FCC Part 15.247

TEST REPORT

For

PROTECH SYSTEMS Co., Ltd

NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.

FCC ID: 2AMRAMH5100

Report Type:	**Product Type:**
Original Report	10.1” Integrated Pad

Report Producer:	Jane Lee
Report Number:	RTWL170619001-00B
Report Date:	2017-10-23
Reviewed By:	Jerry Chang

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REVISION HISTORY

Revision	Issue Date	Description
1.0	2017.10.23	Original

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	PROTECH SYSTEMS Co., Ltd NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.
Manufacturer:	PROTECH SYSTEMS Co., Ltd NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.
Product:	10.1" Integrated Pad
Model:	MH-5100
Trade Name:	PROTECH
Frequency Range:	2402-2480 MHz
Transmit Power:	BDR(GFSK) Mode: -7.47 dBm (0.0001791W) EDR(π/4-DQPSK) Mode:-13.64 dBm(0.0000433W) EDR(8-DPSK) Mode:-14.63 dBm (0.0000344W)
Modulation Technique:	BDR Mode: GFSK EDR Mode: π/4-DQPSK EDR Mode: 8-DPSK
Transmit Data Rate:	BDR(GFSK) Mode: 1 Mbps EDR (π/4-DQPSK) Mode: 2 Mbps EDR (8-DPSK) Mode: 3 Mbps
Number of Channels:	BT Mode: 79 Channels
Antenna Specification:	Microstrip Antenna / Gain: 2.26 dBi
Voltage Range:	Adapter: I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 12Vdc, 2.0A
Date of Test:	June 19, 2017 ~ Oct 23, 2017

**All measurement and test data in this report was gathered from production sample identifier: 170619001 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-06-19.*

1.2 Objective

This report is prepared on behalf of *PROTECH SYSTEMS Co., Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

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

1.3 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with FCC ID: 2AMRAMH5100

1.4 Test Methodology

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

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on
☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
☒68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 under the Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

For BT mode, 79 channels are provided to testing:

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

2.2 Equipment Modifications

No modification was made to the EUT

2.3 EUT Exercise Software

Used "WM_BAN_BM_10_L_BT" software.

Test Software Version		Engineering Mode		
Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	0	0	0
	π/4-DQPSK	0	0	0
	8DPSK	0	0	0

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
Adaptor	Top-Unum Electronics Co., Ltd.	KSASB0241200200D5	DOC	N/A	Adaptor

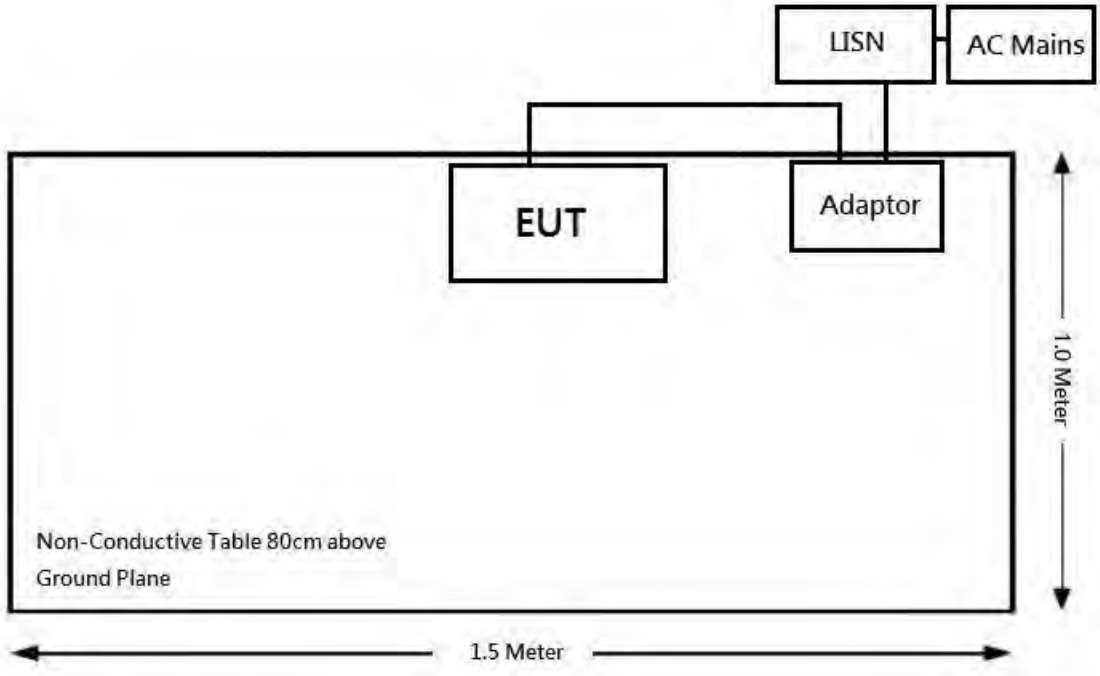
2.5 External Cable List and Details

Cable Description	Length (m)	From	To
N/A	N/A	N/A	N/A

2.6 Block Diagram of Test Setup

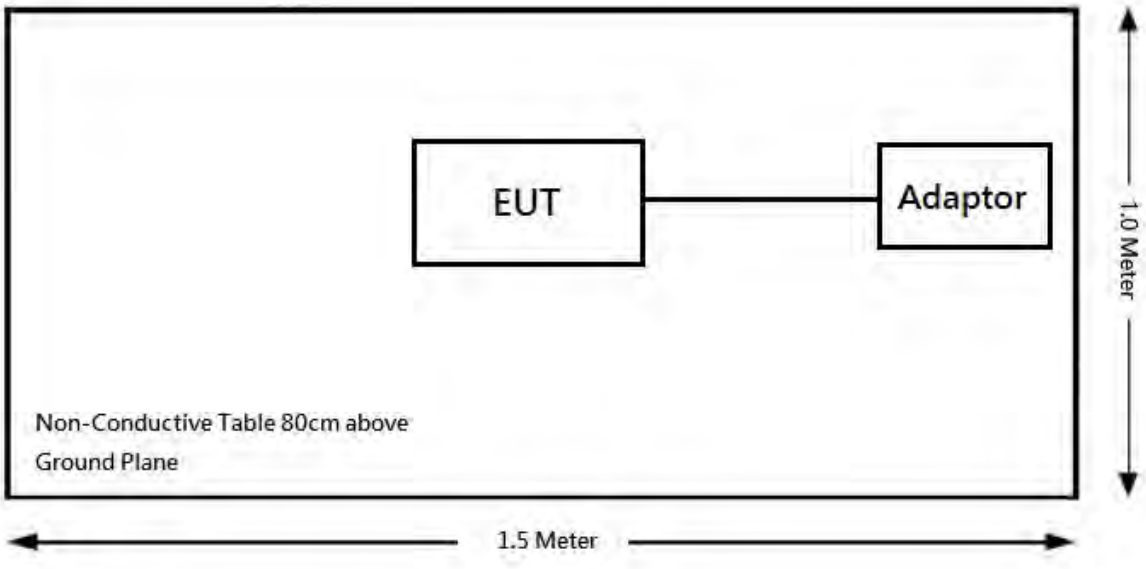
See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.

Conduction:

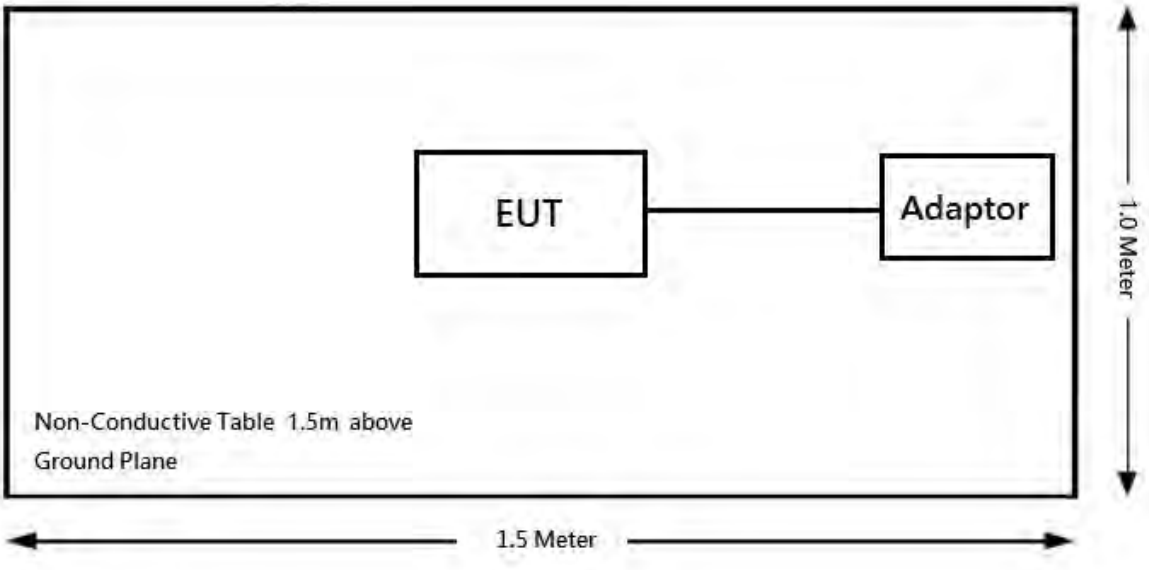


Radiation:

Below 1GHz:



Above 1GHz:


EUT
Adaptor
1.0 Meter
Non-Conductive Table 1.5m above
Ground Plane
1.5 Meter

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247 (a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance

4 FCC §15.247(i), §2.1093 - RF EXPOSURE

4.1 Applicable Standard

4.2 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 v06
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

4.3 Measurement Result

For BT Mode: Worst case

Frequency (MHz)	Tunp-up Power		Evaluation Distrance (mm)	SAR Excluion Result	Extremity SAR Exclusion Limit (1g SAR)
	(dBm)	(mW)			
2480	-7.00	0.1995	5	0.1	3

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 15.203,

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

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6 dBi.

5.2 Antenna List and Details

Manufacturer	Model	Type	Antenna Gain	Result
Gaobotech Technology Co., Ltd.	GA16-25201235B1-101-1	Microstrip Antenna	2.26 dBi	Compliance
Gaobotech Technology Co., Ltd.	GA16-25201235B1-101-2	Microstrip Antenna	3.04 dBi	Compliance

*Remark :
1. GA16-25201235B1-101-1 for Bluetooth and Wifi
2. GA16-25201235B1-101-2 for Wifi

6 FCC §15.207(a) –AC Line Conducted Emissions

6.1 Applicable Standard

According to §15.207

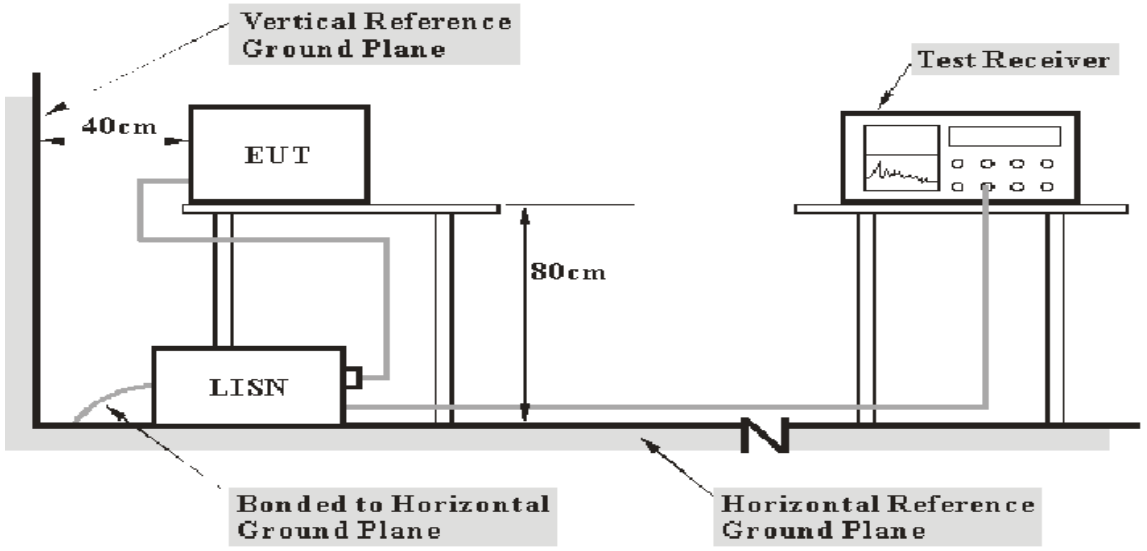
6.2 Measurement Uncertainty

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

6.3 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

6.4 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150kHz to 30MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

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

6.5 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.6 Corrected Factor & Margin Calculation

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

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "Over Limit" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Level – Limit Line

6.7 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date	Calibration Due Date
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
LISN	EMCO	3816/2	00075848	2017/08/02	2018/08/01
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/03	2017/11/02
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2017/08/11	2018/08/10
RF Cable	EMEC	EM-CB5D	001	2017/07/24	2018/07/23
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R

6.8 Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	58 %
ATM Pressure:	1020 hPa

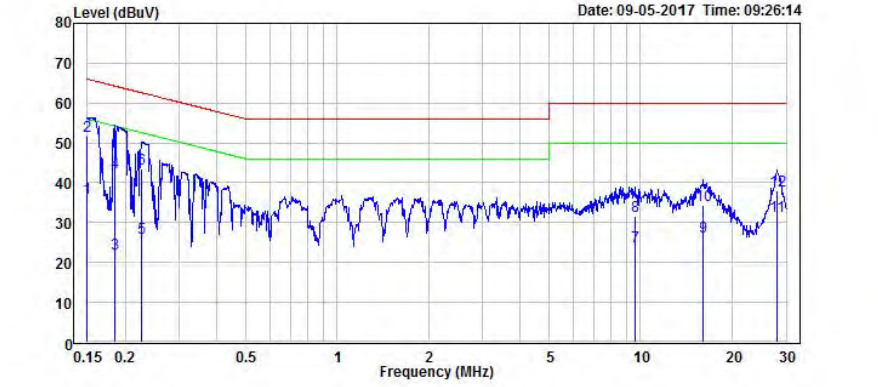
The testing was performed by Andy Shih from 2017-09-05 to 2017-10-17.

6.9 Test Results

Please refer to the following plots and tables.

Mode: Charge + Transmitting Mode

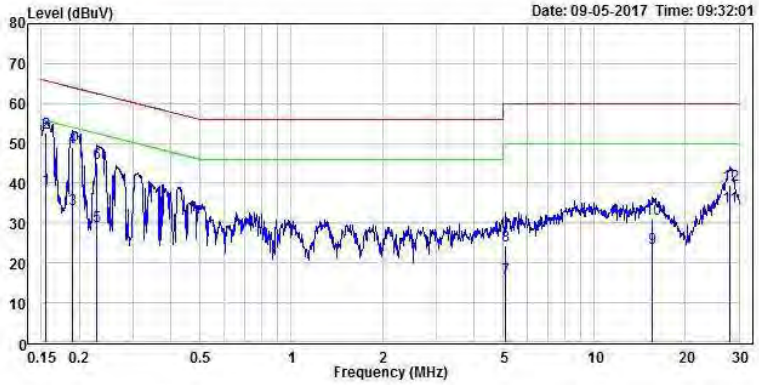
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	36.32	56.00	-19.68	19.50	16.82	Average	Line
2	0.150	51.60	66.00	-14.40	19.50	32.10	QP	Line
3	0.184	22.21	54.31	-32.10	19.50	2.71	Average	Line
4	0.184	42.56	64.31	-21.75	19.50	23.06	QP	Line
5	0.225	26.14	52.62	-26.48	19.50	6.64	Average	Line
6	0.225	43.35	62.62	-19.27	19.50	23.85	QP	Line
7	9.576	24.14	50.00	-25.86	19.77	4.37	Average	Line
8	9.576	31.76	60.00	-28.24	19.77	11.99	QP	Line
9	16.028	26.57	50.00	-23.43	19.79	6.78	Average	Line
10	16.028	34.31	60.00	-25.69	19.79	14.52	QP	Line
11	28.031	31.69	50.00	-18.31	19.88	11.81	Average	Line
12	28.031	38.06	60.00	-21.94	19.88	18.18	QP	Line

Main: AC 120V/60 Hz, Neutral



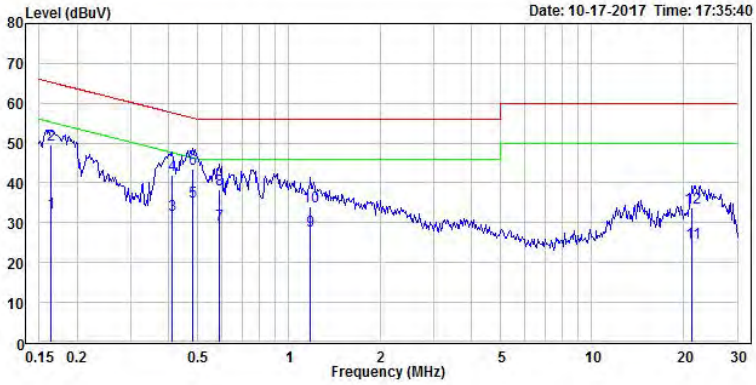
Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.155	38.78	55.73	-16.95	19.63	19.15	Average	Neutral
2	0.155	52.52	65.73	-13.21	19.63	32.89	QP	Neutral
3	0.191	33.33	54.01	-20.68	19.63	13.70	Average	Neutral
4	0.191	48.94	64.01	-15.07	19.63	29.31	QP	Neutral
5	0.229	29.23	52.48	-23.25	19.63	9.60	Average	Neutral
6	0.229	45.12	62.48	-17.36	19.63	25.49	QP	Neutral
7	5.096	16.07	50.00	-33.93	19.82	-3.75	Average	Neutral
8	5.096	24.30	60.00	-35.70	19.82	4.48	QP	Neutral
9	15.524	23.74	50.00	-26.26	19.98	3.76	Average	Neutral
10	15.524	30.90	60.00	-29.10	19.98	10.92	QP	Neutral
11	28.031	34.05	50.00	-15.95	20.13	13.92	Average	Neutral
12	28.031	39.60	60.00	-20.40	20.13	19.47	QP	Neutral

Testing Laboratory
3180

Mode: Charge + Transmitting with White cradle Mode

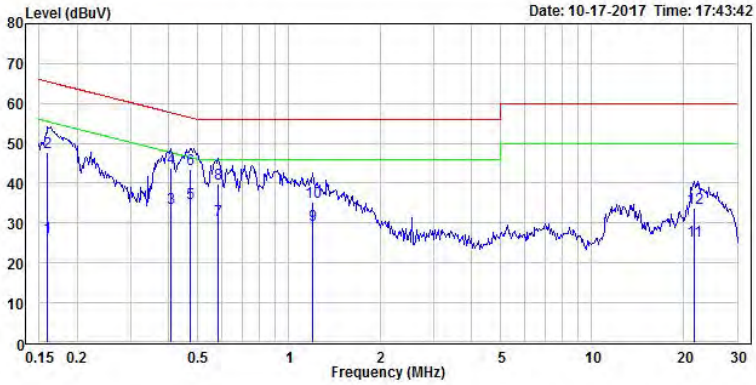
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.164	32.53	55.27	-22.74	19.50	13.03	Average	Line
2	0.164	49.69	65.27	-15.58	19.50	30.19	QP	Line
3	0.413	31.99	47.60	-15.61	19.51	12.48	Average	Line
4	0.413	41.99	57.60	-15.61	19.51	22.48	QP	Line
5	0.480	35.21	46.34	-11.13	19.51	15.70	Average	Line
6	0.480	43.36	56.34	-12.98	19.51	23.85	QP	Line
7	0.591	29.47	46.00	-16.53	19.51	9.96	Average	Line
8	0.591	38.20	56.00	-17.80	19.51	18.69	QP	Line
9	1.181	27.95	46.00	-18.05	19.54	8.41	Average	Line
10	1.181	34.11	56.00	-21.89	19.54	14.57	QP	Line
11	21.298	24.93	50.00	-25.07	19.85	5.08	Average	Line
12	21.298	33.70	60.00	-26.30	19.85	13.85	QP	Line

Main: AC 120V/60 Hz, Neutral

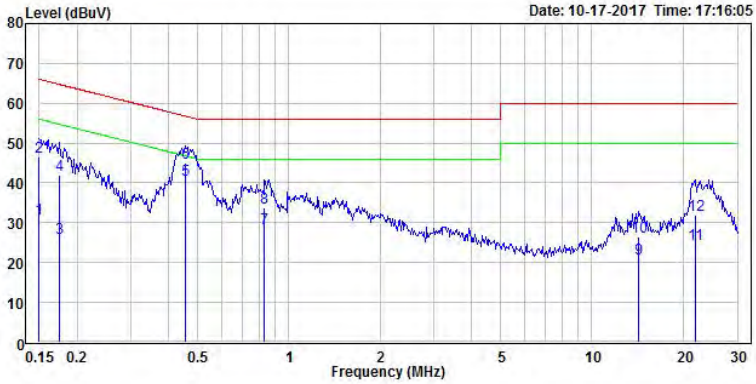


Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.160	26.49	55.47	-28.98	19.63	6.86	Average	Neutral
2	0.160	47.68	65.47	-17.79	19.63	28.05	QP	Neutral
3	0.406	33.64	47.73	-14.09	19.64	14.00	Average	Neutral
4	0.406	43.84	57.73	-13.89	19.64	24.20	QP	Neutral
5	0.472	35.03	46.47	-11.44	19.64	15.39	Average	Neutral
6	0.472	43.47	56.47	-13.00	19.64	23.83	QP	Neutral
7	0.586	30.72	46.00	-15.28	19.64	11.08	Average	Neutral
8	0.586	39.93	56.00	-16.07	19.64	20.29	QP	Neutral
9	1.200	29.40	46.00	-16.60	19.68	9.72	Average	Neutral
10	1.200	35.42	56.00	-20.58	19.68	15.74	QP	Neutral
11	21.640	25.61	50.00	-24.39	20.06	5.55	Average	Neutral
12	21.640	33.90	60.00	-26.10	20.06	13.84	QP	Neutral

Mode: Charge + Transmitting with Black cradle Mode

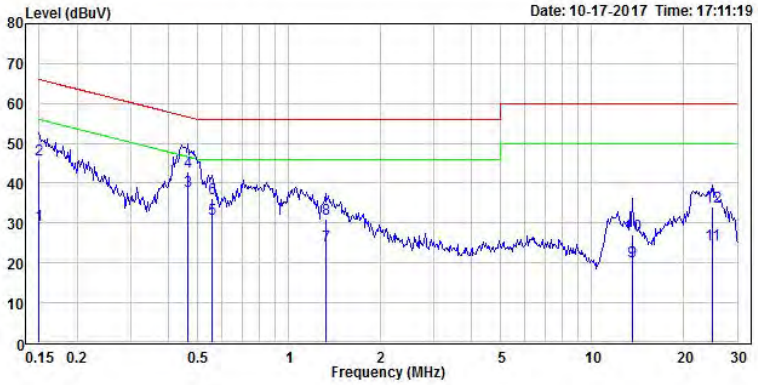
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	31.02	56.00	-24.98	19.50	11.52	Average	Line
2	0.150	46.47	66.00	-19.53	19.50	26.97	QP	Line
3	0.175	26.19	54.74	-28.55	19.50	6.69	Average	Line
4	0.175	41.84	64.74	-22.90	19.50	22.34	QP	Line
5	0.454	40.69	46.80	-6.11	19.51	21.18	Average	Line
6	0.454	45.01	56.80	-11.79	19.51	25.50	QP	Line
7	0.832	28.63	46.00	-17.37	19.52	9.11	Average	Line
8	0.832	33.70	56.00	-22.30	19.52	14.18	QP	Line
9	14.186	21.07	50.00	-28.93	19.79	1.28	Average	Line
10	14.186	26.36	60.00	-33.64	19.79	6.57	QP	Line
11	21.813	24.52	50.00	-25.48	19.86	4.66	Average	Line
12	21.813	31.87	60.00	-28.13	19.86	12.01	QP	Line

Main: AC 120V/60 Hz, Neutral



Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	29.44	56.00	-26.56	19.63	9.81	Average	Neutral
2	0.150	46.01	66.00	-19.99	19.63	26.38	QP	Neutral
3	0.465	37.99	46.60	-8.61	19.64	18.35	Average	Neutral
4	0.465	42.79	56.60	-13.81	19.64	23.15	QP	Neutral
5	0.559	30.98	46.00	-15.02	19.64	11.34	Average	Neutral
6	0.559	36.30	56.00	-19.70	19.64	16.66	QP	Neutral
7	1.320	24.39	46.00	-21.61	19.68	4.71	Average	Neutral
8	1.320	31.13	56.00	-24.87	19.68	11.45	QP	Neutral
9	13.524	20.50	50.00	-29.50	19.96	0.54	Average	Neutral
10	13.524	26.95	60.00	-33.05	19.96	6.99	QP	Neutral
11	24.779	24.78	50.00	-25.22	20.09	4.69	Average	Neutral
12	24.779	34.18	60.00	-25.82	20.09	14.09	QP	Neutral

7 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.2 Measurement Uncertainty

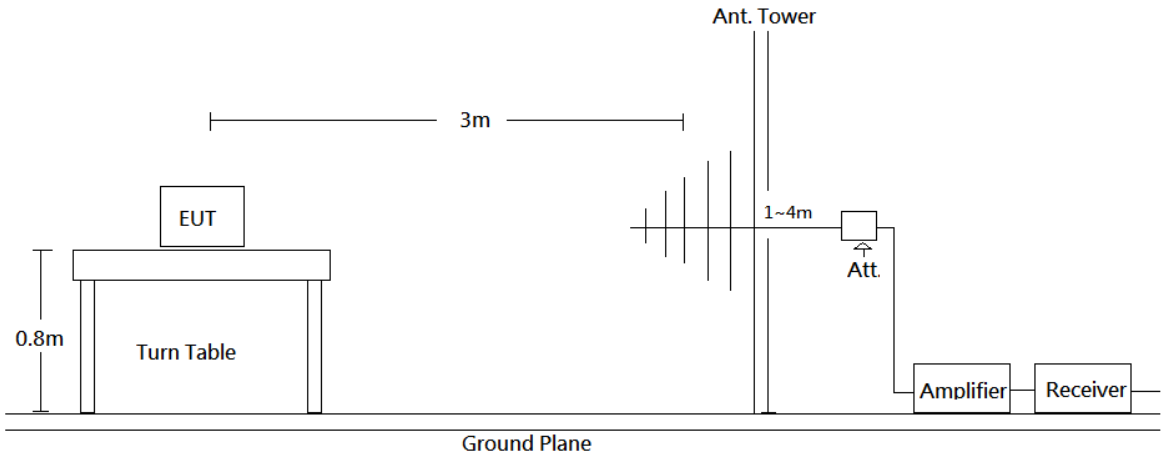
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

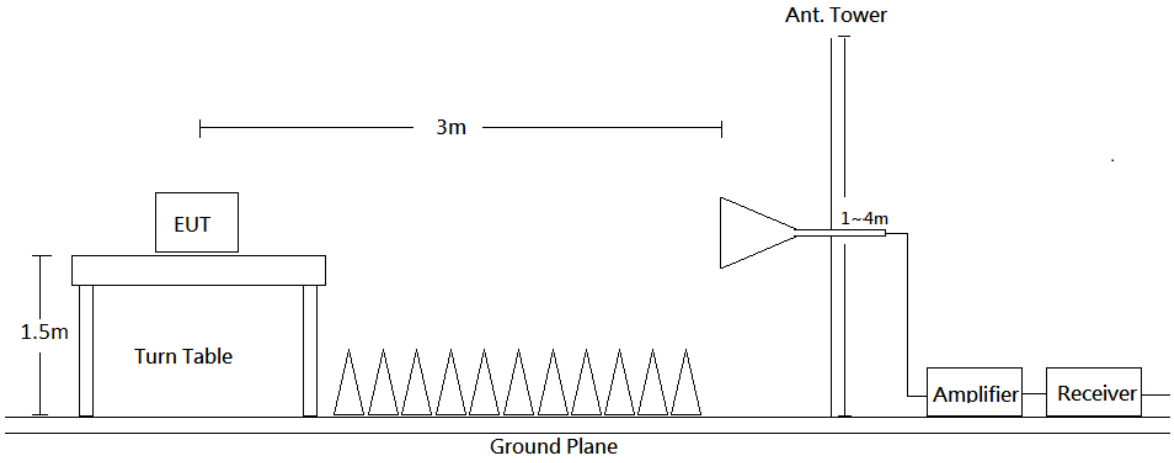
Frequency	Measurement uncertainty
30 MHz~200 MHz	4.21 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.41 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.51 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	4.88 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.30 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

7.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	IF BW	Detector
30-1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Ave

7.5 Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.6 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result –Limit

7.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit. Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$Lm + U(Lm) \leq Llim + Ucispr$

In BACL, U(Lm) is less than Ucispr, if Lm is less than Llim, it implies that the EUT complies with the limit.

7.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
966-A Room					
Bilog Antenna	Sunol & Mini-Circuits	JB6/ UNAT-6+	A050115 / 15542_01	2016/11/16	2017/11/15
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	00062638	2017/09/04	2018/09/03
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	060697	2017/04/14	2018/04/16
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
EMI Test Receiver	R & S	ESR7	101419	2016/11/03	2017/11/03
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/02	2017/11/01
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/11/29	2017/11/28
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2017/01/20	2018/01/19
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

7.9 Test Environmental Conditions

Temperature:	24 ° C
Relative Humidity:	57 %
ATM Pressure:	1020 hPa

The Radiated Spurious emission testing was performed by Ian Tu on 2017-09-08.
The Conducted Spurious Emissions testing was performed by Ian Tu on 2017-09-18.

7.10 Test Results

Mode: Test Mode
(Scan with GFSK, π/4-DQPSK, 8-DPSK Mode, the worst case is BDR (GFSK) Mode)

BDR Mode (30MHz ~25GHz)

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low channel								
220.1200	47.48	-12.75	34.73	46.00	-11.27	100	89	QP
321.0000	45.69	-9.39	36.30	46.00	-9.70	100	20	QP
480.0800	41.72	-6.05	35.67	46.00	-10.33	100	209	QP
2318.455	54.43	-5.05	49.38	74.00	-24.62	147	258	peak
2318.455	40.11	-5.05	35.06	54.00	-18.94	147	258	AVG
2402.000	90.28	-4.86	85.42	N/A	N/A	159	100	peak
2402.000	70.22	-4.86	65.36	N/A	N/A	159	100	AVG
4804.000	39.85	0.93	40.78	74.00	-33.22	117	161	peak
4804.000	32.54	0.93	33.47	54.00	-20.53	117	161	AVG
Middle channel								
198.7800	43.88	-10.96	32.92	43.50	-10.58	100	85	QP
321.0000	46.26	-9.39	36.87	46.00	-9.13	100	1	QP
480.0800	41.51	-6.05	35.46	46.00	-10.54	100	198	QP
2441.000	90.25	-4.76	85.49	N/A	N/A	142	89	peak
2441.000	70.17	-4.76	65.41	N/A	N/A	142	89	AVG
4882.000	39.45	1.23	40.68	74.00	-33.32	141	225	peak
4882.000	33.46	1.23	34.69	54.00	-19.31	141	225	AVG
High channel								
222.0600	47.01	-12.66	34.35	46.00	-11.65	100	87	QP
322.9400	43.87	-9.35	34.52	46.00	-11.48	100	28	QP
480.0800	41.01	-6.05	34.96	46.00	-11.04	100	206	QP
2480.000	90.97	-4.68	86.29	N/A	N/A	155	106	peak
2480.000	68.64	-4.68	63.96	N/A	N/A	155	106	AVG
2493.250	53.89	-4.66	49.23	74.00	-24.77	159	337	peak
2493.250	40.13	-4.66	35.47	54.00	-18.53	159	337	AVG
4960.000	38.85	1.52	40.37	74.00	-33.63	100	176	peak
4960.000	33.96	1.52	35.48	54.00	-18.52	100	176	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low channel								
207.5100	43.53	-12.42	31.11	43.50	-12.39	100	319	QP
480.0800	40.72	-6.05	34.67	46.00	-11.33	100	278	QP
746.8300	35.54	-1.86	33.68	46.00	-12.32	100	280	QP
2369.280	53.88	-4.93	48.95	74.00	-25.05	149	75	peak
2369.280	40.74	-4.93	35.81	54.00	-18.19	149	75	AVG
2402.000	85.90	-4.86	81.04	N/A	N/A	172	295	peak
2402.000	68.26	-4.86	63.40	N/A	N/A	172	295	AVG
4804.000	40.27	0.93	41.20	74.00	-32.80	100	142	peak
4804.000	34.26	0.93	35.19	54.00	-18.81	100	142	AVG
Middle channel								
119.2400	40.08	-10.89	29.19	43.50	-14.31	100	354	QP
480.0800	40.91	-6.05	34.86	46.00	-11.14	100	281	QP
600.3600	35.94	-3.97	31.97	46.00	-14.03	100	225	QP
2441.000	87.24	-4.76	82.48	N/A	N/A	147	111	peak
2441.000	68.69	-4.76	63.93	N/A	N/A	147	111	AVG
4882.000	38.72	1.23	39.95	74.00	-34.05	136	87	peak
4882.000	34.06	1.23	35.29	54.00	-18.71	136	87	AVG
High channel								
101.7800	44.14	-14.05	30.09	43.50	-13.41	100	1	QP
202.6600	37.90	-11.31	26.59	43.50	-16.91	100	326	QP
480.0800	40.94	-6.05	34.89	46.00	-11.11	100	273	QP
2480.000	85.97	-4.68	81.29	N/A	N/A	150	108	peak
2480.000	69.62	-4.68	64.94	N/A	N/A	150	108	AVG
2497.000	53.11	-4.64	48.47	74.00	-25.53	145	187	peak
2497.000	40.32	-4.64	35.68	54.00	-18.32	145	187	AVG
4960.000	40.18	1.52	41.70	74.00	-32.30	127	73	peak
4960.000	34.10	1.52	35.62	54.00	-18.38	127	73	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

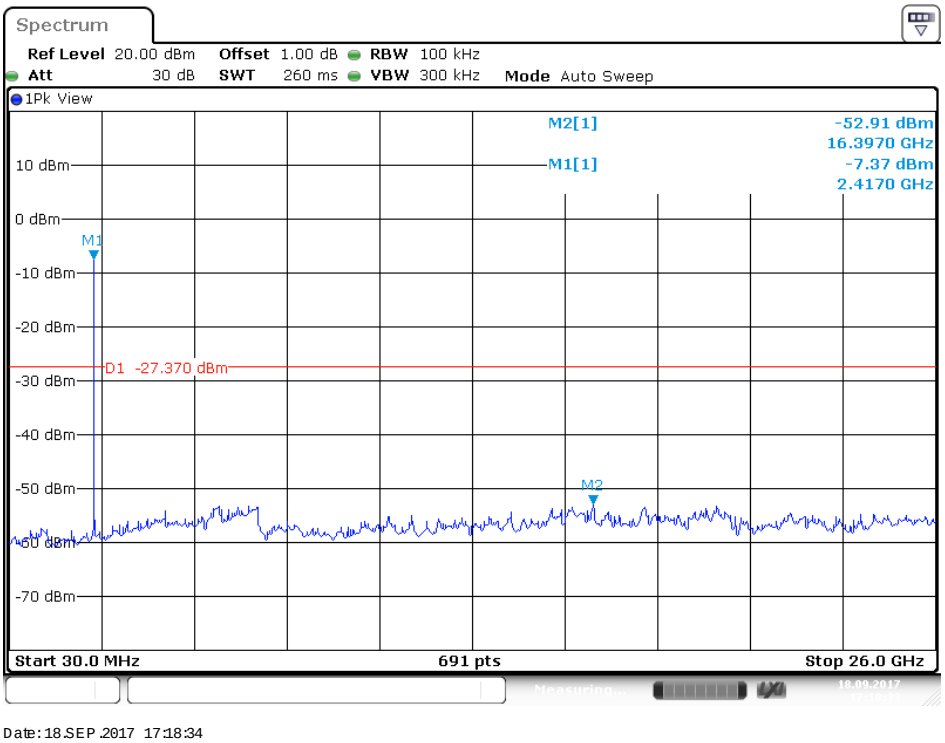
Conducted Spurious Emissions:

:

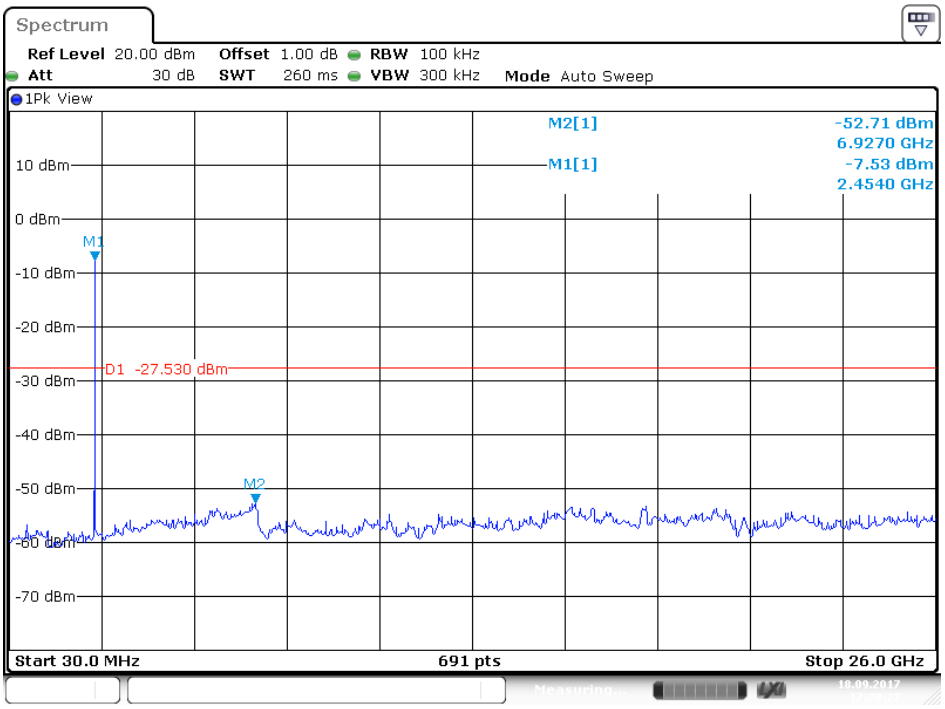
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
BDR Mode (GFSK)				
Low	2402	45.54	≥ 20	PASS
Mid	2441	45.18	≥ 20	PASS
High	2480	44.64	≥ 20	PASS
EDR Mode (π/4-DQPSK):				
Low	2402	41.94	≥ 20	PASS
Mid	2441	40.65	≥ 20	PASS
High	2480	40.78	≥ 20	PASS
EDR Mode (8DPSK):				
Low	2402	41.22	≥ 20	PASS
Mid	2441	40.24	≥ 20	PASS
High	2480	41.18	≥ 20	PASS

BDR Mode (GFSK)

Low Channel

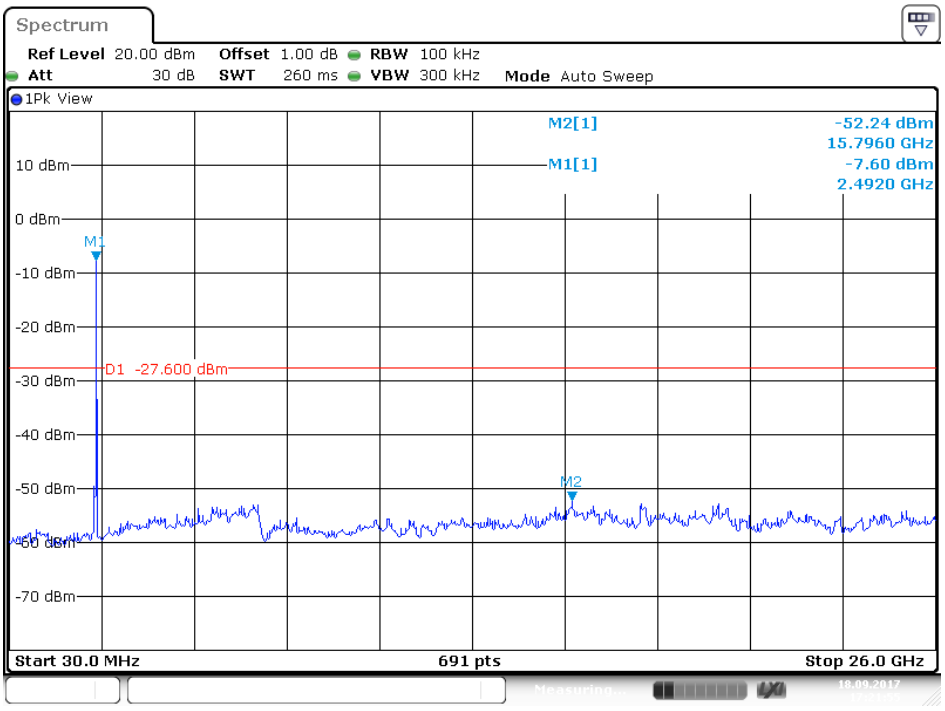


Middle Channel



Date: 18.SEP.2017 17:20:28

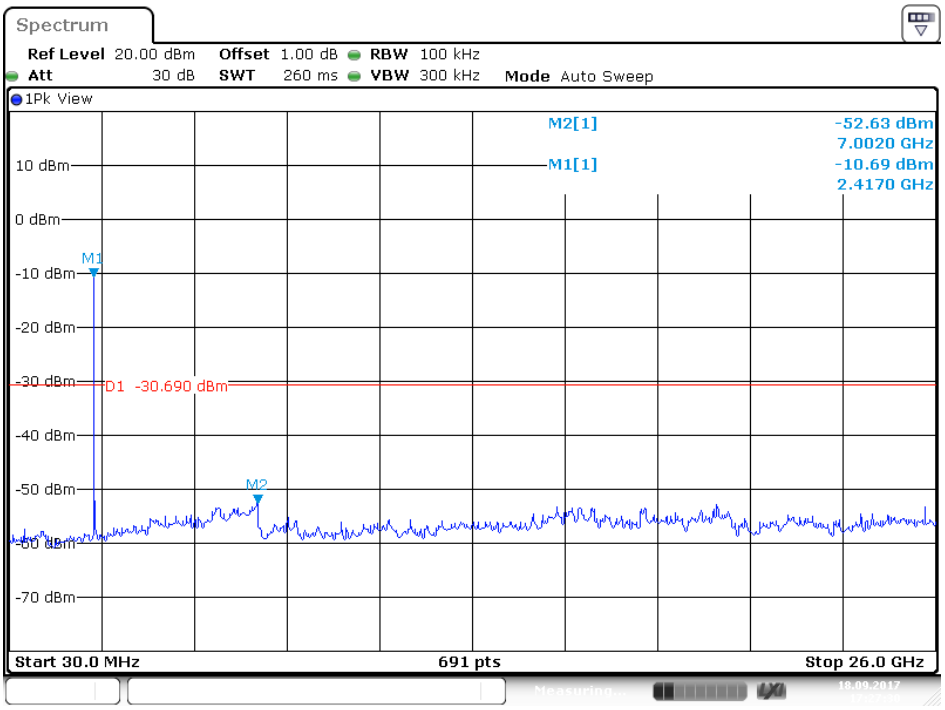
High Channel



Date: 18.SEP.2017 17:21:55

EDR Mode (π/4-DQPSK)

Low Channel



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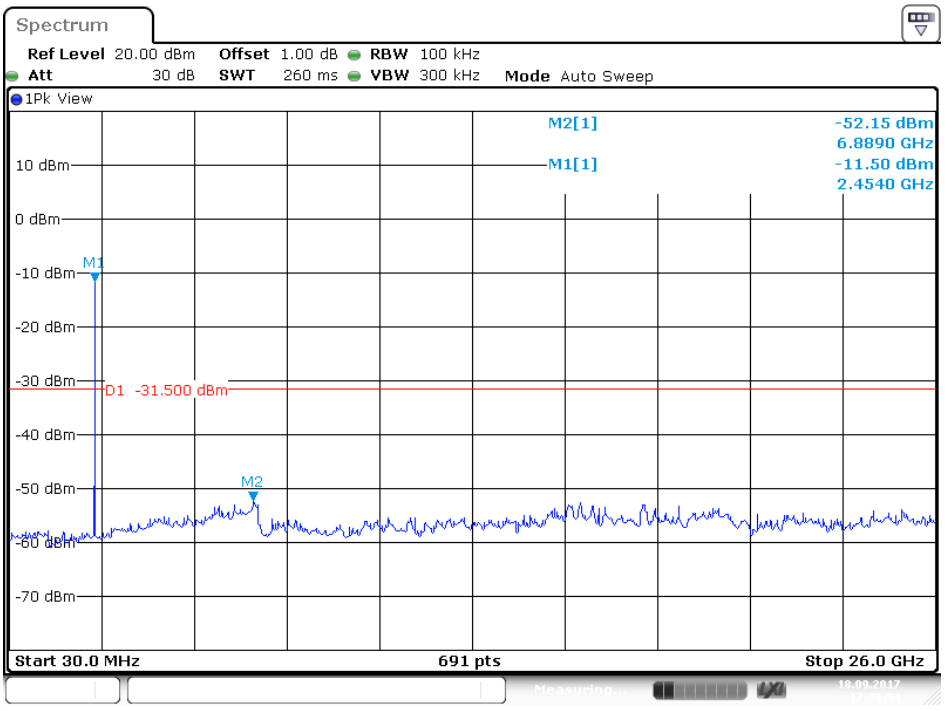
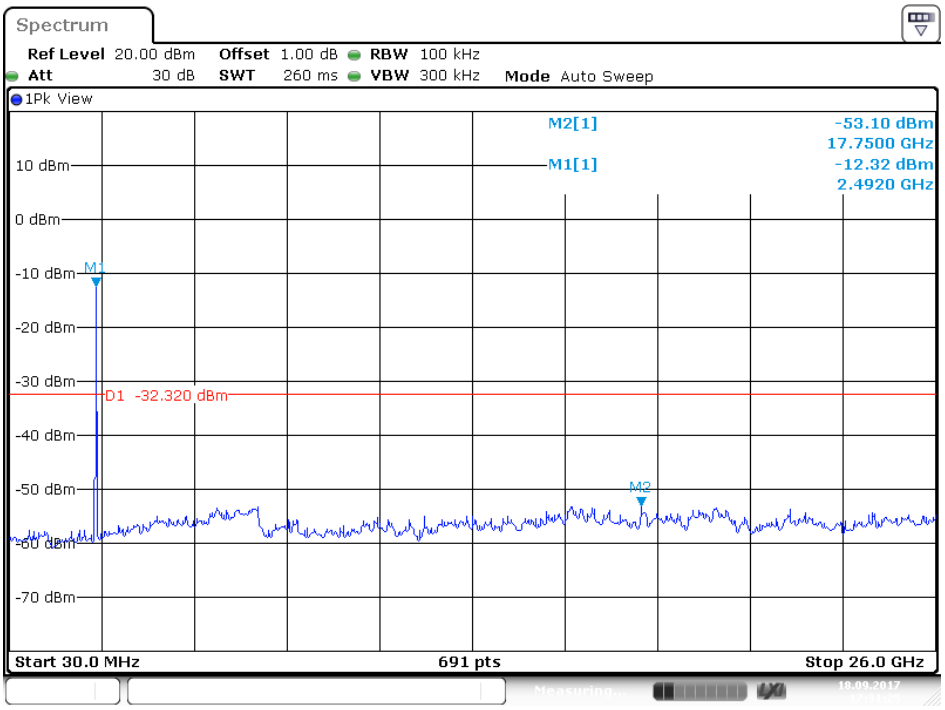
Middle Channel



Date: 18.SEP.2017 17:29:54

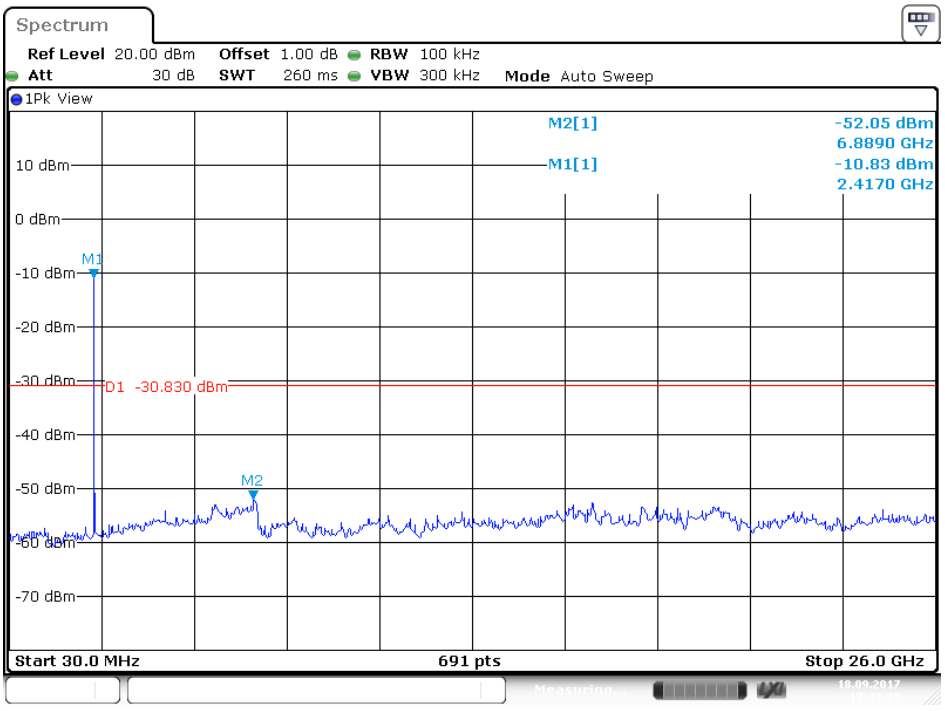
High Channel



Date: 18.SEP.2017 17:31:26

EDR Mode (8-DPSK)

Low Channel



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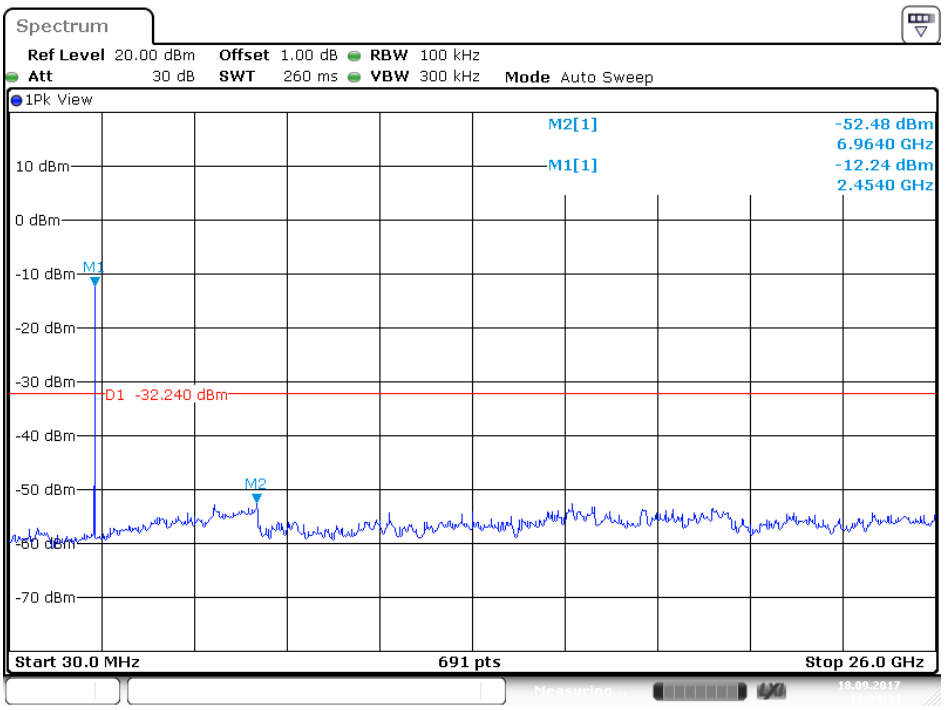
Middle Channel



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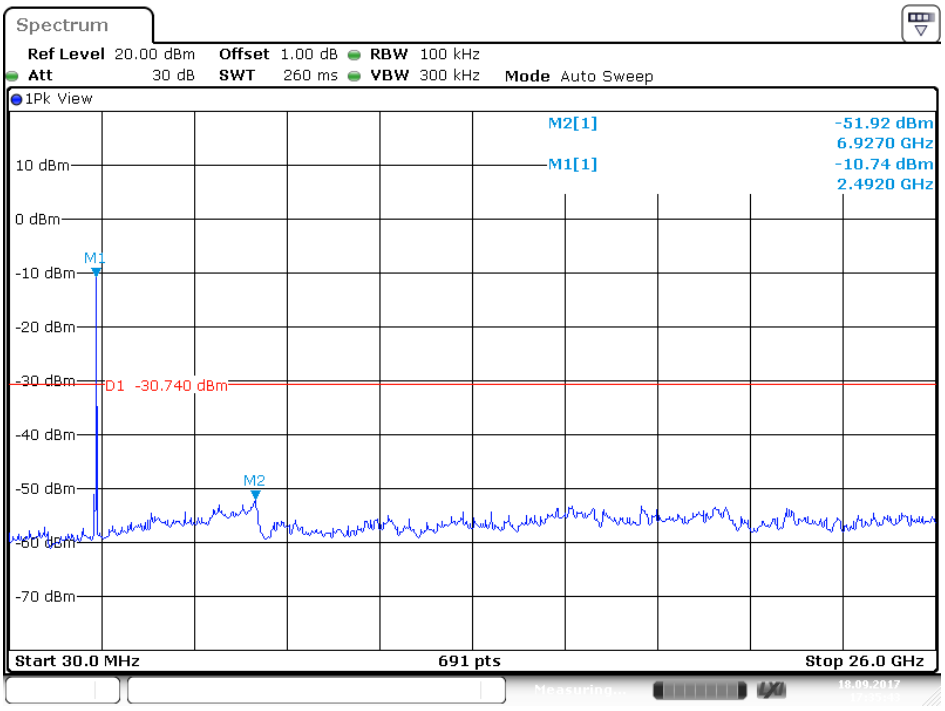
High Channel



Date: 18.SEP.2017 17:35:43

8 FCC §15.247(a)(1) – 20 dB Emission Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a) (1) the maximum 20 dB bandwidth of the hopping channel shall be presented.

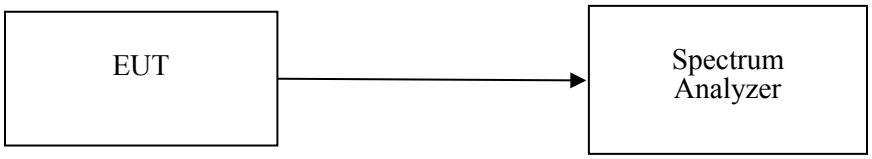
8.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

4. Repeat above procedures until all frequencies measured were complete.



8.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

8.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu from 2017-10-18 to 2017-10-23.

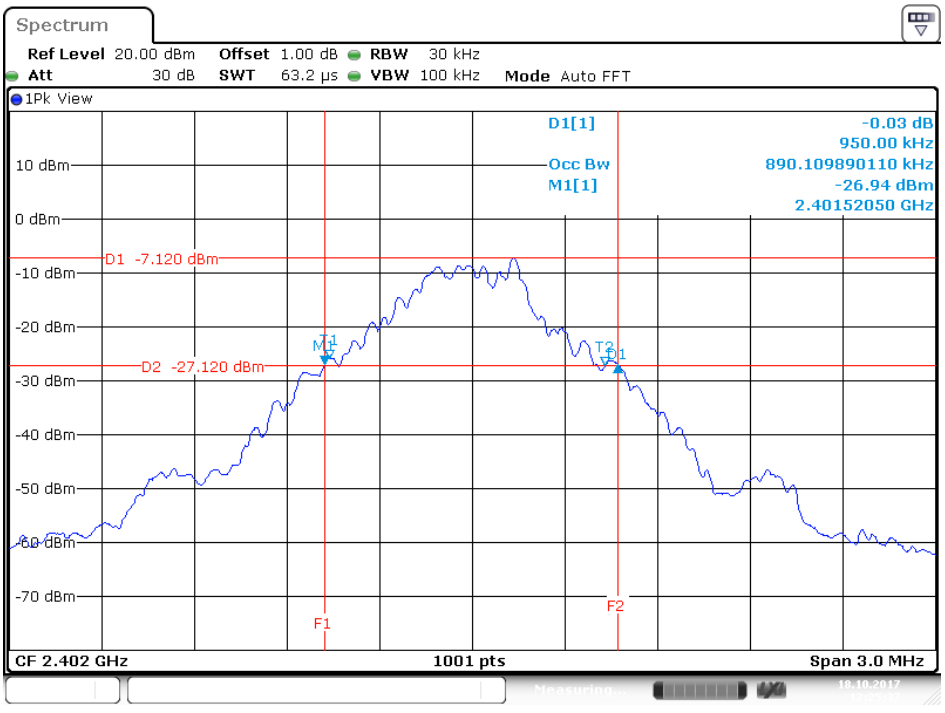
8.5 Test Results

Channel	Frequency (MHz)	20 dBc BW (MHz)
BDR Mode (GFSK)		
Low	2402	0.95
Middle	2441	0.96
High	2480	0.95
EDR Mode (π/4-DQPSK)		
Low	2402	1.35
Middle	2441	1.35
High	2480	1.34
EDR Mode (8-DPSK)		
Low	2402	1.32
Middle	2441	1.30
High	2480	1.30

Please refer to the following plots

BDR Mode (GFSK)

Low Channel



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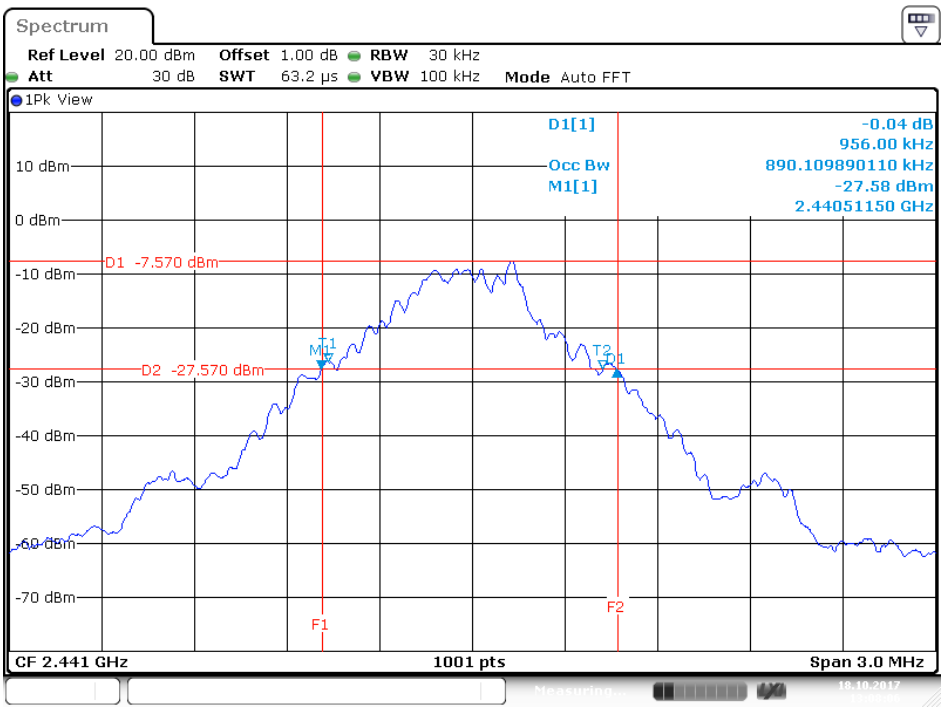
Middle Channel



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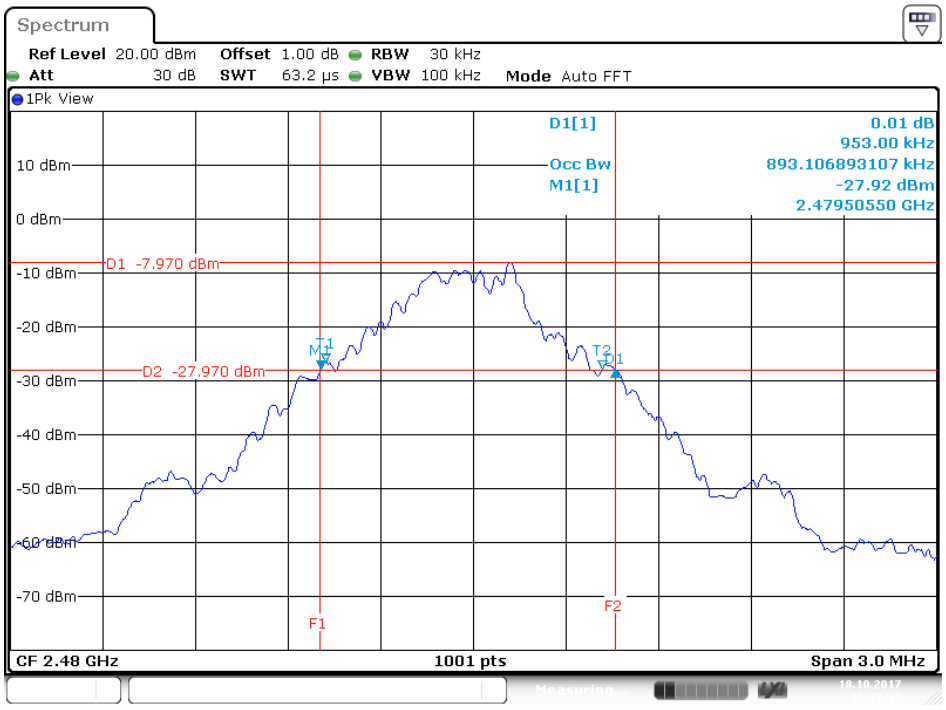
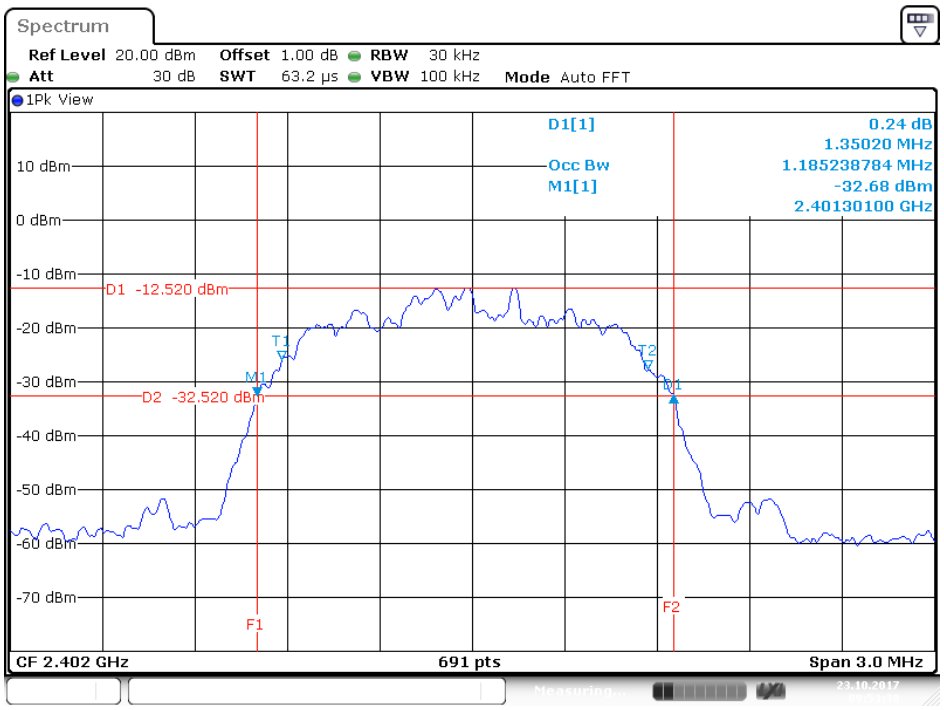
High Channel



Date: 18.OCT.2017 13:15:36

EDR Mode (π/4-DQPSK)

Low Channel



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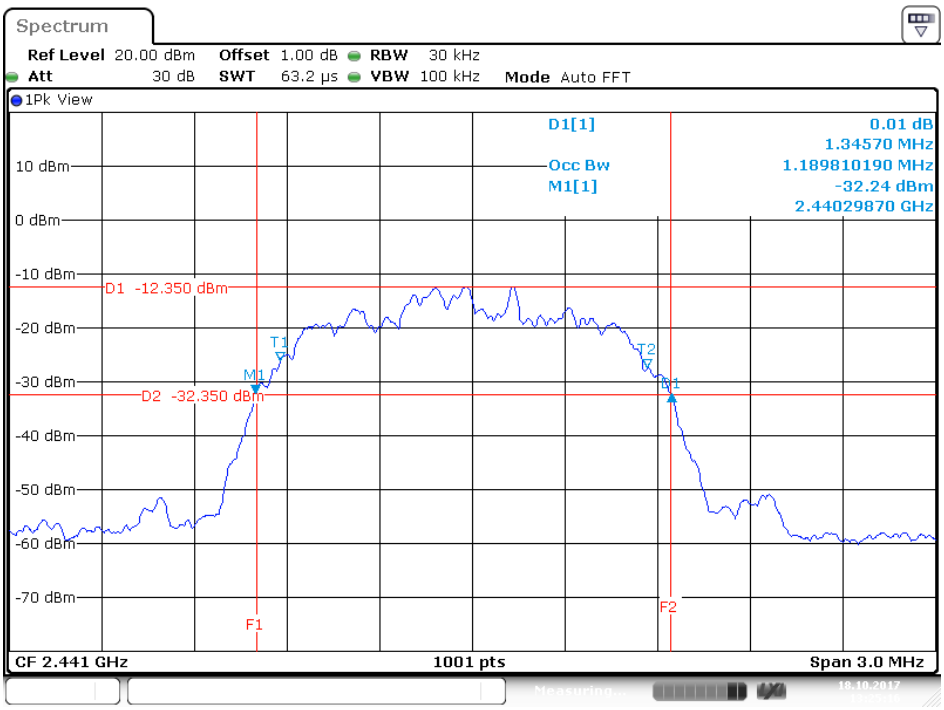
Middle Channel



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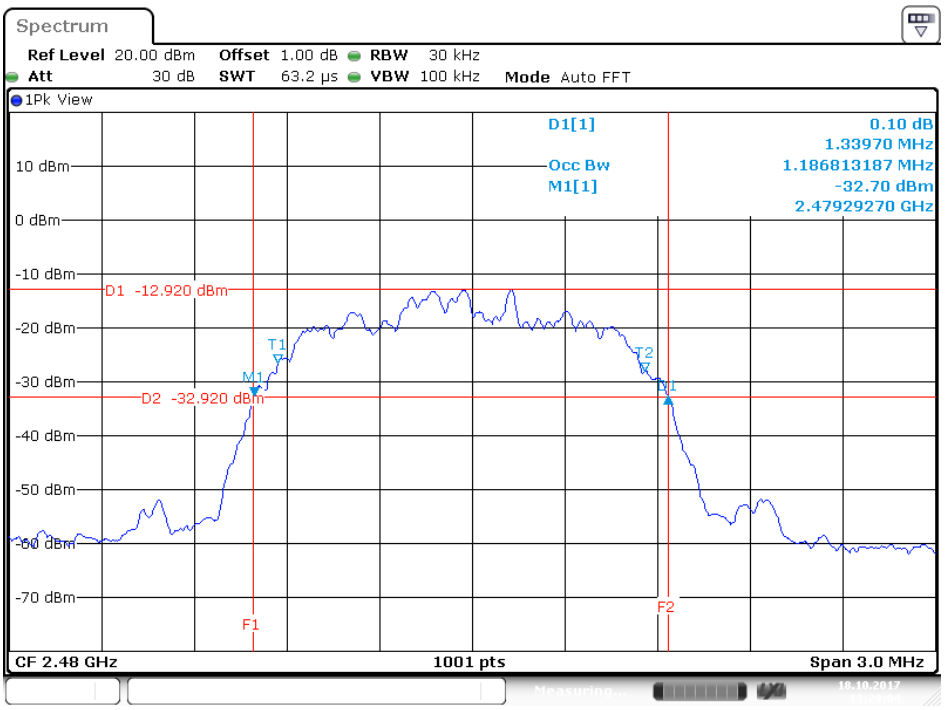
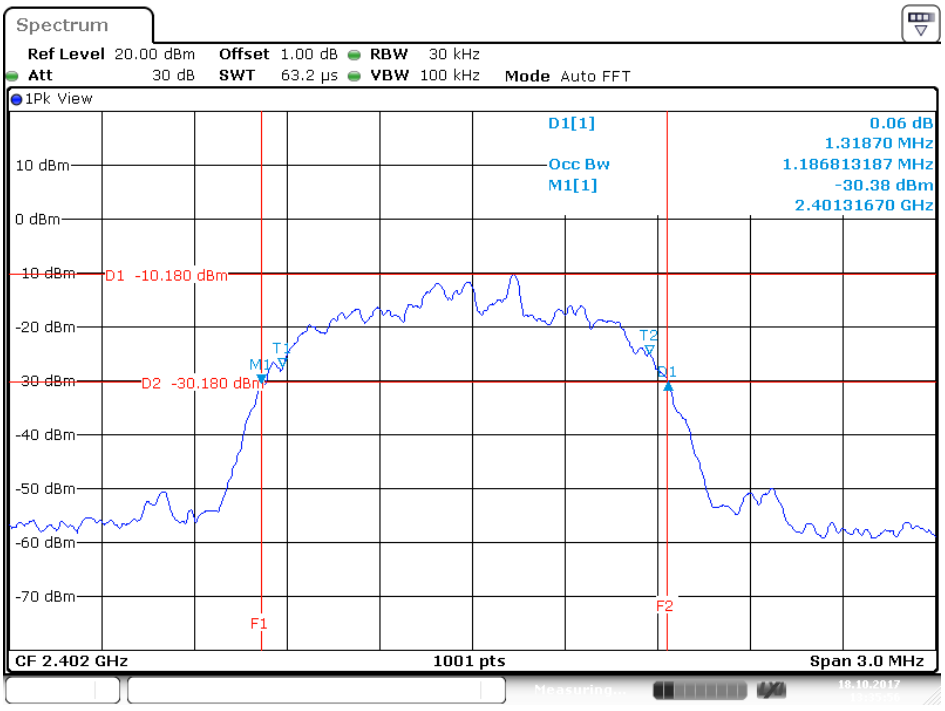
High Channel



Date: 18.OCT.2017 13:29:05

EDR Mode (8-DPSK)

Low Channel



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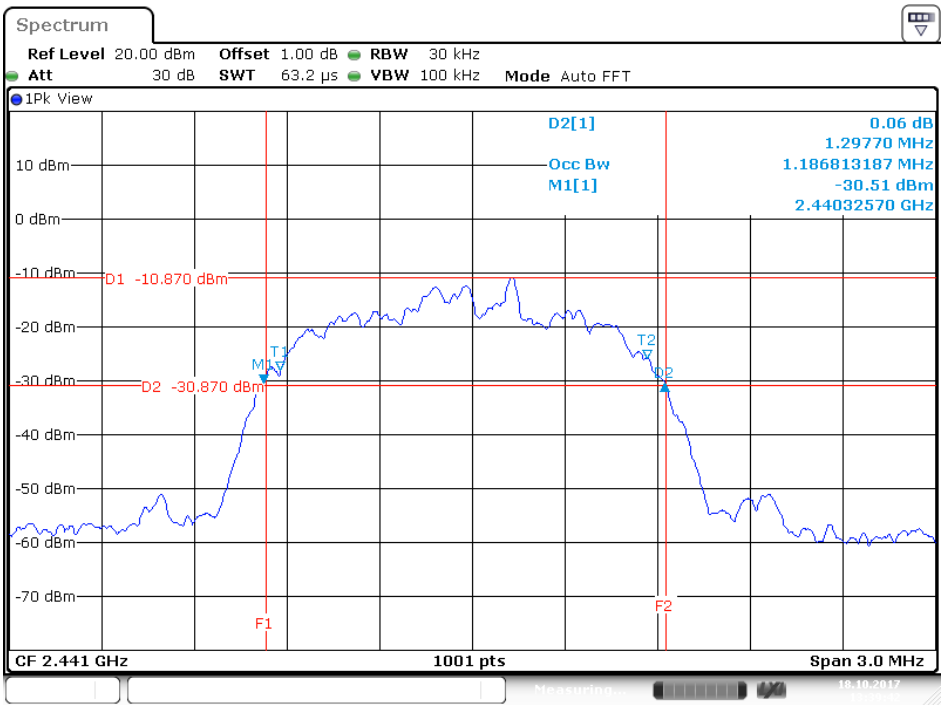
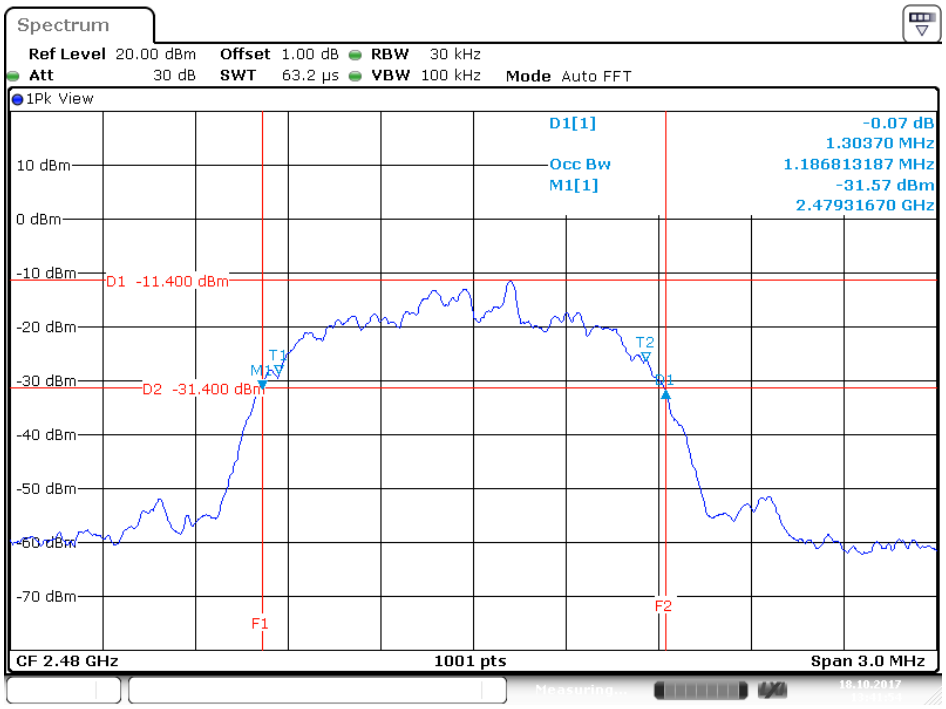
Middle Channel



Date: 18.OCT.2017 13:39:43

High Channel



Date: 18.OCT.2017 13:41:54

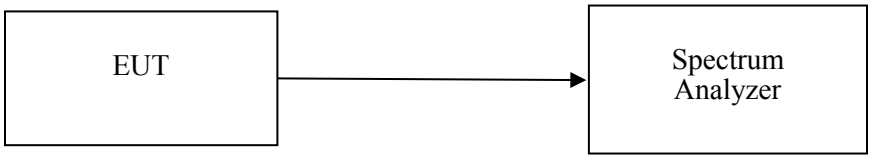
9 FCC §15.247(a)(1) – Channel Separation Test

9.1 Applicable Standard

According to FCC §15.247(a) (1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals..

9.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel
Video (or Average) Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold



9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

9.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu from 2017-08-18 to 2017-09-15.

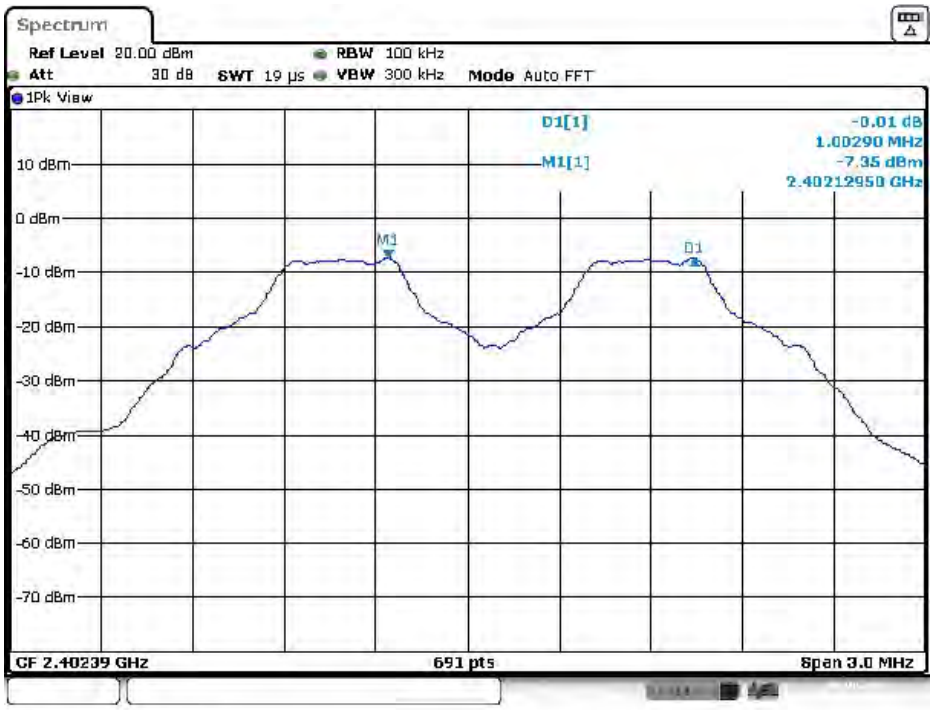
Test Results

Mode	Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
GFSK	Low	1	0.95	0.63	>two-thirds of the 20 dB bandwidth	Compliance
GFSK	Middle	1	0.96	0.64	>two-thirds of the 20 dB bandwidth	Compliance
GFSK	High	1	0.95	0.63	>two-thirds of the 20 dB bandwidth	Compliance
π/4-DQPSK	Low	1	1.35	0.90	>two-thirds of the 20 dB bandwidth	Compliance
π/4-DQPSK	Middle	1	1.35	0.90	>two-thirds of the 20 dB bandwidth	Compliance
π/4-DQPSK	High	1	1.34	0.89	>two-thirds of the 20 dB bandwidth	Compliance
8-DPSK	Low	1	1.32	0.88	>two-thirds of the 20 dB bandwidth	Compliance
8-DPSK	Middle	1	1.3	0.87	>two-thirds of the 20 dB bandwidth	Compliance
8-DPSK	High	1	1.3	0.87	>two-thirds of the 20 dB bandwidth	Compliance

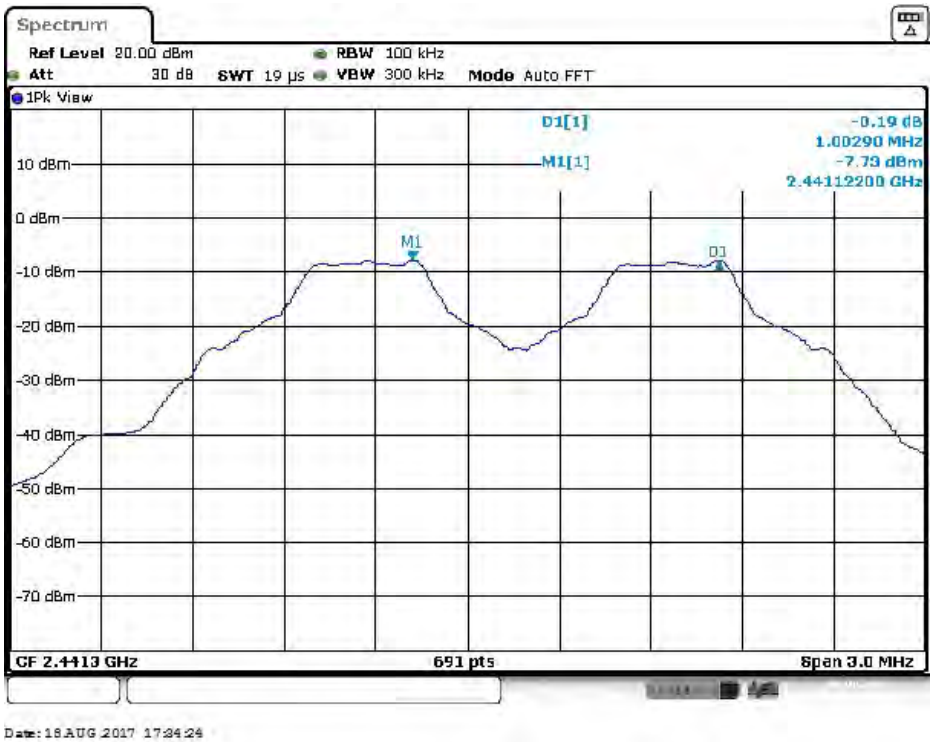
Please refer to the following plots

BDR Mode (GFSK)

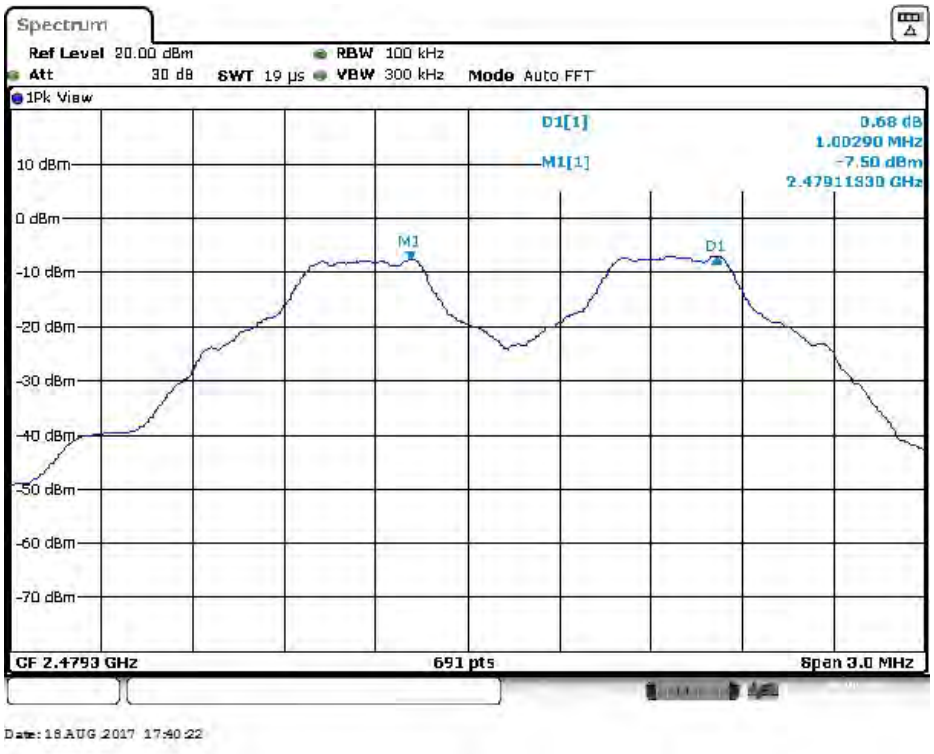
Low Channel



Middle Channel

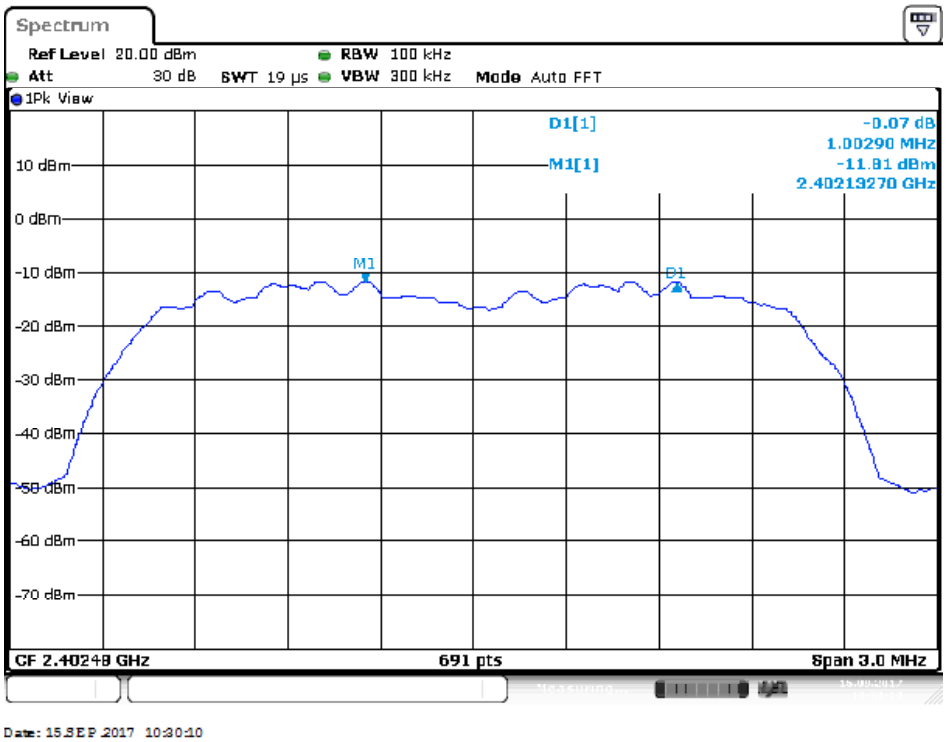


High Channel

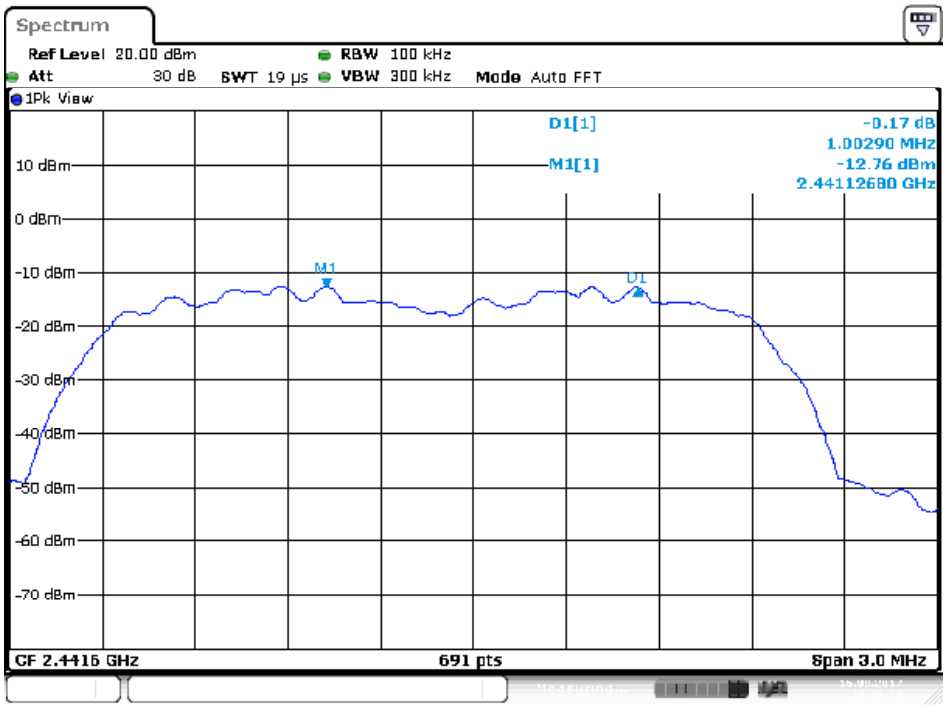


EDR Mode (π/4-DQPSK)

Low Channel

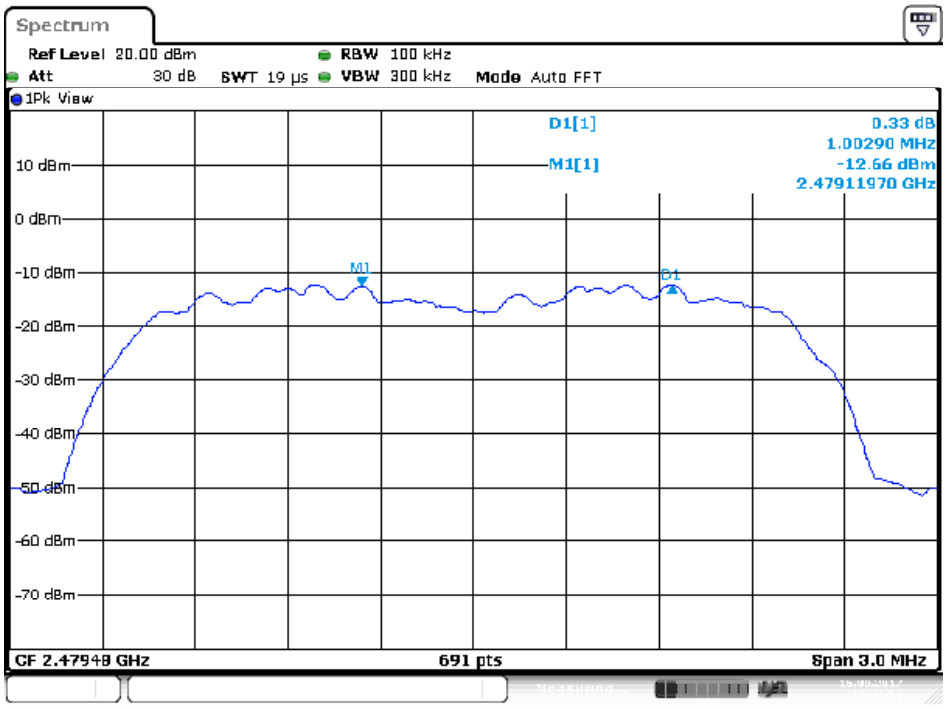


Middle Channel



Date: 15.SEP.2017 10:37:38

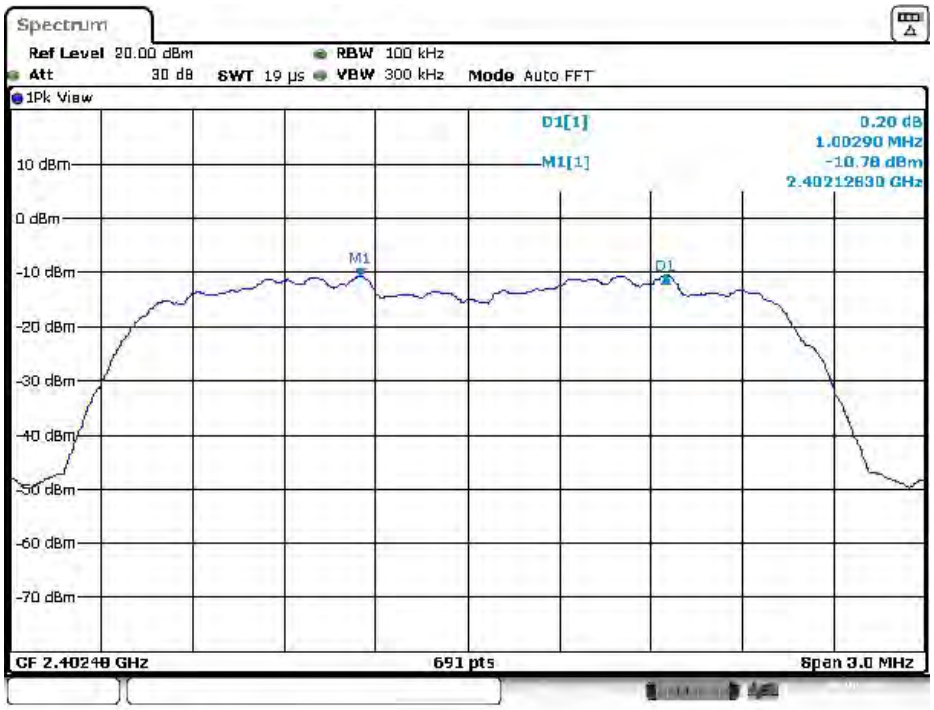
High Channel



Date: 15.SEP.2017 10:44:59

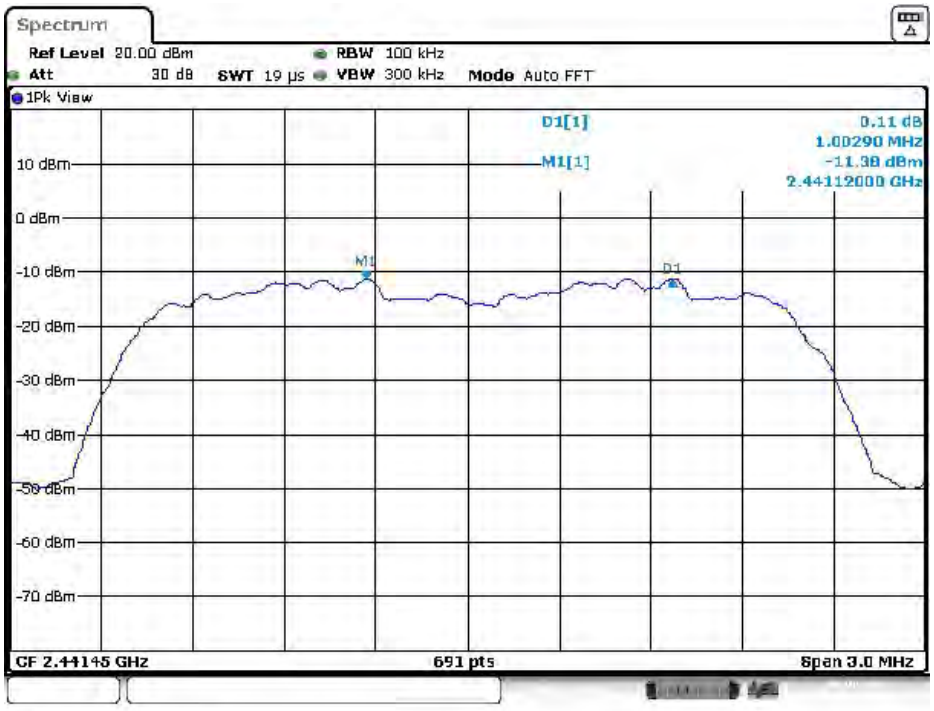
EDR Mode (8-DPSK)

Low Channel



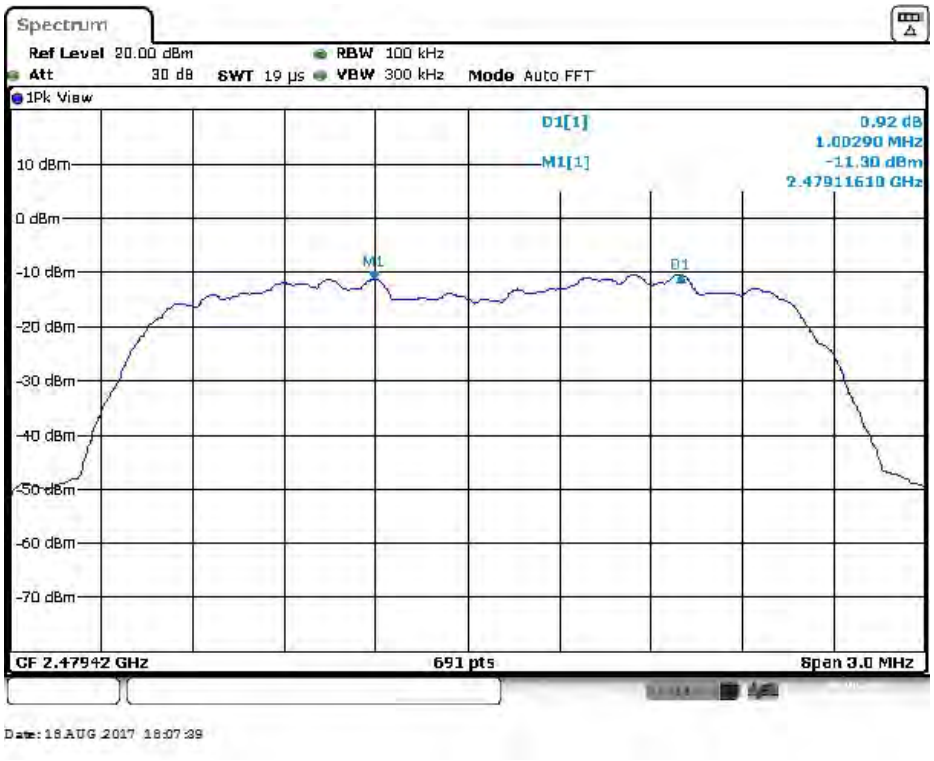
Date: 18.AUG.2017 17:55:54

Middle Channel



Date: 18.AUG.2017 18:01:39

High Channel



10 FCC §15.247(a)(1)(iii) –Time of Occupancy (Dwell Time)

10.1 Applicable Standard

According to FCC §15.247(a) (1)(iii).

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

10.2 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

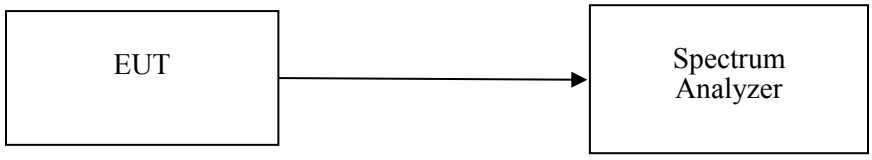
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.

Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.



10.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

10.4 Test Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu from 2017-08-18 to 2017-09-15.

10.5 Test Results

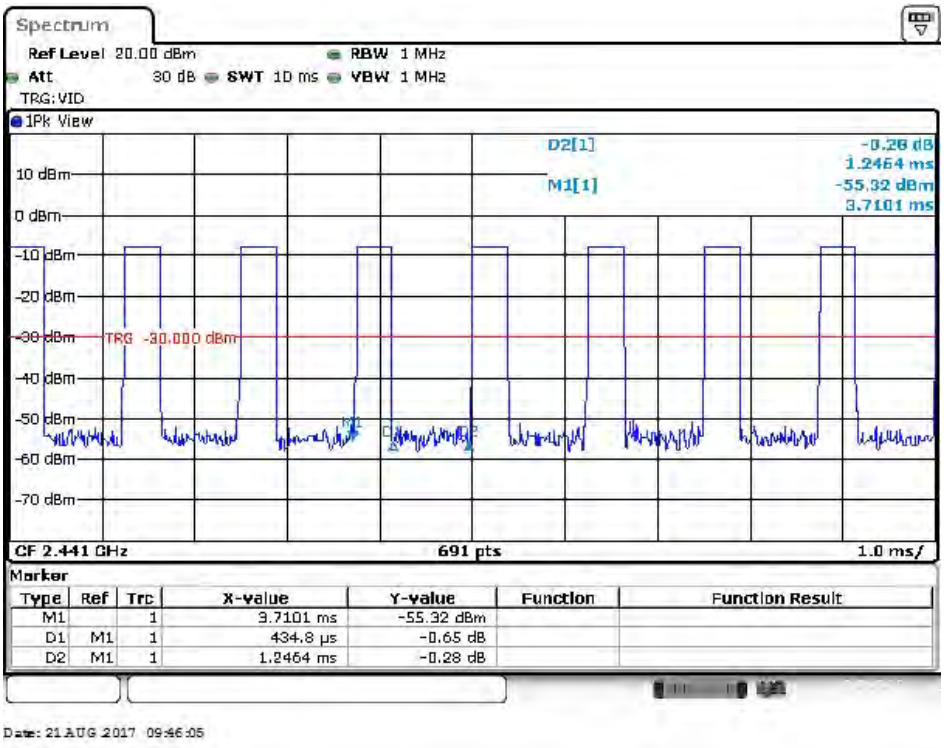
Test mode: BT mode / 2402 ~ 2480MHz(*GFSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**RESULT**
DH1	0.434	310	31.6	134.54	<400	PASS
DH3	1.71	160	31.6	273.60	<400	PASS
DH5	2.275	140	31.6	318.50	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (*π/4-DQPSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**RESULT**
2DH1	0.434	310	31.6	134.54	<400	PASS
2DH3	1.71	160	31.6	273.60	<400	PASS
2DH5	2.275	140	31.6	318.50	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (*8-DPSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**RESULT**
3DH1	0.434	310	31.6	134.54	<400	PASS
3DH3	1.71	160	31.6	273.60	<400	PASS
3DH5	2.275	140	31.6	318.50	<400	PASS

Note: Dwell time=Pulse time (ms) × Hopping Number

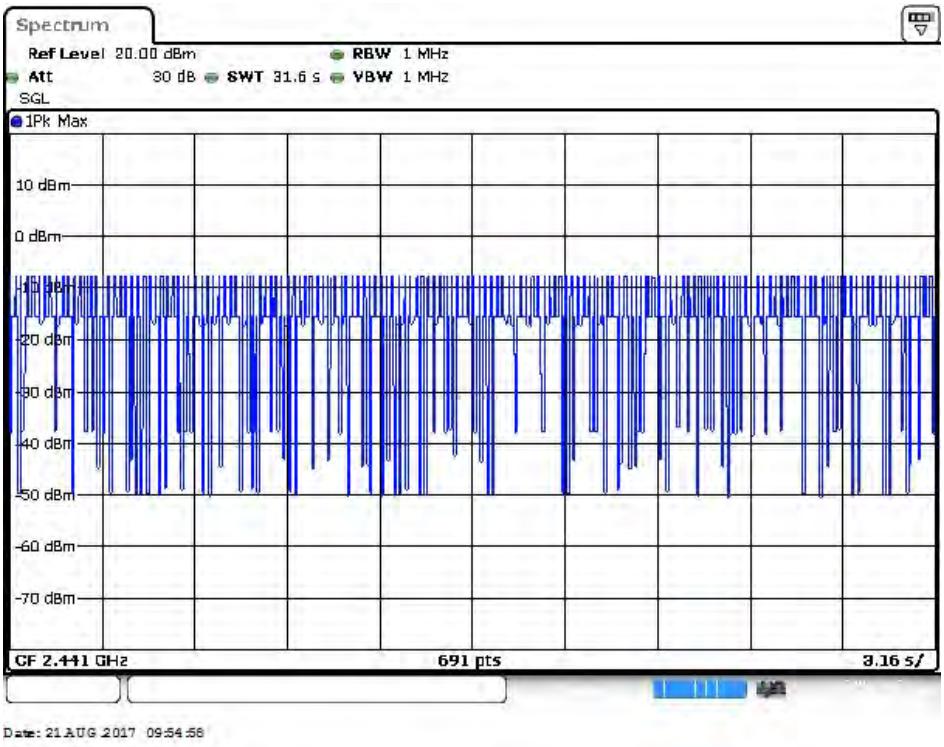
Please refer to the following plots

BDR Mode (GFSK)

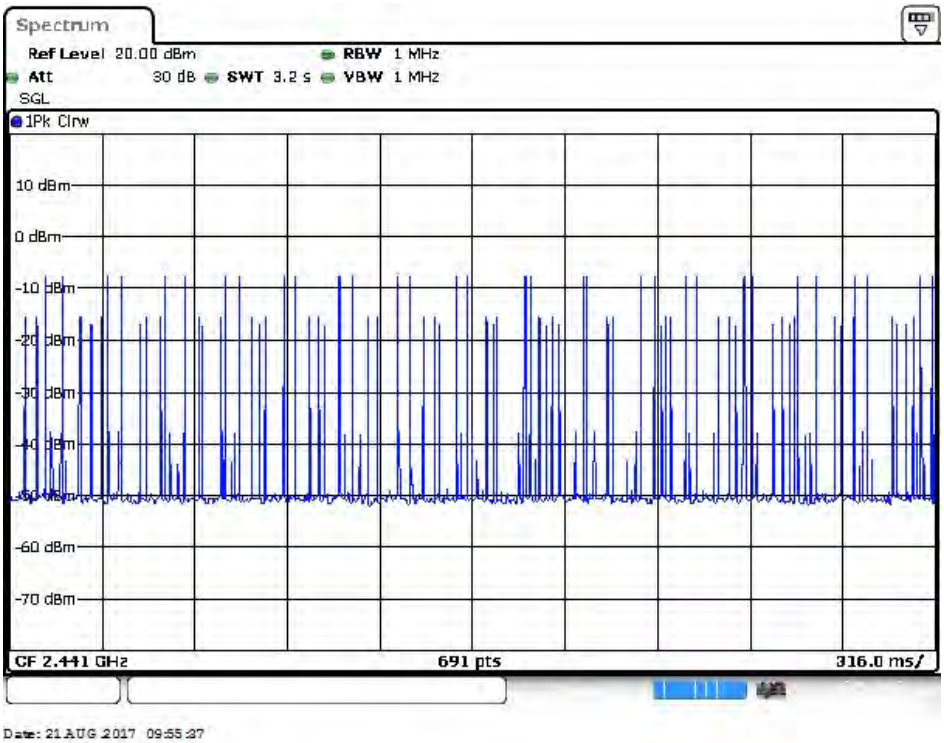
DH1: Pulse Width



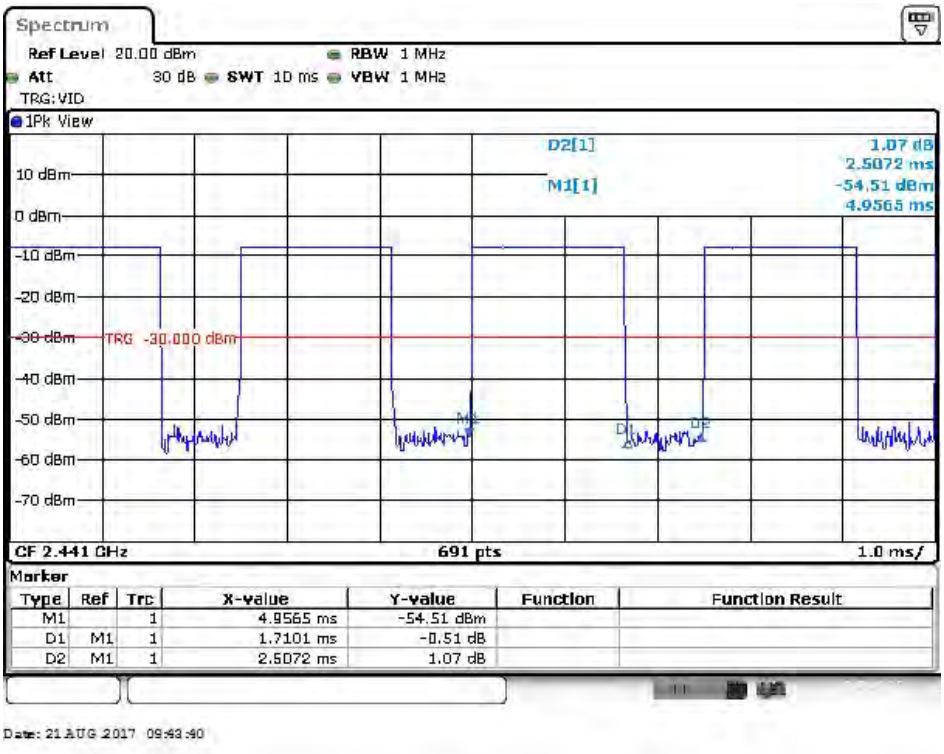
DH1: Hopping Number



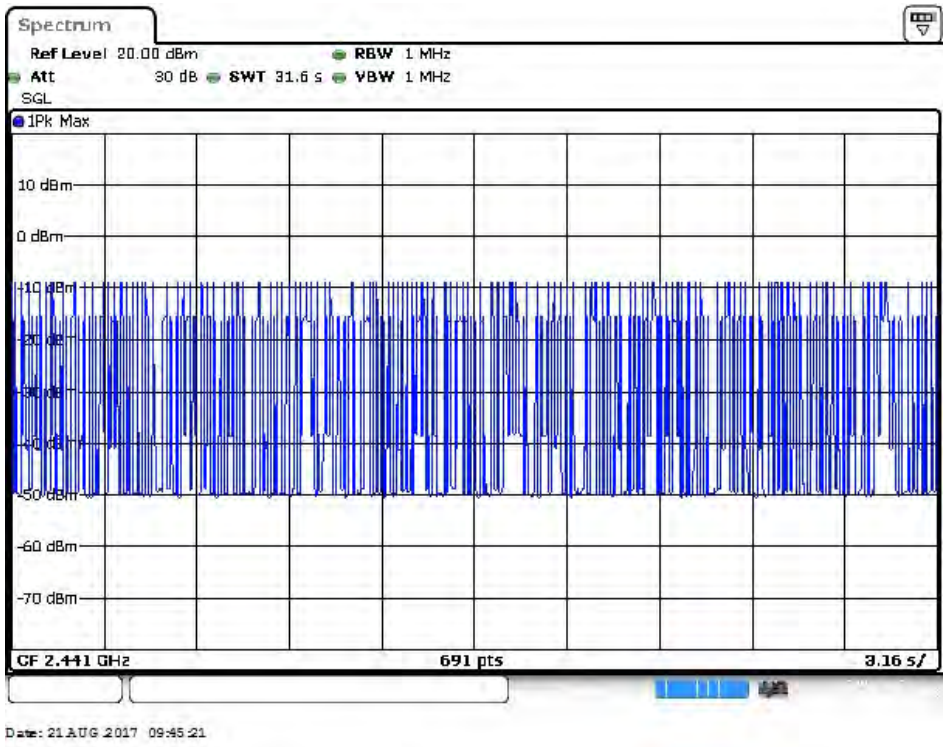
DH1: Hopping Number /10



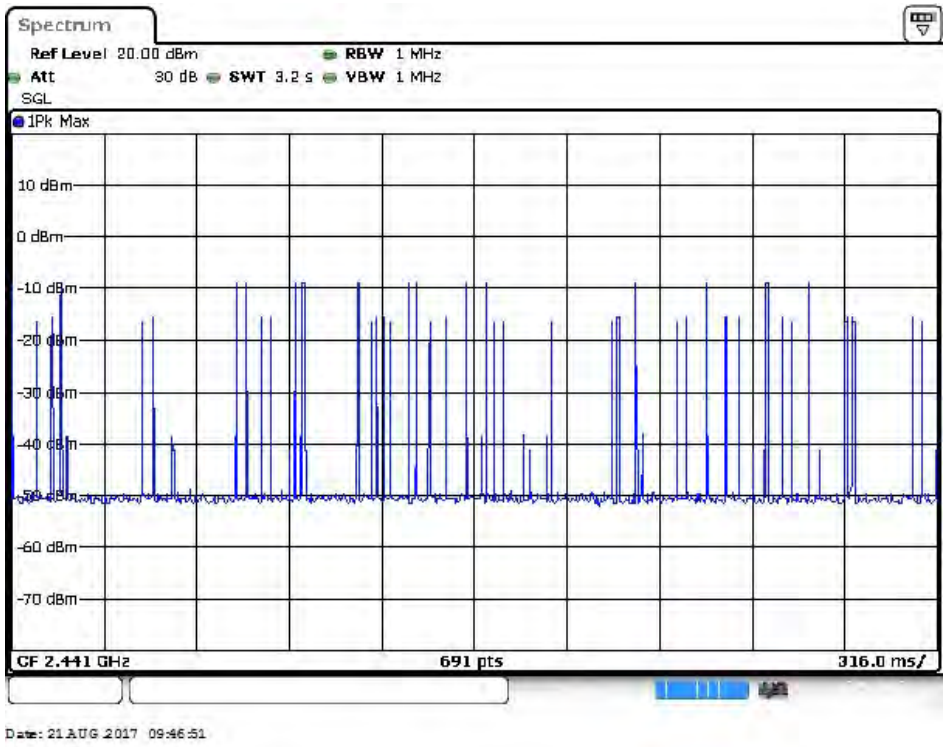
DH3: Pulse Width



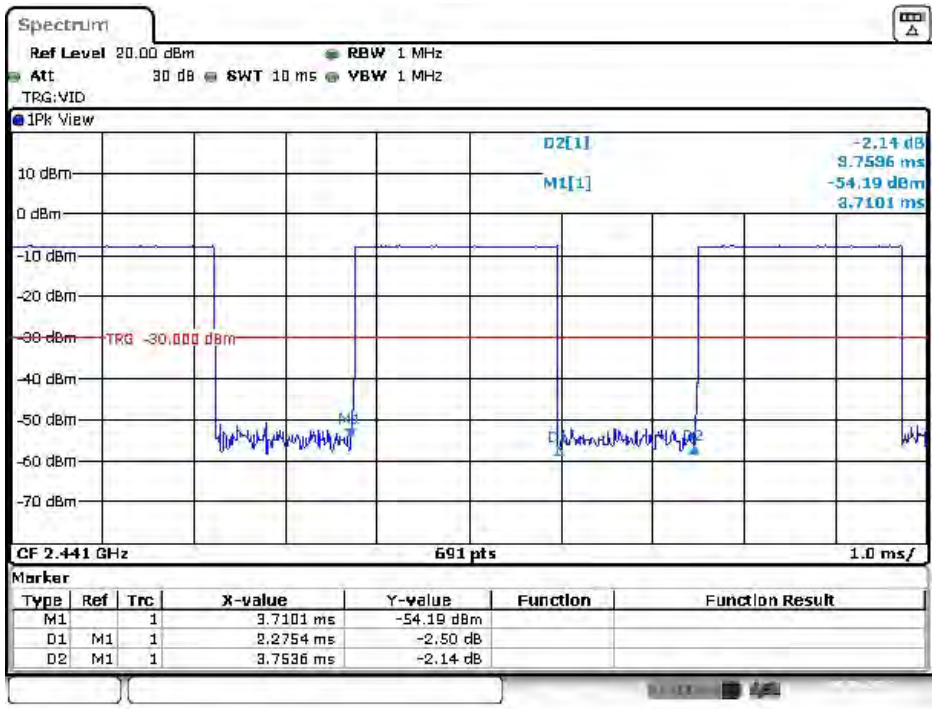
DH3: Hopping Number



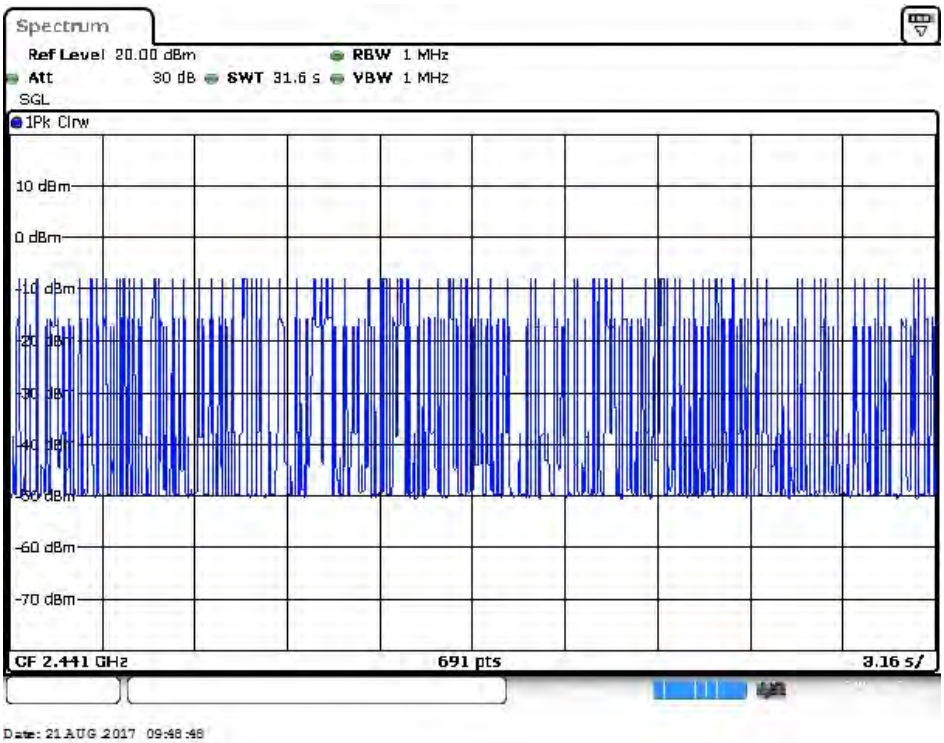
DH3: Hopping Number /10



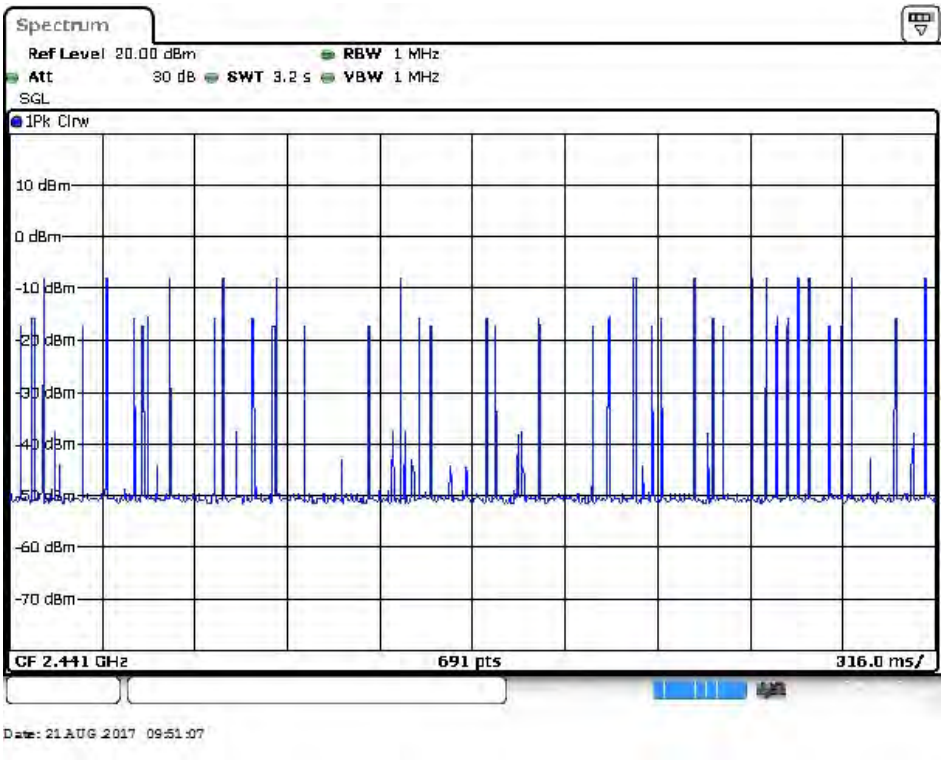
DH5: Pulse Width



DH5: Hopping Number

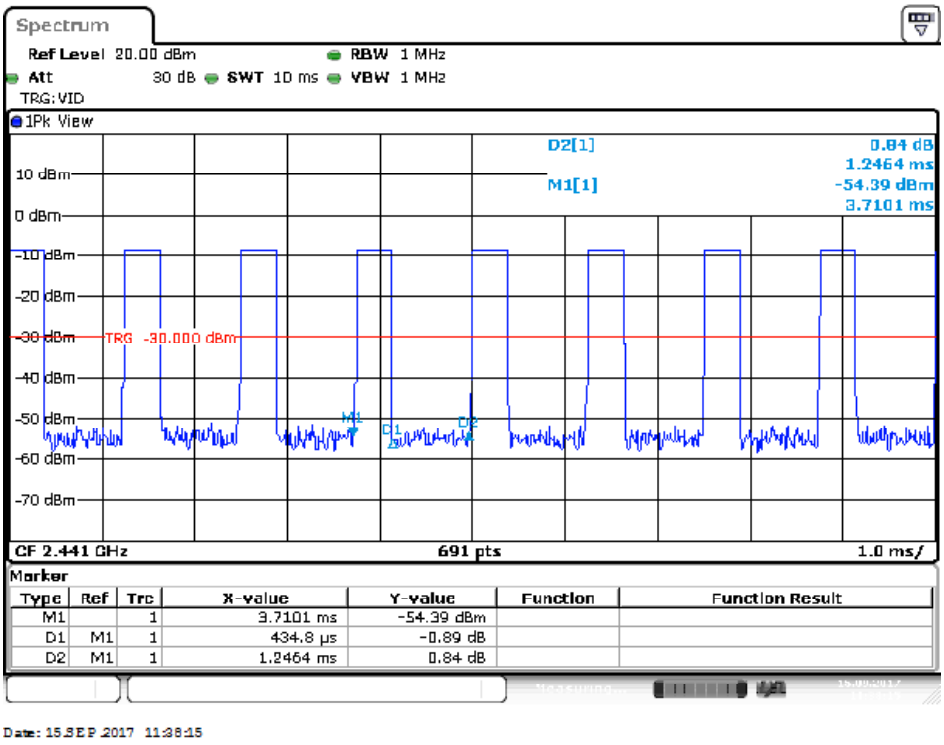


DH5: Hopping Number /10

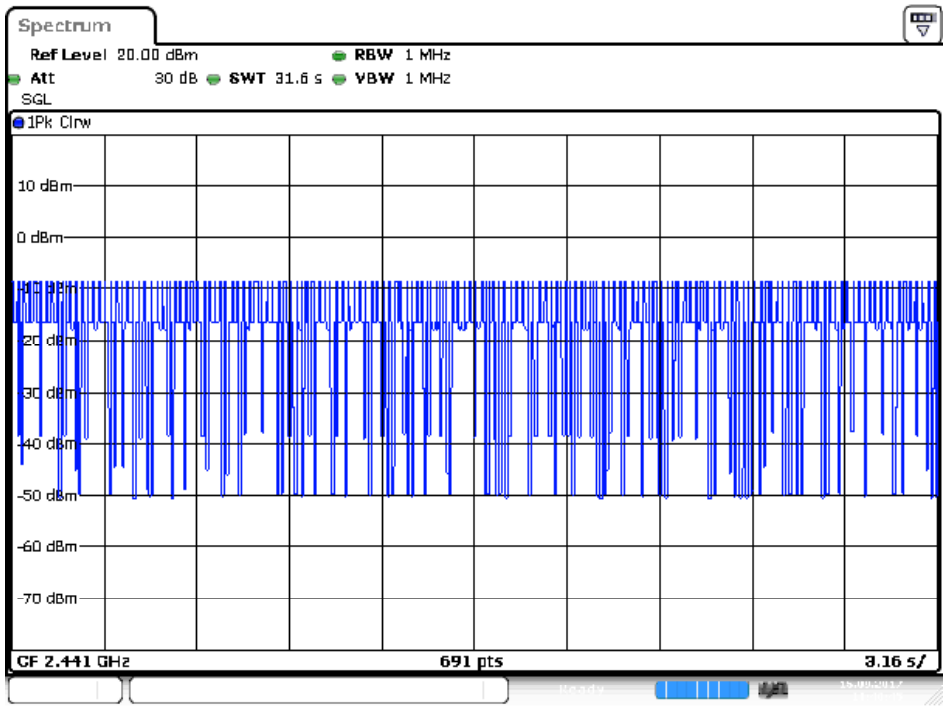


EDR Mode (π/4-DQPSK)

2DH1: Pulse Width

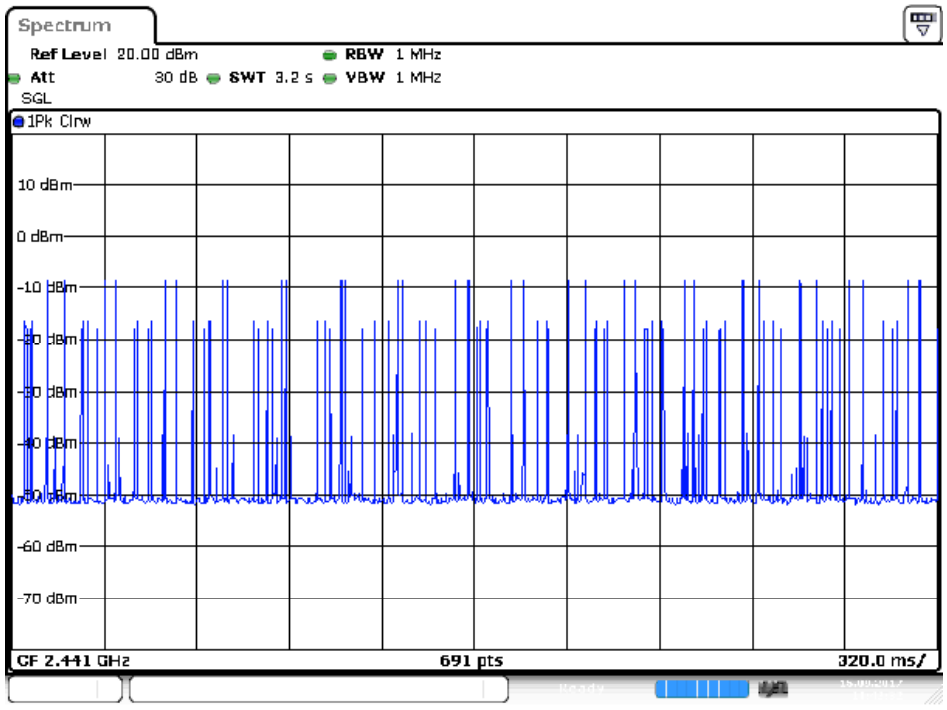


2DH1: Hopping Number



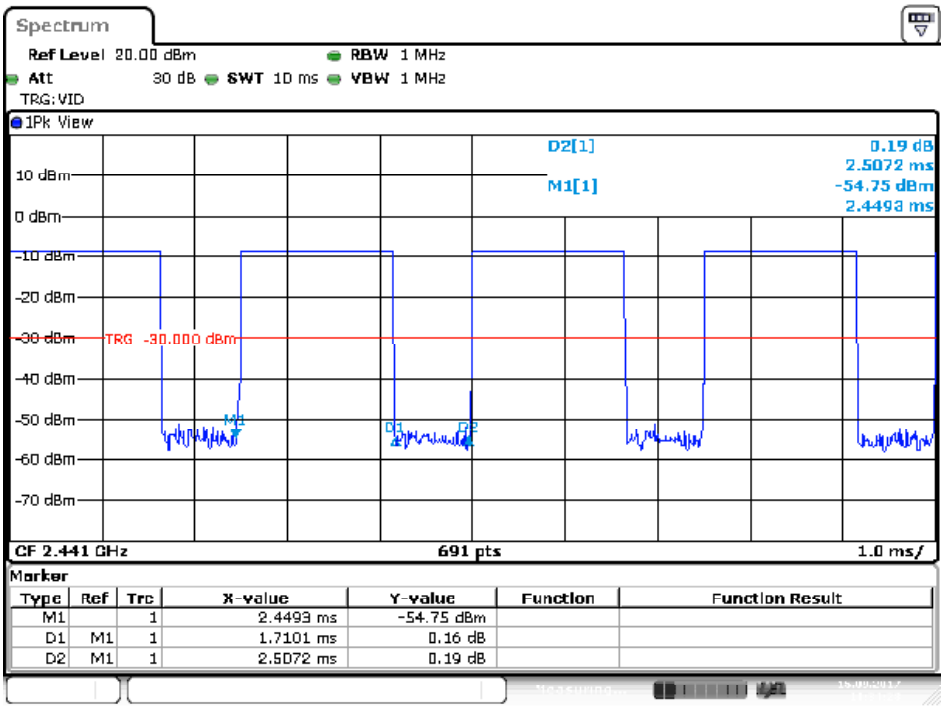
Date: 15.SEP.2017 11:40:46

2DH1: Hopping Number /10



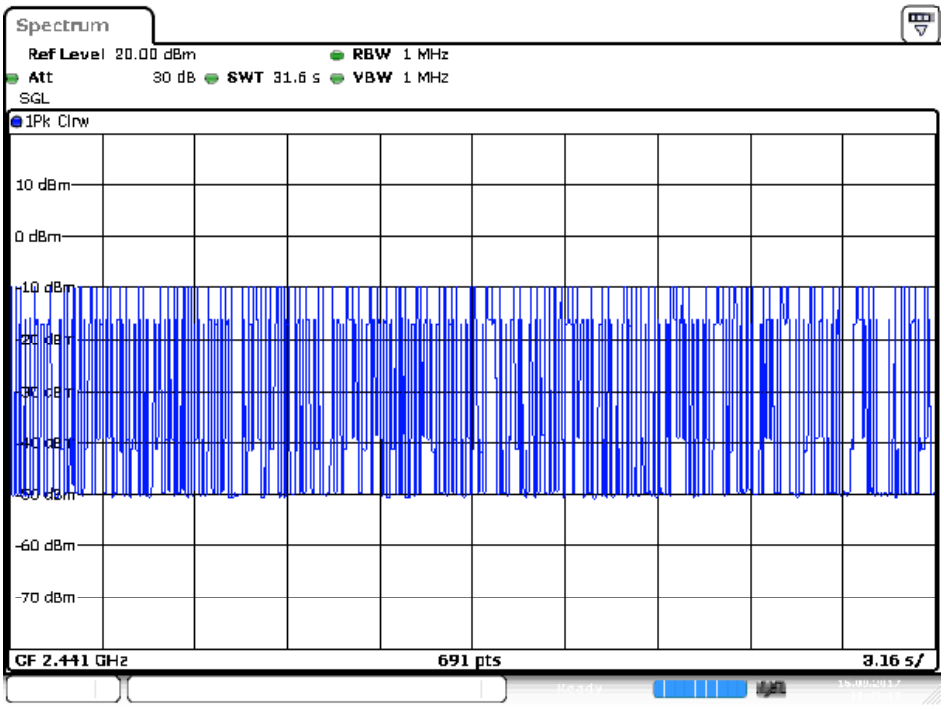
Date: 15.SEP.2017 11:42:33

2DH3: Pulse Width



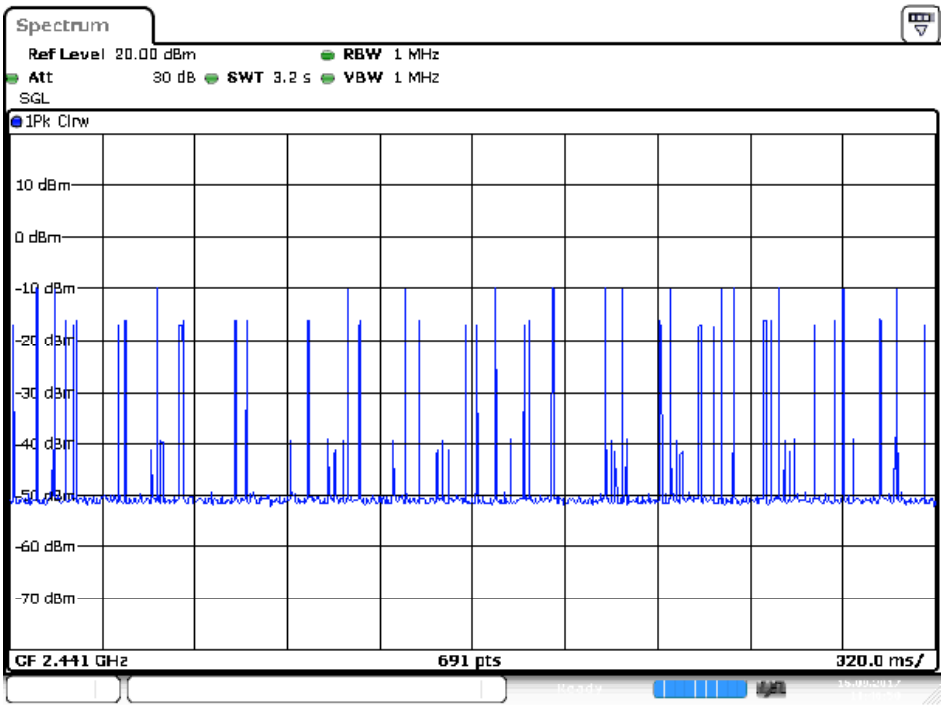
Date: 15.SEP.2017 11:34:28

2DH3: Hopping Number



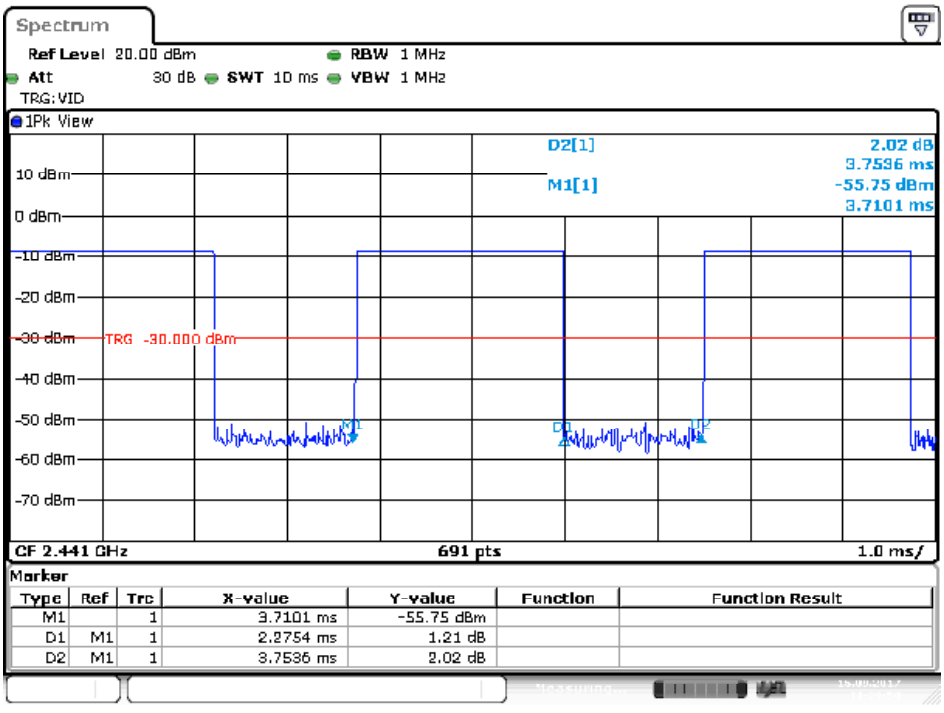
Date: 15.SEP.2017 11:45:13

2DH3: Hopping Number /10



Date: 15.SEP.2017 11:46:51

2DH5: Pulse Width



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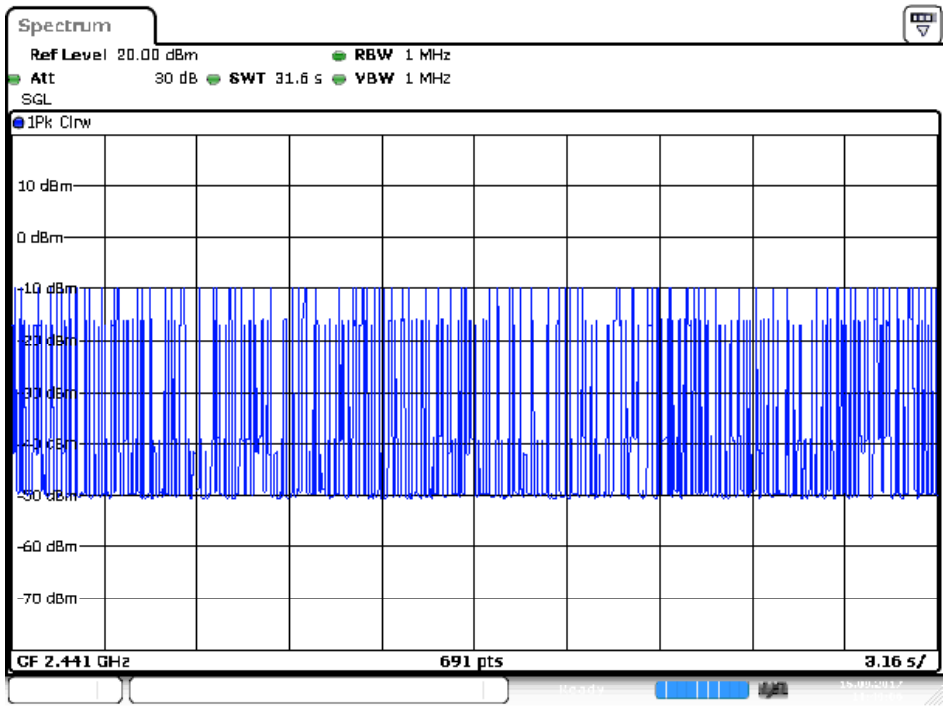
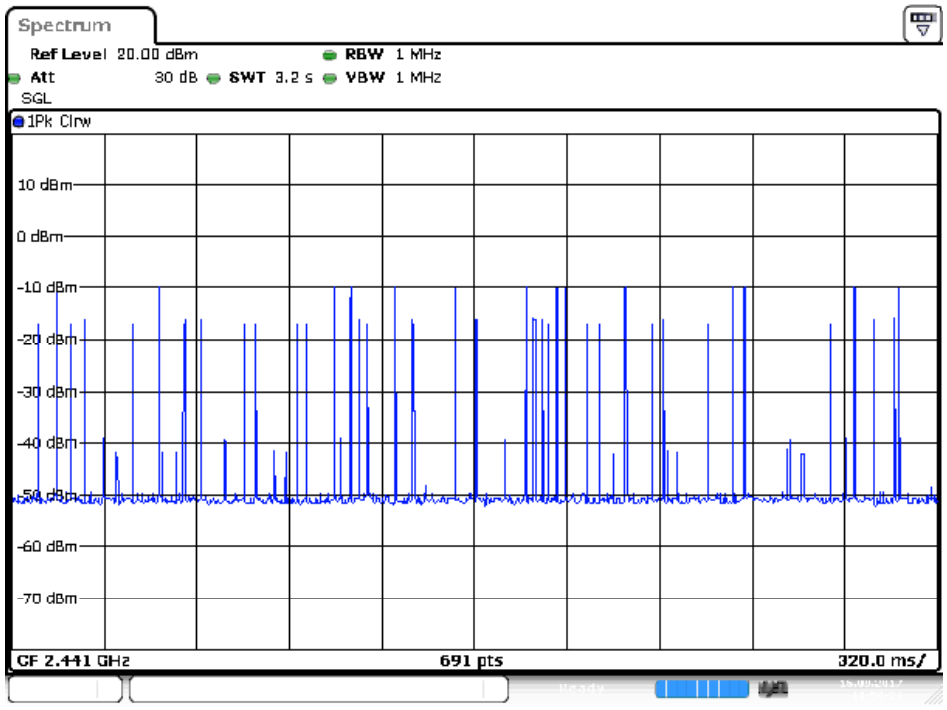
2DH5: Hopping Number



Date: 15.SEP.2017 11:49:07

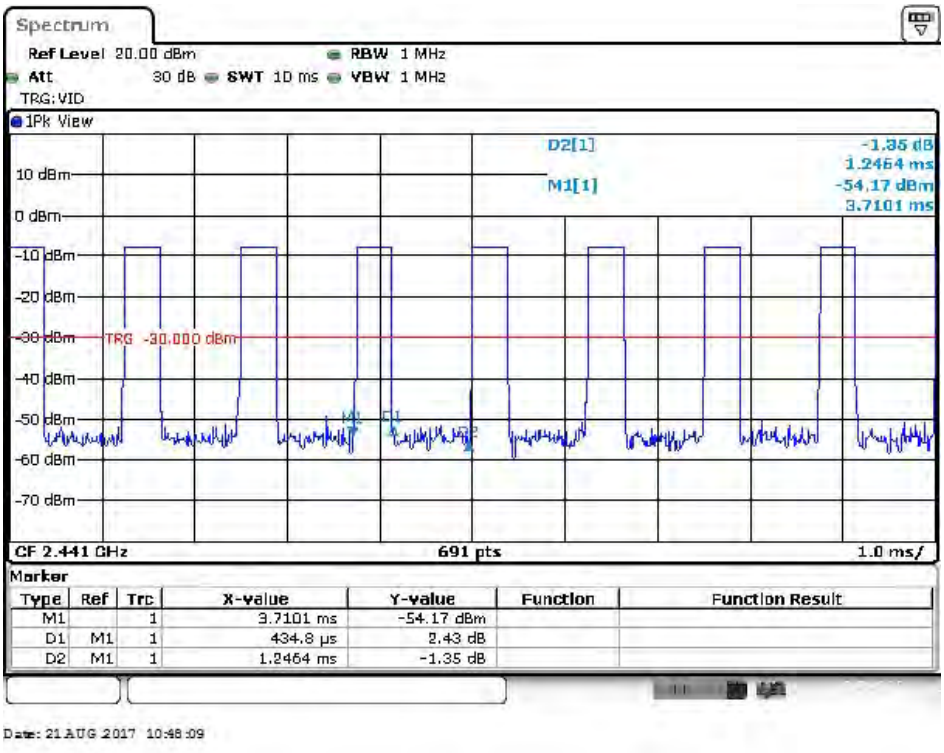
2DH5: Hopping Number /10



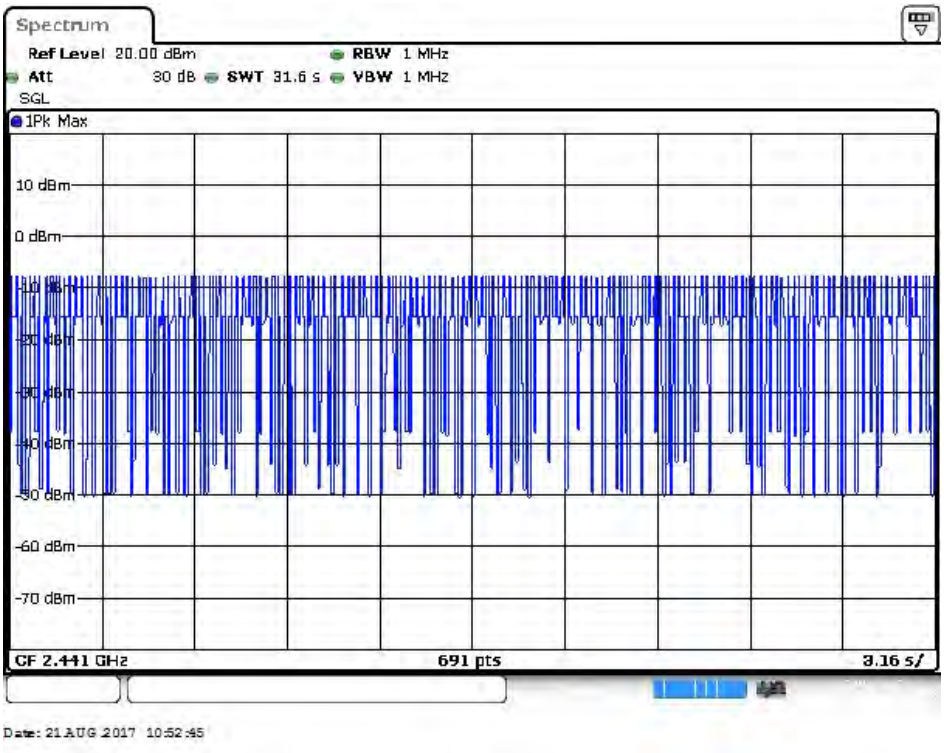
Date: 15.SEP.2017 11:50:22

EDR Mode (8-DPSK)

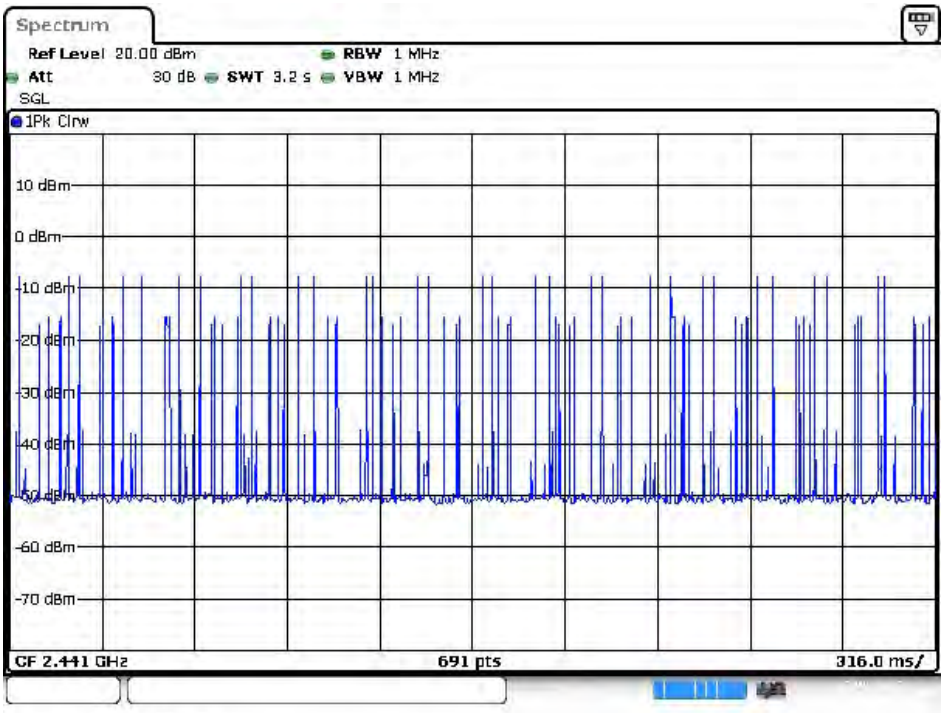
3DH1: Pulse Width



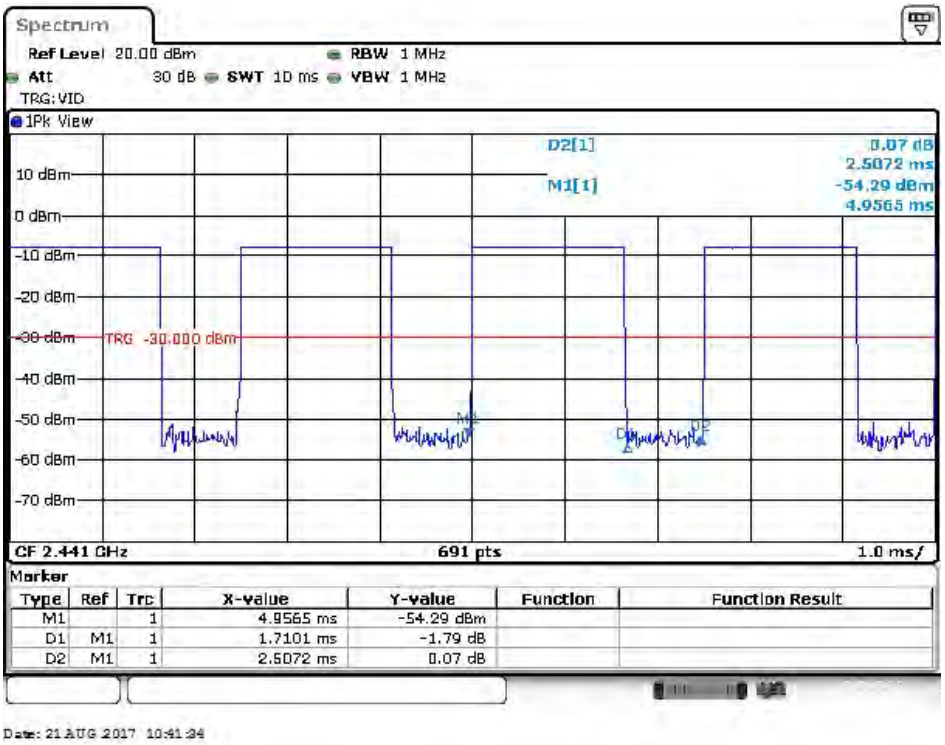
3DH1: Hopping Number



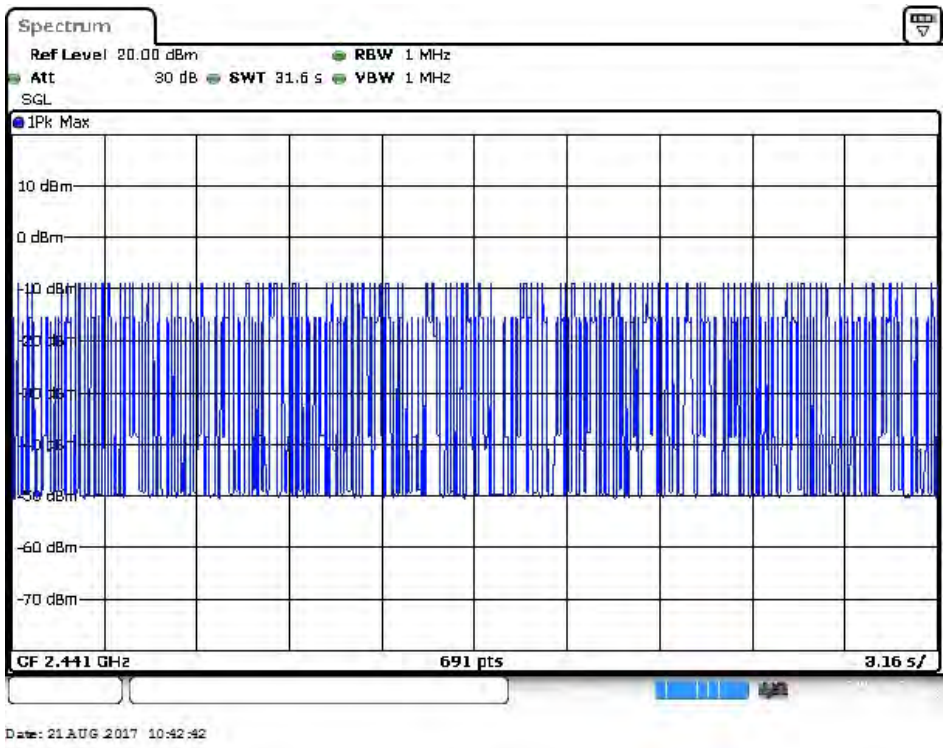
3DH1: Hopping Number /10



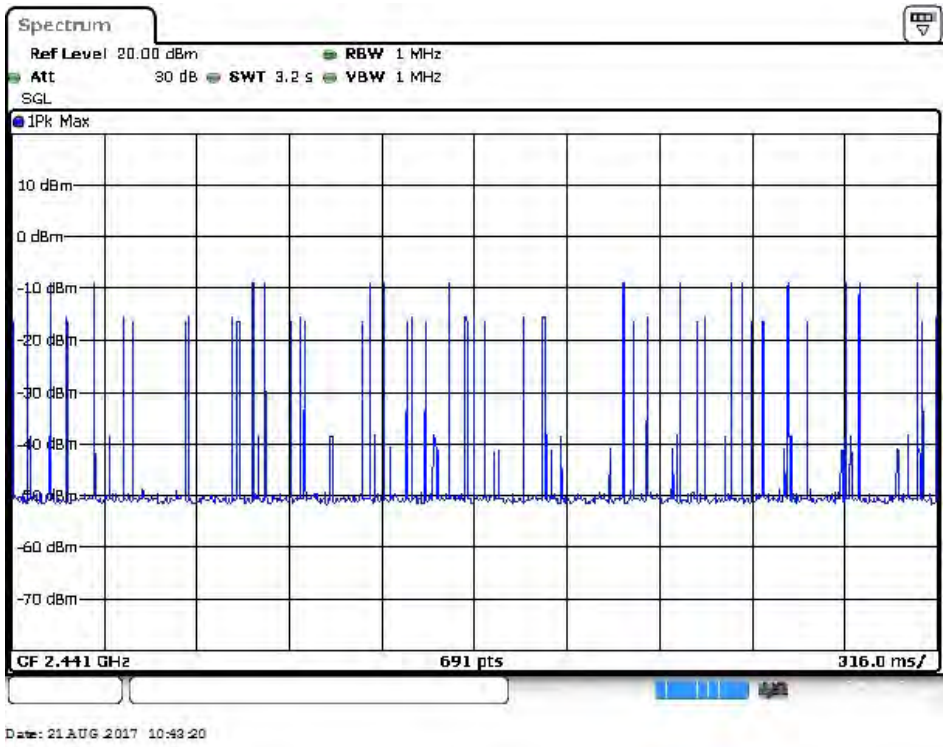
3DH3: Pulse Width



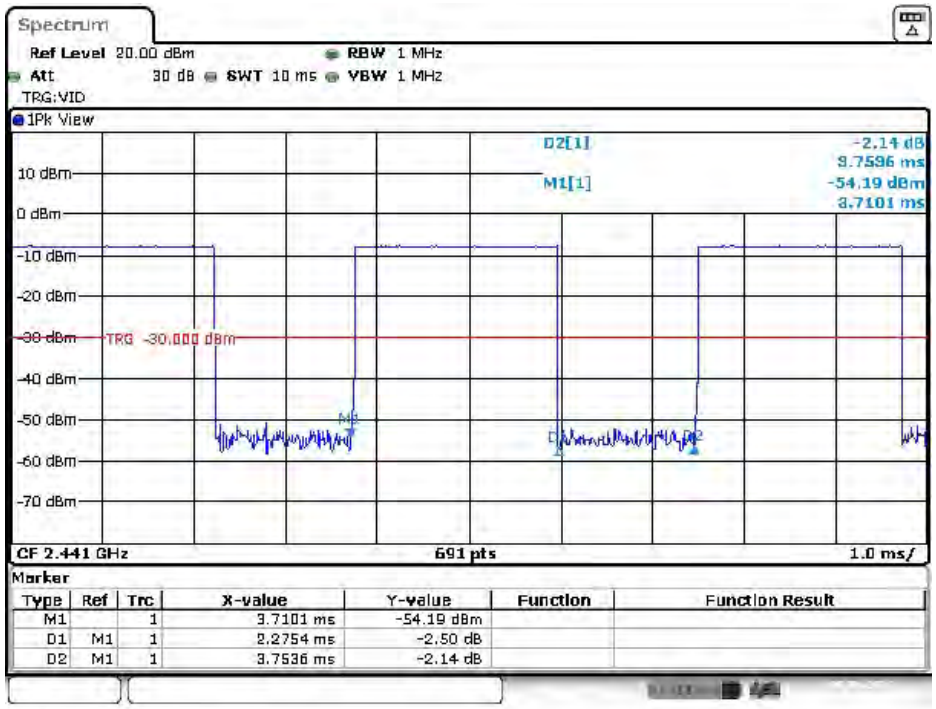
3DH3: Hopping Number



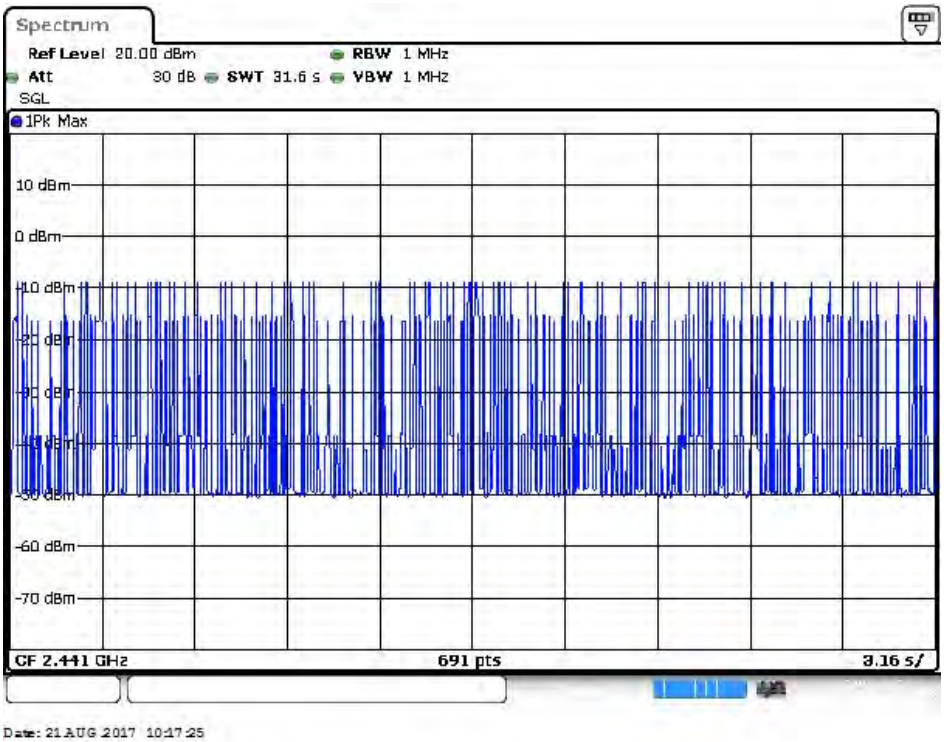
3DH3: Hopping Number /10



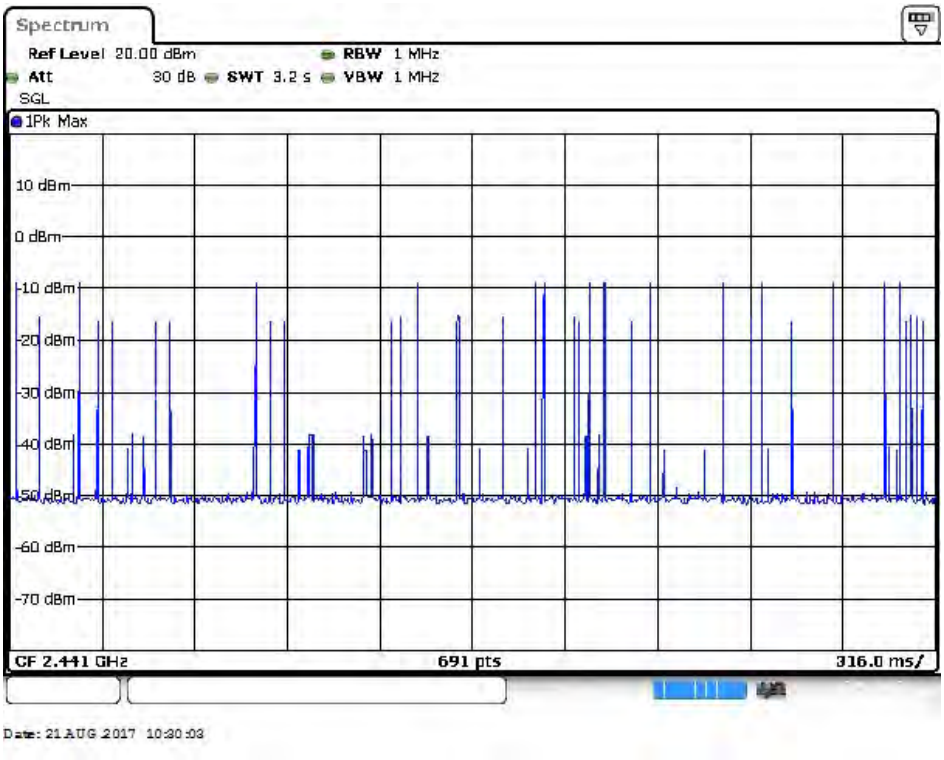
3DH5: Pulse Width



3DH5: Hopping Number



3DH5: Hopping Number /10



11 FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

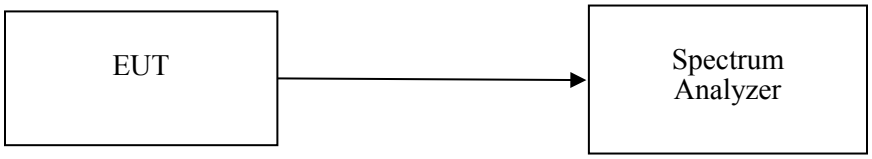
11.1 Applicable Standard

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

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

11.2 Test Procedure

Span = the frequency band of operation
RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold



11.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

11.4 Test Environmental Conditions

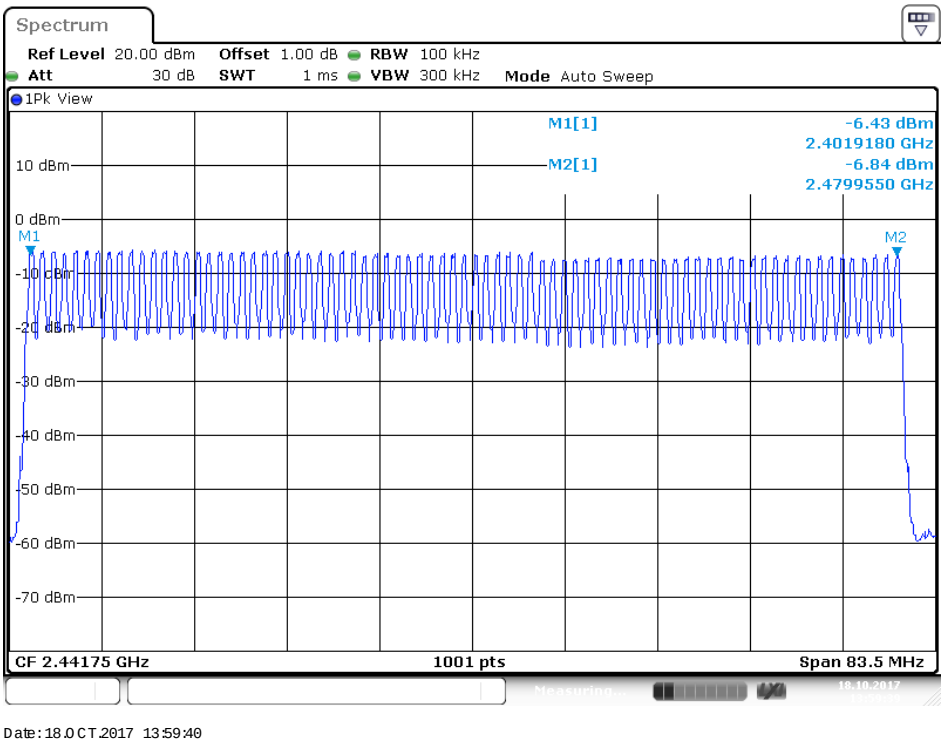
Temperature:	26 ℃
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2017-10-18.

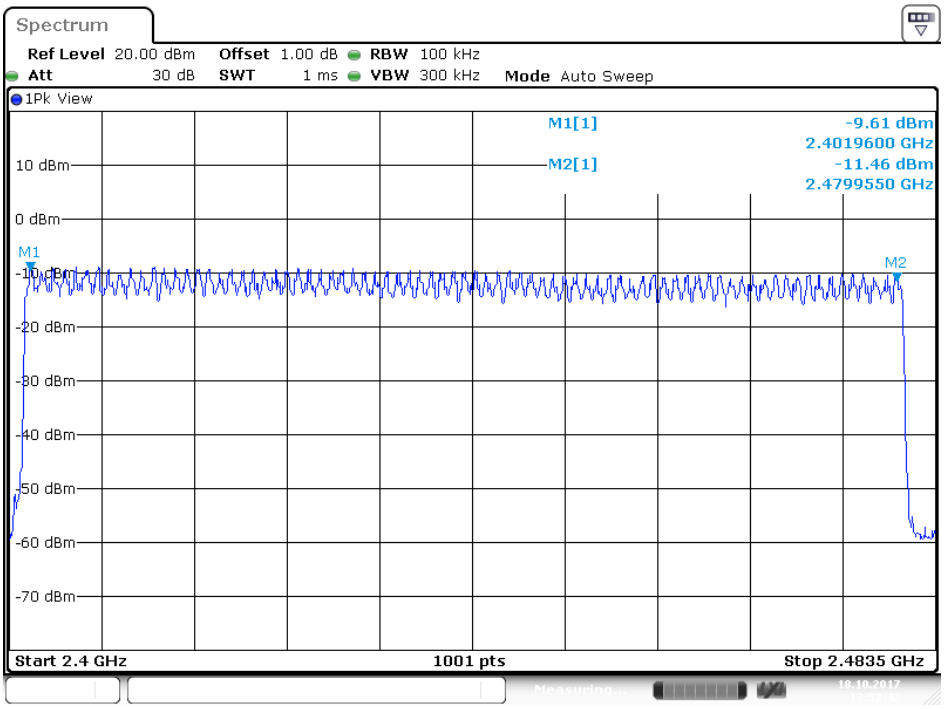
11.5 Test Results

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

BDR Mode (GFSK)



EDR Mode (π/4-DQPSK)



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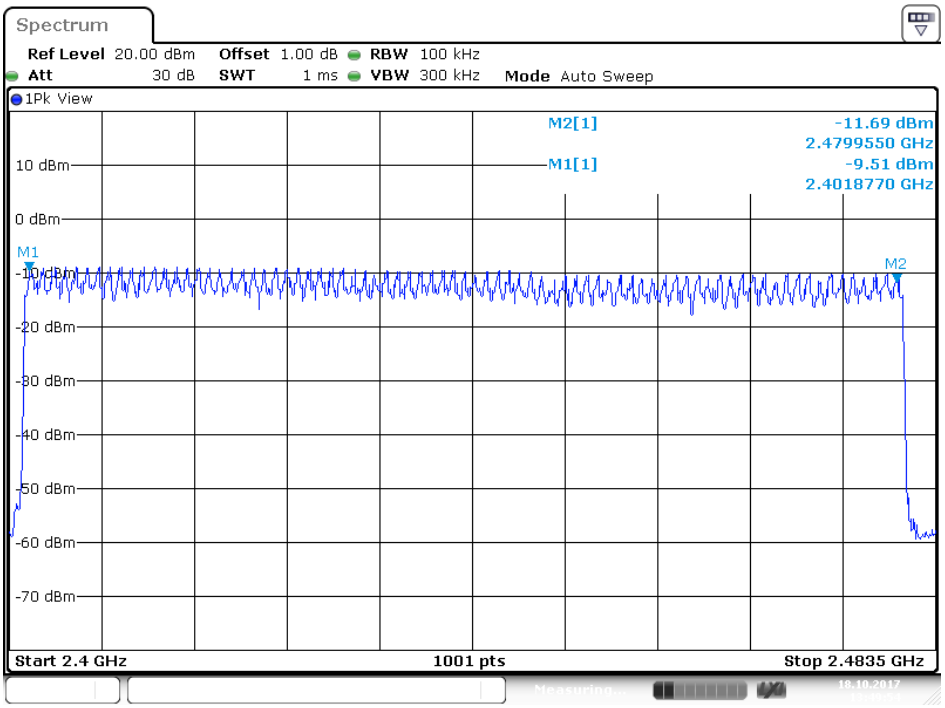
EDR Mode (8-DPSK)



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12 FCC §15.247(b)(1) – Maximum Output Power

12.1 Applicable Standard

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

12.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.

2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an Power sensor.

12.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/3/21	2018/3/20
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

12.4 Test Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2017-08-18.

12.5 Test Results

Channel	Frequency (MHz)	Maximum Conducted Output Power (dBm)	Conducted Output Power (W)	Limit (W)	Result
BDR Mode (GFSK)					
Low	2402	-9.33	0.0001167	1	Compliance
Middle	2441	-7.47	0.0001791	1	Compliance
High	2480	-9.93	0.0001016	1	Compliance
EDR Mode (π/4-DQPSK)					
Low	2402	-14.81	0.000033	1	Compliance
Middle	2441	-13.64	0.0000433	1	Compliance
High	2480	-15.72	0.0000268	1	Compliance
EDR Mode (8-DPSK)					
Low	2402	-15.47	0.0000284	1	Compliance
Middle	2441	-14.63	0.0000344	1	Compliance
High	2480	-16.67	0.0000215	1	Compliance

13 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

13.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

13.2 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz

VBW = 300 kHz

Sweep = coupled

Detector function = peak

Trace = max hold

13.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

13.4 Test Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2017-10-18.

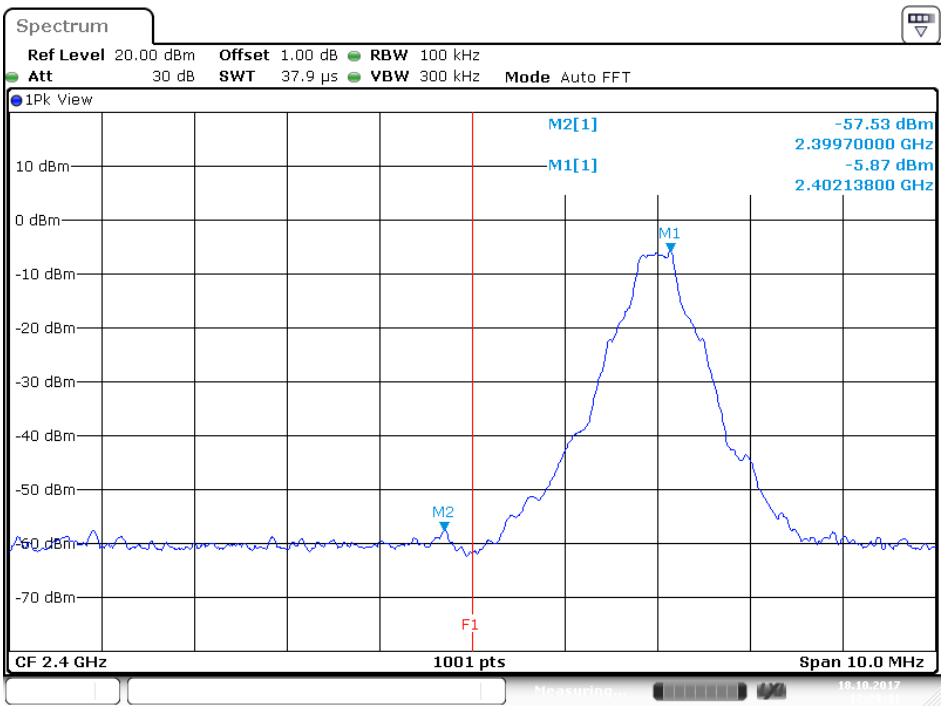
13.5 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
BDR Mode (GFSK)				
Low	2402	51.66	≥ 20	PASS
High	2480	51.47	≥ 20	PASS
BDR Hopping Mode (GFSK)				
Low	2402-2480	52.30	≥ 20	PASS
High	2402-2480	50.51	≥ 20	PASS
EDR Mode (π/4-DQPSK)				
Low	2402	49.29	≥ 20	PASS
High	2480	48.39	≥ 20	PASS
EDR Hopping Mode (π/4-DQPSK)				
Low	2402-2480	48.57	≥ 20	PASS
High	2402-2480	47.61	≥ 20	PASS
EDR Mode (8-DPSK)				
Low	2402	49.75	≥ 20	PASS
High	2480	48.53	≥ 20	PASS
EDR Hopping Mode (8-DPSK)				
Low	2402-2480	48.32	≥ 20	PASS
High	2402-2480	47.49	≥ 20	PASS

Please refer to the following plots

BDR Mode (GFSK)

Band Edge, CH Low



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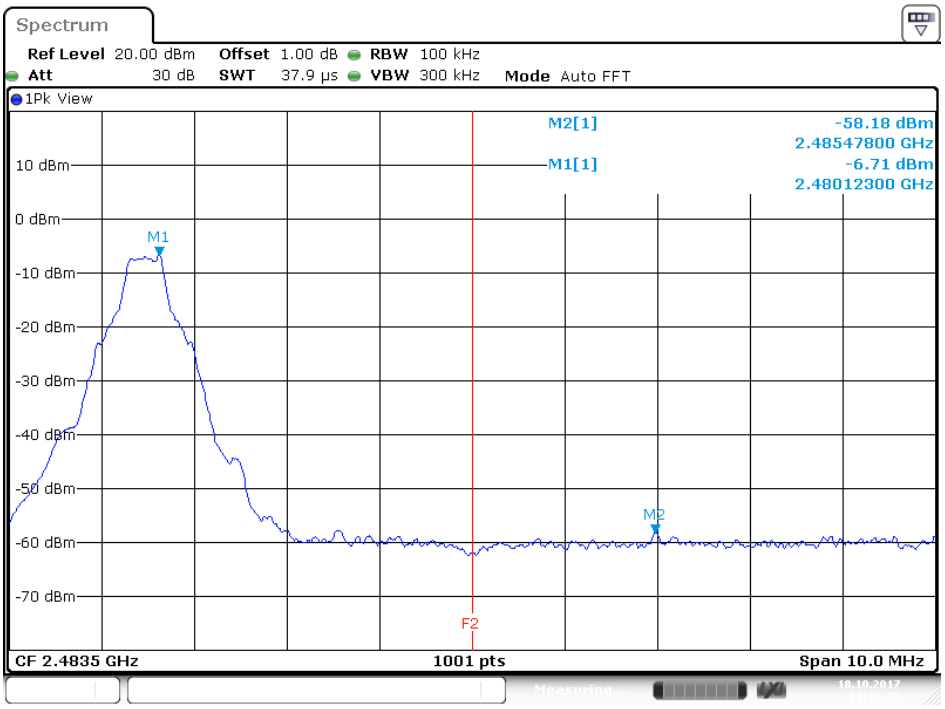
Band Edge, CH High



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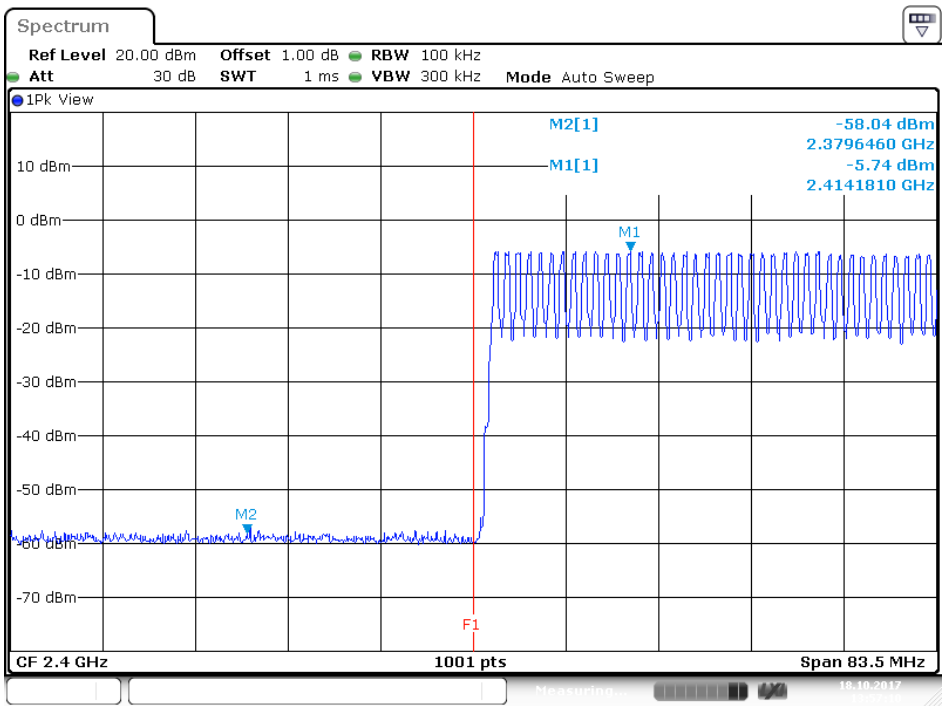
BDR Hopping Mode (GFSK)

Band Edge, CH Low



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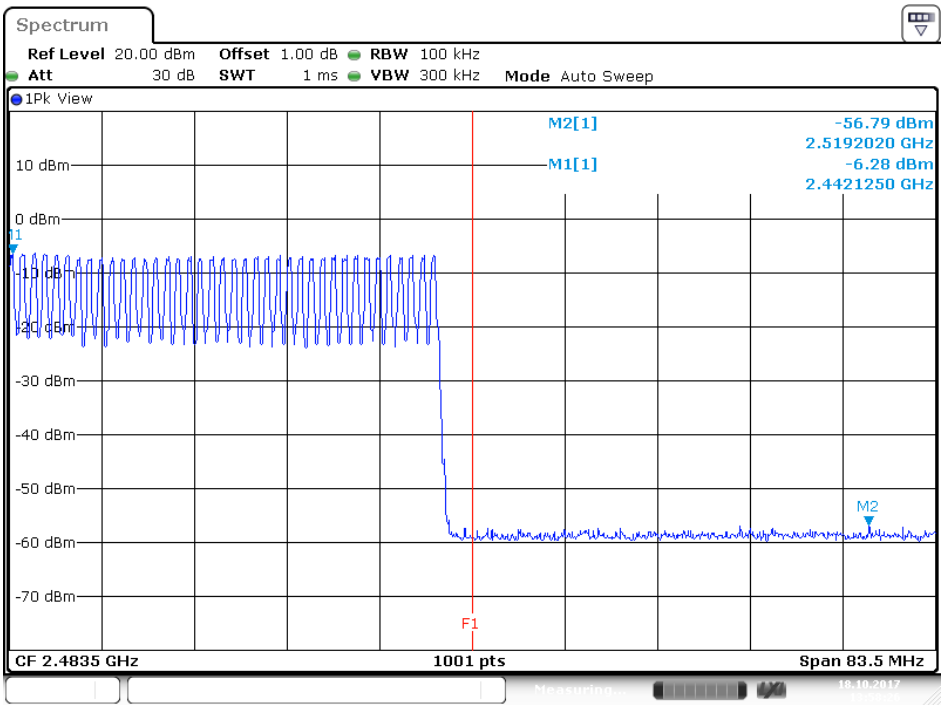
Band Edge, CH High



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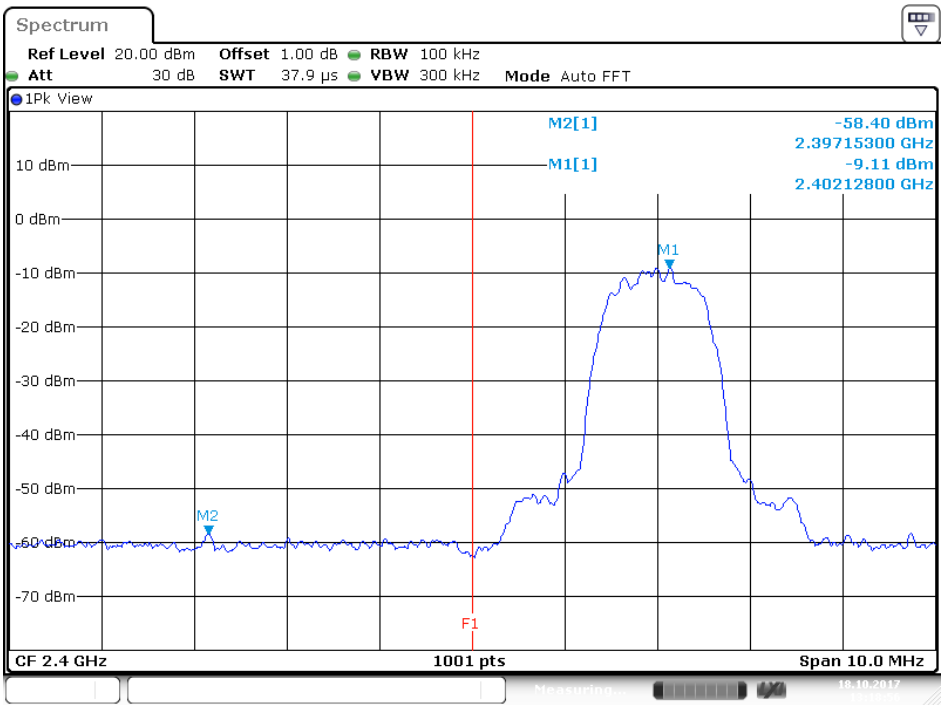
EDR Mode (π/4-DQPSK)

Band Edge, CH Low



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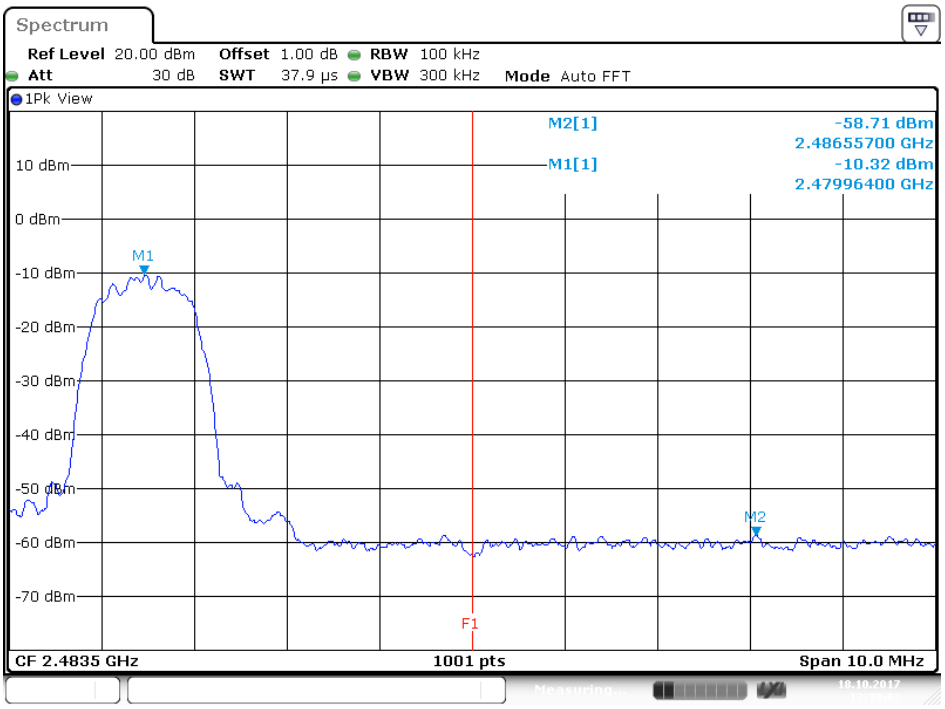
Band Edge, CH High



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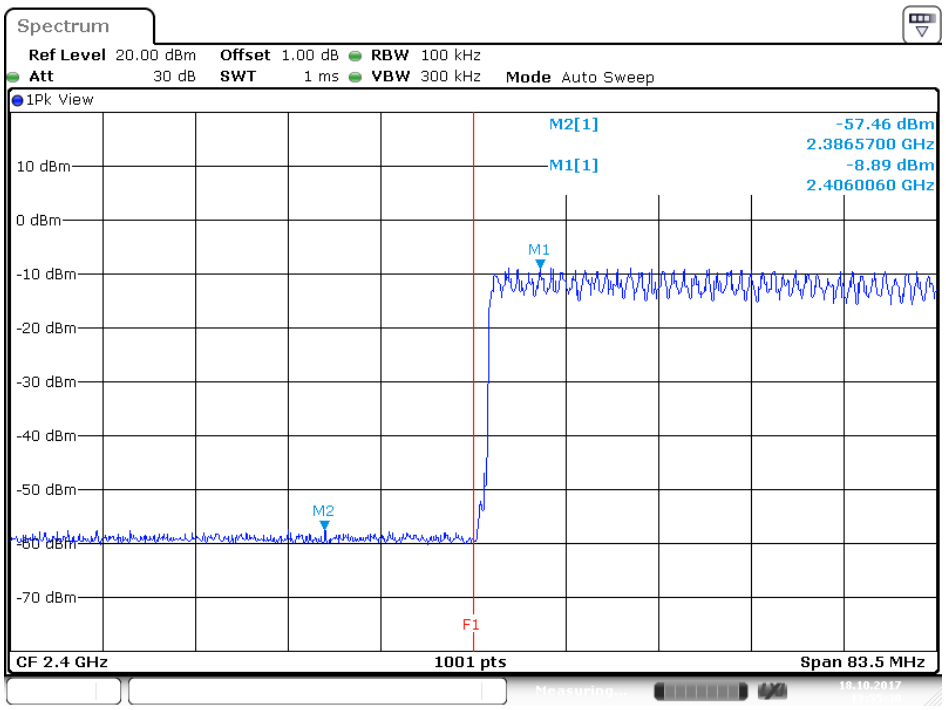
EDR Hopping Mode (π/4-DQPSK)

Band Edge, CH Low



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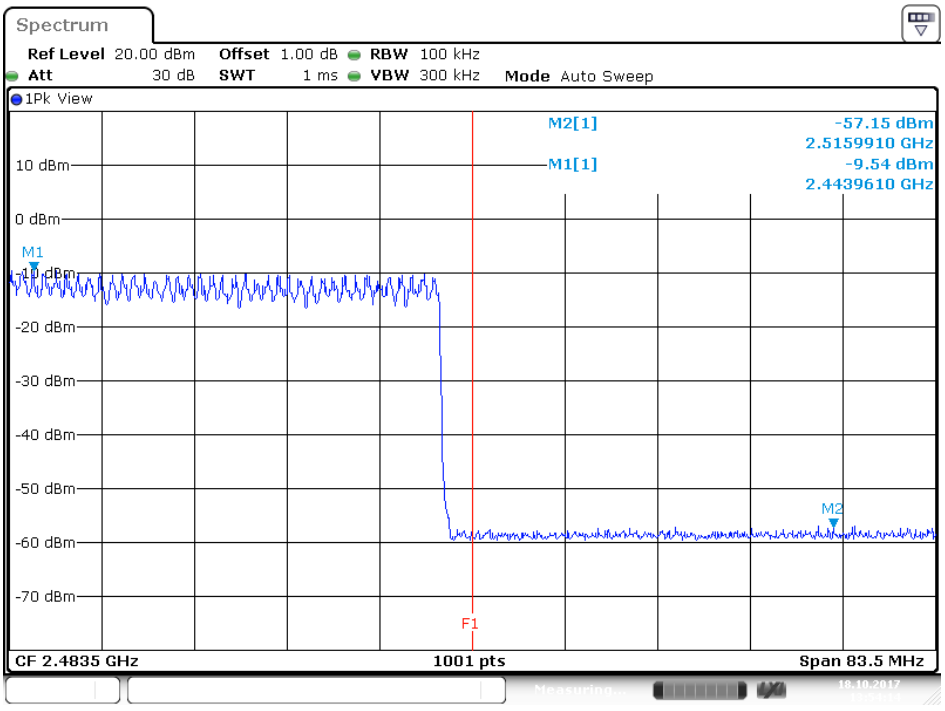
Band Edge, CH High



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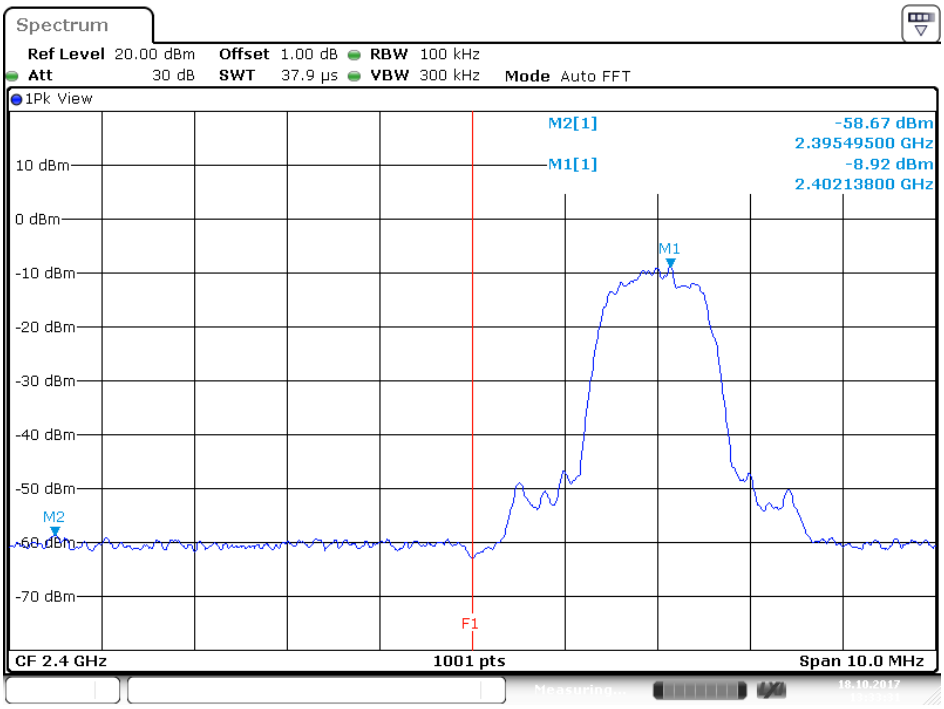
EDR Mode (8-DPSK)

Band Edge, CH Low



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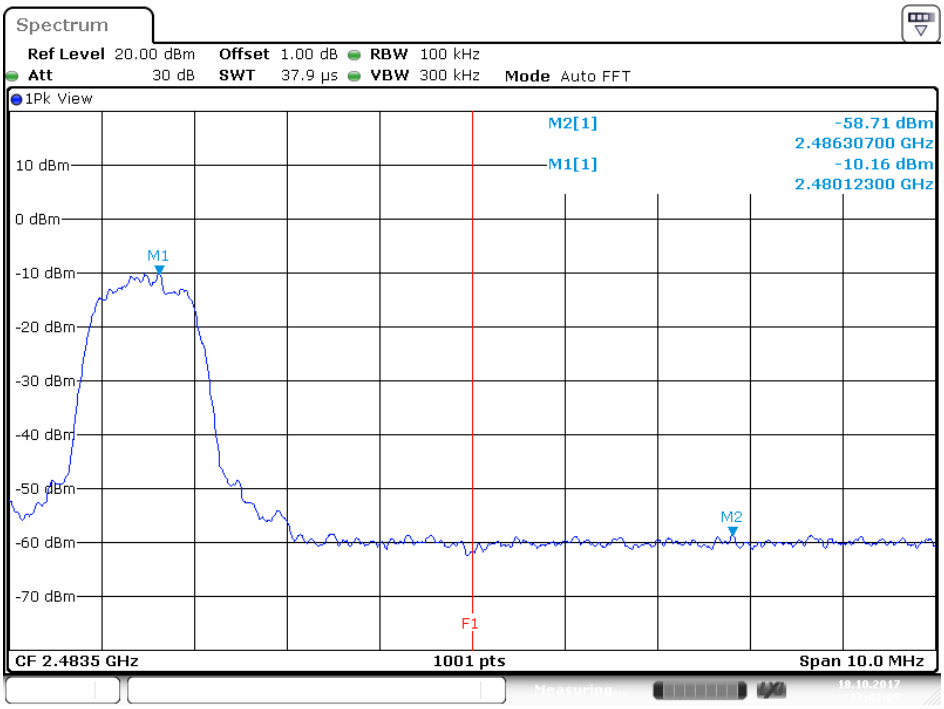
Band Edge, CH High



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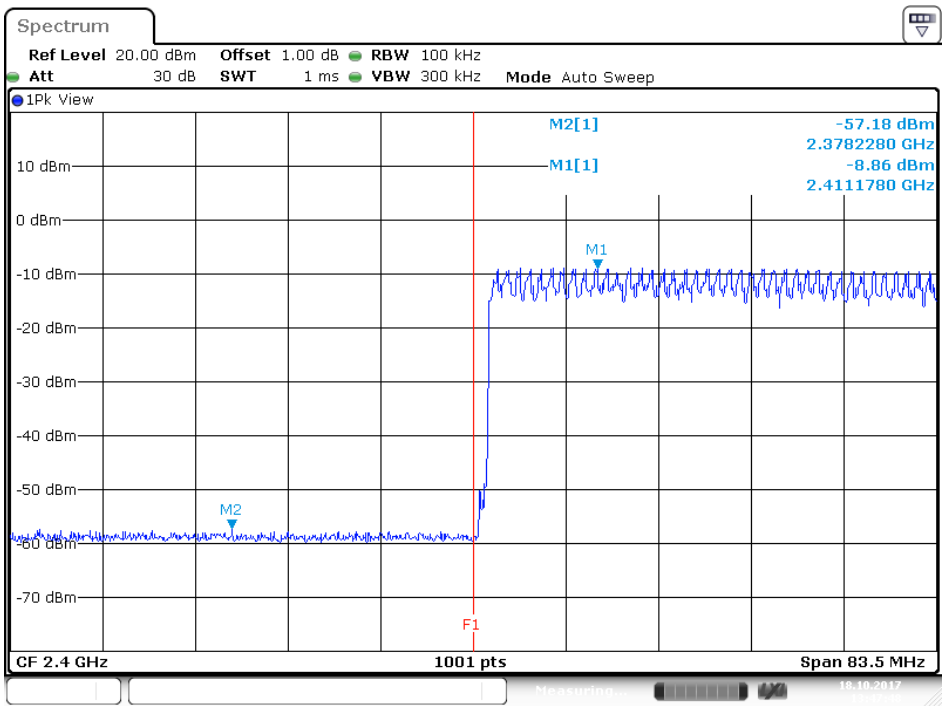
EDR Hopping Mode (8-DPSK)

Band Edge, CH Low



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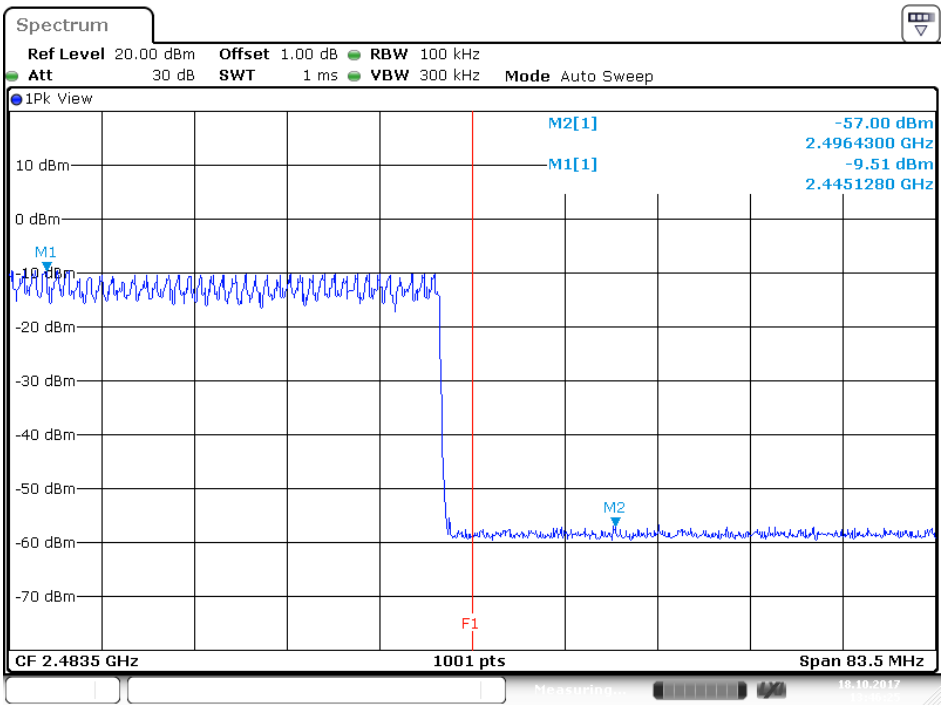
Band Edge, CH High



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