
Test Engineer	:	Jensen Wang	Humidity	:	56%
Test Mode	:	GFSK mode			
Test Results	:	**PASS**			
Note:	1. The test results are listed in next pages. 2. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector and quasi-peak detector need not be carried out. 3. If the limits for the measurement with the average detector are met when using a receiver with a quasi-peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.				

Test Mode : GFSK TX Low								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	4804	V	82.41	-27.27	55.14	74	-18.86	Peak
2	4804	V	72.05	-27.27	44.78	54	-9.22	Avg
3	7206	--	--	--	--	--	--	--
4	9608	--	--	--	--	--	--	--
5	4804	H	85.78	-27.27	58.51	74	-15.49	Peak
6	4804	H	65.70	-27.27	38.43	54	-15.57	Avg
7	7206	--	--	--	--	--	--	--
8	9608	--	--	--	--	--	--	--
Test Mode : GFSK TX Mid								
1	4882	V	86.83	-27.27	59.56	74	-14.44	Peak
2	4882	V	71.02	-27.27	43.75	54	-10.25	Avg
3	7323	--	--	--	--	--	--	--
4	9764	--	--	--	--	--	--	--
5	4882	H	84.04	-27.79	56.25	74	-17.75	Peak
6	4882	H	69.54	-27.79	41.75	54	-12.25	Avg
7	7323	--	--	--	--	--	--	--
8	9764	--	--	--	--	--	--	--
Test Mode : GFSK TX High								
1	4960	V	80.85	-28.30	52.55	74	-21.45	Peak
2	4960	V	67.95	-28.30	39.65	54	-14.35	Avg
3	7440	--	--	--	--	--	--	--
4	9920	--	--	--	--	--	--	--
5	4960	H	80.89	-28.30	52.59	74	-21.41	Peak
6	4960	H	70.44	-28.30	42.14	54	-11.86	Avg
7	7440	--	--	--	--	--	--	--
8	9920	--	--	--	--	--	--	--

Note:
1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.
2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain.
Result=Reading + Correct Factor.
Margin= Result-Limit.

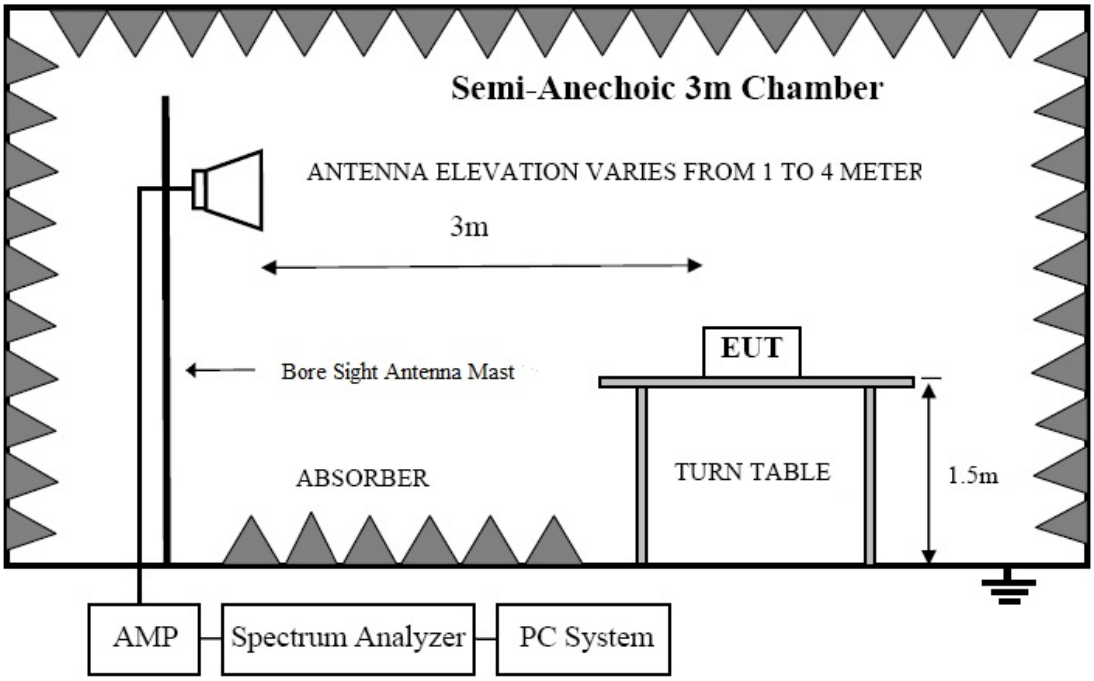
Test Mode : π/4 DQPSK TX Low								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	4804	V	76.46	-27.27	49.19	74	-24.81	Peak
2	4804	V	62.52	-27.27	35.25	54	-18.75	Avg
3	7206	--	--	--	--	--	--	--
4	9608	--	--	--	--	--	--	--
5	4804	H	76.35	-27.27	49.08	74	-24.92	Peak
6	4804	H	63.68	-27.27	34.41	54	-21.59	Avg
7	7206	--	--	--	--	--	--	--
8	9608	--	--	--	--	--	--	--
Test Mode : π/4 DQPSK TX Mid								
1	4882	V	71.28	-27.79	43.49	74	-30.51	Peak
2	4882	V	62.46	-27.79	34.67	54	-19.33	Avg
3	7323	--	--	--	--	--	--	--
4	9764	--	--	--	--	--	--	--
5	4882	H	85.57	-27.79	57.78	74	-16.22	Peak
6	4882	H	70.91	-27.79	43.12	54	-10.88	Avg
7	7323	--	--	--	--	--	--	--
8	9764	--	--	--	--	--	--	--
Test Mode : π/4 DQPSK TX High								
1	4960	V	73.39	-28.30	45.09	74	-28.91	Peak
2	4960	V	60.39	-28.30	32.09	54	-21.91	Avg
3	7440	--	--	--	--	--	--	--
4	9920	--	--	--	--	--	--	--
5	4960	H	73.87	-28.30	45.57	74	-28.43	Peak
6	4960	H	69.13	-28.30	36.83	54	-21.17	Avg
7	7440	--	--	--	--	--	--	--
8	9920	--	--	--	--	--	--	--
Note:	1. Means other frequency and mode comply with standard requirements and at least have 20dB margin. 2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.							

Test Mode : 8DPSK TX Low								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	4804	V	74.16	-27.27	46.89	74	-27.11	Peak
2	4804	V	69.79	-27.27	37.52	54	-21.48	Avg
3	7206	--	--	--	--	--	--	--
4	9608	--	--	--	--	--	--	--
5	4804	H	70.81	-27.27	43.54	74	-30.46	Peak
6	4804	H	60.34	-27.27	33.07	54	-20.93	Avg
7	7206	--	--	--	--	--	--	--
8	9608	--	--	--	--	--	--	--
Test Mode : 8DPSK TX Mid								
1	4882	V	71.38	-27.79	43.59	74	-30.41	Peak
2	4882	V	60.35	-27.79	32.56	54	-21.44	Avg
3	7323	--	--	--	--	--	--	--
4	9764	--	--	--	--	--	--	--
5	4882	H	75.06	-27.79	47.27	74	-26.73	Peak
6	4882	H	67.12	-27.79	36.33	54	-20.67	Avg
7	7323	--	--	--	--	--	--	--
8	9764	--	--	--	--	--	--	--
Test Mode : 8DPSK TX High								
1	4960	V	75.06	-27.79	47.27	74	-26.73	Peak
2	4960	V	68.12	-27.79	36.33	54	-21.67	Avg
3	7440	--	--	--	--	--	--	--
4	9920	--	--	--	--	--	--	--
5	4960	H	70.37	-28.30	42.07	74	-31.93	Peak
6	4960	H	63.39	-28.30	34.09	54	-20.91	Avg
7	7440	--	--	--	--	--	--	--
8	9920	--	--	--	--	--	--	--

Note:
1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.
2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain.
Result=Reading + Correct Factor.
Margin= Result-Limit.

10. Band Edge Test

10.1. Block Diagram of Test Setup



10.2. Test Limit

Please refer section15.247 and section 15.209.

All the lower and upper band-edges emissions appearing within restricted frequency bands shall not exceed the limits shown in FCC part 15.209 and RSS-GEN, all the other emissions outside operation shall be at least 20dB below the fundamental emissions, or comply with FCC part 15.209 and RSS-GEN limits.

All the lower and upper band-edges emissions appearing within 2310MHz to 24100MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz and 5725MHz to 5850MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

10.3. Test Procedure

Refer to ANSI C 63.10, Clause 6.10.

All restriction band and non- restriction band have been tested, only worse case is reported.

10.4.Test Results

Test Date : 2023.11.04					Temperature : 24℃			
Test Engineer : Jensen Wang					Humidity : 56%			
Test Results : **PASS**								
Frequency Range : **2310MHz~2410MHz**								
Test Mode : GFSK TX 2402MHz								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2390	H	68.66	-21.62	47.0419	74	-26.96	Peak
2	2390	H	--	-21.62	--	54	--	Avg
3	2400	H	67.09	-26.08	41.0113	74	-32.99	Peak
4	2400	H	--	-26.08	--	54	--	Avg
1	2390	V	68.35	-21.62	46.7343	74	-27.27	Peak
2	2390	V	--	-21.62	--	54	--	Avg
3	2400	V	65.20	-26.08	39.1192	74	-34.88	Peak
4	2400	V	--	-26.08	--	54	--	Avg
Frequency Range : **2450MHz~2550MHz**								
Test Mode : GFSK TX 2480MHz								
1	2483.5	H	66.44	-25.84	40.5957	74	-33.40	Peak
2	2483.5	H	--	-25.84	--	54	--	Avg
1	2483.5	V	67.07	-25.84	41.226	74	-32.77	Peak
2	2483.5	V	--	-25.84	--	54	--	Avg
Note:	1. Means other frequency and mode comply with standard requirements and at least have 20dB margin. 2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit. 5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.							

Test Date	:	2023.11.04			Temperature	:	24℃	
Test Engineer	:	Jensen Wang			Humidity	:	56%	
Test Results	:	**PASS**						
Frequency Range	:	**2310MHz~2410MHz**						
Test Mode	:	π/4 DQPSK TX 2402MHz						
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2390	H	65.43	-21.62	43.8138	74	-30.19	Peak
2	2390	H	--	-21.62	--	54	--	Avg
3	2400	H	68.14	-26.08	42.0558	74	-31.94	Peak
4	2400	H	--	-26.08	--	54	--	Avg
1	2390	V	69.68	-21.62	48.0619	74	-25.94	Peak
2	2390	V	--	-21.62	--	54	--	Avg
3	2400	V	70.58	-26.08	44.4969	74	-29.50	Peak
4	2400	V	--	-26.08	--	54	--	Avg
Frequency Range	:	**2450MHz~2550MHz**						
Test Mode	:	π/4 DQPSK TX 2480MHz						
1	2483.5	H	67.07	-25.84	41.233	74	-32.77	Peak
2	2483.5	H	--	-25.84	--	54	--	Avg
1	2483.5	V	66.14	-25.84	40.2973	74	-33.70	Peak
2	2483.5	V	--	-25.84	--	54	--	Avg

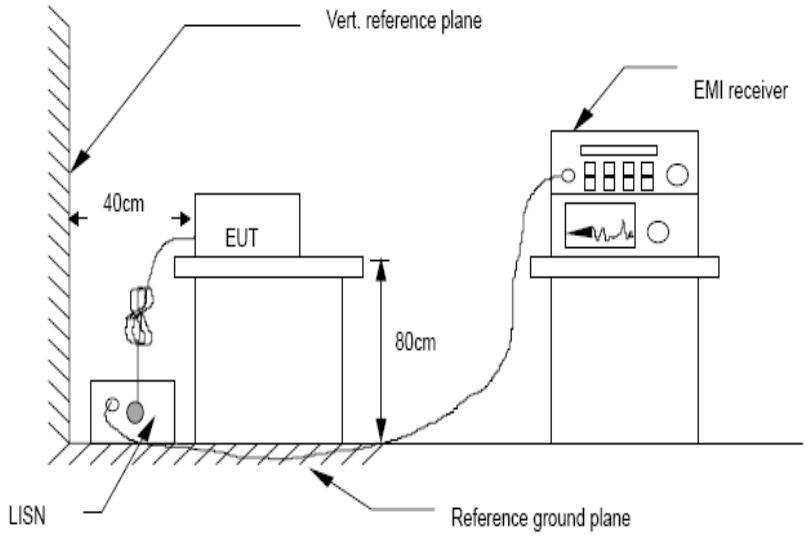
Note:
1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.
2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain.
Result=Reading + Correct Factor.
Margin= Result-Limit.
3. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.

Test Date	:	2023.11.04			Temperature	:	24℃	
Test Engineer	:	Jensen Wang			Humidity	:	56%	
Test Results	:	**PASS**						
Frequency Range	:	**2310MHz~2410MHz**						
Test Mode	:	8DPSK TX 2402MHz						
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2390	H	67.39	-21.62	45.7693	74	-28.23	Peak
2	2390	H	--	-21.62	--	54	--	Avg
3	2400	H	69.78	-26.08	43.7009	74	-30.30	Peak
4	2400	H	--	-26.08	--	54	--	Avg
1	2390	V	68.64	-21.62	47.0196	74	-26.98	Peak
2	2390	V	--	-21.62	--	54	--	Avg
3	2400	V	70.56	-26.08	44.4824	74	-29.52	Peak
4	2400	V	--	-26.08	--	54	--	Avg
Frequency Range	:	**2450MHz~2550MHz**						
Test Mode	:	8DPSK TX 2480MHz						
1	2483.5	H	68.84	-25.84	42.9999	74	-31.00	Peak
2	2483.5	H	--	-25.84	--	54	--	Avg
1	2483.5	V	70.59	-25.84	44.7458	74	-29.25	Peak
2	2483.5	V	--	-25.84	--	54	--	Avg

Note:
1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.
2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain.
Result=Reading + Correct Factor.
Margin= Result-Limit.
5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.

11. Power Line Conducted Emissions

11.1.Block Diagram of Test Setup



11.2.Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

11.3.Test Procedure

(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.

(2) Setup the EUT and simulator as shown in 10.1

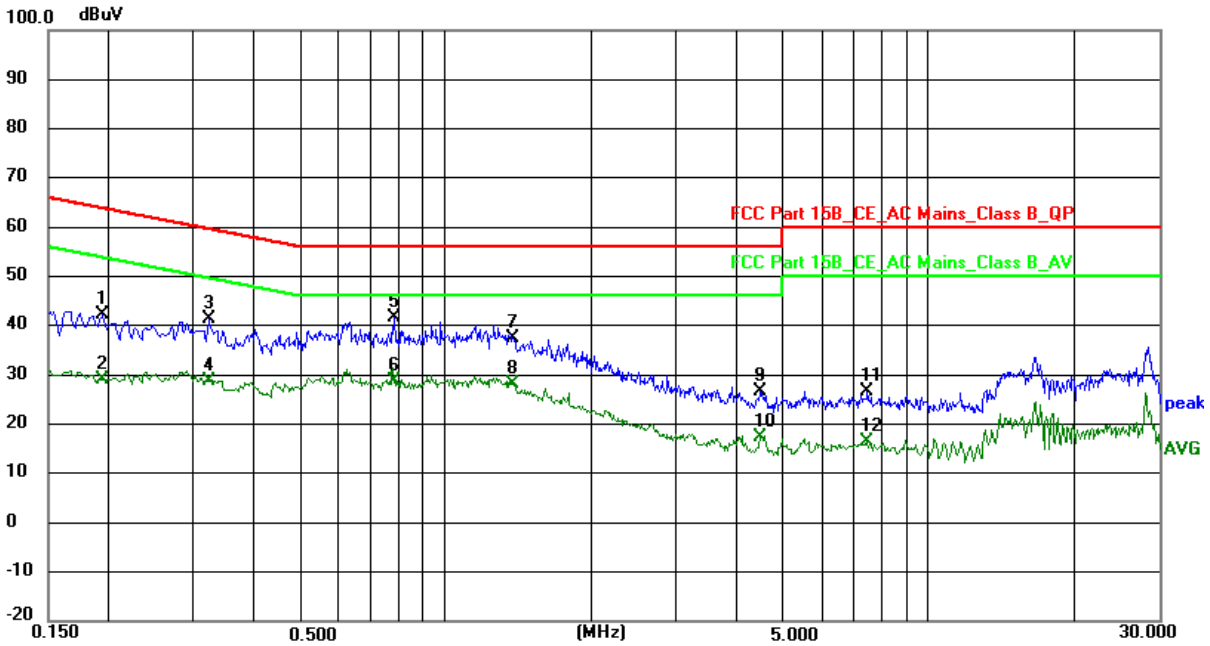
(3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N2), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013on conducted Emission test.

(4) The bandwidth of test receiver is set at 10KHz.
(5) The frequency range from 150 KHz to 30MHz is checked.

11.4.Test Results

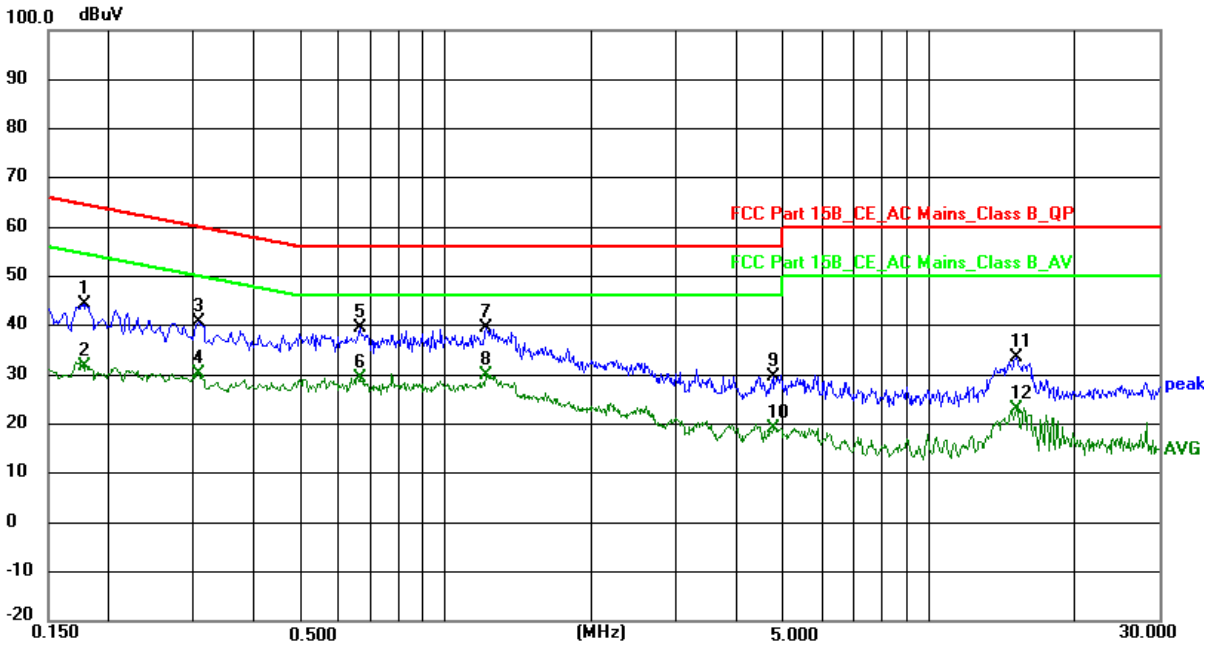
Test Date	:	2023.11.03	Temperature	:	24℃
Test Engineer	:	Jensen Wang	Humidity	:	56%
Test Mode	:	GFSK mode			
Test Results	:	**PASS**			
Note:	1. The test results are listed in next pages. 2. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector and quasi-peak detector need not be carried out. 3. If the limits for the measurement with the average detector are met when using a receiver with a quasi-peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out. 4. All modes have been tested, and only worst data of GFSK mode, Channel 2441MHz (AC 120V/ 60Hz) was listed in this report.				

Polarization: L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1940	32.20	9.95	42.15	63.86	-21.71	peak	P
2	0.1940	19.12	9.95	29.07	53.86	-24.79	AVG	P
3	0.3220	31.41	9.91	41.32	59.66	-18.34	peak	P
4	0.3220	18.86	9.91	28.77	49.66	-20.89	AVG	P
5 *	0.7820	32.16	9.42	41.58	56.00	-14.42	peak	P
6	0.7820	19.41	9.42	28.83	46.00	-17.17	AVG	P
7	1.3740	28.00	9.40	37.40	56.00	-18.60	peak	P
8	1.3740	18.73	9.40	28.13	46.00	-17.87	AVG	P
9	4.4980	17.15	9.40	26.55	56.00	-29.45	peak	P
10	4.4980	7.87	9.40	17.27	46.00	-28.73	AVG	P
11	7.4820	17.00	9.64	26.64	60.00	-33.36	peak	P
12	7.4820	6.75	9.64	16.39	50.00	-33.61	AVG	P

Polarization: N



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1780	34.42	9.93	44.35	64.58	-20.23	peak	P
2	0.1780	21.80	9.93	31.73	54.58	-22.85	AVG	P
3	0.3060	31.03	9.77	40.80	60.08	-19.28	peak	P
4	0.3060	20.59	9.77	30.36	50.08	-19.72	AVG	P
5	0.6620	29.64	9.78	39.42	56.00	-16.58	peak	P
6	0.6620	19.44	9.78	29.22	46.00	-16.78	AVG	P
7	1.2140	30.04	9.46	39.50	56.00	-16.50	peak	P
8 *	1.2140	20.38	9.46	29.84	46.00	-16.16	AVG	P
9	4.7540	20.18	9.55	29.73	56.00	-26.27	peak	P
10	4.7540	9.70	9.55	19.25	46.00	-26.75	AVG	P
11	15.1980	23.71	9.92	33.63	60.00	-26.37	peak	P
12	15.1980	13.27	9.92	23.19	50.00	-26.81	AVG	P

12. Antenna Requirements

12.1.Limit

For intentional device, according to FCC 47 CFR Section 15.203 and RSS-GEN, 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.

12.2.Result

The EUT antenna is internal antenna. It complies with the standard requirement.

13.Photos of test setup

Reference to the **appendix I Test Setup Photo** for details.

14. Photos of EUT

Reference to the **appendix II external photos** and **appendix III internal photos** for details.

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