TEST REPORT

Applicant Name :	Inrico Technologies Co., Ltd
Address :	3/F, Building No.118, High Tech Industrial Park, 72 Guowei Road, Luohu District, Shenzhen,China
Report Number :	SZGMA210719-29779E-RF-00AA1
FCC ID:	2AIV6-2-T529A

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	Intelligent Two Way Radio
Model No.:	T529A
Trade Mark:	Inrico
Date Received:	2021/07/19
Date of Test:	2021/08/04~2021/11/26
Report Date:	2021/12/03

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.

This report cannot be reproduced except in full, without prior written approval of the Company. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
TEST FACILITY 5
SYSTEM TEST CONFIGURATION **6**
DESCRIPTION OF TEST CONFIGURATION 6
EUT EXERCISE SOFTWARE 6
SPECIAL ACCESSORIES 6
EQUIPMENT MODIFICATIONS 6
SUPPORT EQUIPMENT LIST AND DETAILS 6
EXTERNAL I/O CABLE 6
BLOCK DIAGRAM OF TEST SETUP 7
SUMMARY OF TEST RESULTS **9**
TEST EQUIPMENT LIST **10**
FCC§15.247 (I), §1.1307 (B) (1) &§2.1093 – RF EXPOSURE **12**
APPLICABLE STANDARD 12
FCC §15.203 – ANTENNA REQUIREMENT **13**
APPLICABLE STANDARD 13
ANTENNA CONNECTOR CONSTRUCTION 13
FCC §15.207 (A) – AC LINE CONDUCTED EMISSIONS **14**
APPLICABLE STANDARD 14
EUT SETUP 14
EMI TEST RECEIVER SETUP 14
TEST PROCEDURE 14
TRANSD FACTOR & MARGIN CALCULATION 15
TEST DATA 15
FCC §15.205, §15.209 & §15.247(D) – RADIATED EMISSIONS **18**
APPLICABLE STANDARD 18
EUT SETUP 18
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 19
TEST PROCEDURE 19
FACTOR & MARGIN CALCULATION 19
TEST DATA 19
FCC §15.247(A) (1)-CHANNEL SEPARATION TEST **24**
APPLICABLE STANDARD 24
TEST PROCEDURE 24
TEST DATA 24
FCC §15.247(A) (1) – 20 DB EMISSION BANDWIDTH **27**
APPLICABLE STANDARD 27
TEST PROCEDURE 27
TEST DATA 28

FCC §15.247(A) (1) (III)-QUANTITY OF HOPPING CHANNEL TEST 34
APPLICABLE STANDARD 34
TEST PROCEDURE 34
TEST DATA 34
FCC §15.247(A) (1) (III) - TIME OF OCCUPANCY (DWELL TIME) 37
APPLICABLE STANDARD 37
TEST PROCEDURE 37
TEST DATA 37
FCC §15.247(B) (1) - PEAK OUTPUT POWER MEASUREMENT 43
APPLICABLE STANDARD 43
TEST PROCEDURE 43
TEST DATA 43
FCC §15.247(D) - BAND EDGES TESTING 49
APPLICABLE STANDARD 49
TEST PROCEDURE 49
TEST DATA 49

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	Bluetooth: 2402-2480MHz
Maximum conducted peak output power	Bluetooth: 6.31dBm
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 3.7V From Battery
Sample number	SZGMA210719-29779E-RFA1-S1 (RE) SZGMA210719-29779E-RFA1-S2 (RF Conducted Test) (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: HJ-0501000E1-US Input: AC 100-240V, 50/60Hz, 0.2A Output: DC 5.0V, 1000mA

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission 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 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
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
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 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 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), 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

"SP_META_exe_V1.1824.00"* software was use to the EUT tested and power level is 7*. 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

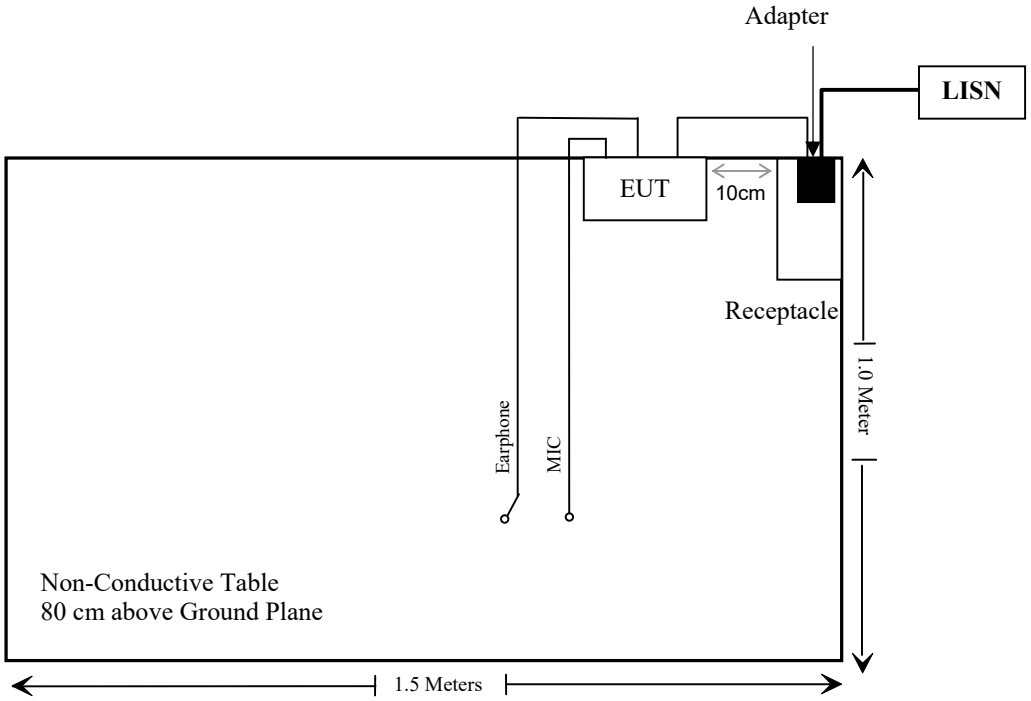
Manufacturer	Description	Model	Serial Number
Inrico	Earphone	Unknown	Unknown
Inrico	MIC	Unknown	Unknown

External I/O Cable

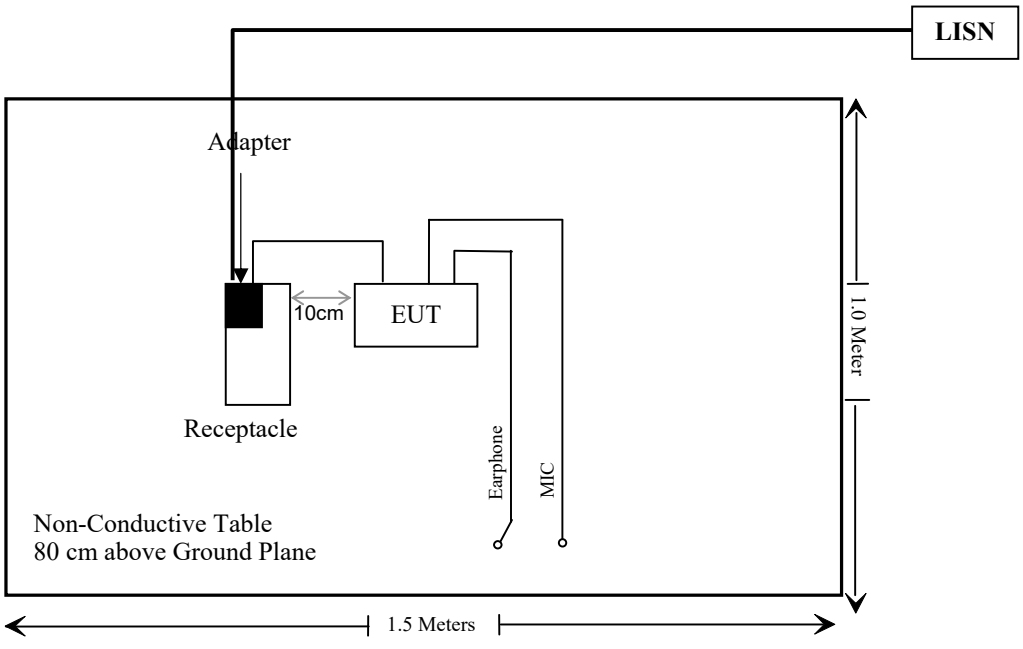
Cable Description	Length (m)	From Port	To
Un-shielding Un-Detachable AC Cable	1.2	LISN	Receptacle
Un-shielding Detachable USB Cable	1.0	EUT	Adapter
Un-shielding Detachable Earphone Cable	1.0	EUT	Earphone
Un-shielding Detachable MIC Cable	1.0	EUT	MIC

Block Diagram of Test Setup

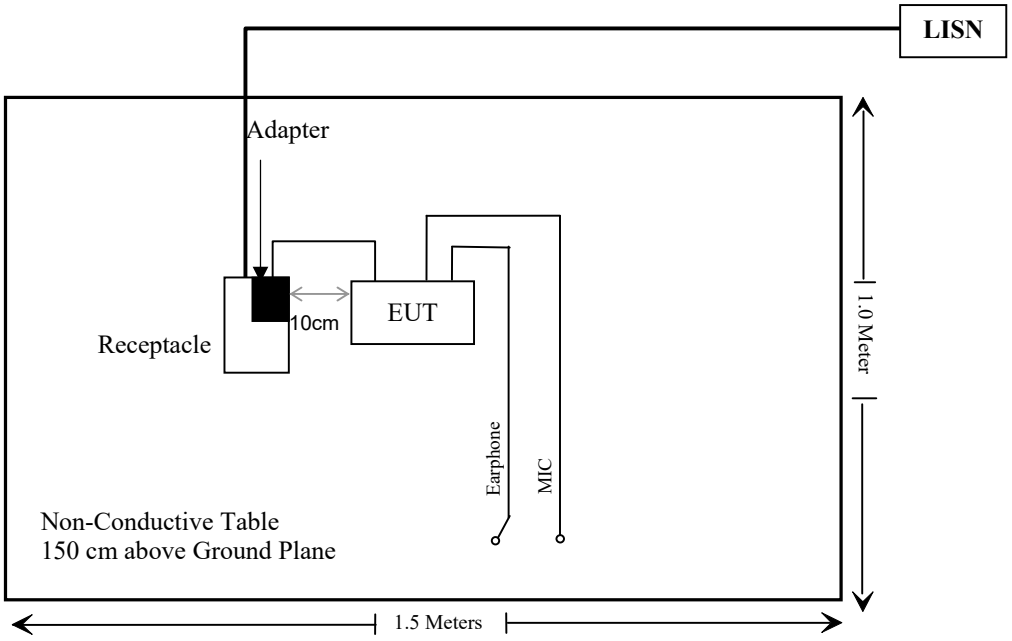
For conducted emission:



For Radiated Emissions(RE Below 1G)



For Radiated Emissions(RE Above 1G)



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	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	2021/11/09	2022/11/08
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
Unknown	RF Coaxial Cable	N-5m	No.3	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-10m	No.7	2021/11/09	2022/11/08
Unknown	RF Coaxial Cable	N-2m	No.8	2021/11/09	2022/11/08
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2020/12/25	2021/12/24
Radiated Emission Test Software: EZ_EMC V 1.1.4.2 (For Below 1GHz)					
Radiated Emission Test Software: e3 19821b (V9) (For Above 1GHz)					

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
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
WEINSCHEL	10dB Attenuator	5324	AU 3842	2020/12/25	2021/12/24

*** 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), §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:

Mode	Frequency (MHz)	Maximum Tune-up power		Calculated Distance (mm)	Calculated Value	Threshold (1-g SAR)	SAR Test Exclusion
		(dBm)	(mW)				
BDR/EDR	2480	7.0	5.01	5	1.6	3.0	**Yes**

Result: Compliant.

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.

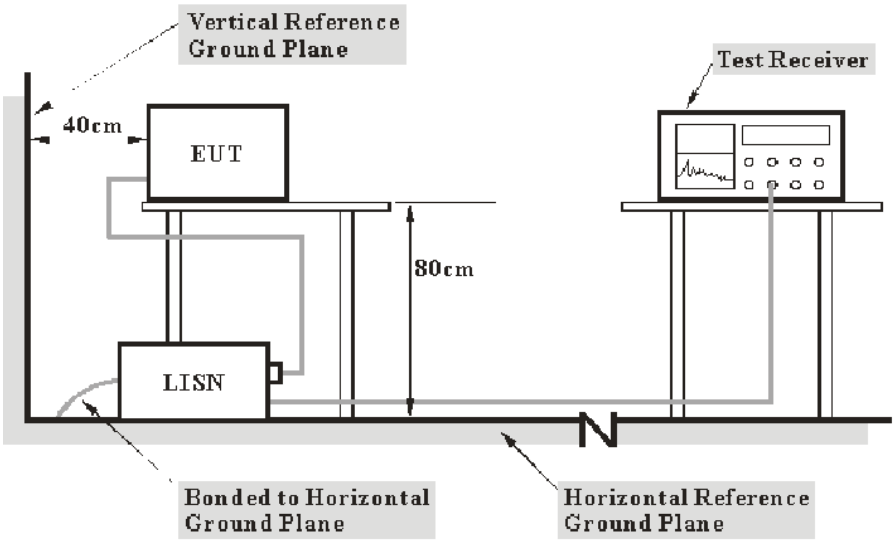
Result: Compliant.

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.

Transd 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

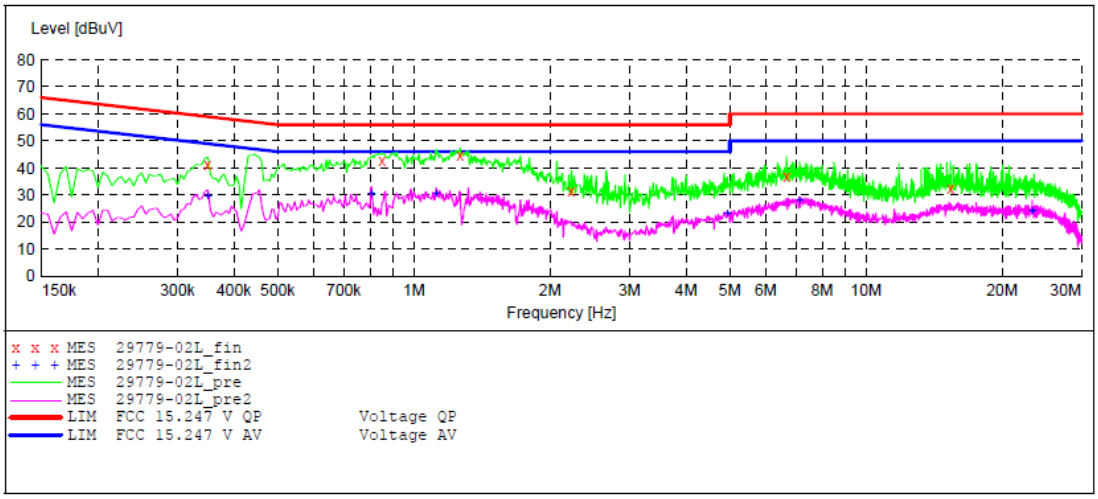
Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Bin Duan on 2021-10-19.

EUT operation mode: Transmitting (worst case GFSK Mode, Middle channel)

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "29779-02L_fin"

2021-10-19 10:58

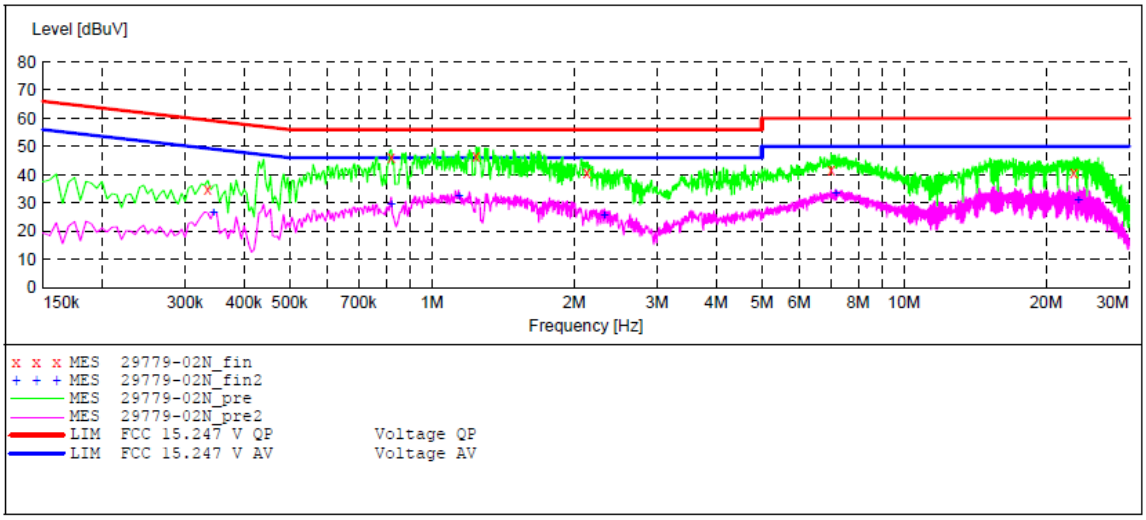
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.350000	41.00	10.9	59	18.0	QP	L1	GND
0.850000	42.90	11.1	56	13.1	QP	L1	GND
1.265000	44.70	11.2	56	11.3	QP	L1	GND
2.230000	31.70	11.3	56	24.3	QP	L1	GND
6.670000	36.90	11.5	60	23.1	QP	L1	GND
15.375000	32.60	11.7	60	27.4	QP	L1	GND

MEASUREMENT RESULT: "29779-02L_fin2"

2021-10-19 10:58

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.350000	29.70	10.9	49	19.3	AV	L1	GND
0.805000	30.50	11.1	46	15.5	AV	L1	GND
1.120000	30.50	11.2	46	15.5	AV	L1	GND
4.940000	23.20	11.4	46	22.8	AV	L1	GND
7.130000	27.90	11.5	50	22.1	AV	L1	GND
23.350000	24.20	11.7	50	25.8	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "29779-02N_fin"

2021-10-19 11:00

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.335000	34.80	10.9	59	24.2	QP	N	GND
0.820000	46.10	11.1	56	9.9	QP	N	GND
1.240000	46.50	11.2	56	9.5	QP	N	GND
2.130000	41.00	11.3	56	15.0	QP	N	GND
7.010000	41.90	11.5	60	18.1	QP	N	GND
22.875000	41.00	11.7	60	19.0	QP	N	GND

MEASUREMENT RESULT: "29779-02N_fin2"

2021-10-19 11:00

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.345000	26.70	10.9	49	22.3	AV	N	GND
0.820000	29.30	11.1	46	16.7	AV	N	GND
1.140000	32.40	11.2	46	13.6	AV	N	GND
2.320000	25.70	11.3	46	20.3	AV	N	GND
7.170000	33.50	11.5	50	16.5	AV	N	GND
23.400000	31.20	11.7	50	18.8	AV	N	GND

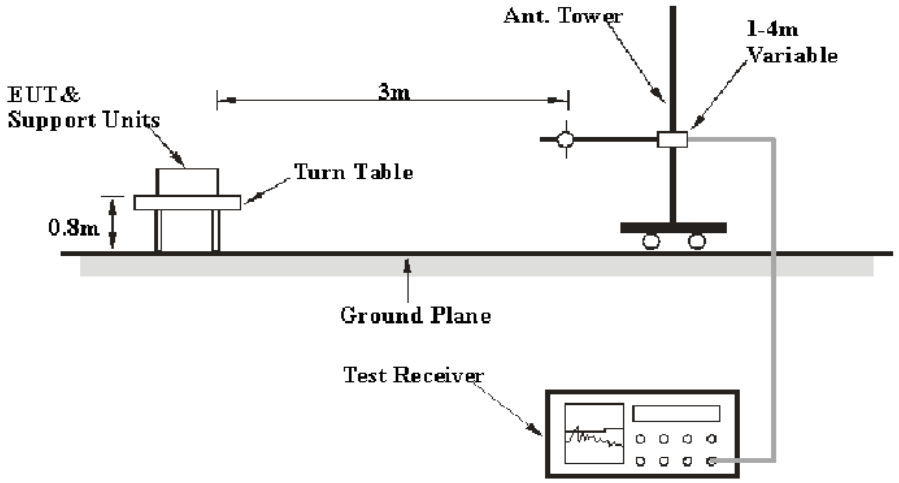
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

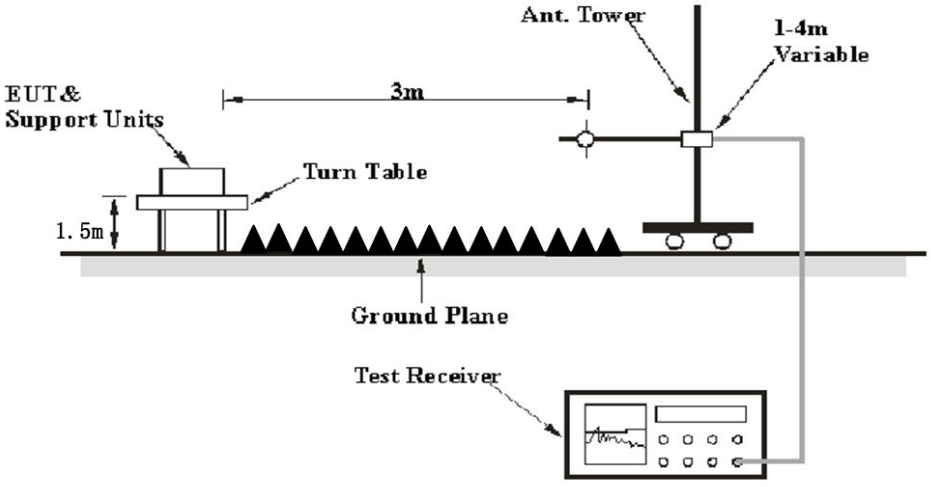
FCC §15.205; §15.209; §15.247(d)

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

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.

Factor & 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 / Corrected Amplitude - Limit
Result / Corrected Amplitude = Reading + Factor

Test Data

Environmental Conditions

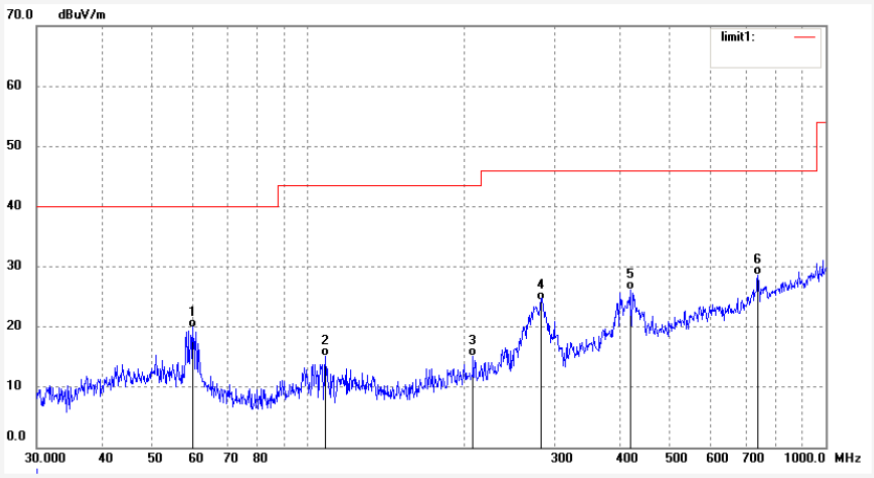
Temperature:	20~25 ℃
Relative Humidity:	45~64 %
ATM Pressure:	101.0 kPa

The testing was performed by Joe on 2021-10-22 for below 1GHz and Chao Mo on 2021-11-26 for above 1GHz.

Test mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

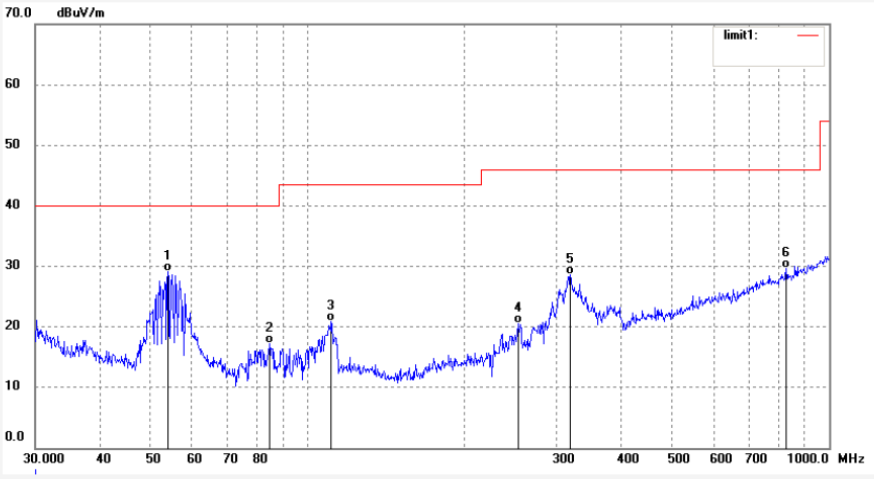
30MHz-1GHz: *(worst case GFSK Mode, Middle channel)*

Horizontal:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	60.0691	38.56	-18.61	19.95	40.00	-20.05	QP			
2	108.2667	34.05	-18.88	15.17	43.50	-28.33	QP			
3	208.5803	32.64	-17.48	15.16	43.50	-28.34	QP			
4	283.9791	39.56	-15.08	24.48	46.00	-21.52	QP			
5	419.1081	37.67	-11.53	26.14	46.00	-19.86	QP			
6	739.6604	34.86	-6.16	28.70	46.00	-17.30	QP			

Vertical



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	53.8818	46.80	-17.59	29.21	40.00	-10.79	QP			
2	84.4054	37.72	-20.42	17.30	40.00	-22.70	QP			
3	110.9571	39.66	-18.71	20.95	43.50	-22.55	QP			
4	252.9482	37.01	-16.40	20.61	46.00	-25.39	QP			
5	318.8170	42.77	-14.14	28.63	46.00	-17.37	QP			
6	827.4934	34.45	-4.86	29.59	46.00	-16.41	QP			

Above 1GHz: *(worst case 8DPSK Mode)*

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave.		Height (m)	Polar (H/V)				
Low Channel (2402 MHz)									
2310	66.5	PK	1	2.1	H	-7.24	59.26	74	-14.74
2310	51.93	Ave	1	2.1	H	-7.24	44.69	54	-9.31
2310	66.12	PK	346	1.7	V	-7.24	58.88	74	-15.12
2310	51.2	Ave	346	1.7	V	-7.24	43.96	54	-10.04
2390	66.67	PK	332	1.8	H	-7.22	59.45	74	-14.55
2390	51.76	Ave	332	1.8	H	-7.22	44.54	54	-9.46
2390	66.11	PK	100	1.6	V	-7.22	58.89	74	-15.11
2390	51.15	Ave	100	1.6	V	-7.22	43.93	54	-10.07
4804	57.07	PK	246	1.3	H	-3.51	53.56	74	-20.44
4804	56.16	PK	123	2.1	V	-3.51	52.65	74	-21.35
Middle Channel (2441 MHz)									
4882	56.75	PK	152	1.5	H	-3.37	53.38	74	-20.62
4882	35.82	Ave	132	1.1	V	-3.37	32.45	54	-21.55
High Channel (2480 MHz)									
2483.5	64.51	PK	79	1.2	H	-7.2	57.31	74	-16.69
2483.5	50.46	Ave	79	1.2	H	-7.2	43.26	54	-10.74
2483.5	64.06	PK	155	2.0	V	-7.2	56.86	74	-17.14
2483.5	49.61	Ave	155	2.0	V	-7.2	42.41	54	-11.59
2500	64.31	PK	273	2.1	H	-7.18	57.13	74	-16.87
2500	49.64	Ave	273	2.1	H	-7.18	42.46	54	-11.54
2500	64.12	PK	164	1.1	V	-7.18	56.94	74	-17.06
2500	49.53	Ave	164	1.1	V	-7.18	42.35	54	-11.65
4960	56.94	PK	76	2.1	H	-3.01	53.93	74	-20.07
4960	55.83	PK	208	1.9	V	-3.01	52.82	74	-21.18

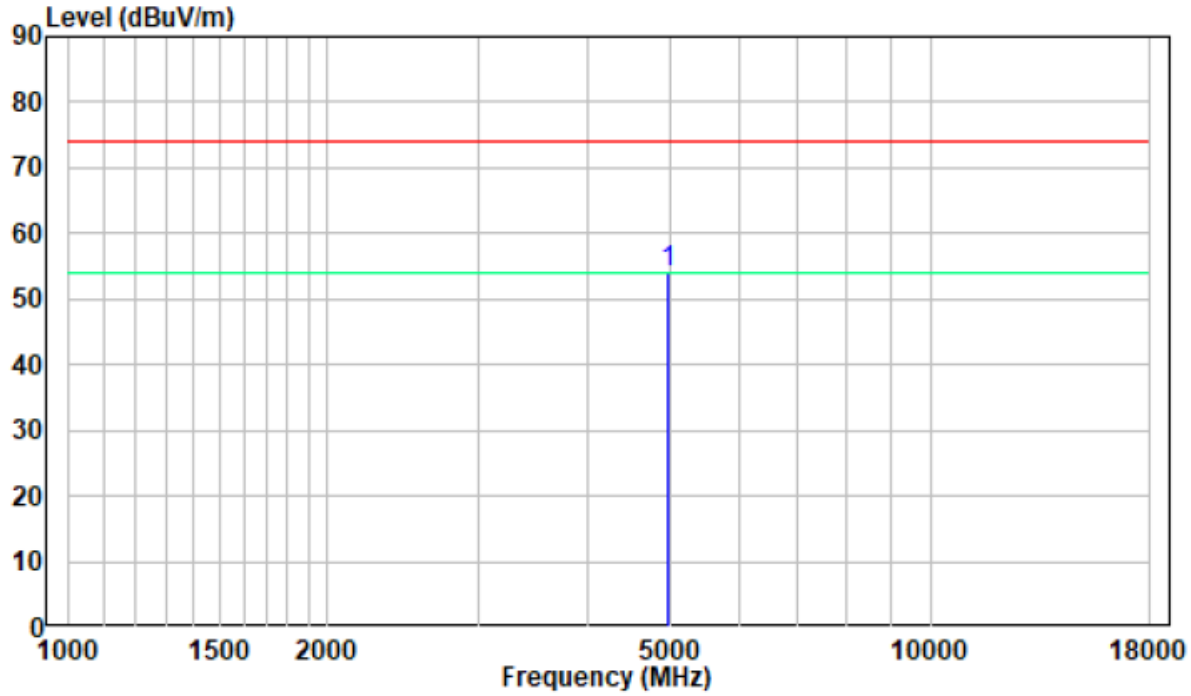
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was less than the limit of average,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

1-18GHz

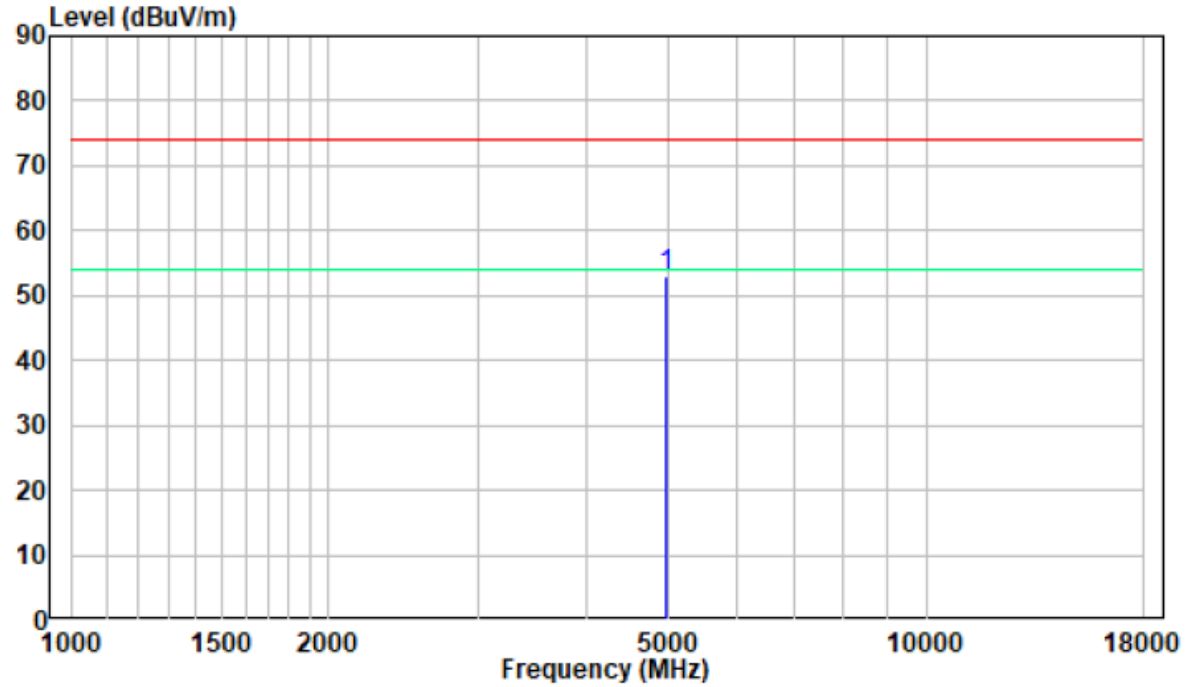
Pre-scan for Peak

High Channel

Horizontal:



Vertical:

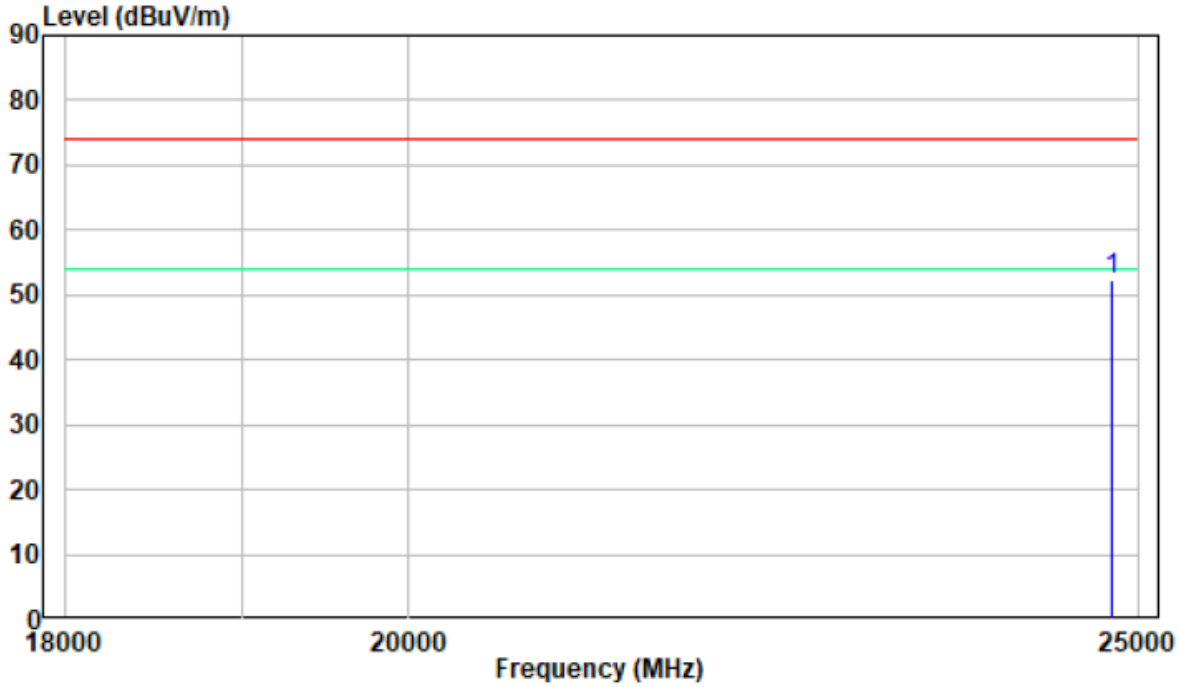


18-25GHz

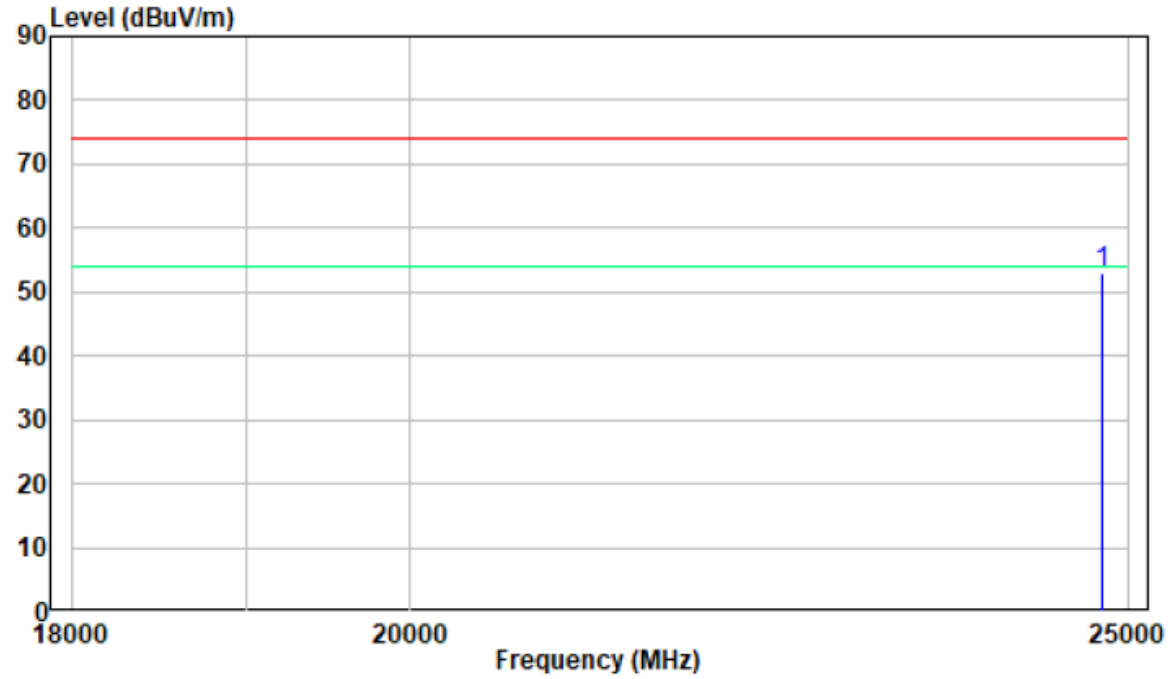
Pre-scan for Peak

High Channel

Horizontal:



Vertical:



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

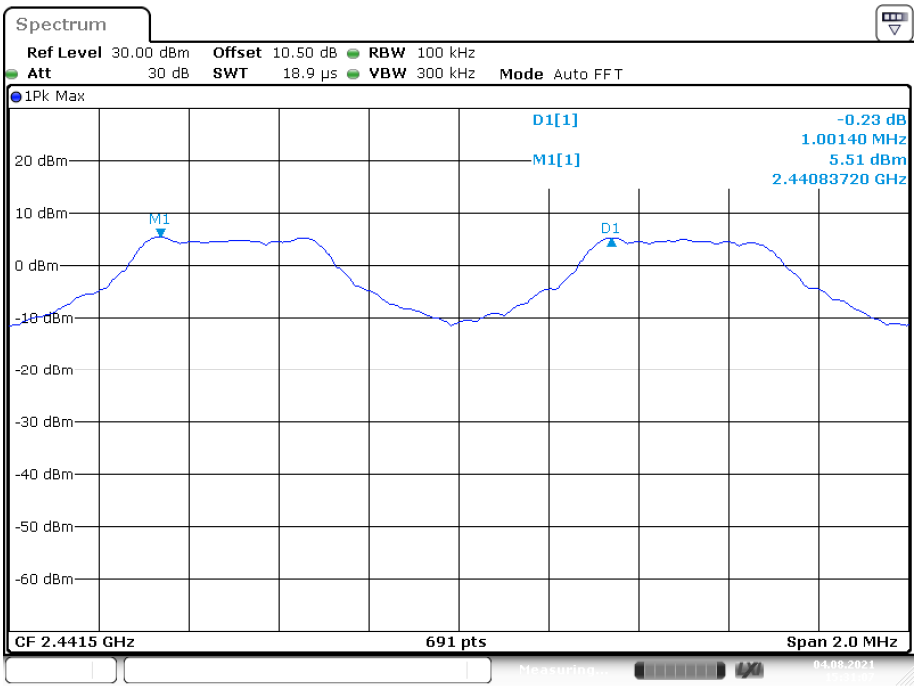
The testing was performed by Paul liu on 2021-08-04.

EUT operation mode: Transmitting

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

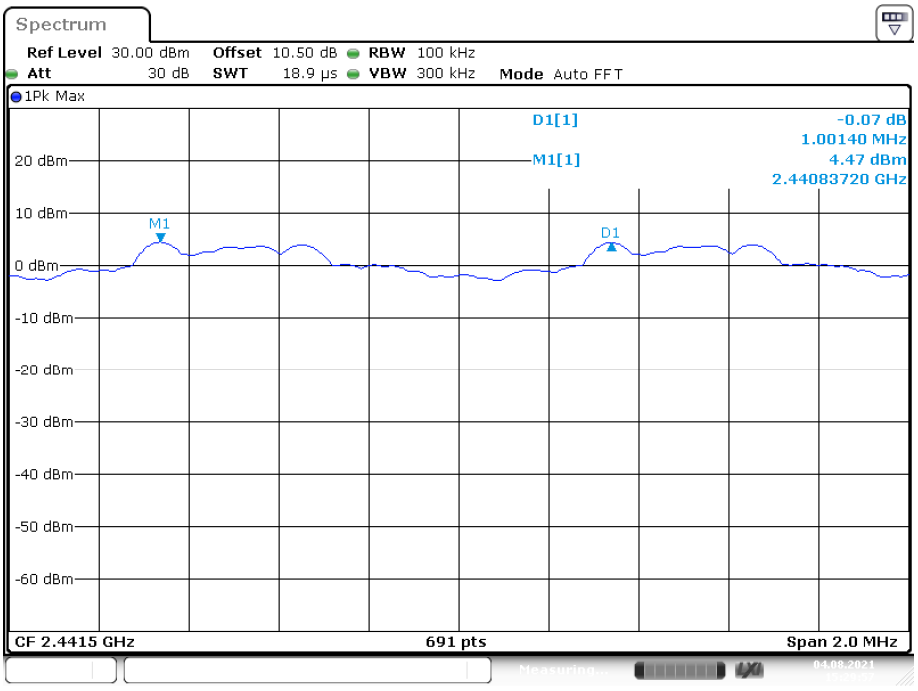
Test Mode	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BDR(GFSK)					
Hopping	1.001	0.926	0.617	> two-thirds of the 20 dB bandwidth	Compliance
EDR(π/4-DQPSK)					
Hopping	1.001	1.248	0.832	> two-thirds of the 20 dB bandwidth	Compliance
EDR(8DPSK)					
Hopping	1.001	1.262	0.841	> two-thirds of the 20 dB bandwidth	Compliance

BDR(GFSK)



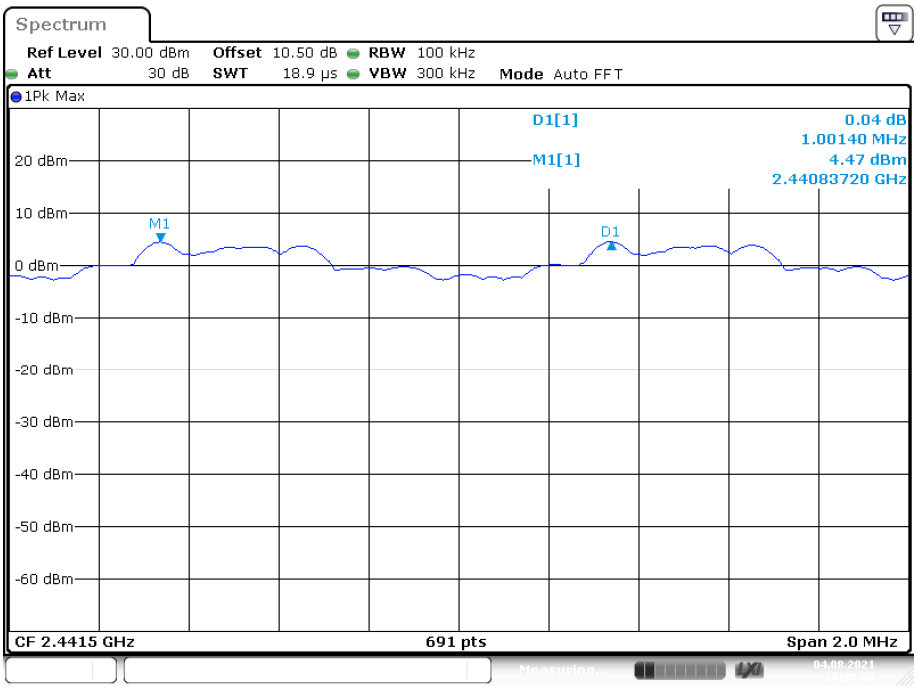
Date: 4.AUG.2021 15:31:07

EDR (π/4-DQPSK)



Date: 4.AUG.2021 15:29:57

EDR (8DPSK)


Spectrum
Ref Level 30.00 dBm Offset 10.50 dB RBW 100 kHz
Att 30 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] 0.04 dB
1.00140 MHz
M1[1] 4.47 dBm
2.44083720 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...
04.08.2021
Date: 4.AUG.2021 15:37:59

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

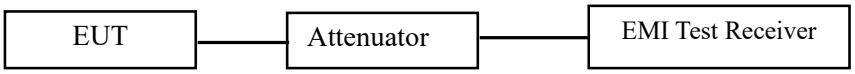
The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• 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 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

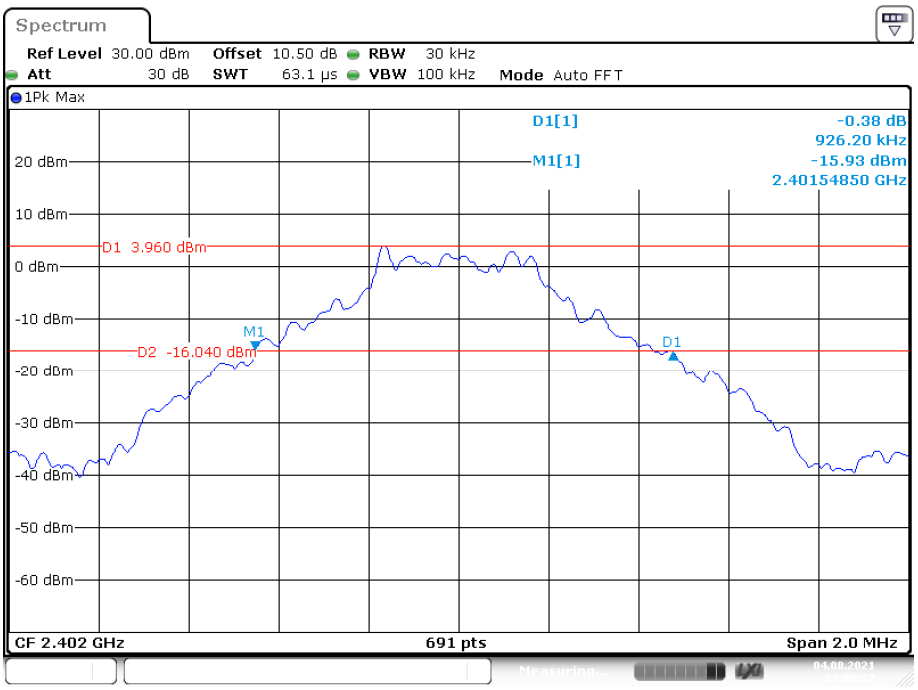
The testing was performed by Paul liu on 2021-08-04.

EUT operation mode: Transmitting

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

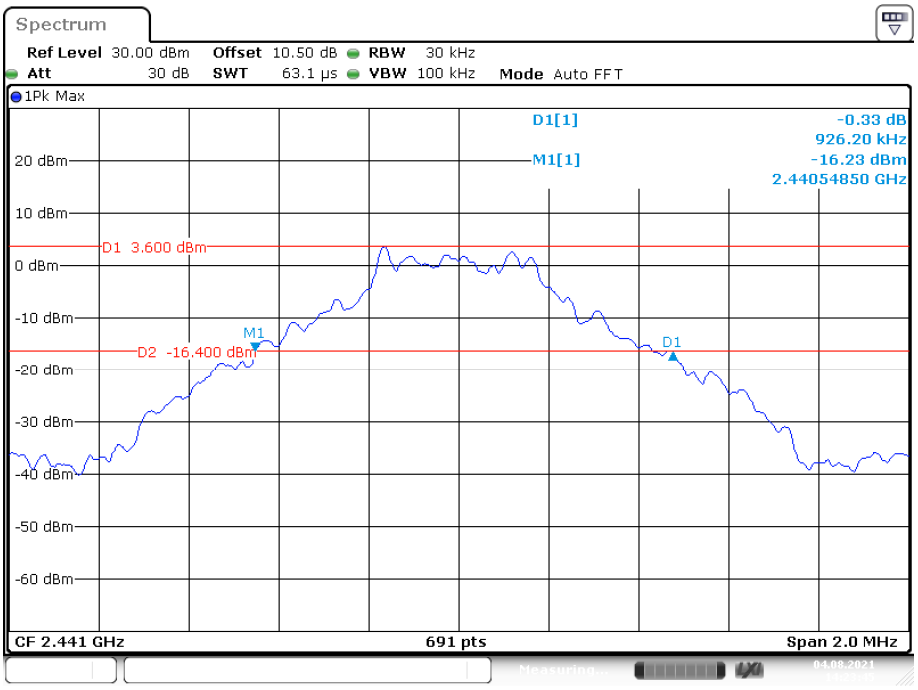
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.926
	Middle	2441	0.926
	High	2480	0.926
EDR (π/4-DQPSK)	Low	2402	1.248
	Middle	2441	1.248
	High	2480	1.248
EDR (8DPSK)	Low	2402	1.262
	Middle	2441	1.262
	High	2480	1.262

BDR(GFSK) : Low Channel



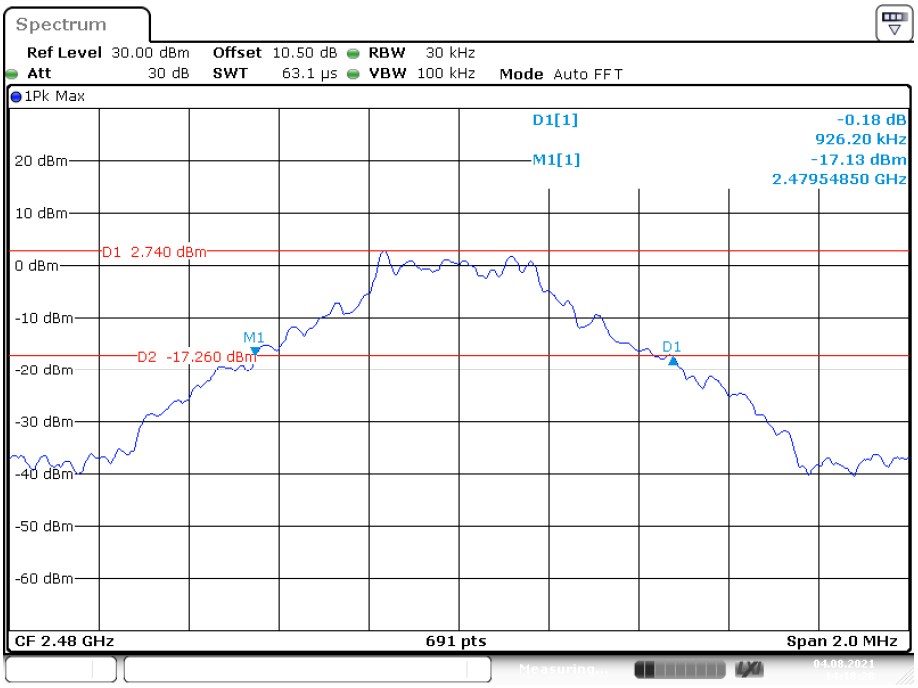
Date: 4.AUG.2021 14:06:22

BDR(GFSK) : Middle Channel



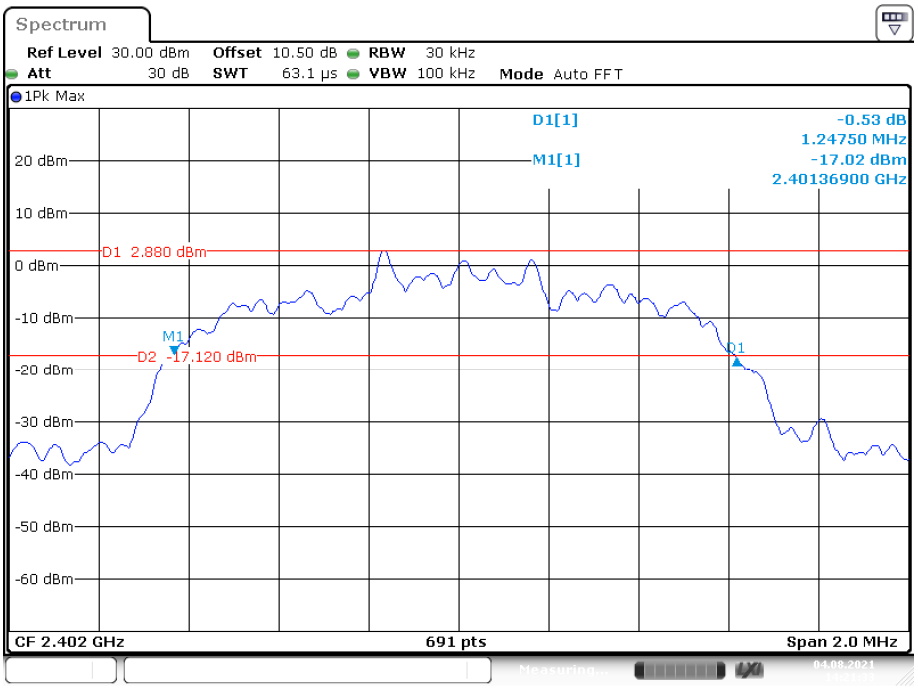
Date: 4.AUG.2021 14:23:45

BDR(GFSK) : High Channel



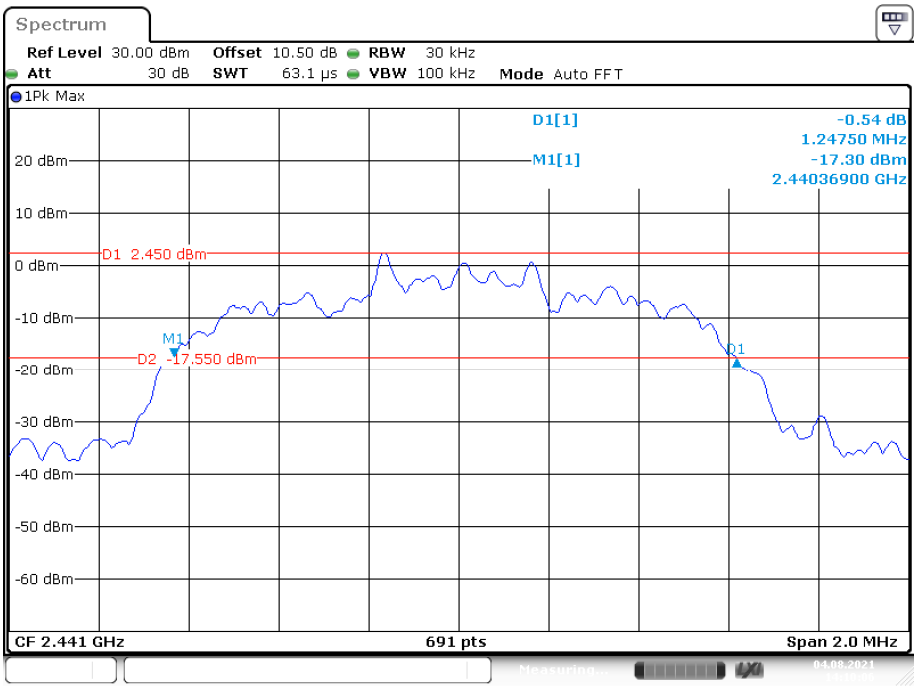
Date: 4.AUG.2021 14:18:28

EDR (π/4-DQPSK): Low Channel



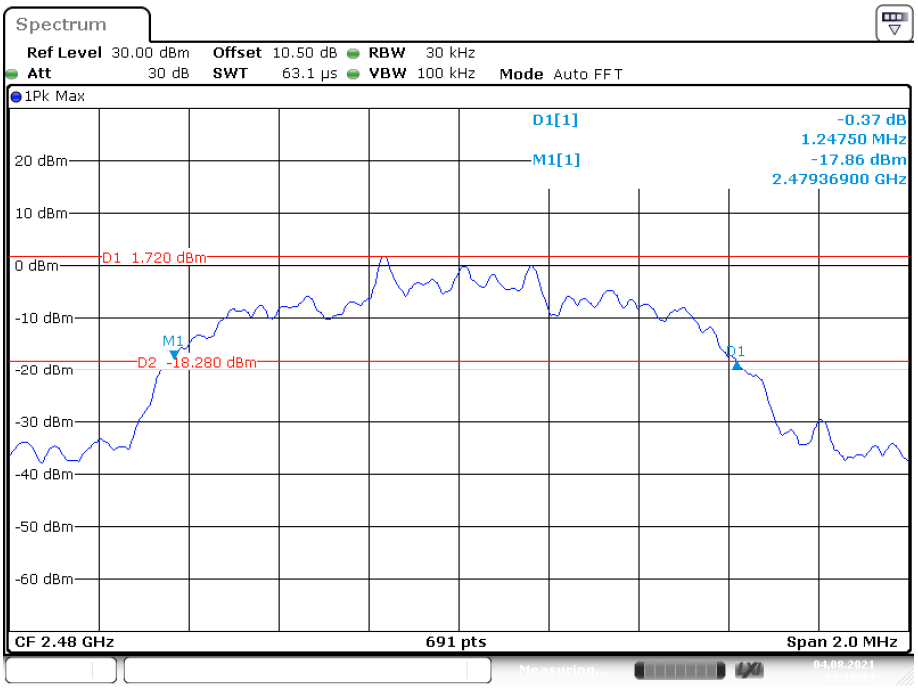
Date: 4.AUG.2021 14:21:33

EDR (π/4-DQPSK): Middle Channel



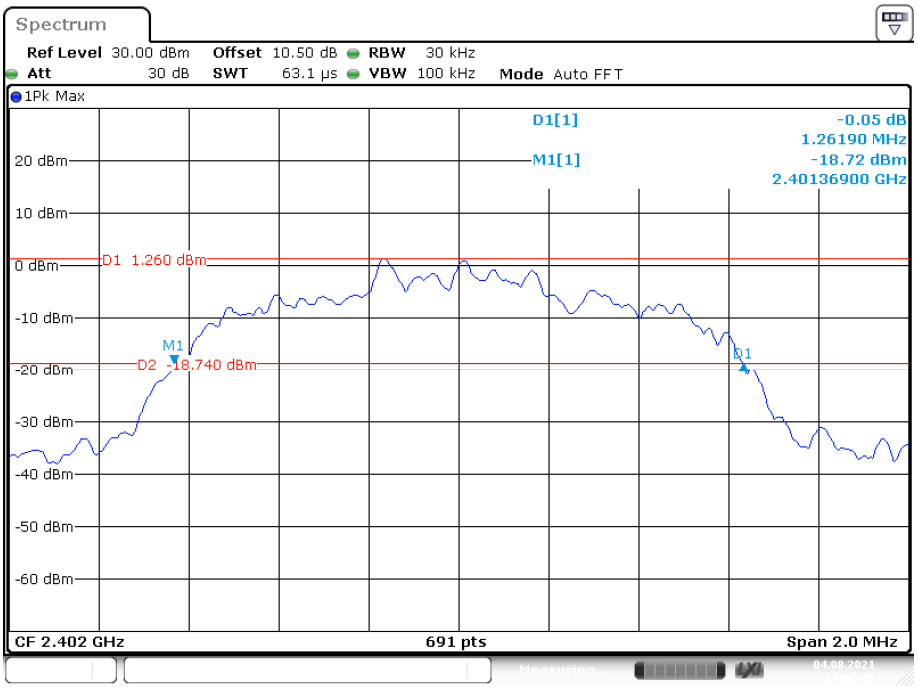
Date: 4.AUG.2021 14:10:06

EDR (π/4-DQPSK): High Channel



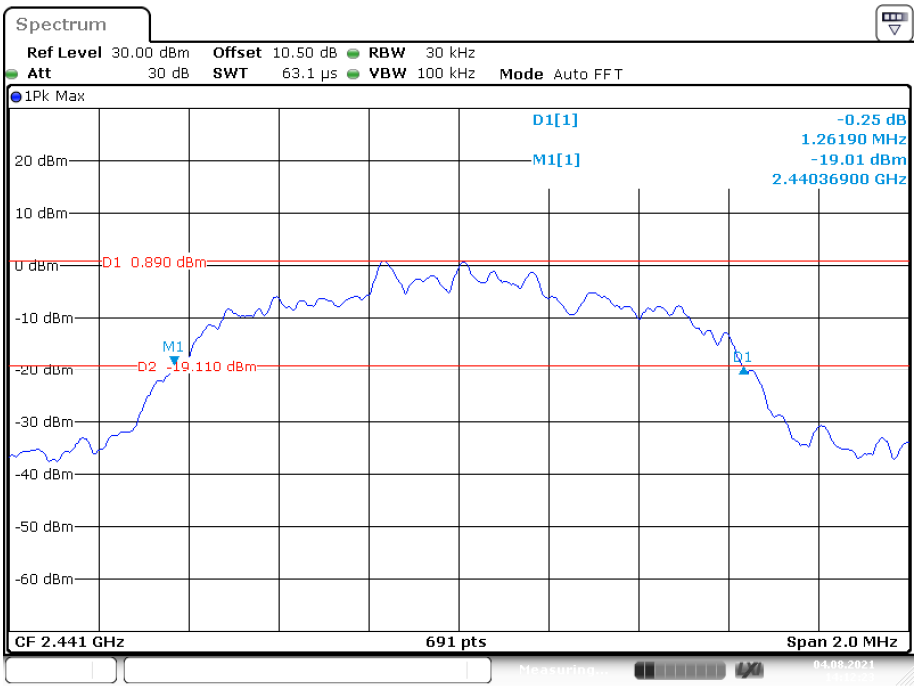
Date: 4.AUG.2021 14:16:13

EDR (8DPSK): Low Channel



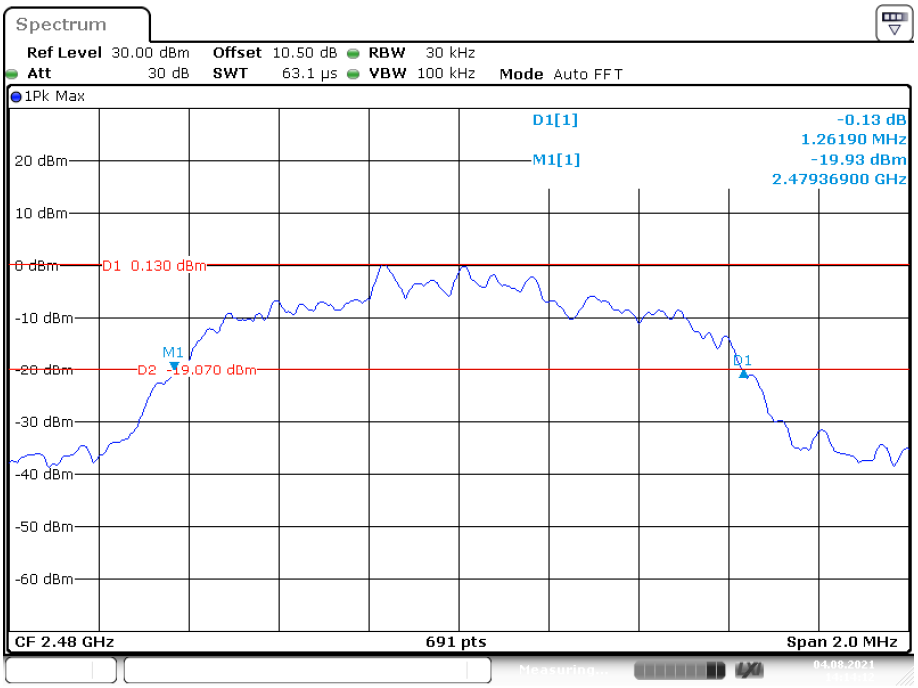
Date: 4.AUG.2021 14:02:46

EDR (8DPSK): Middle Channel



Date: 4.AUG.2021 14:12:23

EDR (8DPSK): High Channel



Date: 4.AUG.2021 14:14:12

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

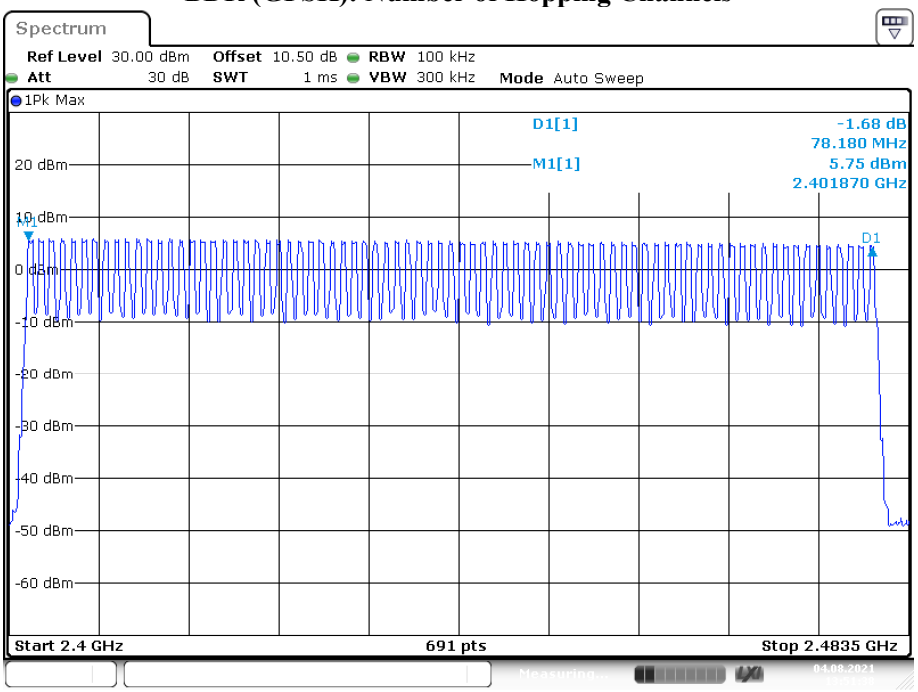
The testing was performed by Paul liu on 2021-08-04.

EUT operation mode: Transmitting

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

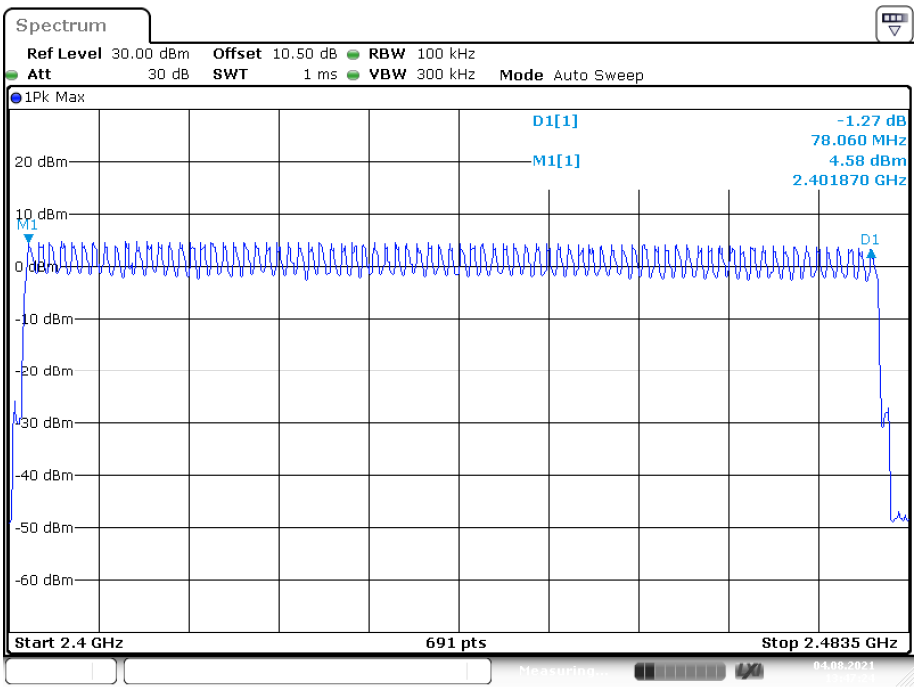
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



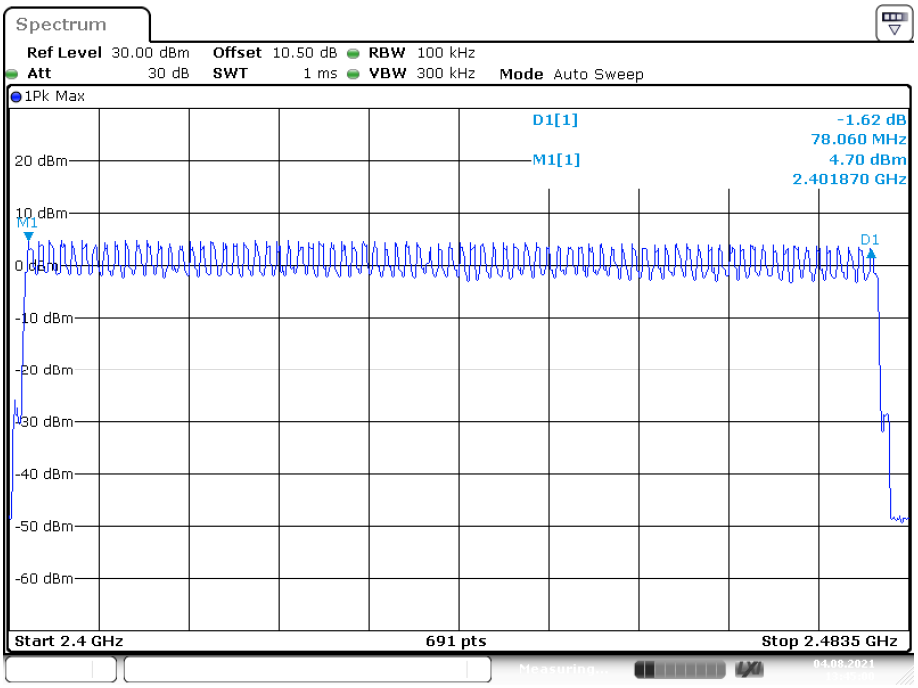
Date: 4.AUG.2021 13:51:38

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



Date: 4.AUG.2021 13:47:24

EDR (8DPSK): Number of Hopping Channels



Date: 4.AUG.2021 13:45:00

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 Paul liu on 2021-08-04 and 2021-08-12.

EUT operation mode: Transmitting

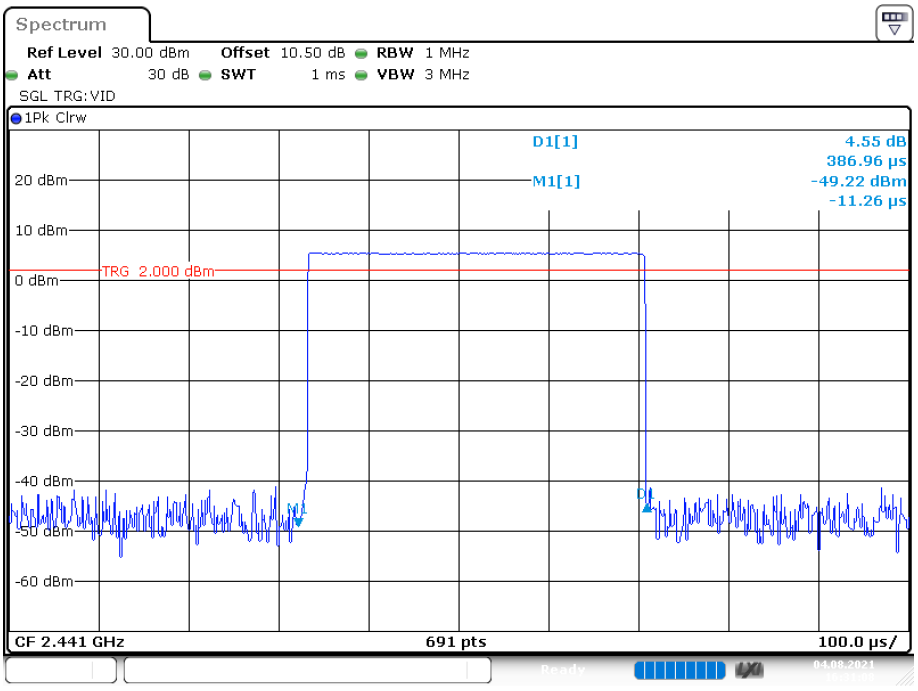
Test Result: Compliant. Please refer to following table and plots

Test Mode	Channel	Pulse Time [ms]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.39	0.125	<=0.4	PASS
DH3	Hop	1.65	0.264	<=0.4	PASS
DH5	Hop	2.91	0.310	<=0.4	PASS
2DH1	Hop	0.39	0.125	<=0.4	PASS
2DH3	Hop	1.66	0.266	<=0.4	PASS
2DH5	Hop	2.91	0.310	<=0.4	PASS
3DH1	Hop	0.39	0.125	<=0.4	PASS
3DH3	Hop	1.66	0.264	<=0.4	PASS
3DH5	Hop	2.92	0.311	<=0.4	PASS

Note 1:
DH1: Result=Pulse Time ×(1600/2/79) ×31.6s
DH3: Result=Pulse Time ×(1600/4/79) ×31.6s
DH5: Result=Pulse Time ×(1600/6/79) ×31.6s

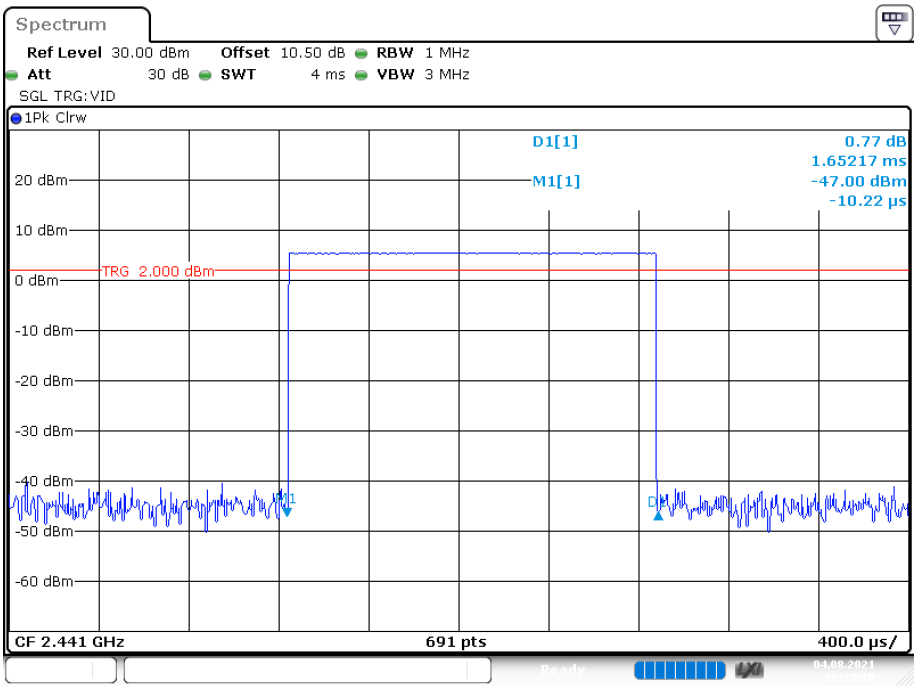
BDR (GFSK):

Pulse time, DH1



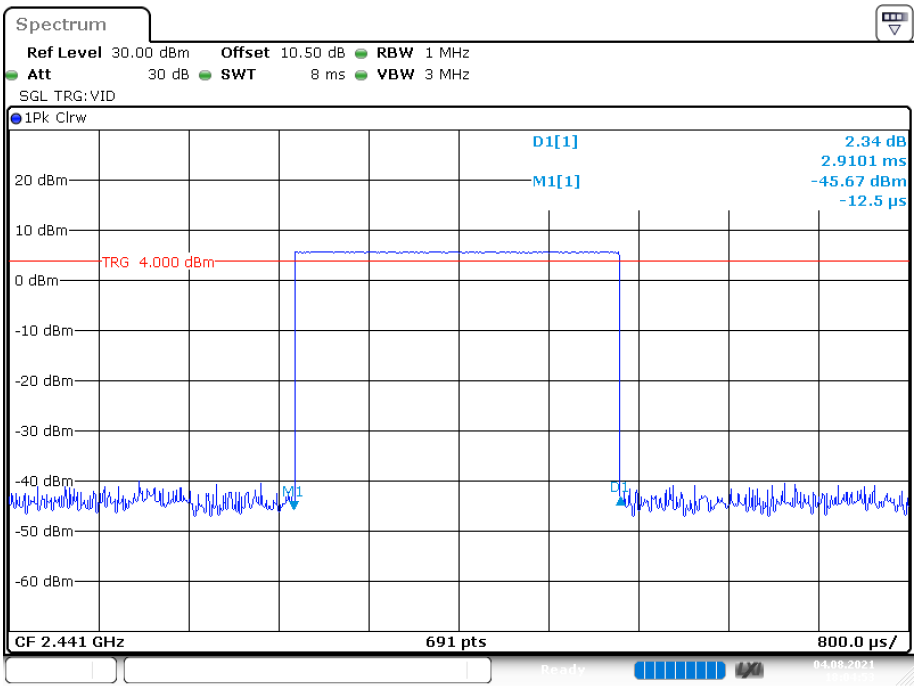
Date: 4.AUG.2021 16:31:09

Pulse time, DH3



Date: 4.AUG.2021 16:33:18

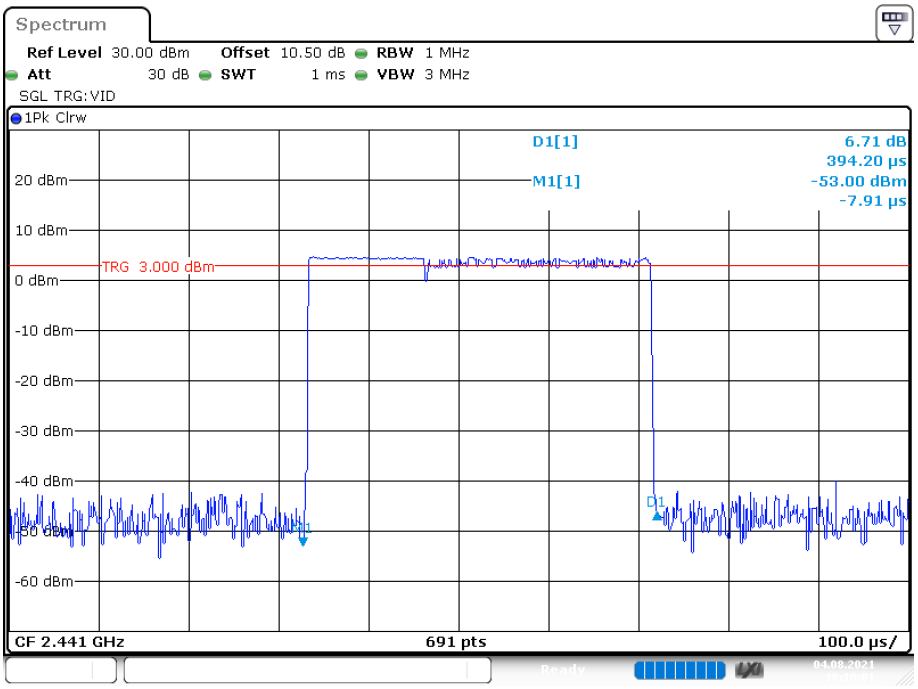
Pulse time, DH5



Date: 4.AUG.2021 18:04:53

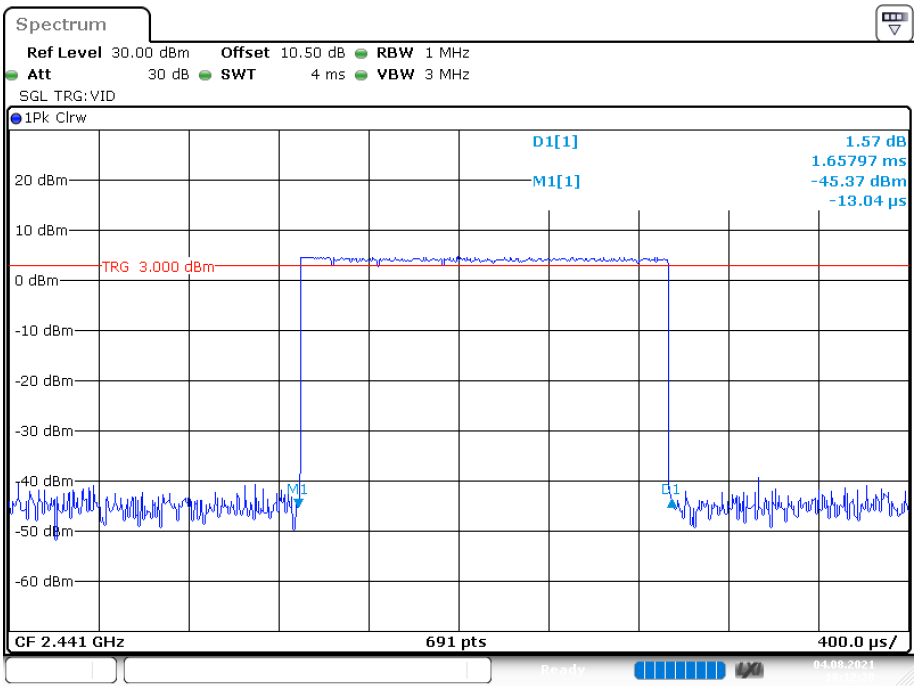
EDR (π/4-DQPSK):

Pulse time, 2DH1



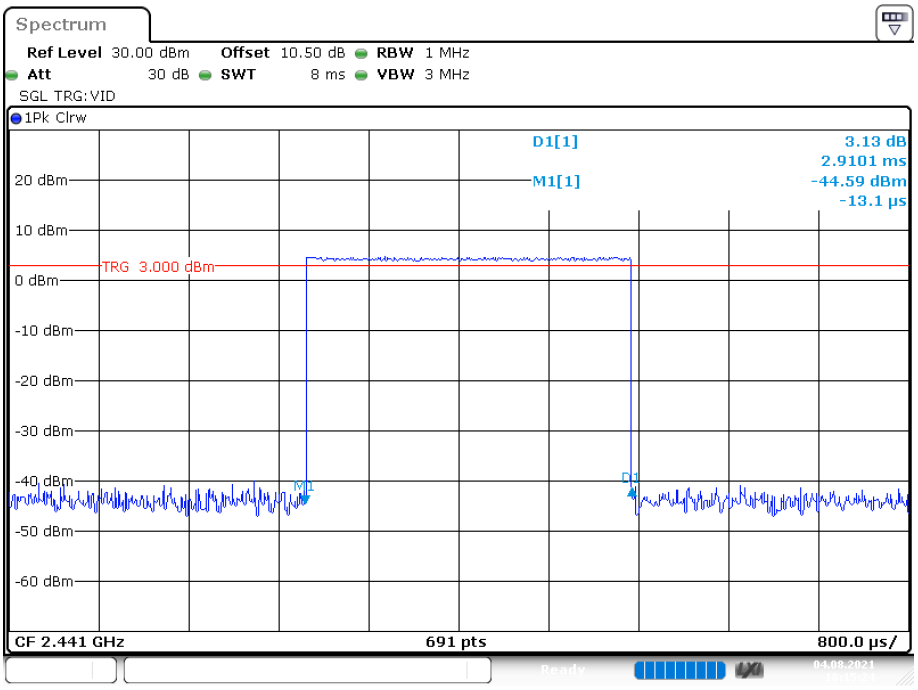
Date: 4.AUG.2021 18:10:02

Pulse time, 2DH3



Date: 4.AUG.2021 18:12:28

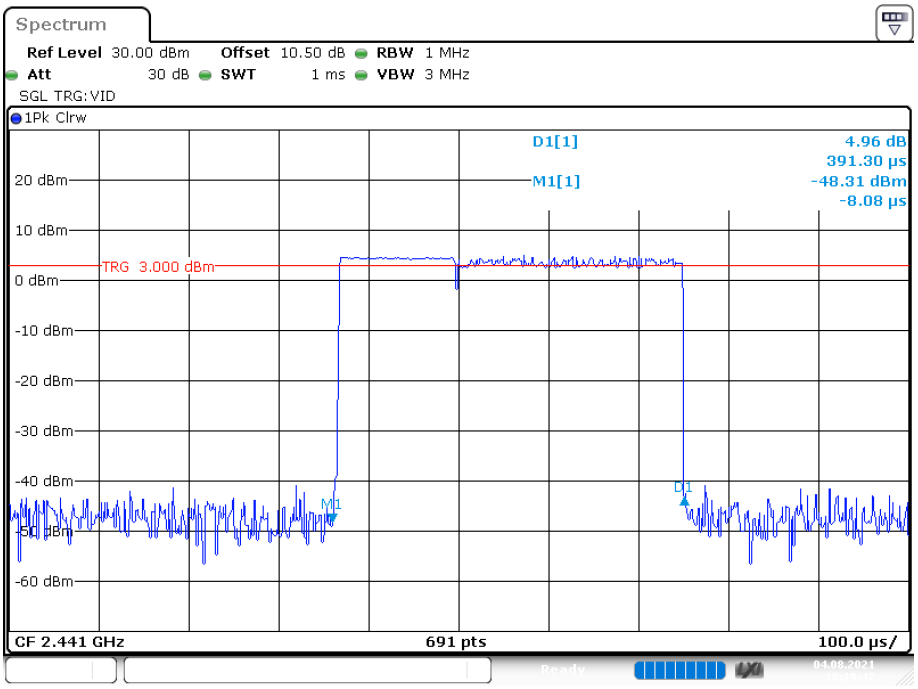
Pulse time, 2DH5



Date: 4.AUG.2021 18:15:24

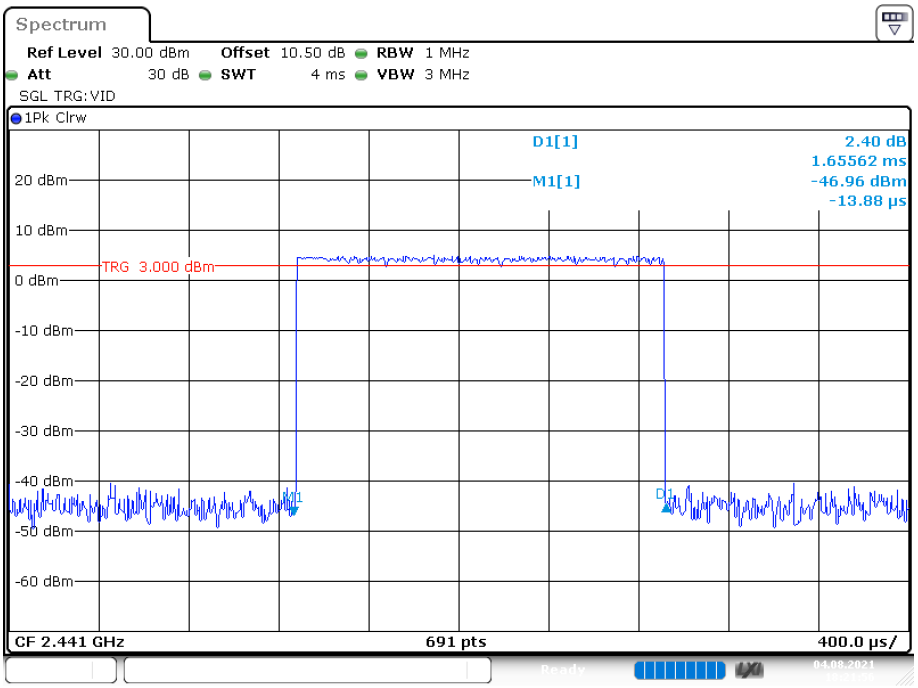
EDR (8DPSK)

Pulse time, 3DH1



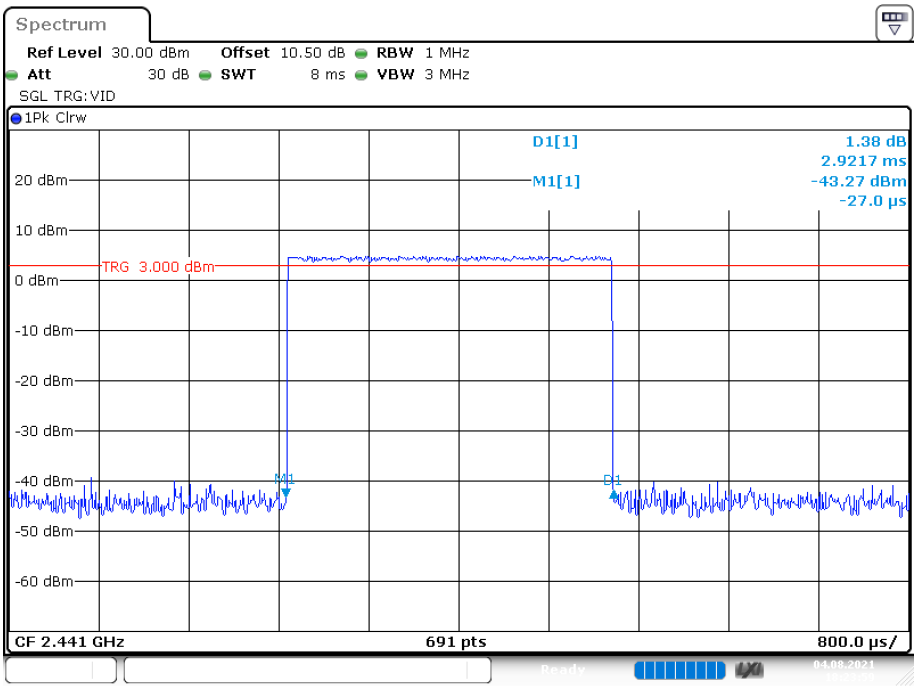
Date: 4.AUG.2021 18:19:48

Pulse time, 3DH3



Date: 4.AUG.2021 18:21:57

Pulse time, 3DH5



Date: 4.AUG.2021 18:24:00

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

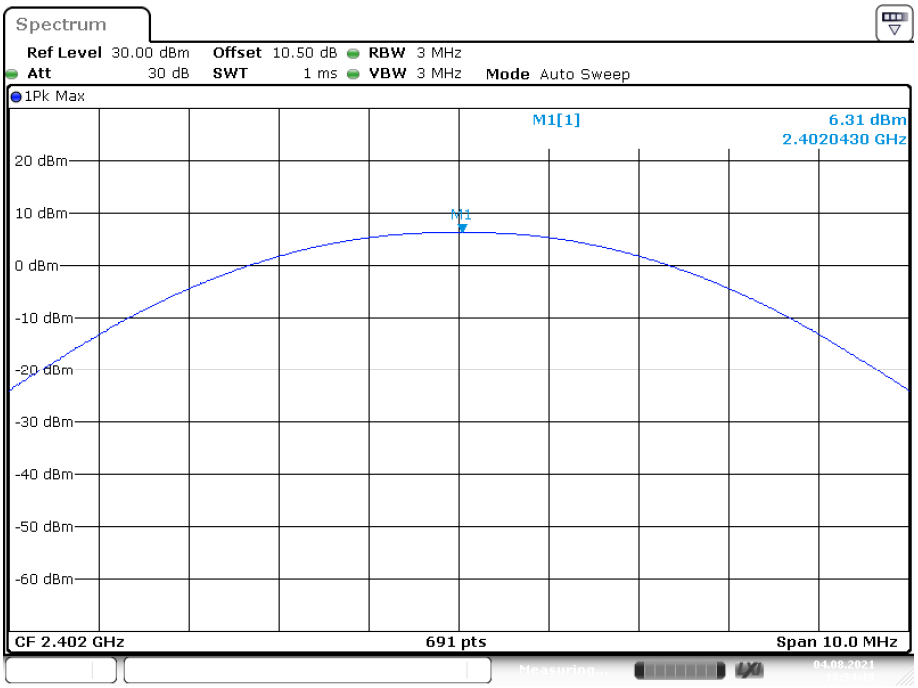
The testing was performed by Paul liu on 2021-08-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following table.

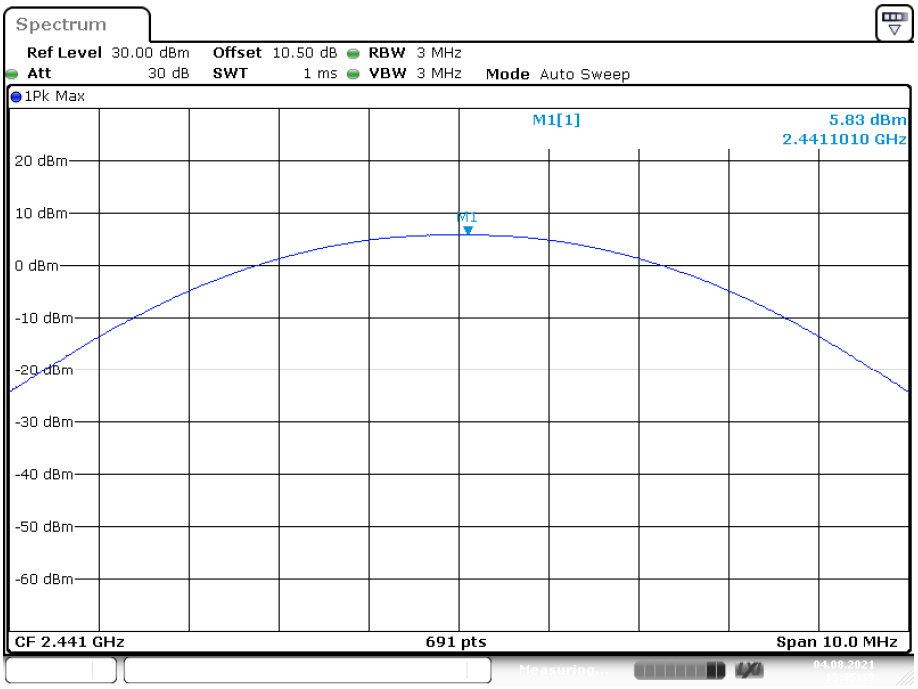
Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR (GFSK)	Low	2402	6.31	21
	Middle	2441	5.83	21
	High	2480	5.04	21
EDR (π/4-DQPSK)	Low	2402	5.41	21
	Middle	2441	5.08	21
	High	2480	4.37	21
EDR (8DPSK)	Low	2402	5.71	21
	Middle	2441	5.34	21
	High	2480	4.60	21

BDR(GFSK) : Low Channel



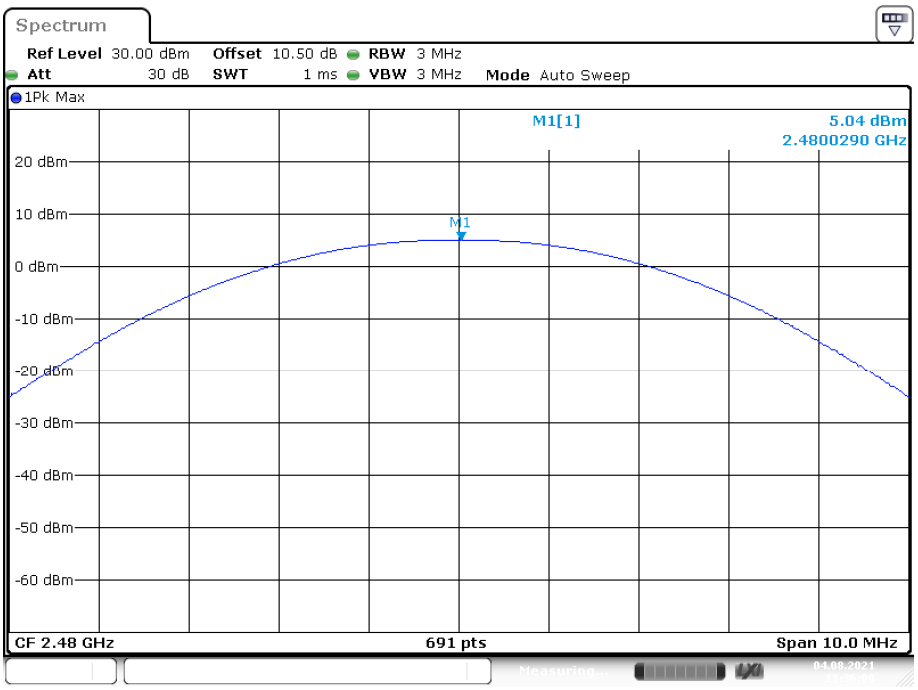
Date: 4.AUG.2021 13:34:18

BDR(GFSK) : Middle Channel



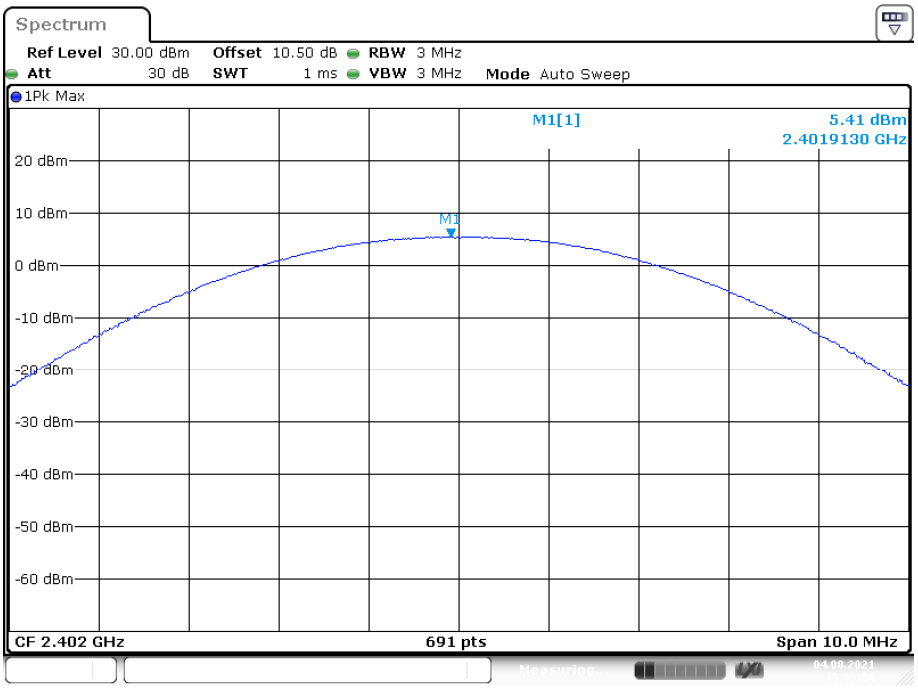
Date: 4.AUG.2021 13:35:19

BDR(GFSK) : High Channel



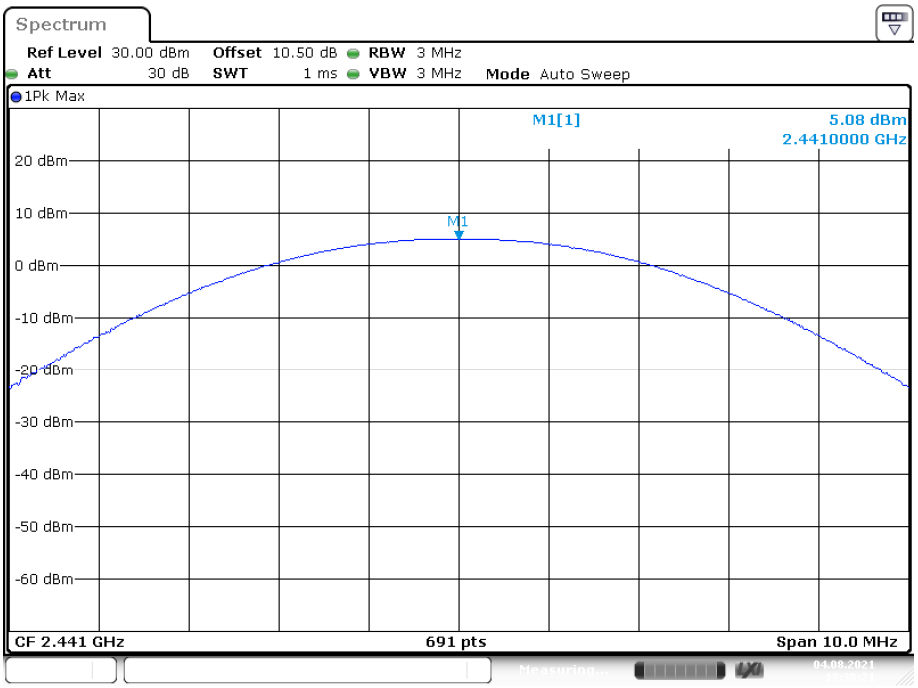
Date: 4.AUG.2021 13:36:08

EDR (π/4-DQPSK): Low Channel



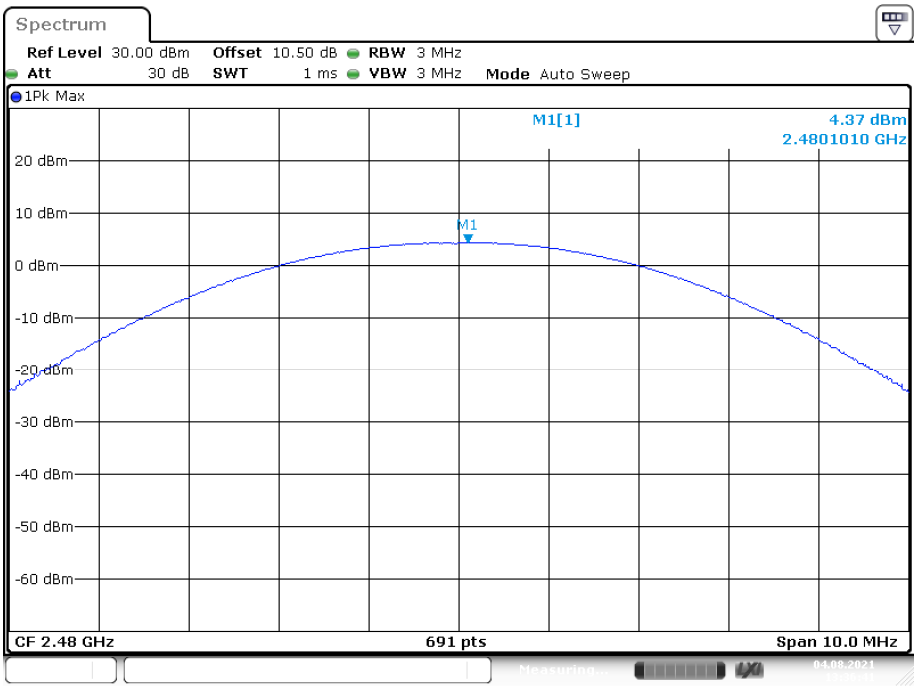
Date: 4.AUG.2021 13:39:04

EDR (π/4-DQPSK): Middle Channel



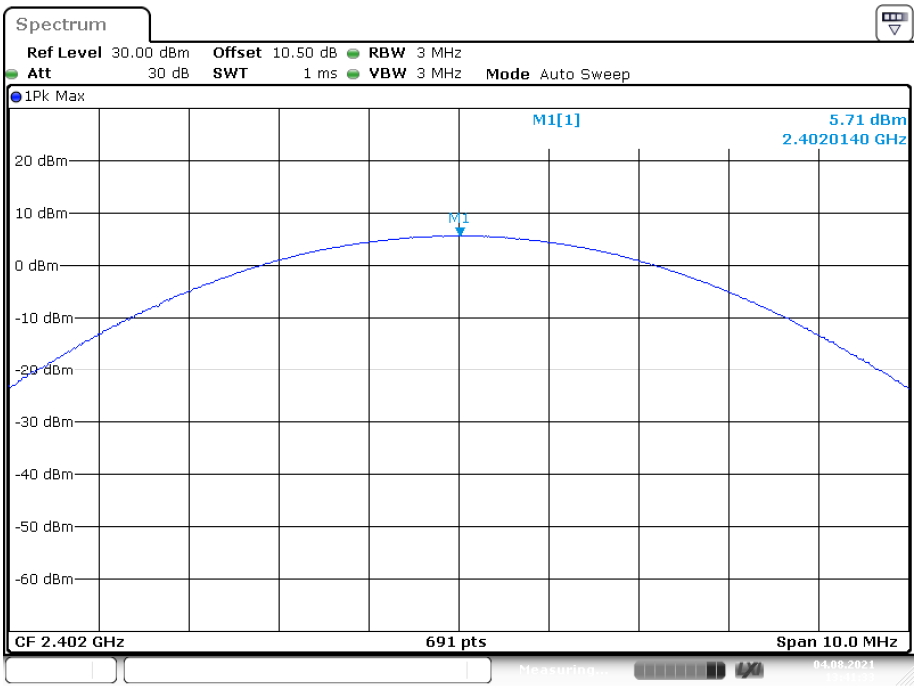
Date: 4.AUG.2021 13:38:21

EDR (π/4-DQPSK): High Channel



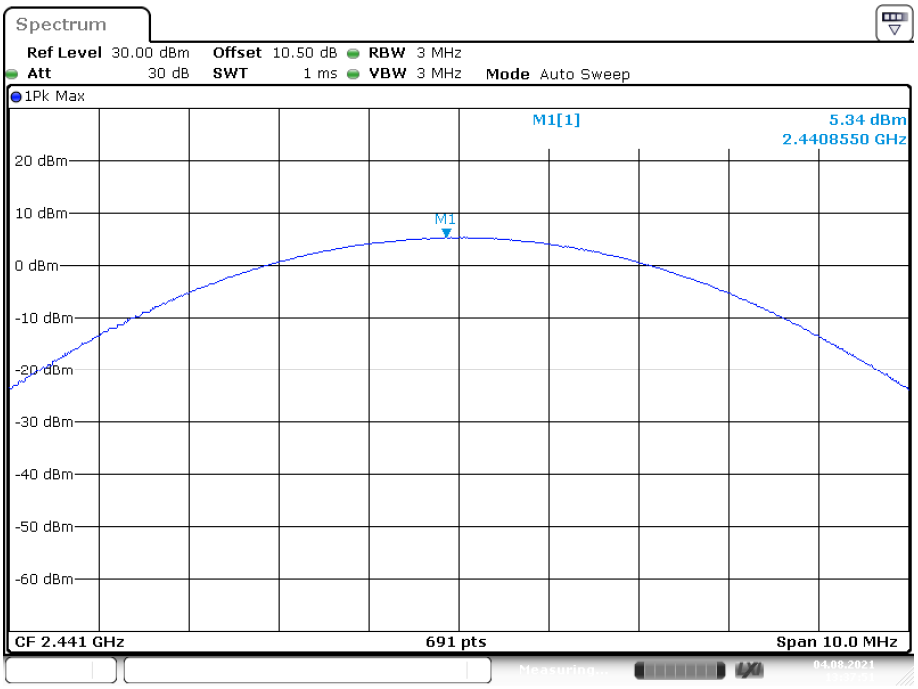
Date: 4.AUG.2021 13:36:41

EDR (8DPSK): Low Channel



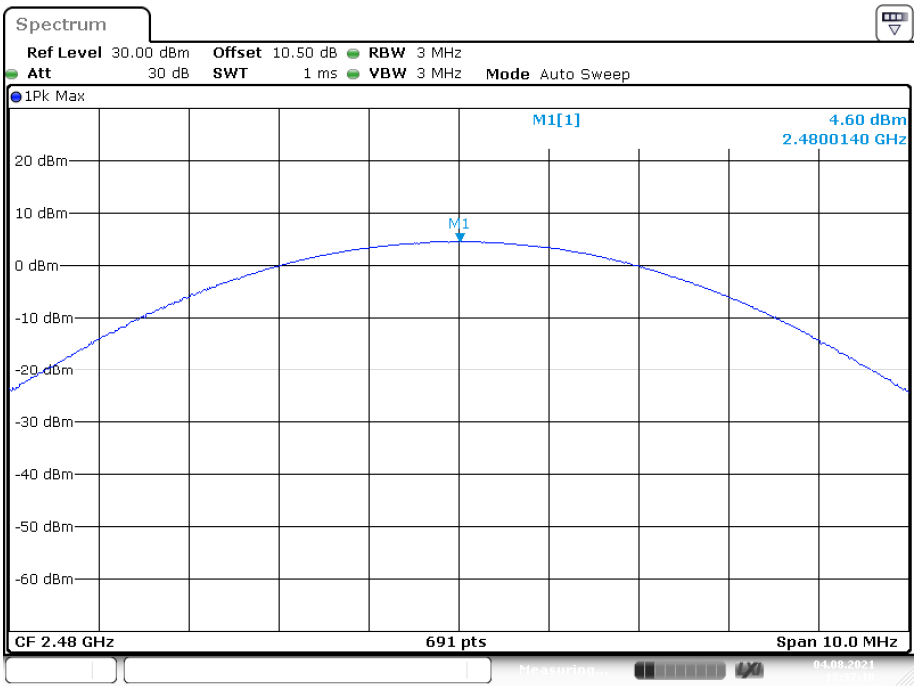
Date: 4.AUG.2021 13:41:33

EDR (8DPSK): Middle Channel



Date: 4.AUG.2021 13:37:51

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

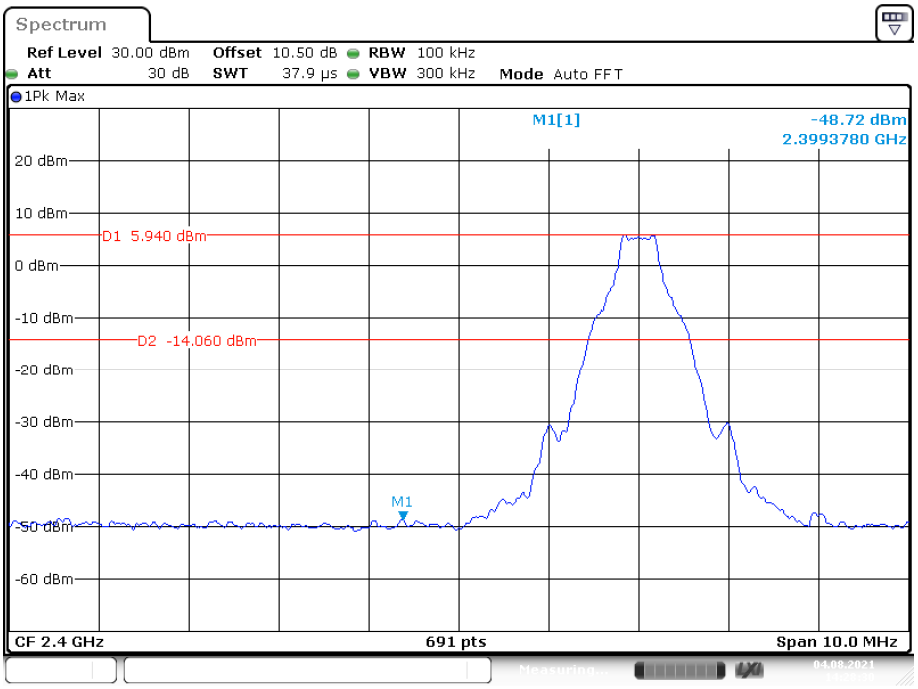
The testing was performed by Paul liu on 2021-08-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following plots.

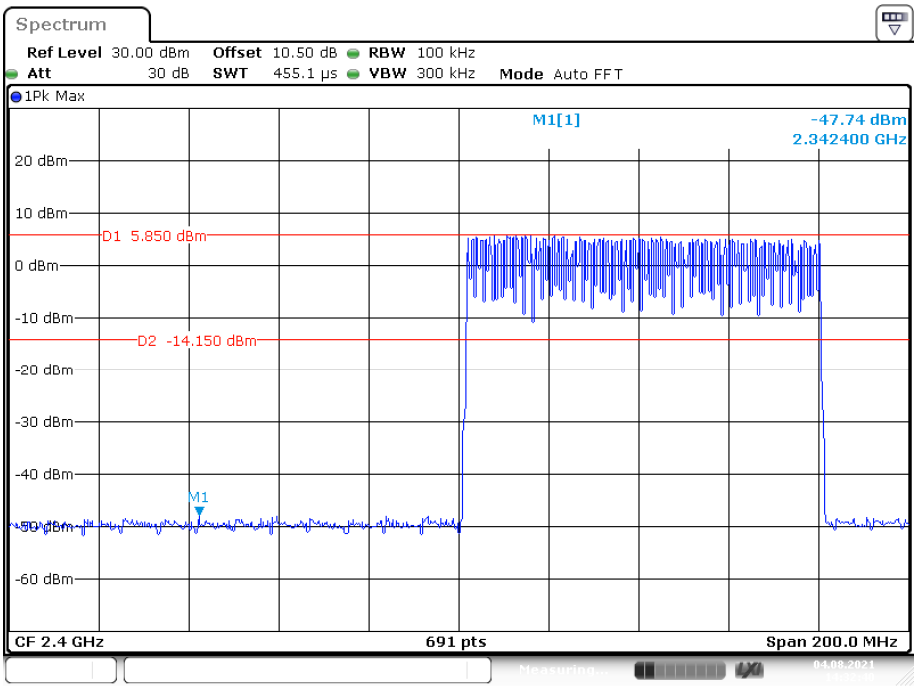
BDR (GFSK): Band Edge-Left Side

Single



Date: 4.AUG.2021 14:28:30

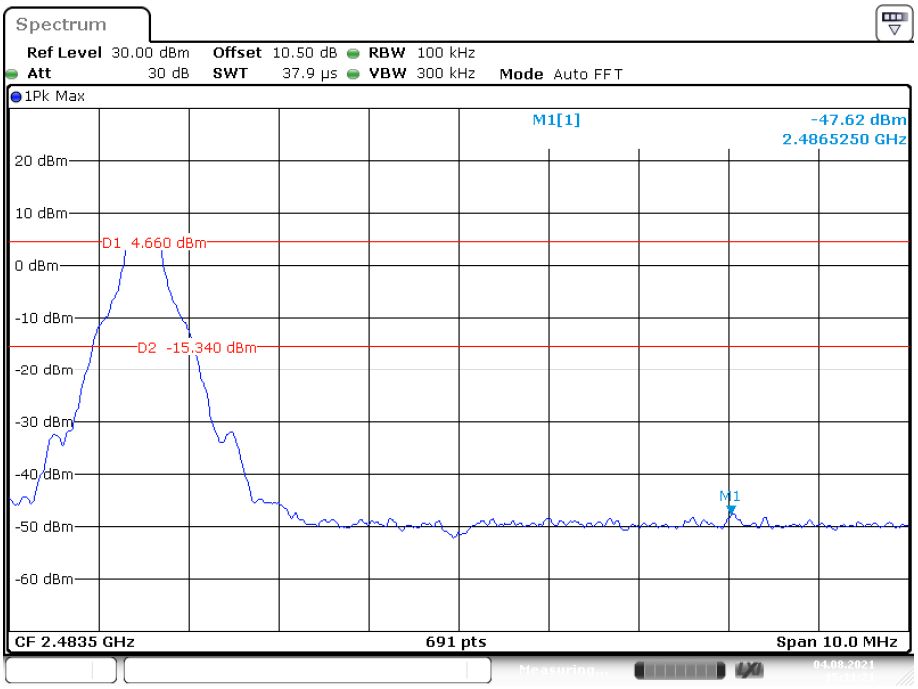
Hopping



Date: 4.AUG.2021 14:32:40

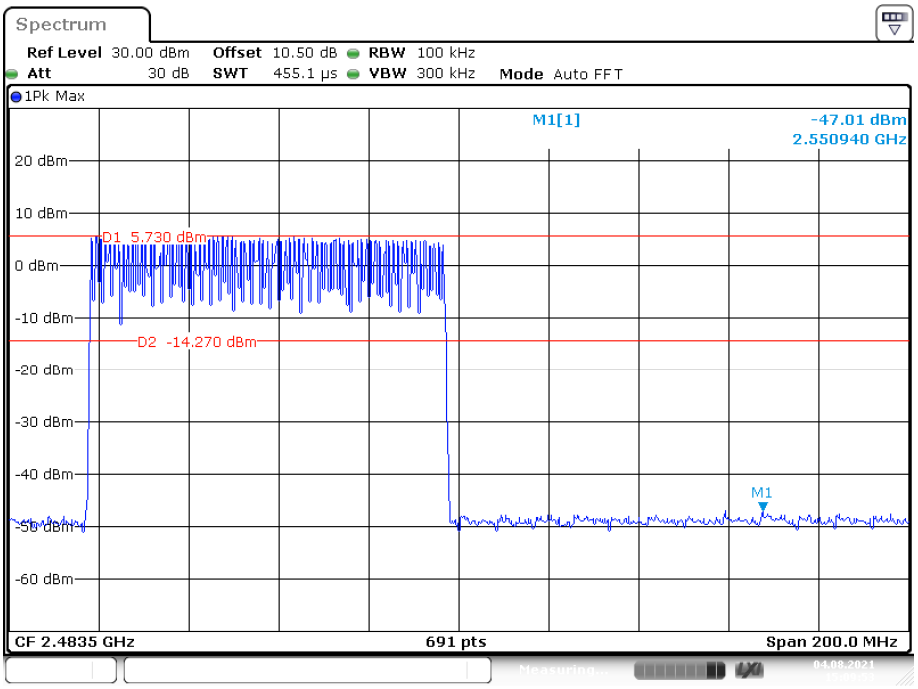
BDR (GFSK): Band Edge-Right Side

Single



Date: 4.AUG.2021 15:11:22

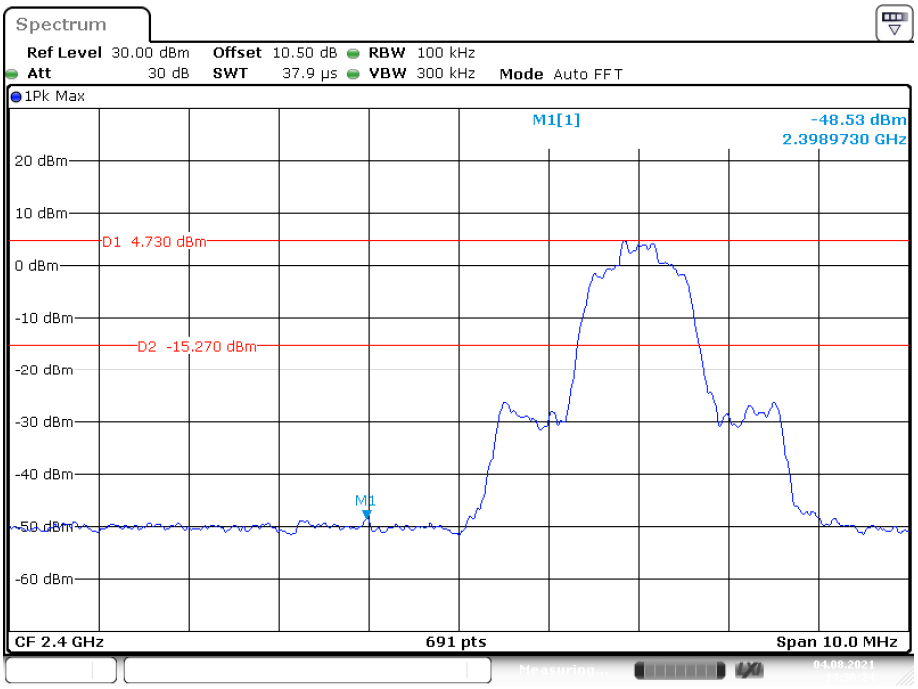
Hopping



Date: 4.AUG.2021 15:09:54

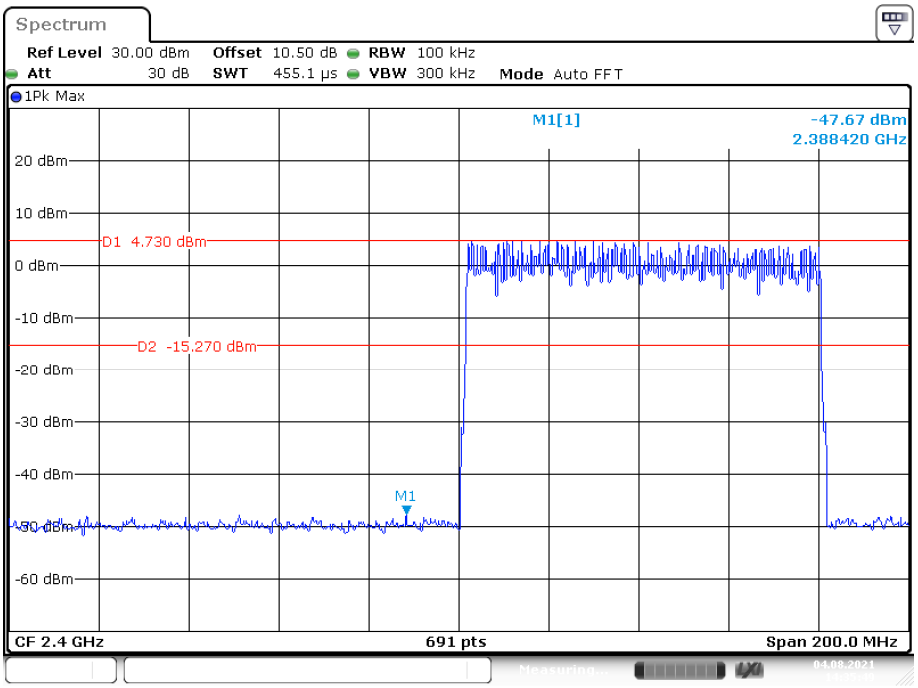
EDR (π/4-DQPSK): Band Edge-Left Side

Single



Date: 4.AUG.2021 14:36:24

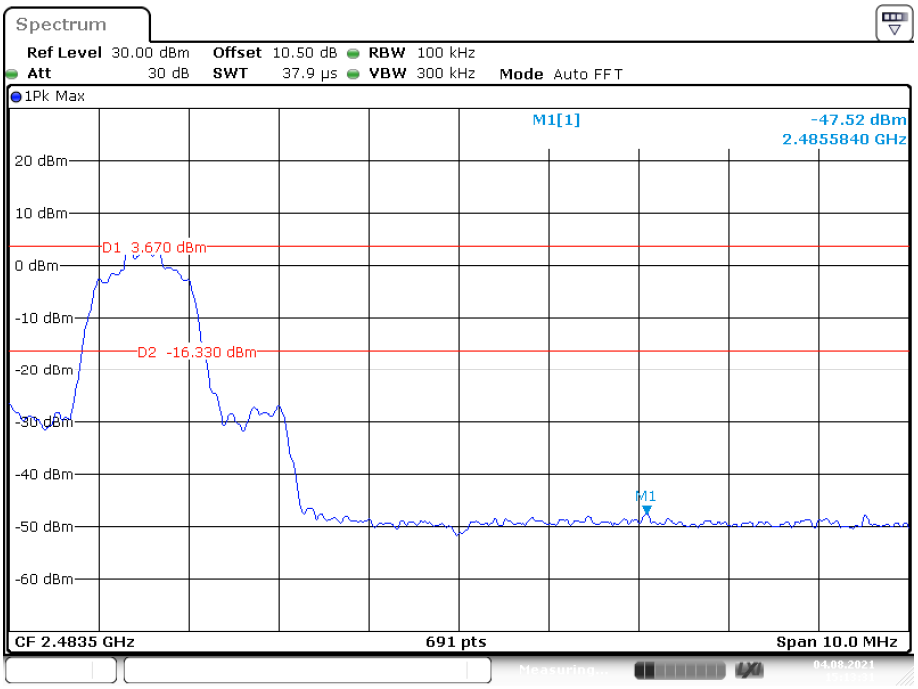
Hopping



Date: 4.AUG.2021 14:35:49

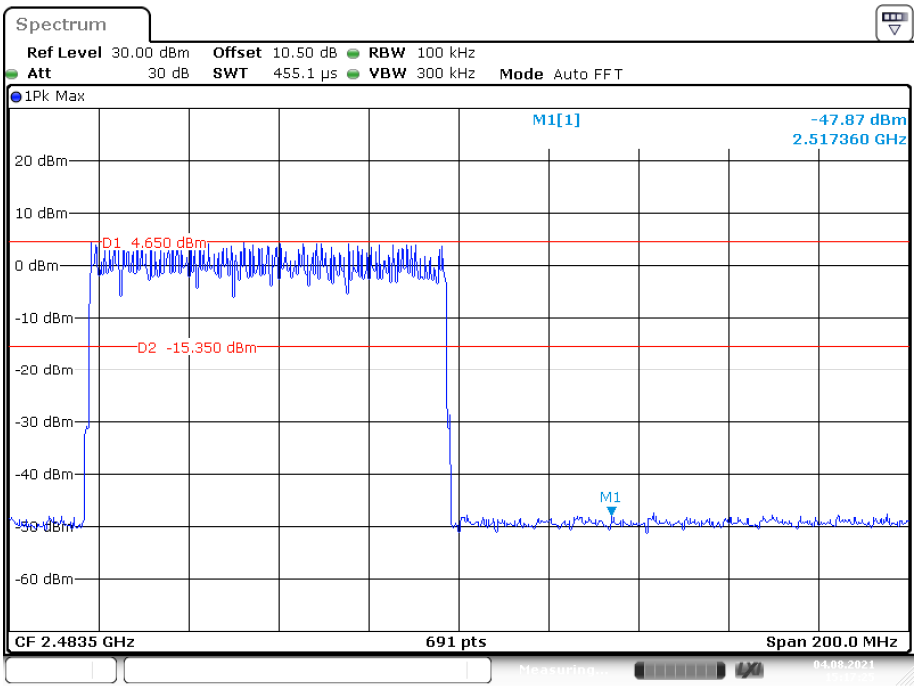
EDR (π/4-DQPSK): Band Edge-Right Side

Single



Date: 4.AUG.2021 15:13:31

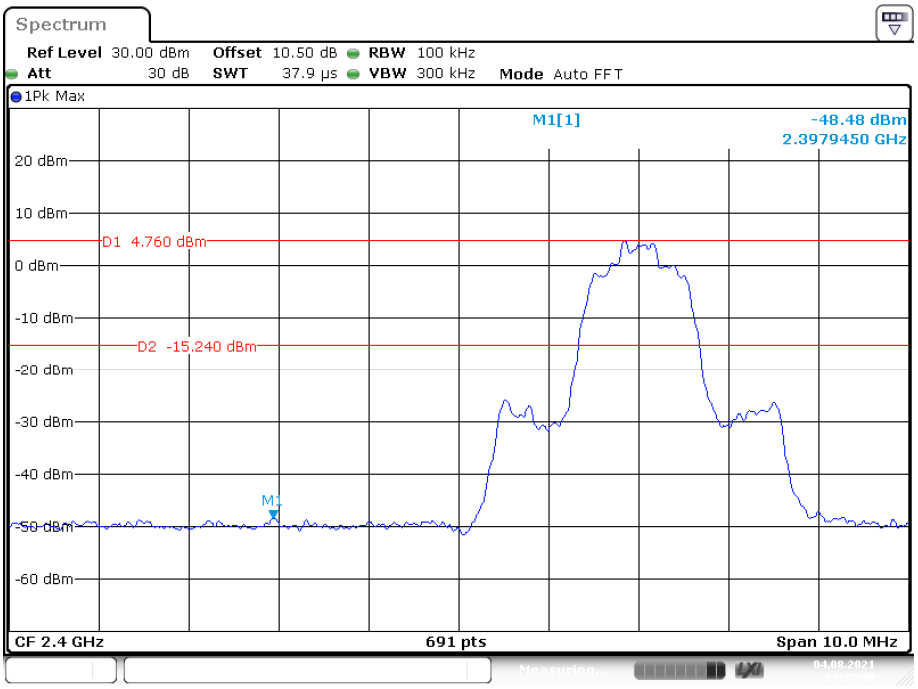
Hopping



Date: 4.AUG.2021 15:17:25

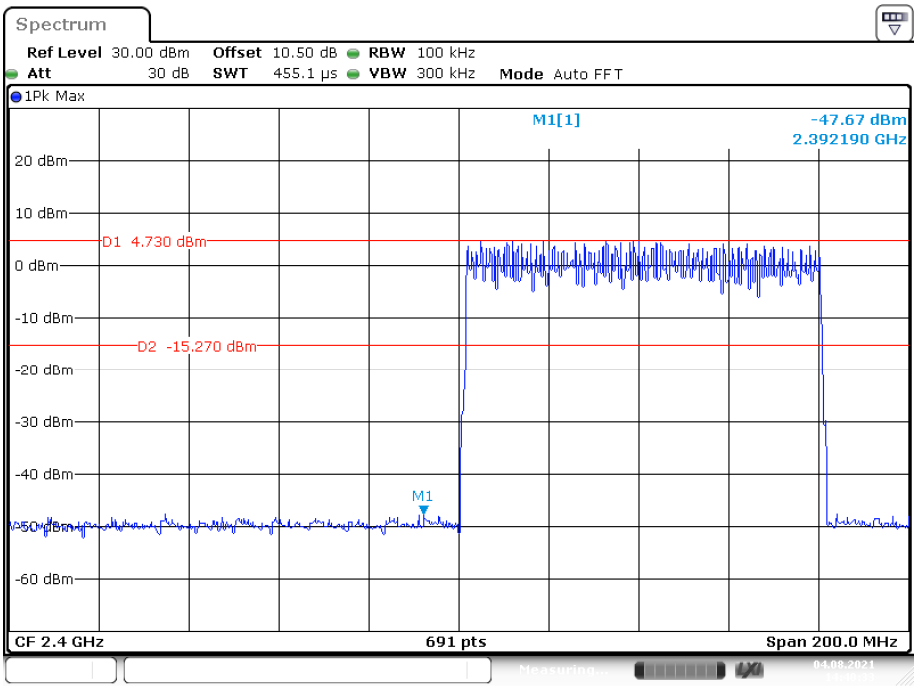
EDR (8DPSK): Band Edge-Left Side

Single



Date: 4.AUG.2021 14:37:41

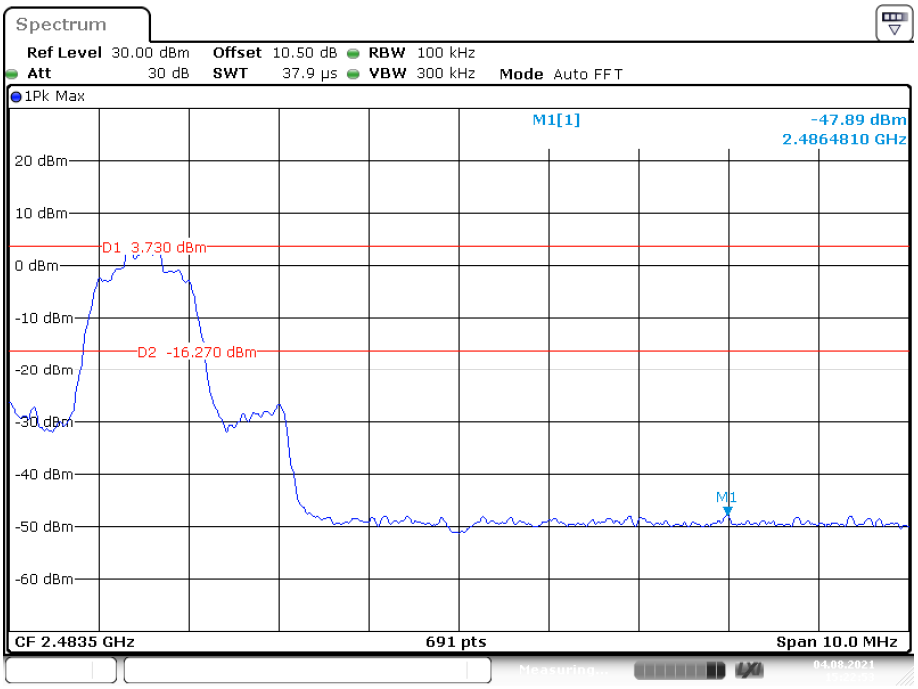
Hopping



Date: 4.AUG.2021 14:40:33

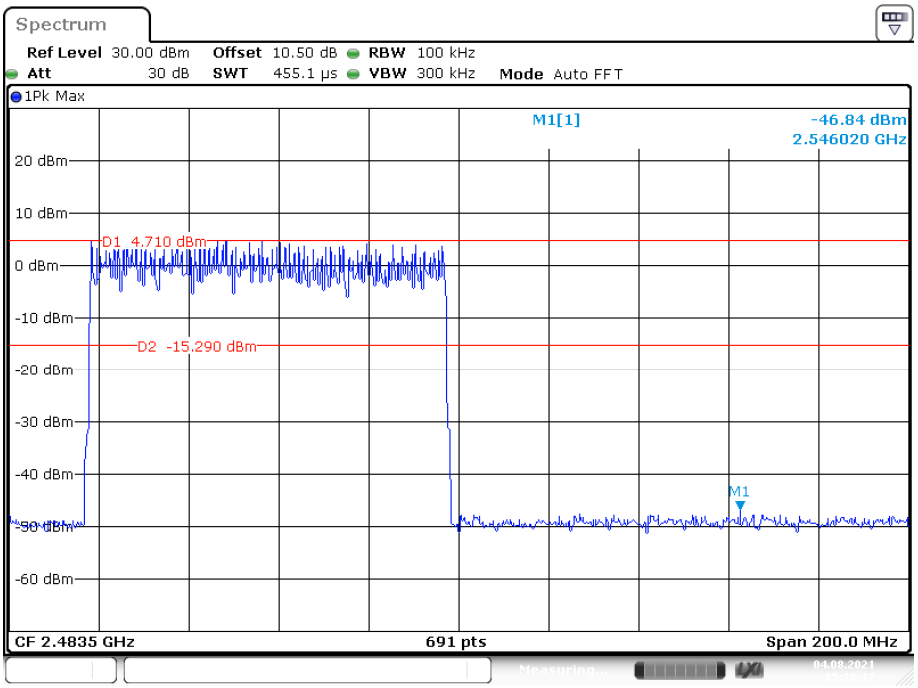
EDR (8DPSK): Band Edge-Right Side

Single



Date: 4.AUG.2021 15:22:53

Hopping



Date: 4.AUG.2021 15:20:17

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