TEST REPORT

Applicant Name :	JEM ACCESSORIES INC.
Address :	32 Brunswick Avenue, Edison, New Jersey, United States,08817
Report Number :	RA230420-17136E-RF-00
FCC ID:	2AHAS-XBS91058EP

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	3pc Audio Essentials Bluetooth Speaker Headphones and Earbuds Gift Set
Model No.:	XBE9-0113
Multiple Model(s) No.:	XBS9-1058-SIL ,XBS9-1072-GRY/MLB9-1072
Trade Mark:	N/A
Date Received:	2023/04/20
Report Date:	2023/05/12

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Dave Liang

EMC Engineer

Approved By:

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230420-17136E-RF-00	Original Report	2023/05/12

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	3pc Audio Essentials Bluetooth Speaker Headphones and Earbuds Gift Set
Tested Model	XBE9-0113
Multiple Models	XBS9-1058-SIL ,XBS9-1072-GRY/MLB9-1072 (model difference see product declaration letter of similarity)
Frequency Range	Bluetooth: 2402~2480MHz
Maximum conducted Peak output power	Bluetooth: 0.52dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification*	2.0 dBi (provided by the applicant)
Voltage Range	DC3.7V from battery or DC5V from USB Charging Port
Sample serial number	247Y_1 for Conducted and Radiated Emissions Test 247Y_2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions	9k-30MHz	2.74dB,k=2
	150kHz-30MHz	2.92dB,k=2
Emissions, Radiated	9kHz - 30MHz	2.06dB
	30MHz - 1GHz	5.08dB
	1GHz- 18GHz	4.96dB
	18GHz-26.5GHz	5.16dB
	26.5GHz-40GHz	4.64dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

"BT_Tool.exe*" exercise software was used and the power level is 7*. The software and power level was provided by the manufacturer.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

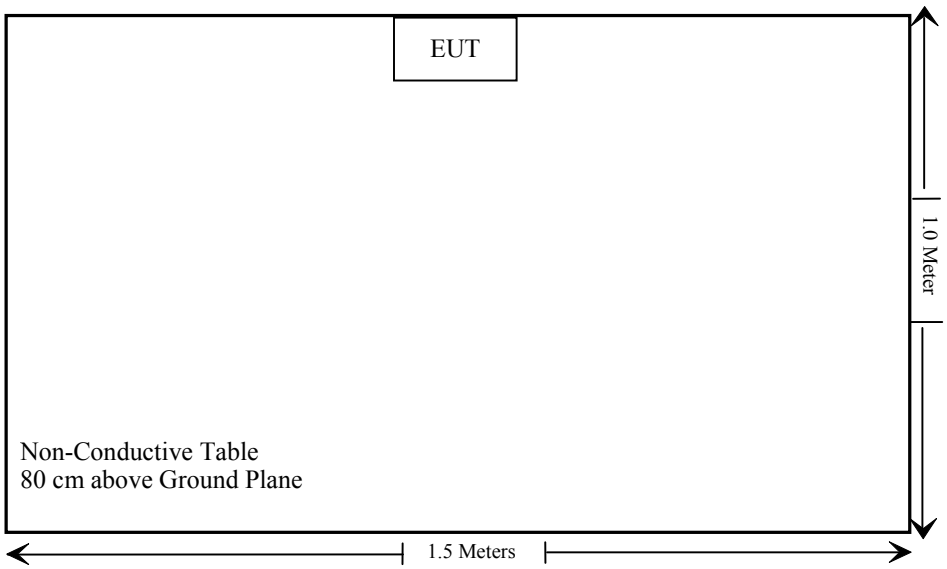
External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

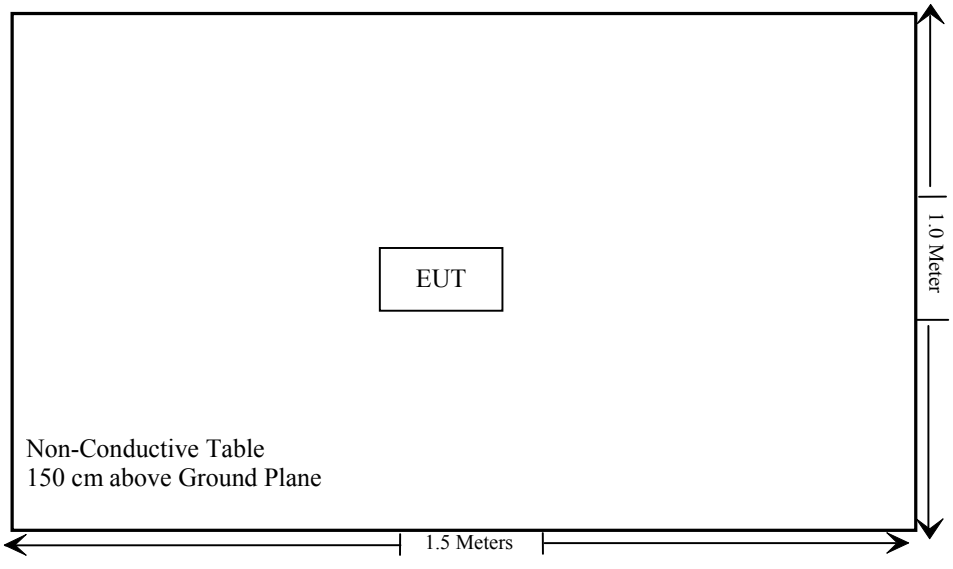
For Radiated Emissions:

Below 1GHz:



Note: the edge of support table was flush with the center of turntable

Above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (3) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

Not Applicable: Bluetooth cannot be transmitting while charging

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emission test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2022/11/08	2023/11/07
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	837	2023/02/22	2026/02/21
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2022/11/25	2023/11/24
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Cable	Unknown	1	Each time	/

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1307 (b) (3) &§2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (3), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance

SAR-Based Exemption:

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum timeaveraged power or maximum time-averaged ERP, whichever is greater.

Per § 1.1307(b)(3)(i)(B), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

For worst case:

Exemption limit:

For f=2.48GHz, d=0.5cm, the P_{th}=2.72mW

The higher of the available maximum time-averaged power or effective radiated power (ERP):

The antenna gain is 2.0dBi (-0.15dBd), 0dBd=2.15dBi

The maximum tune-up conducted power is 1.0dBm (1.26mW), which less than 2.72 mW@2480MHz exemption limit

So the stand-alone SAR test can be exempted.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

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

Antenna Connector Construction

The EUT has one internal antenna, which was permanently attached, and the maximum antenna gain is 2.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

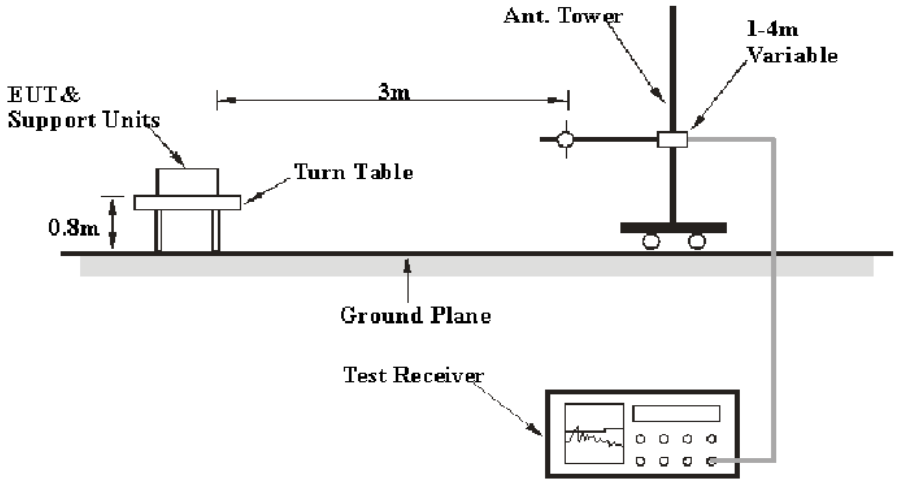
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

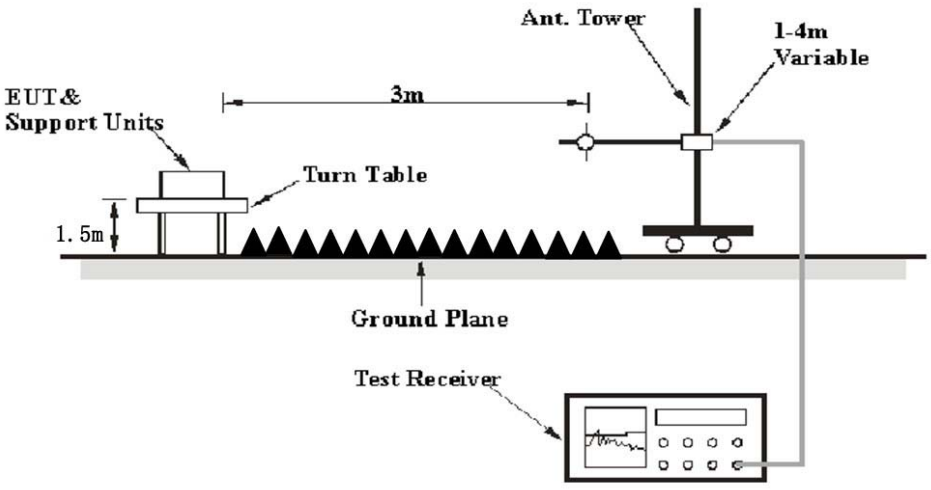
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK

For average measurement:

Use the duty cycle factor correction factor method per 15.35(c).
Duty cycle=On time/100milliseconds, On time=N1*L1+N2*L2+…Nn-1*Ln-1+Nn*Ln,
Where N1 is number of type 1 pulses, L1 is length of type 1 pulse, etc.
Average Emission Level=Peak Emission Level+20*log(Duty cycle)

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

Factor & Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Over Limit/Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	24~25.5℃
Relative Humidity:	52~56%
ATM Pressure:	101.0 kPa

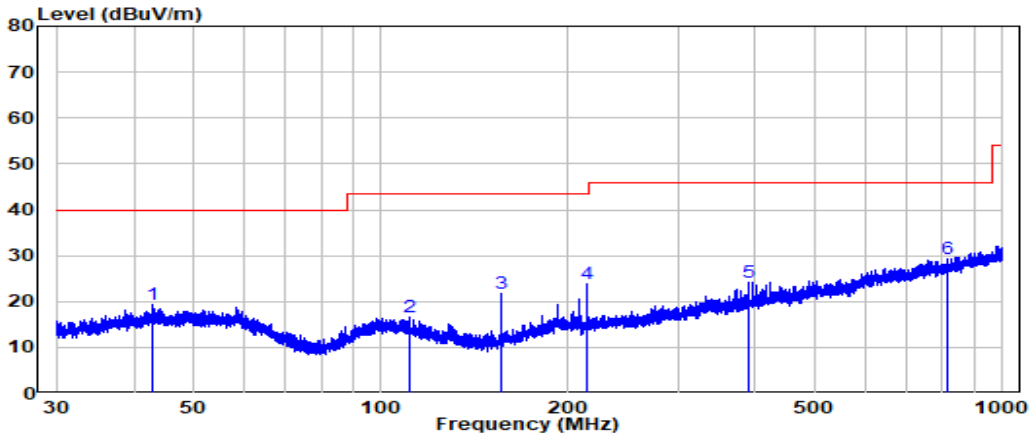
The testing was performed by Jimi Zheng on 2023-04-22 for below 1GHz and Jason liu on 2023-04-25 for above 1GHz.

EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axes of orientation was recorded)

30MHz-1GHz: *(worst case is 8DPSK Mode, low channel)*

Note: When the test result of peak was less than the limit of QP more than 6dB, just peak value were recorded.

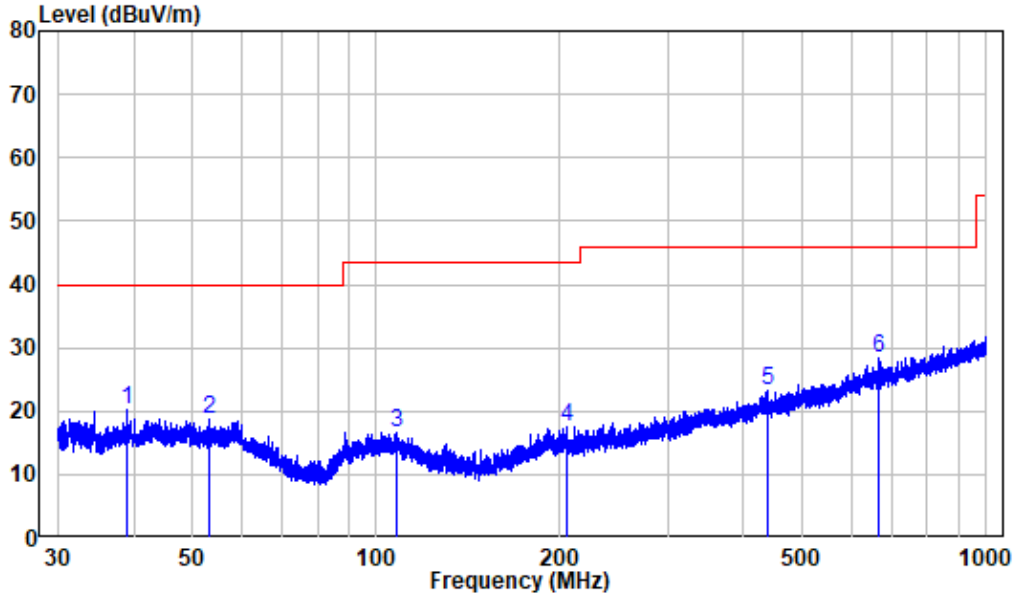
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230420-17136E-RF
Test Mode: BT Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.787	-9.97	29.26	19.29	40.00	-20.71	Peak
2	111.006	-12.10	28.71	16.61	43.50	-26.89	Peak
3	155.979	-14.82	36.48	21.66	43.50	-21.84	Peak
4	214.420	-11.70	35.69	23.99	43.50	-19.51	Peak
5	390.038	-6.89	31.16	24.27	46.00	-21.73	Peak
6	814.896	-0.21	29.47	29.26	46.00	-16.74	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230420-17136E-RF
Test Mode: BT Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	38.939	-10.60	30.98	20.38	40.00	-19.62	Peak
2	53.155	-10.19	28.90	18.71	40.00	-21.29	Peak
3	108.030	-11.99	28.65	16.66	43.50	-26.84	Peak
4	205.765	-11.84	29.29	17.45	43.50	-26.05	Peak
5	437.312	-5.68	28.99	23.31	46.00	-22.69	Peak
6	668.142	-1.66	30.17	28.51	46.00	-17.49	Peak

Above 1GHz: *(worst case is 8DPSK Mode, 3DH5)*

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2321.4	64.65	PK	35	1	H	-10.49	54.16	74	-19.84
2336.69	64.90	PK	5	1.2	V	-10.65	54.25	74	-19.75
2390	64.23	PK	101	2.1	H	-10.70	53.53	74	-20.47
2390	64.98	PK	310	1.9	V	-10.70	54.28	74	-19.72
4804	62.29	PK	6	1.9	H	-6.11	56.18	74	-17.82
4804	61.03	PK	181	1.9	V	-6.11	54.92	74	-19.08
Middle Channel(2441MHz)									
4882	60.06	PK	136	1.3	H	-5.90	54.16	74	-19.84
4882	59.97	PK	130	1.3	V	-5.90	54.07	74	-19.93
High Channel(2480 MHz)									
2483.5	65.13	PK	212	1.2	H	-10.55	54.58	74	-19.42
2483.5	65.44	PK	128	1.5	V	-10.55	54.89	74	-19.11
2489.12	66.61	PK	41	1.9	H	-10.50	56.11	74	-17.89
2495.06	66.51	PK	69	2.1	V	-10.46	56.05	74	-17.95
4960	58.61	PK	18	2.1	H	-5.47	53.14	74	-20.86
4960	58.66	PK	306	2.1	V	-5.47	53.19	74	-20.81

Field Strength of Average							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBμV/m)	FCC Part 15.247		
					Limit (dBμV/m)	Margin (dB)	Comment
Low Channel(2402MHz)							
2321.4	54.16	H	-24.66	29.50	54	-24.50	Bandedge
2336.69	54.25	V	-24.66	29.59	54	-24.41	Bandedge
2390	53.53	H	-24.66	28.87	54	-25.13	Bandedge
2390	54.28	V	-24.66	29.62	54	-24.38	Bandedge
4804	56.18	H	-24.66	31.52	54	-22.48	Harmonic
4804	54.92	V	-24.66	30.26	54	-23.74	Harmonic
Middle Channel(2441MHz)							
4882	54.16	H	-24.66	29.50	54	-24.50	Harmonic
4882	54.07	V	-24.66	29.41	54	-24.59	Harmonic
High Channel(2480MHz)							
2483.5	54.58	H	-24.66	29.92	54	-24.08	Bandedge
2483.5	54.89	V	-24.66	30.23	54	-23.77	Bandedge
2489.12	56.11	H	-24.66	31.45	54	-22.55	Bandedge
2495.06	56.05	V	-24.66	31.39	54	-22.61	Bandedge
4960	53.14	H	-24.66	28.48	54	-25.52	Harmonic
4960	53.19	V	-24.66	28.53	54	-25.47	Harmonic

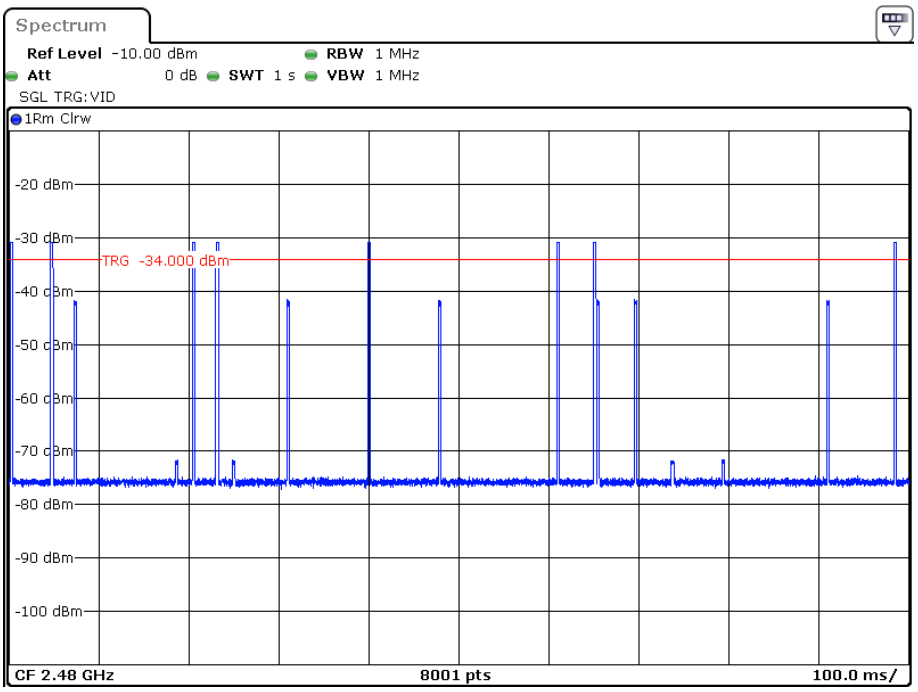
Note:

Absolute Level = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
Average level= Peak level+ Duty Cycle Corrected Factor
The other emissions which were 20dB below limit or in noise floor level was not recorded.

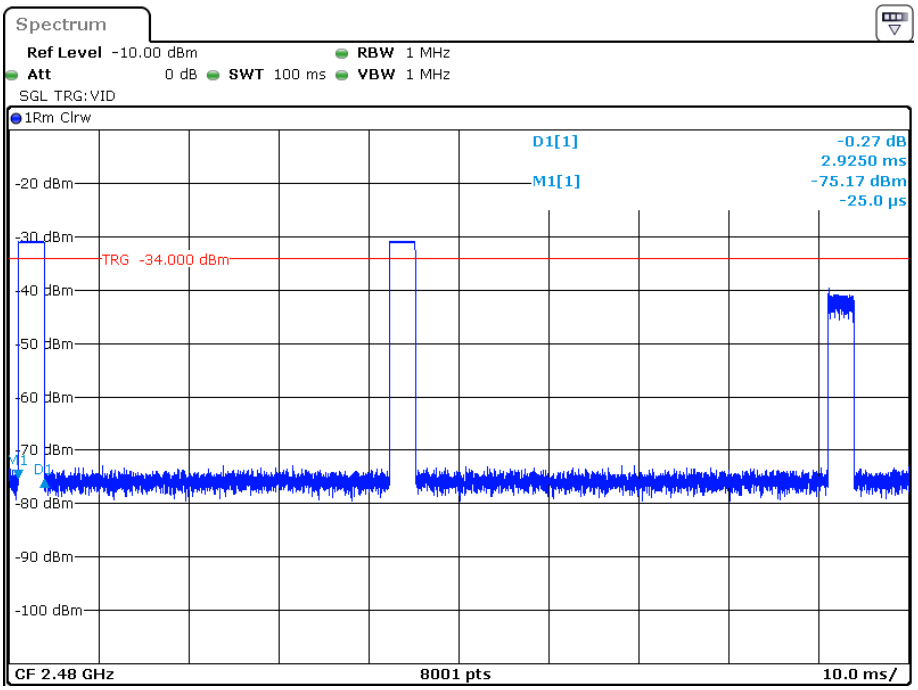
Worst case duty cycle:

Refer the plots, the maximum hops in 100ms period was 2(second high signal was from other channels)
Duty cycle = Ton/100ms = 2.925*2/100=0.0585
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.0585 = -24.66

Duty cycle



Date: 25.APR.2023 09:55:27

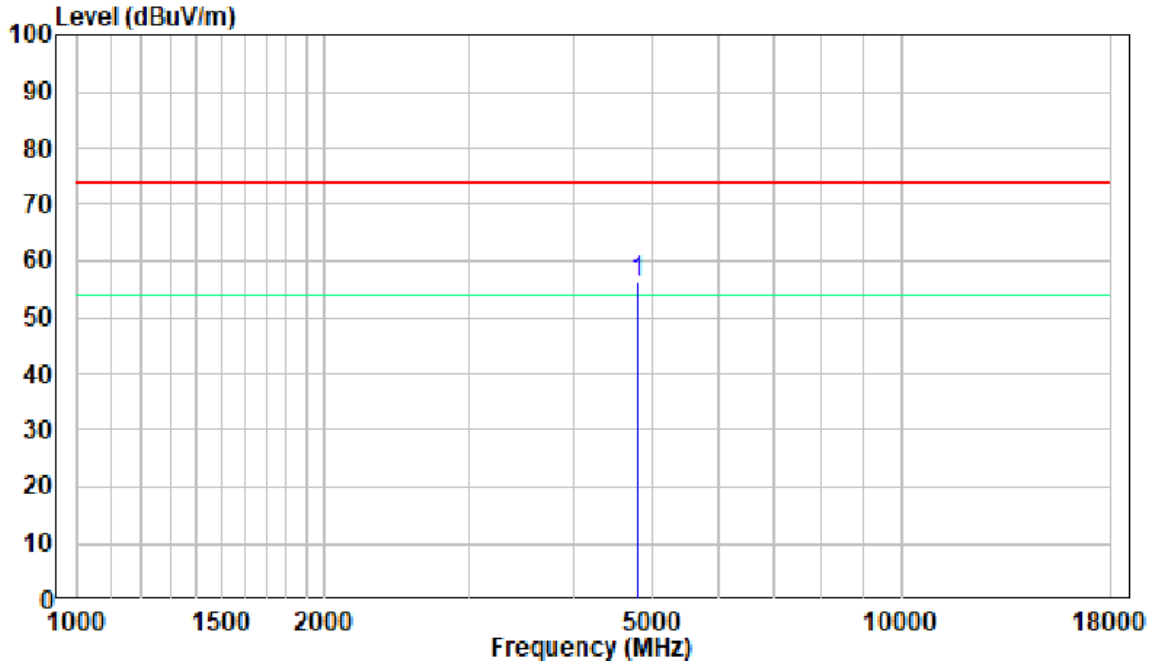


Date: 25.APR.2023 09:53:42

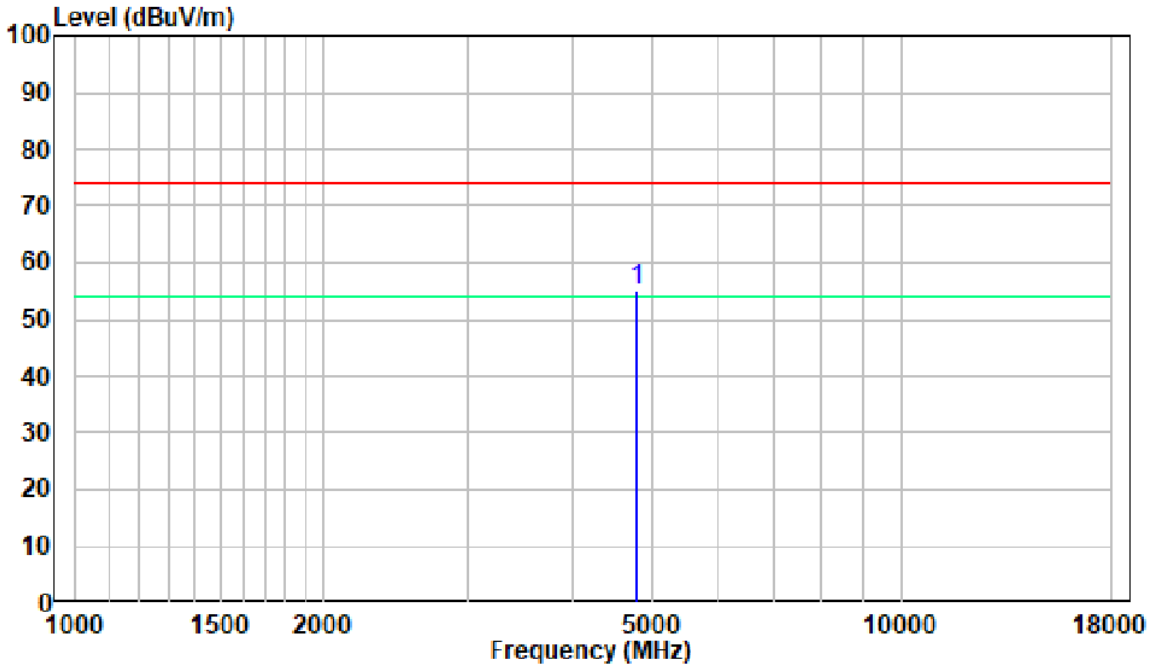
1-18GHz

Pre-scan for Low Channel

Horizontal:



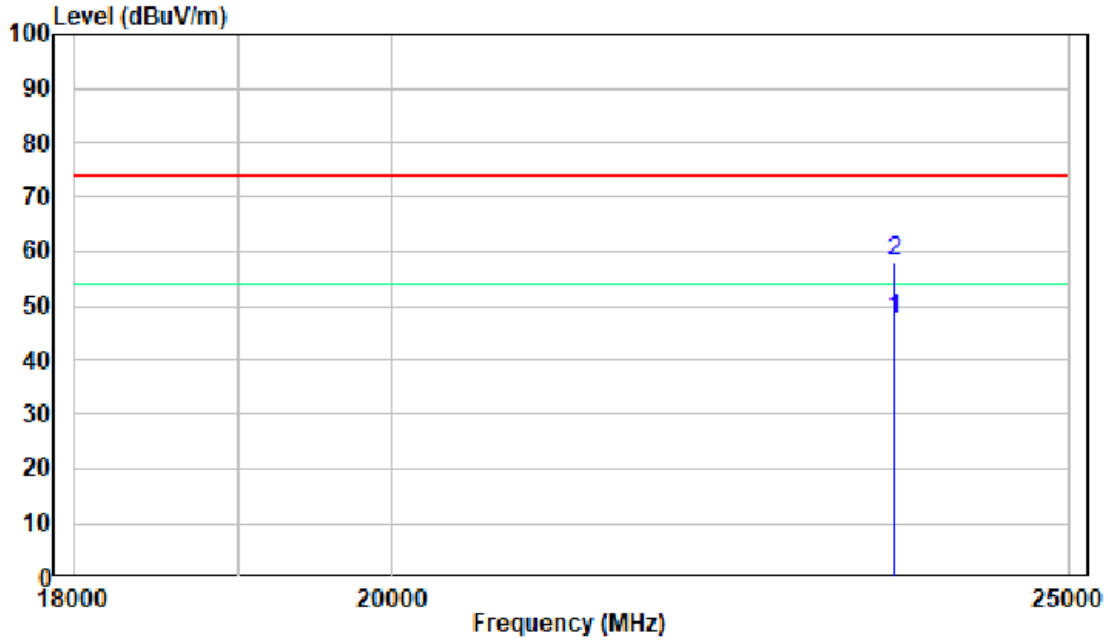
Vertical:



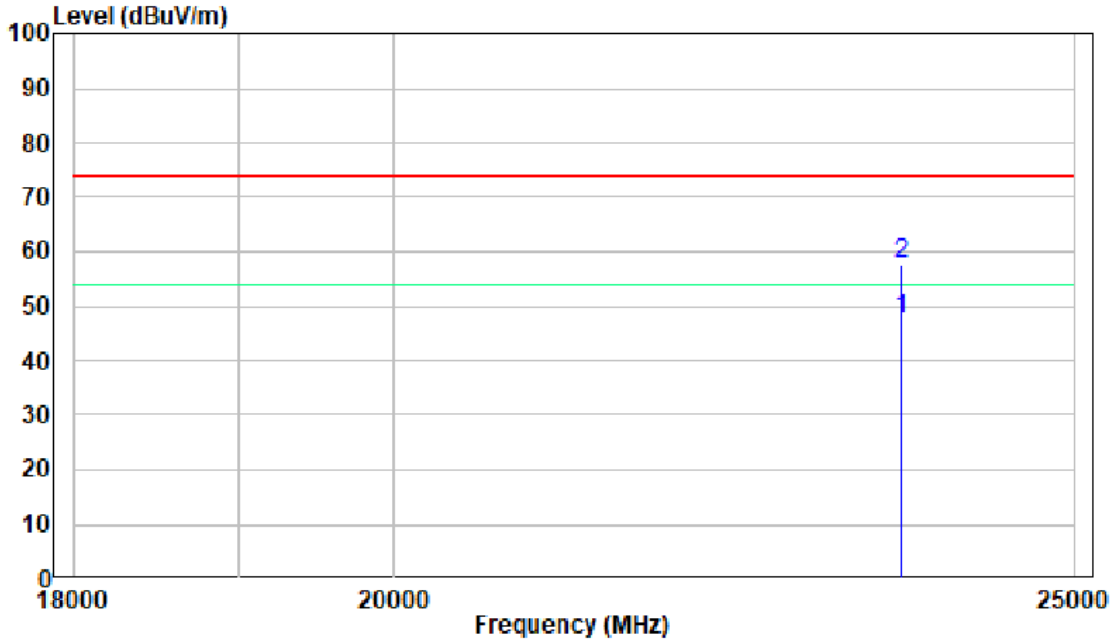
18-25GHz

Pre-scan for Low Channel

Horizontal:



Vertical:



FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

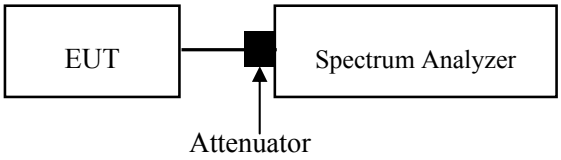
Applicable Standard

Frequency hopping systems shall have hoping 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. 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.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.2

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

The testing was performed by Dave Liang on 2023-04-23.

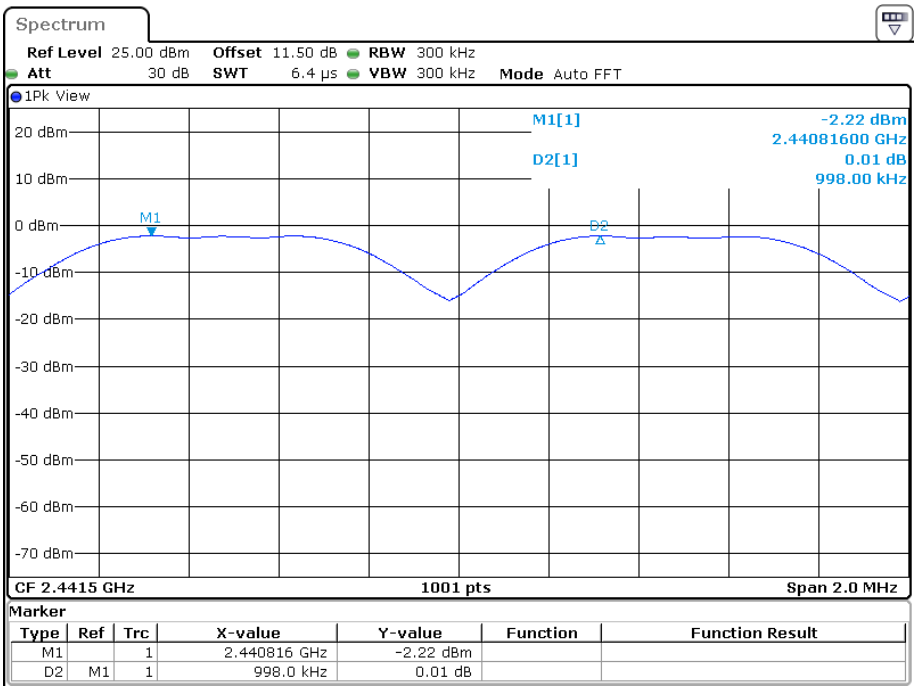
EUT operation mode: Transmitting

Please refer to following table and plots.

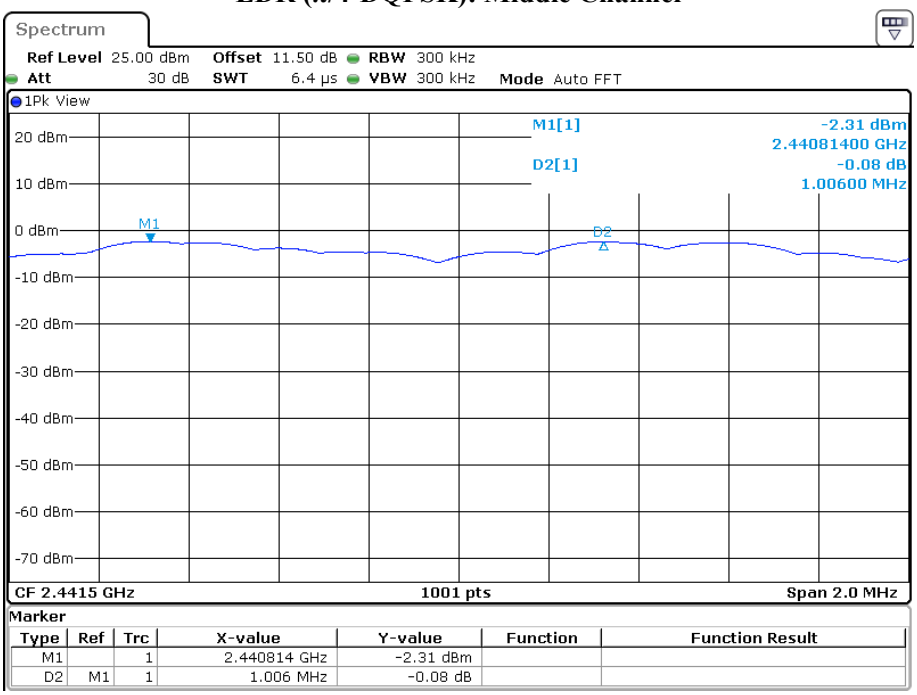
Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit
BDR(GFSK)				
Middle	0.998	0.954	0.636	> two-thirds of the 20 dB bandwidth
EDR(π/4-DQPSK)				
Middle	1.006	1.320	0.880	> two-thirds of the 20 dB bandwidth
EDR(8DPSK)				
Middle	0.982	1.311	0.874	> two-thirds of the 20 dB bandwidth

Note: The limit > two-thirds of the 20 dB bandwidth

BDR (GFSK): Middle Channel

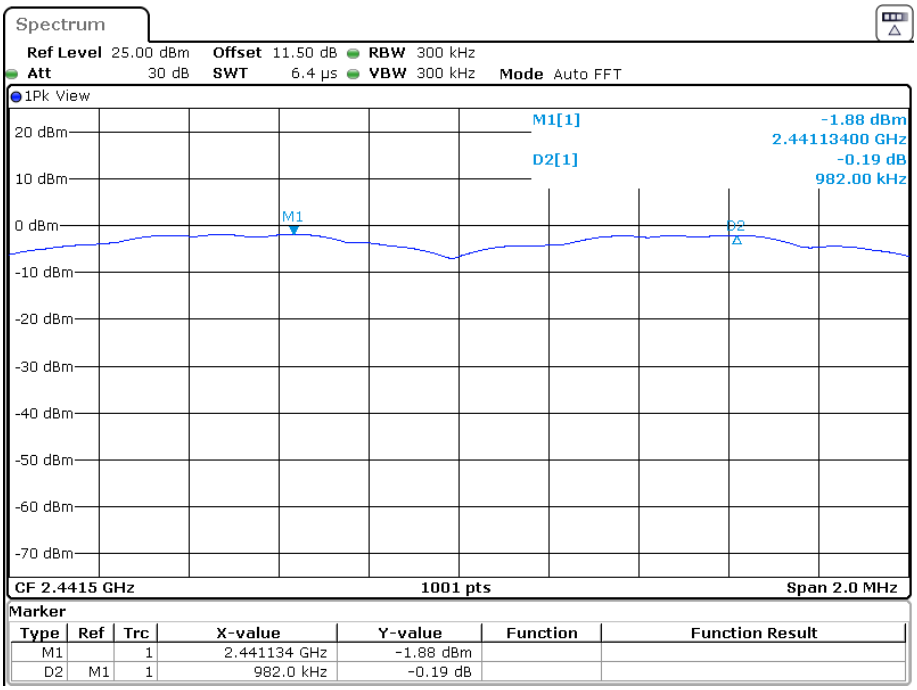


EDR (π/4-DQPSK): Middle Channel



Date: 23.APR.2023 14:18:48

EDR (8DPSK): Middle Channel



Date: 23.APR.2023 14:28:43

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

Applicable Standard

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.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2

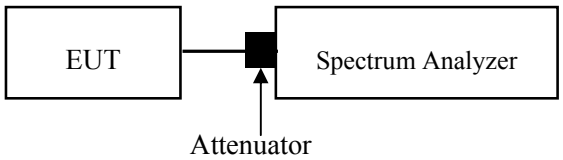
The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / 20 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 20 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.
For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

The testing was performed by Dave Liang on 2023-04-23.

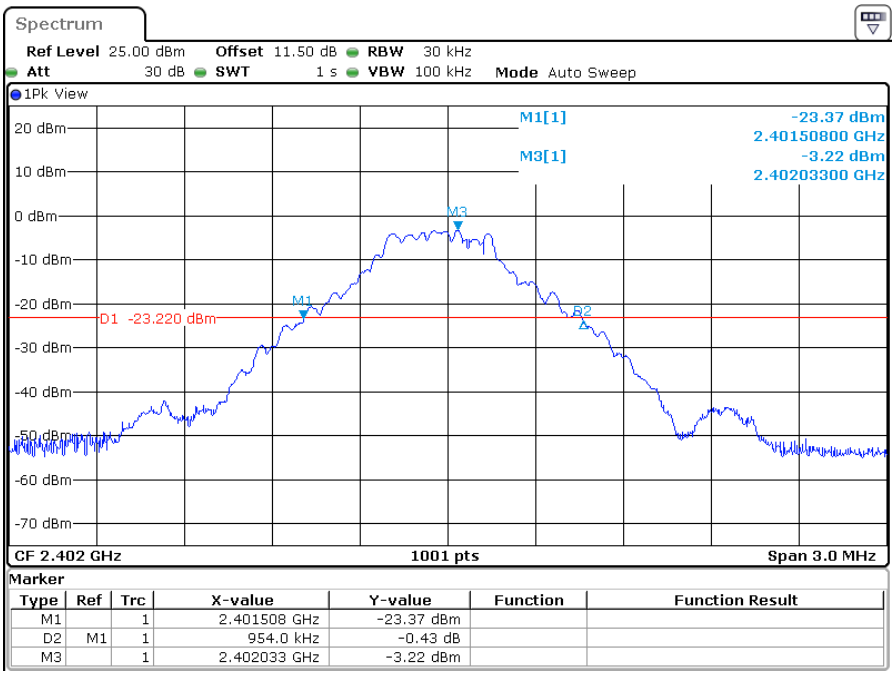
EUT operation mode: Transmitting

Test Result: Compliant.

Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.824	0.954
	Middle	2441	0.830	0.954
	High	2480	0.830	0.954
EDR (π/4-DQPSK)	Low	2402	1.160	1.320
	Middle	2441	1.160	1.320
	High	2480	1.157	1.317
EDR (8DPSK)	Low	2402	1.175	1.311
	Middle	2441	1.175	1.311
	High	2480	1.172	1.311

BDR (GFSK):

20dB Emission Bandwidth, Low Channel

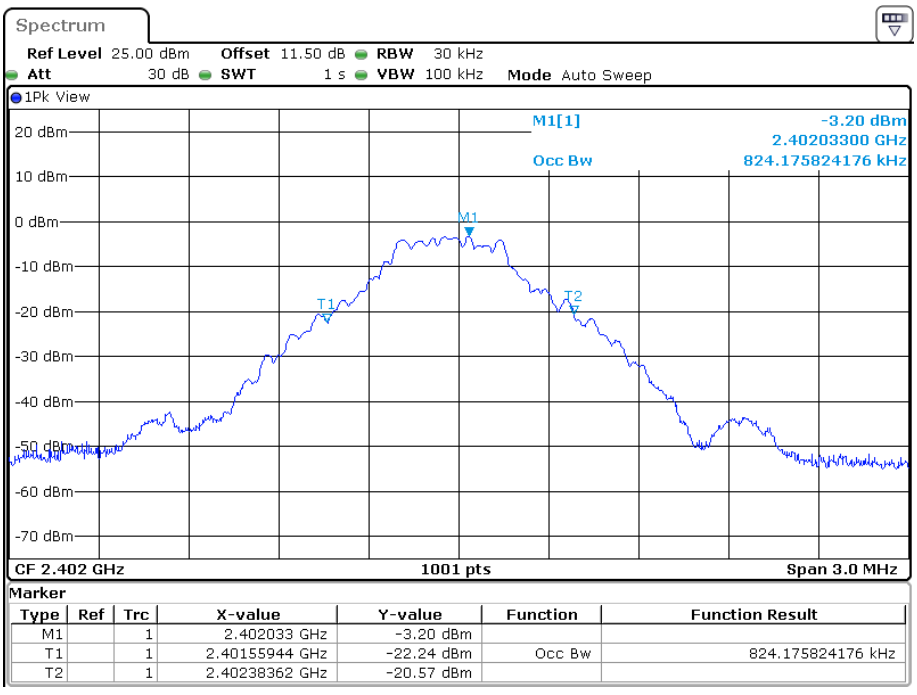


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401508 GHz	-23.37 dBm		
D2	M1	1	954.0 kHz	-0.43 dB		
M3		1	2.402033 GHz	-3.22 dBm		

Date: 23.APR.2023 11:20:41

99% Occupied Bandwidth, Low Channel

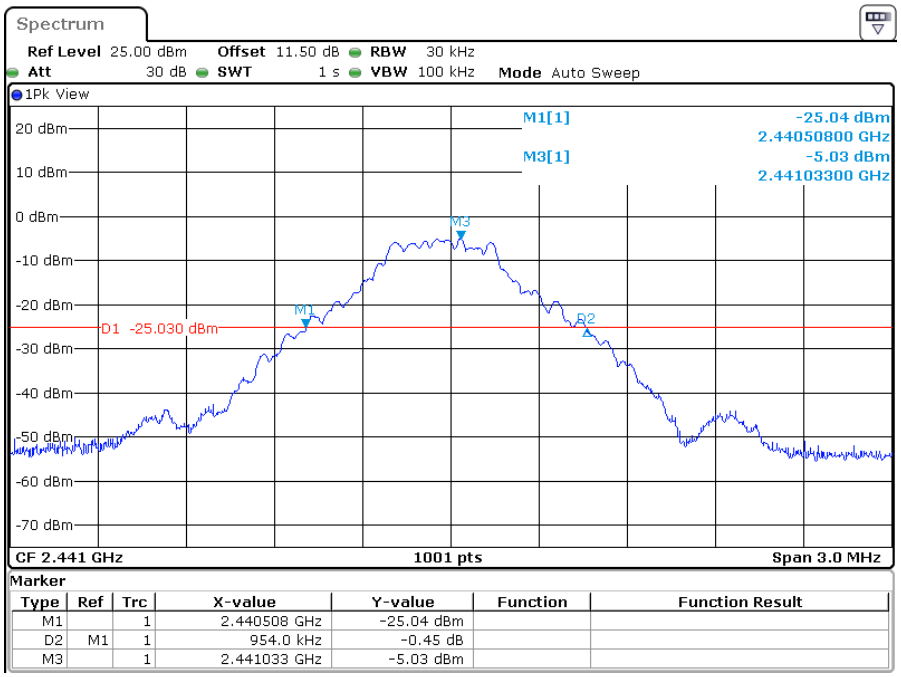


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402033 GHz	-3.20 dBm		
T1		1	2.40155944 GHz	-22.24 dBm	Occ Bw	824.175824176 kHz
T2		1	2.40238362 GHz	-20.57 dBm		

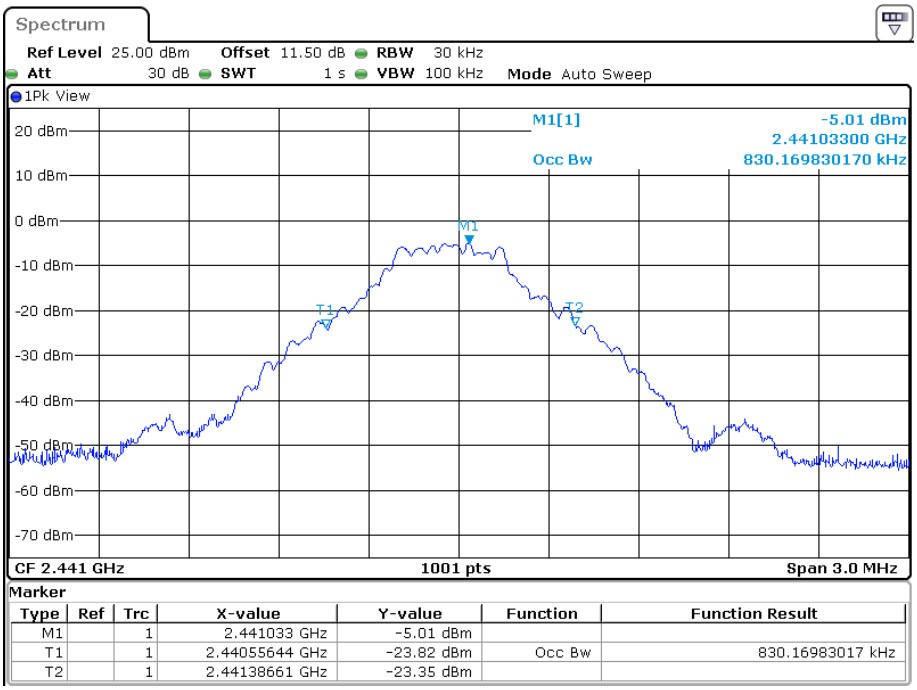
Date: 23.APR.2023 11:20:05

20dB Emission Bandwidth, Middle Channel



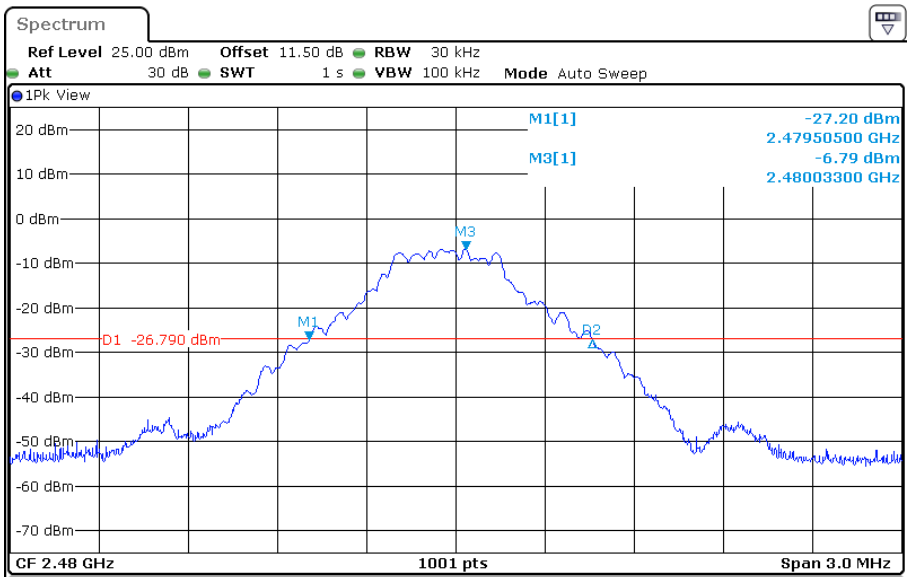
Date: 23.APR.2023 11:33:36

99% Occupied Bandwidth, Middle Channel



Date: 23.APR.2023 11:33:01

20dB Emission Bandwidth, High Channel

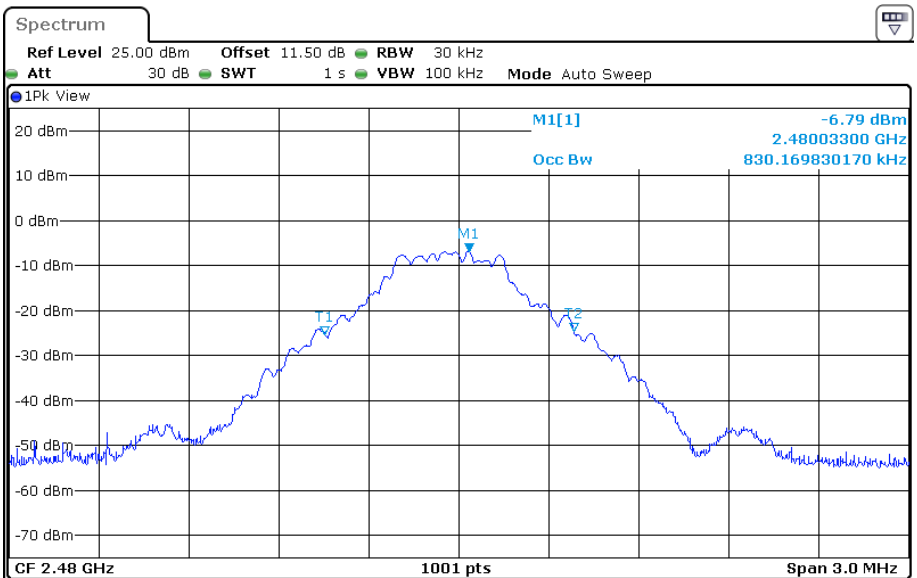


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479505 GHz	-27.20 dBm		
D2	M1	1	954.0 kHz	0.13 dB		
M3		1	2.480033 GHz	-6.79 dBm		

Date: 23.APR.2023 11:45:23

99% Occupied Bandwidth, High Channel



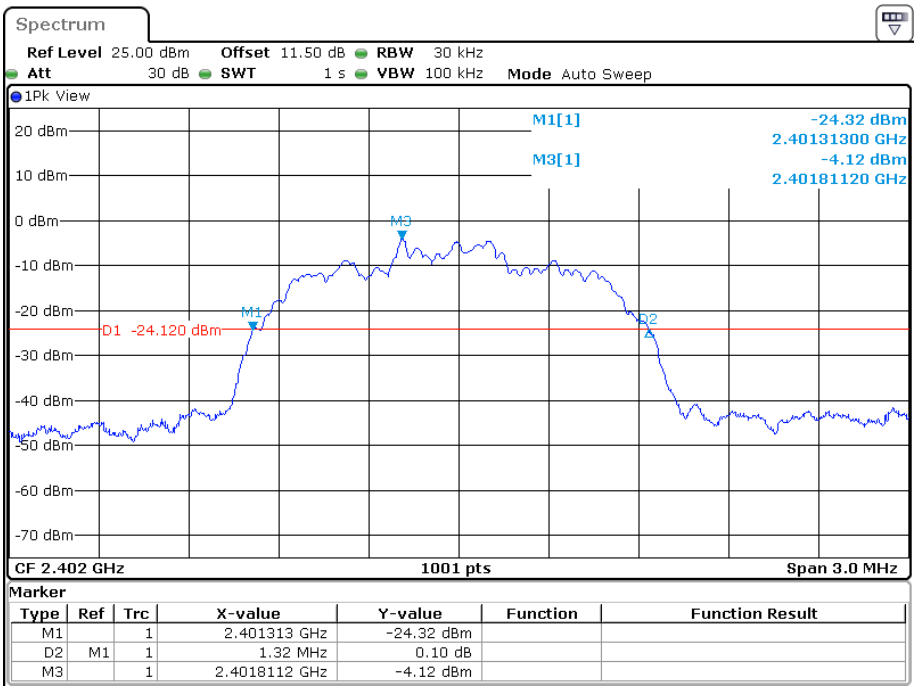
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480033 GHz	-6.79 dBm		
T1		1	2.47955345 GHz	-25.29 dBm	Occ Bw	830.16983017 kHz
T2		1	2.48038362 GHz	-24.72 dBm		

Date: 23.APR.2023 11:44:48

EDR (π/4-DQPSK):

20dB Emission Bandwidth, Low Channel

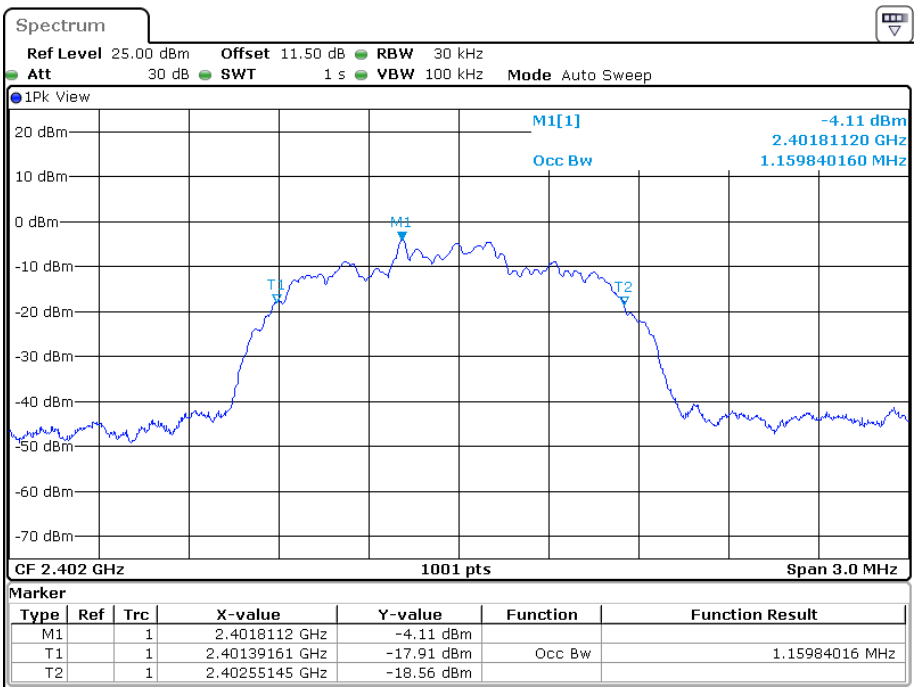


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401313 GHz	-24.32 dBm		
D2	M1	1	1.32 MHz	0.10 dB		
M3		1	2.4018112 GHz	-4.12 dBm		

Date: 23.APR.2023 11:26:50

99% Occupied Bandwidth, Low Channel

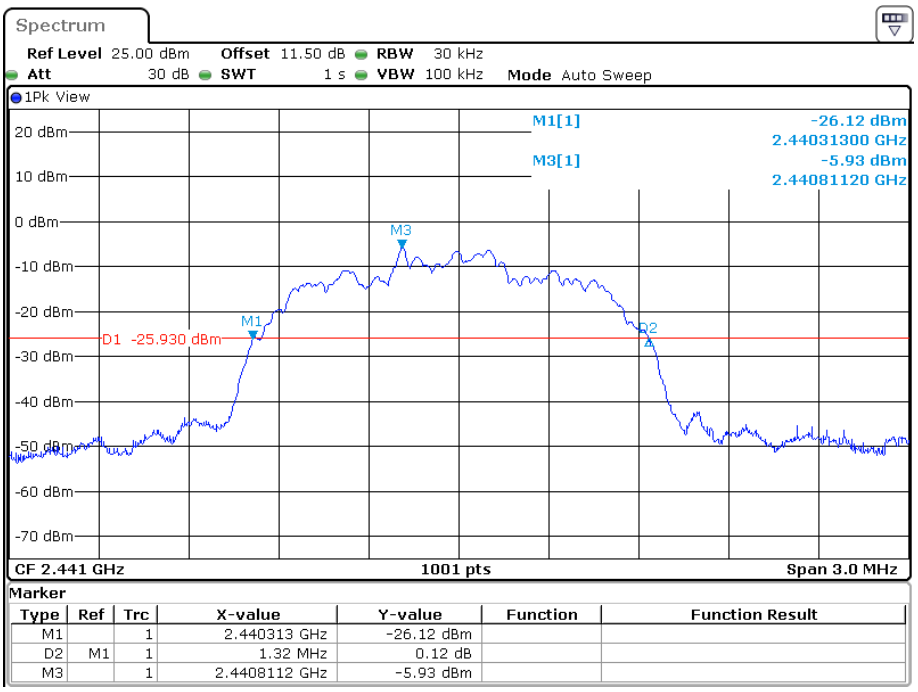


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4018112 GHz	-4.11 dBm		
T1		1	2.40139161 GHz	-17.91 dBm	Occ Bw	1.15984016 MHz
T2		1	2.40255145 GHz	-18.56 dBm		

Date: 23.APR.2023 11:26:14

20dB Emission Bandwidth, Middle Channel

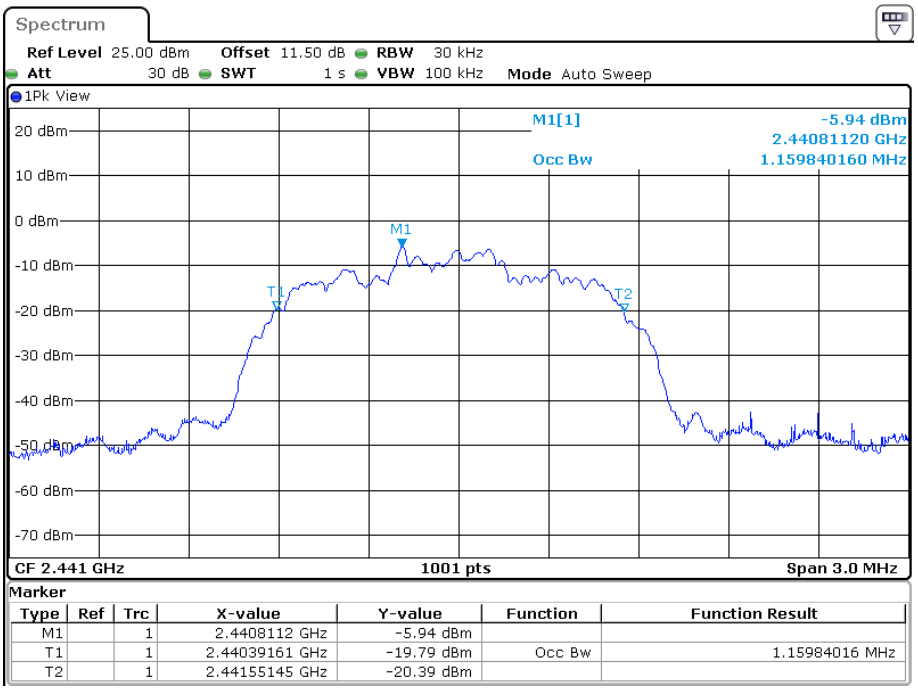


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440313 GHz	-26.12 dBm		
D2	M1	1	1.32 MHz	0.12 dB		
M3		1	2.4408112 GHz	-5.93 dBm		

Date: 23.APR.2023 11:38:43

99% Occupied Bandwidth, Middle Channel

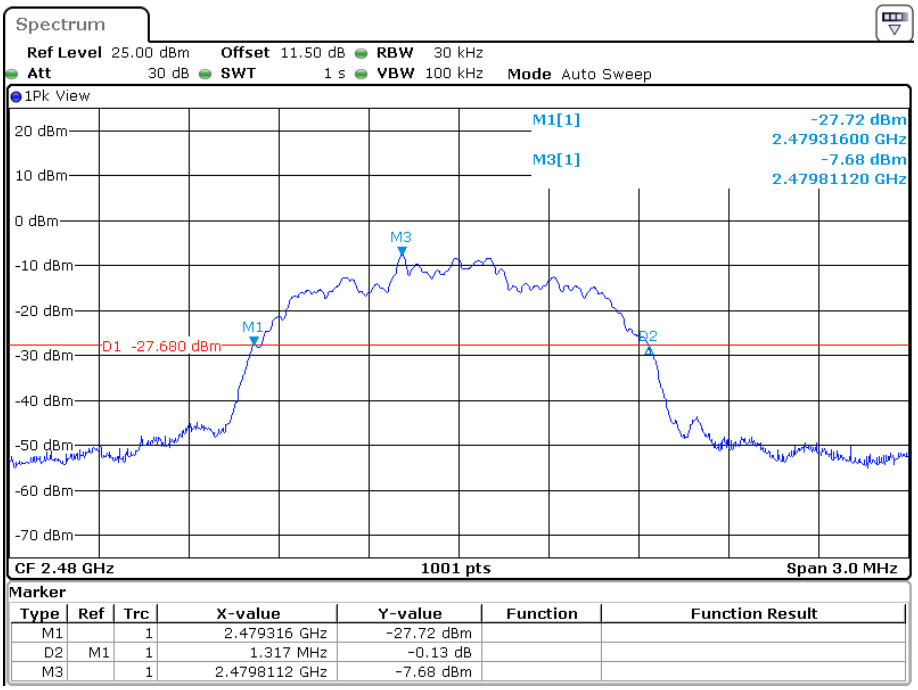


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4408112 GHz	-5.94 dBm		
T1		1	2.44039161 GHz	-19.79 dBm	Occ Bw	1.15984016 MHz
T2		1	2.44155145 GHz	-20.39 dBm		

Date: 23.APR.2023 11:38:07

20dB Emission Bandwidth, High Channel

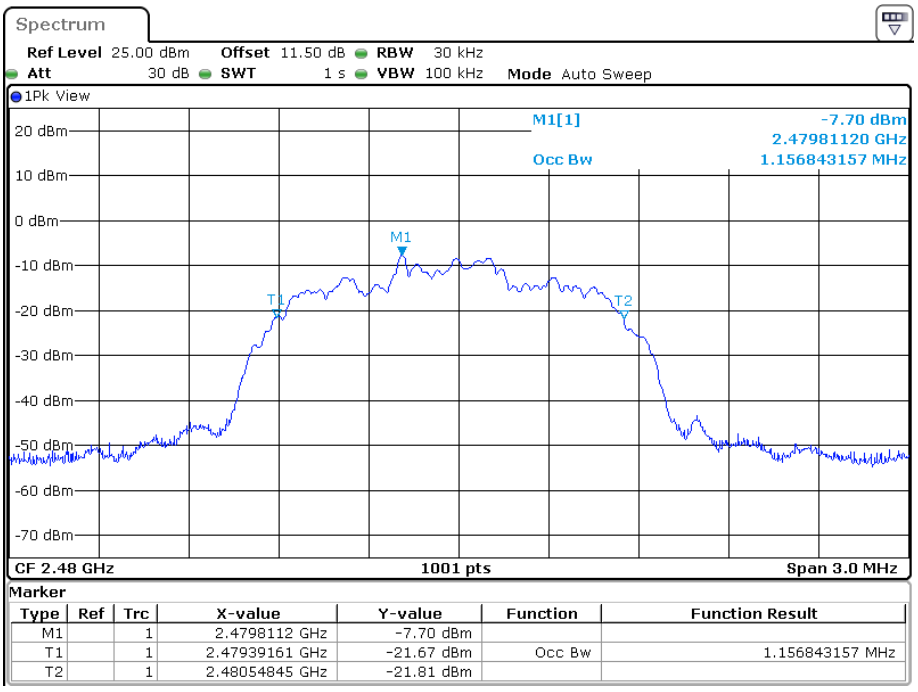


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479316 GHz	-27.72 dBm		
D2	M1	1	1.317 MHz	-0.13 dB		
M3		1	2.4798112 GHz	-7.68 dBm		

Date: 23.APR.2023 11:48:46

99% Occupied Bandwidth, High Channel



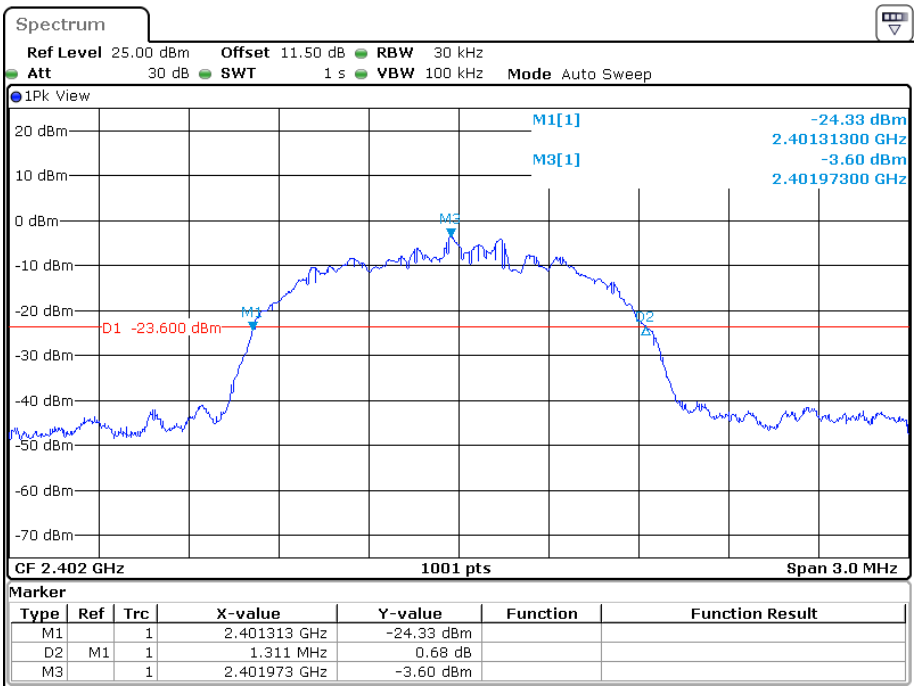
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4798112 GHz	-7.70 dBm		
T1		1	2.47939161 GHz	-21.67 dBm	Occ Bw	1.156843157 MHz
T2		1	2.48054845 GHz	-21.81 dBm		

Date: 23.APR.2023 11:48:11

EDR (8DPSK):

20dB Emission Bandwidth, Low Channel

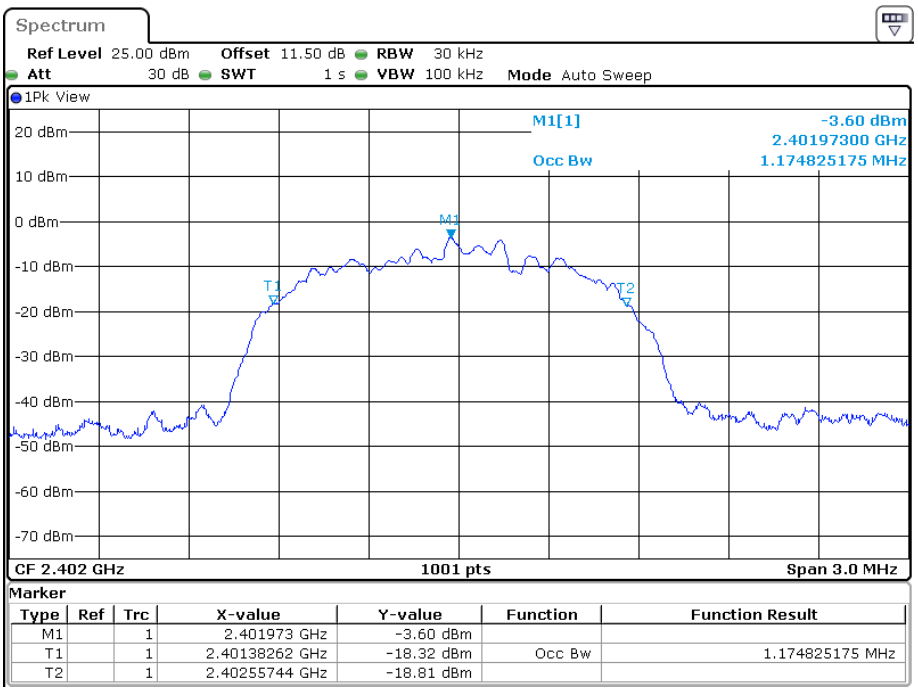


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401313 GHz	-24.33 dBm		
D2	M1	1	1.311 MHz	0.68 dB		
M3		1	2.401973 GHz	-3.60 dBm		

Date: 23.APR.2023 11:29:49

99% Occupied Bandwidth, Low Channel

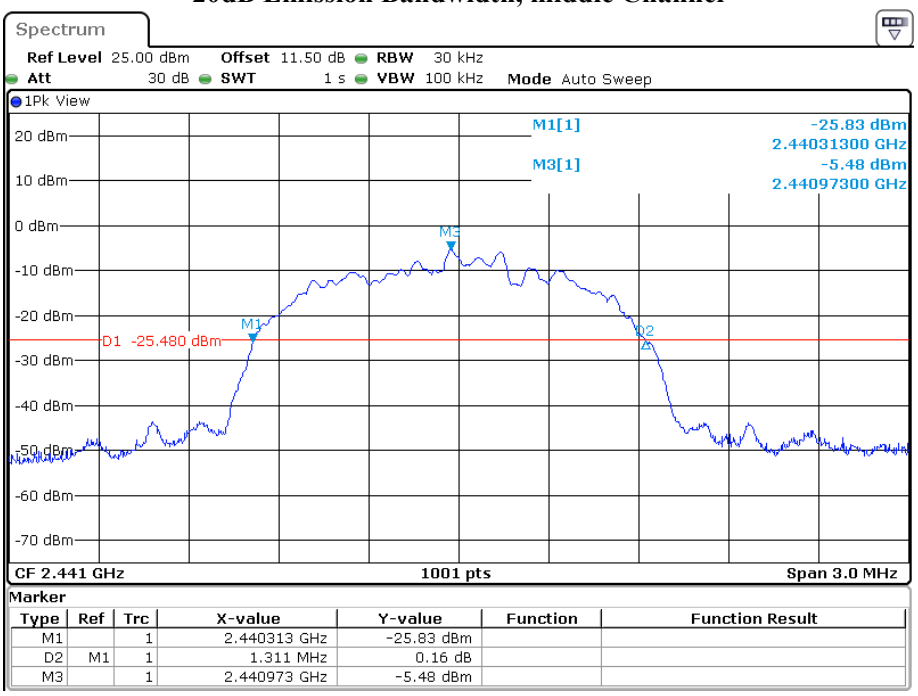


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401973 GHz	-3.60 dBm		
T1		1	2.40138262 GHz	-18.32 dBm	Occ Bw	1.174825175 MHz
T2		1	2.40255744 GHz	-18.81 dBm		

Date: 23.APR.2023 11:29:13

20dB Emission Bandwidth, middle Channel

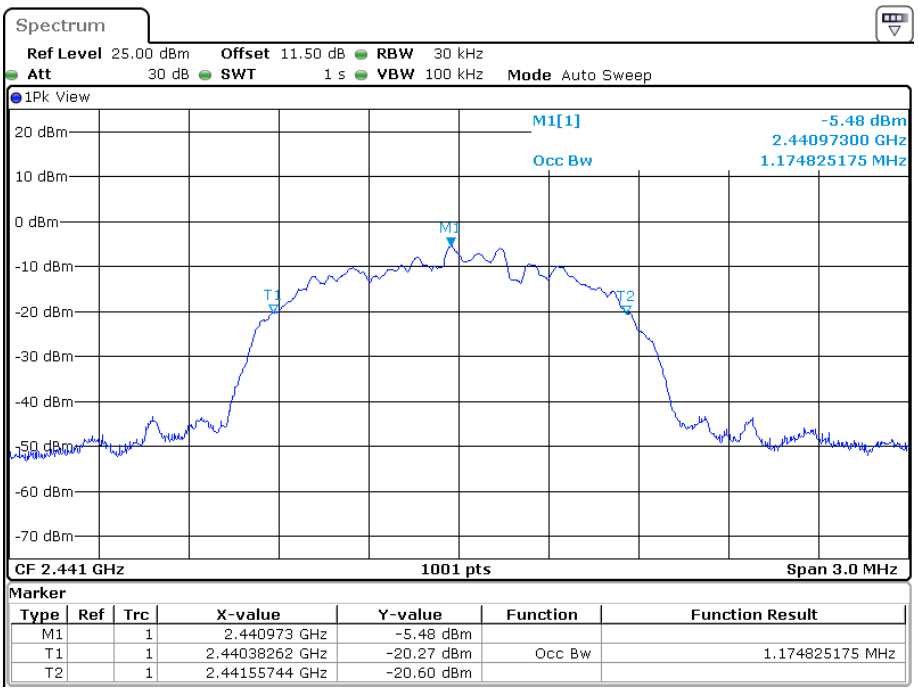


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440313 GHz	-25.83 dBm		
D2	M1	1	1.311 MHz	0.16 dB		
M3		1	2.440973 GHz	-5.48 dBm		

Date: 23.APR.2023 11:42:38

99% Occupied Bandwidth, Middle Channel

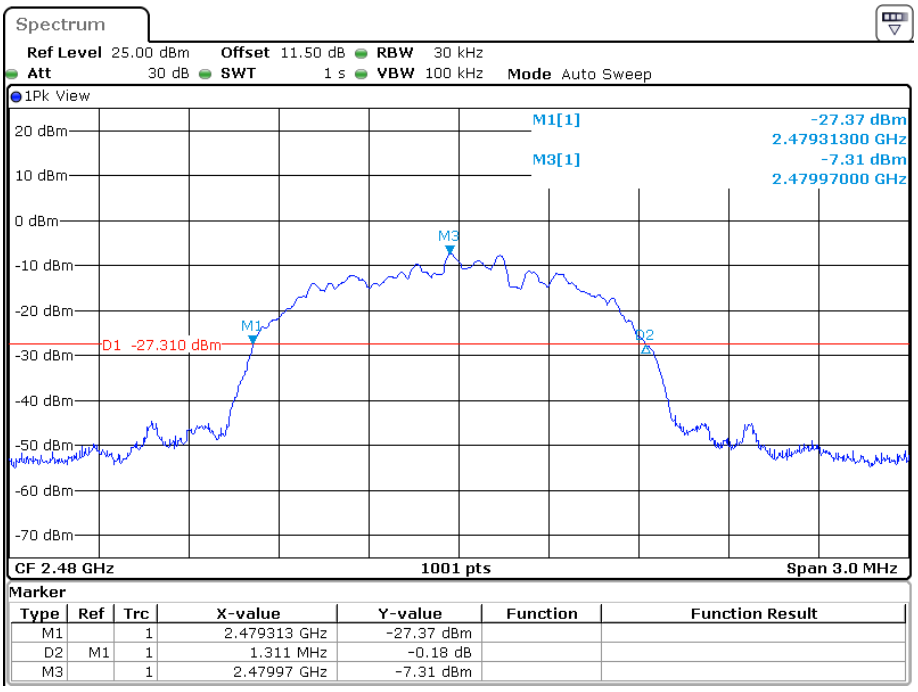


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440973 GHz	-5.48 dBm		
T1		1	2.44038262 GHz	-20.27 dBm	Occ Bw	1.174825175 MHz
T2		1	2.44155744 GHz	-20.60 dBm		

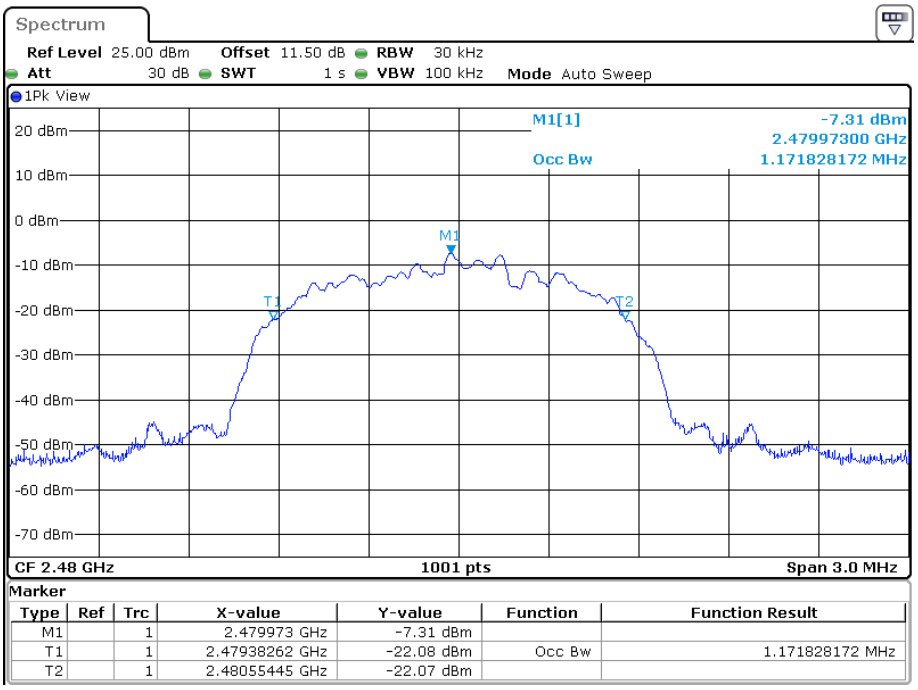
Date: 23.APR.2023 11:42:03

20dB Emission Bandwidth, High Channel



Date: 23.APR.2023 11:51:45

99% Occupied Bandwidth, High Channel



Date: 23.APR.2023 11:51:08

FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

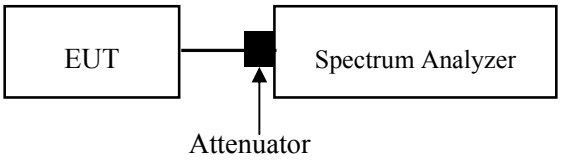
Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.3

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the max-hold function record the quantity of the channel.



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

The testing was performed by Dave Liang on 2023-04-23.

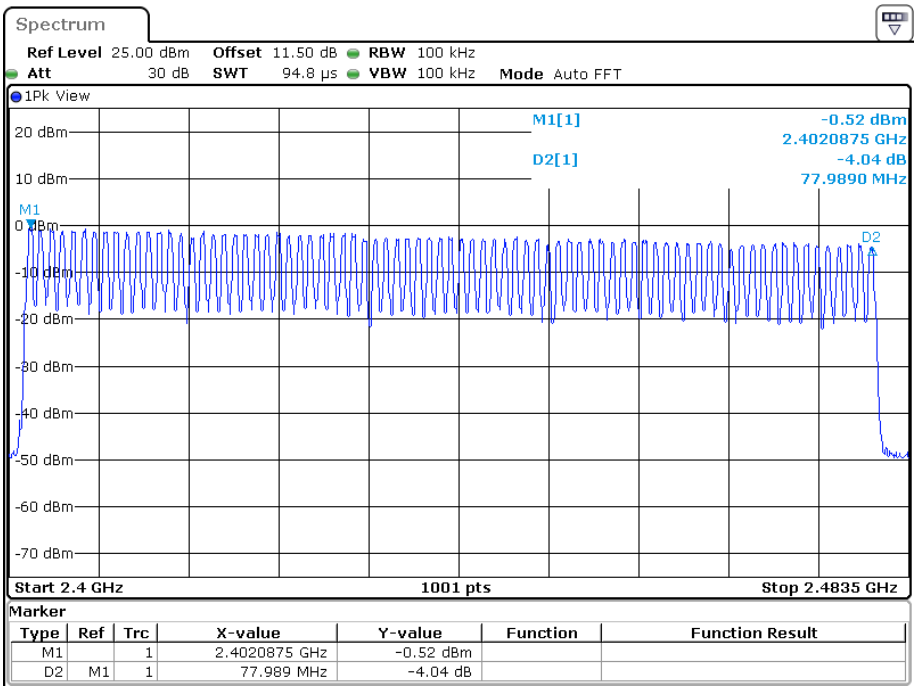
EUT operation mode: Transmitting

Test Result: Pass

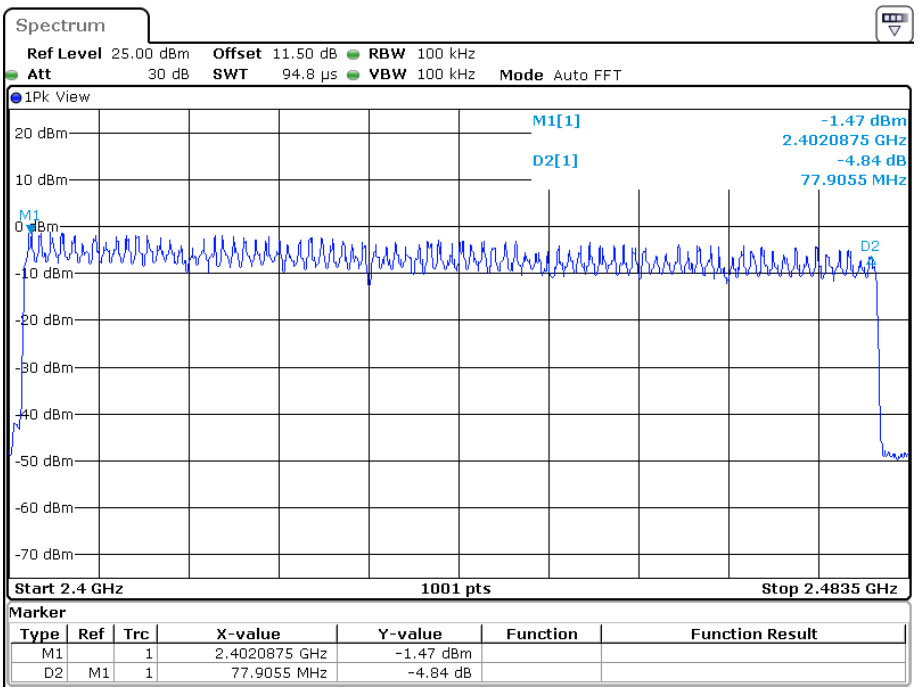
Please refer to following table and plots.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels

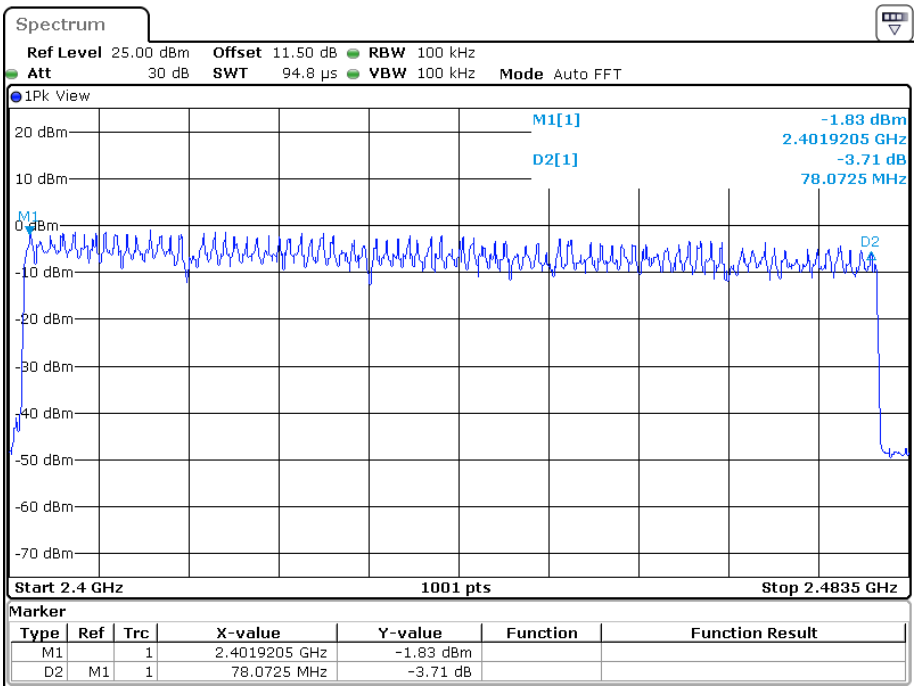


EDR (π/4-DQPSK): Number of Hopping Channels



Date: 23.APR.2023 13:05:46

EDR (8DPSK): Number of Hopping Channels



Date: 23.APR.2023 13:14:07

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

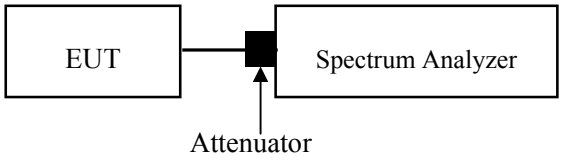
Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.4

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

The testing was performed by Dave Liang on 2023-04-23.

EUT operation mode: Transmitting

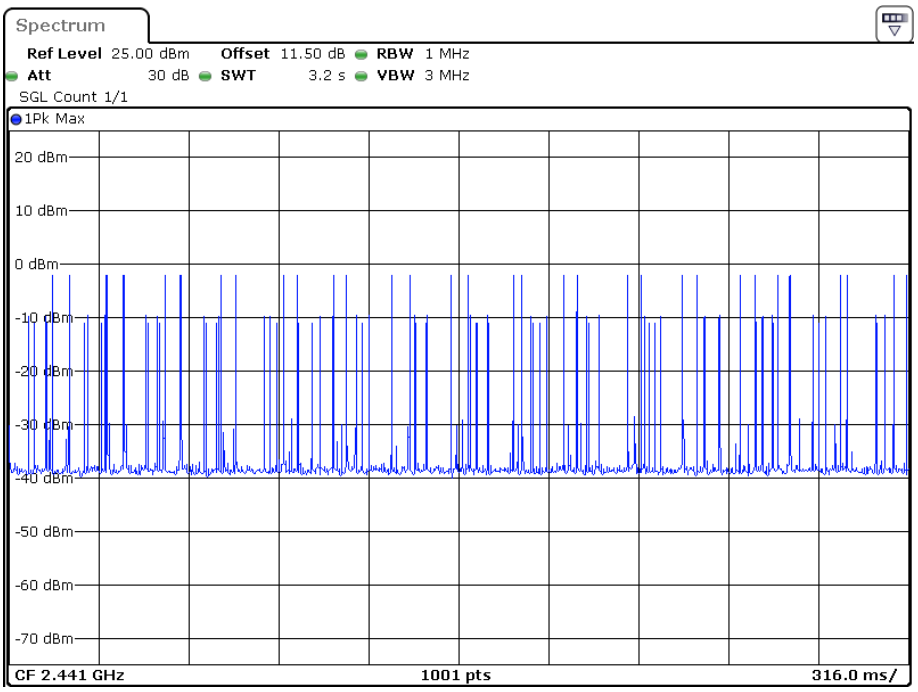
Test Result: Pass

Please refer to following table and plots

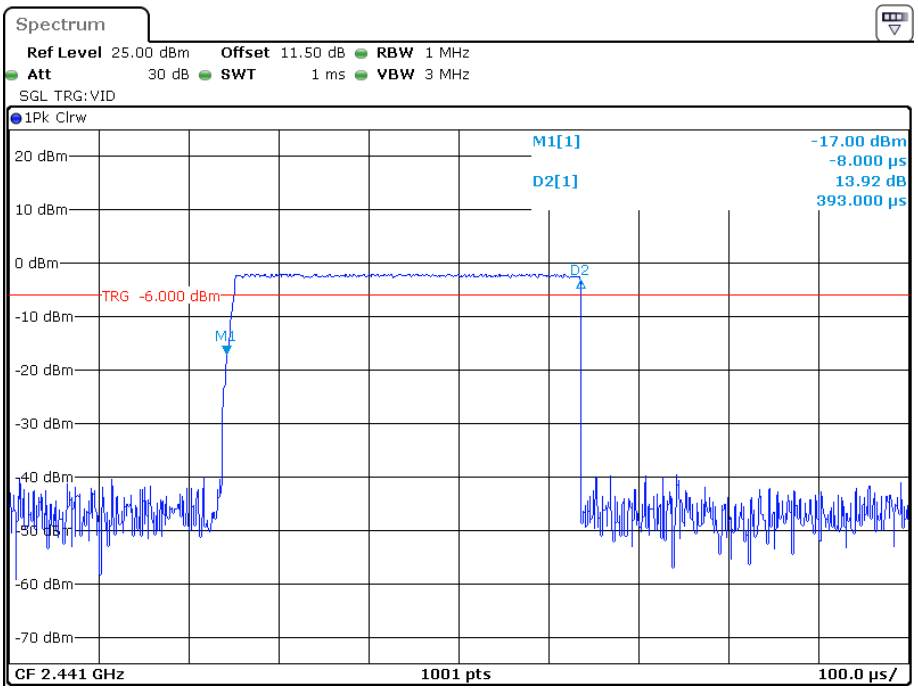
Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.393	320	0.126	≤0.4	PASS
DH3	Hop	1.650	150	0.248	≤0.4	PASS
DH5	Hop	2.900	130	0.377	≤0.4	PASS
2DH1	Hop	0.402	320	0.126	≤0.4	PASS
2DH3	Hop	1.656	150	0.248	≤0.4	PASS
2DH5	Hop	2.900	120	0.348	≤0.4	PASS
3DH1	Hop	0.404	320	0.129	≤0.4	PASS
3DH3	Hop	1.656	140	0.232	≤0.4	PASS
3DH5	Hop	2.905	110	0.320	≤0.4	PASS

Note 1: A period time=0.4*79=31.6(S), Result= Pulse Time *Total hops
Note 2: Total hops=Hopping Number in 3.16s*10
Note 3: Hopping Number in 3.16s=Total of highest signals in 3.16s (Second high signals were other channel)

BDR (GFSK):
DH1

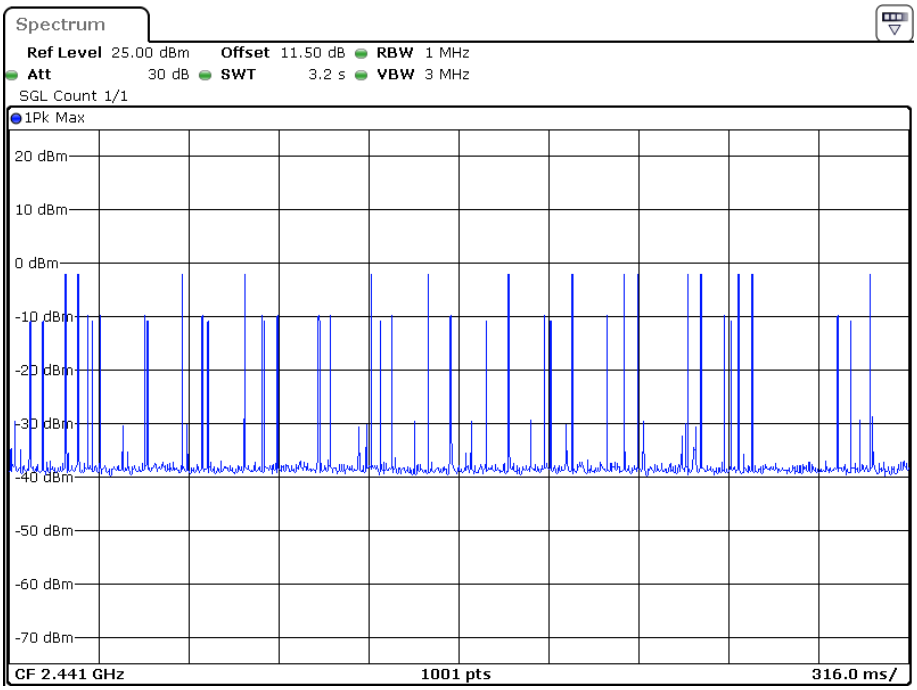


Date: 23.APR.2023 11:54:59

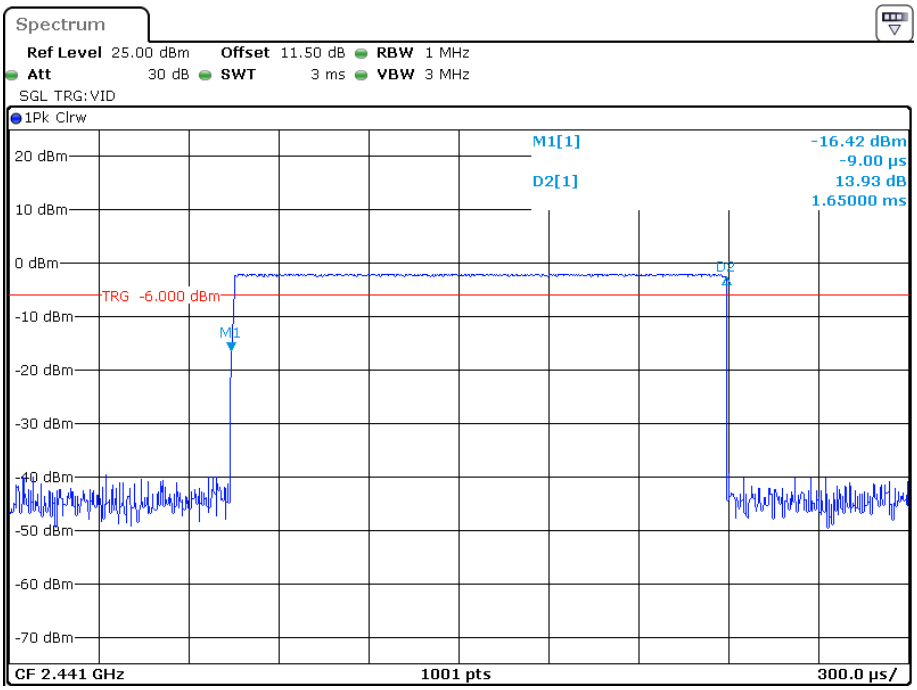


Date: 23.APR.2023 11:55:16

DH3

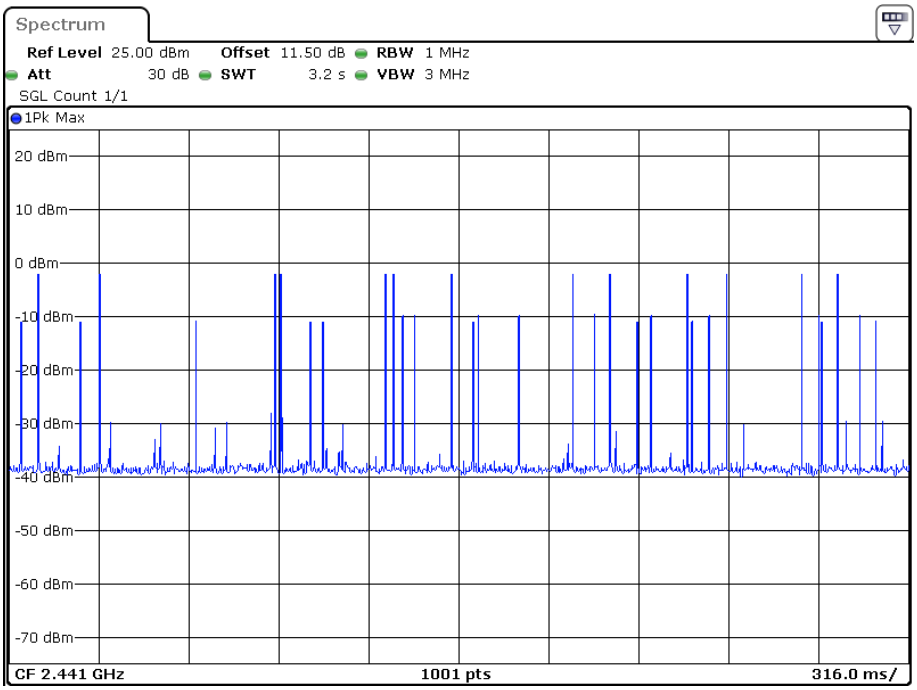


Date: 23.APR.2023 11:56:45

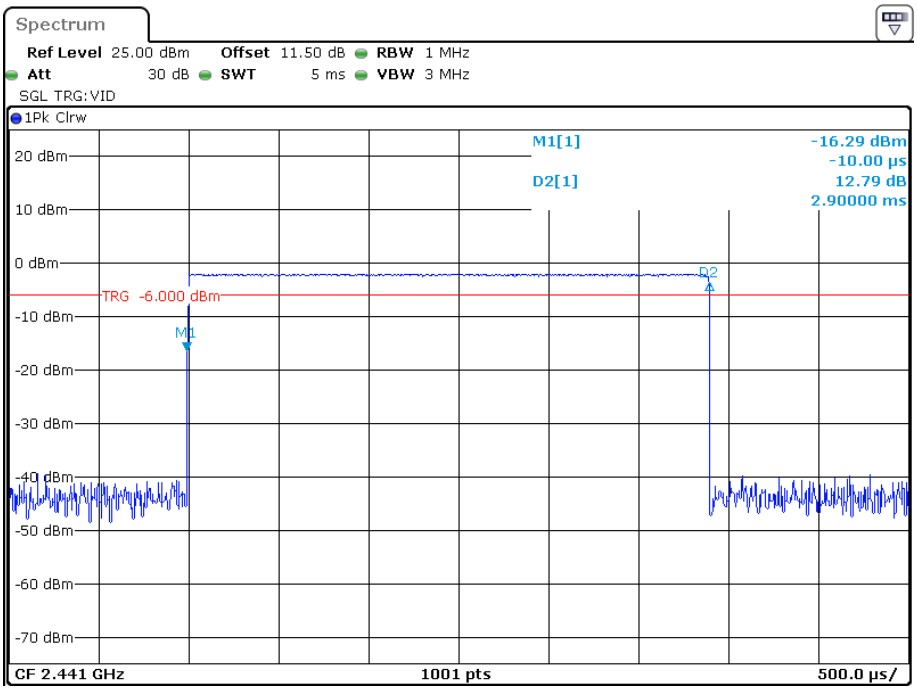


Date: 23.APR.2023 11:57:02

DH5

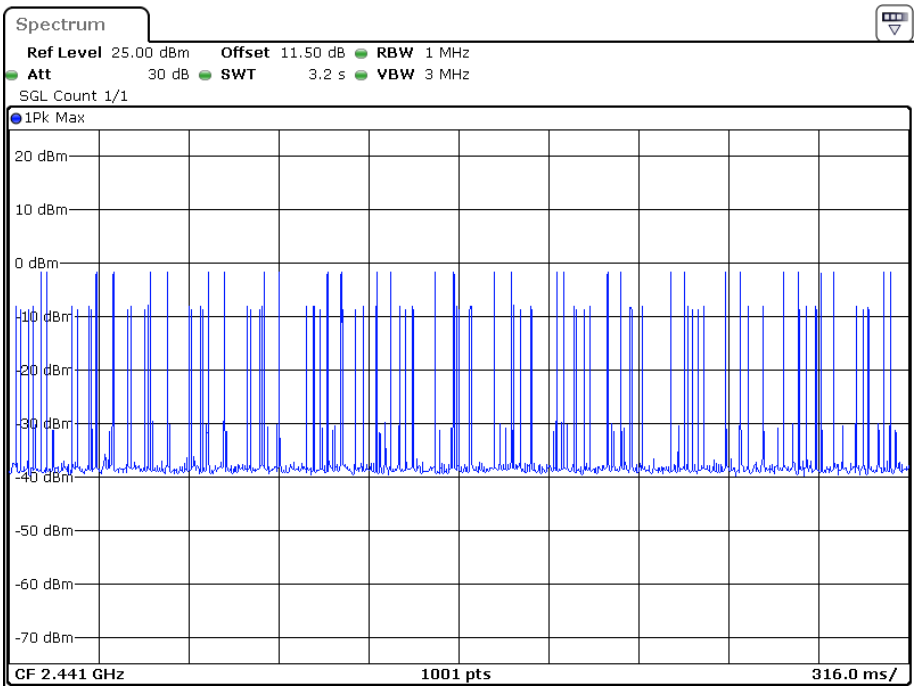


Date: 23.APR.2023 11:59:12

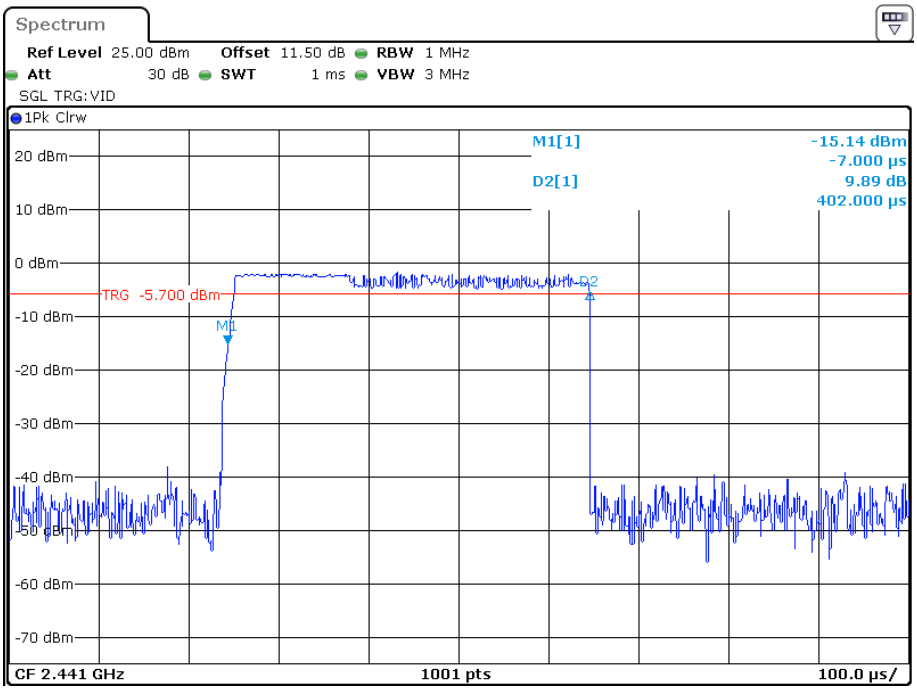


Date: 23.APR.2023 11:59:30

EDR(π/4-DQPSK):
2DH1

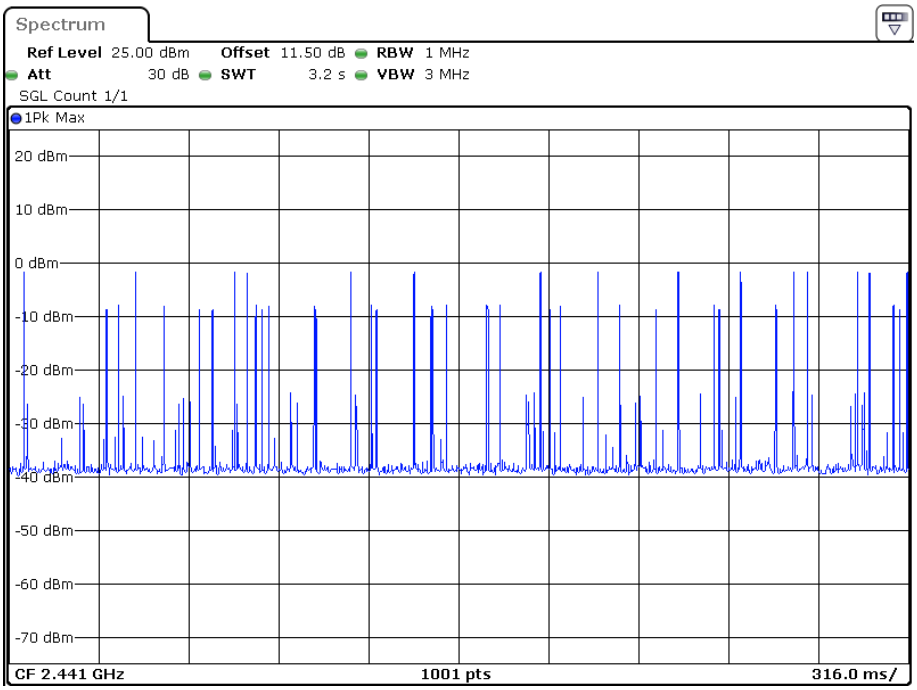


Date: 23.APR.2023 13:02:46

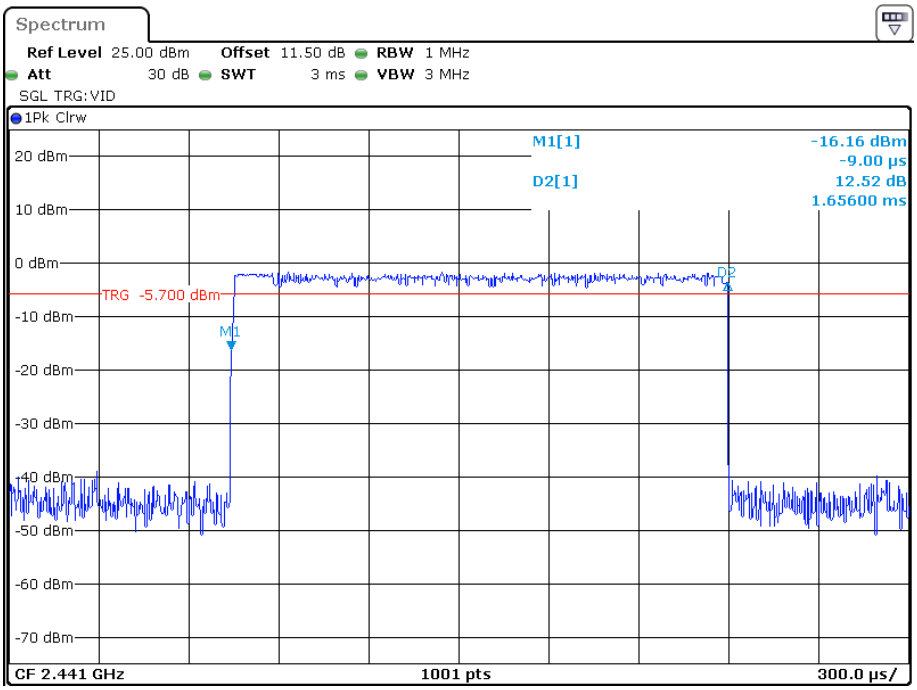


Date: 23.APR.2023 13:03:03

2DH3

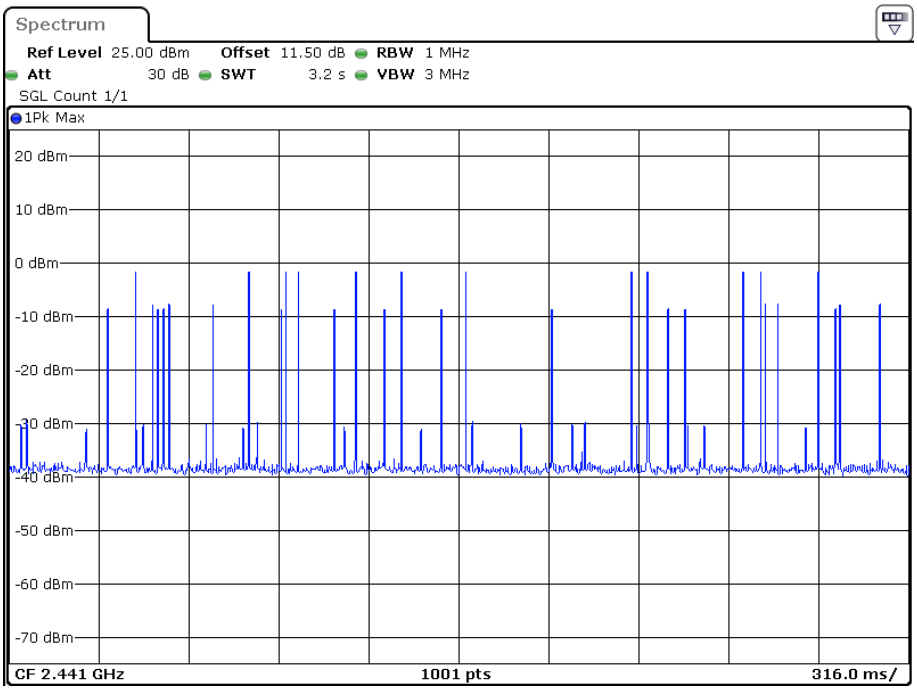


Date: 23.APR.2023 13:03:33

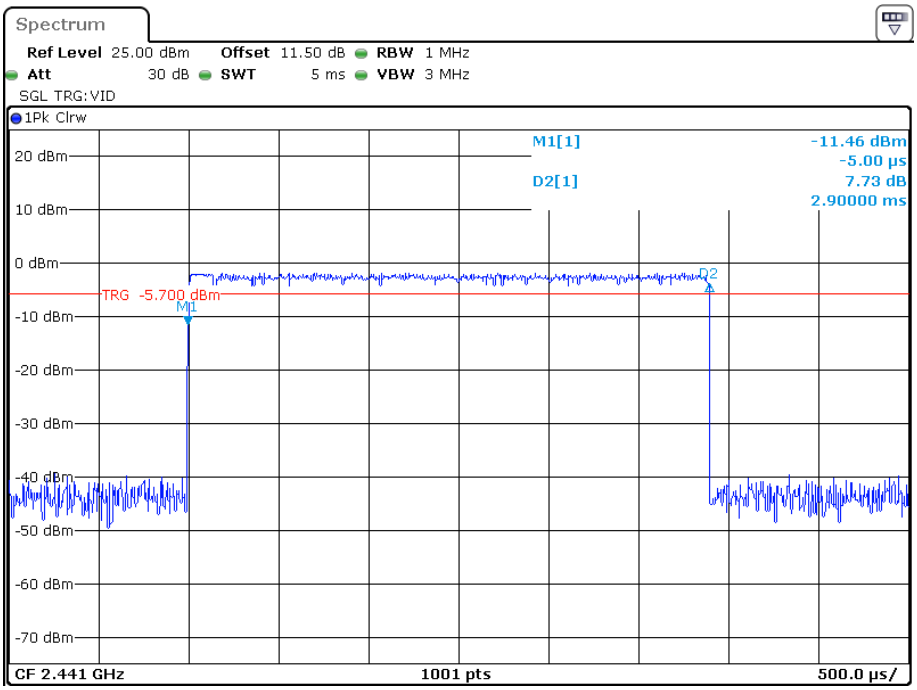


Date: 23.APR.2023 13:03:51

2DH5

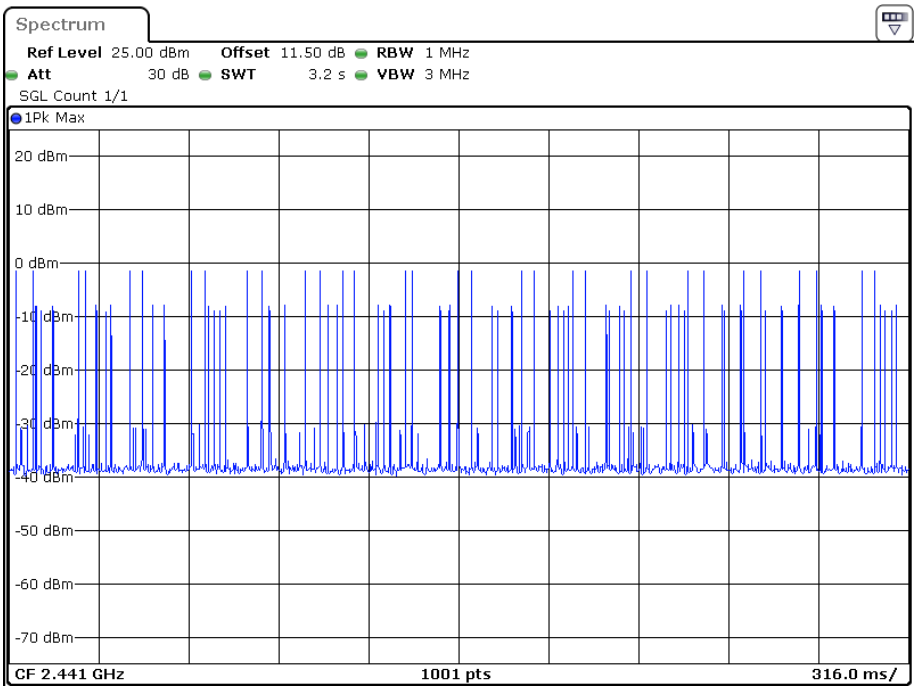


Date: 23.APR.2023 16:36:48

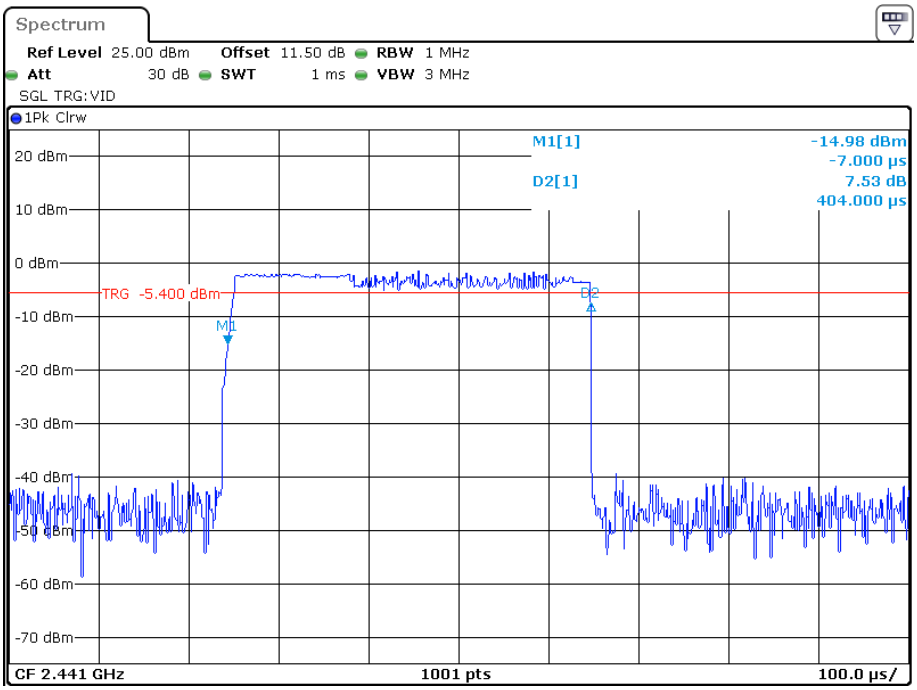


Date: 23.APR.2023 13:06:43

EDR (8DPSK):
3DH1

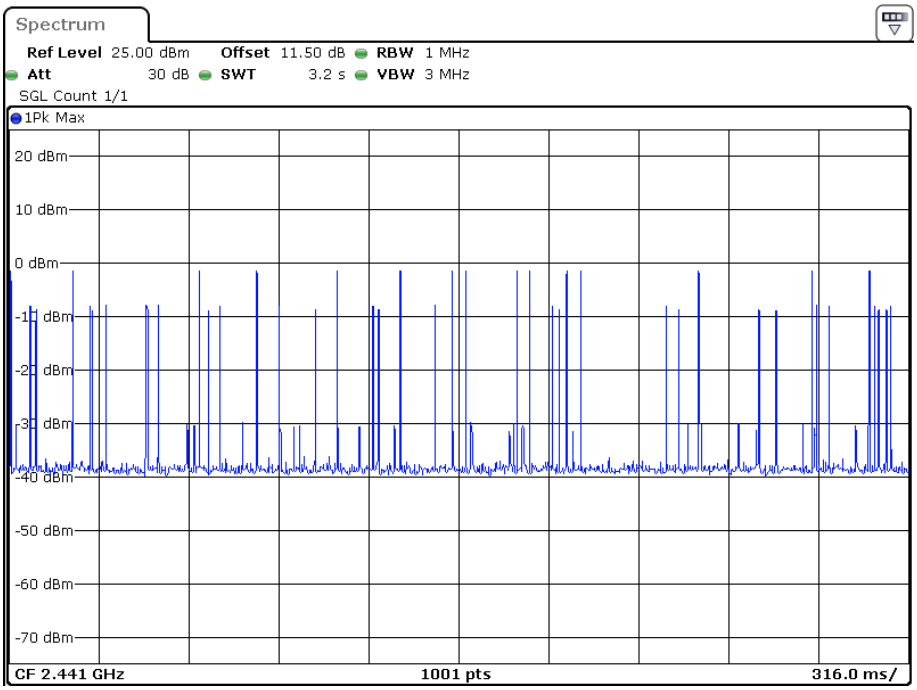


Date: 23.APR.2023 13:10:24

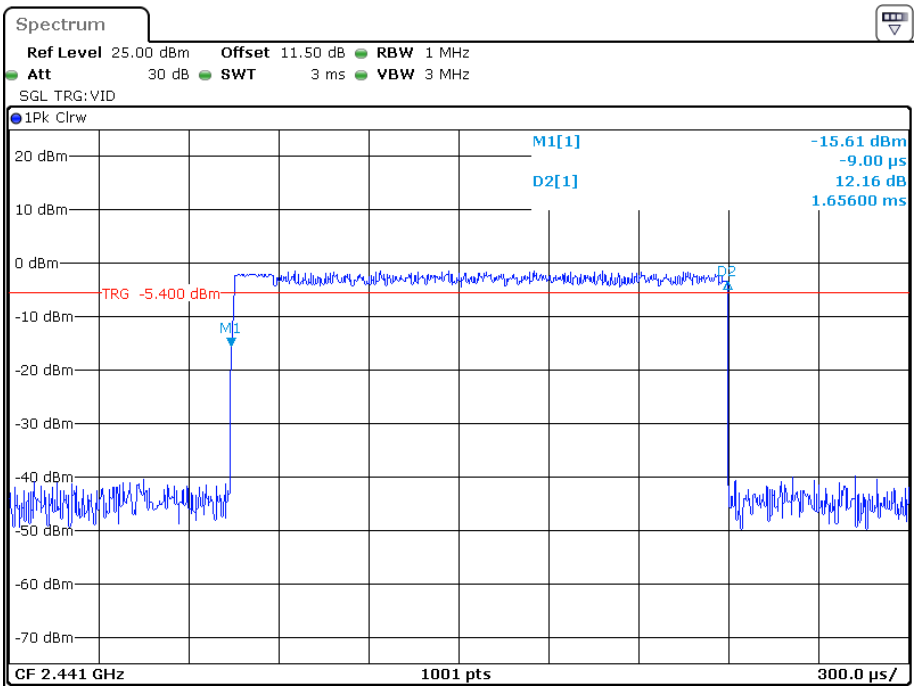


Date: 23.APR.2023 13:10:41

3DH3

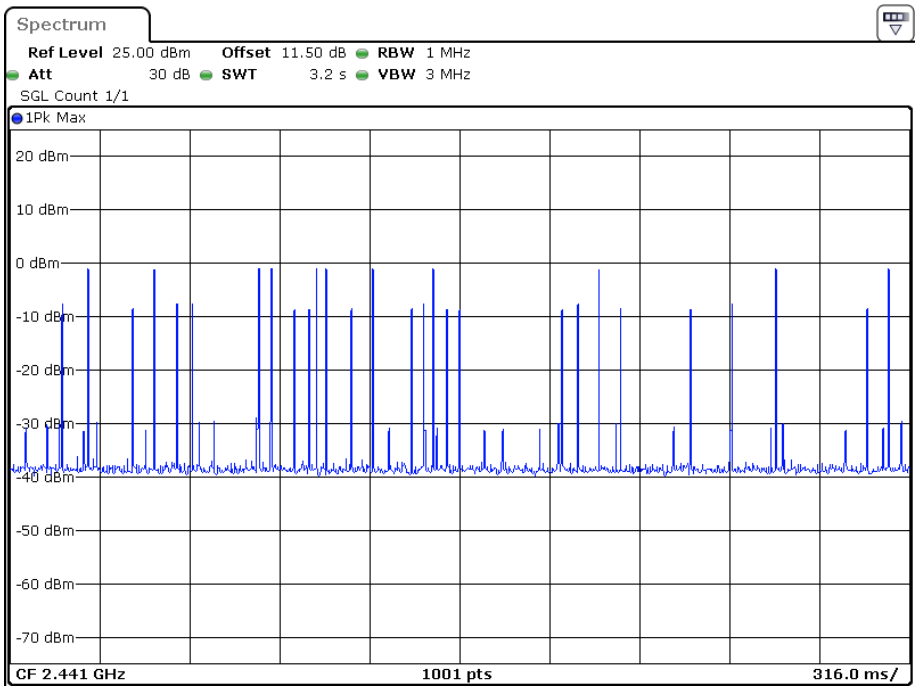


Date: 23.APR.2023 13:11:35

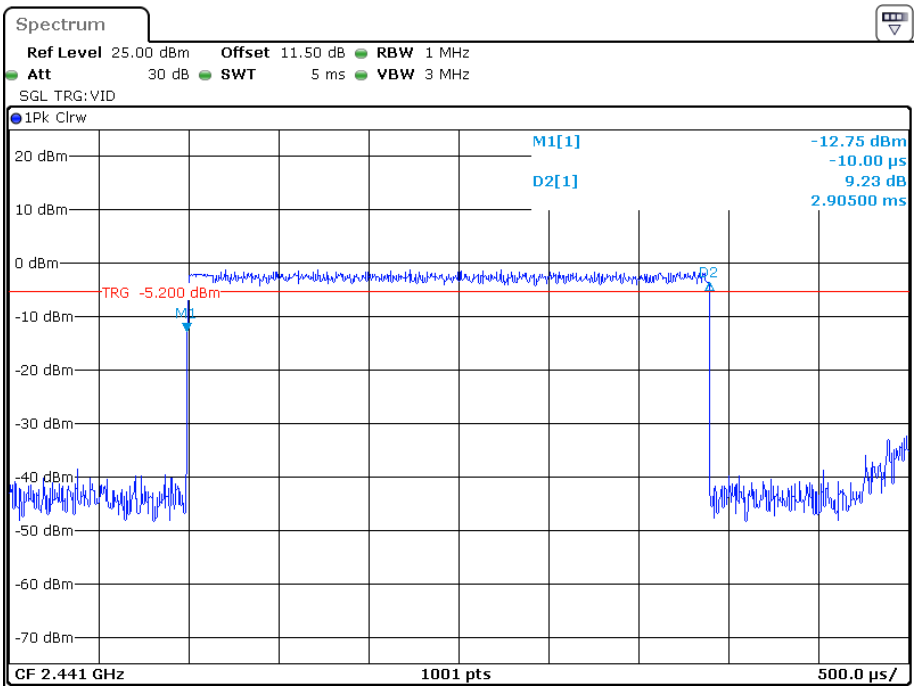


Date: 23.APR.2023 13:11:53

3DH5



Date: 23.APR.2023 16:38:55



Date: 23.APR.2023 13:15:13

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

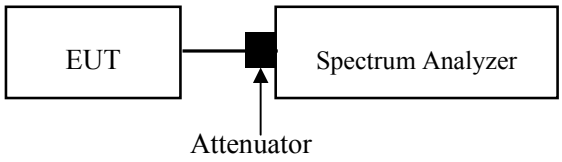
Applicable Standard

According to §15.247(b) (1), 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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.5

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

The testing was performed by Dave Liang on 2023-04-23.

EUT operation mode: Transmitting

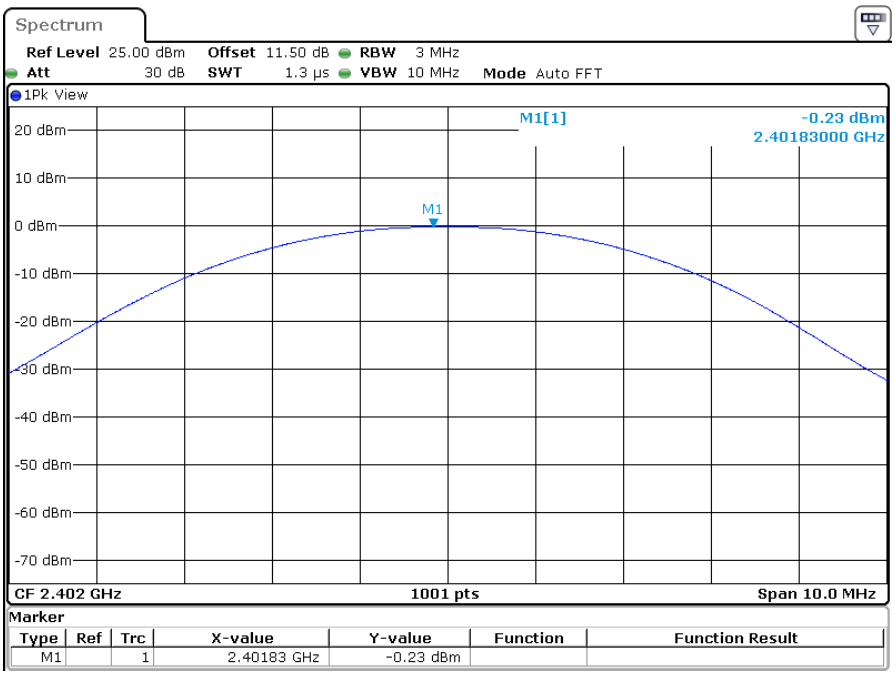
Test Result: Pass

Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR (GFSK)	Low	2402	-0.23	21
	Middle	2441	-2.00	21
	High	2480	-3.77	21
EDR (π/4-DQPSK)	Low	2402	0.18	21
	Middle	2441	-1.57	21
	High	2480	-3.20	21
EDR (8DPSK)	Low	2402	**0.52**	21
	Middle	2441	-1.01	21
	High	2480	-2.71	21

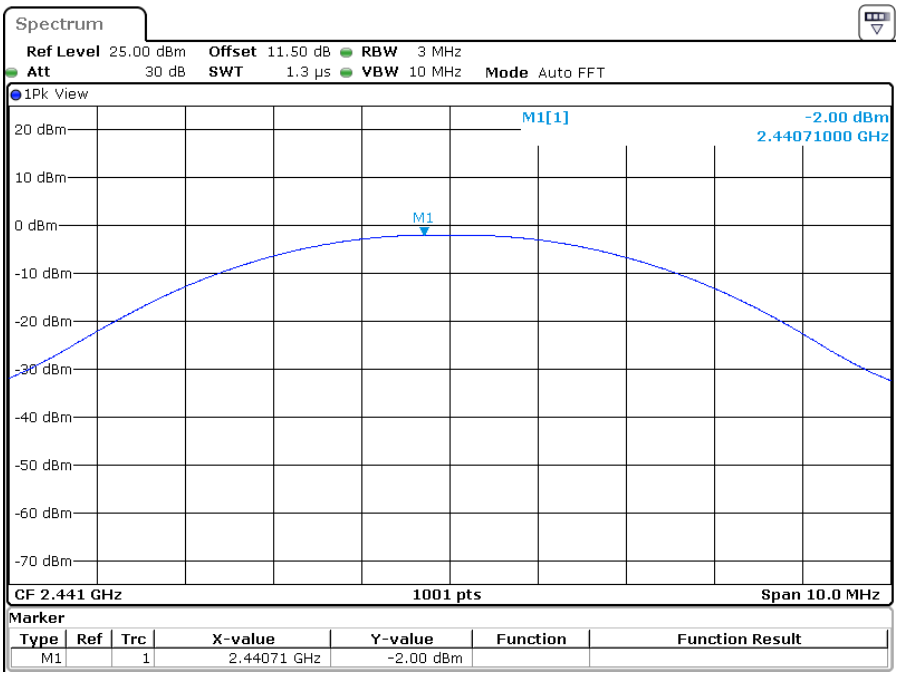
BDR (GFSK):

Low Channel



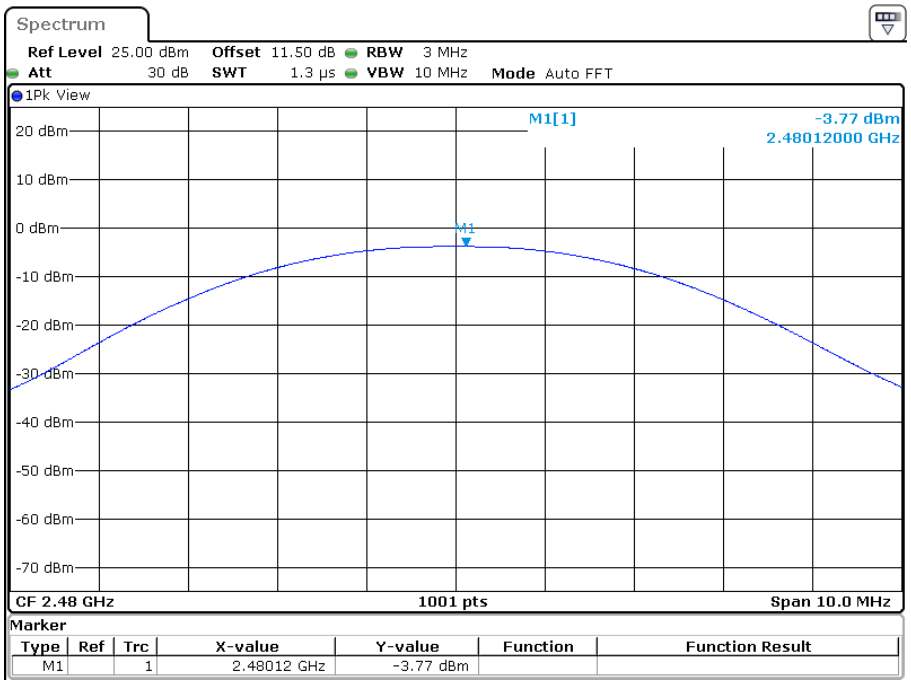
Date: 23.APR.2023 11:19:29

Middle Channel



Date: 23.APR.2023 11:32:25

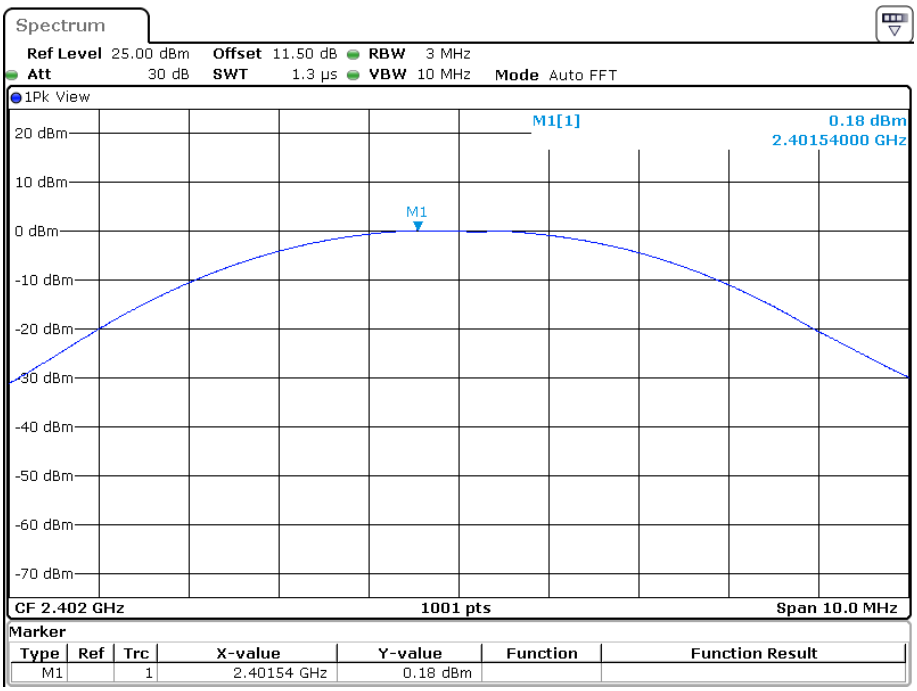
High Channel



Date: 23.APR.2023 11:43:59

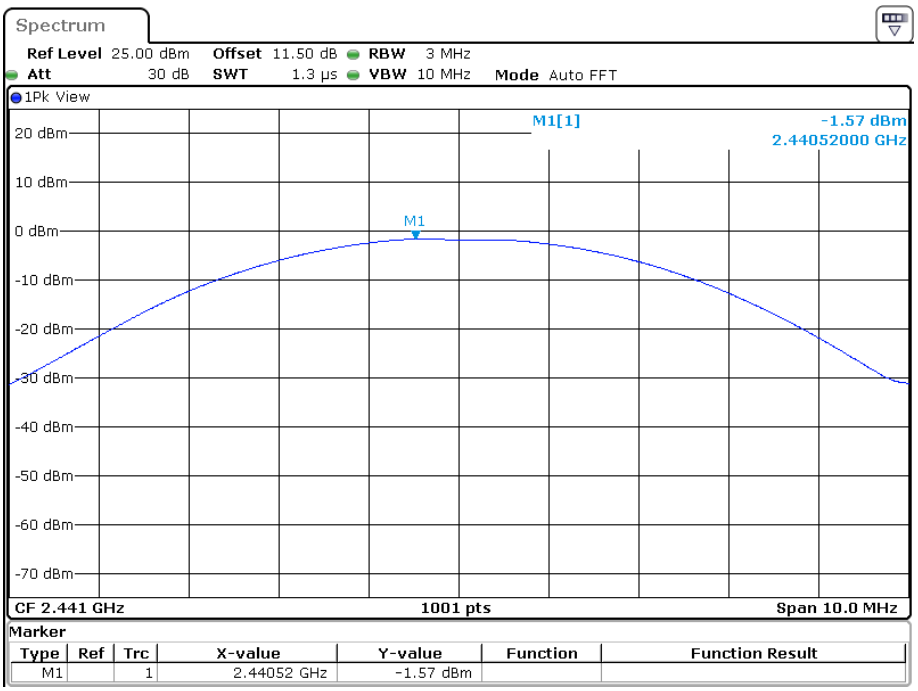
EDR (π/4-DQPSK):

Low Channel



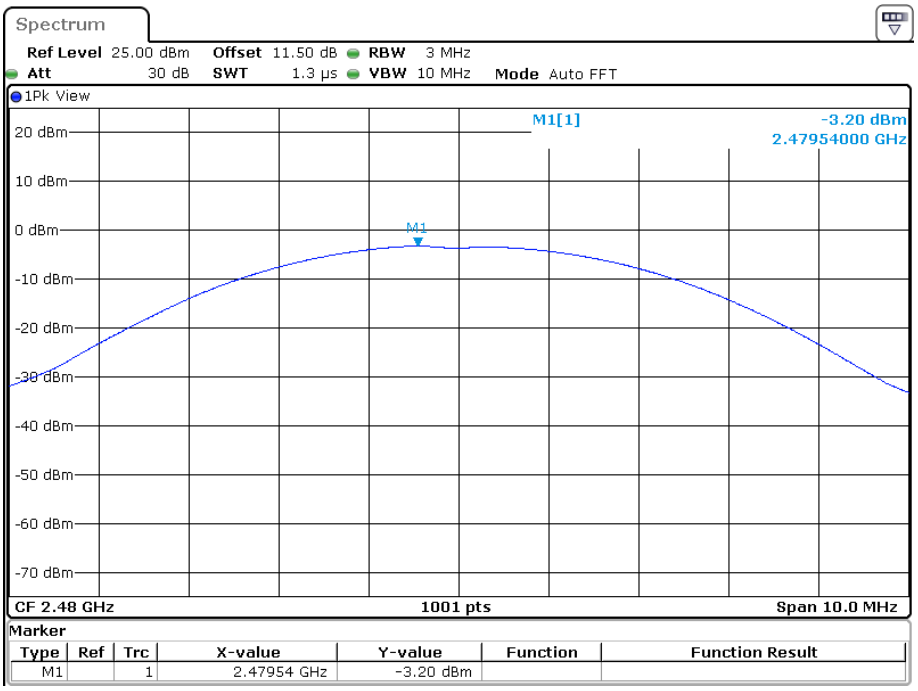
Date: 23.APR.2023 11:25:39

Middle Channel



Date: 23.APR.2023 11:37:20

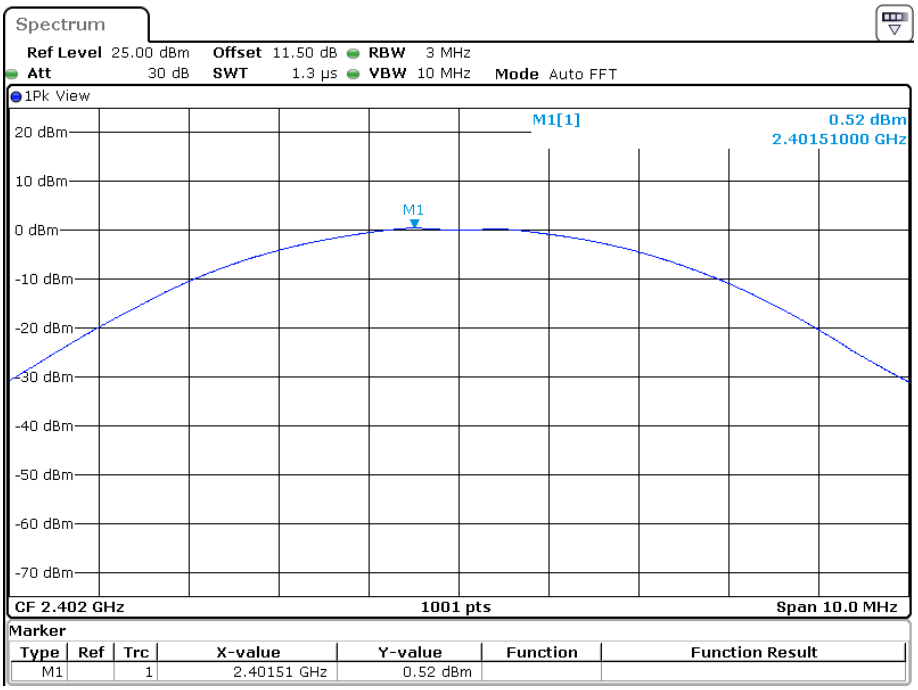
High Channel



Date: 23.APR.2023 11:47:35

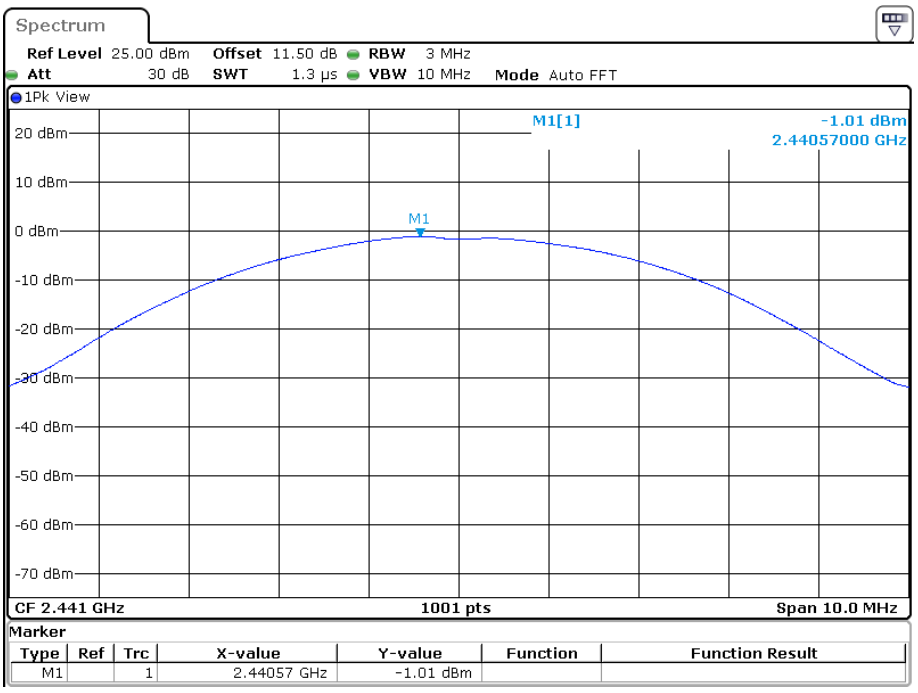
EDR (8DPSK):

Low Channel



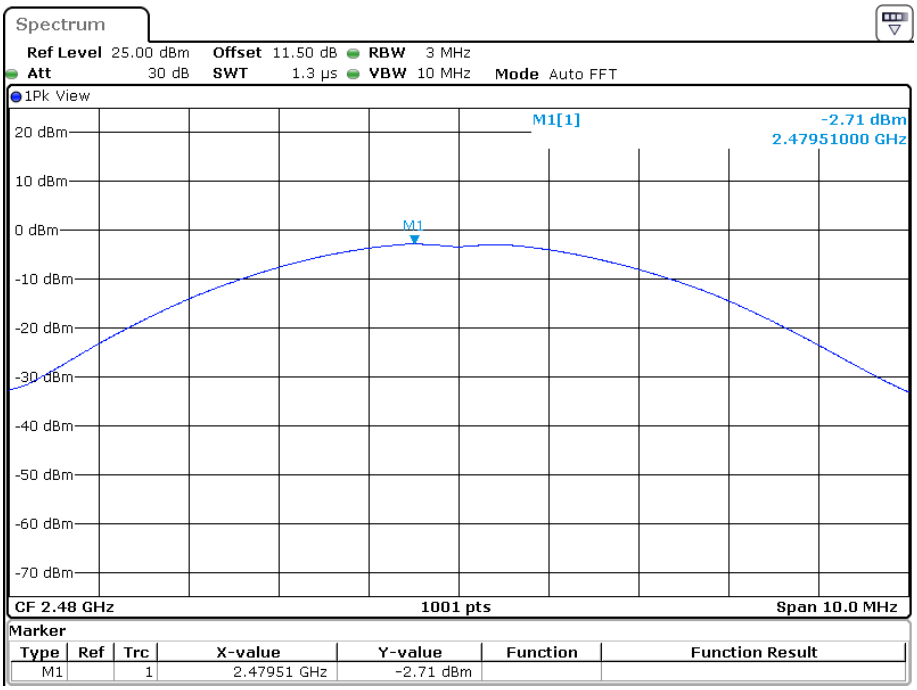
Date: 23.APR.2023 11:28:37

middle Channel



Date: 23.APR.2023 11:41:27

High Channel



FCC §15.247(d) - BAND EDGES TESTING

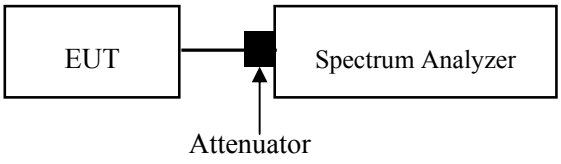
Applicable Standard

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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.6 & Clause 6.10

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	26.8℃
Relative Humidity:	59%
ATM Pressure:	101.0 kPa

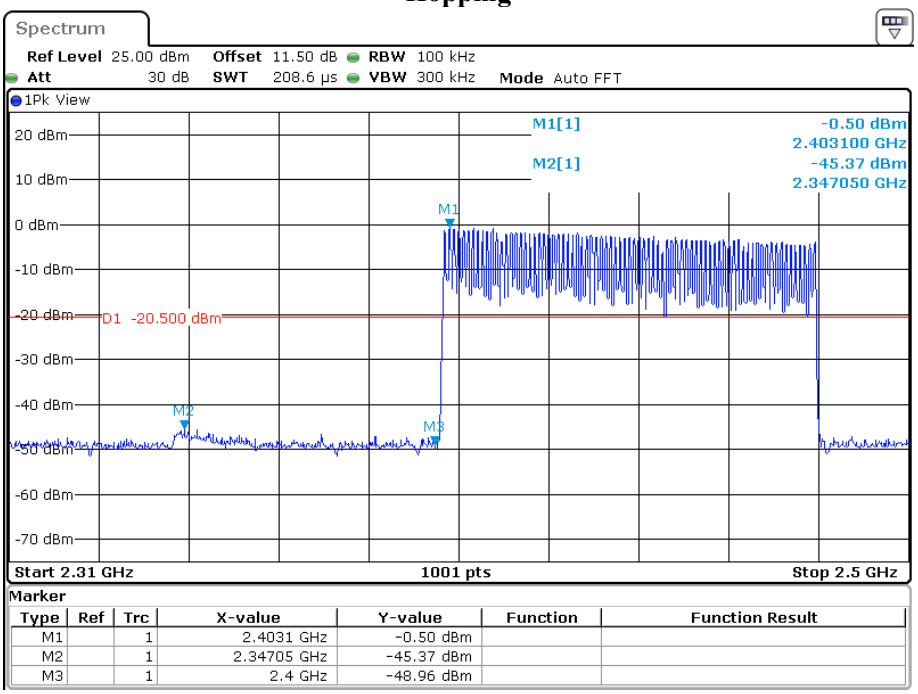
The testing was performed by Dave Liang on 2023-04-23.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to following plots

BDR (GFSK): Band Edge-Left Side Hopping

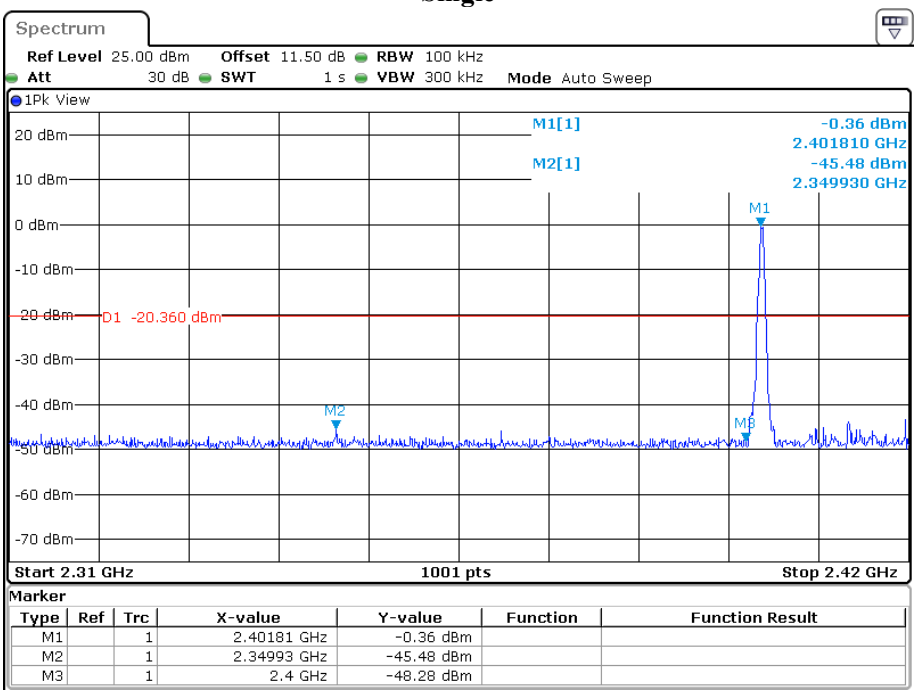


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4031 GHz	-0.50 dBm		
M2		1	2.34705 GHz	-45.37 dBm		
M3		1	2.4 GHz	-48.96 dBm		

Date: 23.APR.2023 12:00:53

Single

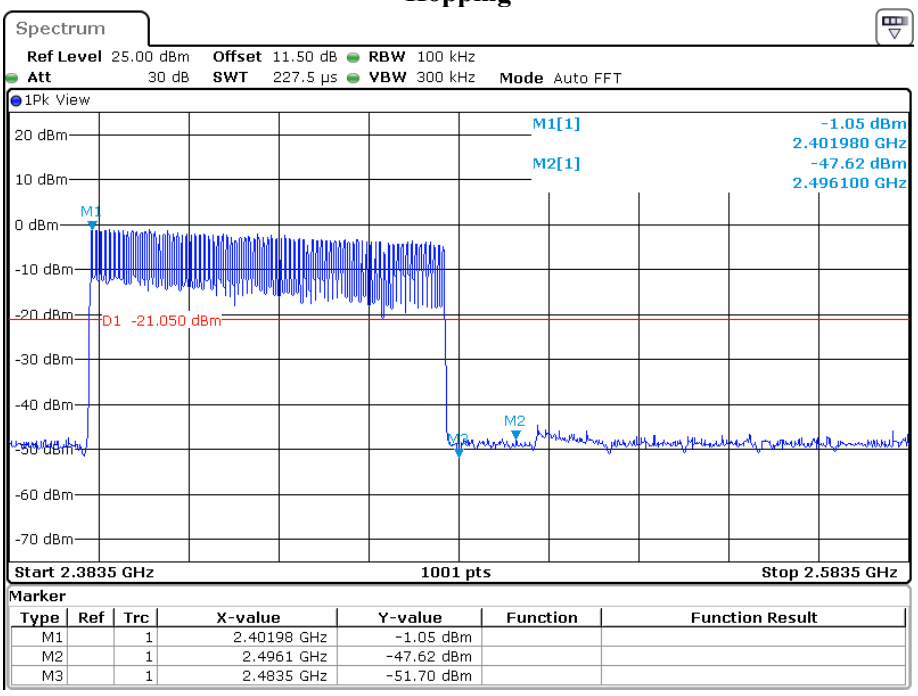


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40181 GHz	-0.36 dBm		
M2		1	2.34993 GHz	-45.48 dBm		
M3		1	2.4 GHz	-48.28 dBm		

Date: 23.APR.2023 11:21:18

BDR (GFSK): Band Edge-Right Side Hopping

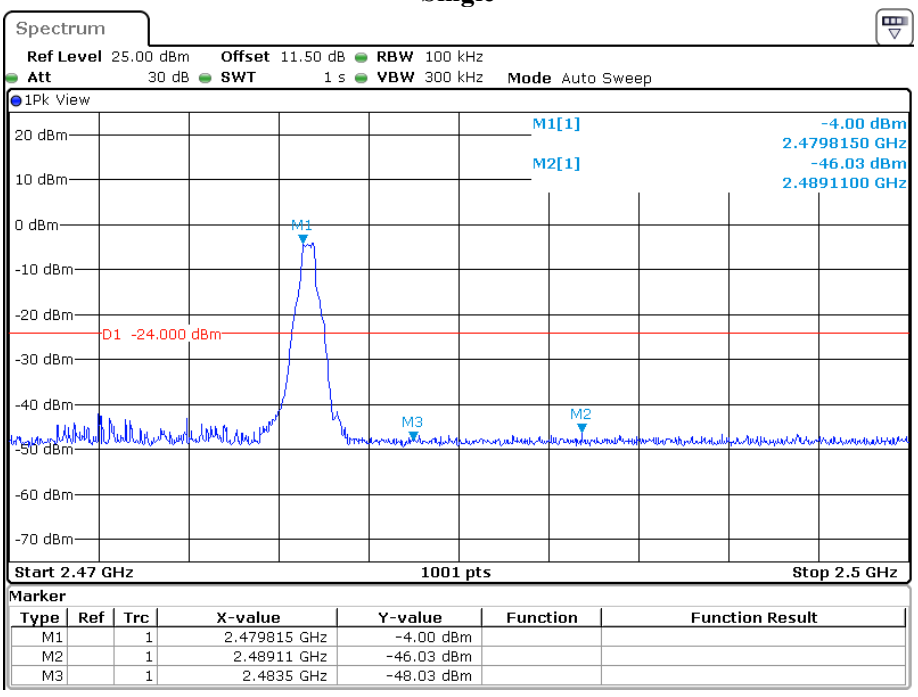


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40198 GHz	-1.05 dBm		
M2		1	2.4961 GHz	-47.62 dBm		
M3		1	2.4835 GHz	-51.70 dBm		

Date: 23.APR.2023 12:02:25

Single

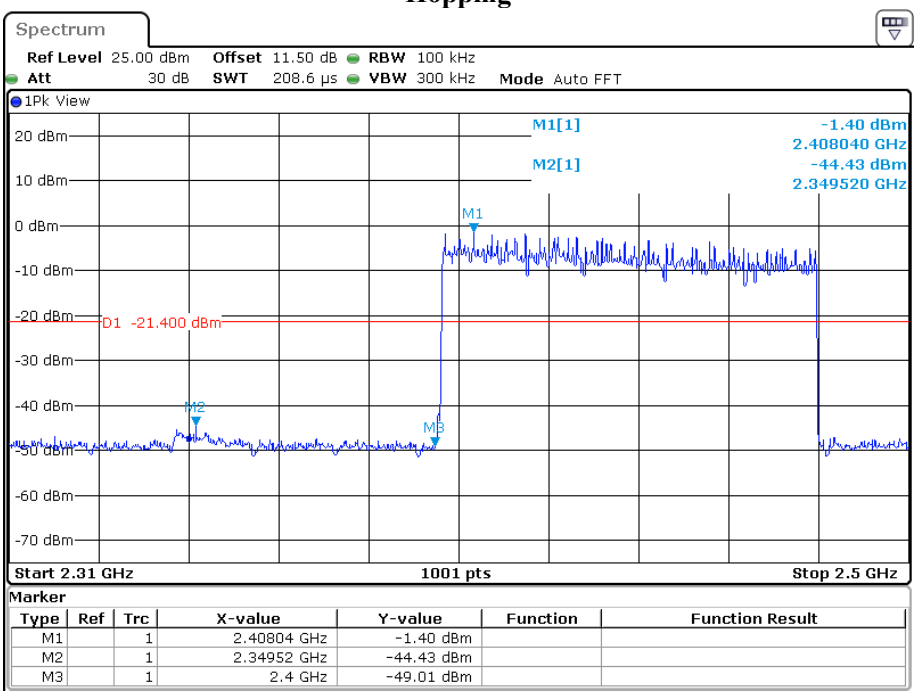


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479815 GHz	-4.00 dBm		
M2		1	2.48911 GHz	-46.03 dBm		
M3		1	2.4835 GHz	-48.03 dBm		

Date: 23.APR.2023 11:46:23

EDR (π/4-DQPSK): Band Edge-Left Side Hopping

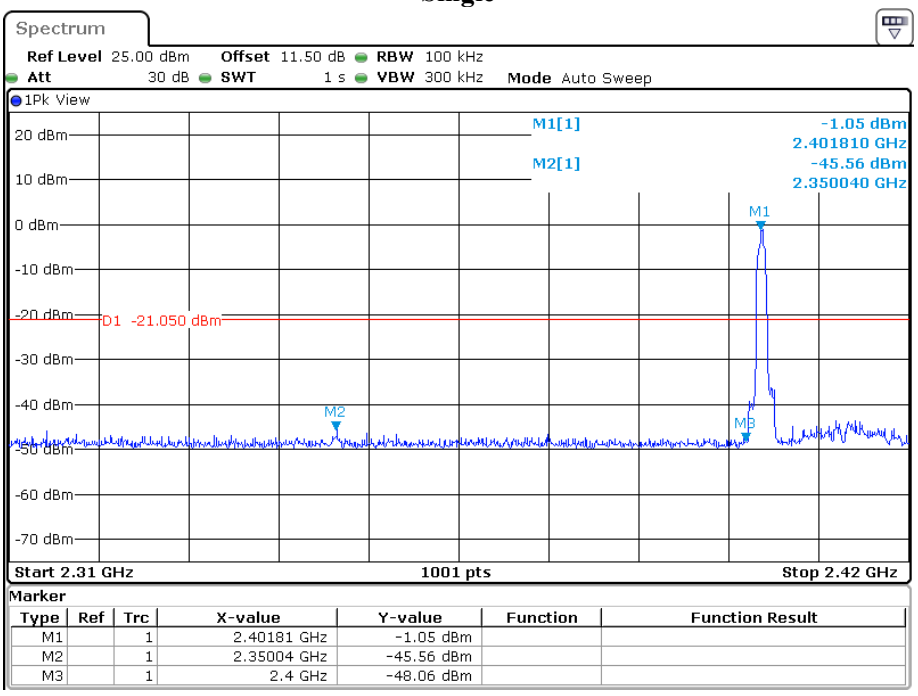


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40804 GHz	-1.40 dBm		
M2		1	2.34952 GHz	-44.43 dBm		
M3		1	2.4 GHz	-49.01 dBm		

Date: 23.APR.2023 13:07:55

Single

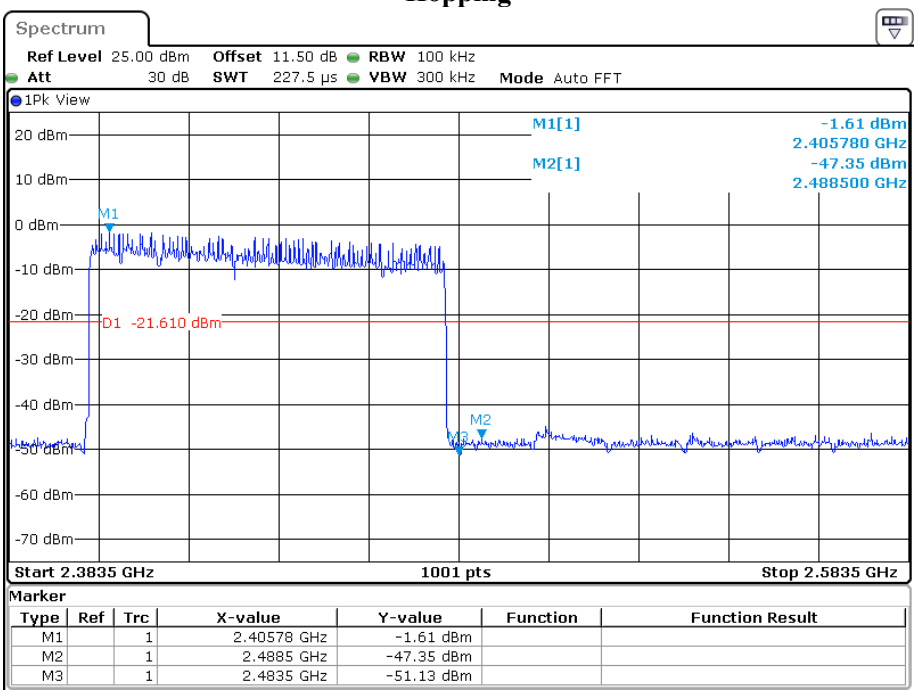


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40181 GHz	-1.05 dBm		
M2		1	2.35004 GHz	-45.56 dBm		
M3		1	2.4 GHz	-48.06 dBm		

Date: 23.APR.2023 11:27:25

EDR (π/4-DQPSK): Band Edge-Right Side Hopping

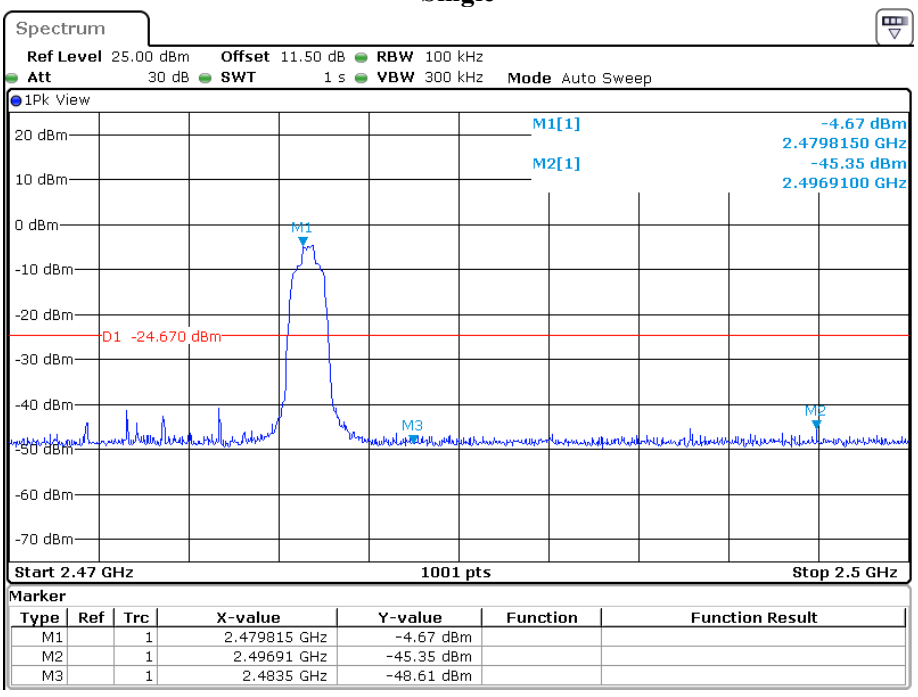


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40578 GHz	-1.61 dBm		
M2		1	2.4885 GHz	-47.35 dBm		
M3		1	2.4835 GHz	-51.13 dBm		

Date: 23.APR.2023 13:09:49

Single

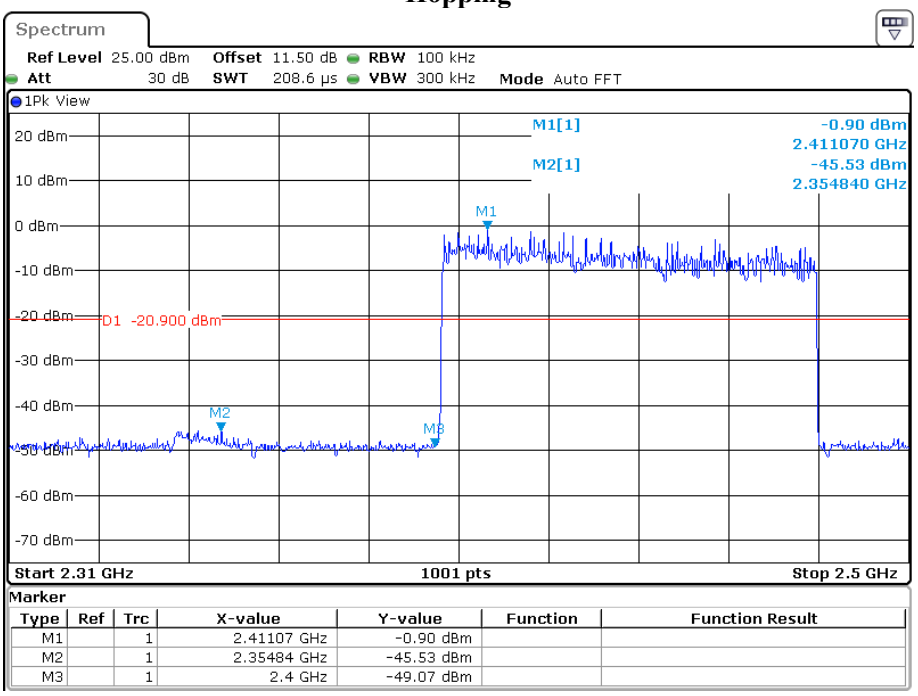


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479815 GHz	-4.67 dBm		
M2		1	2.49691 GHz	-45.35 dBm		
M3		1	2.4835 GHz	-48.61 dBm		

Date: 23.APR.2023 11:49:34

EDR (8DPSK): Band Edge-Left Side Hopping

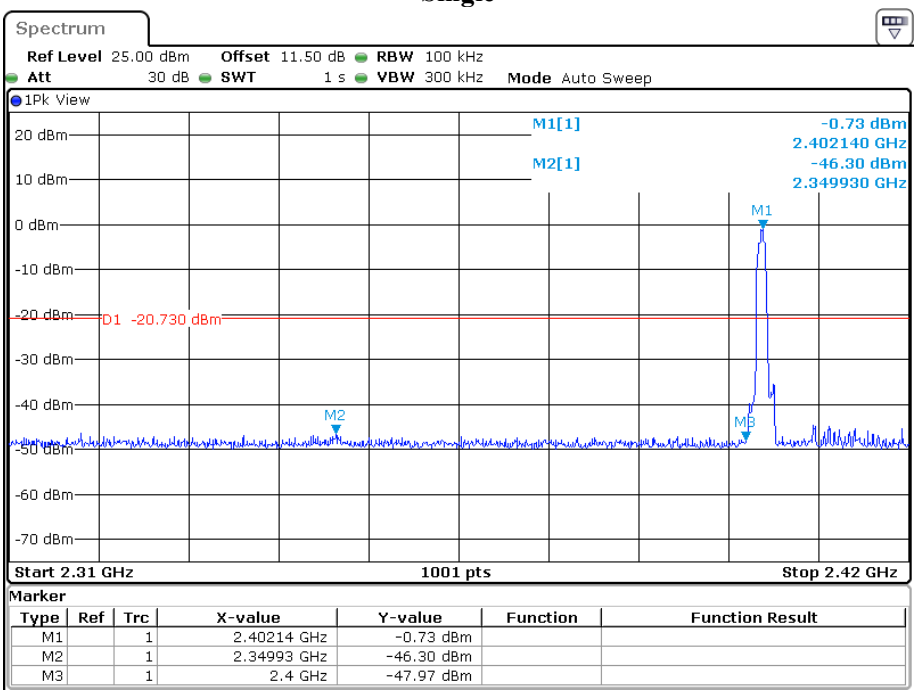


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41107 GHz	-0.90 dBm		
M2		1	2.35484 GHz	-45.53 dBm		
M3		1	2.4 GHz	-49.07 dBm		

Date: 23.APR.2023 13:16:15

Single

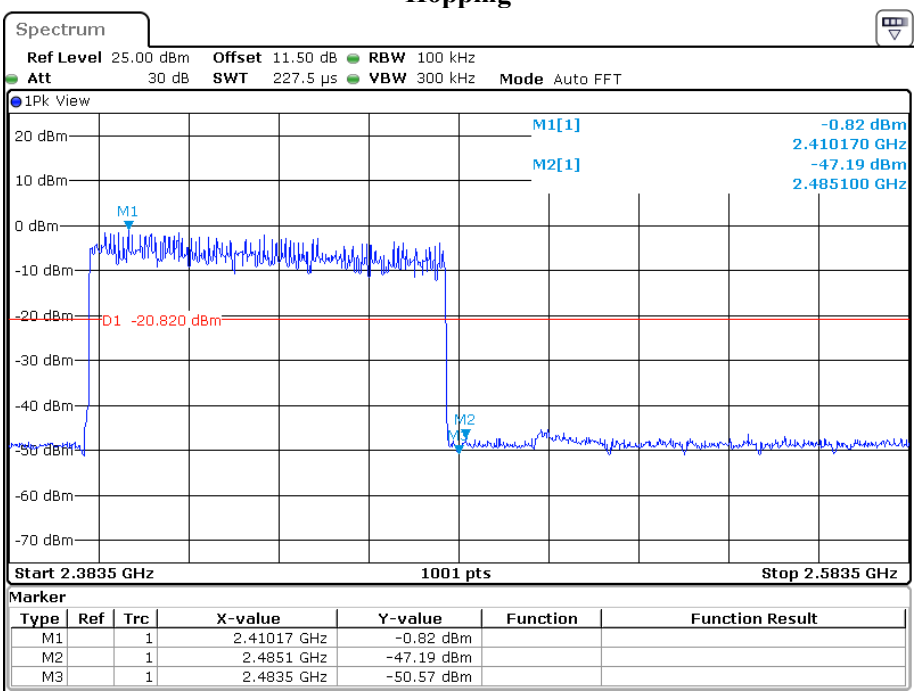


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40214 GHz	-0.73 dBm		
M2		1	2.34993 GHz	-46.30 dBm		
M3		1	2.4 GHz	-47.97 dBm		

Date: 23.APR.2023 11:30:24

EDR (8DPSK): Band Edge-Right Side Hopping

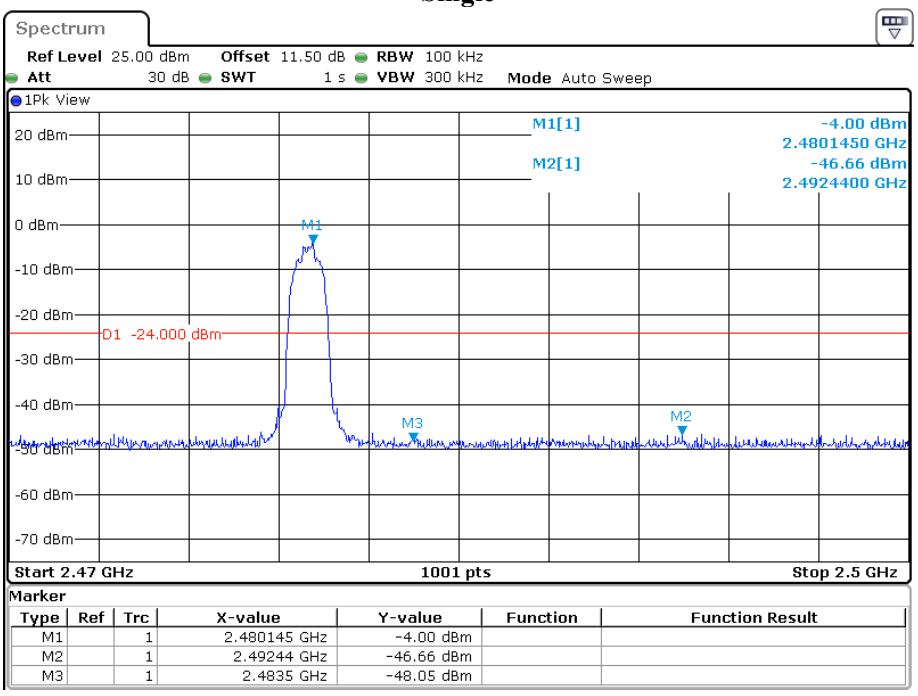


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41017 GHz	-0.82 dBm		
M2		1	2.4851 GHz	-47.19 dBm		
M3		1	2.4835 GHz	-50.57 dBm		

Date: 23.APR.2023 13:18:08

Single



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480145 GHz	-4.00 dBm		
M2		1	2.49244 GHz	-46.66 dBm		
M3		1	2.4835 GHz	-48.05 dBm		

Date: 23.APR.2023 11:52:09

******* END OF REPORT *******