TEST REPORT

Applicant Name :	Zultys, Inc.
Address :	785 Lucerne Drive, Sunnyvale, California, 94085, United States
Report Number :	SZ1210916-48531E-RF-00A
FCC ID:	2APWA-ZIP47GE
IC:	4478A-ZIP47GE

Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247, ISSUE 2, FEBRUARY 2017

Sample Description

Product Type:	Gigabit SIP IP Phone
Model No.:	ZIP 47GE
Multiple Model(s) No.:	N/A
Trade Mark:	Zultys
Date Received:	2021/09/16
Date of Test:	2021/09/24~2021/11/12
Report Date:	2021/11/12

Test Result:	Pass*

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

Prepared and Checked By:

Fan Yang
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".
Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Gigabit SIP IP Phone
Tested Model	ZIP 47GE
HVIN	ZIP 47GE
Frequency Range	Bluetooth: 2402~2480MHz
Transmit Peak Power	11.39dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification*	PCB Antenna: 3dBi
Voltage Range	DC48V from POE or DC5V from adapter
Date of Test	2021-09-24 to 2021-11-12
Sample serial number	CE&RE: SZ1210916-48531E-RF-S1, RF conducted: SZ1210916-48531E-RF-S2 (Assigned by ATC)
Received date	2021-09-16
Sample/EUT Status	Good condition
Adapter 1 information	Model: NSA10EU-05020002 Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 5V, 2.0A
Adapter 2 information	Model: OH-1015A0502000U4-UL Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 5V, 2.0A

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-247, Issue 2, February 2017, RSS-GEN Issue 5, Feb. 2021Amendment 2 of the Innovation, Science and Economic Development Canada rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and RSS-247, Issue 2, February 2017, RSS-GEN Issue 5, Feb. 2021Amendment 2 of the Innovation, Science and Economic Development Canada rules.

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

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB

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

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

"Web explorer"* was used to the config EUT to test mode and the power level is default*. The software and power level was provided by the applicant.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

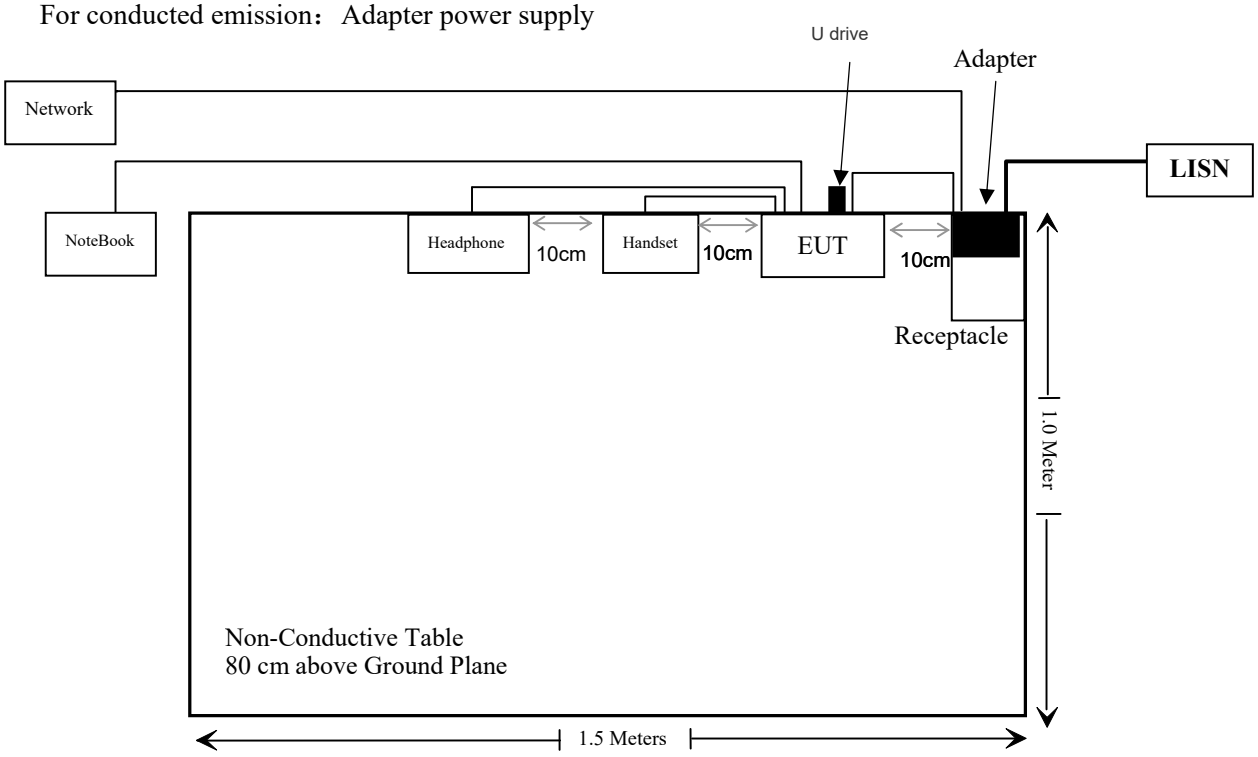
Manufacturer	Description	Model	Serial Number
DELL	NoteBook	Latitude E4710	PC201911252059
Grandstream	Headphone	Unknown	Unknown
Aigo	U drive	U268	Unknown
GOSPELL	POE	G0720-480-050	212701319

External I/O Cable

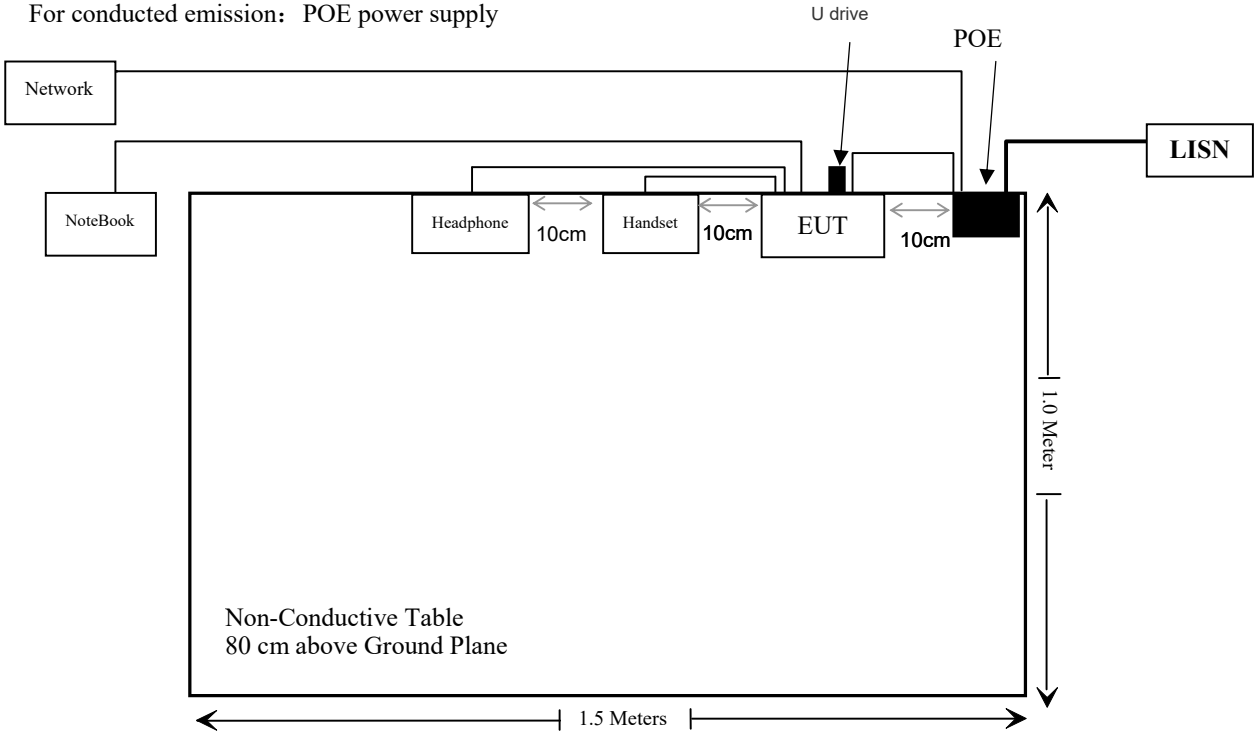
Cable Description	Length (m)	From Port	To
Un-shielding Un-Detachable AC Cable	1.2	LISN	Receptacle
Un-shielding Un-Detachable DC Cable	1.8	Adapter	EUT
Un-shielding Un-Detachable earphone Cable	1.5	EUT	Headphone
Un-shielding Detachable RJ45 Cable	6.0	EUT	Network
Un-shielding Detachable RJ45 Cable	6.0	EUT	NoteBook
Un-shielding Detachable RJ45 Cable	6.0	POE	Network
Un-shielding Detachable RJ45 Cable	1.0	POE	EUT

Block Diagram of Test Setup

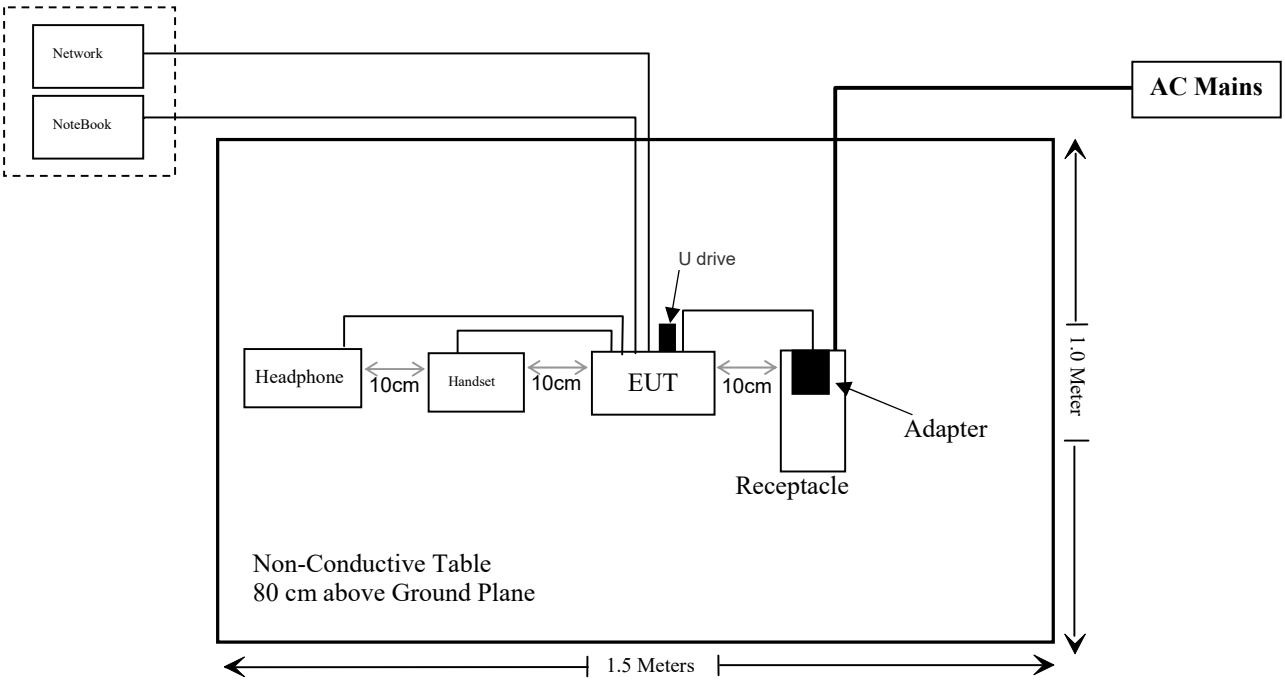
For conducted emission：Adapter power supply



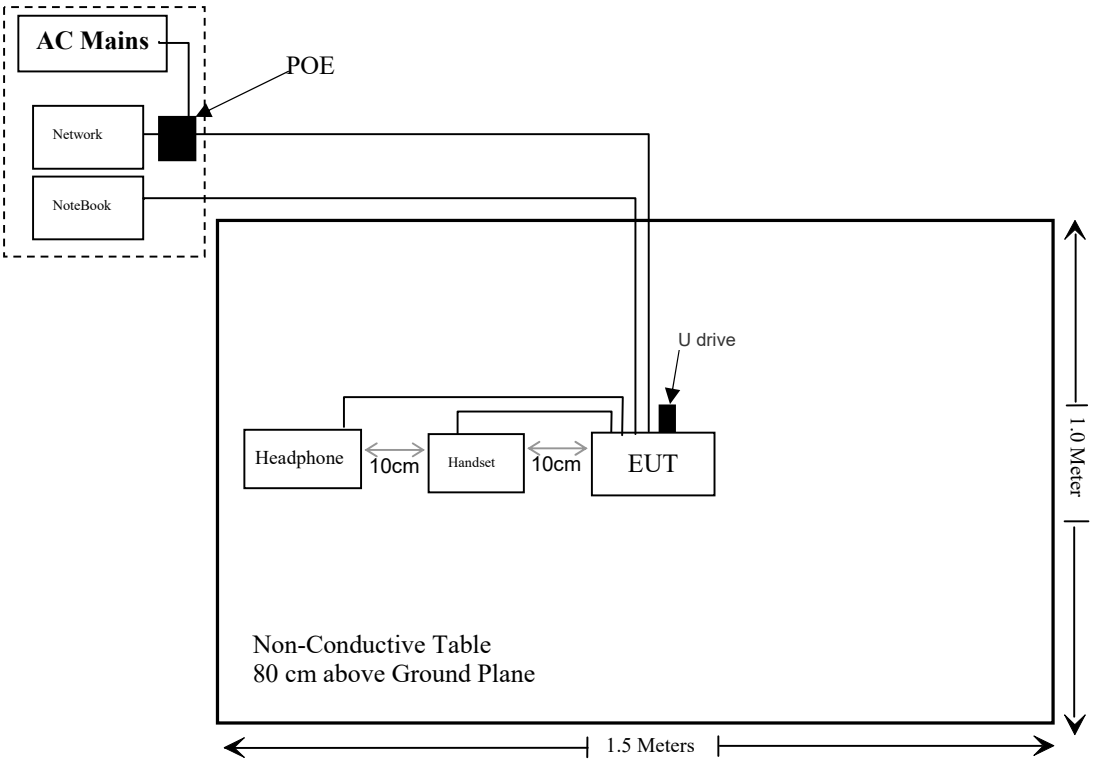
For conducted emission：POE power supply



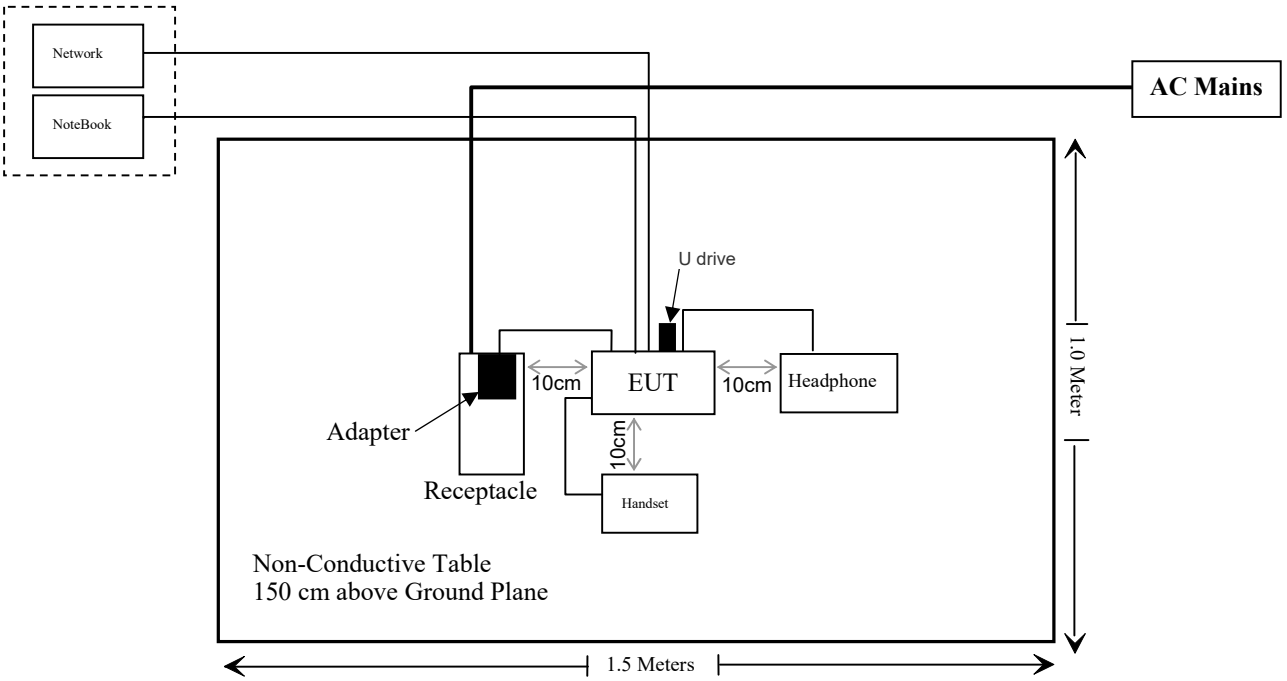
For Radiated emission(below 1G): Adapter power supply



For Radiated emission(below 1G): POE power supply



For Radiated emission(above 1G):



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC §15.247 (i) & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
RSS-102 § 2.5.2	Exemption Limits For Routine Evaluation-RF Exposure Evaluation	Compliant
FCC §15.203 RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207(a) RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §15.205, §15.209, §15.247(d) RSS-247 § 5.5, RSS-GEN § 8.10	Radiated Emissions	Compliant
FCC §15.247(a)(1) RSS-247 § 5.1(a), RSS-GEN § 6.7	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
FCC §15.247(a)(1) RSS-247 § 5.1 (b)	Channel Separation Test	Compliant
FCC §15.247(a)(1)(iii) RSS-247 § 5.1 (d)	Time of Occupancy (Dwell Time)	Compliant
FCC §15.247(a)(1)(iii) RSS-247 § 5.1 (d)	Quantity of hopping channel Test	Compliant
FCC §15.247(b)(1) RSS-247 § 5.1(b) &§ 5.4(b)	Peak Output Power Measurement	Compliant
FCC §15.247(d) RSS-247 § 5.5	Band edges	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50ΩCoaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Conducted Emission Test Software: ES-K1 V1.71					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Radiated Emission Test Software: EZ_EMC V 1.1.4.2					
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2020/12/25	2021/12/24
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2020/12/24	2021/12/23

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

FCC §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = 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)

Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	3.0	2.00	11.5	14.13	20	0.006	1

Note: The Bluetooth, 2.4GHz Wi-Fi and 5GHz Wi-Fi cannot transmit at same time

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

RSS-102 § 2.5.2 –EXEMPTION LIMITS FOR ROUTINE EVALUATION-RF EXPOSURE EVALUATION

Applicable Standard

According to RSS-102 § (2.5.2):

2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Calculated Data:

The maximum tune-up conducted output power is 11.5dBm.

And the maximum antenna gain is 3.0dBi.

So the maximum tune-up EIRP is 14.5dBm=0.028W<2.68W.

f = 2402 MHz:

The limit is $1.31\times10^{-2}\times2402^{0.6834}$=2.68W

So EUT meet the RF Exposure evaluation.

FCC §15.203 & RSS-GEN §6.8 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to FCC § 15.203, the applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has one internal PCB antenna arrangement which was permanently attached and the maximum antenna gain is 3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Gain	Impedance	Frequency Range
PCB	3dBi	50 Ω	2.4~2.5GHz

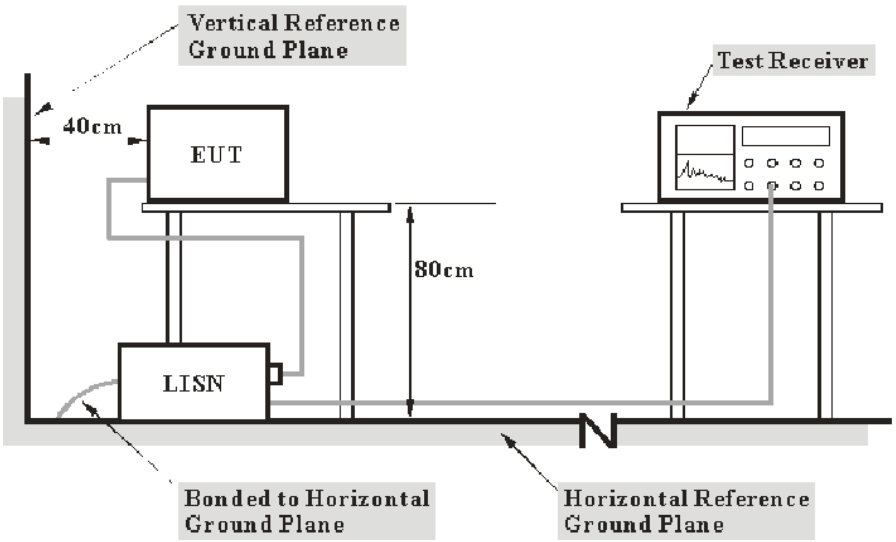
Result: Compliance

FCC §15.207 (a) & RSS-GEN § 8.8 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a), RSS-GEN § 8.8

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 measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207 & RSS-Gen.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

Corrected Factor & Margin Calculation

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

Transd Factor = LISN VDF + Cable Loss

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 = Limit – level
Level= reading level+ Transd Factor

Test Data

Environmental Conditions

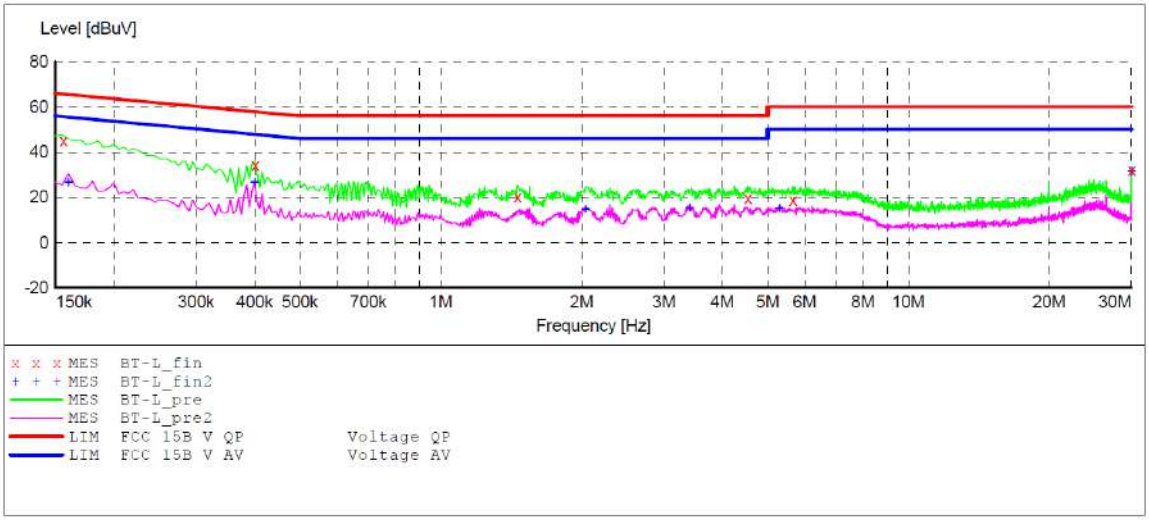
Temperature:	25 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Caro hu on 2021-10-02 and 2021-10-21.

EUT operation mode: Transmitting(worst case is 8DPSK mode, high channel)

For POE:

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "BT-L_fin"

2021-10-21 11:09

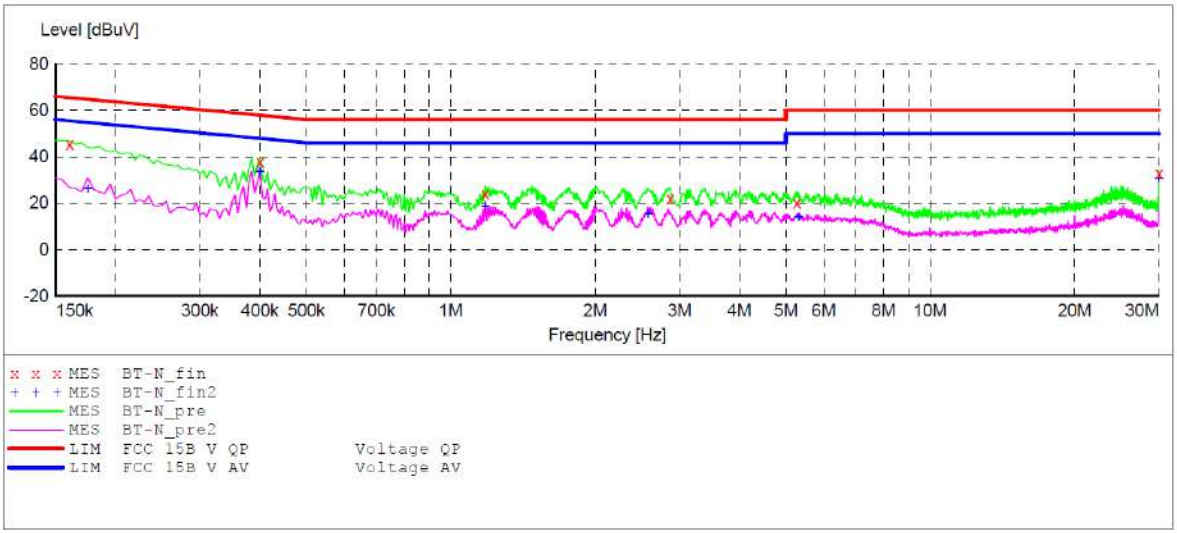
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.155000	31.30	10.8	66	34.7	QP	L1	GND
0.400000	35.00	11.0	58	23.0	QP	L1	GND
1.460000	20.00	11.2	56	36.0	QP	L1	GND
4.540000	19.40	11.4	56	36.6	QP	L1	GND
5.660000	18.80	11.5	60	41.2	QP	L1	GND
30.000000	32.20	11.8	60	27.8	QP	L1	GND

MEASUREMENT RESULT: "BT-L_fin2"

2021-10-21 11:09

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.160000	26.60	10.8	56	29.4	AV	L1	GND
0.400000	26.60	11.0	48	21.4	AV	L1	GND
2.040000	14.70	11.3	46	31.3	AV	L1	GND
3.410000	15.20	11.4	46	30.8	AV	L1	GND
5.300000	15.00	11.4	50	35.0	AV	L1	GND
30.000000	31.20	11.8	50	18.8	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "BT-N_fin"

2021-10-21 11:11

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.160000	31.20	10.8	66	34.8	QP	N	GND
0.400000	37.60	11.0	58	20.4	QP	N	GND
1.180000	23.90	11.2	56	32.1	QP	N	GND
2.870000	22.00	11.3	56	34.0	QP	N	GND
5.270000	20.30	11.4	60	39.7	QP	N	GND
30.000000	32.80	11.8	60	27.2	QP	N	GND

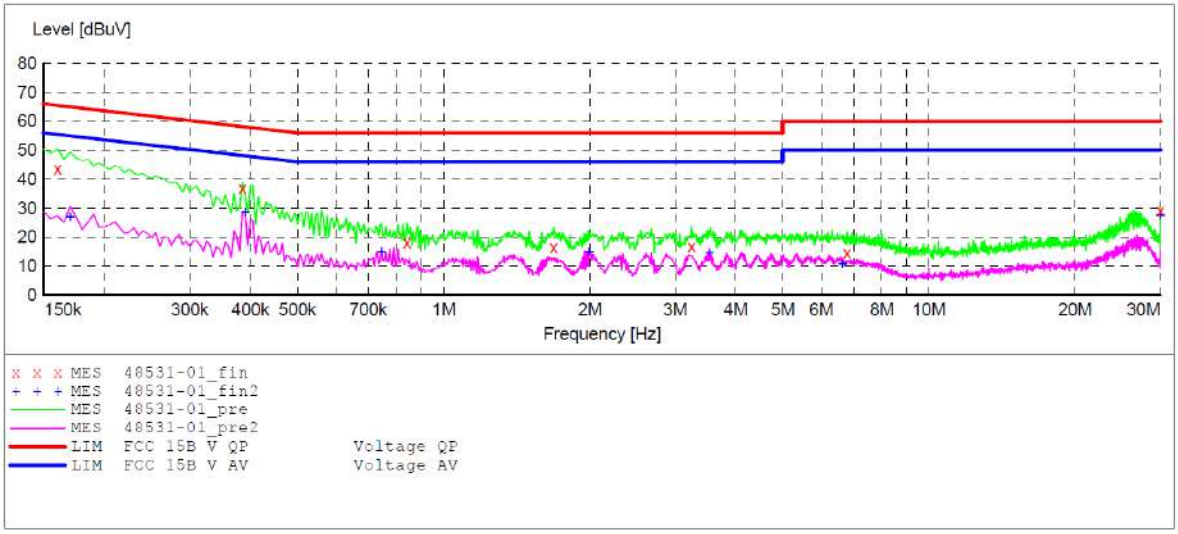
MEASUREMENT RESULT: "BT-N_fin2"

2021-10-21 11:11

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.175000	26.30	10.8	55	28.7	AV	N	GND
0.400000	33.50	11.0	48	14.5	AV	N	GND
1.180000	18.50	11.2	46	27.5	AV	N	GND
2.580000	15.40	11.3	46	30.6	AV	N	GND
5.310000	13.80	11.4	50	36.2	AV	N	GND
30.000000	30.80	11.8	50	19.2	AV	N	GND

For adapter NSA10EU-05020002:

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "48531-01_fin"

2021-10-2 11:49

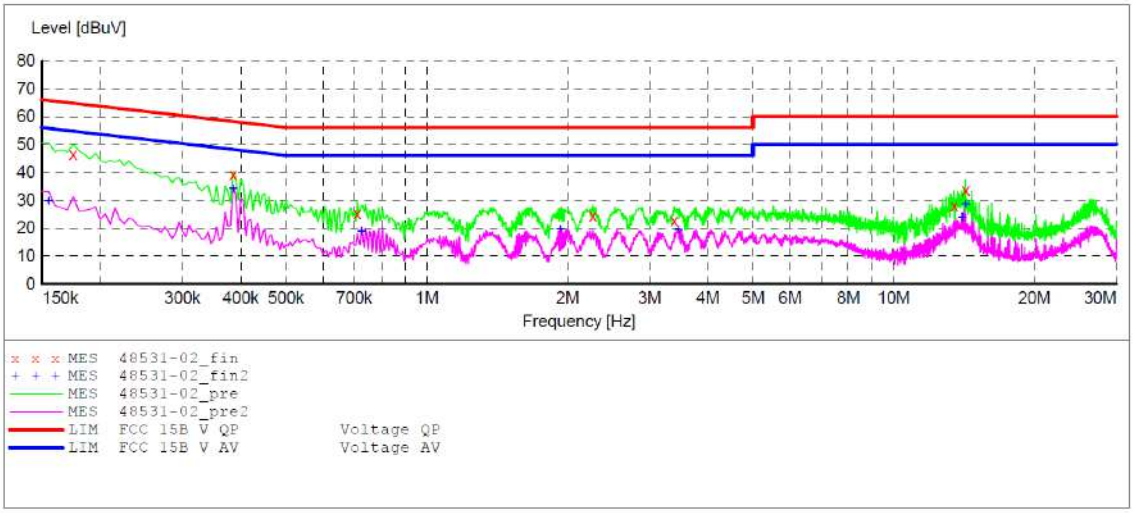
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.160000	43.70	10.8	66	22.3	QP	L1	GND
0.385000	36.90	10.9	58	21.1	QP	L1	GND
0.840000	18.20	11.1	56	37.8	QP	L1	GND
1.685000	16.40	11.2	56	39.6	QP	L1	GND
3.240000	16.80	11.4	56	39.2	QP	L1	GND
6.780000	14.60	11.5	60	45.4	QP	L1	GND
30.000000	29.00	11.8	60	31.0	QP	L1	GND

MEASUREMENT RESULT: "48531-01_fin2"

2021-10-2 11:49

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.170000	26.80	10.8	55	28.2	AV	L1	GND
0.390000	28.40	11.0	48	19.6	AV	L1	GND
0.745000	14.70	11.1	46	31.3	AV	L1	GND
1.995000	14.80	11.3	46	31.2	AV	L1	GND
3.530000	14.60	11.4	46	31.4	AV	L1	GND
6.630000	10.70	11.5	50	39.3	AV	L1	GND
30.000000	27.40	11.8	50	22.6	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "48531-02_fin"

2021-10-2 11:52

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.175000	47.40	10.8	65	17.6	QP	N	GND
0.385000	39.20	10.9	58	18.8	QP	N	GND
0.710000	25.10	11.1	56	30.9	QP	N	GND
2.270000	24.40	11.3	56	31.6	QP	N	GND
3.390000	22.80	11.4	56	33.2	QP	N	GND
13.475000	28.00	11.6	60	32.0	QP	N	GND
14.275000	33.70	11.6	60	26.3	QP	N	GND

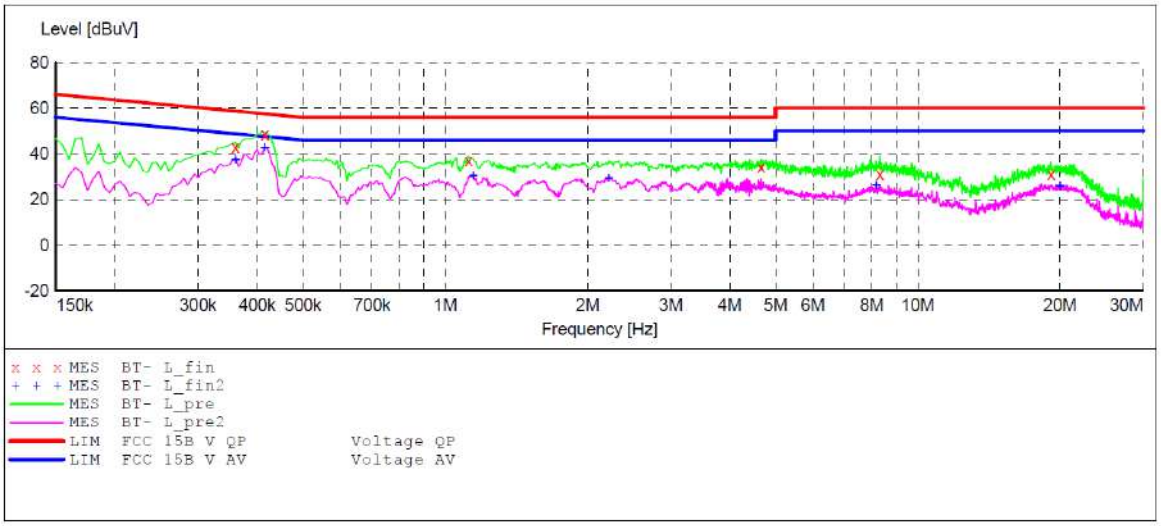
MEASUREMENT RESULT: "48531-02_fin2"

2021-10-2 11:52

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.155000	29.60	10.8	56	26.4	AV	N	GND
0.385000	34.20	10.9	48	13.8	AV	N	GND
0.725000	18.80	11.1	46	27.2	AV	N	GND
1.930000	19.50	11.3	46	26.5	AV	N	GND
3.460000	19.40	11.4	46	26.6	AV	N	GND
14.025000	23.80	11.6	50	26.2	AV	N	GND
14.275000	28.50	11.6	50	21.5	AV	N	GND

For adapter OH-1015A0502000U4-UL:

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "BT- L_fin"

2021-10-21 03:11

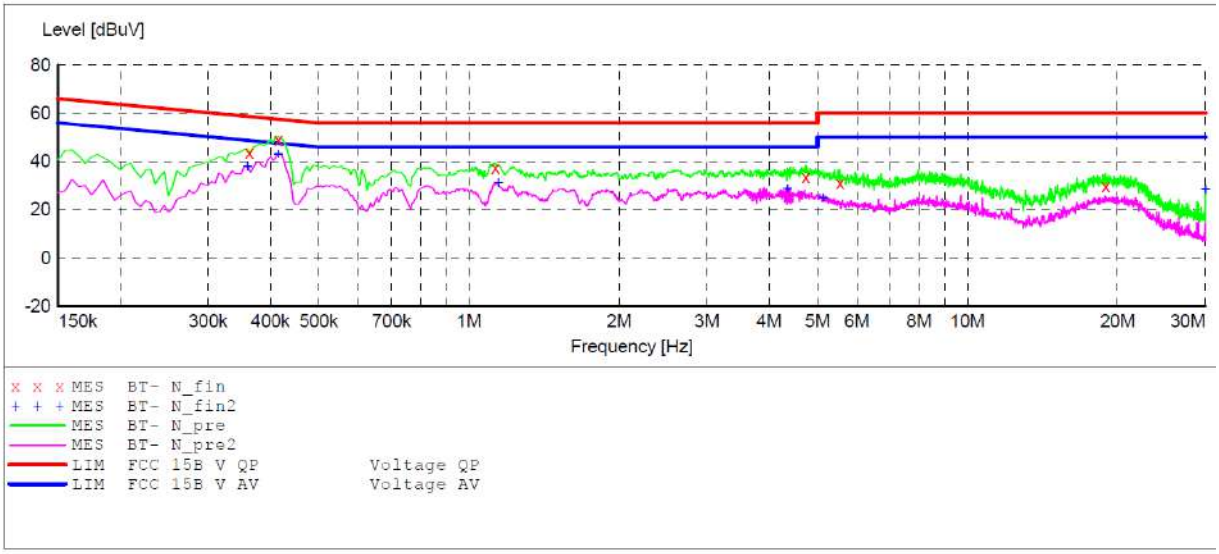
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	27.70	10.9	59	31.3	QP	L1	GND
0.415000	48.50	11.0	58	9.5	QP	L1	GND
1.120000	37.00	11.2	56	19.0	QP	L1	GND
4.660000	34.20	11.4	56	21.8	QP	L1	GND
8.320000	31.00	11.5	60	29.0	QP	L1	GND
19.150000	31.20	11.7	60	28.8	QP	L1	GND

MEASUREMENT RESULT: "BT- L_fin2"

2021-10-21 03:11

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	37.30	10.9	49	11.7	AV	L1	GND
0.415000	42.50	11.0	48	5.5	AV	L1	GND
1.145000	30.40	11.2	46	15.6	AV	L1	GND
2.220000	29.20	11.3	46	16.8	AV	L1	GND
8.170000	26.20	11.5	50	23.8	AV	L1	GND
20.000000	25.70	11.7	50	24.3	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "BT- N_fin"

2021-10-21 03:13

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	25.70	10.9	59	33.3	QP	N	GND
0.415000	48.90	11.0	58	9.1	QP	N	GND
1.130000	37.30	11.2	56	18.7	QP	N	GND
4.740000	33.50	11.4	56	22.5	QP	N	GND
5.550000	31.10	11.5	60	28.9	QP	N	GND
18.900000	29.60	11.7	60	30.4	QP	N	GND

MEASUREMENT RESULT: "BT- N_fin2"

2021-10-21 03:13

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.360000	37.70	10.9	49	11.3	AV	N	GND
0.415000	42.90	11.0	48	5.1	AV	N	GND
1.145000	31.00	11.2	46	15.0	AV	N	GND
4.350000	28.60	11.4	46	17.4	AV	N	GND
5.130000	24.60	11.4	50	25.4	AV	N	GND
30.000000	28.20	11.8	50	21.8	AV	N	GND

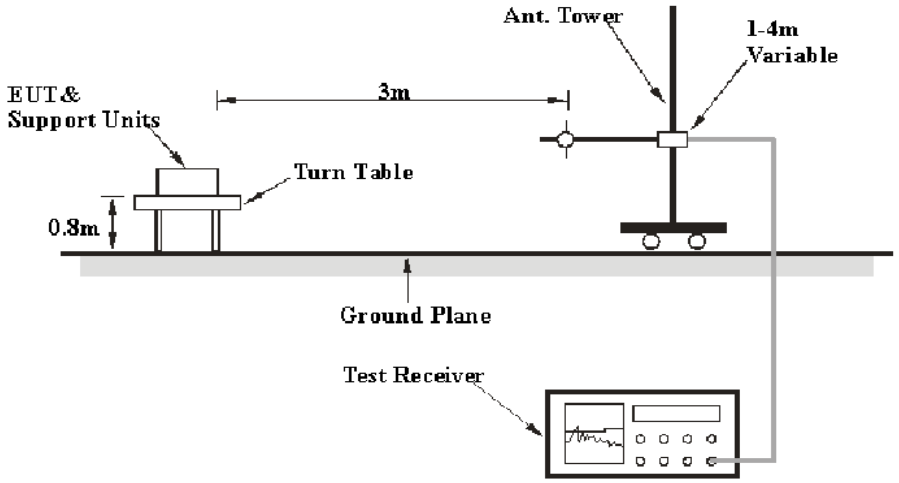
FCC §15.209, §15.205 & §15.247(d) & RSS-247§ 5.5 - Spurious Emissions

Applicable Standard

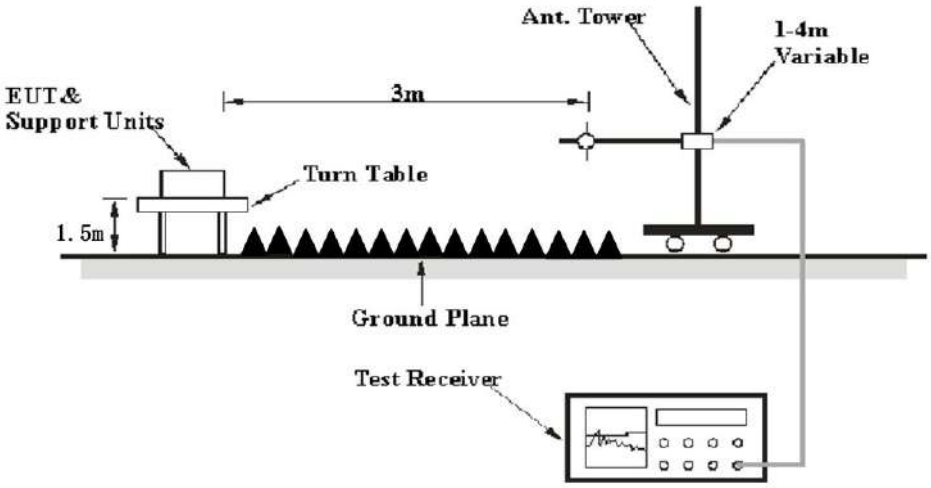
FCC §15.205; §15.209; §15.247(d); RSS-247§ 5.5; RSS-GEN § 8.10

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247, RSS-247, RSS-Gen limits.

EMI Test Receiver & Spectrum Analyzer Setup

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Average

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

The 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:

Factor = Meter Reading + 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 -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Result-Limit
Result = Reading + Factor

Test Data

Environmental Conditions

Temperature:	20~23 ℃
Relative Humidity:	45~50 %
ATM Pressure:	101.0~103.0 kPa

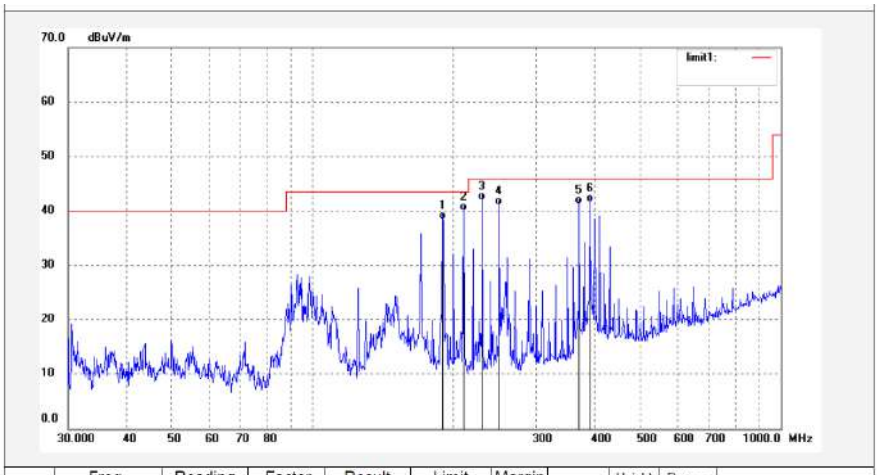
The testing was performed by Icey on 2021-10-23 for below 1GHz and Chao Mo on 2021-10-15 for above 1GHz.

EUT operation mode: Transmitting (*Scan with π/4-DQPSK, 8DPSK mode, the worst case is 8DPSK Mode*)

Below 1GHz: *(worst case is 8DPSK Mode, High channel)*

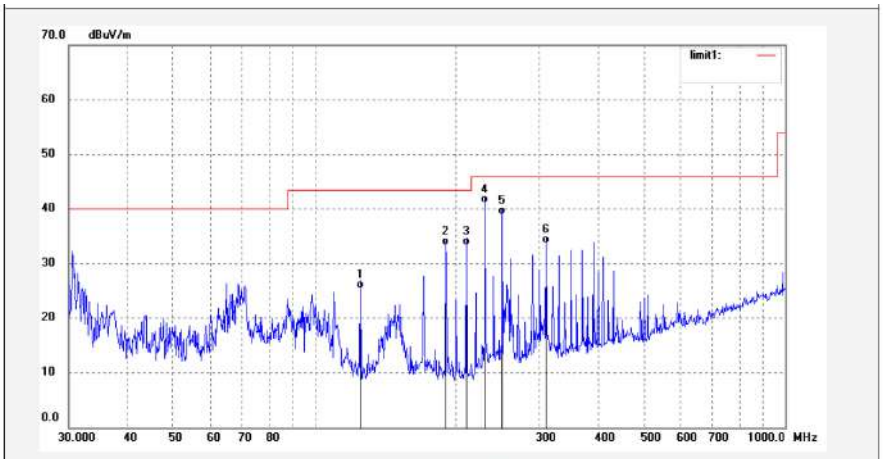
For POE

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	189.7384	56.11	-17.77	38.34	43.50	-5.16	QP			
2	210.0482	57.43	-17.46	39.97	43.50	-3.53	QP			
3	230.0985	58.78	-16.79	41.99	46.00	-4.01	QP			
4	250.3011	57.46	-16.44	41.02	46.00	-4.98	QP			
5	370.7022	54.22	-13.07	41.15	46.00	-4.85	QP			
6	390.7225	54.39	-12.79	41.60	46.00	-4.40	QP			

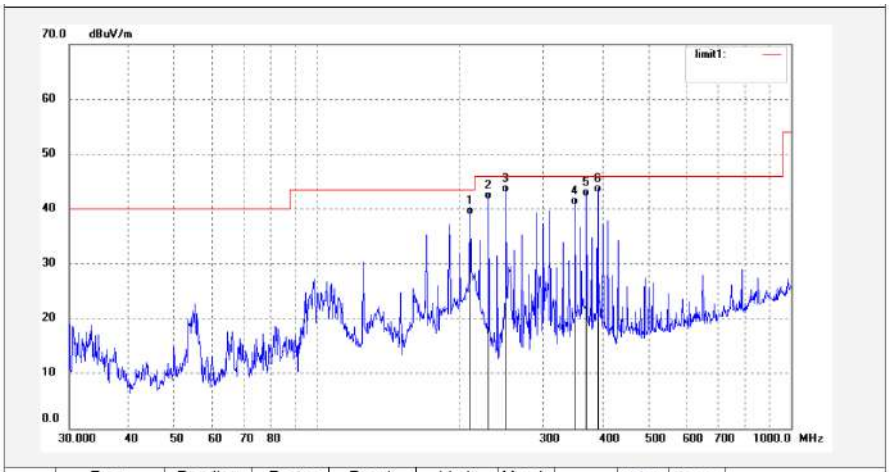
Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	125.0066	44.13	-18.67	25.46	43.50	-18.04	QP			
2	189.7384	51.09	-17.77	33.32	43.50	-10.18	QP			
3	210.0482	50.79	-17.46	33.33	43.50	-10.17	QP			
4	230.0985	57.88	-16.79	41.09	46.00	-4.91	QP			
5	250.3011	55.39	-16.44	38.95	46.00	-7.05	QP			
6	309.9977	48.03	-14.32	33.71	46.00	-12.29	QP			

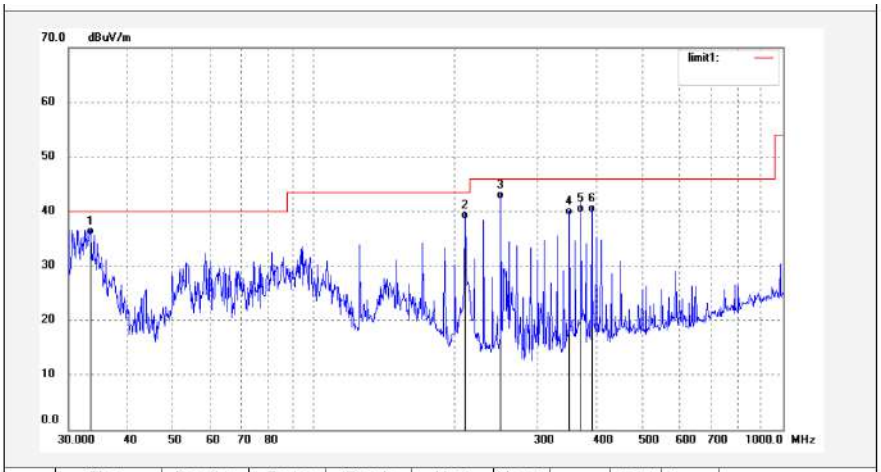
For adapter NSA10EU-05020002:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	210.0482	56.41	-17.46	38.95	43.50	-4.55	QP			
2	230.0985	58.52	-16.79	41.73	46.00	-4.27	QP			
3	250.3012	59.41	-16.44	42.97	46.00	-3.03	QP			
4	350.4768	54.03	-13.30	40.73	46.00	-5.27	QP			
5	370.7023	55.28	-13.07	42.21	46.00	-3.79	QP			
6	390.7226	55.70	-12.79	42.91	46.00	-3.09	QP			

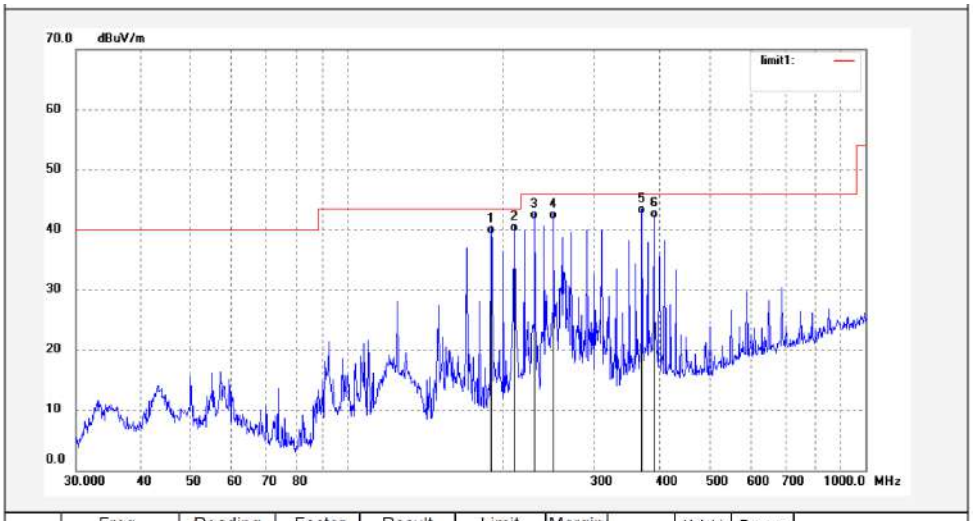
Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	33.4449	50.21	-14.59	35.62	40.00	-4.38	QP			
2	210.0482	56.13	-17.46	38.67	43.50	-4.83	QP			
3	250.3012	58.70	-16.44	42.26	46.00	-3.74	QP			
4	350.4768	52.53	-13.30	39.23	46.00	-6.77	QP			
5	370.7023	52.80	-13.07	39.73	46.00	-6.27	QP			
6	390.7226	52.61	-12.79	39.82	46.00	-6.18	QP			

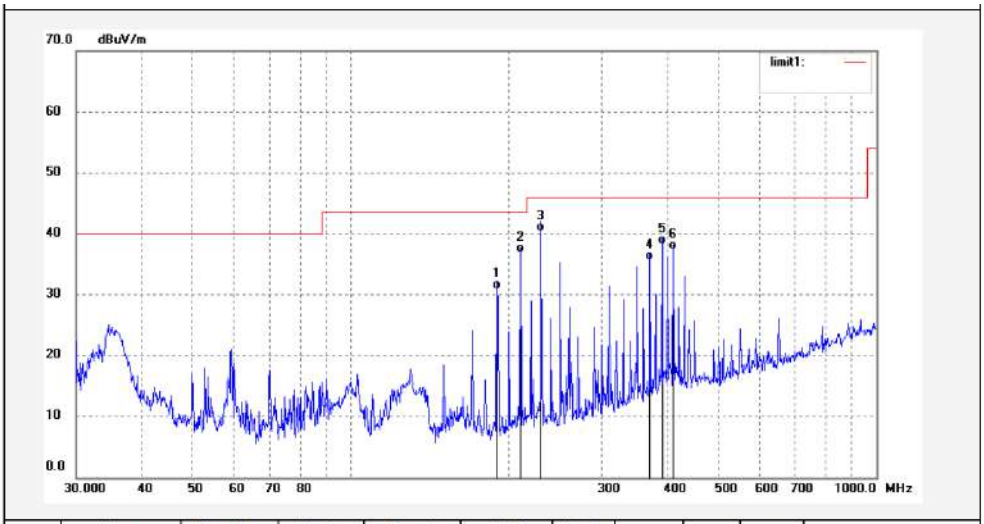
For adapter OH-1015A0502000U4-UL:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	189.7384	57.11	-17.77	39.34	43.50	-4.16	QP			
2	210.0482	57.02	-17.46	39.56	43.50	-3.94	QP			
3	230.0985	58.49	-16.79	41.70	46.00	-4.30	QP			
4	250.3011	58.12	-16.44	41.68	46.00	-4.32	QP			
5	370.7022	55.71	-13.07	42.64	46.00	-3.36	QP			
6	390.7225	54.62	-12.79	41.83	46.00	-4.17	QP			

Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	189.7384	48.68	-17.77	30.91	43.50	-12.59	QP			
2	210.0482	54.33	-17.46	36.87	43.50	-6.63	QP			
3	230.0985	57.06	-16.79	40.27	46.00	-5.73	QP			
4	370.7022	48.68	-13.07	35.61	46.00	-10.39	QP			
5	390.7225	51.08	-12.79	38.29	46.00	-7.71	QP			
6	410.3824	49.42	-12.01	37.41	46.00	-8.59	QP			

Above 1GHz: *(worst case is 8DPSK mode &adapter NSA10EU-05020002)*

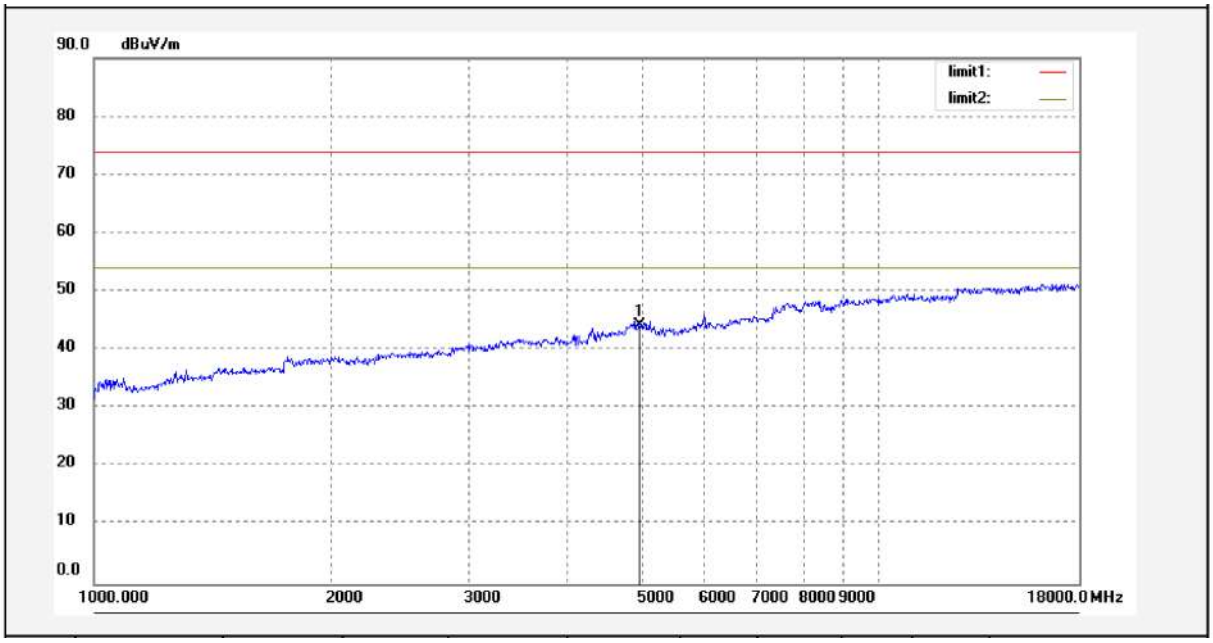
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave.		Height (m)	Polar (H/V)				
Low Channel									
2310	45.05	PK	226	1.2	H	-6.84	38.21	74	-35.79
2310	40.77	PK	154	1.8	V	-6.84	33.93	74	-40.07
2390	45.27	PK	333	1.5	H	-6.44	38.83	74	-35.17
2390	40.67	PK	297	1.1	V	-6.44	34.23	74	-39.77
4804	39.98	PK	106	1.9	H	2.81	42.79	74	-31.21
4804	40.34	PK	52	1.4	V	2.81	43.15	74	-30.85
Middle Channel									
4882	39.45	PK	111	1.6	H	3.04	42.49	74	-31.51
4882	39.99	PK	118	1.2	V	3.04	43.03	74	-30.97
High Channel									
2483.5	45.34	PK	139	1.7	H	-5.96	39.38	74	-34.62
2483.5	44.17	PK	320	1.6	V	-5.96	38.21	74	-35.79
2500	45.64	PK	56	1.7	H	-5.88	39.76	74	-34.24
2500	40.15	PK	173	2.1	V	-5.88	34.27	74	-39.73
4960	40.88	PK	278	2.0	H	3.29	44.17	74	-29.83
4960	40.42	PK	275	1.7	V	3.29	43.71	74	-30.29

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is 20dB to the limit was not recorded.
When the test result of peak was less than the limit of average, just peak value were recorded.

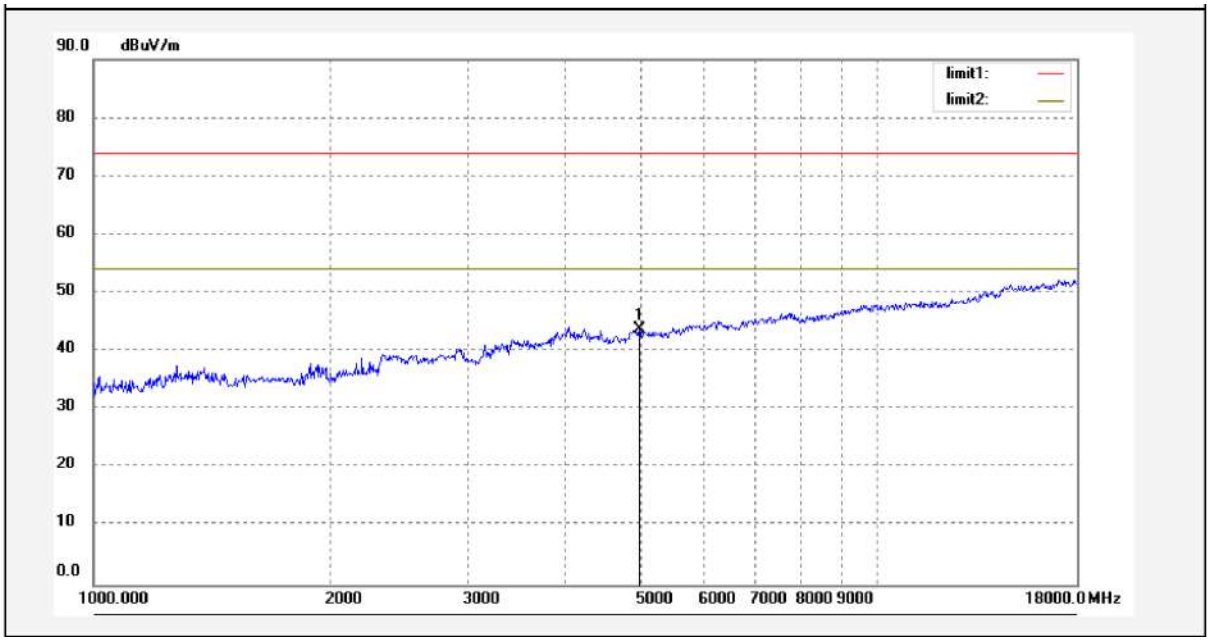
1 GHz - 18 GHz: (Pre-Scan plots)

High channel

Horizontal



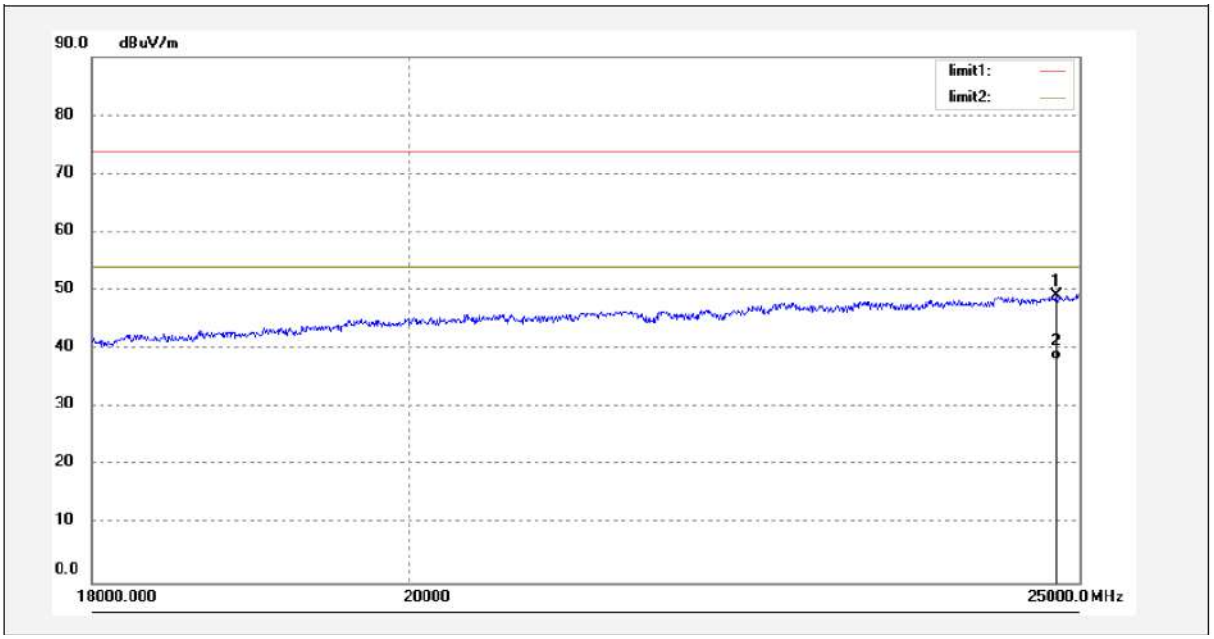
Vertical



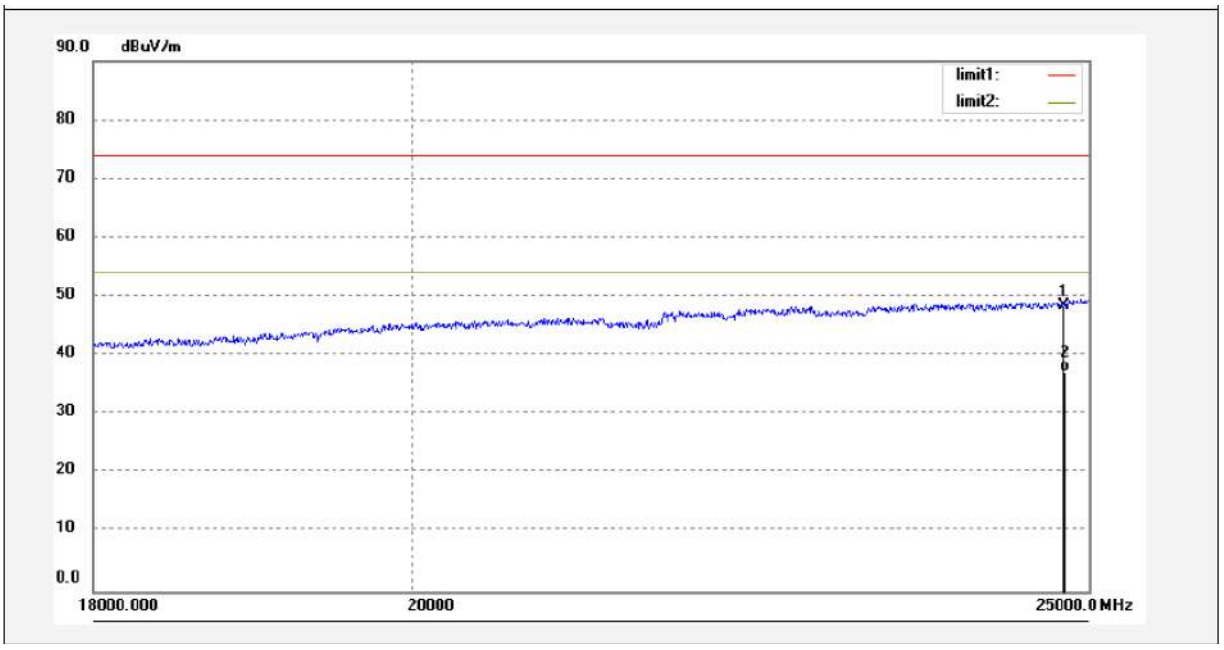
18-25GHz: (Pre-Scan plots)

High channel

Horizontal



Vertical



FCC §15.247(a) (1) & RSS-247 § 5.1 (b) -CHANNEL Separation Test

Applicable Standard

According to FCC §15.247(a) (1):

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to RSS-247 § 5.1 (b):

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure

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.

Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

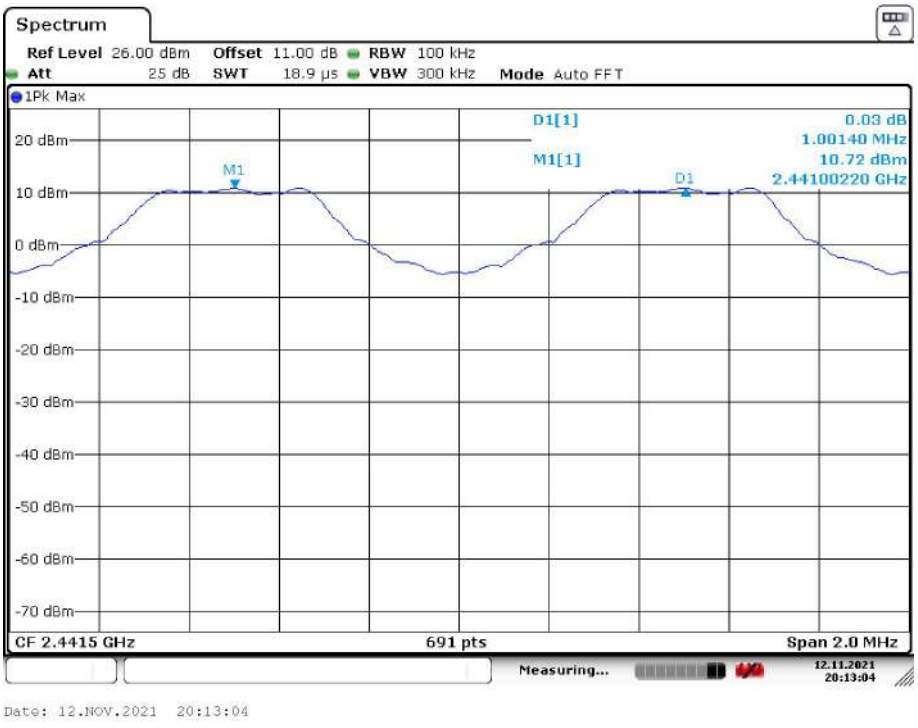
EUT operation mode: Transmitting

Test Result: Pass

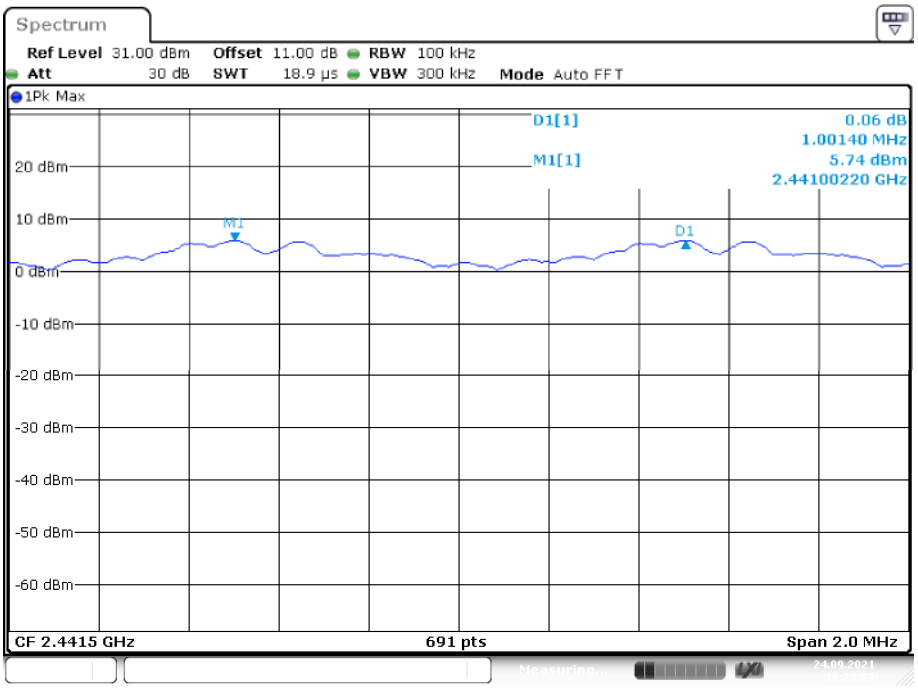
Please refer to following table and plots.

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit
BDR(GFSK)				
Middle	1.001	1.039	0.693	> two-thirds of the 20 dB bandwidth
EDR(π/4-DQPSK)				
Middle	1.001	1.334	0.889	> two-thirds of the 20 dB bandwidth
EDR(8DPSK)				
Middle	1.001	1.308	0.872	> two-thirds of the 20 dB bandwidth

BDR (GFSK)

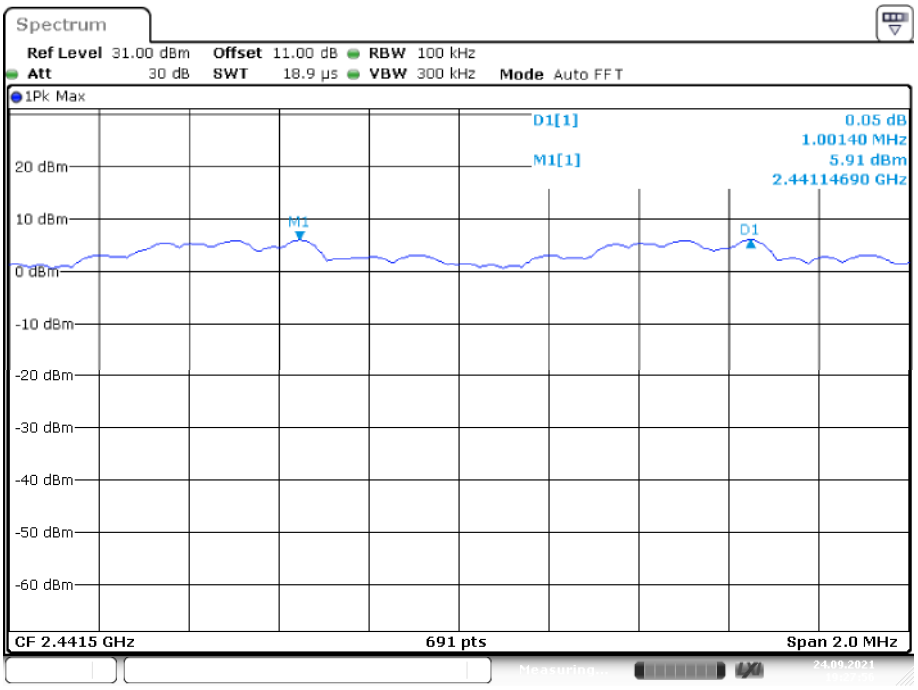


EDR (π/4-DQPSK)



Date: 24.SEP.2021 19:23:23

EDR (8DPSK)



Date: 24.SEP.2021 19:27:56

FCC §15.247(a) (1) & RSS-247 § 5.1 (a), RSS-GEN § 6.7 – 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (1):

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.

According to RSS-247 § 5.1 (a), RSS-GEN § 6.7:

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "20 dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 20 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:

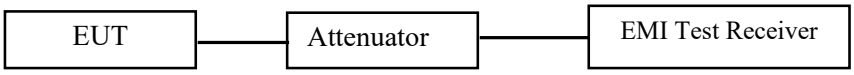
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

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

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

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

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



Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

EUT operation mode: Transmitting

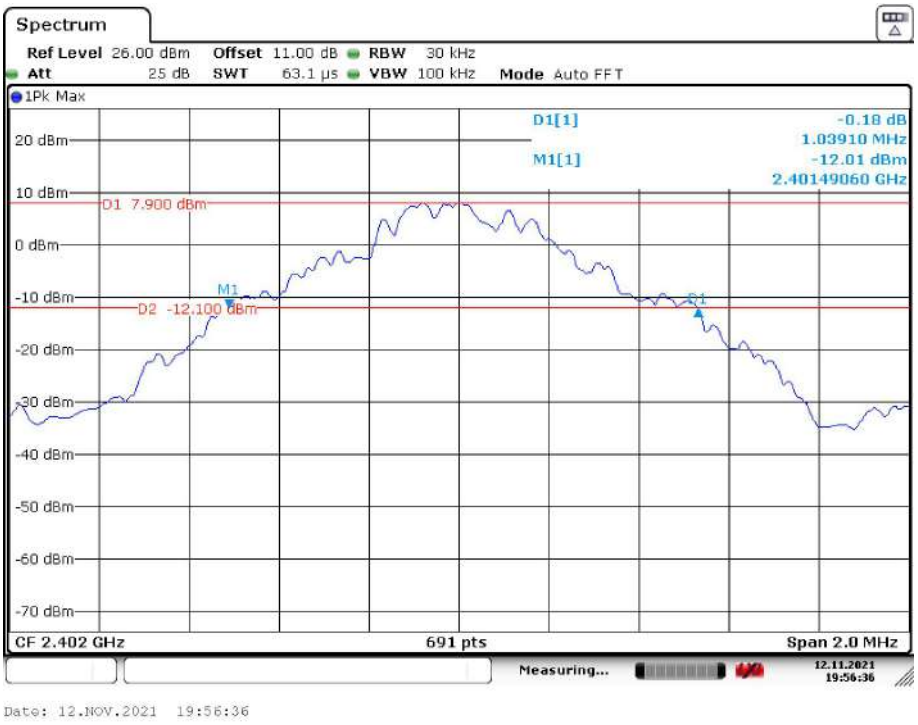
Test Result: Pass

Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.926	1.039
	Middle	2441	0.926	1.036
	High	2480	0.923	1.036
EDR (π/4-DQPSK)	Low	2402	1.190	1.334
	Middle	2441	1.190	1.326
	High	2480	1.185	1.320
EDR (8DPSK)	Low	2402	1.172	1.305
	Middle	2441	1.177	1.285
	High	2480	1.177	1.308

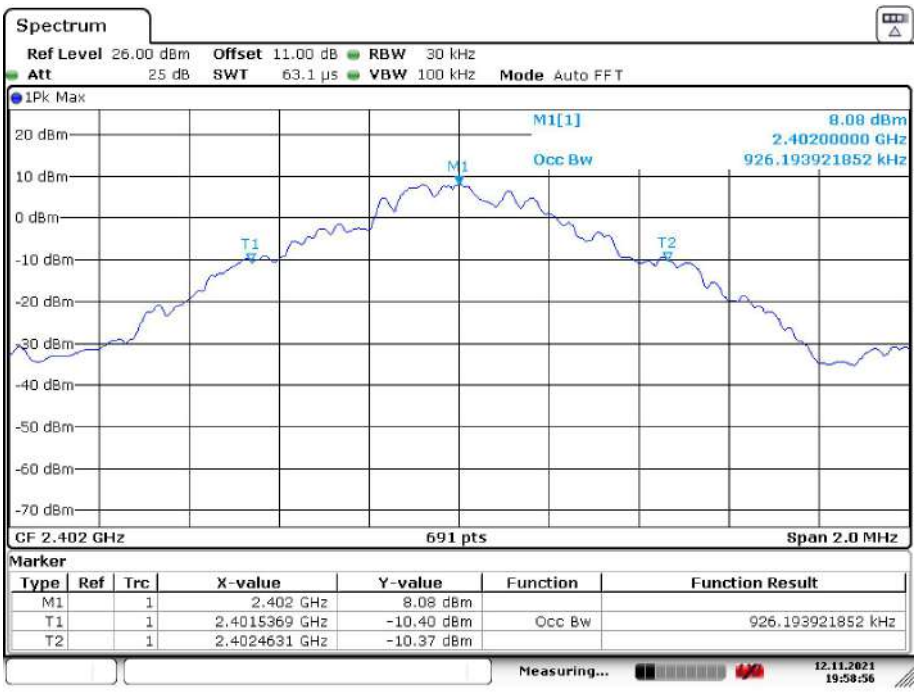
BDR (GFSK):

20dB Emission Bandwidth, Low Channel



Date: 12.NOV.2021 19:56:36

99% Occupied Bandwidth, Low Channel

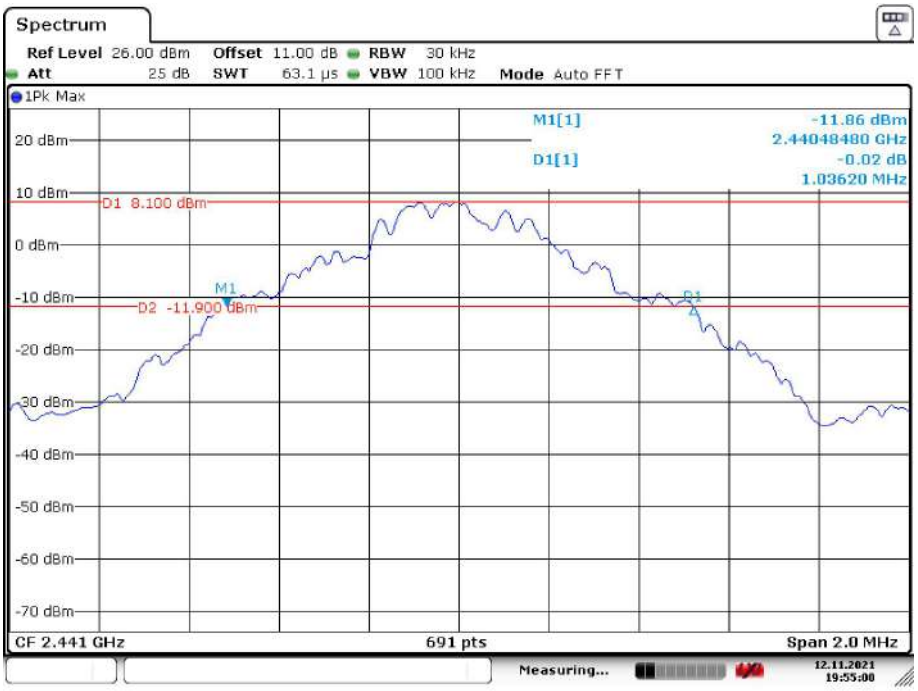


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402 GHz	8.08 dBm		
T1		1	2.4015369 GHz	-10.40 dBm	Occ Bw	926.193921852 kHz
T2		1	2.4024631 GHz	-10.37 dBm		

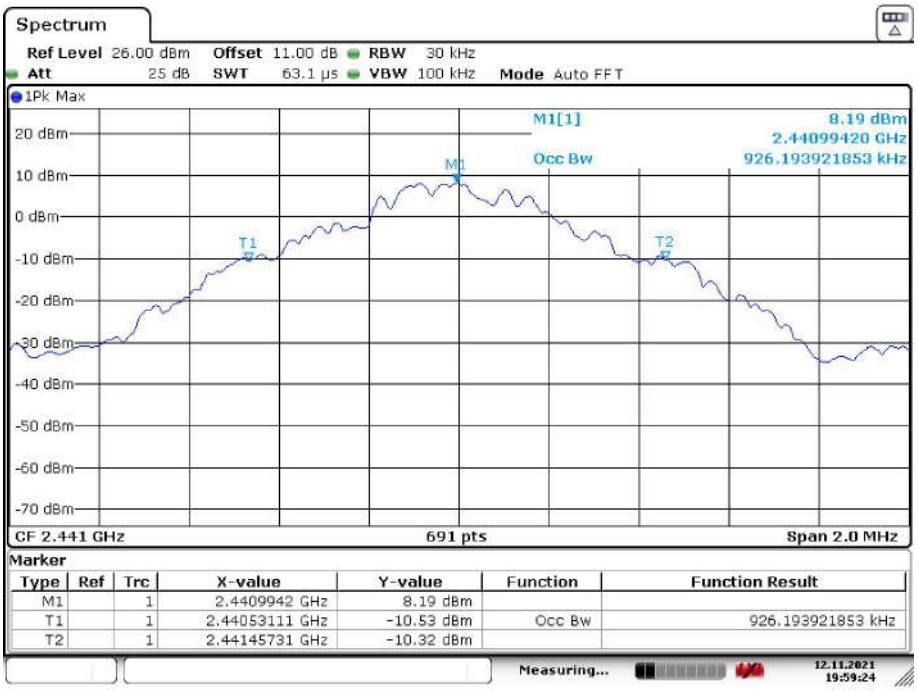
Date: 12.NOV.2021 19:58:56

20dB Emission Bandwidth, Middle Channel



Date: 12.NOV.2021 19:55:00

99% Occupied Bandwidth, Middle Channel

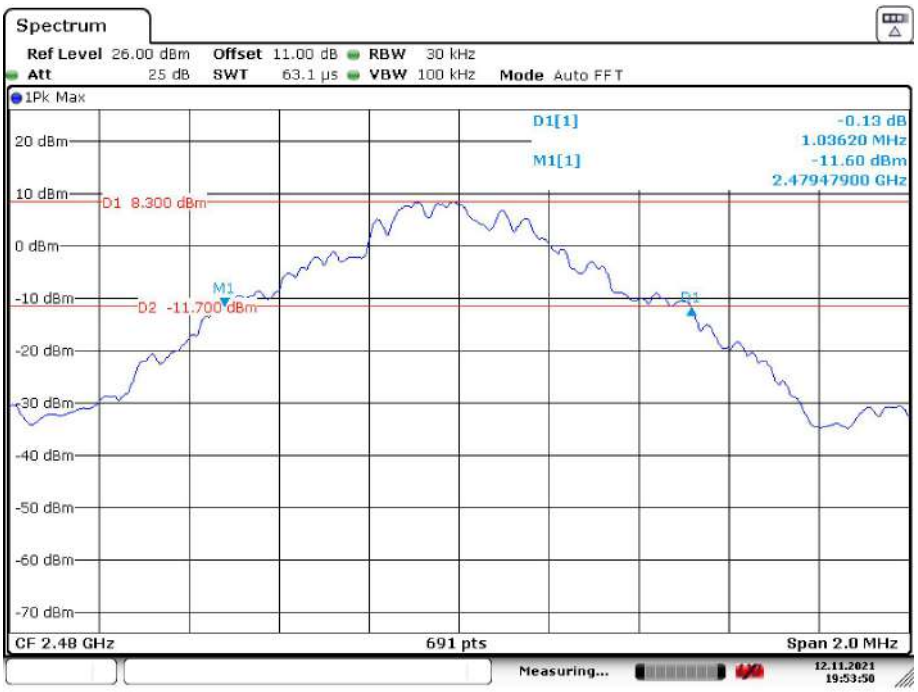


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4409942 GHz	8.19 dBm		
T1		1	2.44053111 GHz	-10.53 dBm	Occ Bw	926.193921853 kHz
T2		1	2.44145731 GHz	-10.32 dBm		

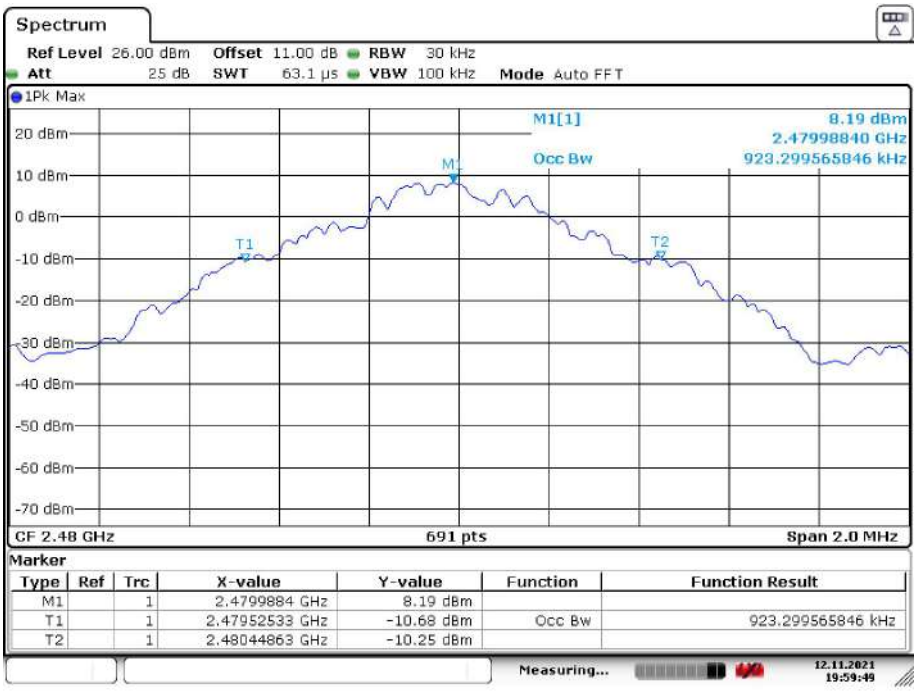
Date: 12.NOV.2021 19:59:24

20dB Emission Bandwidth, High Channel



Date: 12.NOV.2021 19:53:50

99% Occupied Bandwidth, High Channel



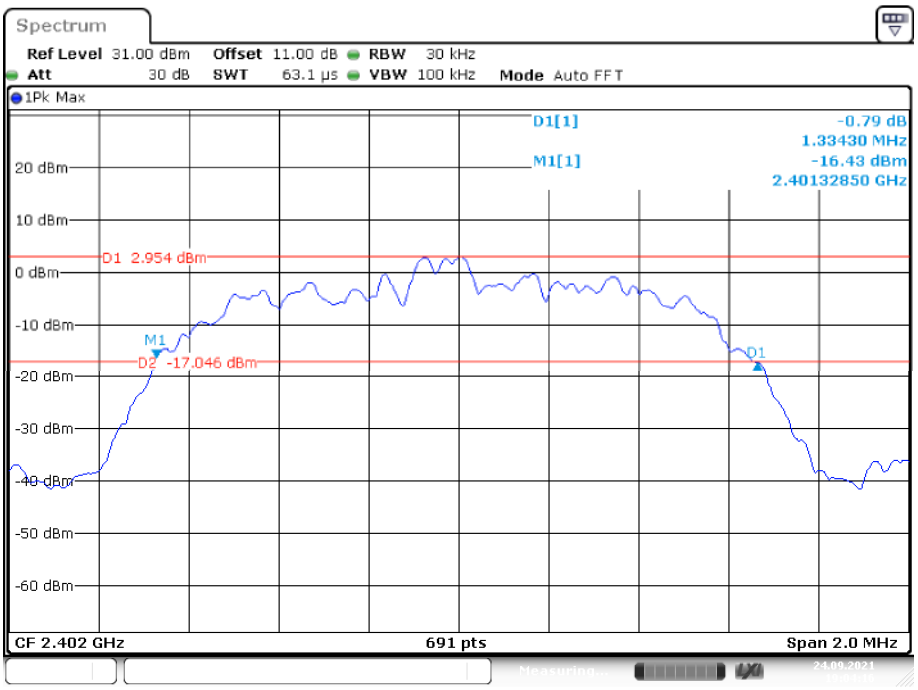
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799884 GHz	8.19 dBm		
T1		1	2.47952533 GHz	-10.68 dBm	Occ Bw	923.299565846 kHz
T2		1	2.48044863 GHz	-10.25 dBm		

Date: 12.NOV.2021 19:59:49

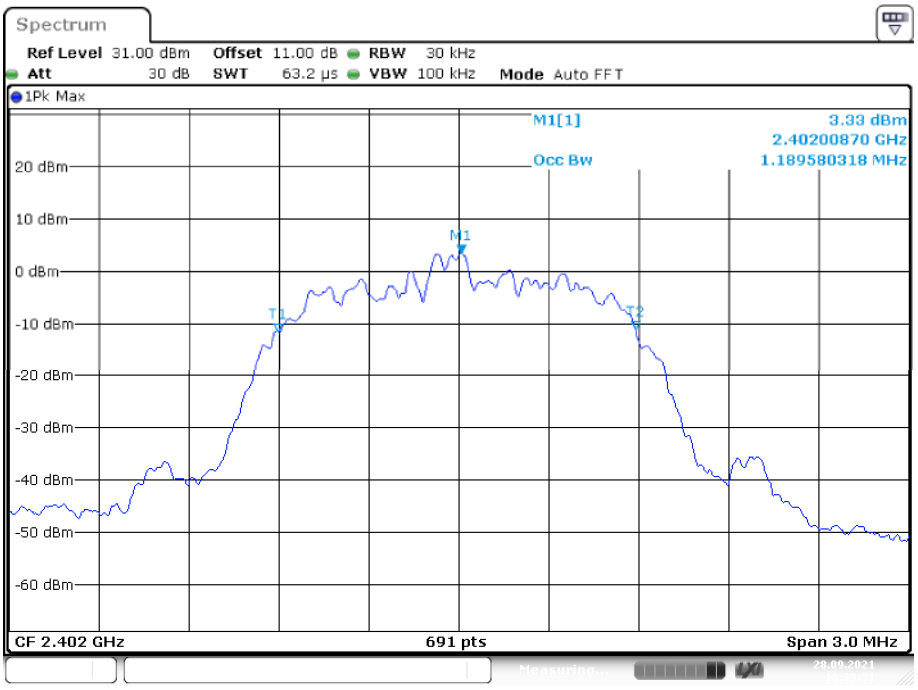
EDR (π/4-DQPSK):

20dB Emission Bandwidth, Low Channel



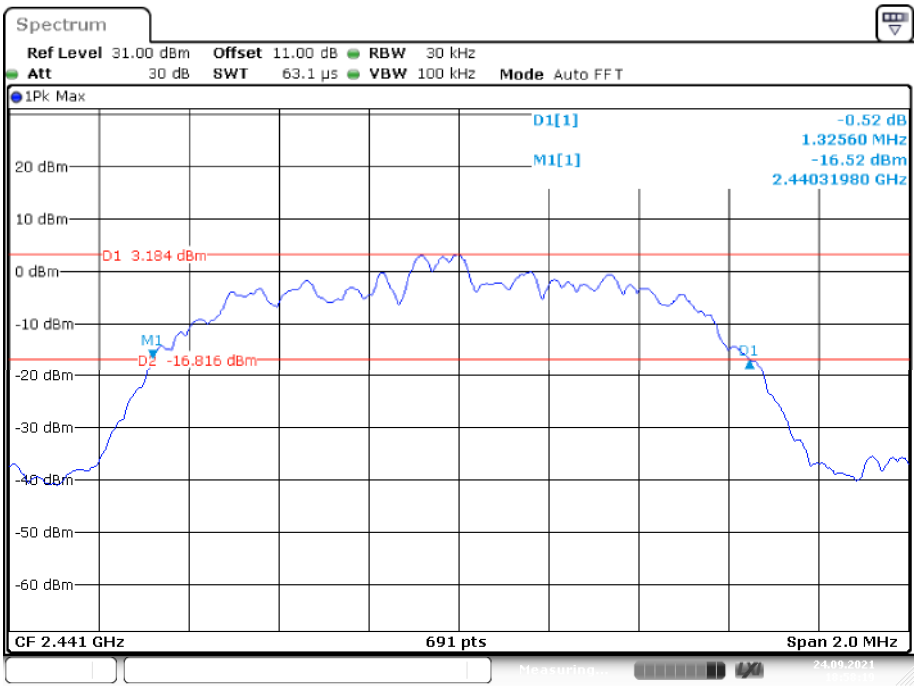
Date: 24.SEP.2021 19:04:16

99% Occupied Bandwidth, Low Channel



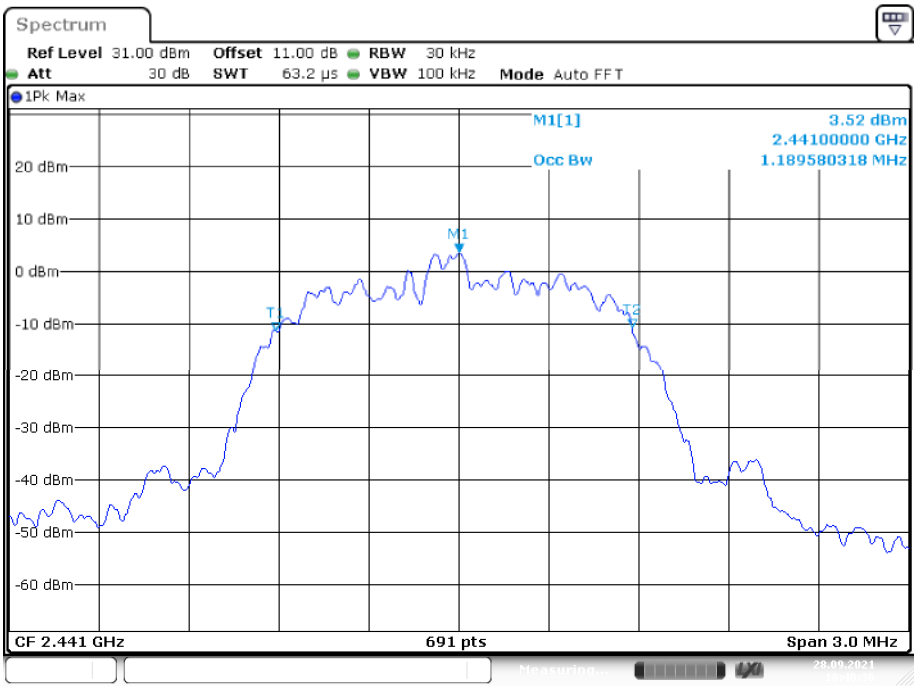
Date: 28.SEP.2021 18:39:31

20dB Emission Bandwidth, Middle Channel



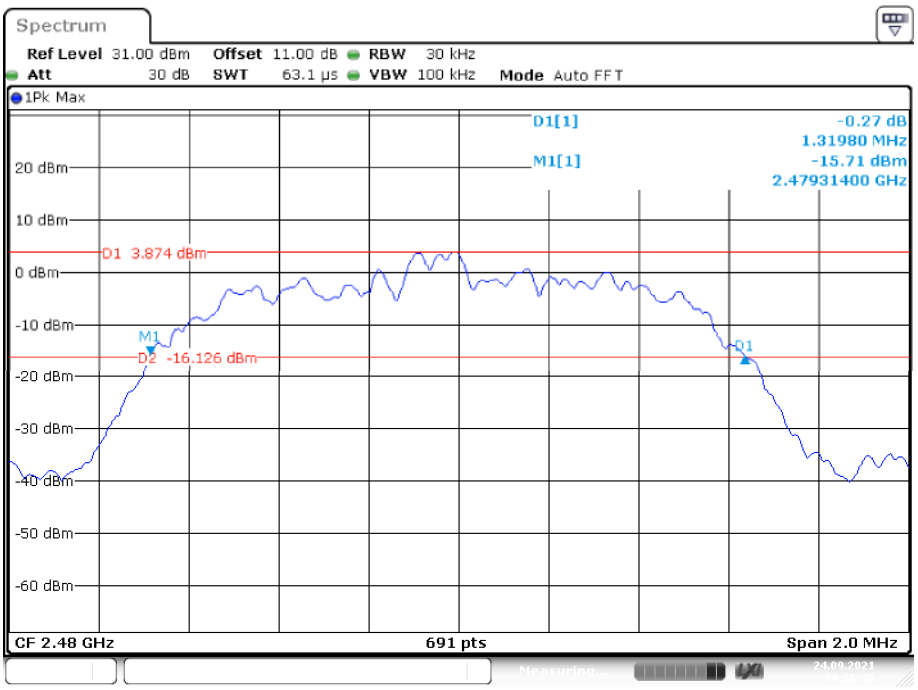
Date: 24.SEP.2021 18:58:19

99% Occupied Bandwidth, Middle Channel



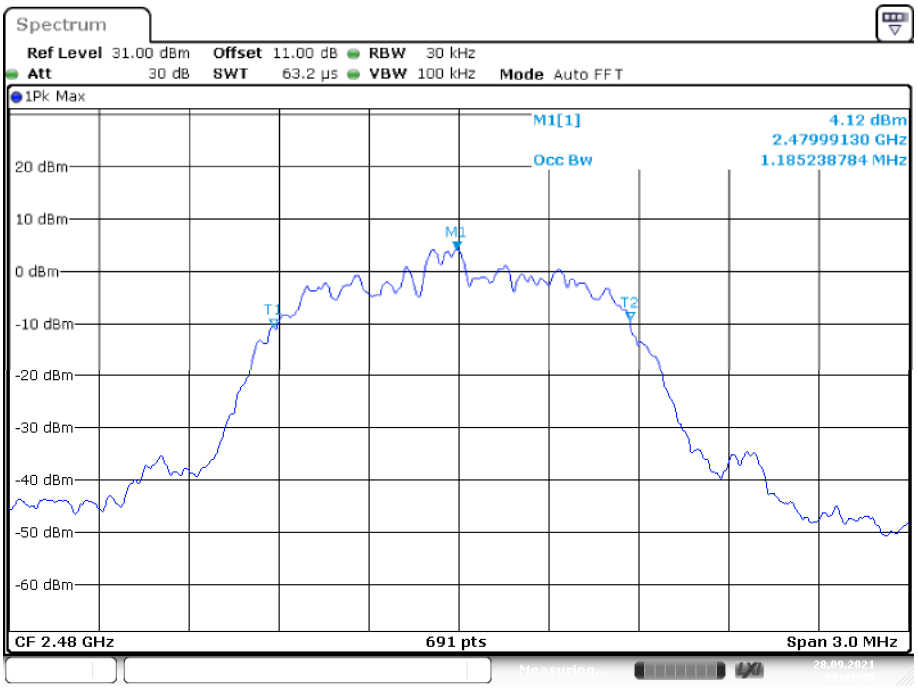
Date: 28.SEP.2021 18:40:36

20dB Emission Bandwidth, High Channel



Date: 24.SEP.2021 18:56:37

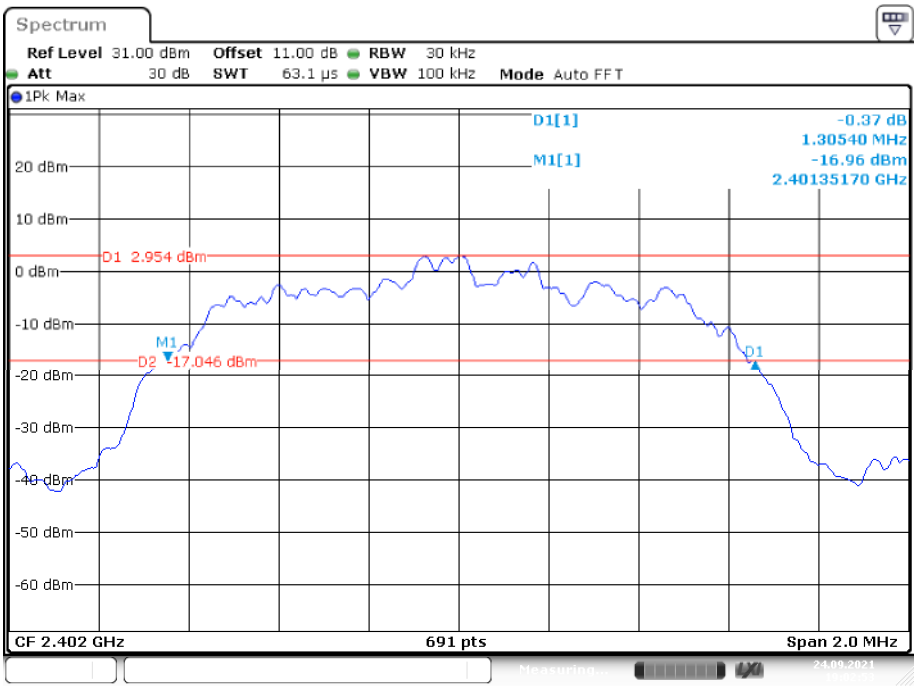
99% Occupied Bandwidth, High Channel



Date: 28.SEP.2021 18:41:45

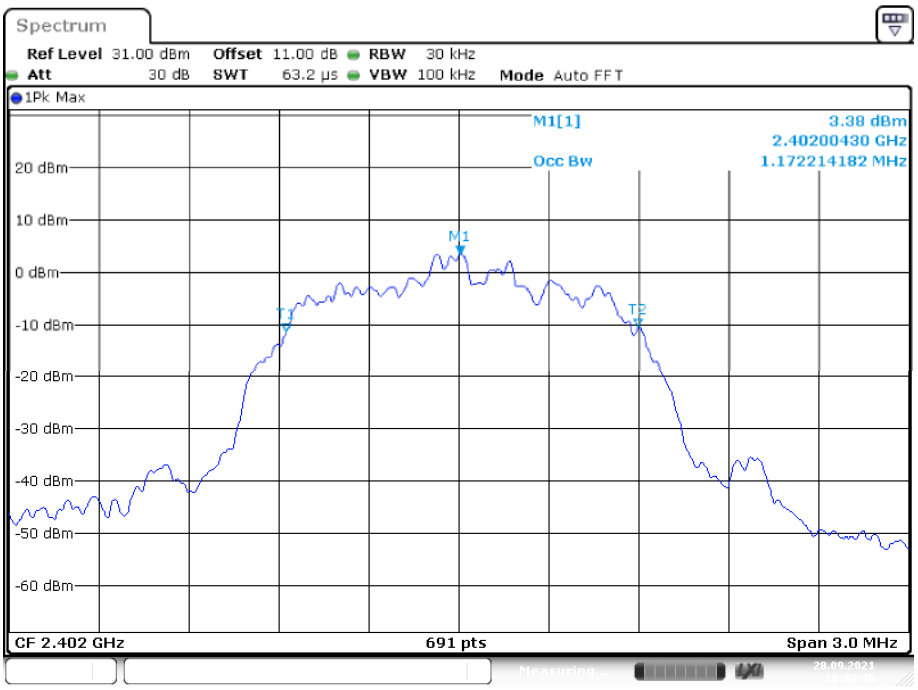
EDR (8DPSK):

20dB Emission Bandwidth, Low Channel



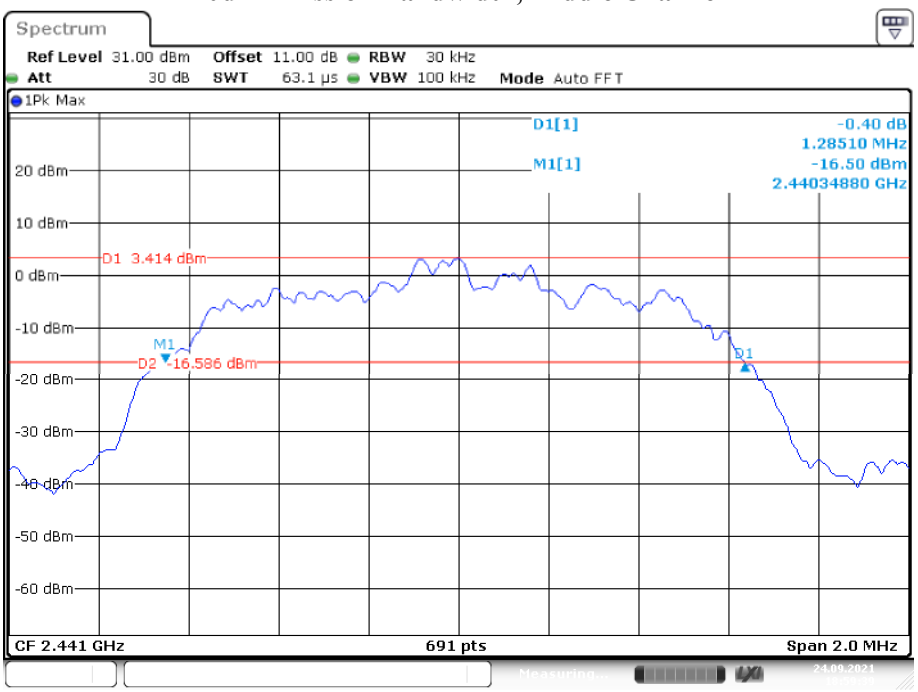
Date: 24.SEP.2021 19:02:53

99% Occupied Bandwidth, Low Channel



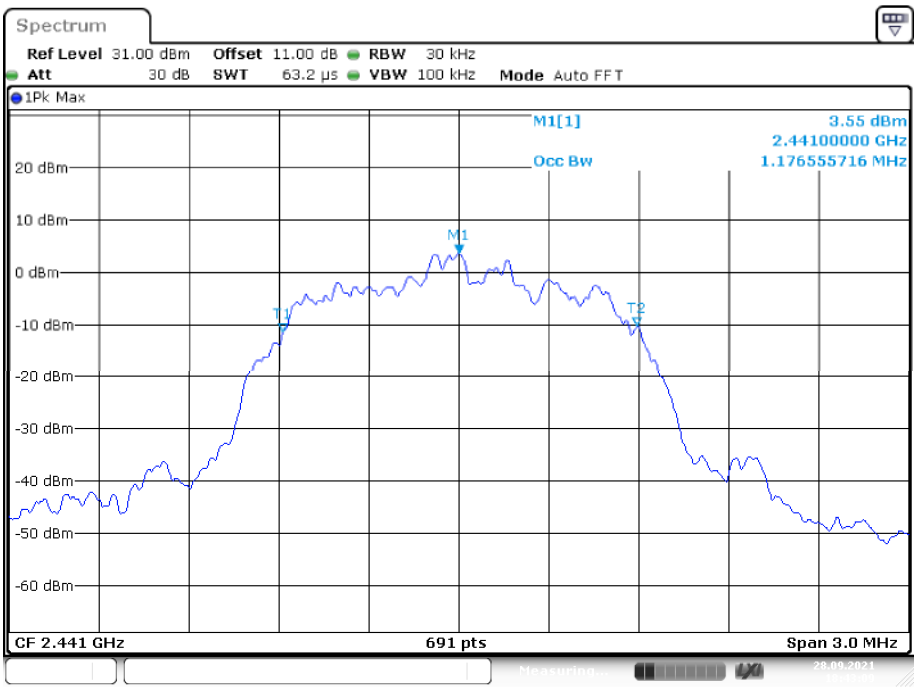
Date: 28.SEP.2021 18:43:46

20dB Emission Bandwidth, middle Channel



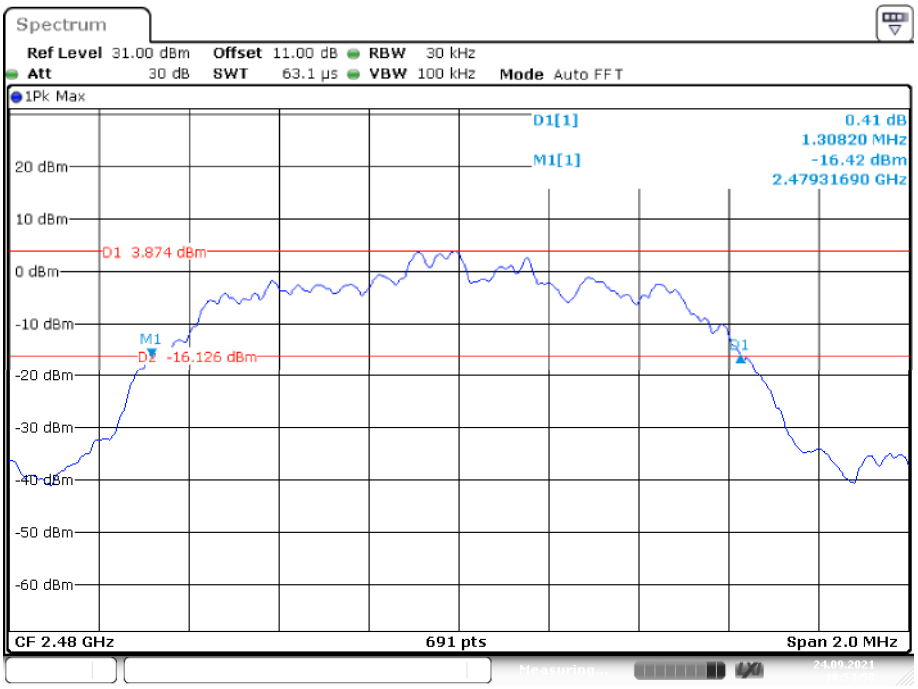
Date: 24.SEP.2021 18:59:39

99% Occupied Bandwidth, Middle Channel



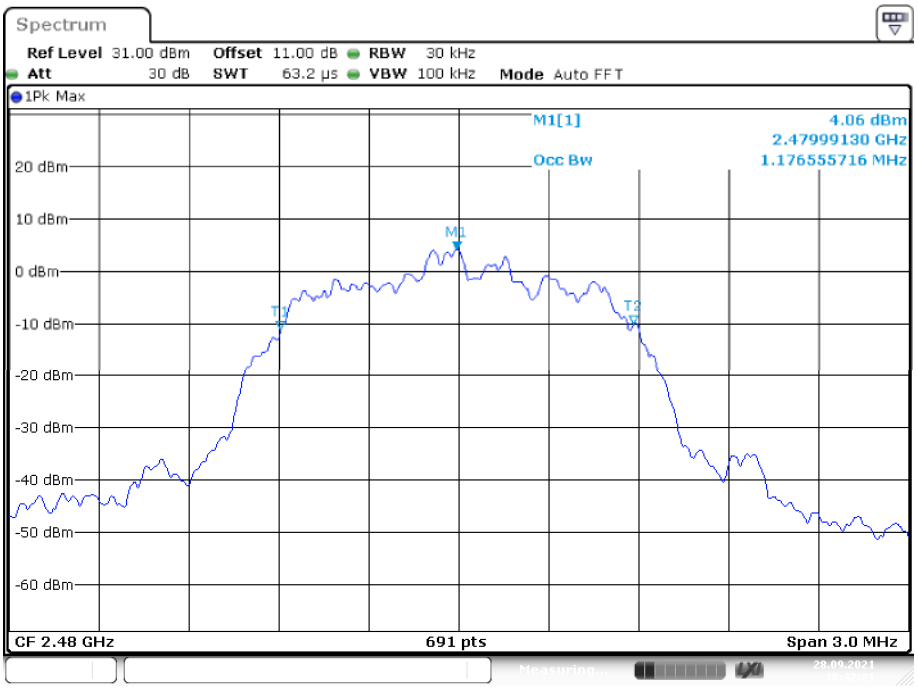
Date: 28.SEP.2021 18:43:09

20dB Emission Bandwidth, High Channel



Date: 24.SEP.2021 18:54:58

99% Occupied Bandwidth, High Channel



Date: 28.SEP.2021 18:42:21

FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - QUANTITY OF HOPPING CHANNEL TEST

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.

According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSS) operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

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.

Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

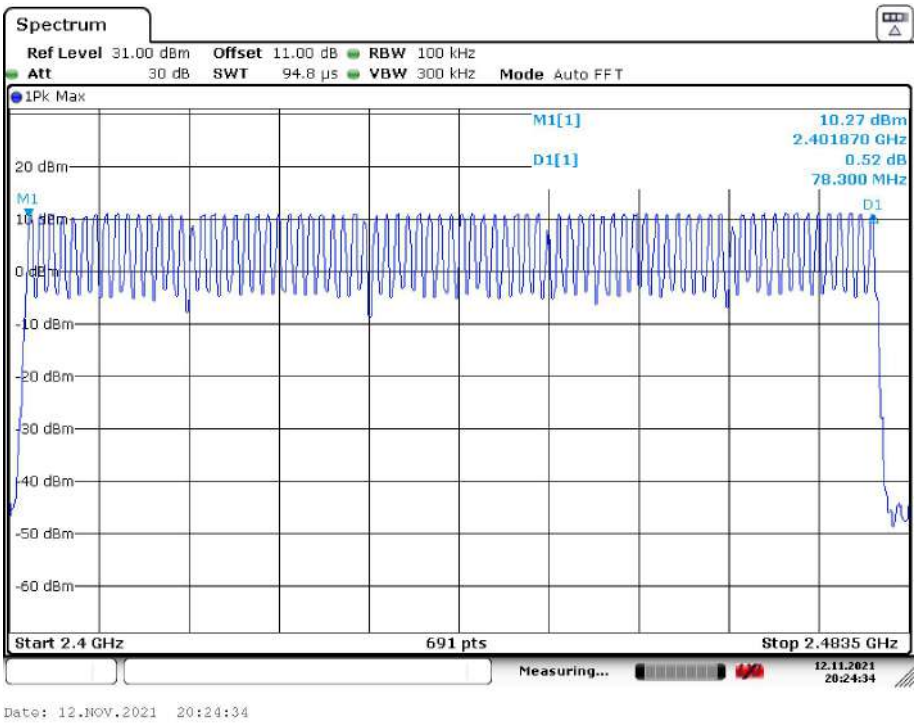
EUT operation mode: Transmitting

Test Result: Pass

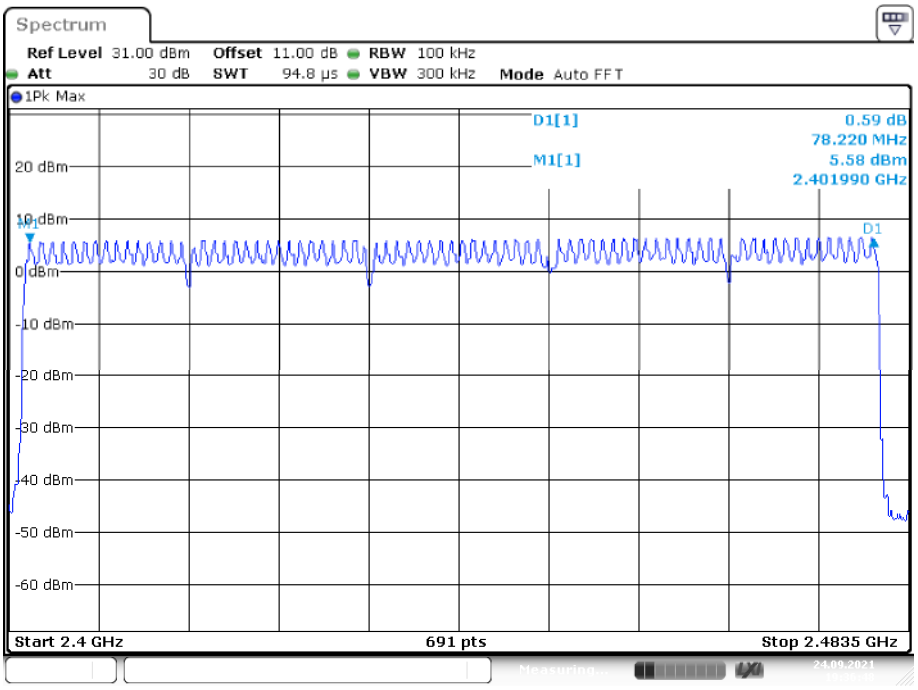
Please refer to following table and plots.

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

BDR (GFSK): Number of Hopping Channels

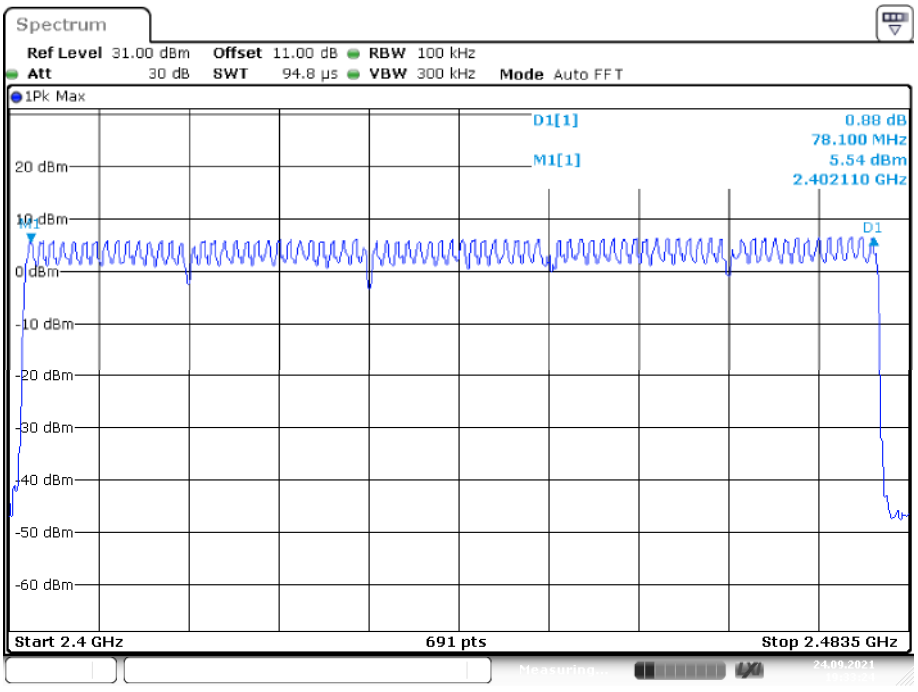


EDR (π/4-DQPSK): Number of Hopping Channels



Date: 24.SEP.2021 19:36:48

EDR (8DPSK): Number of Hopping Channels



Date: 24.SEP.2021 19:33:24

FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

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

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

According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

EUT operation mode: Transmitting

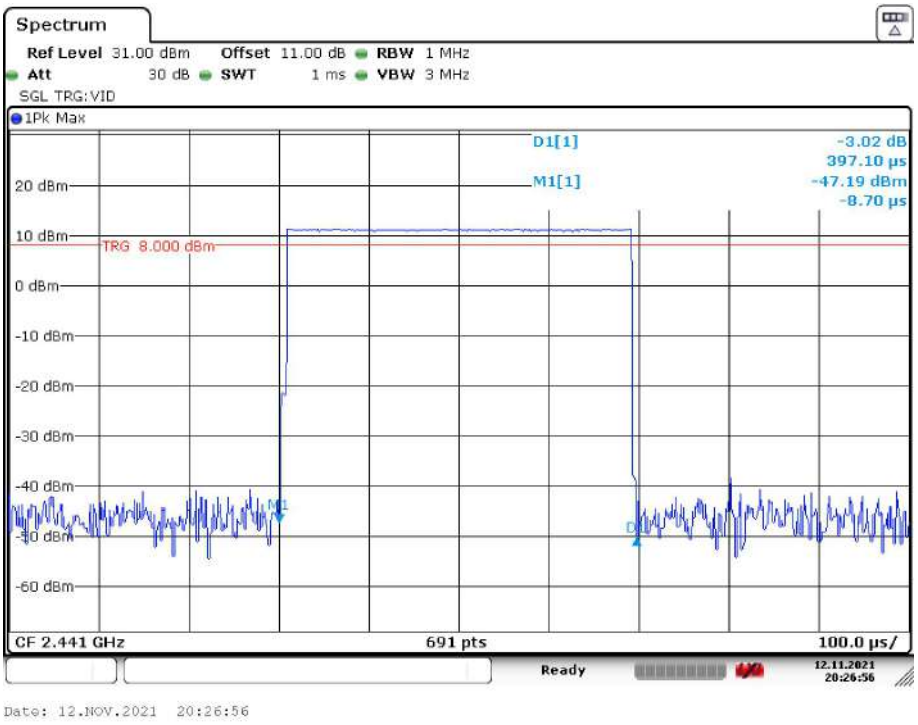
Test Result: Pass

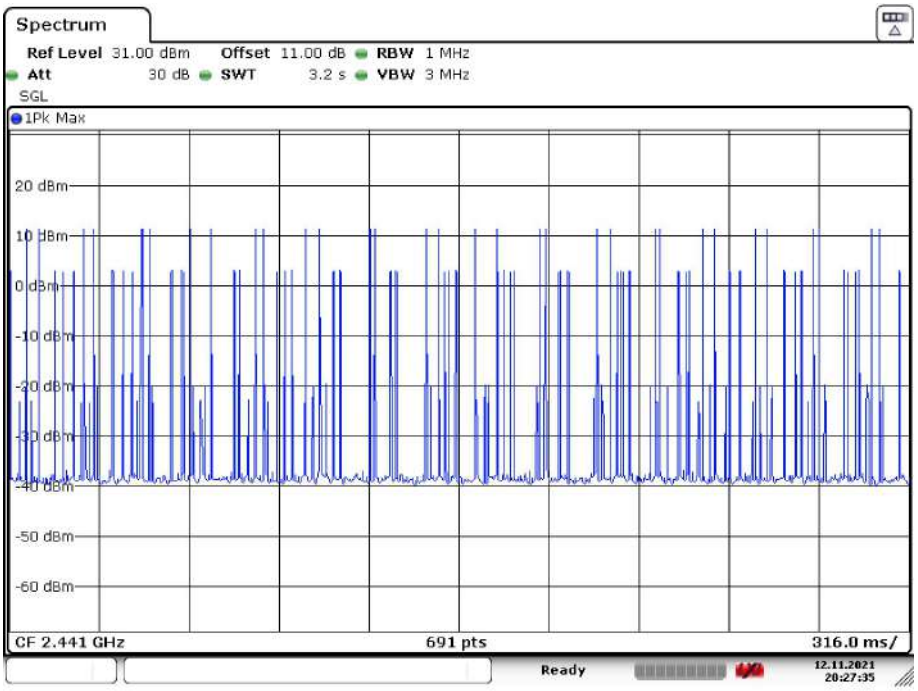
Please refer to following table and plots

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.40	310	0.124	<=0.4	PASS
DH3	Hop	1.66	180	0.299	<=0.4	PASS
DH5	Hop	2.93	110	0.322	<=0.4	PASS
2DH1	Hop	0.41	320	0.131	<=0.4	PASS
2DH3	Hop	1.68	160	0.269	<=0.4	PASS
2DH5	Hop	2.96	130	0.385	<=0.4	PASS
3DH1	Hop	0.41	330	0.135	<=0.4	PASS
3DH3	Hop	1.69	180	0.304	<=0.4	PASS
3DH5	Hop	3.01	130	0.391	<=0.4	PASS

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

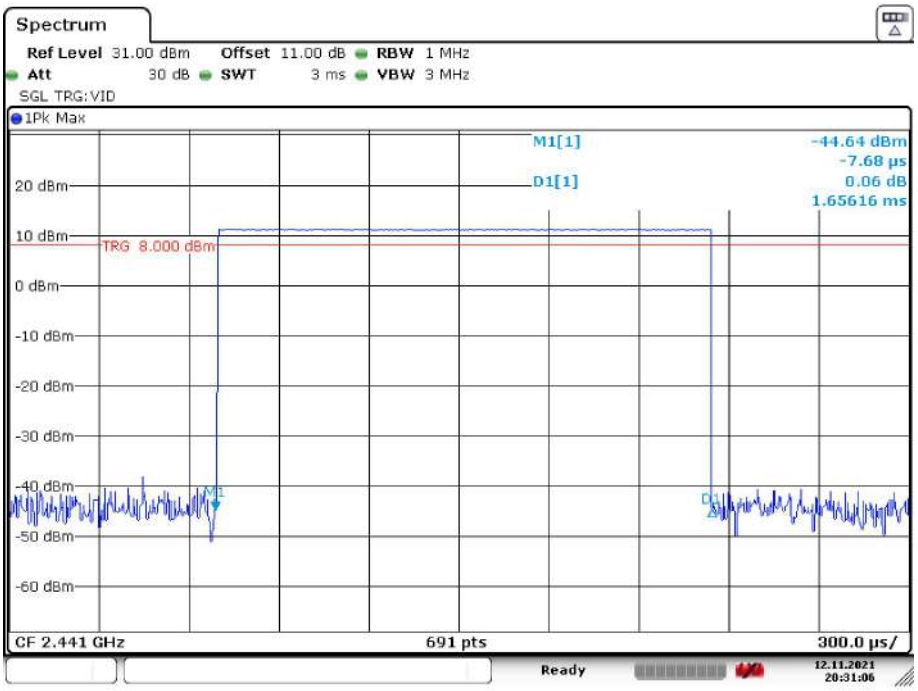
BDR (GFSK):
DH1



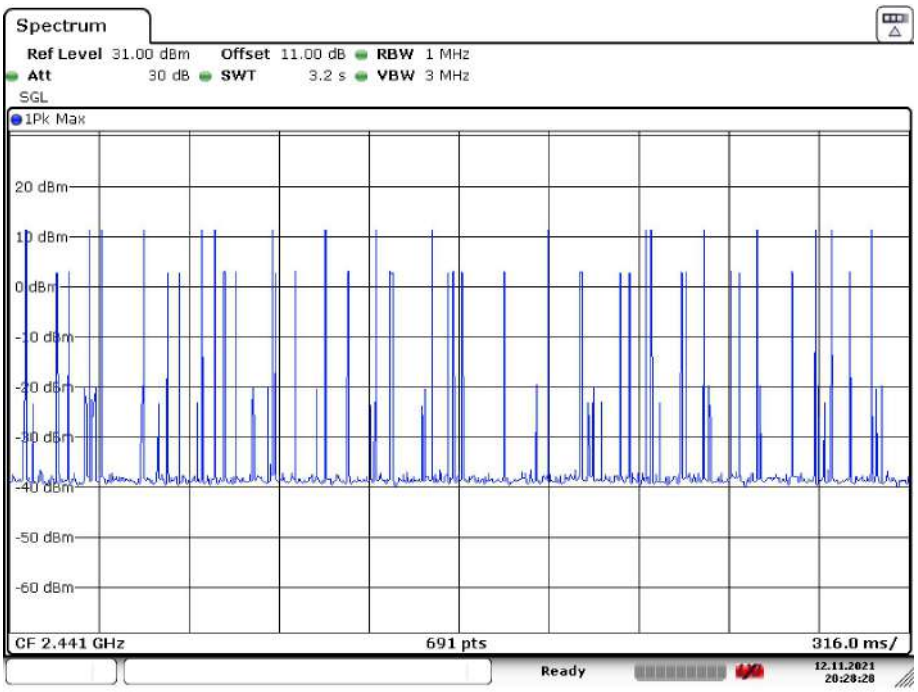


Date: 12.NOV.2021 20:27:35

DH3

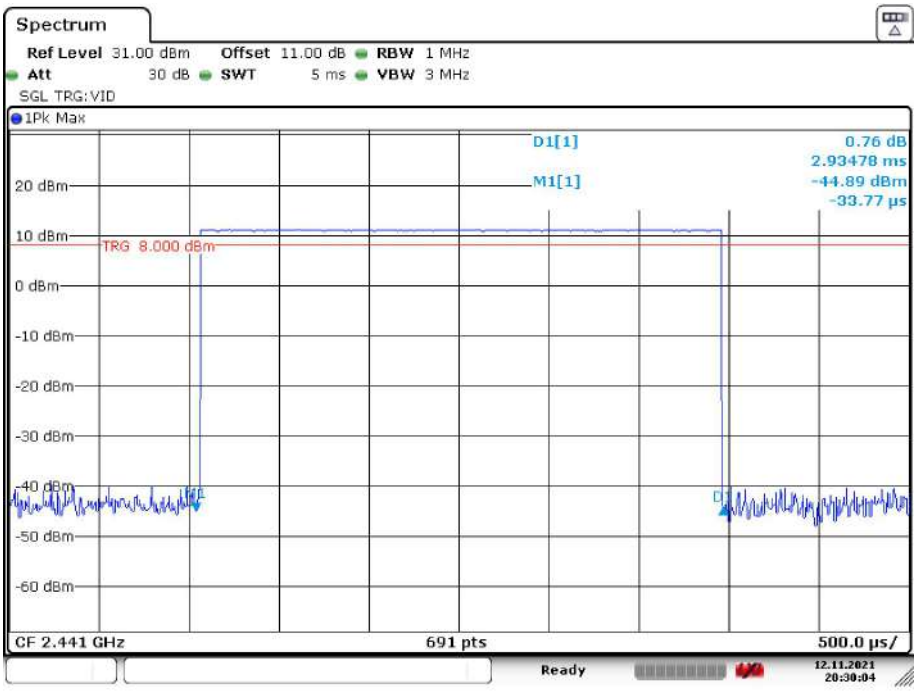


Date: 12.NOV.2021 20:31:06

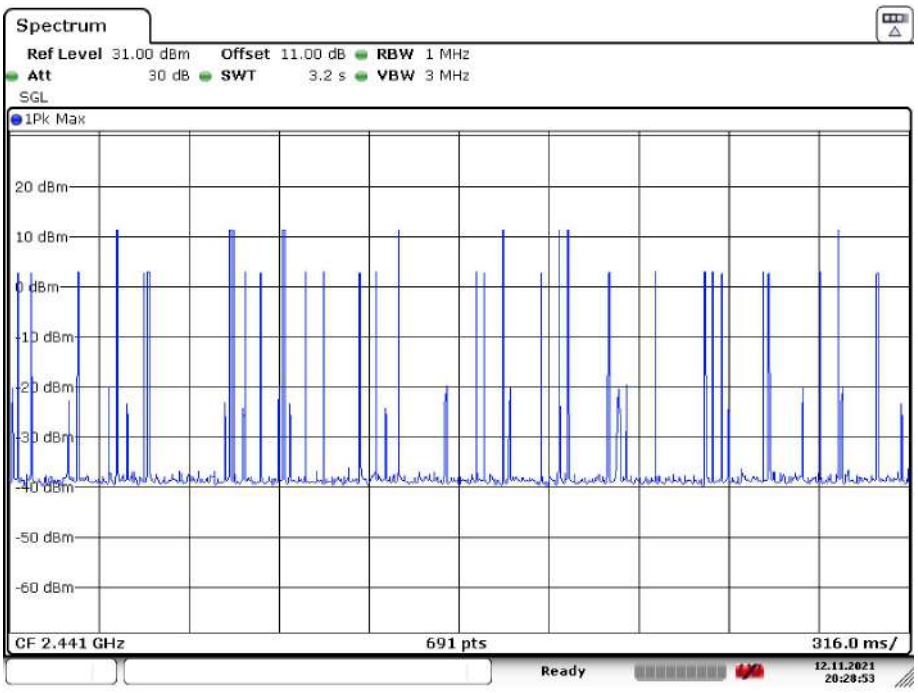


Date: 12.NOV.2021 20:28:28

DH5

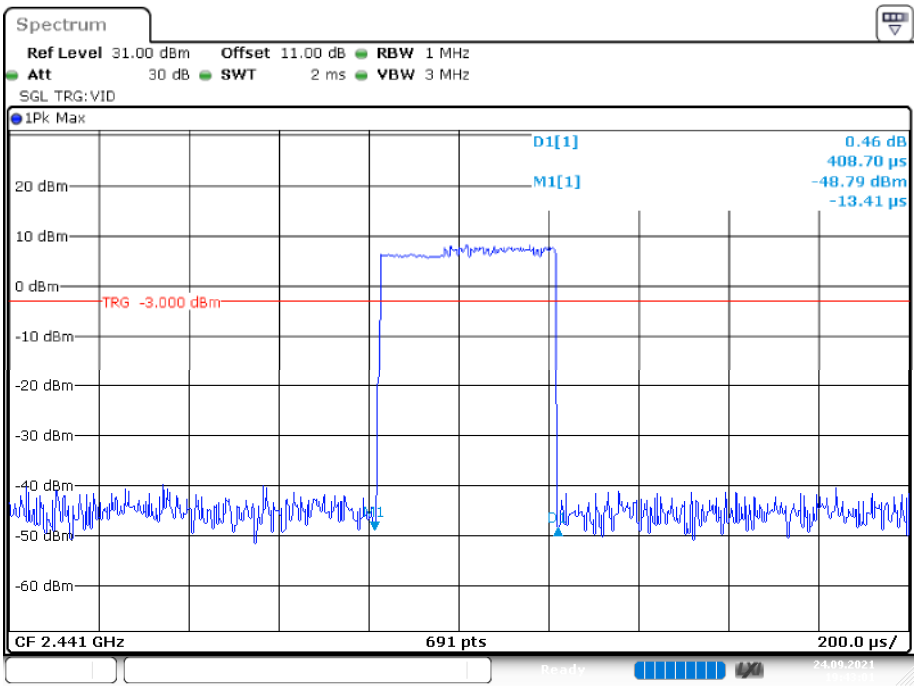


Date: 12.NOV.2021 20:30:04

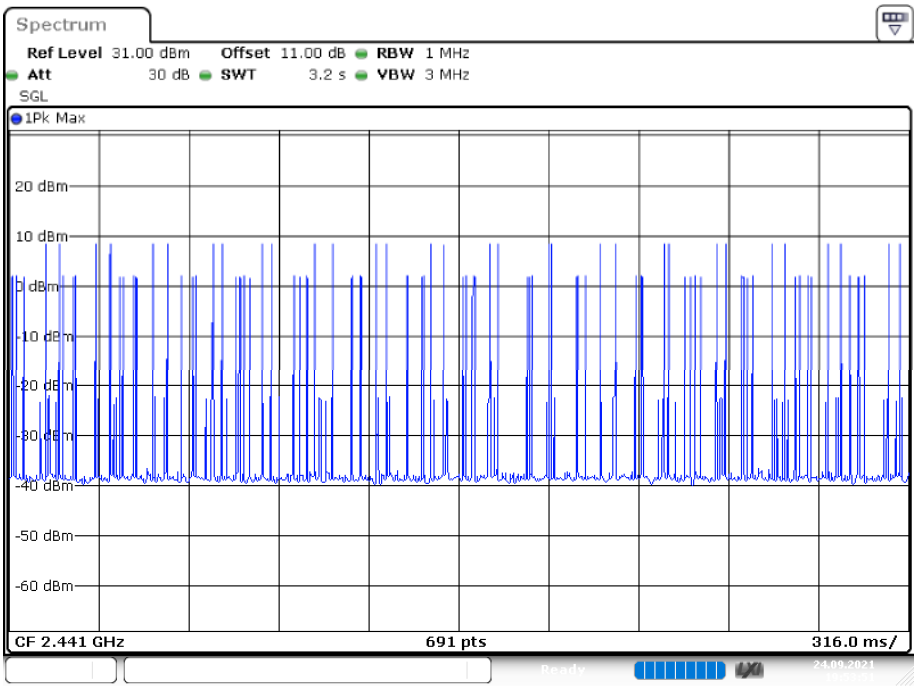


Date: 12.NOV.2021 20:28:53

EDR(π/4-DQPSK):
2DH1

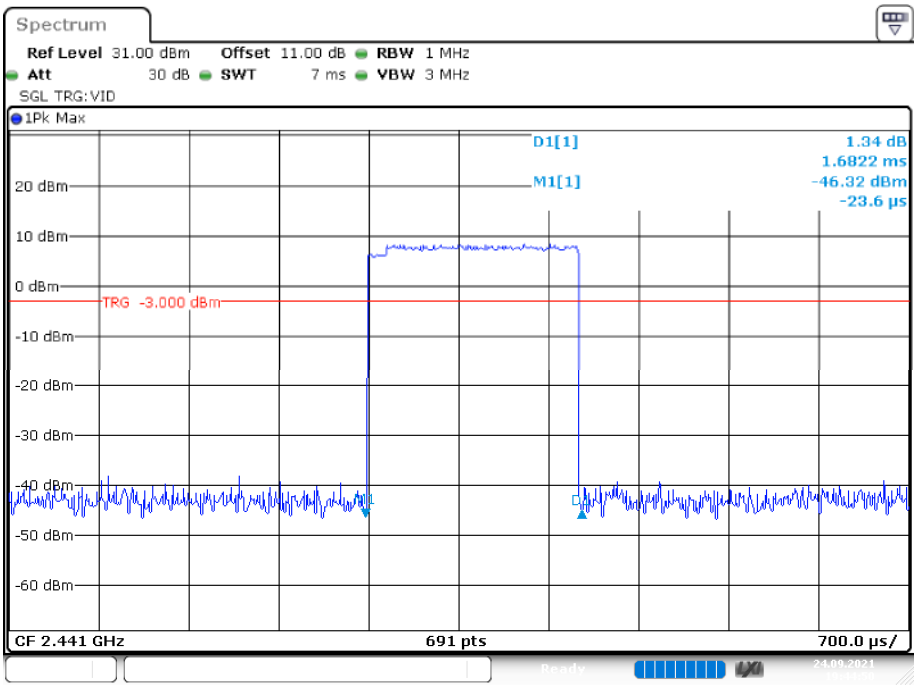


Date: 24.SEP.2021 19:43:01

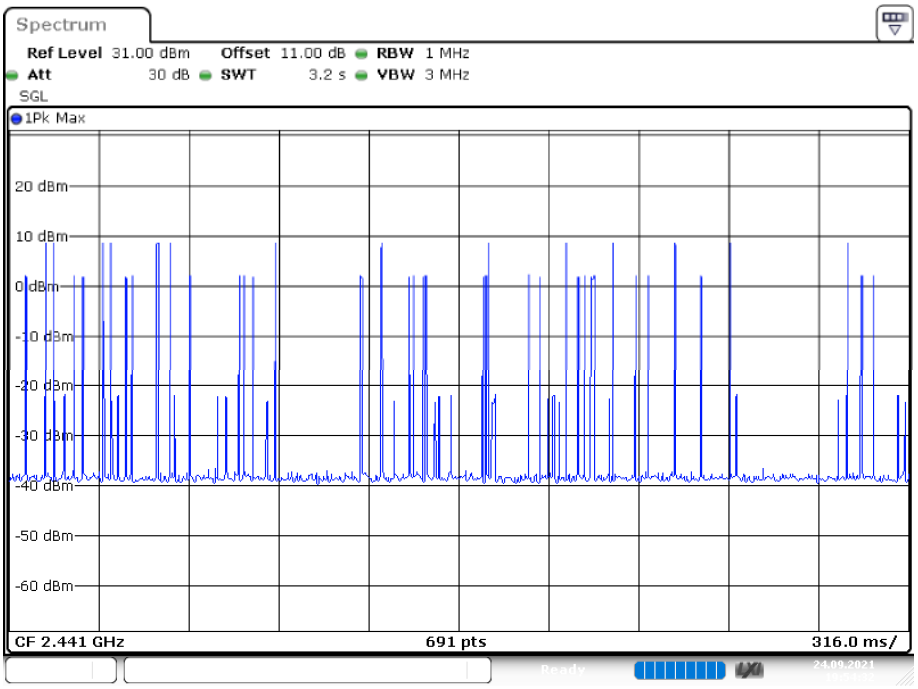


Date: 24.SEP.2021 19:53:51

2DH3

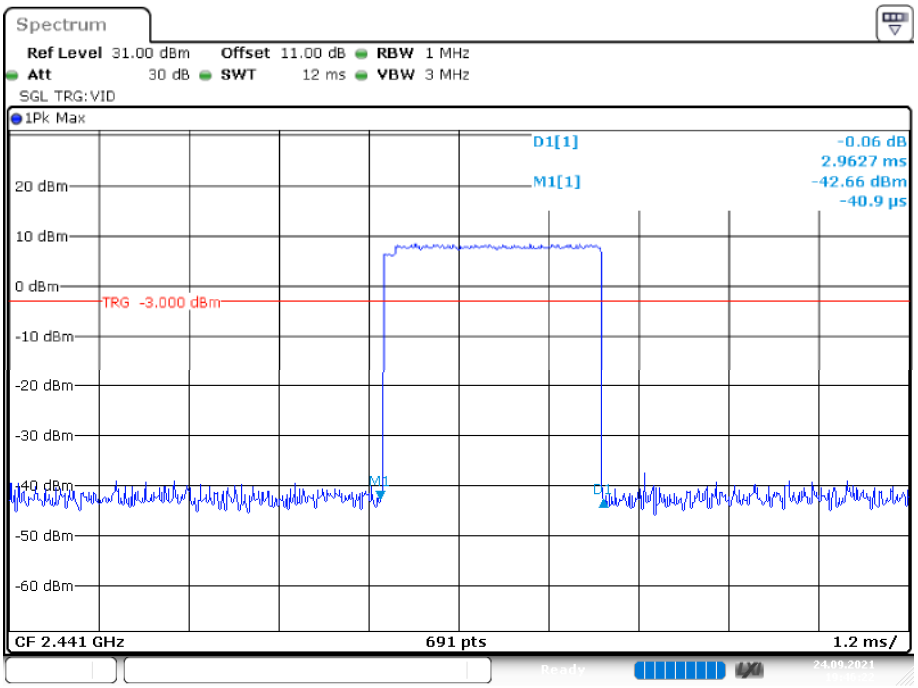


Date: 24.SEP.2021 19:44:50

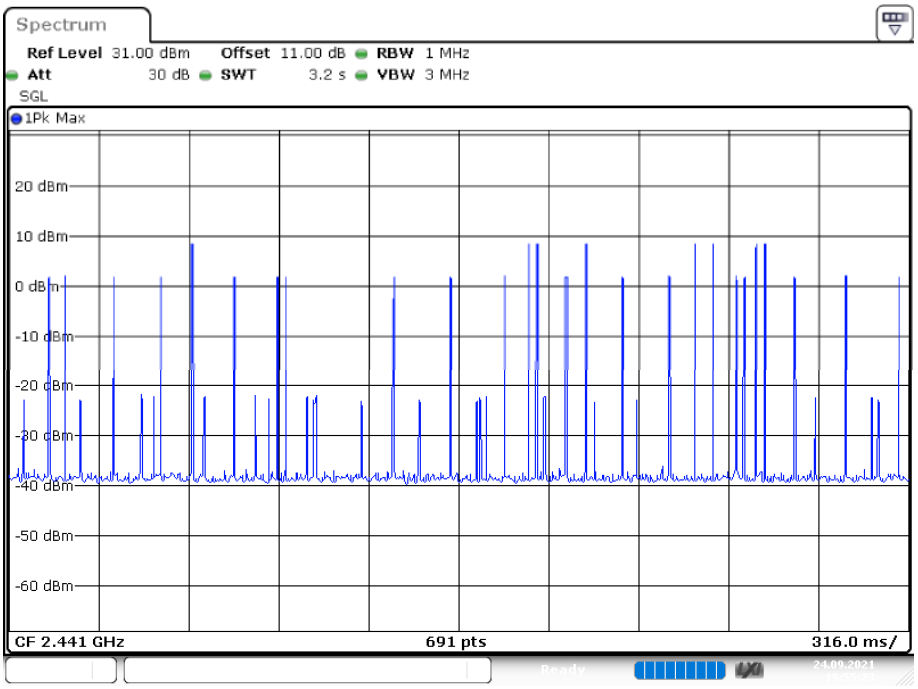


Date: 24.SEP.2021 19:54:32

2DH5

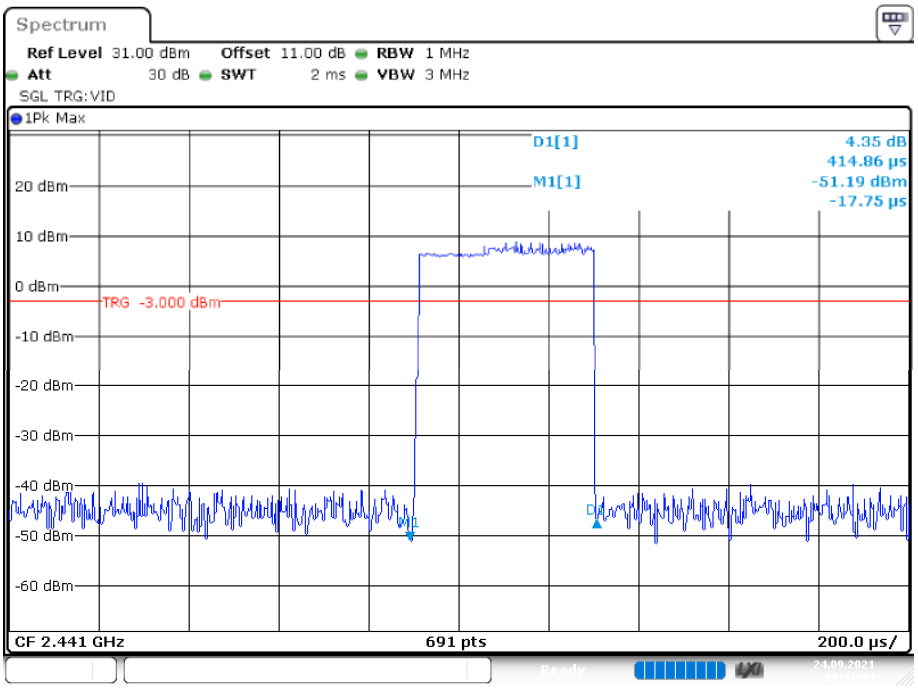


Date: 24.SEP.2021 19:46:22

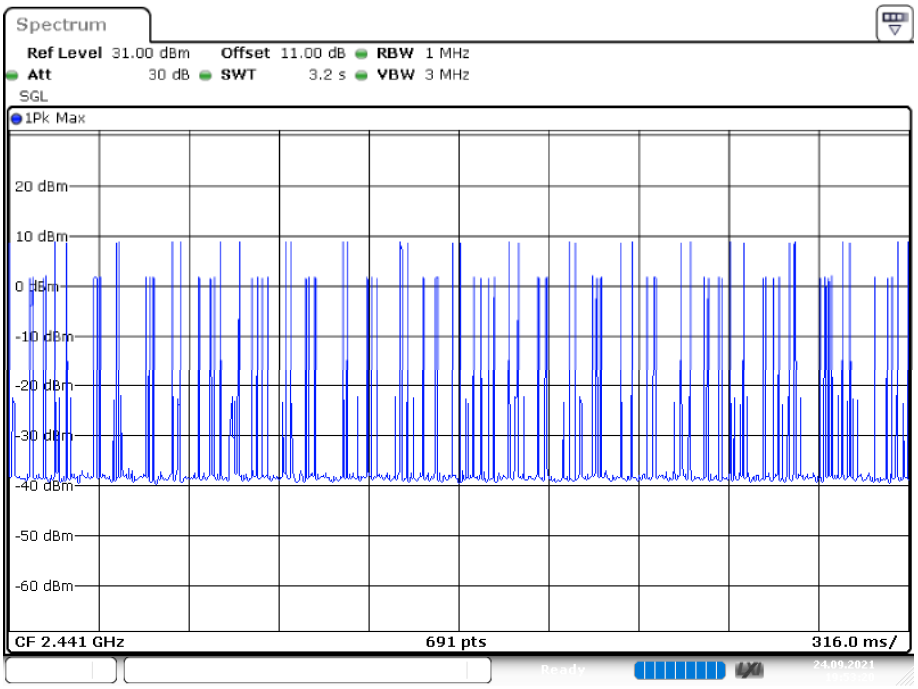


Date: 24.SEP.2021 19:55:24

EDR (8DPSK):
3DH1

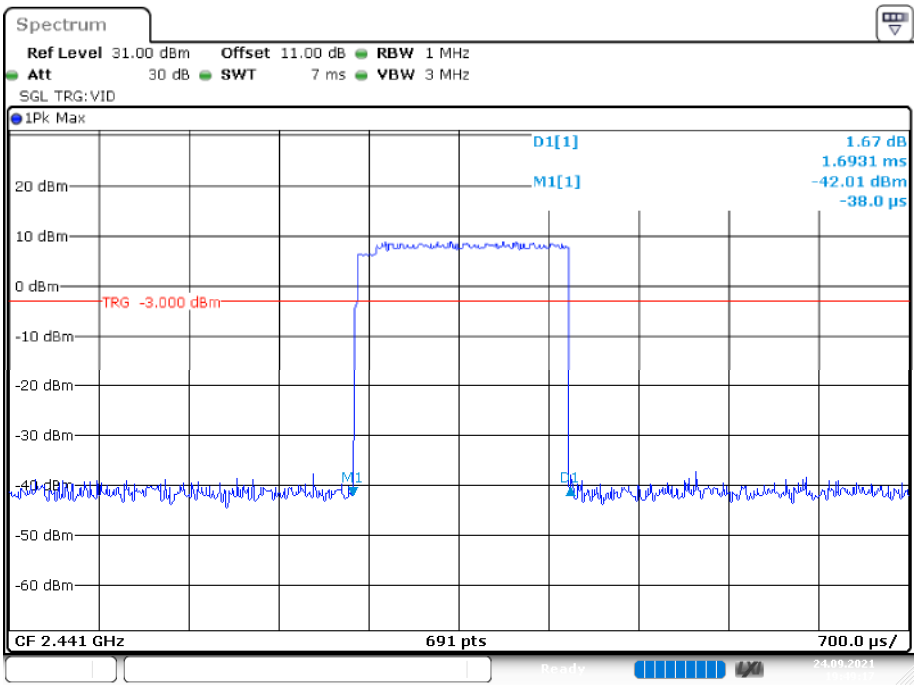


Date: 24.SEP.2021 19:47:44

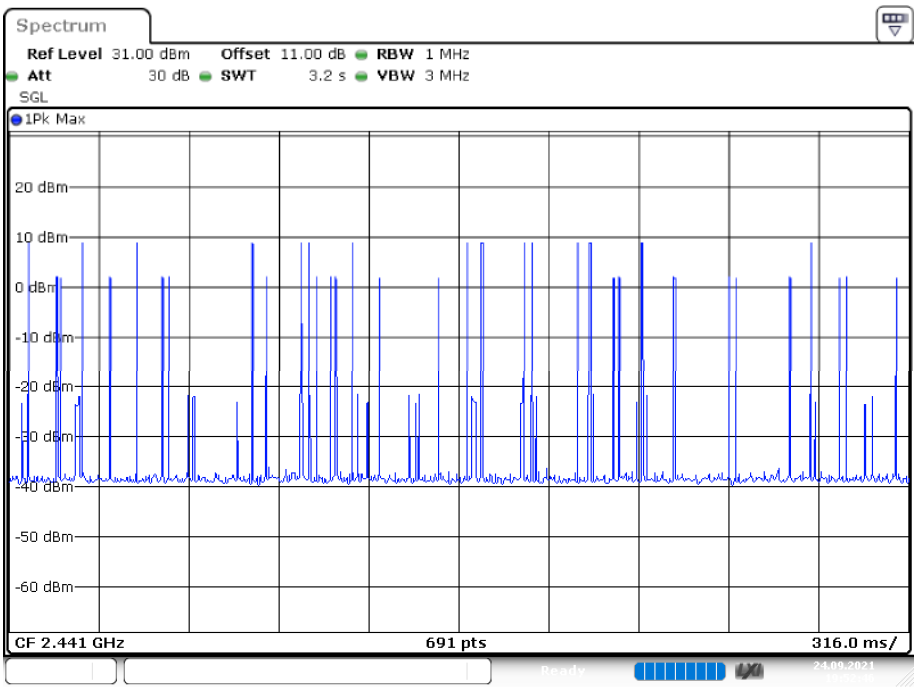


Date: 24.SEP.2021 19:53:20

3DH3

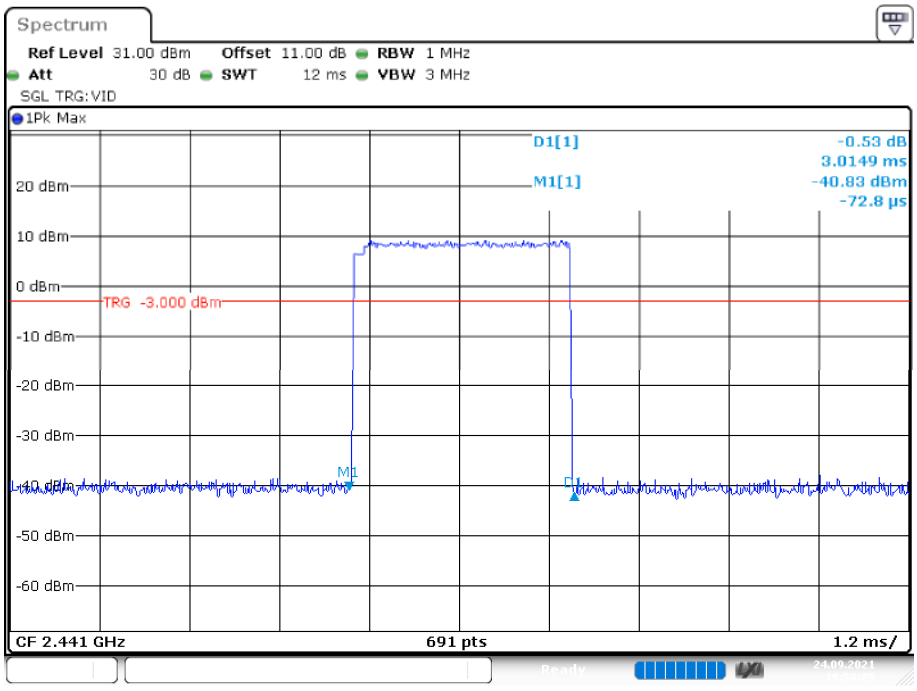


Date: 24.SEP.2021 19:49:17



Date: 24.SEP.2021 19:52:47

3DH5



Date: 24.SEP.2021 19:50:25

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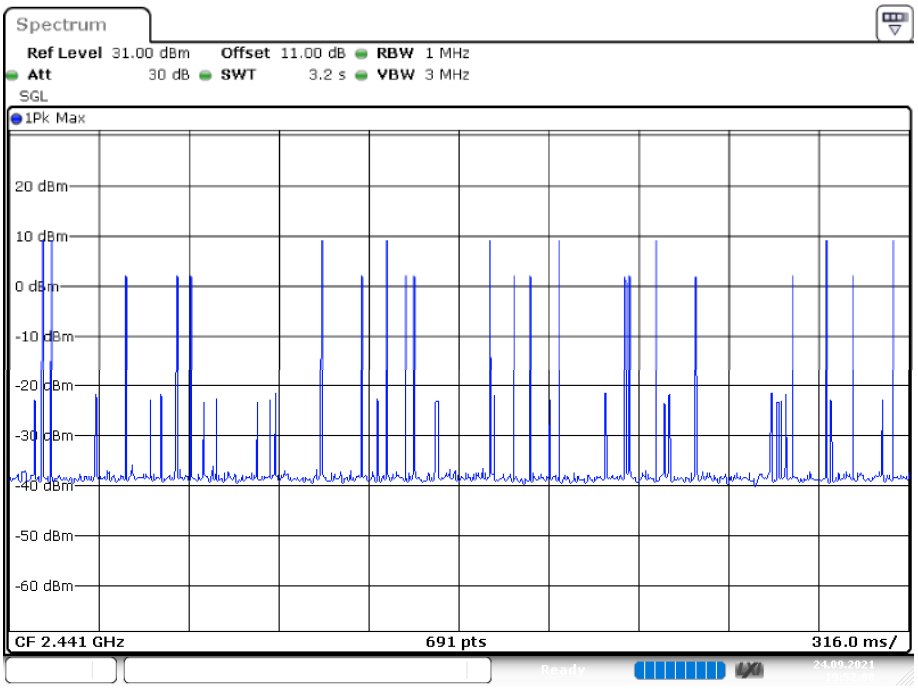


Date: 24.SEP.2021 19:52:09

FCC §15.247(b) (1) & RSS-247§ 5.1(b) &§ 5.4(b) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to FCC §15.247(b) (1):

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

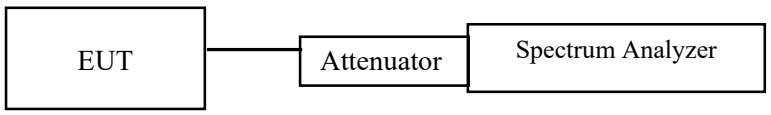
According to RSS-247§ 5.1(b) &§ 5.4(b):

For frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W (see Section 5.4(e) for exceptions).

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

Test Procedure

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



Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

EUT operation mode: Transmitting

Test Result: Pass

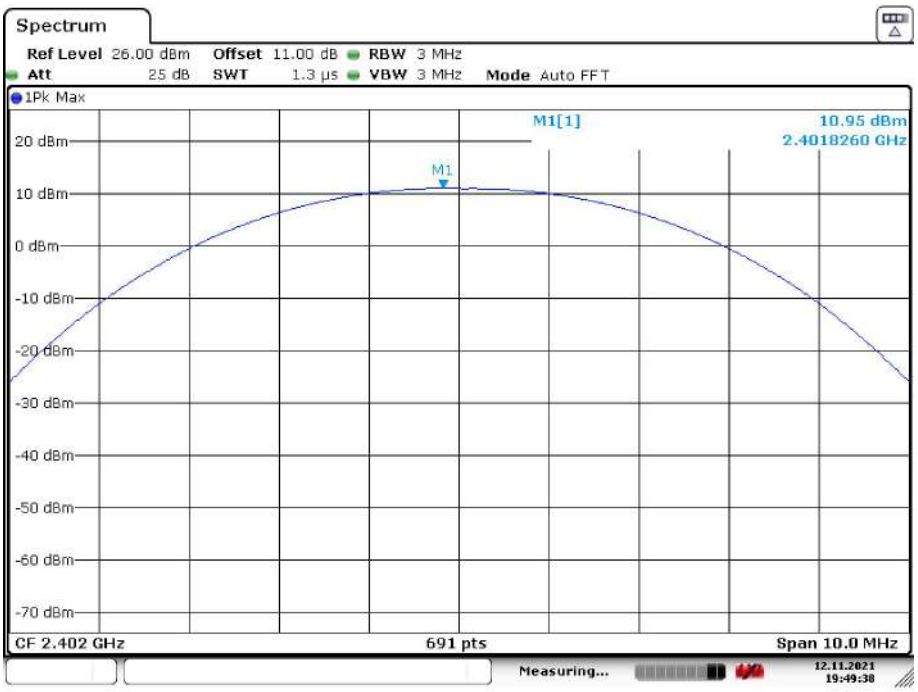
Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR (GFSK)	Low	2402	10.95	21
	Middle	2441	11.04	21
	High	2480	11.39	21
EDR (π/4-DQPSK)	Low	2402	8.20	21
	Middle	2441	8.43	21
	High	2480	8.96	21
EDR (8DPSK)	Low	2402	8.53	21
	Middle	2441	8.85	21
	High	2480	9.23	21

Note 1: The data above was tested in conducted mode.
Note 2: The maximum EIRP is 11.39dBm+3.0dBi=14.39dBm<36dBm, so it can meet the EIRP limit of ISEDC.

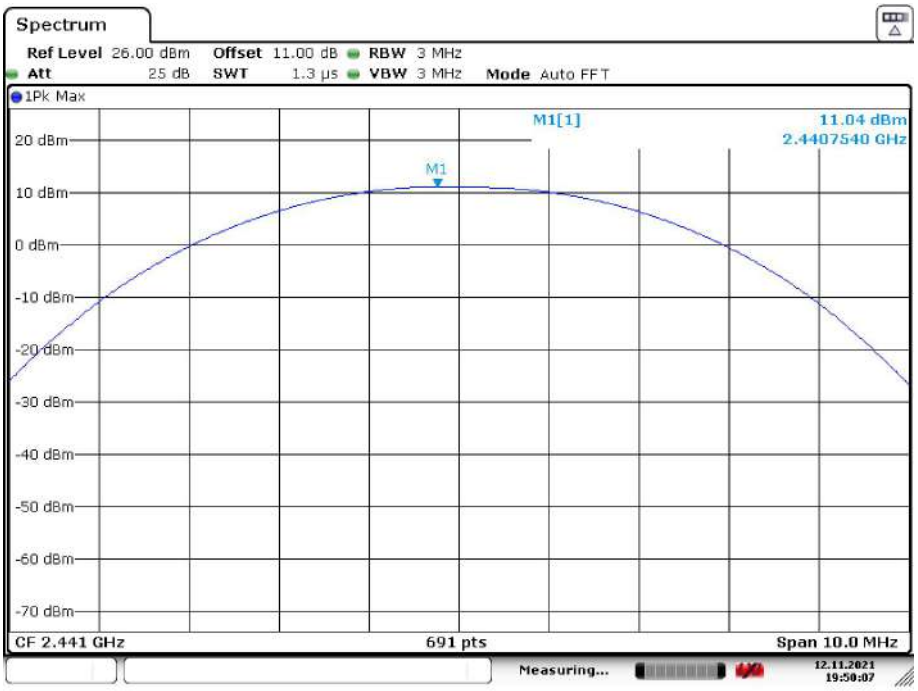
BDR (GFSK):

Low Channel



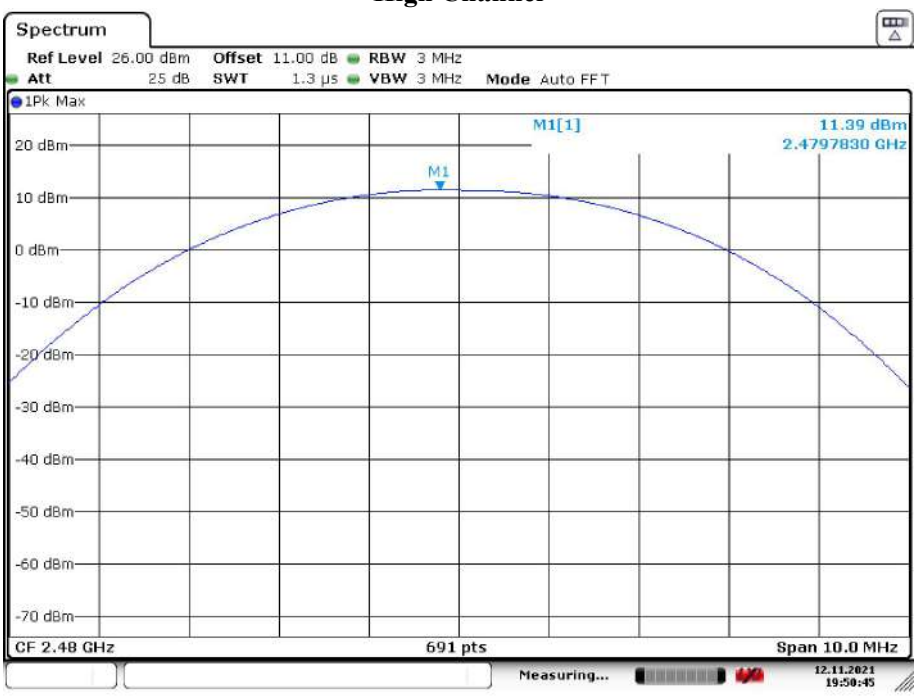
Date: 12.NOV.2021 19:49:38

Middle Channel



Date: 12.NOV.2021 19:50:07

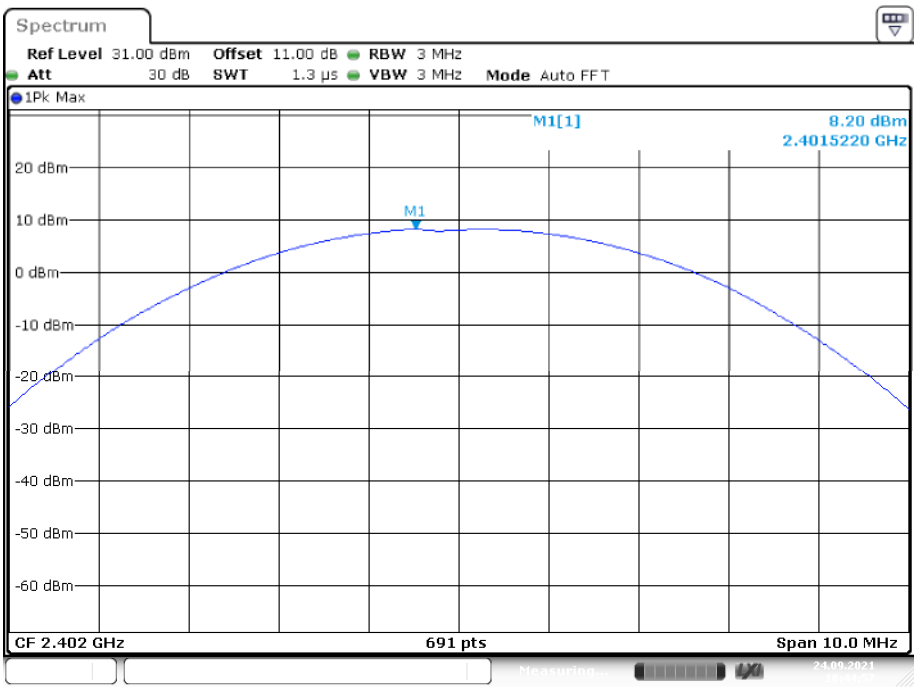
High Channel



Date: 12.NOV.2021 19:50:45

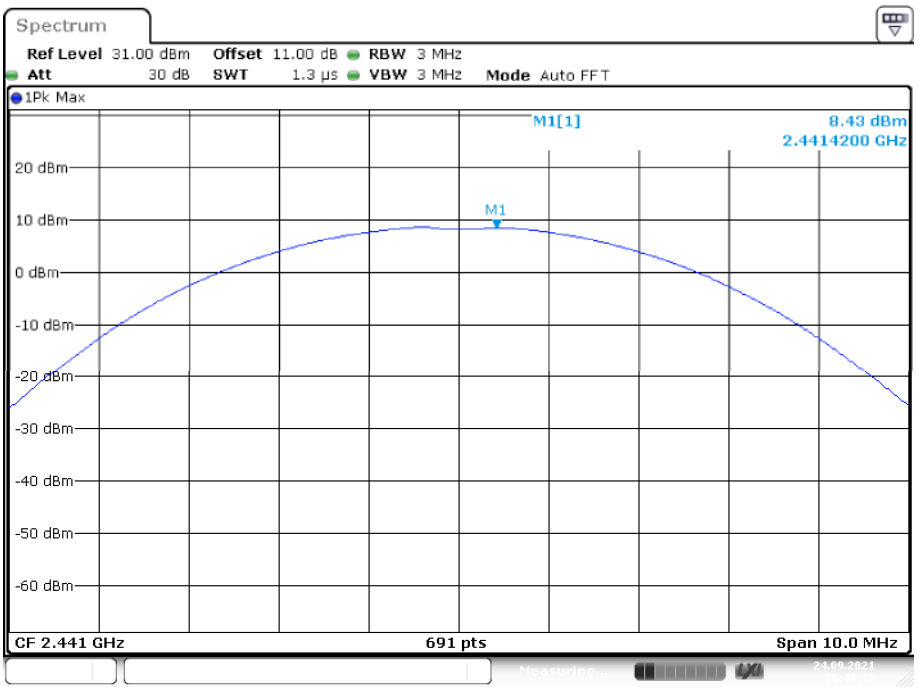
EDR (π/4-DQPSK):

Low Channel



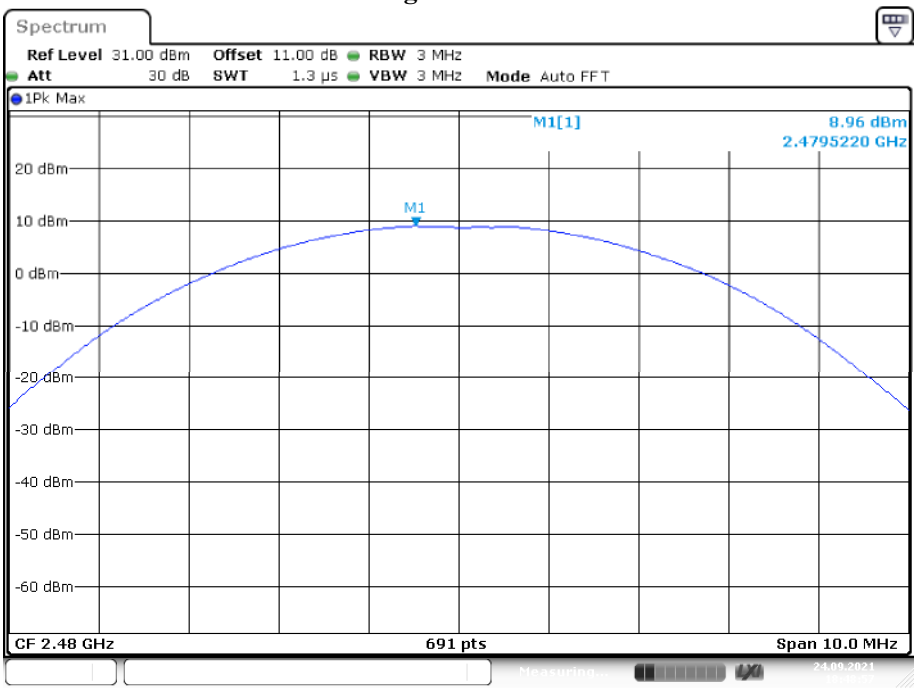
Date: 24.SEP.2021 18:44:57

Middle Channel



Date: 24.SEP.2021 18:48:13

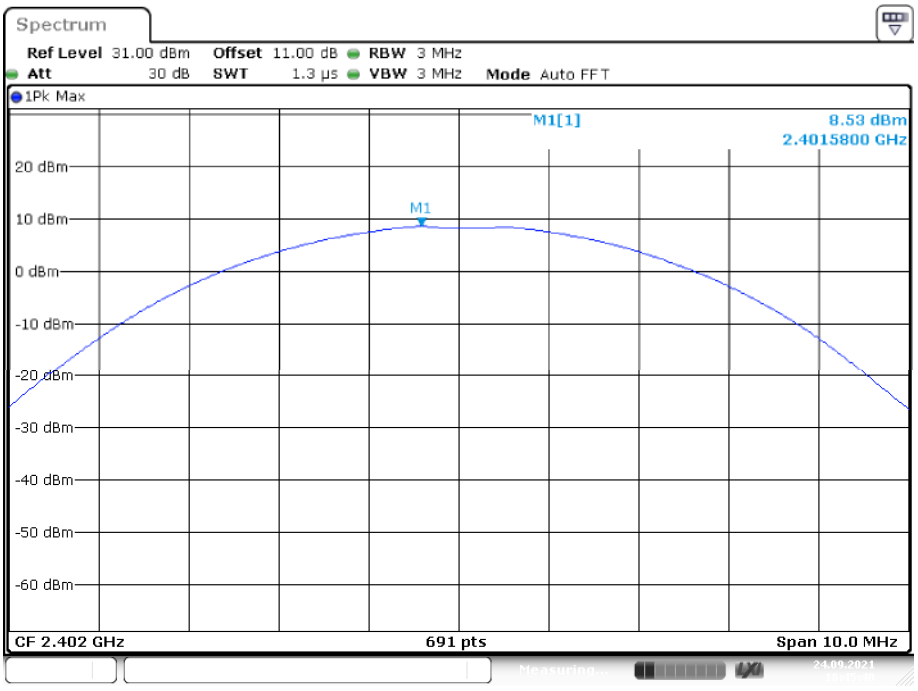
High Channel



Date: 24.SEP.2021 18:48:57

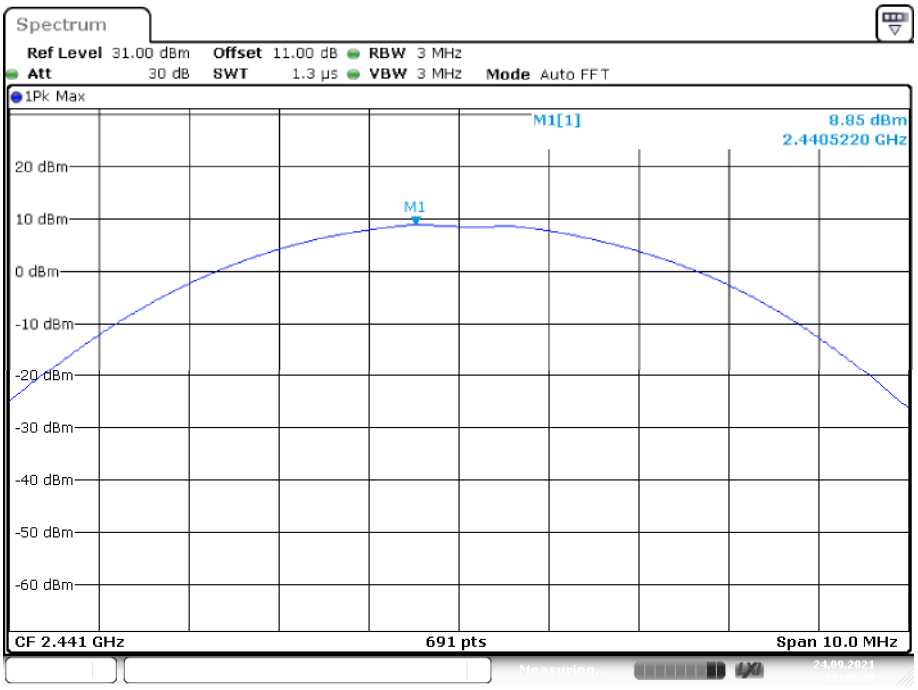
EDR (8DPSK):

Low Channel



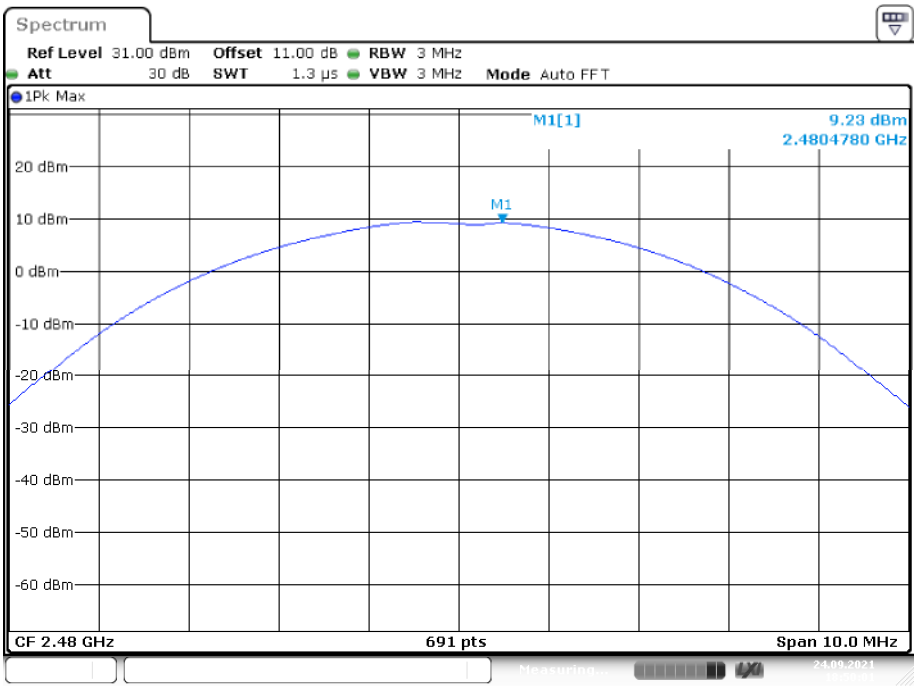
Date: 24.SEP.2021 18:45:40

Middle Channel



Date: 24.SEP.2021 18:46:29

High Channel



FCC §15.247(d) & RSS-247 § 5.5 - BAND EDGES TESTING

Applicable Standard

According to 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)).

According to RSS-247 § 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(e), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	25.7 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

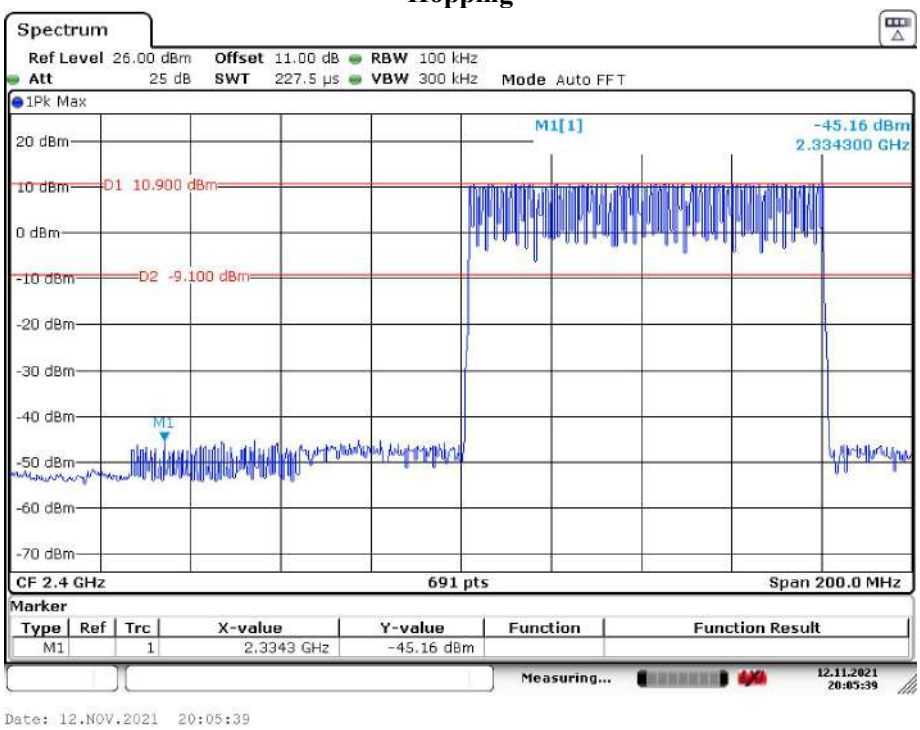
The testing was performed by Fan Yang on 2021-09-24 and 2021-11-12.

EUT operation mode: Transmitting

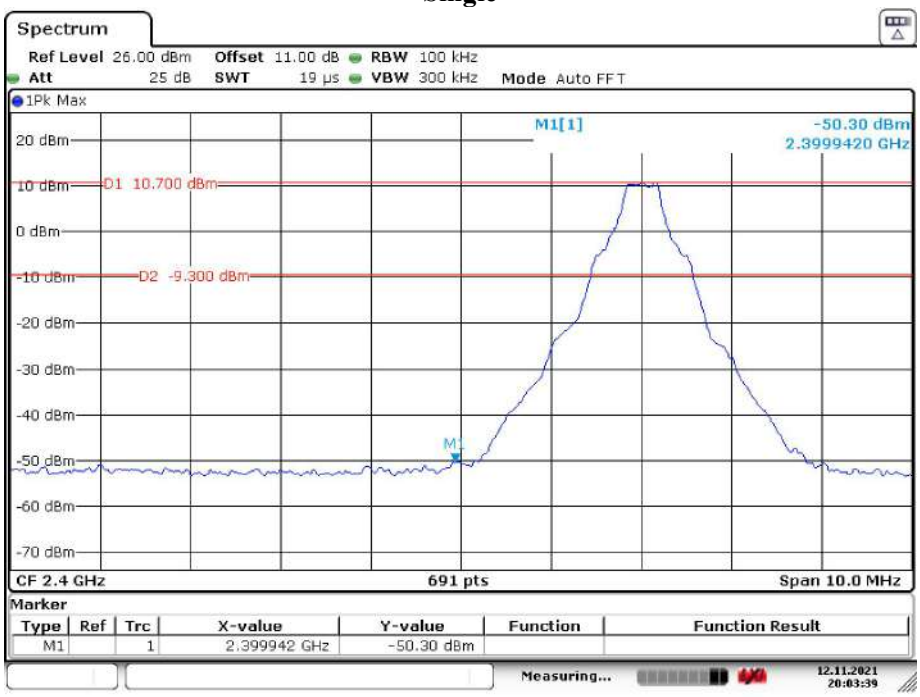
Test Result: Pass

Please refer to following table and plots

BDR (GFSK): Band Edge-Left Side Hopping

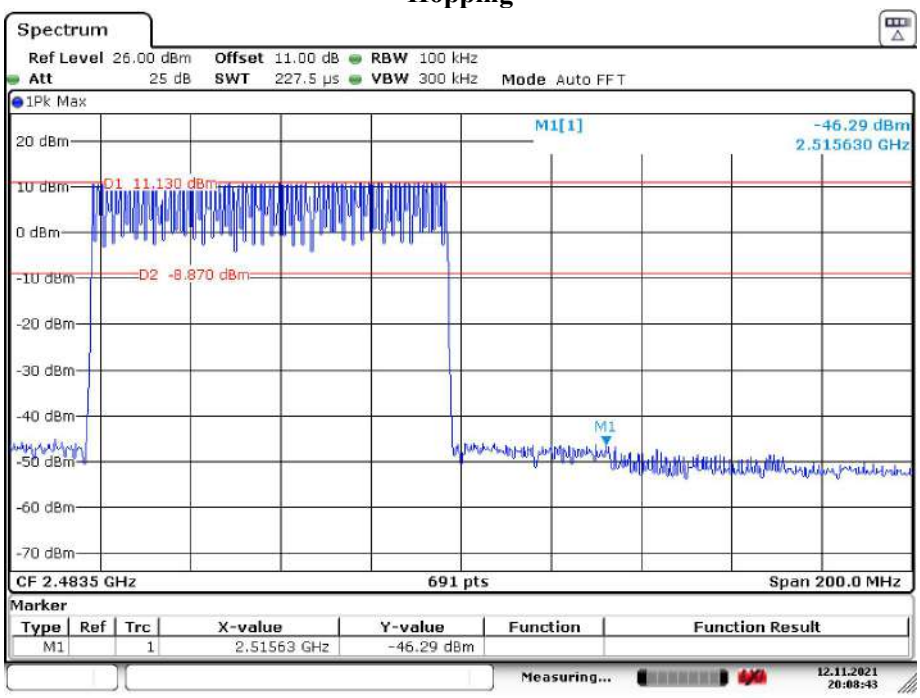


Single



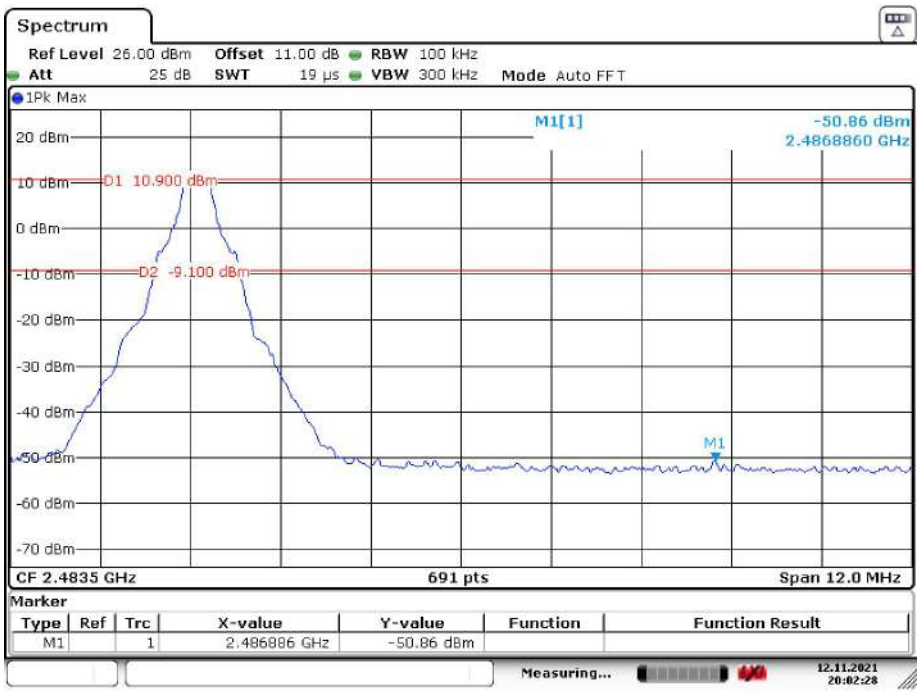
Date: 12.NOV.2021 20:03:40

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



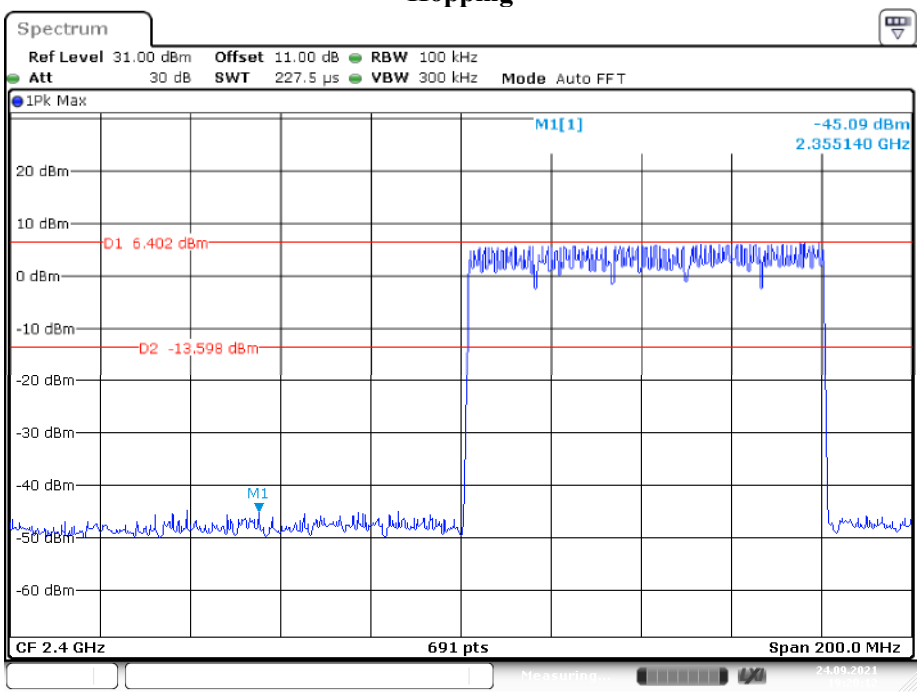
Date: 12.NOV.2021 20:08:43

Single



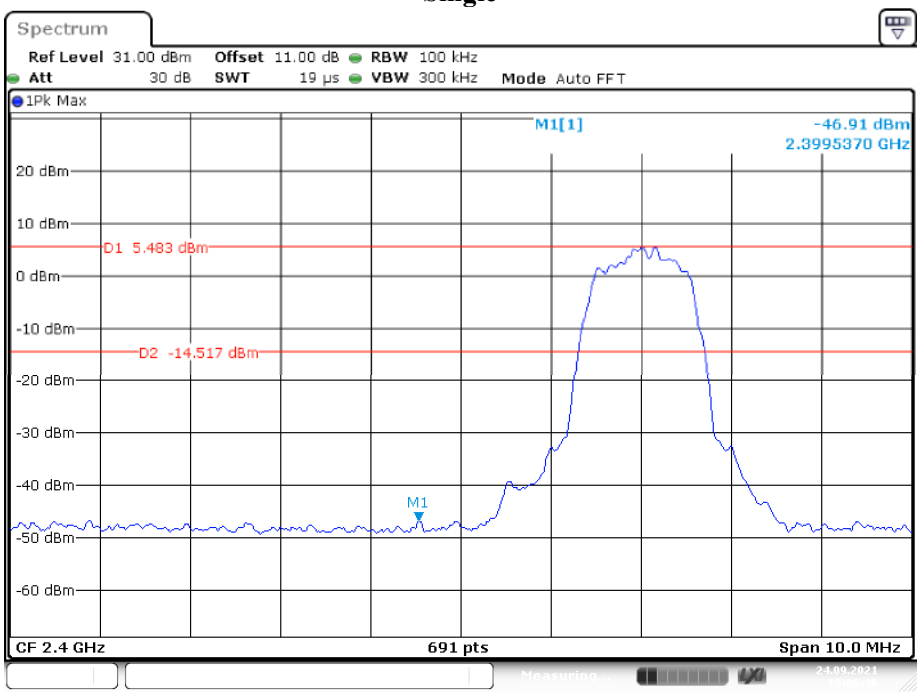
Date: 12.NOV.2021 20:02:28

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



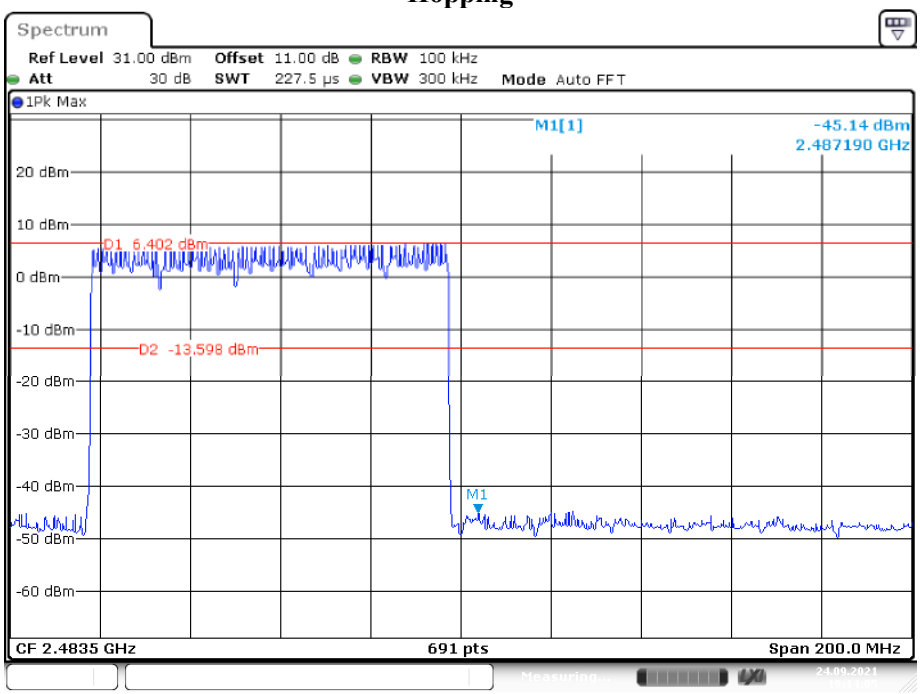
Date: 24.SEP.2021 19:20:13

Single



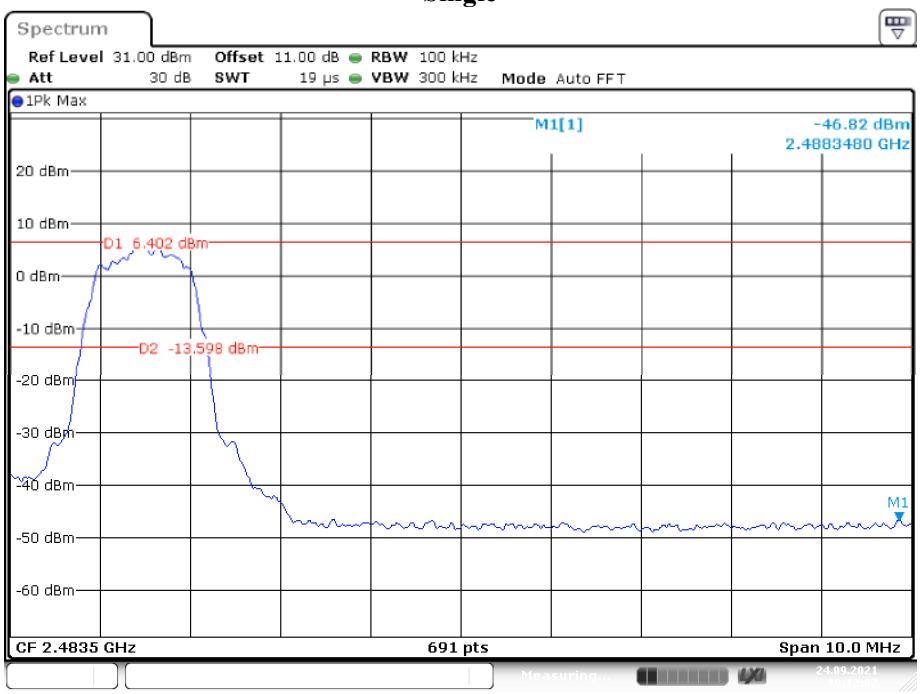
Date: 24.SEP.2021 19:06:36

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



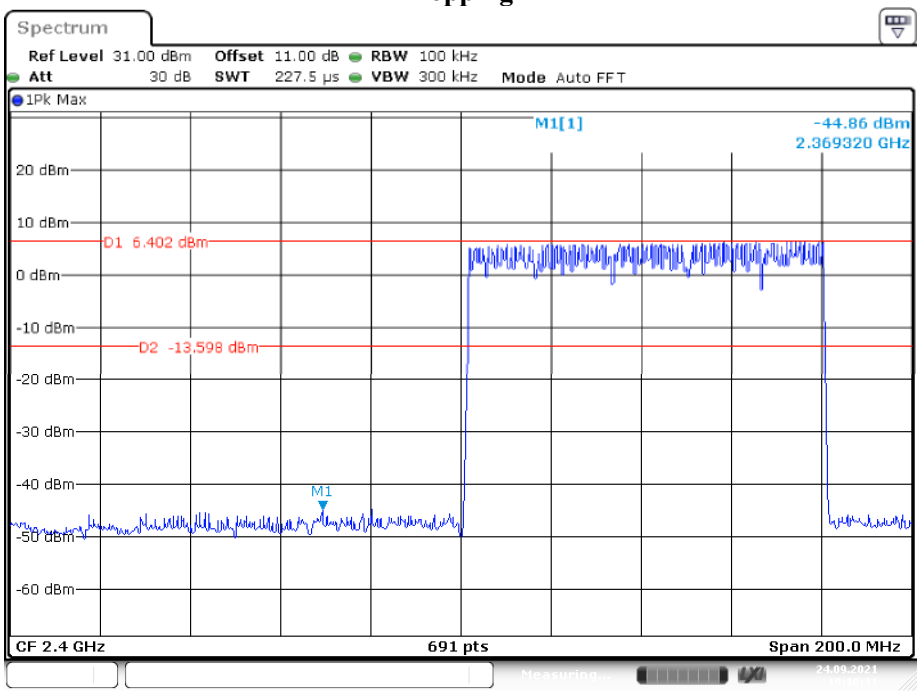
Date: 24.SEP.2021 19:14:05

Single



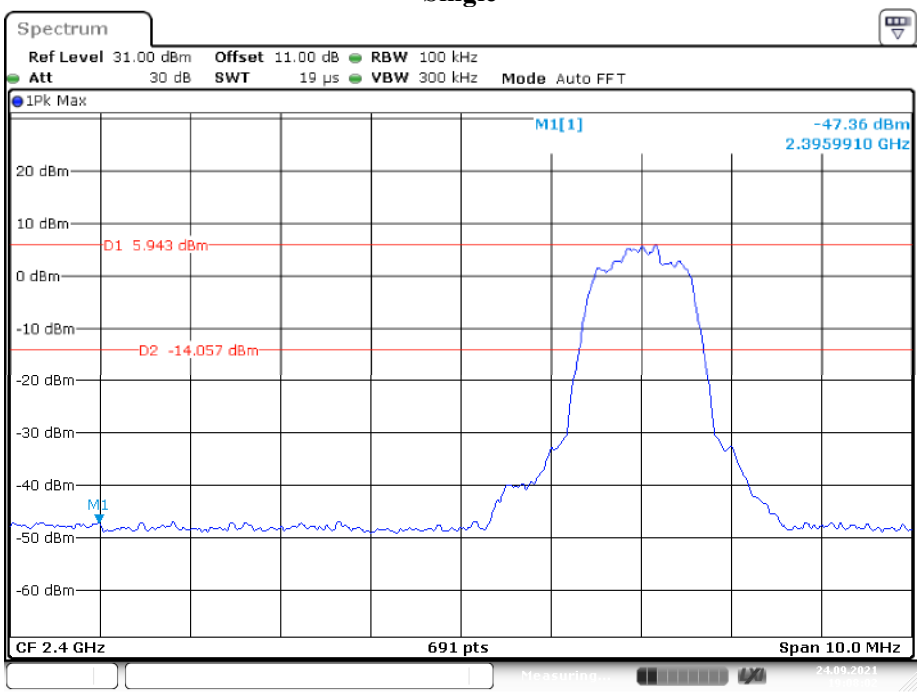
Date: 24.SEP.2021 19:12:02

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



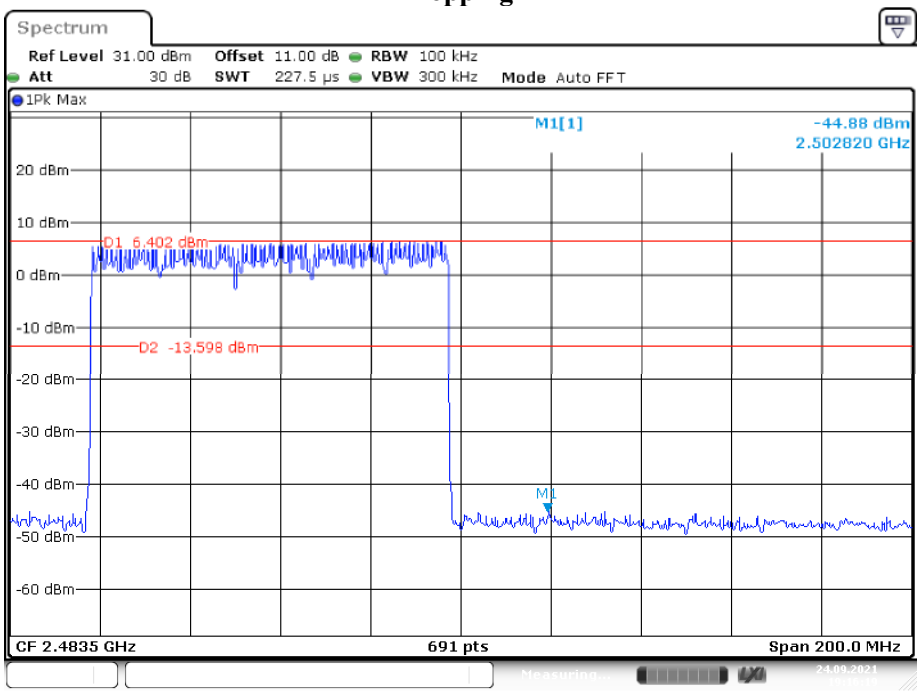
Date: 24.SEP.2021 19:18:31

Single



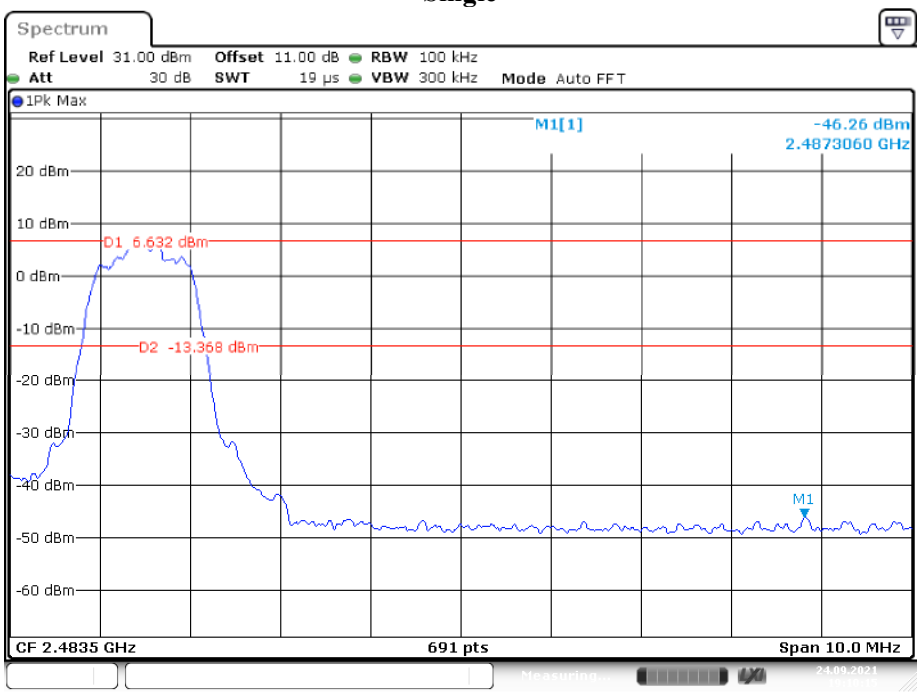
Date: 24.SEP.2021 19:08:02

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



Date: 24.SEP.2021 19:16:19

Single



Date: 24.SEP.2021 19:10:15

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