FCC Part 15.247

TEST REPORT

For

Ten Tronics Co., Ltd

No. 33, Lane 347, Chung-San S.Road Young-Kang District,Tainan, 710 Taiwan

FCC ID: 2ACIA-TTBT013

Report Type: Original Report	**Product Type:** 30W Wall Plate Audio Amplifier with Qualcomm Bluetooth

Report Producer : Jojo Lu

Report Number : RXZ220107002RF01

Report Date : 2022-04-13

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ220107002	RXZ220107002RF01	2022-04-13	Original Report	Jojo Lu

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1. General Information

1.1. Product Description for Equipment under Test (EUT)

Applicant	Ten Tronics Co., Ltd
	No. 33, Lane 347, Chung-San S.Road Young-Kang District,Tainan, 710 **Taiwan**
Manufacturer	Ten Tronics Co., Ltd
	No. 33, Lane 347, Chung-San S.Road Young-Kang District,Tainan, 710 Taiwan
Brand(Trade) Name	N/A
Product (Equipment)	30W Wall Plate Audio Amplifier with Qualcomm Bluetooth
Main Model Name	A-1464WP
Series Model Name	A-1464WPA
Model Discrepancy	A-1464WP: with Micro USB Port A-1464WPA: no Micro USB port
Frequency Range	2402 ~ 2480 MHz
Conducted Peak Output Power	BR(GFSK) Mode: 3.79 dBm EDR(π/4-DQPSK) Mode: 1.57 dBm EDR(8DPSK) Mode: 2.16 dBm
Modulation Technique	BR Mode: GFSK EDR Mode: π/4-DQPSK, 8DPSK
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 Cable ☒ External DC Adapter 24V
	☐ Host System
Received Date	Jan 07, 2022
Date of Test	Feb 8, 2022 ~ Apr 12, 2022

*All measurement and test data in this report was gathered from production sample serial number: RXZ220107002-01 , RXZ220107002-04 (Assigned by BACL, New Taipei Laboratory).

1.2. Objective

This report is prepared on behalf of *Ten Tronics Co., Ltd* 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)

N/A.

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.
FCC 558074 D01 15.247 Meas Guidance v05r02.

1.5. Statement

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

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		+/- 0.93 dBm
Emissions Bandwidth		+/- 0.35 MHz
Unwanted Emissions, conducted		+/- 1.69 dBm
Emissions, radiated	30 MHz~1GHz	+/- 5.22 dB
	1 GHz~18 GHz	+/- 6.12 dB
	18 GHz~40 GHz	+/- 4.99 dB
Temperature		+/- 1.27 ℃
Humidity		+/- 3 %

1.7. Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2022/2/25	18.7	69	1010	Boris Kao
Radiation Spurious Emissions	2022/2/8~2022/3/18	19.8~25.5	54~69	1010	Aaron Pan
Conducted Spurious Emissions	2022/4/12	26	53	1010	Aaron Pan
20 dB Emission Bandwidth	2022/4/12	26	53	1010	Aaron Pan
Channel Separation Test	2022/4/12	26	53	1010	Aaron Pan
Time of Occupancy	2022/4/12	26	53	1010	Aaron Pan
Quantity of hopping channel	2022/4/12	26	53	1010	Aaron Pan
Maximum Output Power	2022/4/12	26	53	1010	Aaron Pan
100 kHz Bandwidth of Frequency Band Edge	2022/4/12	26	53	1010	Aaron Pan

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.

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 "BlueSuite_2_6_7_1408"

Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	Default	Default	Default
	π/4-DQPSK	Default	Default	Default
	8DPSK	Default	Default	Default

2.4. Test Mode

Pre-scan

AC Line Conducted Emissions and Radiated Spurious Emissions

Model 1: A-1464WP (Sample serial number: RXZ220107002-01).

Model 2: A-1464WPA (Sample serial number: RXZ220107002-04).

Worst case is the Model 1: A-1464WP.

Model 1: A-1464WP for all test item.

2.5. Support Equipment List and Details

Description	Manufacturer	Model Number	S/N
NB	DELL	E6410	8N7PXN1
NB Adapter	DELL	DA130PE1-00	JU012
EUT Adapter	TUE	T36-240150HU	N/A
Speaker	EDIFIER	R1850DB	N/A
IPod	Apple	A1320	YM0211EY71Y

2.6. External Cable List and Details

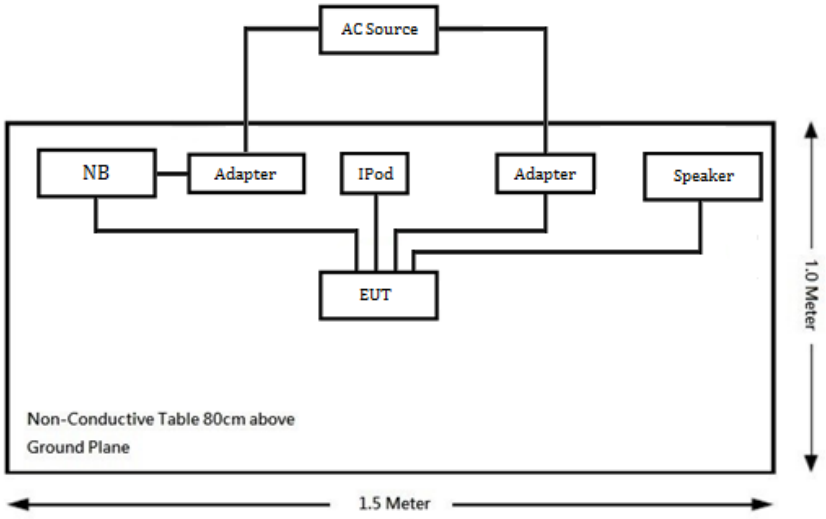
Cable Description	Length (m)	From	To
Micro USB Cable	1.5	EUT	NB
3.5mm Audio Cable	1	EUT	IPod
RCA Audio Cable	1.6	EUT	Speaker
Power cable	1.5	NB Adapter	AC Source

2.7. Block Diagram of Test Setup

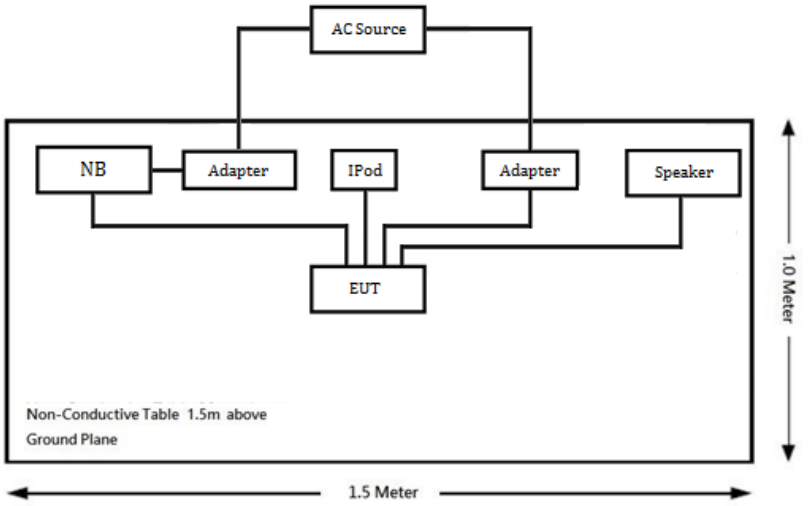
See test photographs attached in annex setup photos for the actual connections between EUT and support equipment.

Radiation:

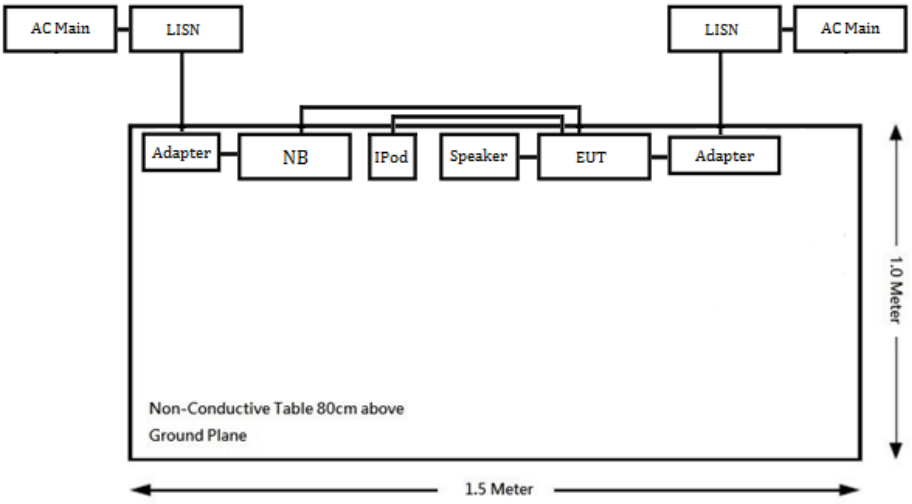
Below 1GHz:



Above 1GHz:



Conduction:



3. Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §1.1310,§2.1091	Maximum Permissible Exposure (MPE)	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

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	101612	2022/1/14	2023/1/13
LISN	Rohde & Schwarz	ENV216	101248	2021/6/8	2022/6/7
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2021/7/23	2022/7/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2021/7/29	2022/7/28
RF Cable	EMEC	EM-CB5D	1	2021/6/11	2022/6/10
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiated Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & EMEC	JB3 &EM-ATT6000-6-NN	A090816-2&ATT-09-003	2022/1/20	2023/1/19
Horn Antenna	EMCO	SAS-571	1020	2021/4/23	2022/4/22
Horn Antenna	ETS-Lindgren	3116	62638	2021/8/11	2022/8/10
Preamplifier	Sonoma	310N	130602	2021/6/8	2022/6/7
Preamplifier	A.H. system Inc.	PAM-0118P	466	2021/11/4	2022/11/3
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2021/12/27	2022/12/26
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2022/1/13	2023/1/12
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2021/11/9	2022/11/8
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2022/1/24	2023/1/23
Coaxial Cable	COMMATE	PEWC	8Dr	2021/12/24	2022/12/23
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2022/1/24	2023/1/23
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2021/12/24	2022/12/23
Cable	EMC	EMC105-SM-SM-10000	201003	2022/1/24	2023/1/23
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2022/1/24	2023/1/23

Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-50CM	15120-1	2022/1/18	2023/1/17
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101204	2021/6/10	2022/6/9
Cable	UTIFLEX	UFA210A	9435	2021/10/5	2022/10/4
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2022/1/24	2023/1/23
Attenuator	MINI-CIRCUITS	BW-S10W5+	1419	2022/2/11	2023/2/10

***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

5. FCC §15.247(i), §1.1310, § 2.1091 - Maximum Permissible Exposure (MPE)

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.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

5.2. RF Exposure Evaluation Result

MPE evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
BT	2402-2480	-2	0.631	4	2.512	20	0.0003	1

Result: MPE evaluation meets the requirements of the **20cm** standard.

6. FCC §15.203 – Antenna Requirements

6.1. Applicable Standard

According to § 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 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
Ten Tronics	TT-ANT01	PCB Antenna	-2 dBi

Result: Compliance

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

7.1. Applicable Standard

According to §15.207

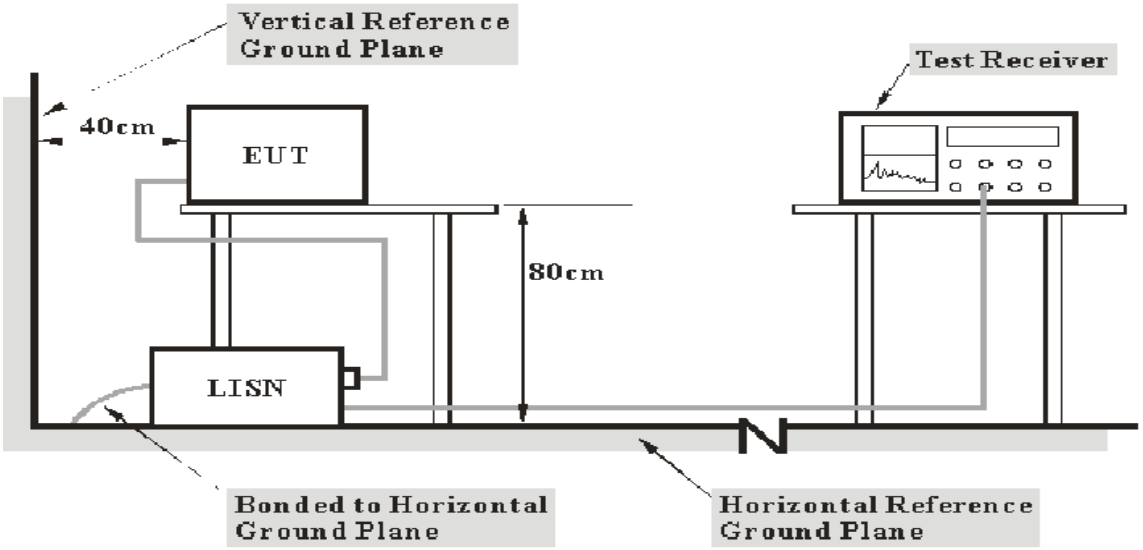
For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured 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

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:

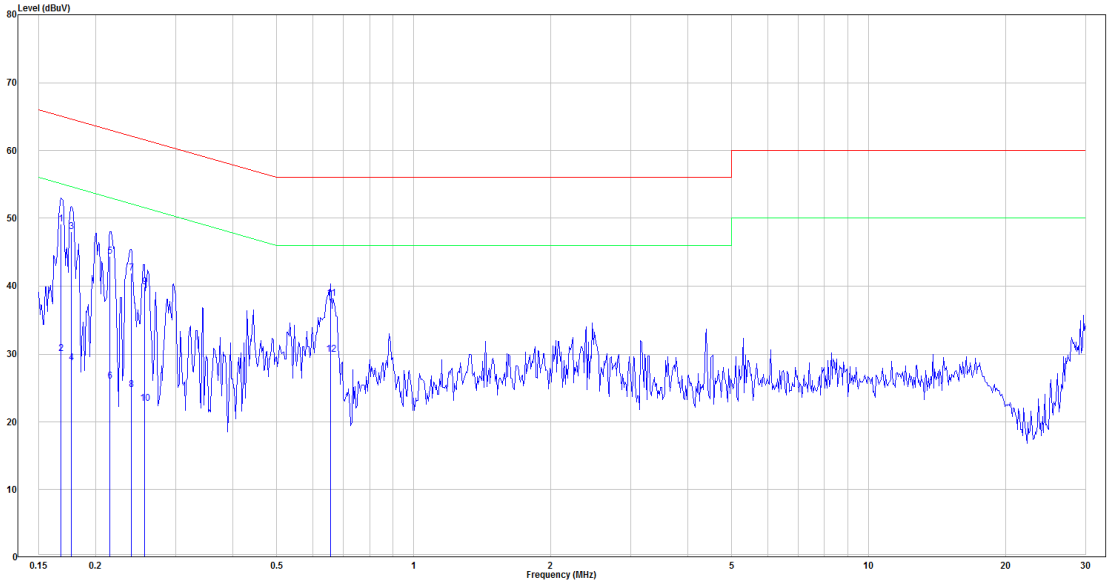
Over Limit = Level – Limit Line

7.6. Test Results

Test Mode: Transmitting

(worst case is BR (GFSK) mode high channel)

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.168	29.64	19.50	49.14	65.08	-15.94	QP
2	0.168	10.53	19.50	30.03	55.08	-25.05	Average
3	0.177	28.53	19.50	48.03	64.64	-16.61	QP
4	0.177	9.22	19.50	28.72	54.64	-25.92	Average
5	0.215	24.94	19.50	44.44	63.01	-18.57	QP
6	0.215	6.46	19.50	25.96	53.01	-27.05	Average
7	0.239	22.36	19.50	41.86	62.13	-20.27	QP
8	0.239	5.27	19.50	24.77	52.13	-27.36	Average
9	0.256	20.34	19.50	39.84	61.56	-21.72	QP
10	0.256	3.23	19.50	22.73	51.56	-28.83	Average
11	0.658	18.66	19.53	38.19	56.00	-17.81	QP
12	0.658	10.45	19.53	29.98	46.00	-16.02	Average

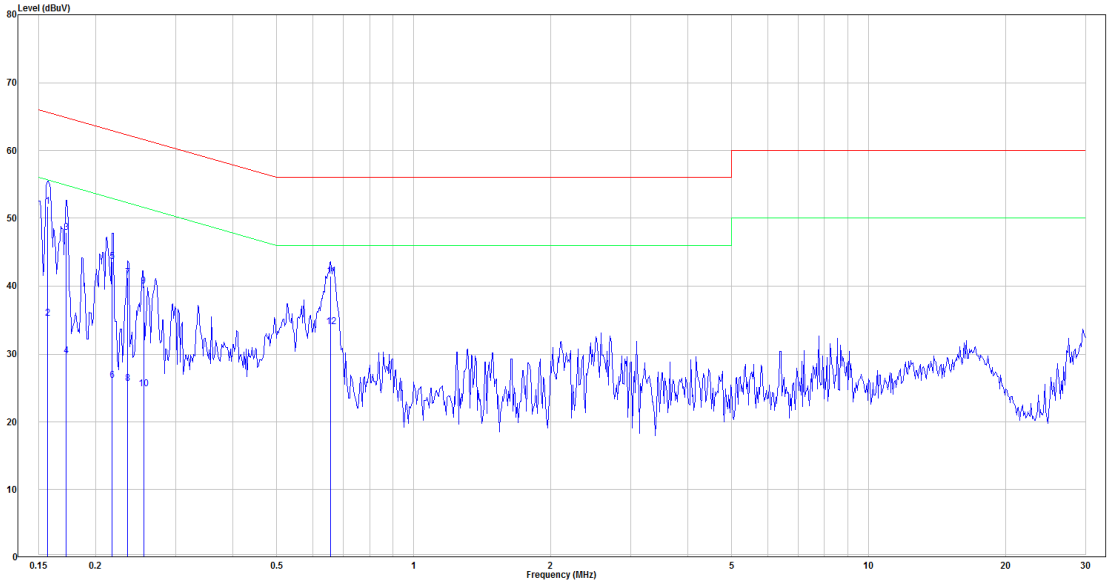
Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

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

Main: AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.156	32.20	19.50	51.70	65.65	-13.95	QP
2	0.156	15.78	19.50	35.28	55.65	-20.37	Average
3	0.172	28.36	19.50	47.86	64.86	-17.00	QP
4	0.172	10.18	19.50	29.68	54.86	-25.18	Average
5	0.217	24.10	19.49	43.59	62.92	-19.33	QP
6	0.217	6.66	19.49	26.15	52.92	-26.77	Average
7	0.235	21.78	19.49	41.27	62.26	-20.99	QP
8	0.235	6.13	19.49	25.62	52.26	-26.64	Average
9	0.255	20.53	19.50	40.03	61.60	-21.57	QP
10	0.255	5.33	19.50	24.83	51.60	-26.77	Average
11	0.658	21.97	19.52	41.49	56.00	-14.51	QP
12	0.658	14.46	19.52	33.98	46.00	-12.02	Average

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

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

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

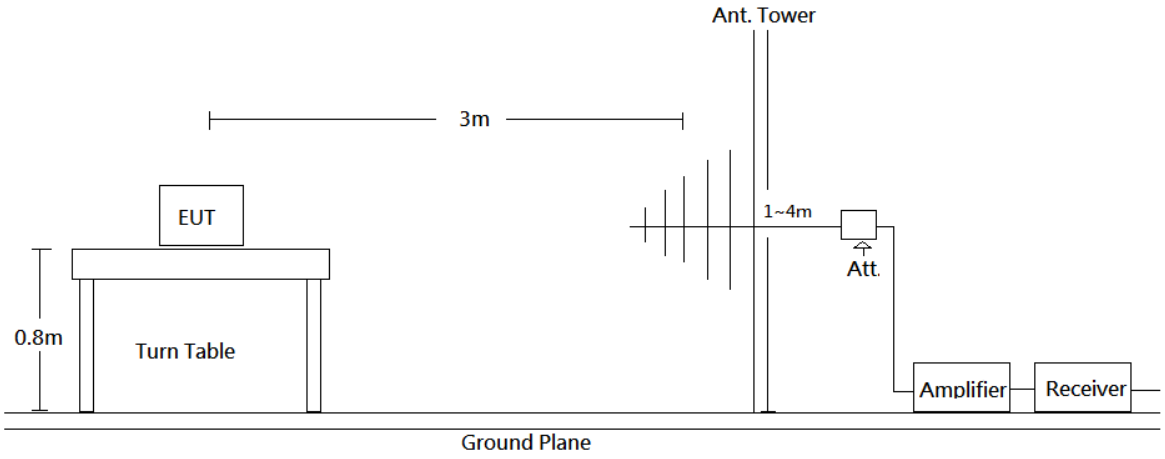
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this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

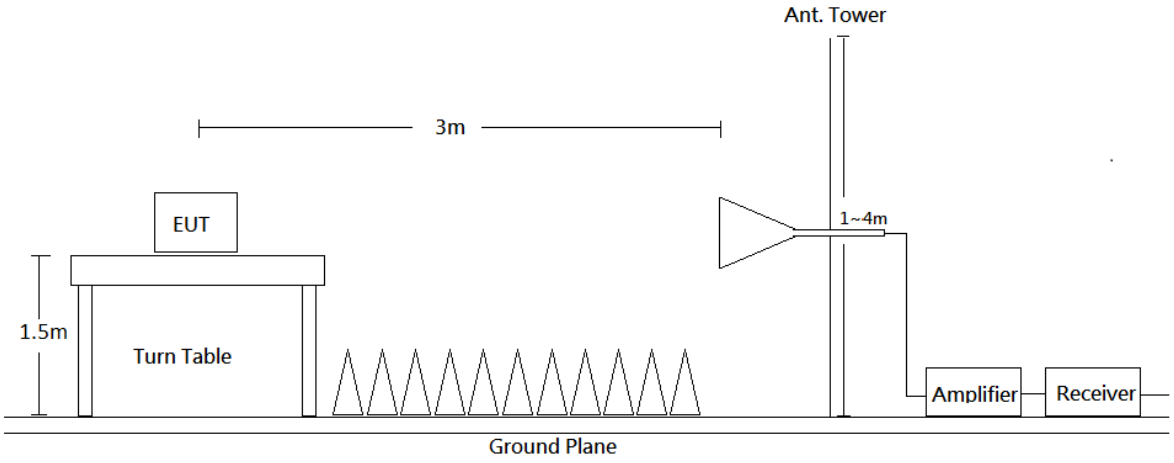
the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, 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.

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:

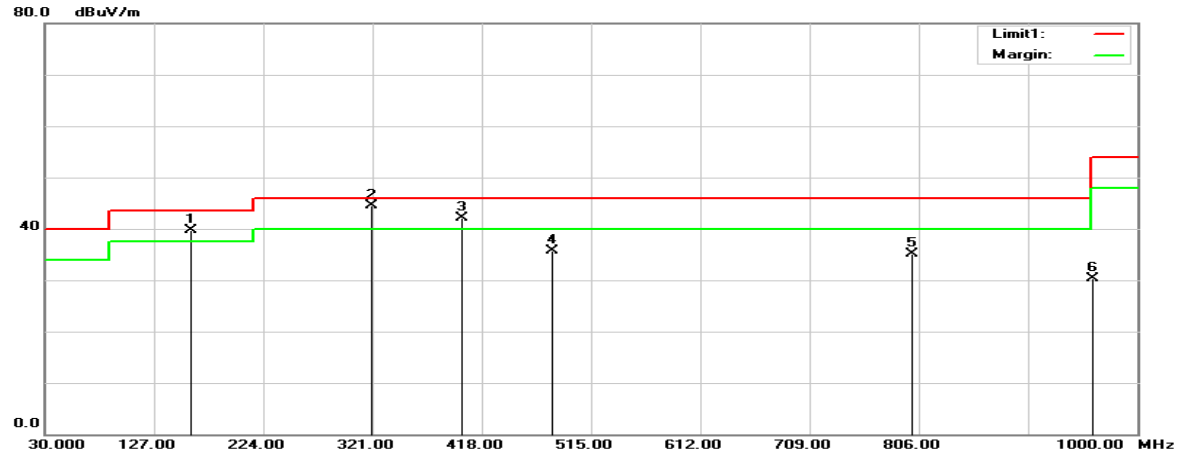
Margin = Result – Limit

8.6. Test Results

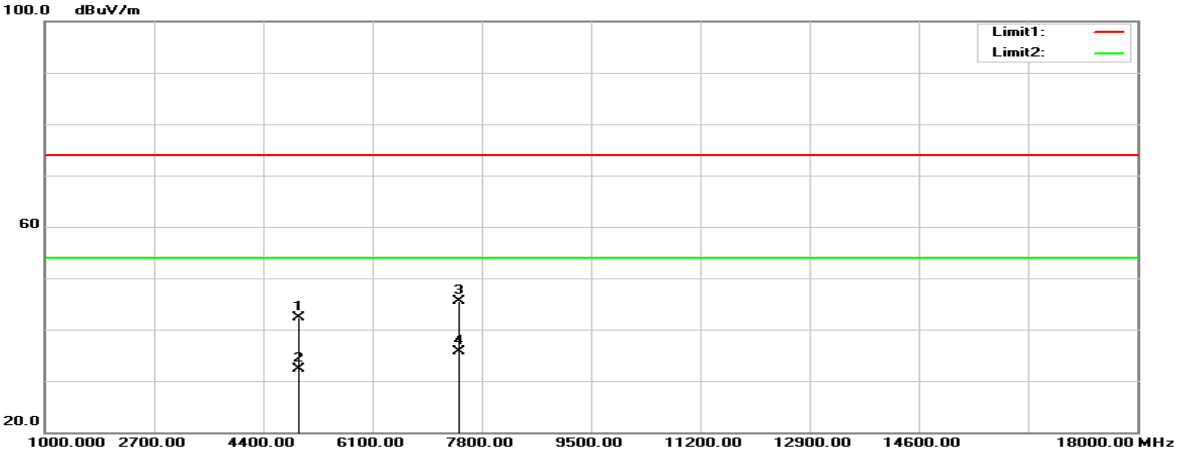
Test Mode: Transmitting (Pre-scan with three orthogonal axis, and worse case as X axis.)

Horizontal (worst case is BR (GFSK) mode high channel)

30MHz-1GHz:



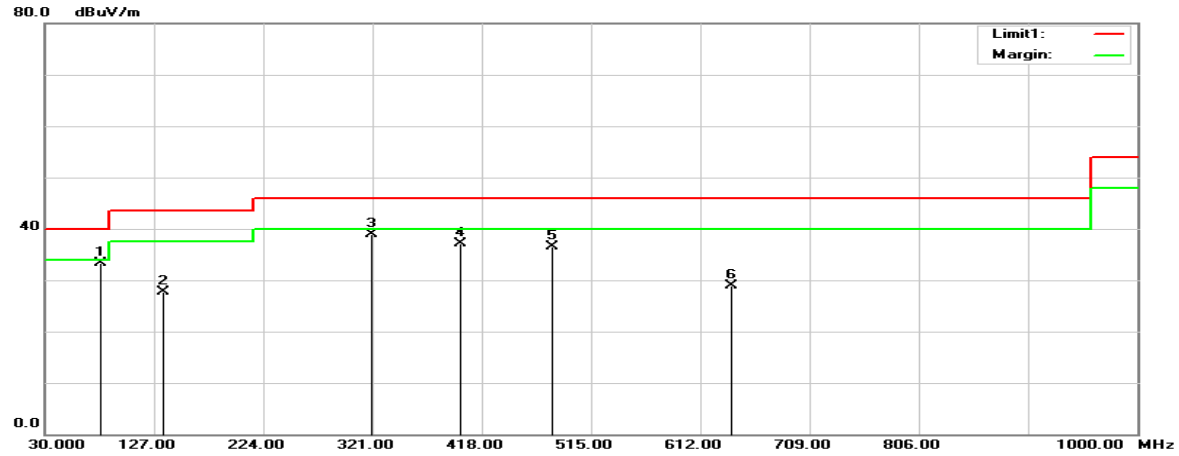
1GHz-18GHz:



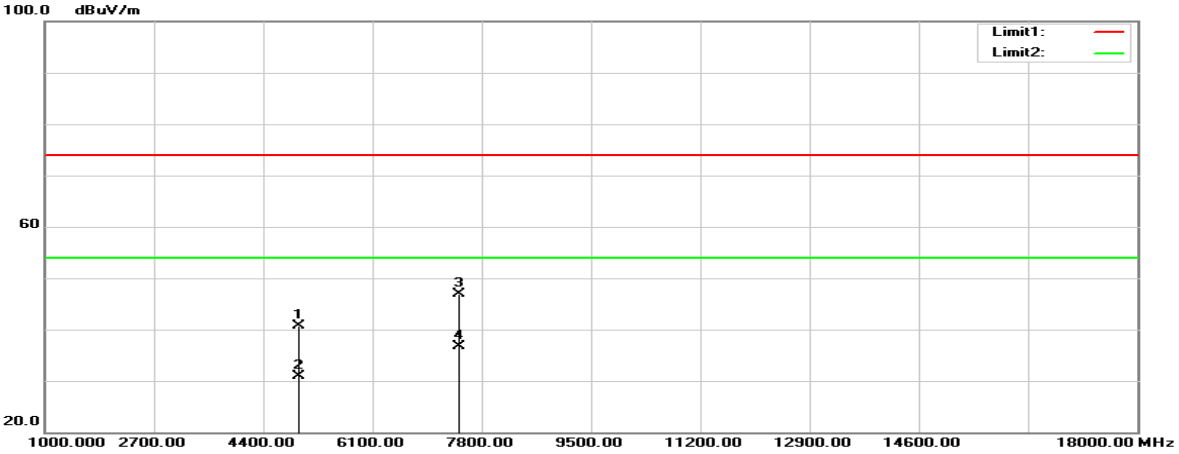
18GHz-26.5GHz:

Vertical worst case is BR (GFSK) mode high channel)

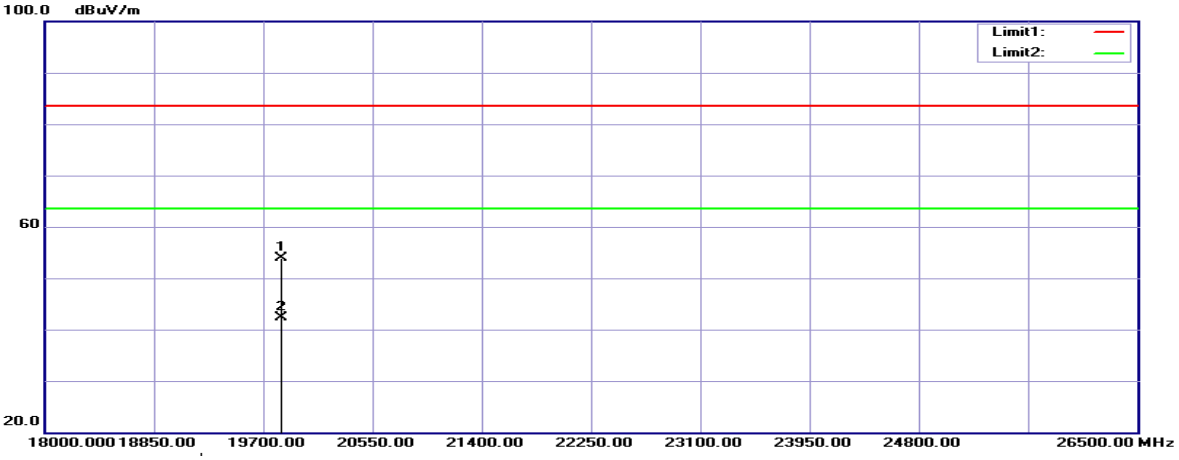
30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:



Below 1GHz

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
159.9800	50.80	-11.14	39.66	43.50	-3.84	100	99	peak
320.0300	54.21	-9.63	44.58	46.00	-1.42	100	126	QP
400.5400	49.98	-7.88	42.10	46.00	-3.90	100	158	peak
480.0800	41.61	-6.00	35.61	46.00	-10.39	100	356	peak
800.1800	36.06	-1.04	35.02	46.00	-10.98	100	145	peak
960.2300	27.93	2.35	30.28	54.00	-23.72	100	23	peak

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
79.4700	49.77	-16.42	33.35	40.00	-6.65	100	234	peak
135.7300	38.15	-10.49	27.66	43.50	-15.84	100	213	peak
320.0300	48.61	-9.63	38.98	46.00	-7.02	100	187	peak
399.5700	44.99	-7.89	37.10	46.00	-8.90	100	230	peak
480.0800	42.44	-6.00	36.44	46.00	-9.56	100	248	peak
640.1300	32.96	-4.04	28.92	46.00	-17.08	100	310	peak

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

Above 1GHz

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK), Low channel								
2365.300	55.65	-9.66	45.99	74.00	-28.01	166	271	peak
2365.300	42.83	-9.66	33.17	54.00	-20.83	166	271	AVG
4804.000	47.41	-2.17	45.24	74.00	-28.76	151	184	peak
4804.000	37.22	-2.17	35.05	54.00	-18.95	151	184	AVG
7206.000	43.06	4.18	47.24	74.00	-26.76	162	233	peak
7206.000	33.28	4.18	37.46	54.00	-16.54	162	233	AVG
BR (GFSK), Middle channel								
4882.000	42.58	-1.86	40.72	74.00	-33.28	166	177	peak
4882.000	32.66	-1.86	30.80	54.00	-23.20	166	177	AVG
7323.000	43.27	5.11	48.38	74.00	-25.62	151	321	peak
7323.000	33.48	5.11	38.59	54.00	-15.41	151	321	AVG
BR (GFSK), High channel								
2486.800	55.94	-8.40	47.54	74.00	-26.46	141	267	peak
2486.800	43.45	-8.40	35.05	54.00	-18.95	141	267	AVG
4960.000	43.88	-1.49	42.39	74.00	-31.61	154	90	peak
4960.000	33.75	-1.49	32.26	54.00	-21.74	154	90	AVG
7440.000	40.25	5.23	45.48	74.00	-28.52	166	145	peak
7440.000	30.38	5.23	35.61	54.00	-18.39	166	145	AVG

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

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK), Low channel								
2347.400	55.84	-9.80	46.04	74.00	-27.96	150	0	peak
2347.400	42.55	-9.80	32.75	54.00	-21.25	150	0	AVG
4804.000	49.23	-2.17	47.06	74.00	-26.94	166	322	peak
4804.000	39.28	-2.17	37.11	54.00	-16.89	166	322	AVG
7206.000	43.53	4.18	47.71	74.00	-26.29	153	154	peak
7206.000	33.45	4.18	37.63	54.00	-16.37	153	154	AVG
BR (GFSK), Middle channel								
4882.000	41.97	-1.86	40.11	74.00	-33.89	166	251	peak
4882.000	31.88	-1.86	30.02	54.00	-23.98	166	251	AVG
7323.000	40.57	5.11	45.68	74.00	-28.32	154	148	peak
7323.000	30.45	5.11	35.56	54.00	-18.44	154	148	AVG
BR (GFSK), High channel								
2487.280	56.32	-8.39	47.93	74.00	-26.07	182	36	peak
2487.280	42.00	-8.39	33.61	54.00	-20.39	182	36	AVG
4960.000	42.19	-1.49	40.70	74.00	-33.30	156	211	peak
4960.000	32.33	-1.49	30.84	54.00	-23.16	156	211	AVG
7440.000	41.67	5.23	46.90	74.00	-27.10	139	134	peak
7440.000	31.54	5.23	36.77	54.00	-17.23	139	134	AVG

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

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (π/4-DQPSK), Low channel								
2378.500	55.45	-9.55	45.90	74.00	-28.10	157	274	peak
2378.500	42.63	-9.55	33.08	54.00	-20.92	157	274	AVG
4804.000	43.45	-2.17	41.28	74.00	-32.72	166	133	peak
4804.000	33.57	-2.17	31.40	54.00	-22.60	166	133	AVG
7206.000	41.84	4.18	46.02	74.00	-27.98	151	215	peak
7206.000	31.65	4.18	35.83	54.00	-18.17	151	215	AVG
EDR (π/4-DQPSK), Middle channel								
4882.000	41.08	-1.86	39.22	74.00	-34.78	161	117	peak
4882.000	31.22	-1.86	29.36	54.00	-24.64	161	117	AVG
7323.000	42.05	5.11	47.16	74.00	-26.84	154	218	peak
7323.000	32.28	5.11	37.39	54.00	-16.61	154	218	AVG
EDR (π/4-DQPSK), High channel								
2483.500	56.98	-8.45	48.53	74.00	-25.47	142	243	peak
2483.500	43.33	-8.45	34.88	54.00	-19.12	142	243	AVG
4960.000	44.09	-1.49	42.60	74.00	-31.40	159	228	peak
4960.000	34.25	-1.49	32.76	54.00	-21.24	159	228	AVG
7440.000	40.85	5.23	46.08	74.00	-27.92	161	324	peak
7440.000	30.54	5.23	35.77	54.00	-18.23	161	324	AVG

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

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (π/4-DQPSK), Low channel								
2342.700	56.64	-9.80	46.84	74.00	-27.16	127	360	peak
2342.700	42.56	-9.80	32.76	54.00	-21.24	127	360	AVG
4804.000	44.03	-2.17	41.86	74.00	-32.14	155	218	peak
4804.000	34.55	-2.17	32.38	54.00	-21.62	155	218	AVG
7206.000	41.74	4.18	45.92	74.00	-28.08	138	146	peak
7206.000	31.58	4.18	35.76	54.00	-18.24	138	146	AVG
EDR (π/4-DQPSK), Middle channel								
4882.000	41.41	-1.86	39.55	74.00	-34.45	166	258	peak
4882.000	31.55	-1.86	29.69	54.00	-24.31	166	258	AVG
7323.000	41.02	5.11	46.13	74.00	-27.87	158	187	peak
7323.000	31.46	5.11	36.57	54.00	-17.43	158	187	AVG
EDR (π/4-DQPSK), High channel								
2488.630	56.26	-8.38	47.88	74.00	-26.12	125	355	peak
2488.630	42.00	-8.38	33.62	54.00	-20.38	125	355	AVG
4960.000	42.05	-1.49	40.56	74.00	-33.44	145	138	peak
4960.000	32.55	-1.49	31.06	54.00	-22.94	145	138	AVG
7440.000	40.74	5.23	45.97	74.00	-28.03	156	211	peak
7440.000	30.68	5.23	35.91	54.00	-18.09	156	211	AVG

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

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (8DPSK), Low channel								
2347.800	57.12	-9.80	47.32	74.00	-26.68	166	274	peak
2347.800	42.99	-9.80	33.19	54.00	-20.81	166	274	AVG
4804.000	43.73	-2.17	41.56	74.00	-32.44	162	228	peak
4804.000	33.54	-2.17	31.37	54.00	-22.63	162	228	AVG
7206.000	41.55	4.18	45.73	74.00	-28.27	153	345	peak
7206.000	31.75	4.18	35.93	54.00	-18.07	153	345	AVG
EDR (8DPSK), Middle channel								
4882.000	42.43	-1.86	40.57	74.00	-33.43	166	213	peak
4882.000	32.55	-1.86	30.69	54.00	-23.31	166	213	AVG
7323.000	42.02	5.11	47.13	74.00	-26.87	154	312	peak
7323.000	32.41	5.11	37.52	54.00	-16.48	154	312	AVG
EDR (8DPSK), High channel								
2483.500	57.53	-8.45	49.08	74.00	-24.92	138	243	peak
2483.500	43.78	-8.45	35.33	54.00	-18.67	138	243	AVG
4960.000	42.55	-1.49	41.06	74.00	-32.94	167	157	peak
4960.000	32.45	-1.49	30.96	54.00	-23.04	167	157	AVG
7440.000	42.38	5.23	47.61	74.00	-26.39	158	214	peak
7440.000	32.28	5.23	37.51	54.00	-16.49	158	214	AVG

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

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (8DPSK), Low channel								
2377.900	56.09	-9.56	46.53	74.00	-27.47	126	353	peak
2377.900	42.55	-9.56	32.99	54.00	-21.01	126	353	AVG
4804.000	41.91	-2.17	39.74	74.00	-34.26	145	148	peak
4804.000	31.82	-2.17	29.65	54.00	-24.35	145	148	AVG
7206.000	40.61	4.18	44.79	74.00	-29.21	164	233	peak
7206.000	30.54	4.18	34.72	54.00	-19.28	164	233	AVG
EDR (8DPSK), Middle channel								
4882.000	43.59	-1.86	41.73	74.00	-32.27	145	189	peak
4882.000	33.45	-1.86	31.59	54.00	-22.41	145	189	AVG
7323.000	40.93	5.11	46.04	74.00	-27.96	166	213	peak
7323.000	30.61	5.11	35.72	54.00	-18.28	166	213	AVG
EDR (8DPSK), High channel								
2488.060	56.72	-8.38	48.34	74.00	-25.66	127	353	peak
2488.060	42.04	-8.38	33.66	54.00	-20.34	127	353	AVG
4960.000	43.20	-1.49	41.71	74.00	-32.29	138	215	peak
4960.000	33.15	-1.49	31.66	54.00	-22.34	138	215	AVG
7440.000	40.14	5.23	45.37	74.00	-28.63	146	145	peak
7440.000	30.28	5.23	35.51	54.00	-18.49	146	145	AVG

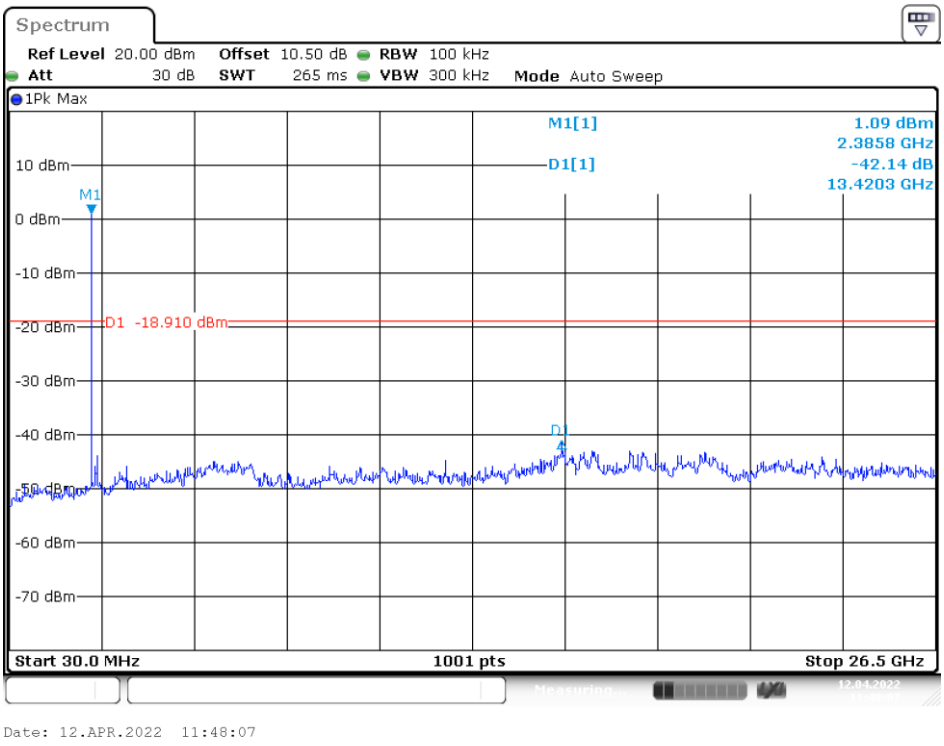
Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

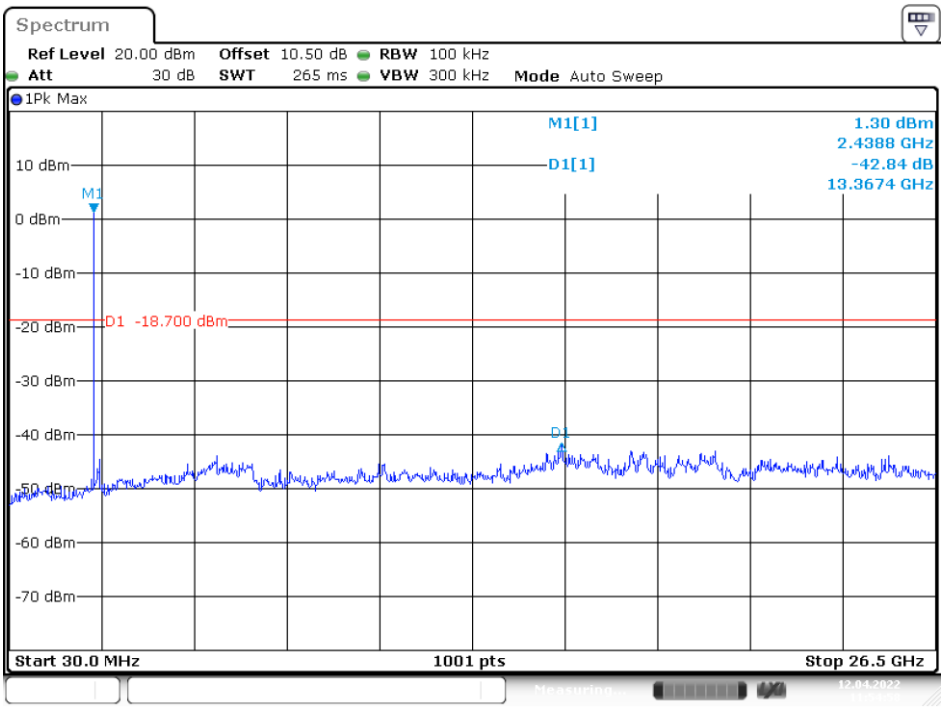
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	42.14	≥ 20	PASS
Middle	2441	42.84	≥ 20	PASS
High	2480	42.74	≥ 20	PASS
EDR Mode (π/4-DQPSK):				
Low	2402	40.27	≥ 20	PASS
Middle	2441	38.42	≥ 20	PASS
High	2480	37.38	≥ 20	PASS
EDR Mode (8DPSK):				
Low	2402	38.53	≥ 20	PASS
Middle	2441	40.99	≥ 20	PASS
High	2480	35.54	≥ 20	PASS

BR Mode (GFSK)

Low Channel



Middle Channel



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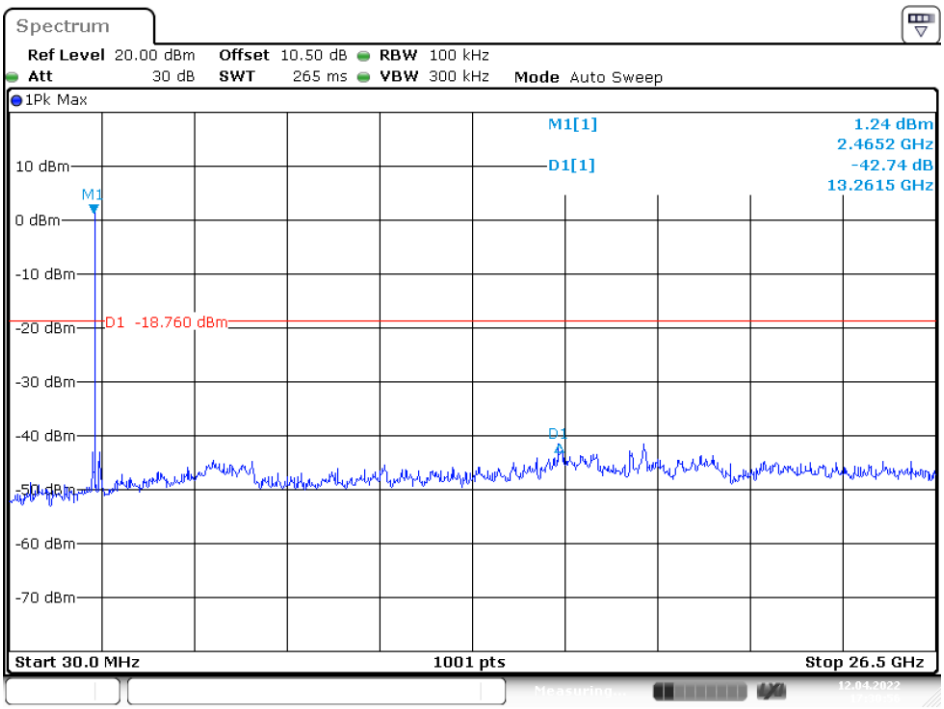
High Channel



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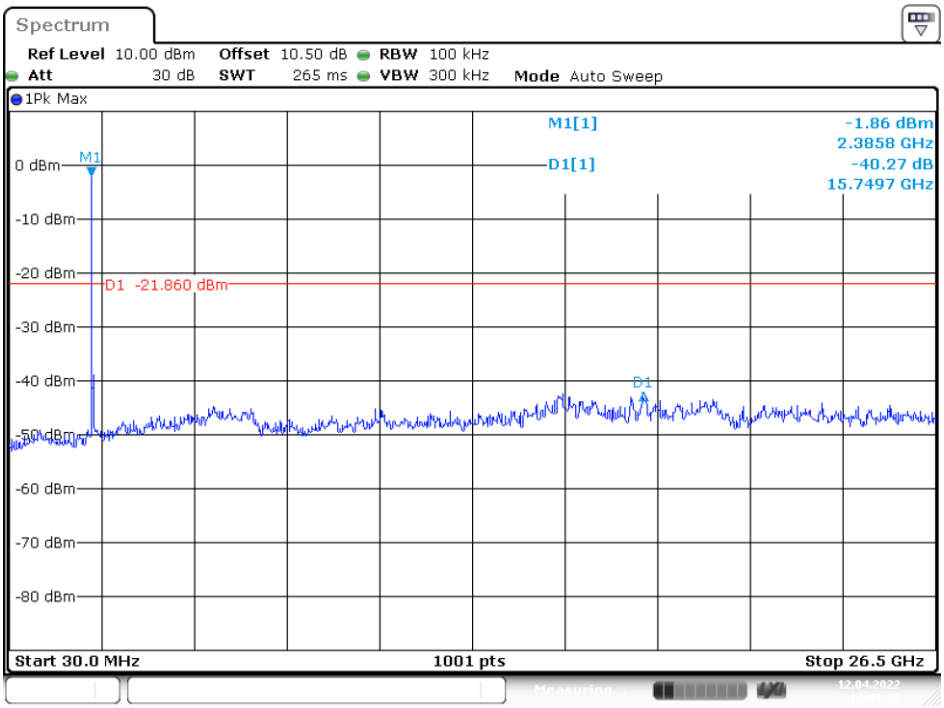
EDR Mode (π/4-DQPSK)

Low Channel



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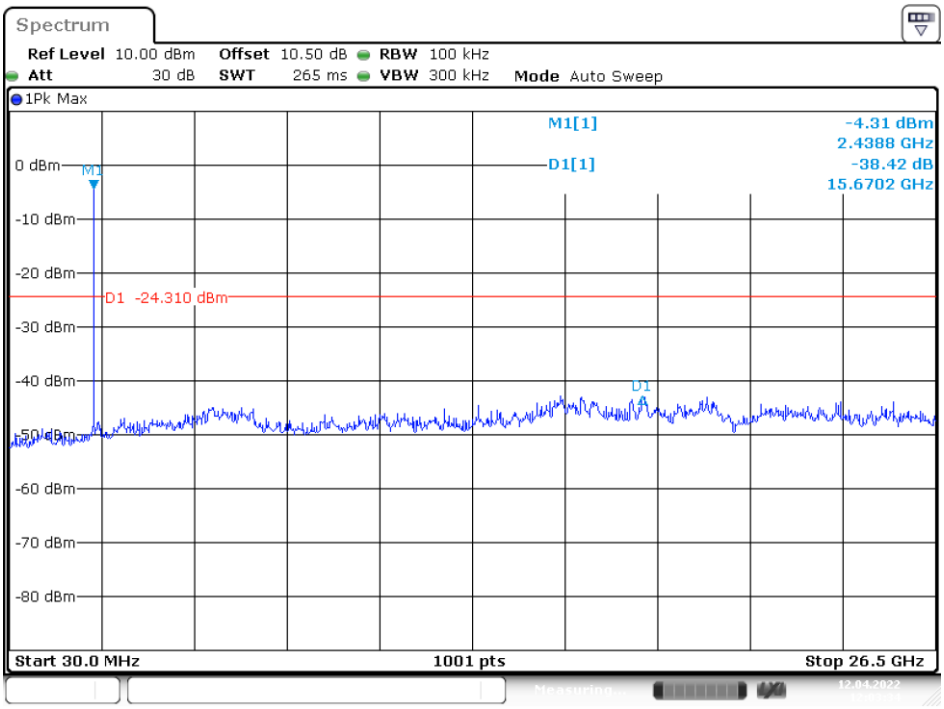
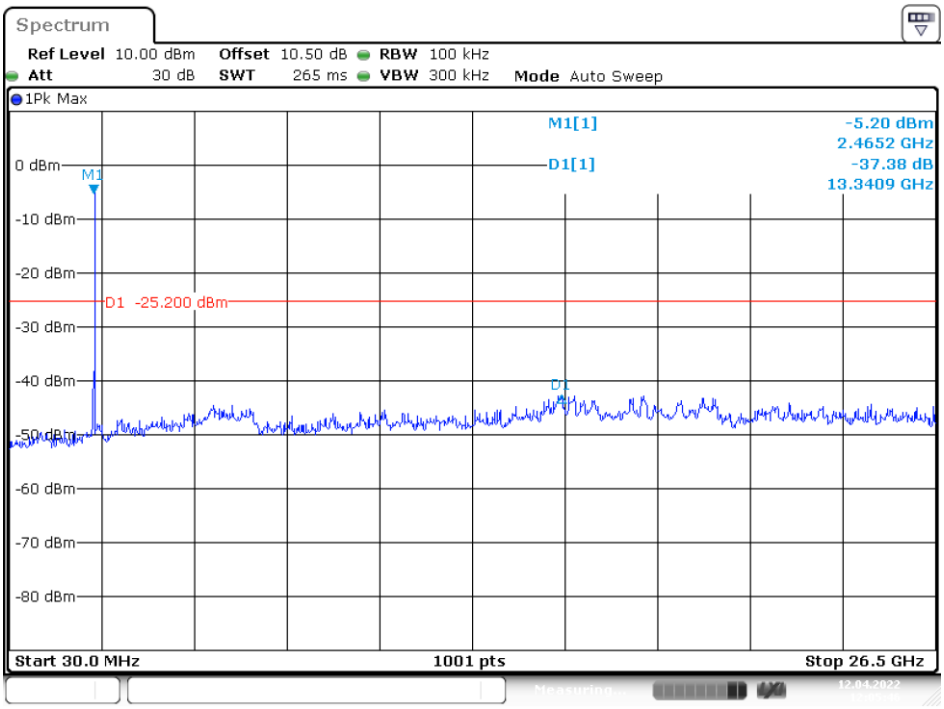
Middle Channel



Date: 12.APR.2022 12:03:34

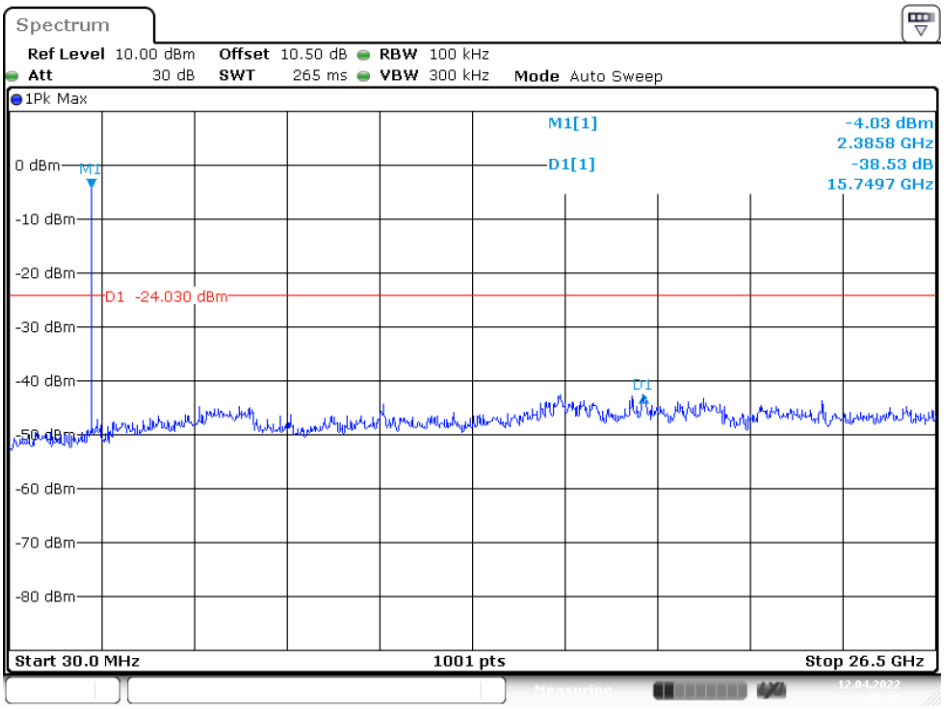
High Channel



Date: 12.APR.2022 12:05:46

EDR Mode (8DPSK)

Low Channel



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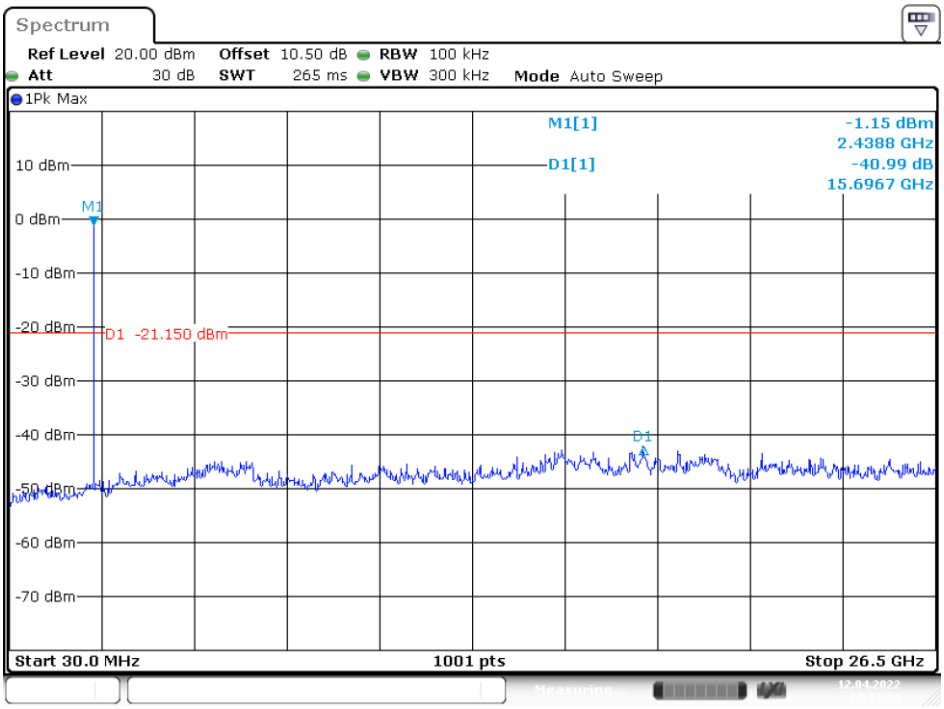
Middle Channel



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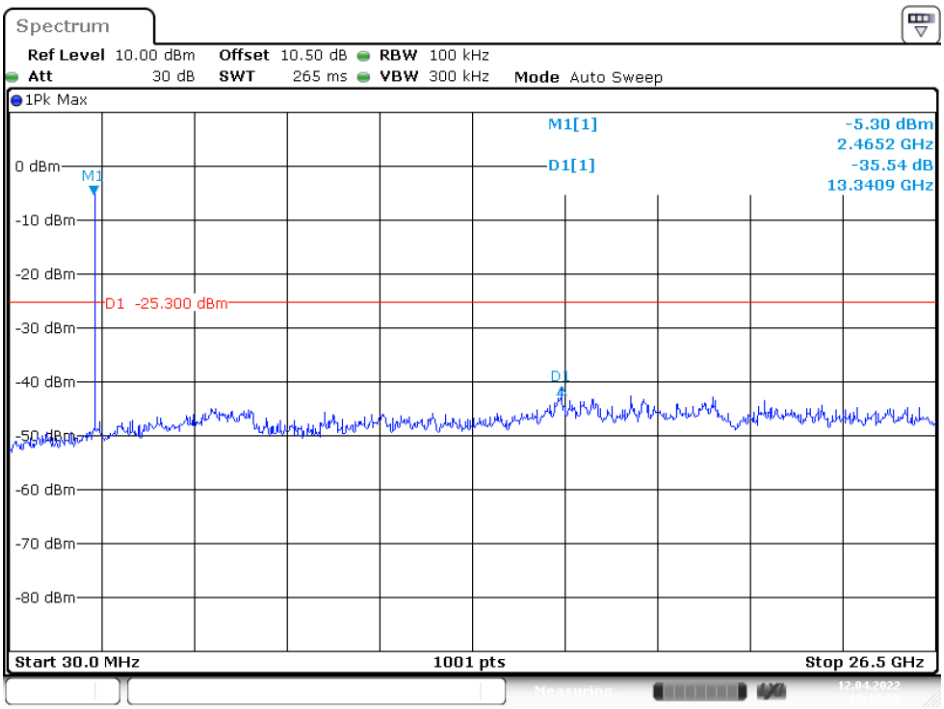
High Channel



Date: 12.APR.2022 12:15:56

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

(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.

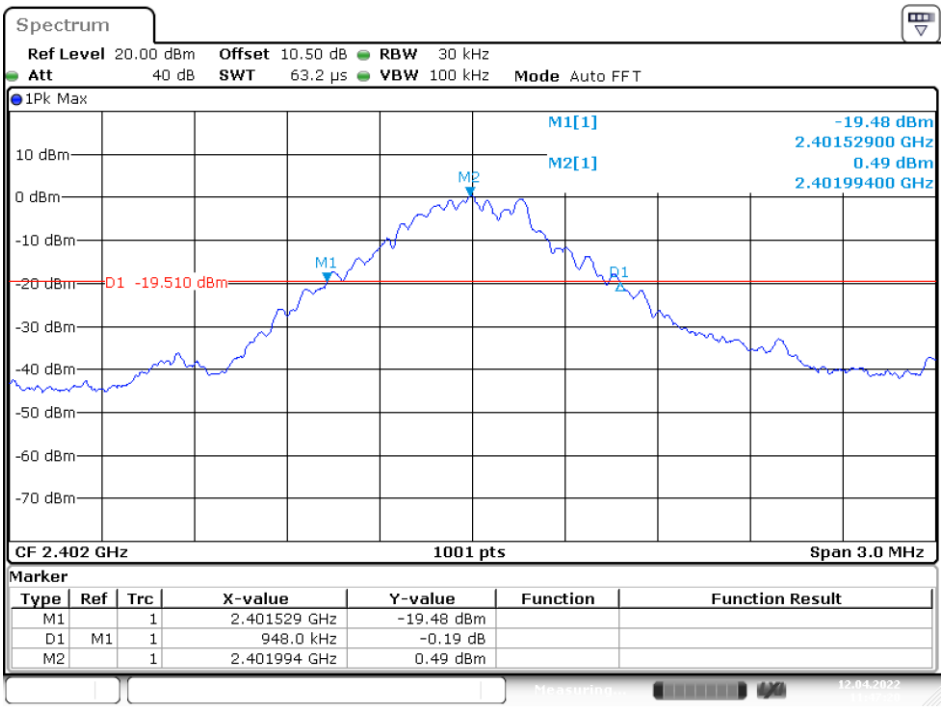
9.3. Test Results

Channel	Frequency (MHz)	20 dBc BW (MHz)
BR Mode (GFSK)		
Low	2402	0.95
Middle	2441	0.95
High	2480	0.95
EDR Mode (π/4-DQPSK)		
Low	2402	1.27
Middle	2441	1.25
High	2480	1.26
EDR Mode (8DPSK)		
Low	2402	1.26
Middle	2441	1.27
High	2480	1.27

Please refer to the following plots

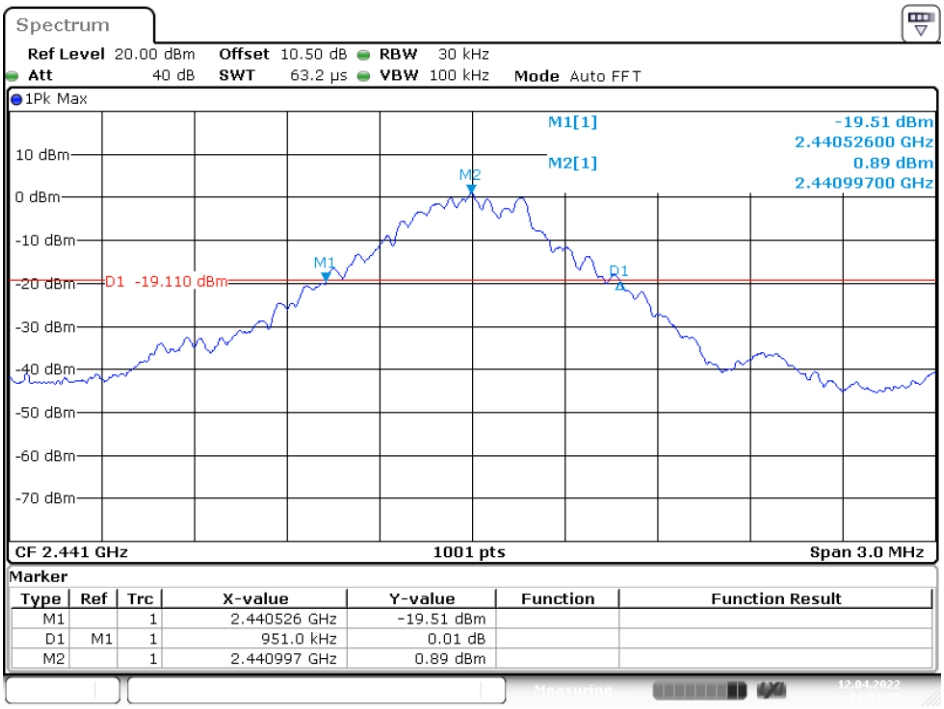
BR Mode (GFSK)

Low Channel



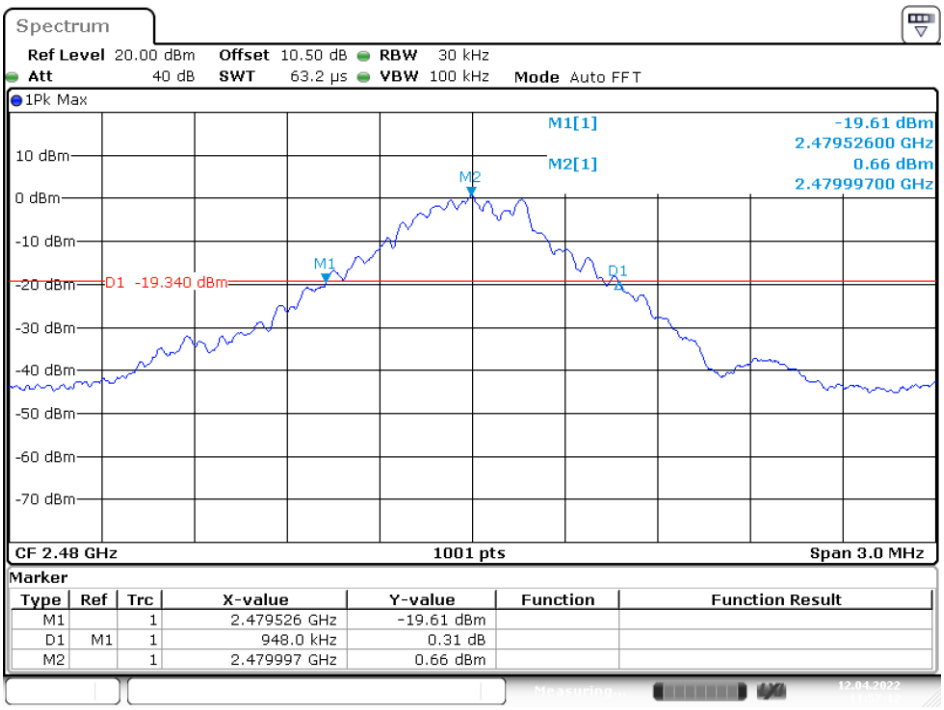
Date: 12.APR.2022 11:47:21

Middle Channel



Date: 12.APR.2022 11:54:27

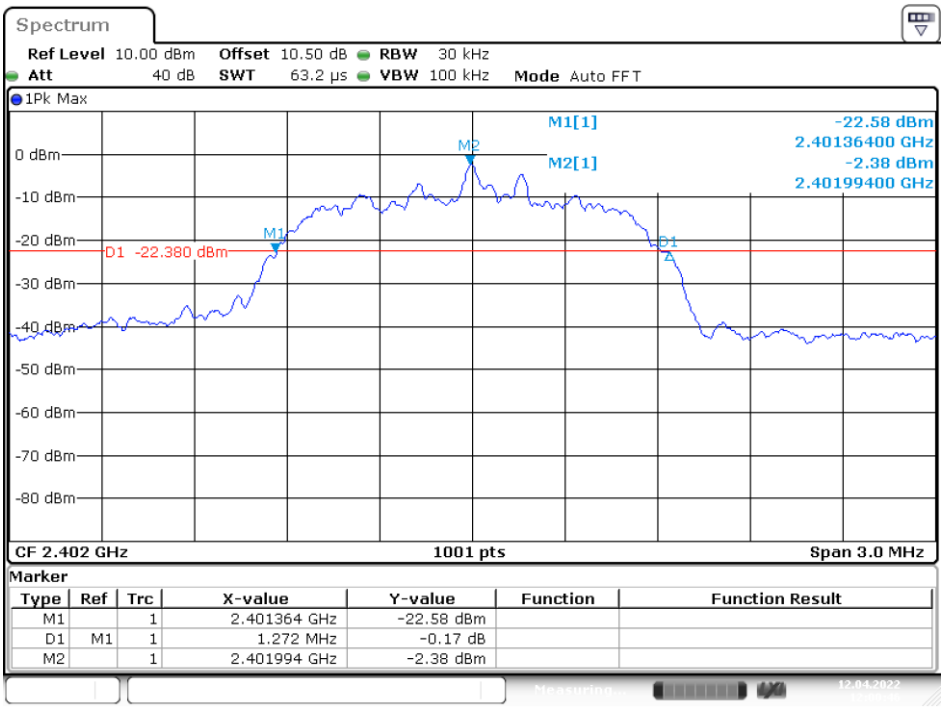
High Channel



Date: 12.APR.2022 11:57:12

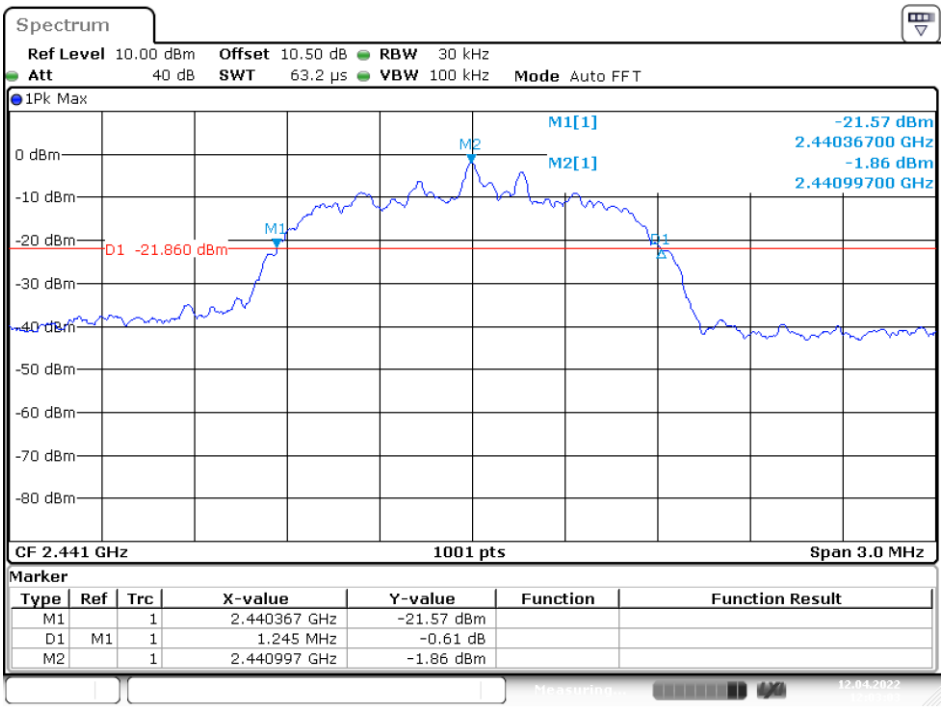
EDR Mode (π/4-DQPSK)

Low Channel



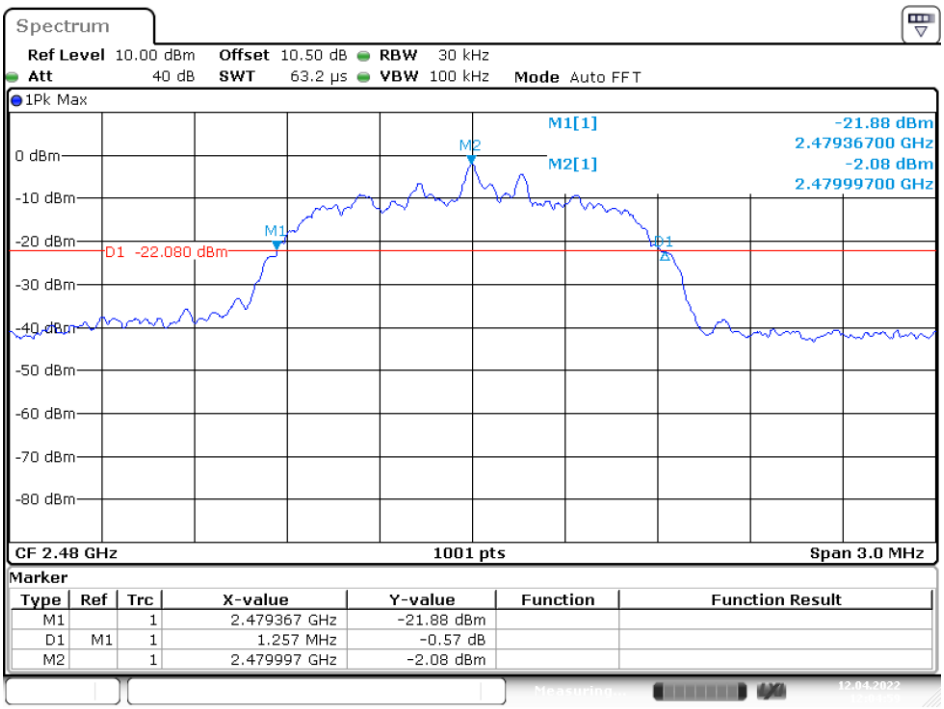
Date: 12.APR.2022 12:00:46

Middle Channel



Date: 12.APR.2022 12:03:03

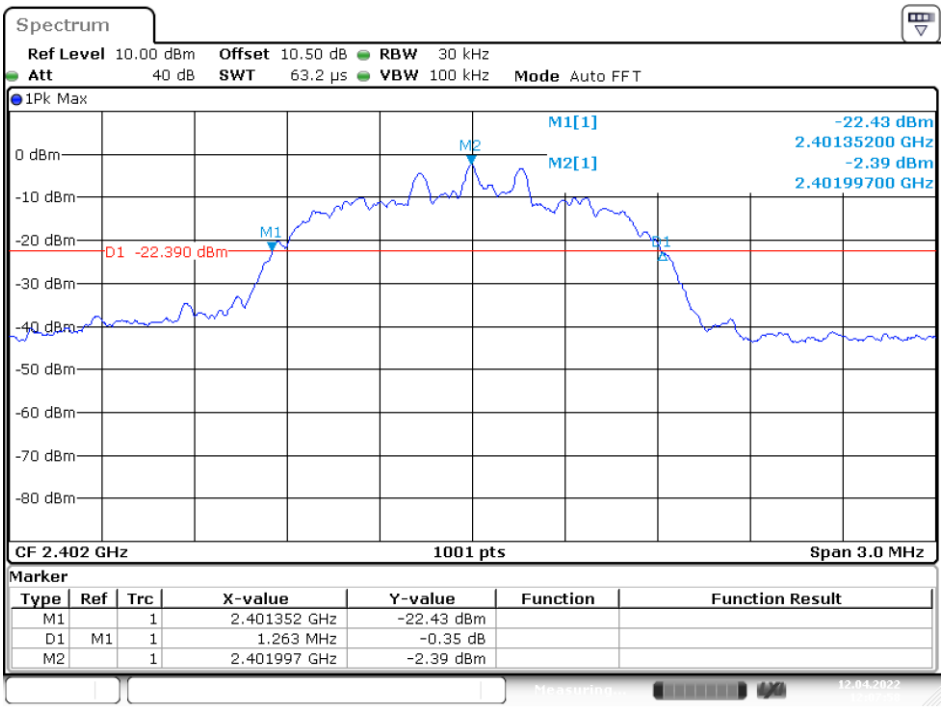
High Channel



Date: 12.APR.2022 12:04:59

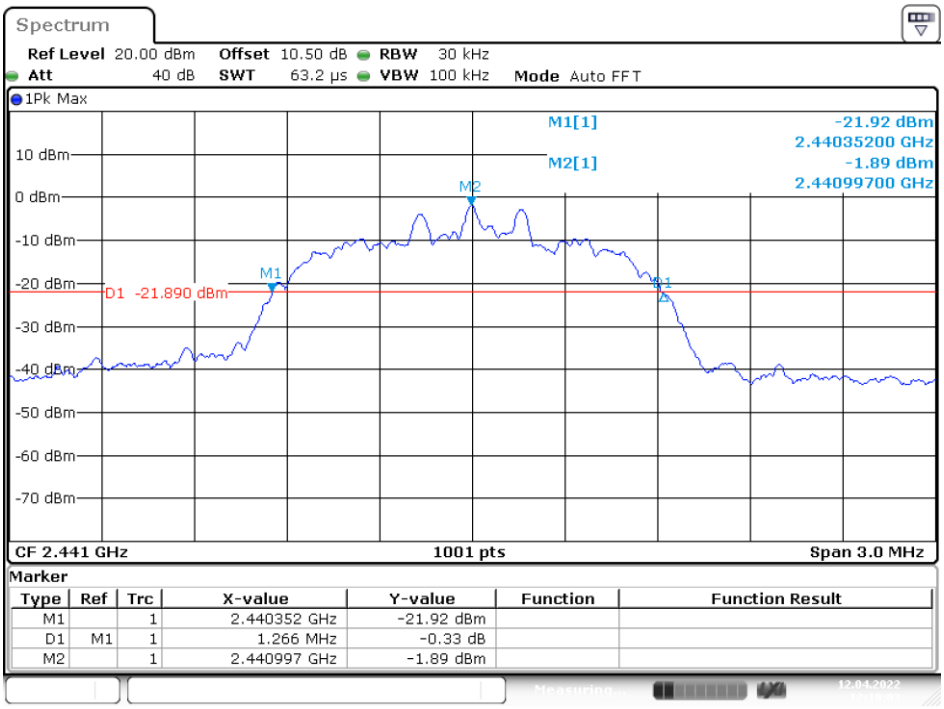
EDR Mode (8DPSK)

Low Channel



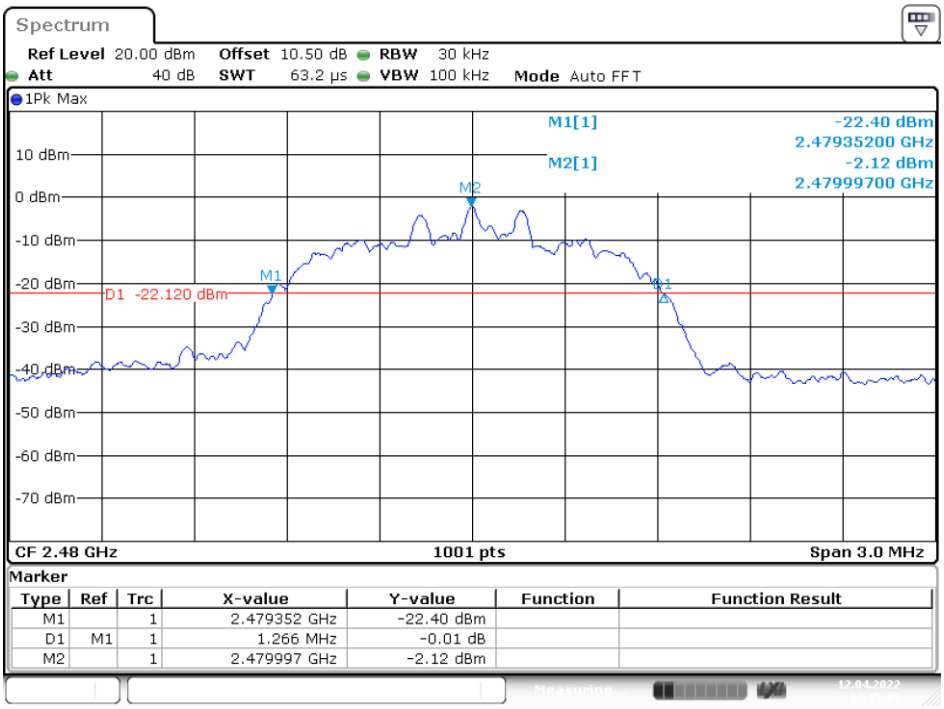
Date: 12.APR.2022 12:07:58

Middle Channel



Date: 12.APR.2022 12:10:03

High Channel



Date: 12.APR.2022 12:15:09

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

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.

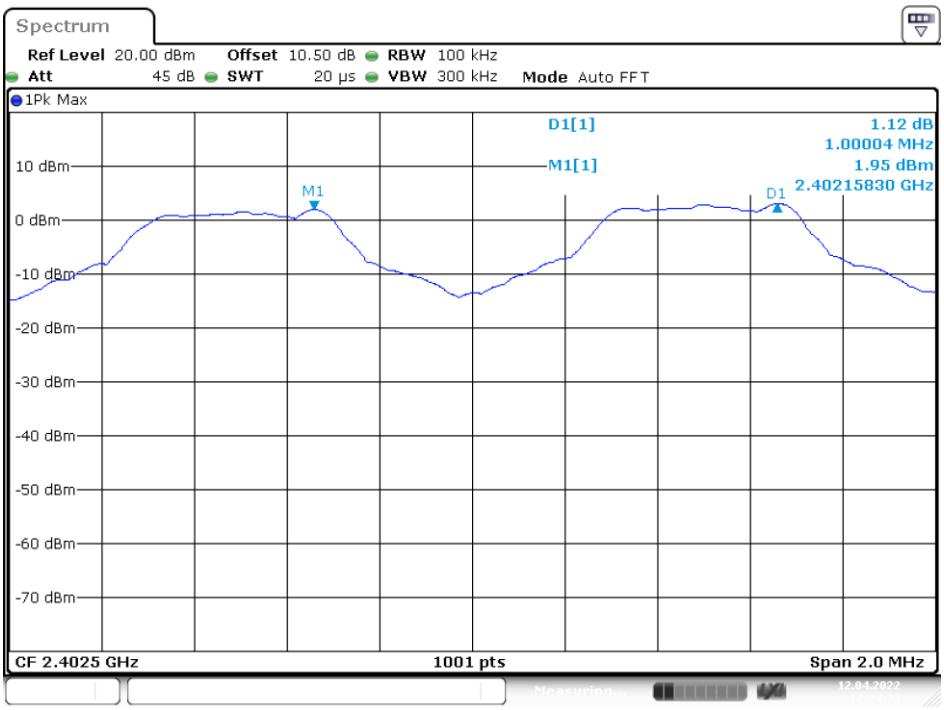
10.3. Test Results

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BR Mode (GFSK)					
Low	1.00	0.95	0.632	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	0.95	0.632	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	0.95	0.632	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode (π/4-DQPSK)					
Low	1.00	1.27	0.848	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	1.25	0.830	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	1.26	0.838	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode (8DPSK)					
Low	1.00	1.26	0.842	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	1.27	0.844	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	1.27	0.844	>two-thirds of the 20 dB bandwidth	Compliance

Please refer to the following plots.

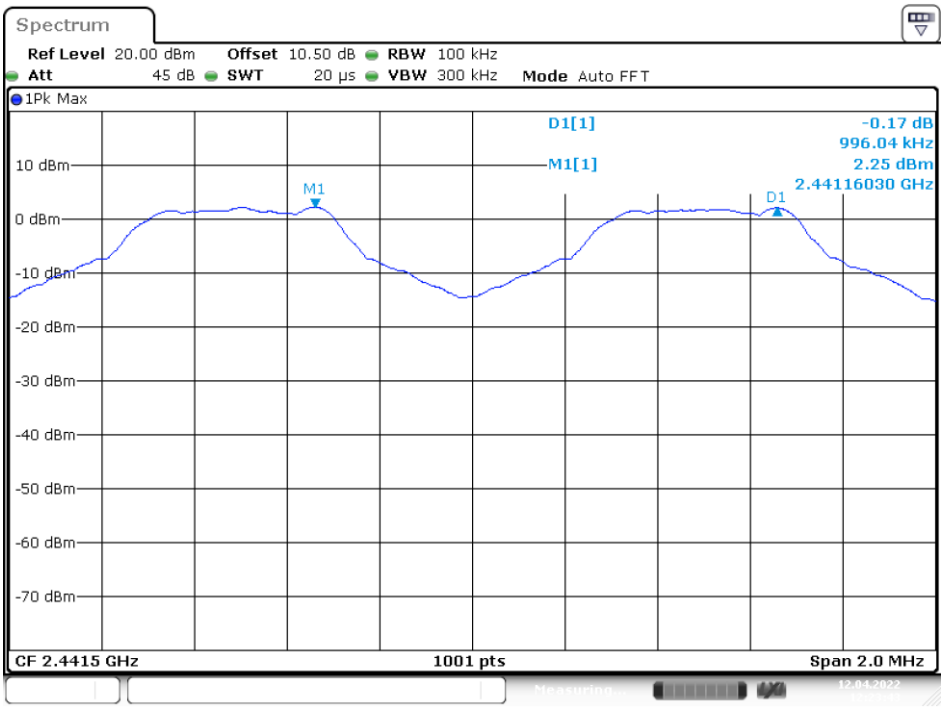
BR Mode (GFSK)

Low Channel



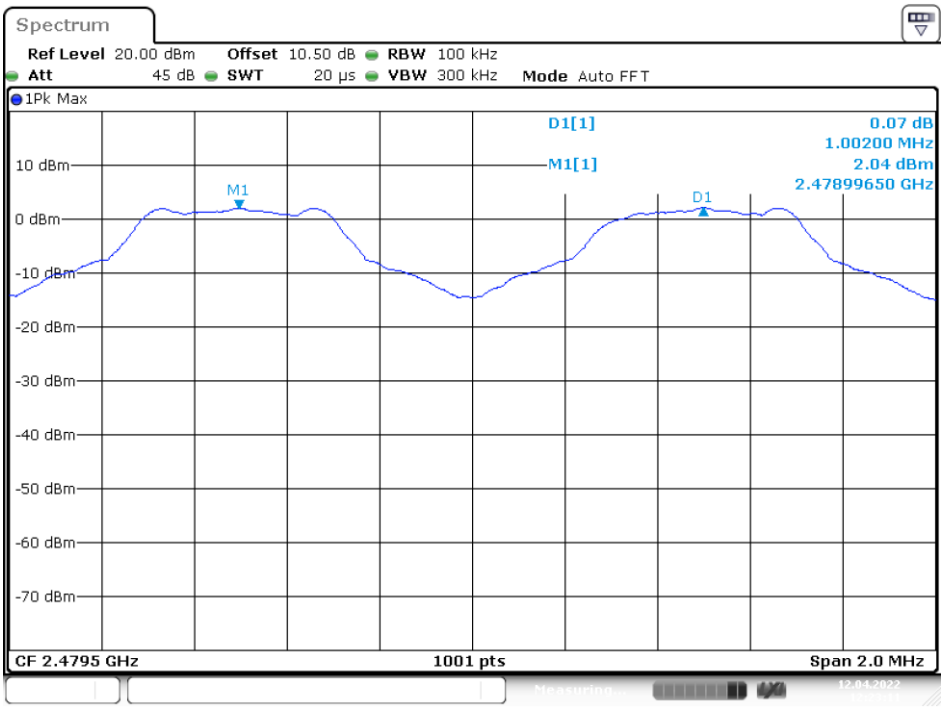
Date: 12.APR.2022 12:24:33

Middle Channel



Date: 12.APR.2022 12:23:43

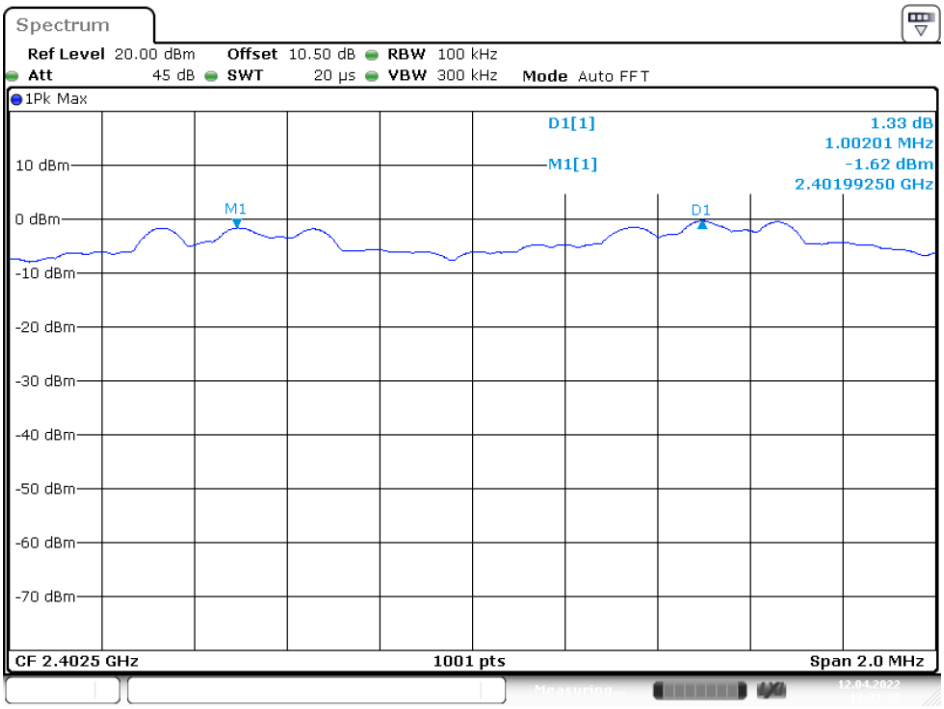
High Channel



Date: 12.APR.2022 12:23:12

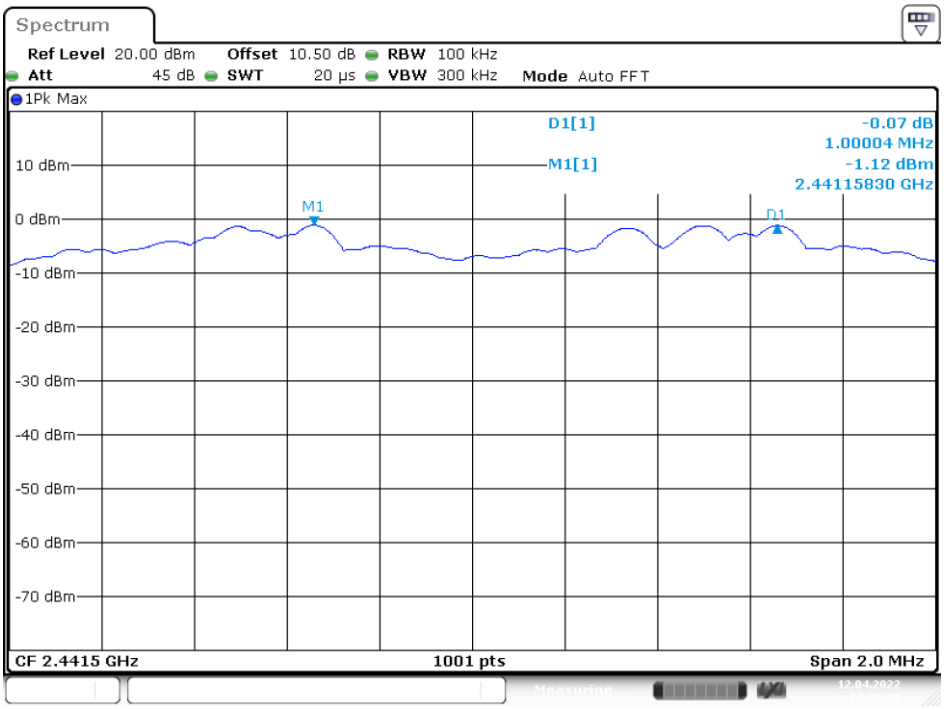
EDR Mode (π/4-DQPSK)

Low Channel



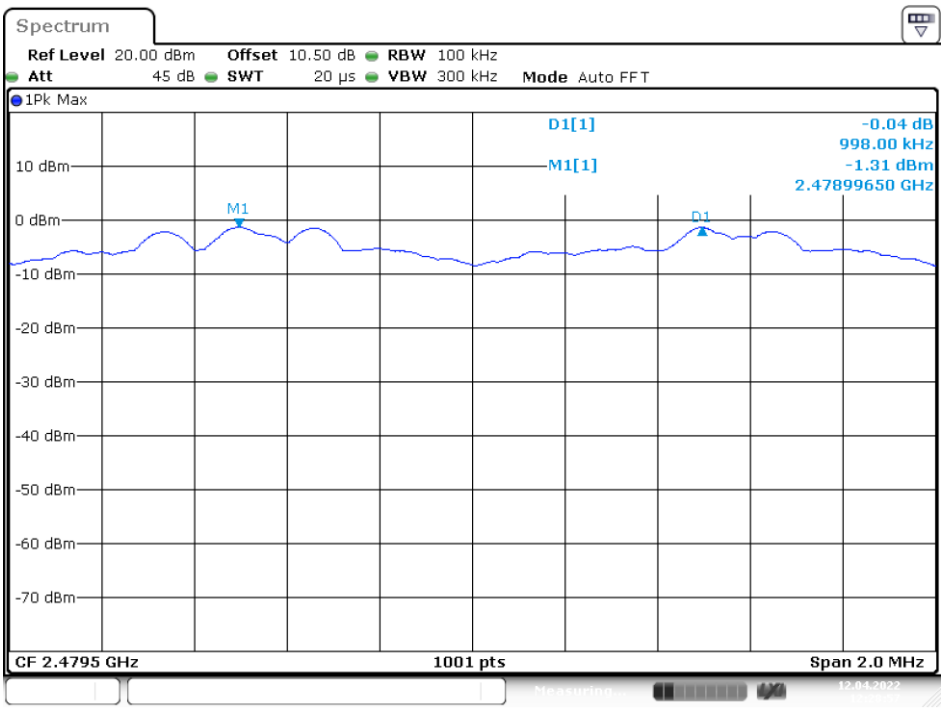
Date: 12.APR.2022 12:31:33

Middle Channel



Date: 12.APR.2022 12:29:38

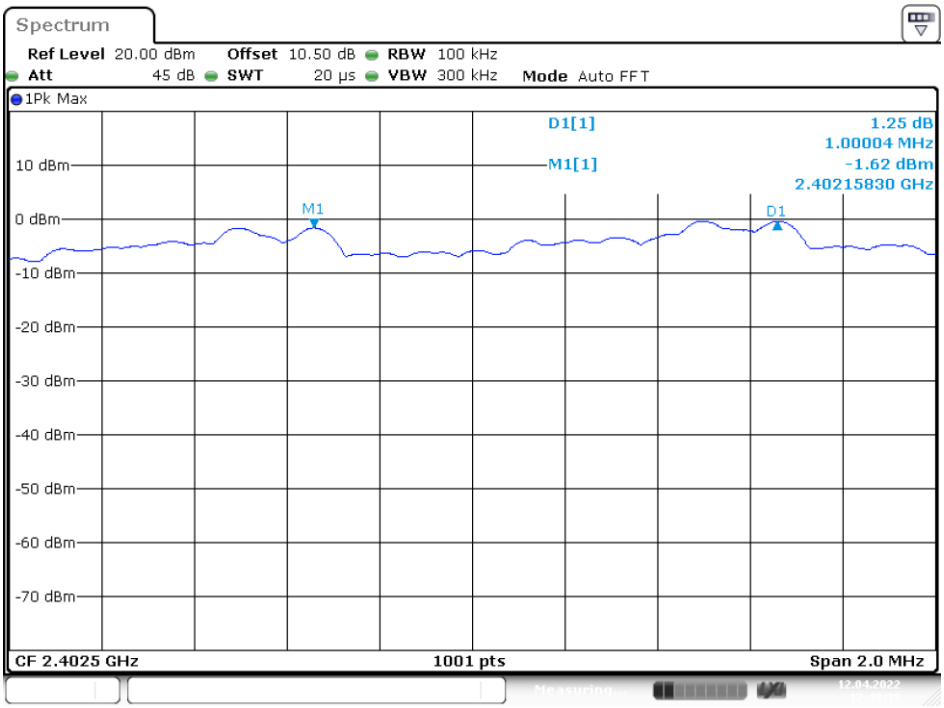
High Channel



Date: 12.APR.2022 12:28:57

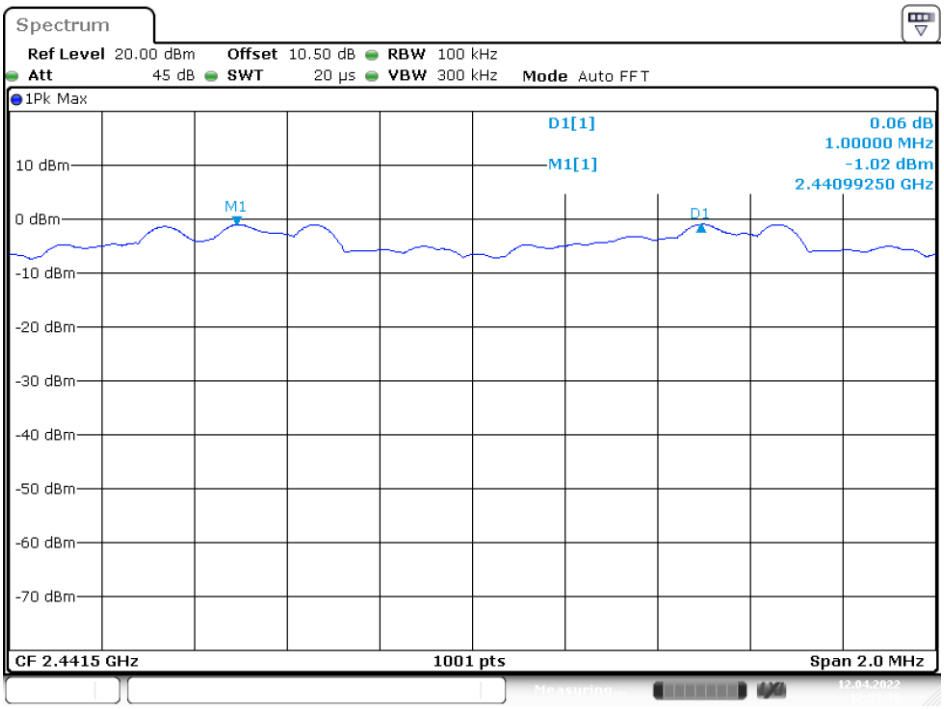
EDR Mode (8DPSK)

Low Channel



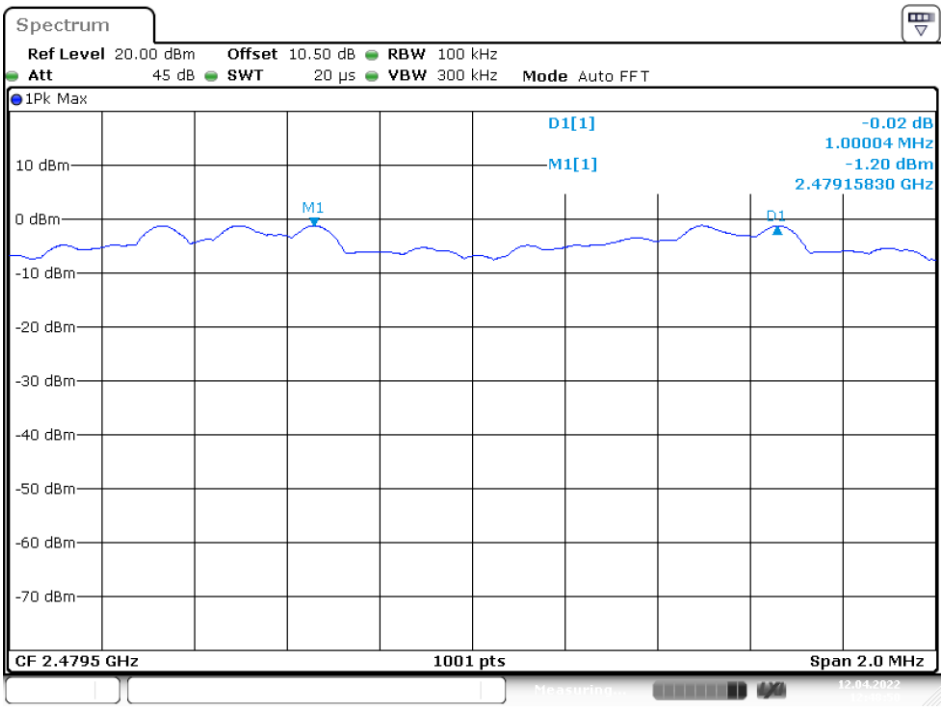
Date: 12.APR.2022 12:40:39

Middle Channel



Date: 12.APR.2022 12:52:30

High Channel



Date: 12.APR.2022 12:48:50

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

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.

11.3. Test Results

Test mode: BR mode / 2402 ~ 2480MHz (GFSK)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
DH1	0.379	320	31.6	121.28	<400	PASS
DH3	1.633	160	31.6	261.28	<400	PASS
DH5	2.888	110	31.6	317.68	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (π/4-DQPSK)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
2DH1	0.396	310	31.6	122.76	<400	PASS
2DH3	1.644	160	31.6	263.04	<400	PASS
2DH5	2.895	110	31.6	318.45	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (8DPSK)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
3DH1	0.402	320	31.6	128.64	<400	PASS
3DH3	1.636	160	31.6	261.76	<400	PASS
3DH5	2.890	110	31.6	317.90	<400	PASS

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

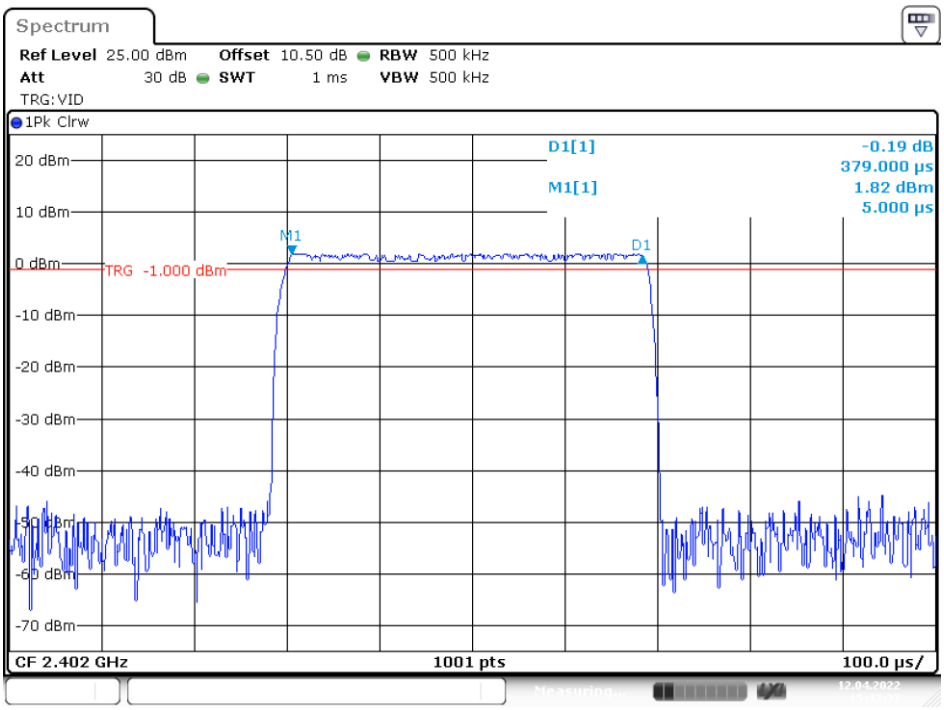
Note 2: Hopping Number = Hopping Number/10 * 10

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

Please refer to the following plots

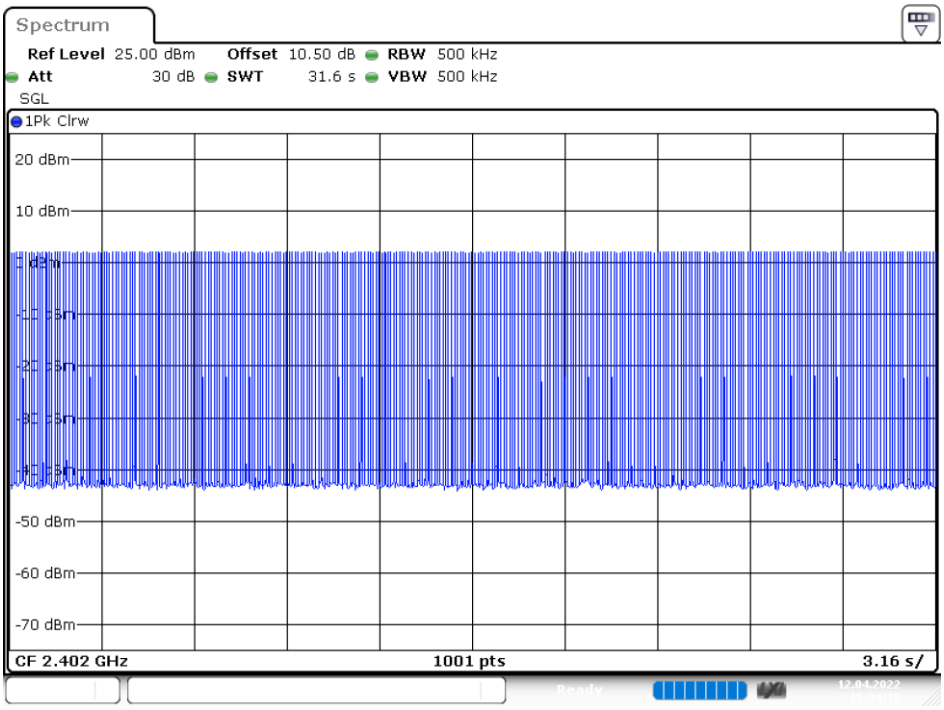
BR Mode (GFSK)

DH1: Pulse Width



Date: 12.APR.2022 15:42:37

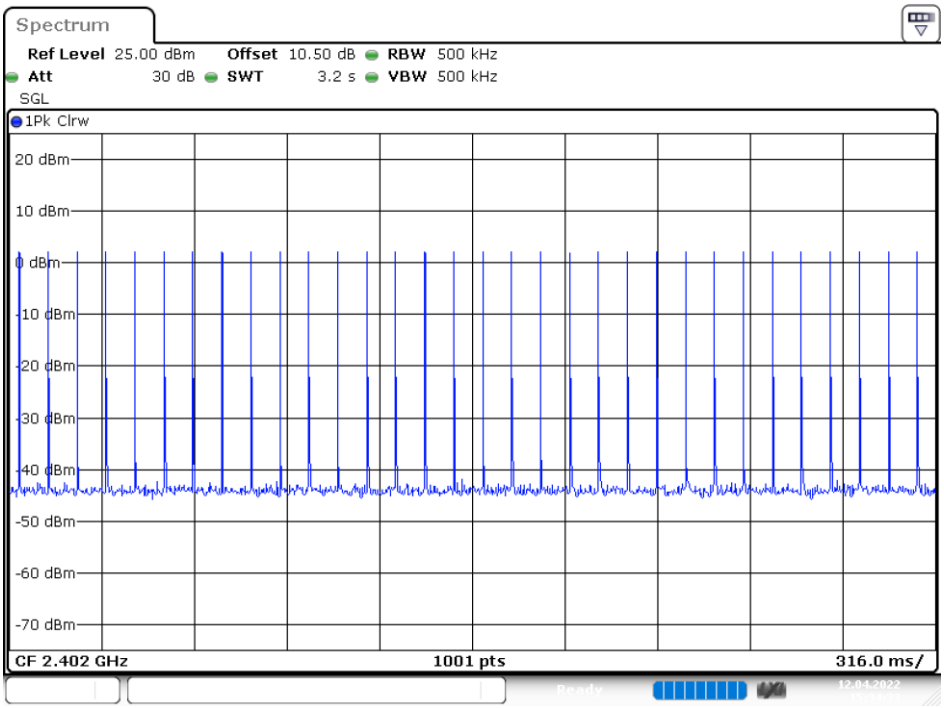
DH1: Hopping Number



Date: 12.APR.2022 15:34:19

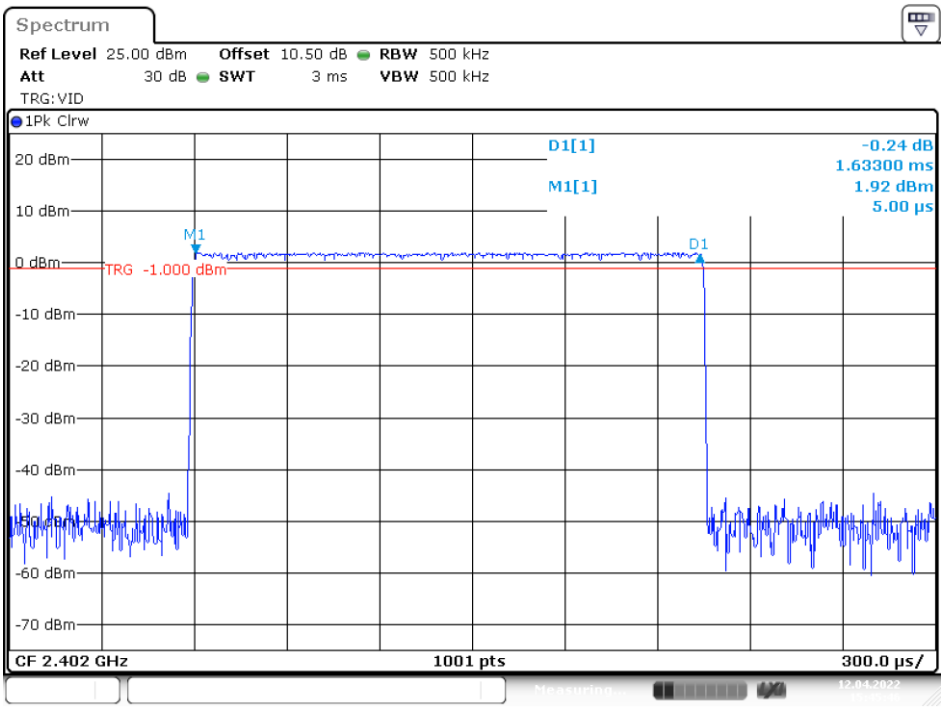
DH1: Hopping Number /10

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



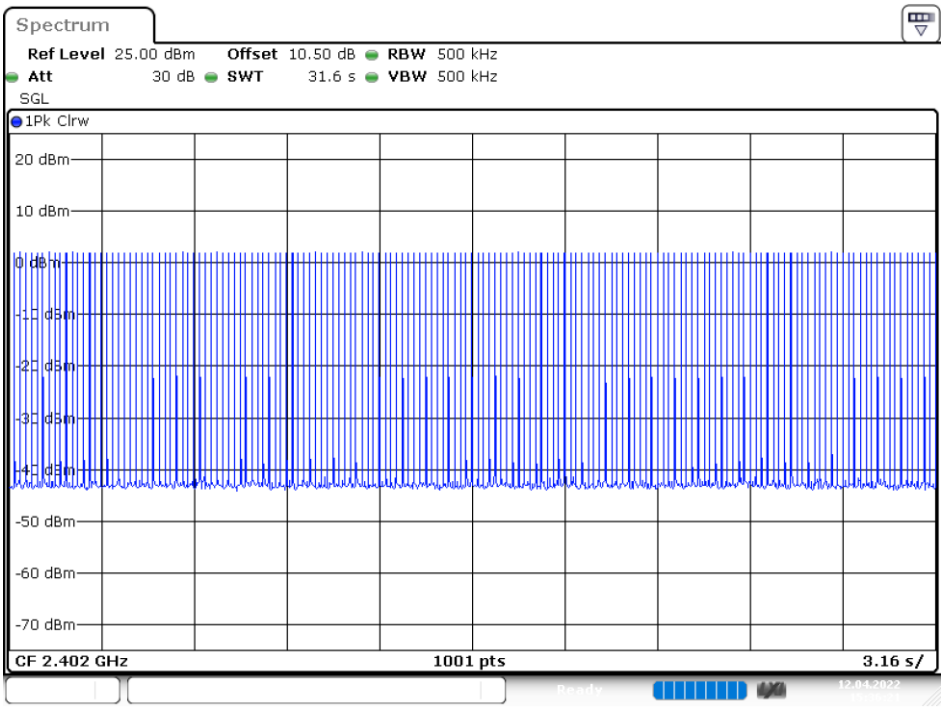
Date: 12.APR.2022 15:34:34

DH3: Pulse Width



Date: 12.APR.2022 15:45:47

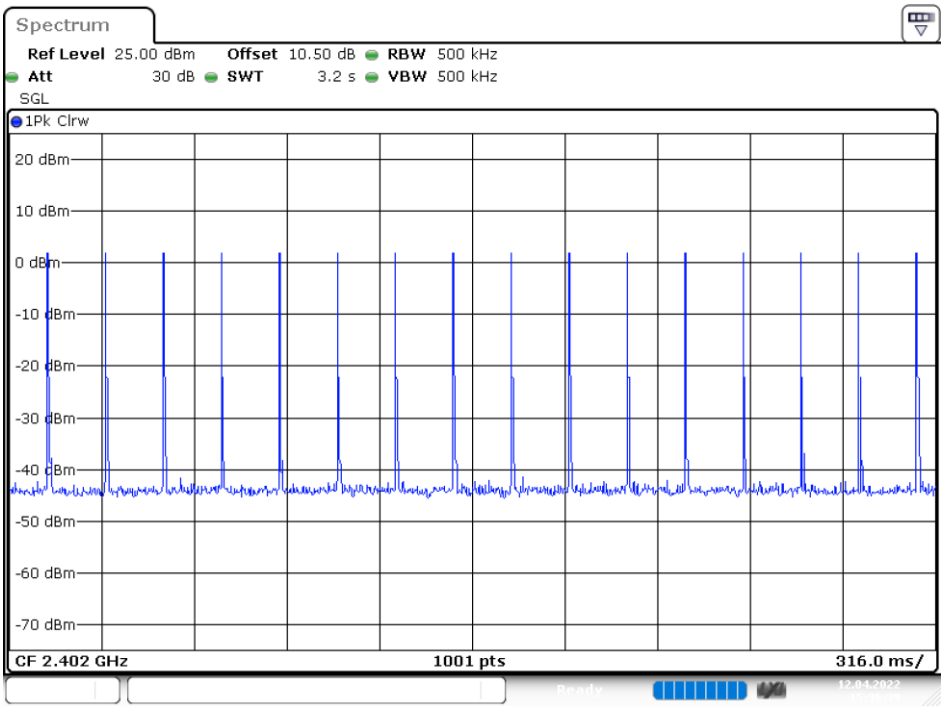
DH3: Hopping Number



Date: 12.APR.2022 15:36:22

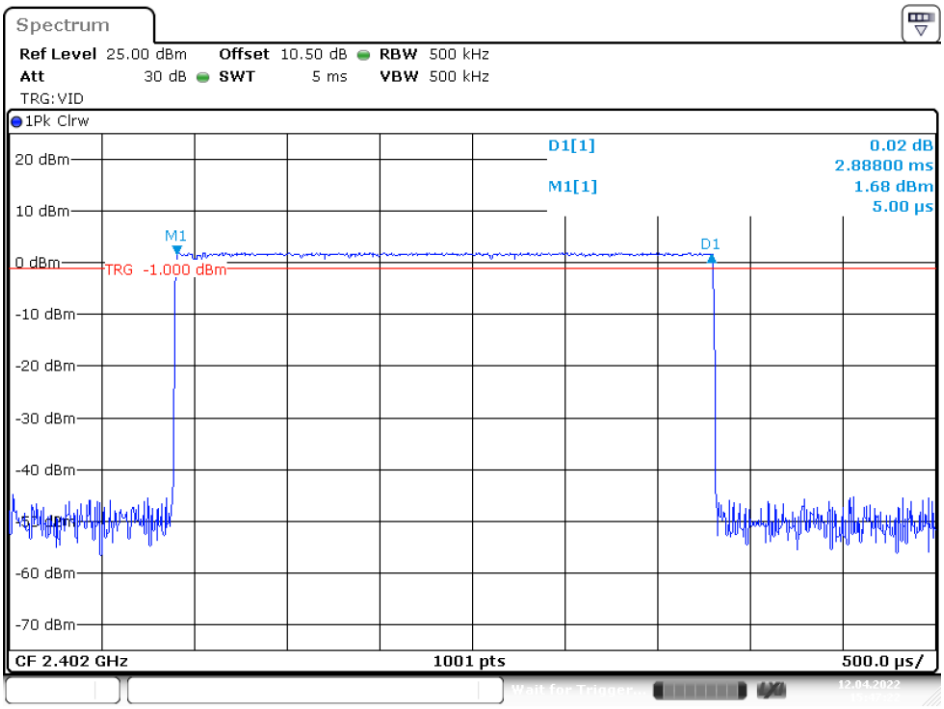
DH3: Hopping Number /10

(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



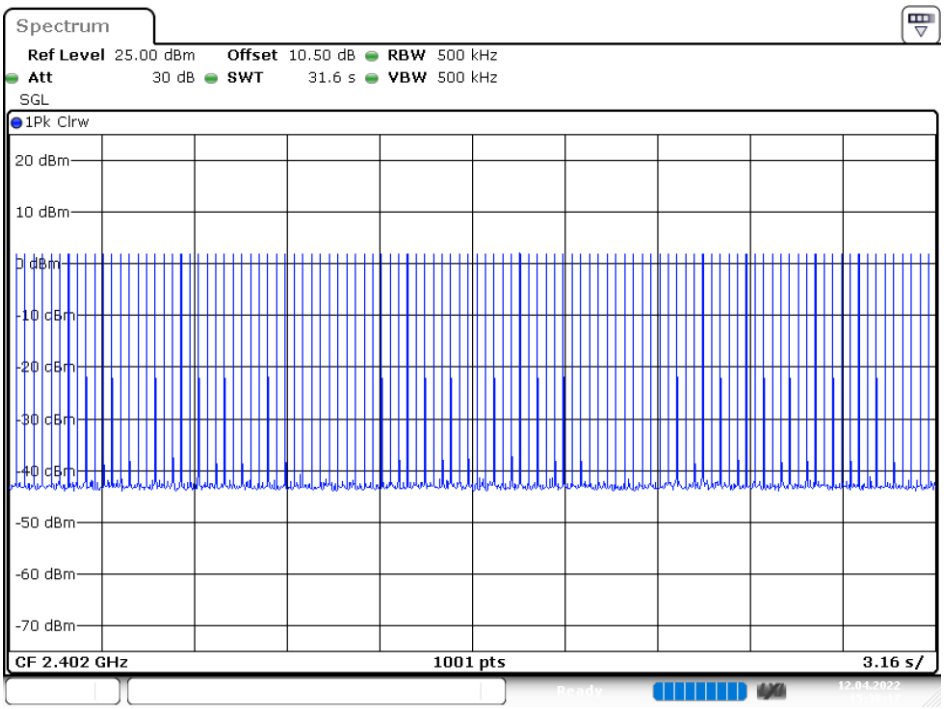
Date: 12.APR.2022 15:36:39

DH5: Pulse Width



Date: 12.APR.2022 15:47:23

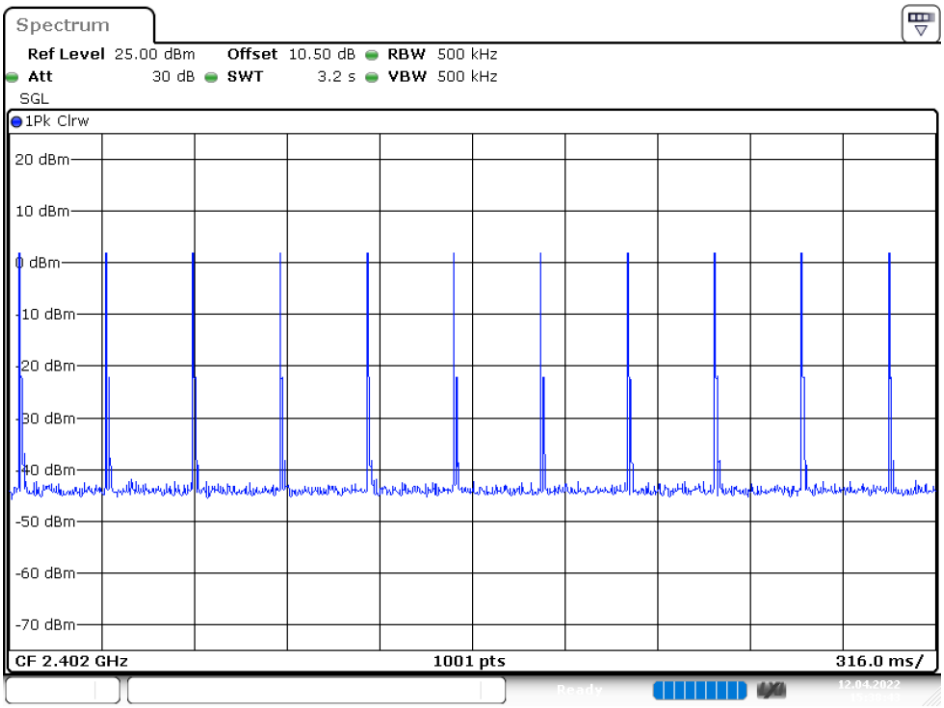
DH5: Hopping Number



Date: 12.APR.2022 15:38:18

DH5: Hopping Number /10

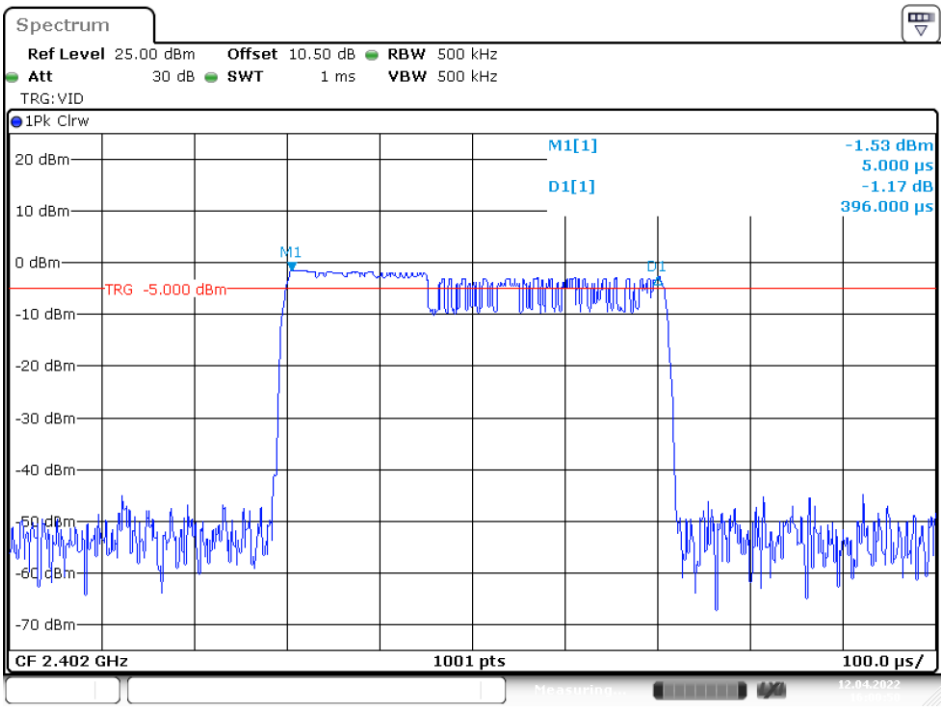
(Hopping Number = 11 in 1/10 period of highest signals, Second High signals were other channel)



Date: 12.APR.2022 15:38:43

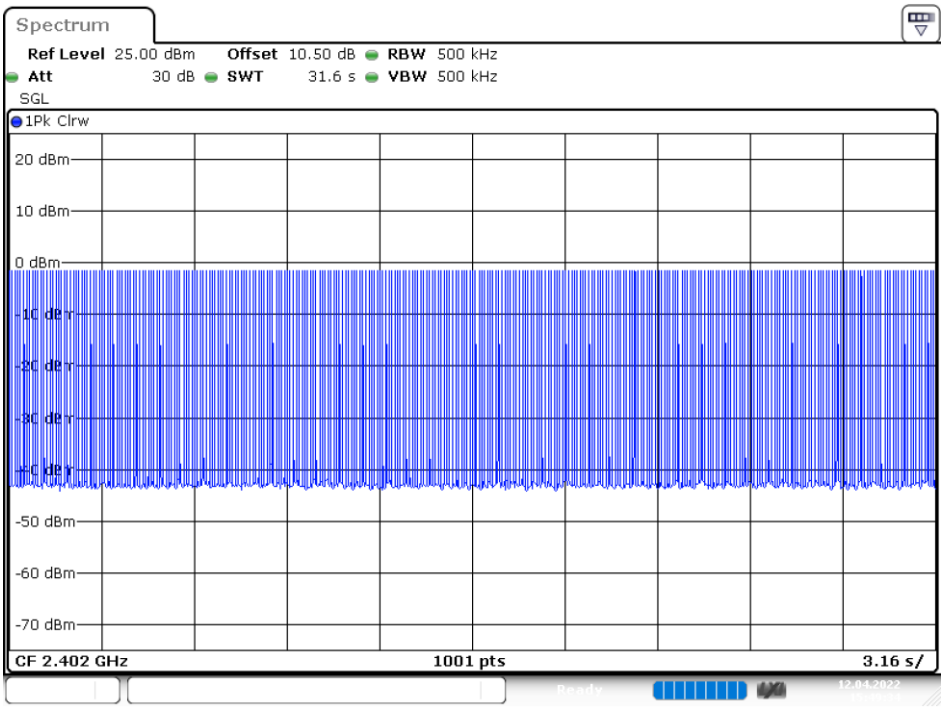
EDR Mode (π/4-DQPSK)

2DH1: Pulse Width



Date: 12.APR.2022 16:00:51

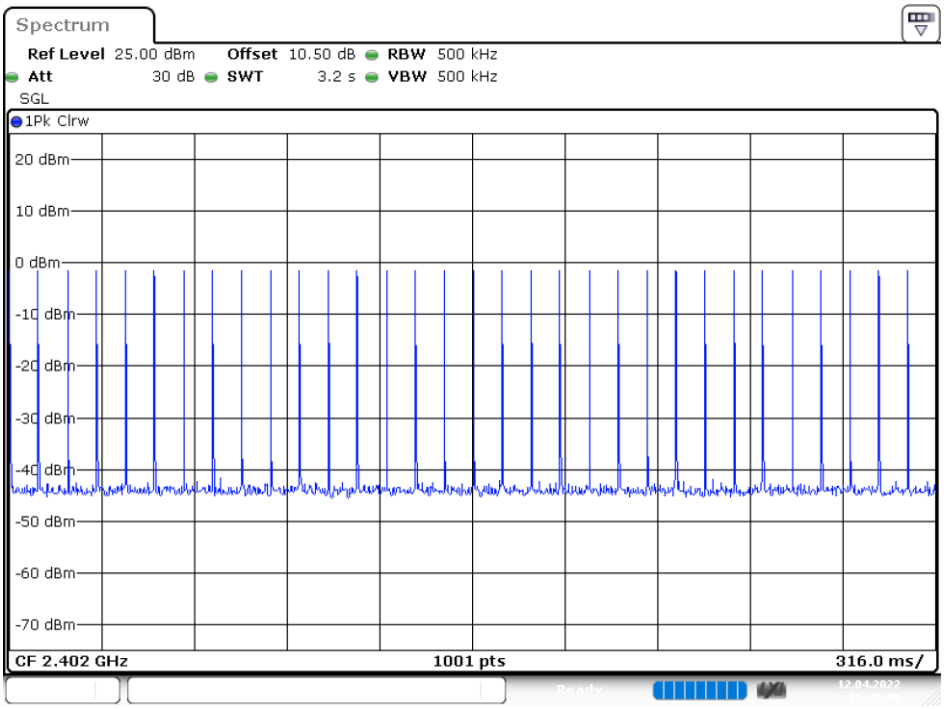
2DH1: Hopping Number



Date: 12.APR.2022 15:49:35

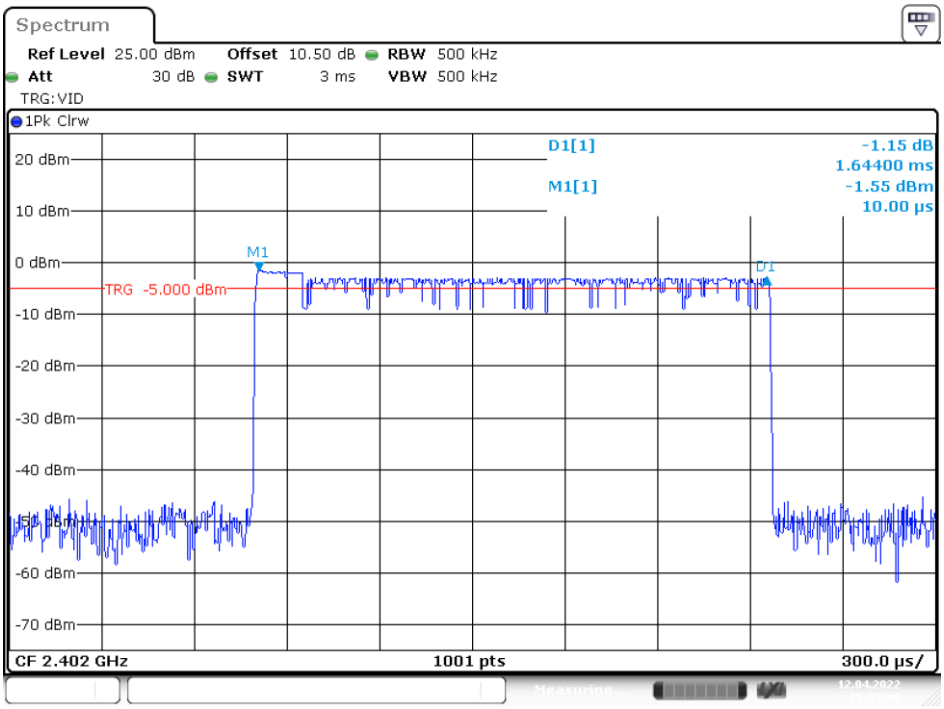
2DH1: Hopping Number /10

(Hopping Number = 31 in 1/10 period of highest signals, Second High signals were other channel)



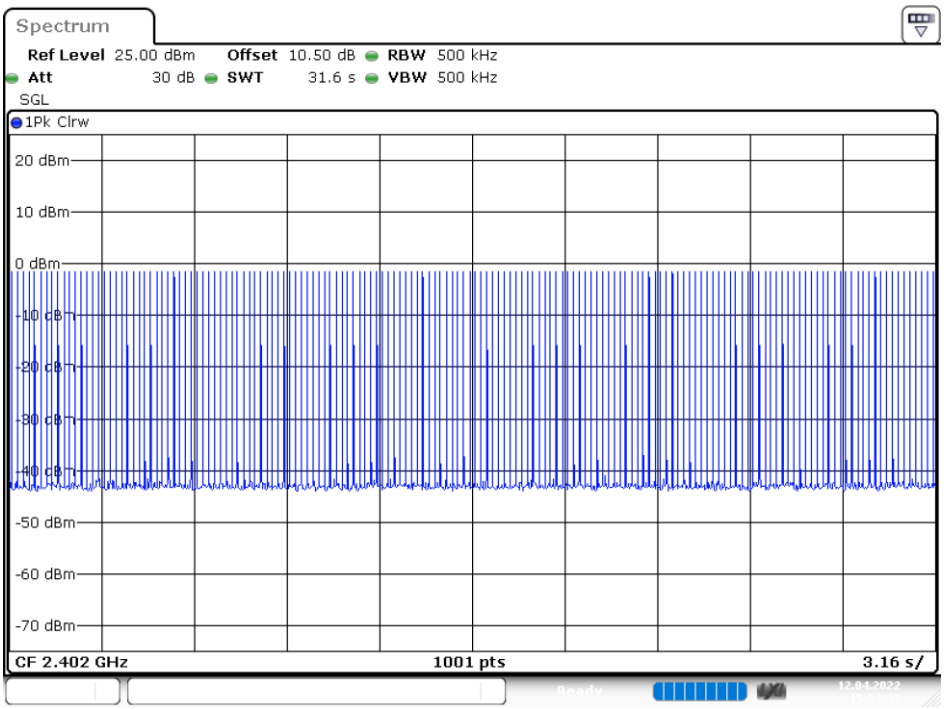
Date: 12.APR.2022 15:49:46

2DH3: Pulse Width



Date: 12.APR.2022 15:59:06

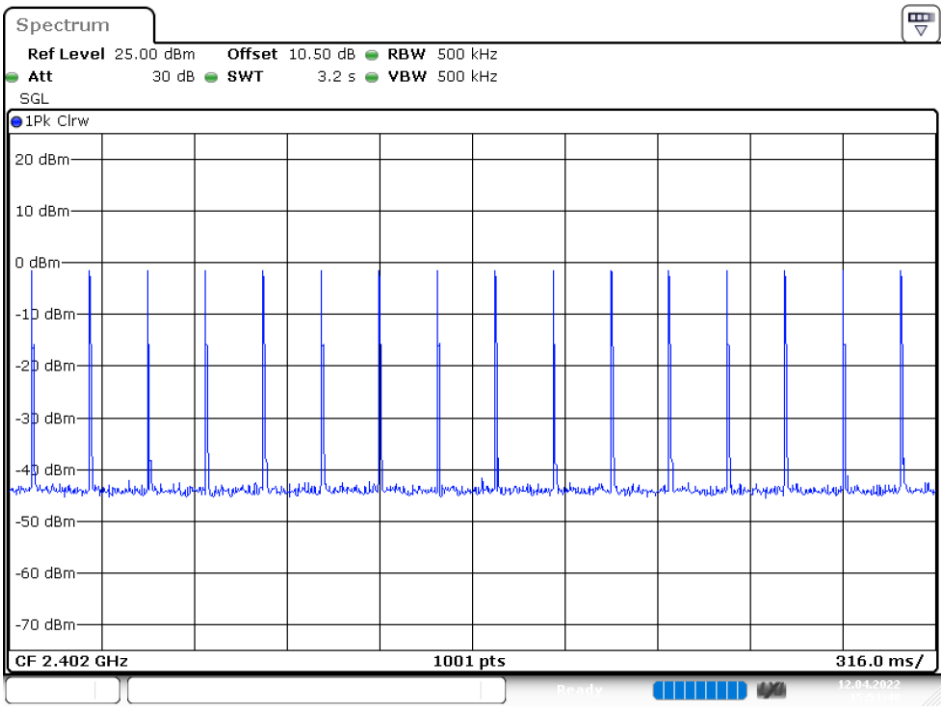
2DH3: Hopping Number



Date: 12.APR.2022 15:51:37

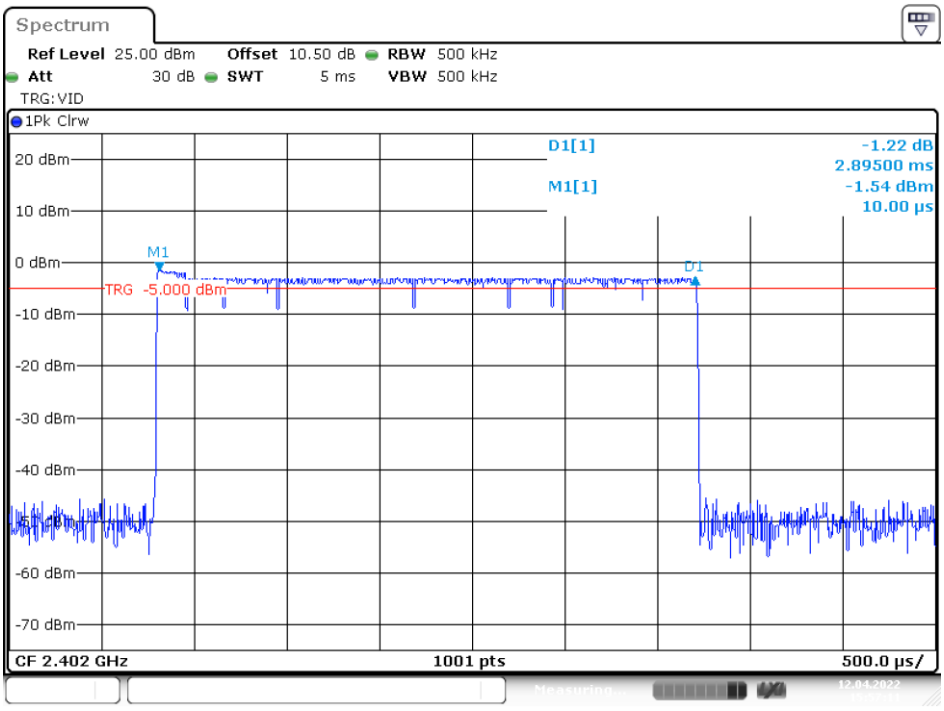
2DH3: Hopping Number /10

(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



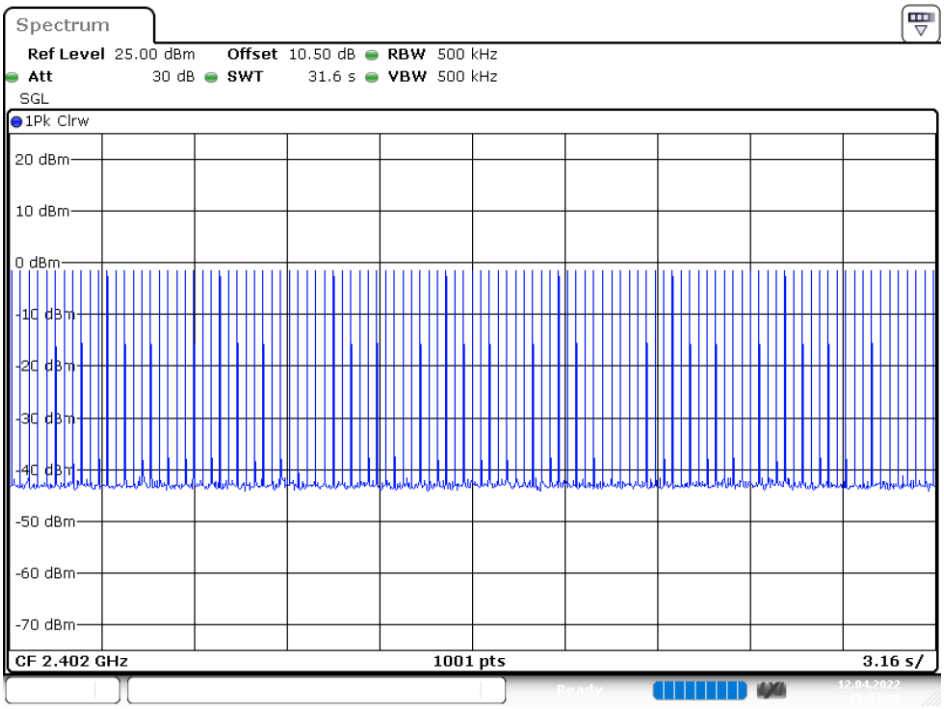
Date: 12.APR.2022 15:51:49

2DH5: Pulse Width



Date: 12.APR.2022 15:57:11

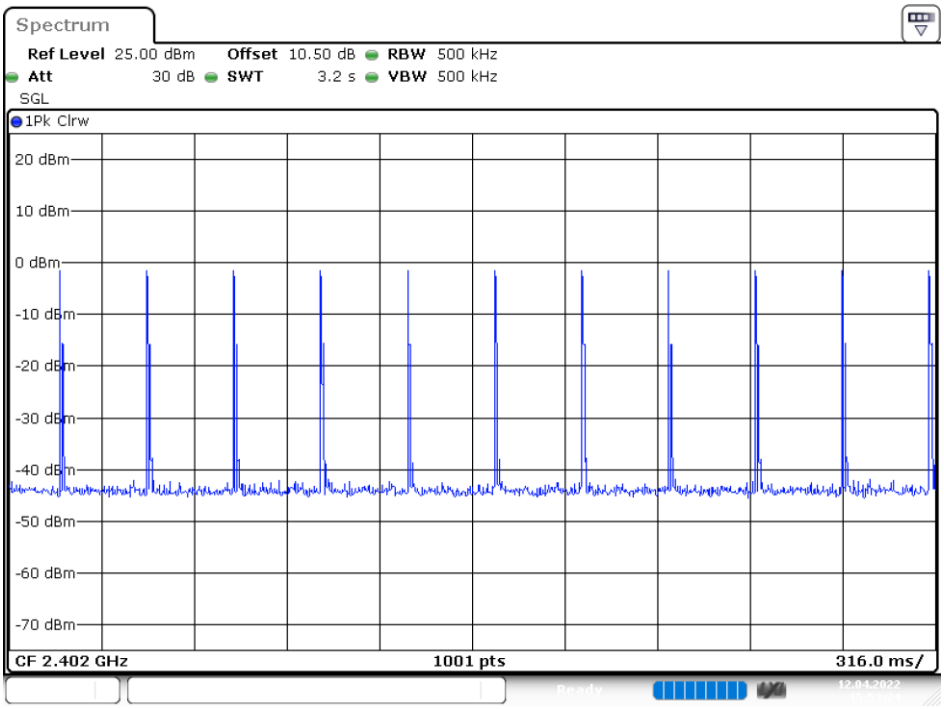
2DH5: Hopping Number



Date: 12.APR.2022 15:53:17

2DH5: Hopping Number /10

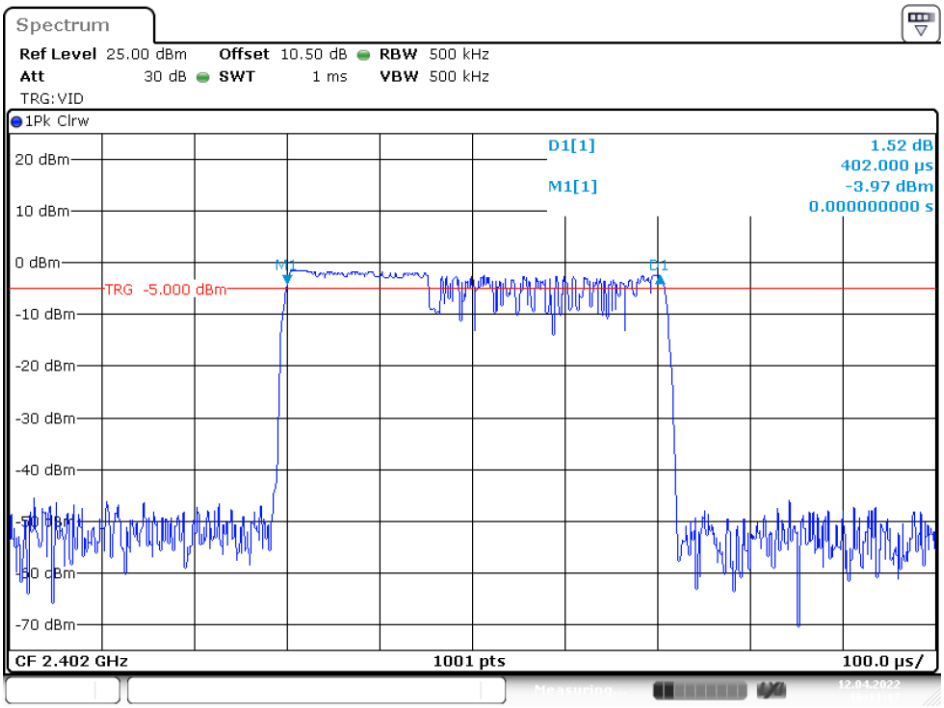
(Hopping Number = 11 in 1/10 period of highest signals, Second High signals were other channel)



Date: 12.APR.2022 15:53:25

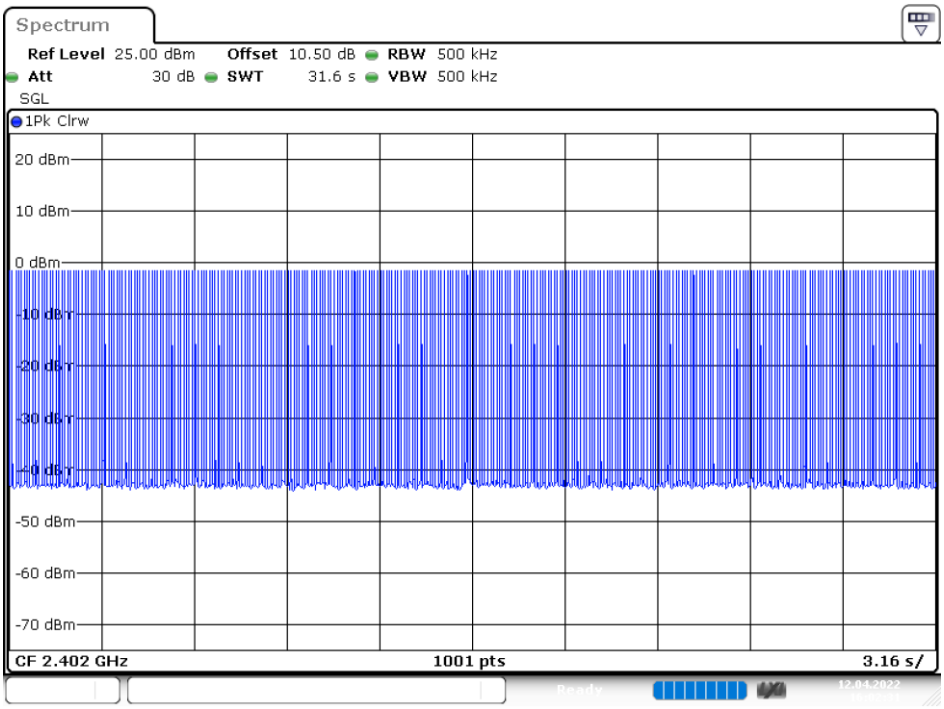
EDR Mode (8DPSK)

3DH1: Pulse Width



Date: 12.APR.2022 16:11:18

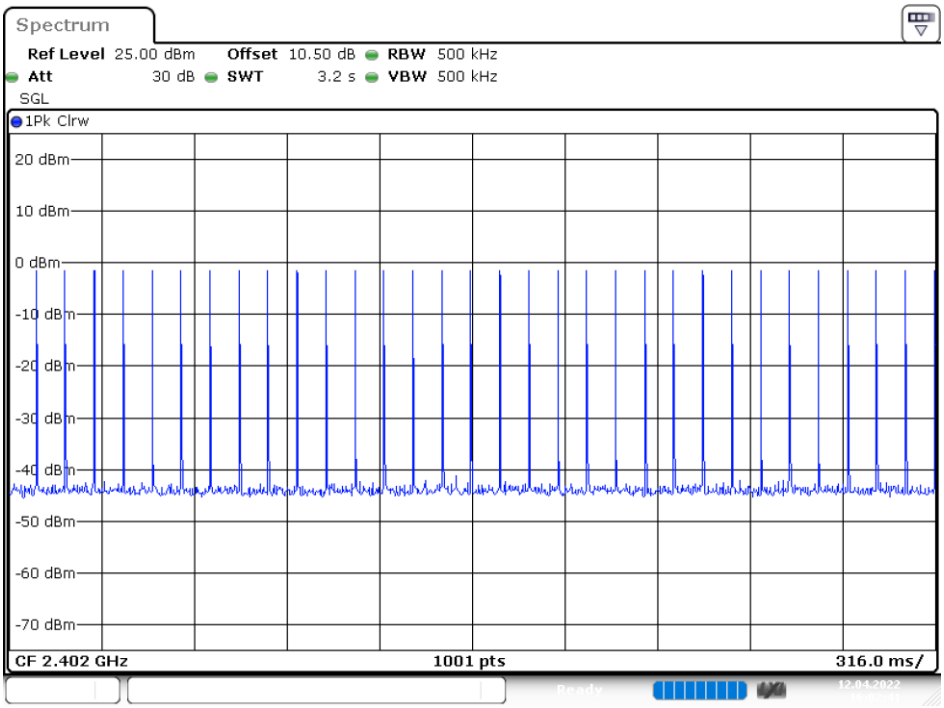
3DH1: Hopping Number



Date: 12.APR.2022 16:02:31

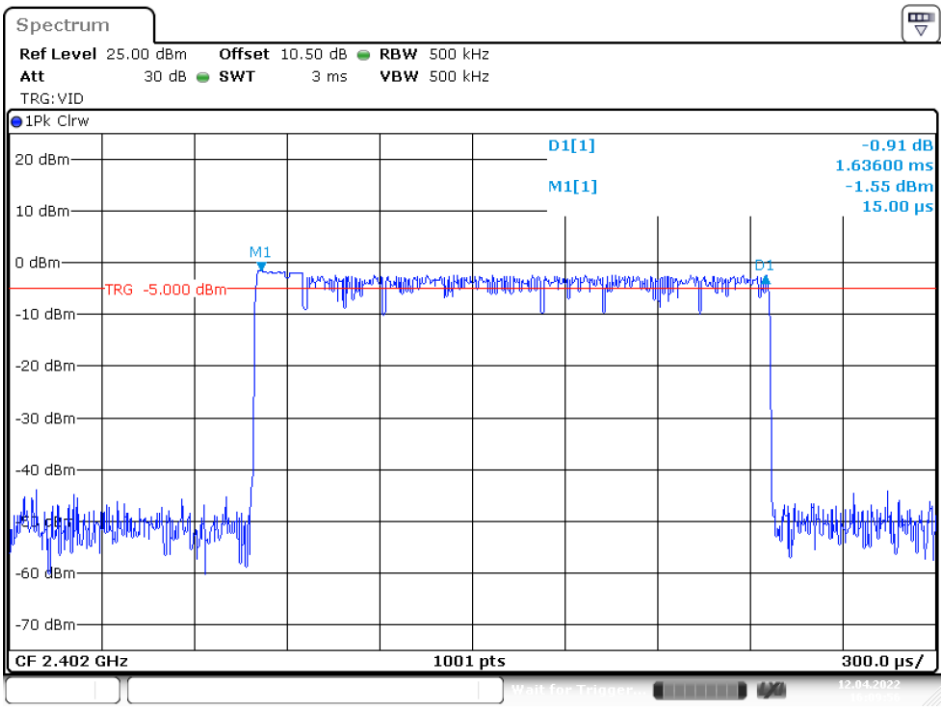
3DH1: Hopping Number /10

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



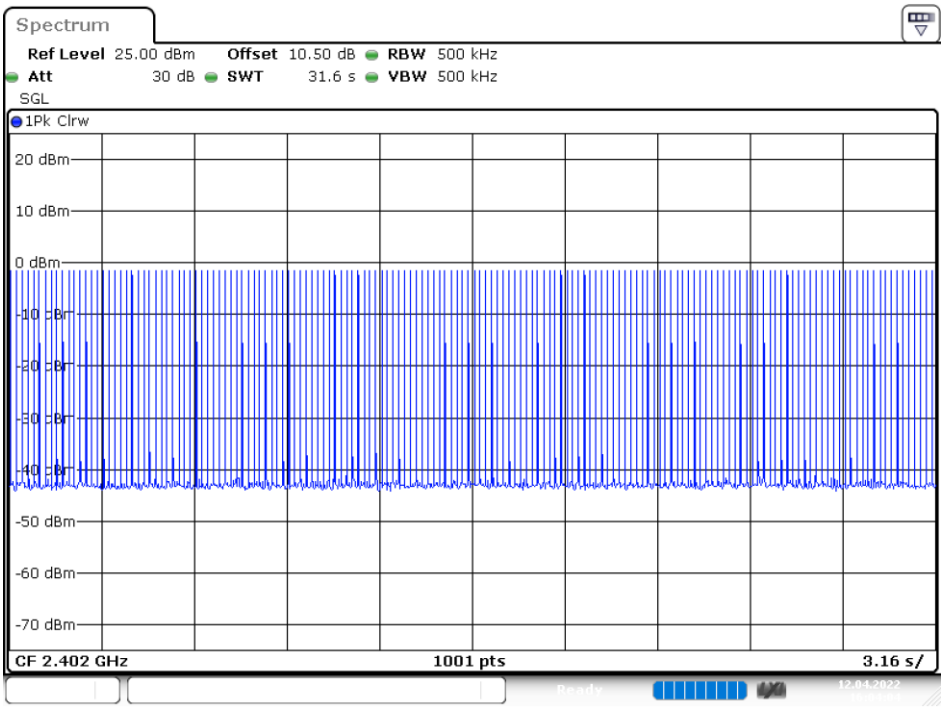
Date: 12.APR.2022 16:02:41

3DH3: Pulse Width



Date: 12.APR.2022 16:09:56

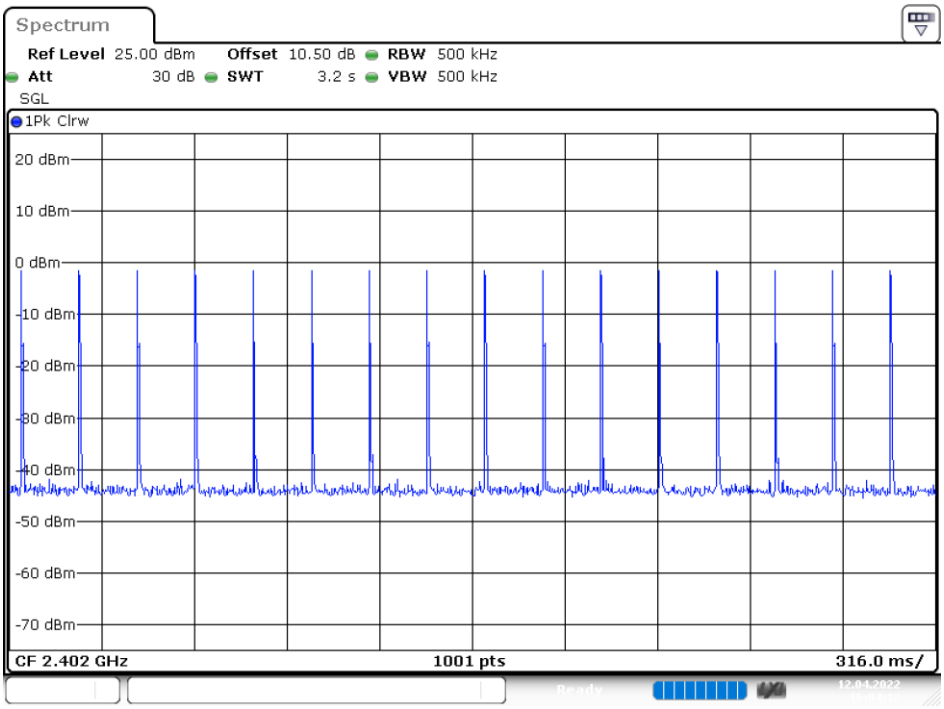
3DH3: Hopping Number



Date: 12.APR.2022 16:04:05

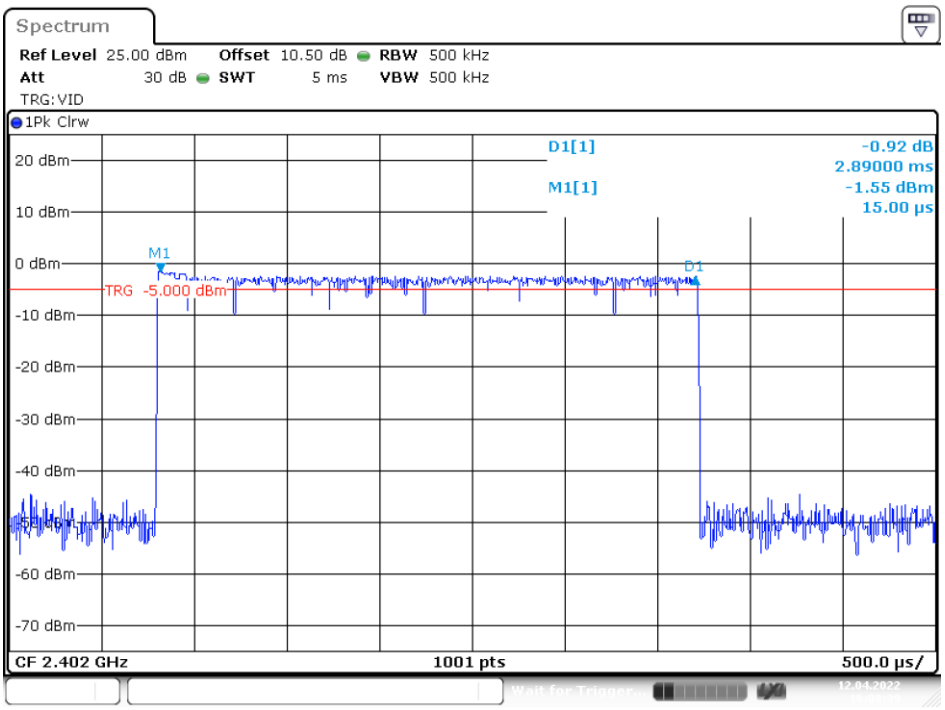
3DH3: Hopping Number /10

(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



Date: 12.APR.2022 16:04:13

3DH5: Pulse Width



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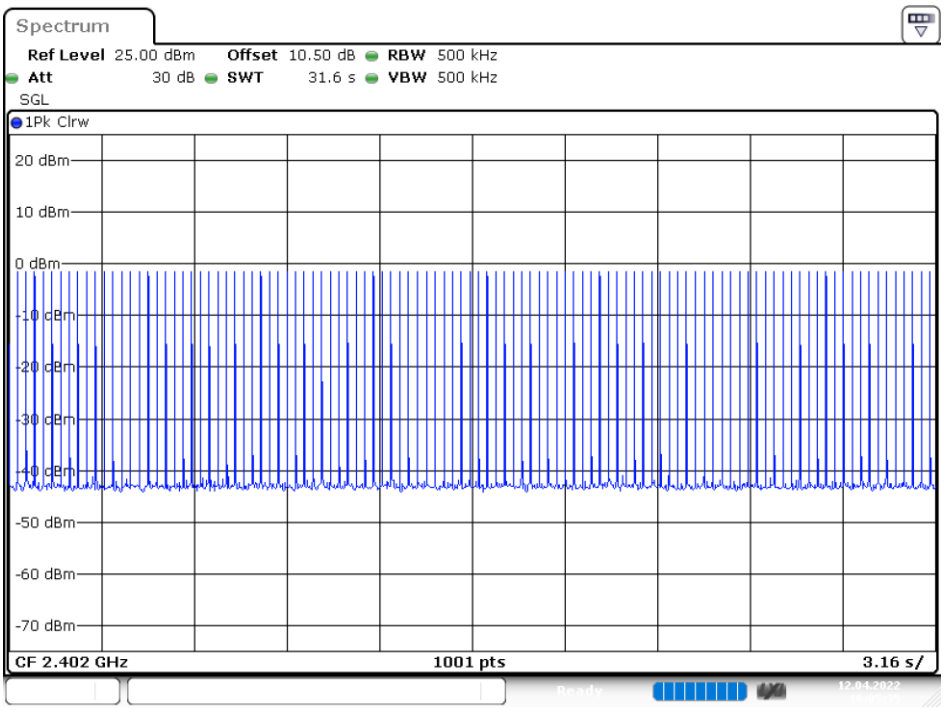
3DH5: Hopping Number



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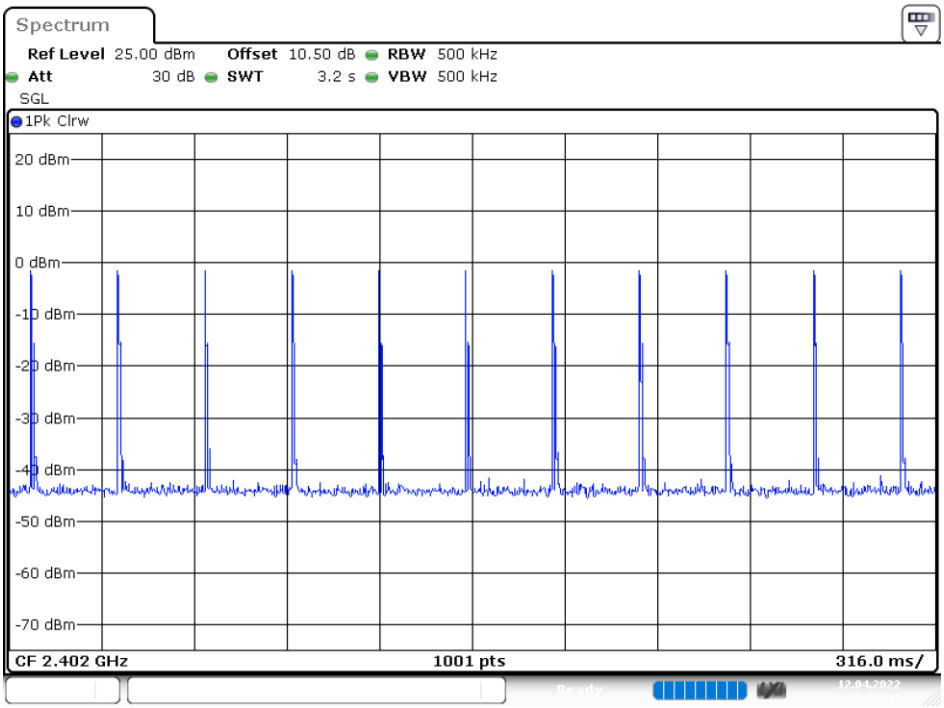
3DH5: Hopping Number /10

(Hopping Number = 11 in 1/10 period of highest signals, Second High signals were other channel)



Date: 12.APR.2022 16:05:45

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

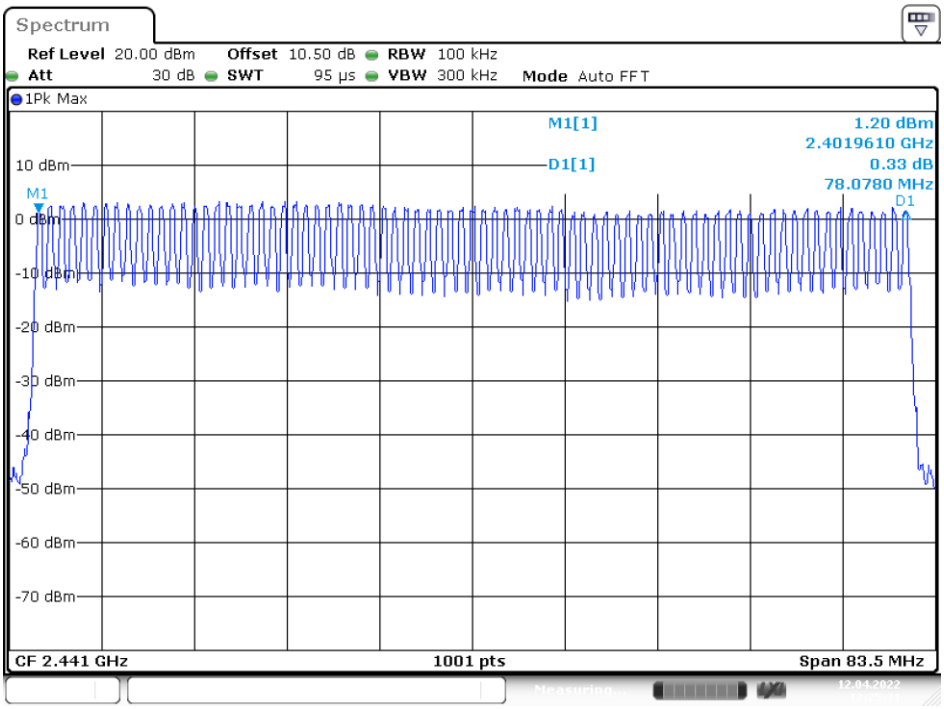
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

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

BR Mode (GFSK)



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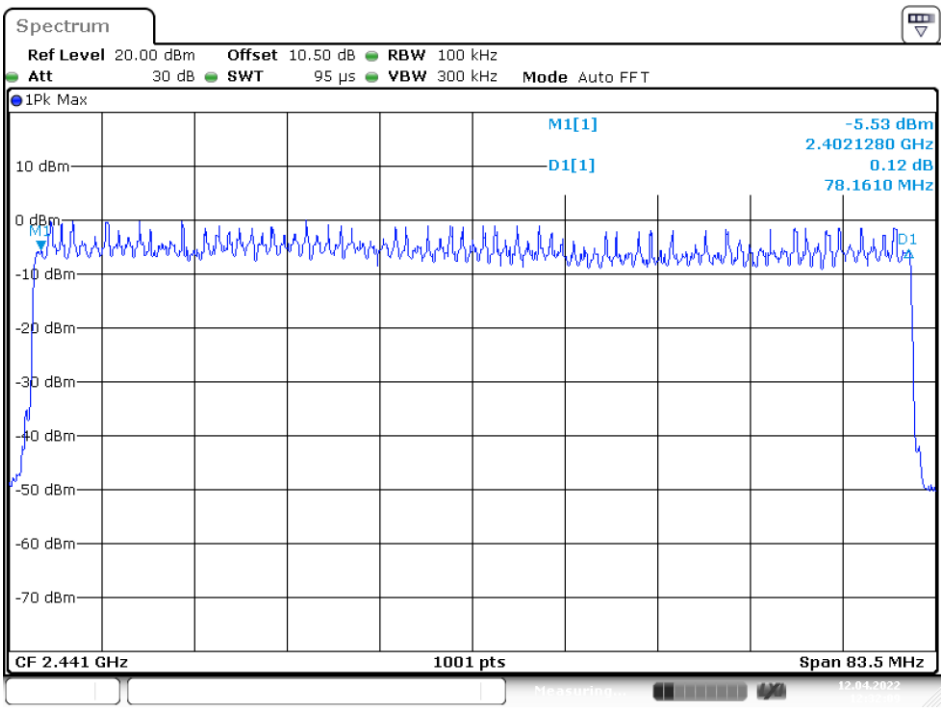
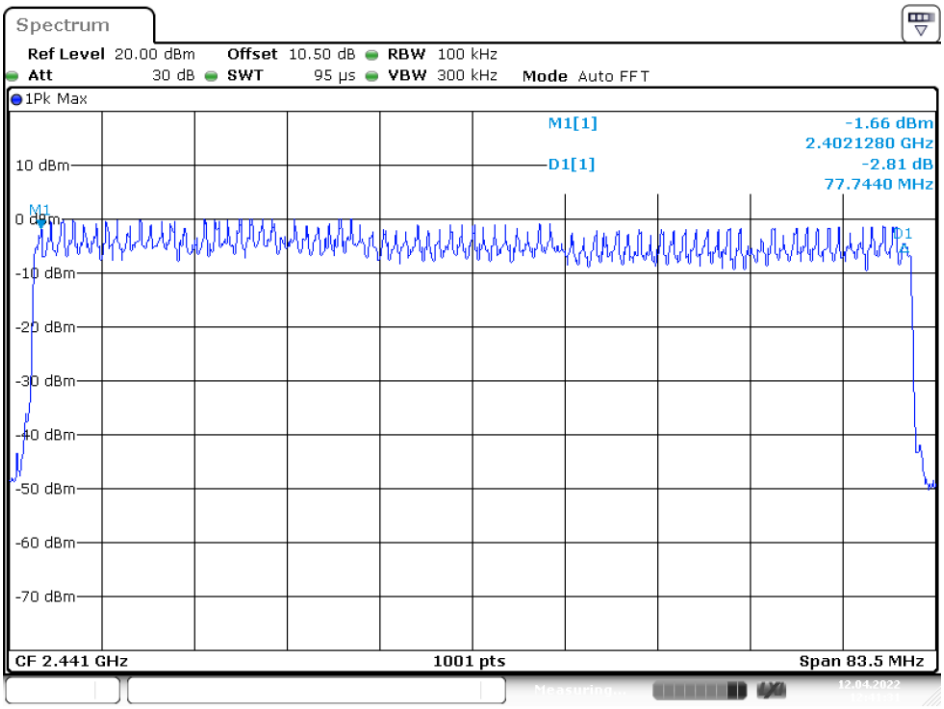
EDR Mode (π/4-DQPSK)



Date: 12.APR.2022 12:32:09

EDR Mode (8DPSK)



Date: 12.APR.2022 12:41:31

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

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	3.18	0.002	0.125	Compliance
Middle	2441	3.79	0.002	0.125	Compliance
High	2480	3.45	0.002	0.125	Compliance
EDR Mode (π/4-DQPSK)					
Low	2402	1.04	0.001	0.125	Compliance
Middle	2441	1.57	0.001	0.125	Compliance
High	2480	1.33	0.001	0.125	Compliance
EDR Mode (8DPSK)					
Low	2402	1.56	0.001	0.125	Compliance
Middle	2441	2.16	0.002	0.125	Compliance
High	2480	1.92	0.002	0.125	Compliance

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

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

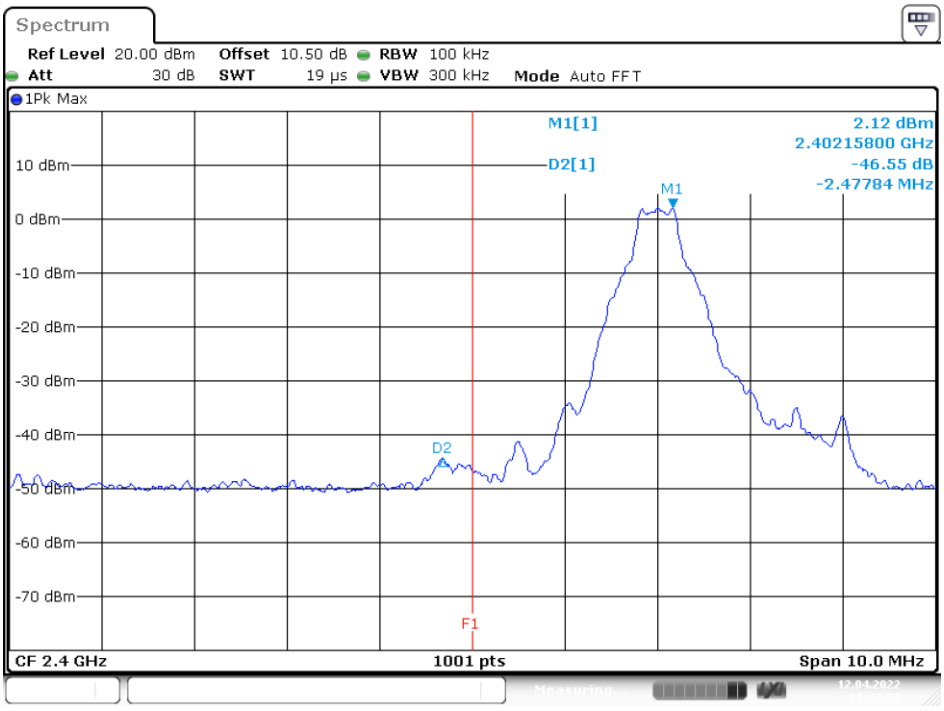
14.3. Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	46.55	≥ 20	PASS
High	2480	49.23	≥ 20	PASS
BR Hopping Mode (GFSK)				
Low	2402-2480	48.38	≥ 20	PASS
High	2402-2480	49.76	≥ 20	PASS
EDR Mode (π/4-DQPSK)				
Low	2402	41.59	≥ 20	PASS
High	2480	46.79	≥ 20	PASS
EDR Hopping Mode (π/4-DQPSK)				
Low	2402-2480	45.68	≥ 20	PASS
High	2402-2480	46.52	≥ 20	PASS
EDR Mode (8DPSK)				
Low	2402	41.52	≥ 20	PASS
High	2480	47.23	≥ 20	PASS
EDR Hopping Mode (8DPSK)				
Low	2402-2480	43.72	≥ 20	PASS
High	2402-2480	46.43	≥ 20	PASS

Please refer to the following plots.

BR Mode (GFSK)

Band Edge, CH Low



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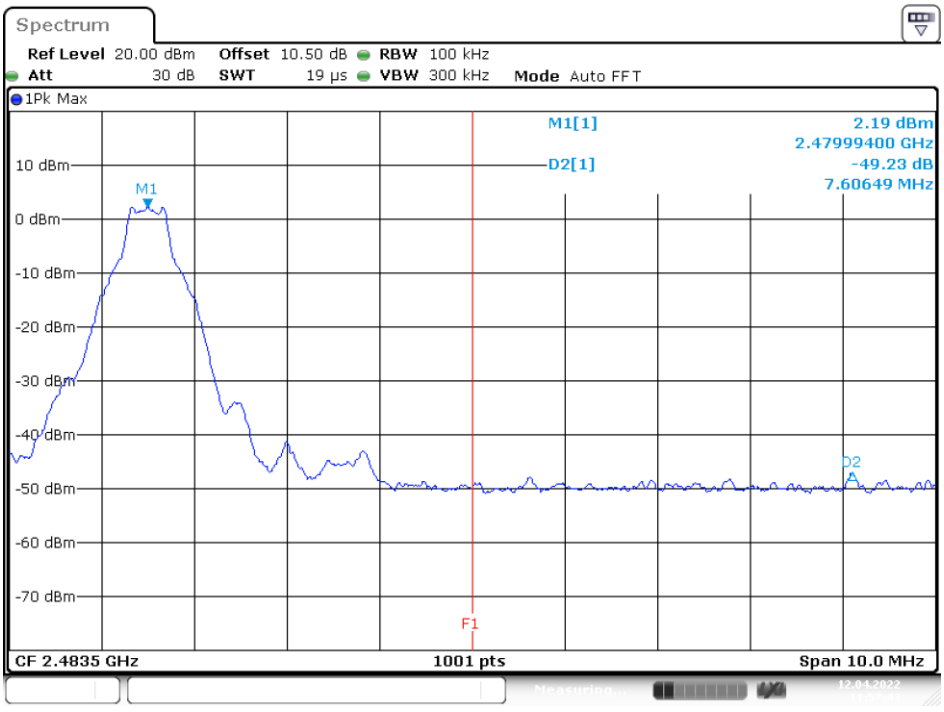
Band Edge, CH High



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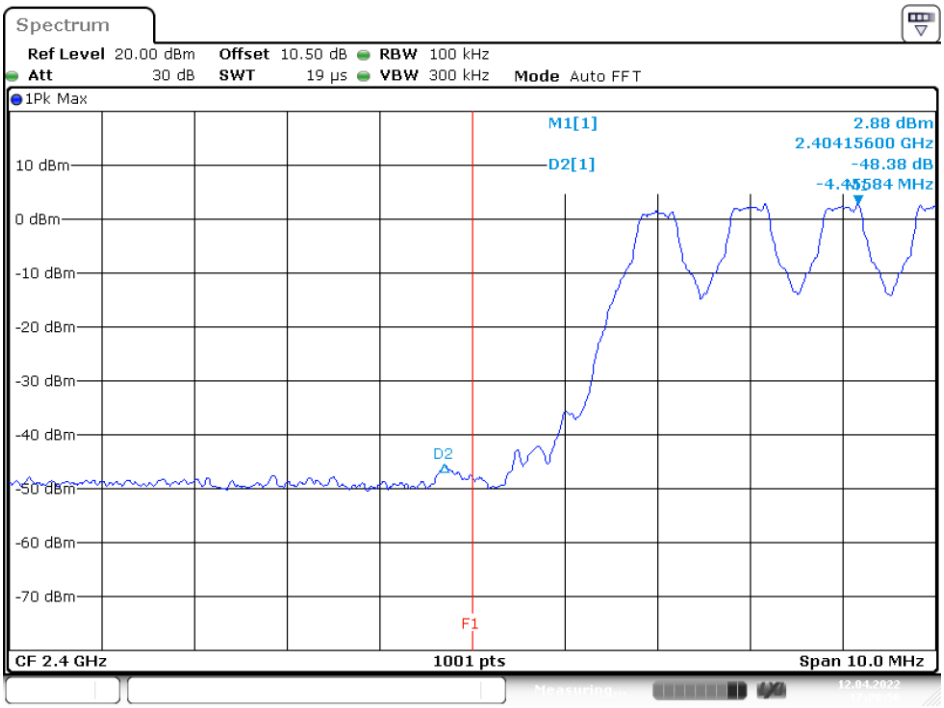
BR Hopping Mode (GFSK)

Band Edge, CH Low



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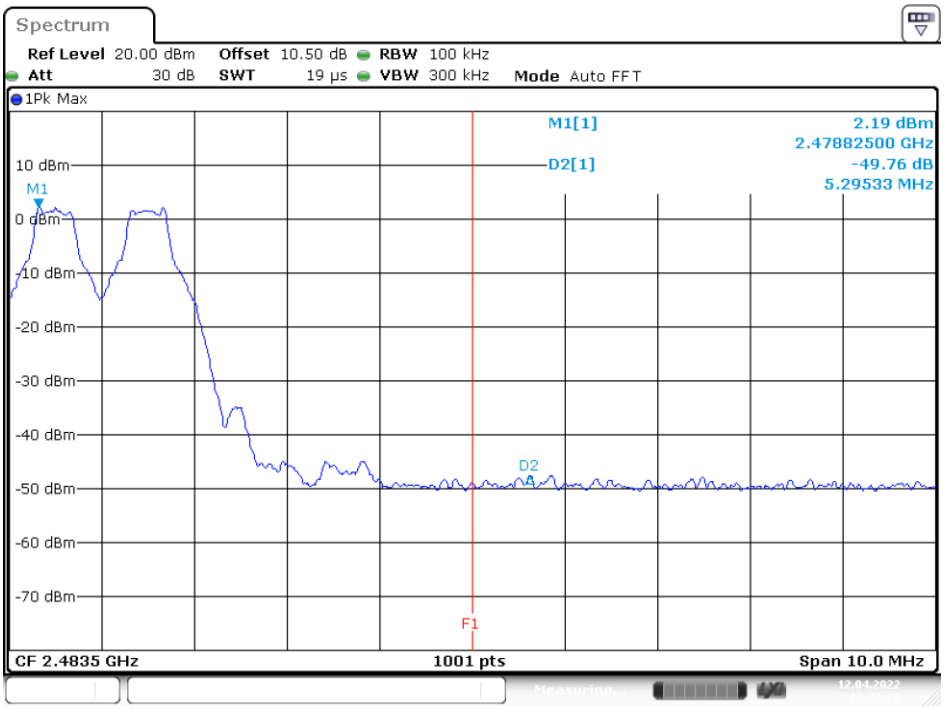
Band Edge, CH High



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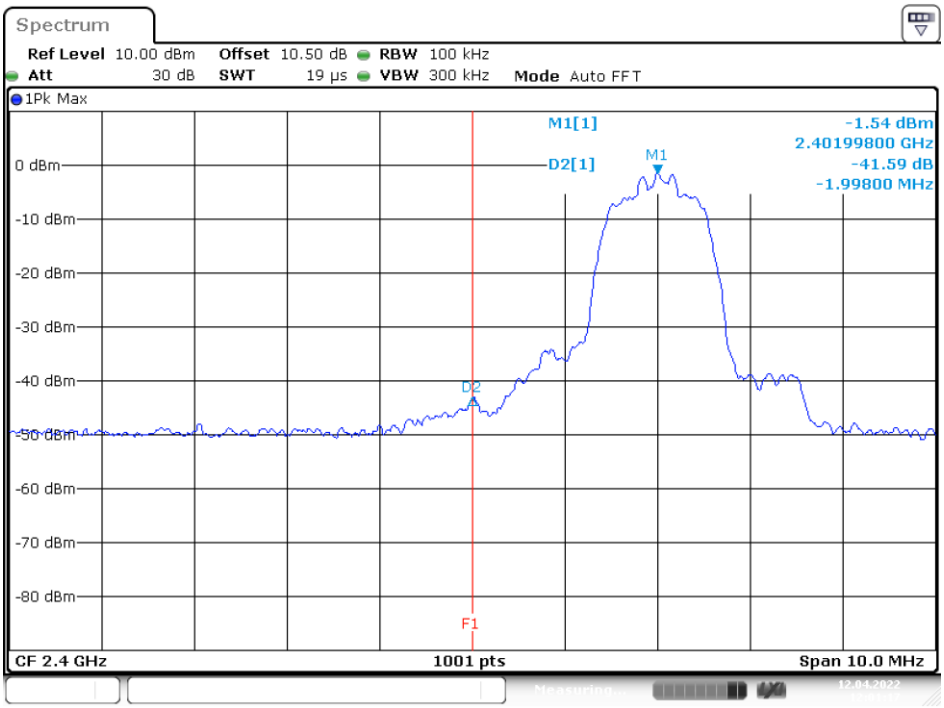
EDR Mode (π/4-DQPSK)

Band Edge, CH Low



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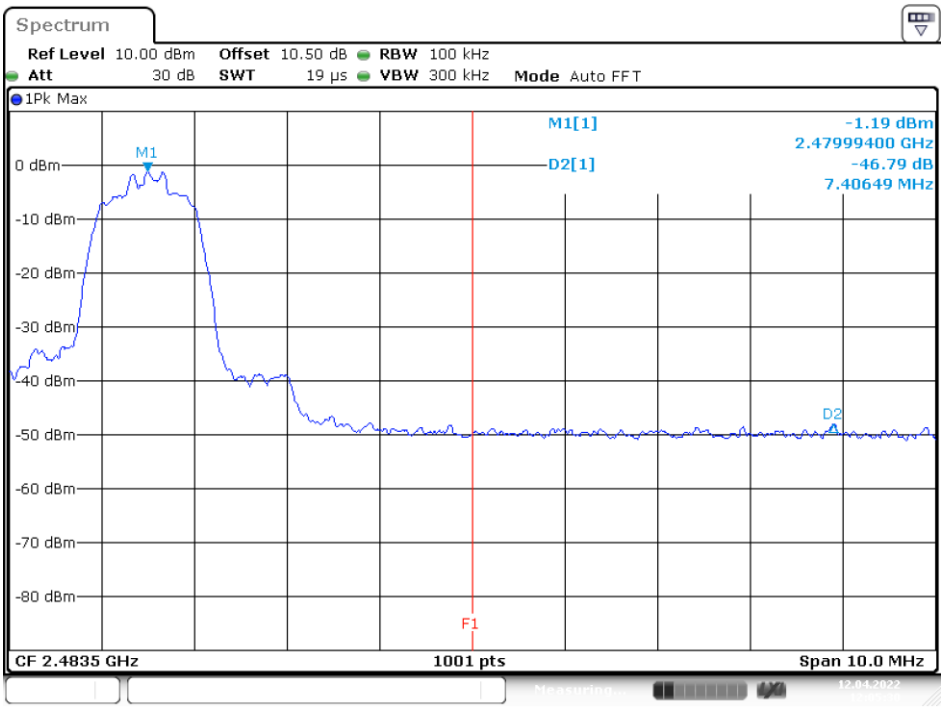
Band Edge, CH High



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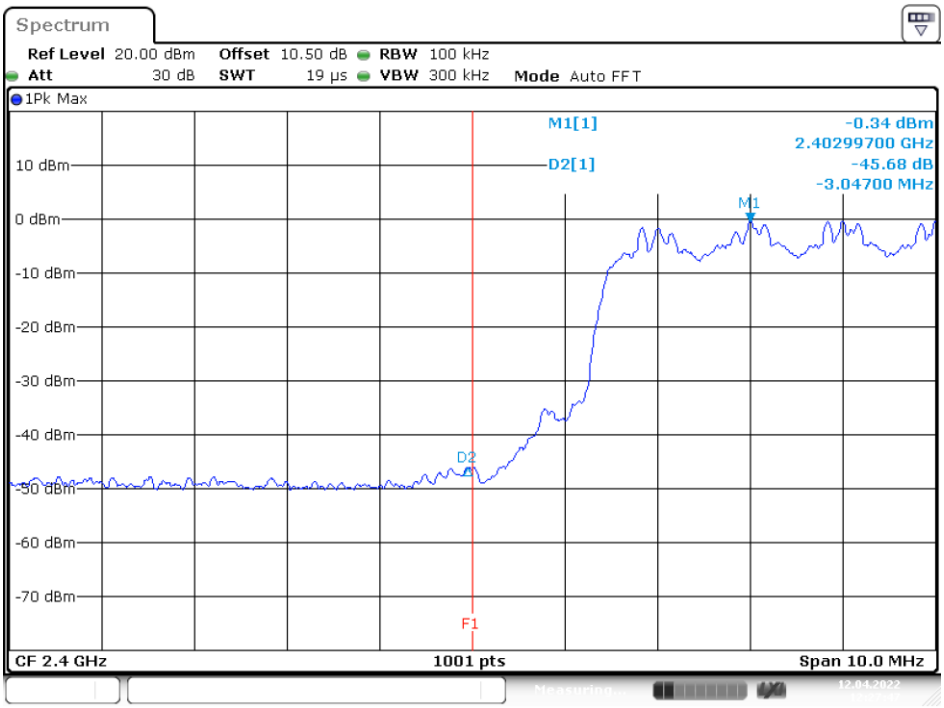
EDR Hopping Mode (π/4-DQPSK)

Band Edge, CH Low



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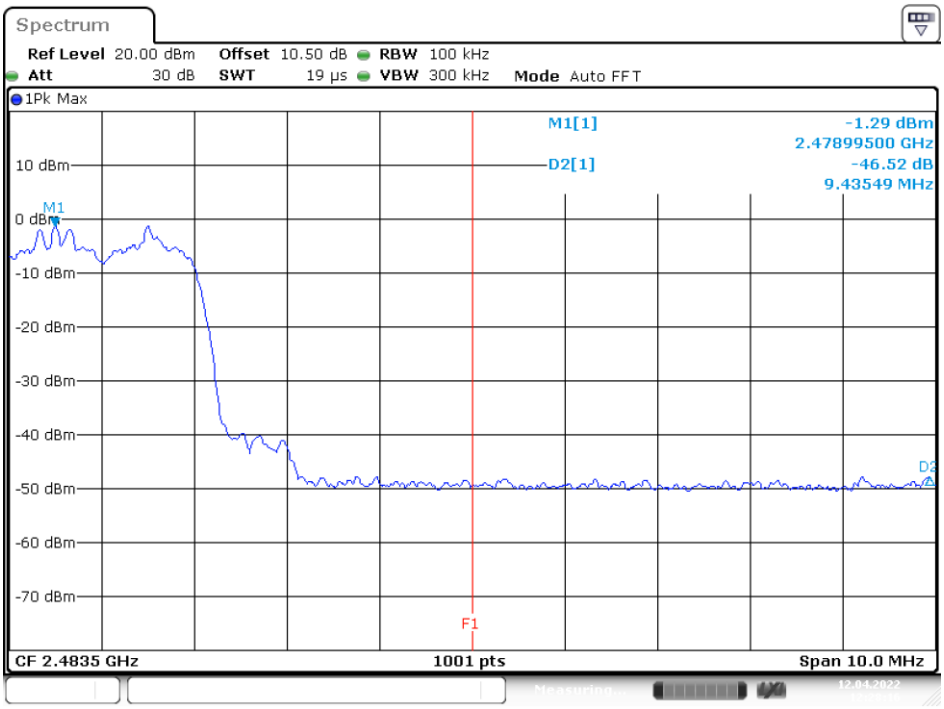
Band Edge, CH High



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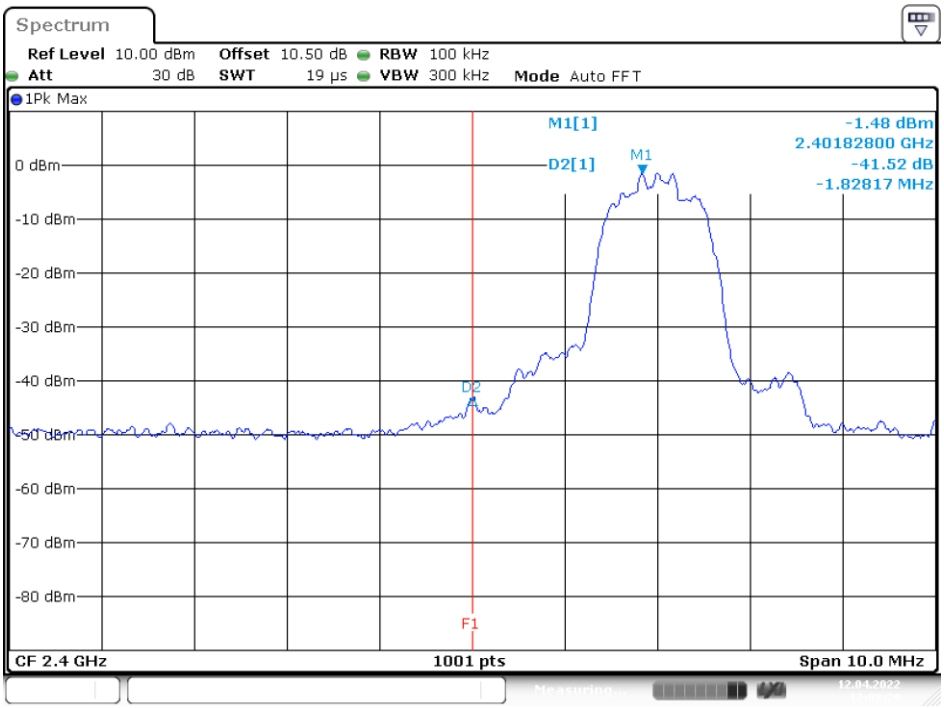
EDR Mode (8DPSK)

Band Edge, CH Low



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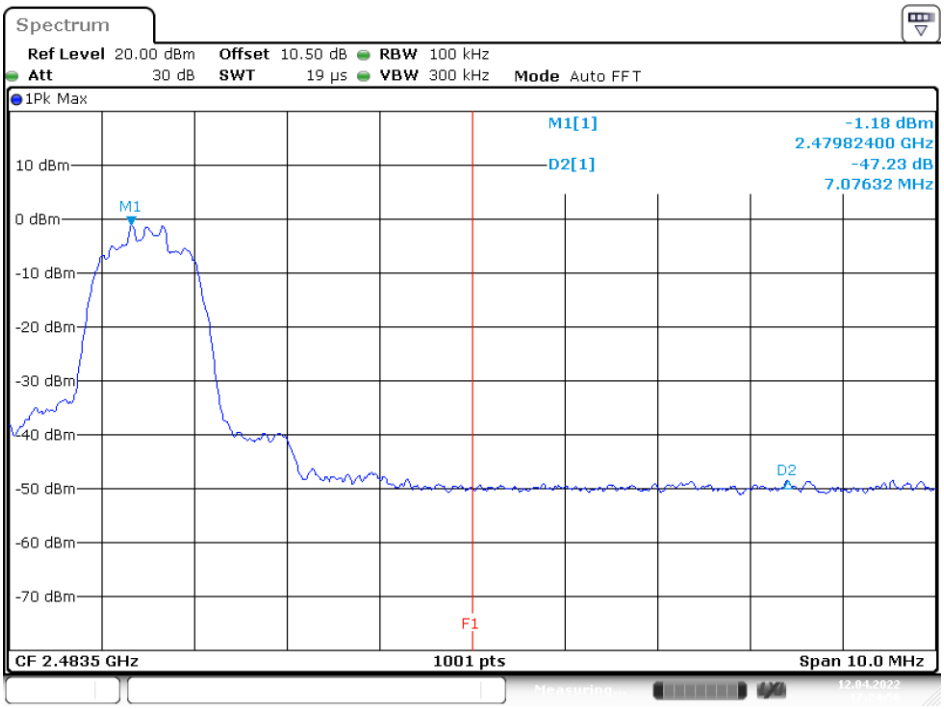
Band Edge, CH High



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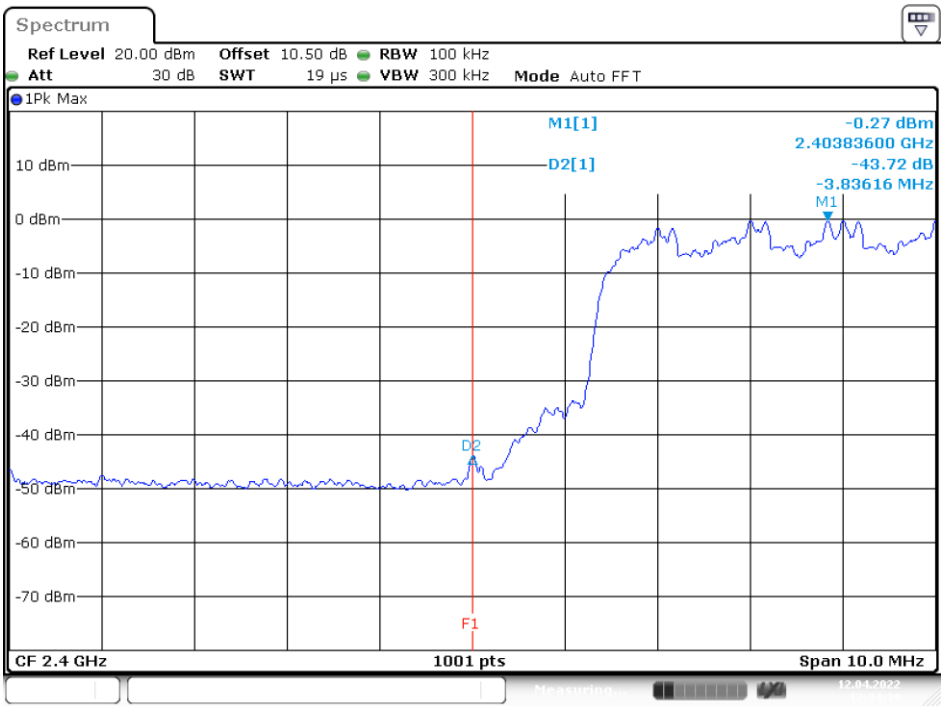
EDR Hopping Mode (8DPSK)

Band Edge, CH Low



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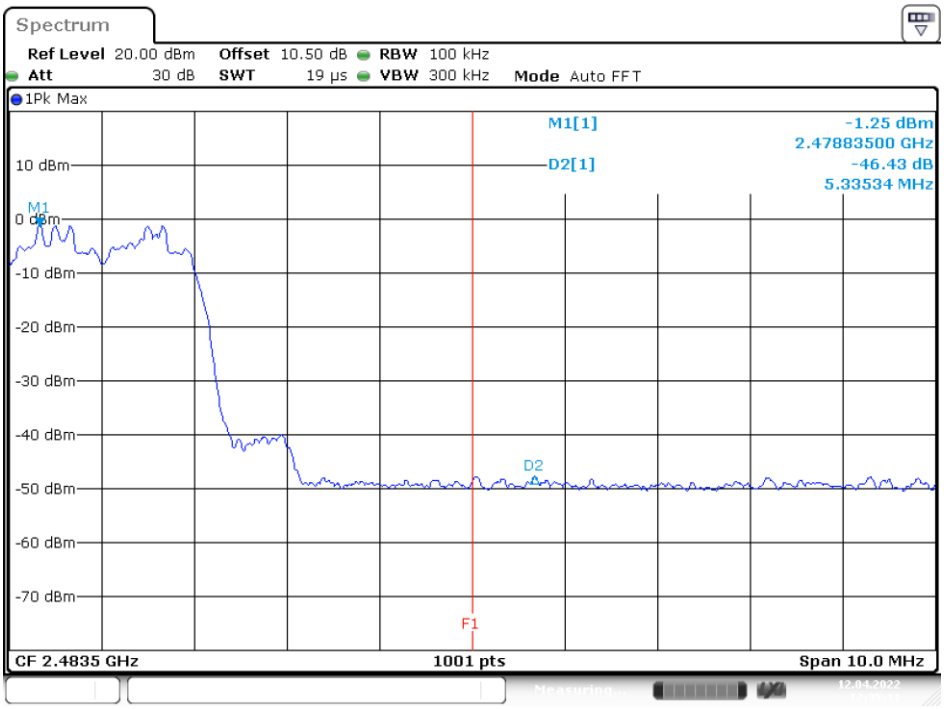
Band Edge, CH High



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