FCC Part 15.247

TEST REPORT

For

Targus International LLC

1211 North Miller Street, Anaheim, CA 92806 USA

FCC ID: OXM000147

Report Type: Original Report	**Product Type:** Bluetooth V5.3 Dual-Mode Dongle

Report Producer : Coco Lin

Report Number : RXZ221215001RF05

Report Date : 2023-05-11

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ221215001	RXZ221215001RF05	2023-05-11	Original Report	Coco Lin

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TABLE OF CONTENTS

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1. General Information

1.1. Product Description for Equipment under Test (EUT)

Manufacturer	Targus International LLC
	1211 North Miller Street, Anaheim, CA 92806 USA
Brand Name	Targus
Product (Equipment)	Bluetooth V5.3 Dual-Mode Dongle
Main Model Name	ACB75B
Frequency Range	2402~2480 MHz
Modulation Technique	BR Mode: GFSK EDR Mode: π/4-DQPSK, 8DPSK
Peak Conducted Output Power	BR(GFSK) Mode: 4.12 dBm EDR(π/4-DQPSK) Mode: 4.11 dBm EDR(8DPSK) Mode: 4.09 dBm
Transmit Data Rate	BR(GFSK) Mode: 1 Mbps EDR(π/4-DQPSK) Mode: 2 Mbps EDR(8DPSK) Mode: 3 Mbps
Power Operation (Voltage Range)	☐ AC 120V/60Hz ☐ Adapter ☐ By AC Power Cord ☐ PoE
	☒ DC Type ☐ Battery ☐ DC Power Supply ☒ External from USB 5V. ☐ External DC Adapter
	☐ Host System via Sever power
Received Date	2022/12/22
Date of Test	2022/12/28~ 2023/2/8

*All measurement and test data in this report was gathered from production sample serial number: RXZ221215001-01 (Assigned by BACL, New Taipei Laboratory).

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1.2. Objective

This report is prepared on behalf of *Targus International LLC* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

1.3. Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with FCC ID: OXM000147

1.4. 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.

1.5. Statement

Decision Rule: No, (The test results do not include MU judgment)

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Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.6. Measurement Uncertainty

Parameter		Uncertainty
AC Mains		+/- 2.36 dB
RF output power, conducted		+/- 1.69 dBm
Occupied Bandwidth		+/- 0.35 MHz
Unwanted Emissions, conducted		+/- 1.69 dBm
Emissions, radiated	30 MHz~1GHz	+/- 5.22 dB
	1 GHz~6 GHz	+/- 6.12 dB
	18 GHz~40 GHz	+/- 4.99 dB
Temperature		+/- 1.27 °C
Humidity		+/- 3 %

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.

1.7. Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2022/12/28	20.1	71	1010	Andy Cheng
Radiation Spurious Emissions	2023/2/4~2023/2/8	19.3~20.9	73~79	1010	Jim Chen
Conducted Spurious Emissions	2023/2/3	25.3	55	1010	Andy Cheng
20 dB Emission Bandwidth	2023/2/3	25.3	55	1010	Andy Cheng
Channel Separation Test	2023/2/3	25.3	55	1010	Andy Cheng
Time of Occupancy	2023/2/3	25.3	55	1010	Andy Cheng
Quantity of hopping channel	2023/2/3	25.3	55	1010	Andy Cheng
Maximum Output Power	2023/2/3	25.3	55	1010	Andy Cheng
100 kHz Bandwidth of Frequency Band Edge	2023/2/3	25.3	55	1010	Andy Cheng

1.8. Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

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2. System Test Configuration

2.1. Description of Test Configuration

For BT mode, 79 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	--	--
2	2404	76	2478
3	2405	77	2479
--	--	78	2480
39	2441	/	/

For BT Modes were tested with channel 0, 39 and 78.

The system was configured for testing in engineering mode, which was provided by manufacturer.

2.2. Equipment Modifications

No modification was made to the EUT.

2.3. EUT Exercise Software

The test software was used "Realtek Bluetooth MP Kit".

Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	0x38	0x38	0x38
	π/4-DQPSK	0x3a	0x3a	0x3a
	8DPSK	0x39	0x39	0x39

2.4. Support Equipment List and Details

Description	Manufacturer	Model Number
NB	DELL	E6410

2.5. External Cable List and Details

N/A

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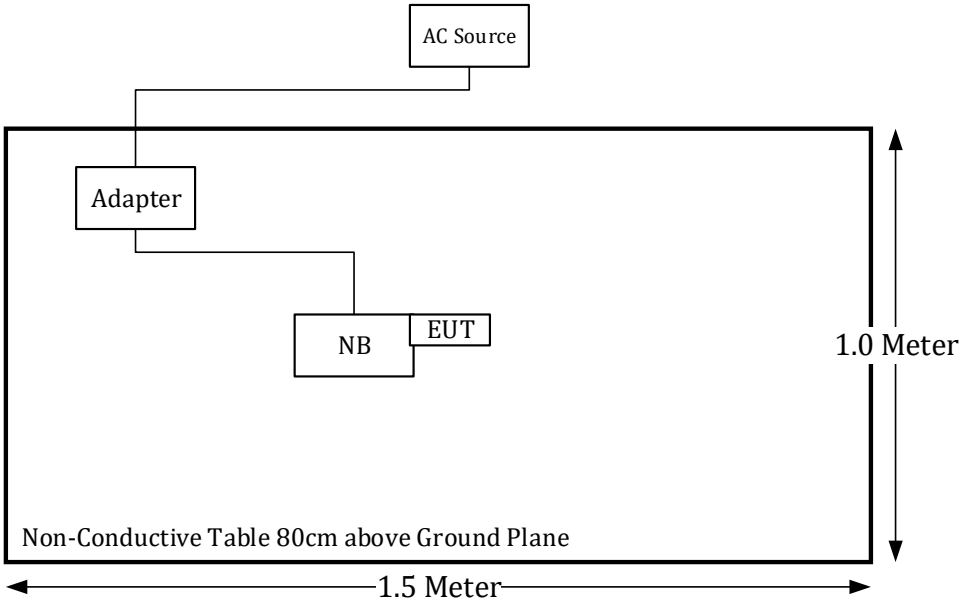
2.6. Block Diagram of Test Setup

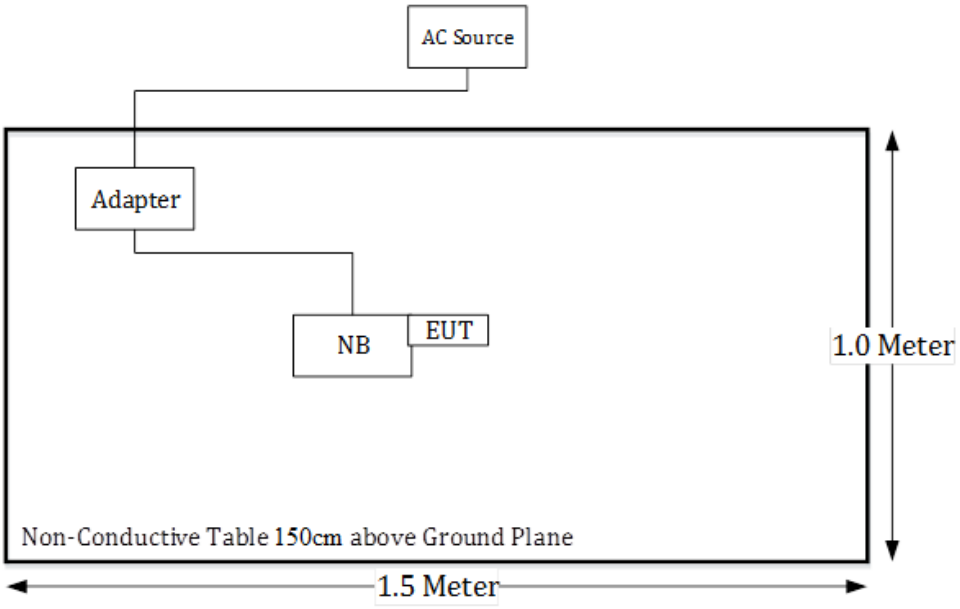
See test photographs attached in annex setup photos for the actual connections between EUT and support equipment.

Radiation:

Below 1GHz:



Above 1GHz:



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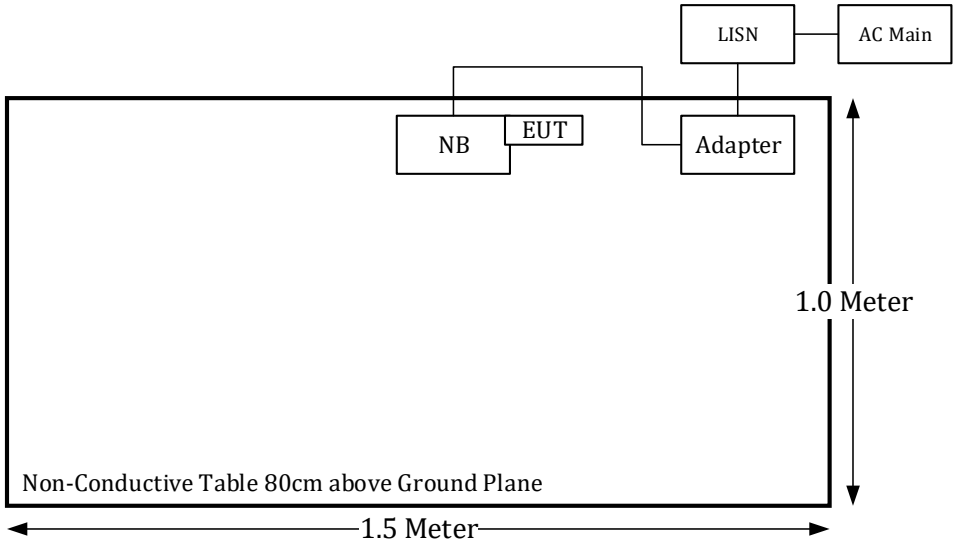
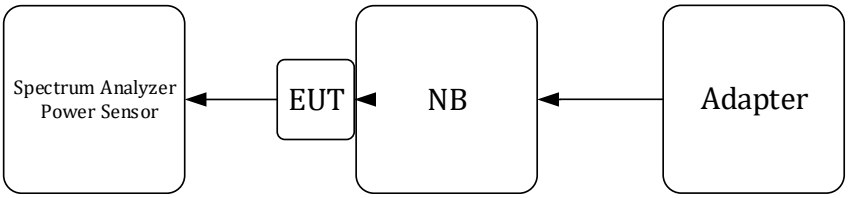
Conduction:



Conducted:



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3. Summary of Test Results

FCC Part 15.247

FCC Rules	Description of Test	Results
§15.247(i), §1.1307(b)(3)(i)	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247 (a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance

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4. Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101248	2022/6/22	2023/6/21
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2022/7/27	2023/7/26
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2022/7/19	2023/7/18
RF Cable	EMEC	EM-CB5D	1	2022/6/7	2023/6/6
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2023/2/2	2024/2/1
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2022/11/2	2023/11/1
Horn Antenna	EMCO	SAS-571	1020	2022/5/25	2023/5/24
Horn Antenna	ETS-Lindgren	3116	62638	2022/8/18	2023/8/17
Preamplifier	Sonoma	310N	130602	2022/6/16	2023/6/15
Preamplifier	A.H. system Inc.	PAM-0118P	470	2022/3/28	2023/3/27
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2023/1/6	2024/1/5
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2023/2/1	2024/1/31
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2023/1/24	2024/1/23
Coaxial Cable	COMMATE	PEWC	8Dr	2022/12/24	2023/12/23
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2023/1/24	2024/1/23
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2022/12/24	2023/12/23
Cable	EMC	EMC105-SM-SM-10000	201003	2023/1/24	2024/1/23
Software	AUDIX	E3	18621a	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2022/2/18	2023/2/17
Cable	UTIFLEX	UFA210A	9435	2022/10/3	2023/10/2
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2023/2/2	2024/2/1
Attenuator	MINI-CIRCUITS	BW-S10W5+	1419	2023/2/2	2024/2/1

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.

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5. FCC §15.247(i), §1.1307(b)(3)(i) – RF EXPOSURE

5.1. Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

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:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (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). *Pth* 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

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

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

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5.2. RF Exposure Evaluation Result

Project info

Band	Freq (MHz)	Tune-up Power (dBm)	Ant Gain (dBi)	Distances (mm)	Tune-up Power (mW)	ERP (dBm)	ERP (mW)
BT	2480	4.2	-4.1	5	2.63	-2.05	0.62
BLE	2480	4.3	-4.1	5	2.69	-1.95	0.64

§ 1.1307(b)(3)(i)(A) and (C) methid is not applicable.

§ 1.1307(b)(3)(i)(B)

Band	Freq (MHz)	Pth (mW)	X	ERP 20cm (mW)	Result Option B
BT	**2480**	**2.72**	**1.905**	**3060**	**exempt**
BLE	**2480**	**2.72**	**1.905**	**3060**	**exempt**

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater. 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).

Result: The EUT meets exemption requirement.

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6. FCC §15.203 – Antenna Requirements

6.1. Applicable Standard

According to § 15.203 and RSS-Gen 6.8: Transmit antenna

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 user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the 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 does not exceed 6dBi.

6.2. Antenna Information

Manufacturer	Model	Type	Antenna Gain
CC&C	BT-330S-V2	PCB Antenna	-4.10dBi

Result: Compliance

7. FCC §15.207(a) – AC Line Conducted Emissions

7.1. Applicable Standard

According to §15.207

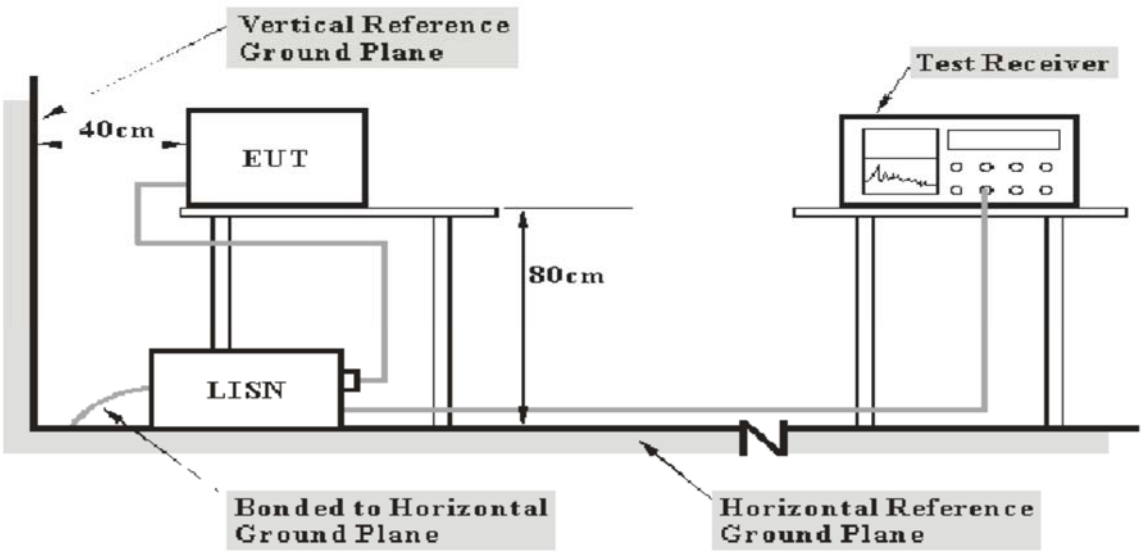
For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

Note 2: A linear average detector is required

7.2. EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

7.3. EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150kHz – 30MHz	9kHz

7.4. Test Procedure

According to ANSI C63.10-2013, section 6.2

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

7.5. Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Over Limit = Level – Limit Line

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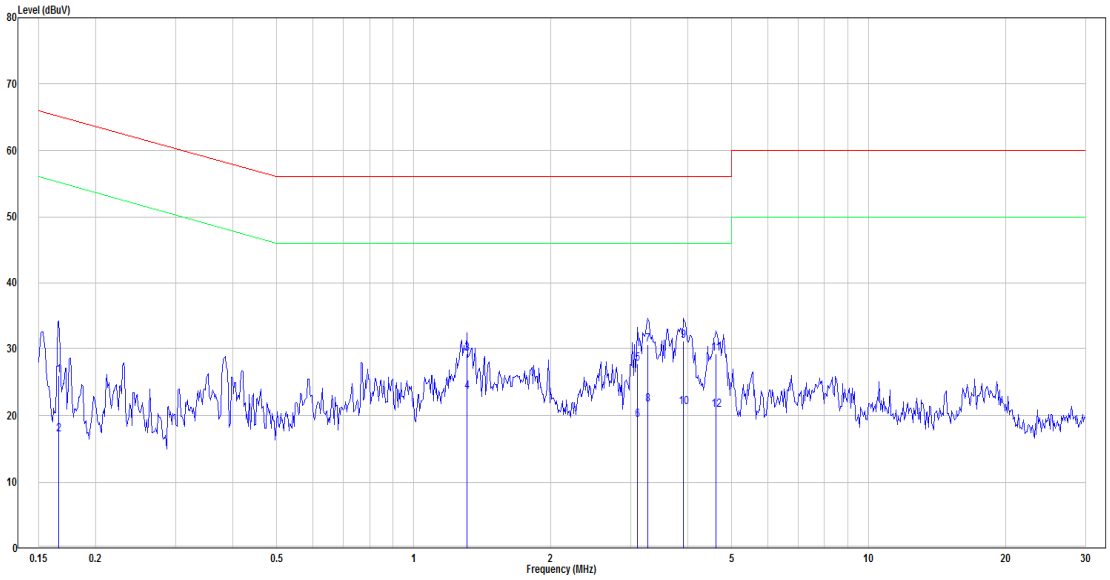
7.6. Test Results

Test Mode: Transmitting

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.166	6.52	19.51	26.03	65.16	-39.13	QP
2	0.166	-2.30	19.51	17.21	55.16	-37.95	Average
3	1.310	9.63	19.55	29.18	56.00	-26.82	QP
4	1.310	3.97	19.55	23.52	46.00	-22.48	Average
5	3.107	8.14	19.61	27.75	56.00	-28.25	QP
6	3.107	-0.23	19.61	19.38	46.00	-26.62	Average
7	3.276	11.05	19.61	30.66	56.00	-25.34	QP
8	3.276	1.95	19.61	21.56	46.00	-24.44	Average
9	3.922	11.51	19.63	31.14	56.00	-24.86	QP
10	3.922	1.64	19.63	21.27	46.00	-24.73	Average
11	4.622	9.64	19.65	29.29	56.00	-26.71	QP
12	4.622	1.11	19.65	20.76	46.00	-25.24	Average

Note:

Result = Reading + Correct Factor

Over Limit = Result– Limit

Correct Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

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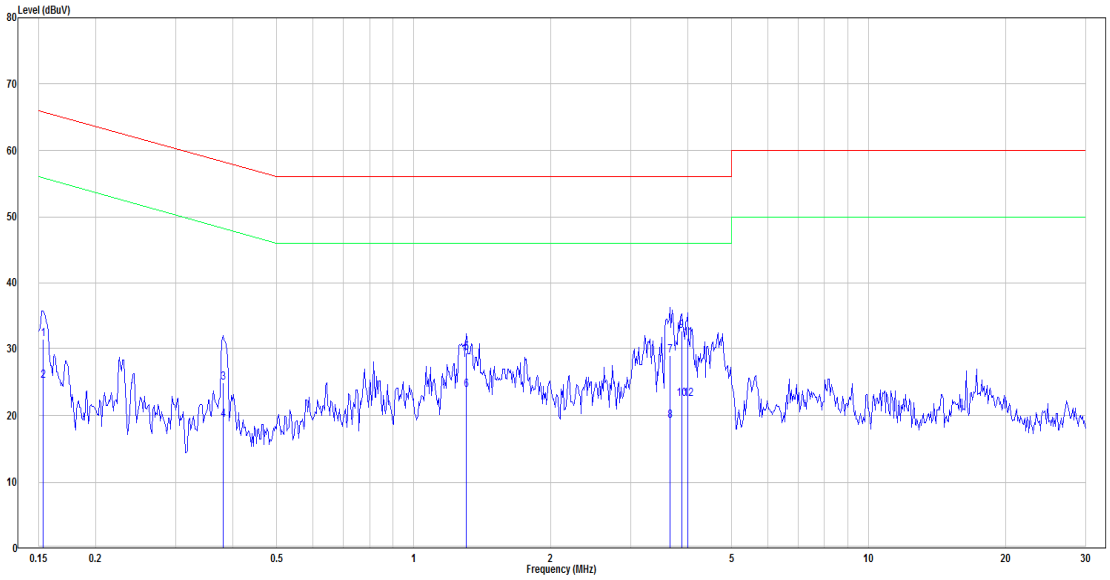
Main: AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.153	11.88	19.51	31.39	65.82	-34.43	QP
2	0.153	5.67	19.51	25.18	55.82	-30.64	Average
3	0.381	5.37	19.52	24.89	58.25	-33.36	QP
4	0.381	-0.23	19.52	19.29	48.25	-28.96	Average
5	1.303	9.81	19.54	29.35	56.00	-26.65	QP
6	1.303	4.33	19.54	23.87	46.00	-22.13	Average
7	3.661	9.30	19.62	28.92	56.00	-27.08	QP
8	3.661	-0.39	19.62	19.23	46.00	-26.77	Average
9	3.881	12.99	19.63	32.62	56.00	-23.38	QP
10	3.881	2.80	19.63	22.43	46.00	-23.57	Average
11	4.006	11.96	19.63	31.59	56.00	-24.41	QP
12	4.006	2.87	19.63	22.50	46.00	-23.50	Average

Note:

Result = Reading + Correct Factor

Over Limit = Result– Limit

Correct Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

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8. FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

8.1. Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	608 – 614	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	5. 35 – 5. 46
2.1735 – 2.1905	16.80425 – 16.80475	1300 – 1427	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1435 – 1626.5	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1645.5 – 1646.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1660 – 1710	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1718.8 – 1722.2	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	2200 – 2300	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2310 – 2390	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2483.5 – 2500	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2690 – 2900	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	3260 – 3267	22.01 – 23.12
8.41425 – 8.41475	162.0125 –167.17	3.332 – 3.339	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3 3458 – 3 358	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3.600 – 4.400	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4		Above 38.6
13.36 – 13.41	399.9 – 410		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) 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

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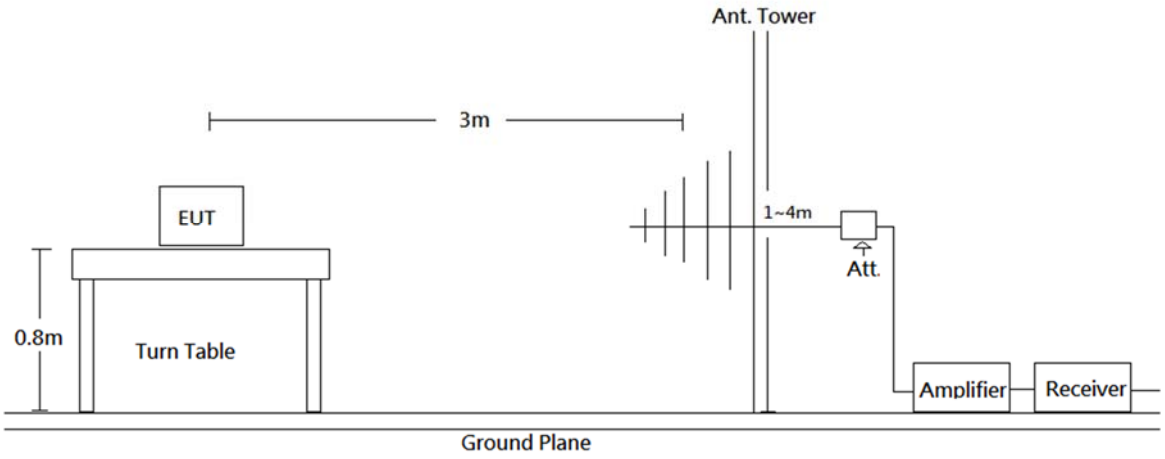
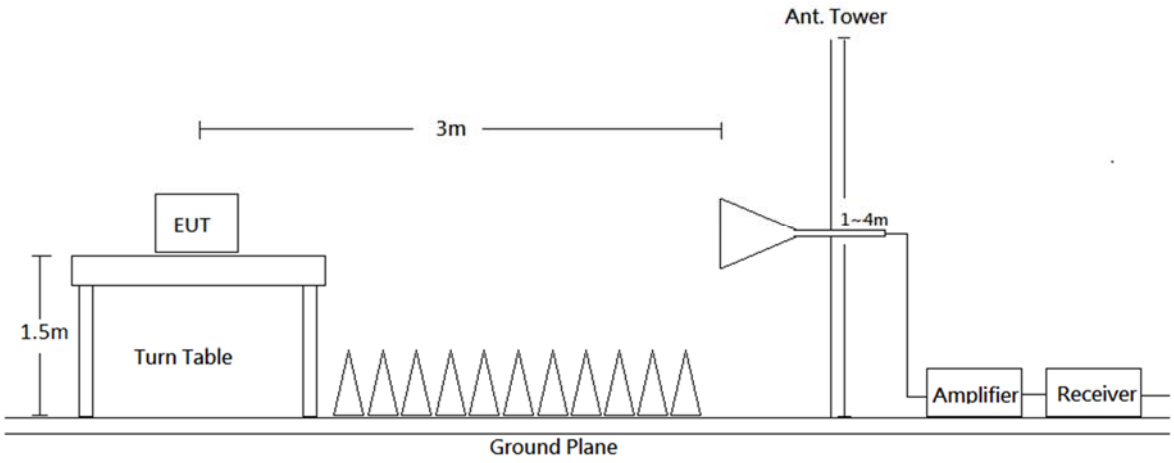
the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 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).

8.2. EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

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8.3. EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Measurement method
30-1000 MHz	120 kHz	/	QP
Above 1 GHz	1 MHz	3 MHz	PK
	1 MHz	10 Hz	Ave

8.4. Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

8.5. Corrected Factor & Margin Calculation

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

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Level = Result – Limit

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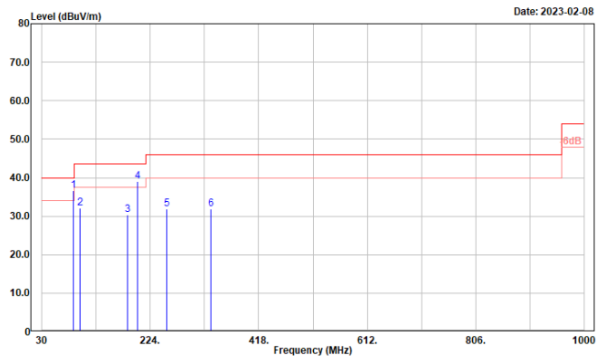
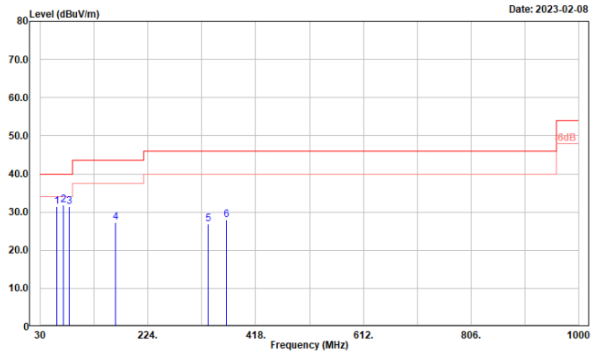
8.6. Test Results

Test Mode: Transmitting

(Pre-scan with three orthogonal axis, and worse case as Z axis.)

(worst case is 8DPSK mode high channel)

30MHz-1GHz:

Horizontal	Vertical
	

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
86.316	51.63	-14.90	36.73	40.00	-3.27	100	124	QP
98.939	44.17	-12.07	32.10	43.50	-11.40	100	116	QP
183.413	40.66	-10.27	30.39	43.50	-13.11	100	63	QP
200.891	48.12	-9.05	39.07	43.50	-4.43	100	232	QP
253.323	41.16	-9.39	31.77	46.00	-14.23	100	181	QP
332.943	38.14	-6.30	31.84	46.00	-14.16	100	351	QP

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
60.100	46.33	-14.94	31.39	40.00	-8.61	100	167	QP
71.752	45.96	-14.04	31.92	40.00	-8.08	100	2	QP
81.461	46.39	-14.87	31.52	40.00	-8.48	100	79	QP
164.965	36.84	-9.53	27.31	43.50	-16.19	100	293	QP
332.943	33.21	-6.30	26.91	46.00	-19.09	100	44	QP
365.956	33.39	-5.33	28.06	46.00	-17.94	100	52	QP

Level = Reading + Factor.

Margin = Level – Limit.

Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

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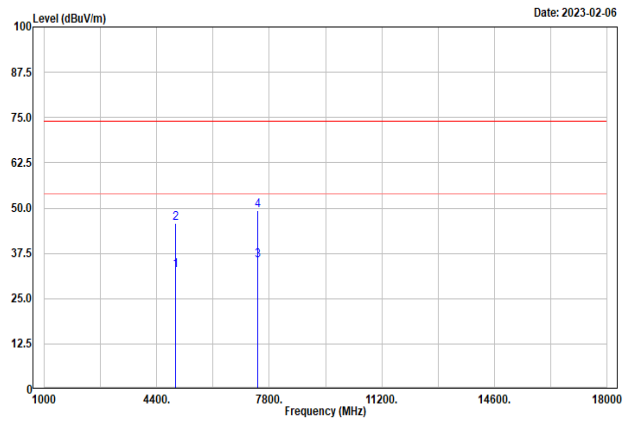
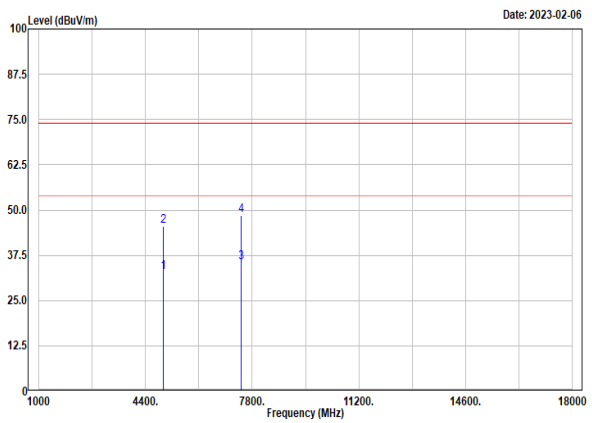
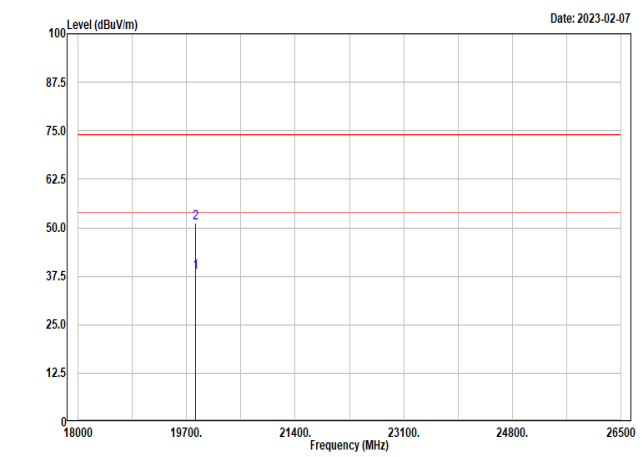
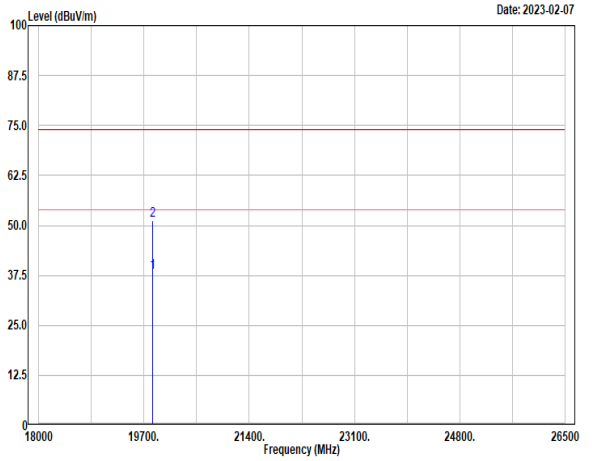
1GHz-18GHz:

Horizontal	Vertical
	

18GHz-26.5GHz:

Horizontal	Vertical
	

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Above 1GHz

BR (GFSK)

Horizontal

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2326.216	40.71	-4.99	35.72	54.00	-18.28	100	157	Average
2326.216	55.19	-4.99	50.20	74.00	-23.80	100	157	Peak
2402.000	97.72	-4.48	93.24			100	157	Average
2402.000	98.31	-4.48	93.83			100	157	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	28.80	3.45	32.25	54.00	-21.75	153	35	Average
4804.000	41.48	3.45	44.93	74.00	-29.07	153	35	Peak
7206.000	26.46	9.05	35.51	54.00	-18.49	147	216	Average
7206.000	39.76	9.05	48.81	74.00	-25.19	147	216	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	96.10	-4.19	91.91			139	157	Average
2441.000	96.74	-4.19	92.55			139	157	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4882.000	28.82	3.58	32.40	54.00	-21.60	155	114	Average
4882.000	41.80	3.58	45.38	74.00	-28.62	155	114	Peak
7323.000	26.81	9.26	36.07	54.00	-17.93	148	140	Average
7323.000	39.51	9.26	48.77	74.00	-25.23	148	140	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	95.33	-3.73	91.60			136	155	Average
2480.000	95.91	-3.73	92.18			136	155	Peak
2519.413	40.56	-3.28	37.28	54.00	-16.72	136	155	Average
2519.413	55.78	-3.28	52.50	74.00	-21.50	136	155	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	28.87	3.92	32.79	54.00	-21.21	154	152	Average
4960.000	42.23	3.92	46.15	74.00	-27.85	154	152	Peak
7440.000	26.12	9.42	35.54	54.00	-18.46	145	187	Average
7440.000	39.23	9.42	48.65	74.00	-25.35	145	187	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

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Vertical

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2340.330	40.80	-4.97	35.83	54.00	-18.17	153	105	Average
2340.330	55.16	-4.97	50.19	74.00	-23.81	153	105	Peak
2402.000	87.35	-4.48	82.87			153	105	Average
2402.000	88.10	-4.48	83.62			153	105	Peak
4804.000	28.78	3.45	32.23	54.00	-21.77	154	59	Average
4804.000	42.33	3.45	45.78	74.00	-28.22	154	59	Peak
7206.000	26.30	9.05	35.35	54.00	-18.65	149	6	Average
7206.000	39.48	9.05	48.53	74.00	-25.47	149	6	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	89.34	-4.19	85.15			101	232	Average
2441.000	90.00	-4.19	85.81			101	232	Peak
4882.000	28.78	3.58	32.36	54.00	-21.64	152	353	Average
4882.000	41.99	3.58	45.57	74.00	-28.43	152	353	Peak
7323.000	26.80	9.26	36.06	54.00	-17.94	147	91	Average
7323.000	40.17	9.26	49.43	74.00	-24.57	147	91	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	88.91	-3.73	85.18			114	234	Average
2480.000	89.52	-3.73	85.79			114	234	Peak
2547.486	40.54	-3.04	37.50	54.00	-16.50	114	234	Average
2547.486	54.09	-3.04	51.05	74.00	-22.95	114	234	Peak
4960.000	28.87	3.92	32.79	54.00	-21.21	156	184	Average
4960.000	41.33	3.92	45.25	74.00	-28.75	156	184	Peak
7440.000	26.13	9.42	35.55	54.00	-18.45	148	360	Average
7440.000	38.68	9.42	48.10	74.00	-25.90	148	360	Peak

Level = Reading + Factor.
Margin = Level – Limit.
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.
Spurious emissions more than 20 dB below the limit were not reported.

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

EDR (π/4-DQPSK)

Horizontal

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2367.257	40.63	-4.79	35.84	54.00	-18.16	138	164	Average
2367.257	55.91	-4.79	51.12	74.00	-22.88	138	164	Peak
2402.000	92.61	-4.48	88.13			138	164	Average
2402.000	96.83	-4.48	92.35			138	164	Peak
4804.000	28.76	3.45	32.21	54.00	-21.79	154	342	Average
4804.000	41.73	3.45	45.18	74.00	-28.82	154	342	Peak
7206.000	26.29	9.05	35.34	54.00	-18.66	146	260	Average
7206.000	39.14	9.05	48.19	74.00	-25.81	146	260	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	90.19	-4.19	86.00			135	159	Average
2441.000	94.88	-4.19	90.69			135	159	Peak
4882.000	28.78	3.58	32.36	54.00	-21.64	155	353	Average
4882.000	41.83	3.58	45.41	74.00	-28.59	155	353	Peak
7323.000	26.74	9.26	36.00	54.00	-18.00	151	106	Average
7323.000	39.70	9.26	48.96	74.00	-25.04	151	106	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	90.91	-3.73	87.18			135	158	Average
2480.000	95.14	-3.73	91.41			135	158	Peak
2500.370	40.52	-3.46	37.06	54.00	-16.94	135	158	Average
2500.370	54.77	-3.46	51.31	74.00	-22.69	135	158	Peak
4960.000	28.92	3.92	32.84	54.00	-21.16	154	195	Average
4960.000	42.06	3.92	45.98	74.00	-28.02	154	195	Peak
7440.000	26.17	9.42	35.59	54.00	-18.41	146	353	Average
7440.000	38.55	9.42	47.97	74.00	-26.03	146	353	Peak

Level = Reading + Factor.
Margin = Level – Limit.
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.
Spurious emissions more than 20 dB below the limit were not reported.

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Vertical

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2367.858	40.66	-4.79	35.87	54.00	-18.13	156	106	Average
2367.858	54.68	-4.79	49.89	74.00	-24.11	156	106	Peak
2402.000	82.62	-4.48	78.14			156	106	Average
2402.000	86.92	-4.48	82.44			156	106	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	28.75	3.45	32.20	54.00	-21.80	155	65	Average
4804.000	41.13	3.45	44.58	74.00	-29.42	155	65	Peak
7206.000	26.29	9.05	35.34	54.00	-18.66	148	320	Average
7206.000	39.15	9.05	48.20	74.00	-25.80	148	320	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	84.92	-4.19	80.73			101	233	Average
2441.000	89.15	-4.19	84.96			101	233	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4882.000	28.78	3.58	32.36	54.00	-21.64	157	82	Average
4882.000	41.76	3.58	45.34	74.00	-28.66	157	82	Peak
7323.000	26.74	9.26	36.00	54.00	-18.00	152	241	Average
7323.000	39.17	9.26	48.43	74.00	-25.57	152	241	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	84.90	-3.73	81.17			102	229	Average
2480.000	89.15	-3.73	85.42			102	229	Peak
2505.213	40.51	-3.42	37.09	54.00	-16.91	102	229	Average
2505.213	55.24	-3.42	51.82	74.00	-22.18	102	229	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	28.87	3.92	32.79	54.00	-21.21	155	0	Average
4960.000	42.16	3.92	46.08	74.00	-27.92	155	0	Peak
7440.000	26.17	9.42	35.59	54.00	-18.41	148	24	Average
7440.000	38.56	9.42	47.98	74.00	-26.02	148	24	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

EDR (8DPSK)

Horizontal

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2320.510	40.68	-5.00	35.68	54.00	-18.32	125	157	Average
2320.510	55.90	-5.00	50.90	74.00	-23.10	125	157	Peak
2402.000	91.84	-4.48	87.36			125	157	Average
2402.000	96.53	-4.48	92.05			125	157	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4804.000	28.76	3.45	32.21	54.00	-21.79	152	229	Average
4804.000	41.63	3.45	45.08	74.00	-28.92	152	229	Peak
7206.000	26.32	9.05	35.37	54.00	-18.63	147	287	Average
7206.000	39.51	9.05	48.56	74.00	-25.44	147	287	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	90.19	-4.19	86.00			135	159	Average
2441.000	94.88	-4.19	90.69			135	159	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4882.000	28.75	3.58	32.33	54.00	-21.67	153	289	Average
4882.000	41.81	3.58	45.39	74.00	-28.61	153	289	Peak
7323.000	26.72	9.26	35.98	54.00	-18.02	147	246	Average
7323.000	38.90	9.26	48.16	74.00	-25.84	147	246	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	90.15	-3.73	86.42			130	158	Average
2480.000	94.82	-3.73	91.09			130	158	Peak
2546.418	40.54	-3.05	37.49	54.00	-16.51	130	158	Average
2546.418	55.81	-3.05	52.76	74.00	-21.24	130	158	Peak

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
4960.000	28.84	3.92	32.76	54.00	-21.24	154	77	Average
4960.000	42.01	3.92	45.93	74.00	-28.07	154	77	Peak
7440.000	26.10	9.42	35.52	54.00	-18.48	148	299	Average
7440.000	39.93	9.42	49.35	74.00	-24.65	148	299	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Vertical

Low channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2340.931	40.66	-4.97	35.69	54.00	-18.31	155	117	Average
2340.931	54.67	-4.97	49.70	74.00	-24.30	155	117	Peak
2402.000	82.04	-4.48	77.56			155	117	Average
2402.000	87.17	-4.48	82.69			155	117	Peak
4804.000	28.75	3.45	32.20	54.00	-21.80	155	4	Average
4804.000	41.92	3.45	45.37	74.00	-28.63	155	4	Peak
7206.000	26.35	9.05	35.40	54.00	-18.60	152	158	Average
7206.000	39.94	9.05	48.99	74.00	-25.01	152	158	Peak

Middle channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2441.000	84.60	-4.19	80.41			104	232	Average
2441.000	89.20	-4.19	85.01			104	232	Peak
4882.000	28.75	3.58	32.33	54.00	-21.67	153	289	Average
4882.000	41.81	3.58	45.39	74.00	-28.61	153	289	Peak
7323.000	26.72	9.26	35.98	54.00	-18.02	147	246	Average
7323.000	38.90	9.26	48.16	74.00	-25.84	147	246	Peak

High channel

Freq.	Reading	Factor	Level	Limit	Margin	Height	Degree	Remark
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	(cm)	(°)	
2480.000	84.55	-3.73	80.82			100	232	Average
2480.000	89.29	-3.73	85.56			100	232	Peak
2547.321	40.50	-3.04	37.46	54.00	-16.54	100	232	Average
2547.321	54.84	-3.04	51.80	74.00	-22.20	100	232	Peak
4960.000	28.79	3.92	32.71	54.00	-21.29	155	79	Average
4960.000	41.58	3.92	45.50	74.00	-28.50	155	79	Peak
7440.000	26.13	9.42	35.55	54.00	-18.45	153	156	Average
7440.000	39.01	9.42	48.43	74.00	-25.57	153	156	Peak

Level = Reading + Factor.

Margin = Level – Limit.

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain.

Spurious emissions more than 20 dB below the limit were not reported.

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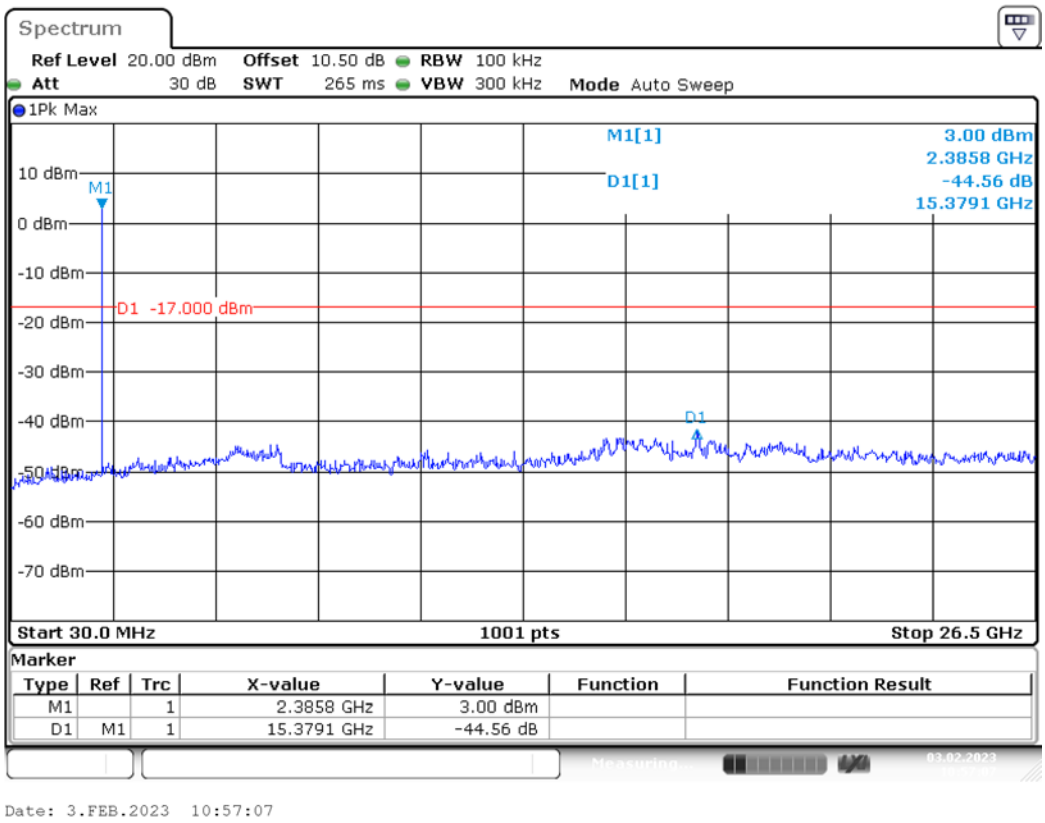
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	44.56	≥ 20	PASS
Mid	2441	43.91	≥ 20	PASS
High	2480	44.19	≥ 20	PASS
EDR Mode (π/4-DQPSK):				
Low	2402	40.16	≥ 20	PASS
Mid	2441	40.53	≥ 20	PASS
High	2480	39.23	≥ 20	PASS
EDR Mode (8DPSK):				
Low	2402	41.27	≥ 20	PASS
Mid	2441	39.52	≥ 20	PASS
High	2480	41.28	≥ 20	PASS

BR Mode (GFSK)

Low Channel



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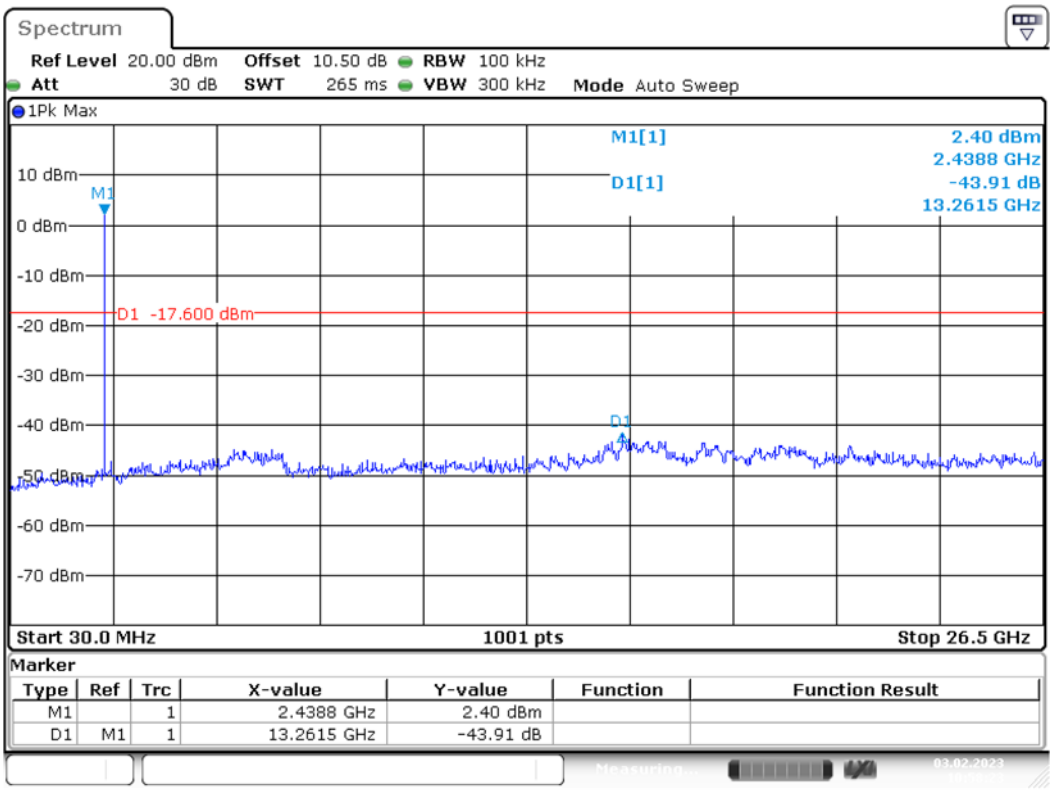
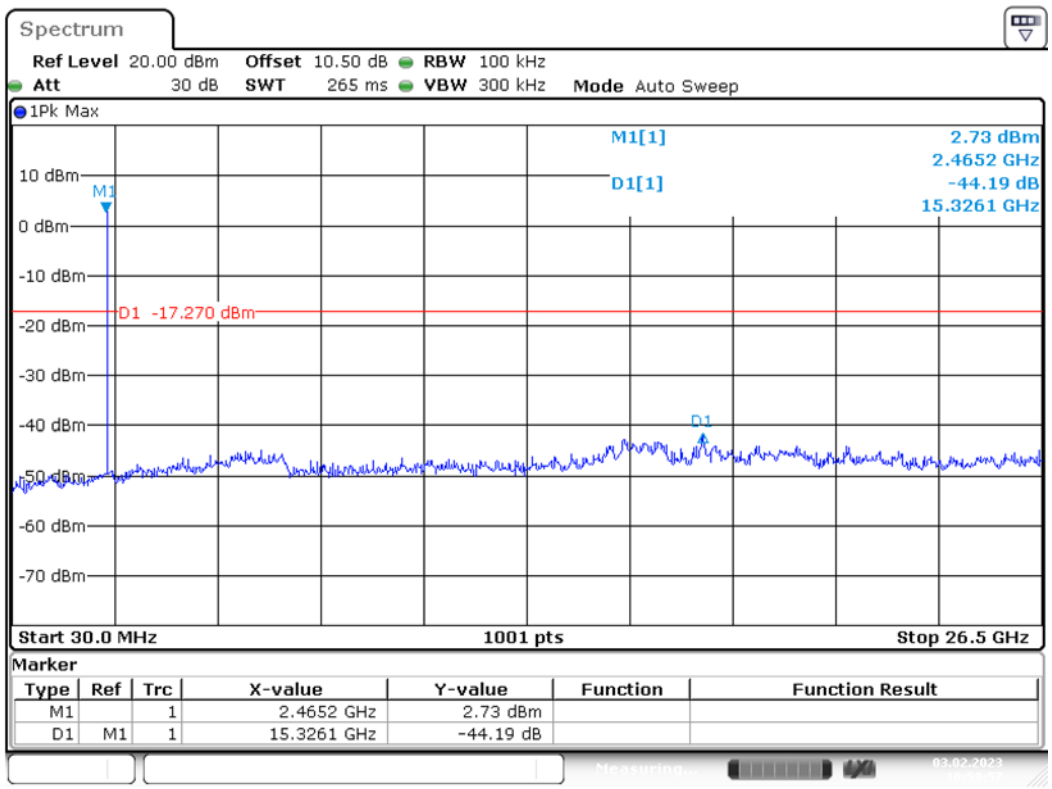
Middle Channel



Date: 3.FEB.2023 10:58:23

High Channel



Date: 3.FEB.2023 10:59:57

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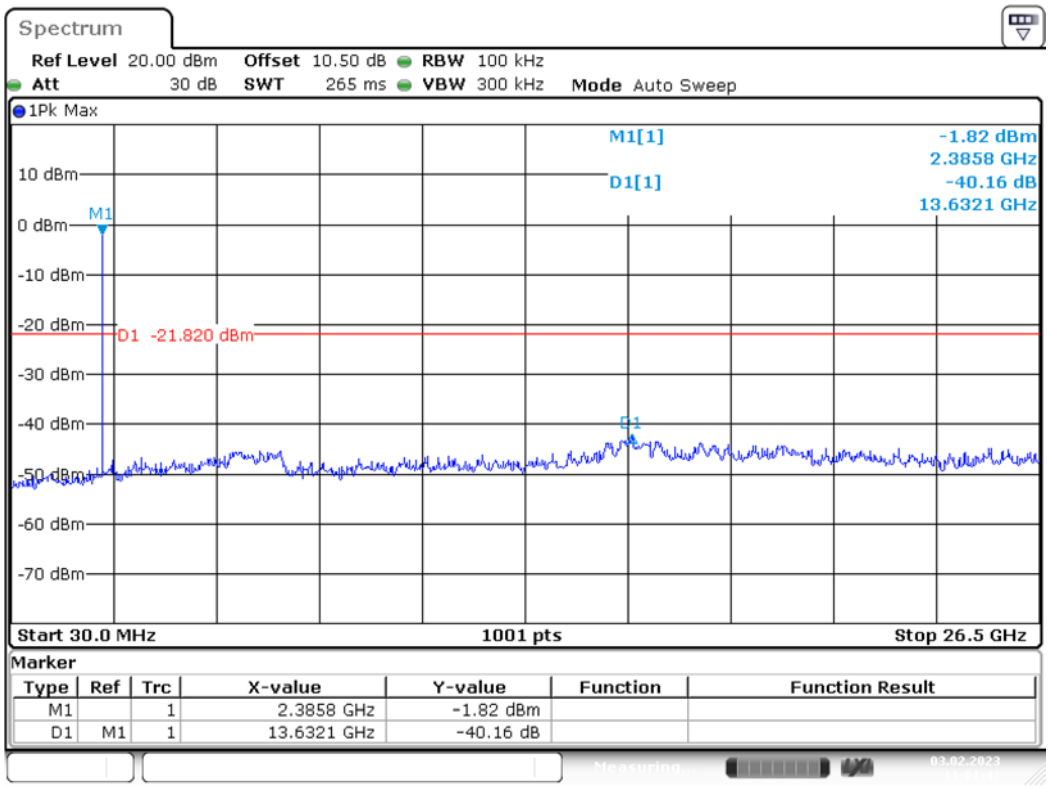
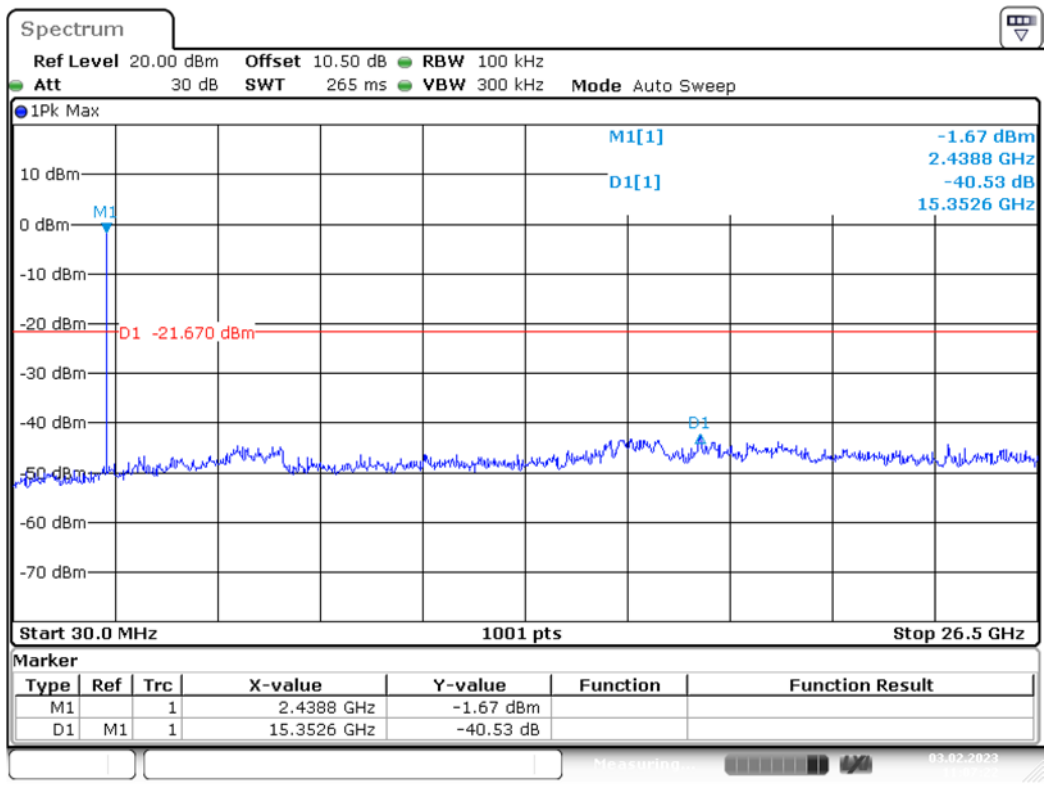
EDR Mode (π/4-DQPSK)

Low Channel



Date: 3.FEB.2023 11:01:42

Middle Channel



Date: 3.FEB.2023 11:07:22

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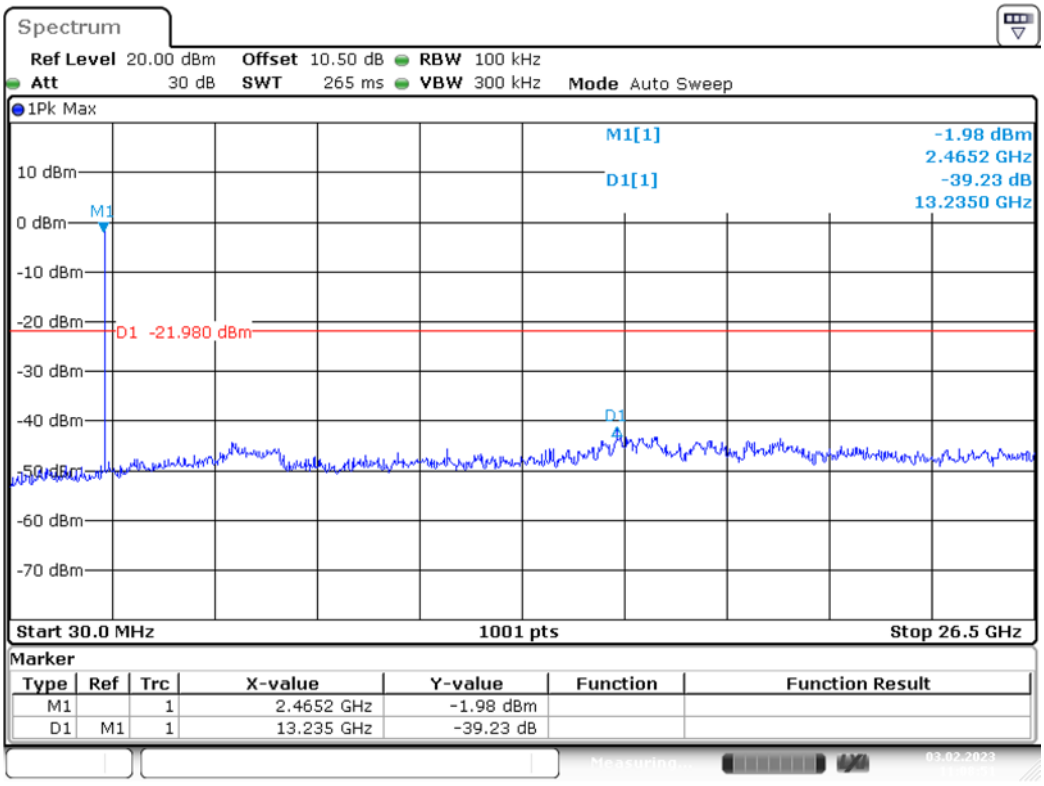
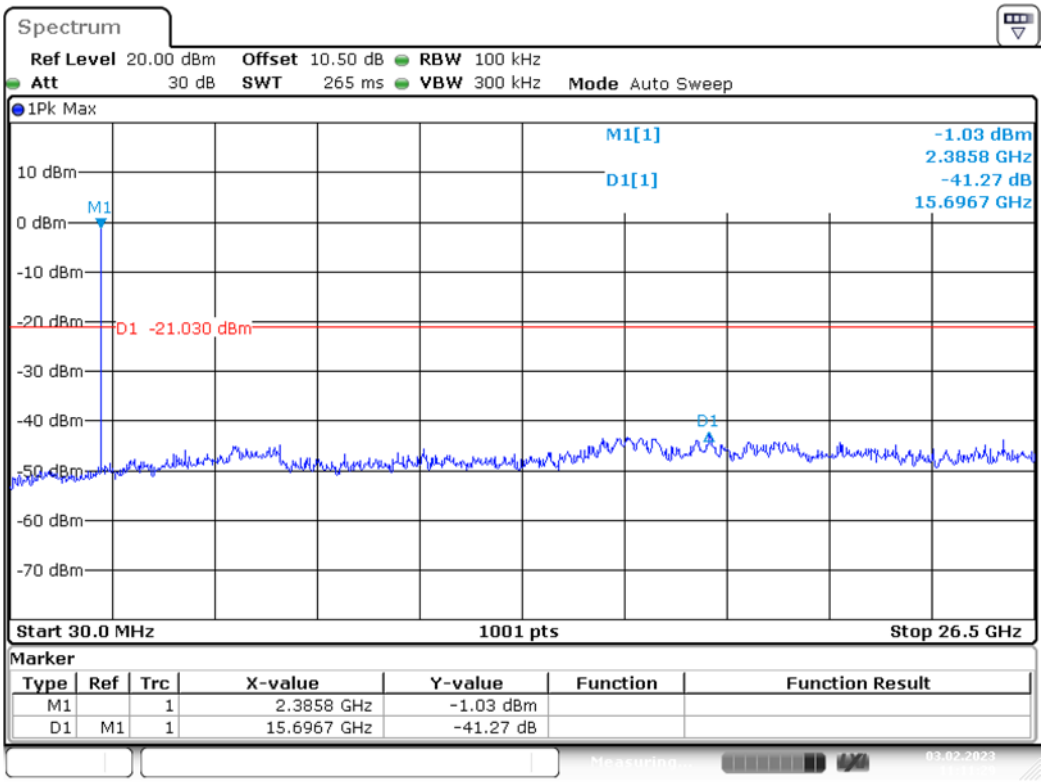
High Channel



Date: 3.FEB.2023 11:08:51

EDR Mode (8DPSK)

Low Channel



Date: 3.FEB.2023 11:11:29

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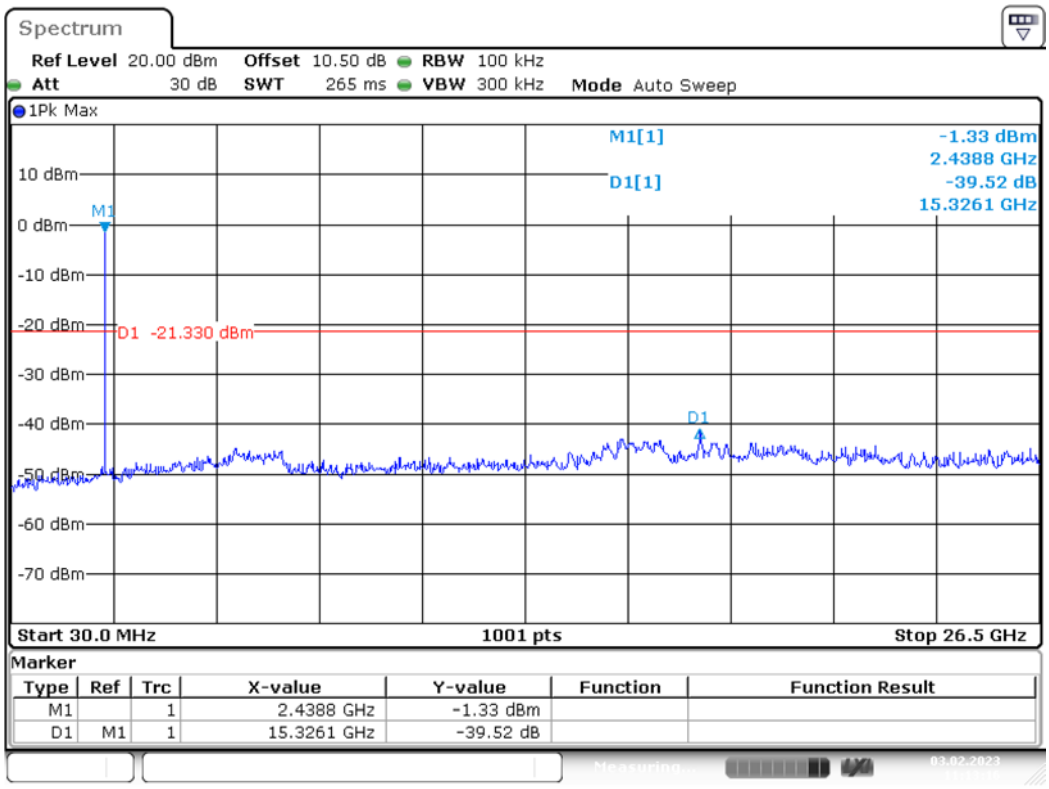
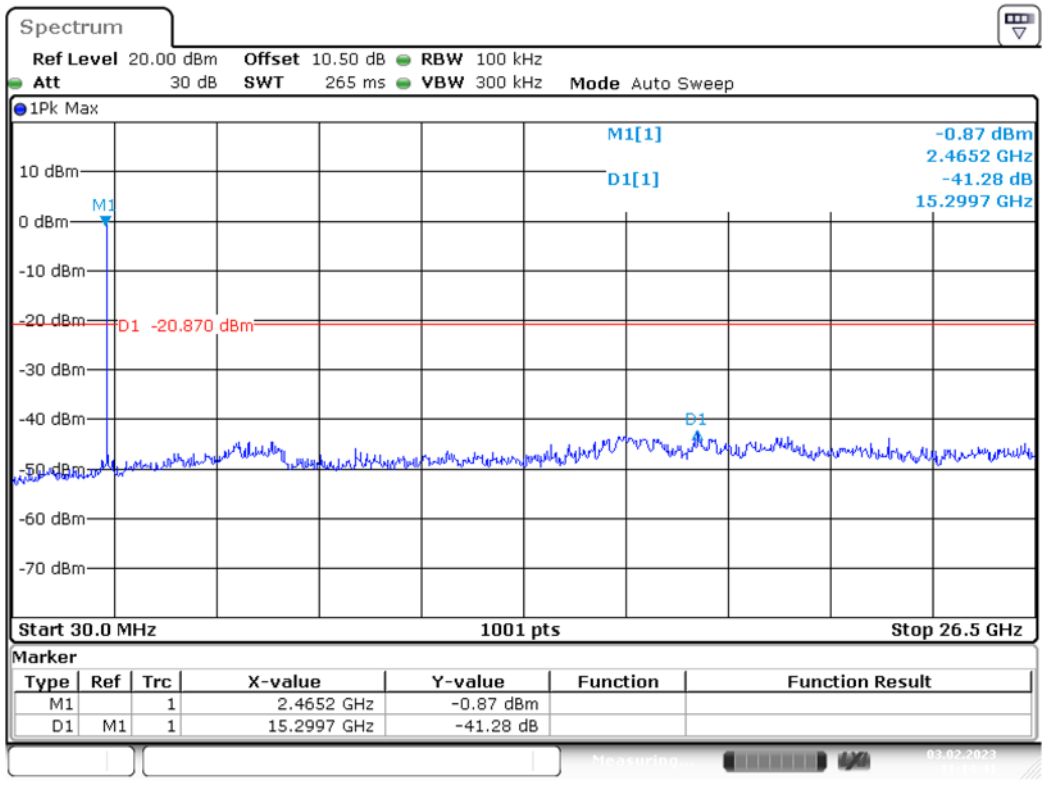
Middle Channel



Date: 3.FEB.2023 11:13:16

High Channel



Date: 3.FEB.2023 11:14:41

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9. FCC §15.247(a)(1) – 20 dB Emission Bandwidth

9.1. Applicable Standard

According to FCC §15.247(a) (1) the maximum 20 dB bandwidth of the hopping channel shall be presented.

9.2. Test Procedure

According to ANSI C63.10-2013, section 7.8.7

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
(3) Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
(4) Repeat above procedures until all frequencies measured were complete.

9.3. Test Results

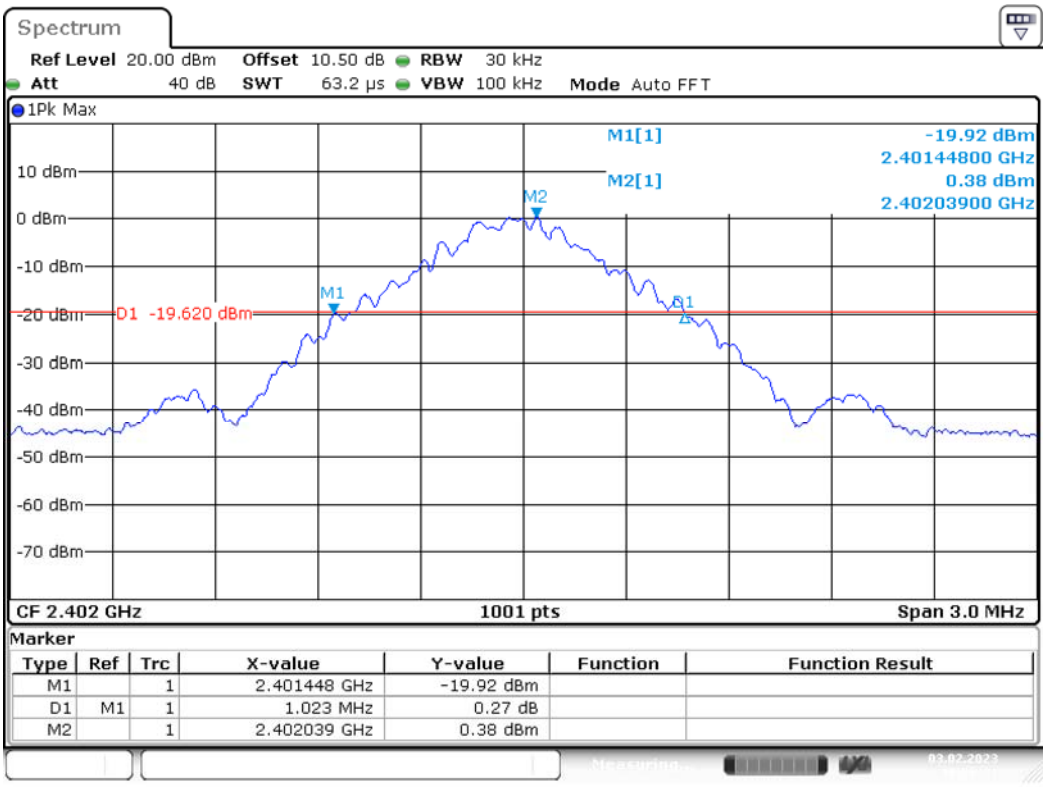
Channel	Frequency (MHz)	20 dBc BW (MHz)
BR Mode (GFSK)		
Low	2402	1.02
Middle	2441	1.03
High	2480	1.02
EDR Mode (π/4-DQPSK)		
Low	2402	1.37
Middle	2441	1.37
High	2480	1.37
EDR Mode (8DPSK)		
Low	2402	1.35
Middle	2441	1.34
High	2480	1.35

Please refer to the following plots

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

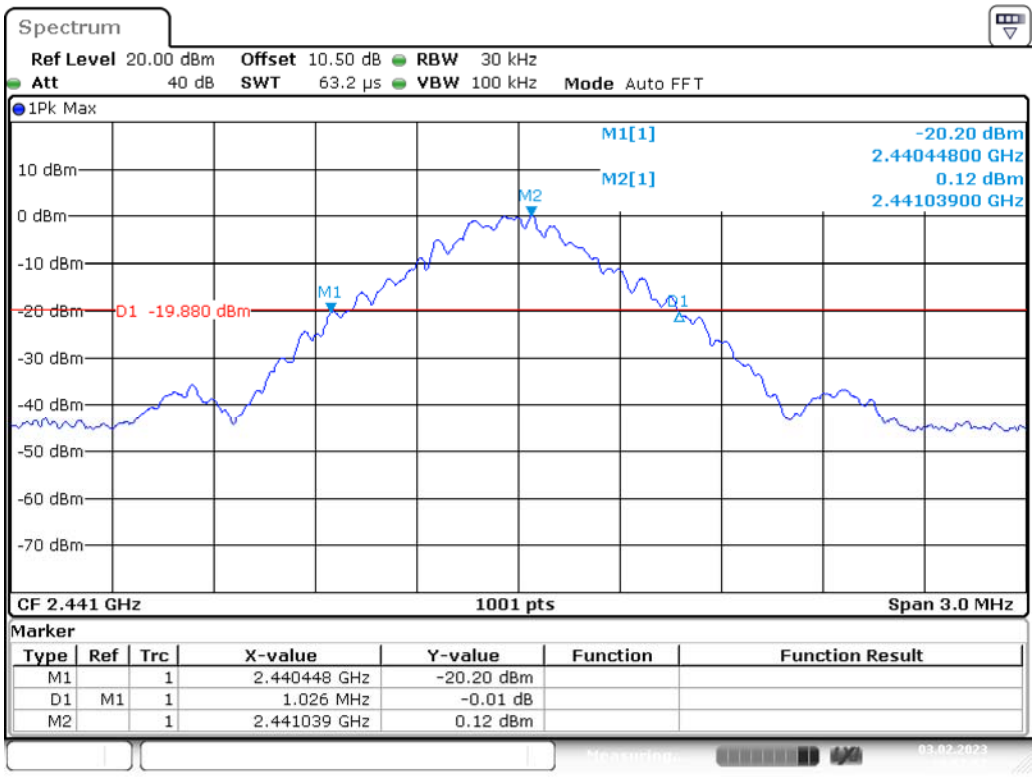
BR Mode (GFSK)

Low Channel



Date: 3.FEB.2023 10:56:20

Middle Channel



Date: 3.FEB.2023 10:57:52

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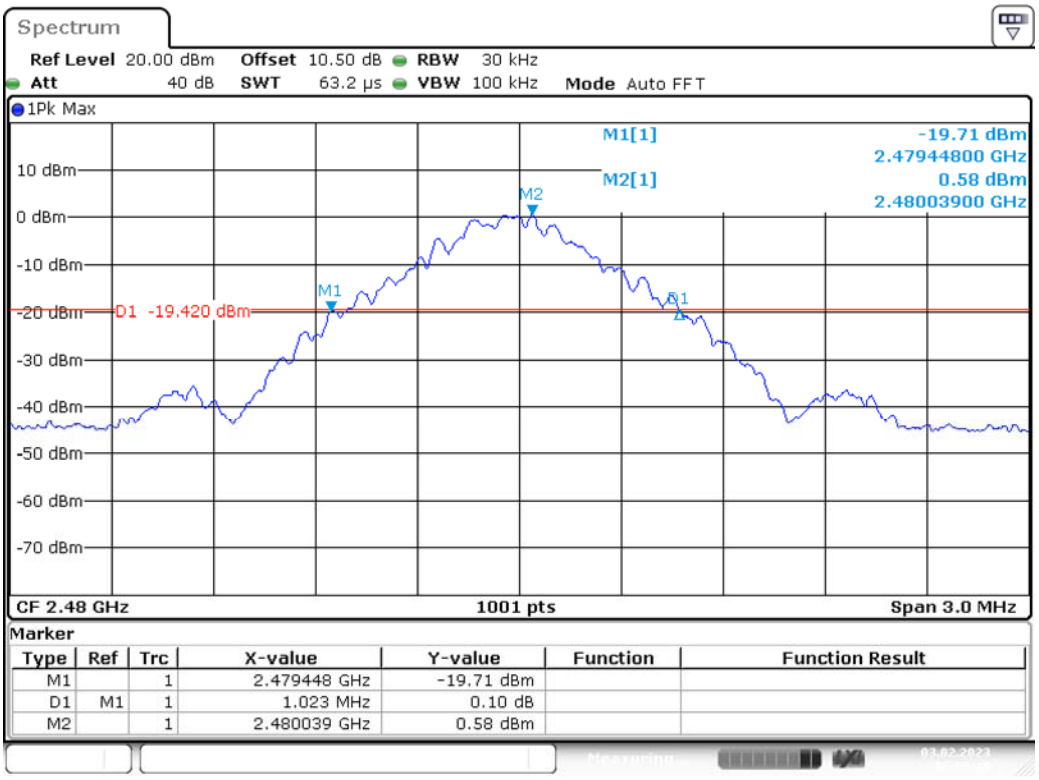
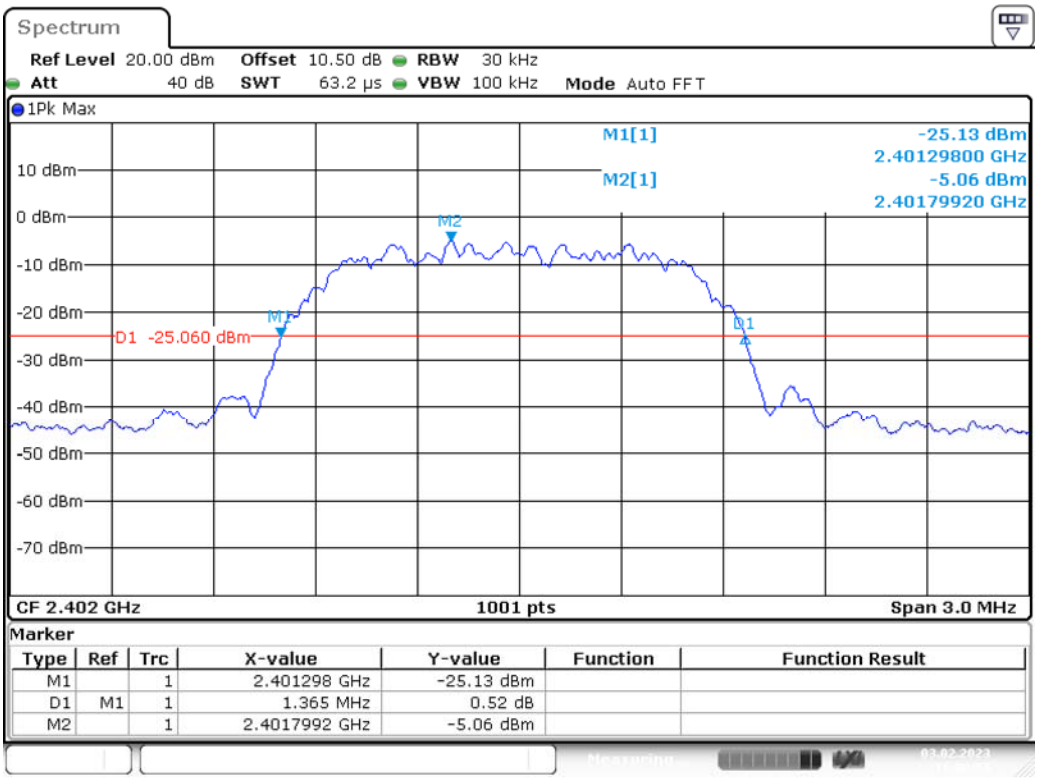
High Channel



Date: 3.FEB.2023 10:59:10

EDR Mode (π/4-DQPSK)

Low Channel



Date: 3.FEB.2023 11:00:55

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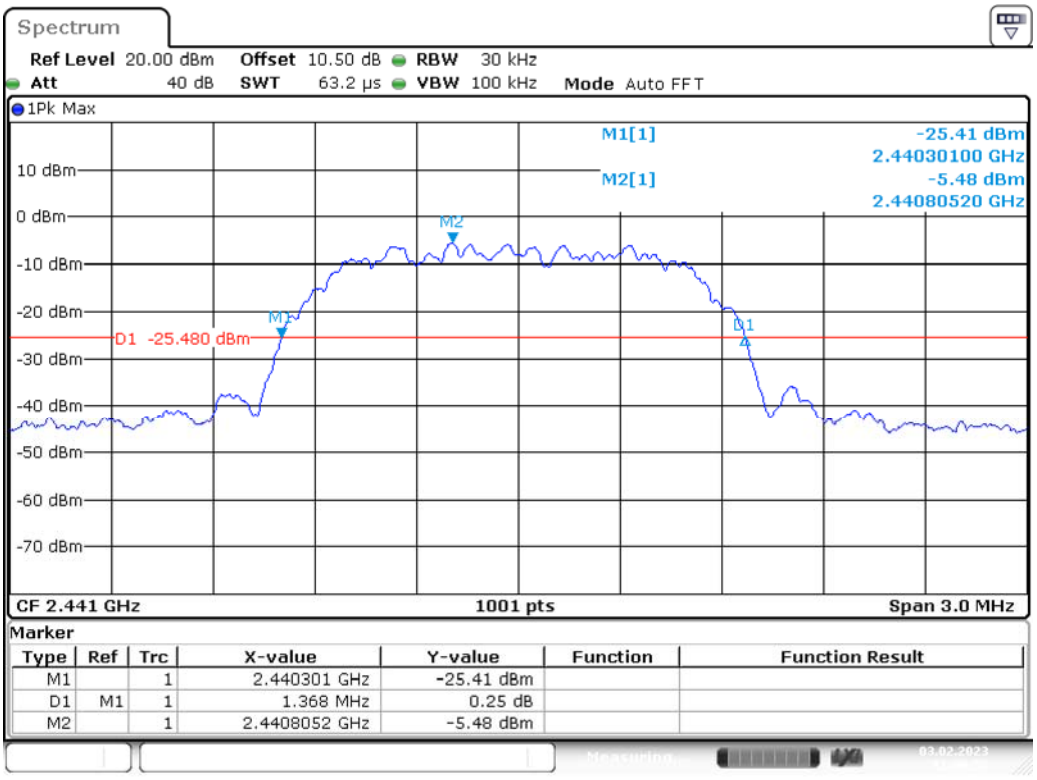
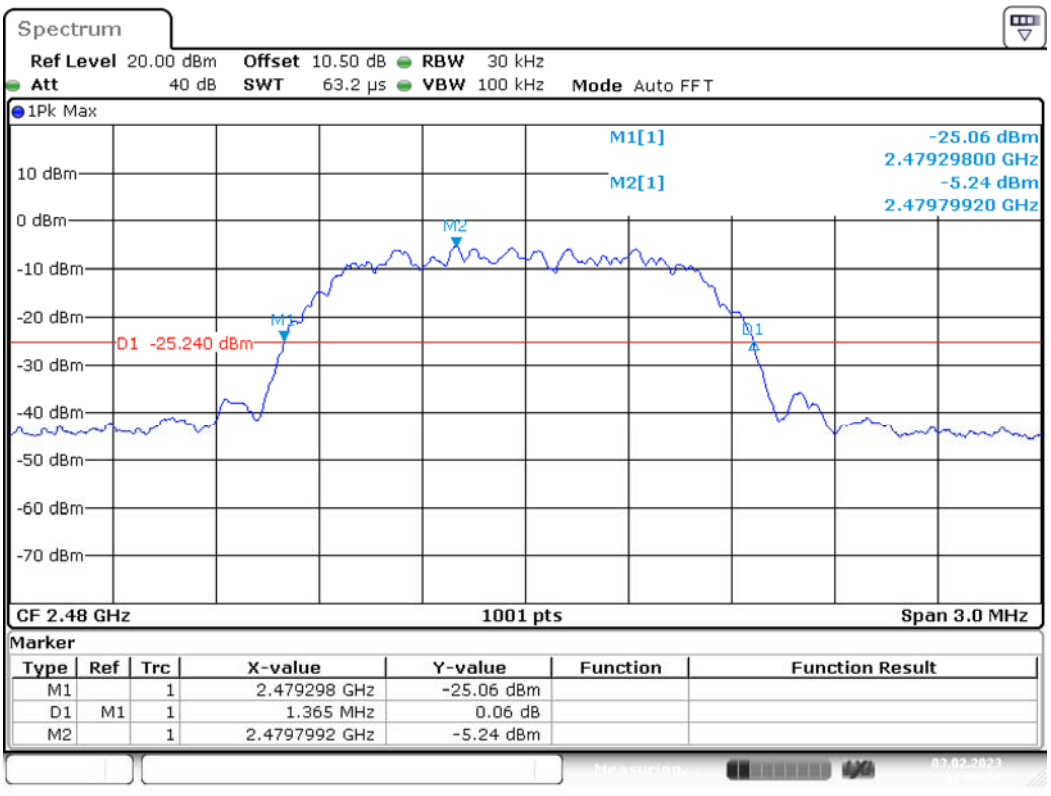
Middle Channel



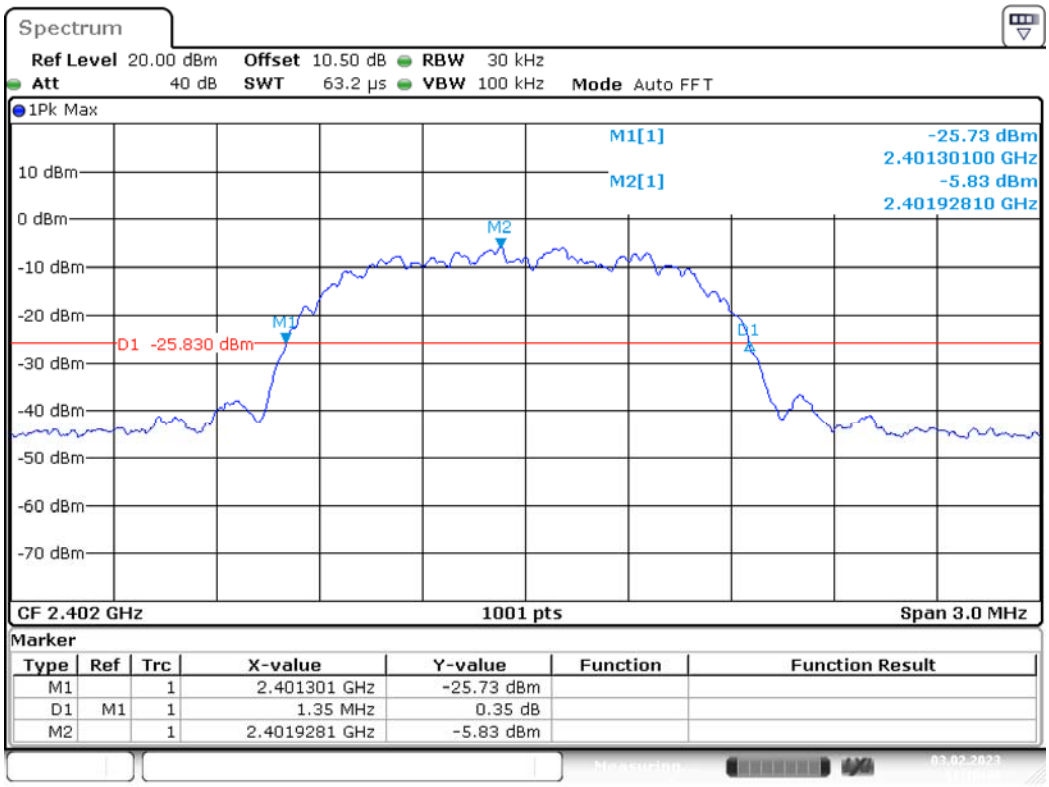
High Channel



Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

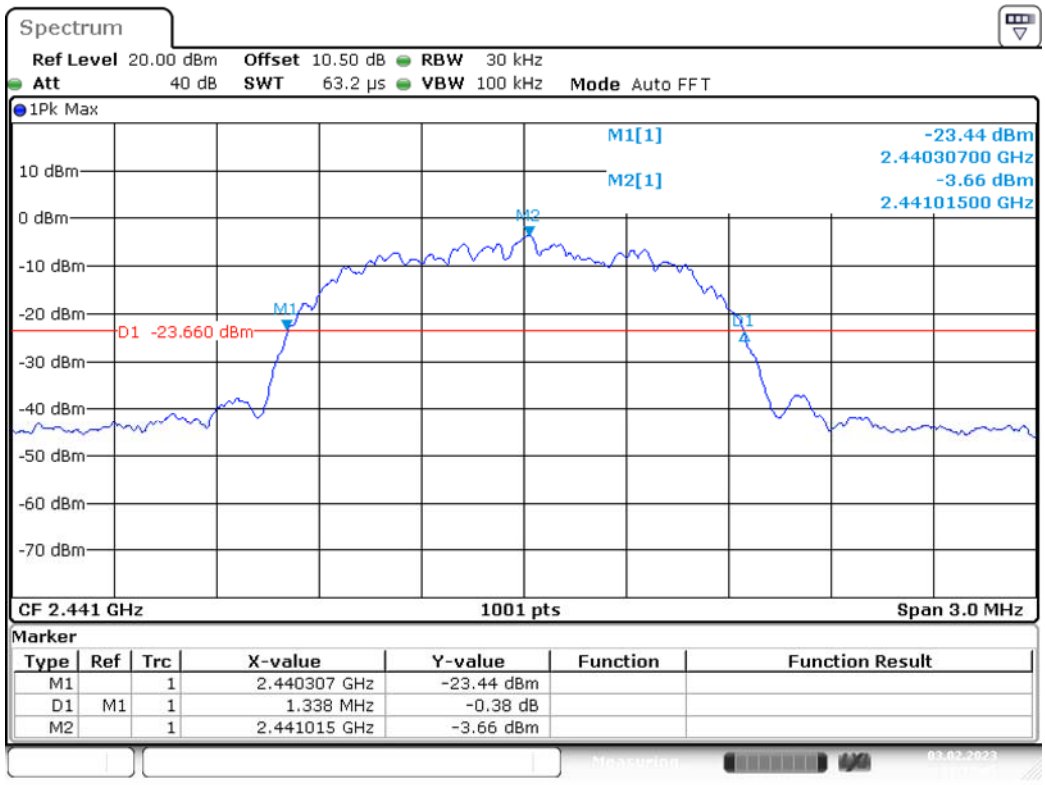
EDR Mode (8DPSK)

Low Channel



Date: 3.FEB.2023 11:10:42

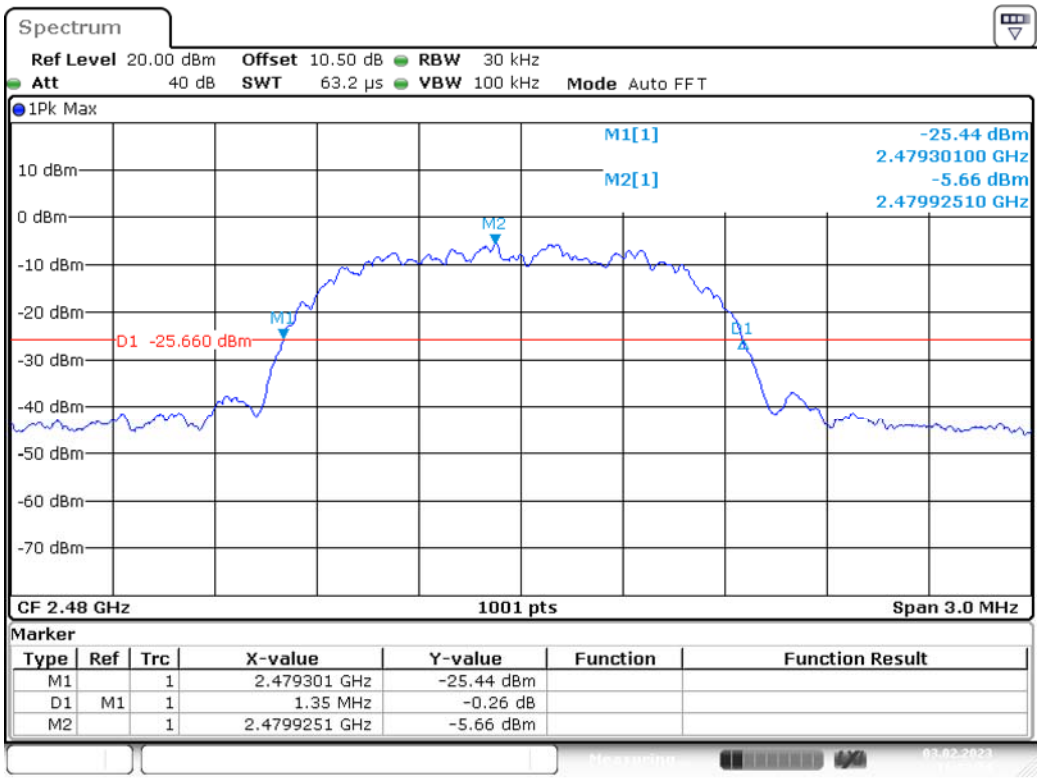
Middle Channel



Date: 3.FEB.2023 11:12:45

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

High Channel



10. FCC §15.247(a)(1) – Channel Separation Test

10.1. Applicable Standard

According to FCC §15.247(a) (1): 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. 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.

10.2. Test Procedure

According to ANSI C63.10-2013, section 7.8.2

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

10.3. Test Results

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BR Mode (GFSK)					
Low	1.000	1.02	0.682	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.000	1.03	0.684	>two-thirds of the 20 dB bandwidth	Compliance
High	1.000	1.02	0.682	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode (π/4-DQPSK)					
Low	1.000	1.37	0.910	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.000	1.37	0.912	>two-thirds of the 20 dB bandwidth	Compliance
High	1.000	1.37	0.910	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode (8DPSK)					
Low	1.000	1.35	0.900	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.000	1.34	0.892	>two-thirds of the 20 dB bandwidth	Compliance
High	1.000	1.35	0.900	>two-thirds of the 20 dB bandwidth	Compliance

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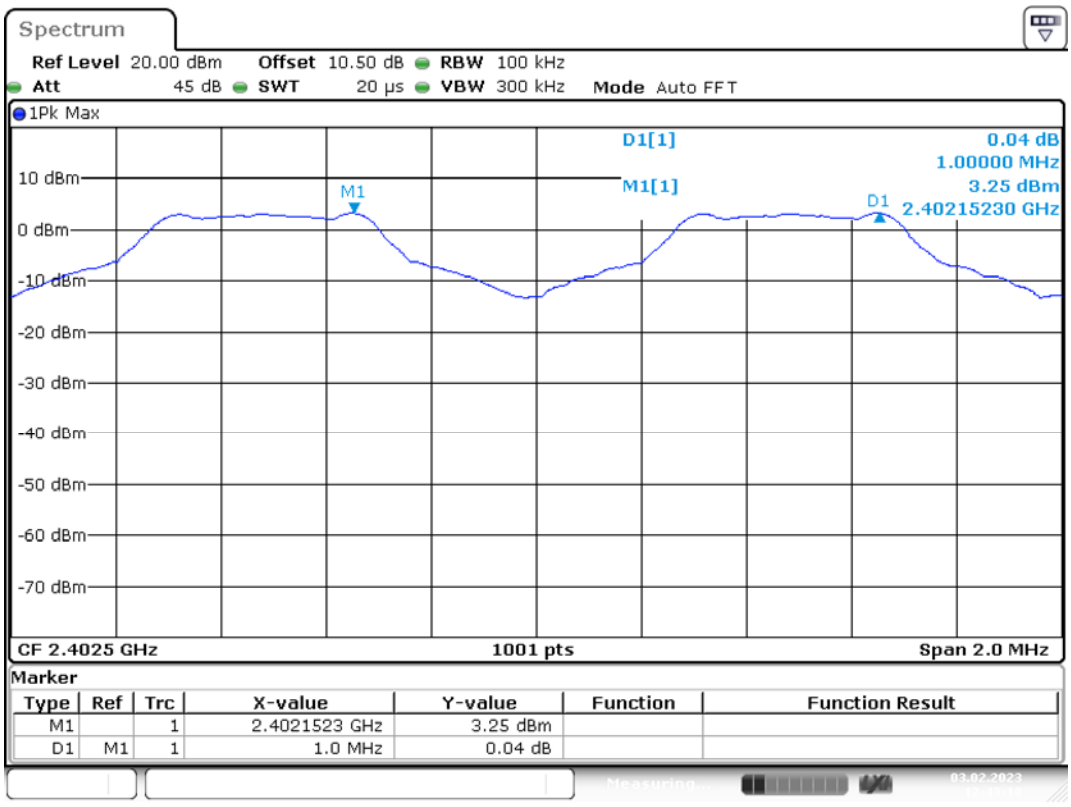
Please refer to the following plots.

BR Mode (GFSK)

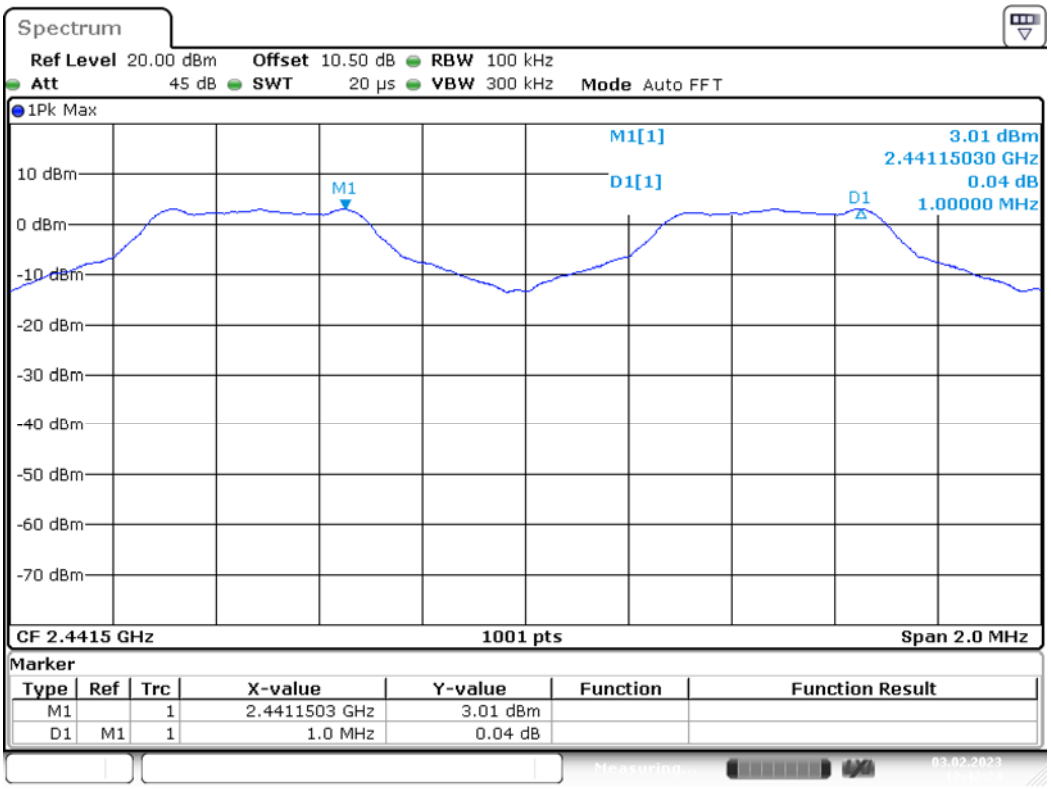
Low Channel



Date: 3.FEB.2023 12:43:18

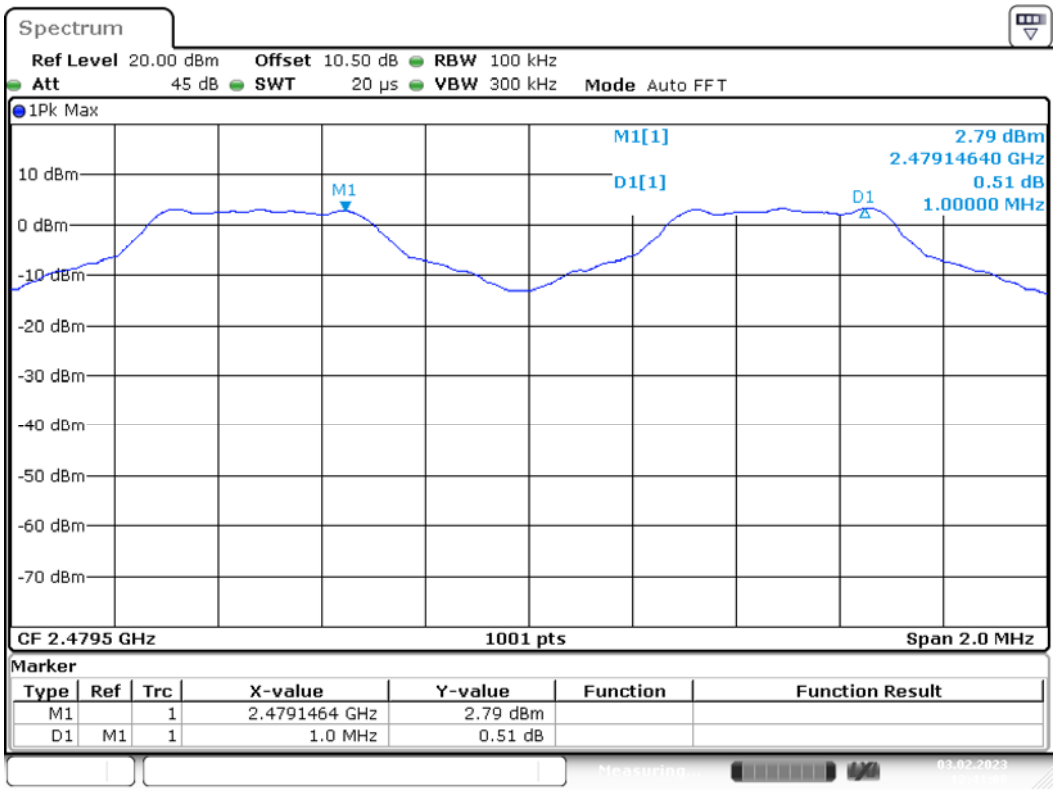
Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Middle Channel



Date: 3.FEB.2023 12:42:24

High Channel

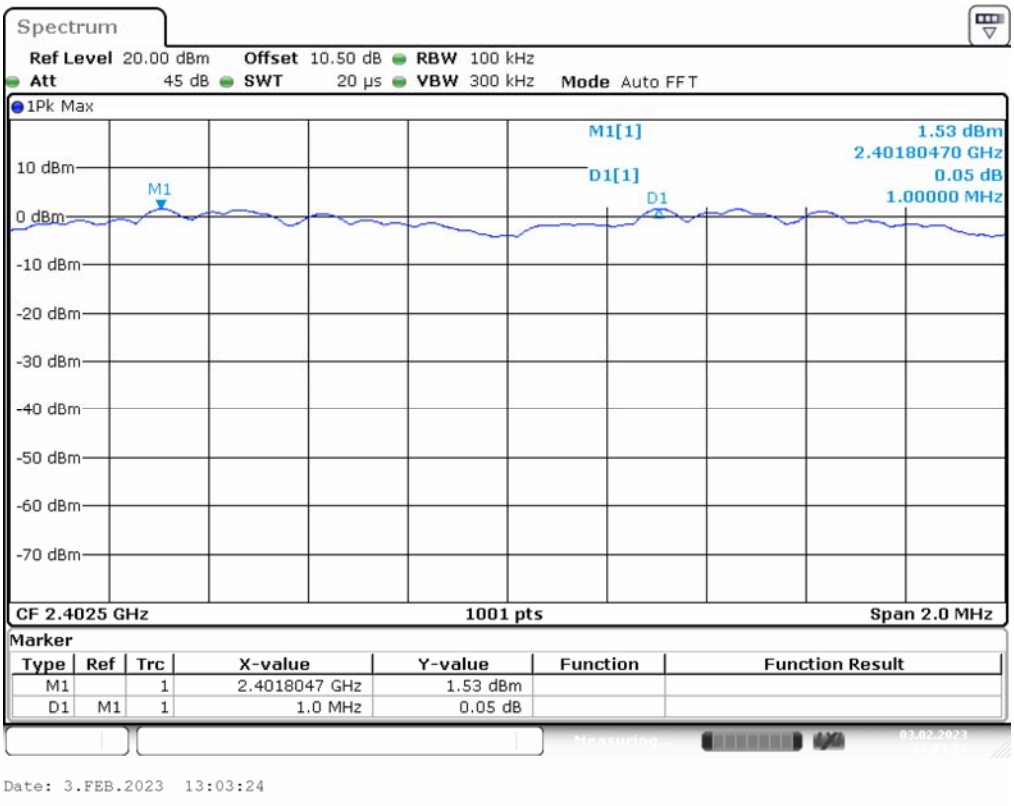


Date: 3.FEB.2023 12:41:08

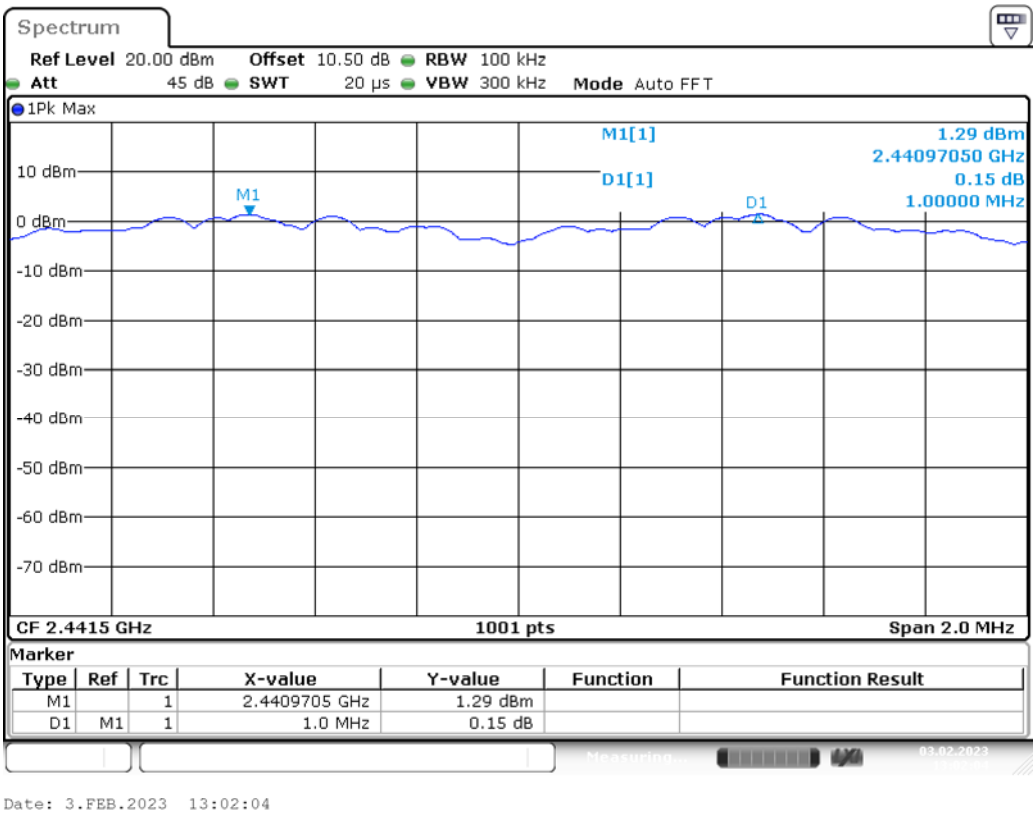
Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

EDR Mode (π/4-DQPSK)

Low Channel



Middle Channel



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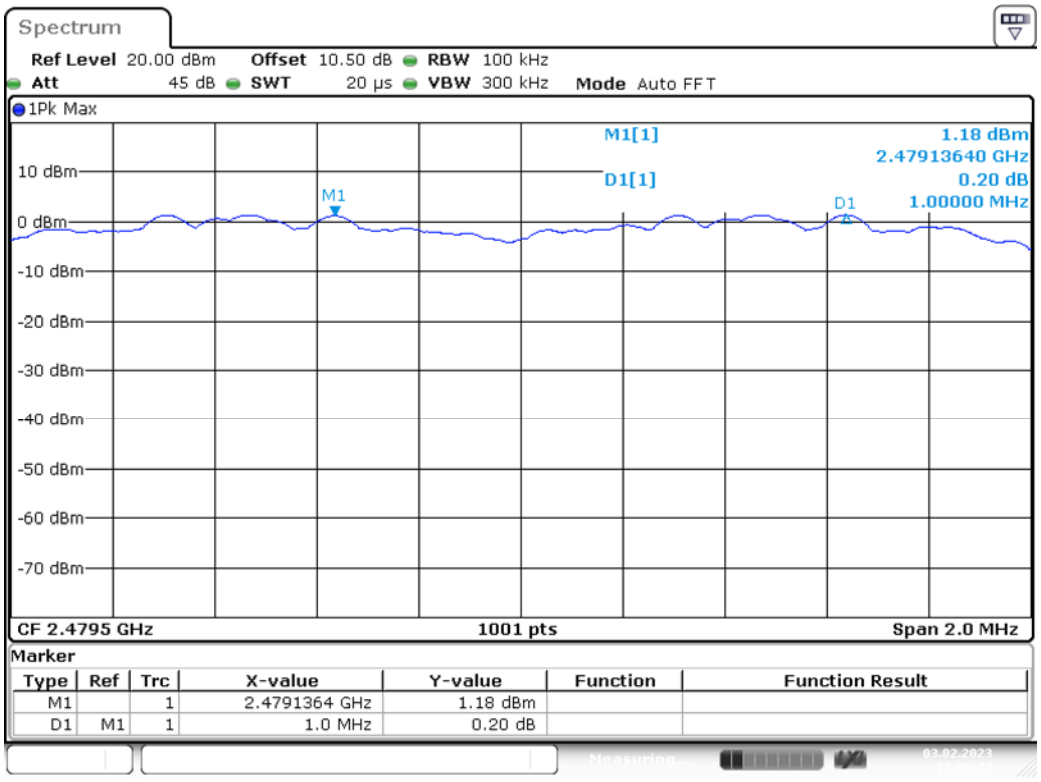
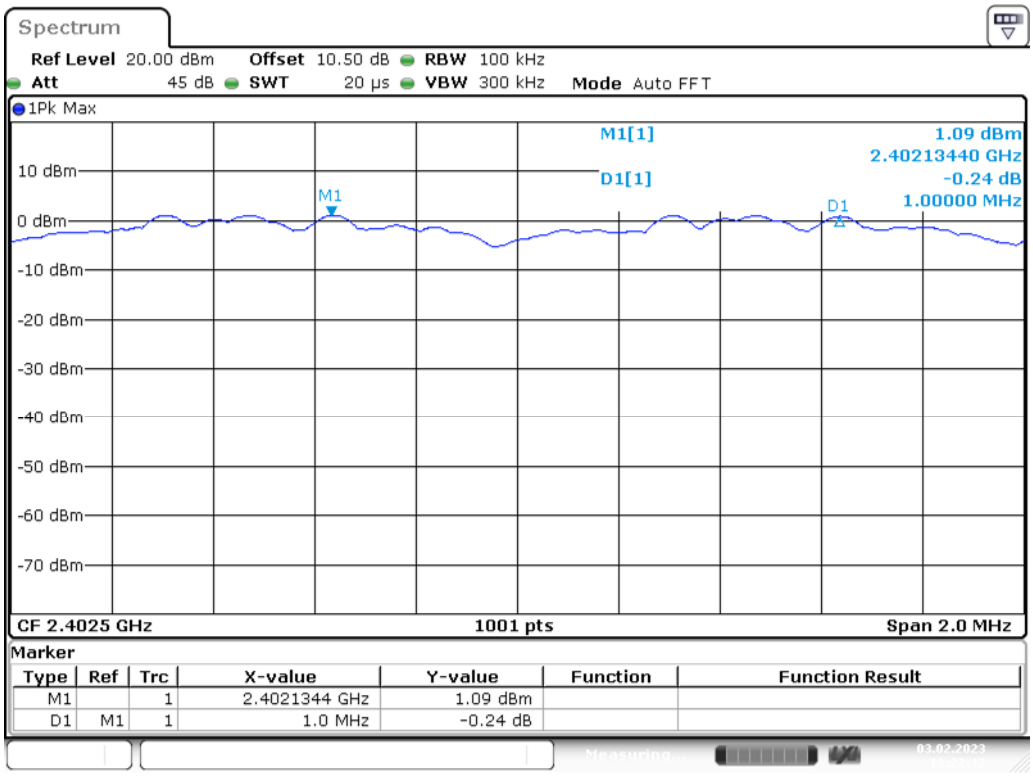
High Channel



Date: 3.FEB.2023 13:00:43

EDR Mode (8DPSK)

Low Channel



Date: 3.FEB.2023 13:22:12

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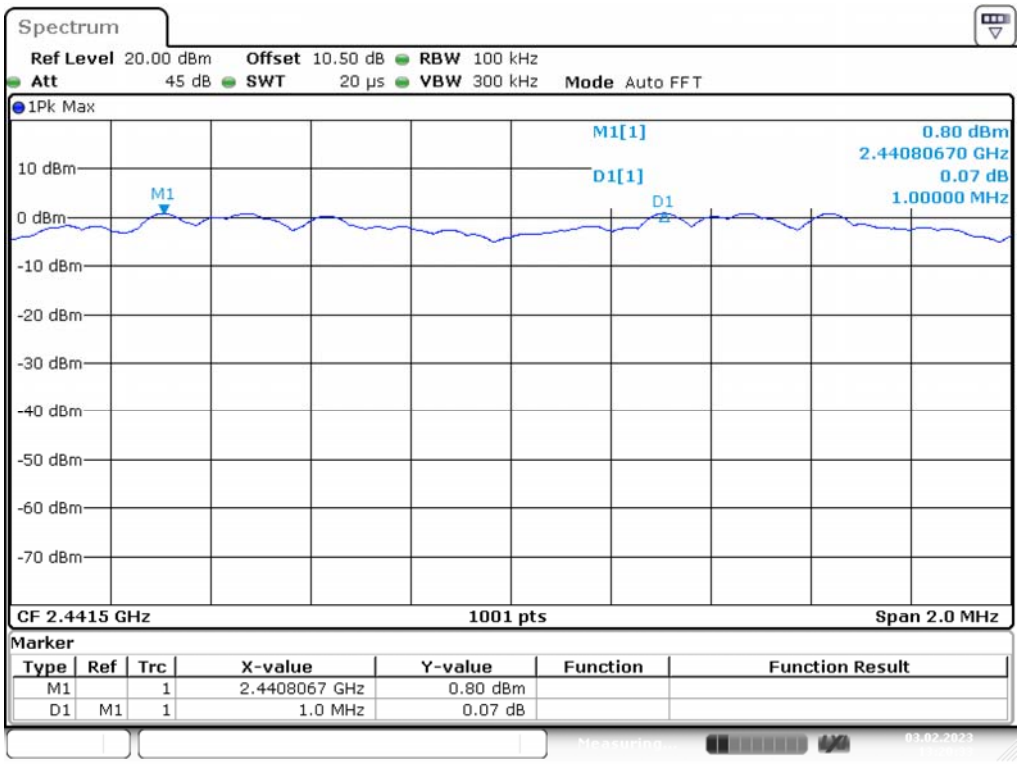
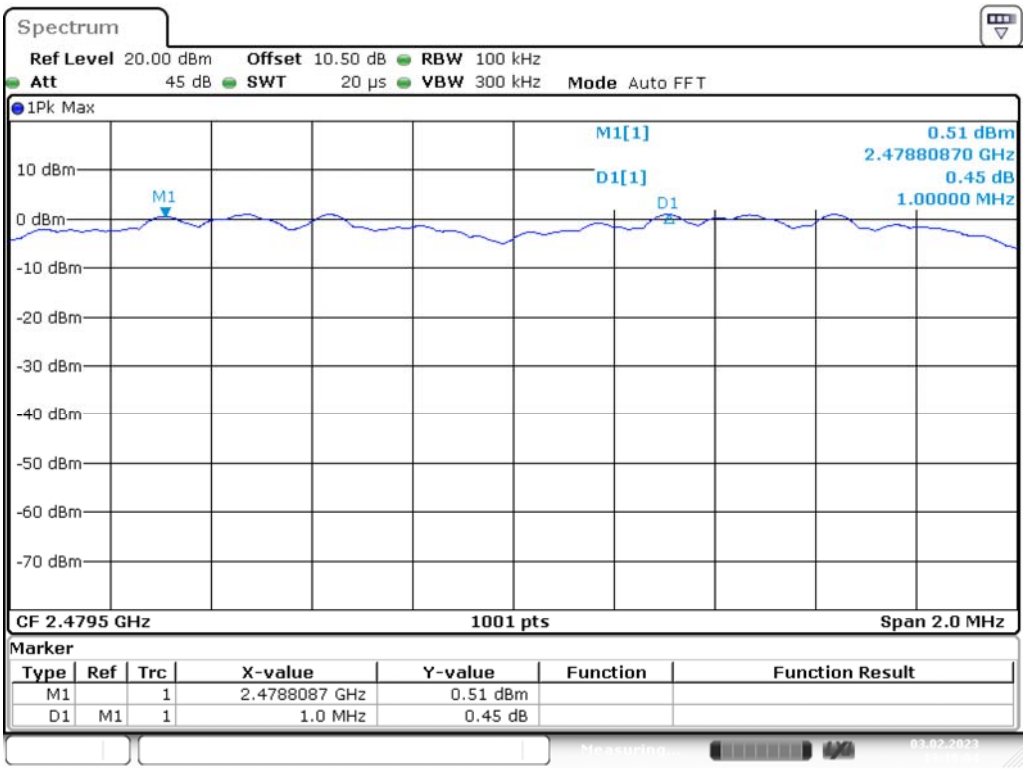
Middle Channel



Date: 3.FEB.2023 13:20:33

High Channel



Date: 3.FEB.2023 13:19:04

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11. FCC§15.247(a)(1)(iii) –Time of Occupancy (Dwell Time)

11.1. Applicable Standard

According to FCC §15.247(a) (1) (iii).

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.

11.2. Test Procedure

According to ANSI C63.10-2013, section 7.8.4

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel RBW ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.

Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

11.3. Test Results

BR mode (GFSK)						
Mode	Pulse Time (ms)	Hopping Number	Period Time (s)	Total of Dwell (ms)	Limit (ms)	Result
DH1	0.38	320	31.6	121.60	<400	PASS
DH3	1.63	130	31.6	211.90	<400	PASS
DH5	2.88	130	31.6	374.40	<400	PASS
EDR mode (π/4-DQPSK)						
Mode	Pulse Time (ms)	Hopping Number	Period Time (s)	Total of Dwell (ms)	Limit (ms)	Result
2DH1	0.39	320	31.6	124.80	<400	PASS
2DH3	1.64	140	31.6	229.60	<400	PASS
2DH5	2.89	130	31.6	375.70	<400	PASS
EDR mode (8DPSK)						
Mode	Pulse Time (ms)	Hopping Number	Period Time (s)	Total of Dwell (ms)	Limit (ms)	Result
3DH1	0.39	320	31.6	124.80	<400	PASS
3DH3	1.64	150	31.6	246.00	<400	PASS
3DH5	2.89	120	31.6	346.80	<400	PASS

Note 1: A period time = 0.4*79 = 31.6 (s), Total of Dwell=Pulse Time * Hopping Number

Note 2: Hopping Number = Hopping Number/10 * 10

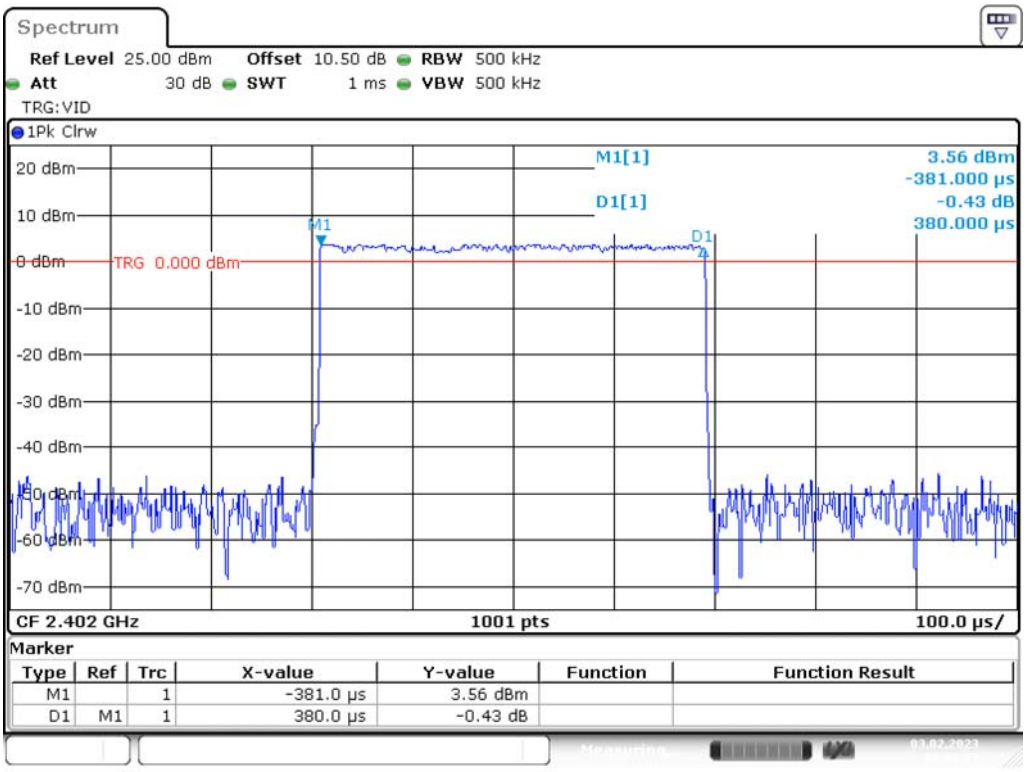
Note 3: Hopping Number/10 = Total of highest signals in 3.16s. (Second high signals were other channel)

Please refer to the following plots

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

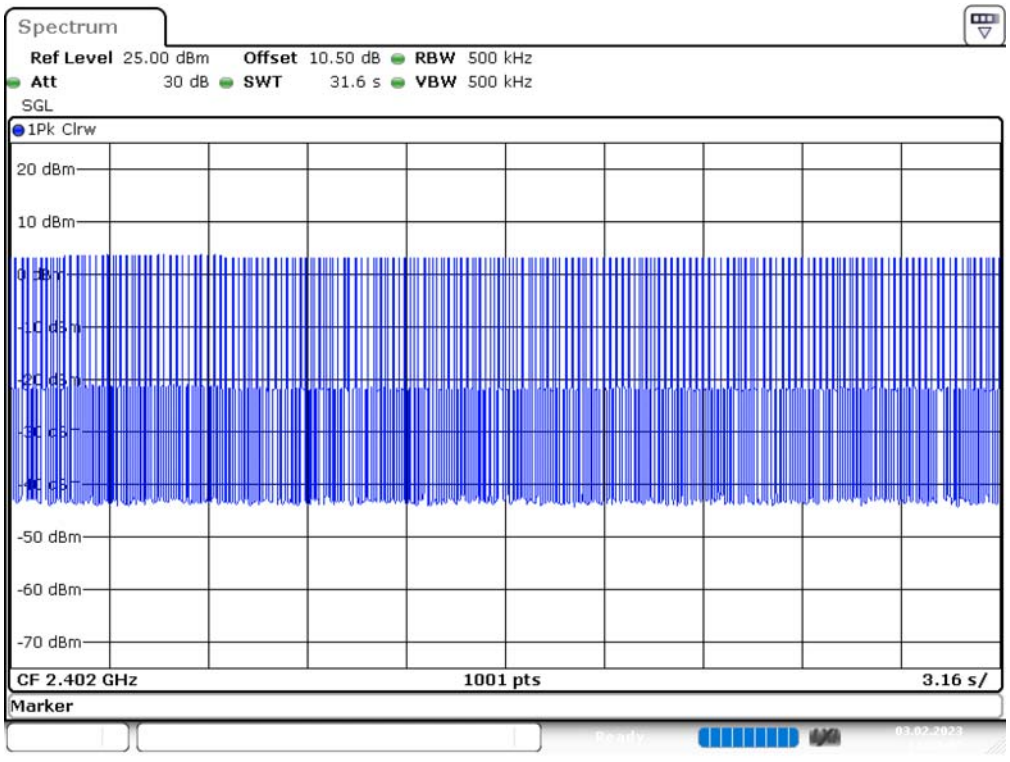
BR Mode (GFSK)

DH1: Pulse Width



Date: 3.FEB.2023 13:43:07

DH1: Hopping Number



Date: 3.FEB.2023 13:29:05

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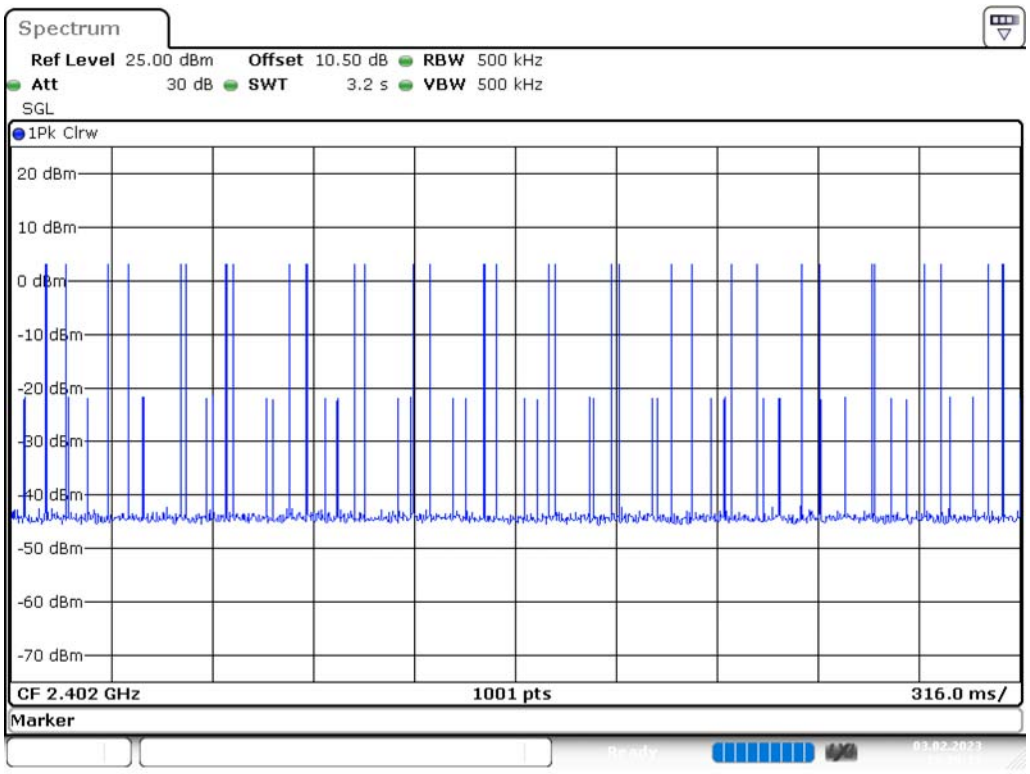
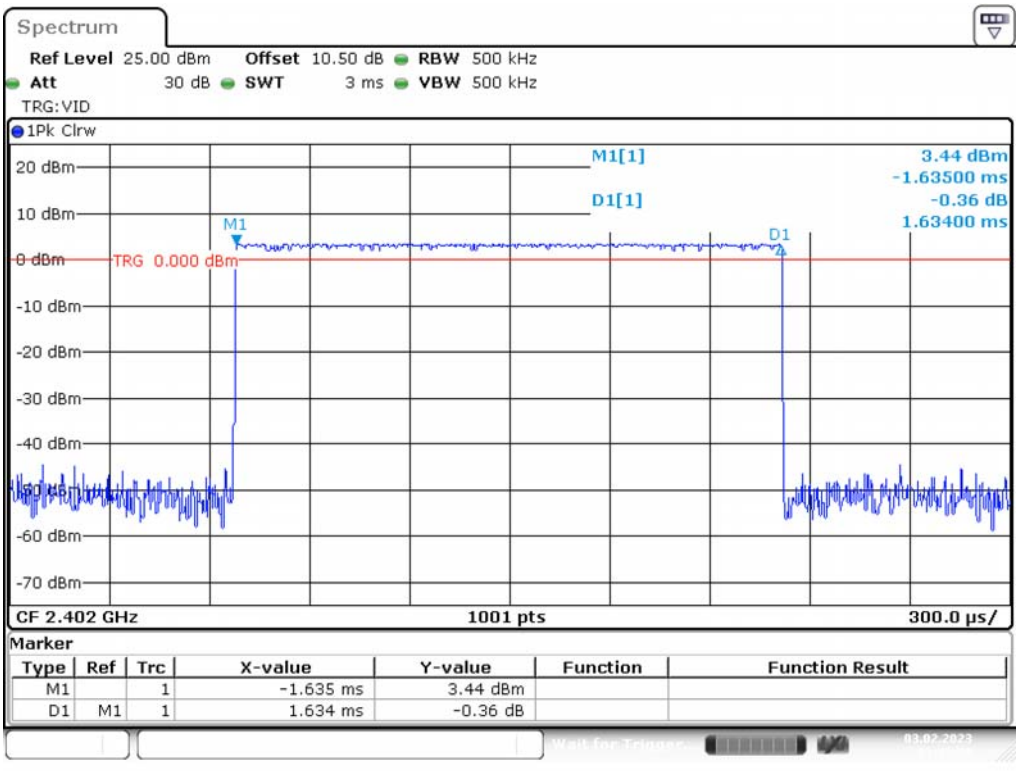
DH1: Hopping Number /10

(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



Date: 3.FEB.2023 13:29:12

DH3: Pulse Width



Date: 3.FEB.2023 13:43:58

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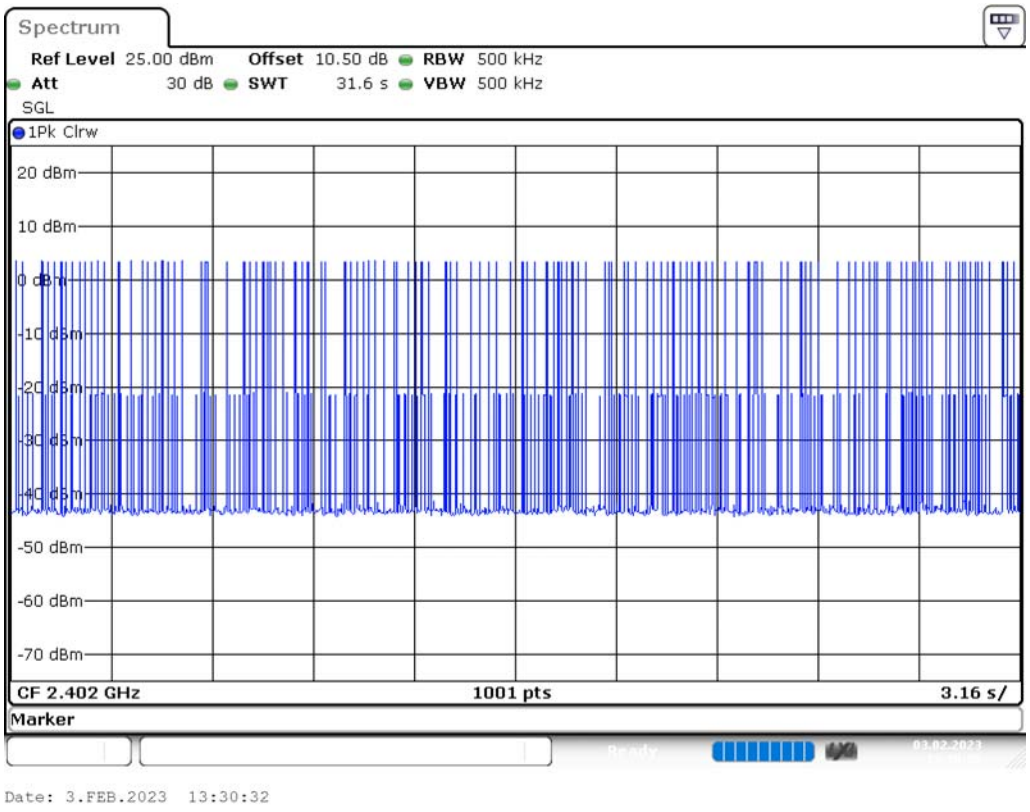
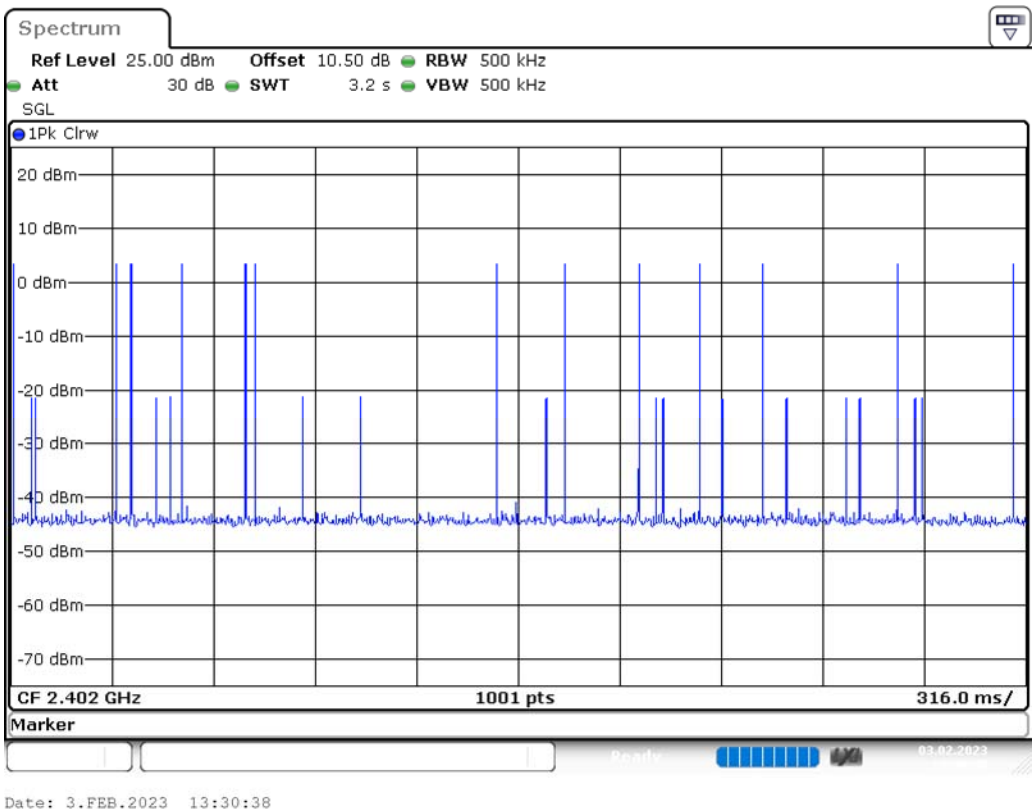
DH3: Hopping Number



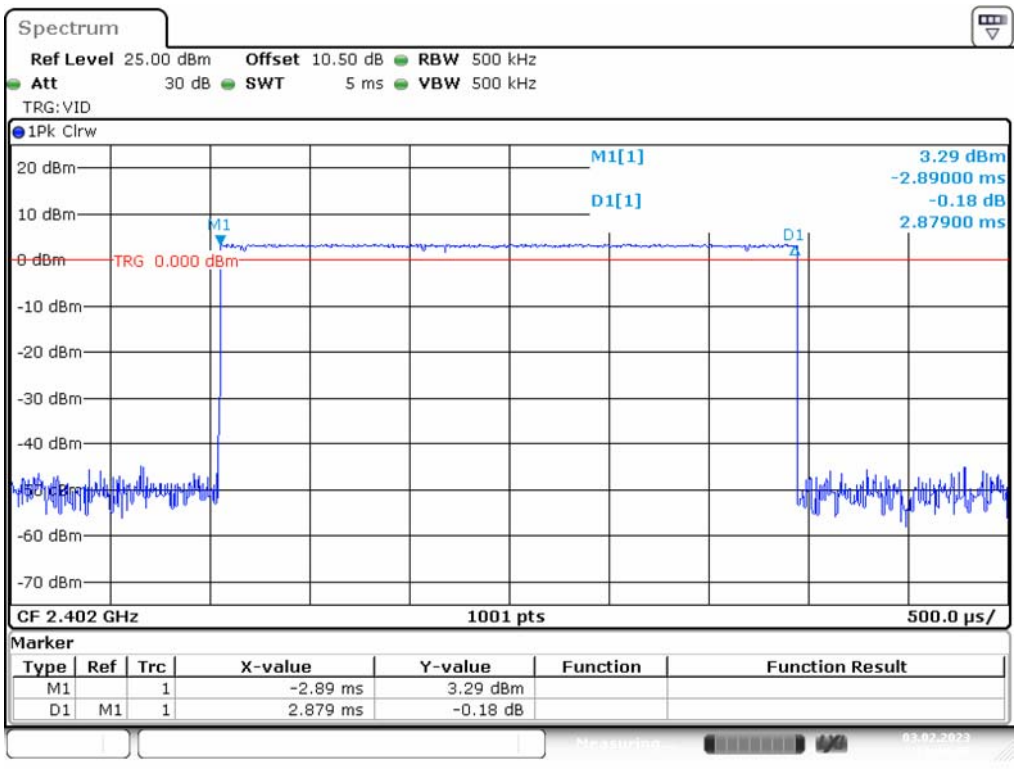
DH3: Hopping Number /10

(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)

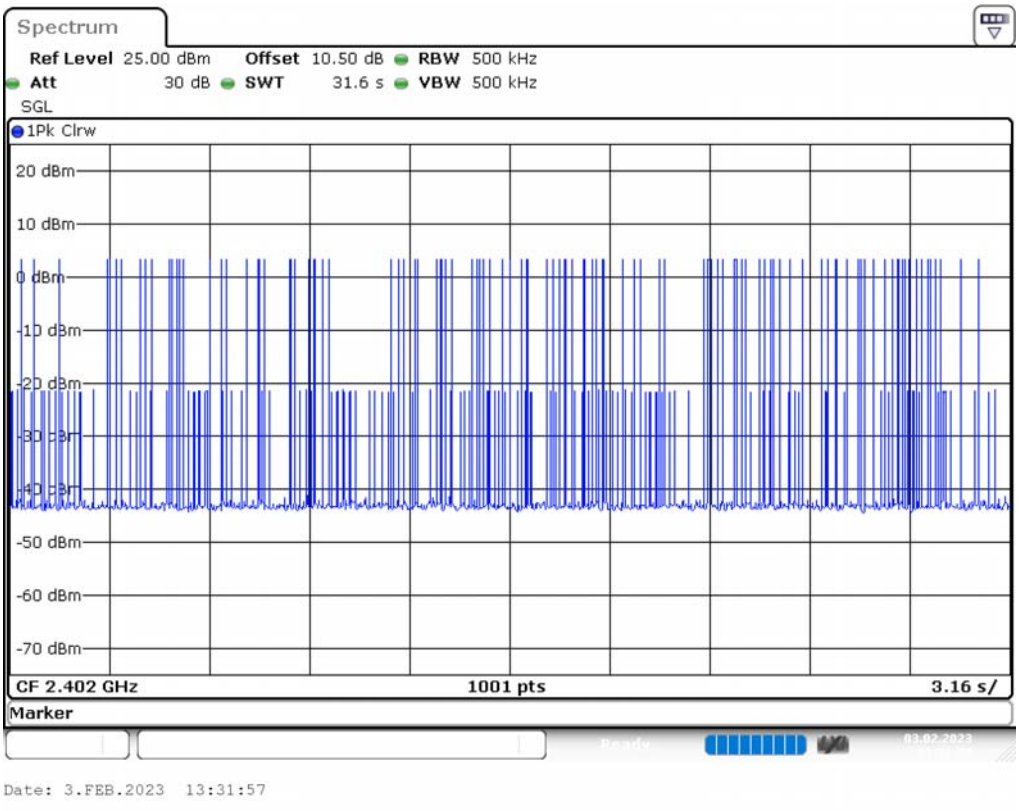


Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

DH5: Pulse Width



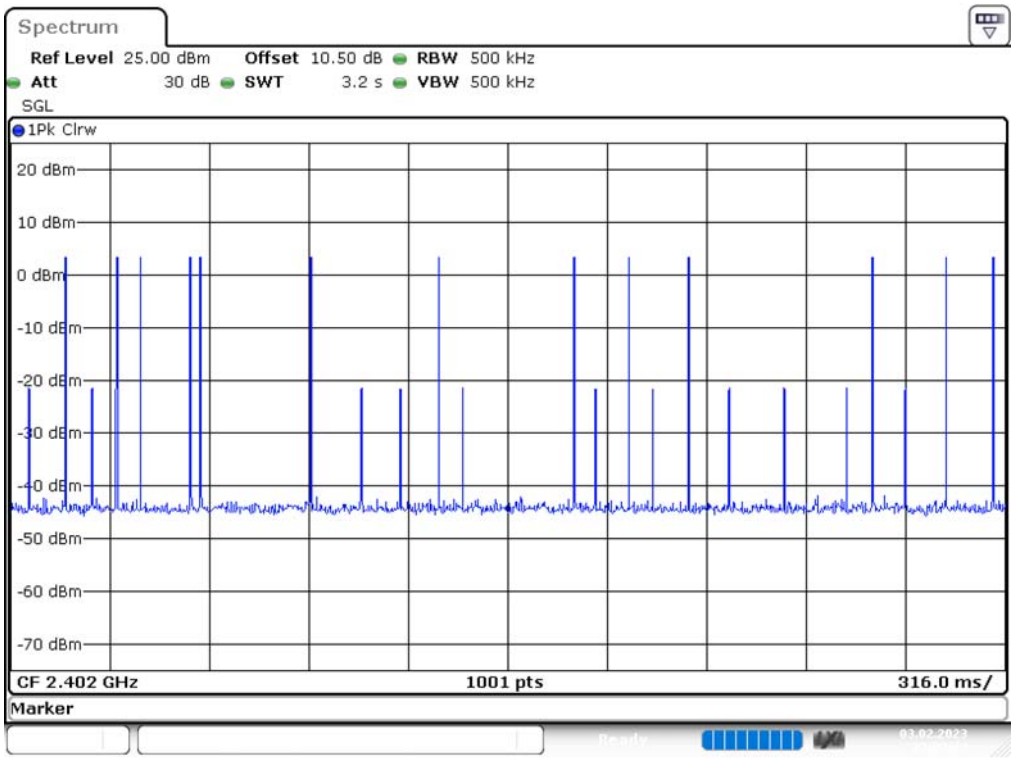
DH5: Hopping Number



Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

DH5: Hopping Number /10

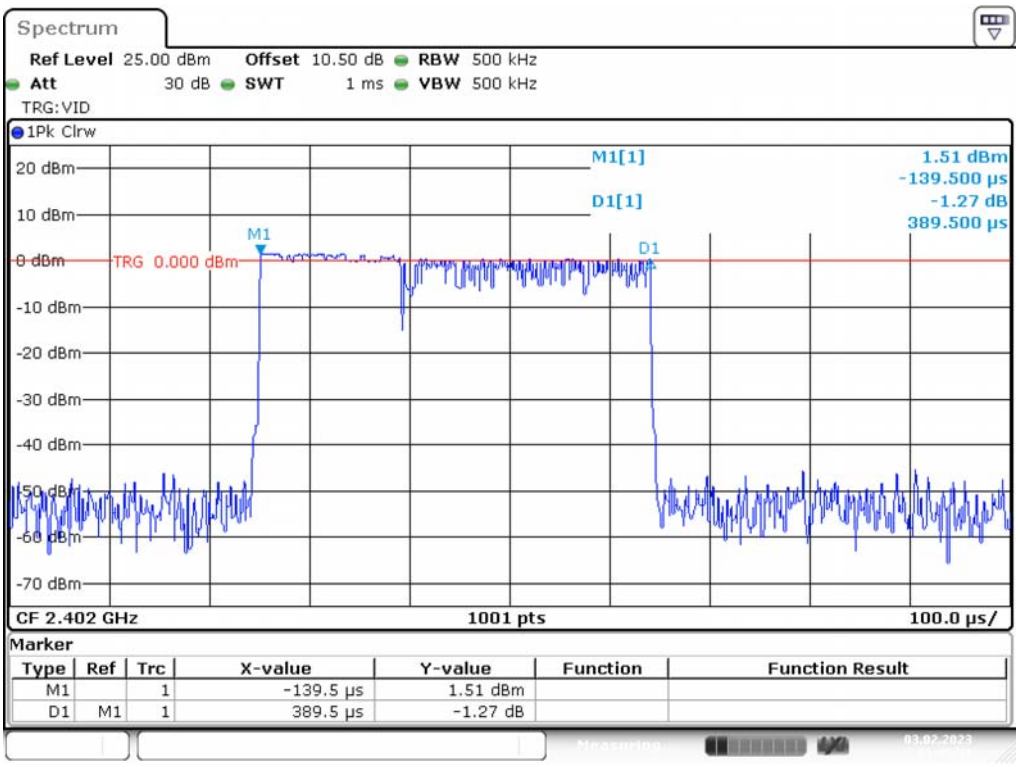
(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)



Date: 3.FEB.2023 13:32:14

EDR Mode (π/4-DQPSK)

2DH1: Pulse Width



Date: 3.FEB.2023 13:45:52

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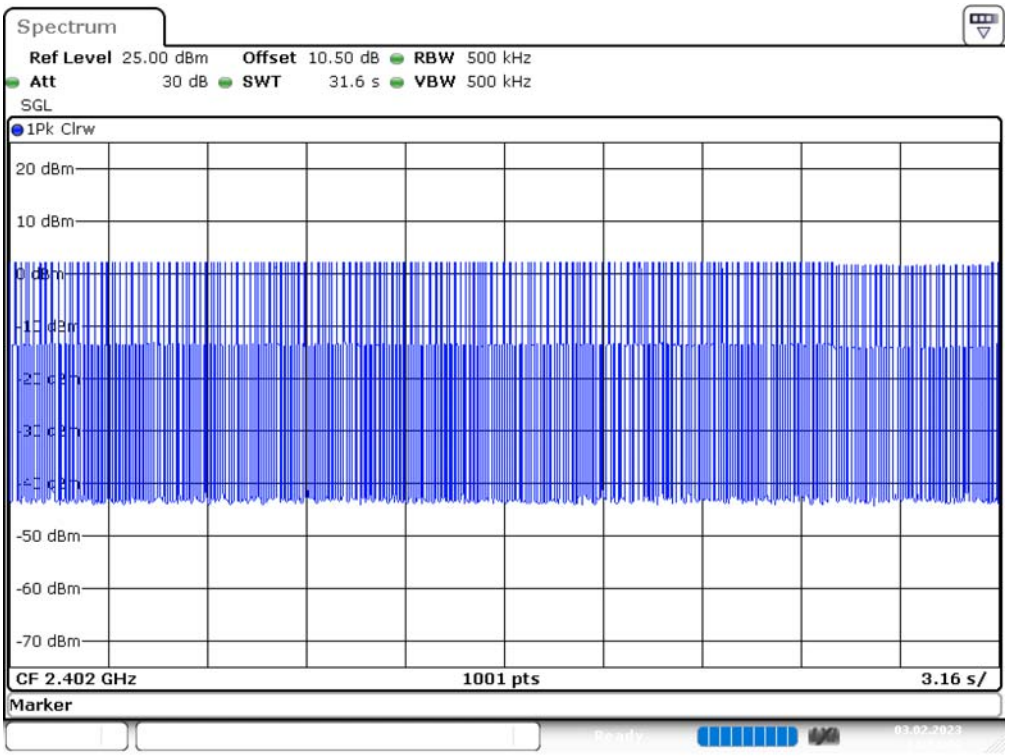
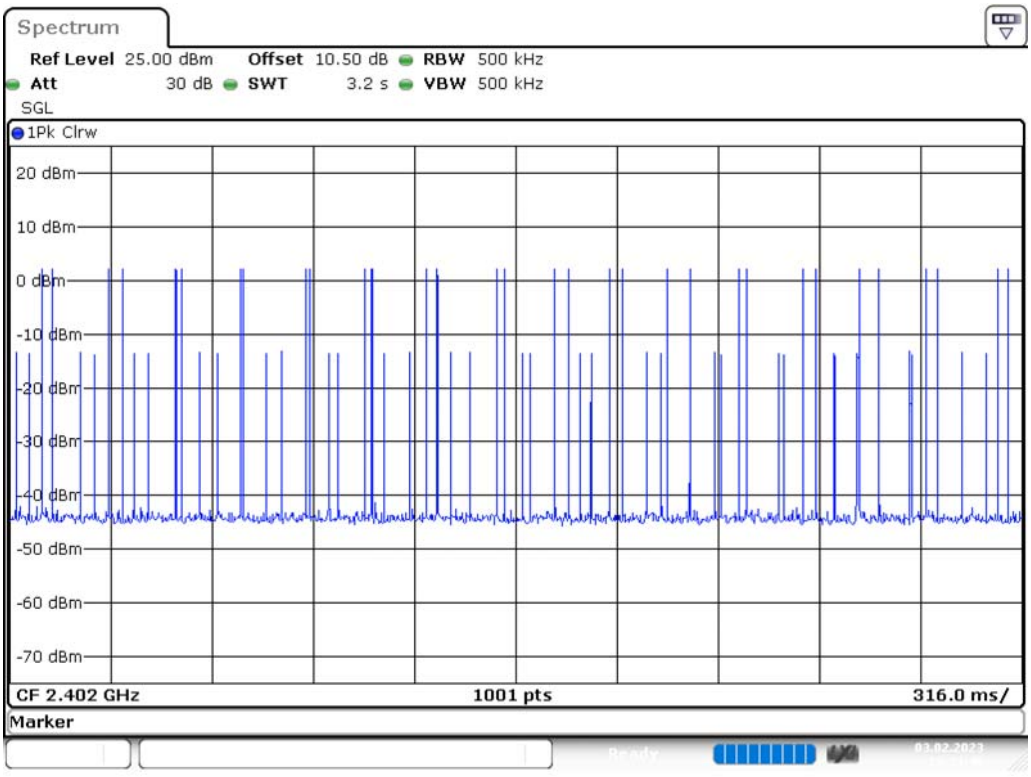
2DH1: Hopping Number



Date: 3.FEB.2023 13:33:41

2DH1: Hopping Number /10

(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



Date: 3.FEB.2023 13:33:46

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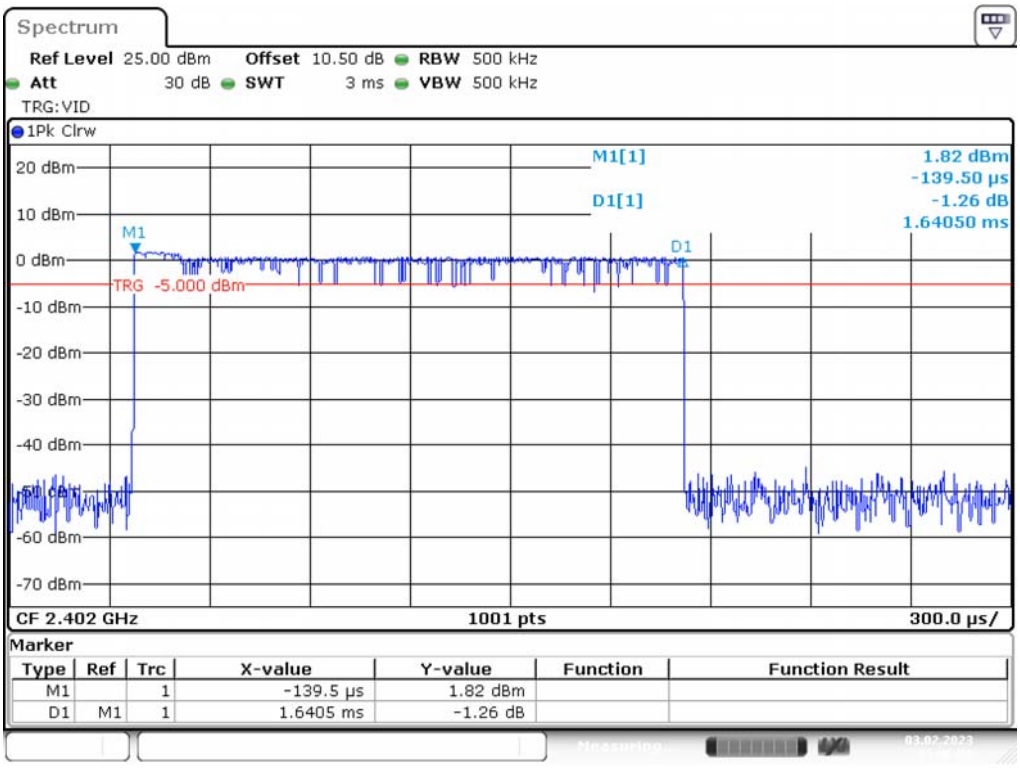
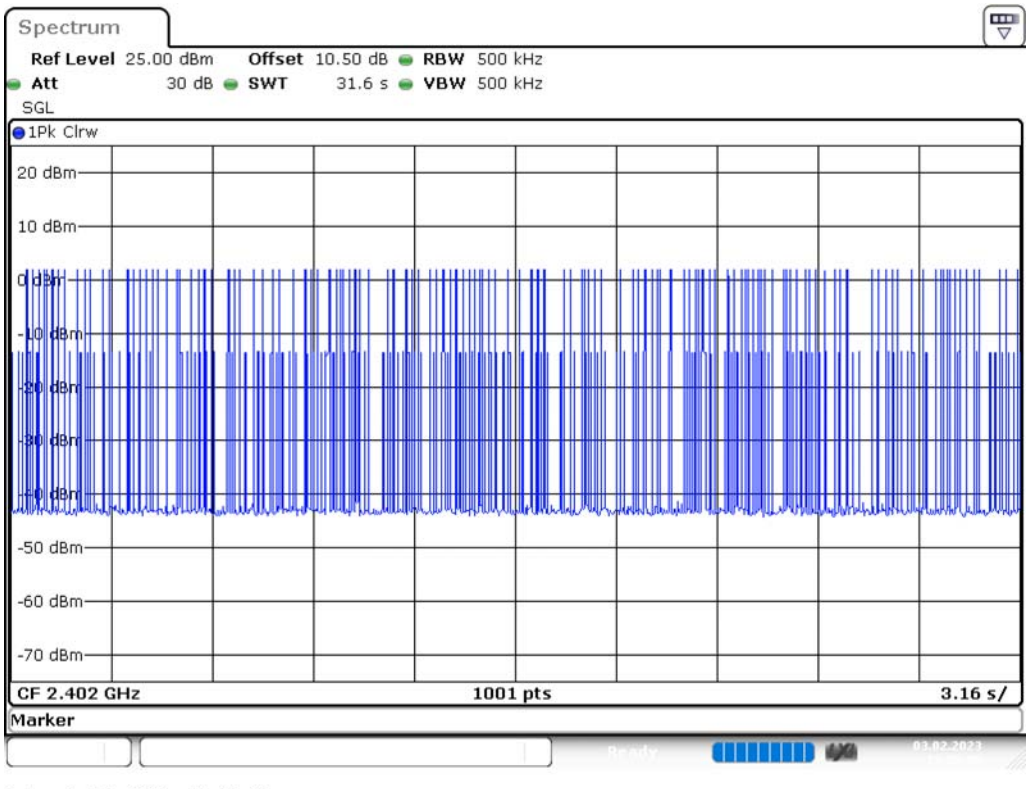
2DH3: Pulse Width



2DH3: Hopping Number



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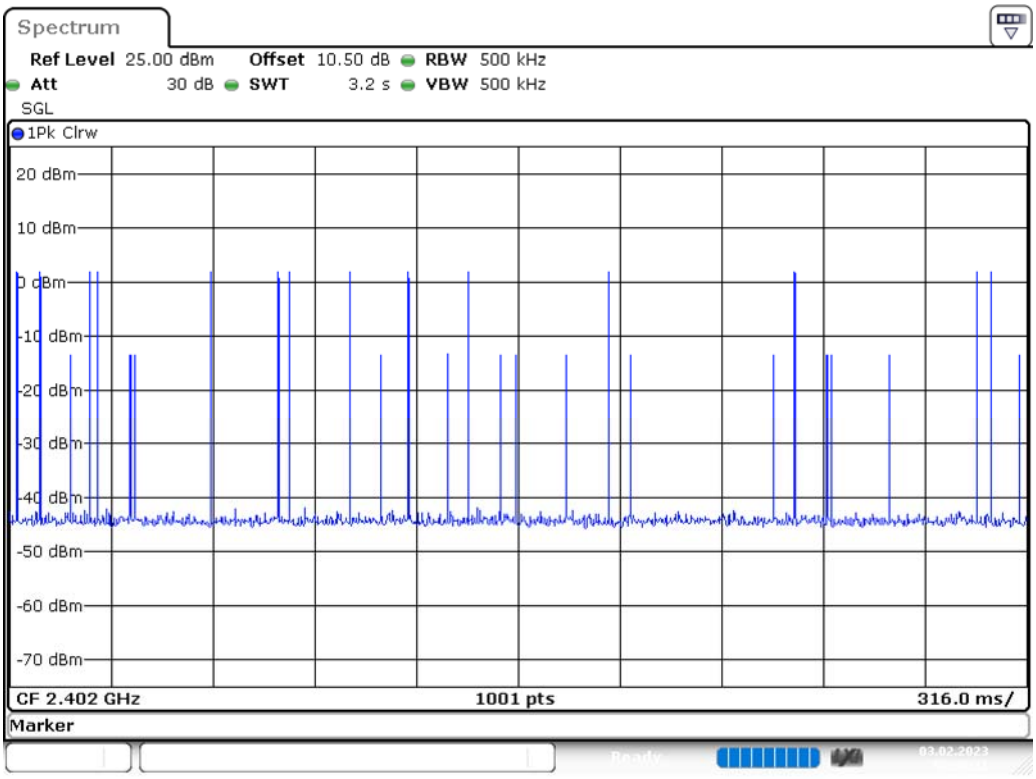
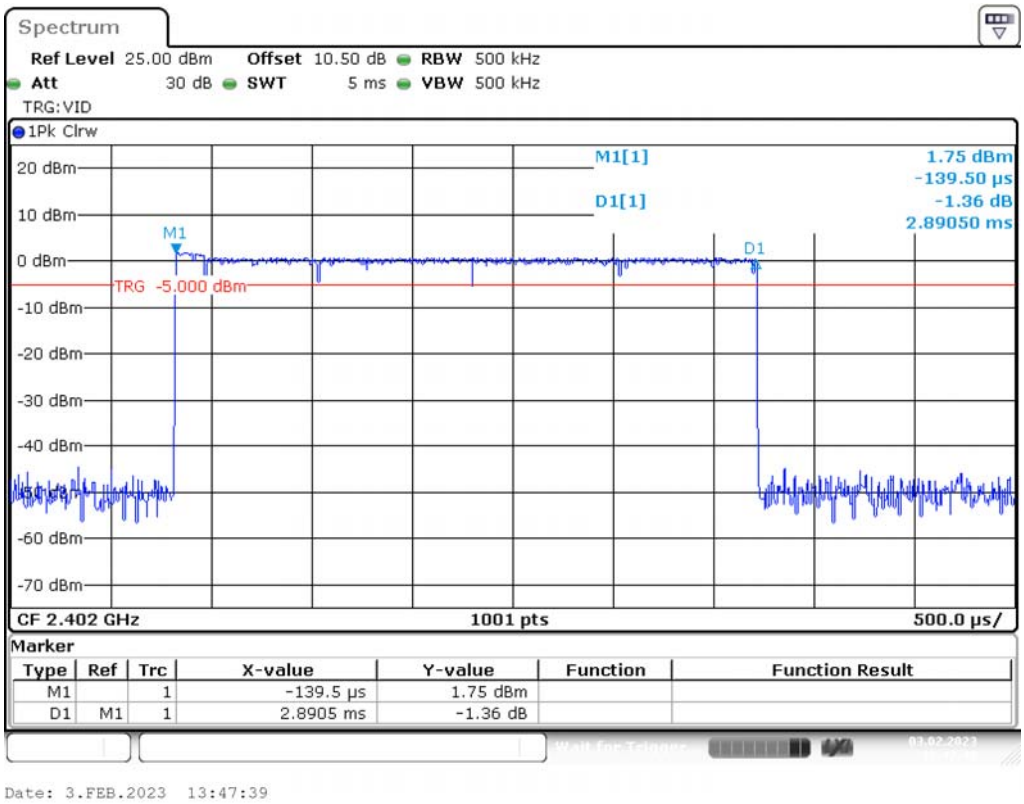
2DH3: Hopping Number /10

(Hopping Number = 14 in 1/10 period of highest signals, Second High signals were other channel)

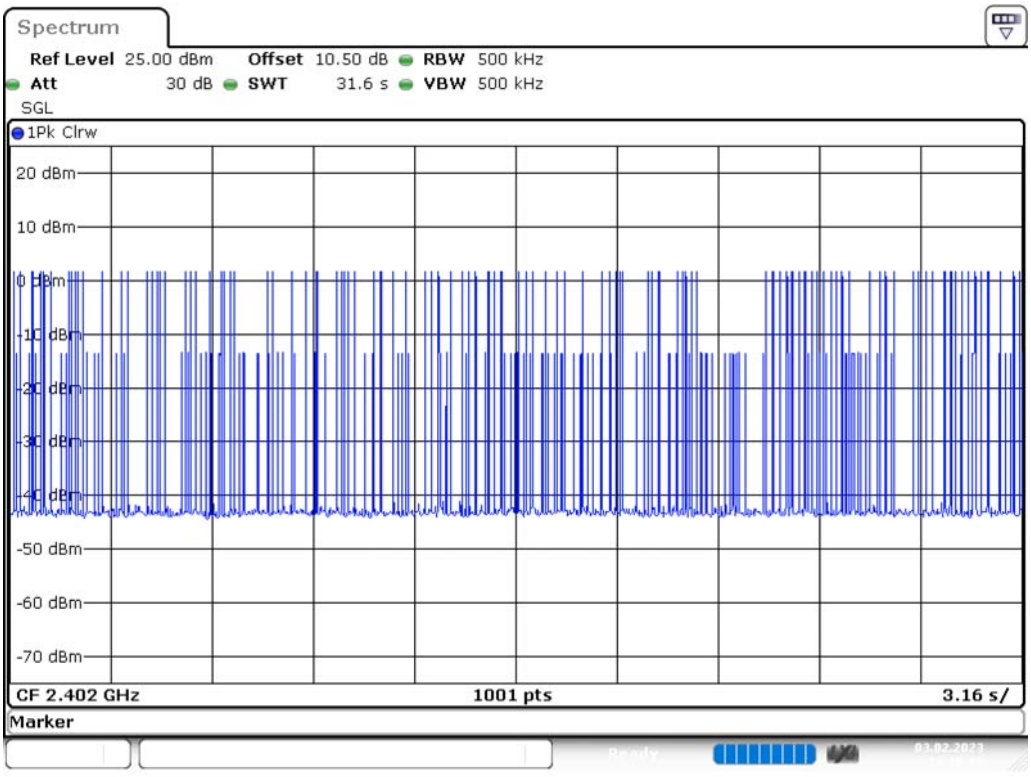


2DH5: Pulse Width



Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

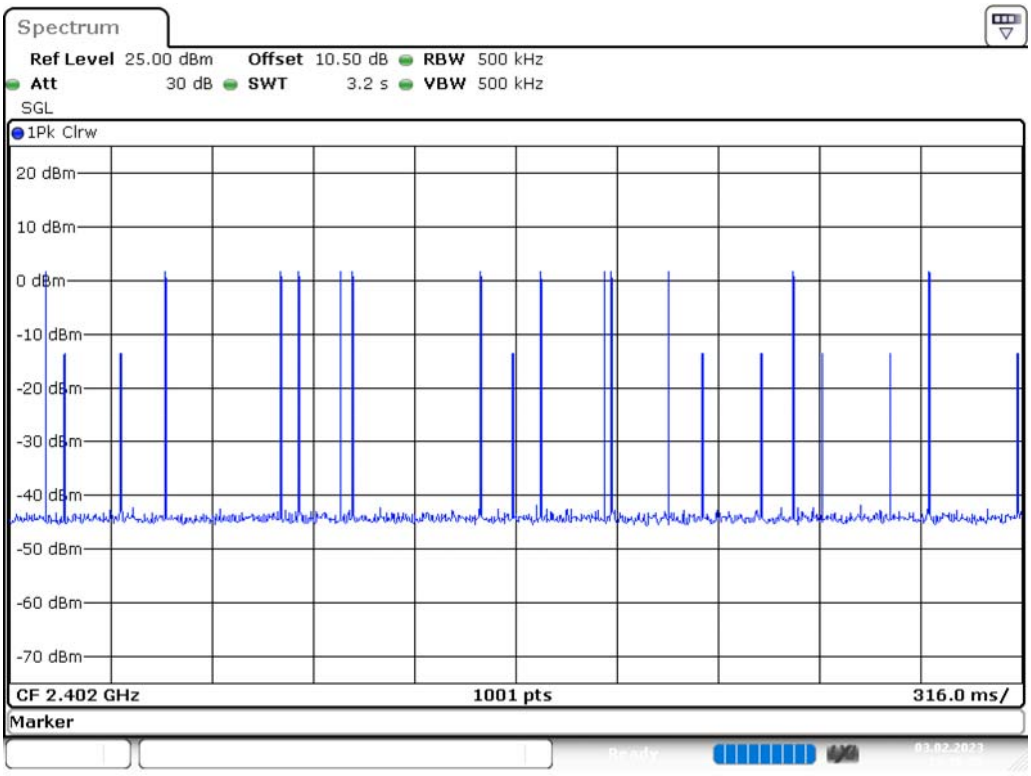
2DH5: Hopping Number



Date: 3.FEB.2023 13:36:30

2DH5: Hopping Number /10

(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)



Date: 3.FEB.2023 13:36:37

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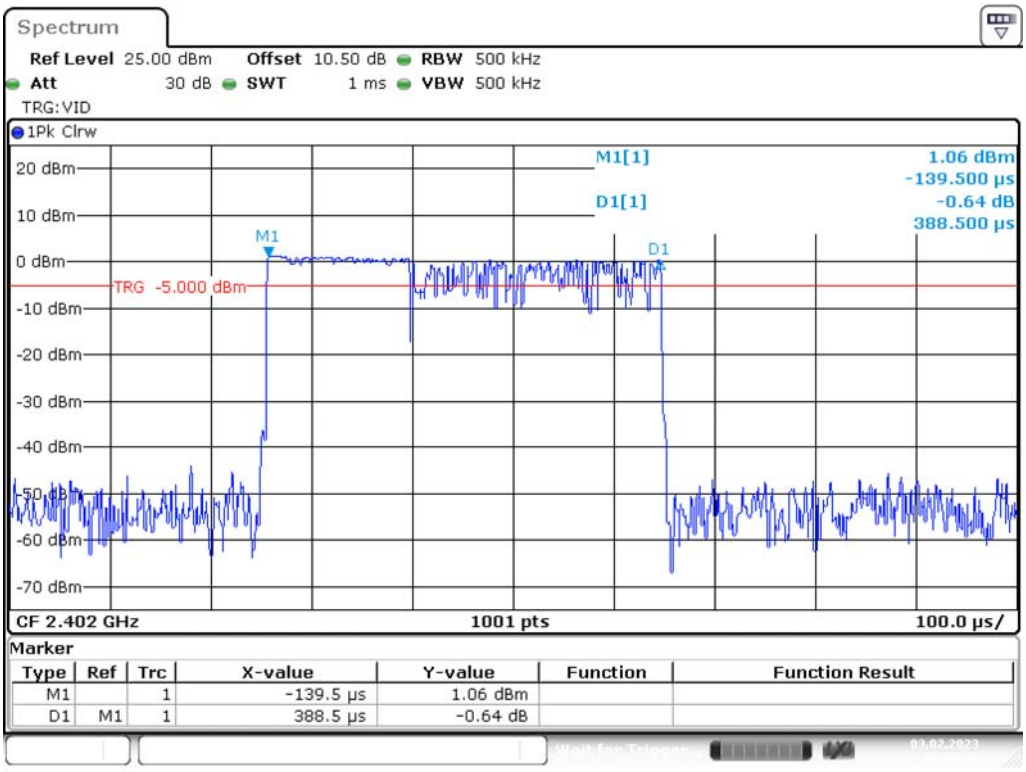
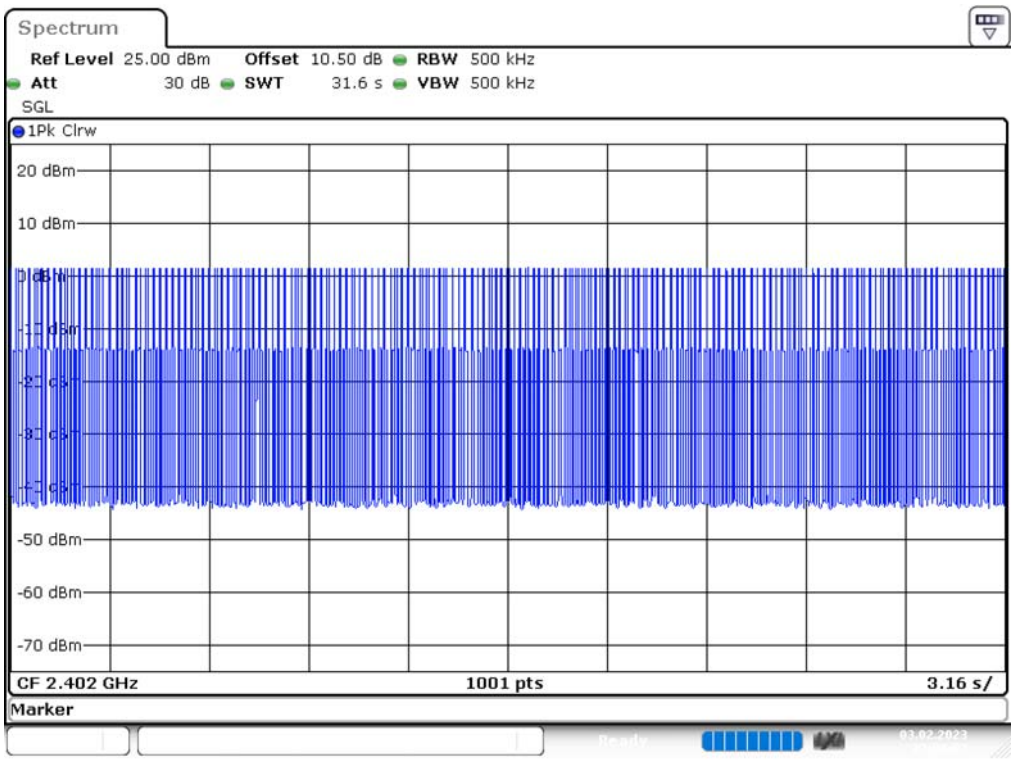
EDR Mode (8DPSK)

3DH1: Pulse Width



Date: 3.FEB.2023 13:49:36

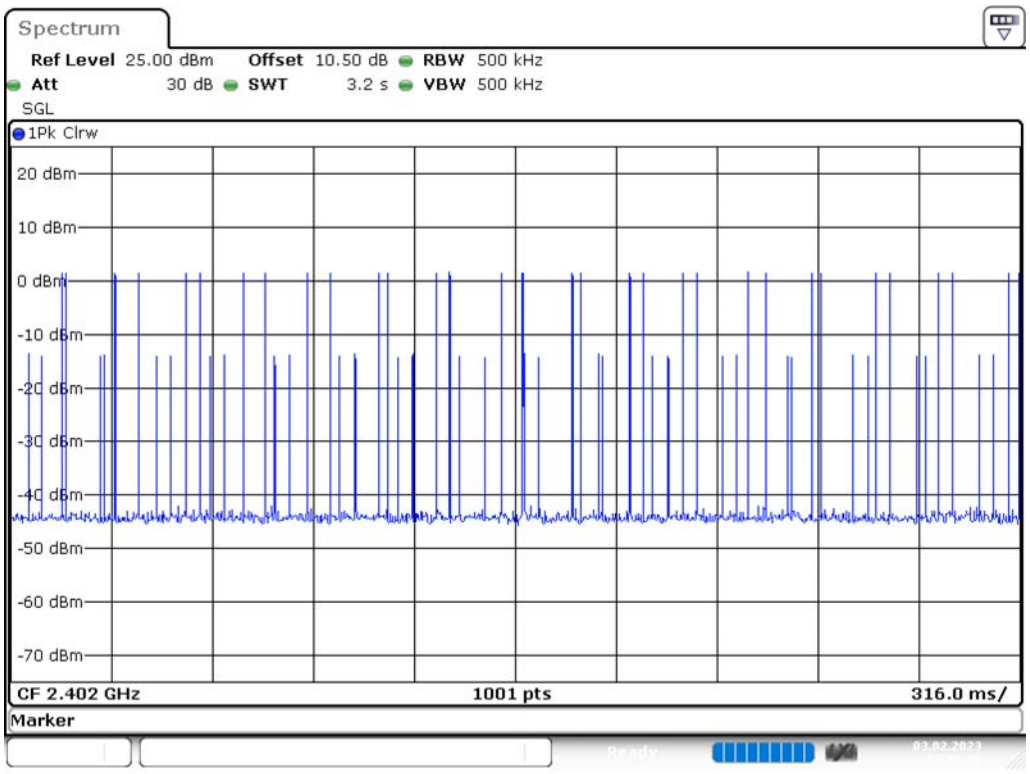
3DH1: Hopping Number



Date: 3.FEB.2023 13:38:01

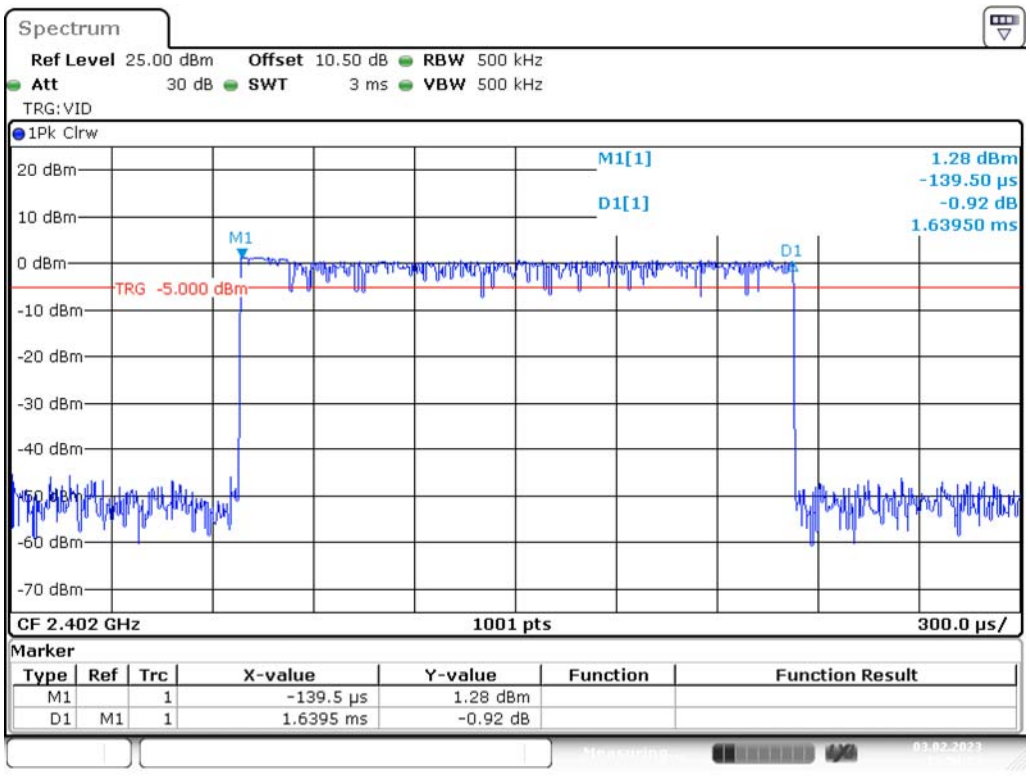
3DH1: Hopping Number /10

(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



Date: 3.FEB.2023 13:38:22

3DH3: Pulse Width



Date: 3.FEB.2023 13:50:24

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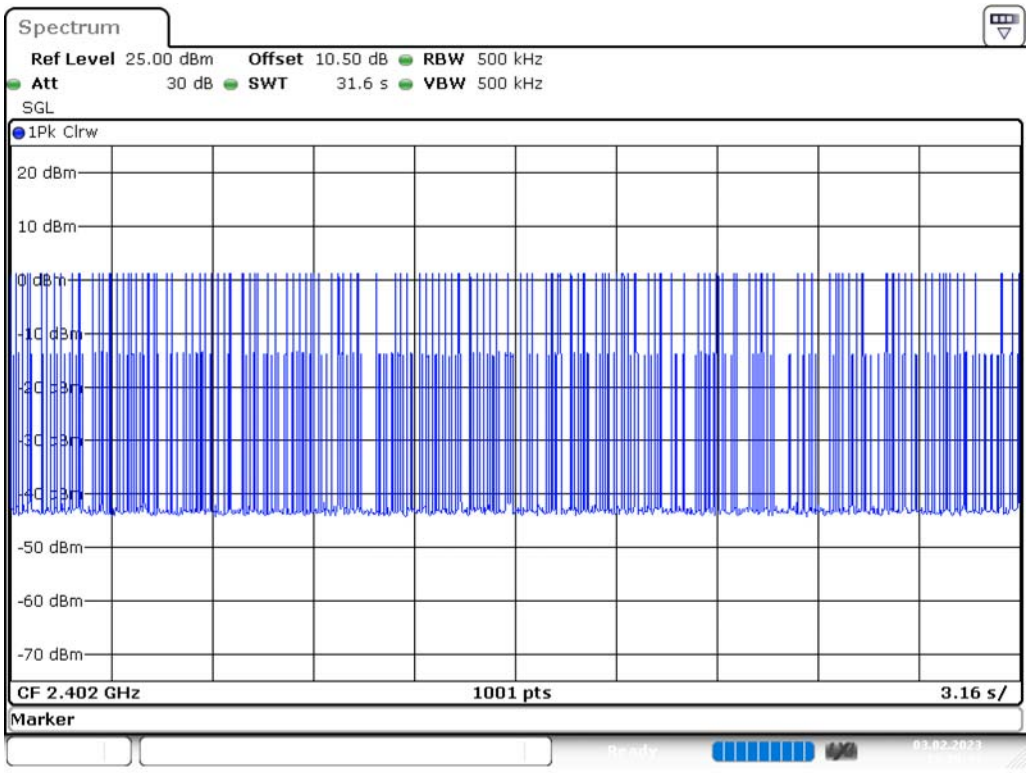
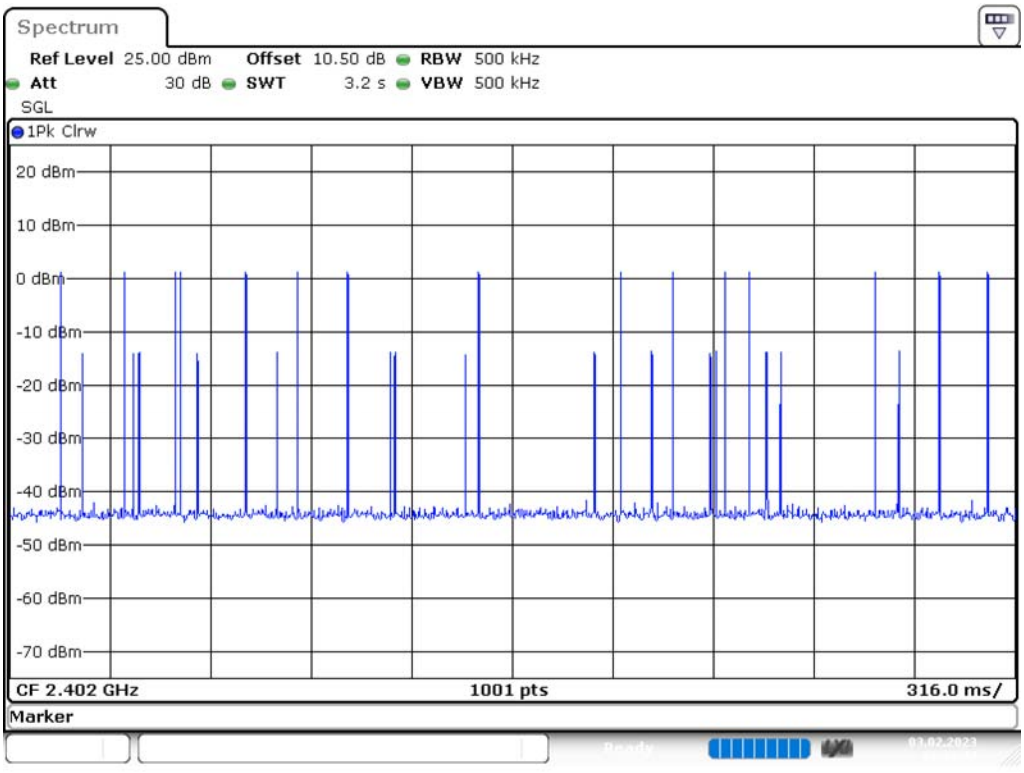
3DH3: Hopping Number



3DH3: Hopping Number /10

(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)



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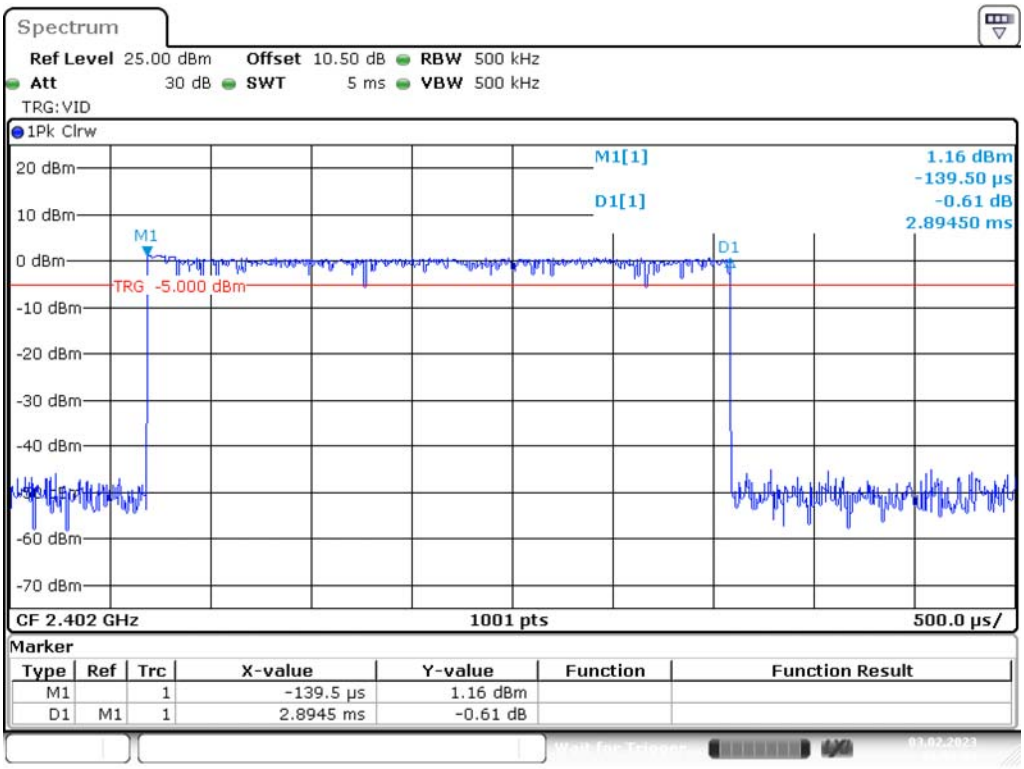
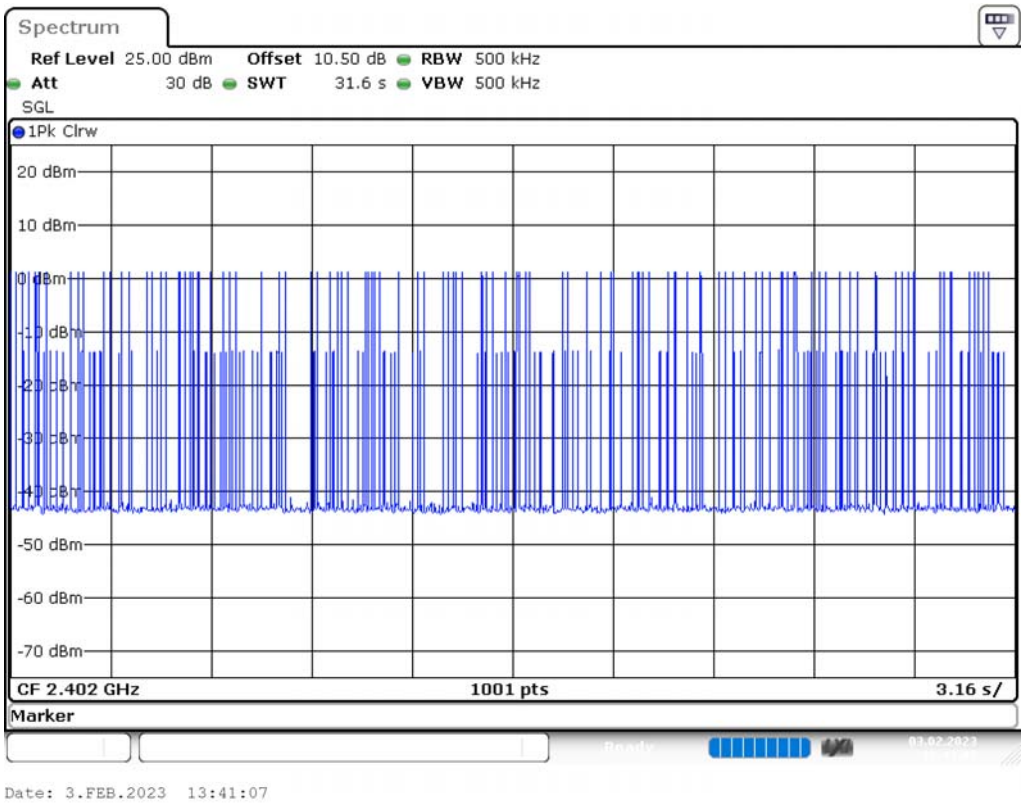
3DH5: Pulse Width



3DH5: Hopping Number



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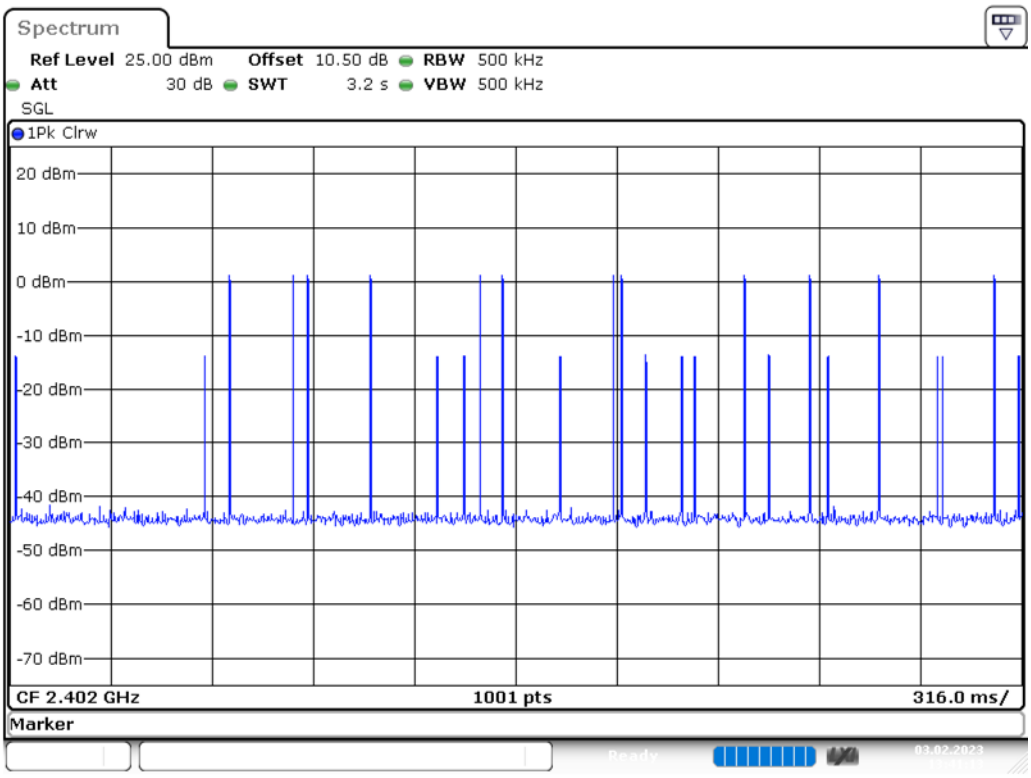
3DH5: Hopping Number /10

(Hopping Number = 12 in 1/10 period of highest signals, Second High signals were other channel)



12. FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

12.1. Applicable Standard

According to FCC §15.247(a) (1) (iii).

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.

12.2. Test Procedure

According to ANSI C63.10-2013, section 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.

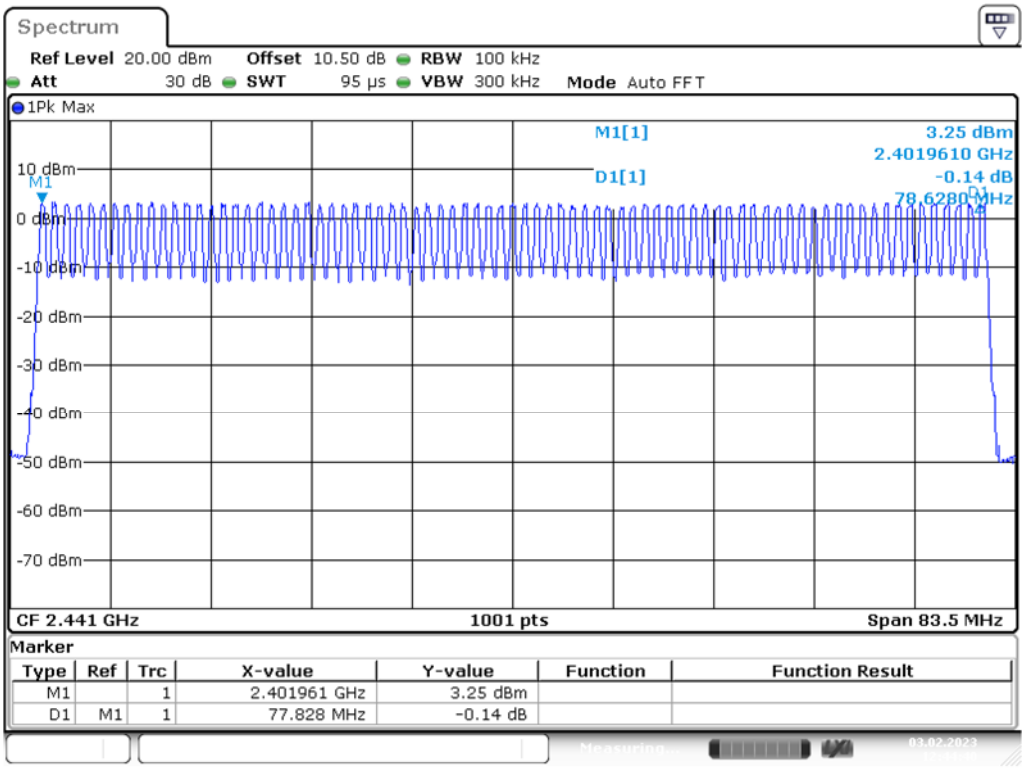
12.3. Test Results

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)	Result
GFSK	2402-2480	79	>15	Compliance
π/4-DQPSK	2402-2480	79	>15	Compliance
8DPSK	2402-2480	79	>15	Compliance

Please refer to the following plots

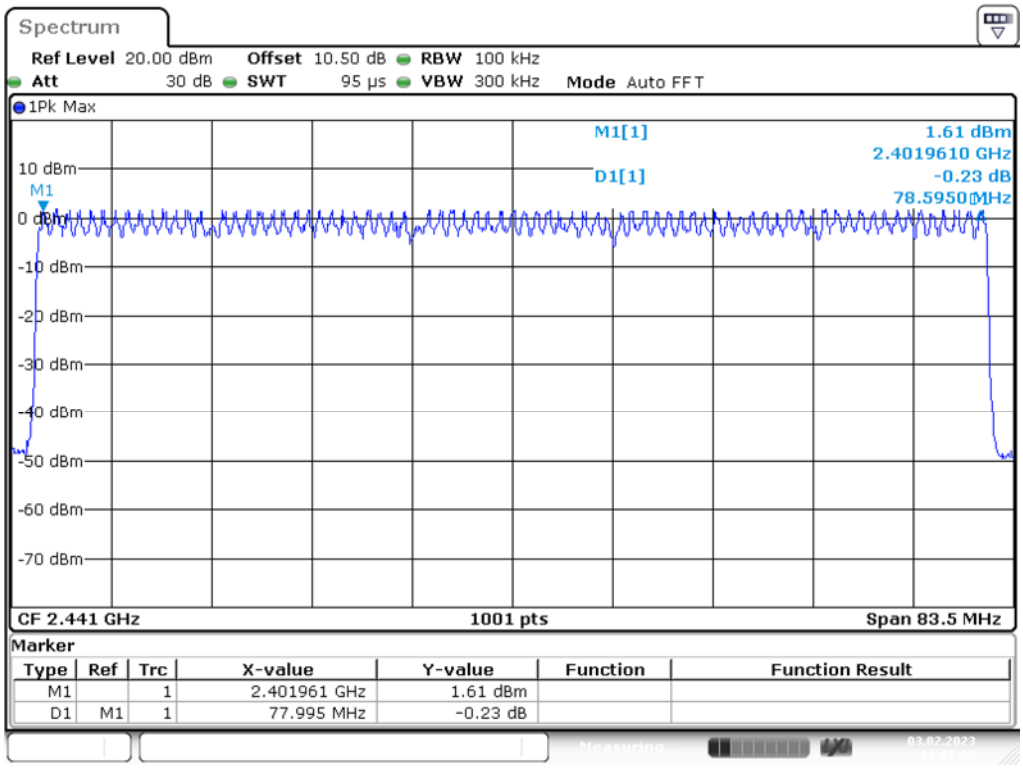
Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

BR Mode (GFSK)



Date: 3.FEB.2023 12:44:40

EDR Mode (π/4-DQPSK)



Date: 3.FEB.2023 13:07:22

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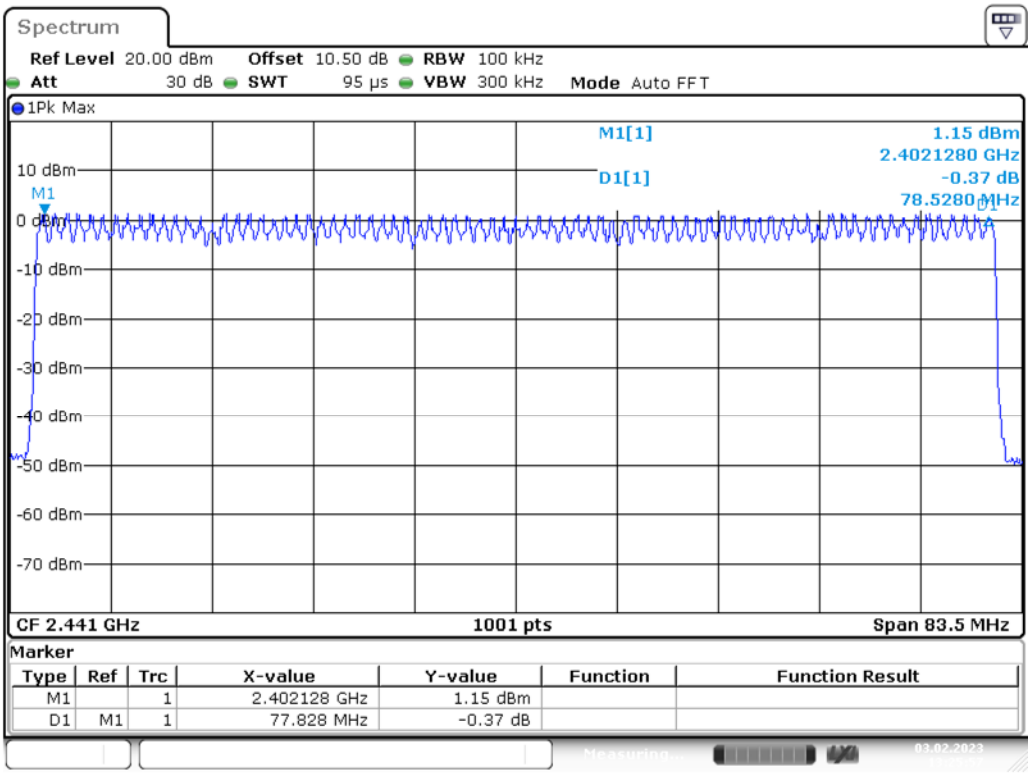
EDR Mode (8DPSK)



Date: 3.FEB.2023 13:25:57

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13. FCC §15.247(b)(1) – Maximum Output Power

13.1. Applicable Standard

According to FCC §15.247(b) (1).

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.

13.2. Test Procedure

According to ANSI C63.10-2013, section 7.8.5

1. Place the EUT on a bench and set it in transmitting mode.

2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

13.3. Test Results

Channel	Frequency (MHz)	Peak Conducted Output Power		Limit (W)	Result
		(dBm)	(W)		
BR Mode (GFSK)					
Low	2402	4.12	0.003	0.125	Compliance
Middle	2441	3.84	0.002	0.125	Compliance
High	2480	3.89	0.002	0.125	Compliance
EDR Mode (π/4-DQPSK)					
Low	2402	4.11	0.003	0.125	Compliance
Middle	2441	3.80	0.002	0.125	Compliance
High	2480	3.87	0.002	0.125	Compliance
EDR Mode (8DPSK)					
Low	2402	4.09	0.003	0.125	Compliance
Middle	2441	3.85	0.002	0.125	Compliance
High	2480	3.88	0.002	0.125	Compliance

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14. FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

14.1. Applicable Standard

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

14.2. Test Procedure

According to ANSI C63.10-2013, section 7.8.6

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz VBW = 300 kHz

Sweep = coupled

Detector function = peak Trace = max hold

14.3. Test Results

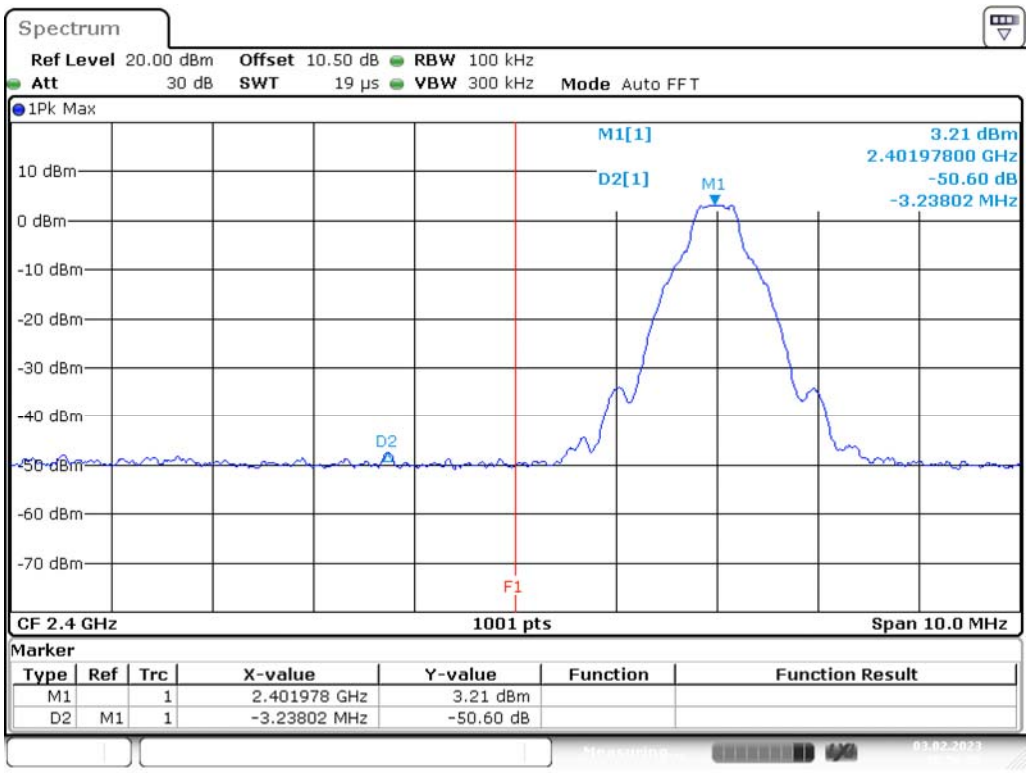
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	50.60	≥ 20	PASS
High	2480	50.80	≥ 20	PASS
BR Hopping Mode (GFSK)				
Low	2402-2480	51.89	≥ 20	PASS
High	2402-2480	50.41	≥ 20	PASS
EDR Mode (π/4-DQPSK)				
Low	2402	47.63	≥ 20	PASS
High	2480	48.19	≥ 20	PASS
EDR Hopping Mode (π/4-DQPSK)				
Low	2402-2480	48.55	≥ 20	PASS
High	2402-2480	48.64	≥ 20	PASS
EDR Mode (8DPSK)				
Low	2402	47.68	≥ 20	PASS
High	2480	47.57	≥ 20	PASS
EDR Hopping Mode (8DPSK)				
Low	2402-2480	49.13	≥ 20	PASS
High	2402-2480	48.46	≥ 20	PASS

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

Please refer to the following plots.

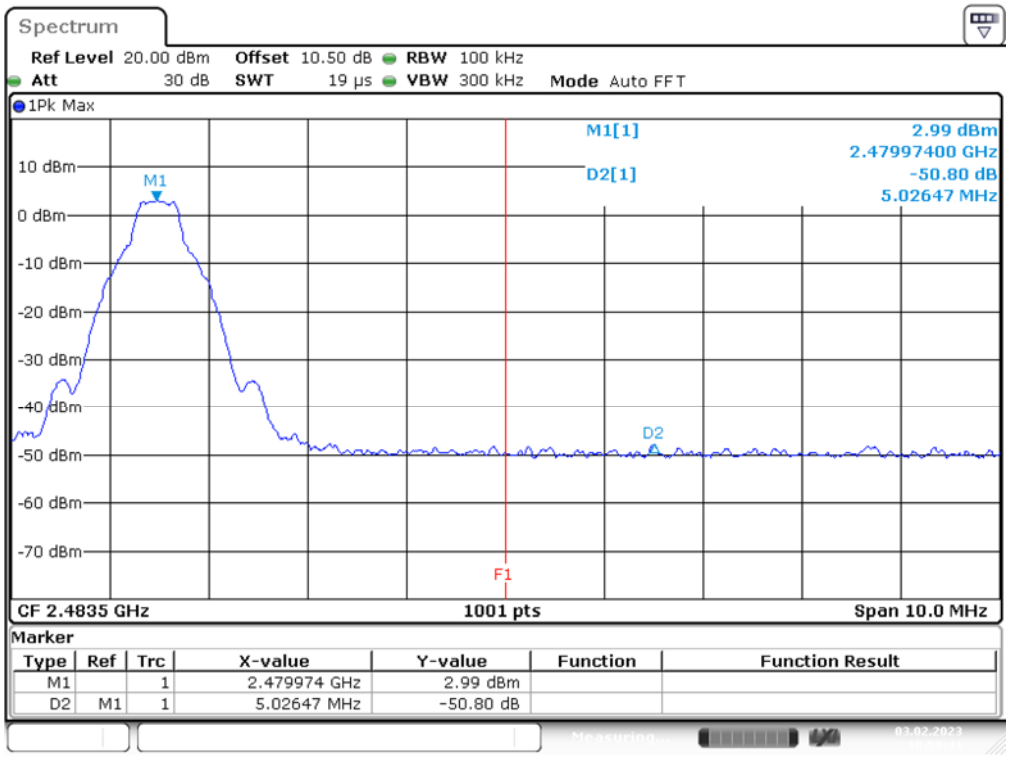
BR Mode (GFSK)

Band Edge, CH Low



Date: 3.FEB.2023 10:56:52

Band Edge, CH High



Date: 3.FEB.2023 10:59:41

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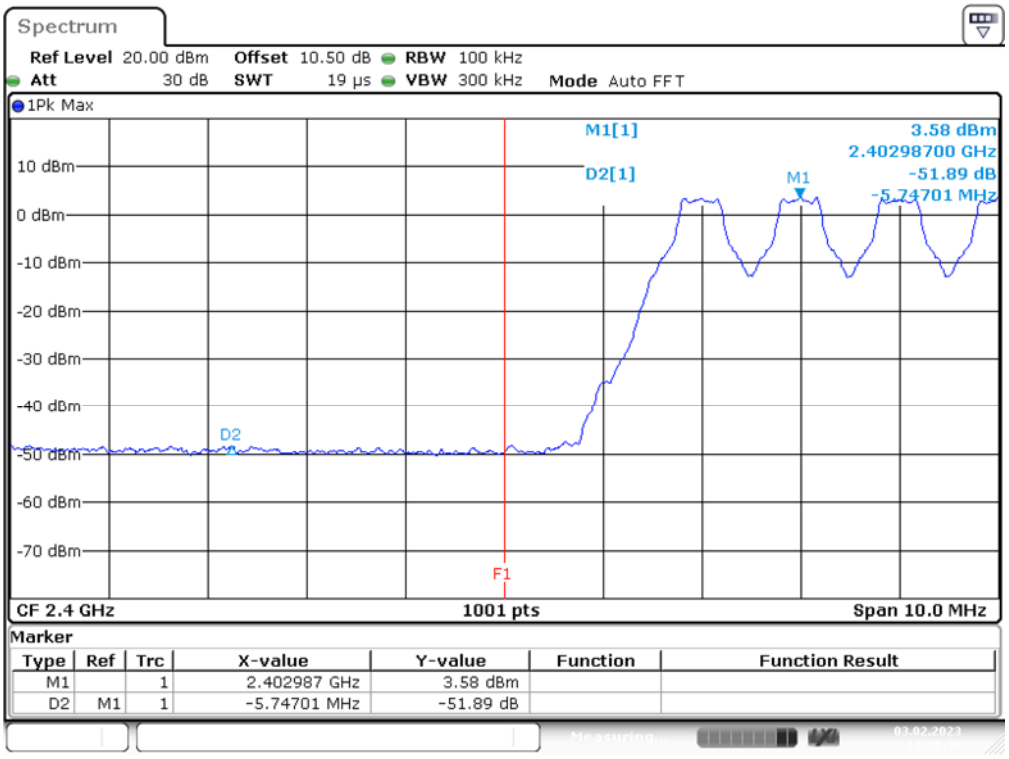
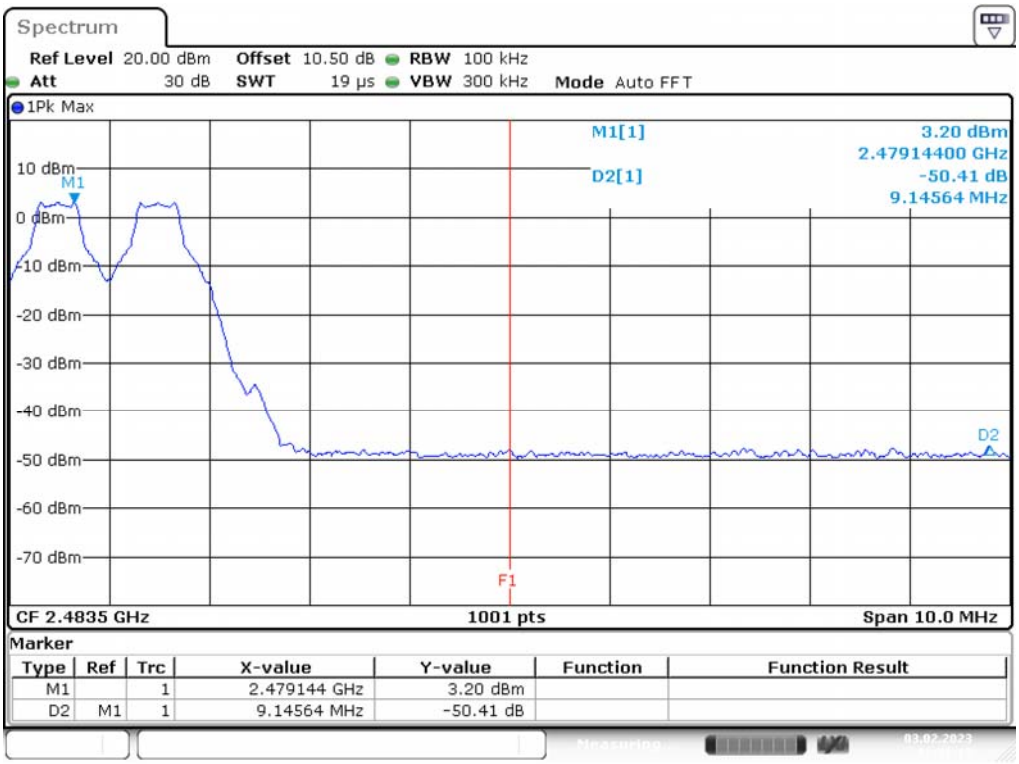
BR Hopping Mode (GFSK)

Band Edge, CH Low



Date: 3.FEB.2023 11:28:36

Band Edge, CH High

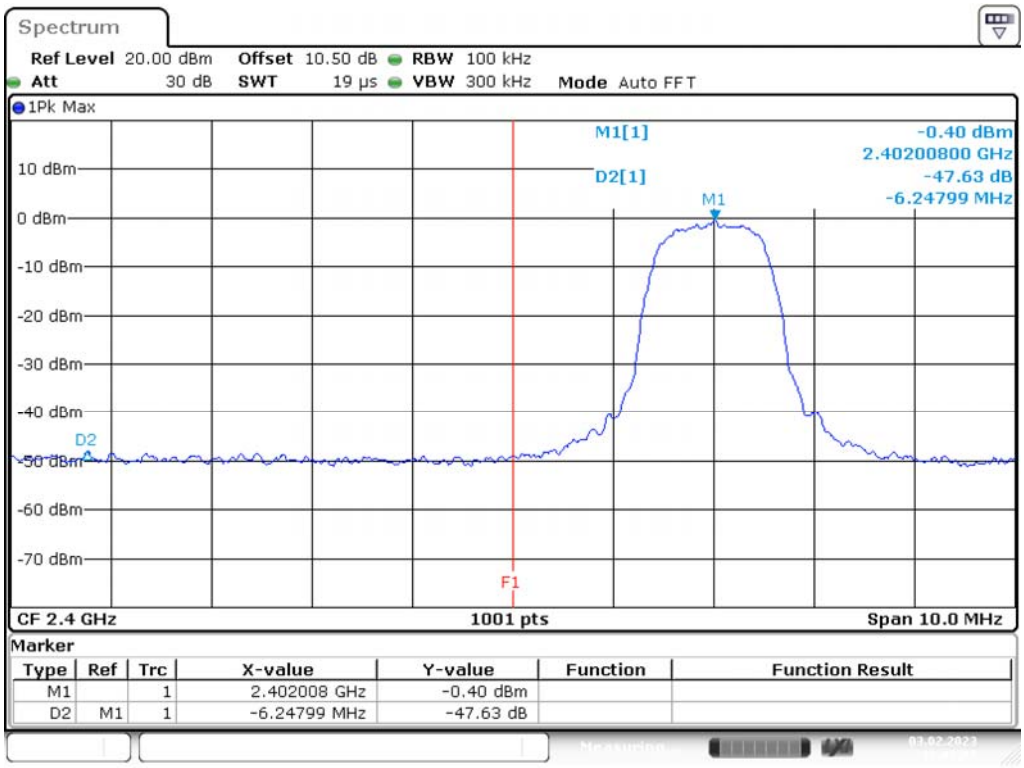


Date: 3.FEB.2023 11:31:12

Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

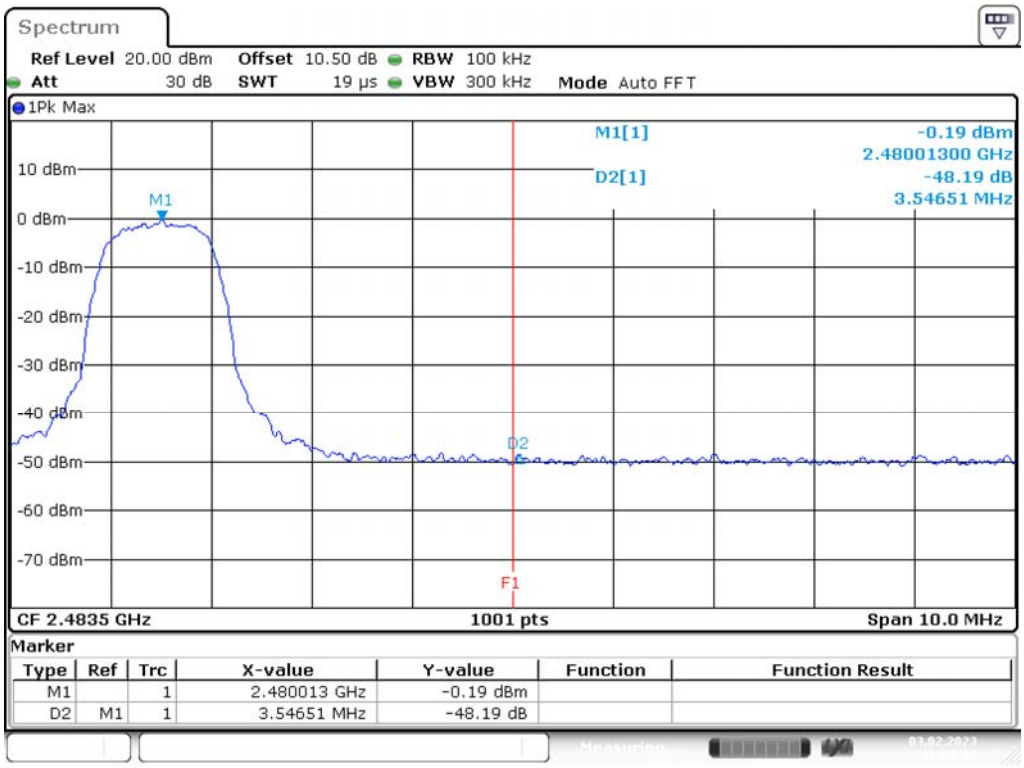
EDR Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 3.FEB.2023 11:01:26

Band Edge, CH High



Date: 3.FEB.2023 11:08:35

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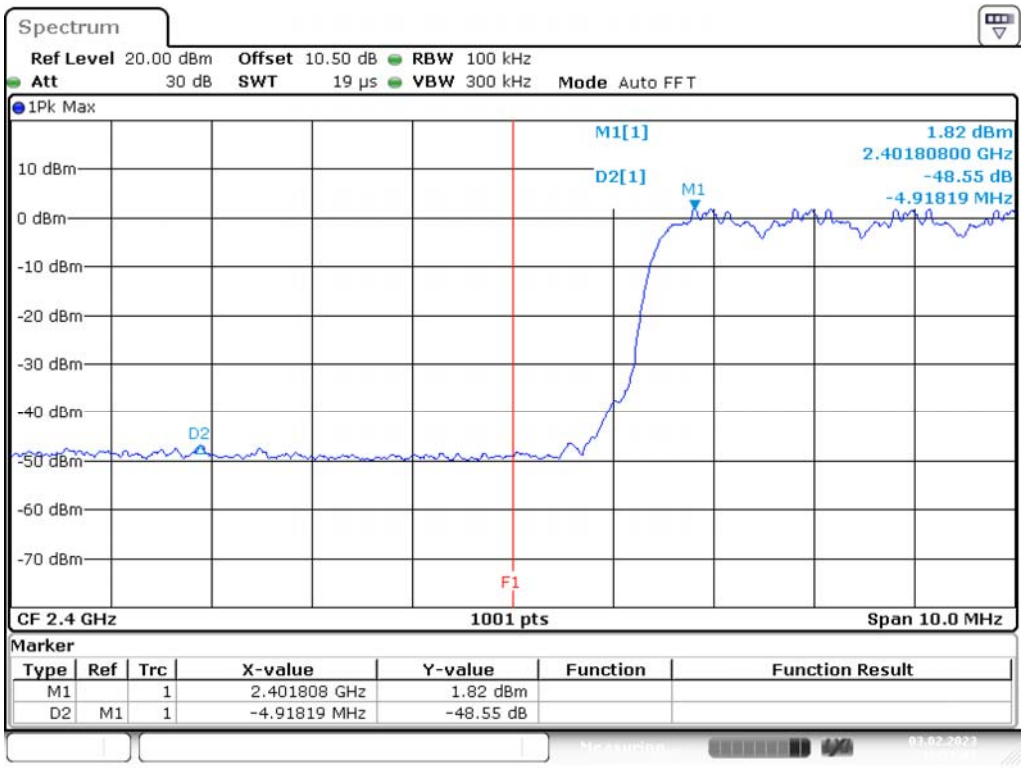
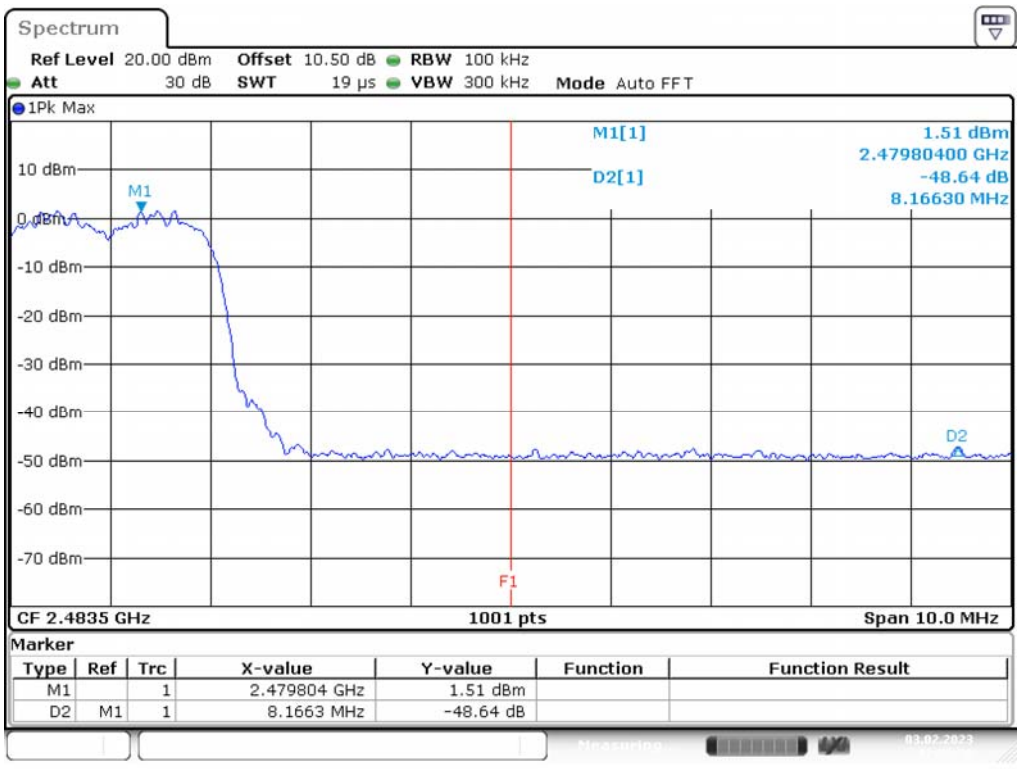
EDR Hopping Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 3.FEB.2023 12:51:07

Band Edge, CH High



Date: 3.FEB.2023 12:58:36

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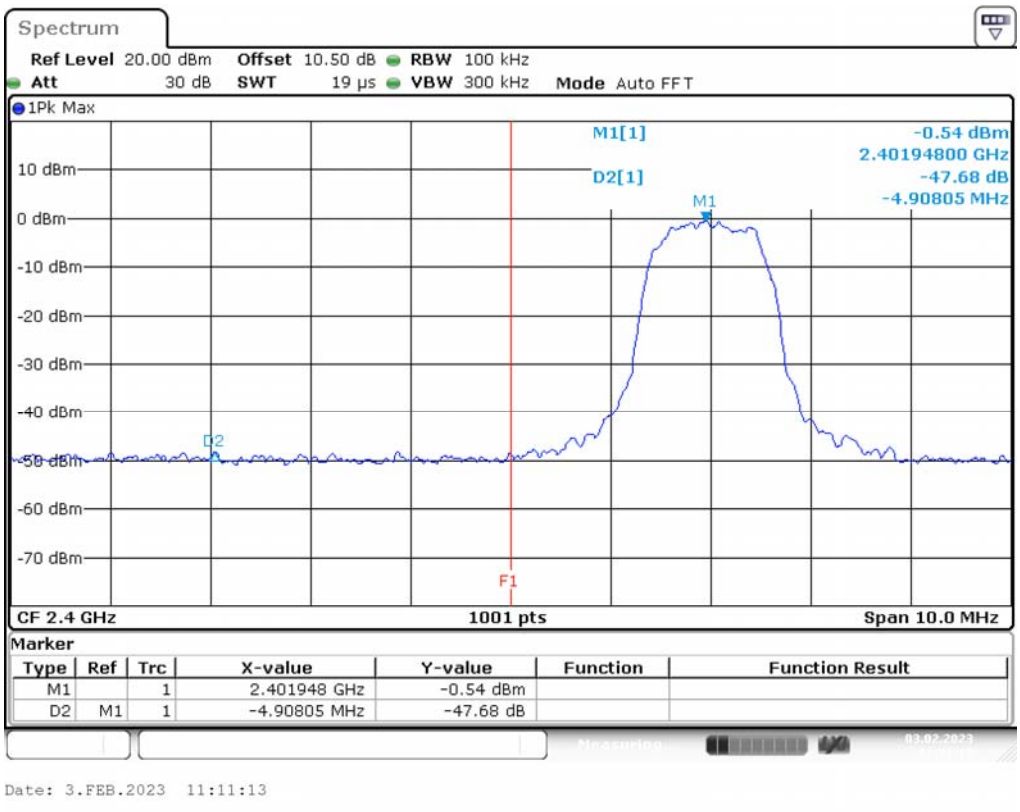
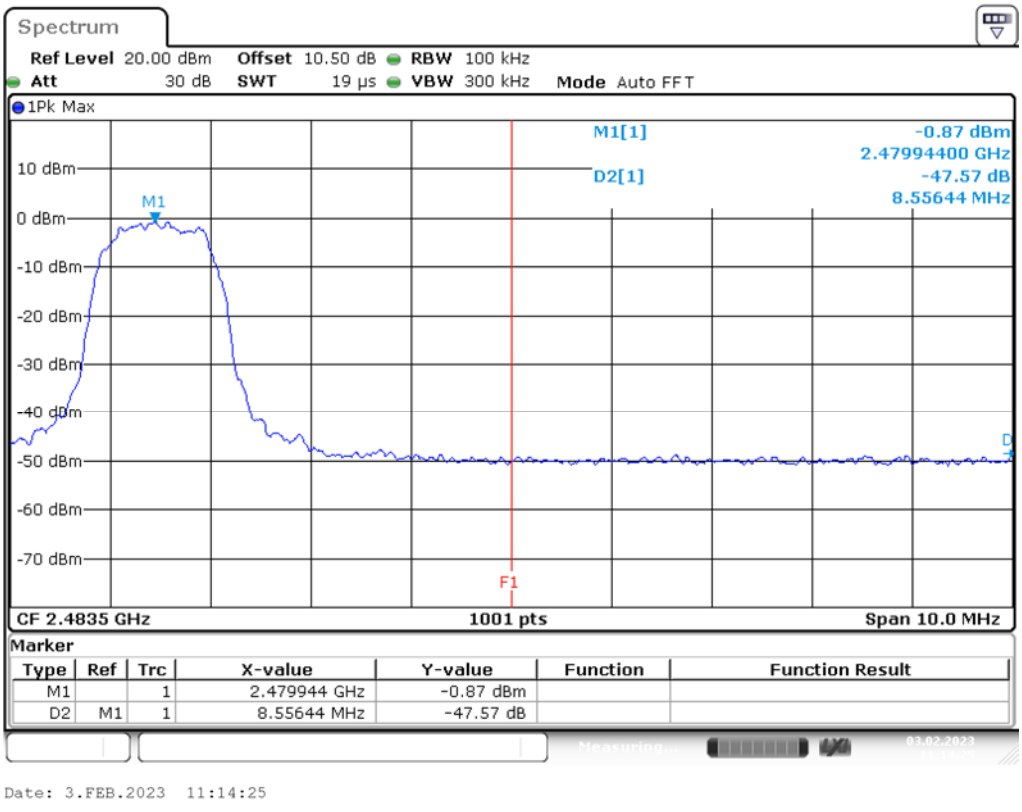
EDR Mode (8DPSK)

Band Edge, CH Low



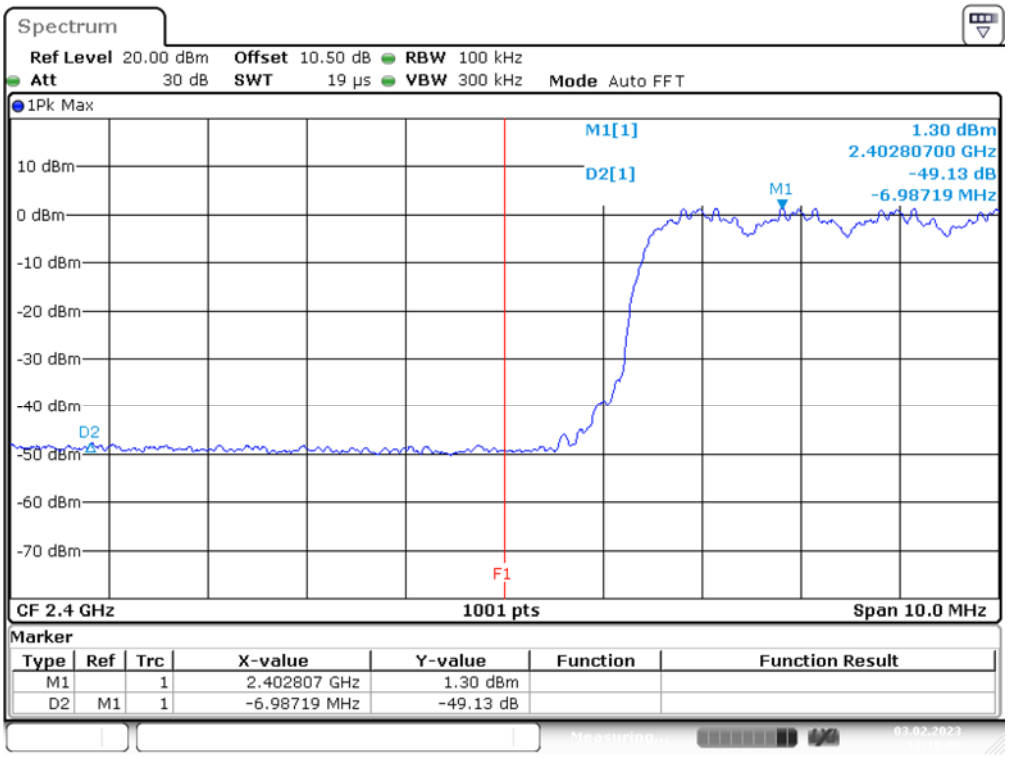
Band Edge, CH High



Note: It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)

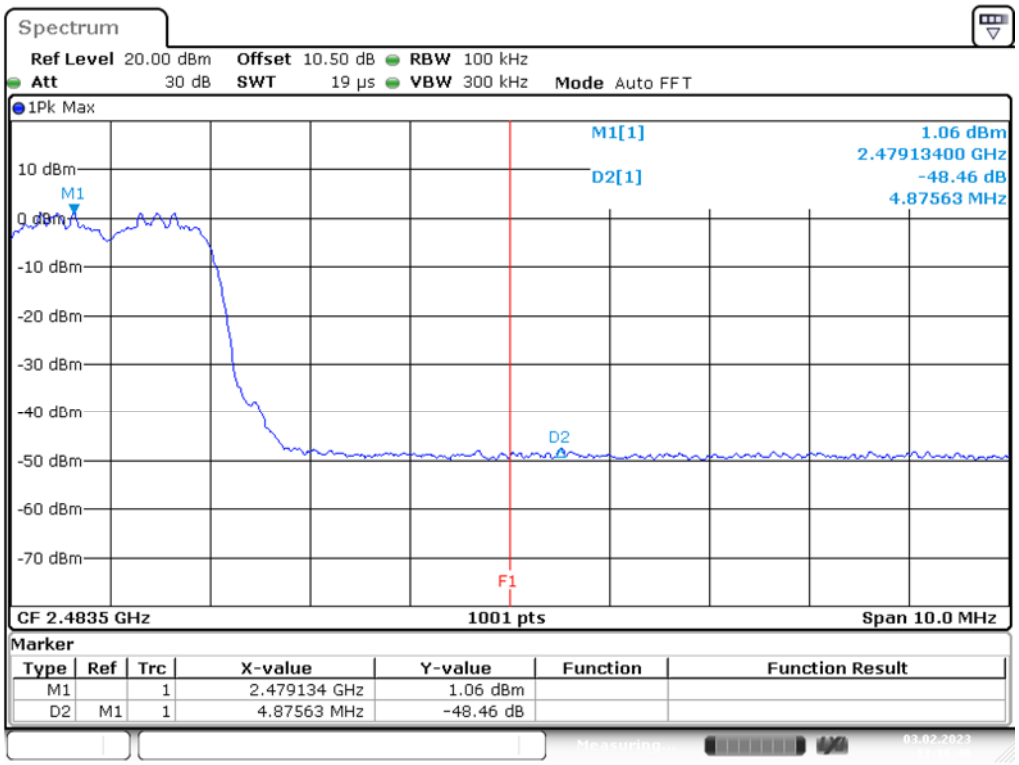
EDR Hopping Mode (8DPSK)

Band Edge, CH Low



Date: 3.FEB.2023 13:10:00

Band Edge, CH High



Date: 3.FEB.2023 13:16:40

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

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