ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

FCC PART 15.247
TEST REPORT

For

Inrico Technologies Co., Ltd

3/F, Building No.118, High Tech Industrial Park, 72 Guowei Road,
Luohu District, Shenzhen, China

FCC ID: 2AIV6-2-S200

Report Type:	**Product Type:**
Original Report	Intelligent Two Way Radio

Report Number: SZGMA210719-29698E-RF-00A

Report Date: 2021-08-27

Reviewed By: Alvin Huang, Lab Manager

Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen)
1st Floor, East (3) Block, Laobing Building, Xingye Road, Baoan District, Shenzhen, Guangdong, P.R.C.
Tel: +86-755-33320018
Fax: +86-755-33320008
www.baclcorp.com.cn

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

BACL 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	Intelligent Two Way Radio
Tested Model	S200
Frequency Range	Bluetooth: 2402-2480MHz
Maximum conducted peak output power	Bluetooth: 6.01dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification*	1.5dBi(It is provided by the applicant)
Voltage Range	DC5V from adapter or DC 3.8V From Battery
Date of Test	2021-07-20 to 2021-08-23
Sample number	SZGMA210719-29698E-RFA1-S1 SZGMA210719-29698E-RFA1-S2 (RF Conducted Test) (Assigned by BACL, Shenzhen)
Received date	2021-07-19
Sample/EUT Status	Good condition
Adapter information	Model: HJ-0502000W2-US Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5.0V, 2000mA

Objective

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

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

Test Methodology

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

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). 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
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.70dB
RF conducted test with spectrum		±1.4dB
AC Power Lines Conducted Emissions		±1.72dB
Emissions, Radiated	Below 1GHz	±4.40dB
	Above 1GHz	±4.60dB
Temperature		±1℃
Humidity		±6%
Supply voltages		±0.4%

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 1st Floor, East (3) Block, Laobing Building, Xingye Road, Baoan District, Shenzhen, Guangdong, P.R.C

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.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 27372.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

Test in the engineer mode, and the power level is default*. The software and power level was provided by the manufacturer.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

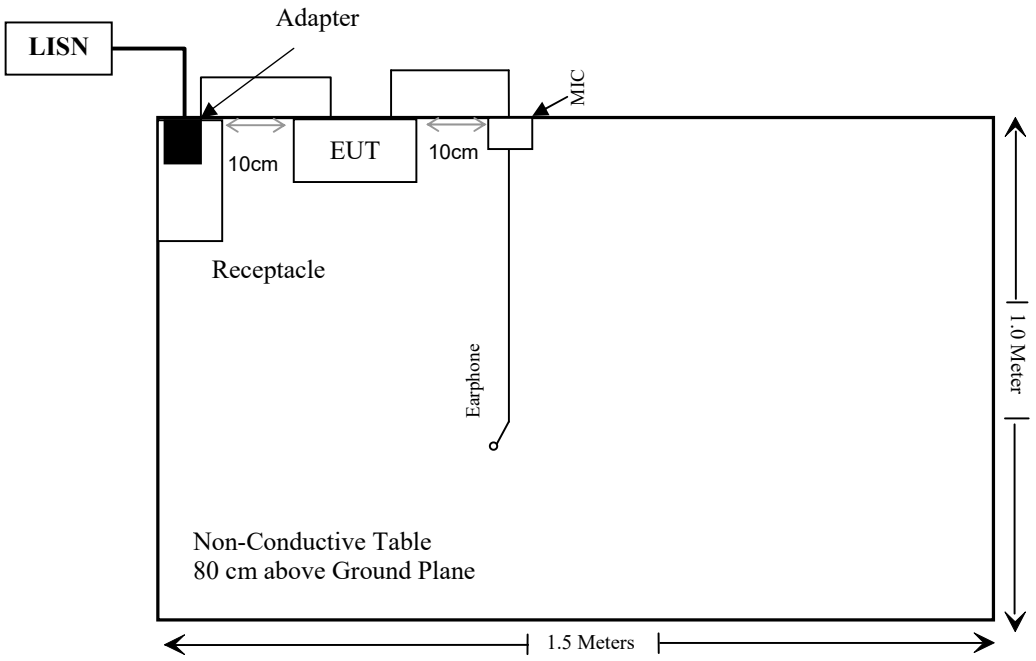
Manufacturer	Description	Model	Serial Number
Inrico	Earphone	Unknown	Unknown
Inrico	MIC	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-Shielding Un-Detachable AC Cable	1.2	LISN	Receptacle
Un-Shielding Detachable USB Cable	1.0	Adapter	EUT
Un-Shielding Detachable Earphone Cable	1.0	MIC	Earphone
Un-Shielding Detachable MIC Cable	1.0	EUT	MIC

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100784	2021/02/03	2022/02/02
Rohde & Schwarz	LISN	ENV216	101748	2021/02/03	2022/02/02
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2020/11/29	2021/11/28
Rohde & Schwarz	CE Test software	ES-K1	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	100784	2021/02/02	2022/02/02
Sonoma instrument	Pre-amplifier	310 N	186014	2021/08/03	2022/08/02
SCHWARZBECK	Broadband Antenna	VULB 9163	9163-872	2020/1/5	2023/1/4
Unknown	Cable	Chamber Cable 1	UFB311A-0-0788-50V50VTV	2021/02/03	2022/02/03
Unknown	Cable	Chamber Cable 2	UFB311A-0-0789-50V50VTV	2021/02/03	2022/02/03
Unknown	Cable 2	RF Cable 2	UFB311A-0-0787-50V50VTV	2021/02/03	2022/02/03
Rohde & Schwarz	Auto test software	EZ_EMC.db	1.1.4.2	NCR	NCR
CHIGO	Temperature & Humidity Meter	HTC-1S	T-03-EM458	2021/4/12	2022/4/11
Rohde & Schwarz	Spectrum Analyzer	FSV40	101590	2020/12/14	2021/12/13
Preamplifer	Pre-amplifier	PAM-0118	226	2020/11/29	2021/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/06/29	2022/06/29
Agilent	Horn Antenna	AHA-118S	3017	2021-02-25	2022-2-24
Unknown	Cable	Chamber Cable 1	UFB311A-0-0788-50V50VTV	2021/02/03	2022/02/03
Unknown	Cable	Chamber Cable 2	UFB311A-0-0789-50V50VTV	2021/02/03	2022/02/03
Unknown	Cable 2	RF Cable 2	UFB311A-0-0787-50V50VTV	2021/02/03	2022/02/03
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2020/12/06	2023/12/05
wainwrigh	Band Reject filter	WRCG2400	2.4G filter	2021/04/20	2022/04/20

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
R&S	EMI Test Receiver	ESR3	100784	2021/02/02	2022/02/02
Rohde & Schwarz	Spectrum Analyzer	FSV40	101590	2020/12/14	2021/12/13
narda	10dB Attenuator	769-10	03407	2020/11/29	2021/11/28
Unknown	RF Cable	Unknown	24533	2020/11/29	2021/11/28

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1307 (b) (1) &§2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §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

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.

For worst case:

Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
	(dBm)	(mW)				
2402-2480	7.0	7.08	5	2.2	3.0	Yes

Result: No Standalone SAR test is required

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

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

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached and the antenna gain is 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

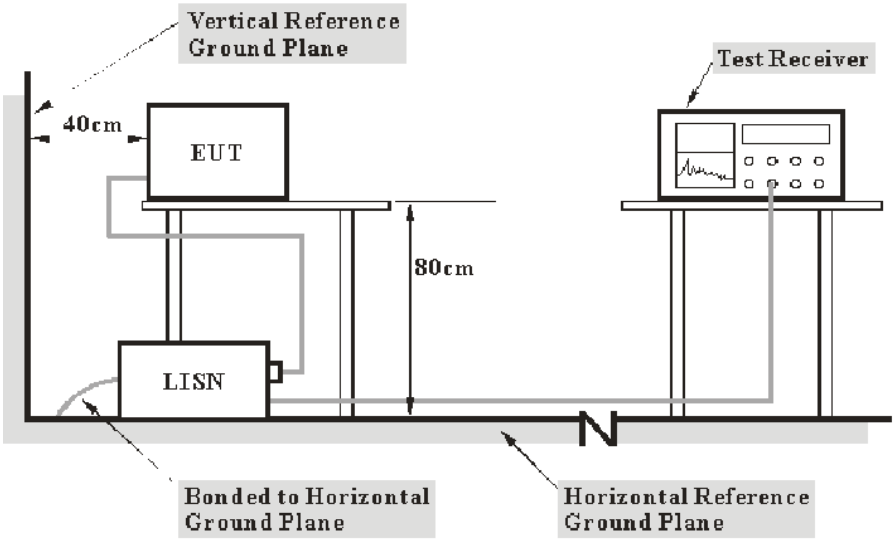
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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.

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

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

Corrected Factor & Margin Calculation

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

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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 – Corrected Amplitude

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	70 %
ATM Pressure:	101.0 kPa

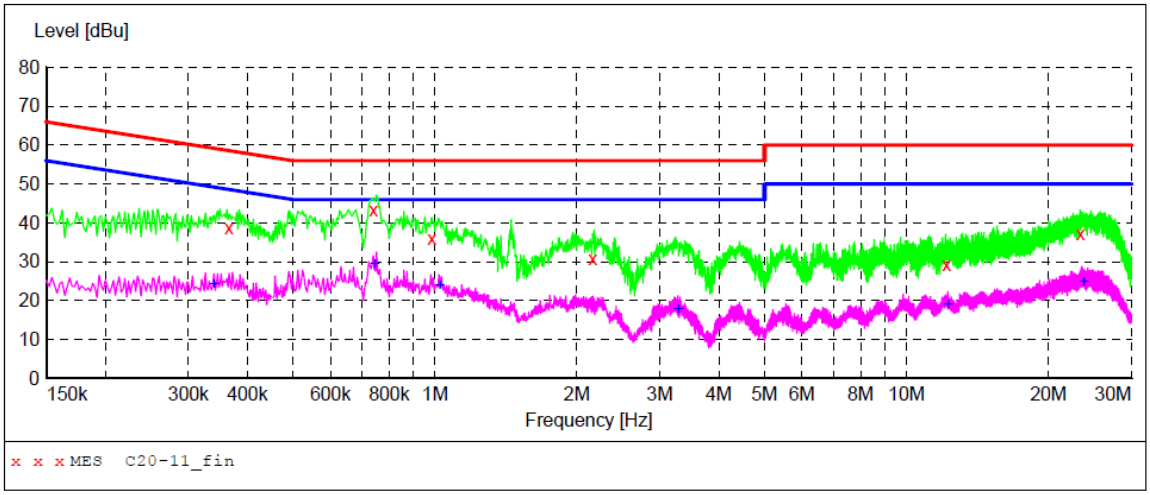
The testing was performed by LYA on 2021-07-20.

EUT operation mode: Transmitting

AC 120V/60 Hz, Line

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "C20-11_fin"

7/20/2021 5:37PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.365000	38.60	10.1	59	21.4	QP	L1	GND
0.740000	43.20	10.1	56	12.8	QP	L1	GND
0.985000	35.80	10.1	56	20.2	QP	L1	GND
2.160000	30.60	10.1	56	25.4	QP	L1	GND
12.175000	29.20	10.2	60	30.8	QP	L1	GND
23.375000	37.20	10.3	60	22.8	QP	L1	GND

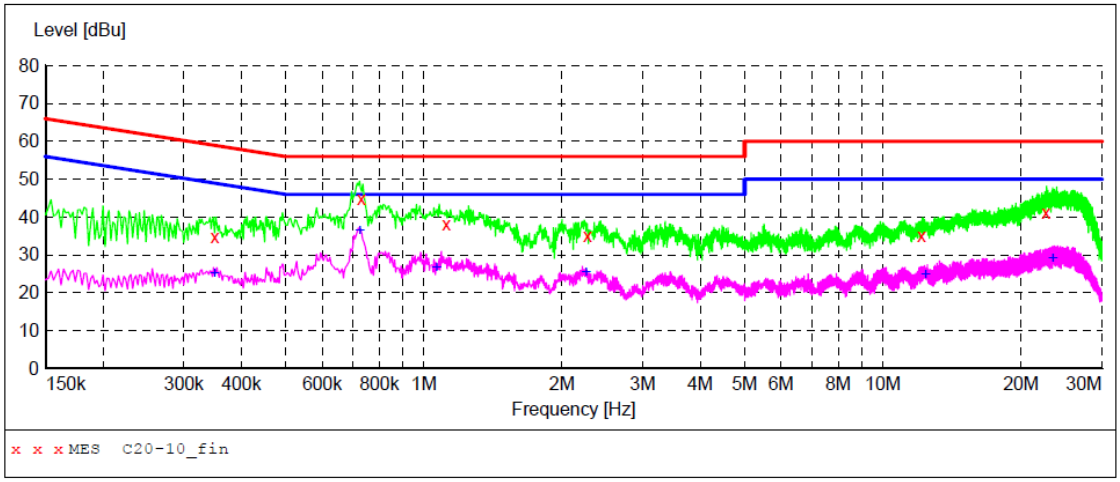
MEASUREMENT RESULT: "C20-11_fin2"

7/20/2021 5:37PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.340000	24.40	10.1	49	24.6	AV	L1	GND
0.745000	29.60	10.1	46	16.4	AV	L1	GND
1.025000	24.00	10.1	46	22.0	AV	L1	GND
3.280000	17.80	10.1	46	28.2	AV	L1	GND
12.270000	19.20	10.2	50	30.8	AV	L1	GND
23.750000	24.90	10.3	50	25.1	AV	L1	GND

AC 120V/60 Hz, Neutral

SCAN TABLE: "Voltage (9K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "C20-10_fin"

7/20/2021 5:33PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.350000	34.70	10.1	59	24.3	QP	N	GND
0.730000	44.80	10.1	56	11.2	QP	N	GND
1.120000	38.00	10.1	56	18.0	QP	N	GND
2.270000	35.00	10.1	56	21.0	QP	N	GND
12.135000	34.90	10.2	60	25.1	QP	N	GND
22.655000	41.00	10.3	60	19.0	QP	N	GND

MEASUREMENT RESULT: "C20-10_fin2"

7/20/2021 5:33PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.350000	25.30	10.1	49	23.7	AV	N	GND
0.725000	36.60	10.1	46	9.4	AV	N	GND
1.065000	26.70	10.1	46	19.3	AV	N	GND
2.255000	25.50	10.1	46	20.5	AV	N	GND
12.405000	24.80	10.2	50	25.2	AV	N	GND
23.420000	29.30	10.3	50	20.7	AV	N	GND

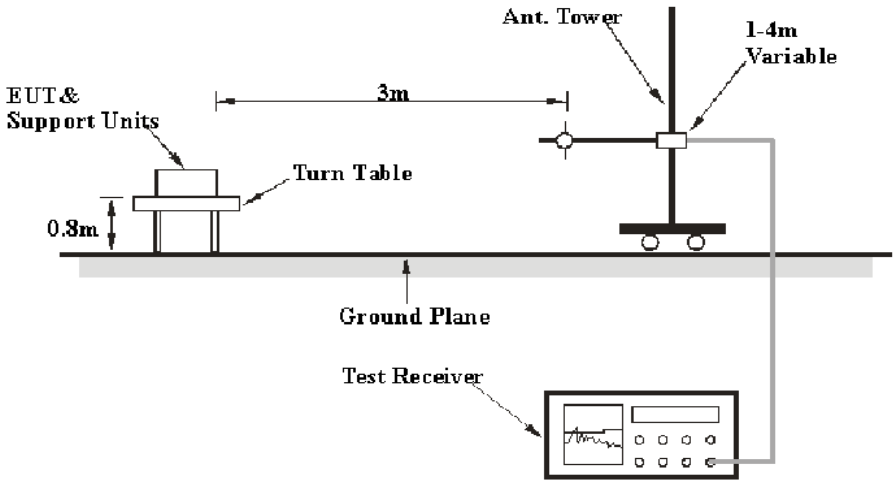
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

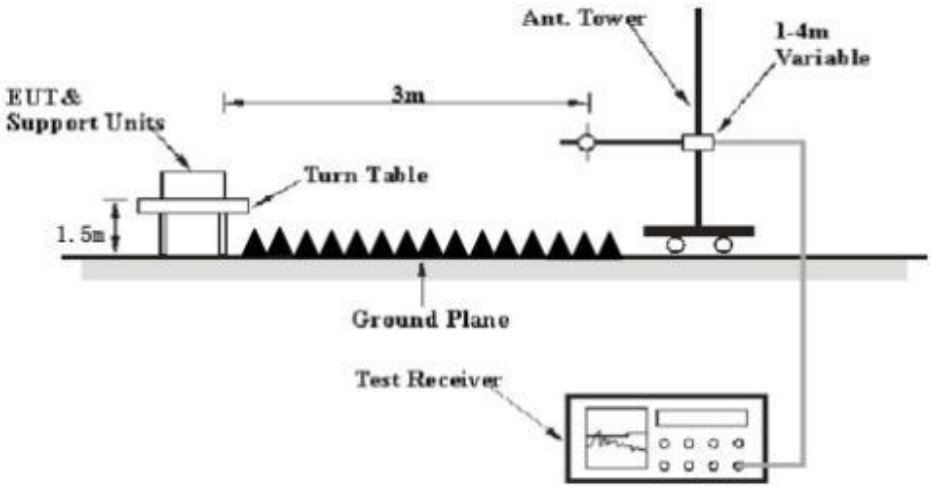
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, according to the ANSI C63.10-2013, 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 Corrected Amplitude 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:

Corrected Amplitude = 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 = Limit – Corrected Amplitude

Test Data

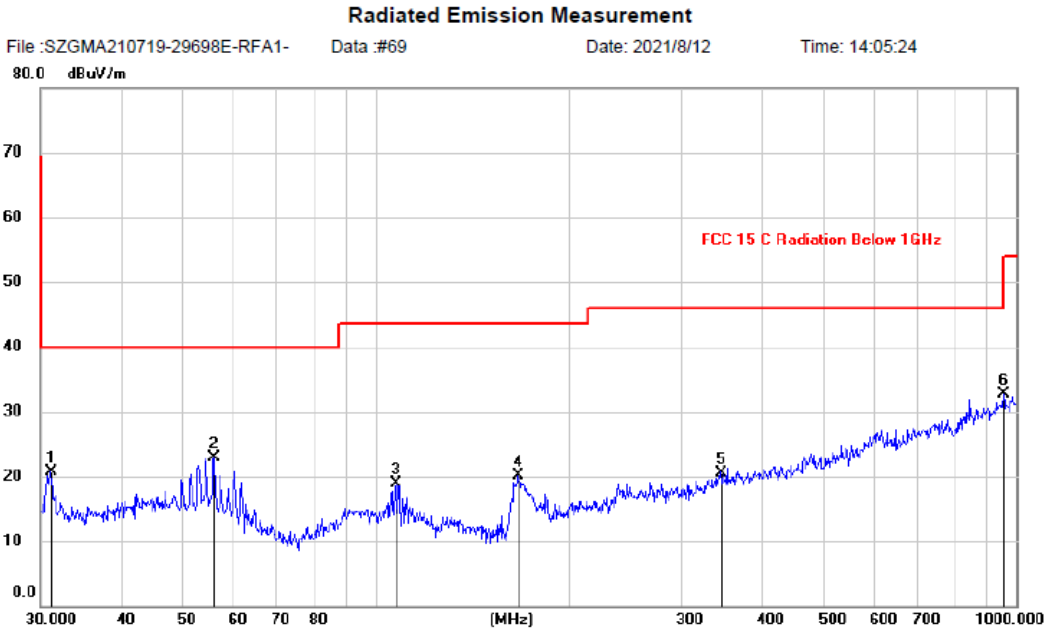
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Mark on 2021-08-12 for below 1GHz and on 2021-08-23 for above 1GHz.

EUT operation mode: Transmitting

30 MHz~1 GHz:



Site : 966 Chamber
Limit: FCC 15 C Radiation Below 1GHz
EUT: Intelligent Two Way Radio
M/N: S200
Mode: BT&WIFI+Transmitting
Note:
Operator: Mark

Polarization: *Vertical*
Power:
Distance: 3m

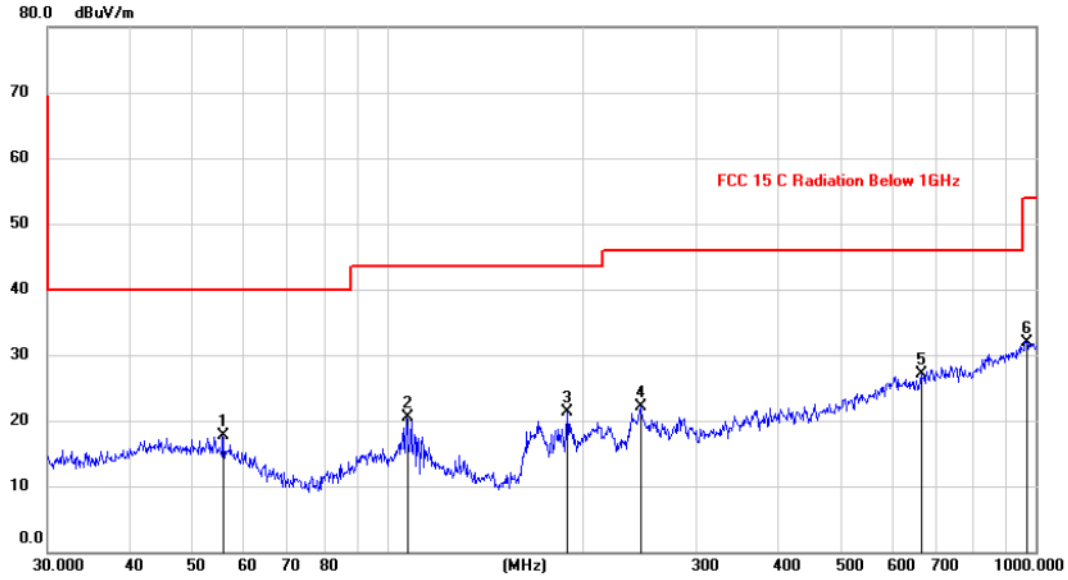
Temperature: 25
Humidity: 56 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		31.1797	34.12	-13.47	20.65	40.00	-19.35	peak			
2		56.0007	35.28	-12.38	22.90	40.00	-17.10	peak			
3		107.6987	32.02	-13.13	18.89	43.50	-24.61	peak			
4		167.2366	35.81	-15.74	20.07	43.50	-23.43	peak			
5		346.2015	28.78	-8.18	20.60	46.00	-25.40	peak			
6	*	955.4380	30.29	2.47	32.76	46.00	-13.24	peak			

*:Maximum data x:Over limit !:over margin

Radiated Emission Measurement

File :SZGMA210719-29698E-RFA1- Data :#70 Date: 2021/8/12 Time: 14:06:40



Site : 966 Chamber
Limit: FCC 15 C Radiation Below 1GHz
EUT: Intelligent Two Way Radio
M/N: S200
Mode: BT&WIFI+Transmitting
Note:
Operator: Mark

Polarization: ***Horizontal***
Power:
Distance: 3m

Temperature: 25
Humidity: 56 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		55.9026	30.14	-12.36	17.78	40.00	-22.22	peak			
2		107.5101	33.66	-13.12	20.54	43.50	-22.96	peak			
3		189.7385	35.45	-14.21	21.24	43.50	-22.26	peak			
4		245.9509	33.46	-11.37	22.09	46.00	-23.91	peak			
5	*	666.9719	29.81	-2.77	27.04	46.00	-18.96	peak			
6		967.2364	29.19	2.78	31.97	54.00	-22.03	peak			

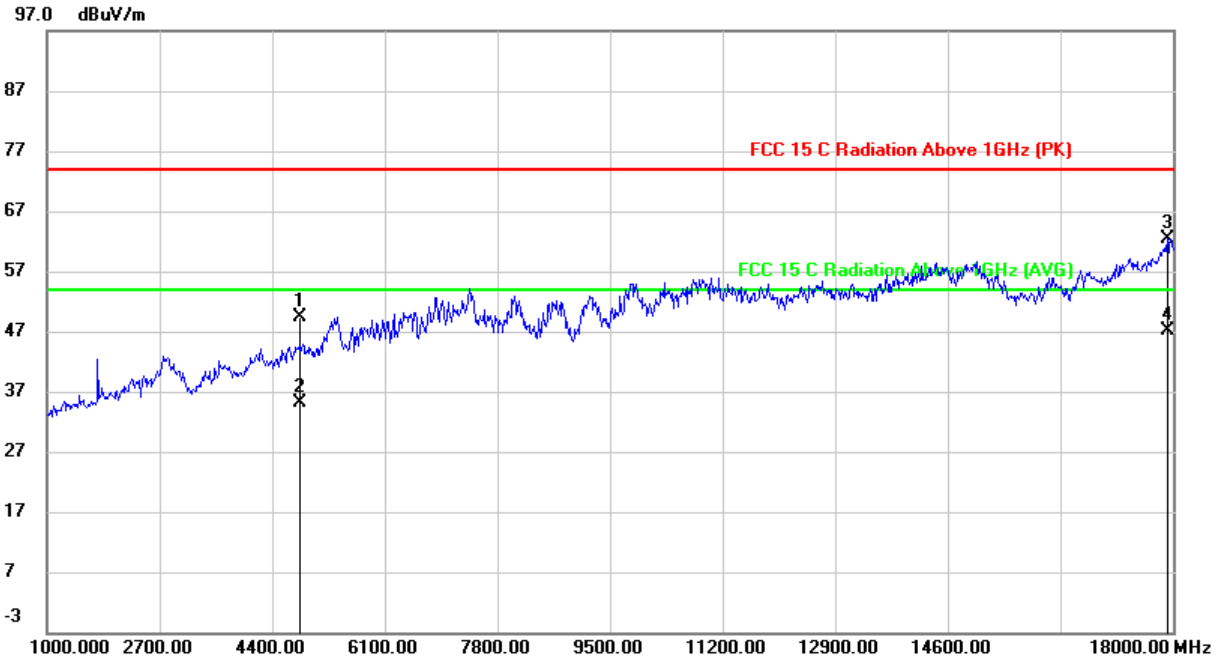
*:Maximum data x:Over limit !:over margin

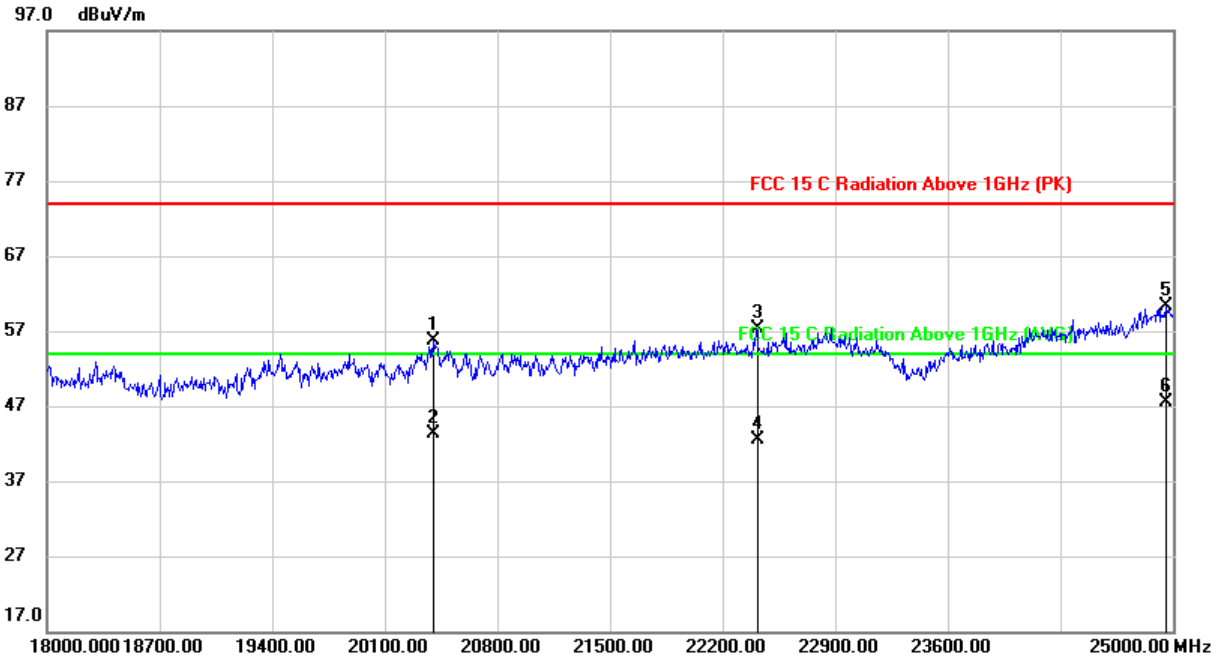
1 GHz - 25 GHz: (*Scan with GFSK, π/4-DQPSK, 8DPSK mode, the worst case is GFSK Mode*)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2390.00	29.81	PK	191	1.1	H	30.91	60.72	74.0	13.28
2390.00	14.26	Ave.	191	1.1	H	30.91	45.17	54.0	8.83
2485.60	27.36	PK	210	1.7	H	30.72	58.08	74.0	15.92
2485.60	13.20	Ave.	210	1.7	H	30.72	43.92	54.0	10.08
4804.00	52.91	PK	238	1.2	H	-3.52	49.39	74.0	24.61
4804.00	38.60	Ave.	238	1.2	H	-3.52	35.08	54.0	18.92
Middle Channel (2441 MHz)									
4882.00	51.11	PK	271	1.9	H	-2.94	48.17	74.0	25.83
4882.00	37.45	Ave.	271	1.9	H	-2.94	34.51	54.0	19.49
High Channel (2480 MHz)									
2389.50	26.54	PK	76	2.4	H	30.91	57.45	74.0	16.55
2389.50	13.05	Ave.	76	2.4	H	30.91	43.96	54.0	10.04
2483.50	27.09	PK	64	2.4	H	30.72	57.81	74.0	16.19
2483.50	14.29	Ave.	64	2.4	H	30.72	45.01	54.0	8.99
4960.00	50.88	PK	284	2.4	H	-2.73	48.15	74.0	25.85
4960.00	36.05	Ave.	284	2.4	H	-2.73	33.32	54.0	20.68

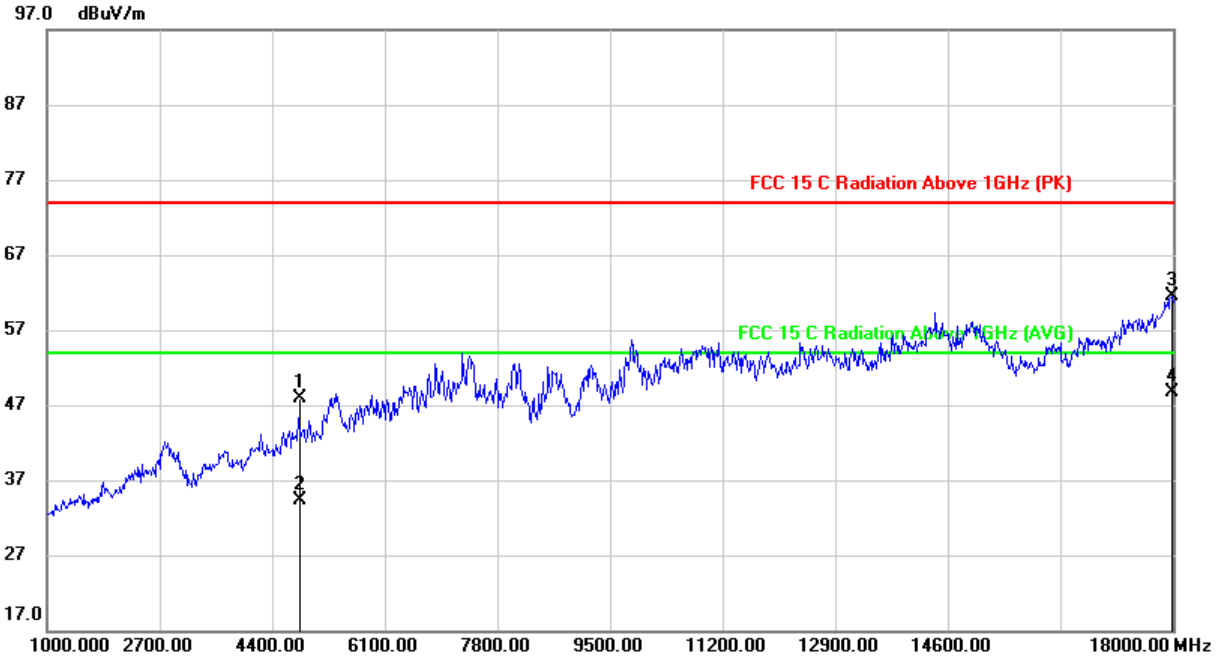
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.

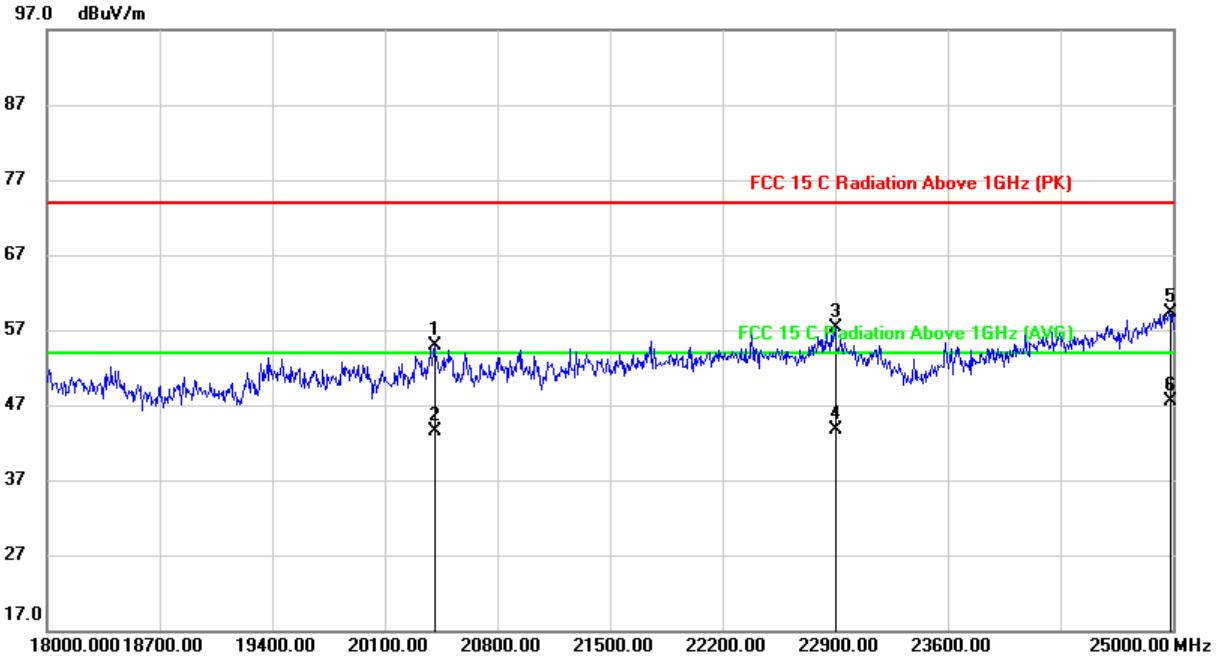
Pre-scan with Low channel Peak
Horizontal





Vertical


97.0 dBuV/m
87
77
67
57
47
37
27
17.0
FCC 15 C Radiation Above 1GHz (PK)
FCC 15 C Radiation Above 1GHz (AVG)
1
2
3
4
1000.000 2700.00 4400.00 6100.00 7800.00 9500.00 11200.00 12900.00 14600.00 18000.00 MHz


97.0 dBuV/m
87
77
67
57
47
37
27
17.0
FCC 15 C Radiation Above 1GHz (PK)
FCC 15 C Radiation Above 1GHz (AVG)
1
2
3
4
5
6
18000.000 18700.00 19400.00 20100.00 20800.00 21500.00 22200.00 22900.00 23600.00 25000.00 MHz

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

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by LYA on 2021-07-29.

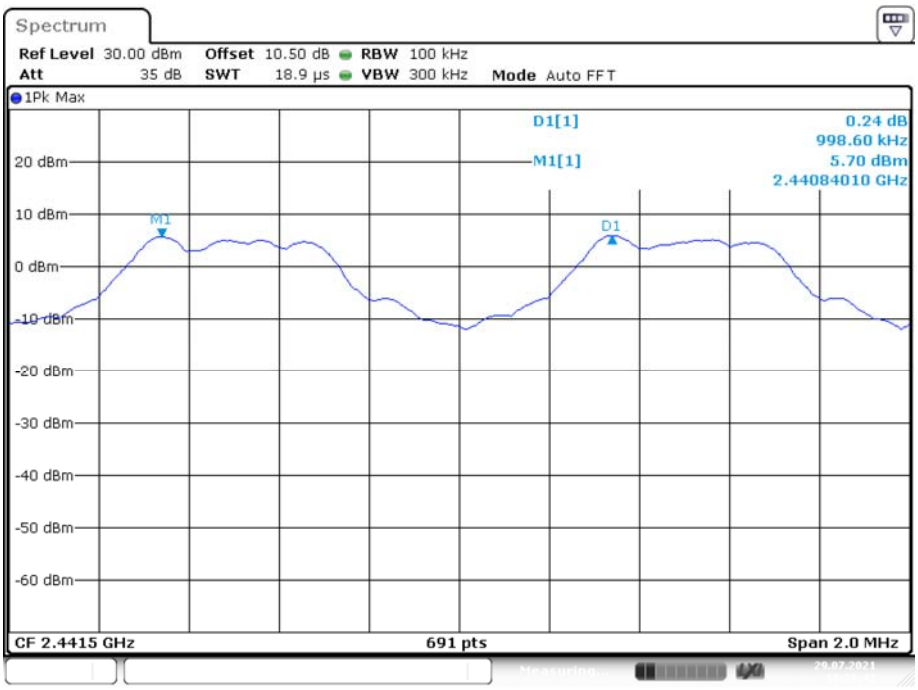
EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following table and plots.

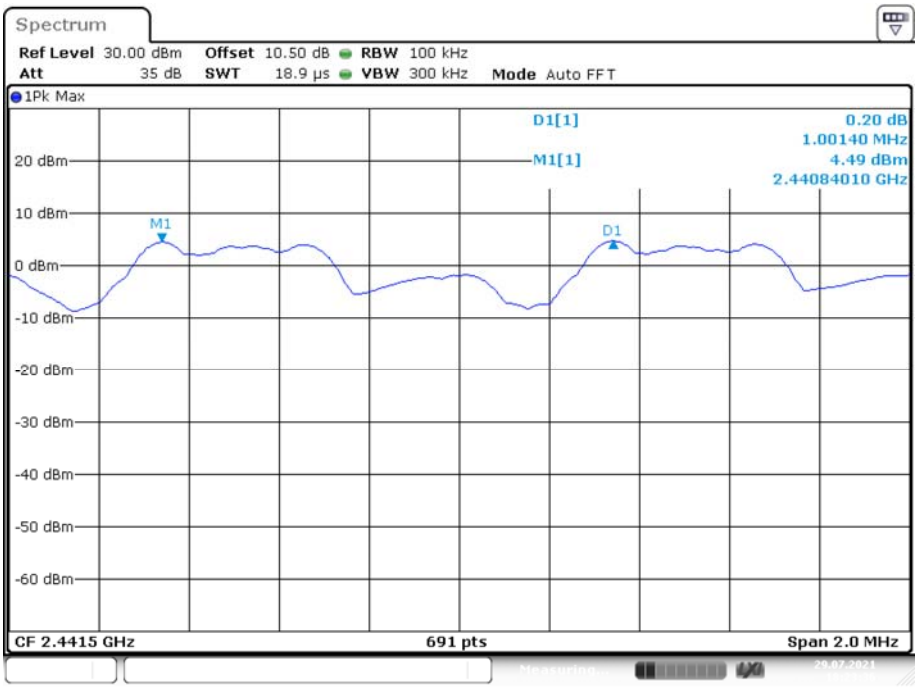
Test Mode	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BDR(GFSK)					
Hopping	0.999	0.897	0.598	> two-thirds of the 20 dB bandwidth	Compliance
EDR(π/4-DQPSK)					
Hopping	1.001	1.129	0.753	> two-thirds of the 20 dB bandwidth	Compliance
EDR(8DPSK)					
Hopping	0.999.	1.158	0.772	> two-thirds of the 20 dB bandwidth	Compliance

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

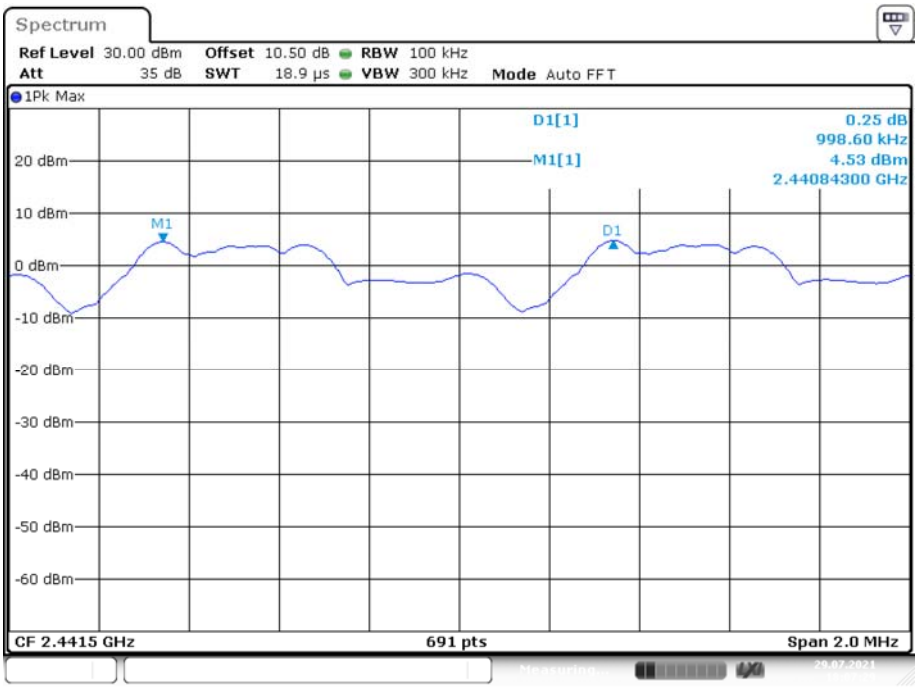
BDR(GFSK)



EDR (π/4-DQPSK)



EDR (8DPSK)


Spectrum
Ref Level 30.00 dBm Offset 10.50 dB RBW 100 kHz
Att 35 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] 0.25 dB
998.60 kHz
M1[1] 4.53 dBm
2.44084300 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D1
CF 2.4415 GHz
691 pts
Span 2.0 MHz
Measuring...
29.07.2021
Date: 29.JUL.2021 18:07:29

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

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.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

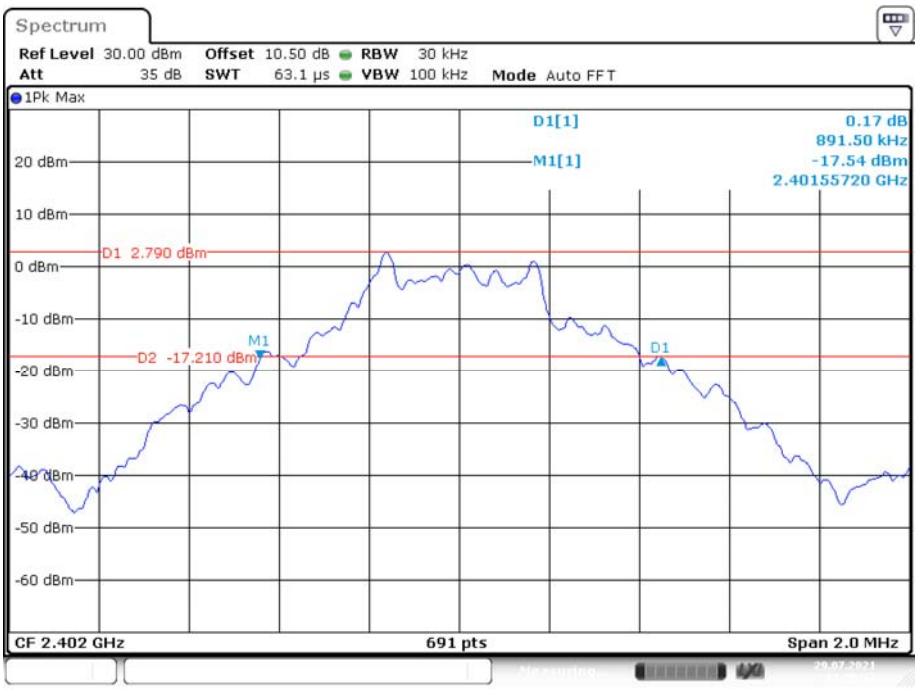
The testing was performed by LYA on 2021-07-29.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following table and plots.

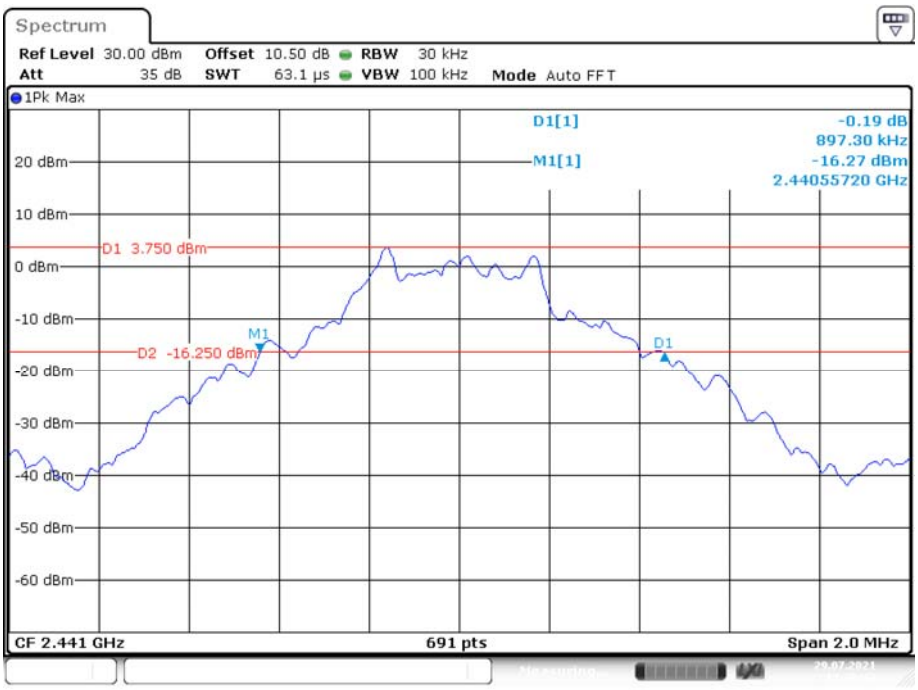
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.892
	Middle	2441	0.897
	High	2480	0.897
EDR (π/4-DQPSK)	Low	2402	1.126
	Middle	2441	1.129
	High	2480	1.126
EDR (8DPSK)	Low	2402	1.158
	Middle	2441	1.158
	High	2480	1.158

BDR(GFSK) : Low Channel



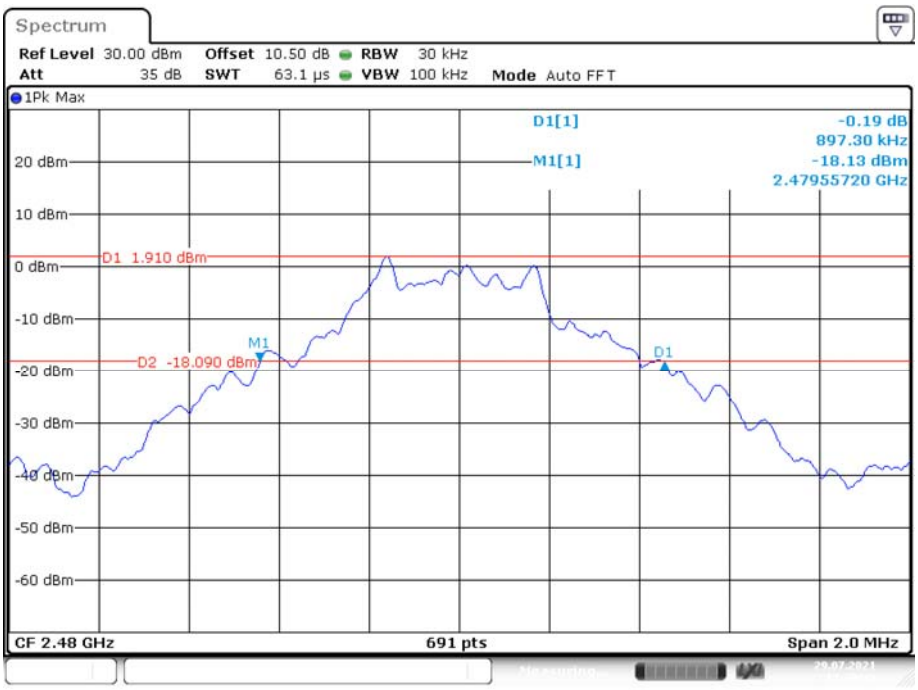
Date: 29.JUL.2021 17:15:14

BDR(GFSK) : Middle Channel



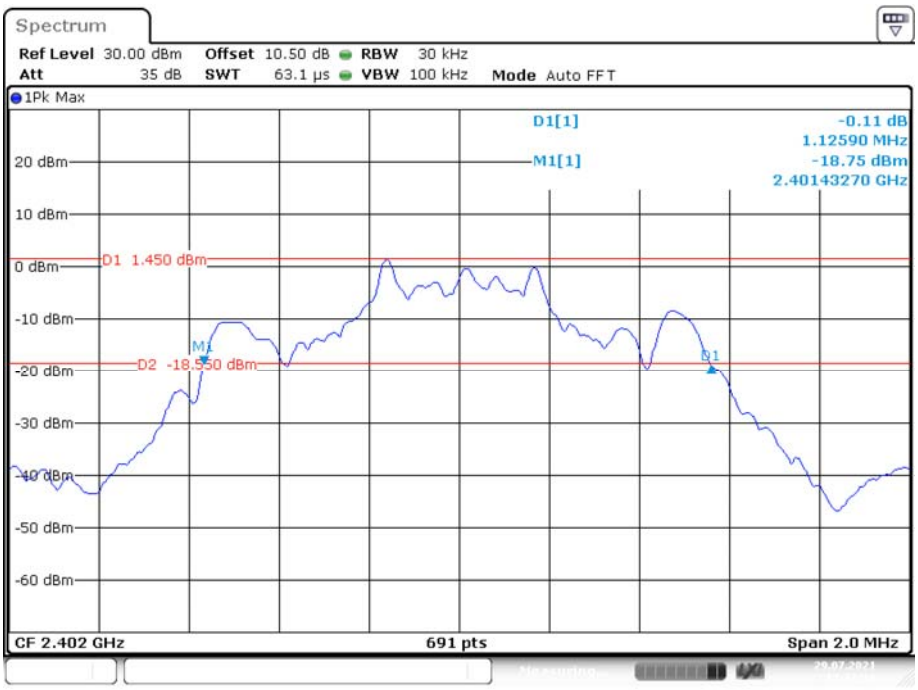
Date: 29.JUL.2021 17:16:43

BDR(GFSK) : High Channel



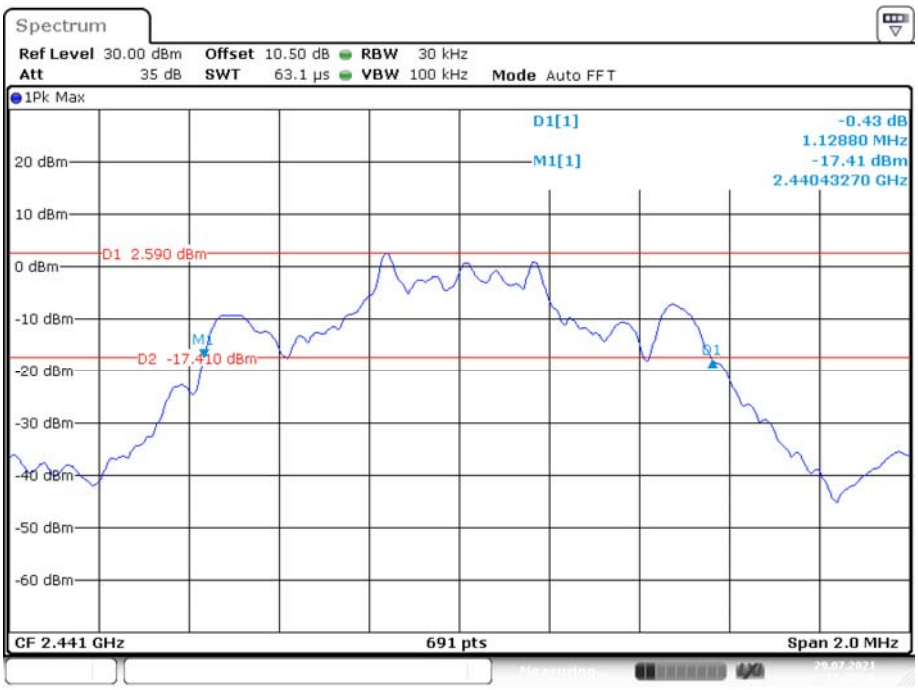
Date: 29.JUL.2021 17:19:40

EDR (π/4-DQPSK): Low Channel



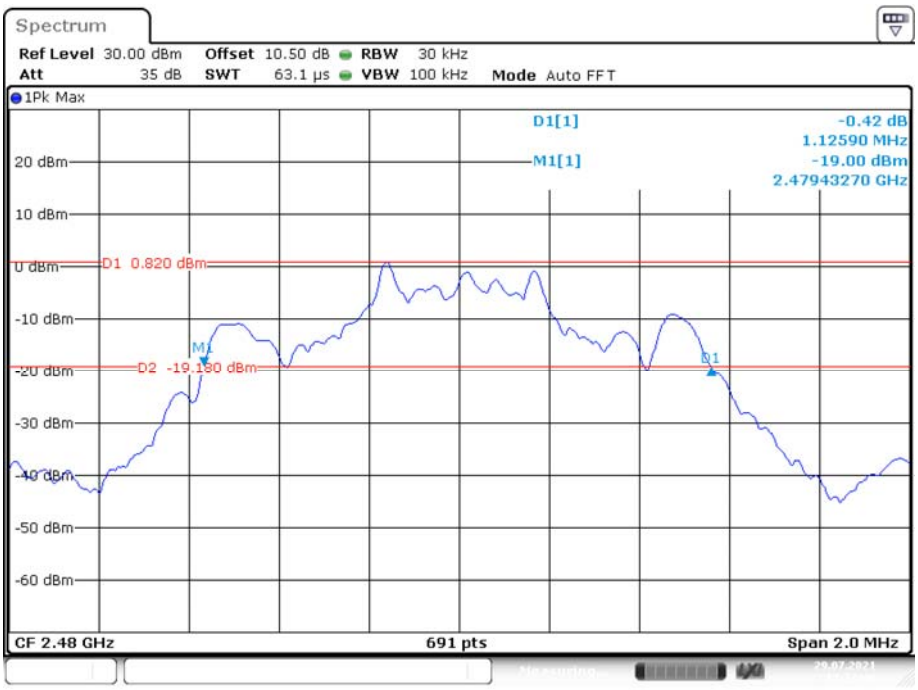
Date: 29.JUL.2021 17:31:18

EDR (π/4-DQPSK): Middle Channel



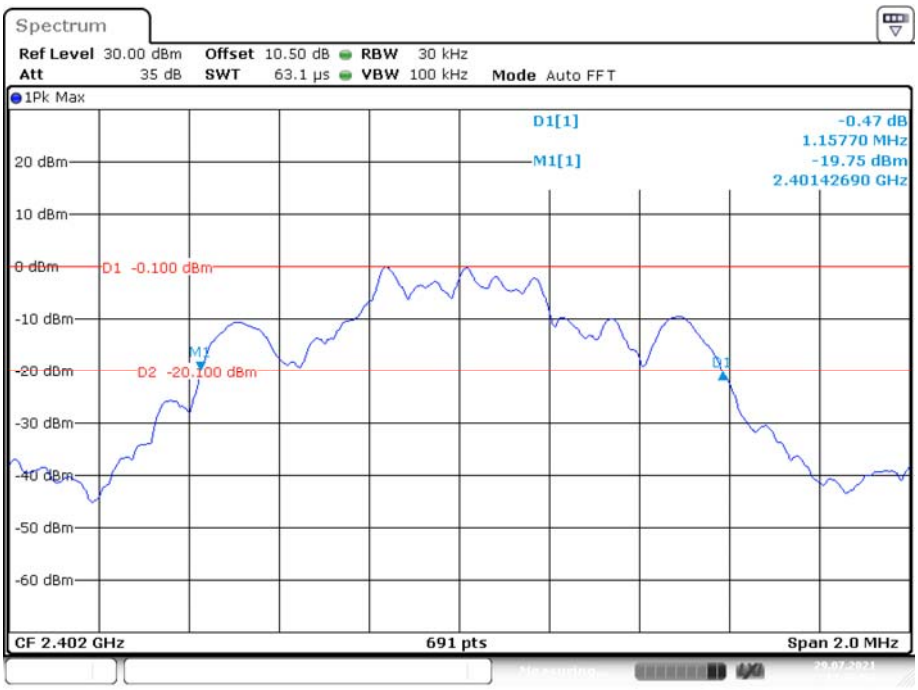
Date: 29.JUL.2021 17:27:17

EDR (π/4-DQPSK): High Channel



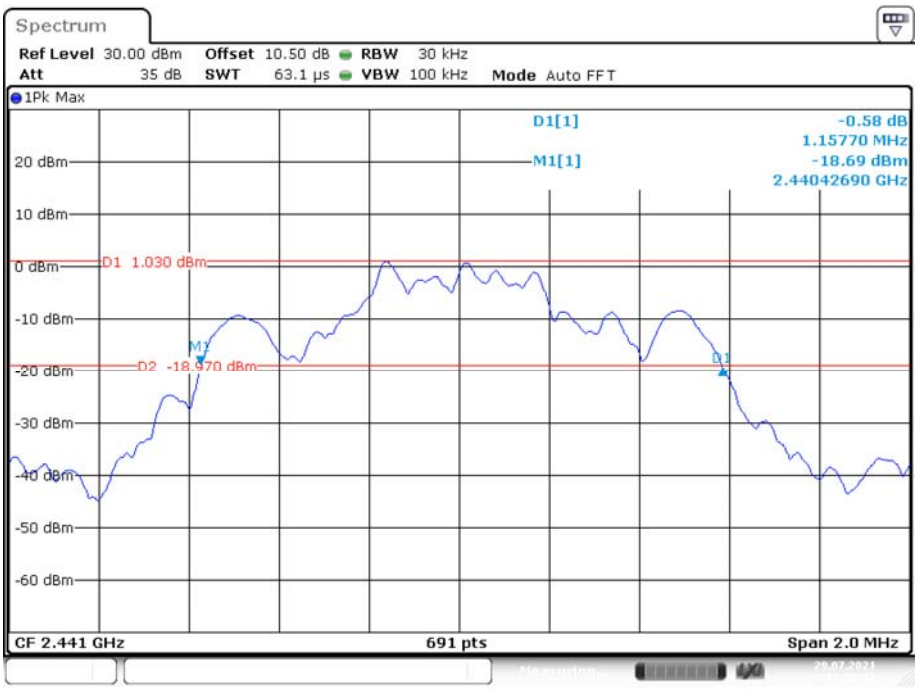
Date: 29.JUL.2021 17:21:49

EDR (8DPSK): Low Channel



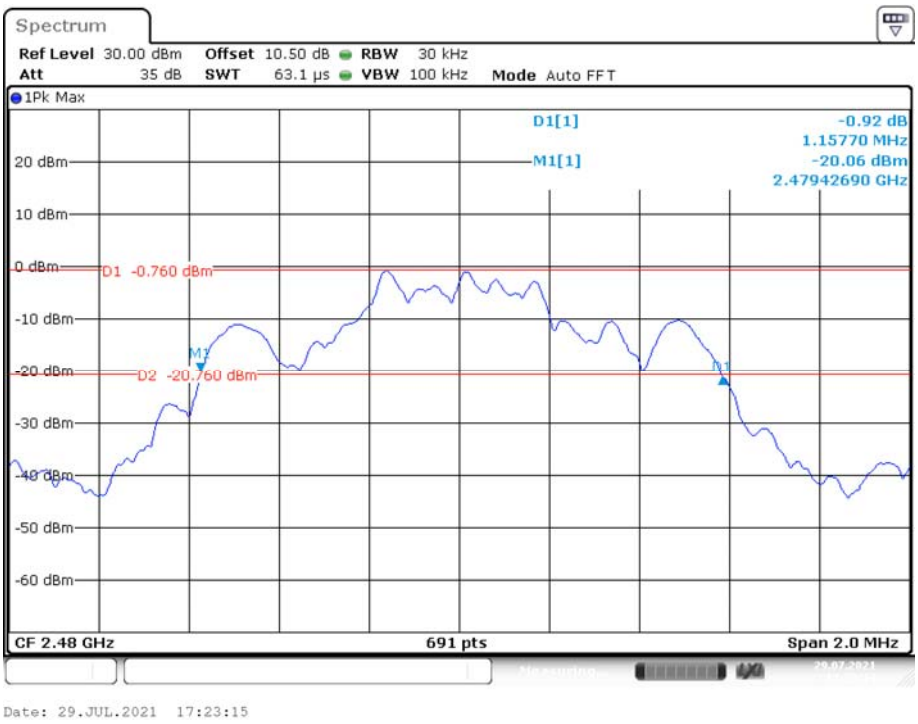
Date: 29.JUL.2021 17:37:00

EDR (8DPSK): Middle Channel



Date: 29.JUL.2021 17:25:13

EDR (8DPSK): High Channel



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

Applicable Standard

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

Test Procedure

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 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

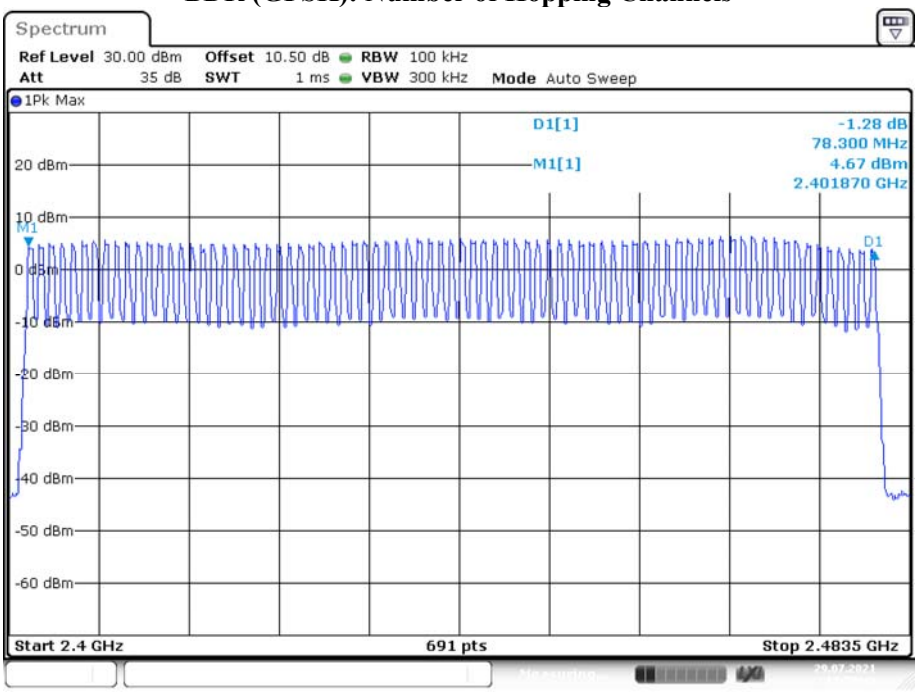
The testing was performed by LYA on 2021-07-29.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following table and plots.

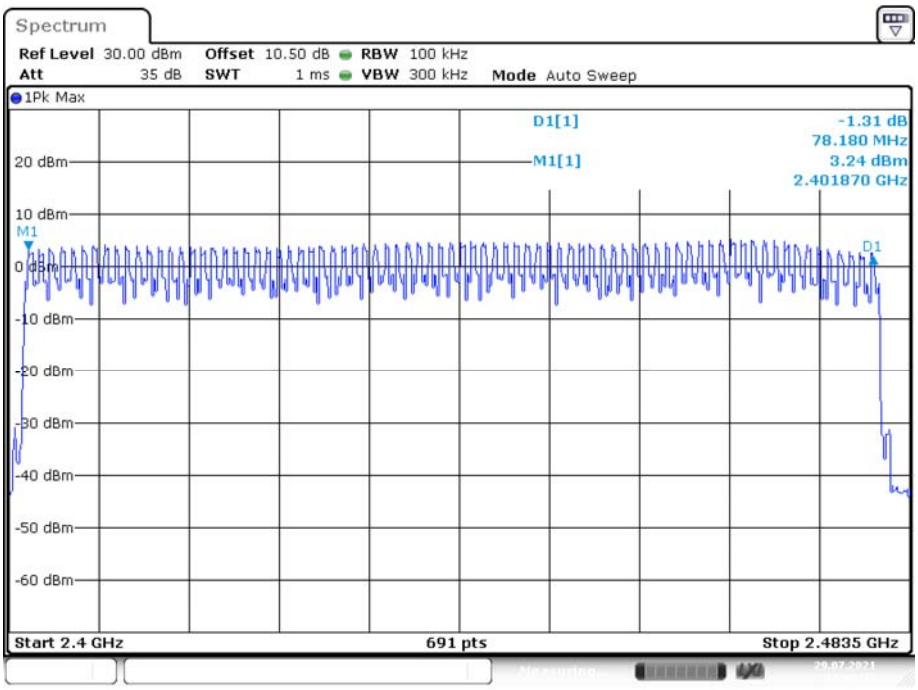
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



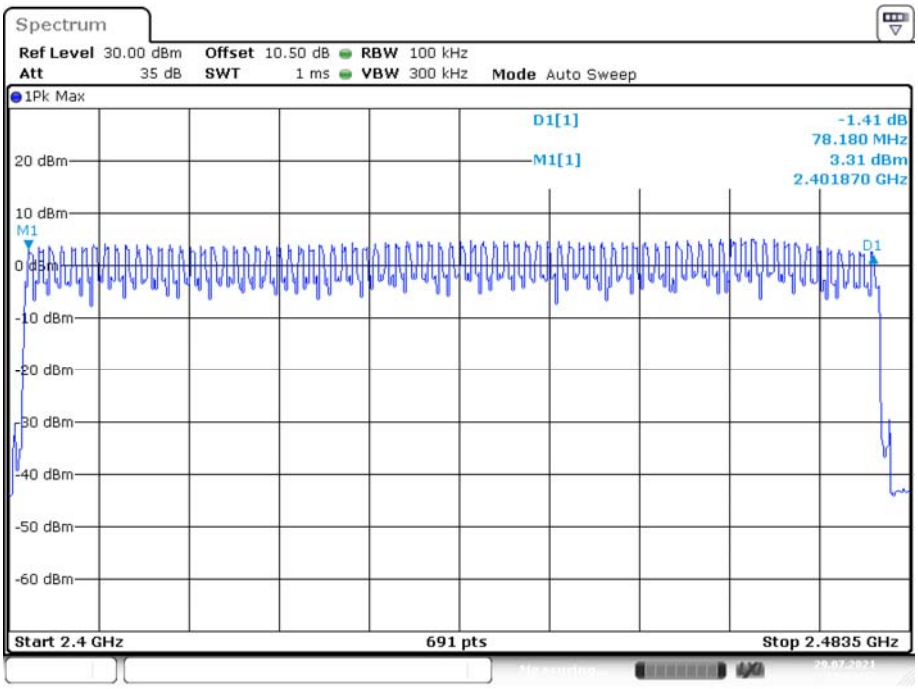
Date: 29.JUL.2021 17:58:40

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



Date: 29.JUL.2021 18:01:36

EDR (8DPSK): Number of Hopping Channels



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

Applicable Standard

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

Test Procedure

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 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by LYA from 2021-08-06 to 2021-08-12.

EUT operation mode: Transmitting

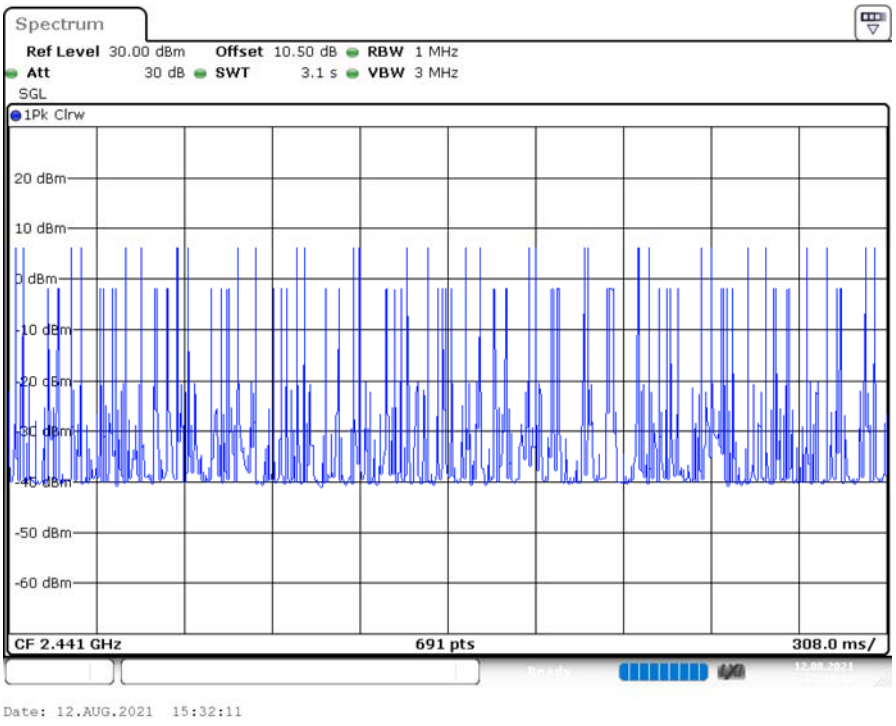
Test Result: Compliant. Please refer to following table and plots

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.39	320	0.125	<=0.4	PASS
DH3	Hop	1.65	140	0.231	<=0.4	PASS
DH5	Hop	2.91	110	0.320	<=0.4	PASS
2DH1	Hop	0.39	310	0.121	<=0.4	PASS
2DH3	Hop	1.66	170	0.281	<=0.4	PASS
2DH5	Hop	2.91	110	0.320	<=0.4	PASS
3DH1	Hop	0.39	300	0.117	<=0.4	PASS
3DH3	Hop	1.66	150	0.248	<=0.4	PASS
3DH5	Hop	2.92	130	0.380	<=0.4	PASS

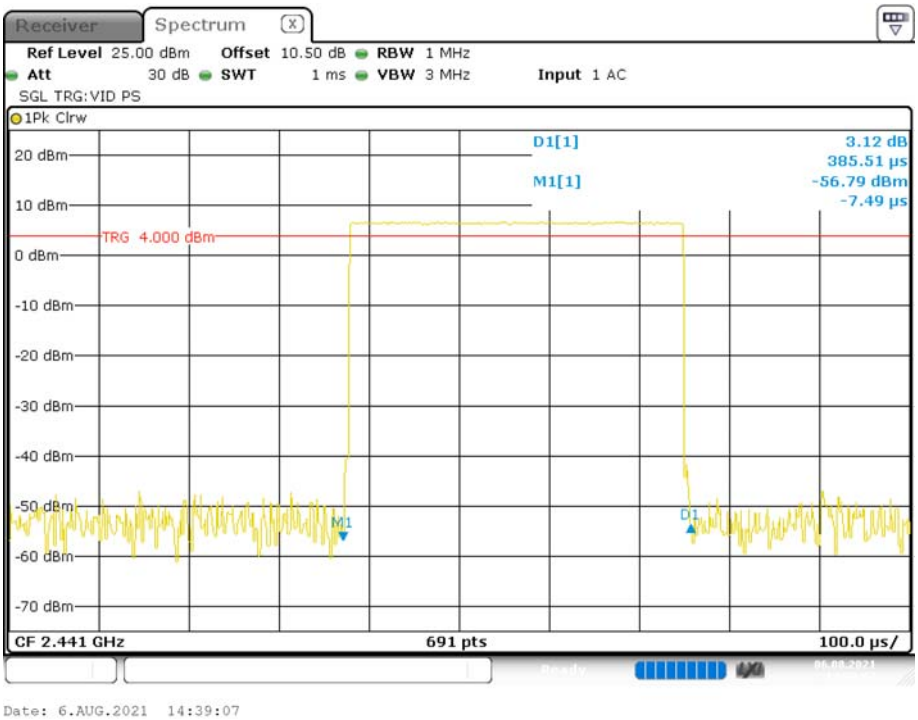
Note 1: A period time=0.39*79=30.81 (S), Result= Pulse Time *Total hops
Note 2: Total hops=Hopping Number in 3.08s*10
Note 3: Hopping Number in 3.08s=Total of highest signals in 3.08s (Second high signals were other channel)

BDR (GFSK):

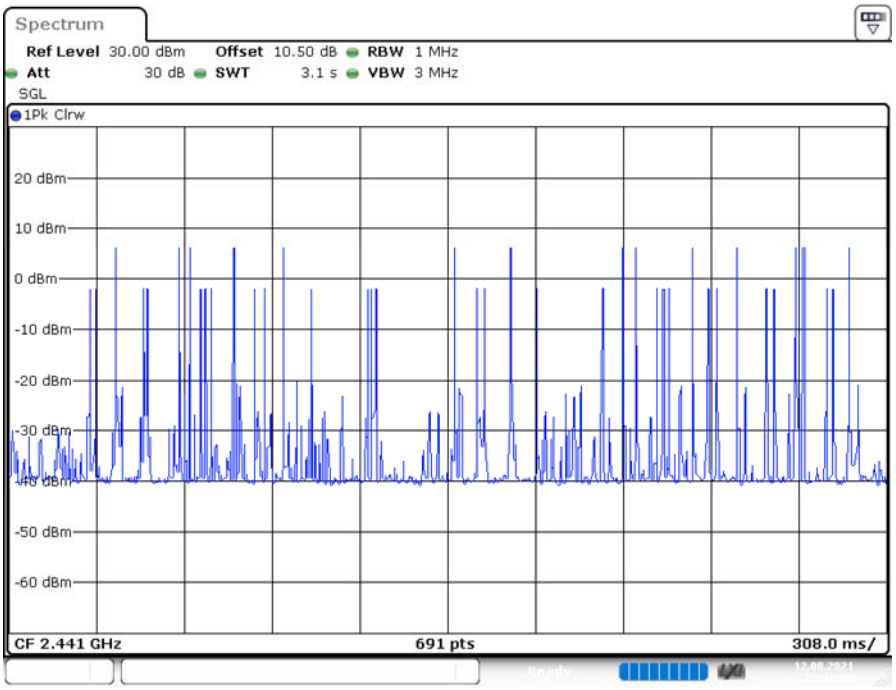
Hopping, DH1



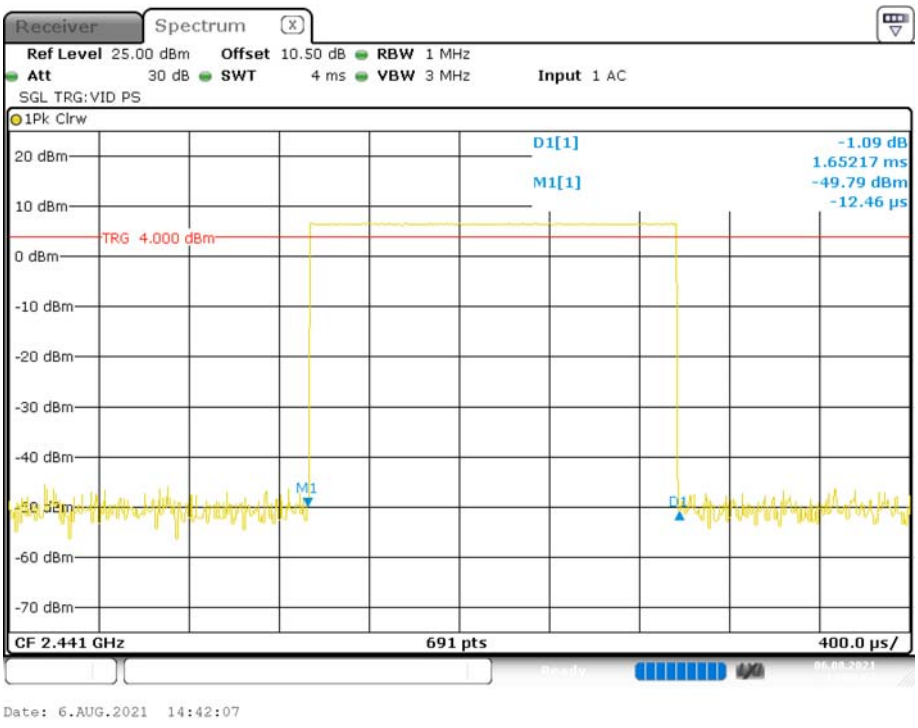
Pulse time, DH1



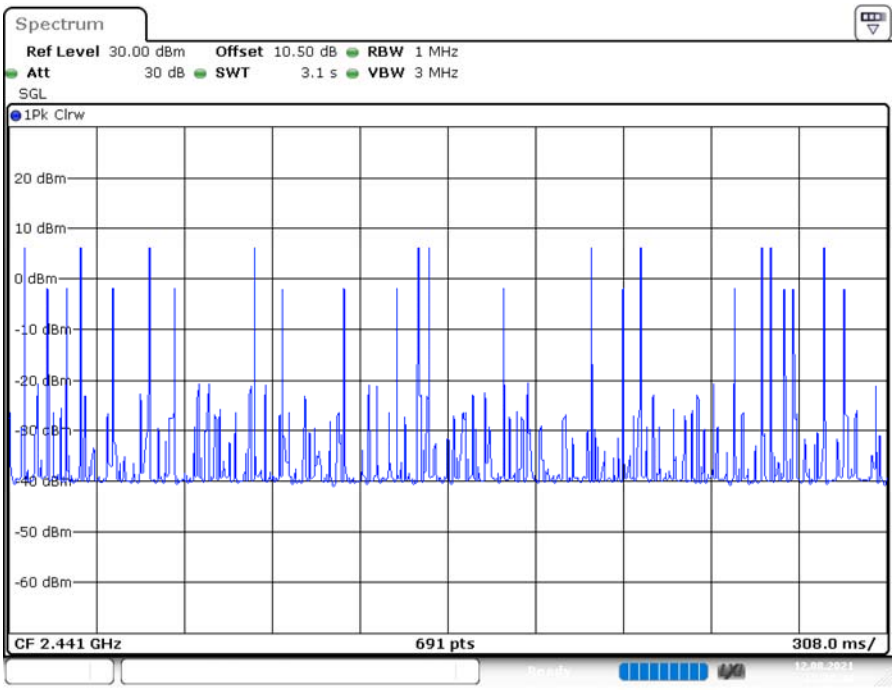
Hopping, DH3



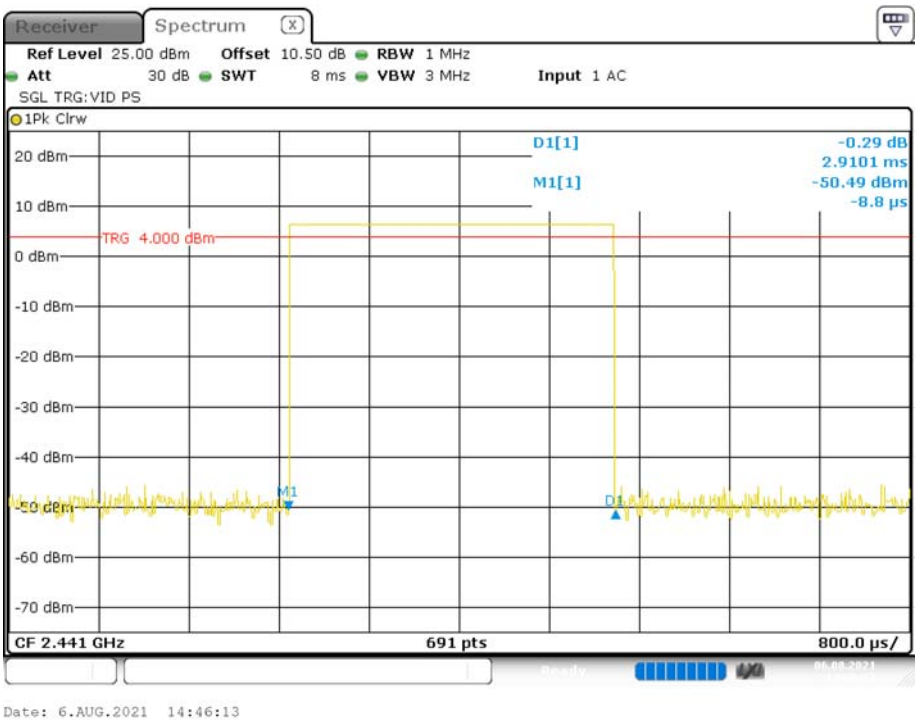
Pulse time, DH3



Hopping, DH5

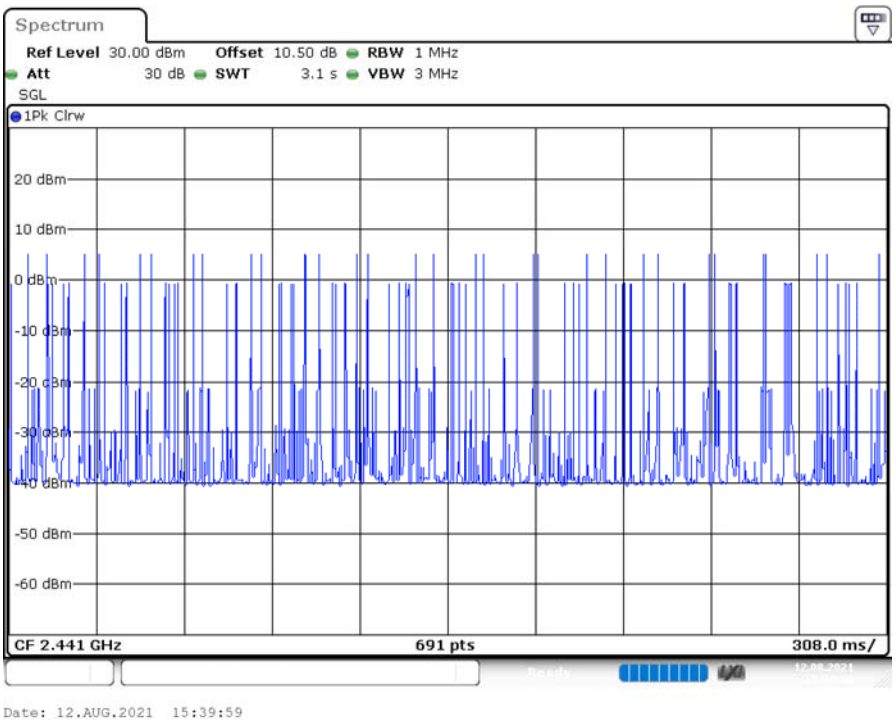


Pulse time, DH5

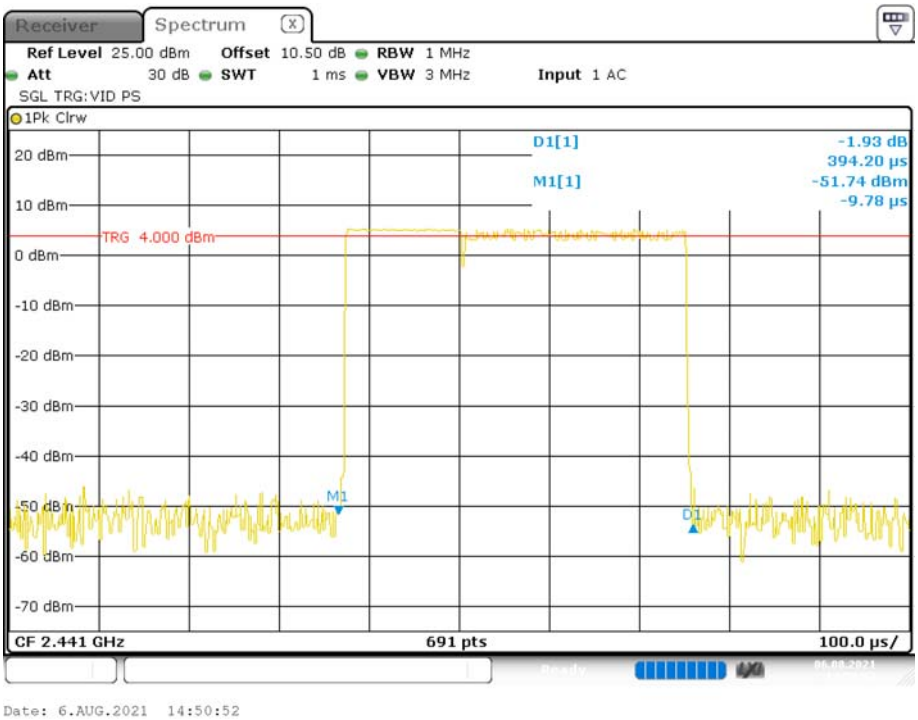


EDR (π/4-DQPSK):

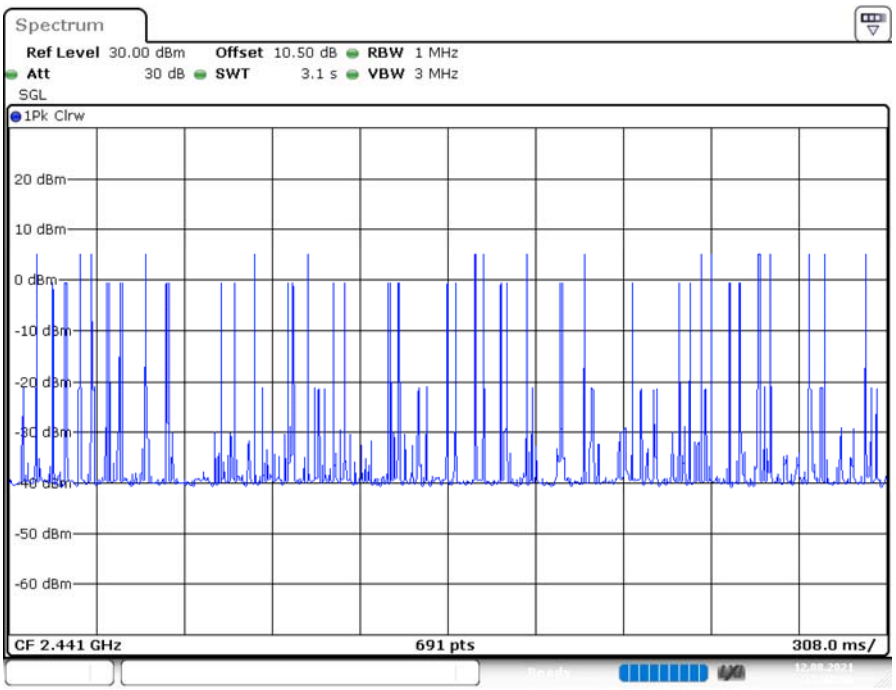
Hopping, 2DH1



Pulse time, 2DH1

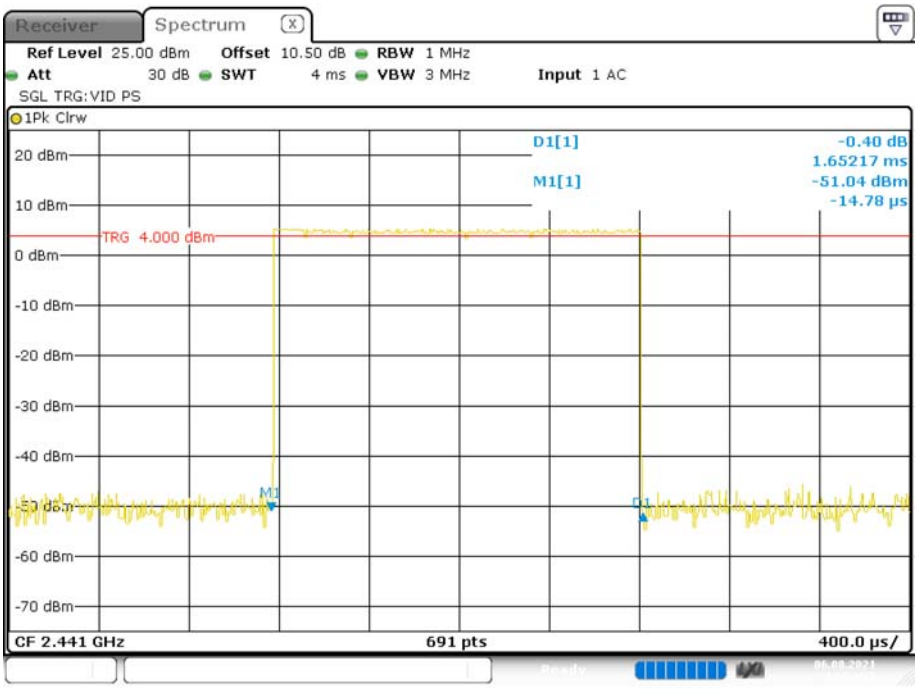


Hopping, 2DH3



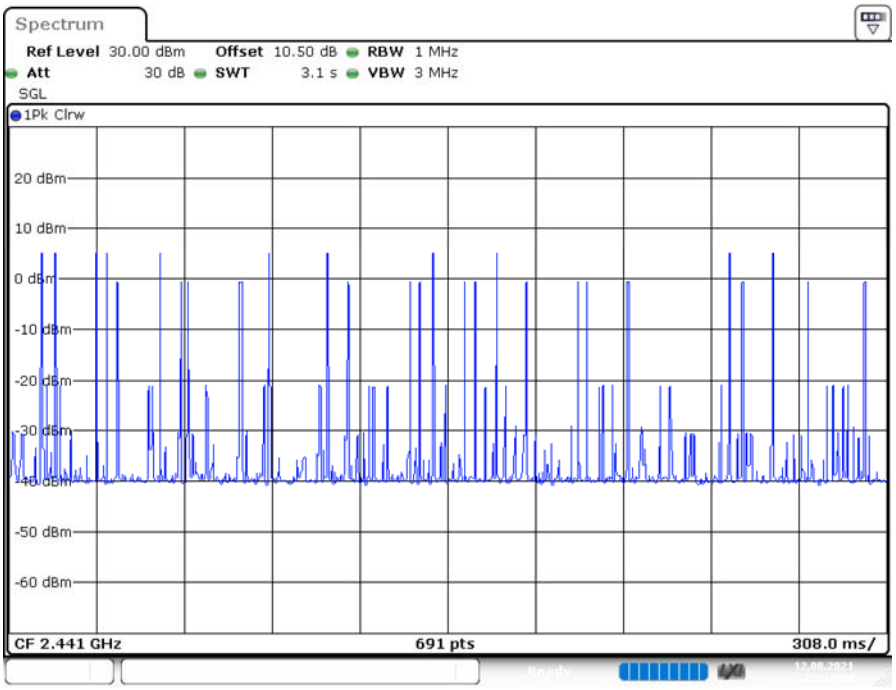
Date: 12.AUG.2021 15:40:57

Pulse time, 2DH3

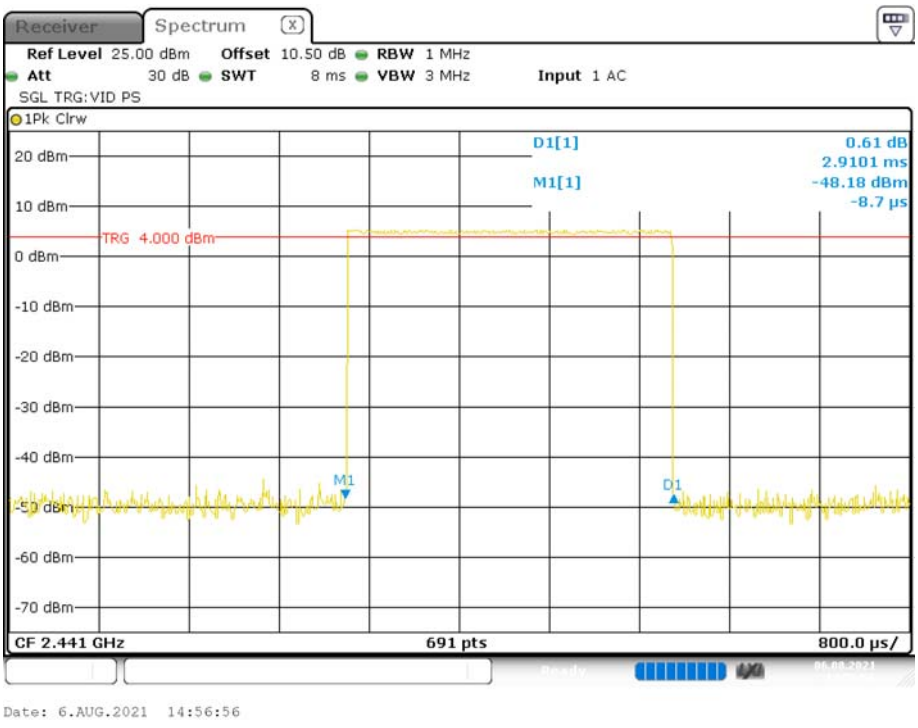


Date: 6.AUG.2021 14:54:15

Hopping, 2DH5

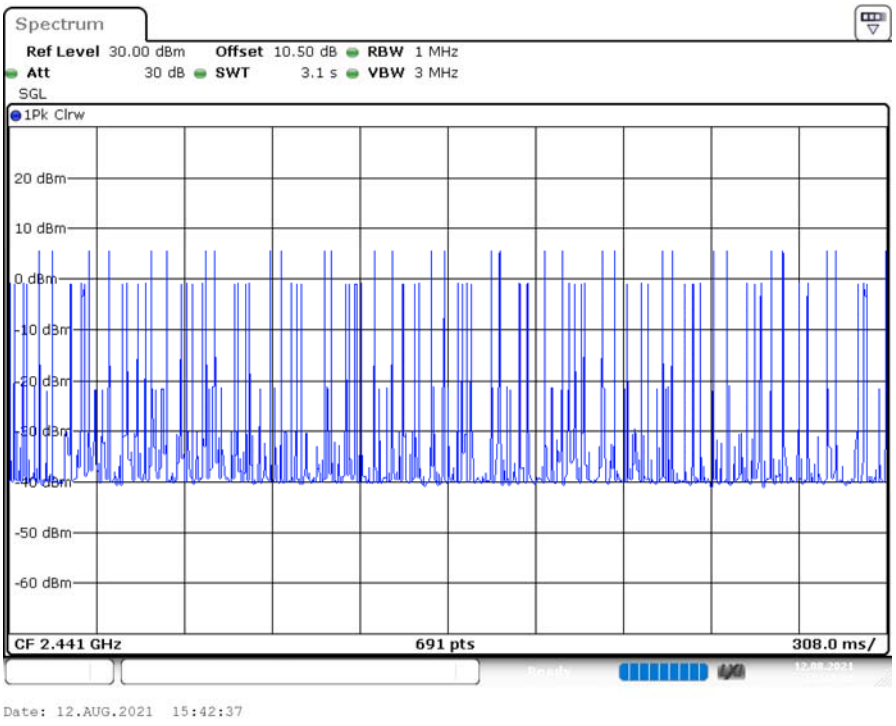


Pulse time, 2DH5

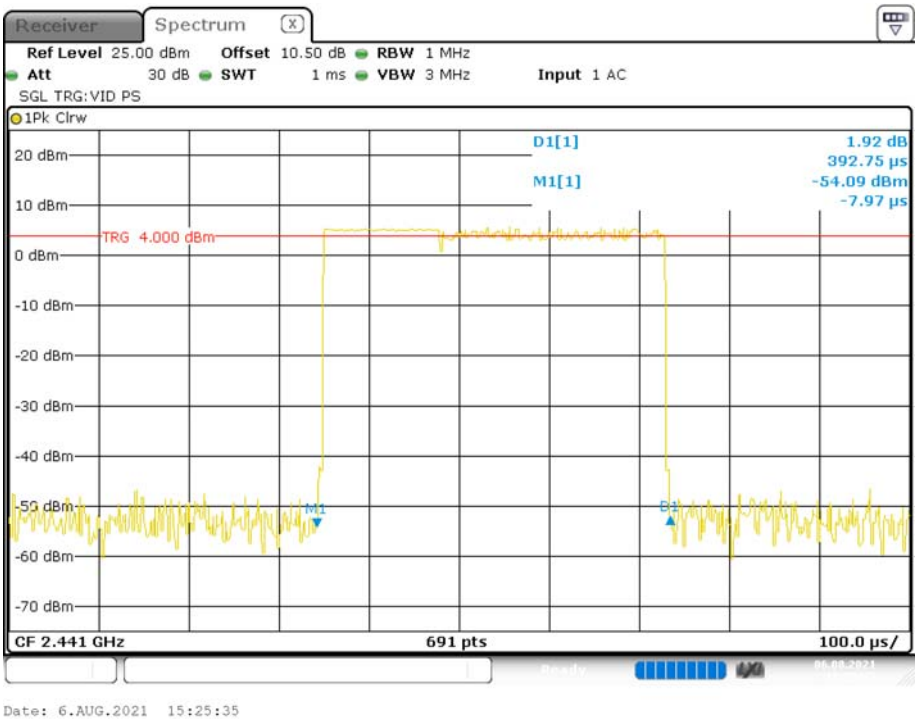


EDR (8DPSK)

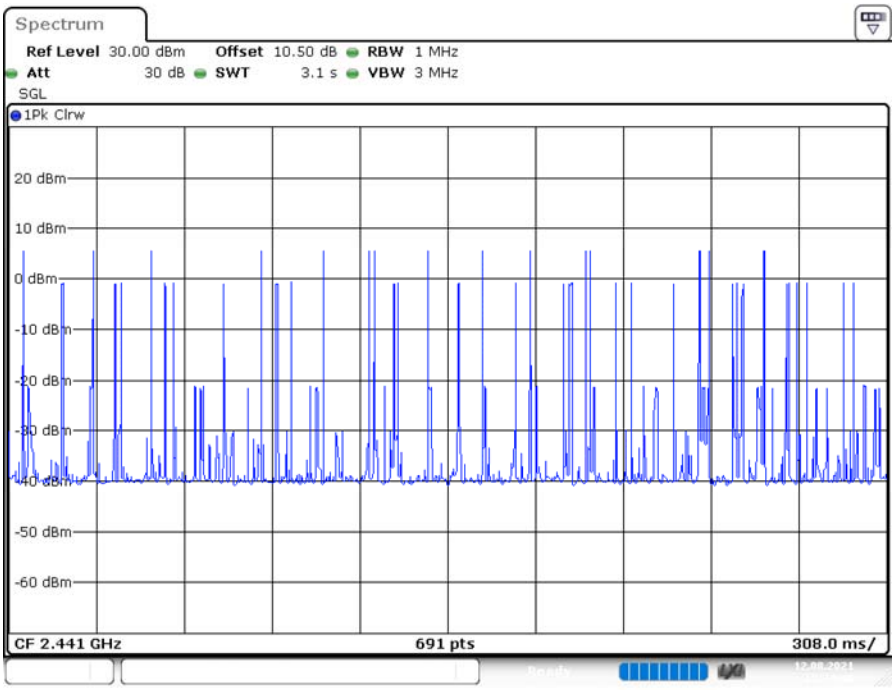
Hopping, 3DH1



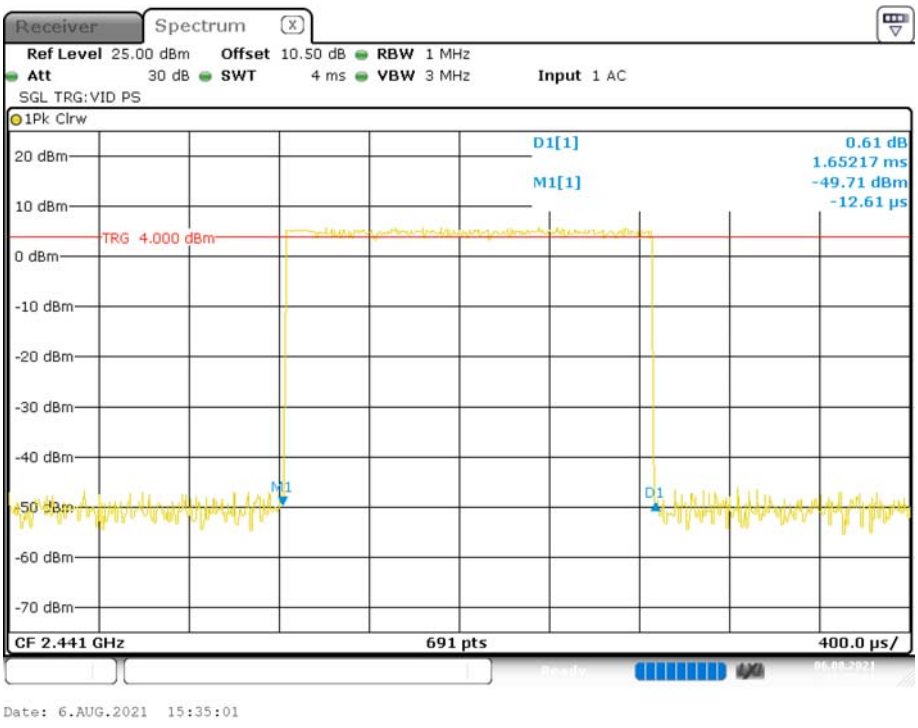
Pulse time, 3DH1



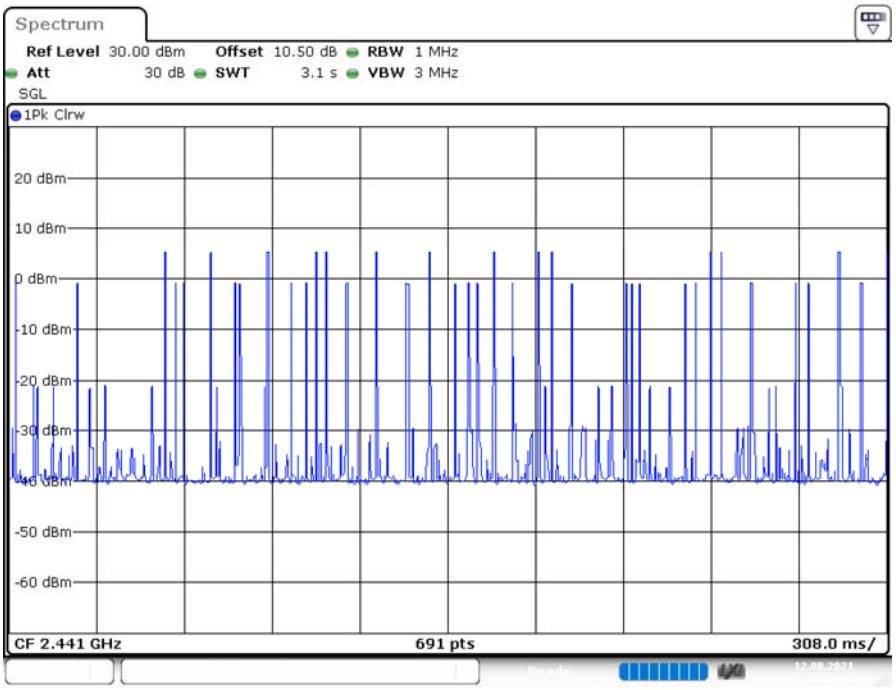
Hopping, 3DH3



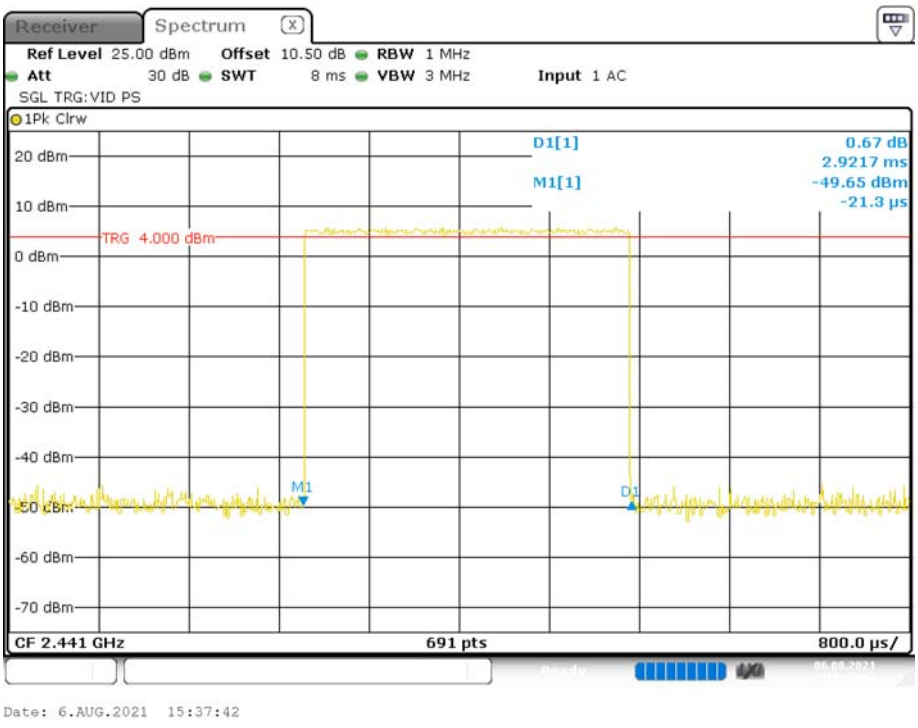
Pulse time, 3DH3



Hopping, 3DH5



Pulse time, 3DH5



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

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

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 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

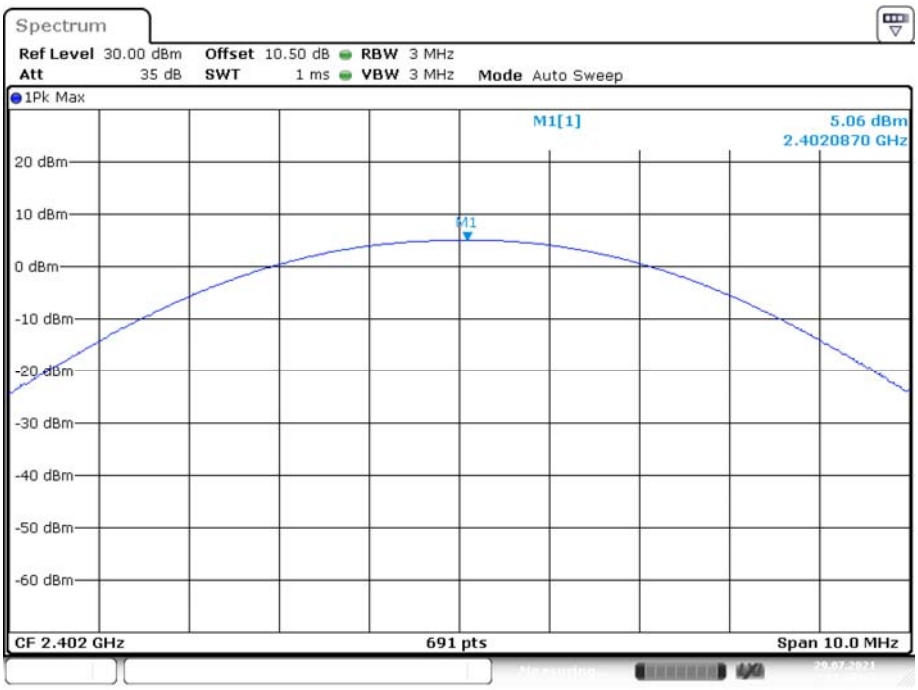
The testing was performed by LYA on 2021-07-29.

EUT operation mode: Transmitting

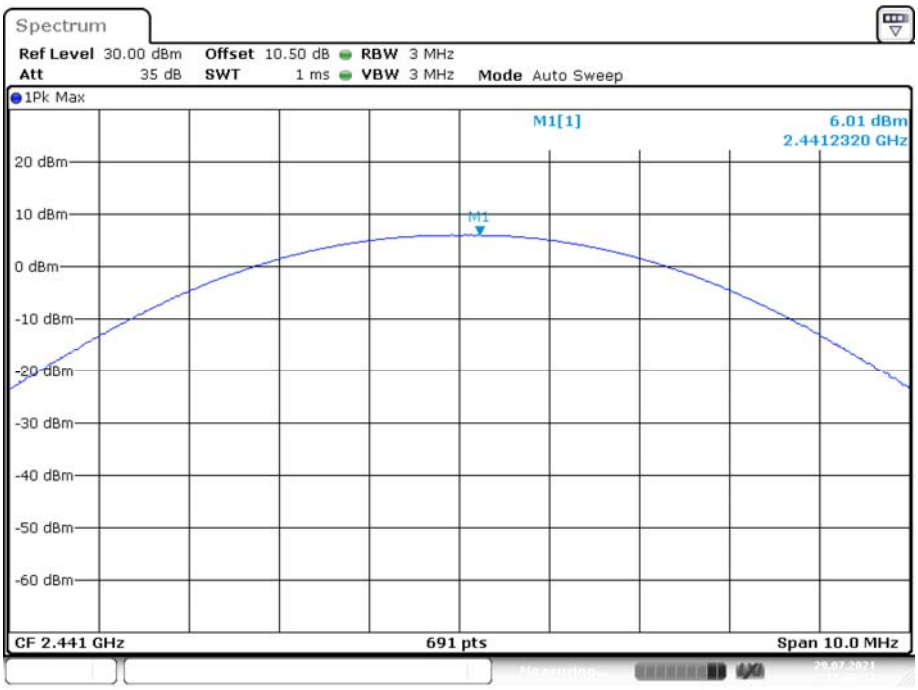
Test Result: Compliant. Please refer to following table.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR (GFSK)	Low	2402	5.06	21
	Middle	2441	6.01	21
	High	2480	4.16	21
EDR (π/4-DQPSK)	Low	2402	3.87	21
	Middle	2441	5.03	21
	High	2480	3.18	21
EDR (8DPSK)	Low	2402	3.88	21
	Middle	2441	5.02	21
	High	2480	3.21	21

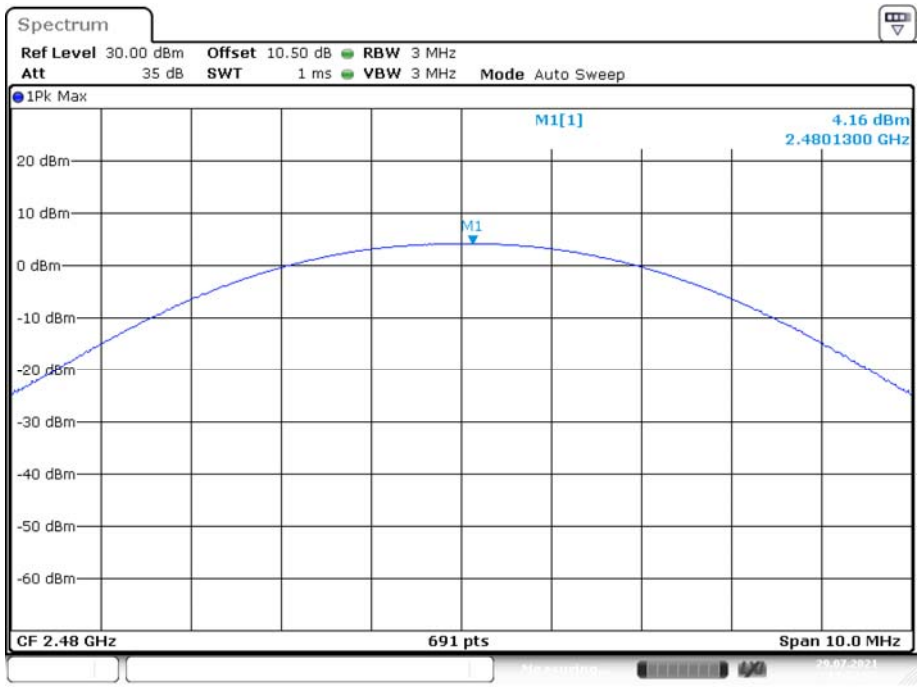
BDR(GFSK) : Low Channel



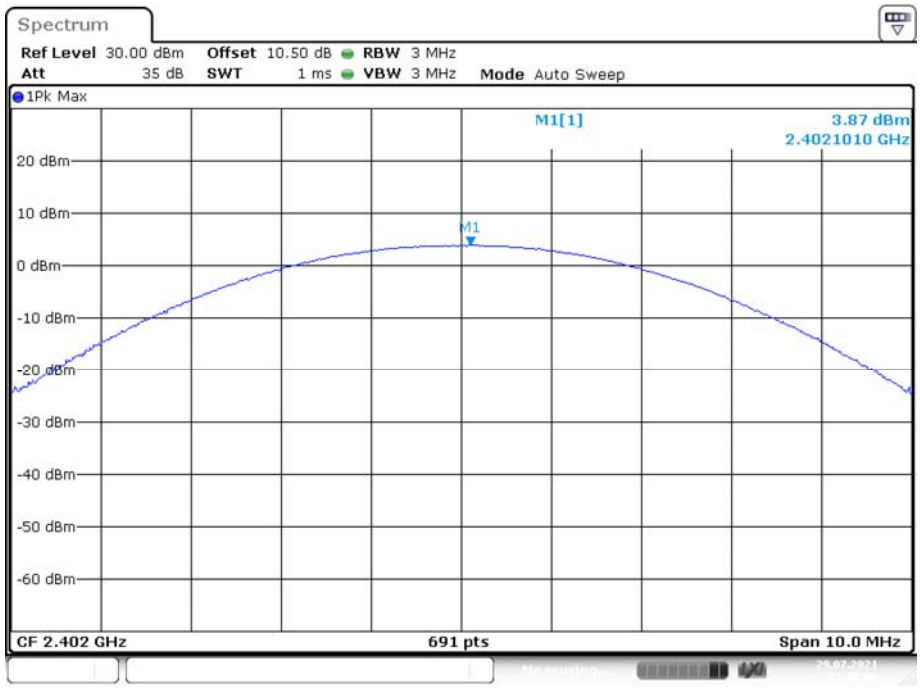
BDR(GFSK) : Middle Channel



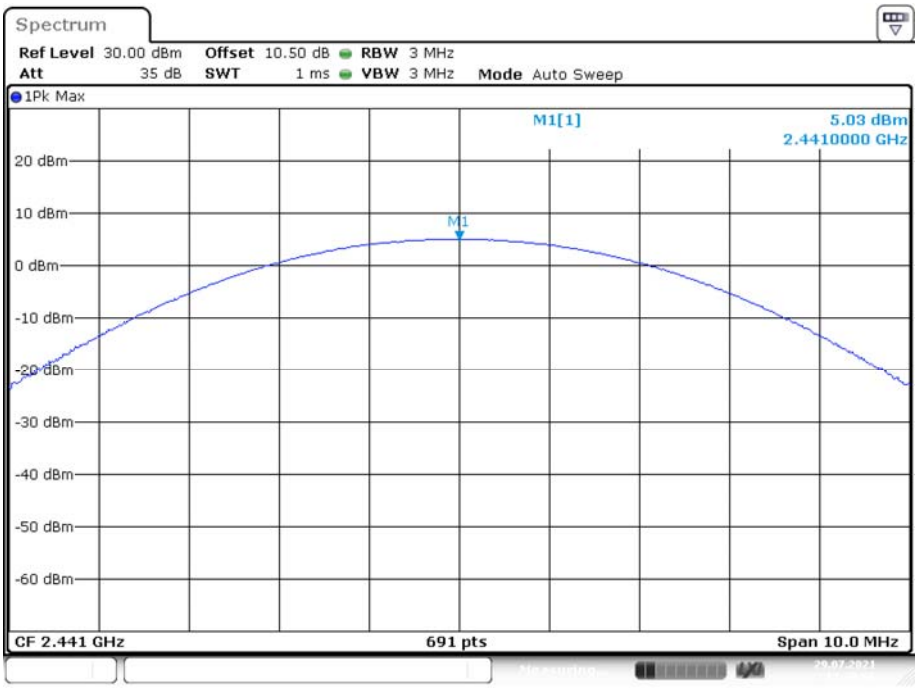
BDR(GFSK) : High Channel



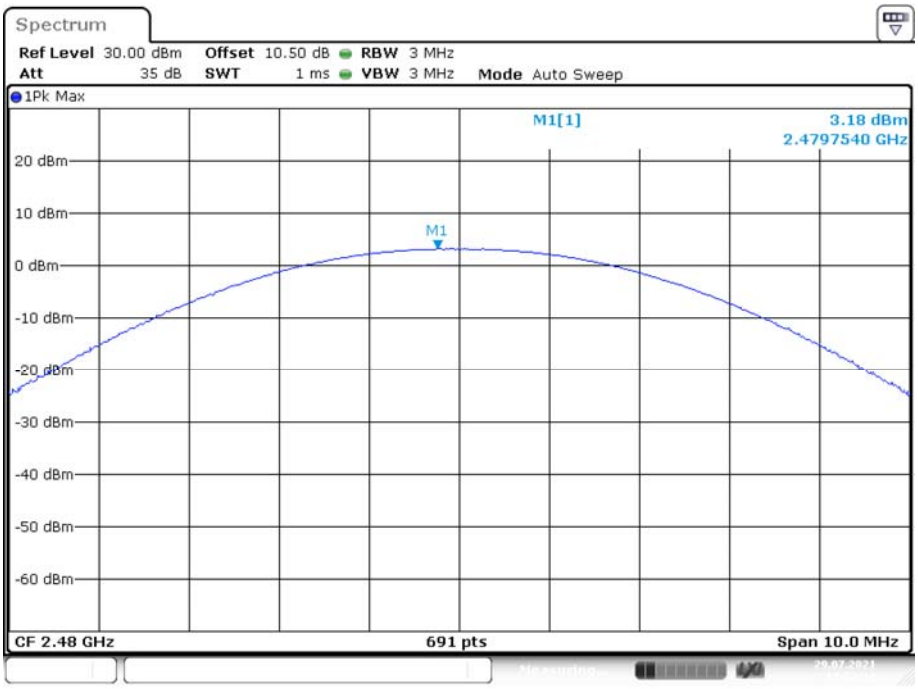
EDR (π/4-DQPSK): Low Channel



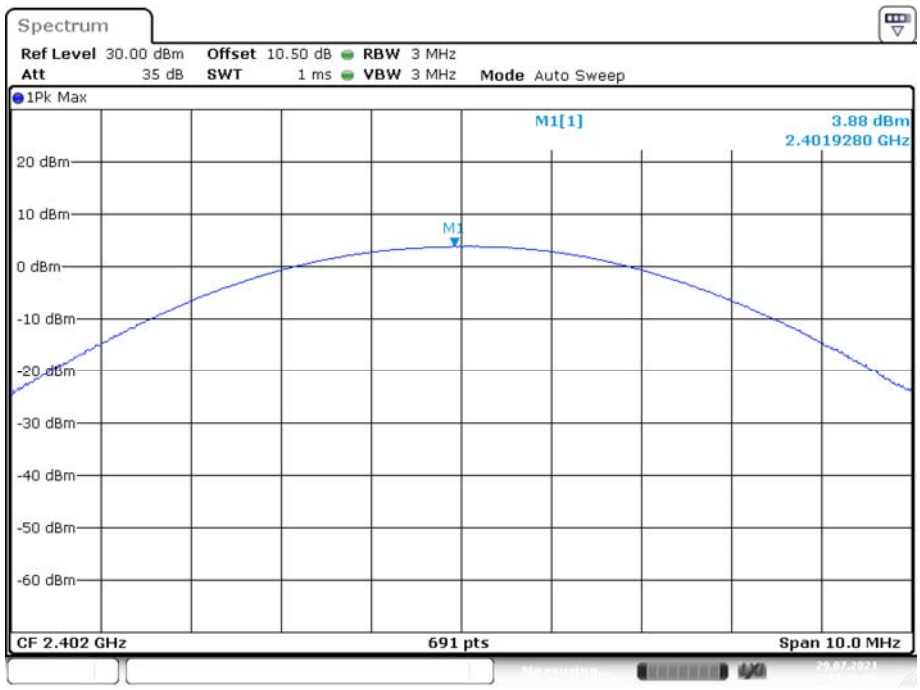
EDR (π/4-DQPSK): Middle Channel



EDR (π/4-DQPSK): High Channel



EDR (8DPSK): Low Channel



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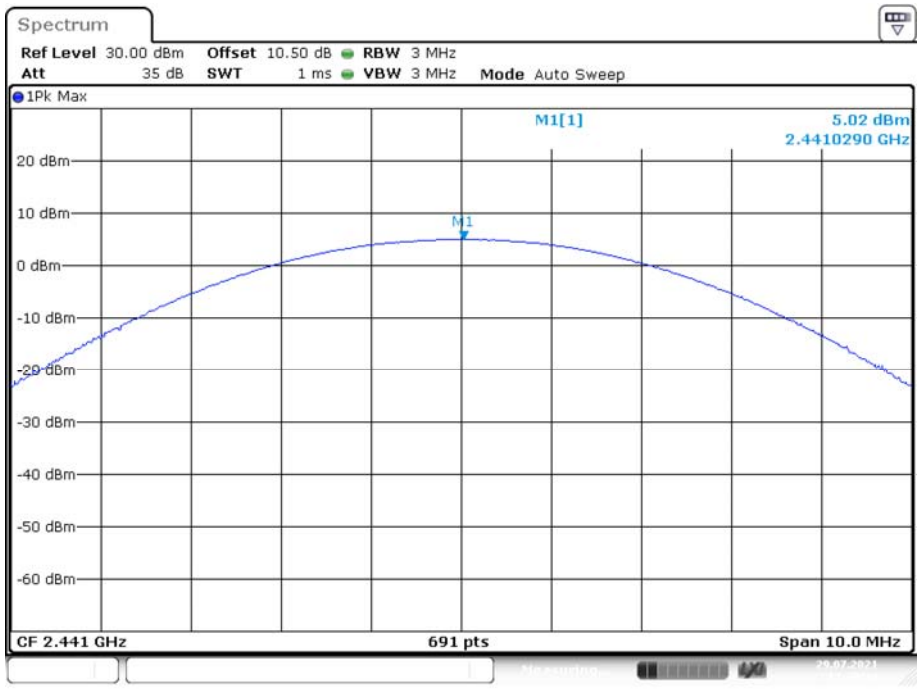
EDR (8DPSK): Middle Channel



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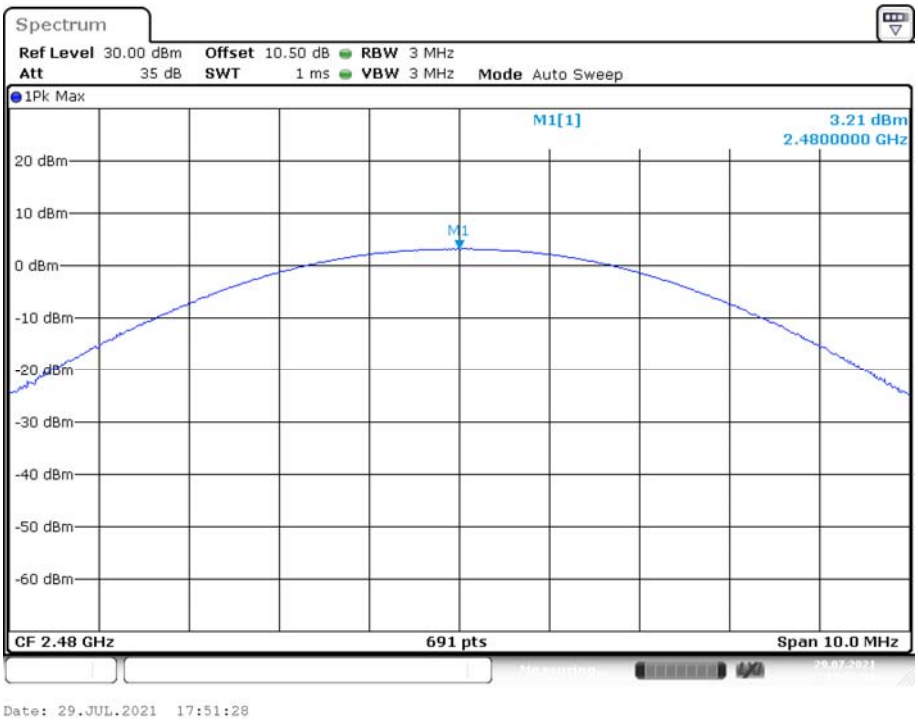
EDR (8DPSK): High Channel



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

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 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

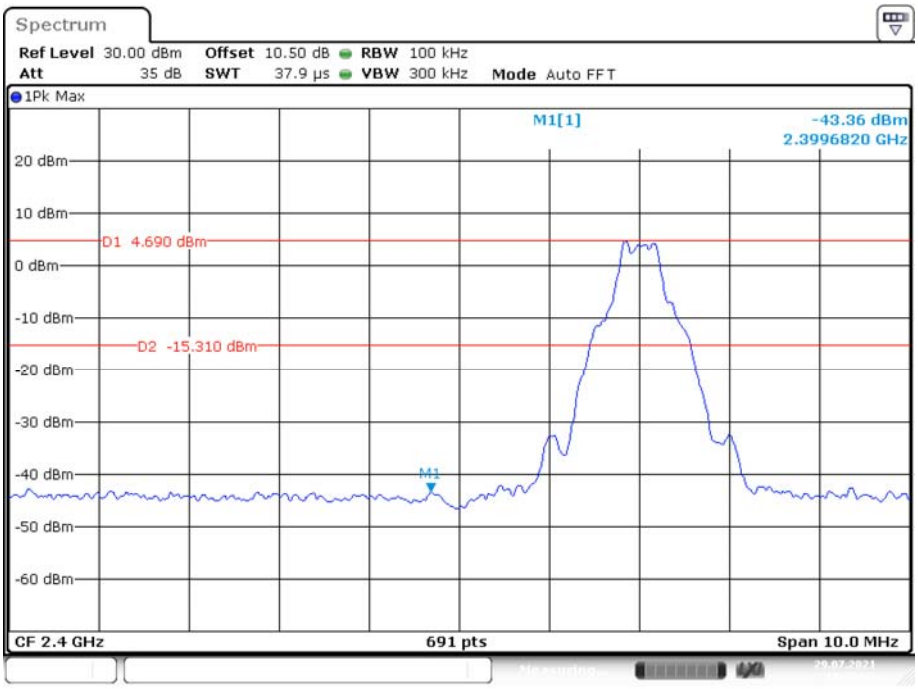
The testing was performed by LYA on 2021-07-29.

EUT operation mode: Transmitting

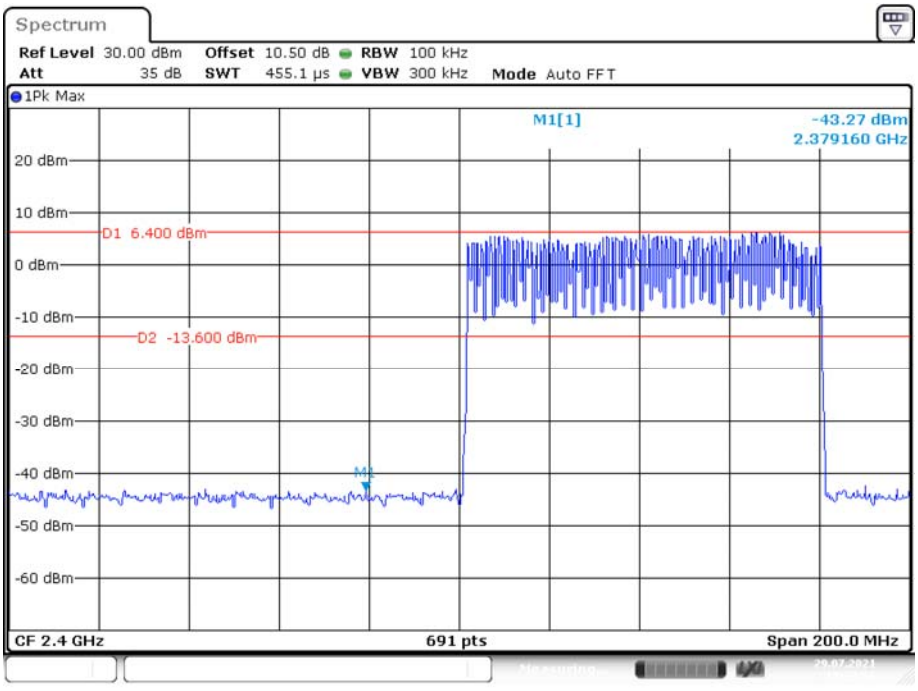
Test Result: Compliant. Please refer to following plots.

BDR (GFSK): Band Edge-Left Side

Single

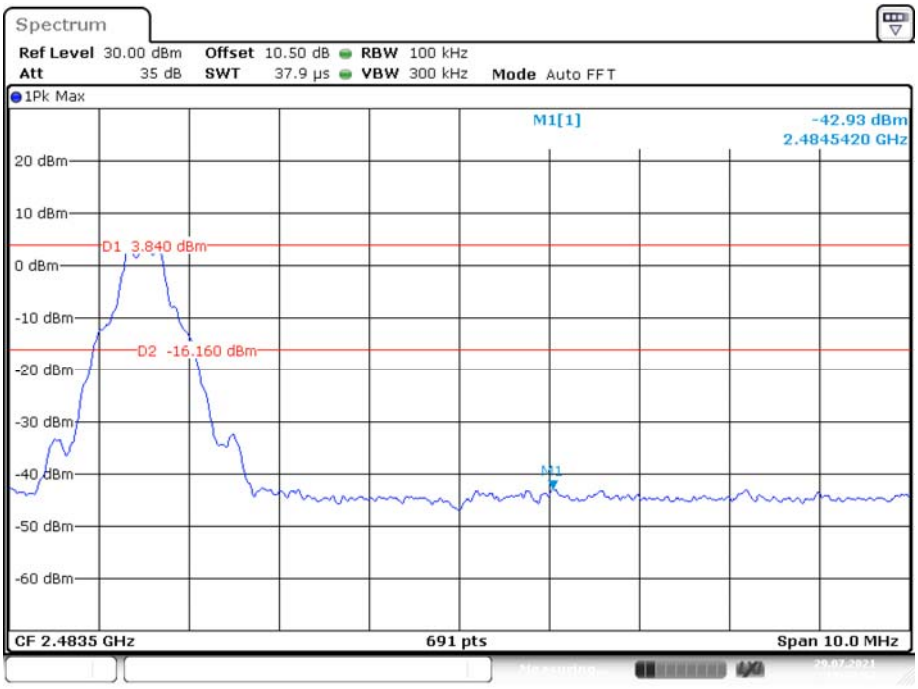


Hopping



BDR (GFSK): Band Edge-Right Side

Single



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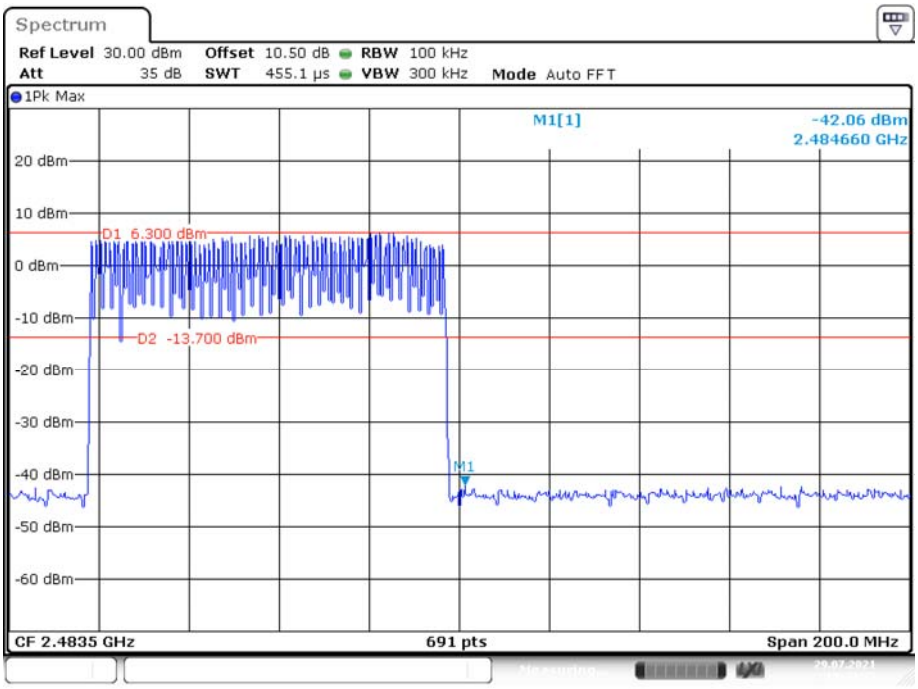
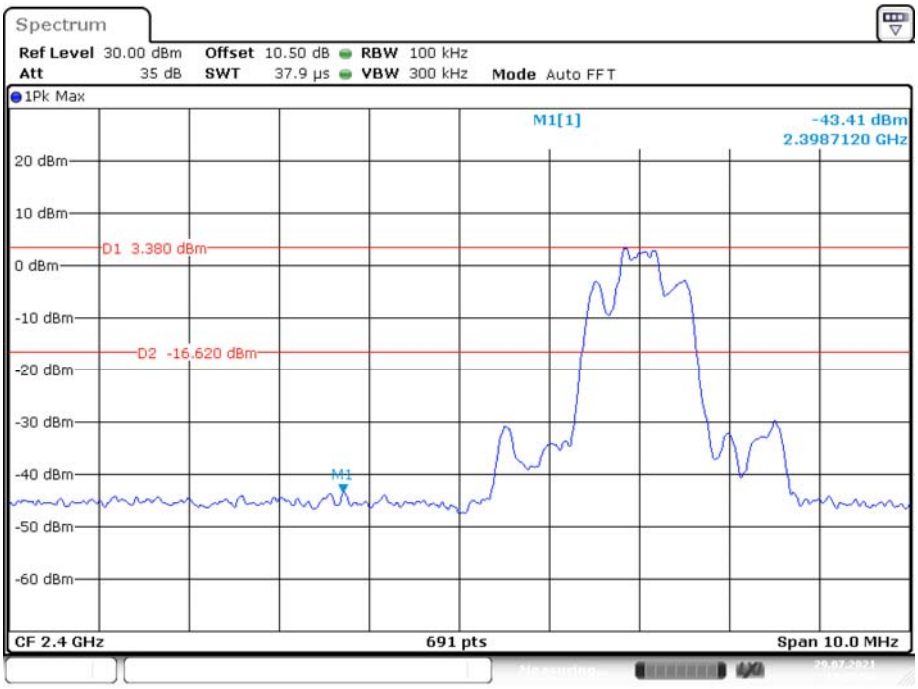
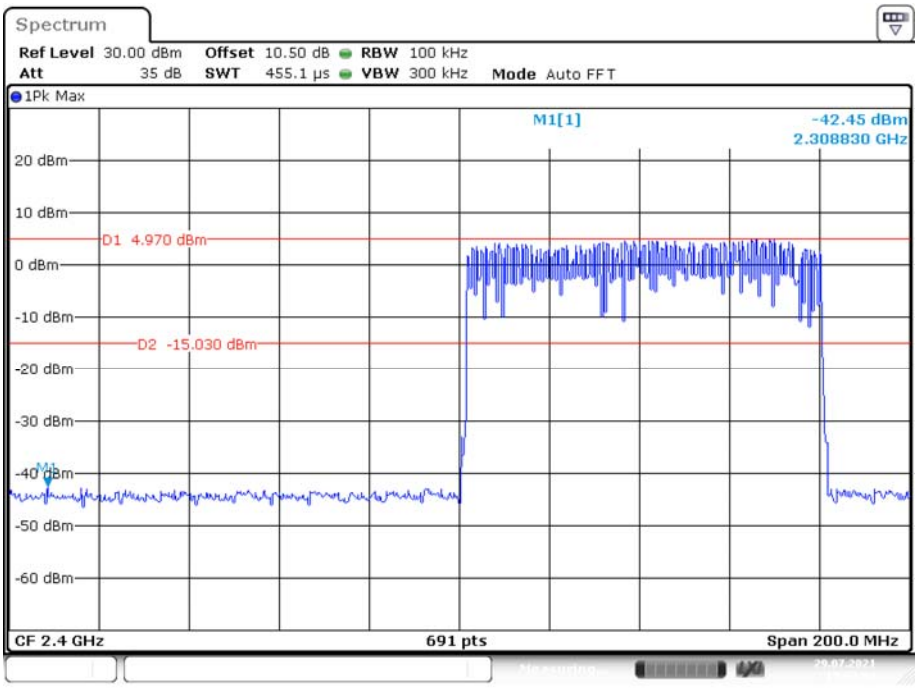


EDR (π/4-DQPSK): Band Edge-Left Side

Single

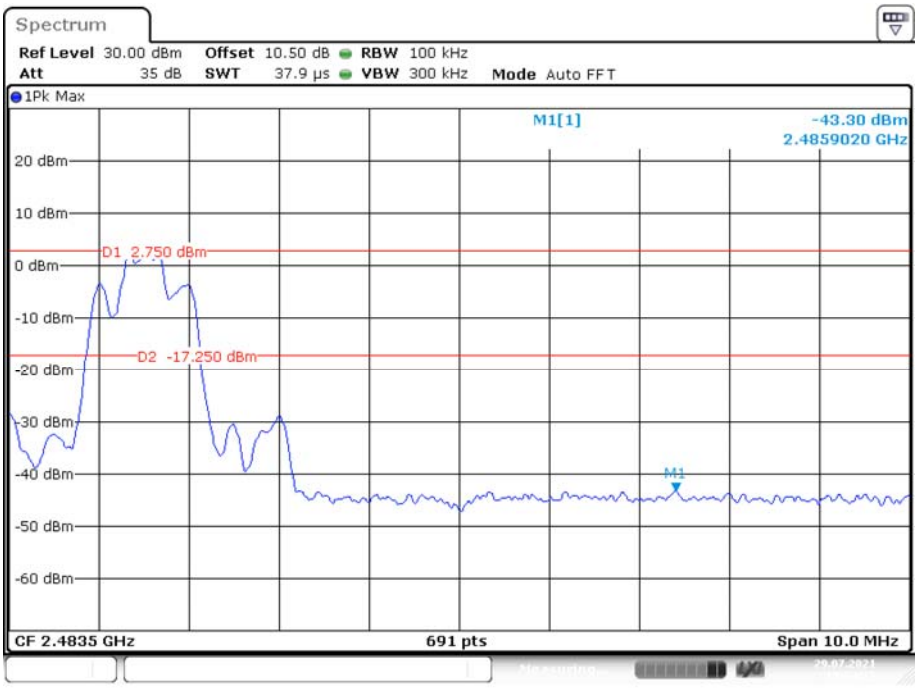


Hopping

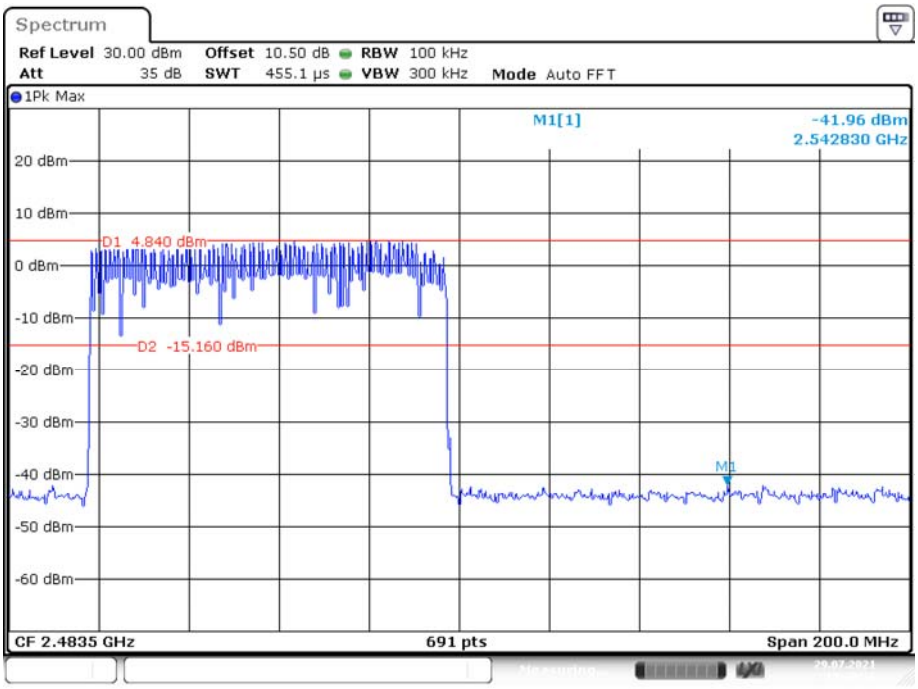


EDR (π/4-DQPSK): Band Edge-Right Side

Single

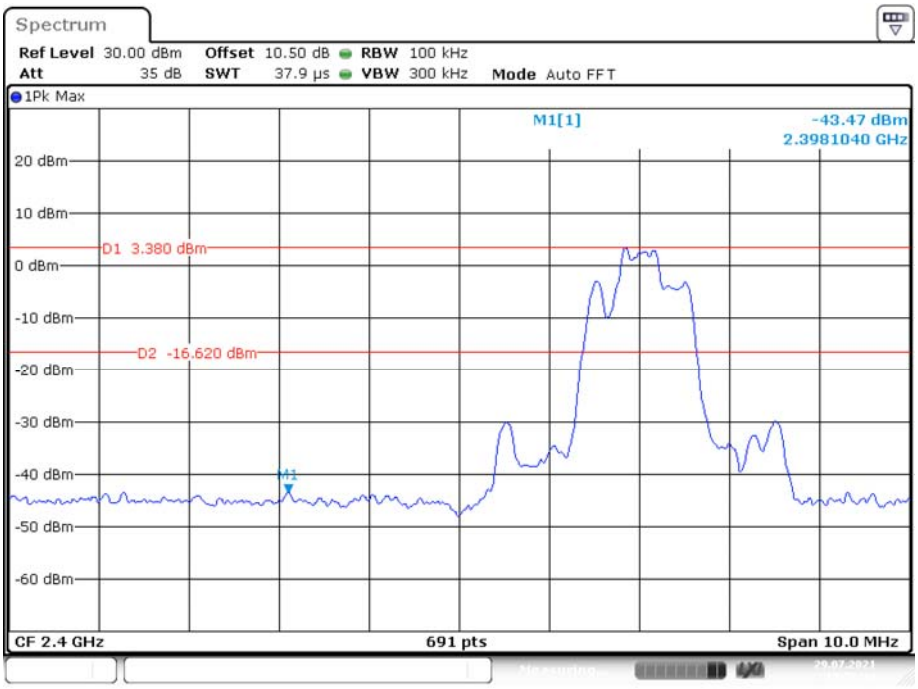


Hopping



EDR (8DPSK): Band Edge-Left Side

Single



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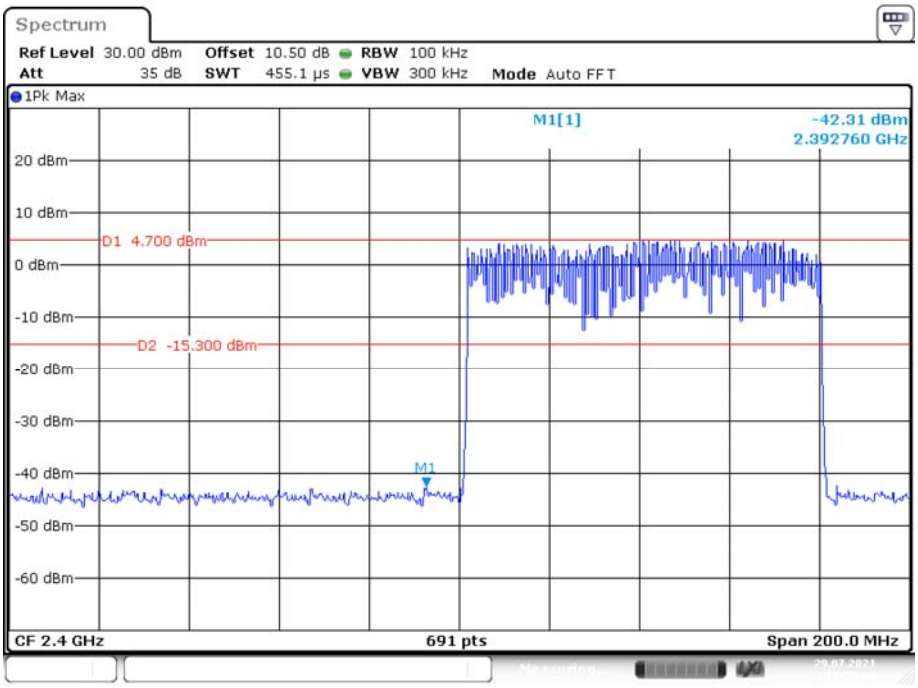
Hopping



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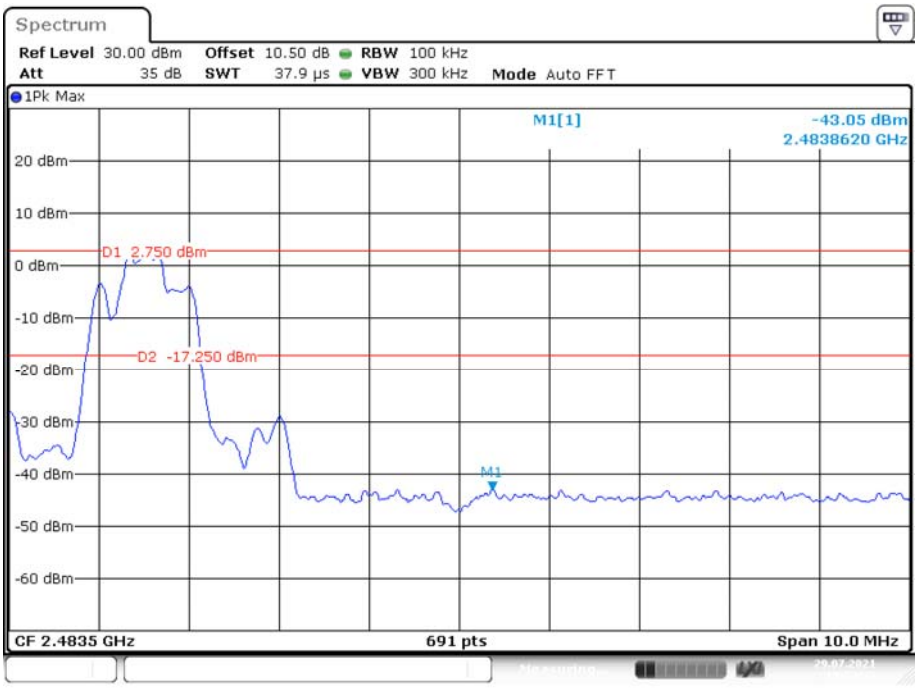
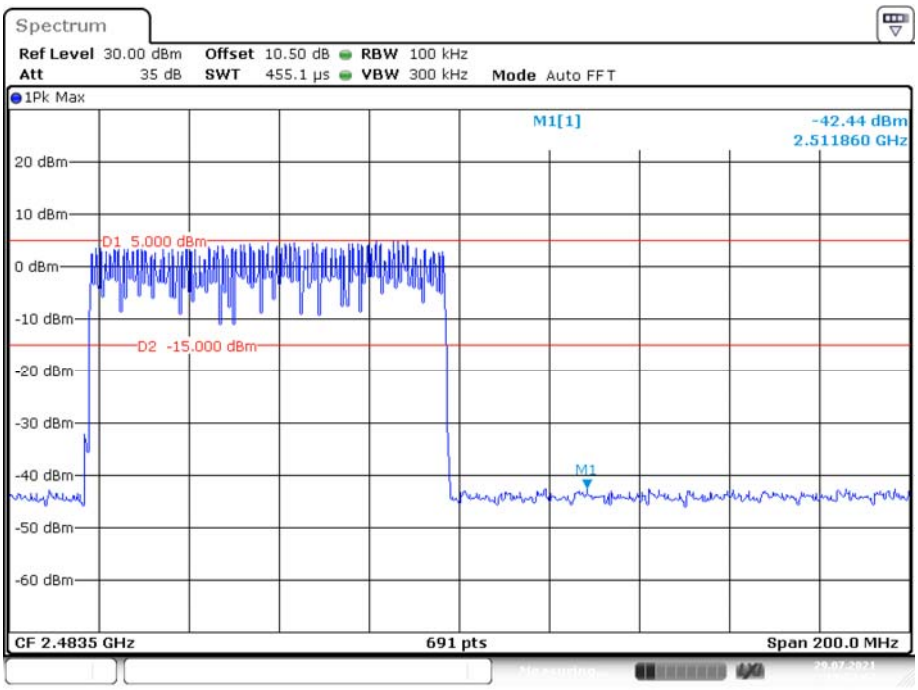
EDR (8DPSK): Band Edge-Right Side

Single



Hopping



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