



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.247

TEST REPORT

For

eMoMo Technology Co., Ltd

Fourth Floor, Yonghe Building, Taiwan Industrial P Shiyuan, Baoan, Shenzhen, Guangdong

FCC ID: A4E-E105

Report Type: Original Report	Product Name: TVaRound Transmitter
Report Number: RDG191018005-00A	
Report Date: 2019-10-29	
Reviewed By:	Gavin Xu RF Engineer
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

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
MEASUREMENT UNCERTAINTY	5
TEST FACILITY	5
DECLARATIONS	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	7
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	7
SUPPORT CABLE LIST AND DETAILS	7
BLOCK DIAGRAM OF TEST SETUP	8
SUMMARY OF TEST RESULTS.....	9
FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	10
APPLICABLE STANDARD	10
FCC §15.203 - ANTENNA REQUIREMENT.....	11
APPLICABLE STANDARD	11
ANTENNA CONNECTOR CONSTRUCTION	11
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	12
APPLICABLE STANDARD	12
EUT SETUP	12
EMI TEST RECEIVER SETUP.....	12
TEST PROCEDURE	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	13
TEST EQUIPMENT LIST AND DETAILS.....	13
TEST DATA	13
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	16
APPLICABLE STANDARD	16
EUT SETUP	16
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	17
TEST PROCEDURE	17
TEST EQUIPMENT LIST AND DETAILS.....	17
CORRECTED AMPLITUDE & MARGIN CALCULATION	18
TEST DATA	18
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST	24
APPLICABLE STANDARD	24
TEST EQUIPMENT LIST AND DETAILS.....	24
TEST PROCEDURE	24
TEST DATA	24
FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING.....	30
APPLICABLE STANDARD	30
TEST PROCEDURE	30

TEST EQUIPMENT LIST AND DETAILS.....	30
TEST DATA	30
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST	36
APPLICABLE STANDARD	36
TEST PROCEDURE	36
TEST EQUIPMENT LIST AND DETAILS.....	36
TEST DATA	36
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....	39
APPLICABLE STANDARD	39
TEST PROCEDURE	39
TEST EQUIPMENT LIST AND DETAILS.....	39
TEST DATA	39
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT	45
APPLICABLE STANDARD	45
TEST PROCEDURE	45
TEST EQUIPMENT LIST AND DETAILS.....	45
TEST DATA	45
FCC §15.247(d) - BAND EDGES TESTING	47
APPLICABLE STANDARD	47
TEST PROCEDURE	47
TEST EQUIPMENT LIST AND DETAILS.....	47
TEST DATA	48

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	TVaRound Transmitter
EUT Model:	E105
Multiple Models:	E105A,E105B,E105C
Operation Frequency:	2402MHz-2480MHz
Modulation Type:	GFSK; $\pi/4$ DQPSK; 8DPSK
Rated Input Voltage:	3.7V DC from battery or 5V DC from USB port
External Dimension:	62mm(L)*62mm(W)*15mm(H)
Serial Number:	191018005
EUT Received Date:	2019.10.18
EUT Received Status:	Good

Note: This series products model: E105 and E105A,E105B,E105C are electrically identical. Model E105 was selected for fully testing and the detailed information can be referred to the declaration.

Objective

This report is prepared on behalf of **eMoMo Technology Co., Ltd** 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, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s)

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 °C
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 an asterisk '*'. 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.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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.

Test mode:

M1: RX & AUX (EUT link to smart phone by bluetooth, link to sound by AUX cable)

M2: RX & SPDIF (EUT link to smart phone by bluetooth, link to sound by fiber optical)

M3: TX & AUX (EUT link to smart phone by AUX cable, link to sound by bluetooth)

M4: TX & SPDIF (EUT link to DVD player by fiber optical, link to sound by bluetooth)

EUT Exercise Software

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

Mode	Packet type	Channel	Frequency (MHz)	Packet length	Power Level
GFSK	DH1	Low	2402	27	50
		Middle	2441	27	50
		High	2480	27	50
	DH3	Low	2402	183	50
		Middle	2441	183	50
		High	2480	183	50
	DH5	Low	2402	339	50
		Middle	2441	339	50
		High	2480	339	50
$\pi/4$ DQPSK	2DH1	Low	2402	54	50
		Middle	2441	54	50
		High	2480	54	50
	2DH3	Low	2402	367	50
		Middle	2441	367	50
		High	2480	367	50
	2DH5	Low	2402	679	50
		Middle	2441	679	50
		High	2480	679	50
8DPSK	3DH1	Low	2402	83	50
		Middle	2441	83	50
		High	2480	83	50
	3DH3	Low	2402	552	50
		Middle	2441	552	50
		High	2480	552	50
	3DH5	Low	2402	1021	50
		Middle	2441	1021	50
		High	2480	1021	50

Equipment Modifications

No modification was made to the EUT.

Local Support Equipment List and Details

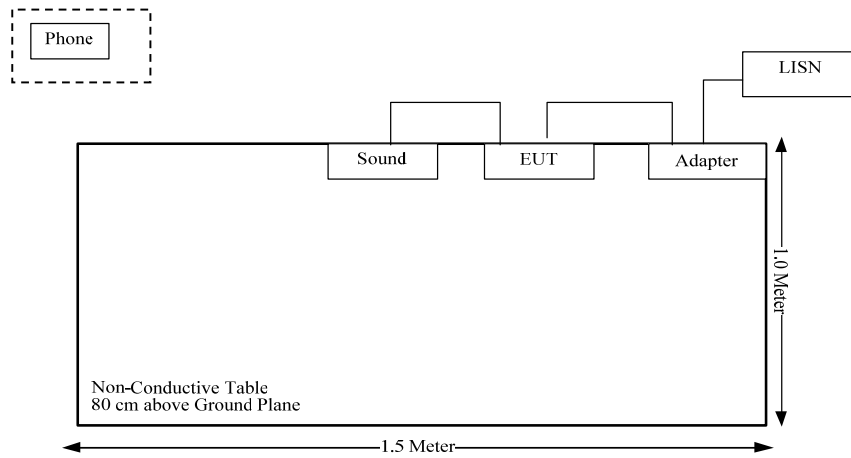
Manufacturer	Description	Model	Serial Number
EDIFIER	SOUND	R1024	/
OPPO	Smartphone	A59s	20117011606122400
Switching Power Supply	Adapter	HB05M-0501501SPA	7376088

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB cable	yes	No	0.8	Adapter	EUT
AUX cable	no	no	1.5	EUT	Sound

Block Diagram of Test Setup

M1:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247(i) & §1.1310 & §2.1091	Maximum permissible exposure (MPE)	Compliance
FCC §15.203	Antenna requirement	Compliance
FCC §15.207(a)	AC line conducted emissions	Compliance
FCC §15.205, §15.209, §15.247(d)	Spurious emissions	Compliance
FCC §15.247(a)(1)	Channel separation	Compliance
FCC §15.247(a)(1)	20 dB bandwidth	Compliance
FCC §15.247(a)(1)(iii)	Quantity of hopping channel test	Compliance
FCC §15.247(a)(1)(iii)	Time of occupancy (dwell time)	Compliance
FCC §15.247(b)(1)	Peak output power measurement	Compliance
FCC §15.247(d)	Band edges	Compliance

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/cm²);

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);

Calculated Data:

Mode	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)			
Bluetooth	2402-2480	0	1	3.0	2.00	20.00	0.0004	1.0

Result: The device meet FCC MPE at 20 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
PCB	50	0 dBi/2.4~2.5GHz

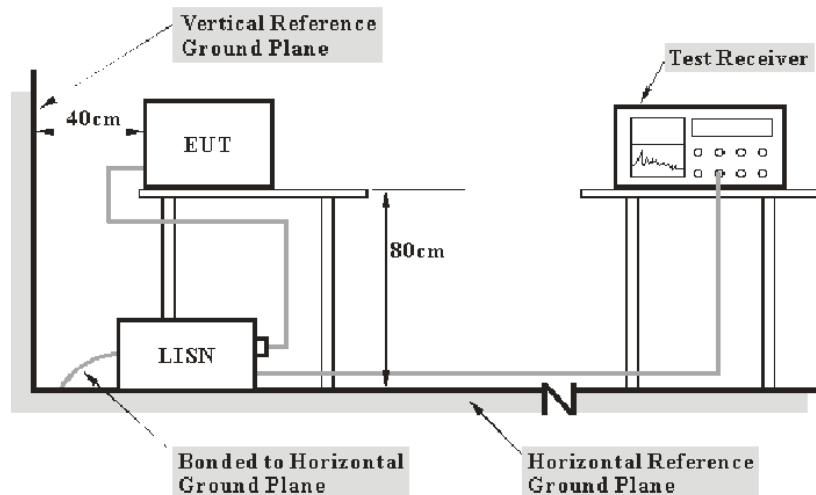
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

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

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

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

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first 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.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF : voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within 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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2019-09-05	2020-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2018-12-10	2019-12-10
R&S	EMI Test Receiver	ESPI	100120	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

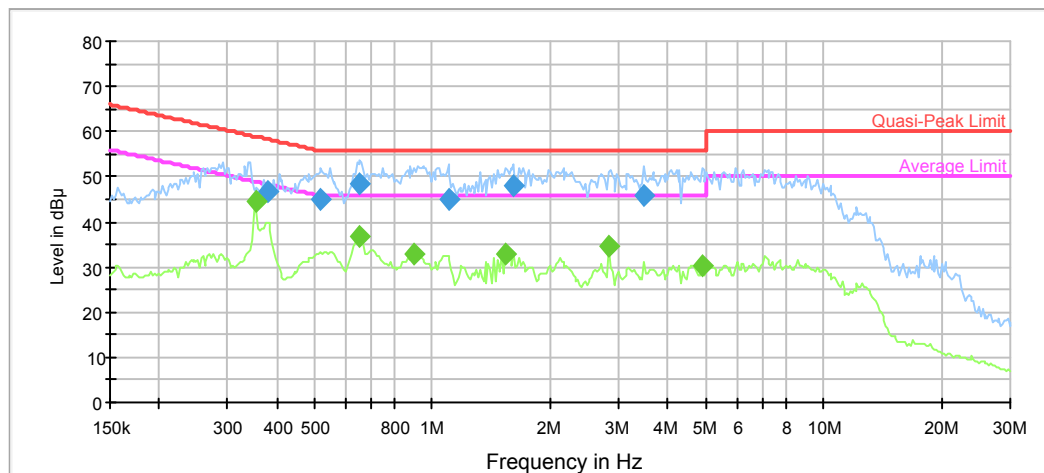
Temperature:	25.5°C
Relative Humidity:	61%
ATM Pressure:	100.7kPa
Tester:	Sem xiang
Test Date:	2019-10-22

Test Result: Compliance

Pre-scan all test modes, the worst case is M1.

Test Mode: M1

AC120V, 60 Hz, Line:

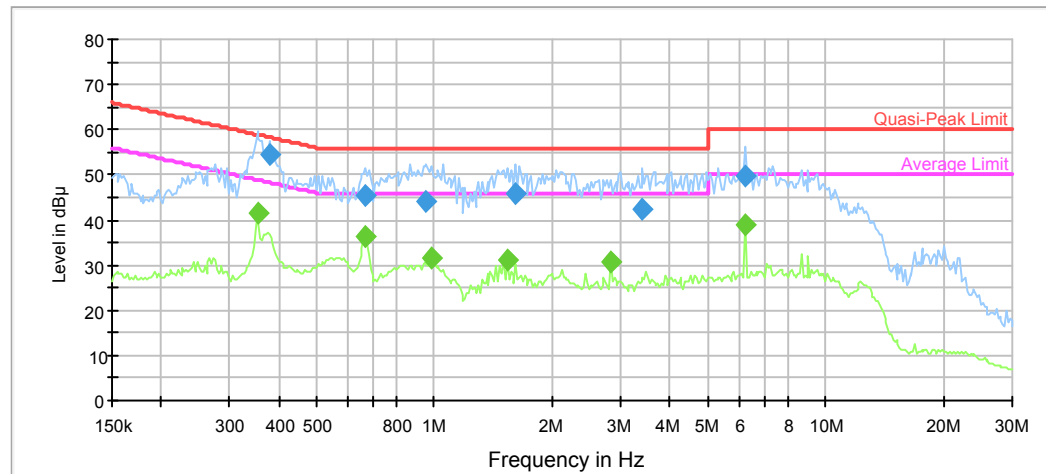


Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.378425	46.7	9.000	L1	10.0	10.6	58.3
0.520311	44.9	9.000	L1	9.9	11.1	56.0
0.654116	48.2	9.000	L1	9.8	7.8	56.0
1.097403	44.9	9.000	L1	9.8	11.1	56.0
1.617707	47.9	9.000	L1	9.7	8.1	56.0
3.480532	46.0	9.000	L1	9.8	10.0	56.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.352963	44.5	9.000	L1	10.0	4.4	48.9
0.654116	36.7	9.000	L1	9.8	9.3	46.0
0.899371	32.7	9.000	L1	9.8	13.3	46.0
1.539193	33.0	9.000	L1	9.7	13.0	46.0
2.824209	34.5	9.000	L1	9.8	11.5	46.0
4.881714	30.2	9.000	L1	9.8	15.8	46.0

AC120V, 60 Hz, Neutral:**Final Result 1**

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.378425	54.7	9.000	N	10.0	3.6	58.3
0.667264	45.2	9.000	N	9.8	10.8	56.0
0.954700	44.3	9.000	N	9.8	11.7	56.0
1.617707	45.9	9.000	N	9.8	10.1	56.0
3.411952	42.4	9.000	N	9.8	13.6	56.0
6.260467	49.8	9.000	N	9.8	10.2	60.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.352963	41.7	9.000	N	10.0	7.2	48.9
0.667264	36.2	9.000	N	9.8	9.8	46.0
0.983629	31.6	9.000	N	9.8	14.4	46.0
1.539193	31.3	9.000	N	9.8	14.7	46.0
2.824209	30.6	9.000	N	9.8	15.4	46.0
6.260467	38.8	9.000	N	9.8	11.2	50.0

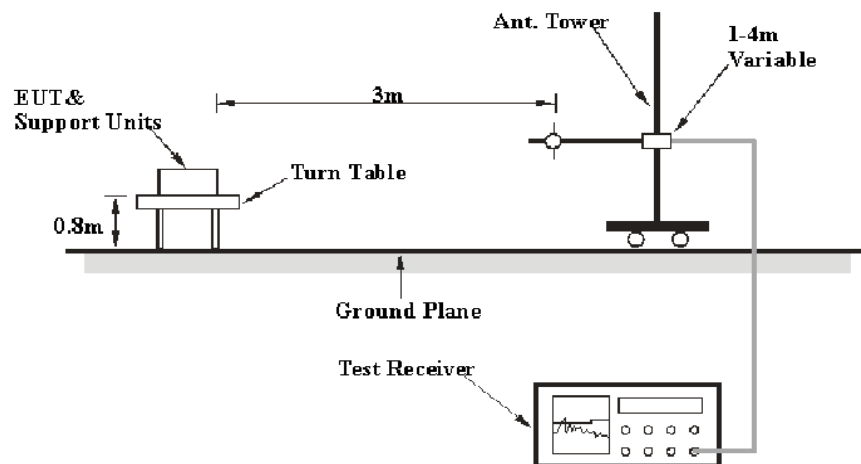
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

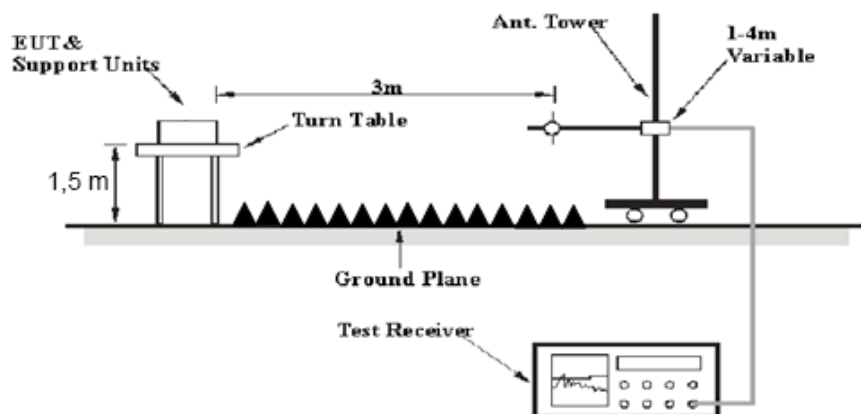
FCC §15.247 (d); §15.209; §15.205;

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-06-26	2020-06-26
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-0075-01	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
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	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).

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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data

Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	27°C	26.5°C
Relative Humidity:	49%	47%
ATM Pressure:	100.7kPa	100.2kPa
Tester:	Neil Liao	Neil Liao
Test Date:	2019-10-22	2019-10-23

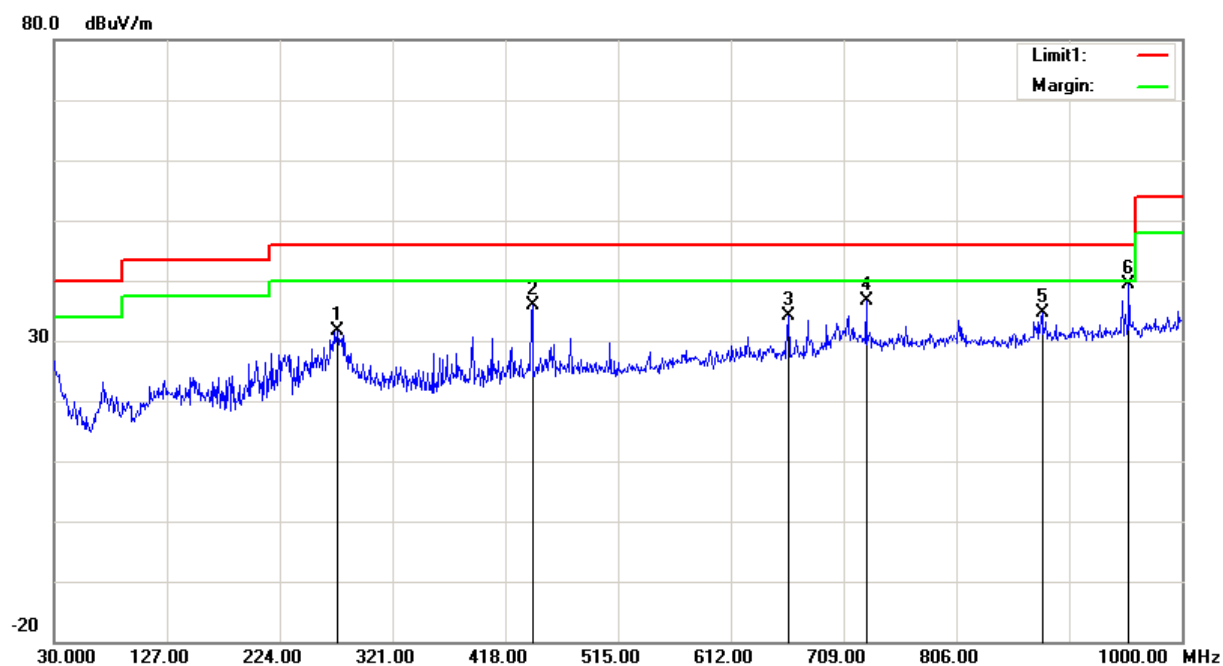
Test Mode: M1

Pre-scan all test modes, the worst case is M1.

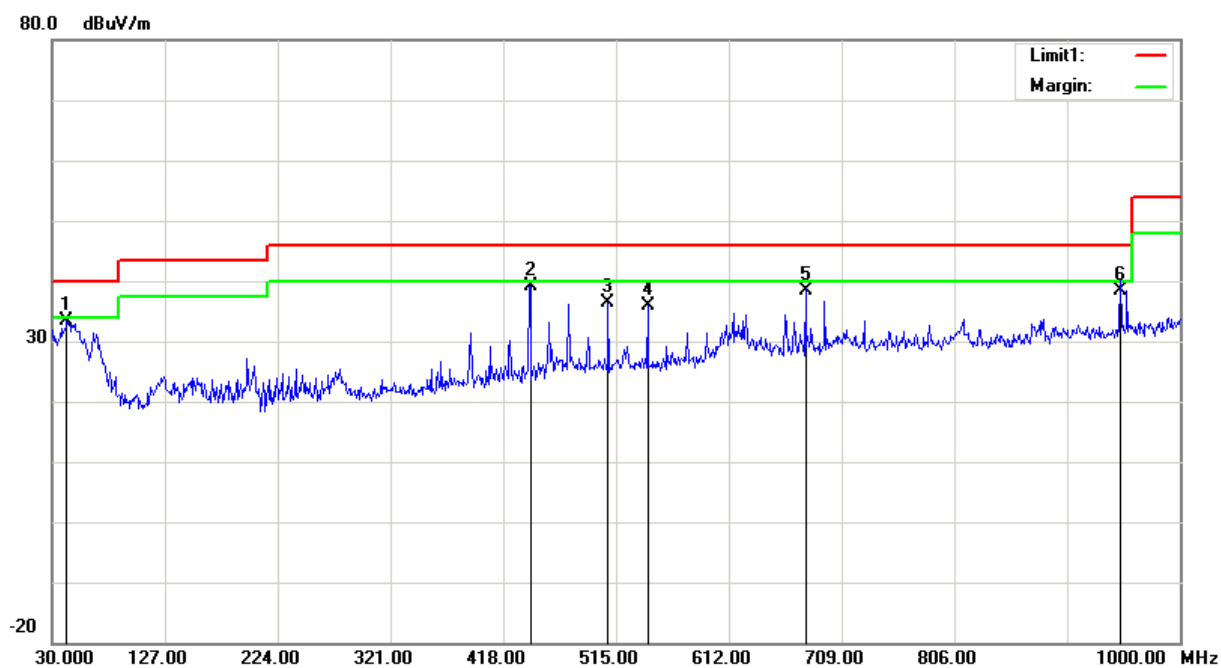
Test mode: M1

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

Horizontal:



Frequency (MHz)	Receiver Reading (dBμV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
273.4700	35.80	peak	-4.12	31.68	46.00	14.32
441.2800	37.17	peak	-1.20	35.97	46.00	10.03
661.4700	31.99	peak	2.18	34.17	46.00	11.83
728.4000	33.32	peak	3.26	36.58	46.00	9.42
879.7200	35.03	peak	-0.47	34.56	46.00	11.44
954.4100	38.44	peak	0.82	39.26	46.00	6.74

Vertical:

Frequency (MHz)	Receiver Reading (dB μ V)	Remark	Correction Factor (dB/m)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
42.6100	41.16	peak	-7.66	33.50	40.00	6.50
441.2800	40.29	peak	-1.20	39.09	46.00	6.91
508.2100	36.55	peak	-0.27	36.28	46.00	9.72
542.1600	35.57	peak	0.31	35.88	46.00	10.12
677.9600	35.91	peak	2.59	38.50	46.00	7.50
948.5900	37.63	QP	0.85	38.48	46.00	7.52

2)1GHz-25GHz:

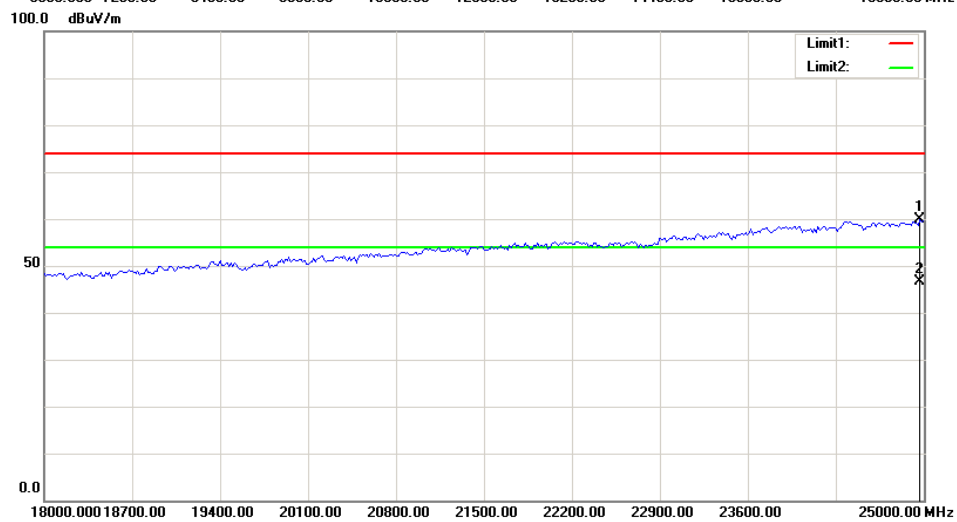
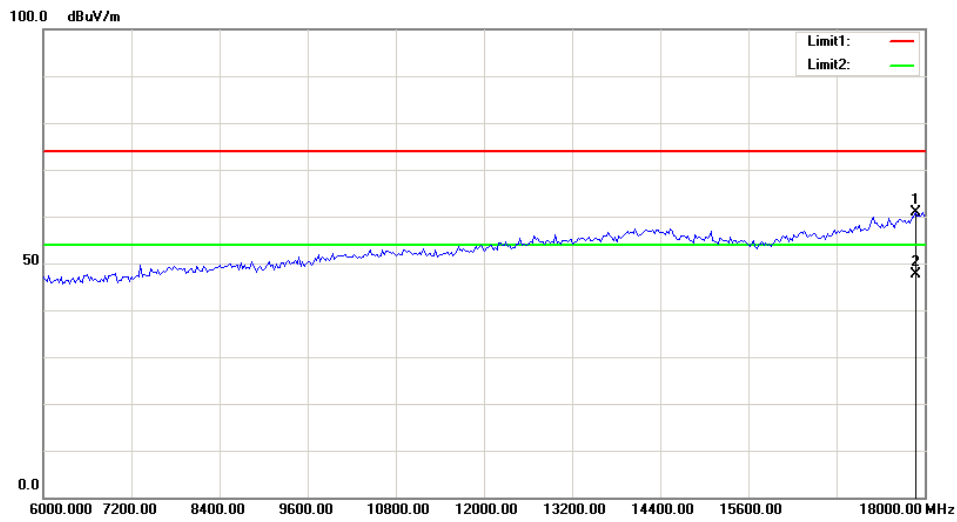
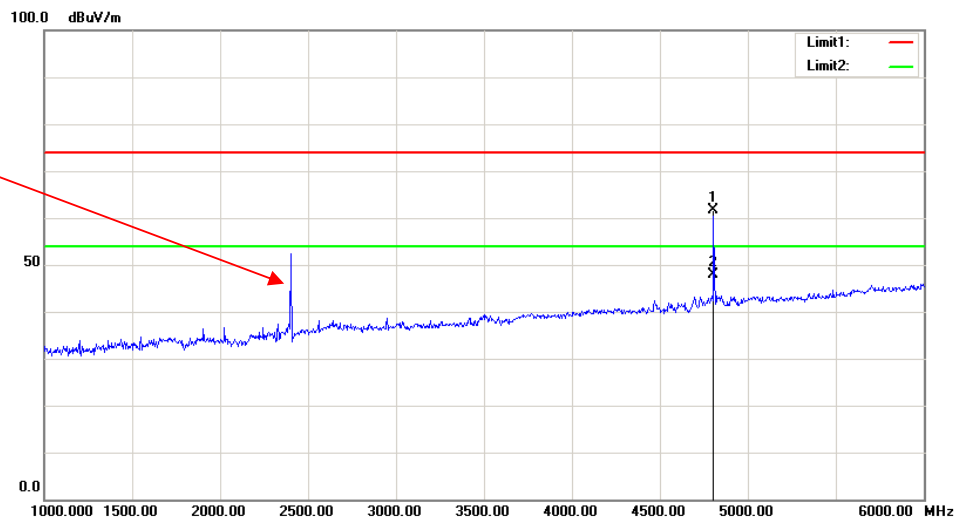
Pre-scan all modes, the worst case as below.

BDR(GFSK) mode

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									
2390.00	24.85	PK	H	24.80	3.33	0.00	52.98	74.00	21.02
2390.00	10.98	AV	H	24.80	3.33	0.00	39.11	54.00	14.89
4804.00	54.69	PK	H	29.71	4.58	27.36	61.62	74.00	12.38
4804.00	41.03	AV	H	29.71	4.58	27.36	47.96	54.00	6.04
7206.00	38.54	PK	H	33.93	5.59	27.19	50.87	74.00	23.13
7206.00	26.99	AV	H	33.93	5.59	27.19	39.32	54.00	14.68
Middle Channel: 2441 MHz									
4882.00	53.25	PK	H	29.86	4.56	27.56	60.11	74.00	13.89
4882.00	40.56	AV	H	29.86	4.56	27.56	47.42	54.00	6.58
7323.00	39.74	PK	H	34.12	5.69	27.26	52.29	74.00	21.71
7323.00	27.33	AV	H	34.12	5.69	27.26	39.88	54.00	14.12
High Channel: 2480 MHz									
2483.50	37.48	PK	H	24.97	3.38	0.00	65.83	74.00	8.17
2483.50	17.23	AV	H	24.97	3.38	0.00	45.58	54.00	8.42
4960.00	52.86	PK	H	30.02	4.58	27.37	60.09	74.00	13.91
4960.00	39.99	AV	H	30.02	4.58	27.37	47.22	54.00	6.78
7440.00	39.68	PK	H	34.30	5.79	27.22	52.55	74.00	21.45
7440.00	27.26	AV	H	34.30	5.79	27.22	40.13	54.00	13.87

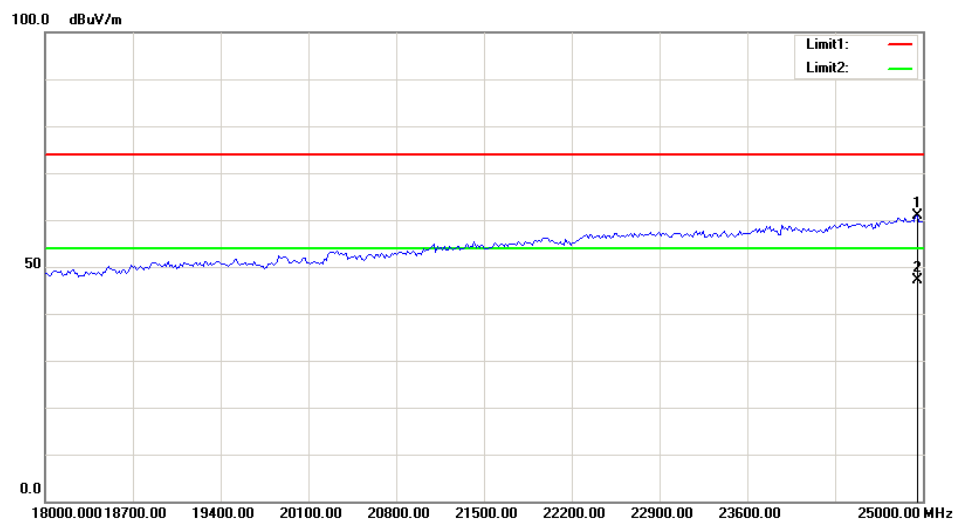
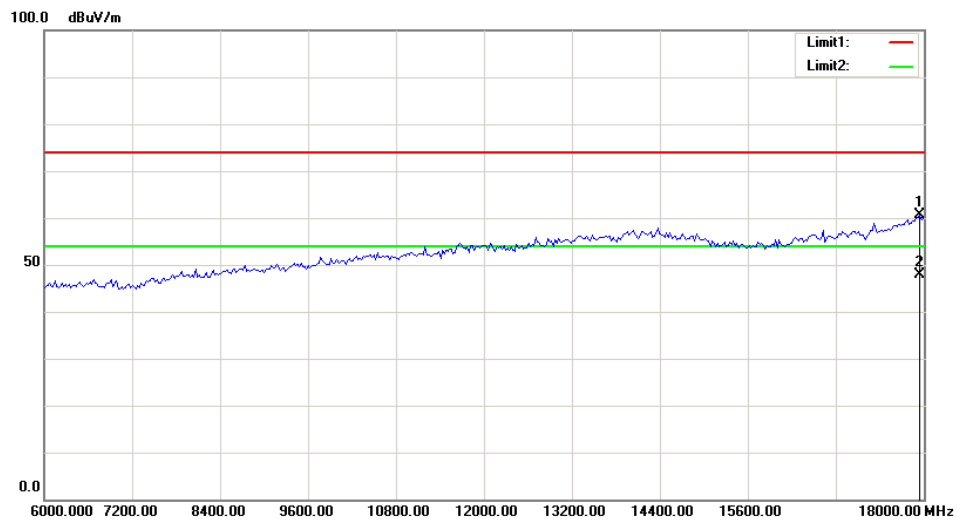
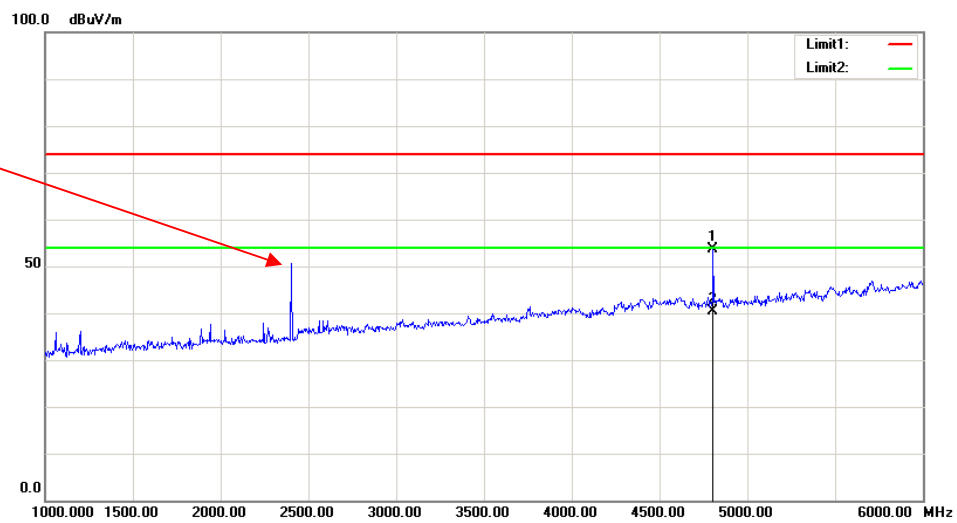
Worst plots (GFSK low channel was the worst)
Horizontal

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 hopping 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	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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:	28.2°C
Relative Humidity:	51%
ATM Pressure:	100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-25

Test Result: Compliance.

Please refer to following tables and plots

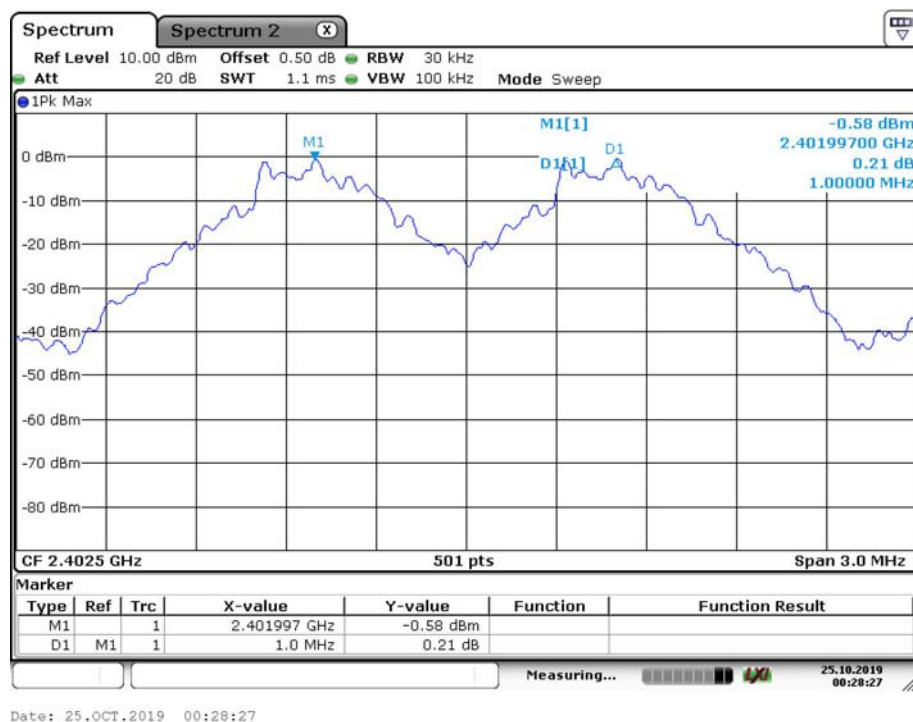
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402-2403	1.000	0.59
	Middle	2441-2442	1.000	0.58
	High	2480-2479	1.006	0.58
EDR ($\pi/4$ -DQPSK)	Low	2402-2403	1.000	0.82
	Middle	2441-2442	1.000	0.82
	High	2480-2479	1.000	0.84
EDR (8DPSK)	Low	2402-2403	1.006	0.81
	Middle	2441-2442	0.994	0.81
	High	2480-2479	1.000	0.81

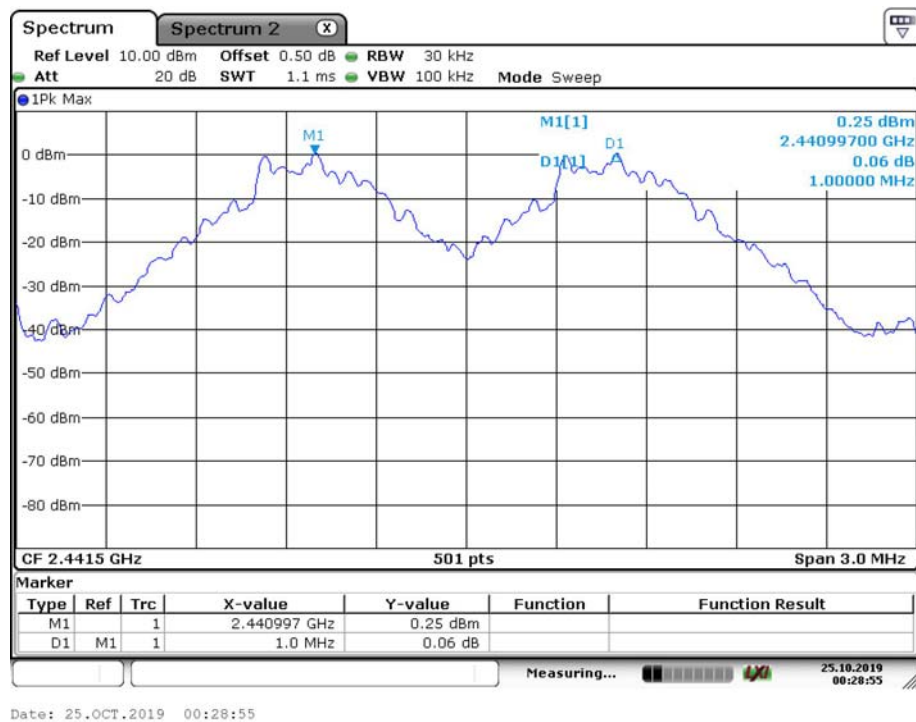
Note: Limit= $(2/3) \times 20\text{dB bandwidth}$

BDR Mode (GFSK):

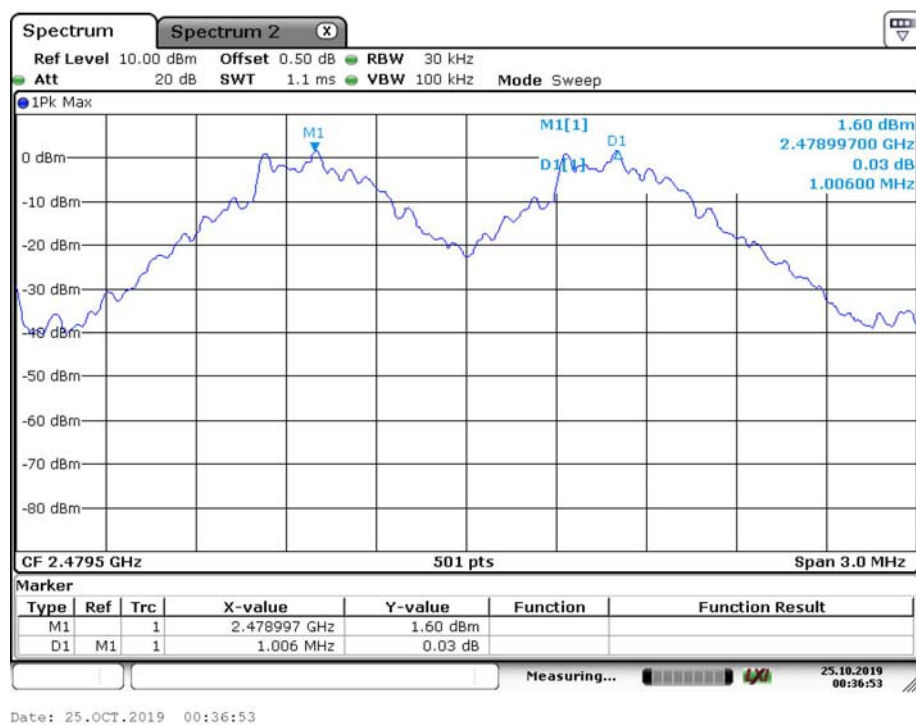
Low Channel

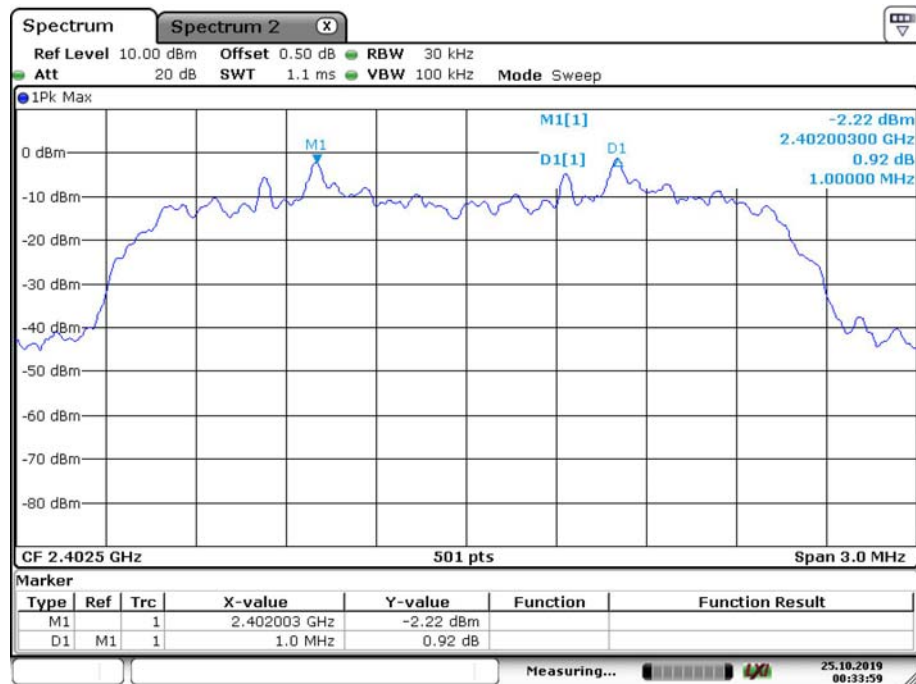


Middle Channel

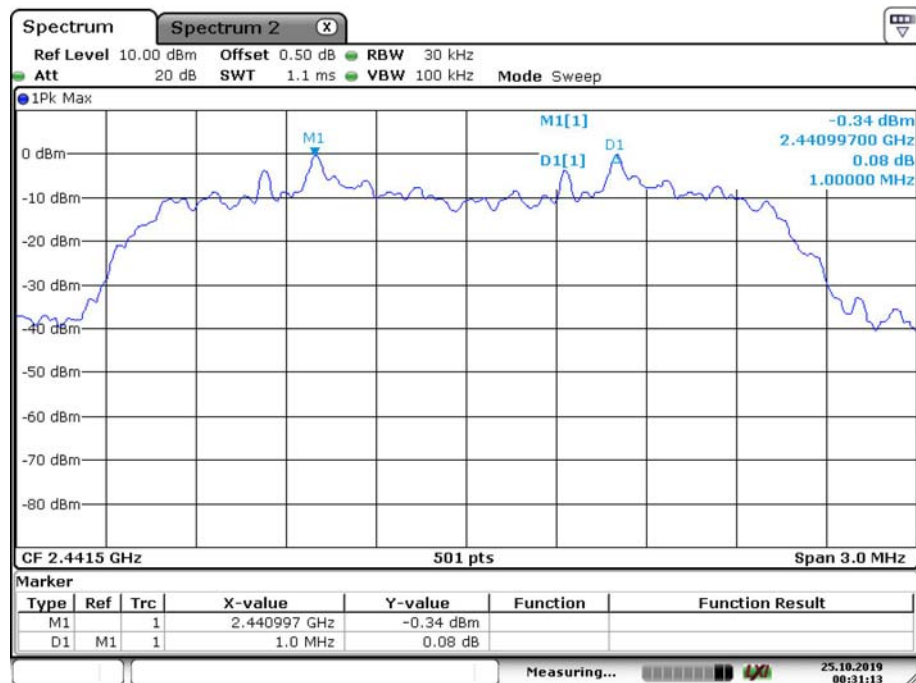


High Channel



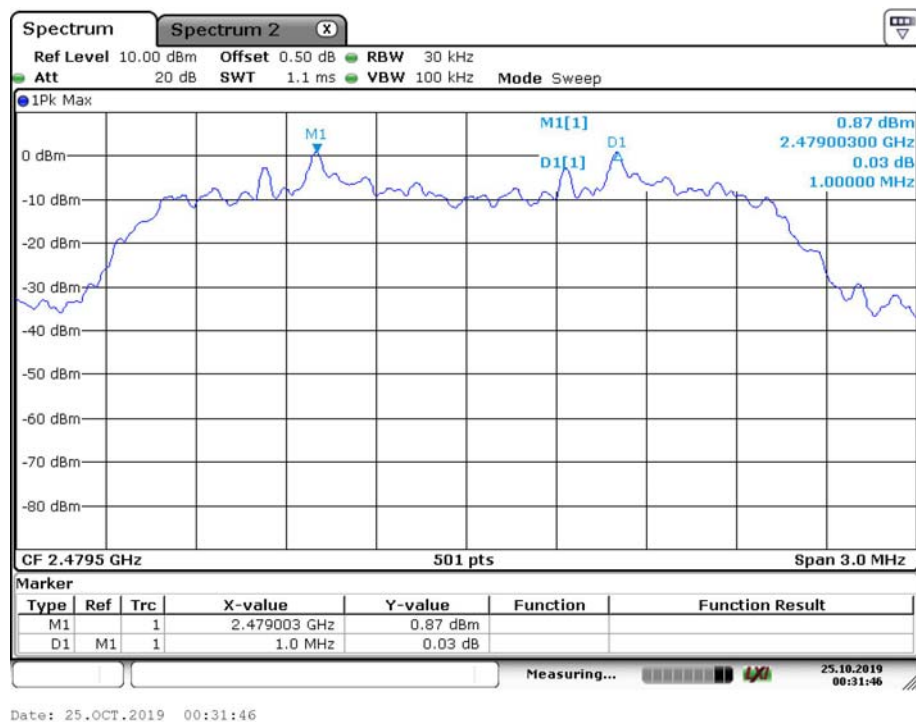
*EDR Mode ($\pi/4$ -DQPSK):***Low Channel**

Date: 25.OCT.2019 00:33:59

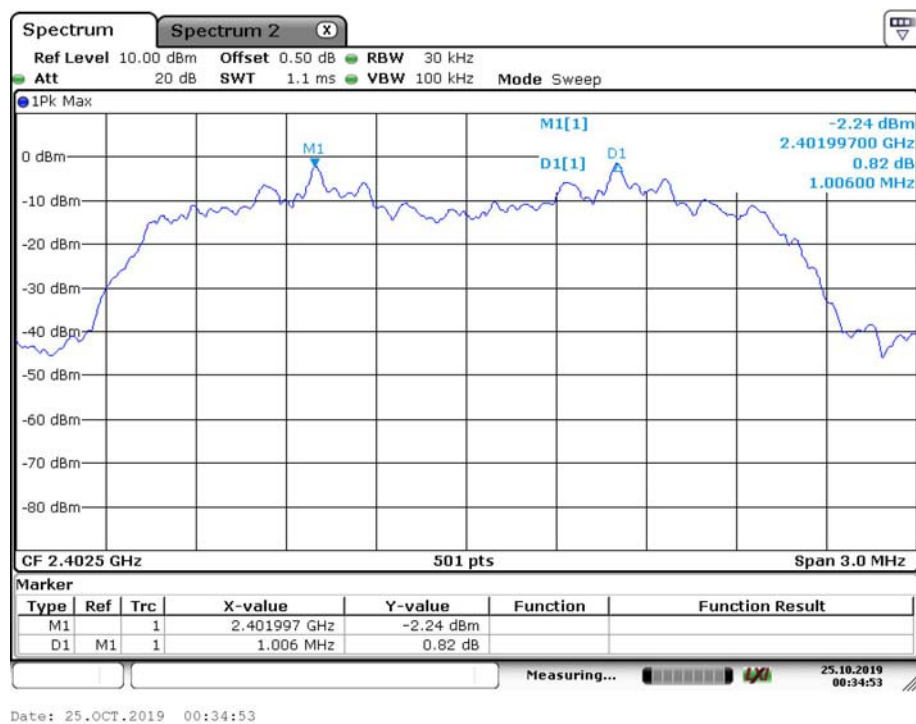
Middle Channel

Date: 25.OCT.2019 00:31:13

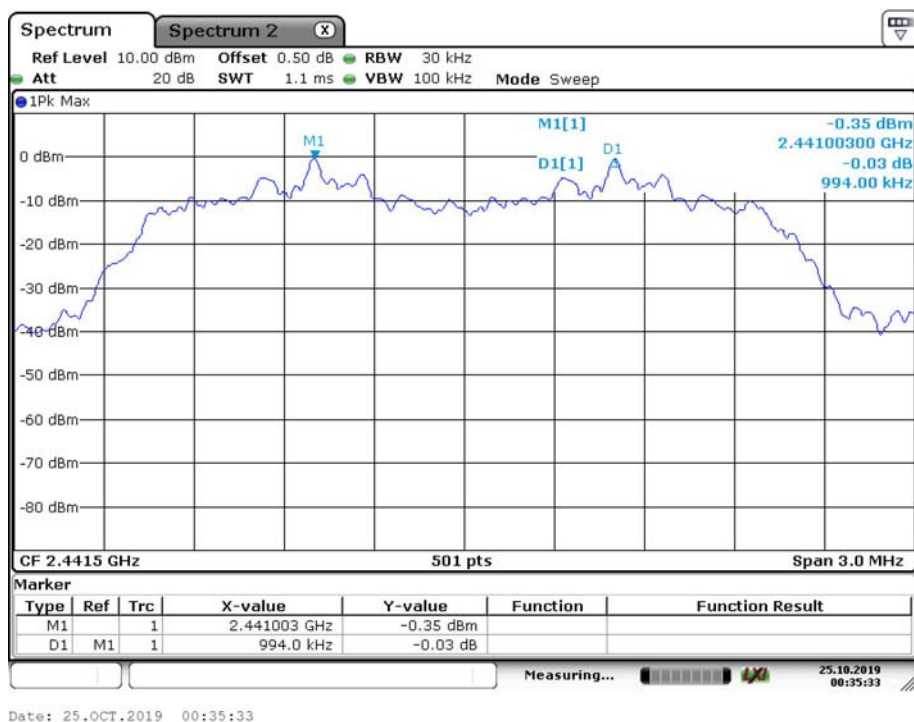
High Channel

*EDR Mode (8DPSK):*

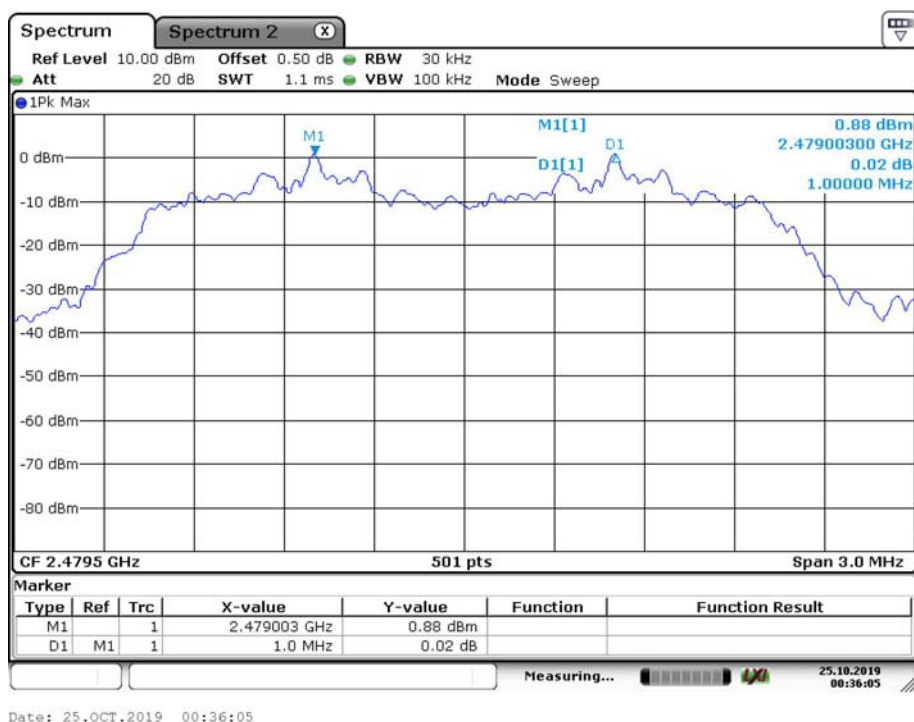
Low Channel



Middle Channel



High Channel



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	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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:	26.4~28.2°C
Relative Humidity:	51~55%
ATM Pressure:	100.5~100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-24~2019-10-25

Test Result: Compliance.

Please refer to following tables and plots

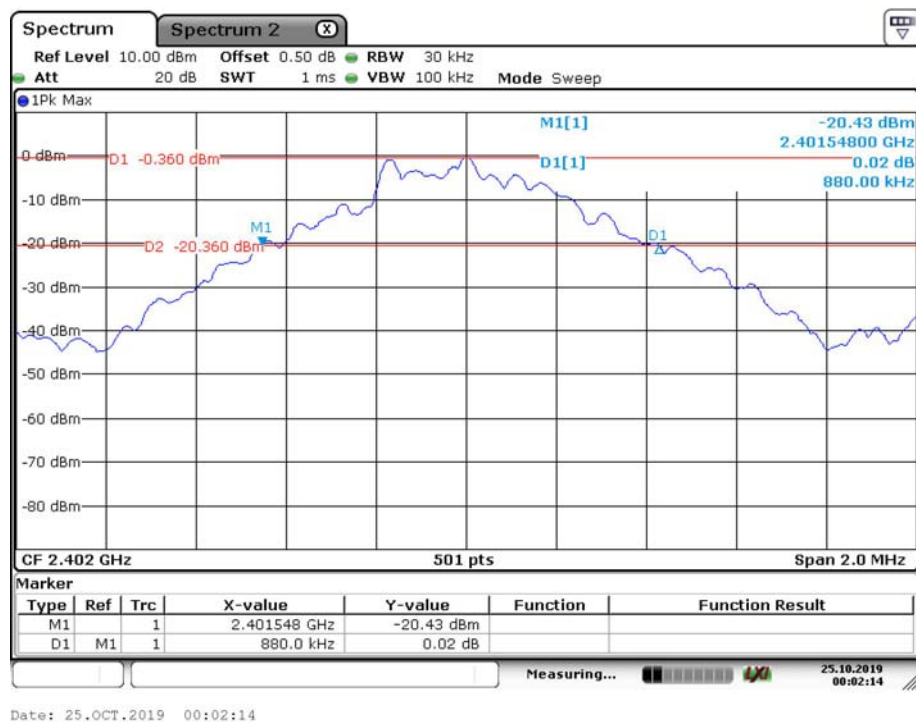
Test Mode: Transmitting

20 dB OBW

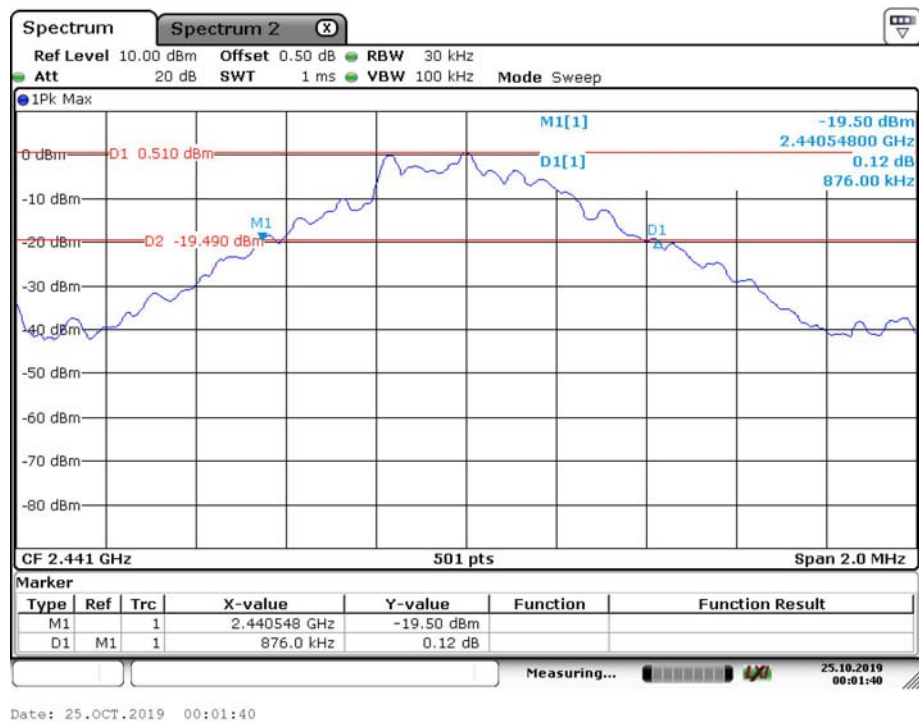
Mode	Channel	Frequency (MHz)	Result (MHz)
GFSK	Low	2402	0.880
	Middle	2441	0.876
	High	2480	0.876
$\pi/4$ DQPSK	Low	2402	1.224
	Middle	2441	1.224
	High	2480	1.256
8DPSK	Low	2402	1.212
	Middle	2441	1.216
	High	2480	1.216

BDR Mode (GFSK):

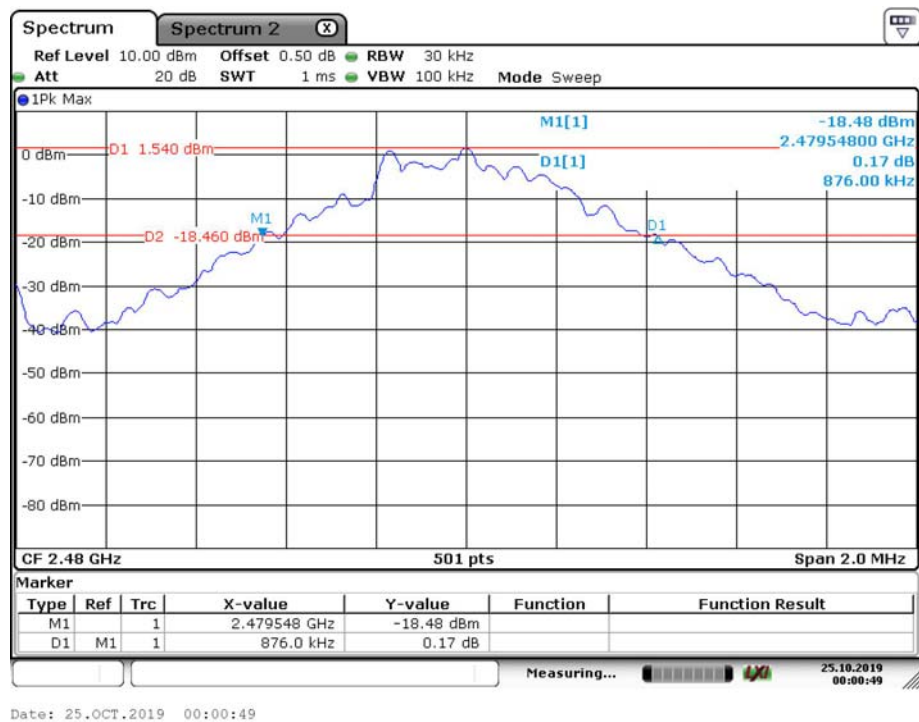
Low Channel

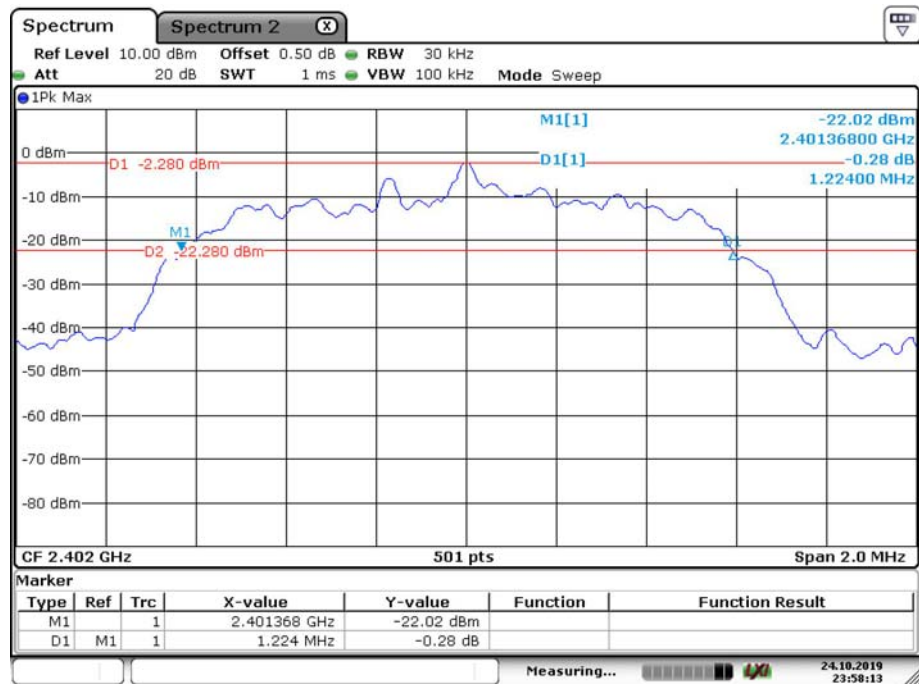


Middle Channel

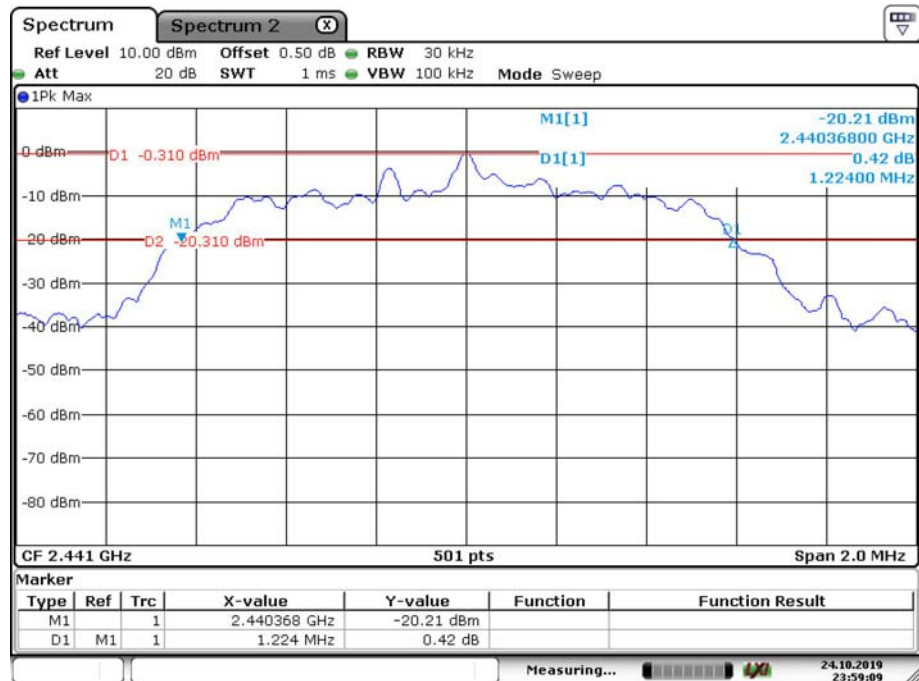


High Channel



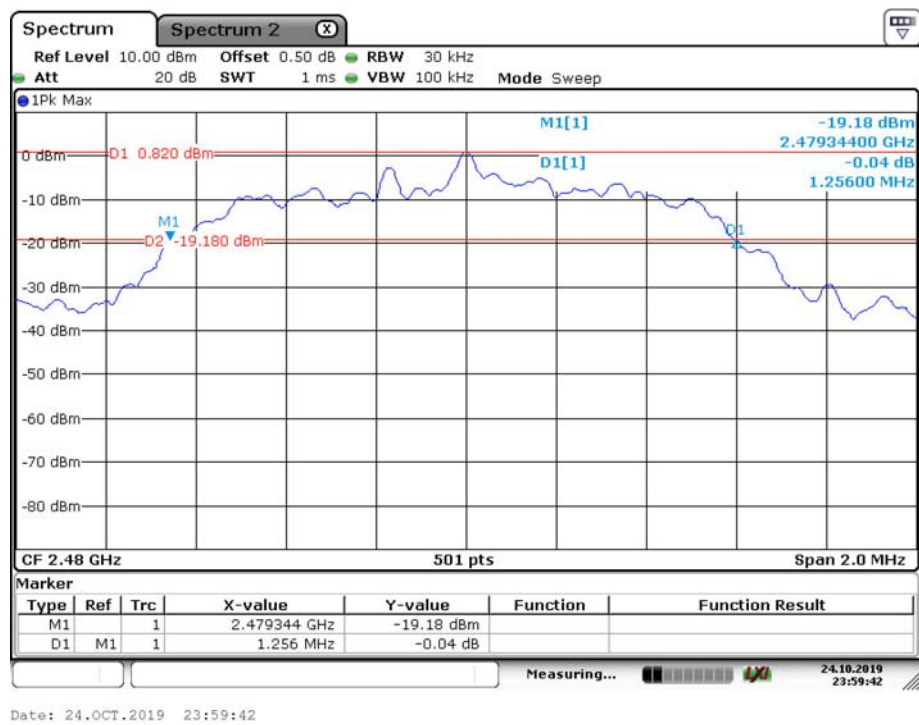
*EDR Mode ($\pi/4$ -DQPSK):***Low Channel**

Date: 24.OCT.2019 23:58:13

Middle Channel

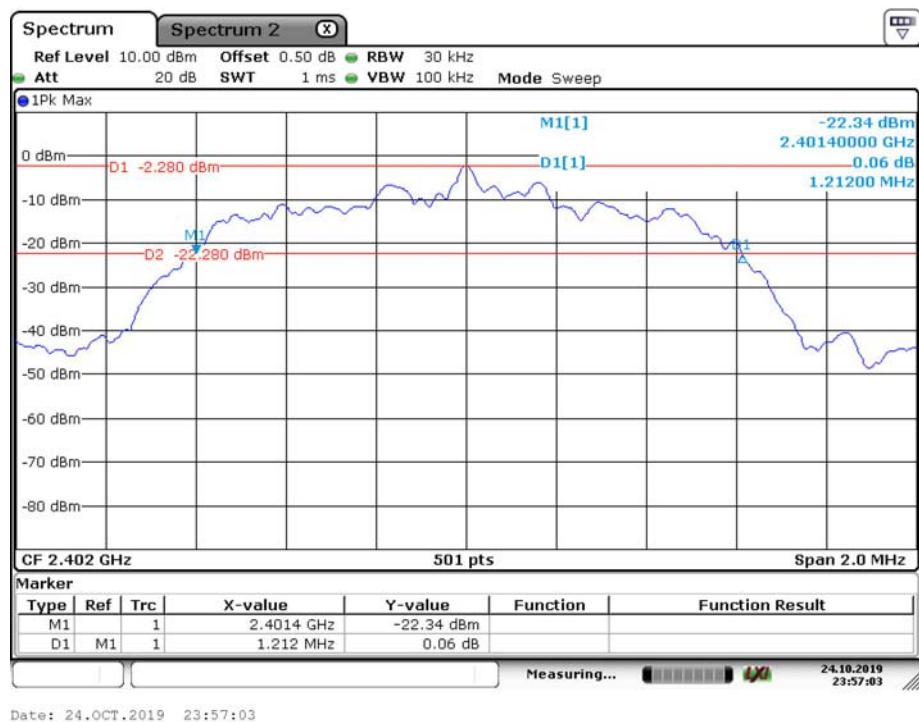
Date: 24.OCT.2019 23:59:09

High Channel

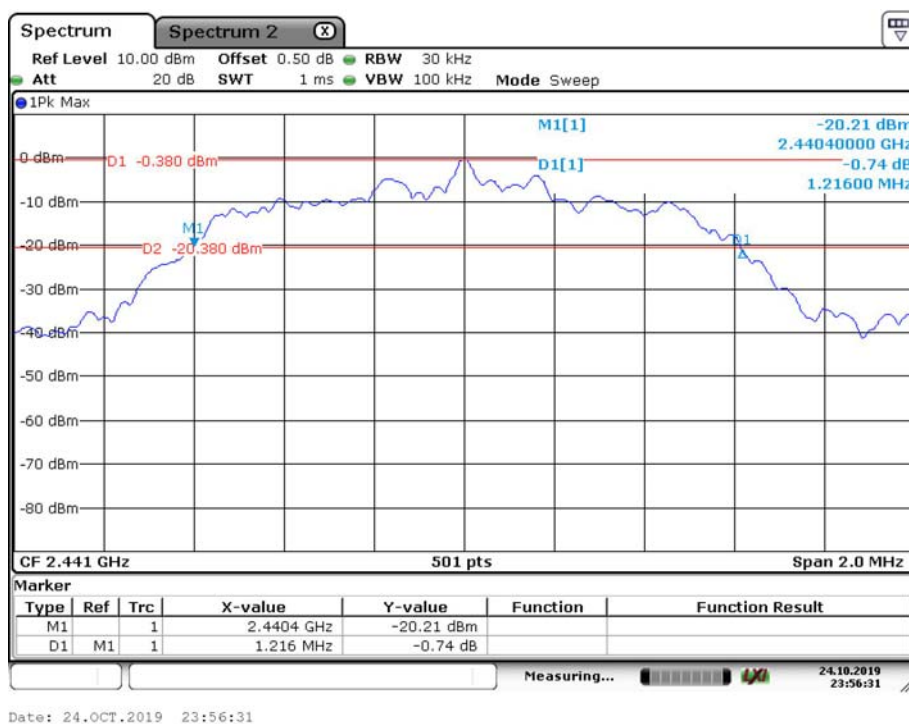


EDR Mode (8DPSK):

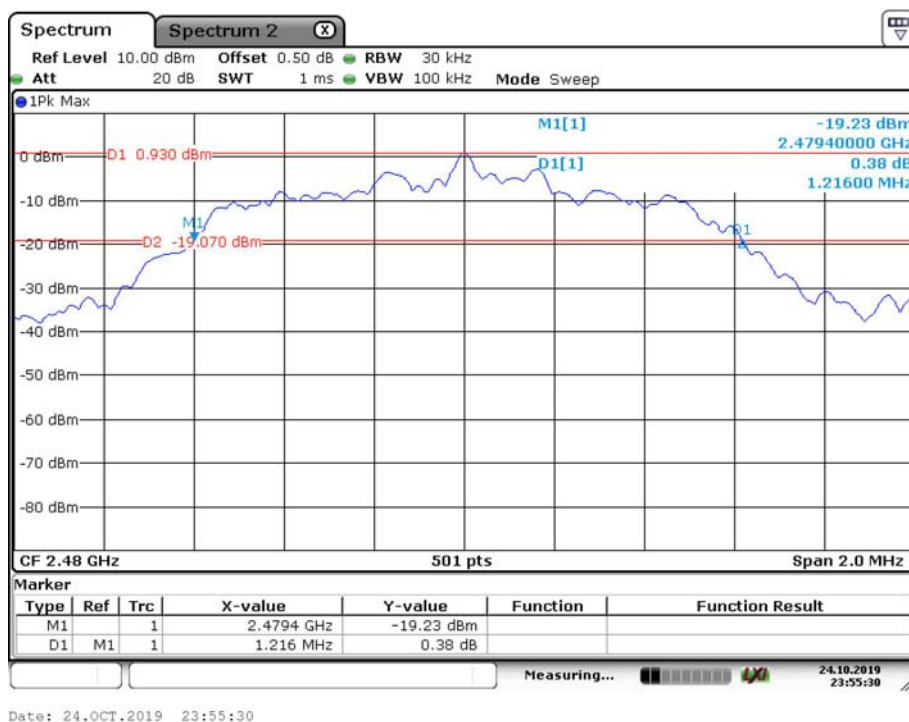
Low Channel



Middle Channel



High Channel



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

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

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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:	28.2°C
Relative Humidity:	51%
ATM Pressure:	100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-25

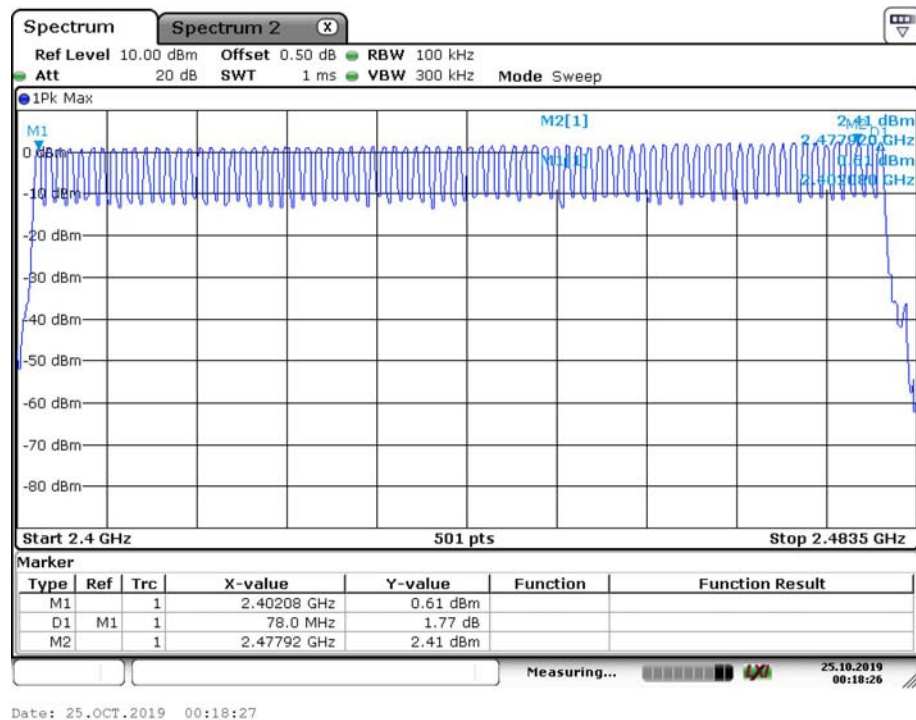
Test Result: Compliance.

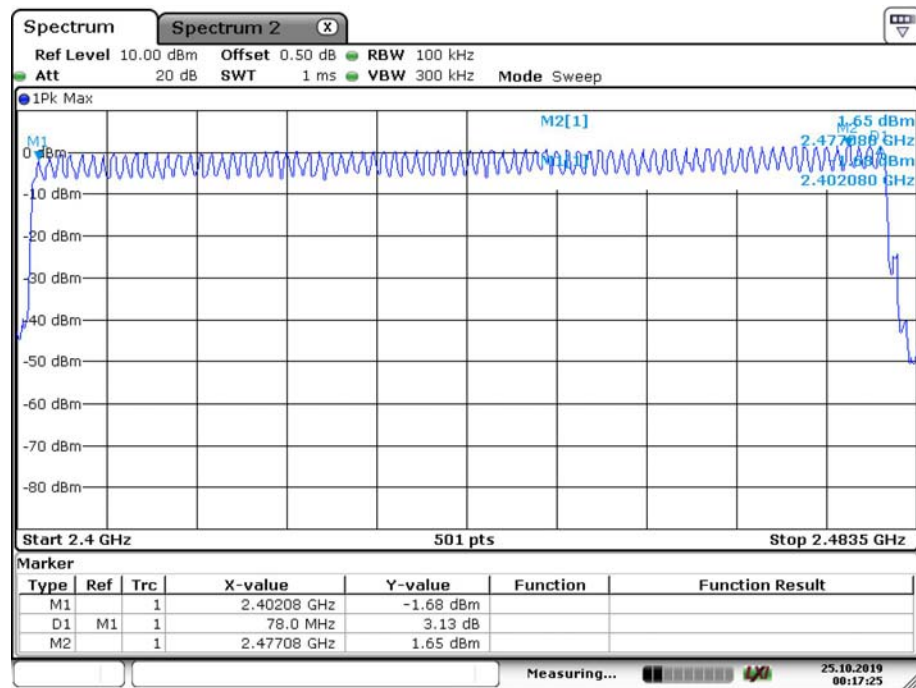
Please refer to following tables and plots

Test Mode: Transmitting

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

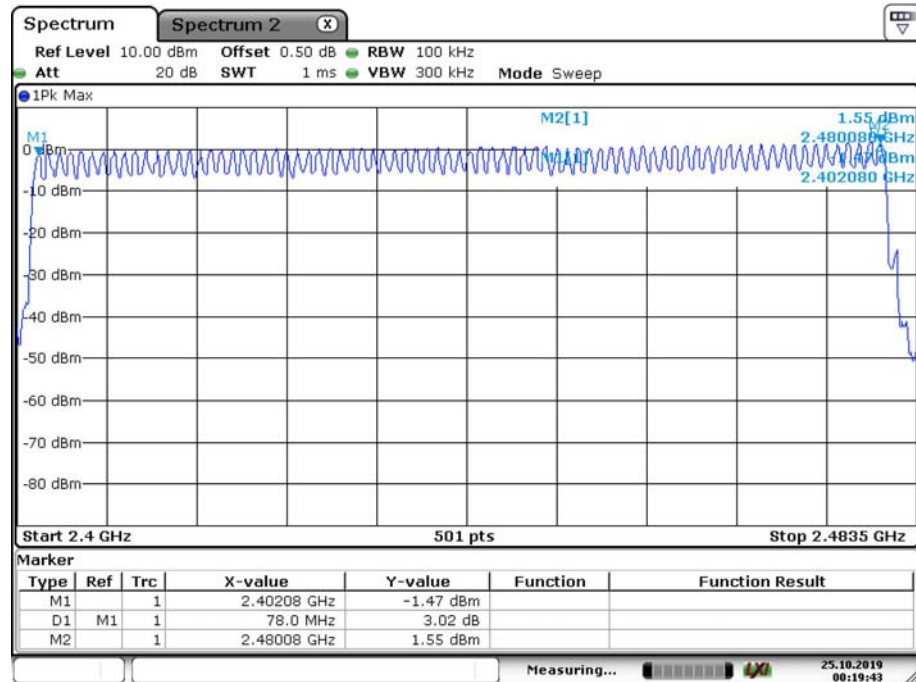
GFSK



$\pi/4$ -DQPSK

Date: 25.OCT.2019 00:17:25

8DPSK



Date: 25.OCT.2019 00:19:43

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	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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:	28.2°C
Relative Humidity:	51%
ATM Pressure:	100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-25

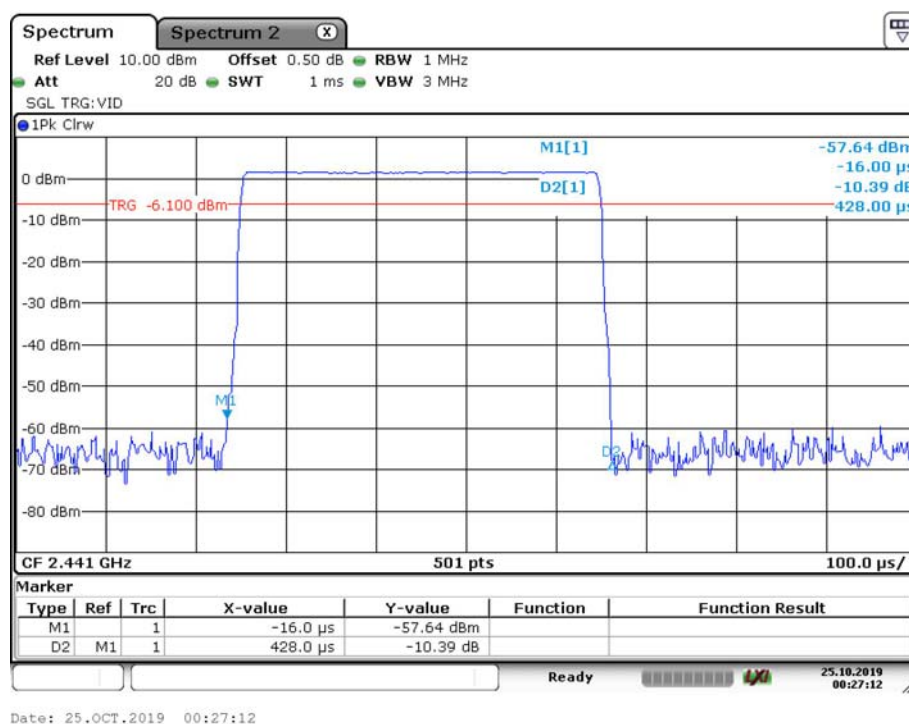
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

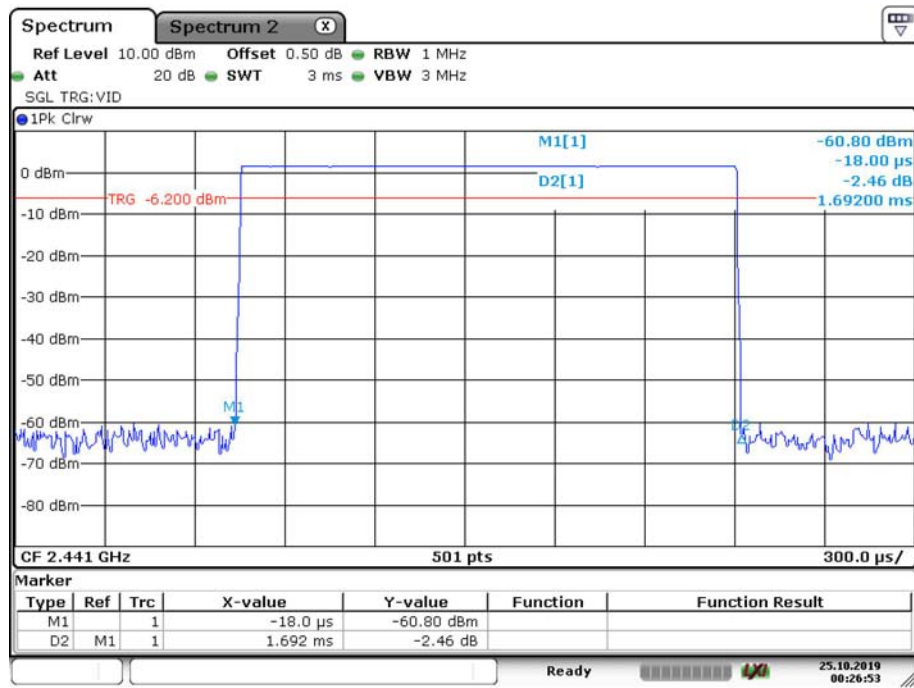
Mode	Packet type	Channel	Frequency (MHz)	Pulse width (ms)	Result (s)	Limit (s)
GFSK	DH1	Middle	2441	0.428	0.137	≤0.4
	DH3	Middle	2441	1.692	0.271	
	DH5	Middle	2441	2.950	0.315	
$\pi/4$ DQPSK	2DH1	Middle	2441	0.440	0.141	
	2DH3	Middle	2441	1.704	0.273	
	2DH5	Middle	2441	2.960	0.315	
8DPSK	3DH1	Middle	2441	0.440	0.141	
	3DH3	Middle	2441	1.698	0.272	
	3DH5	Middle	2441	2.960	0.316	

Note:
 DH1:Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s
 DH3:Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s
 DH5:Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s

*BDR Mode (GFSK):***DH1: Middle Channel**

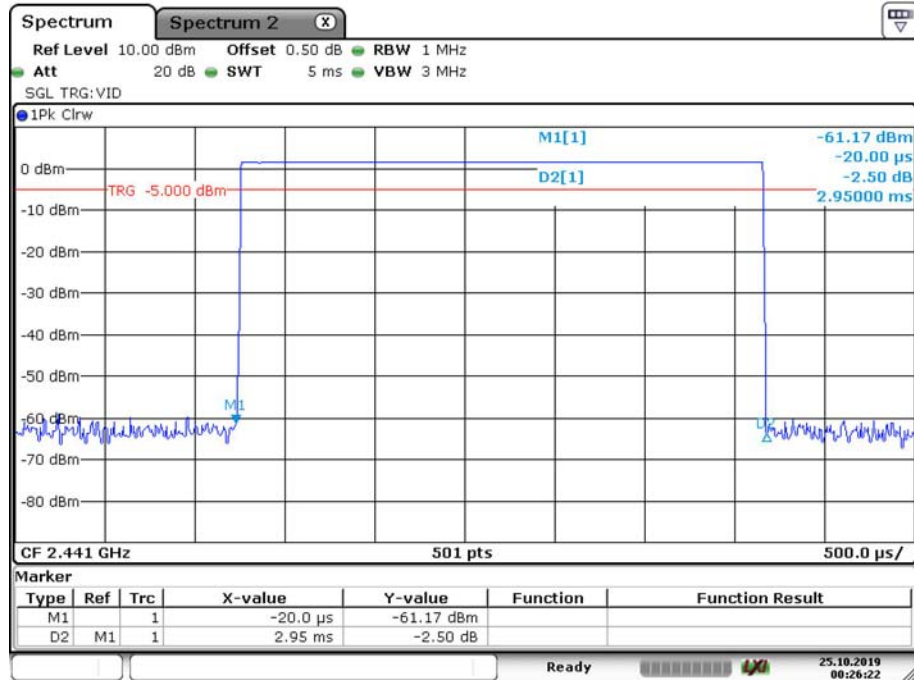
Date: 25.OCT.2019 00:27:12

DH3: Middle Channel



Date: 25.OCT.2019 00:26:53

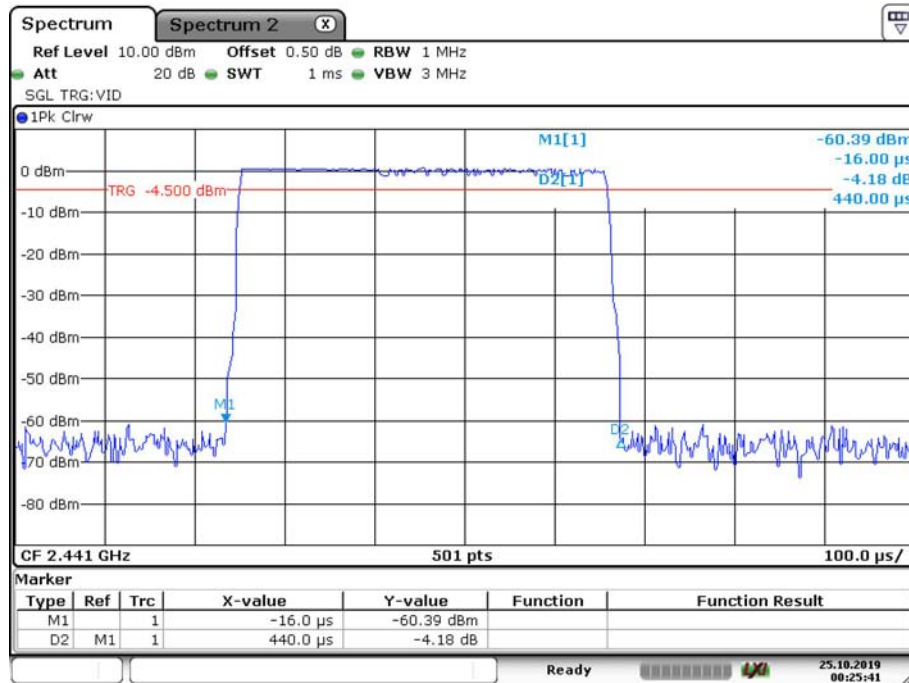
DH5: Middle Channel



Date: 25.OCT.2019 00:26:22

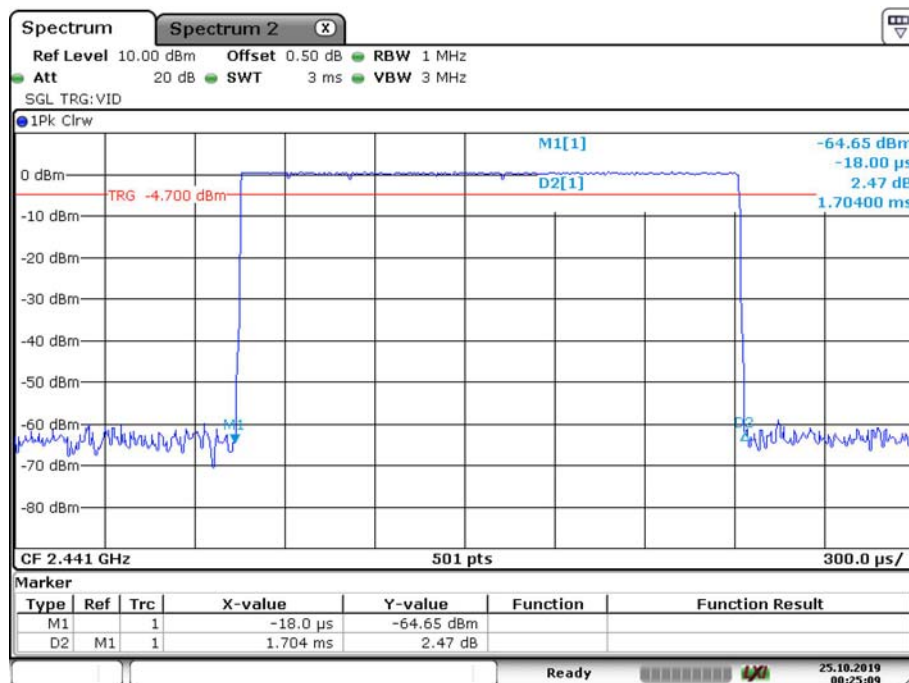
EDR Mode ($\pi/4$ -DQPSK):

2DH1: Middle Channel



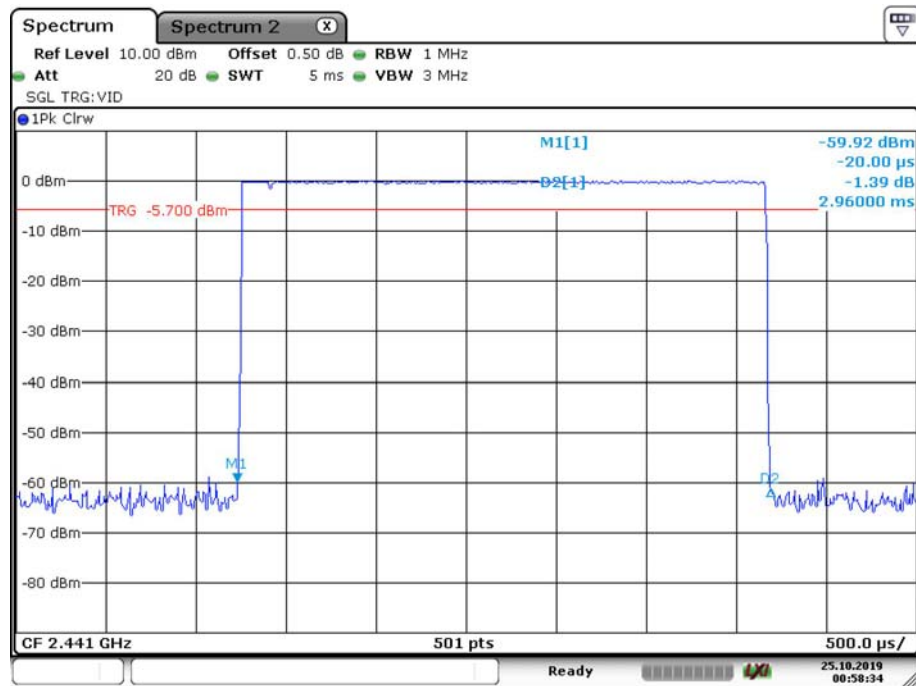
Date: 25.OCT.2019 00:25:42

2DH3: Middle Channel



Date: 25.OCT.2019 00:25:09

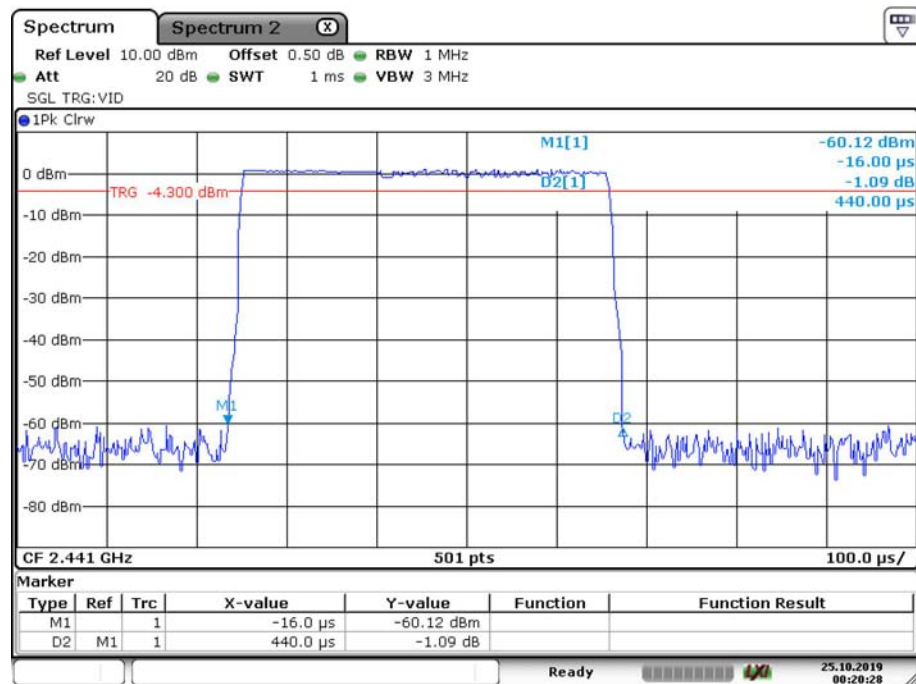
2DH5: Middle Channel



Date: 25.OCT.2019 00:58:34

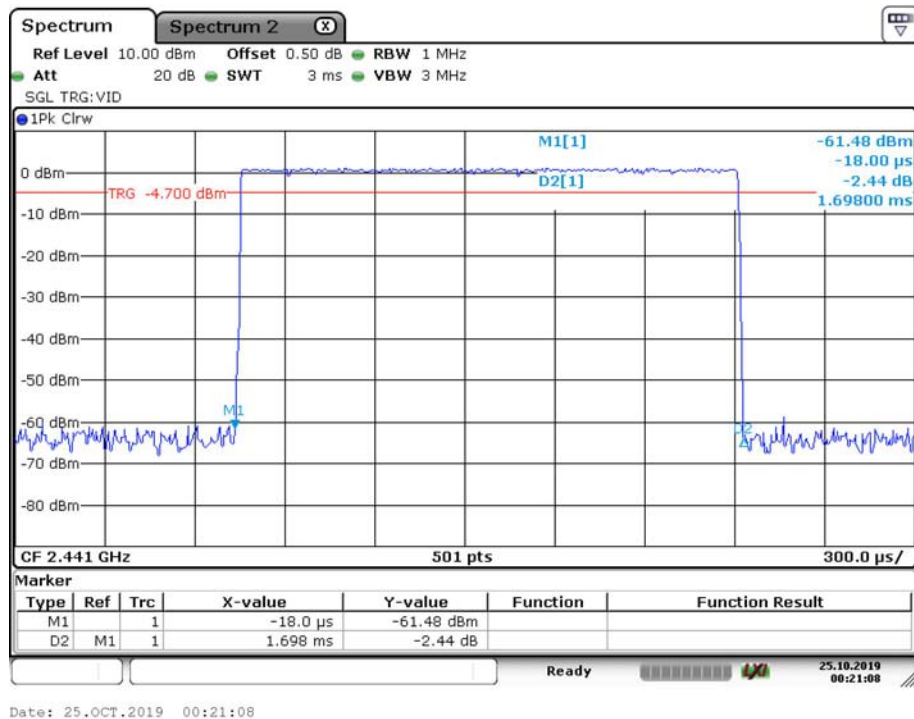
EDR Mode (8DPSK):

3DH1: Middle Channel

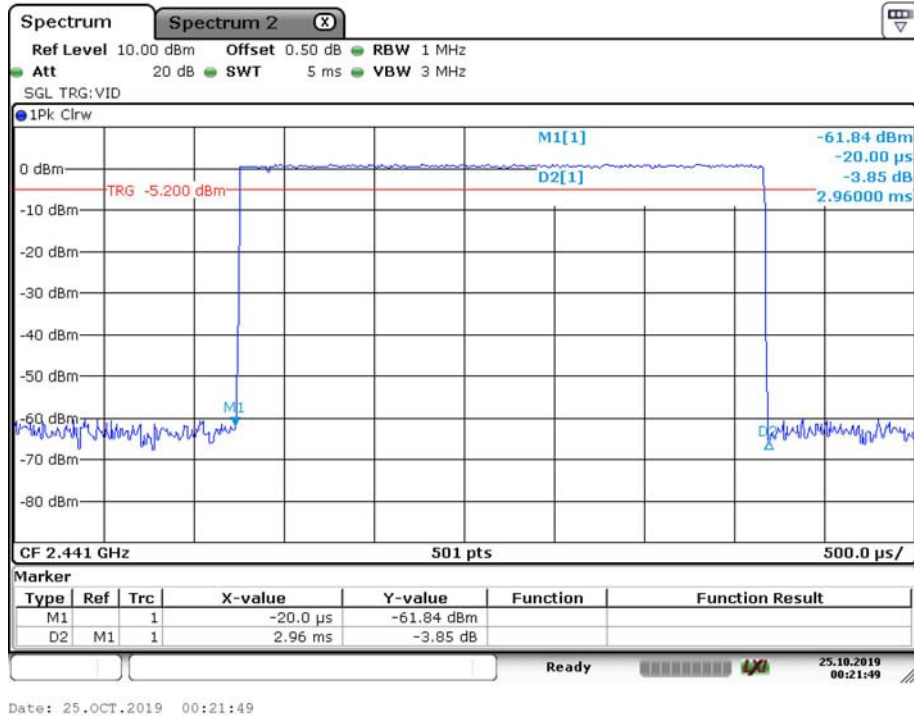


Date: 25.OCT.2019 00:20:28

3DH3: Middle Channel



3DH5: Middle Channel



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
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2019-09-23	2020-09-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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:	26.4~28.2°C
Relative Humidity:	51~55%
ATM Pressure:	100.5~100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-24~2019-10-25

Test Result: Compliance.

Test Mode: Transmitting

Mode	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	1.31	≤ 21
	2441	1.60	
	2478	2.80	
	2480	2.71	
EDR Mode ($\pi/4$ -DQPSK)	2402	0.70	
	2441	1.59	
	2477	2.67	
	2480	2.59	
EDR Mode (8DPSK)	2402	0.60	
	2441	1.55	
	2480	2.44	

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.

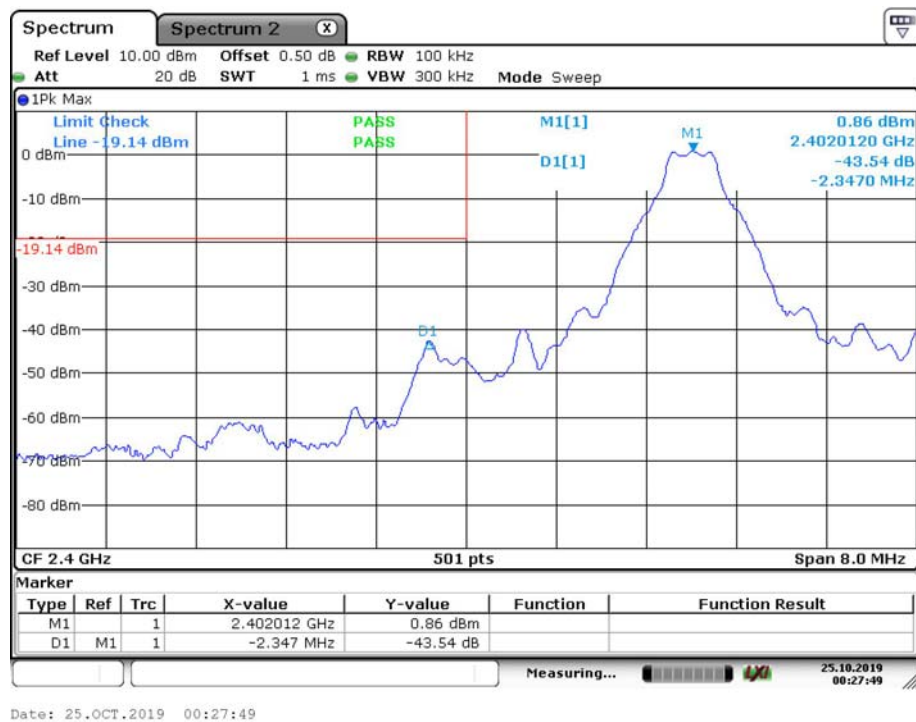
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/05	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	OE01203219	2019-05-06	2020-05-06

* **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).

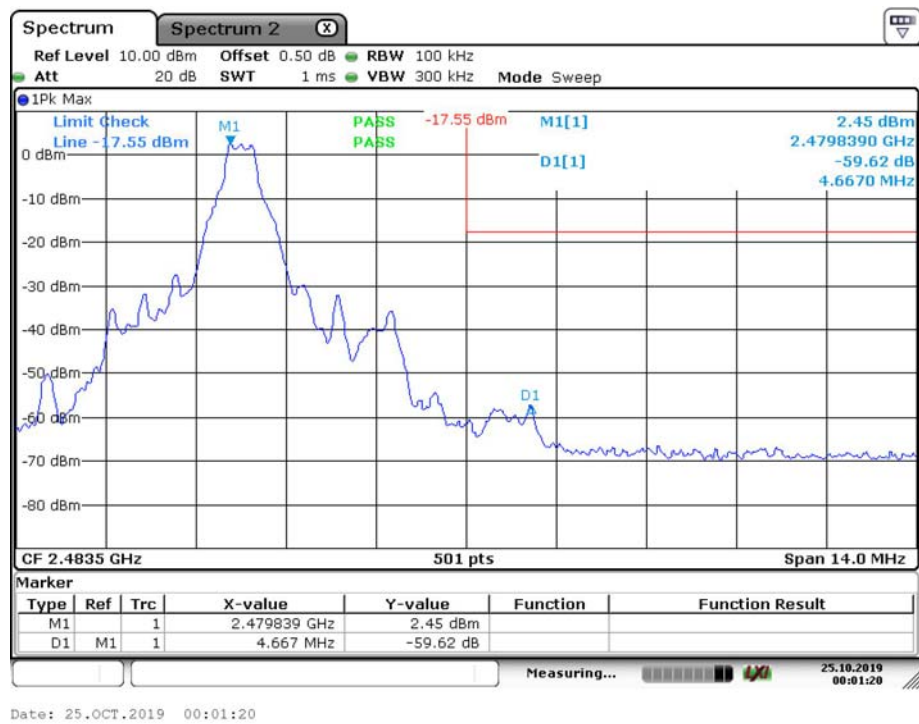
Test Data**Environmental Conditions**

Temperature:	26.4~28.2°C
Relative Humidity:	51~55%
ATM Pressure:	100.5~100.6kPa
Tester:	Vern Shen
Test Date:	2019-10-24~2019-10-25

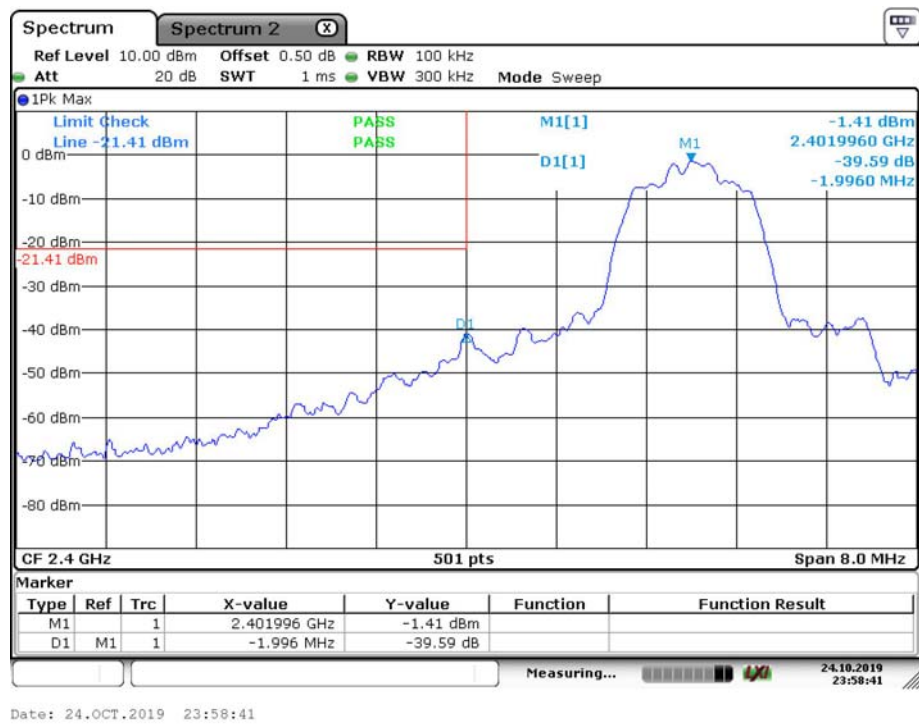
Test Result: Compliance*Single Channel:**BDR Mode (GFSK):***Band Edge, Left Side**

Date: 25.OCT.2019 00:27:49

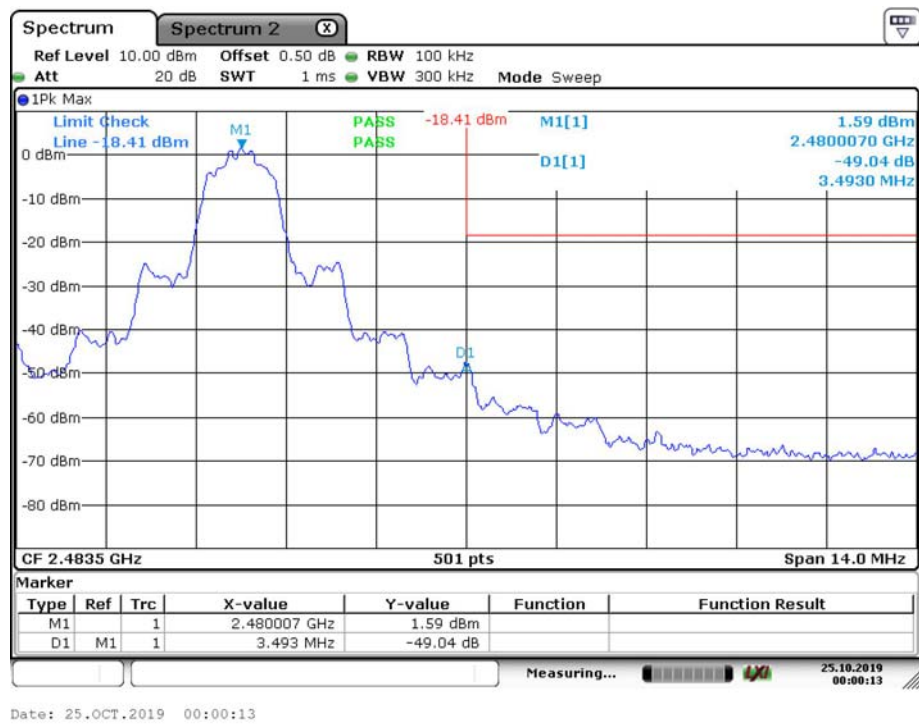
Band Edge, Right Side

*EDR Mode ($\pi/4$ -DQPSK):*

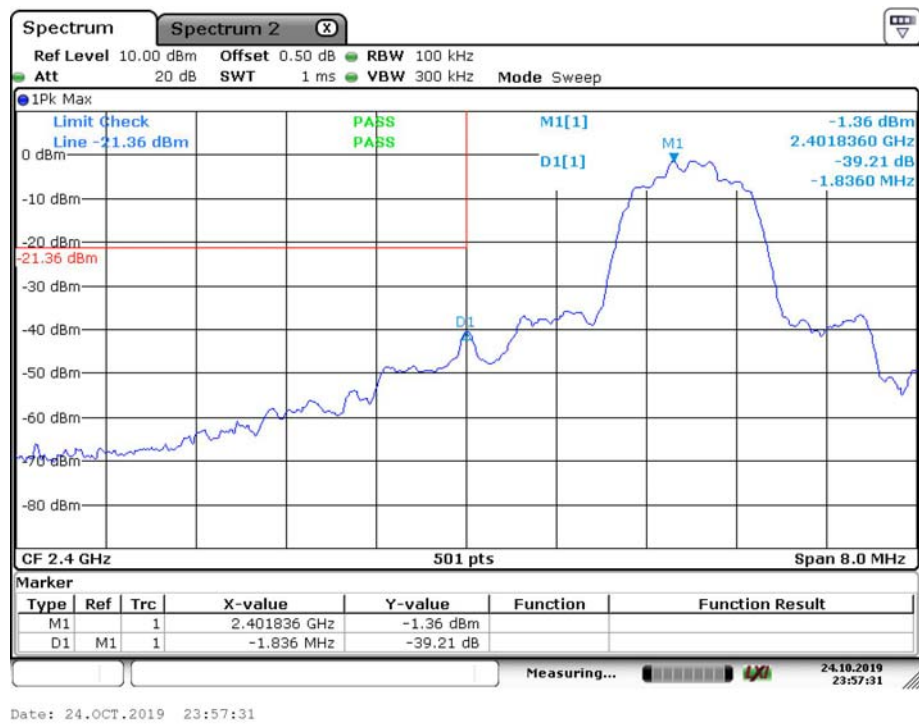
Band Edge, Left Side



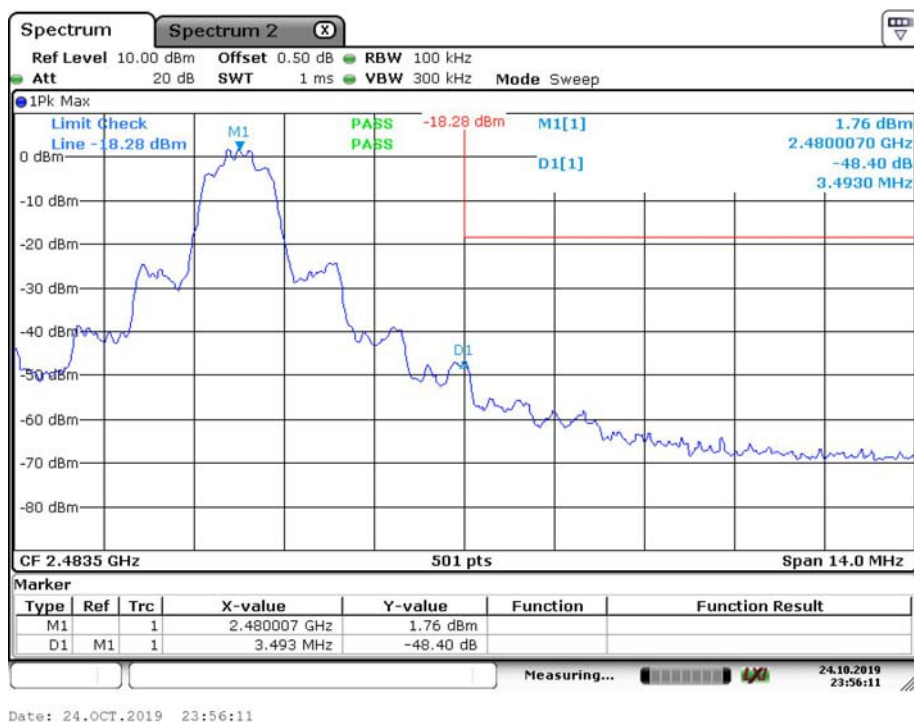
Band Edge, Right Side

*EDR Mode (8DPSK):*

Band Edge, Left Side

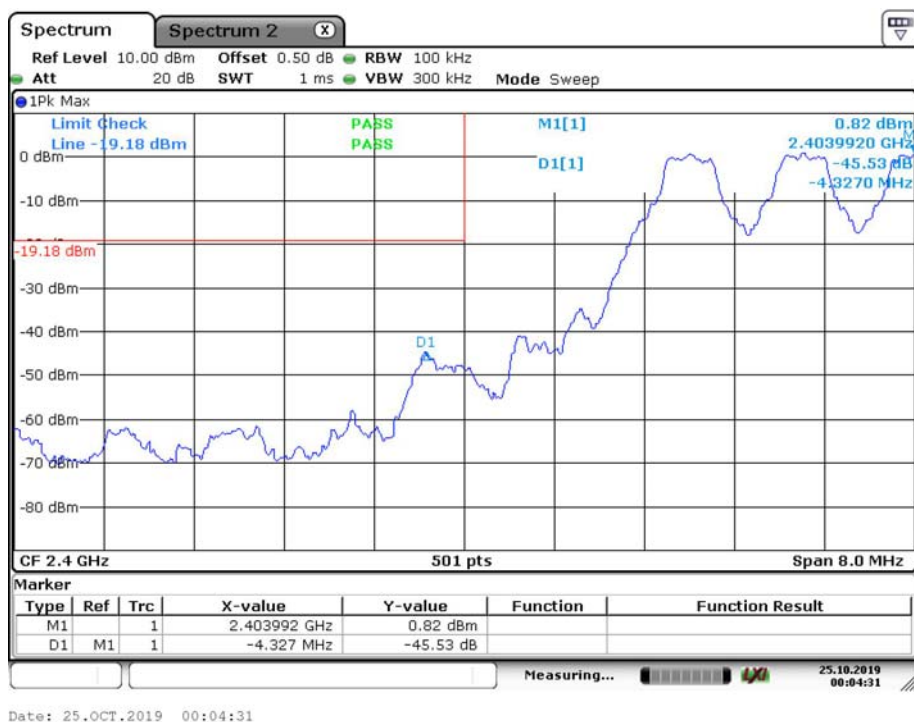


Band Edge, Right Side

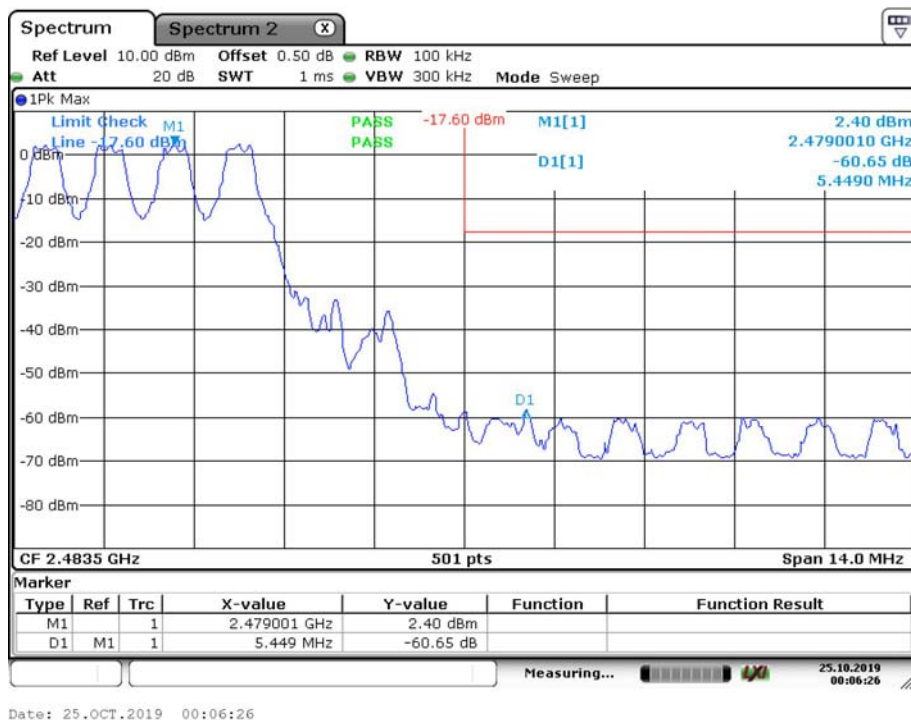


Hopping Mode,
EDR Mode (GFSK):

Band Edge, Left Side

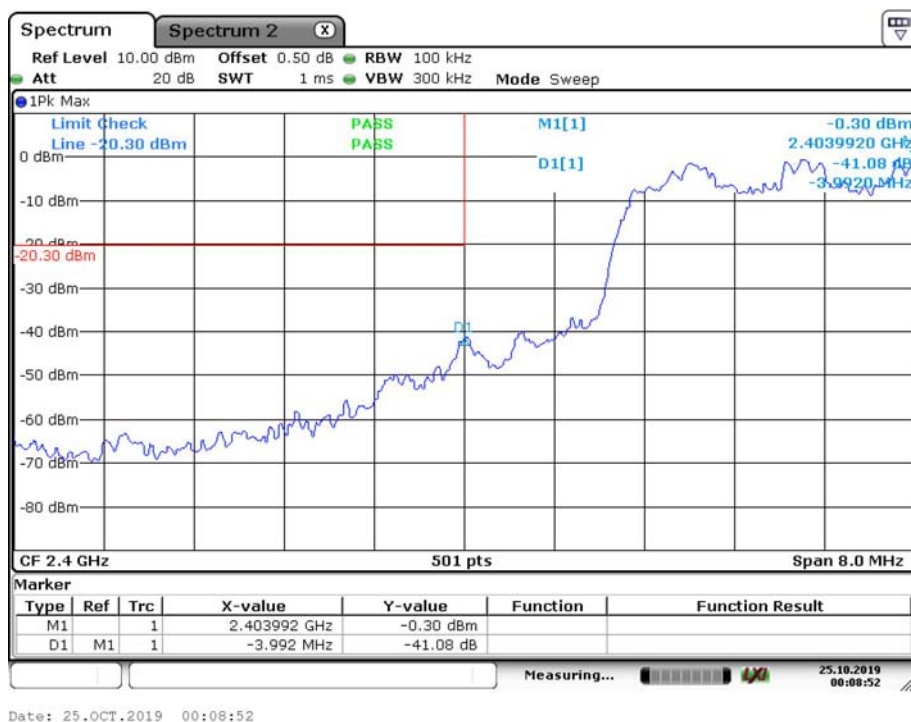


Band Edge, Right Side

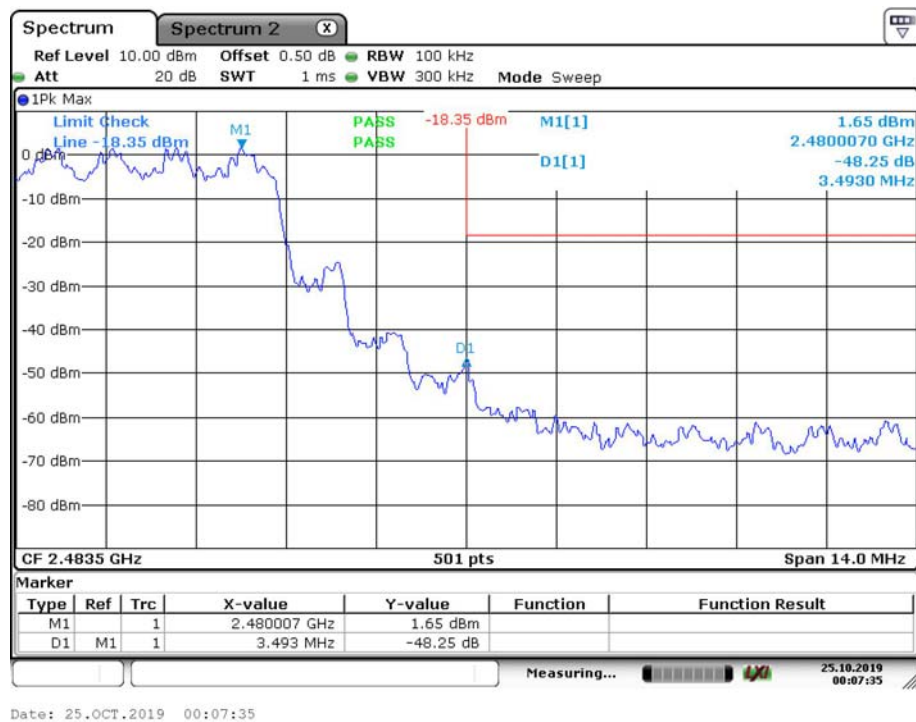


BDR Mode ($\pi/4$ DQPSK):

Band Edge, Left Side

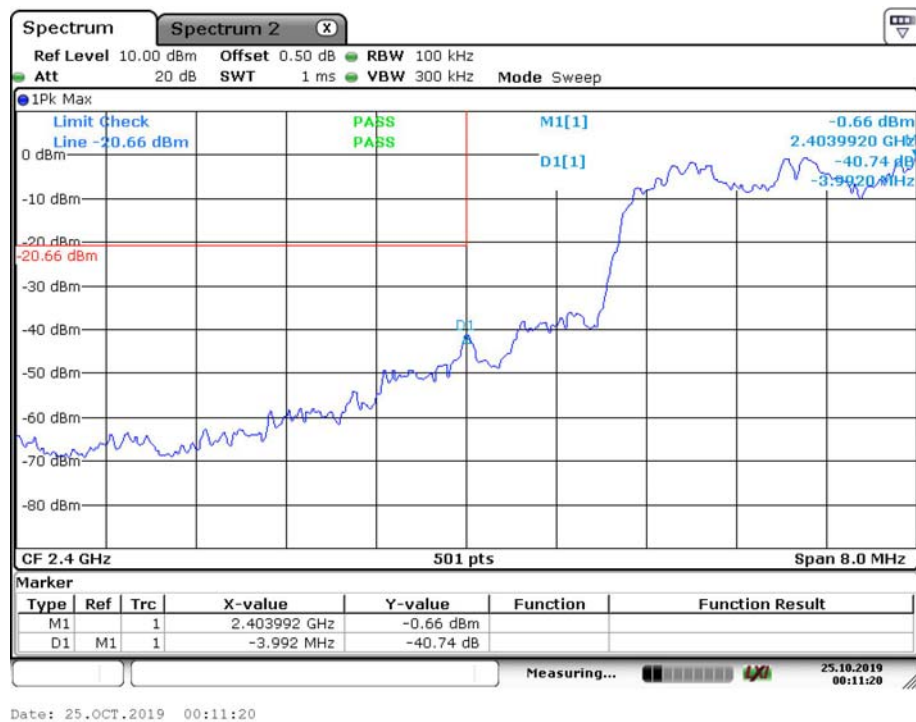


Band Edge, Right Side

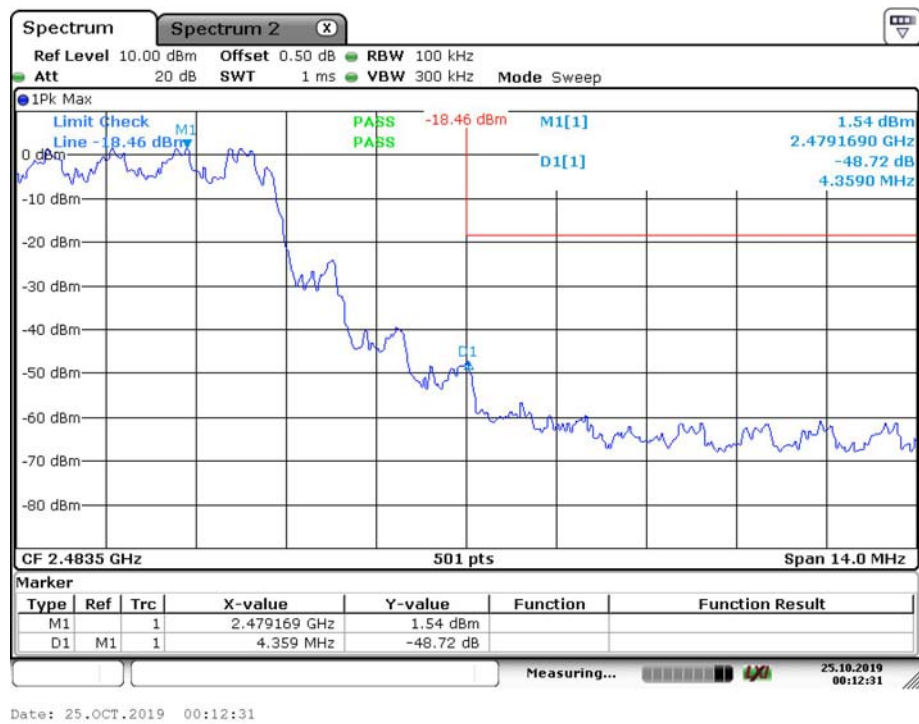


BDR Mode (8DPSK):

Band Edge, Left Side



Band Edge, Right Side



**** END OF REPORT ****