FCC Part 15.247

TEST REPORT

For

M5Stack Technology Co., Ltd

106,1st Floor,Building 1,Bright Technology Park 88 Zhuguang North Road,XiliTaoyuan Street,Nanshan District,Shenzhen,Guangdong,China

FCC ID: 2AN3WM5ATOMU

Report Type: Original Report	**Product Type:** M5AtomU

Report Producer : Jane Chen

Report Number : RXZ211213004RF01

Report Date : 2022-02-22

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ211213004	RXZ211213004RF01	2022-02-22	Original Report	Jane Chen

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1. General Information

1.1. Product Description for Equipment under Test (EUT)

Applicant	M5Stack Technology Co., Ltd
	106,1st Floor,Building 1,Bright Technology Park 88 Zhuguang North Road,XiliTaoyuan Street,Nanshan District,Shenzhen,Guangdong,China
Manufacturer	M5Stack Technology Co., Ltd
	106,1st Floor,Building 1,Bright Technology Park 88 Zhuguang North Road,XiliTaoyuan Street,Nanshan District,Shenzhen,Guangdong,China
Brand(Trade) Name	M5Stack
Product (Equipment)	M5AtomU
Main Model Name	AtomU
Series Model Name	BoksLINK
Model Discrepancy	The major electrical and mechanical constructions of series models are identical to the basic model, except interfaces. The model, AtomU is the testing sample, and the final test data are shown on this test report.
Frequency Range	2402 ~ 2480 MHz
Transmit Power	BR(GFSK) Mode: 9.36 dBm EDR(π/4-DQPSK) Mode: 8.86 dBm EDR(8DPSK) Mode: 9.05 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 Type ☐ Adapter ☐ By AC Power Cord ☐ PoE
	☒ DC 5V ☐ Battery ☐ DC Power Supply ☒ External from USB Port ☐ External DC Adapter
	☐ Host System
Received Date	Dec. 14, 2021
Date of Test	Dec. 26, 2021 ~ Jan. 10, 2022

*All measurement and test data in this report was gathered from production sample serial number: RXZ211213004-01 (Assigned by BACL, New Taipei Laboratory).

1.2. Objective

This report is prepared on behalf of *M5Stack Technology 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)

FCC Part 15.247 DTS submissions with FCC ID: 2AN3WM5ATOMU

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.
KDB 558074 D01 15.247 Meas Guidance v05r02

1.5. Statement of Compliance

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

It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (New Taipei Laboratory)
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		+/- 0.93 dB
Occupied Bandwidth		+/- 0.35 MHz
Unwanted Emissions, conducted		+/- 1.69 dBm
Emissions, radiated	30 MHz~1GHz	+/- 5.46 dB
	1 GHz~18 GHz	+/- 5.24 dB
	18 GHz~40 GHz	+/- 5.86 dB
Temperature		+/- 1.27 °C
Humidity		+/- 3 %

1.7. Environmental Conditions

Test Site	Test Date	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2022/01/10	19.6	53	1010	David
Radiation Spurious Emissions	2022/01/08~ 2022/01/10	19.2~20.4	60~67	1010	Howard
Conducted Spurious Emissions	2021/12/26	22.3	44	1010	Howard
20 dB Emission Bandwidth	2021/12/26	22.3	44	1010	Howard
Channel Separation Test	2021/12/27	24.1	47	1010	Howard
Time of Occupancy	2021/12/27	24.1	47	1010	Howard
Quantity of hopping channel	2021/12/27	24.1	47	1010	Howard
Maximum Output Power	2021/12/26	22.3	44	1010	Howard
100 kHz Bandwidth of Frequency Band Edge	2021/12/26~ 2021/12/27	22.3~24.1	44~47	1010	Howard

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)
1	2402	40	2441
2	2403	--	--
3	2404	--	--
4	2405	77	2478
--	--	78	2479
39	2440	79	2480

For BT Modes were tested with channel 1, 40 and 79.

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 “EspRFtestTool V2.4”

Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	8	8	8
	π/4-DQPSK	6	6	6
	8DPSK	6	6	6

2.4. Test Mode

Model: AtomU for all test item.

2.5. Support Equipment List and Details

Description	Manufacturer	Model Number	S/N
NB	DELL	E6410	8N7PXN1

2.6. External Cable List and Details

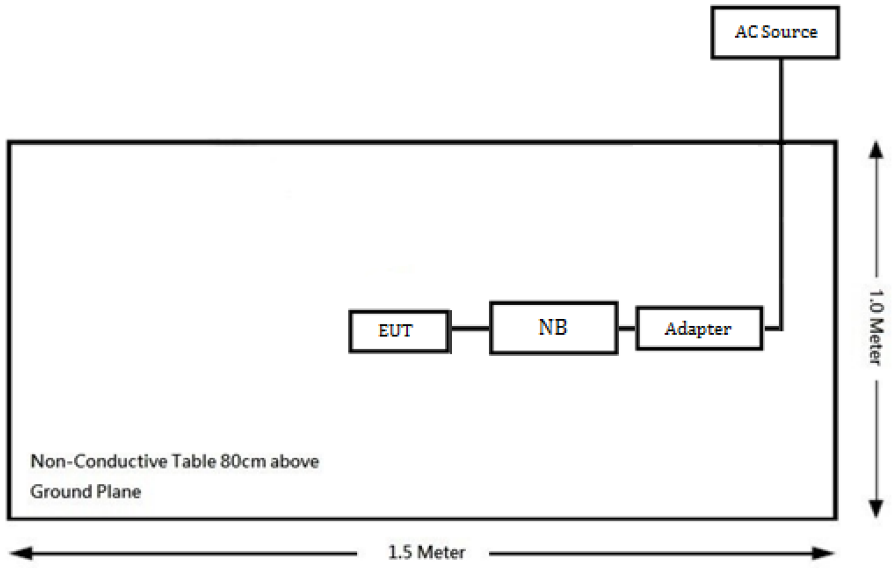
Cable Description	Length (m)	From	To
USB extension cable	1.5	EUT	NB

2.7. Block Diagram of Test Setup

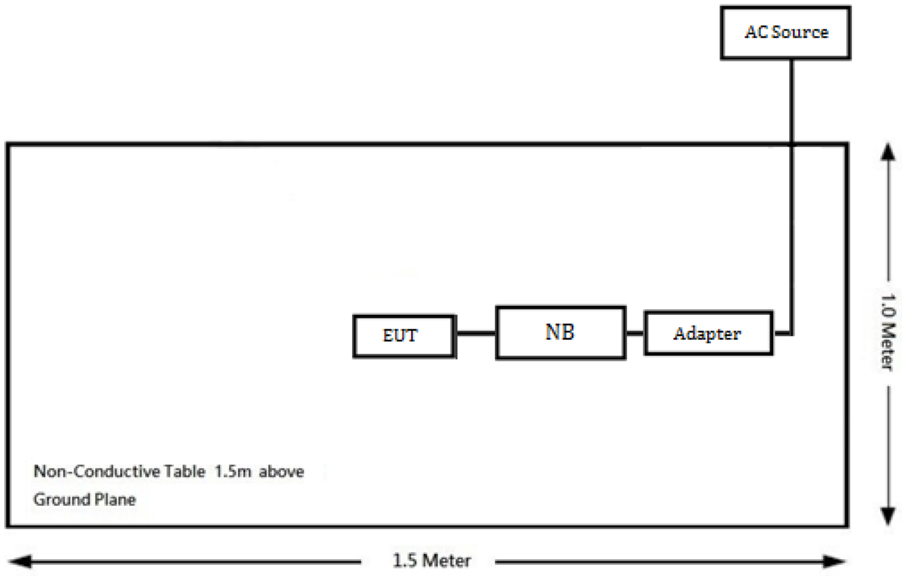
See test photographs attached in annex setup photos for the actual connections between EUT and support equipment.

Radiation:

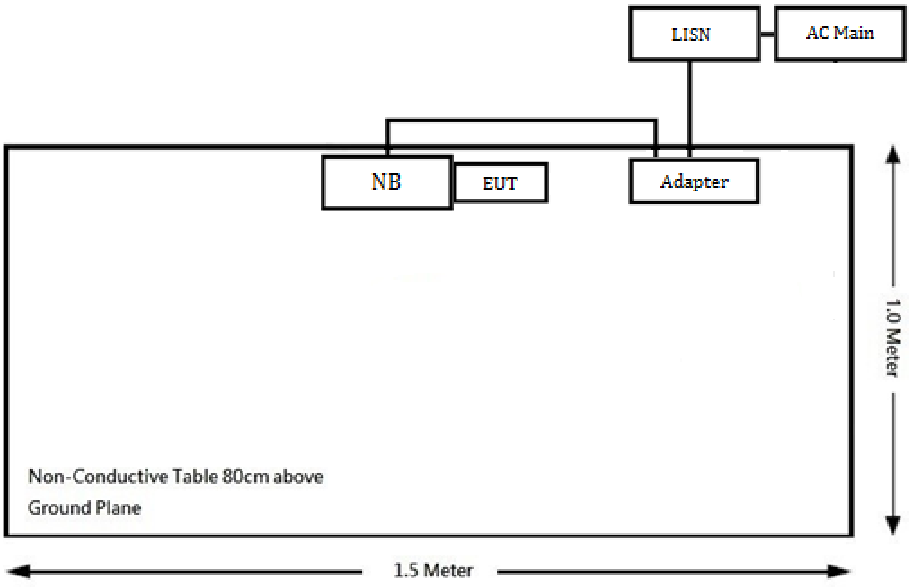
Below 1GHz:



Above 1GHz:



Conduction:


LISN
AC Main
NB
EUT
Adapter
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

3. Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §1.1310, §2.1093	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

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	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 & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2021/1/19	2022/1/18
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
Microware Preamplifier	EM Electronics Corporation	EM18G40G	60656	2021/12/22	2022/12/21
Preamplifier	A.H. system Inc.	PAM-0118P	470	2021/3/15	2022/3/14
Spectrum Analyzer	Rohde & Schwarz	FSV40	101204	2021/06/10	2022/06/09
EMI Test Receiver	Rohde & Schwarz	ESR3	102099	2021/6/9	2022/6/8
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2021/2/1	2022/1/31
Coaxial Cable	COMMATE	PEWC	8Dr	2021/12/19	2022/12/18
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2021/2/1	2022/1/31
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2021/12/19	2022/12/18
Cable	EMC	EMC105-SM-SM-10000	201003	2021/2/3	2022/2/2
Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2021/2/1	2022/1/31

Coaxial Cable	ROSNOL	K1K50-UP0264-K1K50-50CM	15120-1	2021/1/28	2022/1/27
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2021/1/7	2022/1/6
Cable	UTIFLEX	UFA210A	9435	2021/10/5	2022/10/4
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2021/1/28	2022/1/27
Attenuator	MINI-CIRCUITS	BW-S10W5+	1419	2021/1/28	2022/1/27

***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, § 2.1093 – RF Exposure

5.1. Applicable Standard

According to §2.1093 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission’s guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·

[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

5.2. RF Exposure Evaluation Result

RF Exposure evaluation:

Mode	Frequency Range (MHz)	Tunp-up Power		Evaluation Distance (mm)	Calculated Value	Threshold	SAR Test Exclusion
		(dBm)	(mW)			(1-g SAR)	
WIFI 2.4G	2412-2462	9.5	8.913	5	2.8	3	Yes
BLE	2402-2480	9.5	8.913	5	2.8	3	Yes
BT	2402-2480	9.5	8.913	5	2.8	3	Yes

Result: SAR test is exempted.

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
PROANT	PRO-OB-440	PIFA Antenna	2 dBi

Result: Compliance

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

7.1. Applicable Standard

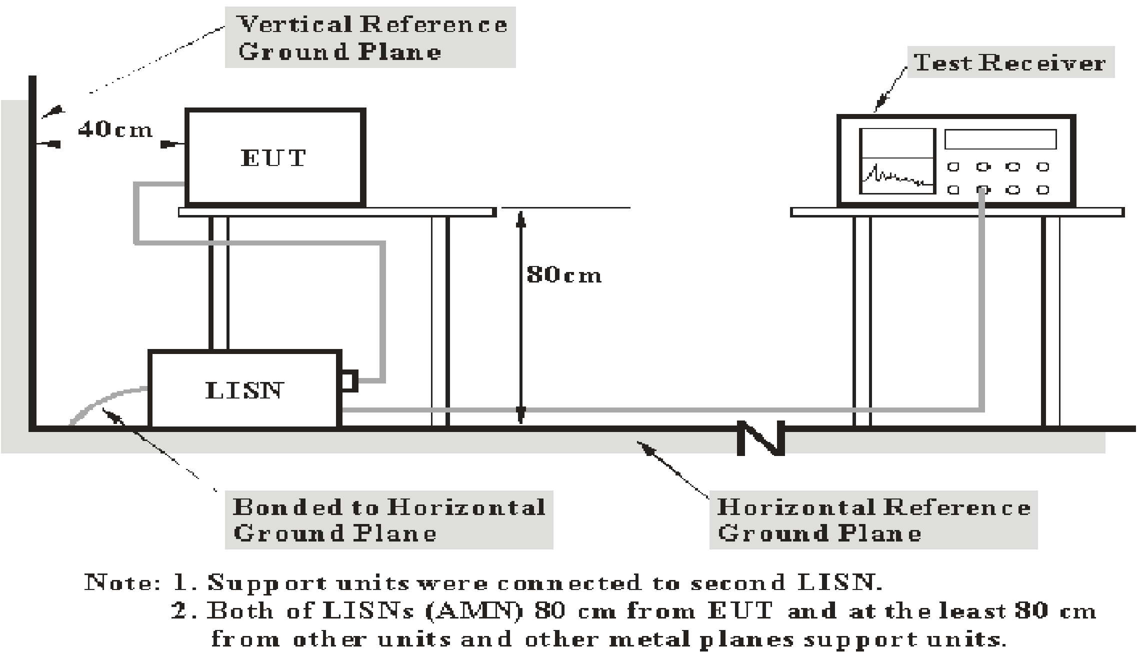
According to §15.207

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 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

7.2. EUT Setup



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:

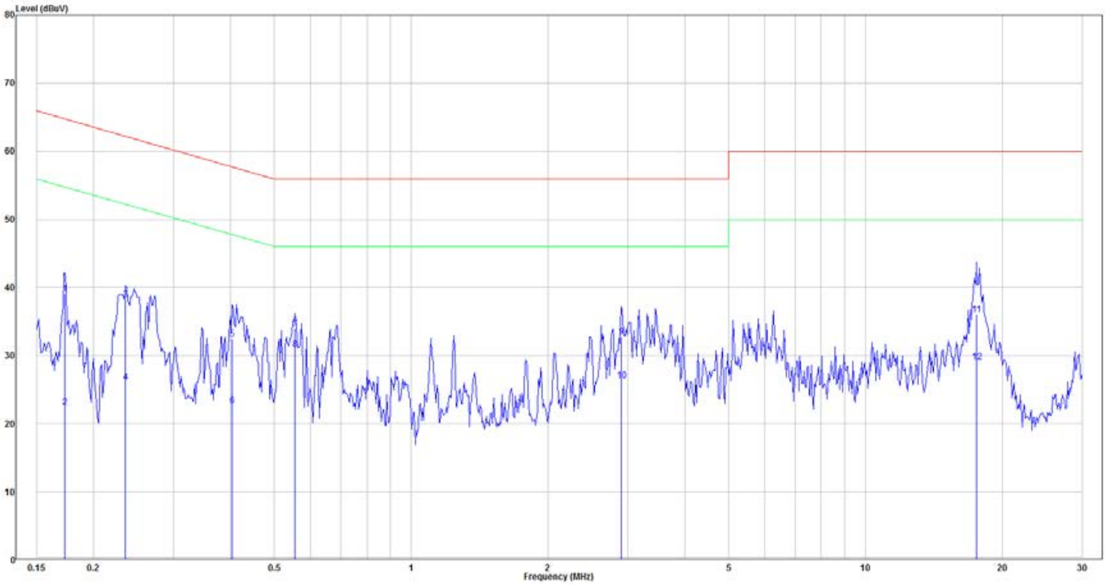
Over Limit = Level – Limit Line

7.6. Test Results

Test Mode: Transmitting

(Worst case is BR (GFSK) mode, Middle Channel)

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBμV)	Factor(dB)	(dBμV)	(dBμV)	(dB)	
1	0.173	19.47	19.59	39.06	64.81	-25.75	QP
2	0.173	2.83	19.59	22.42	54.81	-32.39	Average
3	0.235	18.68	19.58	38.26	62.26	-24.00	QP
4	0.235	6.54	19.58	26.12	52.26	-26.14	Average
5	0.404	12.90	19.58	32.48	57.77	-25.29	QP
6	0.404	3.06	19.58	22.64	47.77	-25.13	Average
7	0.555	14.38	19.59	33.97	56.00	-22.03	QP
8	0.555	11.32	19.59	30.91	46.00	-15.09	Average
9	2.900	13.06	19.66	32.72	56.00	-23.28	QP
10	2.900	6.68	19.66	26.34	46.00	-19.66	Average
11	17.568	16.14	19.85	35.99	60.00	-24.01	QP
12	17.568	9.19	19.85	29.04	50.00	-20.96	Average

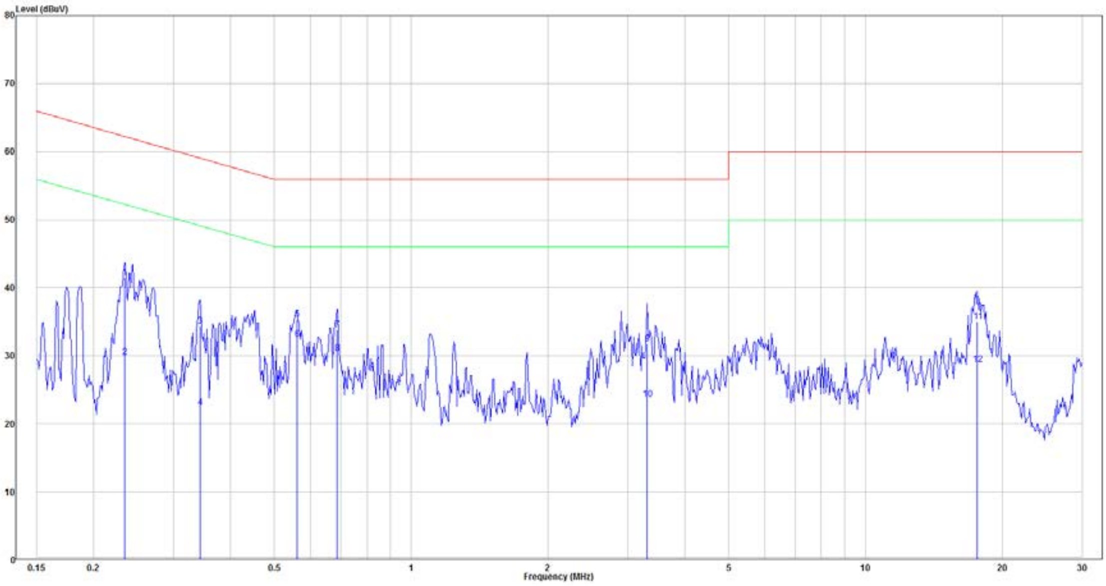
Note:

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	0.234	21.86	19.57	41.43	62.30	-20.87	QP
2	0.234	10.22	19.57	29.79	52.30	-22.51	Average
3	0.343	14.81	19.57	34.38	59.13	-24.75	QP
4	0.343	2.89	19.57	22.46	49.13	-26.67	Average
5	0.561	15.75	19.58	35.33	56.00	-20.67	QP
6	0.561	12.87	19.58	32.45	46.00	-13.55	Average
7	0.686	14.29	19.59	33.88	56.00	-22.12	QP
8	0.686	10.78	19.59	30.37	46.00	-15.63	Average
9	3.310	12.07	19.67	31.74	56.00	-24.26	QP
10	3.310	3.95	19.67	23.62	46.00	-22.38	Average
11	17.661	15.14	19.91	35.05	60.00	-24.95	QP
12	17.661	8.78	19.91	28.69	50.00	-21.31	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:

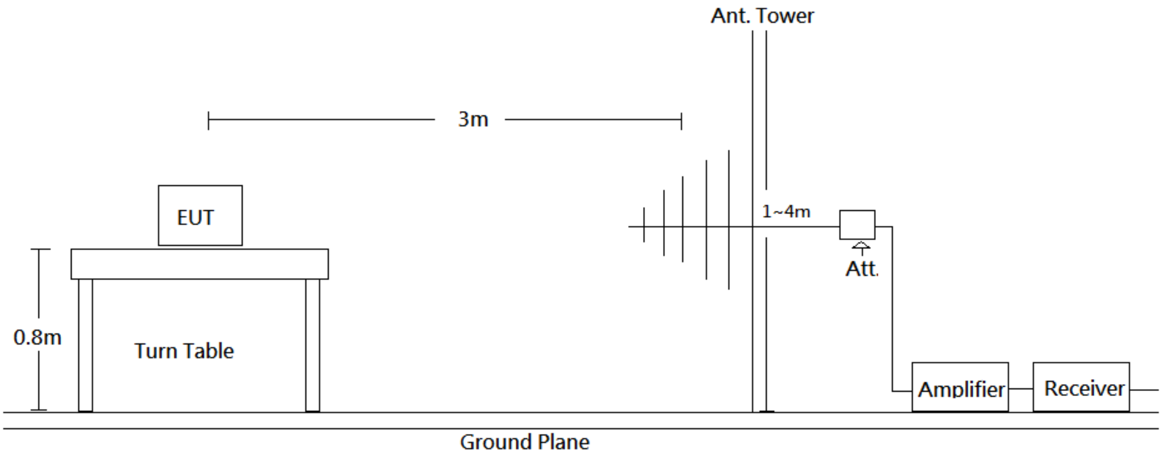
Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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.

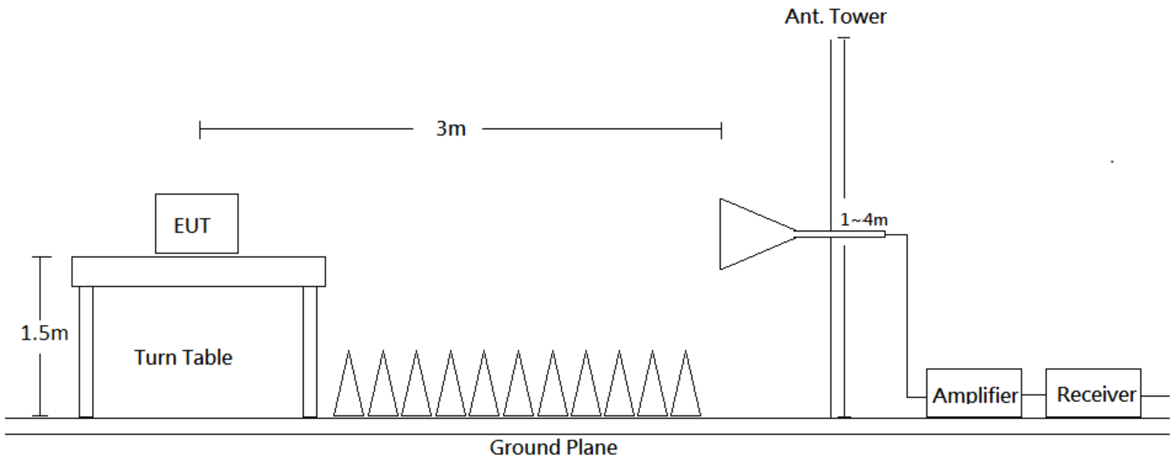
As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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:

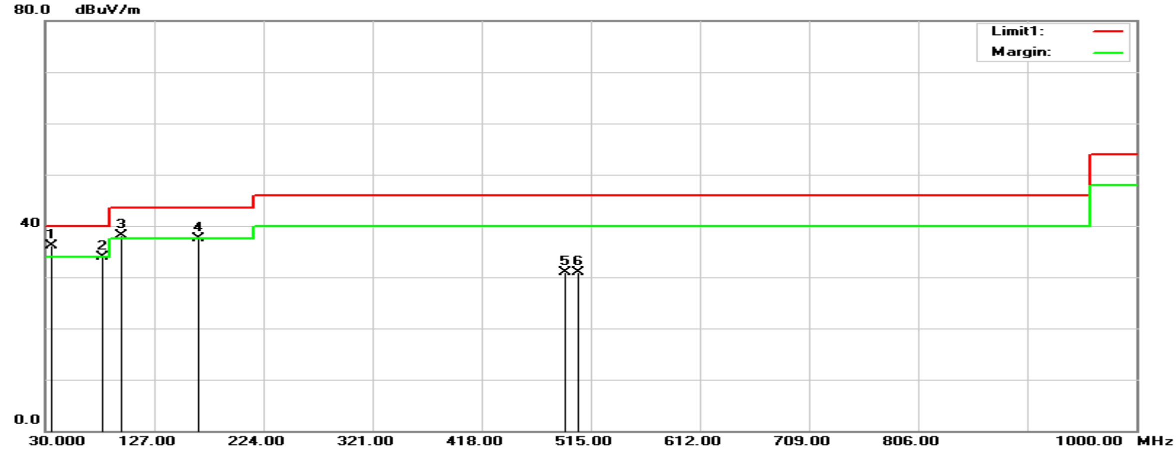
Margin = Result – Limit

8.6. Test Results

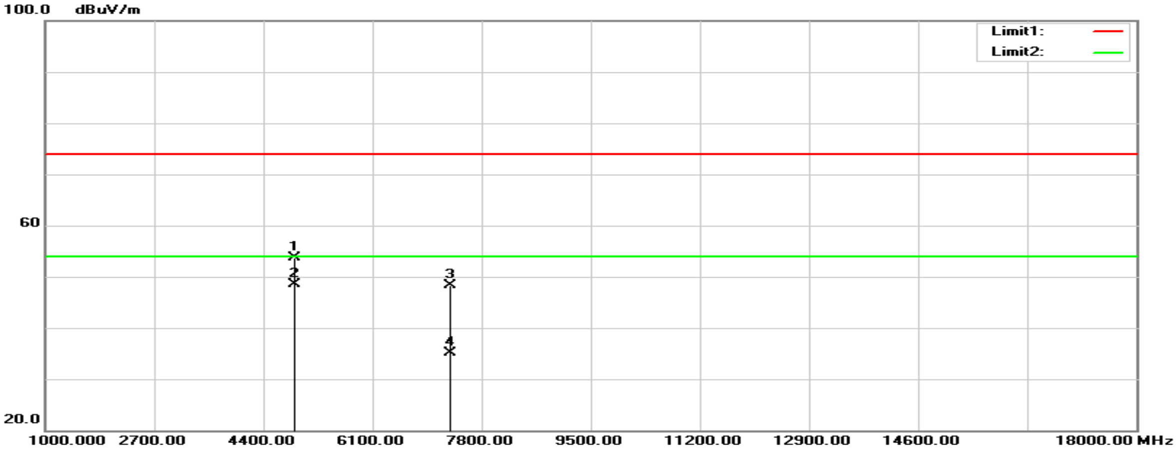
Test Mode: Transmitting (Pre-scan with three orthogonal axis, and worse case as X axis.)

Horizontal (worst case is BR (GFSK) mode, middle channel)

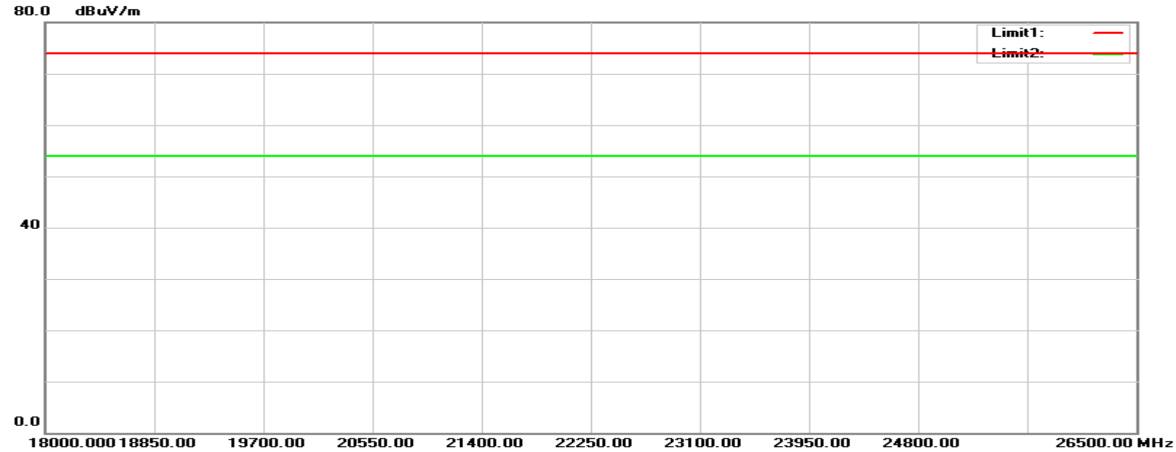
30MHz-1GHz:



1GHz-18GHz:

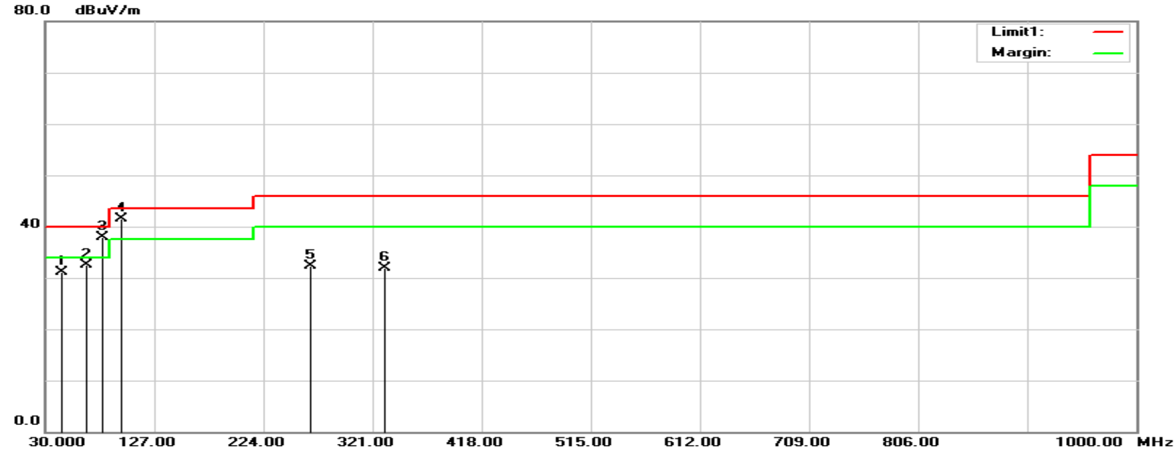


18GHz-26.5GHz:

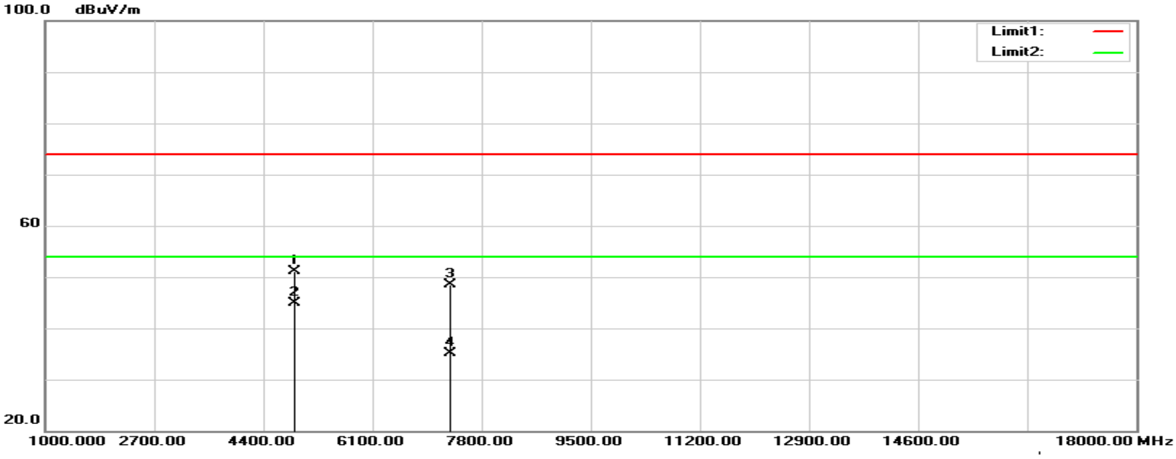


Vertical worst case is BR (GFSK) mode middle channel)

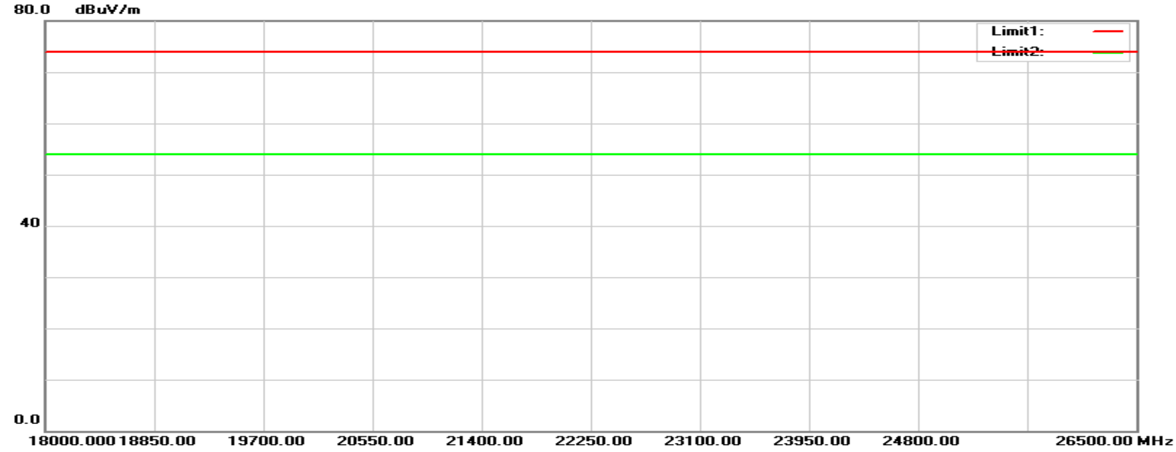
30MHz-1GHz:



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
35.8200	43.89	-7.87	36.02	40.00	-3.98	100	241	peak
81.4100	50.43	-16.62	33.81	40.00	-6.19	100	125	peak
97.9000	52.90	-14.71	38.19	43.50	-5.31	100	65	peak
165.8000	49.21	-11.71	37.50	43.50	-6.00	100	158	peak
491.7200	36.70	-5.77	30.93	46.00	-15.07	100	14	peak
504.3300	36.57	-5.65	30.92	46.00	-15.08	100	72	peak

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
44.5500	44.70	-13.59	31.11	40.00	-8.89	100	241	peak
66.8600	49.15	-16.57	32.58	40.00	-7.42	100	15	peak
81.4100	54.53	-16.62	37.91	40.00	-2.09	100	16	peak
97.9000	56.25	-14.71	41.54	43.50	-1.96	100	111	peak
265.7100	43.06	-10.80	32.26	46.00	-13.74	100	259	peak
331.6700	41.25	-9.44	31.81	46.00	-14.19	100	12	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								
2390.000	61.40	-9.46	51.94	74.00	-22.06	142	31	peak
2390.000	44.77	-9.46	35.31	54.00	-18.69	142	31	AVG
4804.000	53.25	-2.17	51.08	74.00	-22.92	113	153	peak
4804.000	47.33	-2.17	45.16	54.00	-8.84	113	153	AVG
7206.000	43.76	4.18	47.94	74.00	-26.06	152	148	peak
7206.000	29.70	4.18	33.88	54.00	-20.12	152	148	AVG
BR (GFSK), Middle channel								
4882.000	55.49	-1.86	53.63	74.00	-20.37	114	155	peak
4882.000	50.28	-1.86	48.42	54.00	-5.58	114	155	AVG
7323.000	43.29	5.11	48.40	74.00	-25.60	150	95	peak
7323.000	30.00	5.11	35.11	54.00	-18.89	150	95	AVG
BR (GFSK), High channel								
2487.250	69.71	-8.39	61.32	74.00	-12.68	143	34	peak
2487.250	55.11	-8.39	46.72	54.00	-7.28	143	34	AVG
4960.000	55.25	-1.49	53.76	74.00	-20.24	115	161	peak
4960.000	49.87	-1.49	48.38	54.00	-5.62	115	161	AVG
7440.000	43.08	5.23	48.31	74.00	-25.69	159	78	peak
7440.000	29.48	5.23	34.71	54.00	-19.29	159	78	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								
2390.000	57.66	-9.46	48.20	74.00	-25.80	178	178	peak
2390.000	43.79	-9.46	34.33	54.00	-19.67	178	178	AVG
4804.000	49.65	-2.17	47.48	74.00	-26.52	155	81	peak
4804.000	42.94	-2.17	40.77	54.00	-13.23	155	81	AVG
7206.000	43.49	4.18	47.67	74.00	-26.33	150	254	peak
7206.000	30.56	4.18	34.74	54.00	-19.26	150	254	AVG
BR (GFSK), Middle channel								
4882.000	52.88	-1.86	51.02	74.00	-22.98	157	100	peak
4882.000	46.84	-1.86	44.98	54.00	-9.02	157	100	AVG
7323.000	43.45	5.11	48.56	74.00	-25.44	154	71	peak
7323.000	29.90	5.11	35.01	54.00	-18.99	154	71	AVG
BR (GFSK), High channel								
2486.890	61.33	-8.40	52.93	74.00	-21.07	181	168	peak
2486.890	47.84	-8.40	39.44	54.00	-14.56	181	168	AVG
4960.000	52.66	-1.49	51.17	74.00	-22.83	158	102	peak
4960.000	46.98	-1.49	45.49	54.00	-8.51	158	102	AVG
7440.000	43.16	5.23	48.39	74.00	-25.61	152	54	peak
7440.000	29.49	5.23	34.72	54.00	-19.28	152	54	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	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
(MHz)	(dBμV)	Factor(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)	
EDR (π/4-DQPSK), Low channel								
2389.700	60.73	-9.46	51.27	74.00	-22.73	139	35	peak
2389.700	47.36	-9.46	37.90	54.00	-16.10	139	35	AVG
4804.000	58.27	-2.17	56.10	74.00	-17.90	102	155	peak
4804.000	50.03	-2.17	47.86	54.00	-6.14	102	155	AVG
7206.000	44.53	4.18	48.71	74.00	-25.29	151	157	peak
7206.000	29.77	4.18	33.95	54.00	-20.05	151	157	AVG
EDR (π/4-DQPSK), Middle channel								
4882.000	56.89	-1.86	55.03	74.00	-18.97	145	155	peak
4882.000	48.73	-1.86	46.87	54.00	-7.13	145	155	AVG
7323.000	44.28	5.11	49.39	74.00	-24.61	150	185	peak
7323.000	29.97	5.11	35.08	54.00	-18.92	150	185	AVG
EDR (π/4-DQPSK), High channel								
2488.030	69.77	-8.38	61.39	74.00	-12.61	143	54	peak
2488.030	55.22	-8.38	46.84	54.00	-7.16	143	54	AVG
4960.000	57.12	-1.49	55.63	74.00	-18.37	118	160	peak
4960.000	47.97	-1.49	46.48	54.00	-7.52	118	160	AVG
7440.000	43.06	5.23	48.29	74.00	-25.71	150	135	peak
7440.000	29.49	5.23	34.72	54.00	-19.28	150	135	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								
2382.600	56.25	-9.52	46.73	74.00	-27.27	175	182	peak
2382.600	43.83	-9.52	34.31	54.00	-19.69	175	182	AVG
4804.000	55.97	-2.17	53.80	74.00	-20.20	145	127	peak
4804.000	46.88	-2.17	44.71	54.00	-9.29	145	127	AVG
7206.000	42.93	4.18	47.11	74.00	-26.89	154	195	peak
7206.000	27.32	4.18	31.50	54.00	-22.50	154	195	AVG
EDR (π/4-DQPSK), Middle channel								
4882.000	54.18	-1.86	52.32	74.00	-21.68	158	88	peak
4882.000	44.22	-1.86	42.36	54.00	-11.64	158	88	AVG
7323.000	44.38	5.11	49.49	74.00	-24.51	150	185	peak
7323.000	29.94	5.11	35.05	54.00	-18.95	150	185	AVG
EDR (π/4-DQPSK), High channel								
2488.930	61.98	-8.37	53.61	74.00	-20.39	180	165	peak
2488.930	48.37	-8.37	40.00	54.00	-14.00	180	165	AVG
4960.000	53.88	-1.49	52.39	74.00	-21.61	160	82	peak
4960.000	44.50	-1.49	43.01	54.00	-10.99	160	82	AVG
7440.000	43.00	5.23	48.23	74.00	-25.77	157	65	peak
7440.000	29.50	5.23	34.73	54.00	-19.27	157	65	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								
2390.000	61.43	-9.46	51.97	74.00	-22.03	145	40	peak
2390.000	47.41	-9.46	37.95	54.00	-16.05	145	40	AVG
4804.000	58.82	-2.17	56.65	74.00	-17.35	105	158	peak
4804.000	50.72	-2.17	48.55	54.00	-5.45	105	158	AVG
7206.000	43.07	4.18	47.25	74.00	-26.75	158	95	peak
7206.000	29.87	4.18	34.05	54.00	-19.95	158	95	AVG
EDR (8DPSK), Middle channel								
4882.000	63.11	-1.86	61.25	74.00	-12.75	108	160	peak
4882.000	54.30	-1.86	52.44	54.00	-1.56	108	160	AVG
7323.000	43.46	5.11	48.57	74.00	-25.43	158	77	peak
7323.000	30.00	5.11	35.11	54.00	-18.89	158	77	AVG
EDR (8DPSK), High channel								
2487.910	69.69	-8.39	61.30	74.00	-12.70	145	33	peak
2487.910	55.11	-8.39	46.72	54.00	-7.28	145	33	AVG
4960.000	62.74	-1.49	61.25	74.00	-12.75	108	164	peak
4960.000	53.93	-1.49	52.44	54.00	-1.56	108	164	AVG
7440.000	42.21	5.23	47.44	74.00	-26.56	157	65	peak
7440.000	28.44	5.23	33.67	54.00	-20.33	157	65	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

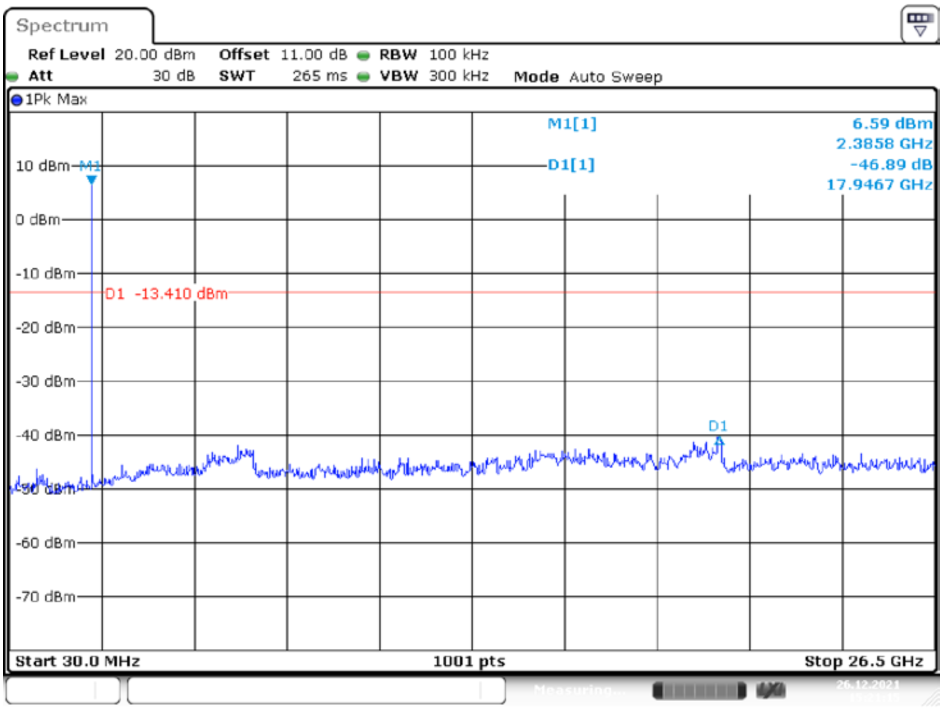
Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (8DPSK), Low channel								
2390.000	55.45	-9.46	45.99	74.00	-28.01	180	195	peak
2390.000	43.49	-9.46	34.03	54.00	-19.97	180	195	AVG
4804.000	54.59	-2.17	52.42	74.00	-21.58	150	132	peak
4804.000	46.97	-2.17	44.80	54.00	-9.20	150	132	AVG
7206.000	43.45	4.18	47.63	74.00	-26.37	152	144	peak
7206.000	29.74	4.18	33.92	54.00	-20.08	152	144	AVG
EDR (8DPSK), Middle channel								
4882.000	58.26	-1.86	56.40	74.00	-17.60	125	158	peak
4882.000	51.36	-1.86	49.50	54.00	-4.50	125	158	AVG
7323.000	43.86	5.11	48.97	74.00	-25.03	151	254	peak
7323.000	30.12	5.11	35.23	54.00	-18.77	151	254	AVG
EDR (8DPSK), High channel								
2485.570	62.21	-8.42	53.79	74.00	-20.21	185	162	peak
2485.570	47.79	-8.42	39.37	54.00	-14.63	185	162	AVG
4960.000	61.02	-1.49	59.53	74.00	-14.47	150	99	peak
4960.000	52.12	-1.49	50.63	54.00	-3.37	150	99	AVG
7440.000	43.00	5.23	48.23	74.00	-25.77	145	125	peak
7440.000	29.00	5.23	34.23	54.00	-19.77	145	125	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:

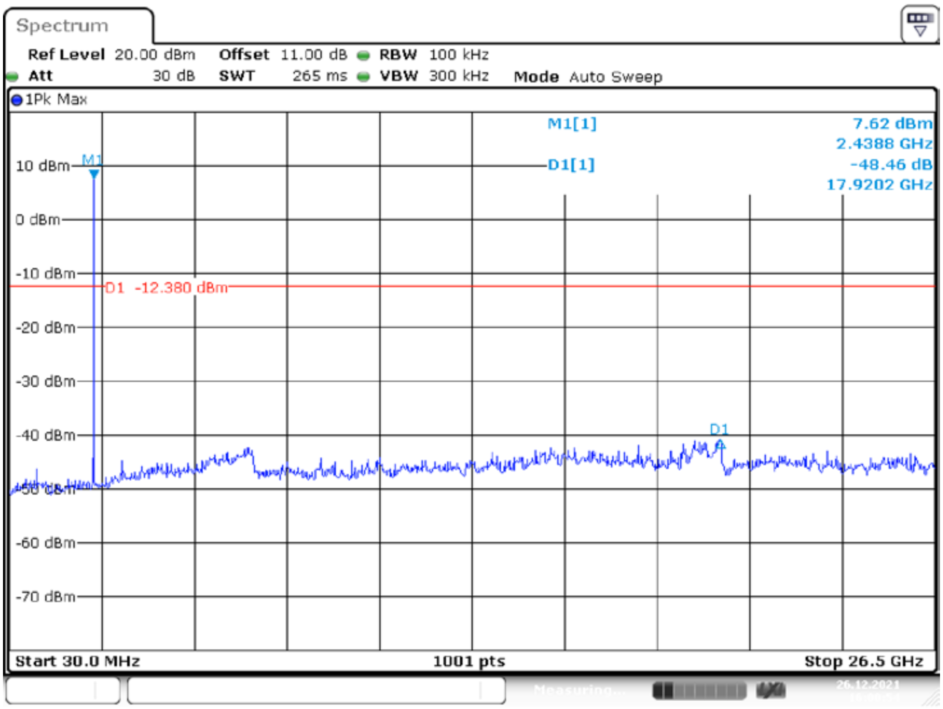
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	46.89	≥ 20	PASS
Middle	2441	48.46	≥ 20	PASS
High	2480	46.89	≥ 20	PASS
EDR Mode (π/4-DQPSK):				
Low	2402	43.06	≥ 20	PASS
Middle	2441	44.44	≥ 20	PASS
High	2480	43.87	≥ 20	PASS
EDR Mode (8DPSK):				
Low	2402	44.22	≥ 20	PASS
Middle	2441	45.18	≥ 20	PASS
High	2480	44.17	≥ 20	PASS

BR Mode (GFSK)
Low Channel



Date: 26.DEC.2021 15:21:15

Middle Channel



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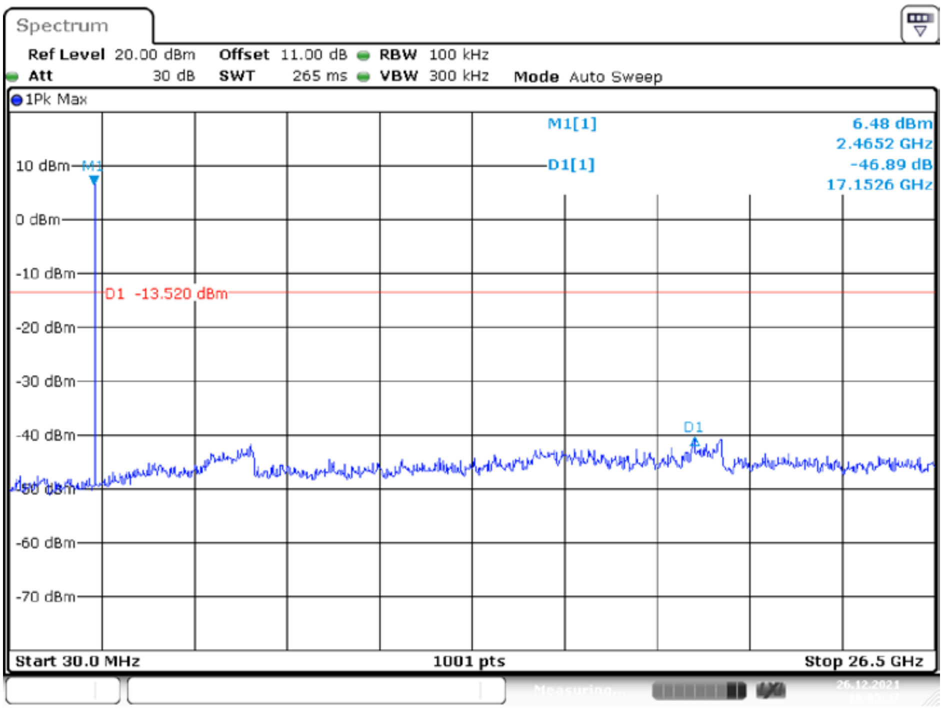
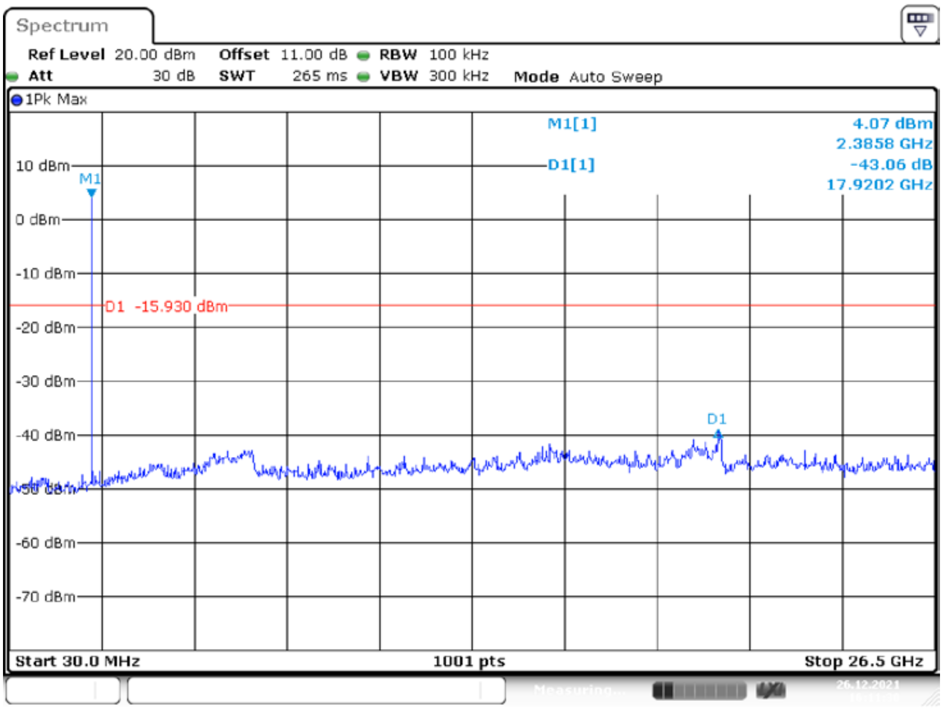
High Channel



Date: 26.DEC.2021 16:05:48

EDR Mode (π/4-DQPSK)

Low Channel



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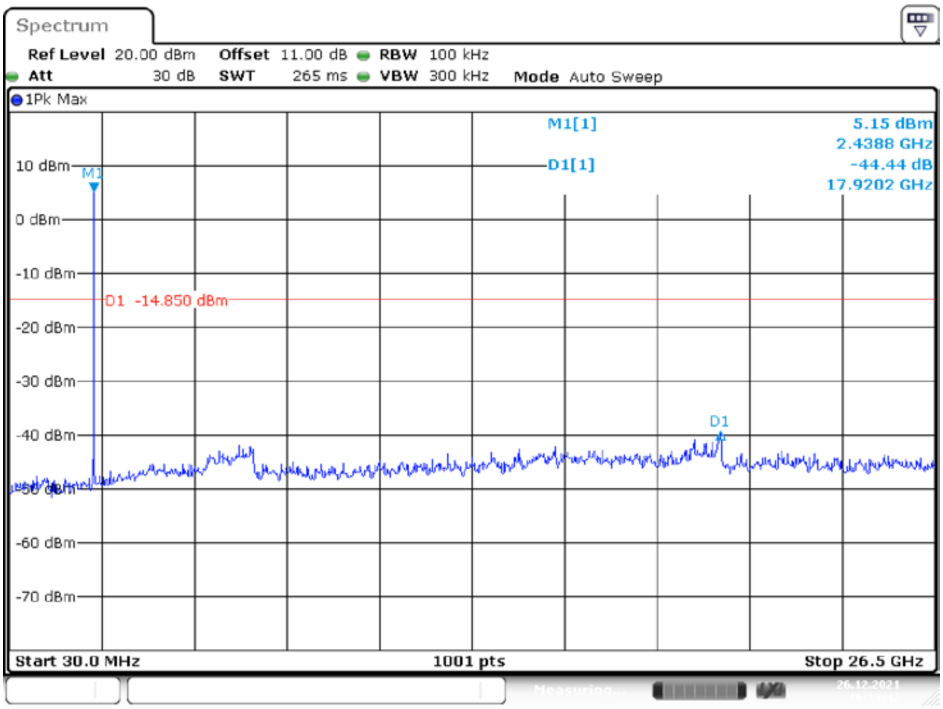
Middle Channel



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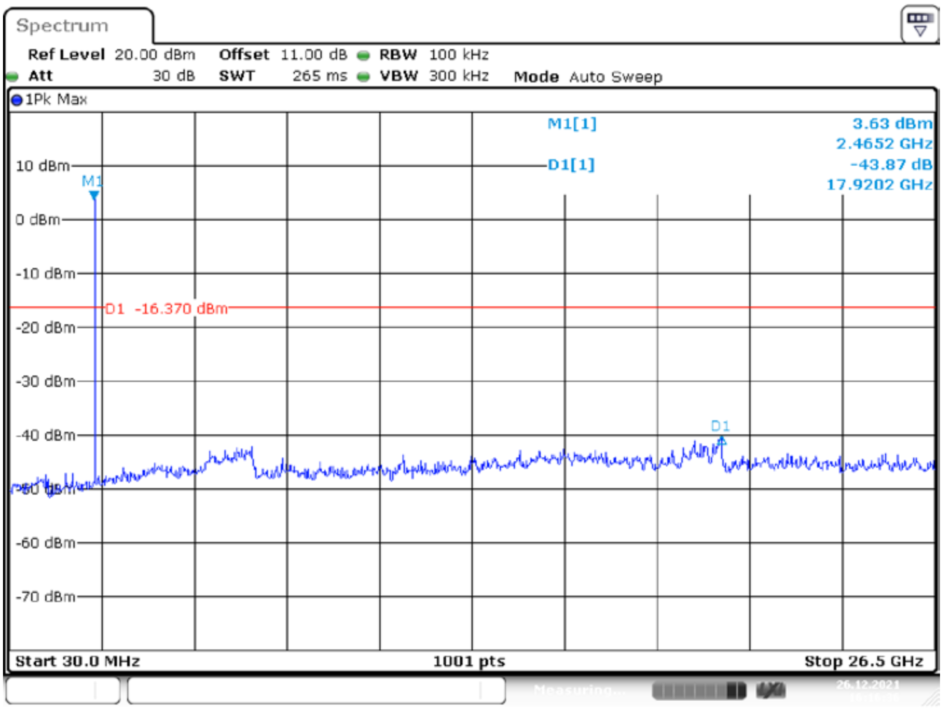
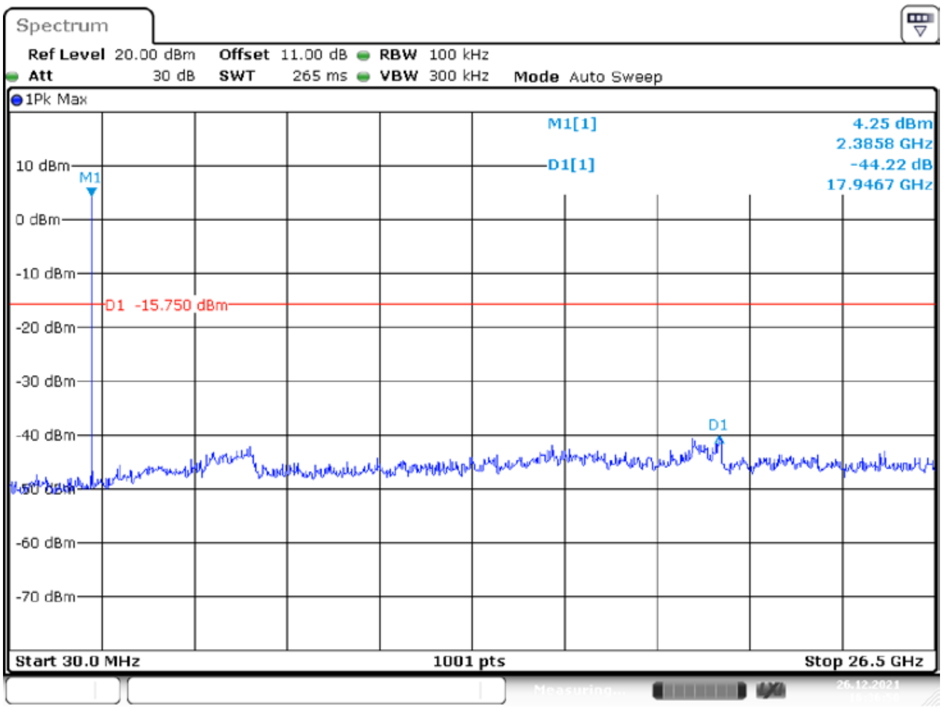
High Channel



Date: 26.DEC.2021 16:16:37

EDR Mode (8DPSK)

Low Channel



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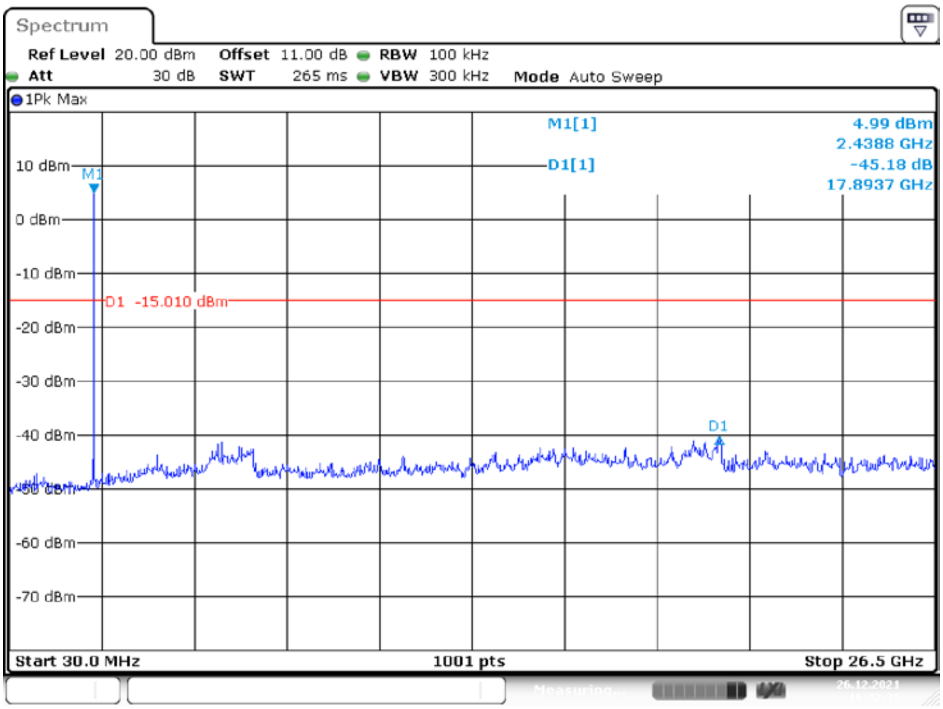
Middle Channel



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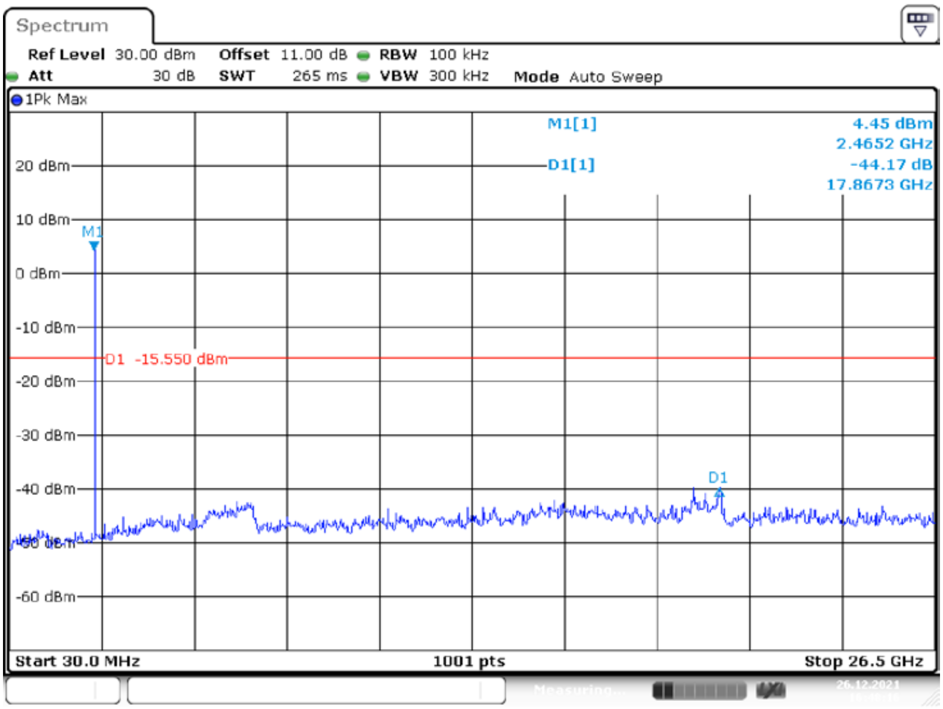
High Channel



Date: 26.DEC.2021 16:48:17

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.

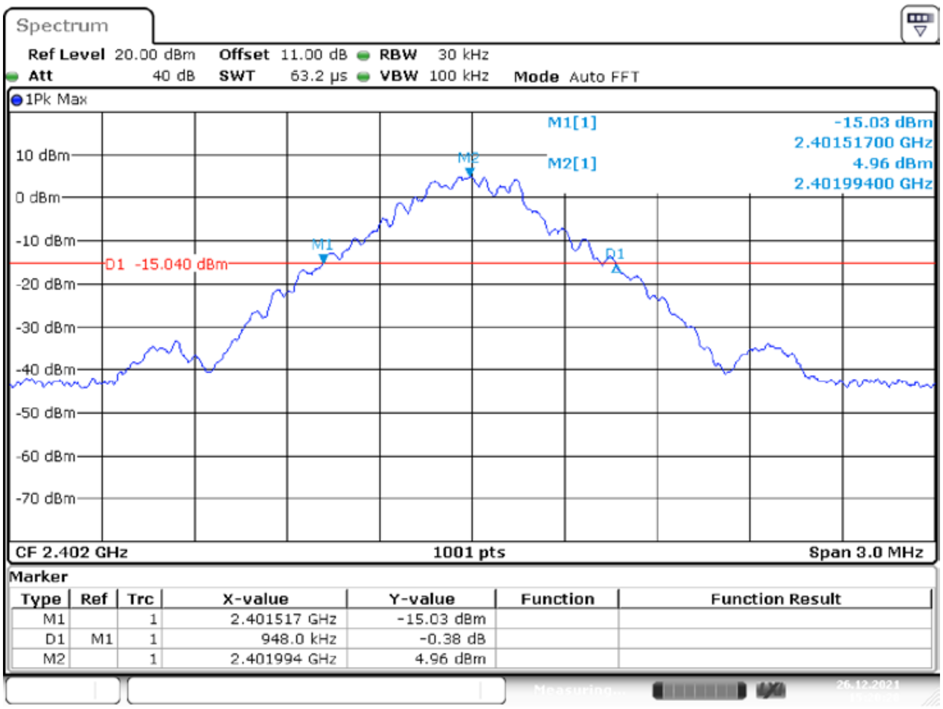
9.3. Test Results

Channel	**Frequency (MHz)**	**20 dBc BW (MHz)**
BR Mode (GFSK)		
Low	2402	0.95
Middle	2441	0.94
High	2480	0.95
EDR Mode (π/4-DQPSK)		
Low	2402	1.33
Middle	2441	1.32
High	2480	1.32
EDR Mode (8DPSK)		
Low	2402	1.31
Middle	2441	1.31
High	2480	1.31

Please refer to the following plots

BR Mode (GFSK)

Low Channel



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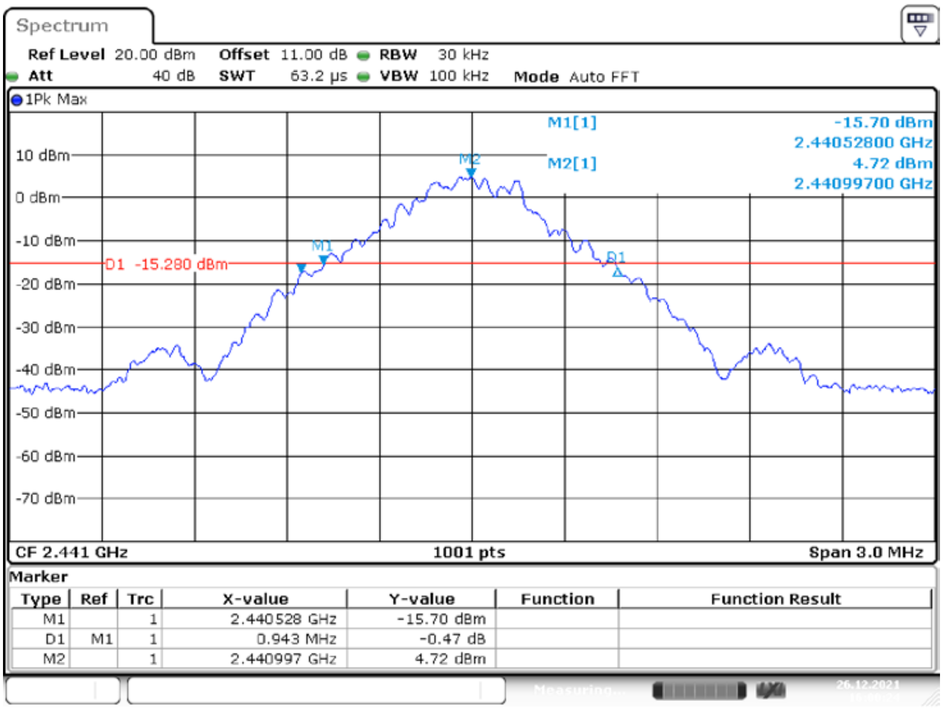
Middle Channel



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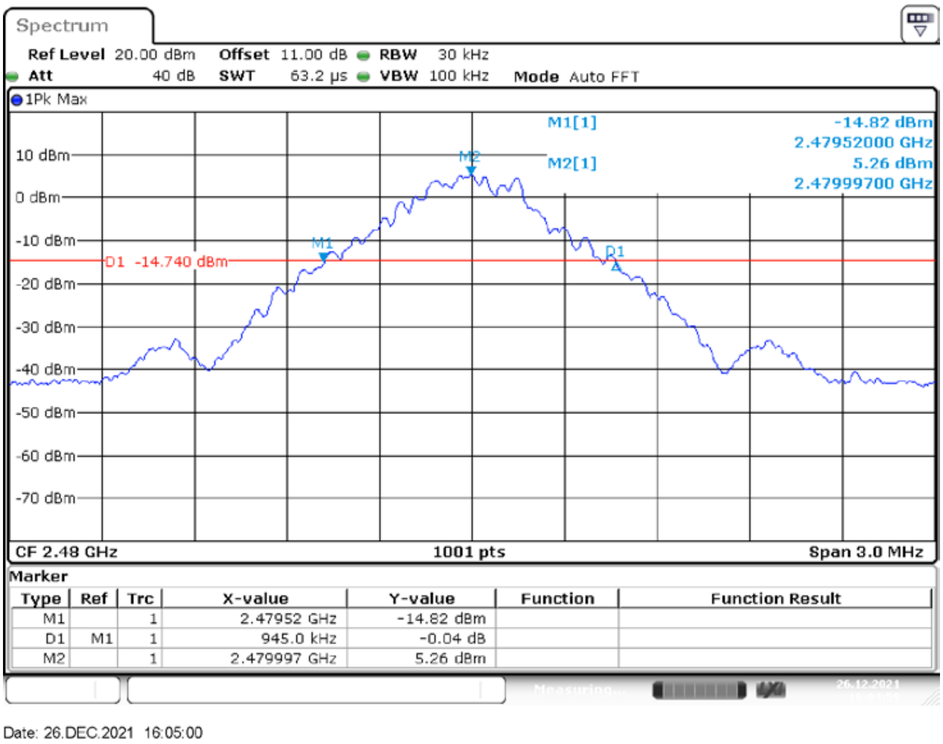
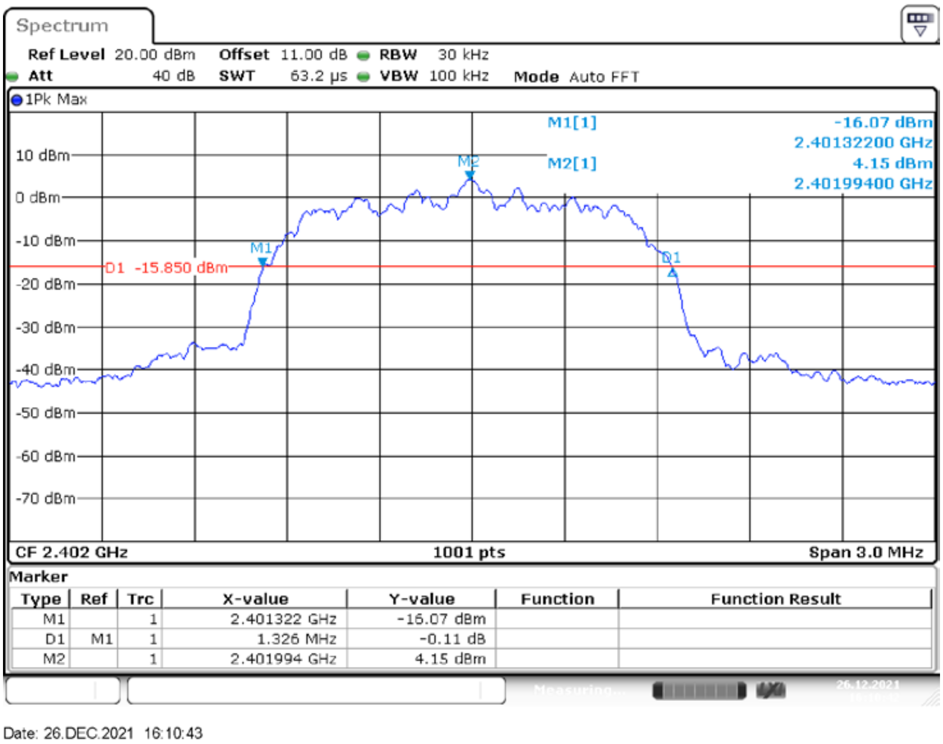
High Channel

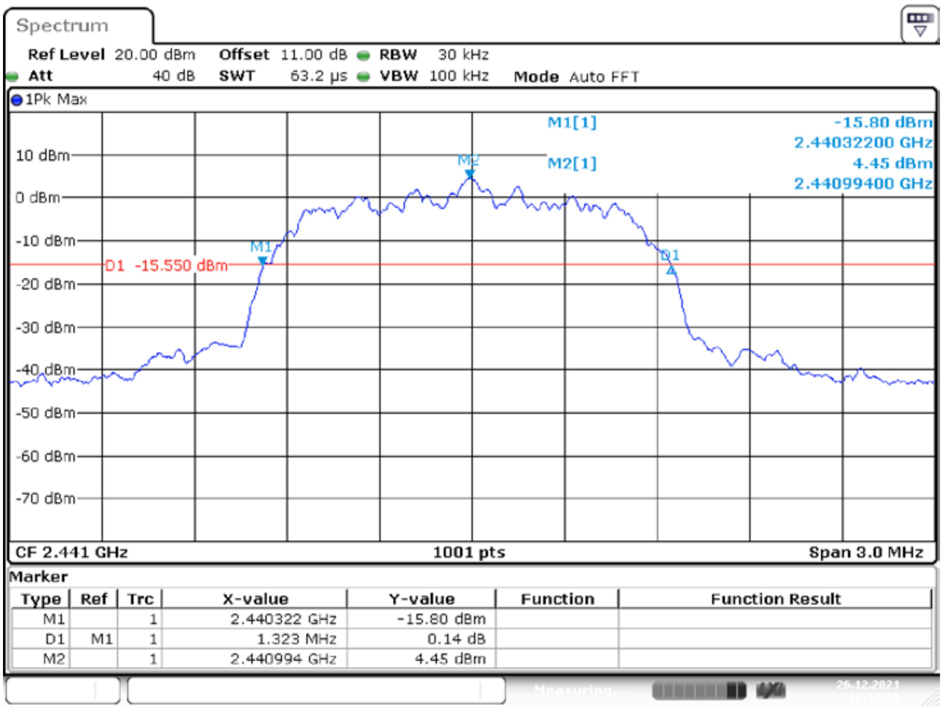


EDR Mode (π/4-DQPSK)

Low Channel



Middle Channel



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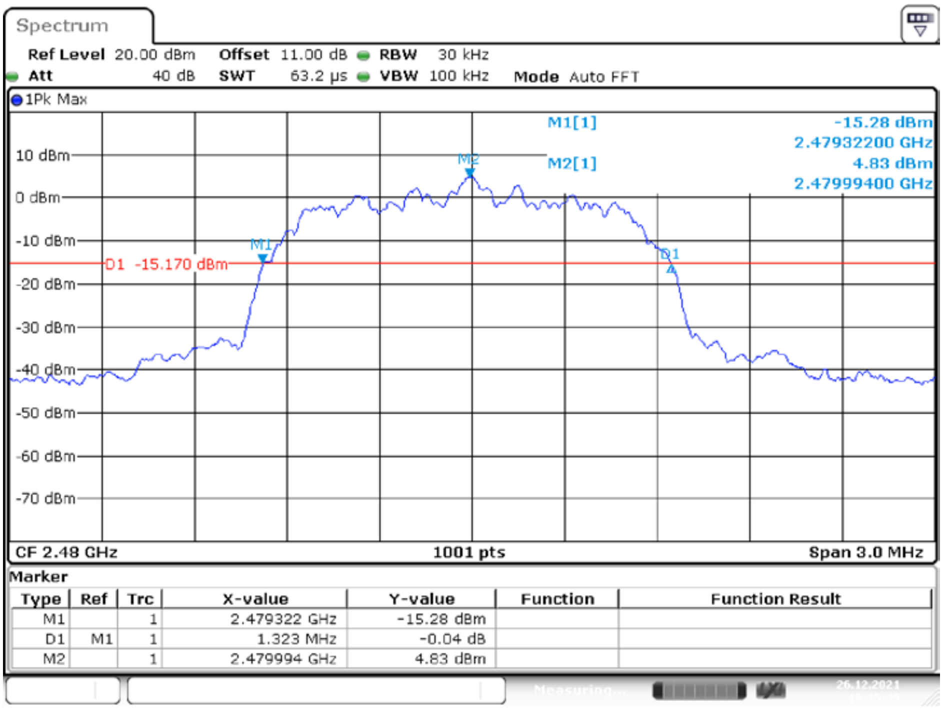
High Channel



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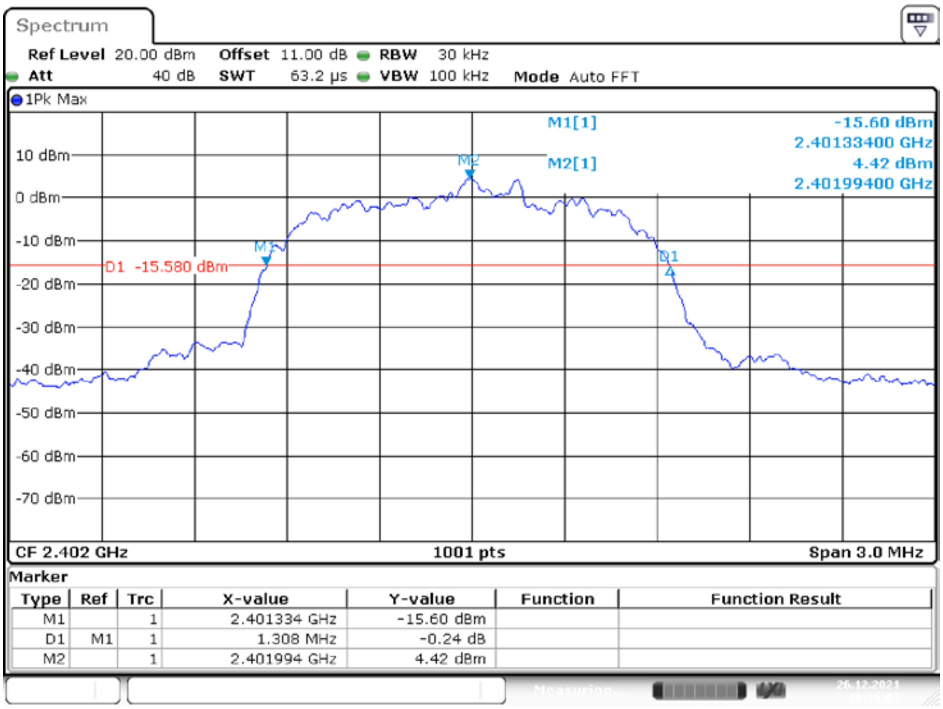
EDR Mode (8DPSK)

Low Channel



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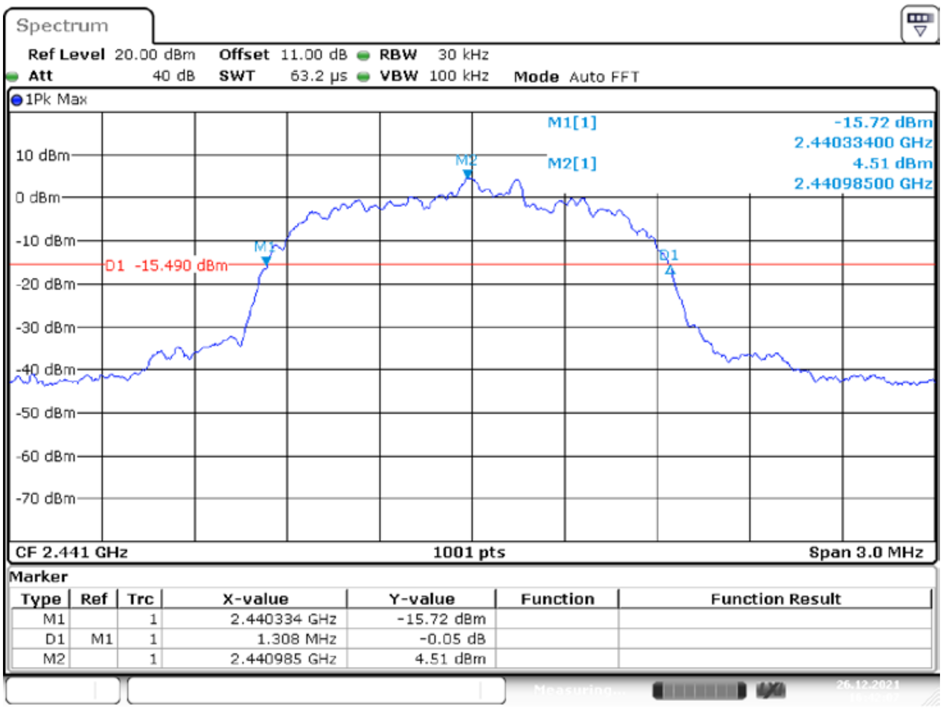
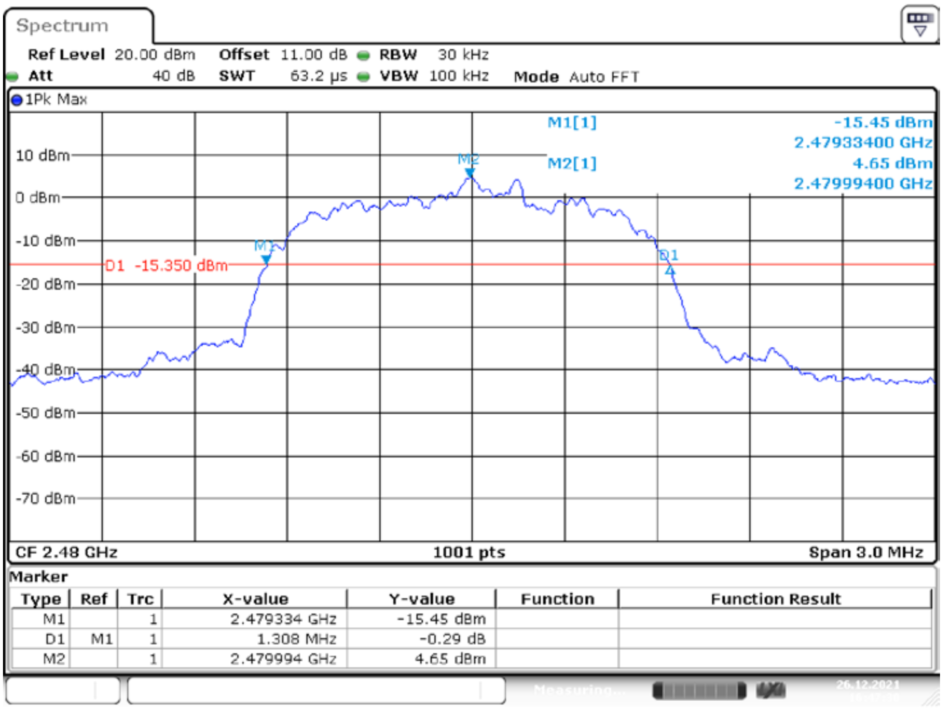
Middle Channel



Date: 26.DEC.2021 16:42:08

High Channel



Date: 26.DEC.2021 16:47:30

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.

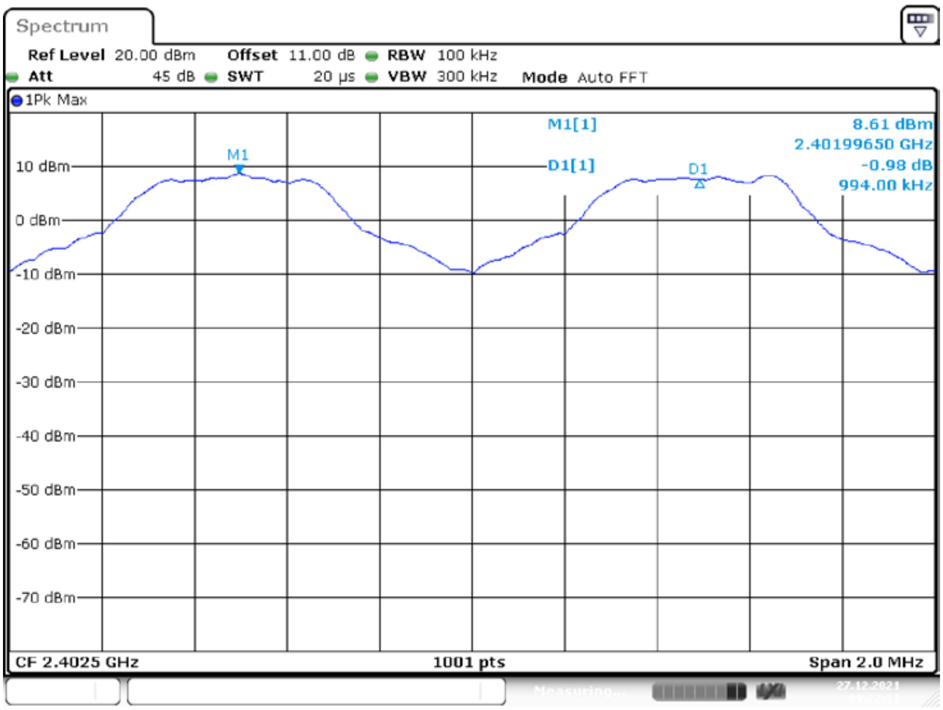
10.3. Test Results

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BR Mode (GFSK)					
Low	0.99	0.95	0.632	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	0.94	0.629	>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	1.01	1.33	0.884	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	1.32	0.882	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	1.32	0.882	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode (8DPSK)					
Low	1.00	1.31	0.872	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.00	1.31	0.872	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	1.31	0.872	>two-thirds of the 20 dB bandwidth	Compliance

Please refer to the following plots.

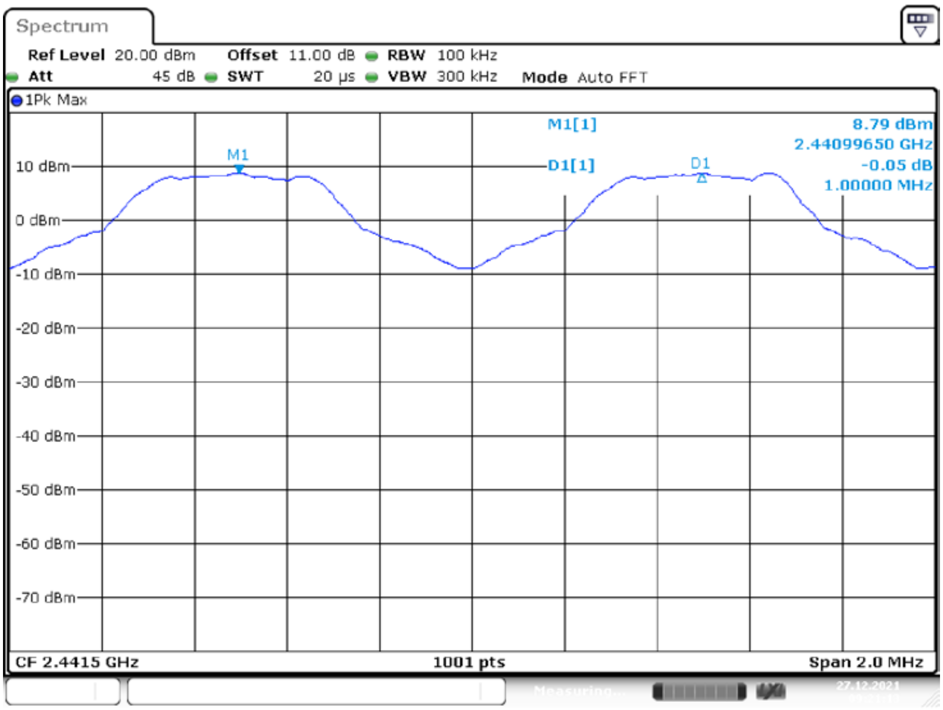
BR Mode (GFSK)

Low Channel



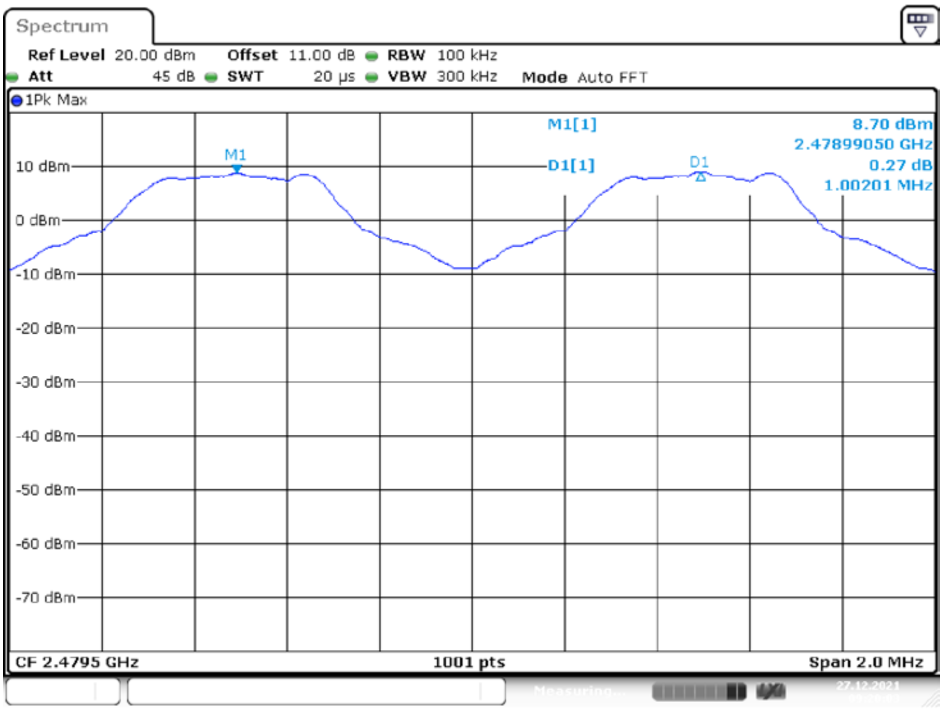
Date: 27.DEC.2021 09:22:32

Middle Channel



Date: 27.DEC.2021 09:21:14

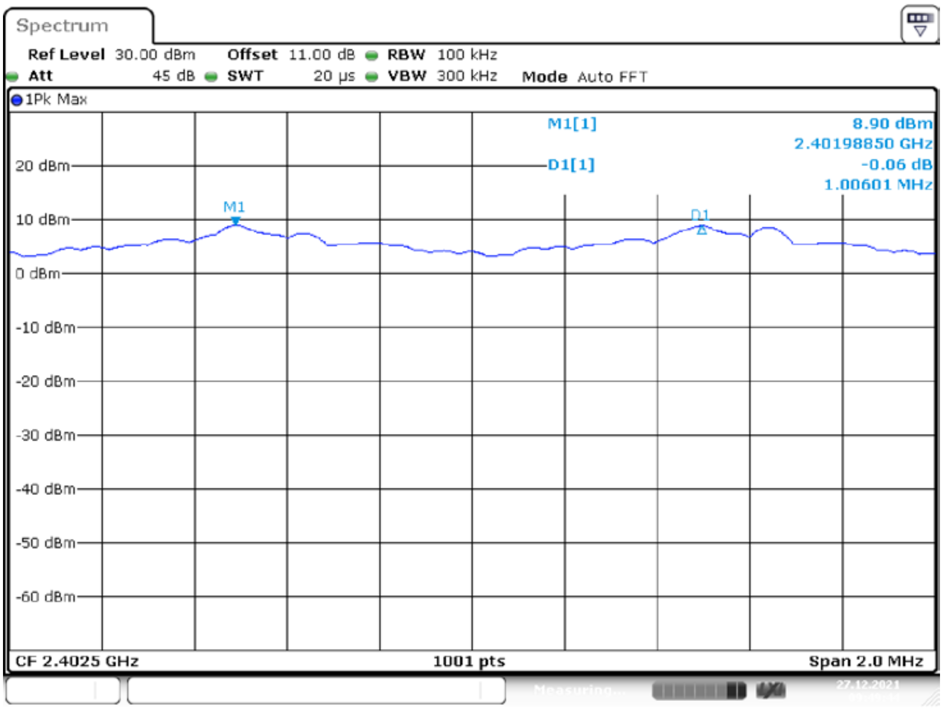
High Channel



Date: 27.DEC.2021 09:20:04

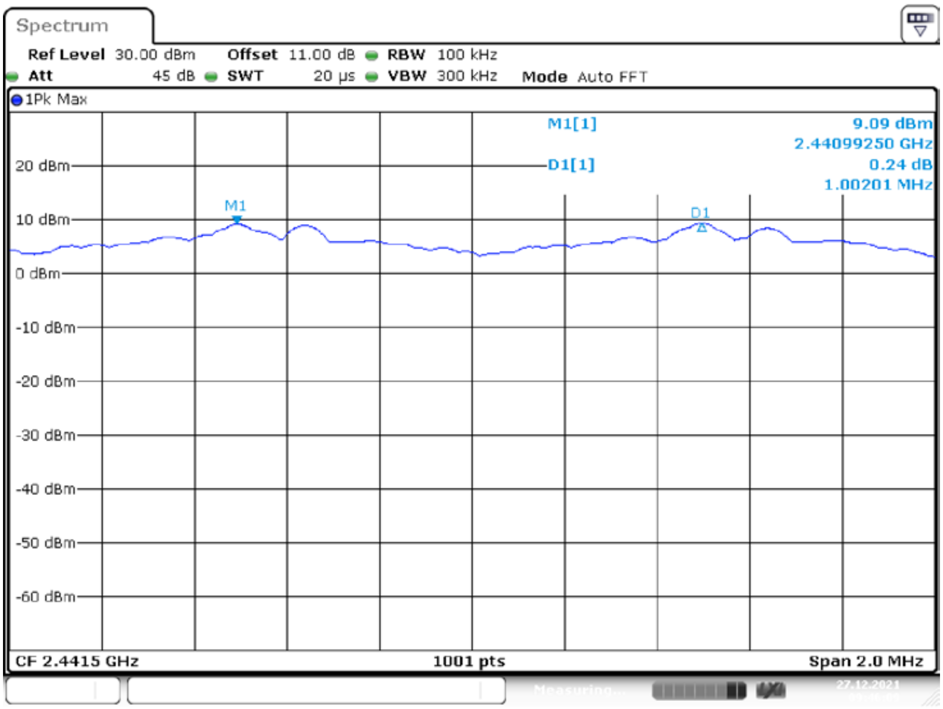
EDR Mode (π/4-DQPSK)

Low Channel



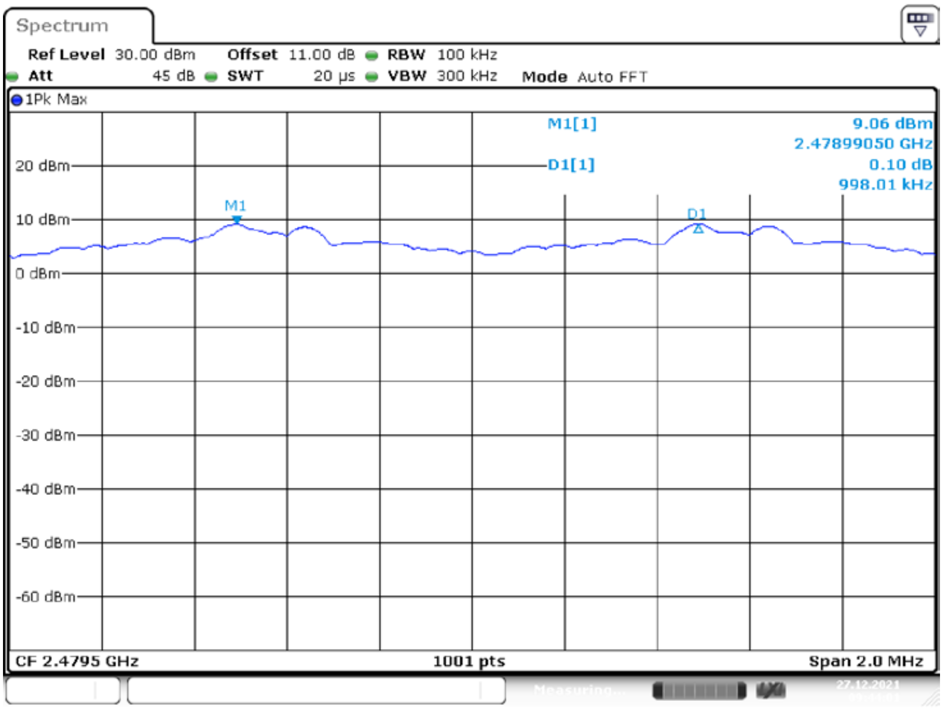
Date: 27.DEC.2021 09:49:45

Middle Channel



Date: 27.DEC.2021 09:46:09

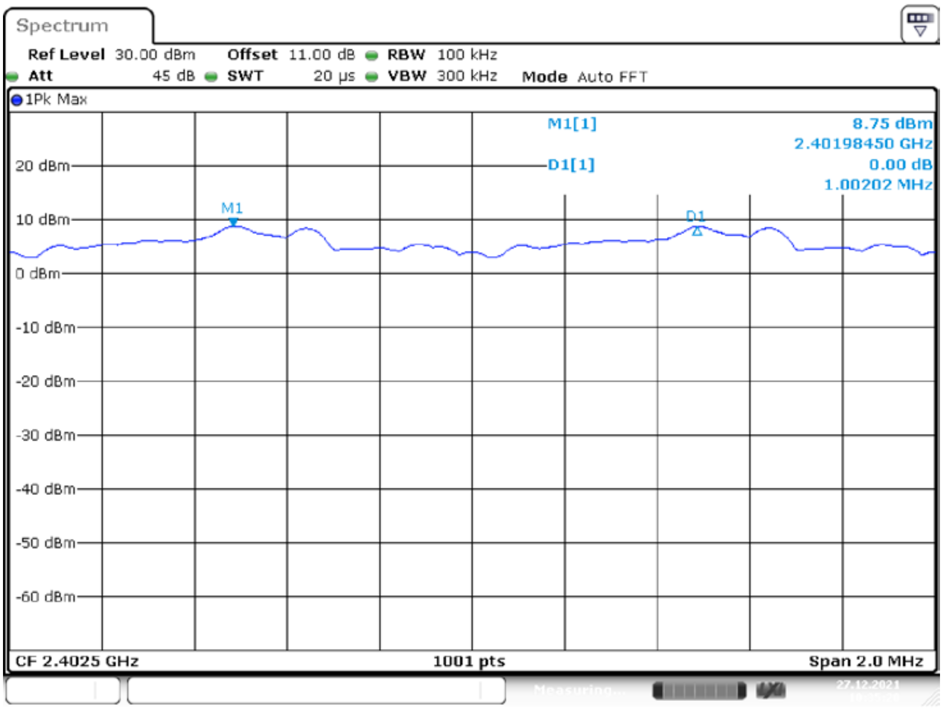
High Channel



Date: 27.DEC.2021 09:44:01

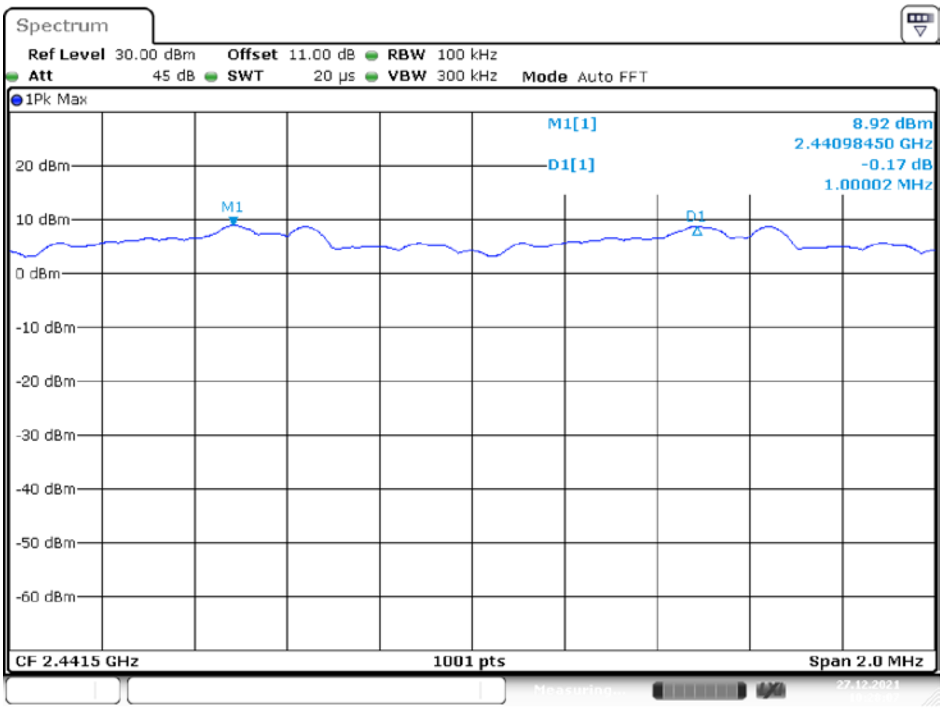
EDR Mode (8DPSK)

Low Channel



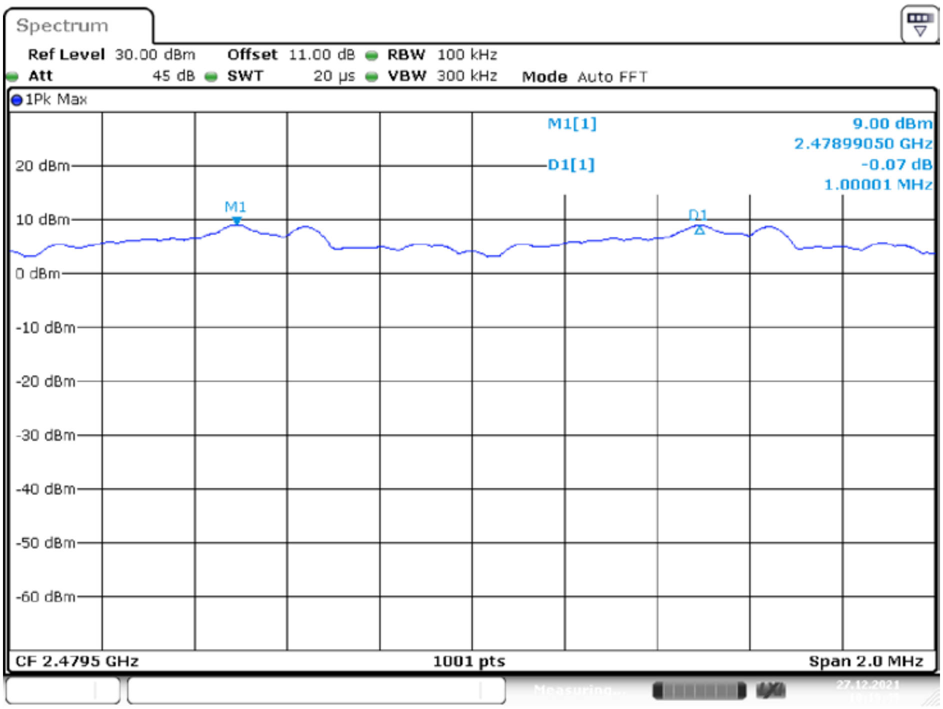
Date: 27.DEC.2021 10:35:20

Middle Channel



Date: 27.DEC.2021 10:28:06

High Channel



Date: 27.DEC.2021 10:19:49

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	0.375	130	31.6	48.75	<400	PASS
DH3	1.633	130	31.6	212.29	<400	PASS
DH5	2.881	90	31.6	259.29	<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	0.388	110	31.6	42.68	<400	PASS
2DH3	1.640	80	31.6	131.20	<400	PASS
2DH5	2.884	50	31.6	144.20	<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	0.386	150	31.6	57.90	<400	PASS
3DH3	1.637	130	31.6	212.81	<400	PASS
3DH5	2.884	100	31.6	288.40	<400	PASS

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

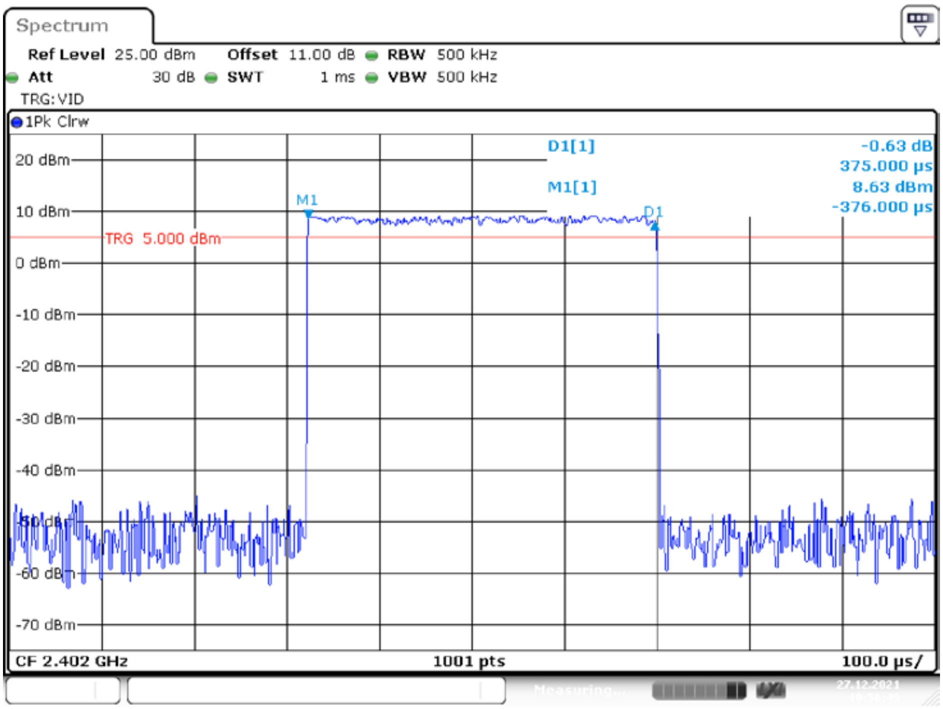
Note 2: Hopping Number = Hopping Number/10 * 10

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

Please refer to the following plots

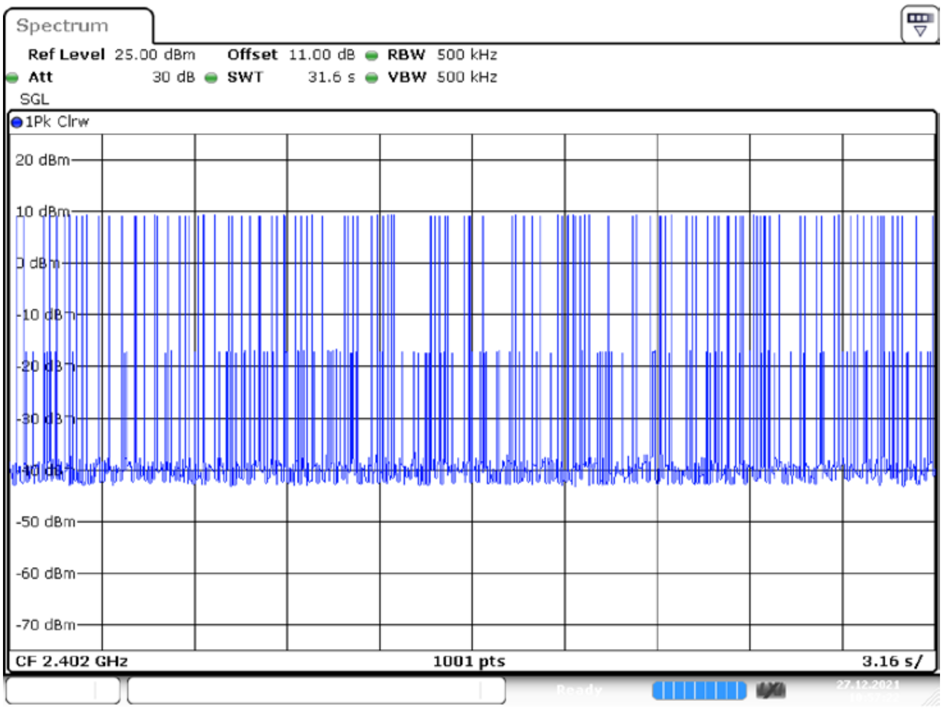
BR Mode (GFSK)

DH1: Pulse Width



Date: 27.DEC.2021 10:56:50

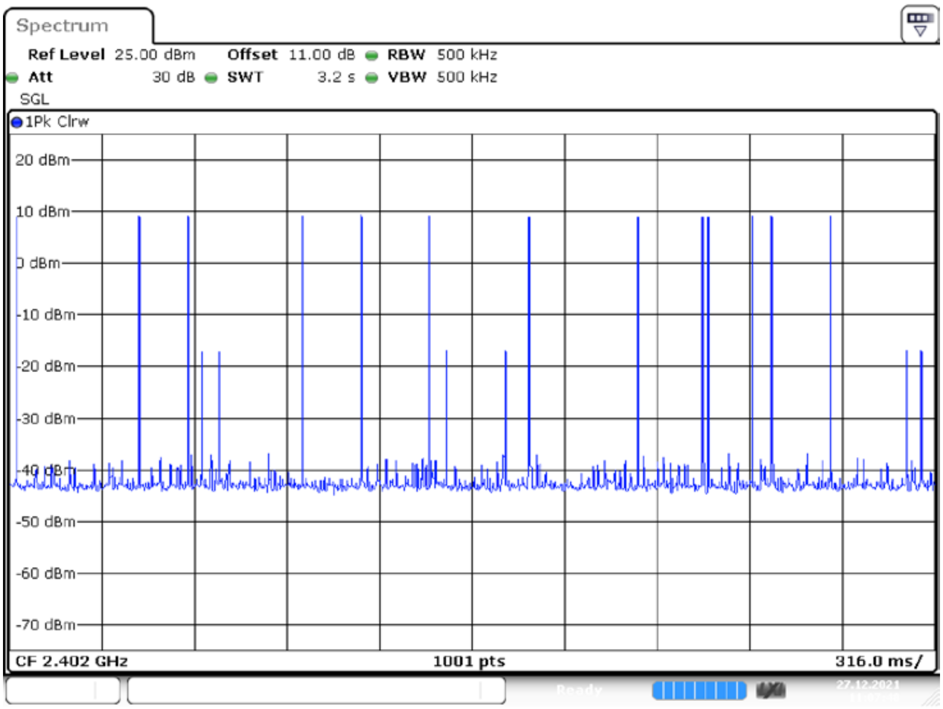
DH1: Hopping Number



Date: 27.DEC.2021 10:57:22

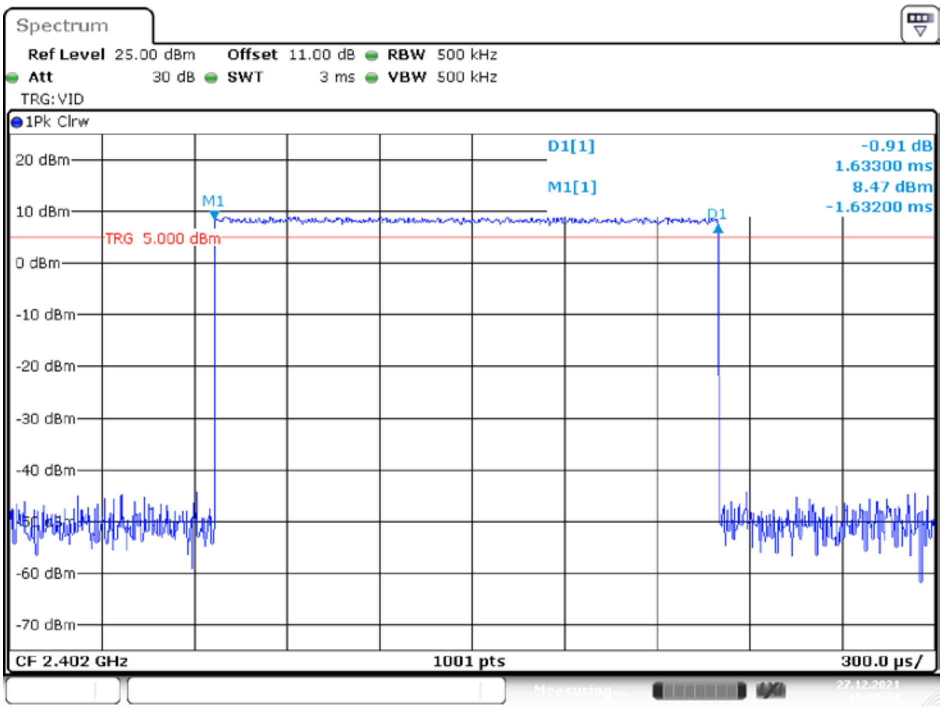
DH1: Hopping Number /10

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



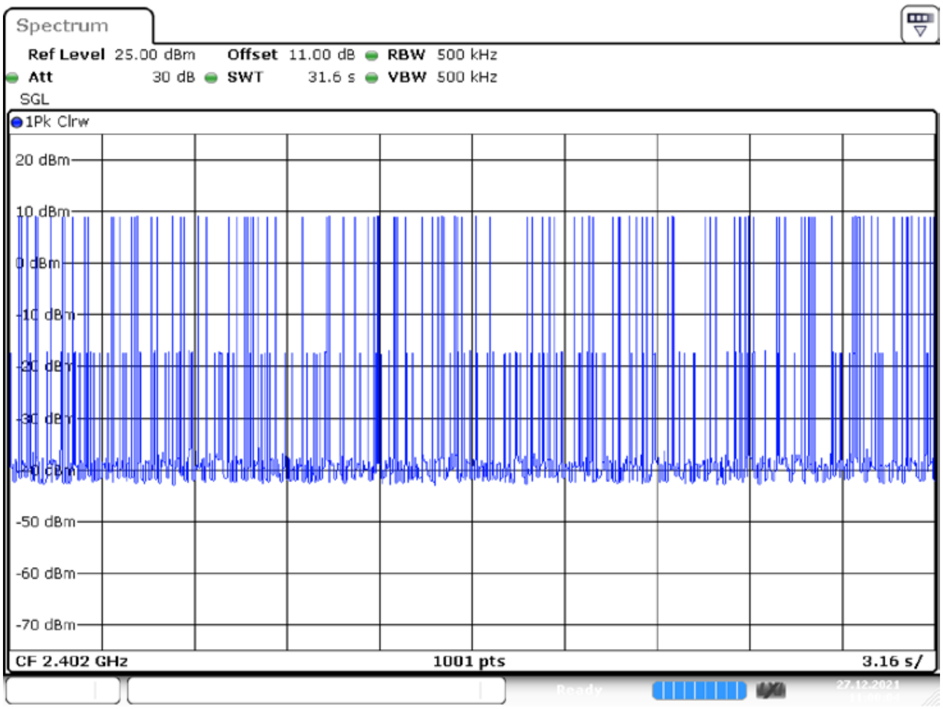
Date: 27.DEC.2021 11:07:48

DH3: Pulse Width



Date: 27.DEC.2021 10:59:32

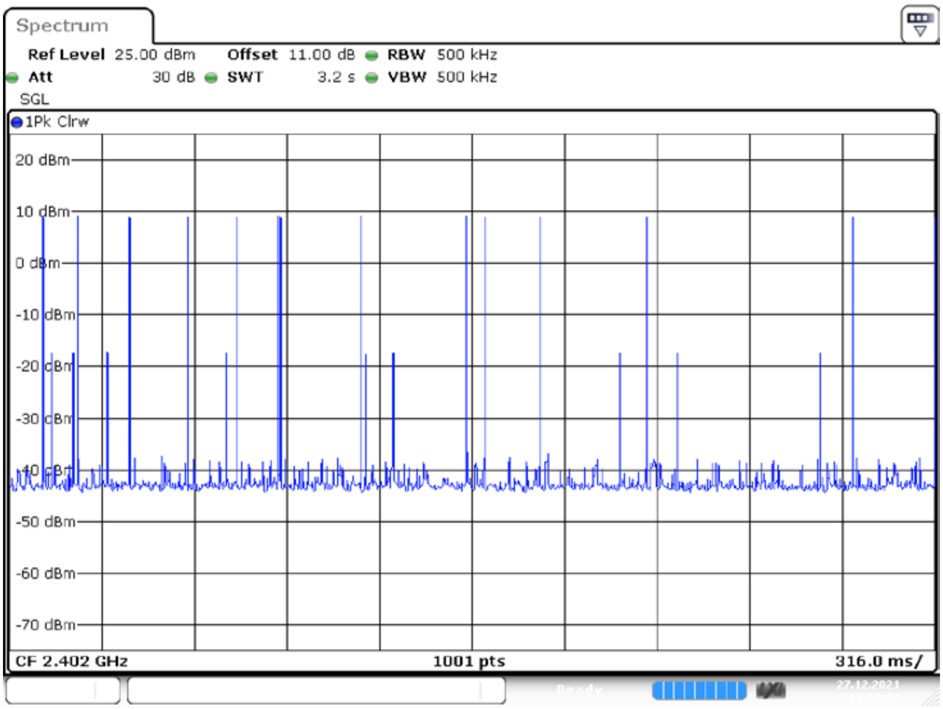
DH3: Hopping Number



Date: 27.DEC.2021 11:00:04

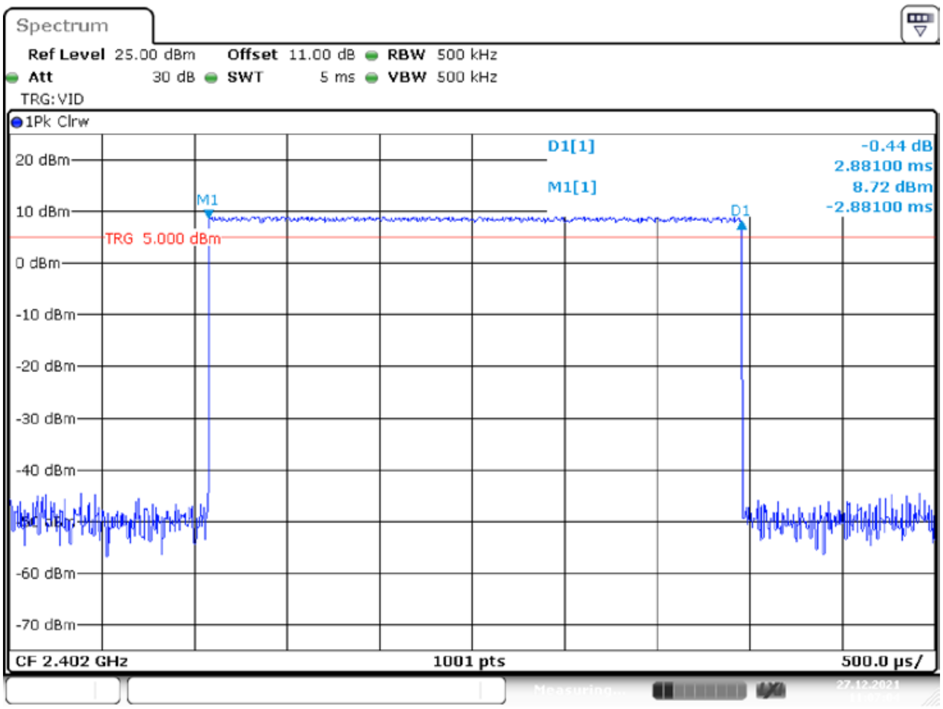
DH3: Hopping Number /10

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



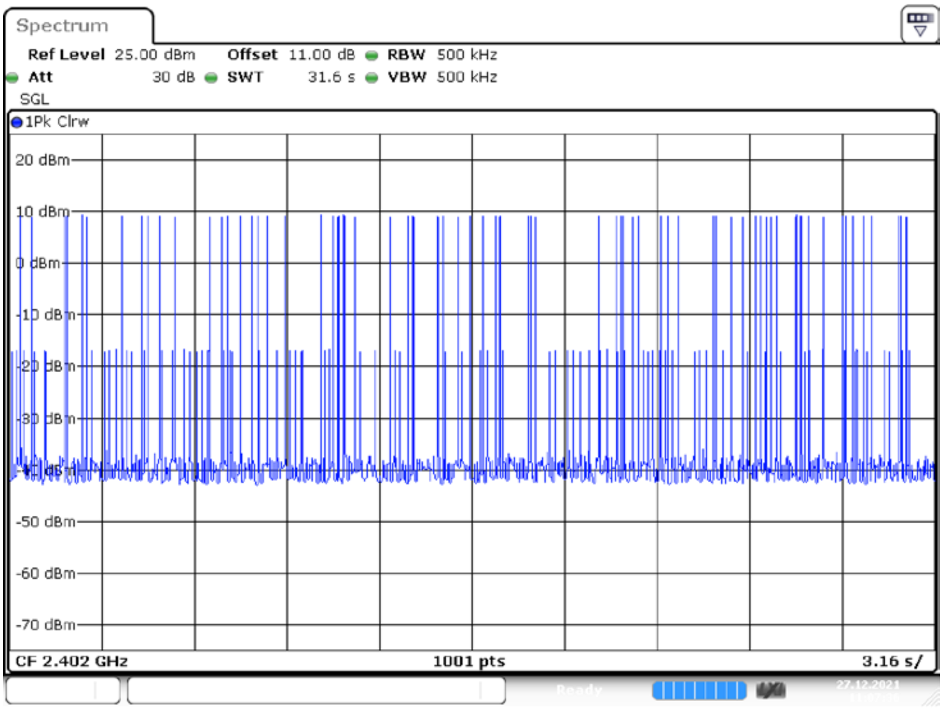
Date: 27.DEC.2021 11:01:04

DH5: Pulse Width



Date: 27.DEC.2021 11:07:05

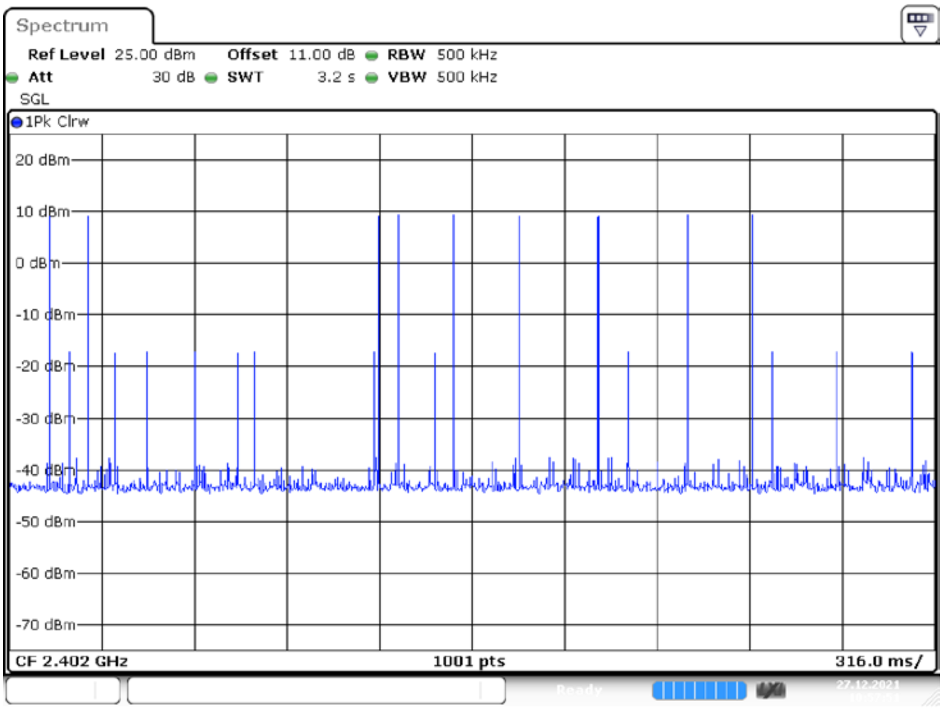
DH5: Hopping Number



Date: 27.DEC.2021 11:07:37

DH5: Hopping Number /10

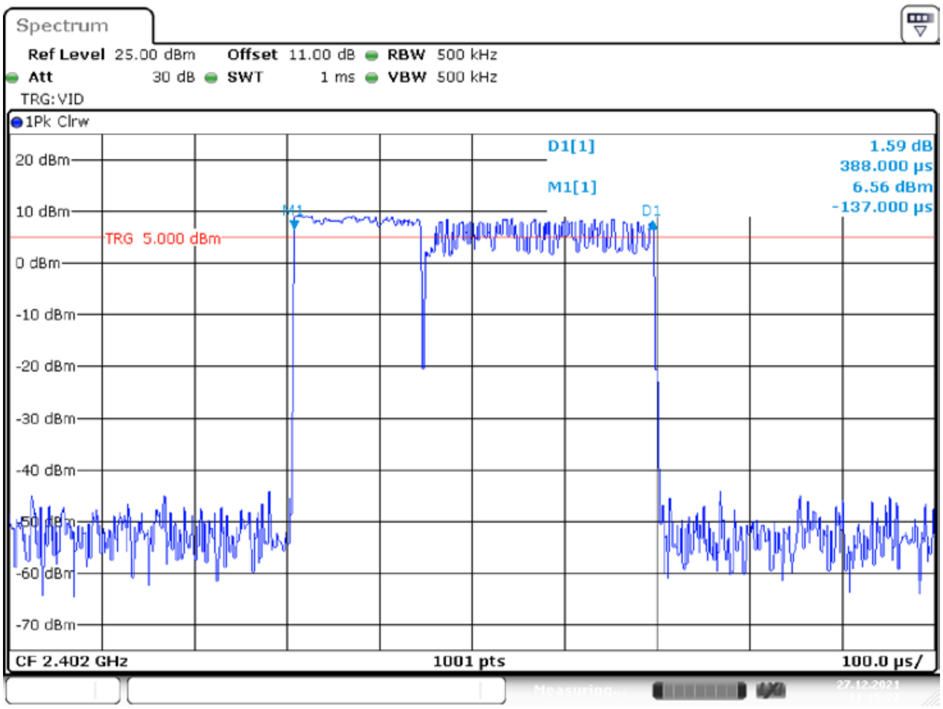
(Hopping Number = 9 in 1/10 period of highest signals, Second High signals were other channel)



Date: 27.DEC.2021 10:57:52

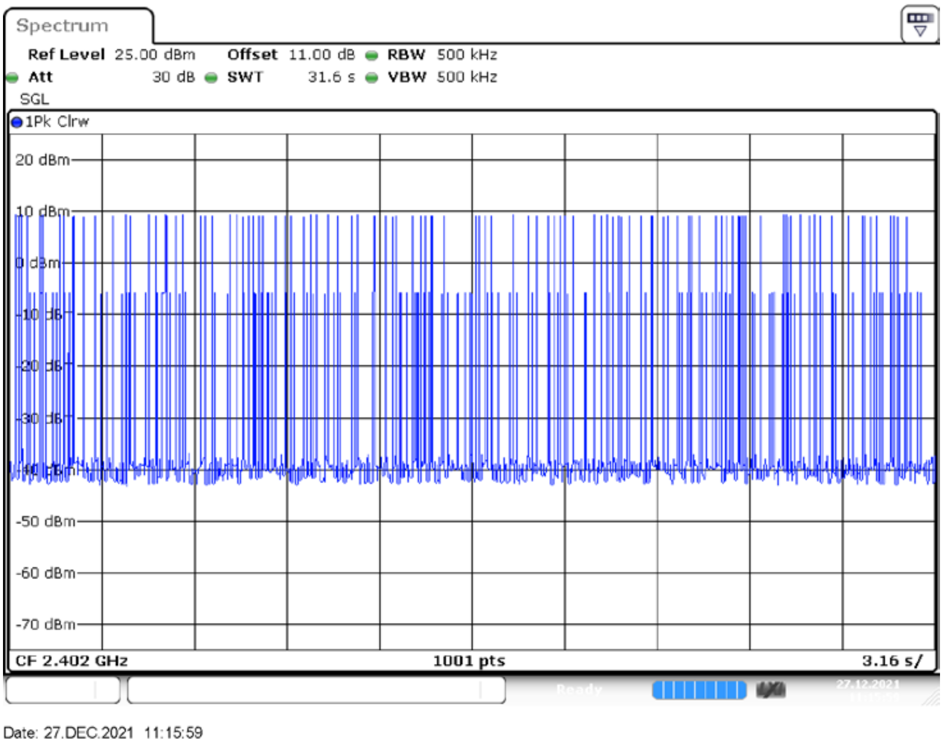
EDR Mode (π/4-DQPSK)

2DH1: Pulse Width



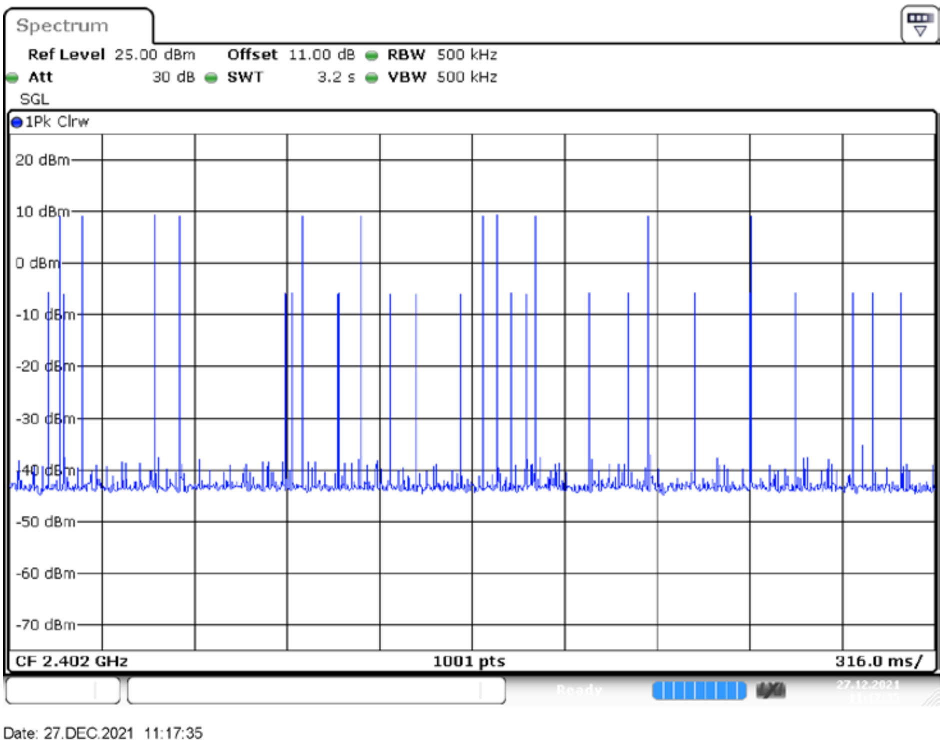
Date: 27.DEC.2021 11:15:27

2DH1: Hopping Number

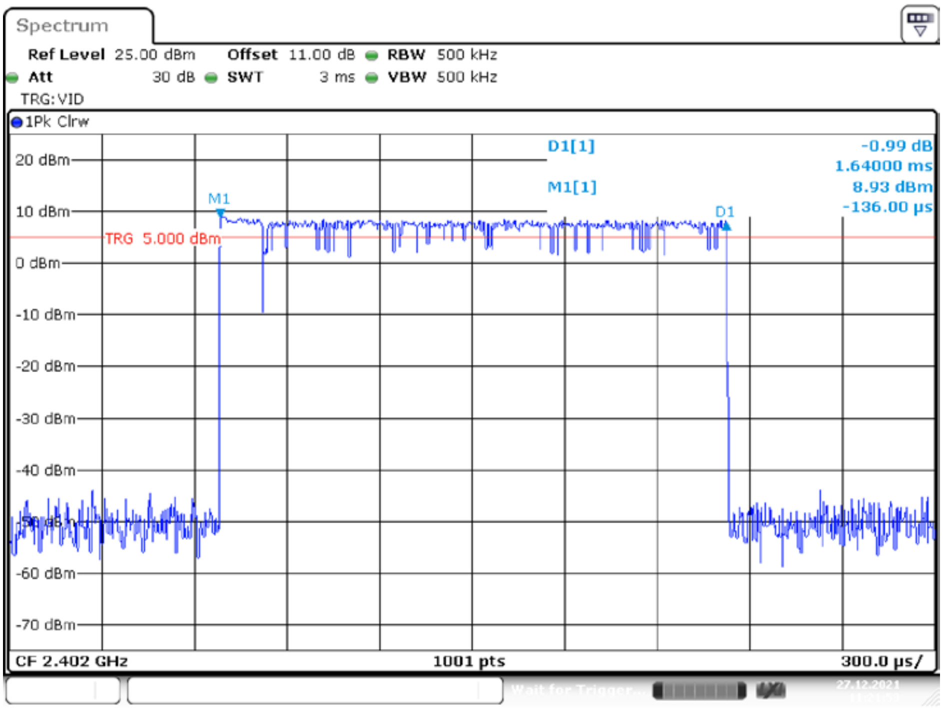


2DH1: Hopping Number /10

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

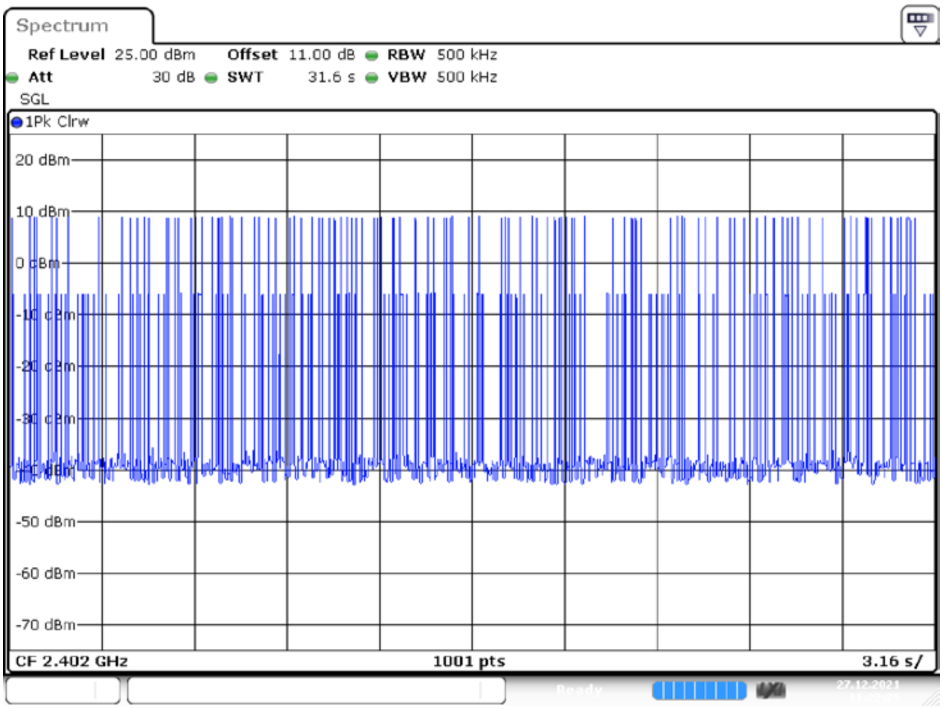


2DH3: Pulse Width



Date: 27.DEC.2021 11:21:53

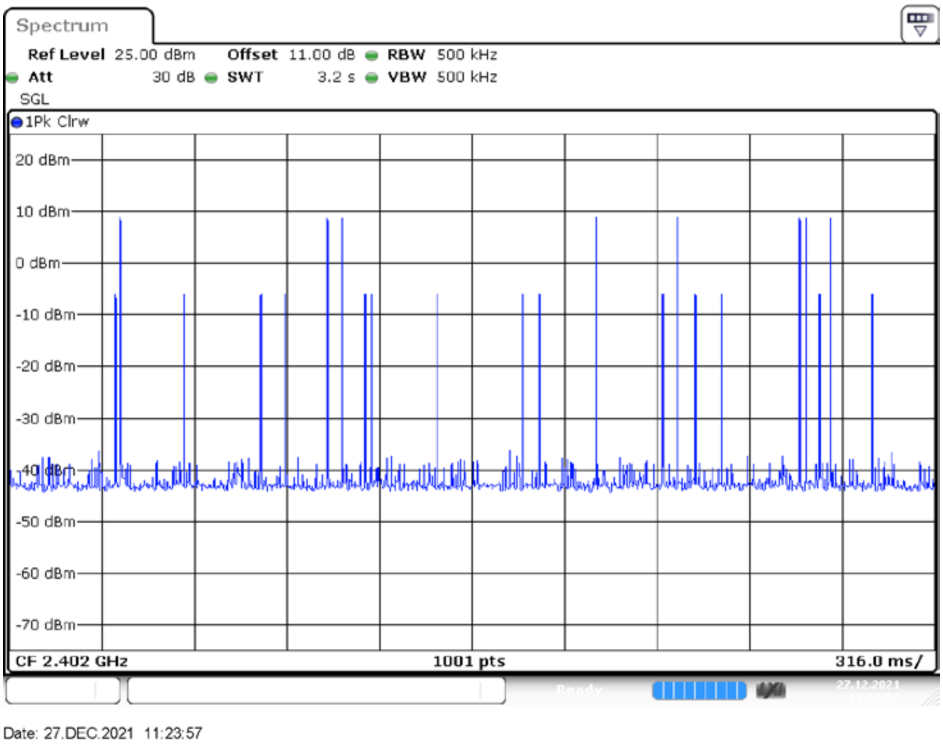
2DH3: Hopping Number



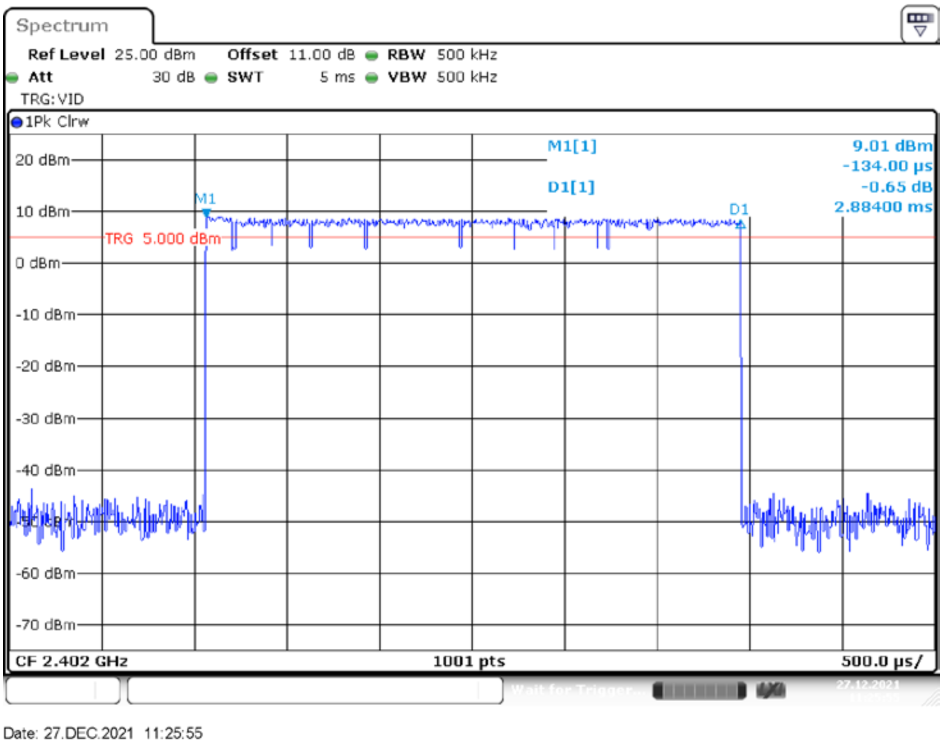
Date: 27.DEC.2021 11:22:25

2DH3: Hopping Number /10

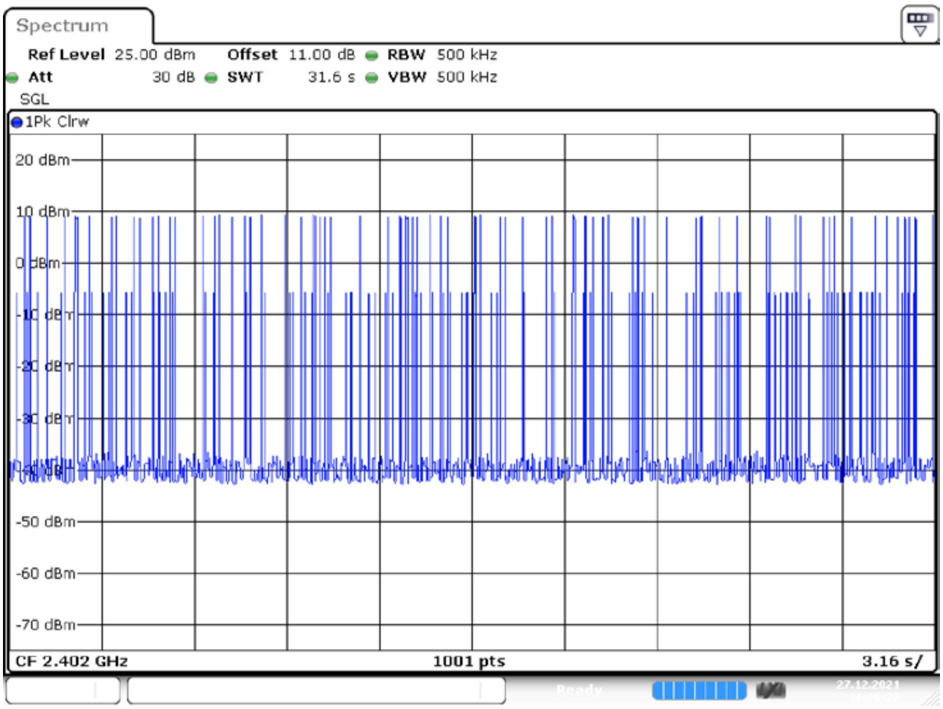
(Hopping Number = 8 in 1/10 period of highest signals, Second High signals were other channel)



2DH5: Pulse Width



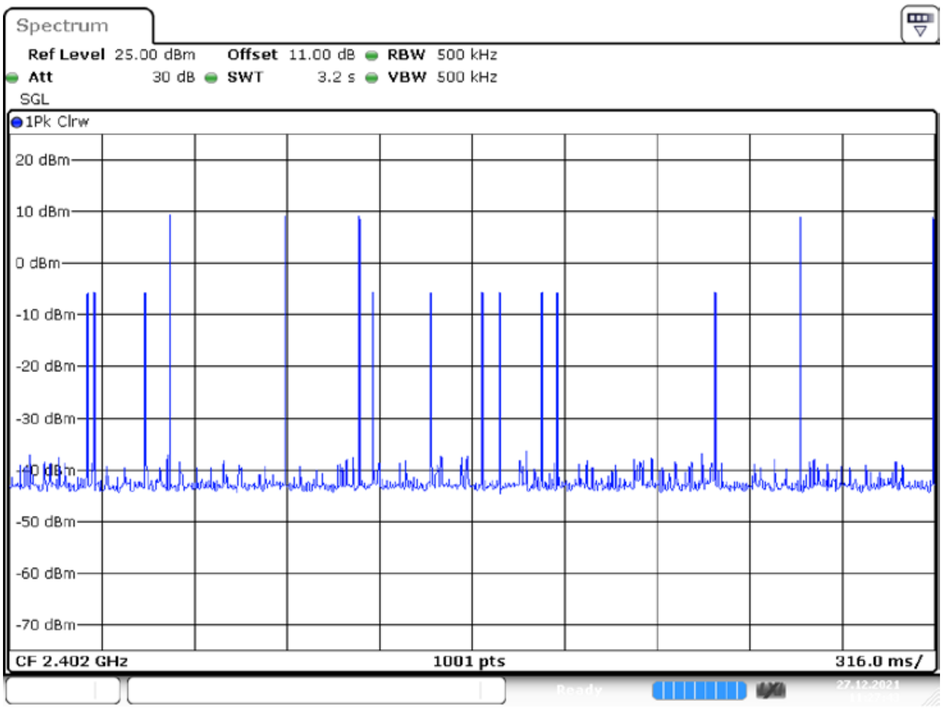
2DH5: Hopping Number



Date: 27.DEC.2021 11:26:27

2DH5: Hopping Number /10

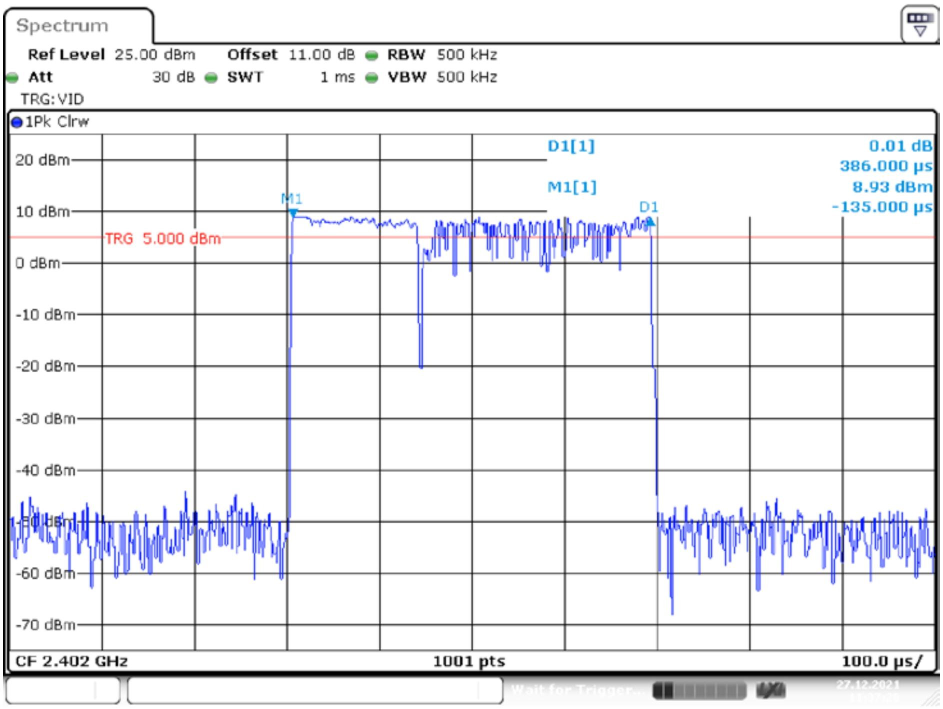
(Hopping Number = 5 in 1/10 period of highest signals, Second High signals were other channel)



Date: 27.DEC.2021 11:27:43

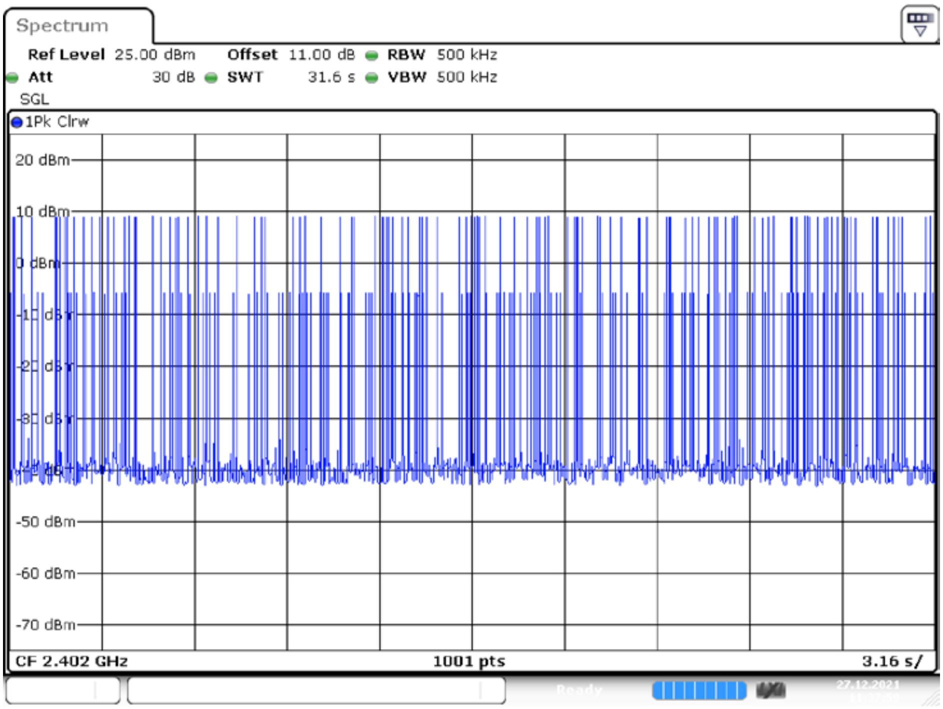
EDR Mode (8DPSK)

3DH1: Pulse Width



Date: 27.DEC.2021 11:37:26

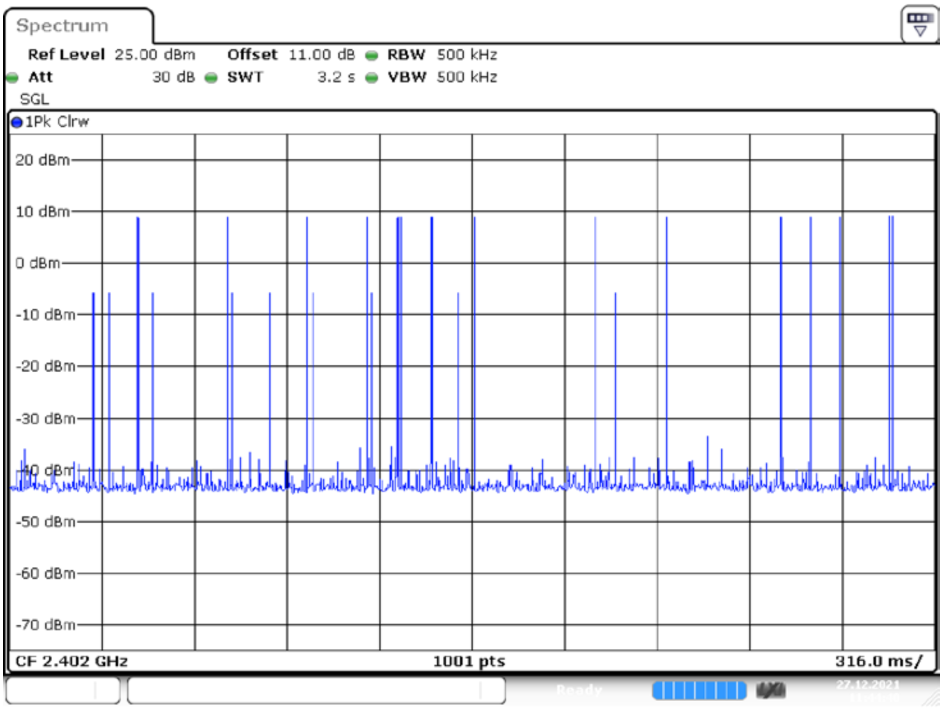
3DH1: Hopping Number



Date: 27.DEC.2021 11:37:59

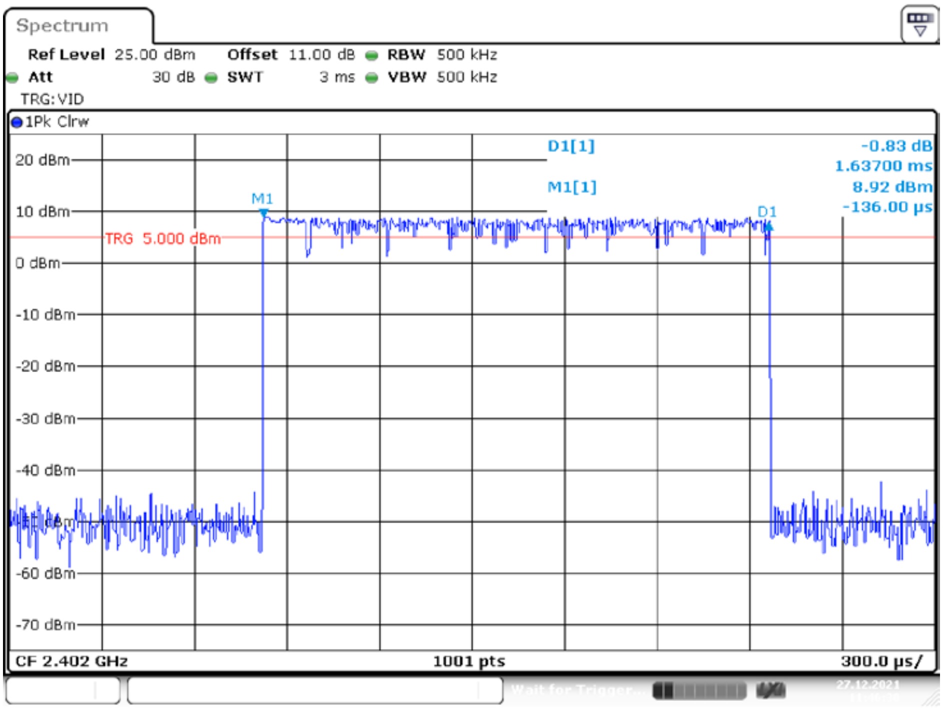
3DH1: Hopping Number /10

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



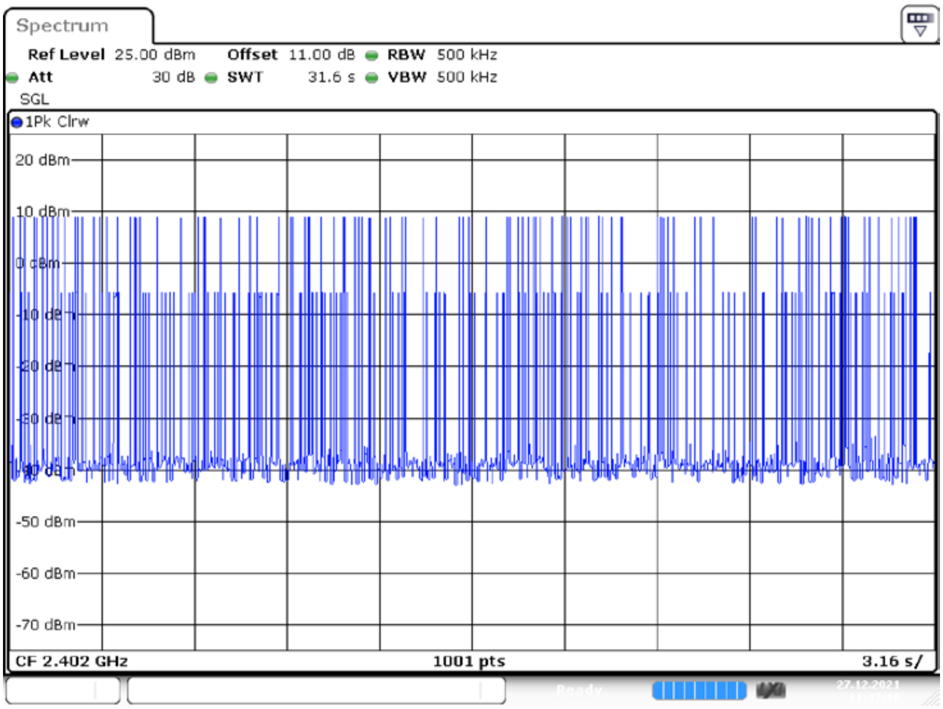
Date: 27.DEC.2021 11:44:40

3DH3: Pulse Width



Date: 27.DEC.2021 11:46:38

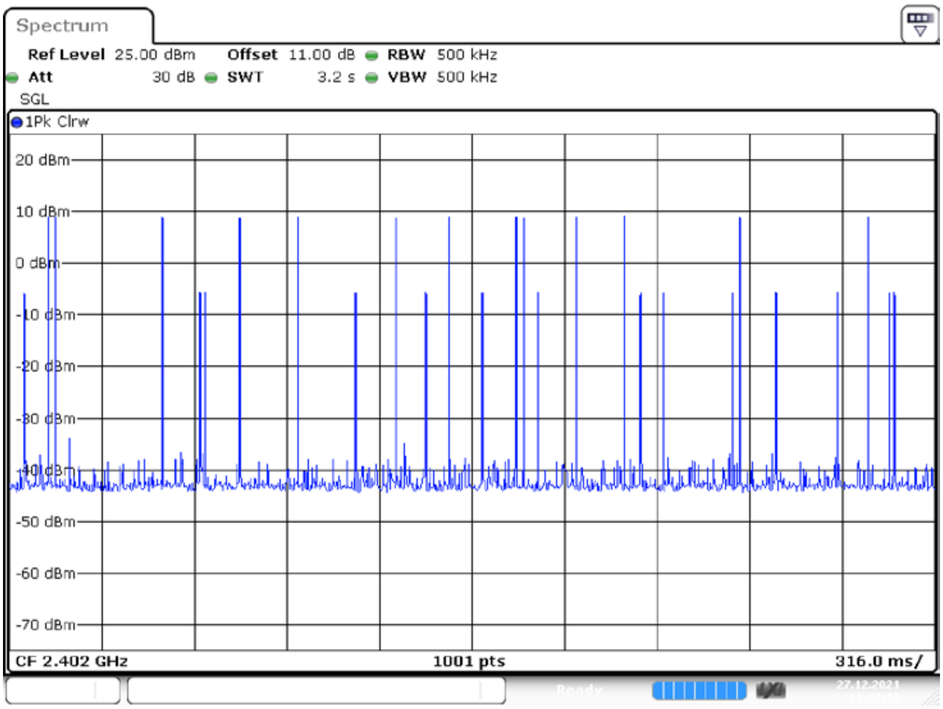
3DH3: Hopping Number



Date: 27.DEC.2021 11:47:10

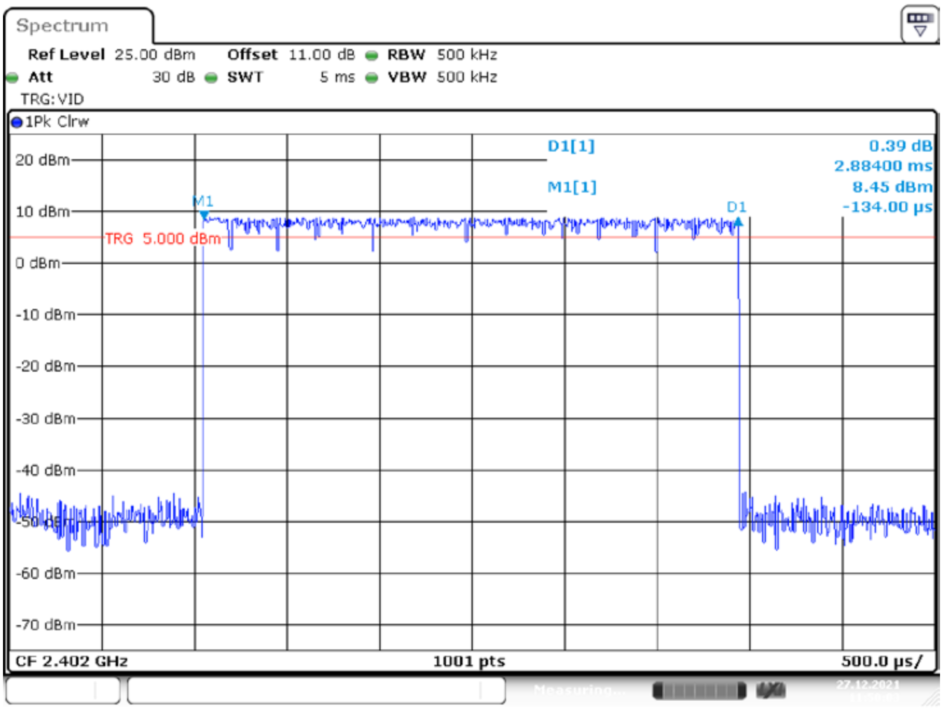
3DH3: Hopping Number /10

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



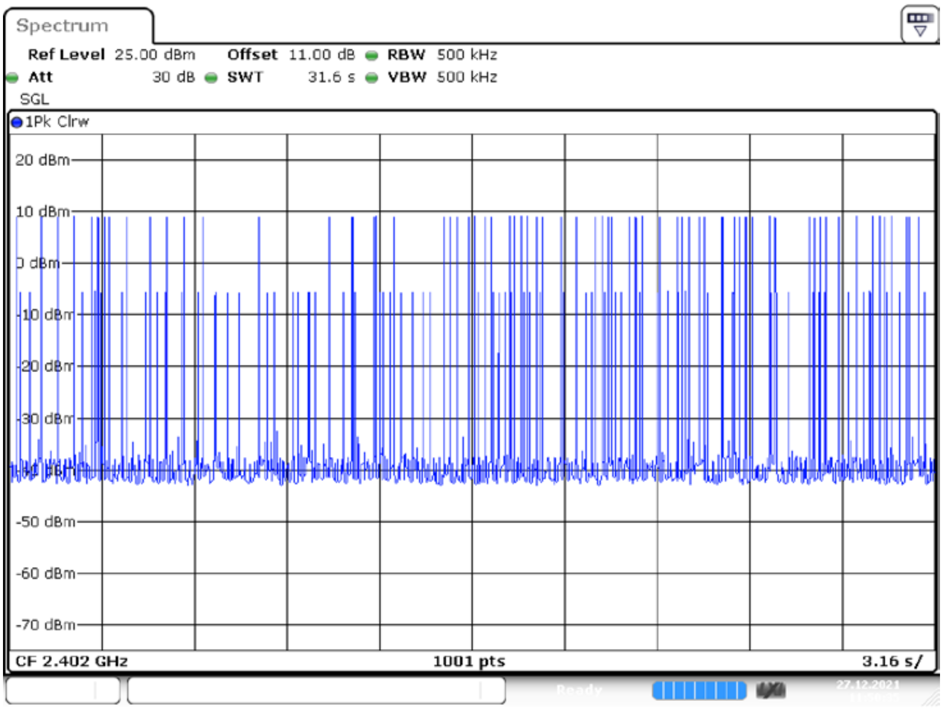
Date: 27.DEC.2021 11:47:20

3DH5: Pulse Width



Date: 27.DEC.2021 11:50:03

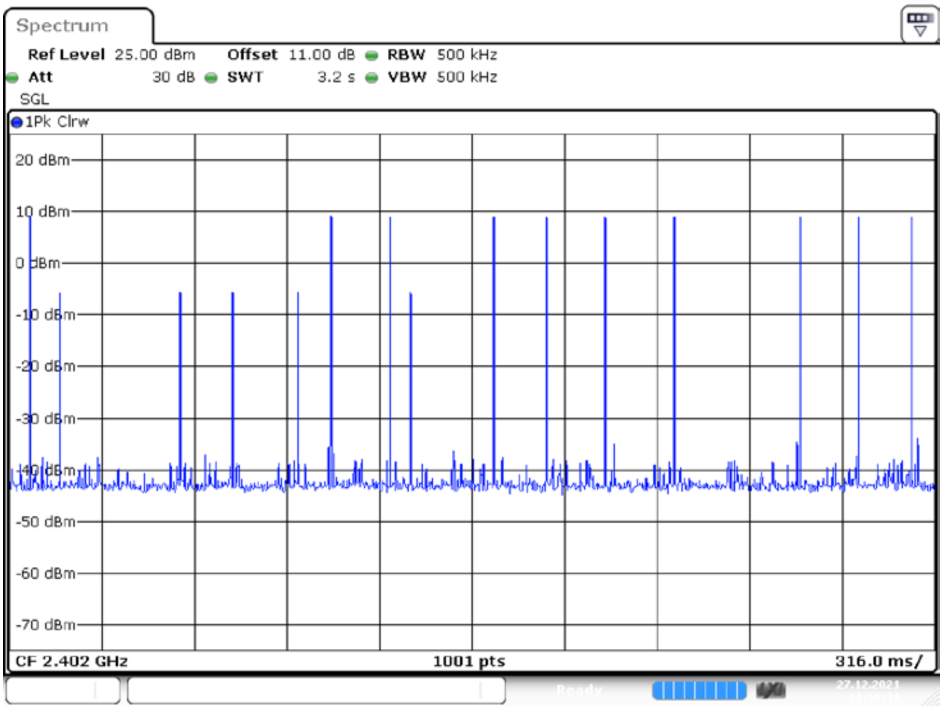
3DH5: Hopping Number



Date: 27.DEC.2021 11:50:35

3DH5: Hopping Number /10

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



Date: 27.DEC.2021 11:56:31

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

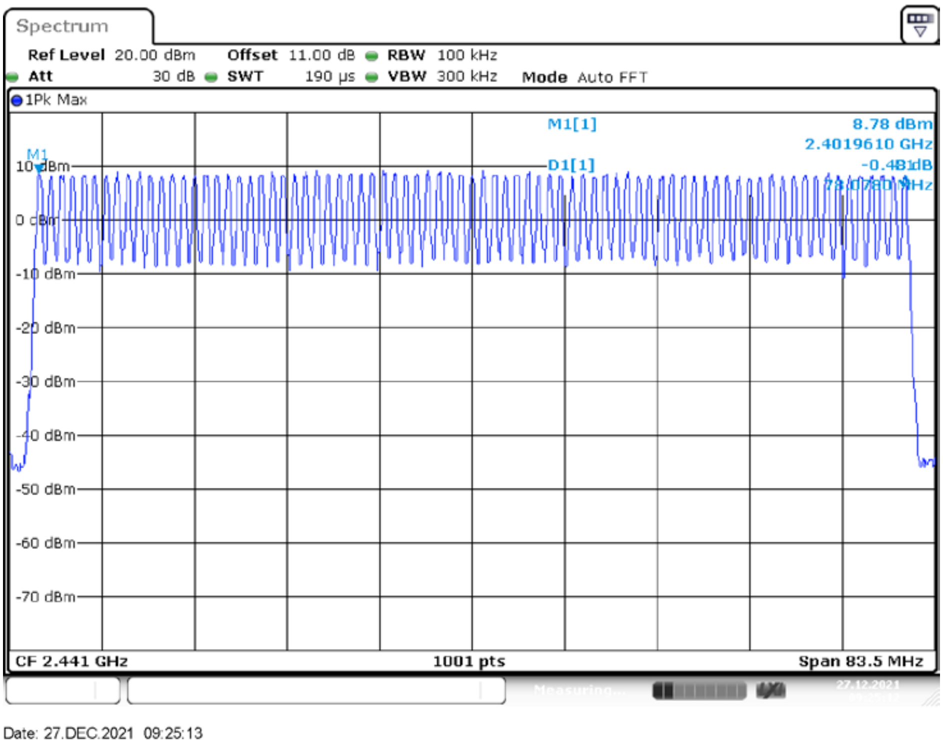
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

12.3. Test Results

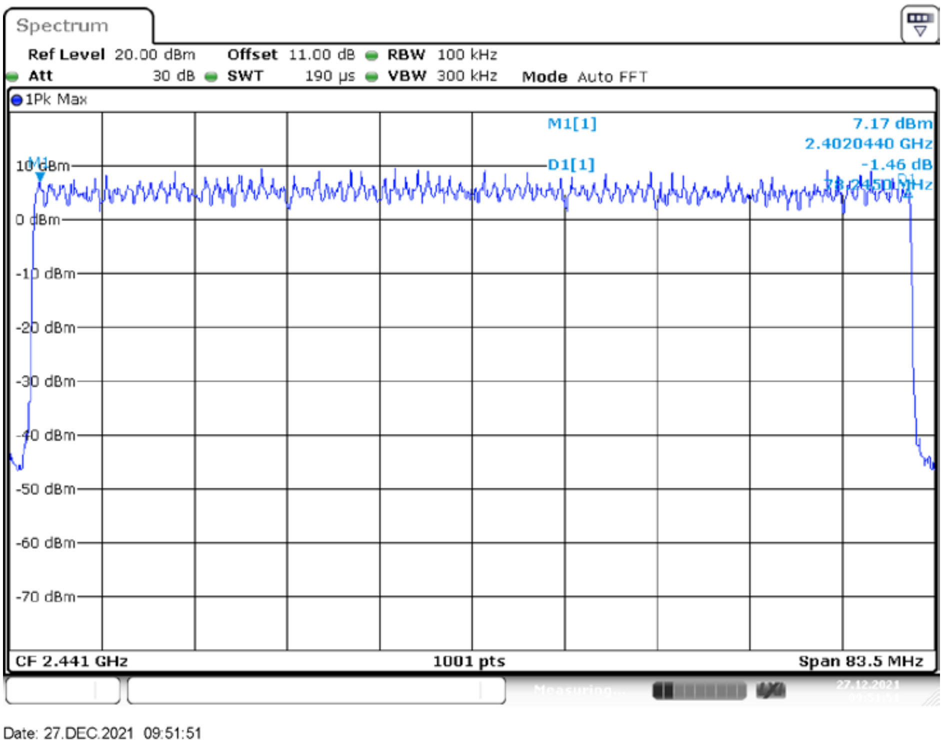
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)	Result
GFSK	2402-2480	79	>15	Compliance
π/4-DQPSK	2402-2480	79	>15	Compliance
8DPSK	2402-2480	79	>15	Compliance

Please refer to the following plots

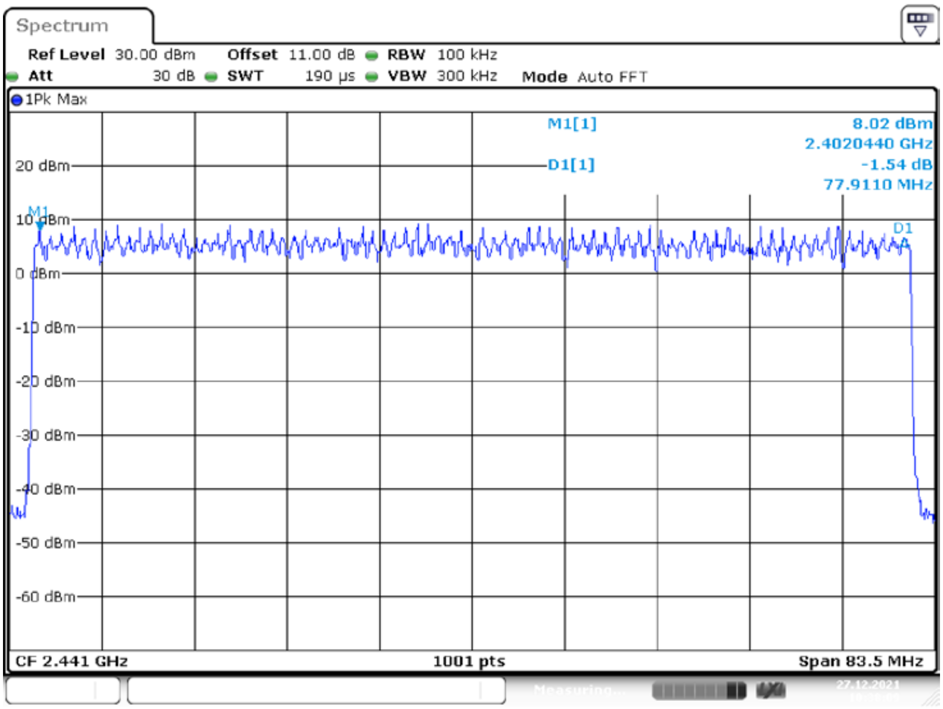
BR Mode (GFSK)



EDR Mode (π/4-DQPSK)



EDR Mode (8DPSK)



Date: 27.DEC.2021 10:38:09

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	9.04	0.008	0.125	Compliance
Middle	2441	9.36	0.009	0.125	Compliance
High	2480	9.32	0.009	0.125	Compliance
EDR Mode (π/4-DQPSK)					
Low	2402	8.71	0.007	0.125	Compliance
Middle	2441	8.86	0.008	0.125	Compliance
High	2480	8.47	0.007	0.125	Compliance
EDR Mode (8DPSK)					
Low	2402	8.93	0.008	0.125	Compliance
Middle	2441	9.05	0.008	0.125	Compliance
High	2480	8.82	0.008	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

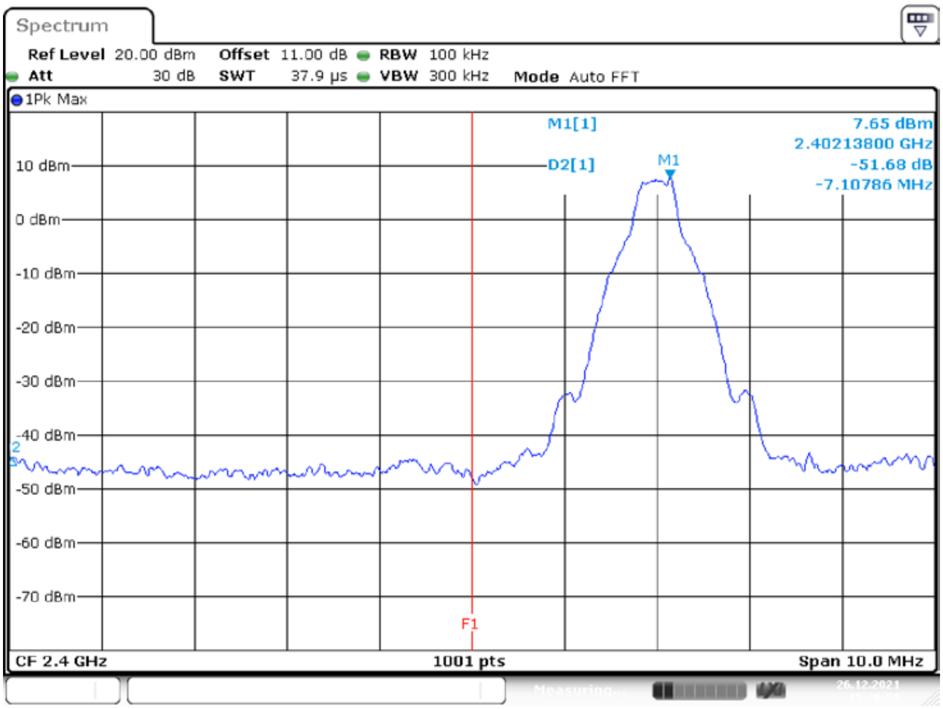
14.3. Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	51.68	≥ 20	PASS
High	2480	51.01	≥ 20	PASS
BR Hopping Mode (GFSK)				
Low	2402-2480	50.78	≥ 20	PASS
High	2402-2480	51.02	≥ 20	PASS
EDR Mode (π/4-DQPSK)				
Low	2402	50.59	≥ 20	PASS
High	2480	50.22	≥ 20	PASS
EDR Hopping Mode (π/4-DQPSK)				
Low	2402-2480	51.66	≥ 20	PASS
High	2402-2480	51.70	≥ 20	PASS
EDR Mode (8DPSK)				
Low	2402	51.31	≥ 20	PASS
High	2480	50.72	≥ 20	PASS
EDR Hopping Mode (8DPSK)				
Low	2402-2480	51.33	≥ 20	PASS
High	2402-2480	51.22	≥ 20	PASS

Please refer to the following plots.

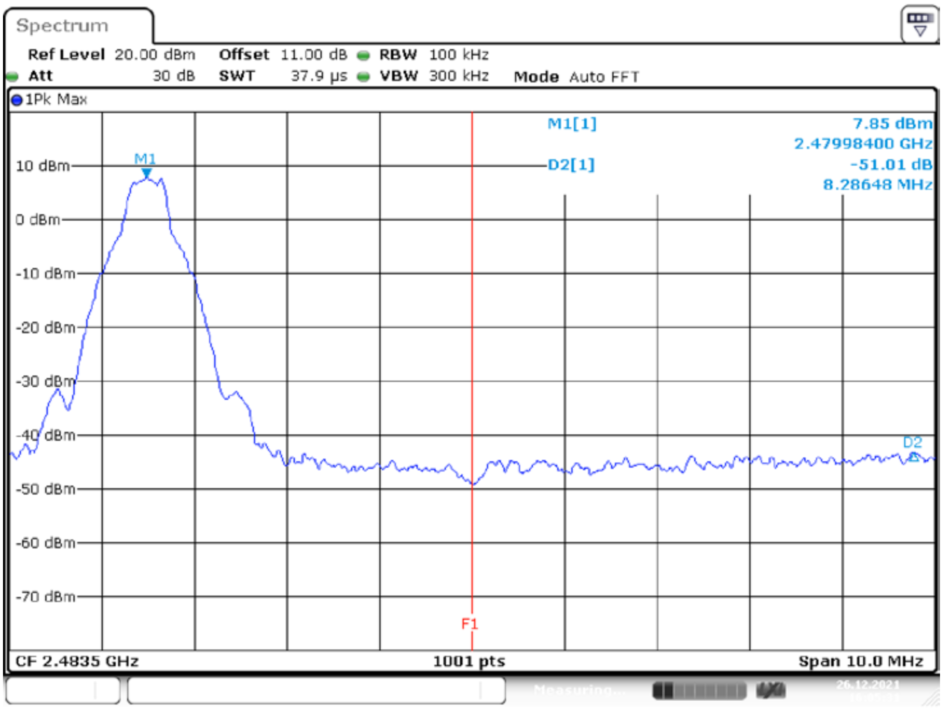
BR Mode (GFSK)

Band Edge, CH Low



Date: 26.DEC.2021 15:20:59

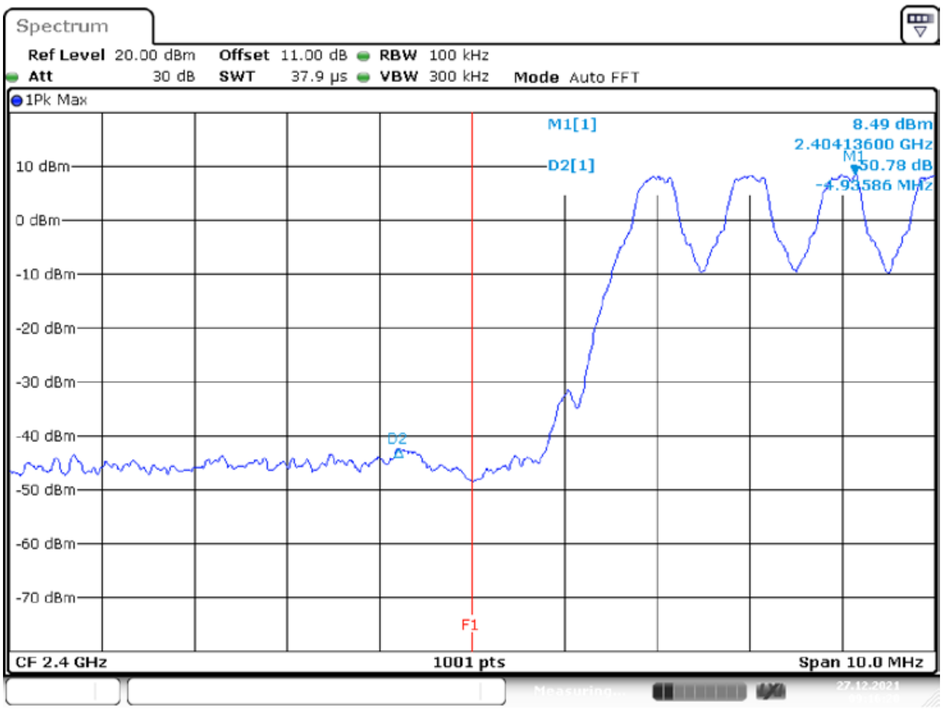
Band Edge, CH High



Date: 26.DEC.2021 16:05:32

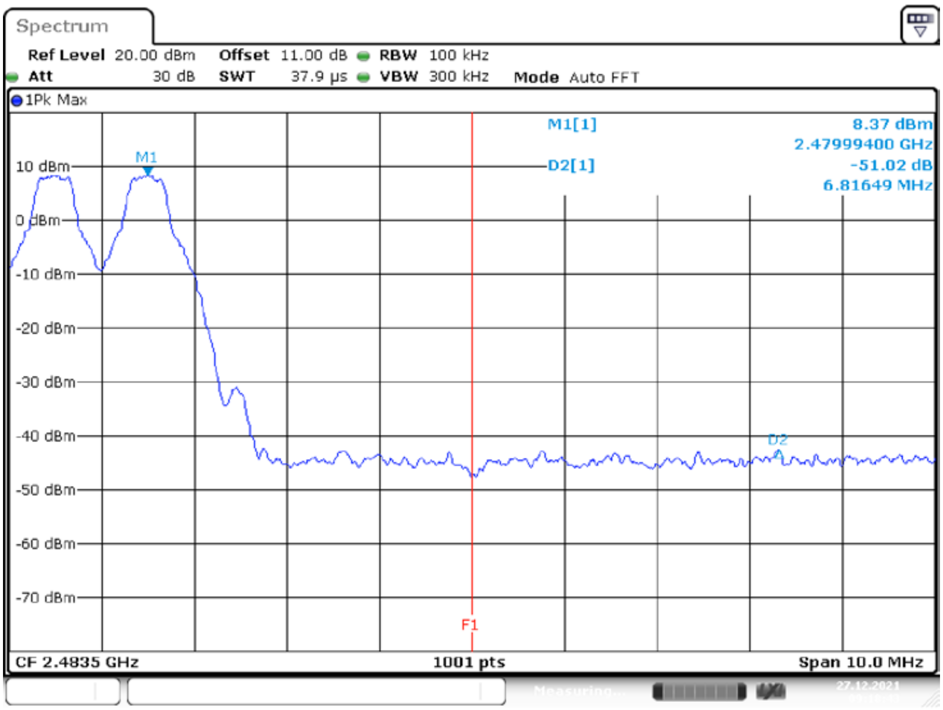
BR Hopping Mode (GFSK)

Band Edge, CH Low



Date: 27.DEC.2021 09:16:21

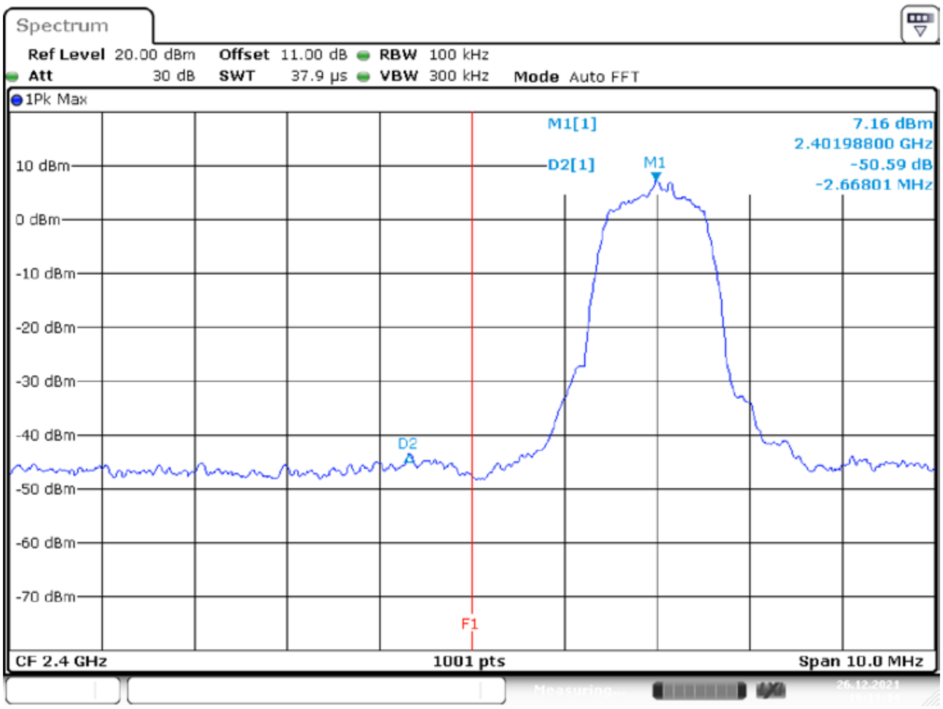
Band Edge, CH High



Date: 27.DEC.2021 09:18:43

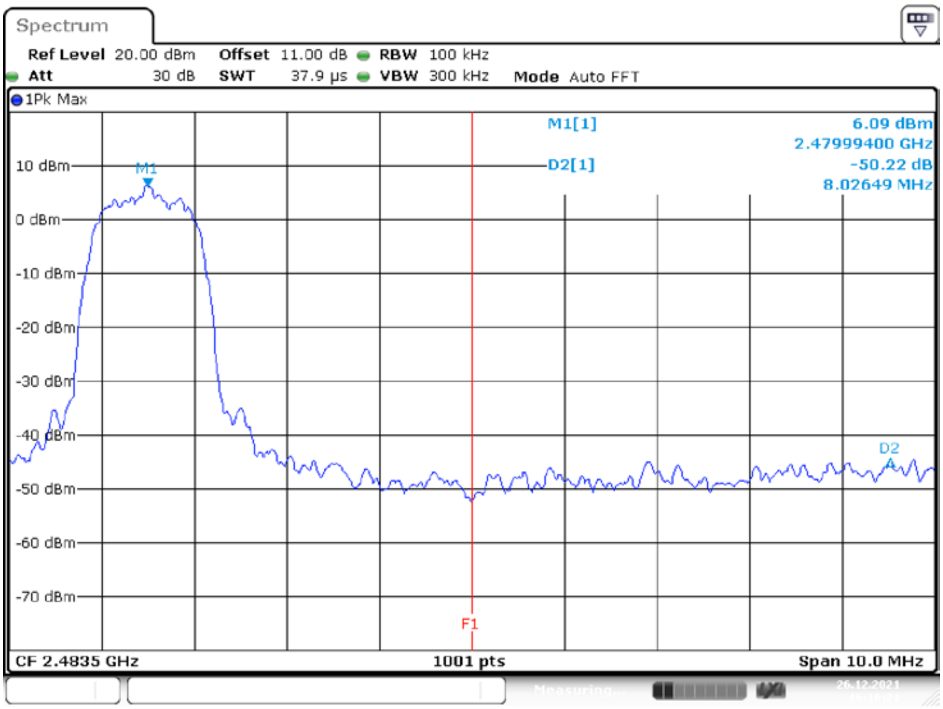
EDR Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 26.DEC.2021 16:11:14

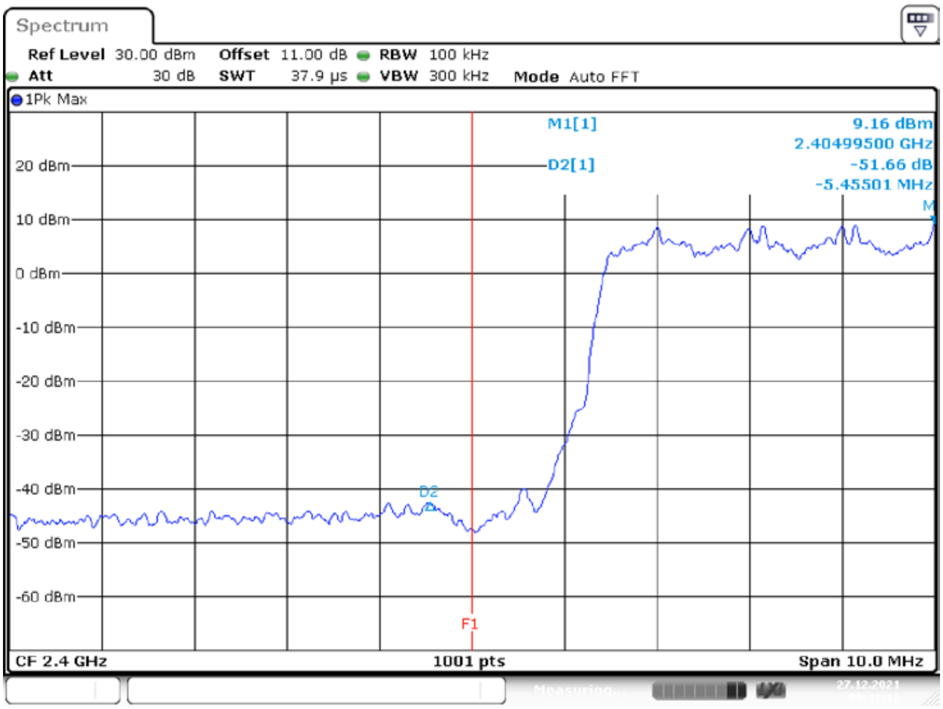
Band Edge, CH High



Date: 26.DEC.2021 16:16:21

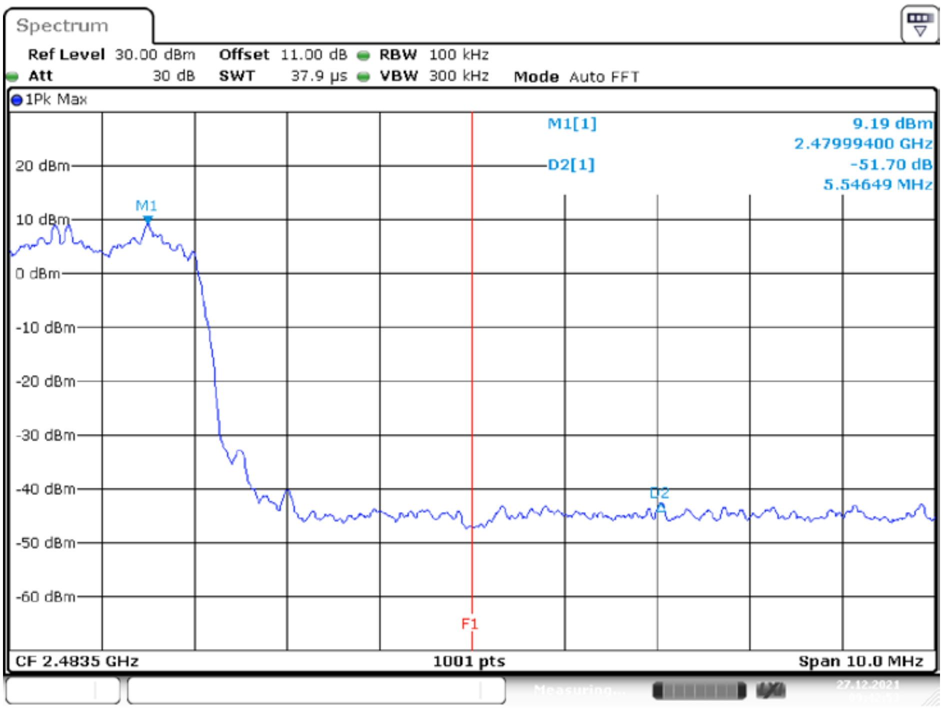
EDR Hopping Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 27.DEC.2021 09:41:11

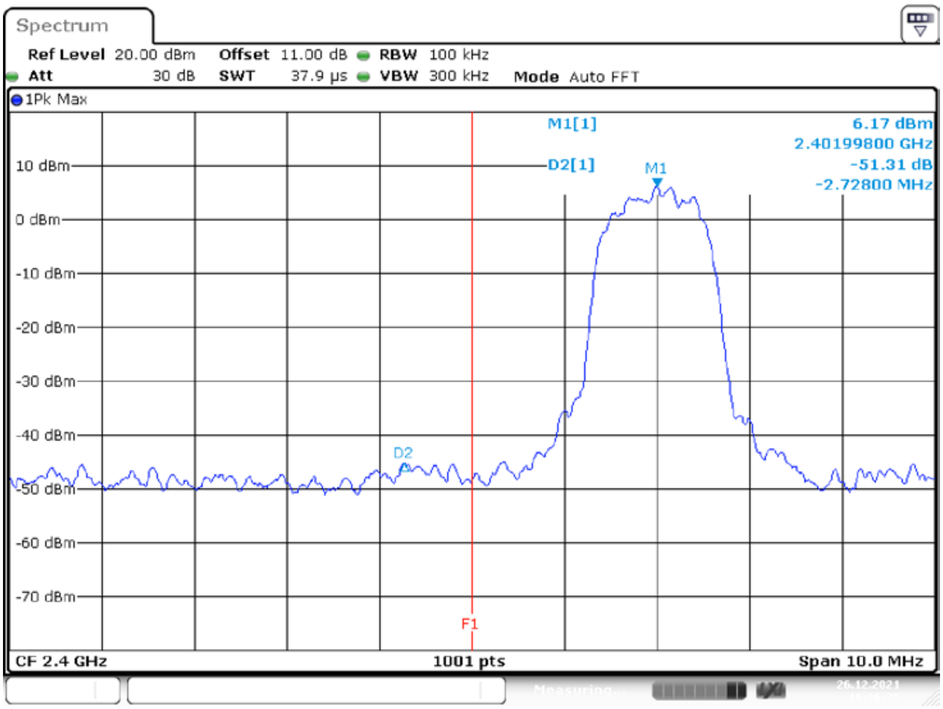
Band Edge, CH High



Date: 27.DEC.2021 09:42:54

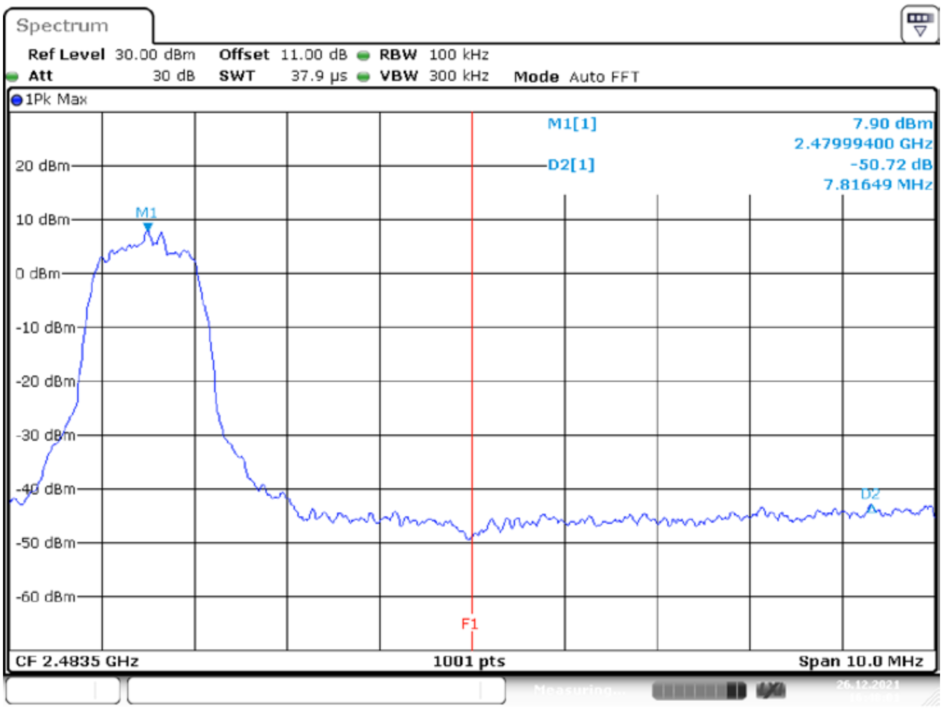
EDR Mode (8DPSK)

Band Edge, CH Low



Date: 26.DEC.2021 16:36:35

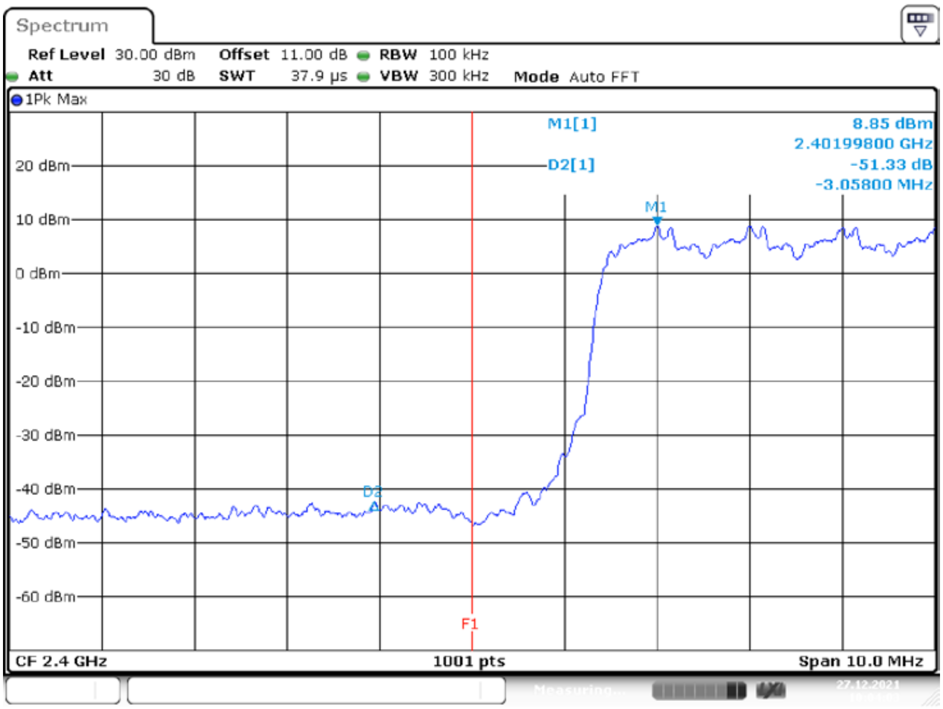
Band Edge, CH High



Date: 26.DEC.2021 16:48:01

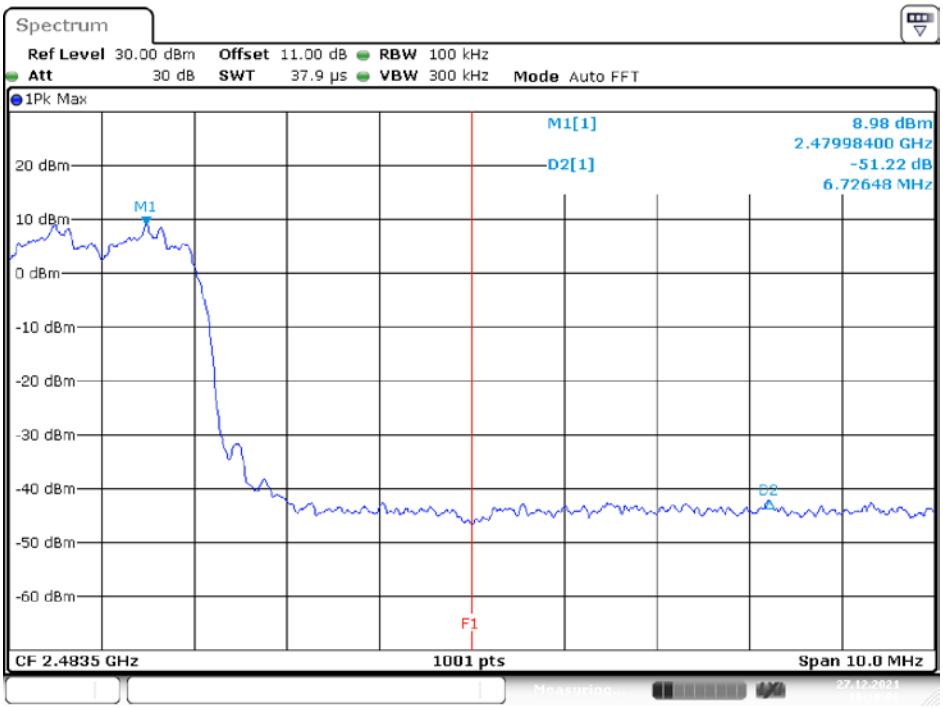
EDR Hopping Mode (8DPSK)

Band Edge, CH Low



Date: 27.DEC.2021 10:04:03

Band Edge, CH High



Date: 27.DEC.2021 10:10:06

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