TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057 China

FCC ID: YAMHM78XUV

Report Type:	**Product Name:**
Original Report	DIGITAL MOBILE RADIO

Report Number:	RDG191122009-00B
Report Date:	2020-01-07
Reviewed By:	Ivan Cao Assistant Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	DIGITAL MOBILE RADIO
EUT Model:	HM782 Uv
Mutiple Models:	HM780 Uv,HM786 Uv,HM788 Uv,HM785 Uv
Operation Frequency:	2402-2480MHz
Maximum Peak Output Power (Conducted):	2.79 dBm
Modulation Type:	GFSK, π/4-DQPSK, 8DPSK
Rated Input Voltage:	DC 13.6 V
Serial Number:	RDG191122009-RF-S1
EUT Received Date:	2019-11-25
EUT Received Status:	Good

Note: The series product, models HM780 Uv,HM786 Uv,HM788 Uv,HM785 Uv and HM782 Uv are electrically identical, The difference between them please refer to the declaration letter for details. For marketing purpose, we selected HM782 Uv for fully test.

Objective

This report is prepared on behalf of ***Hytera Communications Corporation Limited*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules

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

Related Submittal(s)/Grant(s)

FCC Part 22&74&80&90 TNB submissions with FCC ID: YAMHM78XUV
FCC Part 15C DTS submissions with FCC ID: YAMHM78XUV

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "△ ". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk "★".

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

EUT Exercise Software

The ' CSR Buetest' was used during test, which was provided by manufacturer. The maximum power level was configured by the software as below table:

Mode	Channel	Frequency (MHz)	Power Level Setting
GFSK	Low	2402	default
	Middle	2441	default
	High	2480	default
π/4-DQPSK	Low	2402	default
	Middle	2441	default
	High	2480	default
8DPSK	Low	2402	default
	Middle	2441	default
	High	2480	default

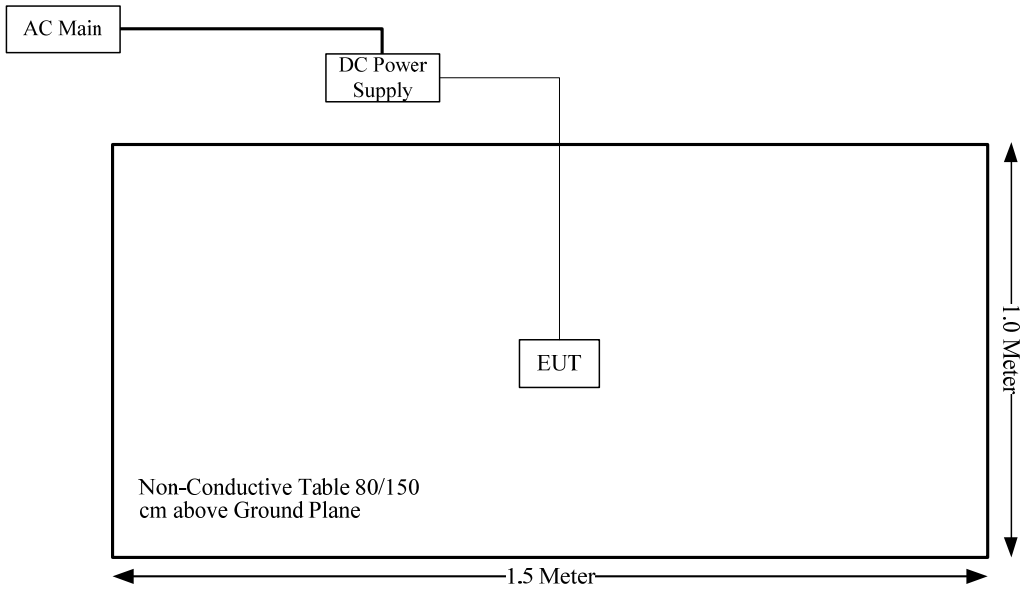
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Pro instrument	DC Power Supply	pps3300	3300012

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
DC Cable	No	No	2	DC power Supply	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC§15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
FCC §15.207(a)	AC line conducted emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

Not Applicable： the device was powered by vehicle battery.

FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	0	1.00	3	2.00	40.00	0.0001	1.0

The Bluetooth and UHF can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{BT}/S_{limit-BT}+ S_{UHF}/S_{limit-UHF}$

$=0.0001/1+0.35/1.511$

$=0.23$

< 1.0

Result: The device meet FCC MPE at 40 cm distance

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, fulfill the requirement of this section. Please refer to below information and the EUT photos:

Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range
Chip	50	0 dBi/2.4~2.5GHz

Result: Compliance.

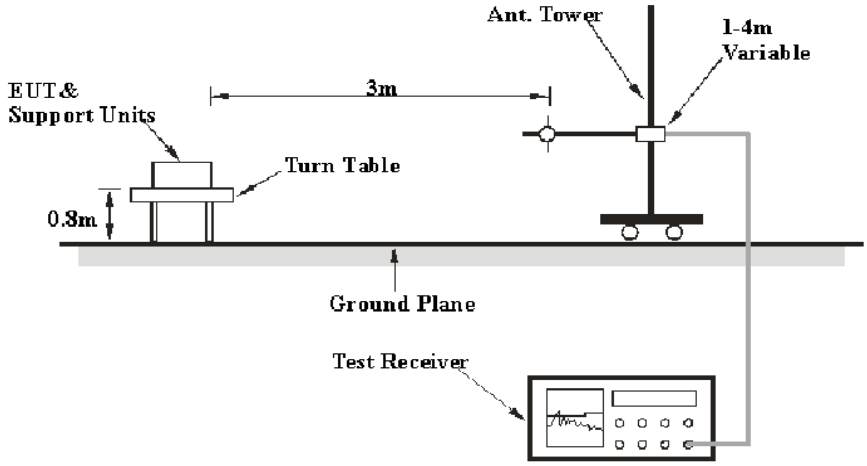
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

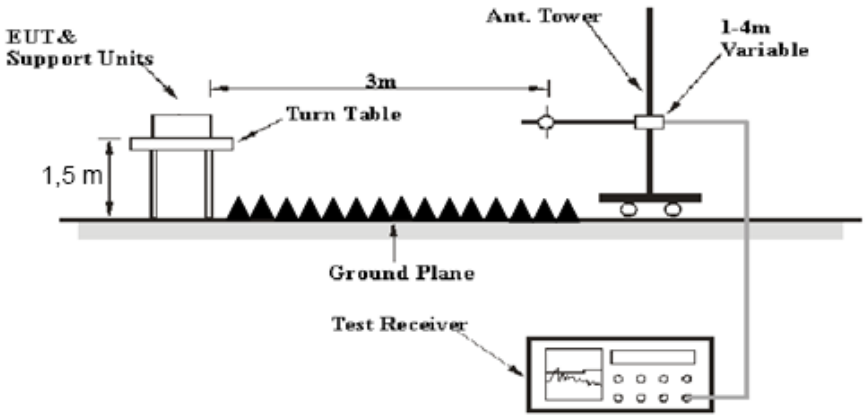
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 3 meters chamber A, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

According to FCC public notice: DA-00-705, during the radiated emission test, 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	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Below 1GHz					
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
Radiation Above 1GHz					
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2017-12-06	2020-12-05
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2019-06-27	2020-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2019-06-16	2020-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2019-06-16	2020-06-16

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

Test Data

Environmental Conditions

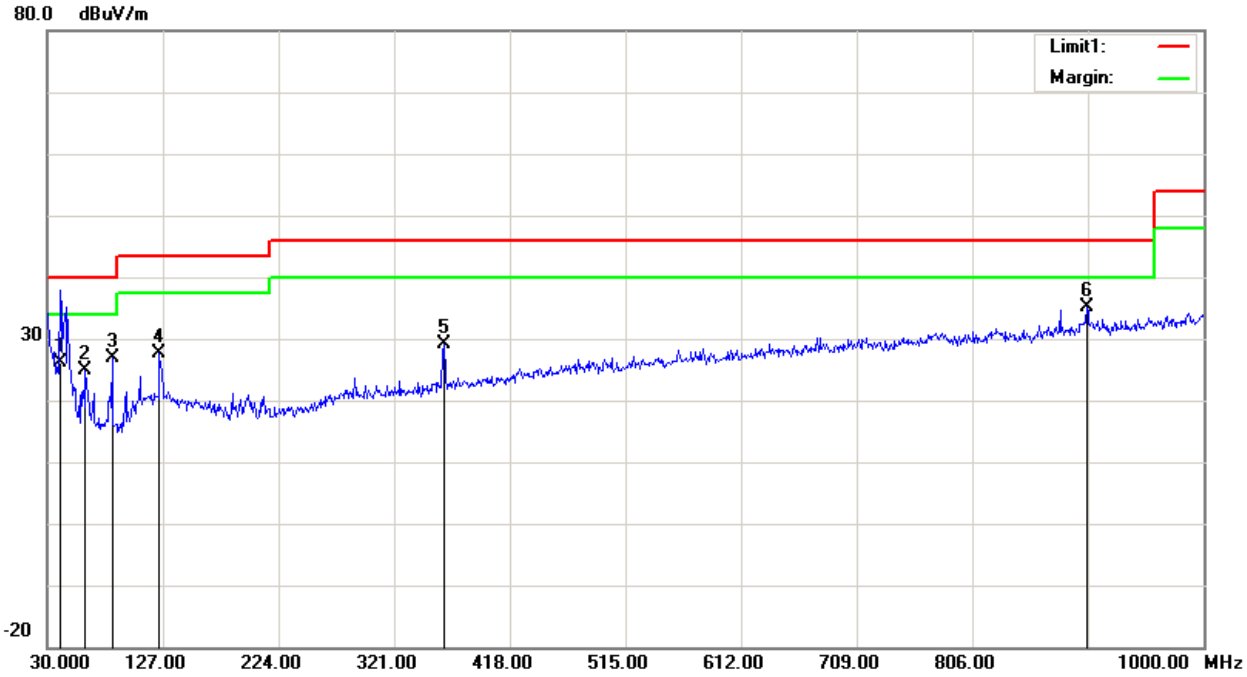
Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	23.9 °C	23.9 °C
Relative Humidity:	40%	40%
ATM Pressure:	102kPa	102kPa
Tester:	Lucy Lu	Lucy Lu
Test Date:	2019-12-30	2019-12-30

Test Mode: Transmitting

Please refer to following table and plots:

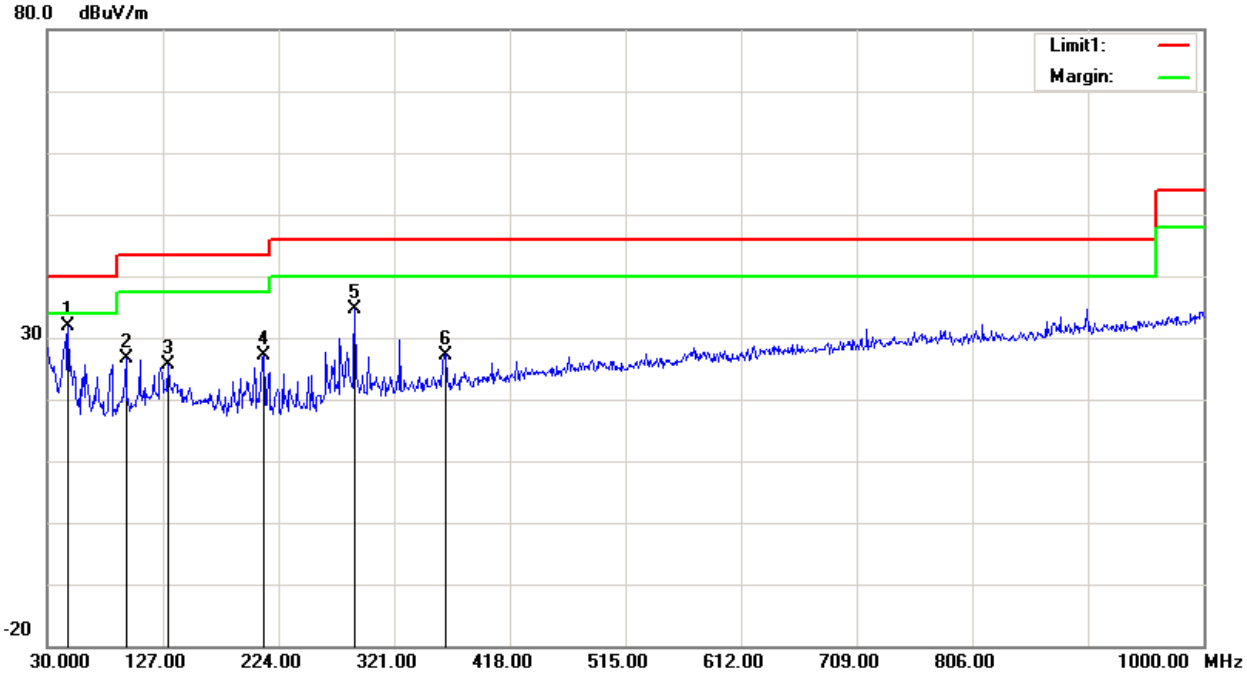
1) 30MHz-1GHz (GFSK high channel was the worst)

Horizontal:



No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	40.6200	32.50	QP	-6.28	26.22	40.00	13.78
2	62.0100	36.90	peak	-12.01	24.89	40.00	15.11
3	84.3200	38.36	peak	-11.38	26.98	40.00	13.02
4	124.0900	32.21	peak	-4.56	27.65	43.50	15.85
5	362.7100	31.92	peak	-2.81	29.11	46.00	16.89
6	902.0300	34.97	peak	0.14	35.11	46.00	10.89

Vertical:



No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	47.4600	42.28	peak	-10.36	31.92	40.00	8.08
2	95.9600	36.56	peak	-9.99	26.57	43.50	16.93
3	131.8500	30.61	peak	-4.89	25.72	43.50	17.78
4	211.3900	34.42	peak	-7.38	27.04	43.50	16.46
5	288.0200	38.67	peak	-4.03	34.64	46.00	11.36
6	364.6500	30.07	peak	-2.82	27.25	46.00	18.75

2)1GHz-25GHz:

BDR Mode (GFSK)

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	65.03	PK	H	28.10	1.80	0.00	94.93	N/A	N/A
2402.00	54.82	AV	H	28.10	1.80	0.00	84.72	N/A	N/A
2402.00	68.13	PK	V	28.10	1.80	0.00	98.03	N/A	N/A
2402.00	57.68	AV	V	28.10	1.80	0.00	87.58	N/A	N/A
2390.00	25.45	PK	V	28.08	1.80	0.00	55.33	74.00	18.67
2390.00	13.31	AV	V	28.08	1.80	0.00	43.19	54.00	10.81
4804.00	47.41	PK	V	32.91	3.17	25.60	57.89	74.00	16.11
4804.00	35.89	AV	V	32.91	3.17	25.60	46.37	54.00	7.63
7206.00	38.76	PK	V	35.74	4.82	25.60	53.72	74.00	20.28
7206.00	26.34	AV	V	35.74	4.82	25.60	41.30	54.00	12.70
Middle Channel: 2441 MHz									
2441.00	66.57	PK	H	28.18	1.82	0.00	96.57	N/A	N/A
2441.00	56.12	AV	H	28.18	1.82	0.00	86.12	N/A	N/A
2441.00	69.45	PK	V	28.18	1.82	0.00	99.45	N/A	N/A
2441.00	59.01	AV	V	28.18	1.82	0.00	89.01	N/A	N/A
4882.00	48.15	PK	V	33.06	3.27	25.66	58.82	74.00	15.18
4882.00	37.50	AV	V	33.06	3.27	25.66	48.17	54.00	5.83
7323.00	38.02	PK	V	36.04	4.62	25.73	52.95	74.00	21.05
7323.00	25.84	AV	V	36.04	4.62	25.73	40.77	54.00	13.23
High Channel: 2480 MHz									
2480.00	68.02	PK	H	28.26	1.84	0.00	98.12	N/A	N/A
2480.00	58.23	AV	H	28.26	1.84	0.00	88.33	N/A	N/A
2480.00	71.28	PK	V	28.26	1.84	0.00	101.38	N/A	N/A
2480.00	61.11	AV	V	28.26	1.84	0.00	91.21	N/A	N/A
2483.50	26.77	PK	V	28.27	1.84	0.00	56.88	74.00	17.12
2483.50	14.08	AV	V	28.27	1.84	0.00	44.19	54.00	9.81
4960.00	49.84	PK	V	33.22	3.23	25.63	60.66	74.00	13.34
4960.00	38.21	AV	V	33.22	3.23	25.63	49.03	54.00	4.97
7440.00	37.56	PK	V	36.34	4.41	25.85	52.46	74.00	21.54
7440.00	25.04	AV	V	36.34	4.41	25.85	39.94	54.00	14.06

EDR（π/4-DQPSK)

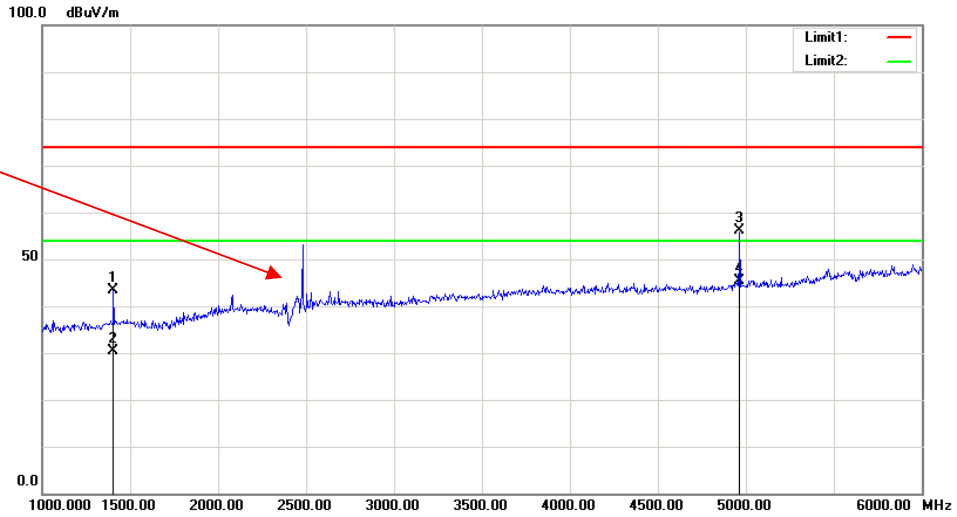
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	63.87	PK	H	28.10	1.80	0.00	93.77	N/A	N/A
2402.00	51.93	AV	H	28.10	1.80	0.00	81.83	N/A	N/A
2402.00	66.80	PK	V	28.10	1.80	0.00	96.70	N/A	N/A
2402.00	54.79	AV	V	28.10	1.80	0.00	84.69	N/A	N/A
2390.00	25.13	PK	V	28.08	1.80	0.00	55.01	74.00	18.99
2390.00	13.35	AV	V	28.08	1.80	0.00	43.23	54.00	10.77
4804.00	43.12	PK	V	32.91	3.17	25.60	53.60	74.00	20.40
4804.00	28.31	AV	V	32.91	3.17	25.60	38.79	54.00	15.21
7206.00	35.33	PK	V	35.74	4.82	25.60	50.29	74.00	23.71
7206.00	22.54	AV	V	35.74	4.82	25.60	37.50	54.00	16.50
Middle Channel: 2441 MHz									
2441.00	64.53	PK	H	28.18	1.82	0.00	94.53	N/A	N/A
2441.00	52.67	AV	H	28.18	1.82	0.00	82.67	N/A	N/A
2441.00	67.31	PK	V	28.18	1.82	0.00	97.31	N/A	N/A
2441.00	55.42	AV	V	28.18	1.82	0.00	85.42	N/A	N/A
4882.00	43.68	PK	V	33.06	3.27	25.66	54.35	74.00	19.65
4882.00	28.65	AV	V	33.06	3.27	25.66	39.32	54.00	14.68
7323.00	34.90	PK	V	36.04	4.62	25.73	49.83	74.00	24.17
7323.00	22.63	AV	V	36.04	4.62	25.73	37.56	54.00	16.44
High Channel: 2480 MHz									
2480.00	65.88	PK	H	28.26	1.84	0.00	95.98	N/A	N/A
2480.00	53.74	AV	H	28.26	1.84	0.00	83.84	N/A	N/A
2480.00	68.99	PK	V	28.26	1.84	0.00	99.09	N/A	N/A
2480.00	56.97	AV	V	28.26	1.84	0.00	87.07	N/A	N/A
2483.50	26.34	PK	V	28.27	1.84	0.00	56.45	74.00	17.55
2483.50	14.02	AV	V	28.27	1.84	0.00	44.13	54.00	9.87
4960.00	44.18	PK	V	33.22	3.23	25.63	55.00	74.00	19.00
4960.00	29.82	AV	V	33.22	3.23	25.63	40.64	54.00	13.36
7440.00	35.12	PK	V	36.34	4.41	25.85	50.02	74.00	23.98
7440.00	22.56	AV	V	36.34	4.41	25.85	37.46	54.00	16.54

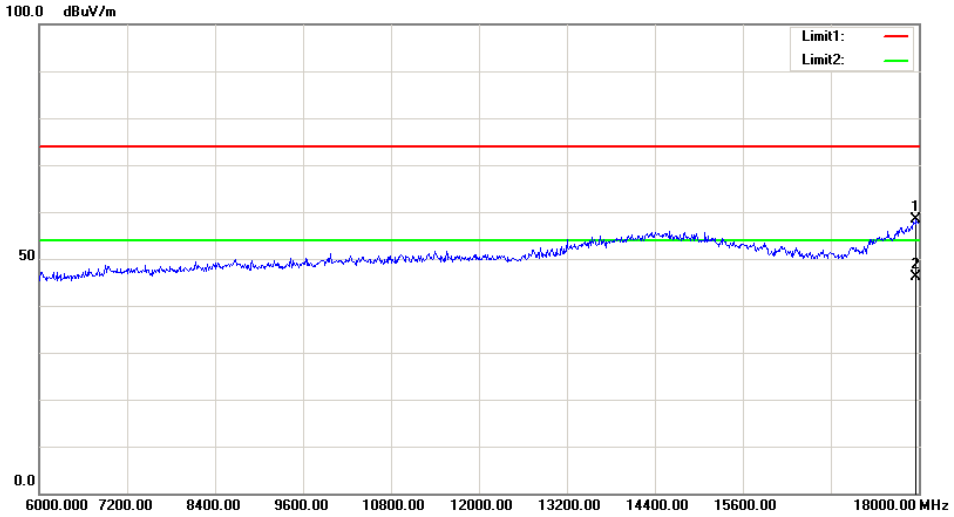
EDR_ (8-DPSK)

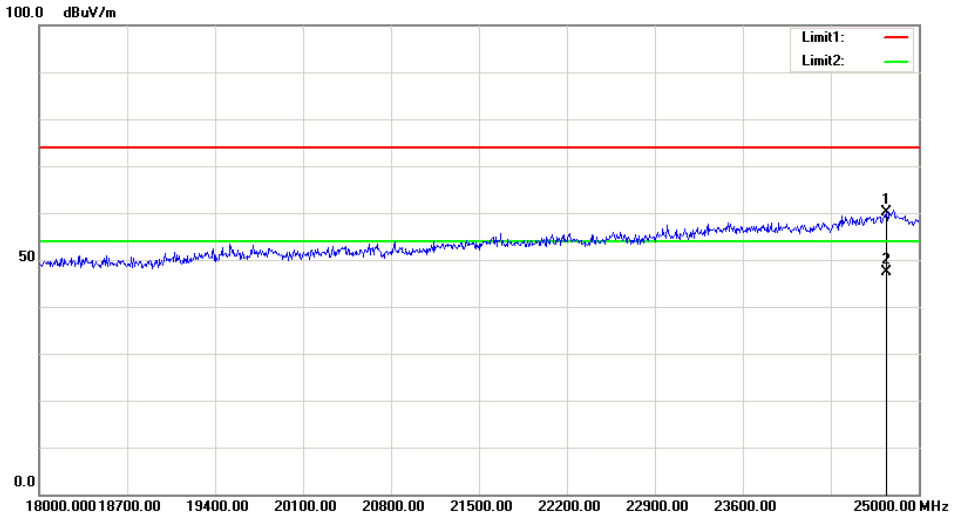
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	63.80	PK	H	28.10	1.80	0.00	93.70	N/A	N/A
2402.00	50.24	AV	H	28.10	1.80	0.00	80.14	N/A	N/A
2402.00	66.25	PK	V	28.10	1.80	0.00	96.15	N/A	N/A
2402.00	53.48	AV	V	28.10	1.80	0.00	83.38	N/A	N/A
2390.00	25.12	PK	V	28.08	1.80	0.00	55.00	74.00	19.00
2390.00	13.26	AV	V	28.08	1.80	0.00	43.14	54.00	10.86
4804.00	43.27	PK	V	32.91	3.17	25.60	53.75	74.00	20.25
4804.00	27.92	AV	V	32.91	3.17	25.60	38.40	54.00	15.60
7206.00	35.15	PK	V	35.74	4.82	25.60	50.11	74.00	23.89
7206.00	22.64	AV	V	35.74	4.82	25.60	37.60	54.00	16.40
Middle Channel: 2441 MHz									
2441.00	64.02	PK	H	28.18	1.82	0.00	94.02	N/A	N/A
2441.00	50.79	AV	H	28.18	1.82	0.00	80.79	N/A	N/A
2441.00	67.65	PK	V	28.18	1.82	0.00	97.65	N/A	N/A
2441.00	54.82	AV	V	28.18	1.82	0.00	84.82	N/A	N/A
4882.00	44.02	PK	V	33.06	3.27	25.66	54.69	74.00	19.31
4882.00	28.35	AV	V	33.06	3.27	25.66	39.02	54.00	14.98
7323.00	35.40	PK	V	36.04	4.62	25.73	50.33	74.00	23.67
7323.00	22.74	AV	V	36.04	4.62	25.73	37.67	54.00	16.33
High Channel: 2480 MHz									
2480.00	65.80	PK	H	28.26	1.84	0.00	95.90	N/A	N/A
2480.00	53.72	AV	H	28.26	1.84	0.00	83.82	N/A	N/A
2480.00	68.87	PK	V	28.26	1.84	0.00	98.97	N/A	N/A
2480.00	55.98	AV	V	28.26	1.84	0.00	86.08	N/A	N/A
2483.50	25.97	PK	V	28.27	1.84	0.00	56.08	74.00	17.92
2483.50	14.00	AV	V	28.27	1.84	0.00	44.11	54.00	9.89
4960.00	44.84	PK	V	33.22	3.23	25.63	55.66	74.00	18.34
4960.00	29.51	AV	V	33.22	3.23	25.63	40.33	54.00	13.67
7440.00	35.33	PK	V	36.34	4.41	25.85	50.23	74.00	23.77
7440.00	22.46	AV	V	36.34	4.41	25.85	37.36	54.00	16.64

Worst plots (GFSK High channel was the worst)
Horizontal:

Fundamental Test with Band Rejection Filter

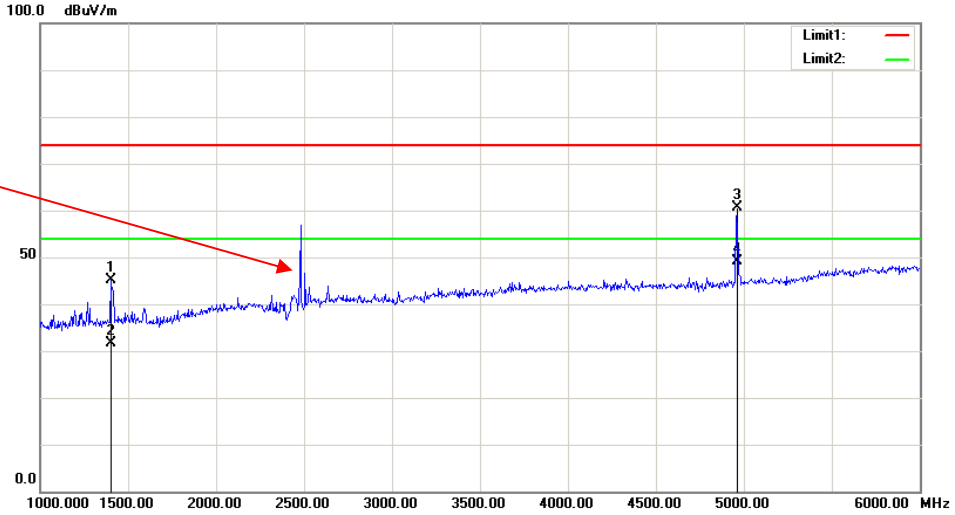


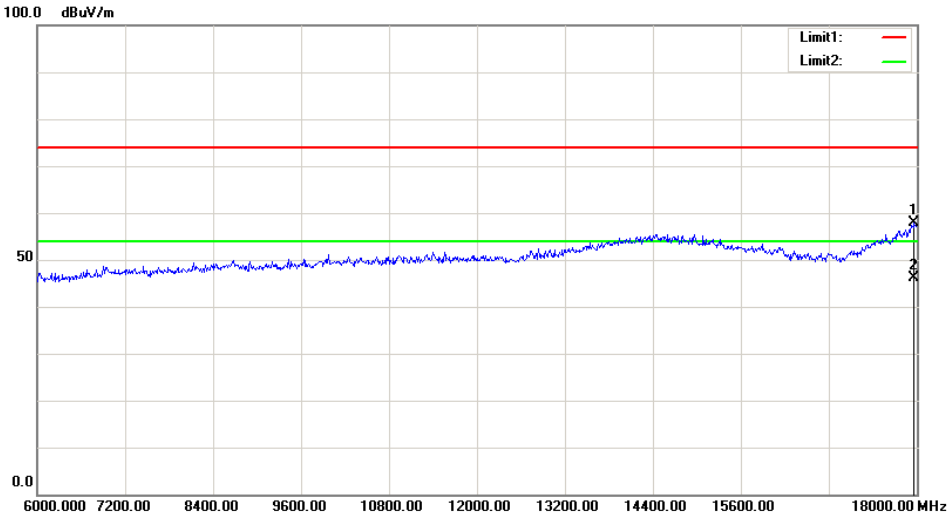


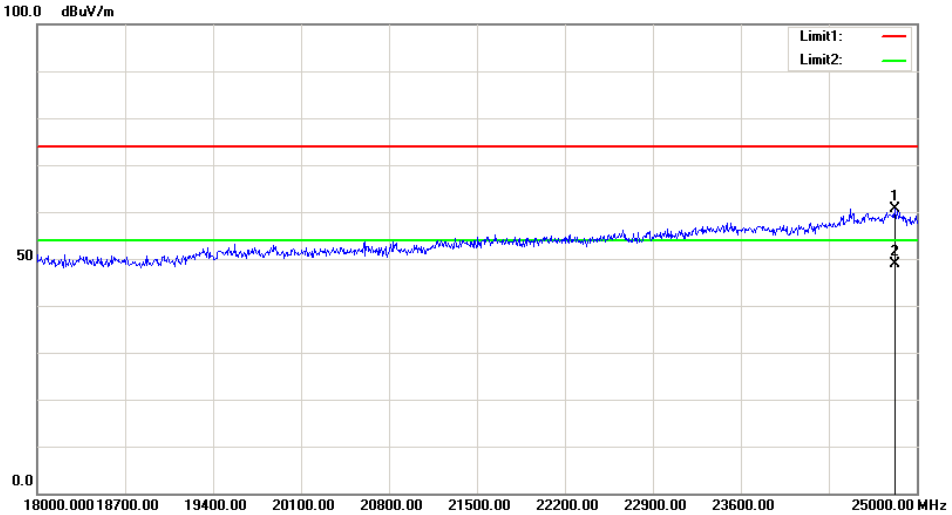


Vertical

Fundamental Test with Band Rejection Filter







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 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

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

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

Test Result: Compliance.

Please refer to following tables and plots

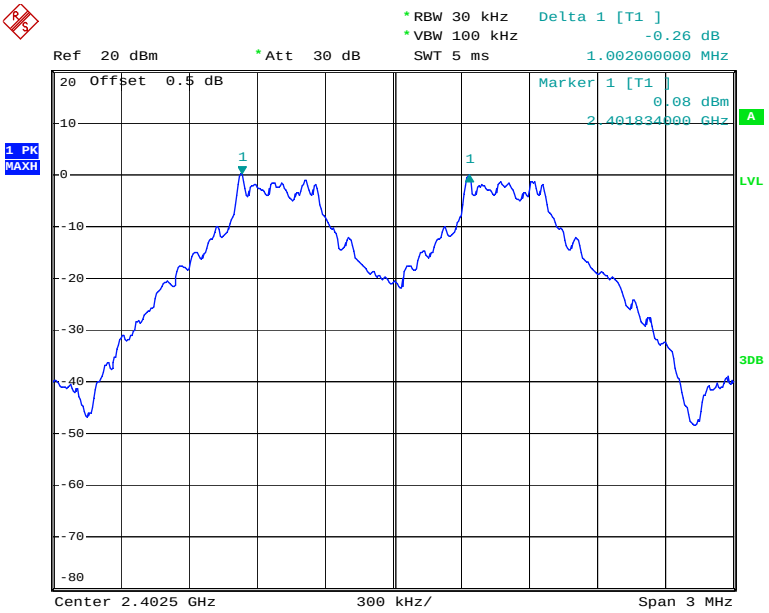
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	1.002	0.66
	Middle	2441	1.002	0.61
	High	2480	1.002	0.62
EDR (π/4-DQPSK)	Low	2402	1.002	0.83
	Middle	2441	1.002	0.83
	High	2480	0.996	0.84
EDR (8DPSK)	Low	2402	0.996	0.84
	Middle	2441	1.002	0.84
	High	2480	1.002	0.84

Note: Limit= (2/3) × 20dB bandwidth

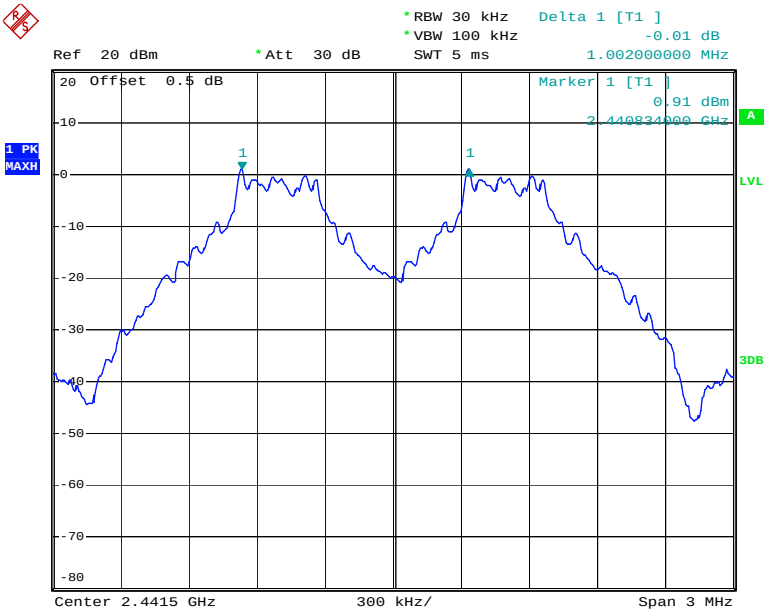
BDR Mode (GFSK):

Low Channel



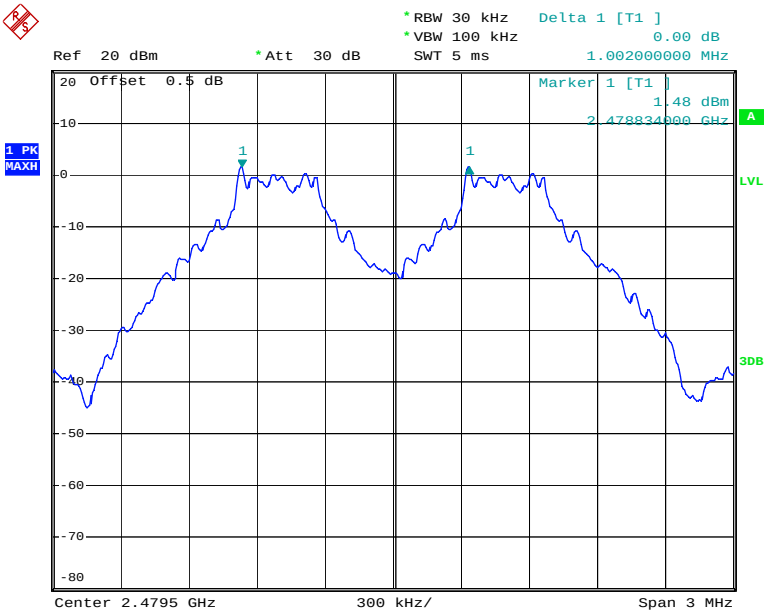
Date: 18.DEC.2019 19:35:27

Middle Channel



Date: 18.DEC.2019 19:36:15

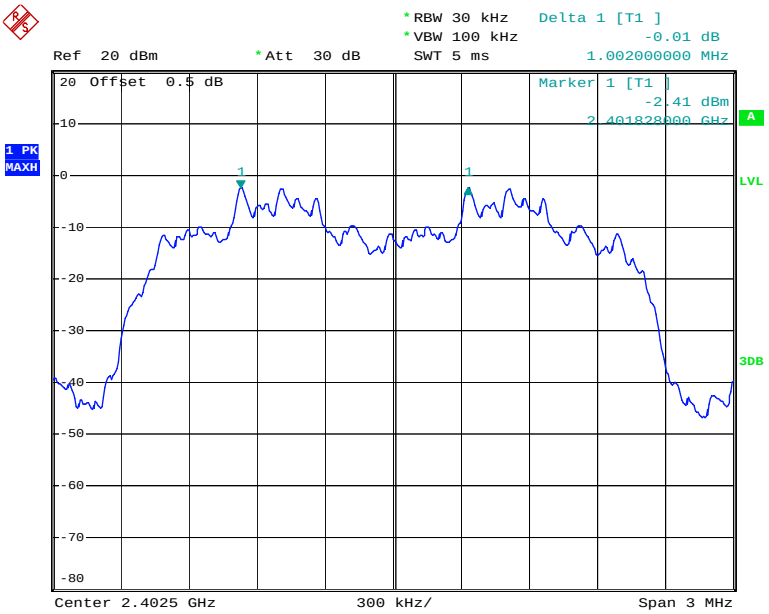
High Channel



Date: 18.DEC.2019 19:40:01

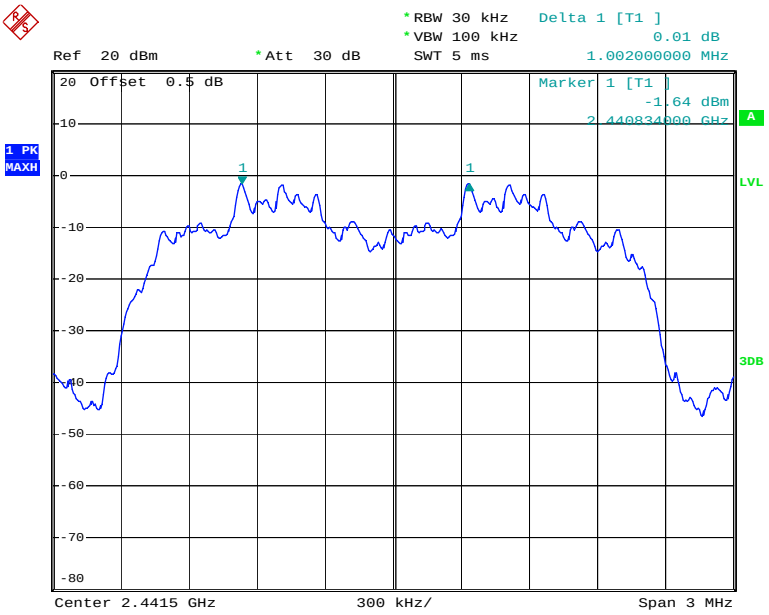
EDR Mode (π/4-DQPSK):

Low Channel



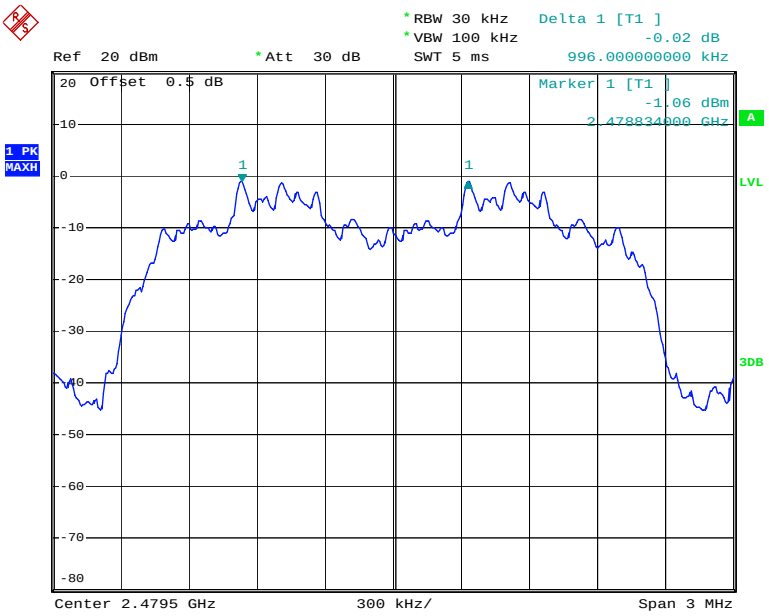
Date: 18.DEC.2019 19:42:02

Middle Channel



Date: 18.DEC.2019 19:45:02

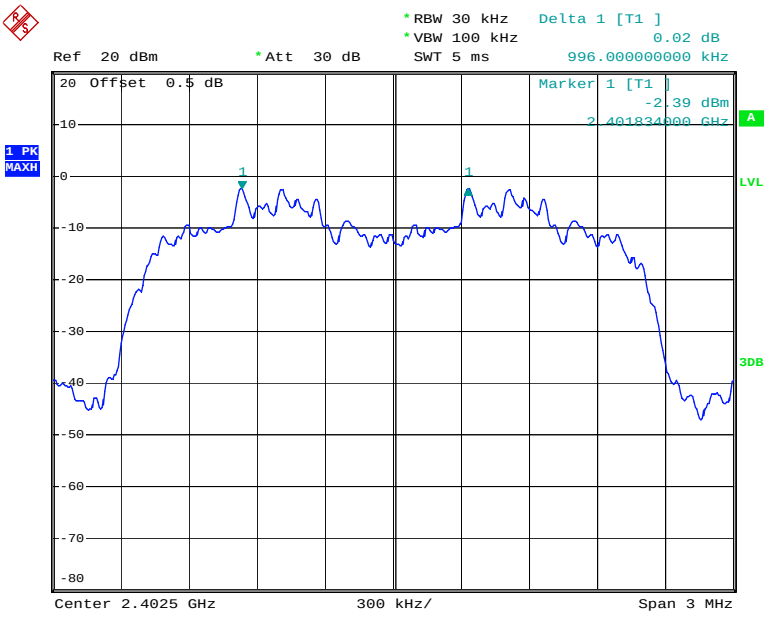
High Channel



Date: 18.DEC.2019 19:48:24

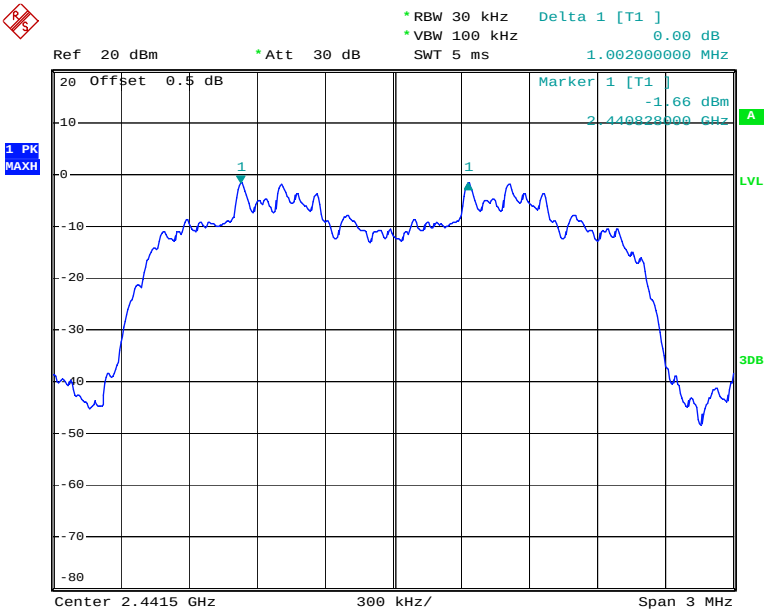
EDR Mode (8DPSK):

Low Channel



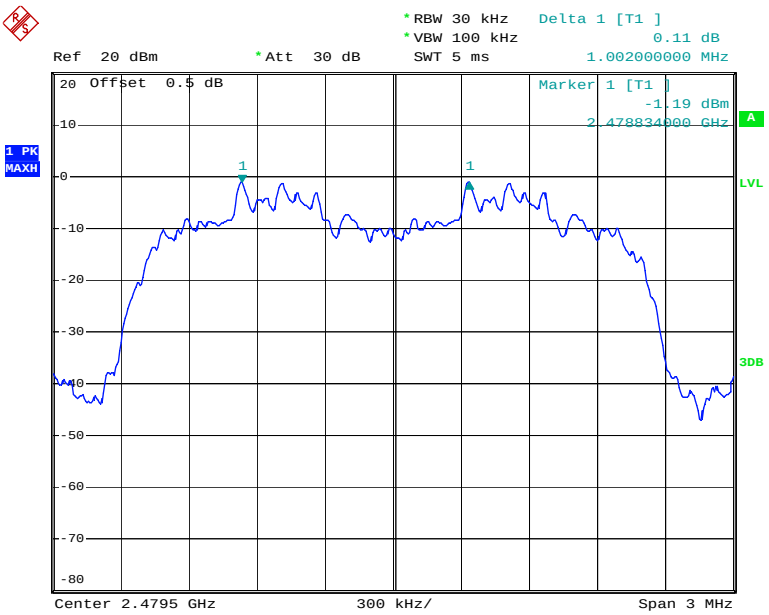
Date: 18.DEC.2019 19:52:54

Middle Channel



Date: 18.DEC.2019 19:53:47

High Channel



Date: 18.DEC.2019 19:56:12

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

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

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

Test Data

Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

Test Result: Compliance.

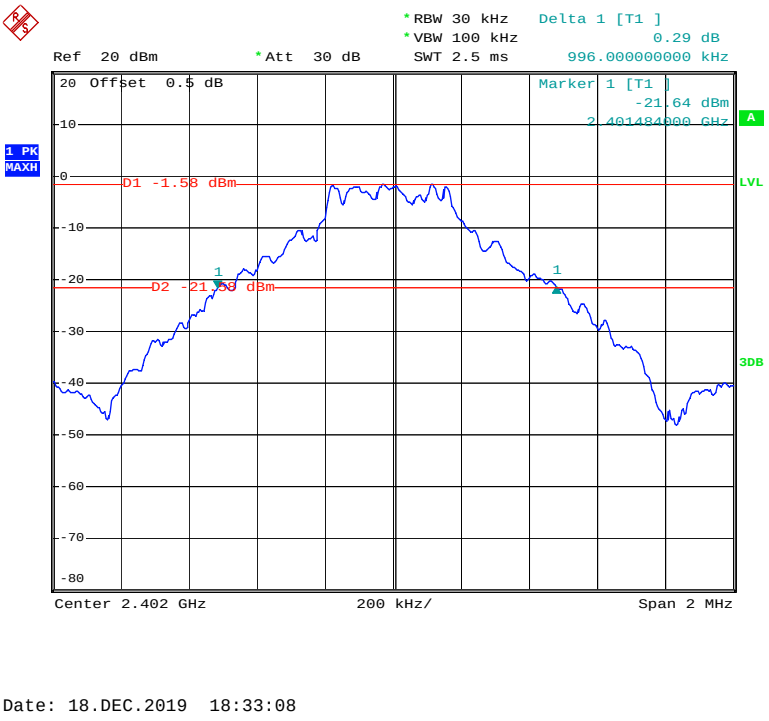
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.996
	Middle	2441	0.920
	High	2480	0.924
EDR Mode (π/4-DQPSK)	Low	2402	1.252
	Middle	2441	1.252
	High	2480	1.256
EDR Mode (8-DPSK)	Low	2402	1.256
	Middle	2441	1.260
	High	2480	1.256

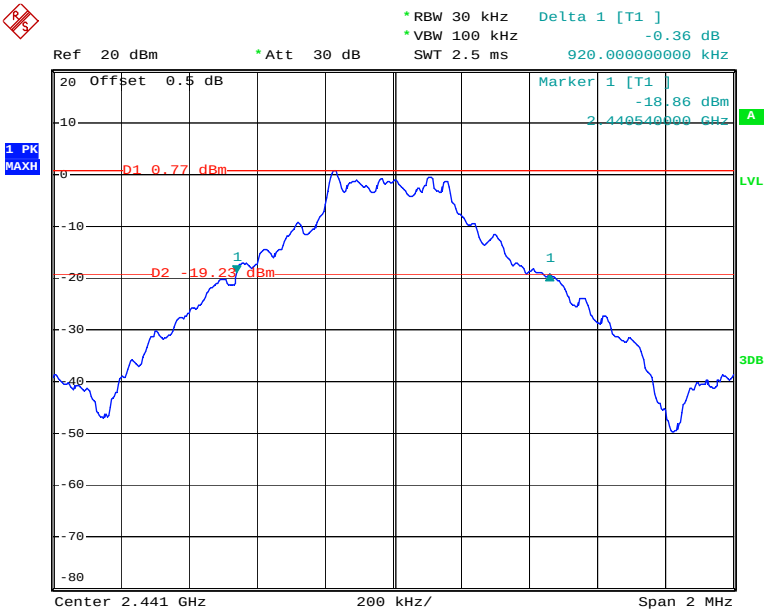
BDR Mode (GFSK):

Low Channel



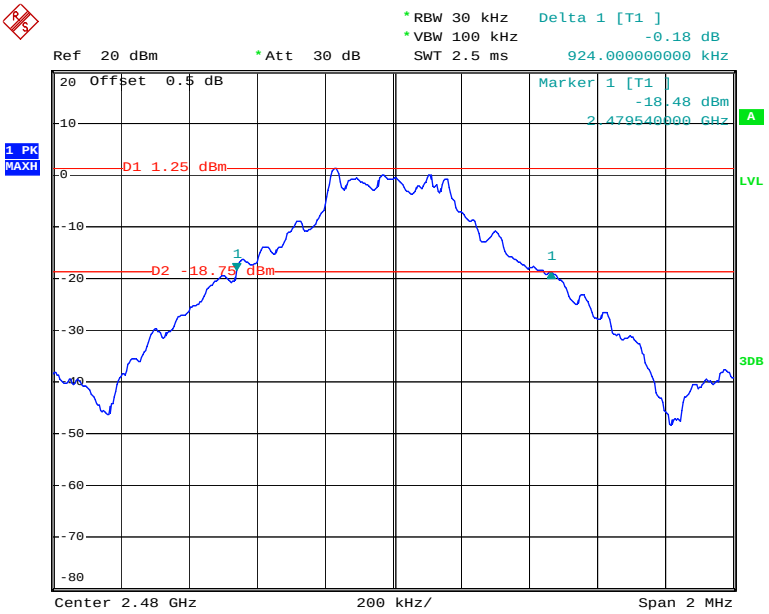
Date: 18.DEC.2019 18:33:08

Middle Channel



Date: 18.DEC.2019 18:35:19

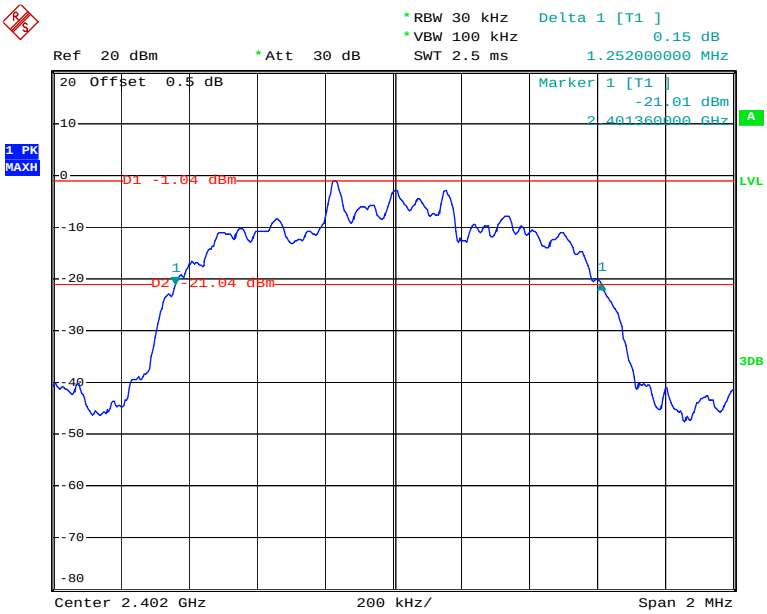
High Channel



Date: 18.DEC.2019 18:36:20

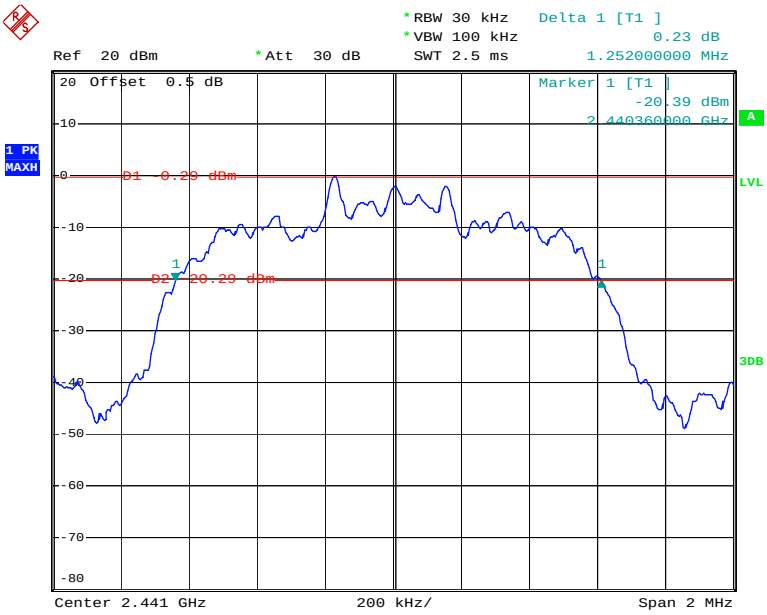
EDR Mode (π/4-DQPSK):

Low Channel



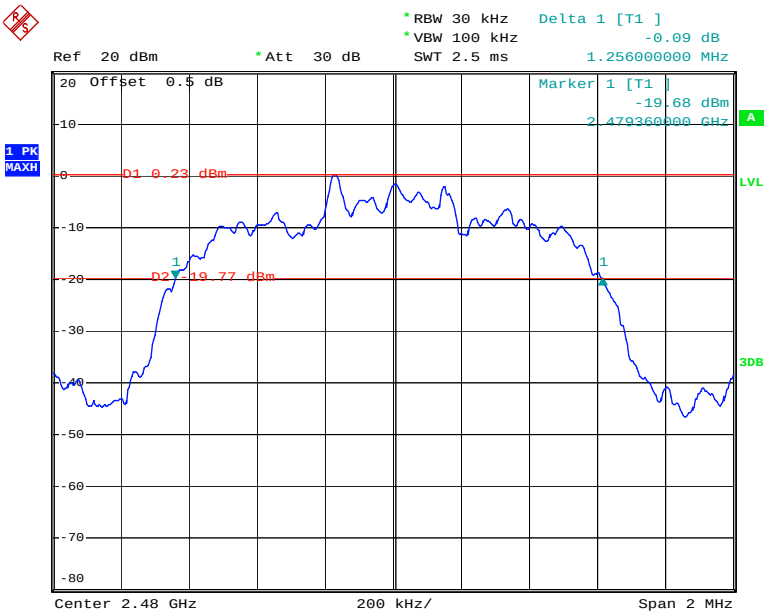
Date: 18.DEC.2019 18:38:28

Middle Channel



Date: 18.DEC.2019 18:40:15

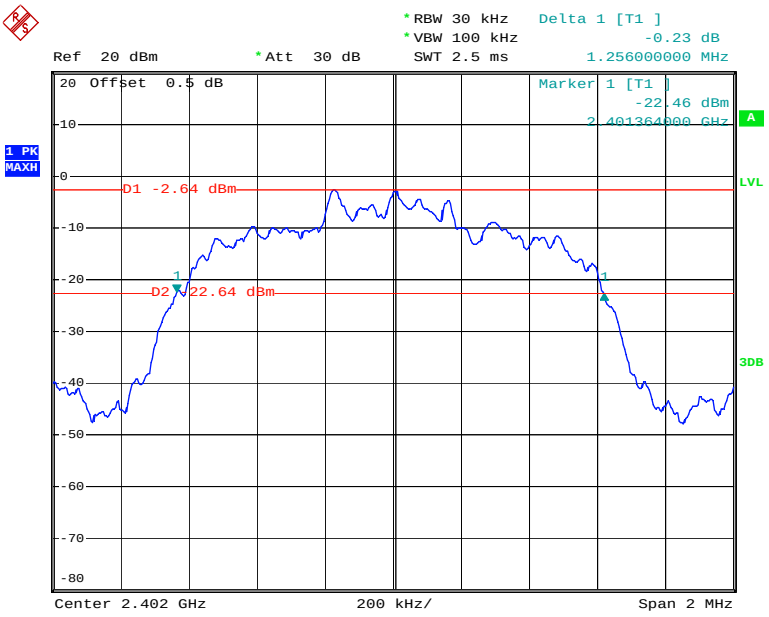
High Channel



Date: 18.DEC.2019 18:41:31

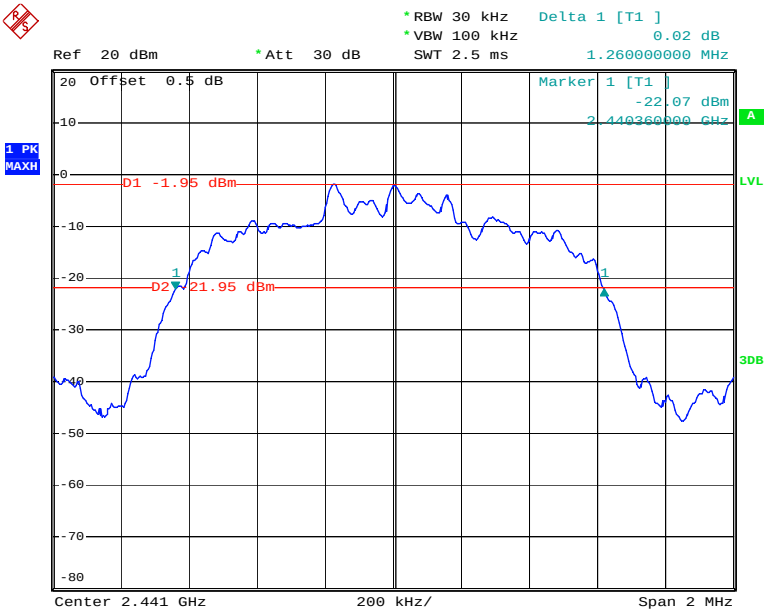
EDR Mode (8DPSK):

Low Channel



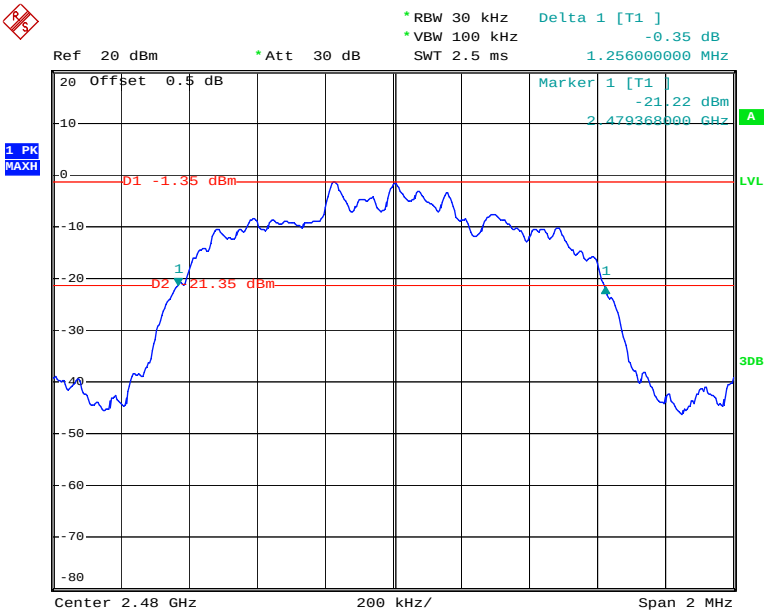
Date: 18.DEC.2019 18:43:07

Middle Channel



Date: 18.DEC.2019 18:44:28

High Channel



Date: 18.DEC.2019 18:46:04

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

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

Test Data

Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

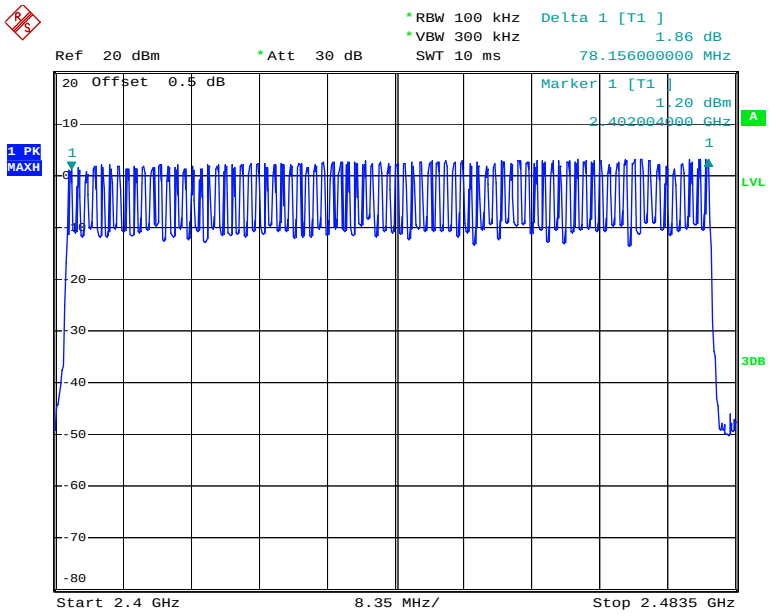
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

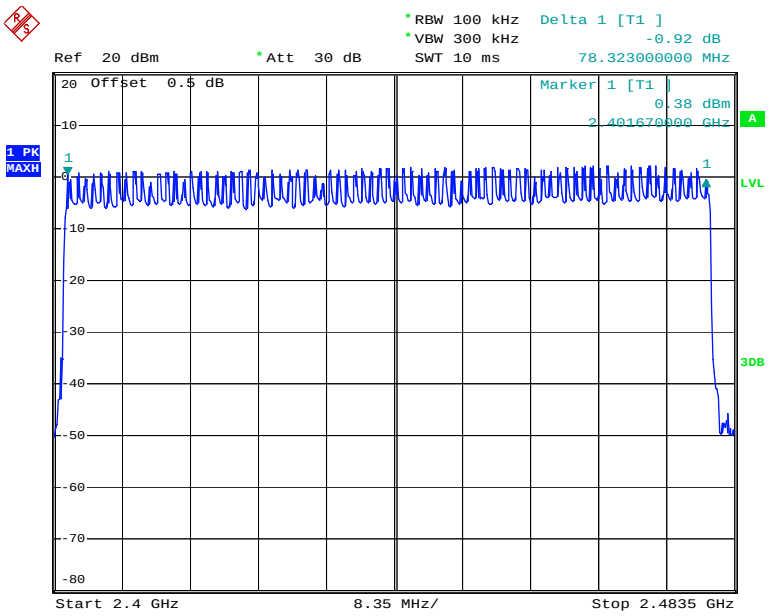
Test mode	Frequency Range (MHz)	Number of Hopping Channel	Limit
GFSK	2400-2483.5	79	≥15
π/4-DQPSK	2400-2483.5	79	≥15
8-DPSK	2400-2483.5	79	≥15

GFSK



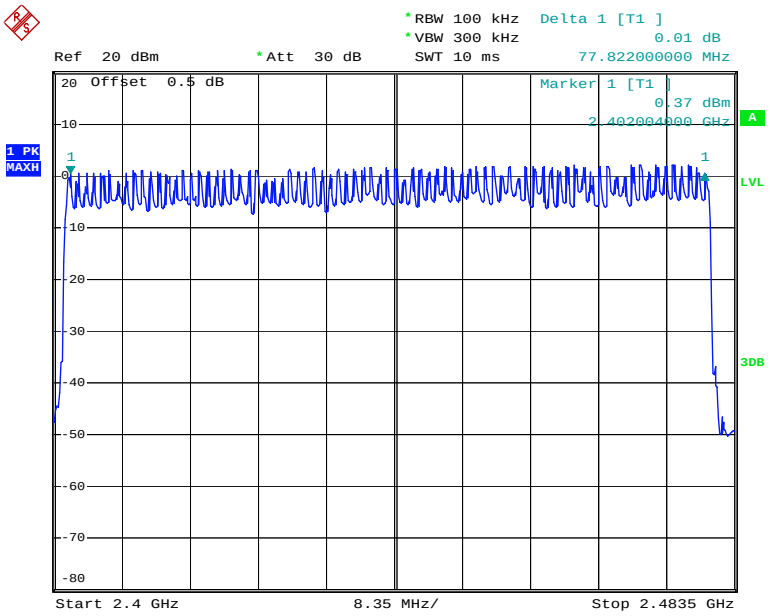
Date: 18.DEC.2019 19:19:53

π/4-DQPSK



Date: 18.DEC.2019 19:12:28

8DPSK



Date: 18.DEC.2019 19:16:31

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

The EUT was worked in channel hopping; the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

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

Test Data

Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

Test Result: Compliance.

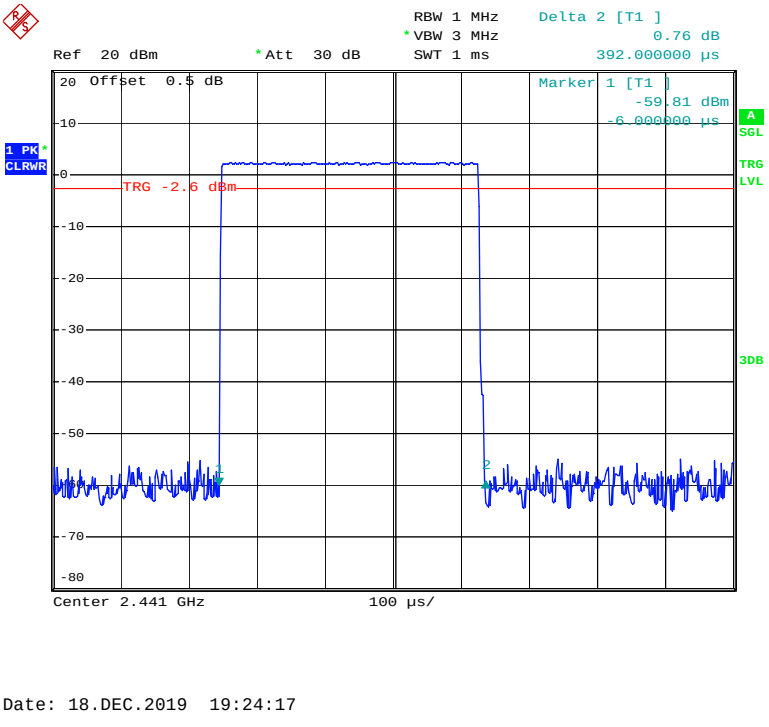
Please refer to following tables and plots

Test Mode: Transmitting

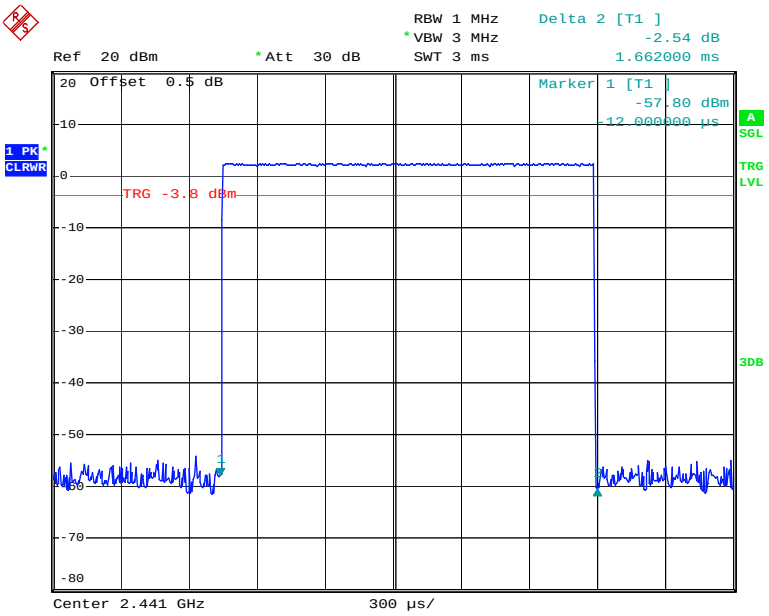
Mode	Packet type	Channel	Frequency (MHz)	Puse width (ms)	Result (s)	Limit (s)
GFSK	DH1	Middle	2441	0.392	0.125	0.4
	DH3	Middle	2441	1.662	0.266	
	DH5	Middle	2441	2.920	0.311	
π/4-DQPSK	2DH1	Middle	2441	0.398	0.127	
	2DH3	Middle	2441	1.662	0.266	
	2DH5	Middle	2441	2.910	0.310	
8DPSK	3DH1	Middle	2441	0.400	0.128	
	3DH3	Middle	2441	1.662	0.266	
	3DH5	Middle	2441	2.920	0.311	
Note: DH1:Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s DH3:Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s DH5:Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s						

BDR Mode (GFSK):

DH1: Middle Channel

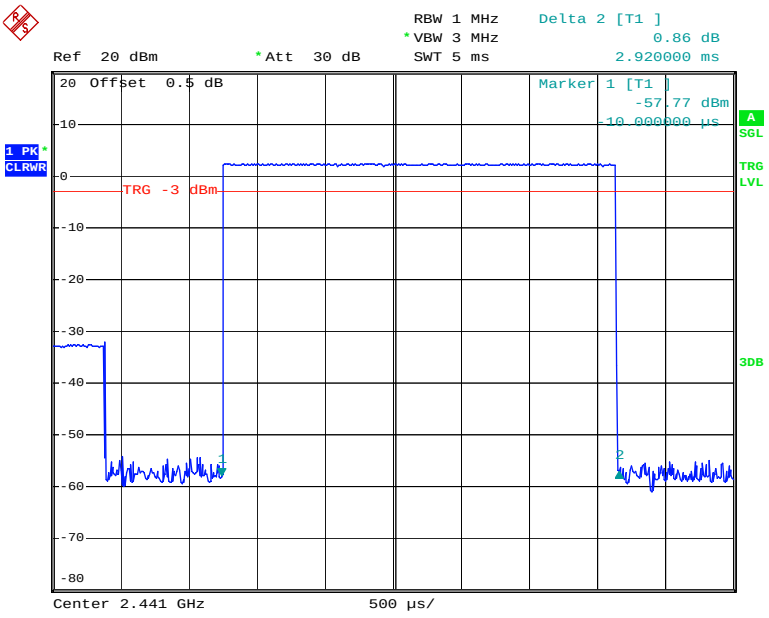


DH3: Middle Channel



Date: 18.DEC.2019 19:25:03

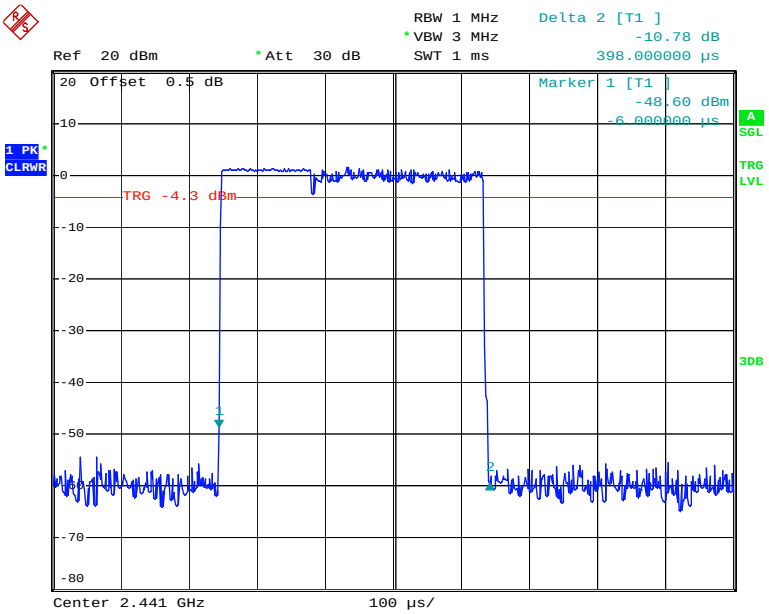
DH5: Middle Channel



Date: 18.DEC.2019 19:25:34

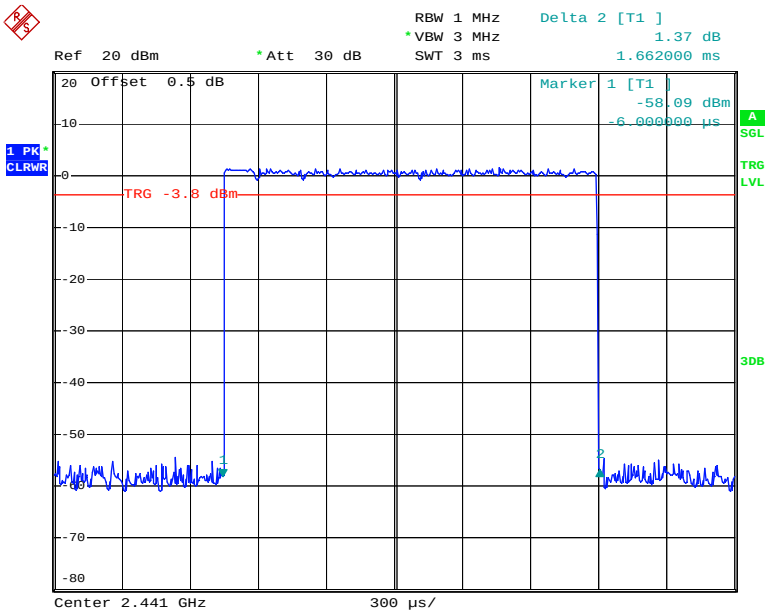
EDR Mode (π/4-DQPSK):

2DH1: Middle Channel



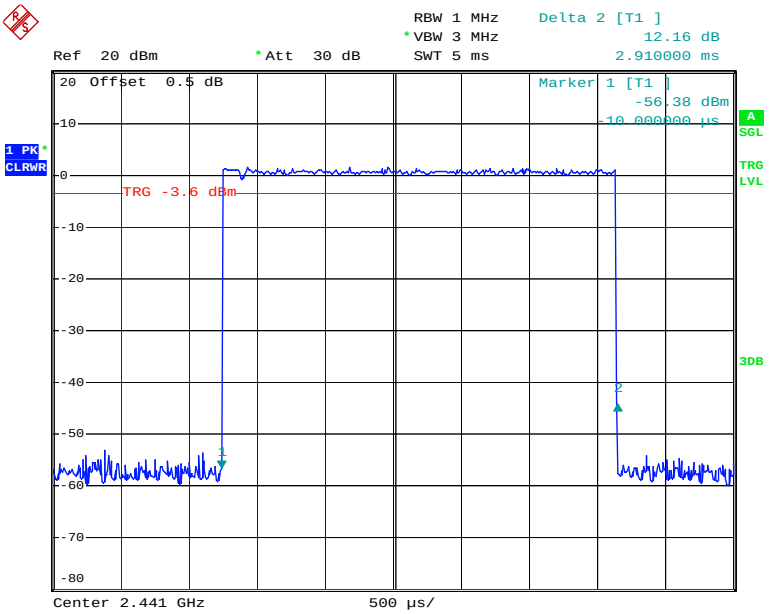
Date: 18.DEC.2019 19:27:21

2DH3: Middle Channel



Date: 18.DEC.2019 19:28:09

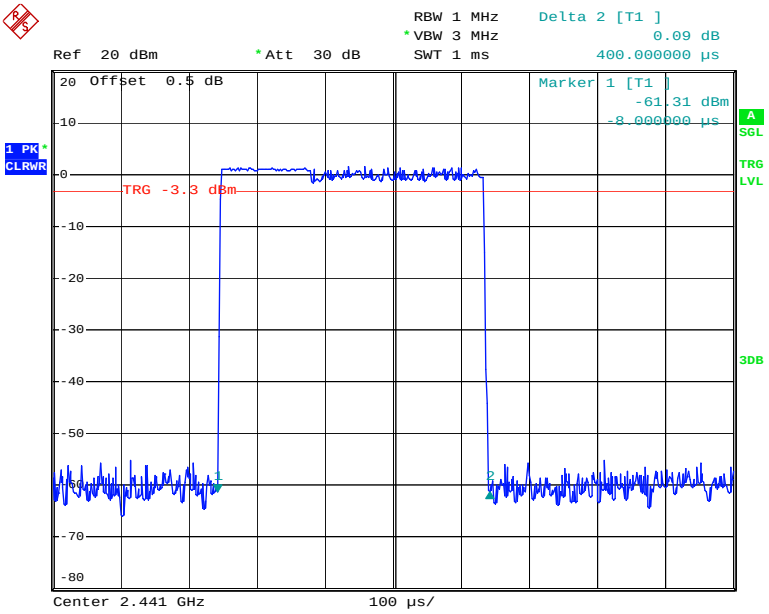
2DH5: Middle Channel



Date: 18.DEC.2019 19:29:25

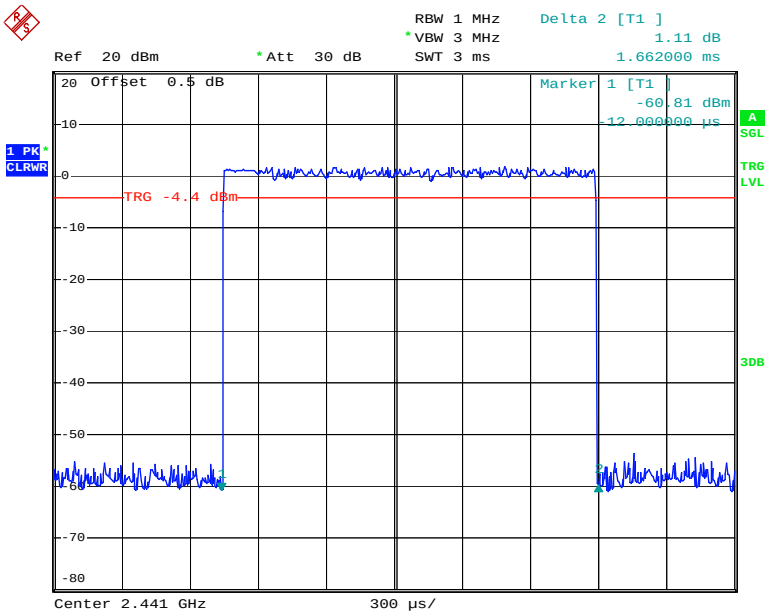
EDR Mode (8-DPSK):

3DH1: Middle Channel



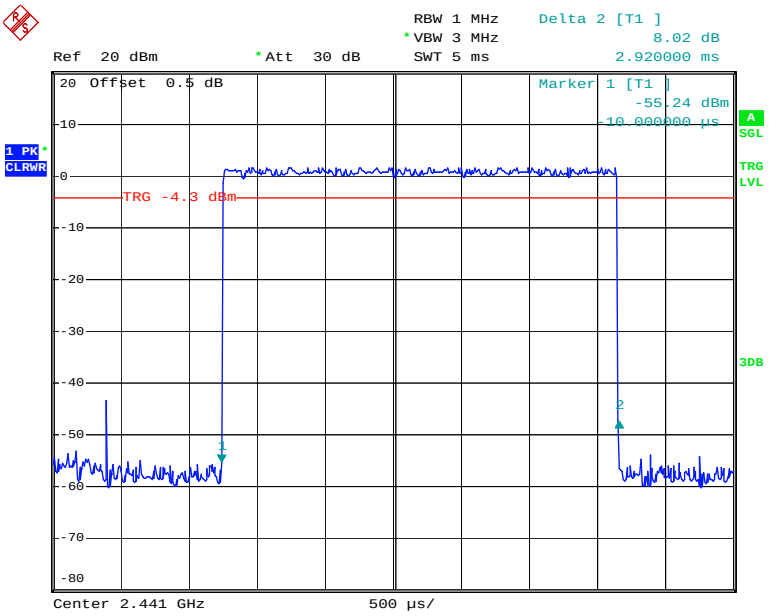
Date: 18.DEC.2019 19:30:32

3DH3: Middle Channel



Date: 18.DEC.2019 19:32:22

3DH5: Middle Channel



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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. 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A
Agilent	USB Wideband Power Sensor	U2021XA	MY5425009	2019-05-09	2020-05-09

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

Test Data

Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

Test Result: Compliance.

Test Mode: Transmitting

Mode	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	1.47	21
	2441	2.27	21
	2480	**2.79**	21
EDR Mode (π/4-DQPSK)	2402	1.23	21
	2441	2.05	21
	2480	2.60	21
EDR Mode (8-DPSK)	2402	1.35	21
	2441	2.21	21
	2480	2.79	21

Note: The data above was tested in conducted mode.

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/ VBW of spectrum analyzer to 100/300 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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each time	N/A

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

Test Data

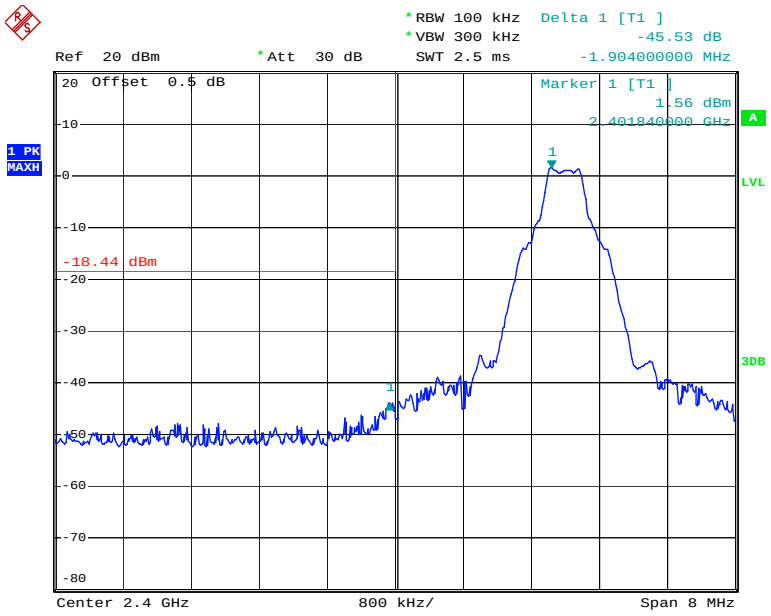
Environmental Conditions

Temperature:	27.9C
Relative Humidity:	57 %
ATM Pressure:	102.1kPa
Tester:	Severn Zhu
Test Date:	2019-12-18

Test Result: Compliance

Single Channel:
BDR Mode (GFSK):

Band Edge, Left Side



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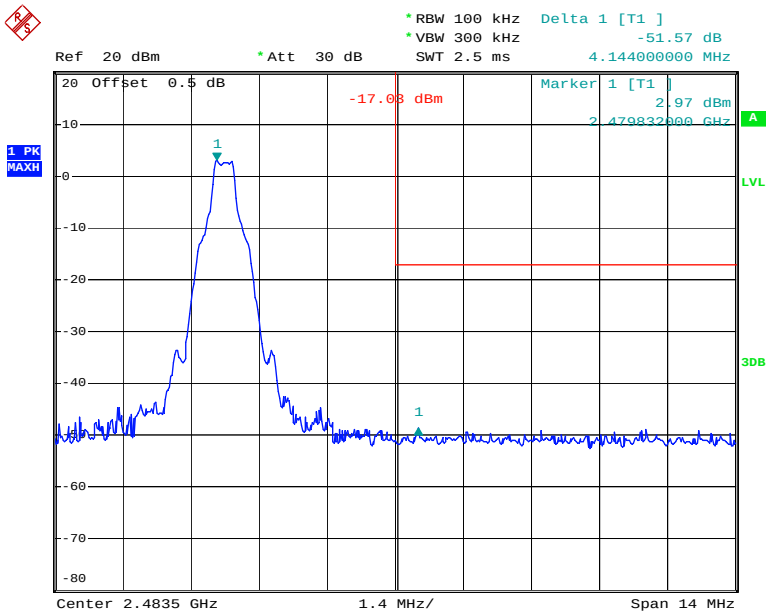
Band Edge, Right Side



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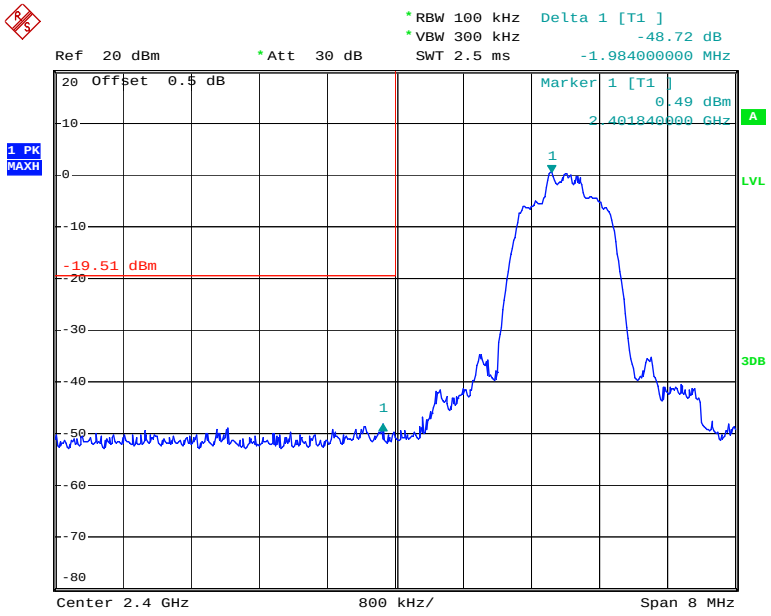
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



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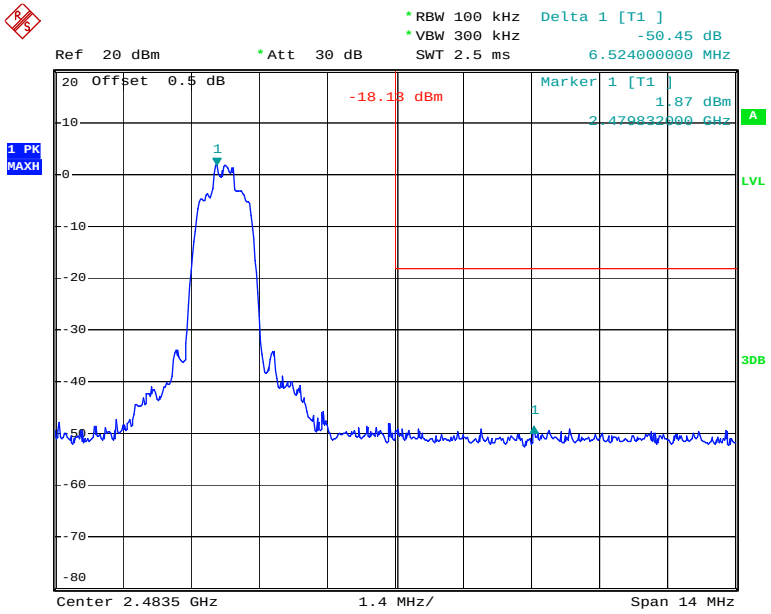
Band Edge, Right Side



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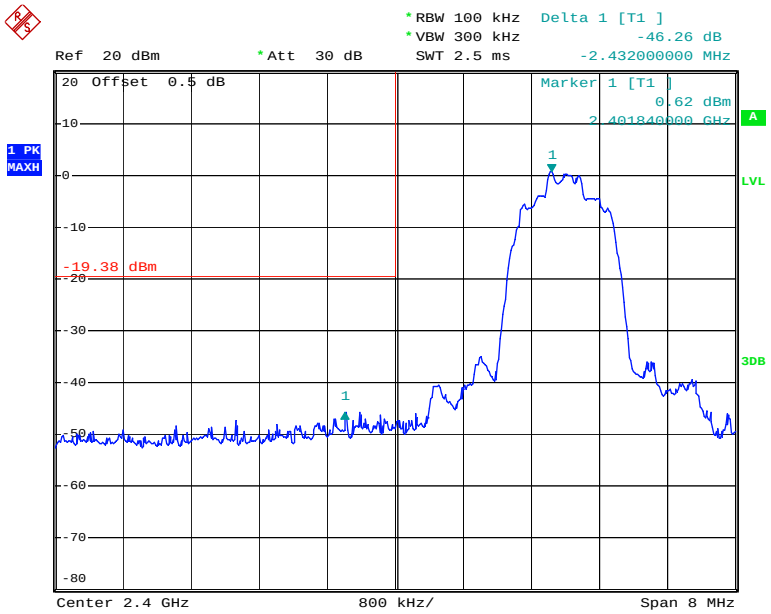
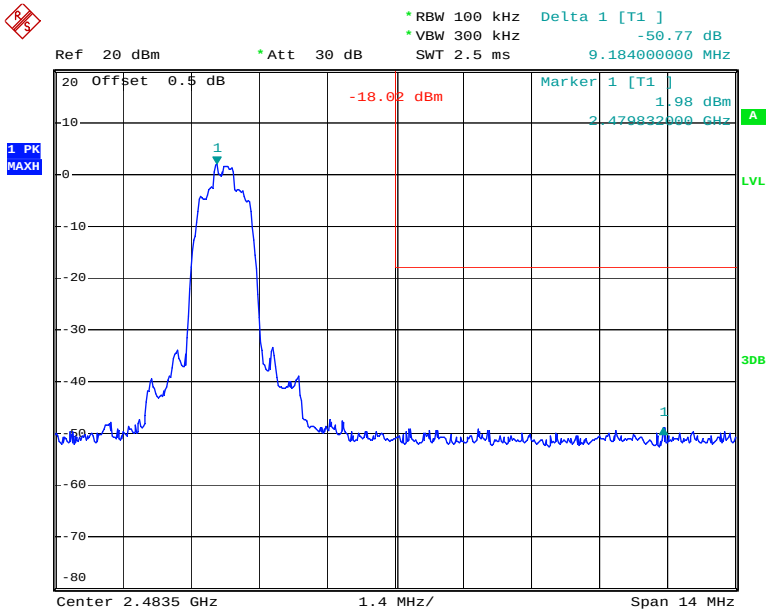
EDR Mode (8DPSK)

Band Edge, Left Side



Date: 18.DEC.2019 18:44:00

Band Edge, Right Side



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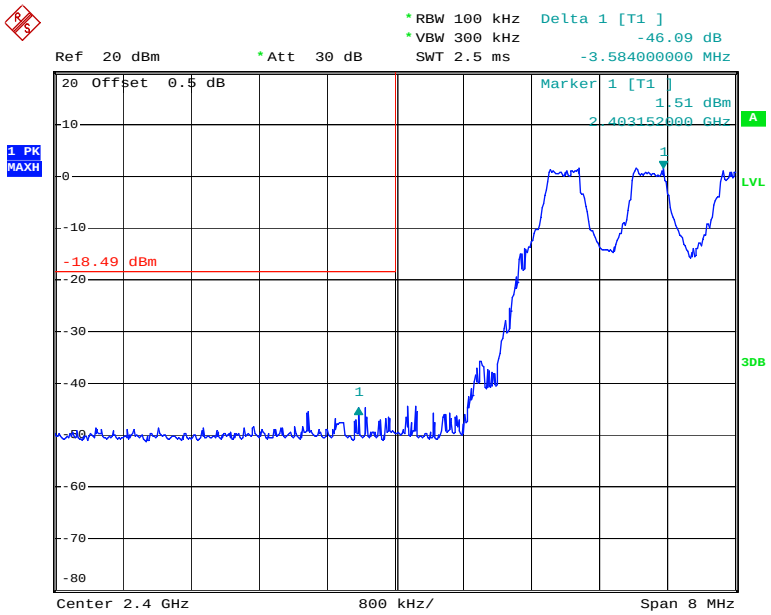
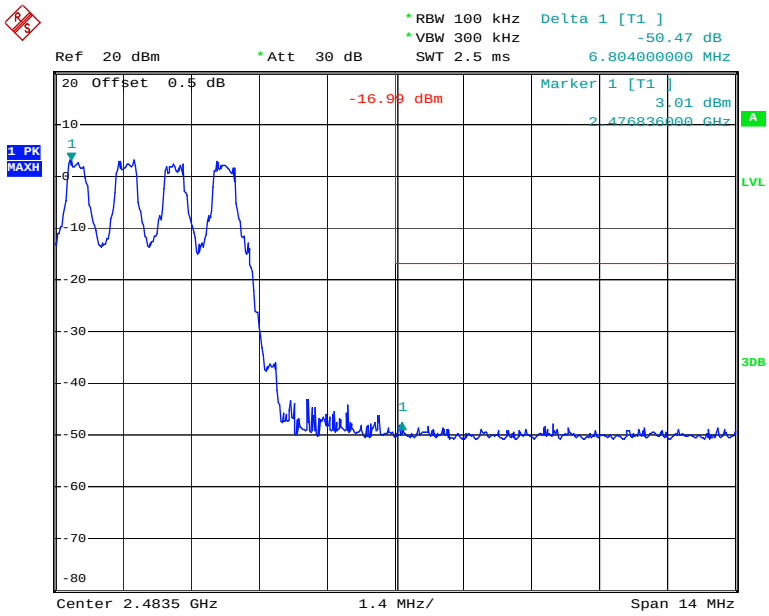
Hopping Mode,
BDR Mode (GFSK):

Band Edge, Left Side



Date: 18.DEC.2019 18:57:04

Band Edge, Right Side



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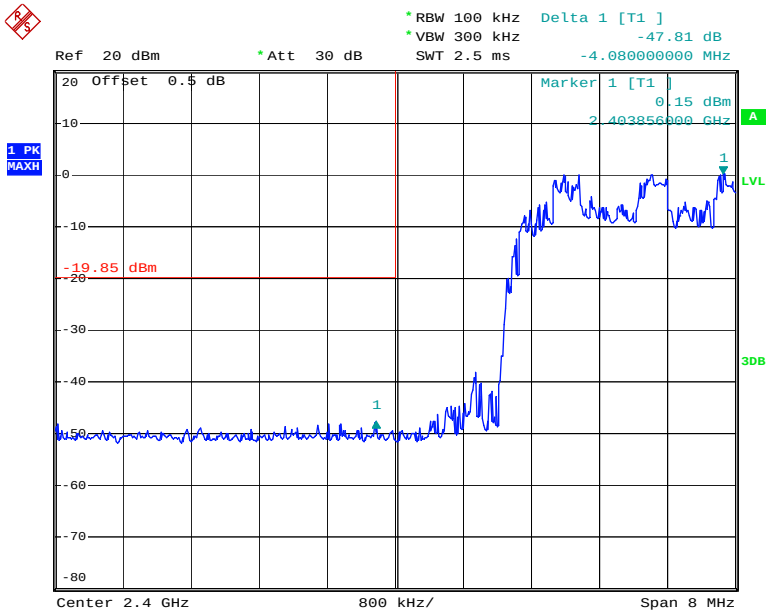
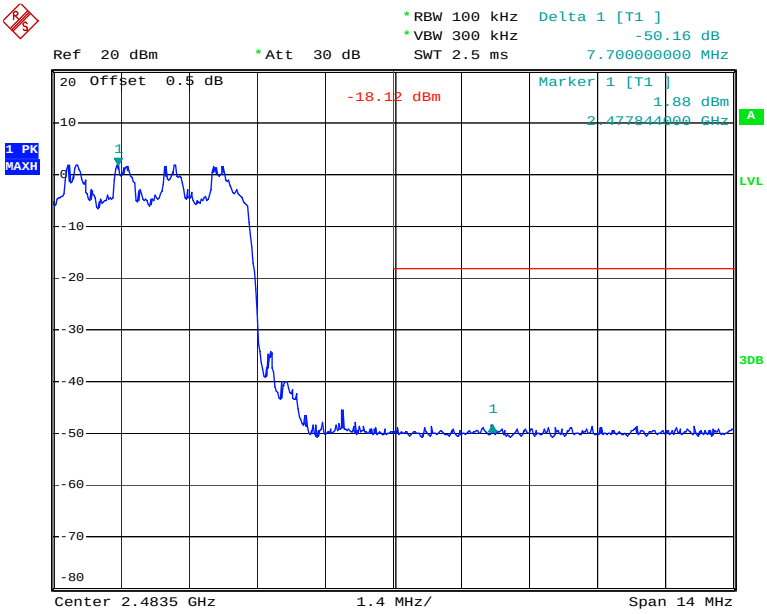
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



Date: 18.DEC.2019 19:01:46

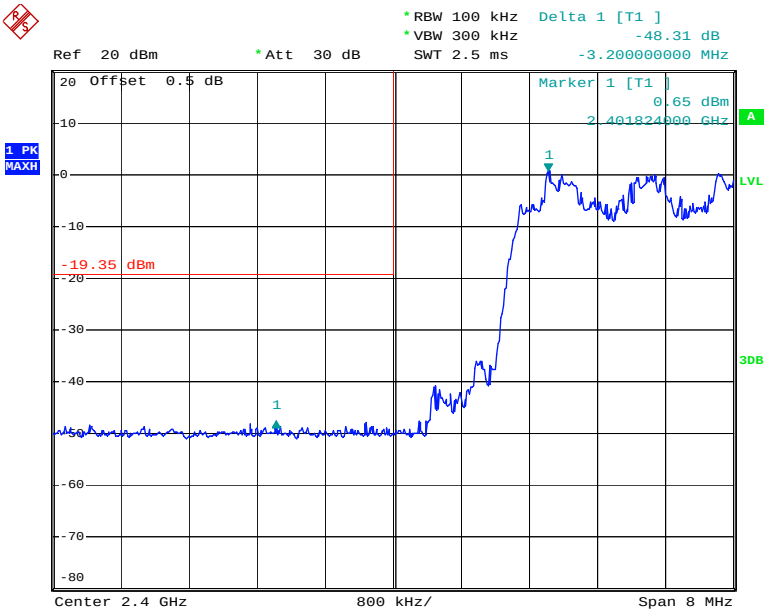
Band Edge, Right Side



Date: 18.DEC.2019 19:06:18

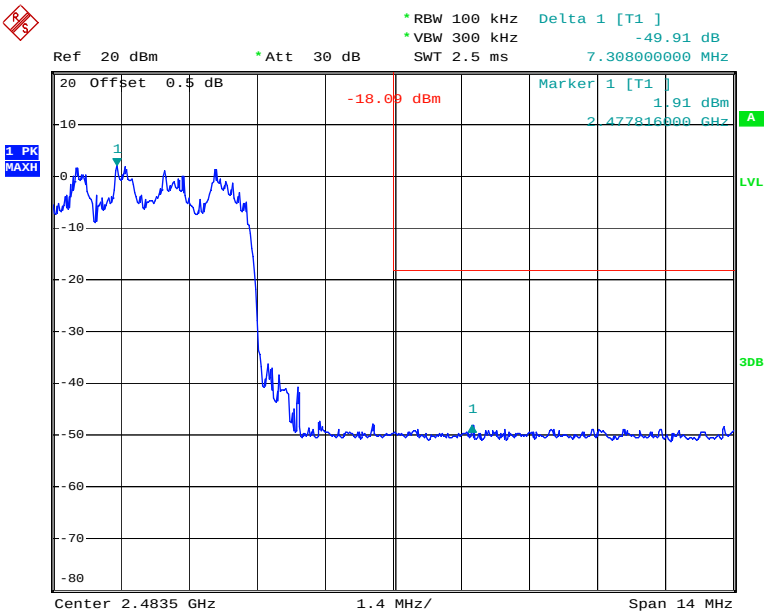
EDR Mode (8DPSK):

Band Edge, Left Side



Date: 18.DEC.2019 18:52:16

Band Edge, Right Side



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