

FCC PART 15.247

TEST REPORT

For

AKUVOX (XIAMEN) NETWORKS CO., LTD.

10/F, No.56, Software Park II , Xiamen, China

FCC ID: 2AHCR-VPR73G

Report Type: Original Report	Product Name: Video Phone
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Video Phone
EUT Model:		VP-R73G
Multiple Models:		R73G
Operation Frequency:		2402-2480MHz
Maximum Output Power (Conducted):		3.61 dBm
Modulation Type:		GFSK, $\pi/4$ -DQPSK, 8DPSK
Rated Input Voltage:		DC 12V from adapter or DC48V from PoE
Adapter Information	Model:	KL-AD3060VA
	Input:	100-240Vac
	Output:	DC 12V 1.5A
External Dimension:		260mm(L)*90mm(W)*230mm(H)
Serial Number:		190225051
EUT Received Date:		2019/3/2

Notes: Model VP-R73G was selected for fully testing, the detailed information about the difference among R73G and model VP-R73G can be referred to the declaration letter which was stated and guaranteed by the manufacturer.

Objective

This report is prepared on behalf of AKUVOX (XIAMEN) NETWORKS 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)

FCC Part 15E NII submissions with FCC ID: 2AHCR-VPR73G
FCC Part 15C DTS submissions with FCC ID: 2AHCR-VPR73G
FCC Part 15B JAB submissions with FCC ID: 2AHCR-VPR73G

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)

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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

EUT Exercise Software

The software ' RFTesTool' was used for testing, which was provided by manufacturer, the maximum power was configured as below table:

Test Software Version	RFTesTool		
Test Frequency	2402MHz	2441MHz	2480MHz
GFSK	0	0	0
$\pi/4$ -DQPSK	0	0	0
8-DPSK	0	0	0

Equipment Modifications

No modification was made to the EUT.

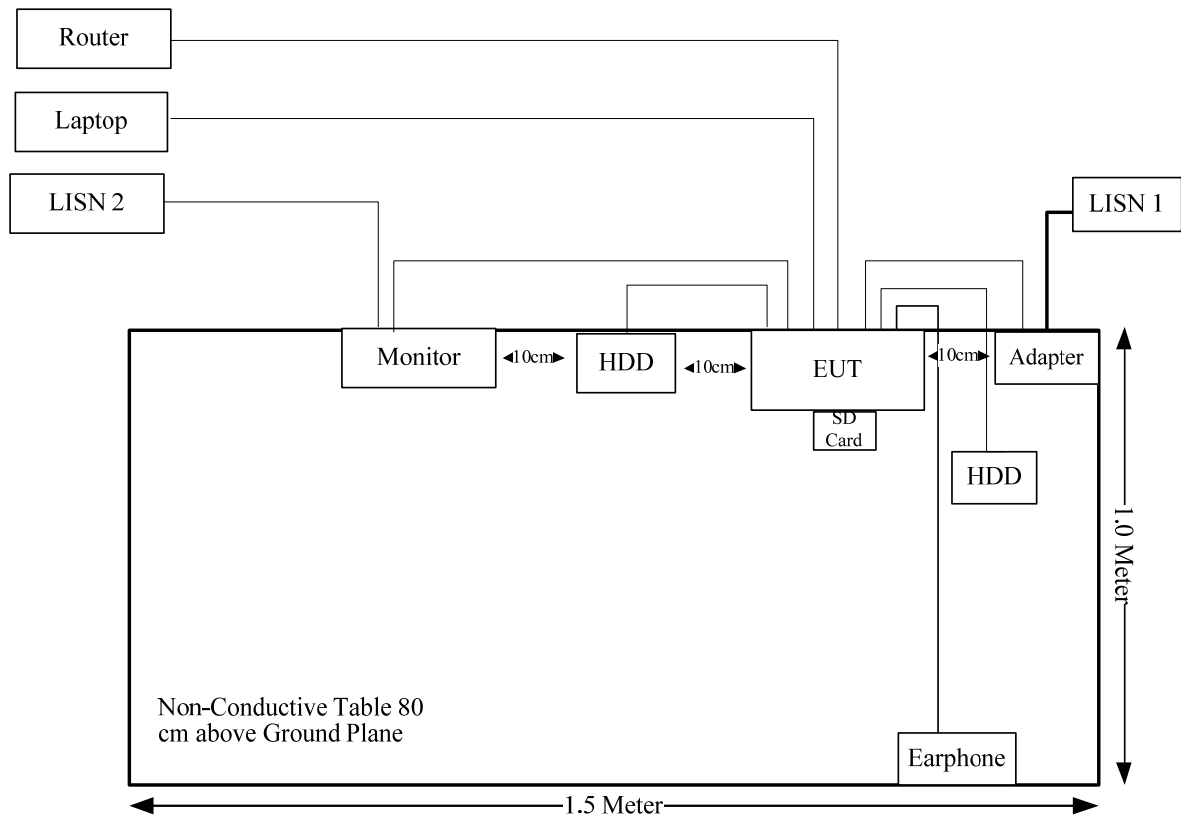
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
SanDisk	SD Card	CZ36	521253
TOSKIBA	USB-HDD	Un-known	/
TOSKIBA	USB-HDD	Un-known	/
Un-known	Earphone	Un-known	/
SAMSUNG	Monitor	S22C330H	JPTVOB2337
A Division of Cisco Systems, Inc	POE	SA06-20S48-V	GPSESU-48P401-AM5BH
DELL	Laptop	PP11L	QDS-BRCM1017
Huawei	Router	WS5200	2.01701E+15

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Earphone cable	No	No	1	EUT	Earphone
adapter cable	No	No	1.5	adapter	EUT
USB Cable	Yes	No	0.5	EUT	HDD
HDMI Cable	Yes	No	1	EUT	Monitor
RJ45 Cable	No	No	1	Router	EUT
RJ45 Cable	No	No	1	EUT	Laptop

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
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:

Modes	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)			
2.4G Wifi	2412-2462	2.8	1.91	22	158.49	20.00	0.0601	1.0
Bluetooth BDR/EDR	2402-2480	2.8	1.91	4	2.51	20.00	0.0010	1.0
Bluetooth LE	2402-2480	2.8	1.91	5	3.16	20.00	0.0012	1.0
5G Wifi	5180-5825	6.5	4.47	12	15.85	20.00	0.0141	1.0

Note: The WLAN 2.4G, 5G or Bluetooth can't transmit simultaneously.

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
FPC	50	2.8dBi/2.4~2.5GHz 6.5 dBi/5.15~5.85GHz

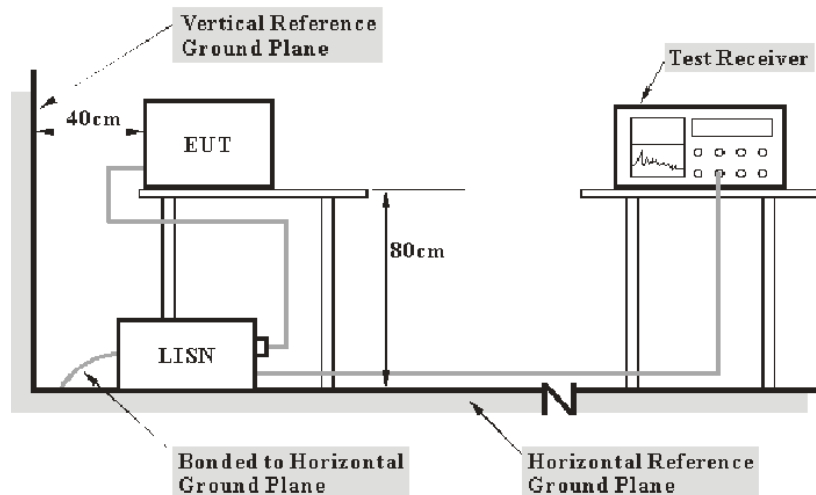
Result: Compliance.

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
R&S	EMI Test Receiver	ESCS 30	830245/006	2018-12-10	2019-12-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2018-09-05	2019-09-05
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

* **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

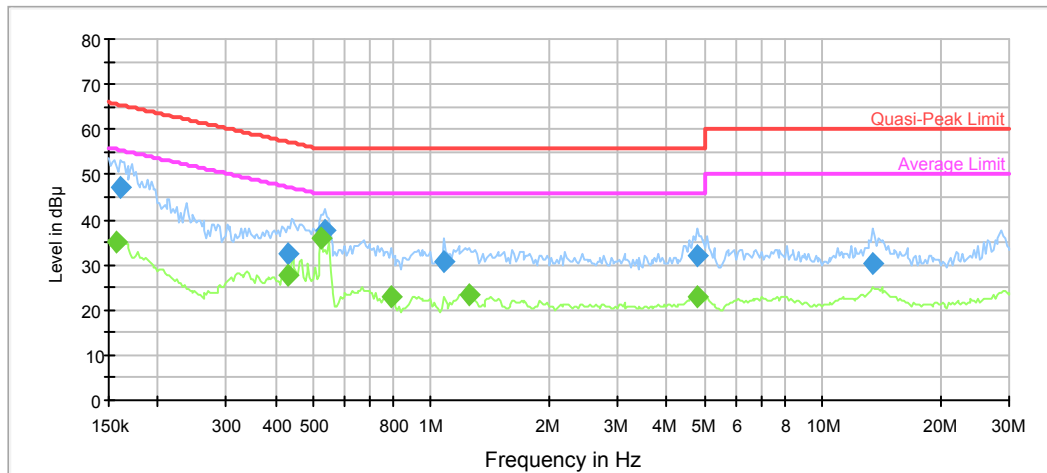
Temperature:	27.1 °C
Relative Humidity:	58%
ATM Pressure:	99.8 kPa
Test by:	Lily Xie
Test Date:	2019-05-01

Test Result: Compliance

Test Mode: Transmitting

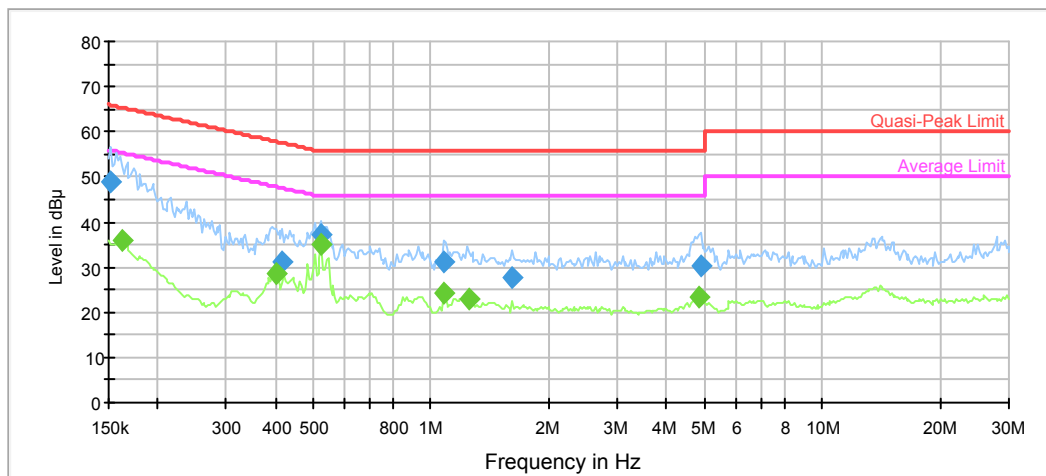
Adapter:

AC120V, 60 Hz, Line:



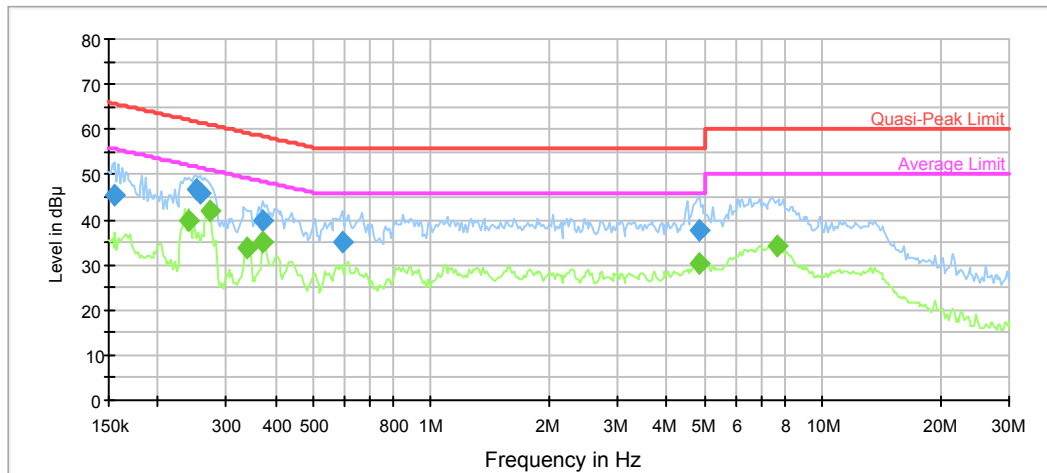
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.160820	47.1	9.000	L1	11.0	18.3	65.4
0.430682	32.4	9.000	L1	9.9	24.8	57.2
0.536077	37.5	9.000	L1	9.9	18.5	56.0
1.075780	30.7	9.000	L1	9.8	25.3	56.0
4.785525	31.9	9.000	L1	9.8	24.1	56.0
13.469532	30.1	9.000	L1	9.9	29.9	60.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.157652	34.9	9.000	L1	11.1	20.7	55.6
0.430682	27.5	9.000	L1	9.9	19.7	47.2
0.525514	35.9	9.000	L1	9.9	10.1	46.0
0.790244	22.8	9.000	L1	9.8	23.2	46.0
1.248947	23.4	9.000	L1	9.8	22.6	46.0
4.785525	22.9	9.000	L1	9.8	23.1	46.0

AC120V, 60 Hz, Neutral:

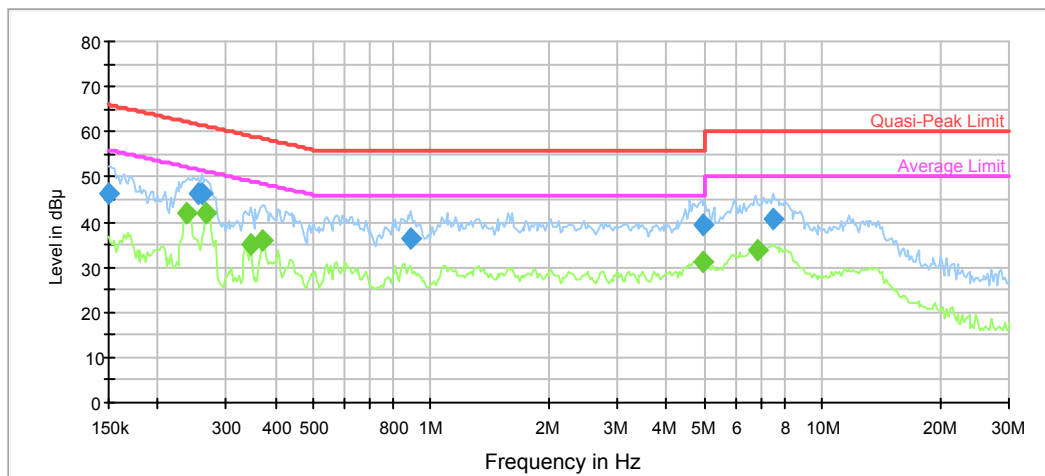
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.151500	49.0	9.000	N	11.1	16.9	65.9
0.418016	31.3	9.000	N	9.9	26.2	57.5
0.525514	37.1	9.000	N	9.9	18.9	56.0
1.075780	31.1	9.000	N	9.8	24.9	56.0
1.617707	27.7	9.000	N	9.8	28.3	56.0
4.881714	30.2	9.000	N	9.8	25.8	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.162429	35.8	9.000	N	11.0	19.5	55.3
0.401705	28.4	9.000	N	10.0	19.4	47.8
0.525514	35.2	9.000	N	9.9	10.8	46.0
1.075780	24.2	9.000	N	9.8	21.8	46.0
1.248947	22.9	9.000	N	9.8	23.1	46.0
4.833381	23.5	9.000	N	9.8	22.5	46.0

PoE:**AC120V, 60 Hz, Line:**

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.156091	45.3	9.000	L1	11.1	20.4	65.7
0.251654	46.6	9.000	L1	10.3	15.1	61.7
0.256712	45.8	9.000	L1	10.3	15.7	61.5
0.370968	39.7	9.000	L1	10.0	18.8	58.5
0.592163	35.1	9.000	L1	9.8	20.9	56.0
4.833381	37.8	9.000	L1	9.8	18.2	56.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.239440	39.6	9.000	L1	10.4	12.5	52.1
0.272505	41.9	9.000	L1	10.2	9.1	51.0
0.339191	33.6	9.000	L1	10.1	15.6	49.2
0.370968	35.1	9.000	L1	10.0	13.4	48.5
4.833381	30.5	9.000	L1	9.8	15.5	46.0
7.638959	34.2	9.000	L1	9.8	15.8	50.0

AC120V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	46.4	9.000	N	11.2	19.6	66.0
0.254170	46.5	9.000	N	10.3	15.1	61.6
0.259279	46.3	9.000	N	10.3	15.2	61.5
0.890466	36.1	9.000	N	9.8	19.9	56.0
4.930532	39.2	9.000	N	9.8	16.8	56.0
7.488442	40.7	9.000	N	9.8	19.3	60.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.237069	41.8	9.000	N	10.4	10.4	52.2
0.267135	41.7	9.000	N	10.3	9.5	51.2
0.346009	35.0	9.000	N	10.0	14.1	49.1
0.370968	35.8	9.000	N	10.0	12.7	48.5
4.930532	31.2	9.000	N	9.8	14.8	46.0
6.846980	33.8	9.000	N	9.8	16.2	50.0

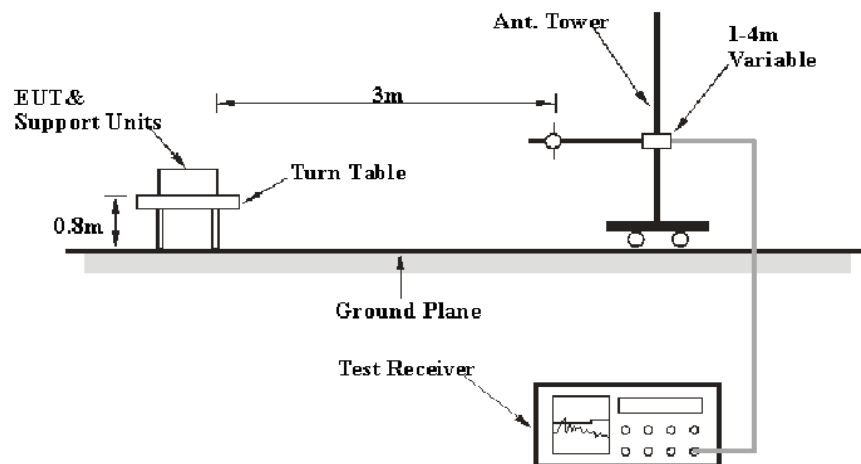
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

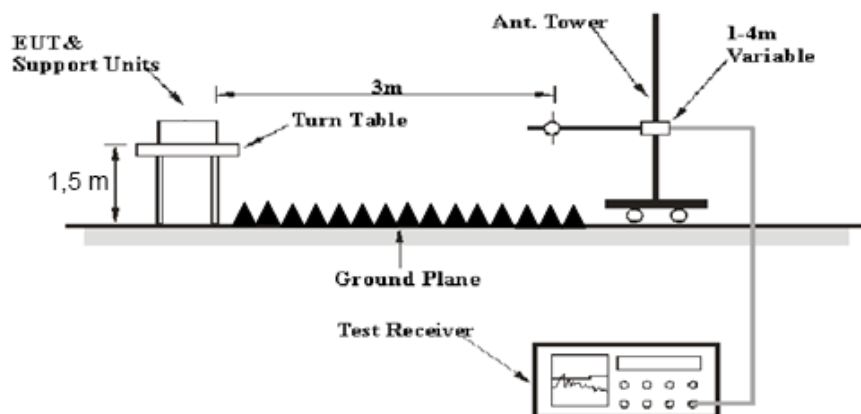
FCC §15.247 (d); §15.209; §15.205;

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	2018-06-26	2019-06-26
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	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2020-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2018-06-27	2019-06-27
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2018-06-27	2019-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2018-06-16	2019-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2018-06-16	2019-06-16

* **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

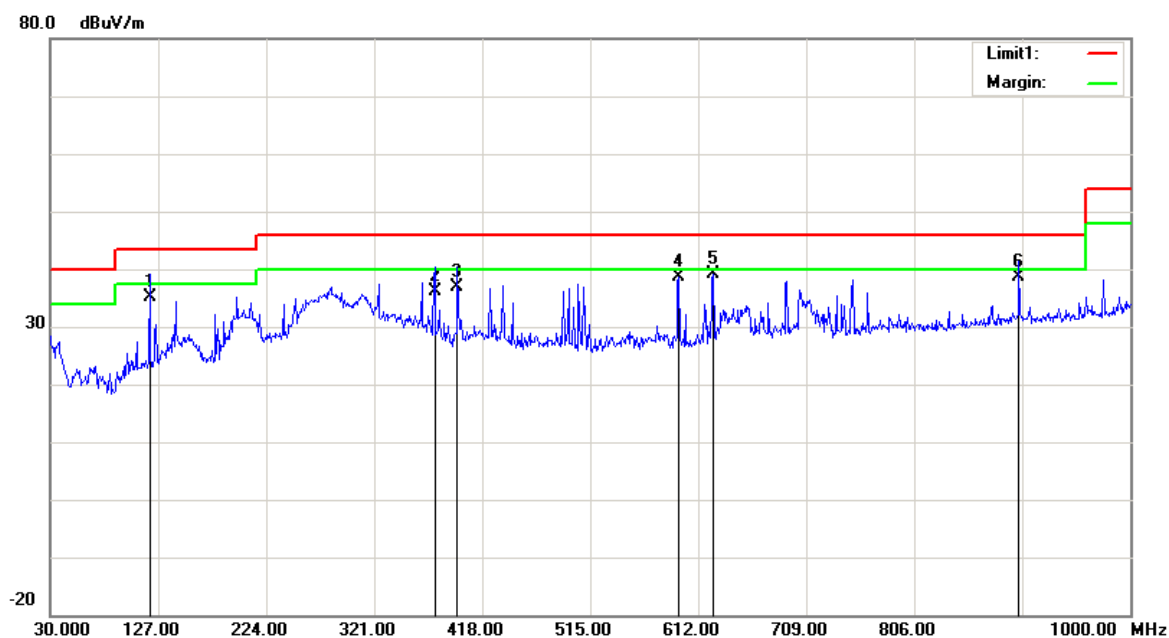
Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	27.0 °C	23.6 °C
Relative Humidity:	50 %	61 %
ATM Pressure:	100.5 kPa	101.4 kPa
Tester:	Tyler pan	Kami Zhou
Test Date:	2019-06-23	2019-03-14

Test Mode: Transmitting

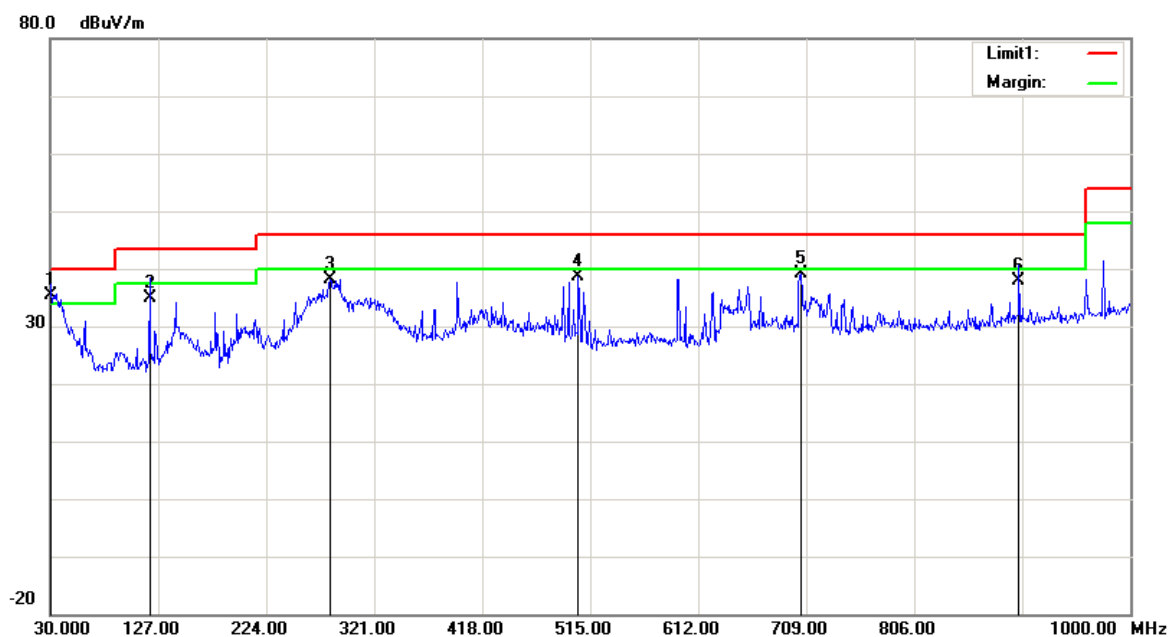
Pre scan Adapter and POE, adapter is the worst case

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

Horizontal:



Frequency (MHz)	Receiver Reading (dBμV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
119.2400	40.01	QP	-4.84	35.17	43.50	8.33
375.3200	38.96	QP	-2.72	36.24	46.00	9.76
395.6900	38.86	QP	-2.07	36.79	46.00	9.21
594.5400	37.71	peak	0.86	38.57	46.00	7.43
625.5800	37.31	peak	1.79	39.10	46.00	6.90
900.0900	38.46	QP	0.12	38.58	46.00	7.42

Vertical:

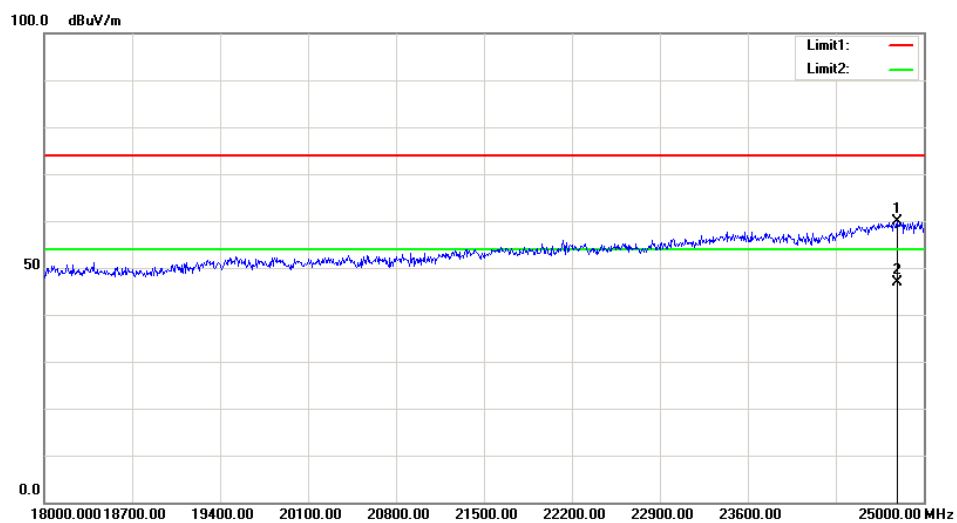
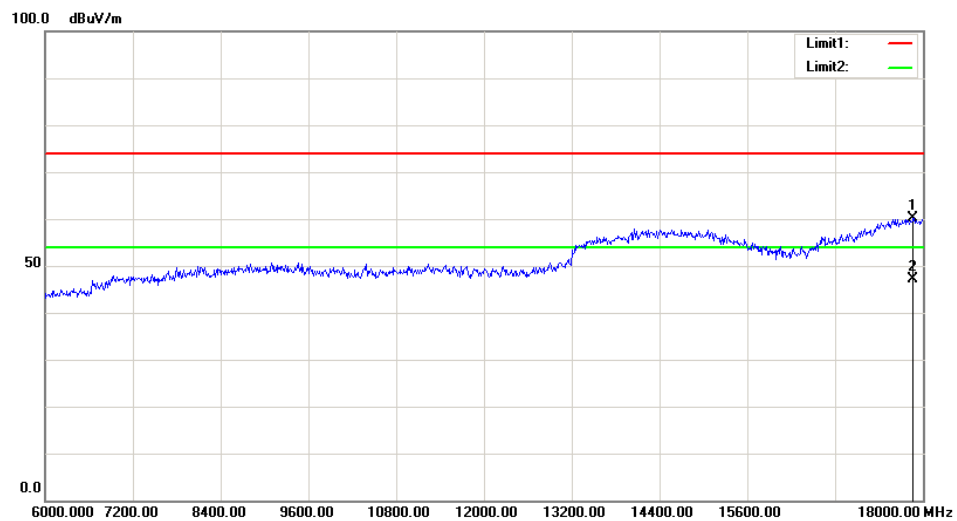
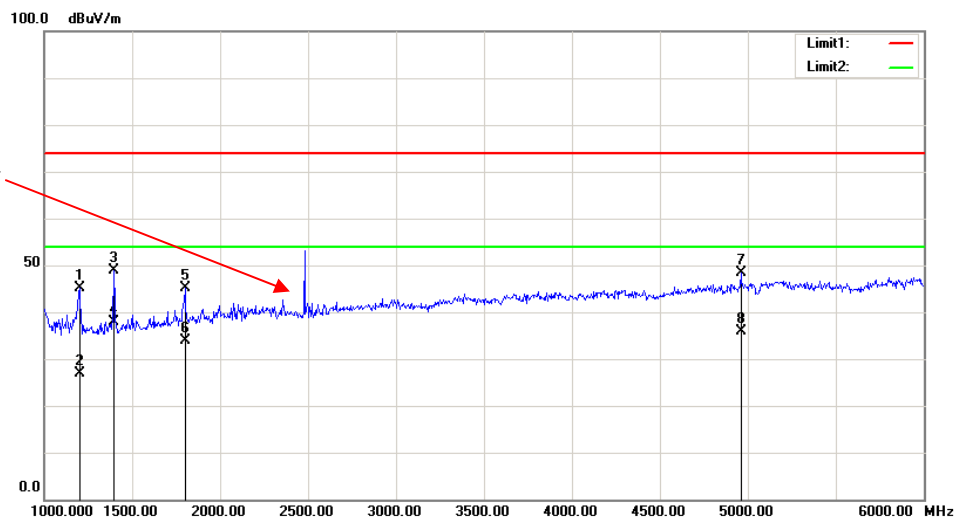
Frequency (MHz)	Receiver Reading (dB μ V)	Remark	Correction Factor (dB/m)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
30.0000	33.77	QP	1.72	35.49	40.00	4.51
119.2400	39.65	QP	-4.84	34.81	43.50	8.69
281.2300	42.37	peak	-4.12	38.25	46.00	7.75
504.3300	39.00	peak	-0.28	38.72	46.00	7.28
704.1500	35.88	peak	3.15	39.03	46.00	6.97
900.0900	37.88	QP	0.12	38.00	46.00	8.00

2)1GHz-25GHz (BDR was the worst):

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	67.46	PK	H	28.10	1.80	0.00	97.36	N/A	N/A
2402.00	56.75	AV	H	28.10	1.80	0.00	86.65	N/A	N/A
2402.00	63.05	PK	V	28.10	1.80	0.00	92.95	N/A	N/A
2402.00	52.89	AV	V	28.10	1.80	0.00	82.79	N/A	N/A
2390.00	26.73	PK	H	28.08	1.80	0.00	56.61	74.00	17.39
2390.00	12.76	AV	H	28.08	1.80	0.00	42.64	54.00	11.36
4804.00	47.50	PK	H	32.91	3.17	37.20	46.38	74.00	27.62
4804.00	34.15	AV	H	32.91	3.17	37.20	33.03	54.00	20.97
7206.00	46.54	PK	H	35.74	4.82	37.23	49.87	74.00	24.13
7206.00	32.16	AV	H	35.74	4.82	37.23	35.49	54.00	18.51
1200.00	57.66	PK	H	24.18	1.47	35.61	47.70	74.00	26.30
1200.00	38.67	AV	H	24.18	1.47	35.61	28.71	54.00	25.29
1395.00	54.69	PK	H	24.84	1.63	36.02	45.14	74.00	28.86
1395.00	43.58	AV	H	24.84	1.63	36.02	34.03	54.00	19.97
1800.00	54.61	PK	H	26.46	1.66	35.89	46.84	74.00	27.16
1800.00	43.54	AV	H	26.46	1.66	35.89	35.77	54.00	18.23
Middle Channel: 2441 MHz									
2441.00	69.40	PK	H	28.18	1.82	0.00	99.40	N/A	N/A
2441.00	59.13	AV	H	28.18	1.82	0.00	89.13	N/A	N/A
2441.00	65.10	PK	V	28.18	1.82	0.00	95.10	N/A	N/A
2441.00	54.87	AV	V	28.18	1.82	0.00	84.87	N/A	N/A
4882.00	48.76	PK	H	33.06	3.27	37.21	47.88	74.00	26.12
4882.00	36.21	AV	H	33.06	3.27	37.21	35.33	54.00	18.67
7323.00	46.53	PK	H	36.04	4.62	37.38	49.81	74.00	24.19
7323.00	33.12	AV	H	36.04	4.62	37.38	36.40	54.00	17.60
1200.00	60.34	PK	H	24.18	1.47	35.61	50.38	74.00	23.62
1200.00	41.34	AV	H	24.18	1.47	35.61	31.38	54.00	22.62
1395.00	55.65	PK	H	24.84	1.63	36.02	46.10	74.00	27.90
1395.00	44.50	AV	H	24.84	1.63	36.02	34.95	54.00	19.05
1800.00	53.36	PK	H	26.46	1.66	35.89	45.59	74.00	28.41
1800.00	42.35	AV	H	26.46	1.66	35.89	34.58	54.00	19.42
High Channel: 2480 MHz									
2480.00	69.53	PK	H	28.26	1.84	0.00	99.63	N/A	N/A
2480.00	59.39	AV	H	28.26	1.84	0.00	89.49	N/A	N/A
2480.00	64.74	PK	V	28.26	1.84	0.00	94.84	N/A	N/A
2480.00	54.68	AV	V	28.26	1.84	0.00	84.78	N/A	N/A
2483.50	25.08	PK	H	28.27	1.84	0.00	55.19	74.00	18.81
2483.50	13.88	AV	H	28.27	1.84	0.00	43.99	54.00	10.01
4960.00	49.13	PK	H	33.22	3.23	37.25	48.33	74.00	25.67
4960.00	36.67	AV	H	33.22	3.23	37.25	35.87	54.00	18.13
7440.00	47.10	PK	H	36.34	4.41	37.52	50.33	74.00	23.67
7440.00	33.80	AV	H	36.34	4.41	37.52	37.03	54.00	16.97
1200.00	55.19	PK	H	24.18	1.47	35.61	45.23	74.00	28.77
1200.00	36.74	AV	H	24.18	1.47	35.61	26.78	54.00	27.22
1395.00	58.43	PK	H	24.84	1.63	36.02	48.88	74.00	25.12
1395.00	47.35	AV	H	24.84	1.63	36.02	37.80	54.00	16.20
1800.00	52.79	PK	H	26.46	1.66	35.89	45.02	74.00	28.98
1800.00	41.65	AV	H	26.46	1.66	35.89	33.88	54.00	20.12

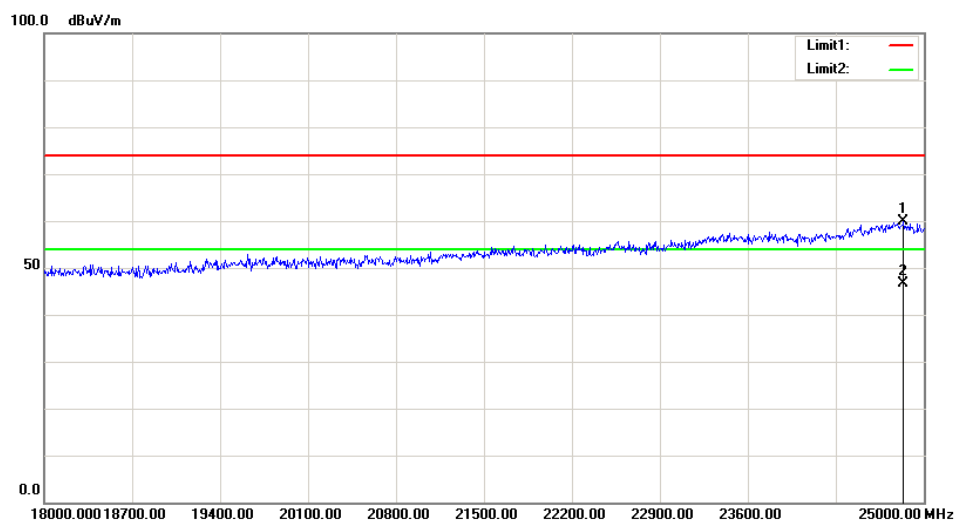
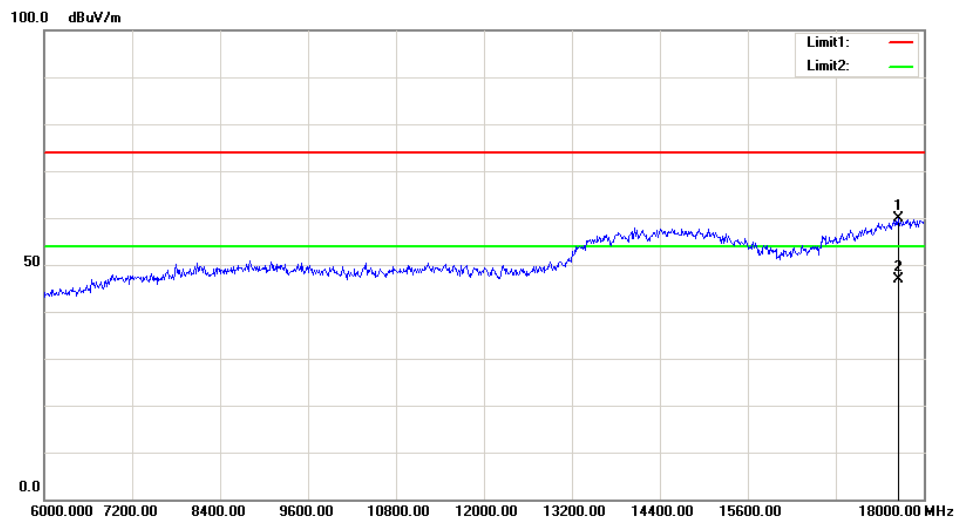
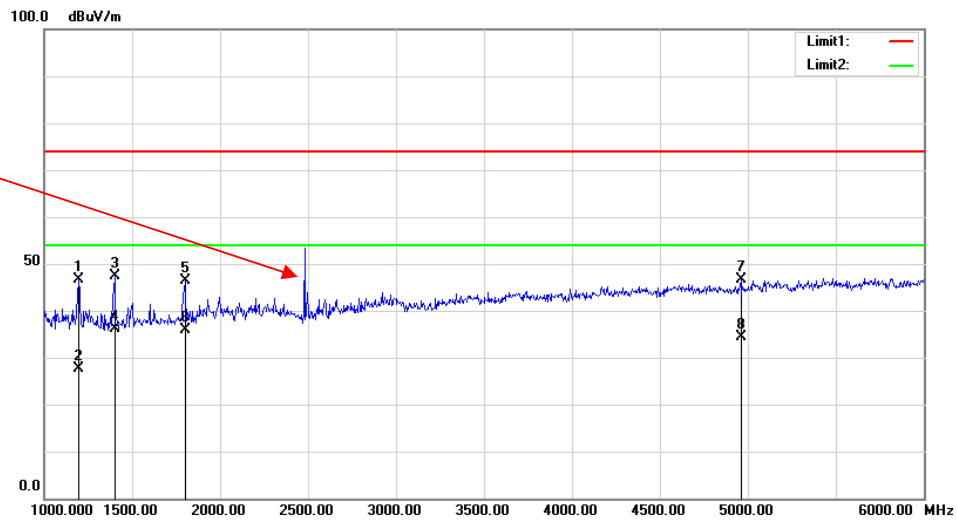
Worst plots (BDR High channel was the worst)
Horizontal

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 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	EMI Test Receiver	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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:	23 °C
Relative Humidity:	63 %
ATM Pressure:	100.9 kPa
Test by:	Carrie He
Test Date:	2019-03-09

Test Result: Compliance.

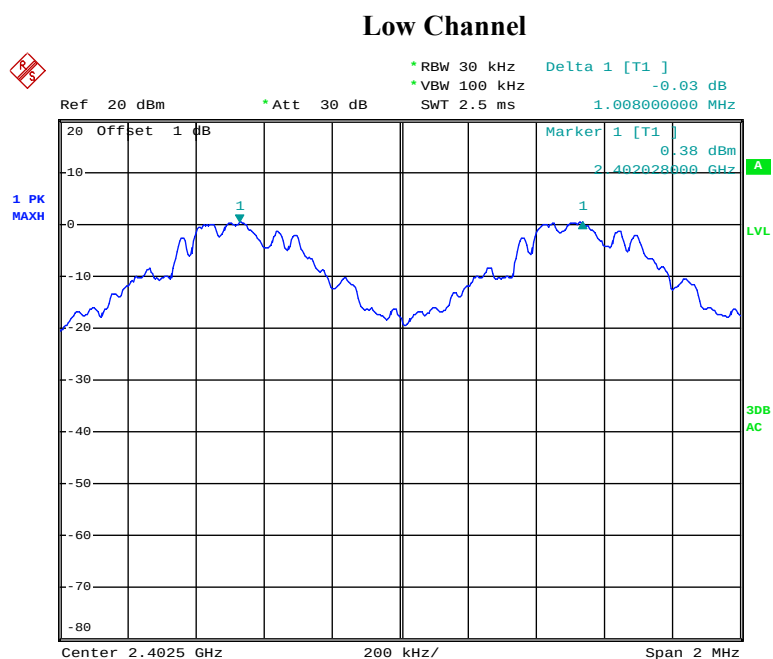
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	1.008	0.70
	Middle	2441	1.000	0.70
	High	2480	0.996	0.70
EDR ($\pi/4$ -DQPSK)	Low	2402	1.000	0.91
	Middle	2441	1.008	0.91
	High	2480	1.004	0.91
EDR (8DPSK)	Low	2402	1.004	0.88
	Middle	2441	1.000	0.89
	High	2480	1.004	0.89

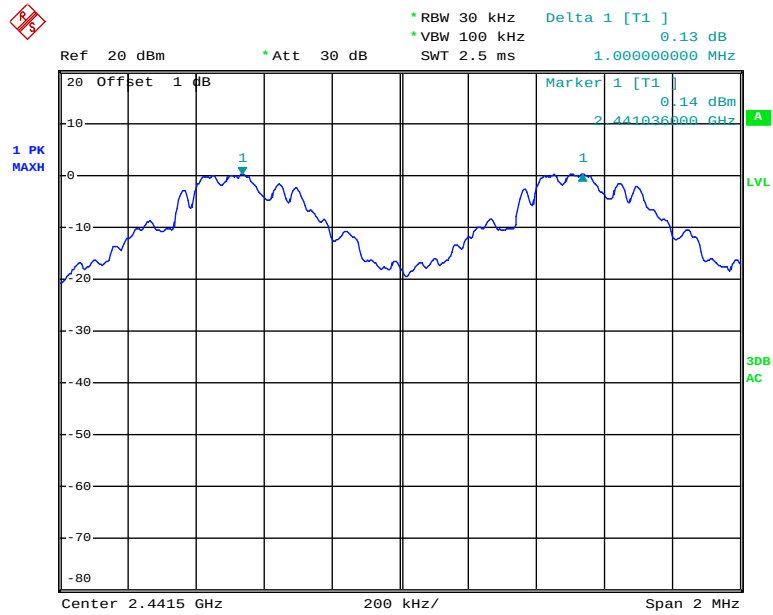
Note: Limit = $(2/3) \times 20\text{dB bandwidth}$

BDR Mode (GFSK):



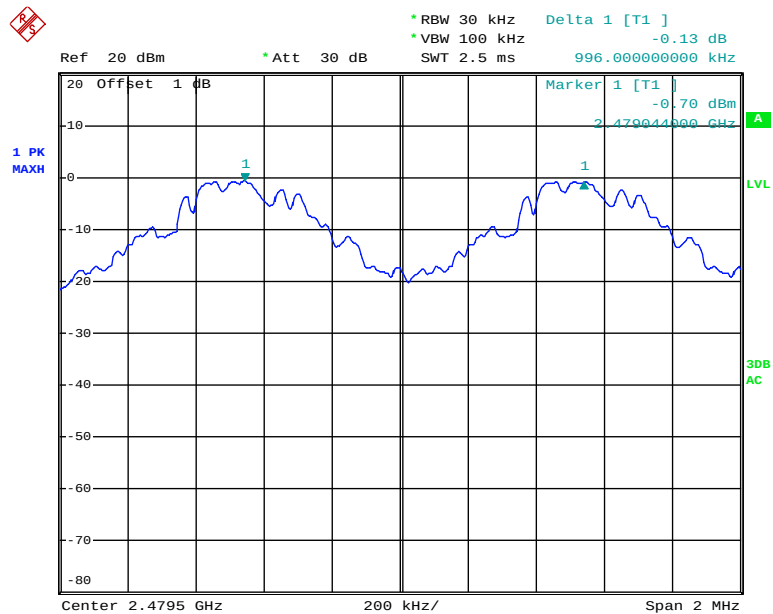
Date: 9.MAR.2019 10:33:36

Middle Channel

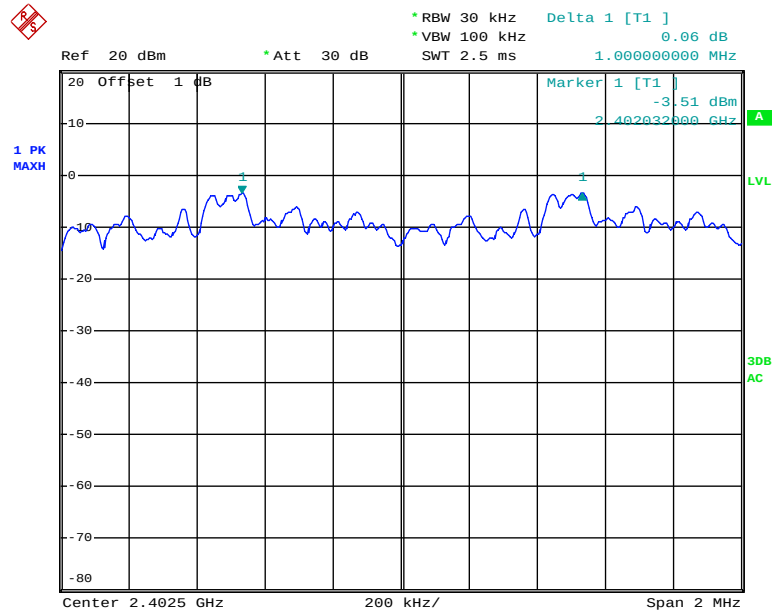


Date: 9.MAR.2019 10:35:18

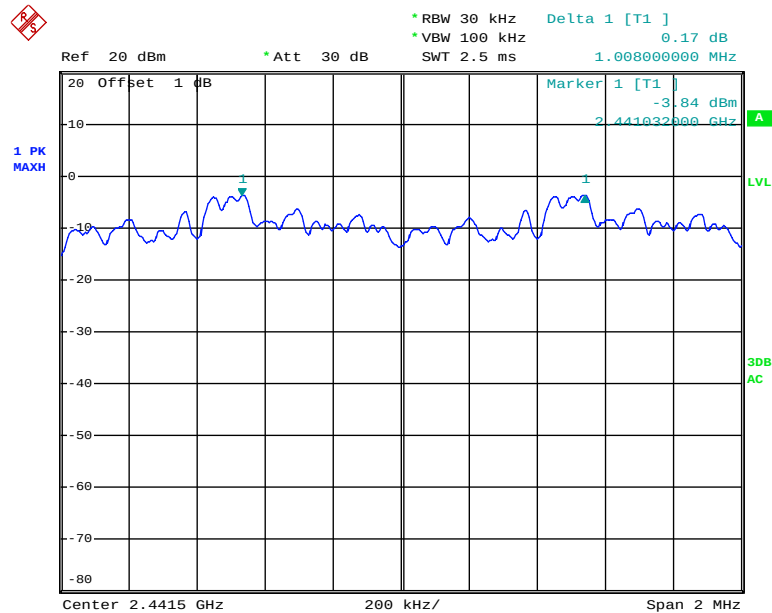
High Channel



Date: 9.MAR.2019 10:37:54

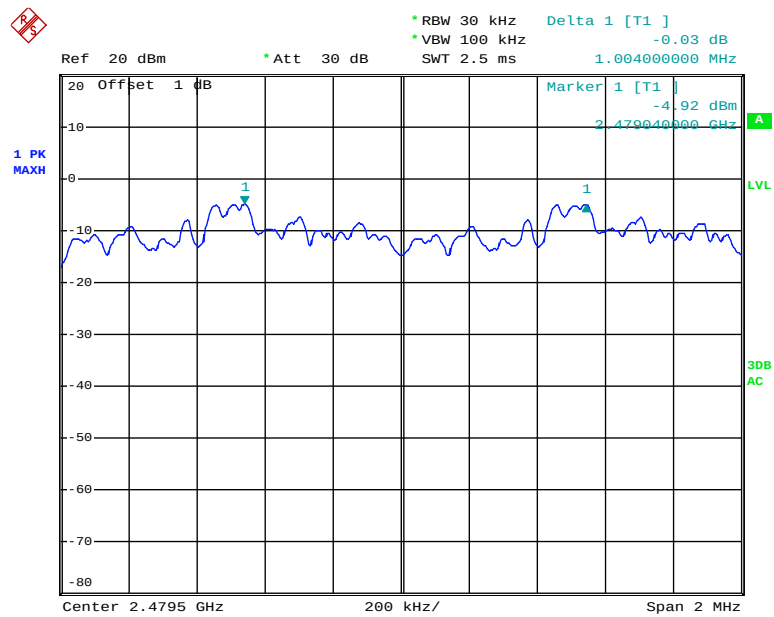
*EDR Mode ($\pi/4$ -DQPSK):***Low Channel**

Date: 9.MAR.2019 10:40:08

Middle Channel

Date: 9.MAR.2019 10:43:12

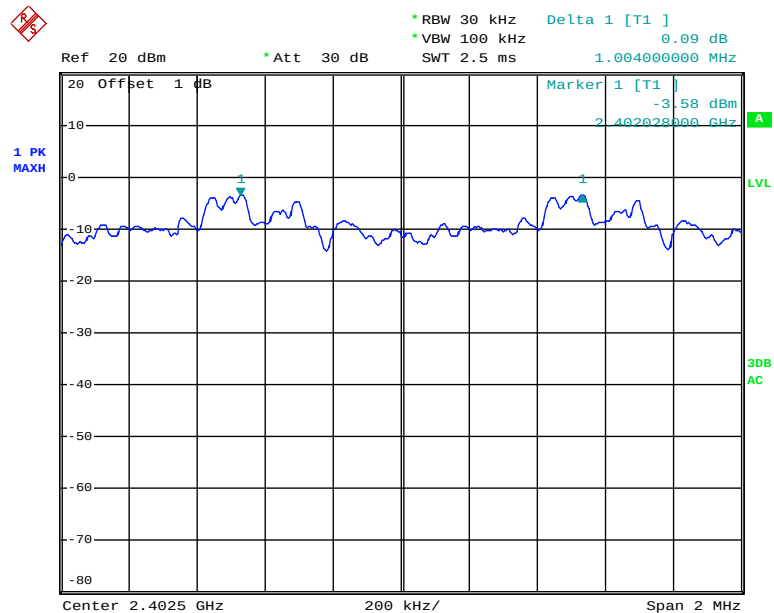
High Channel



Date: 9.MAR.2019 10:45:18

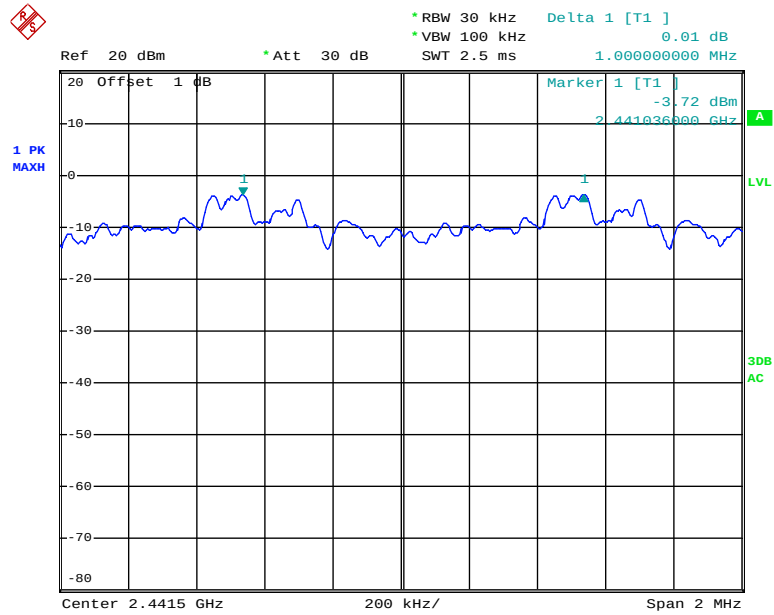
EDR Mode (8DPSK):

Low Channel



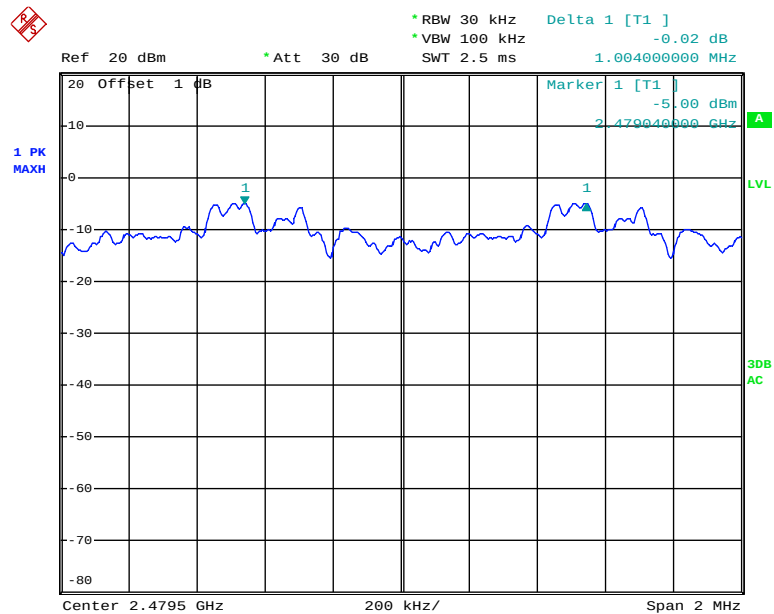
Date: 9.MAR.2019 10:47:48

Middle Channel



Date: 9.MAR.2019 10:49:31

High Channel



Date: 9.MAR.2019 10:51:40

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	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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:	23 °C
Relative Humidity:	63 %
ATM Pressure:	100.9 kPa
Test by:	Carrie He
Test Date:	2019-03-09

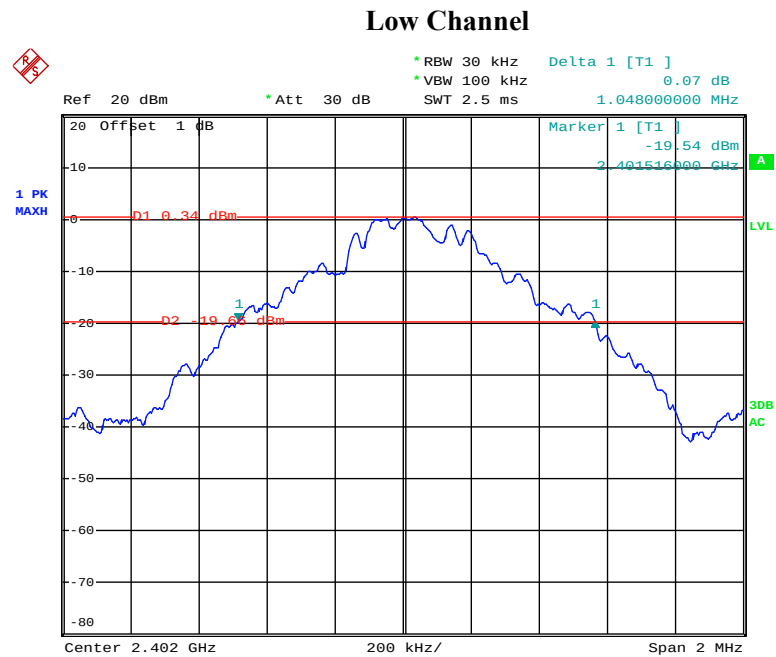
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

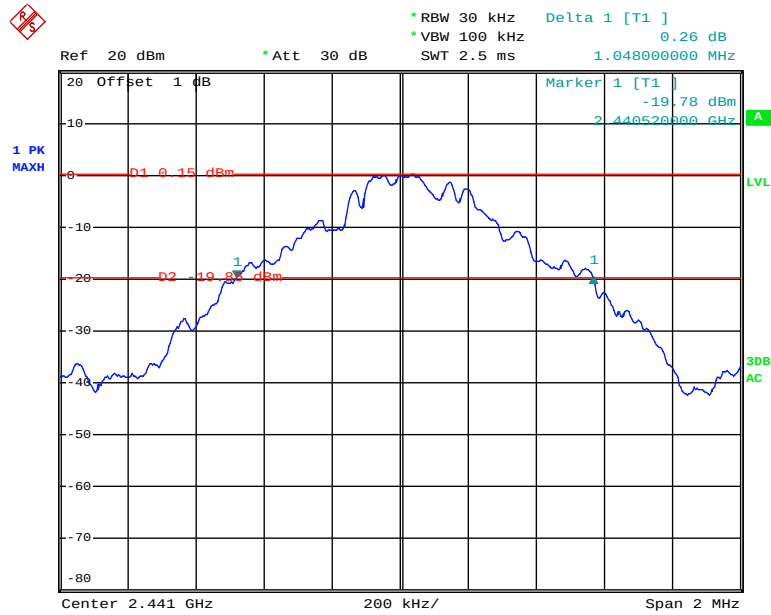
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	1.048
	Middle	2441	1.048
	High	2480	1.052
EDR Mode ($\pi/4$ -DQPSK)	Low	2402	1.360
	Middle	2441	1.360
	High	2480	1.360
EDR Mode (8DPSK)	Low	2402	1.324
	Middle	2441	1.328
	High	2480	1.336

BDR Mode (GFSK):



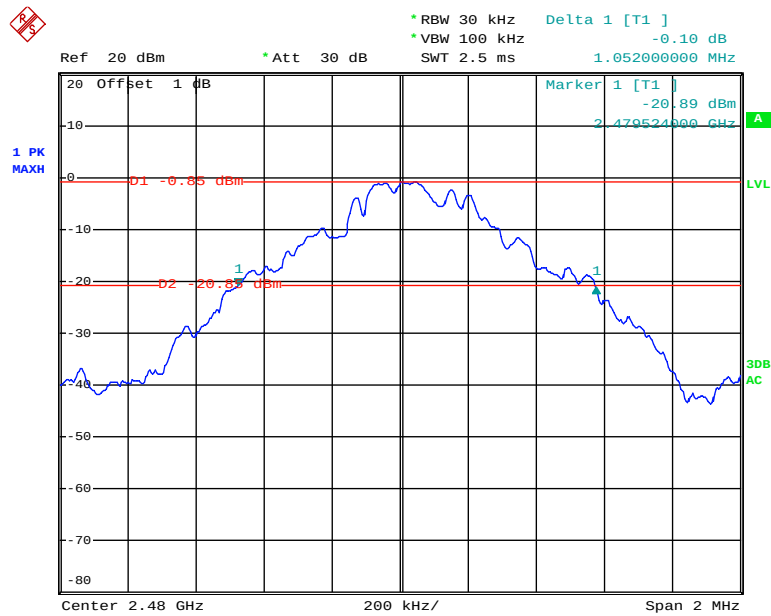
Date: 9.MAR.2019 10:32:00

Middle Channel



Date: 9.MAR.2019 10:34:17

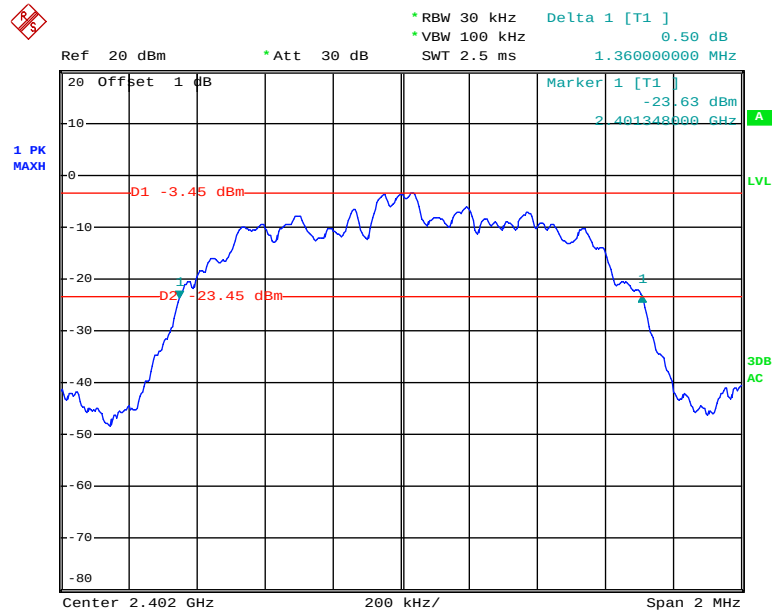
High Channel



Date: 9.MAR.2019 10:35:46

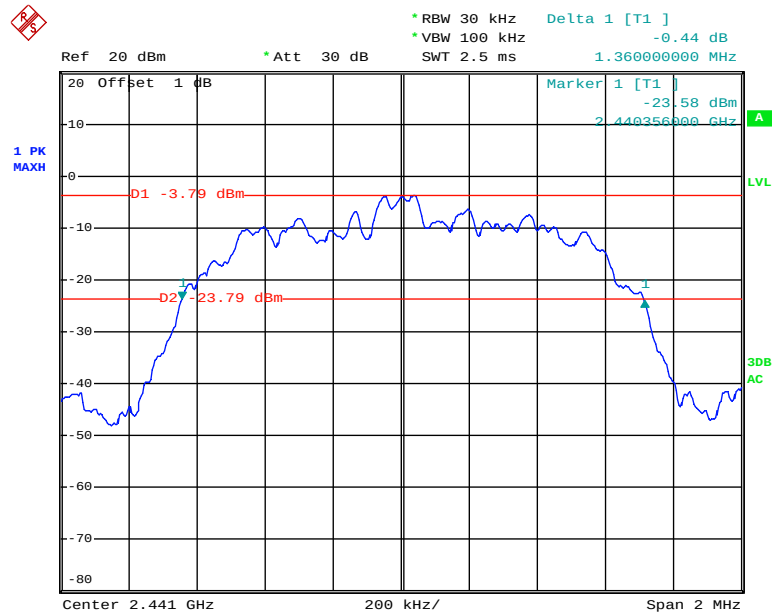
EDR Mode ($\pi/4$ -DQPSK):

Low Channel



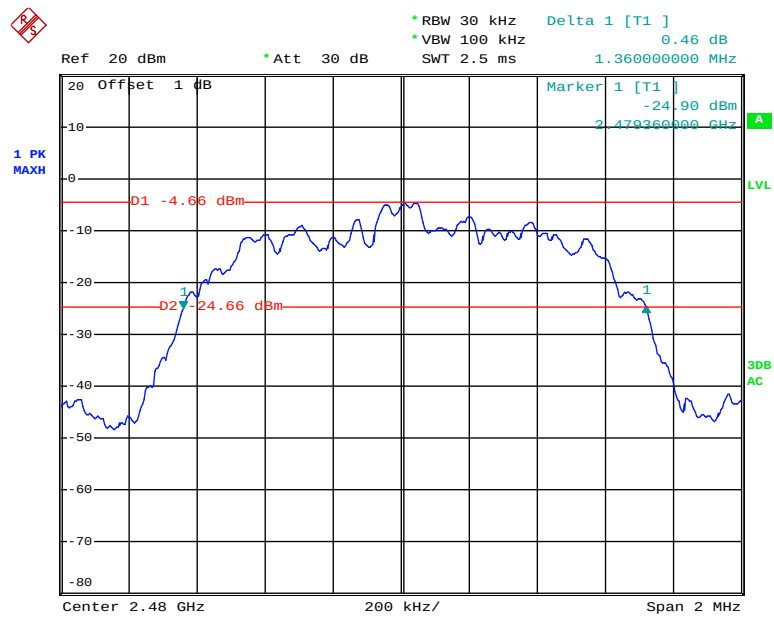
Date: 9.MAR.2019 10:38:45

Middle Channel



Date: 9.MAR.2019 10:40:58

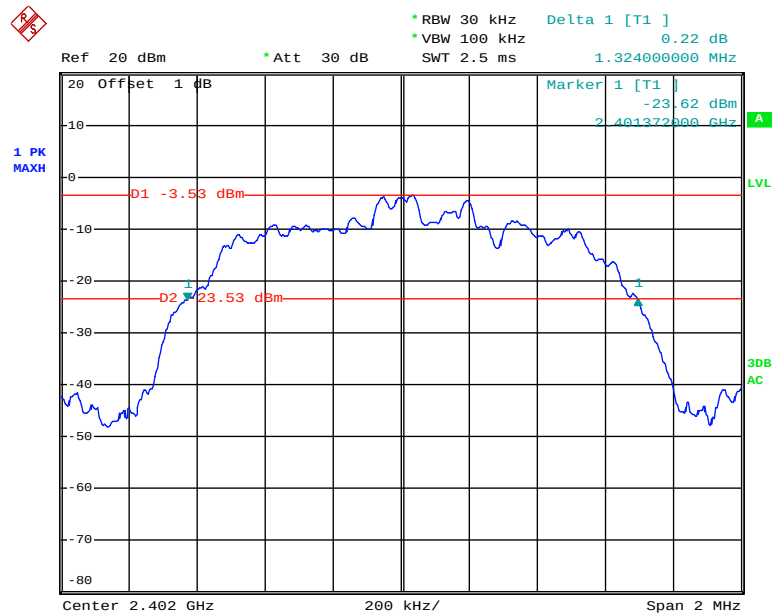
High Channel



Date: 9.MAR.2019 10:43:45

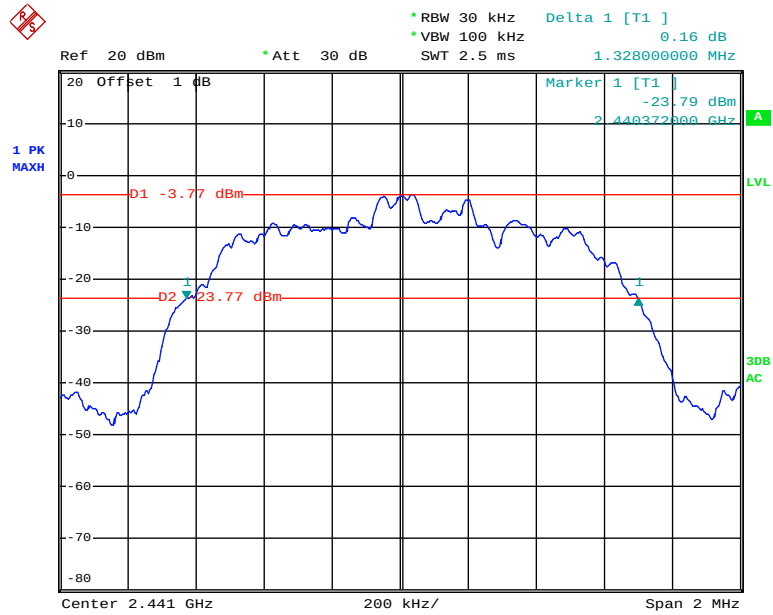
EDR Mode (8DPSK):

Low Channel



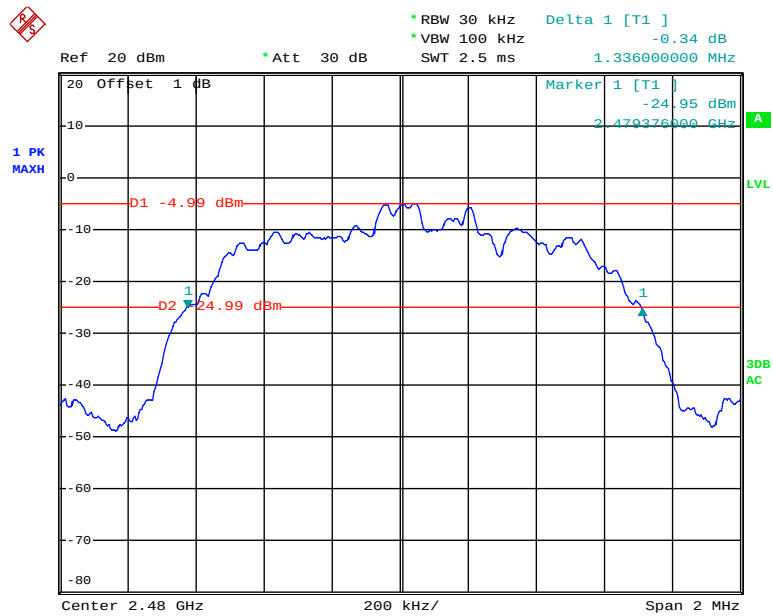
Date: 9.MAR.2019 10:46:06

Middle Channel



Date: 9.MAR.2019 10:48:30

High Channel



Date: 9.MAR.2019 10:50:04

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	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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

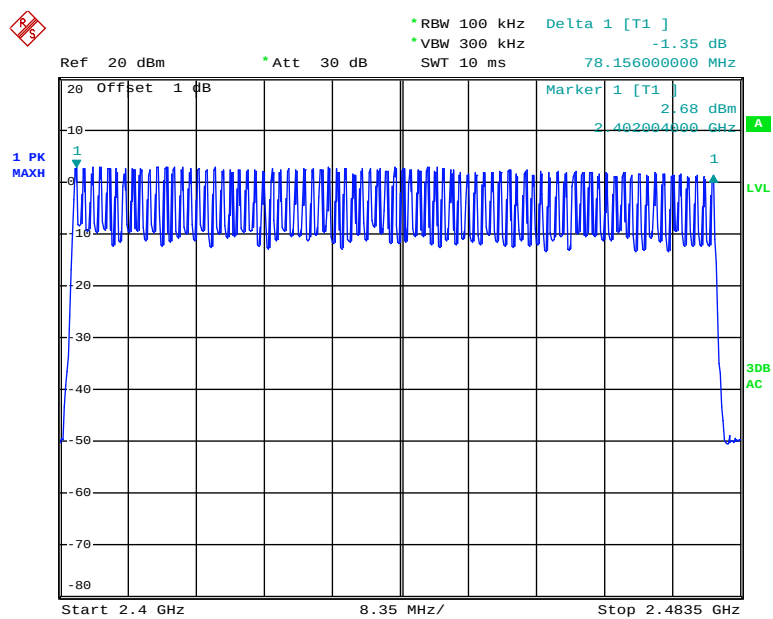
Temperature:	23 °C
Relative Humidity:	63 %
ATM Pressure:	100.9 kPa
Test by:	Carrie He
Test Date:	2019-03-09

Test Result: Compliance.

Please refer to following tables and plots

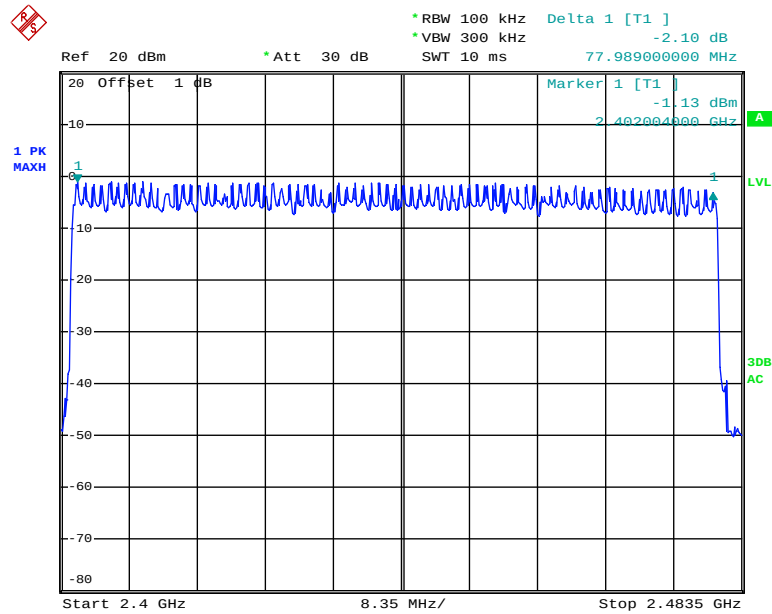
Test Mode: Transmitting

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

BDR Mode (GFSK)

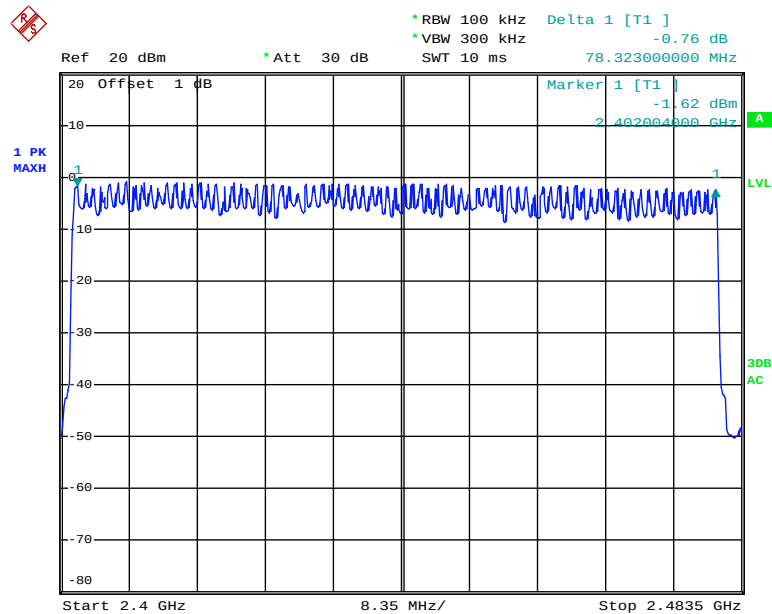
Date: 9.MAR.2019 11:12:32

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



Date: 9.MAR.2019 11:15:05

EDR Mode (8DPSK)



Date: 9.MAR.2019 11:17:21

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	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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**

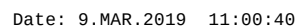
Temperature:	23 °C
Relative Humidity:	63 %
ATM Pressure:	100.9 kPa
Test by:	Carrie He
Test Date:	2019-03-09

Test Result: Compliance.

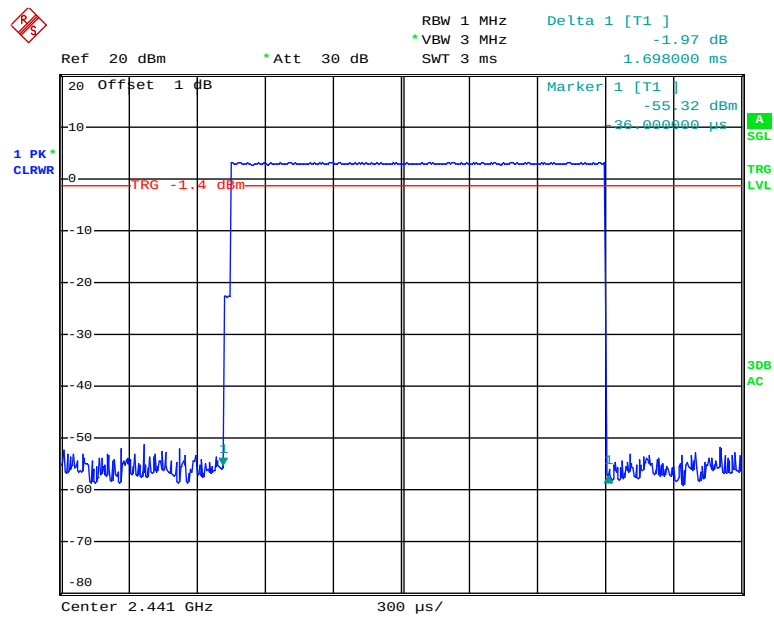
Please refer to following tables and plots

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	1.698	0.272	
	DH5	Middle	2441	2.950	0.315	
$\pi/4$ -DQPSK	2DH1	Middle	2441	0.434	0.139	
	2DH3	Middle	2441	1.698	0.272	
	2DH5	Middle	2441	2.970	0.317	
8DPSK	3DH1	Middle	2441	0.434	0.139	
	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						

DH1: Middle Channel

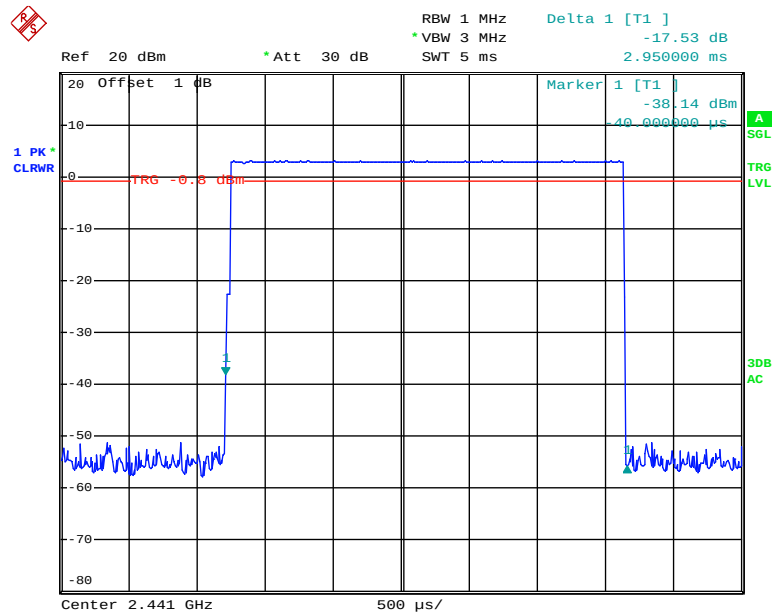


DH3: Middle Channel



Date: 9.MAR.2019 11:01:44

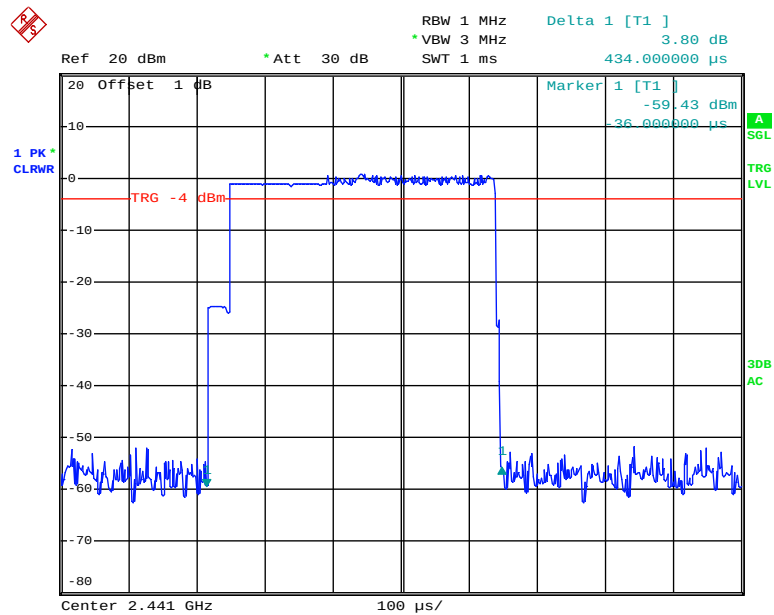
DH5: Middle Channel



Date: 9.MAR.2019 11:02:16

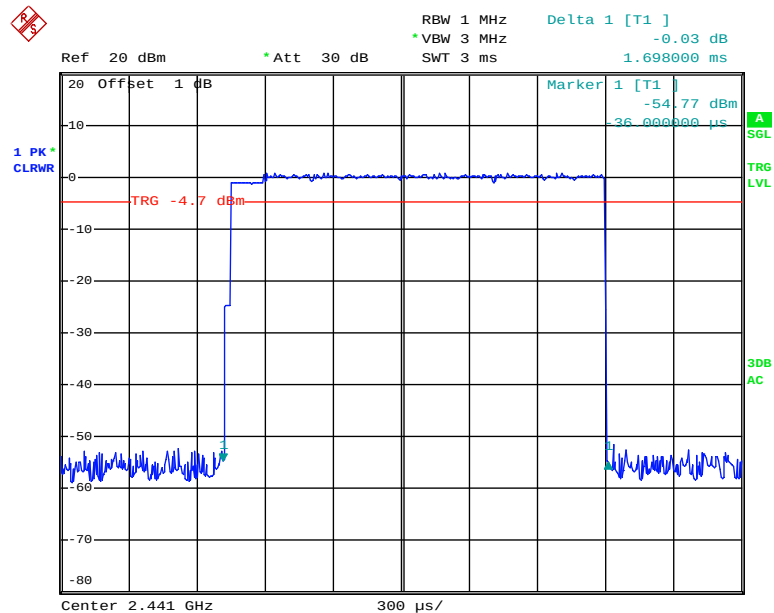
2EDR Mode ($\pi/4$ -DQPSK):

2DH1: Middle Channel

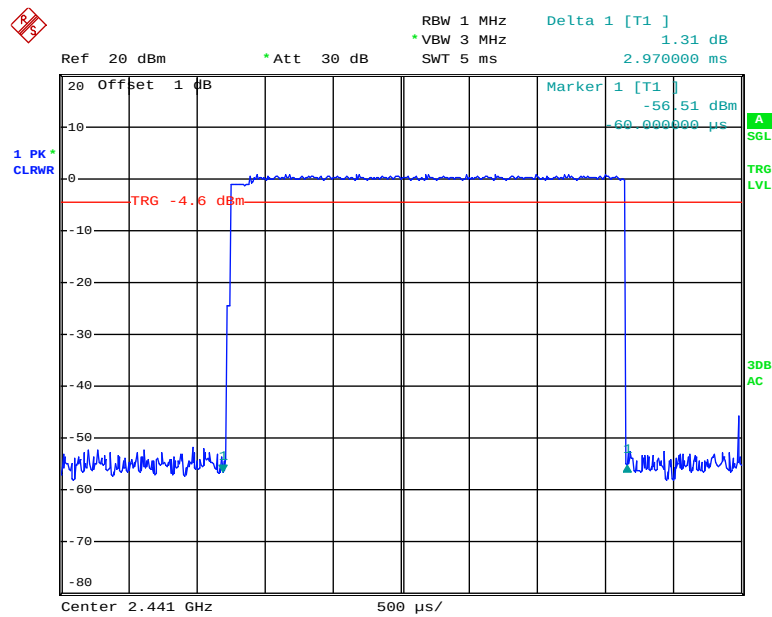


Date: 9.MAR.2019 11:05:59

2DH3: Middle Channel

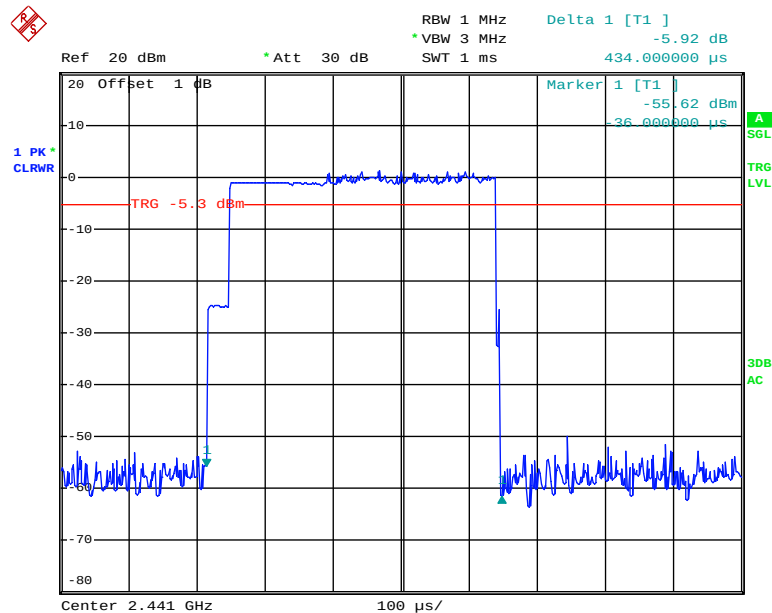


Date: 9.MAR.2019 11:06:31

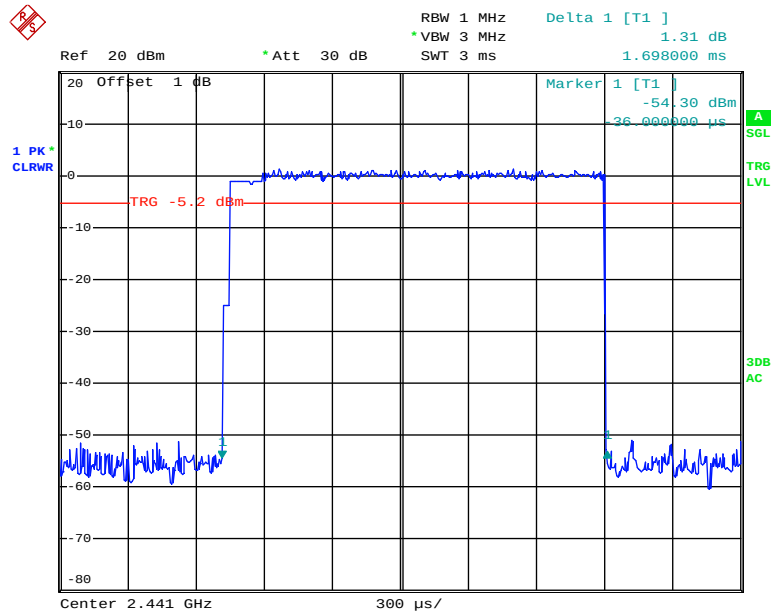
2DH5: Middle Channel

Date: 9.MAR.2019 11:09:07

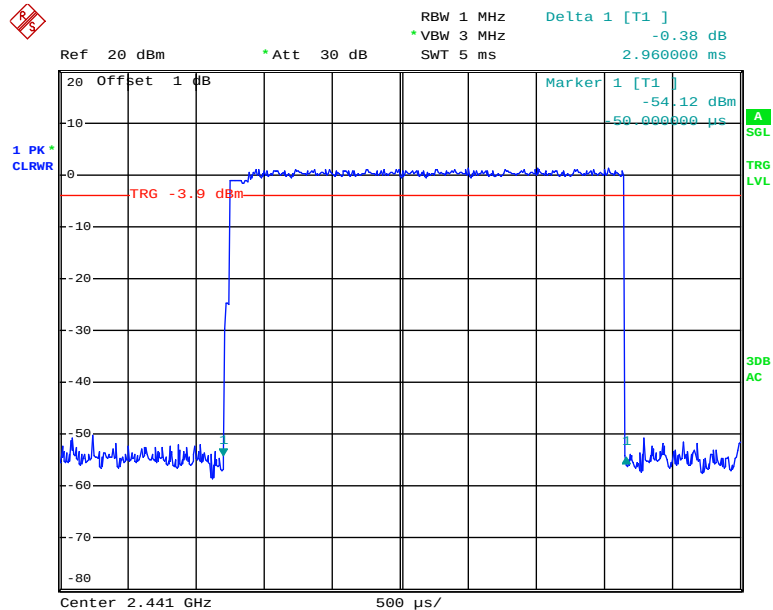
3EDR Mode 8DPSK):

3DH1: Middle Channel

Date: 9.MAR.2019 11:09:42

3DH3: Middle Channel

Date: 9.MAR.2019 11:10:06

3DH5: Middle Channel

Date: 9.MAR.2019 11:10:32

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
R&S	EMI Test Receiver	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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**

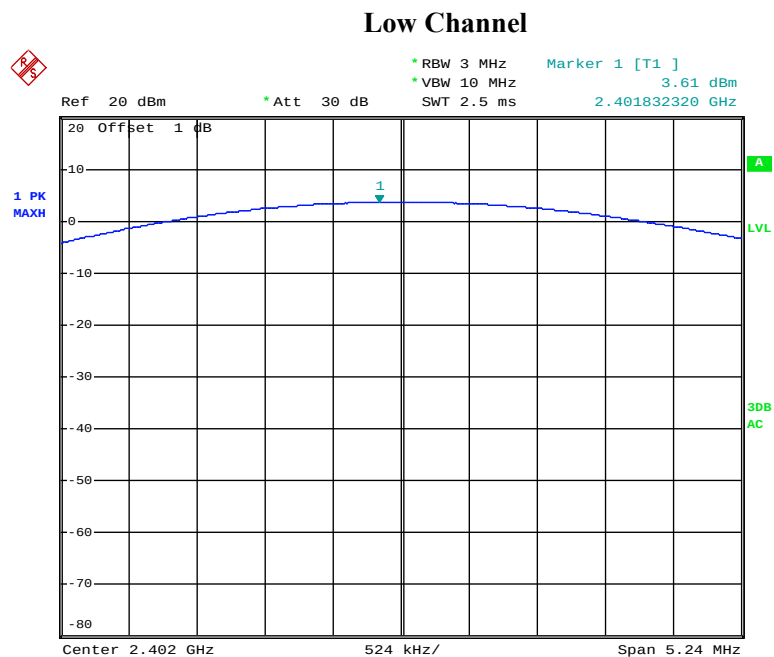
Temperature:	23 °C
Relative Humidity:	63 %
ATM Pressure:	100.9 kPa
Test by:	Carrie He
Test Date:	2019-03-09

Test Result: Compliance.

Test Mode: Transmitting

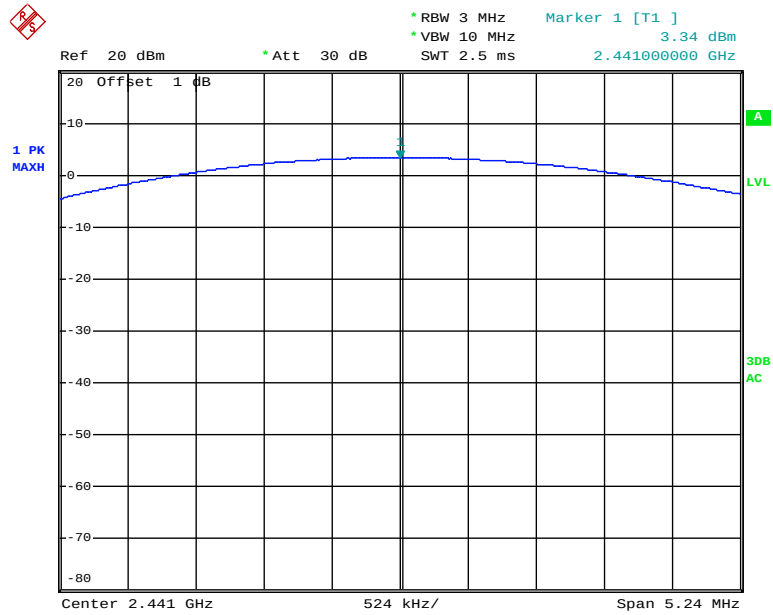
Mode	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	3.61	21
	2441	3.34	21
	2480	2.45	21
EDR Mode ($\pi/4$ -DQPSK)	2402	1.87	21
	2441	1.47	21
	2480	0.44	21
EDR Mode (8DPSK)	2402	2.30	21
	2441	2.05	21
	2480	0.92	21

Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

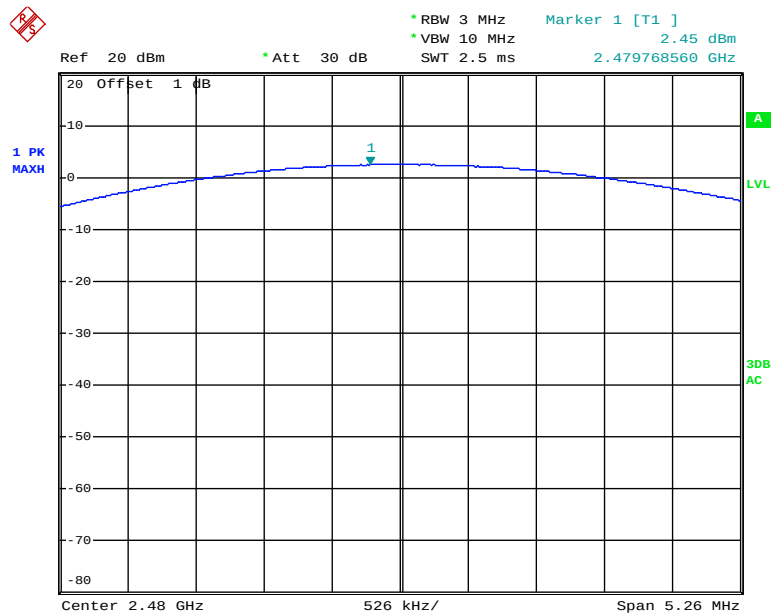
Date: 9.MAR.2019 10:32:32

Middle Channel

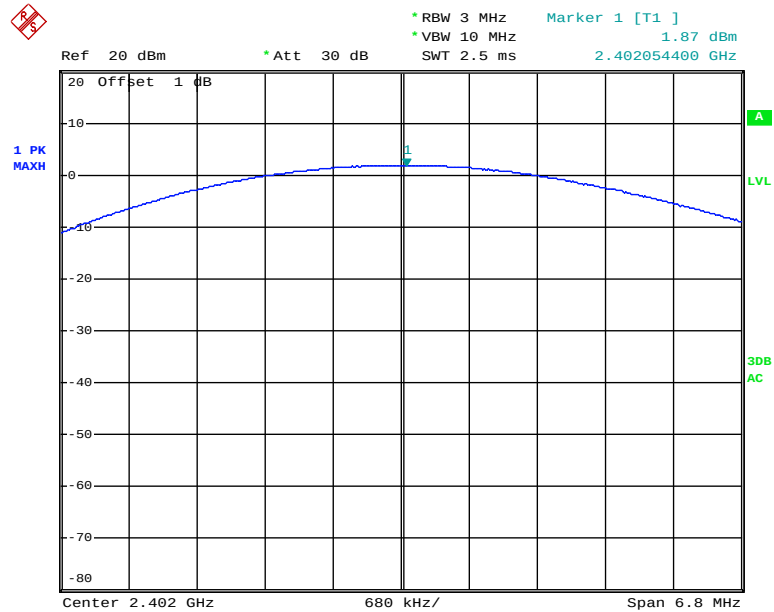


Date: 9.MAR.2019 10:34:46

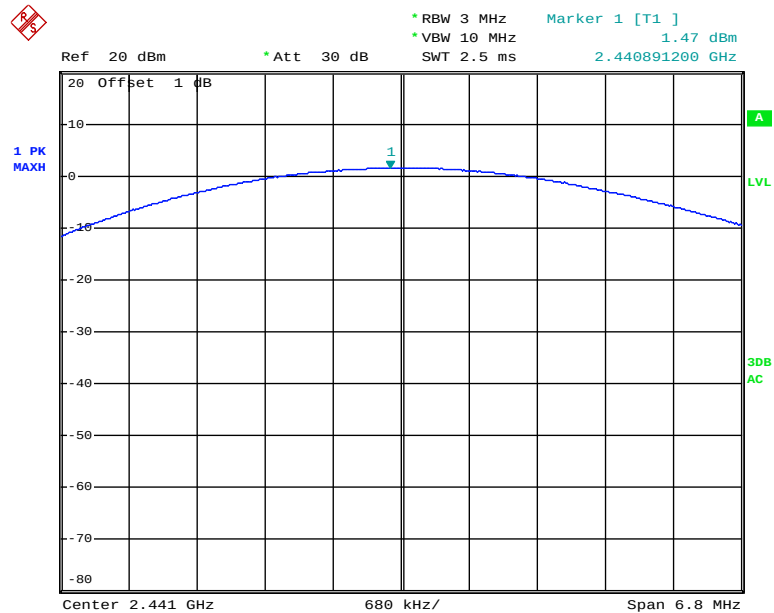
High Channel



Date: 9.MAR.2019 10:36:12

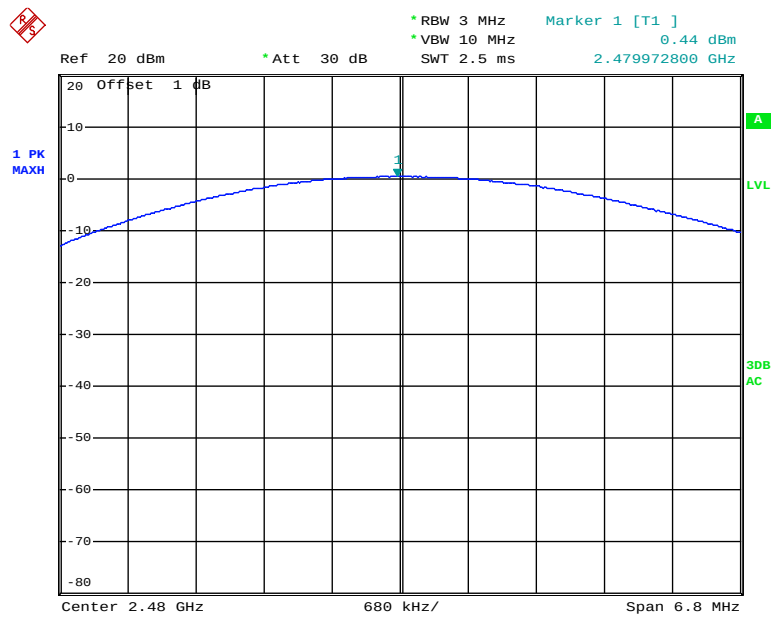
*EDR Mode ($\pi/4$ -DQPSK):***Low Channel**

Date: 9.MAR.2019 10:39:16

Middle Channel

Date: 9.MAR.2019 10:41:32

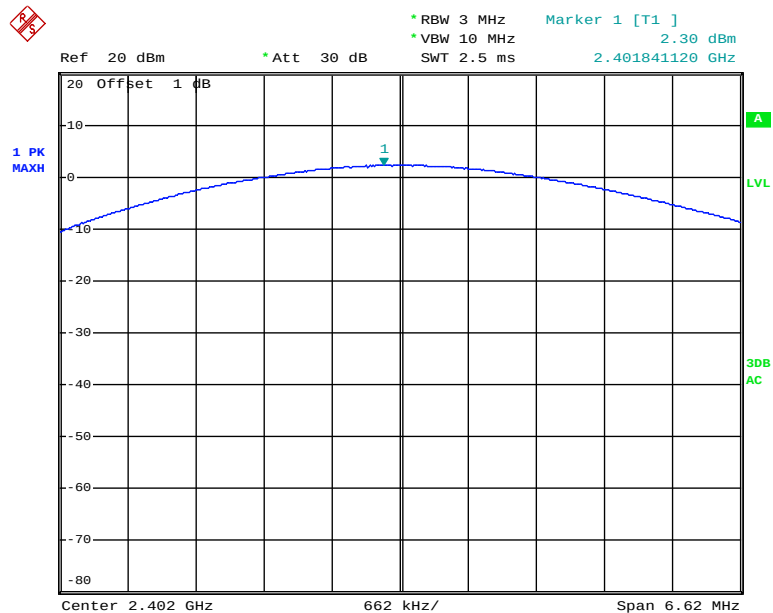
High Channel



Date: 9.MAR.2019 10:44:20

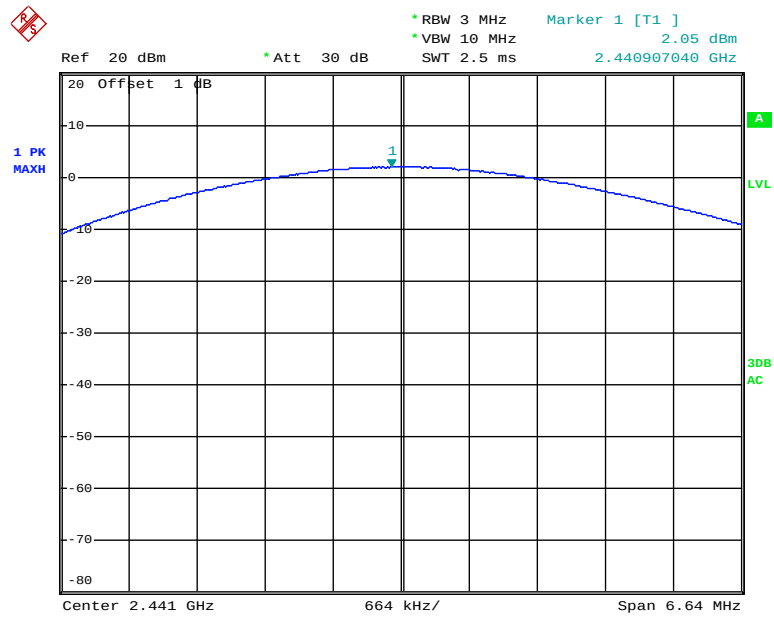
EDR Mode (8DPSK):

Low Channel



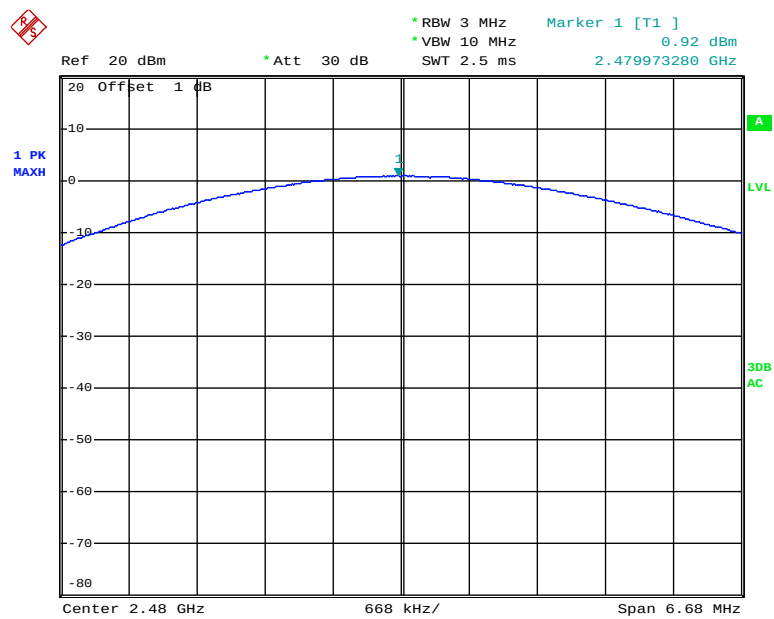
Date: 9.MAR.2019 10:46:41

Middle Channel



Date: 9.MAR.2019 10:49:01

High Channel



Date: 9.MAR.2019 10:50:35

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

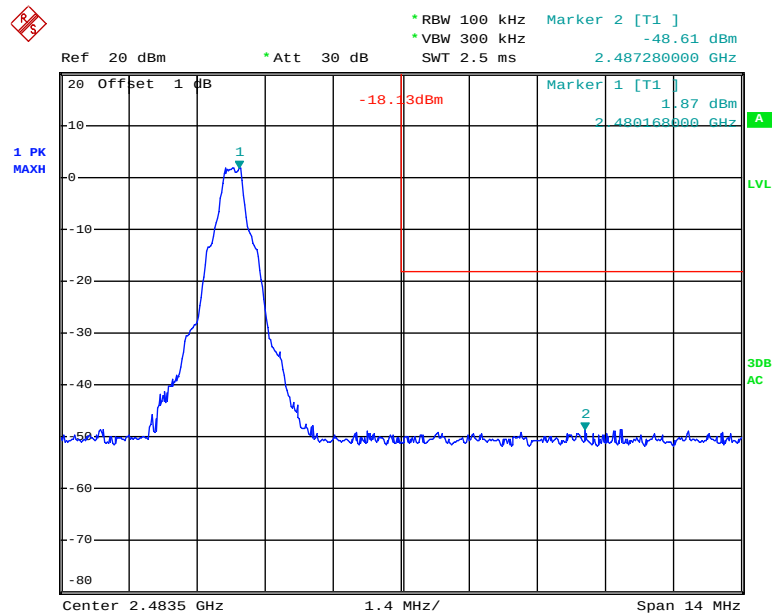
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting 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	ESCI	101121	2018-03-23	2019-03-23
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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).

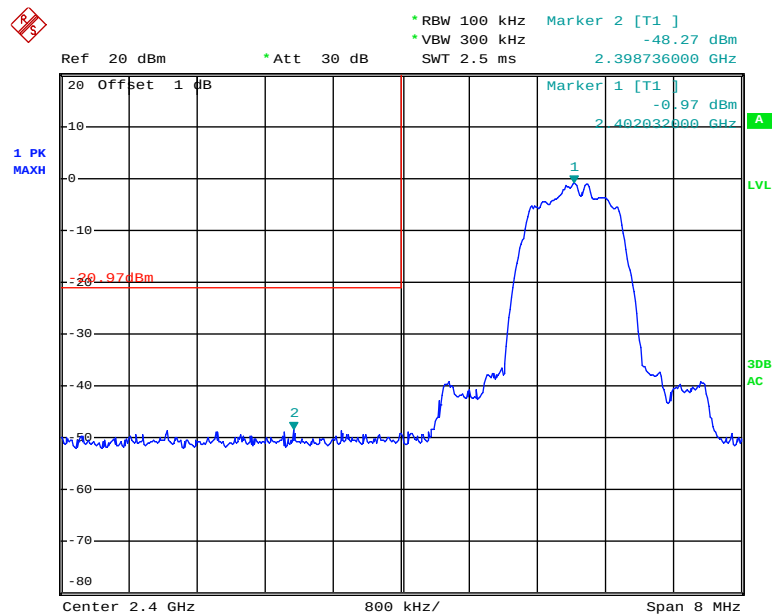
Band Edge, Right Side



Date: 9.MAR.2019 10:36:34

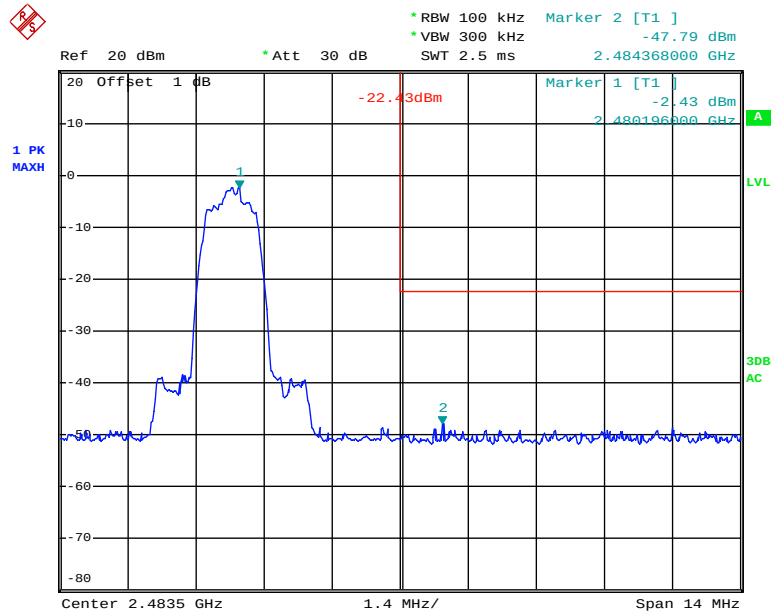
EDR Mode ($\pi/4$ -DQPSK):

Band Edge, Left Side



Date: 9.MAR.2019 10:39:38

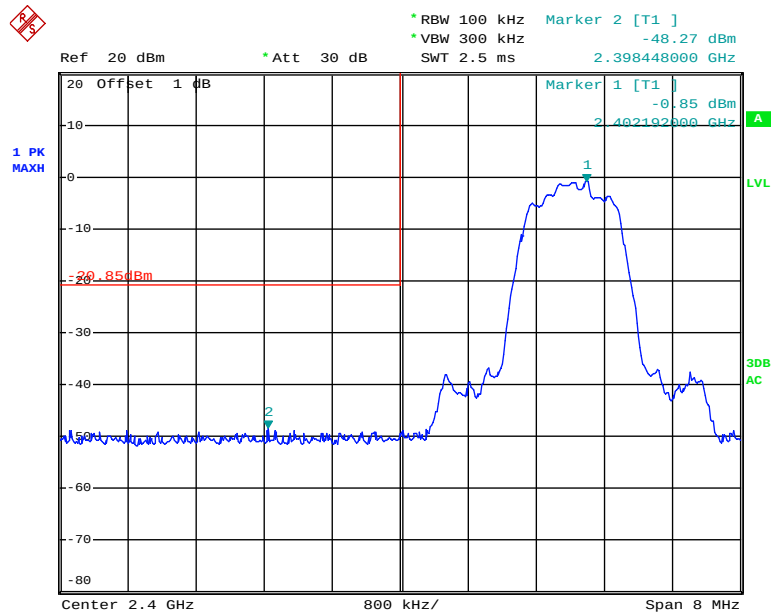
Band Edge, Right Side



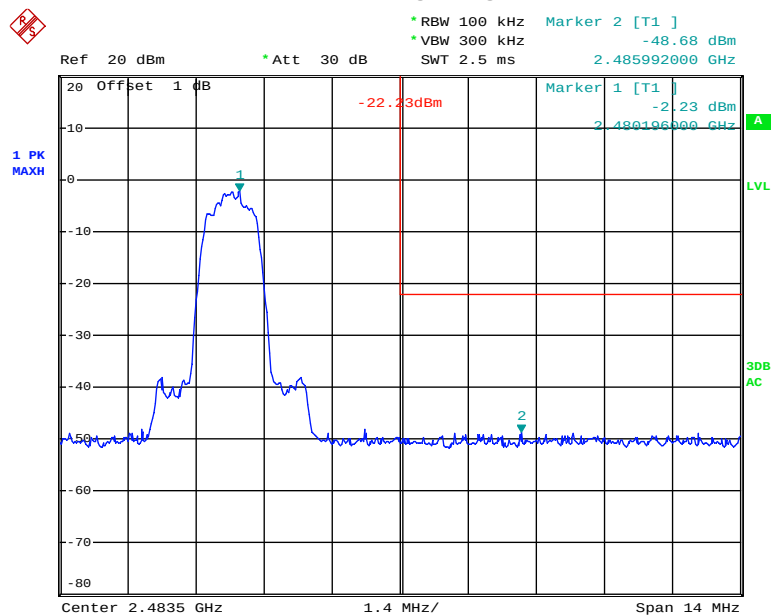
Date: 9.MAR.2019 10:44:42

EDR Mode (8DPSK):

Band Edge, Left Side

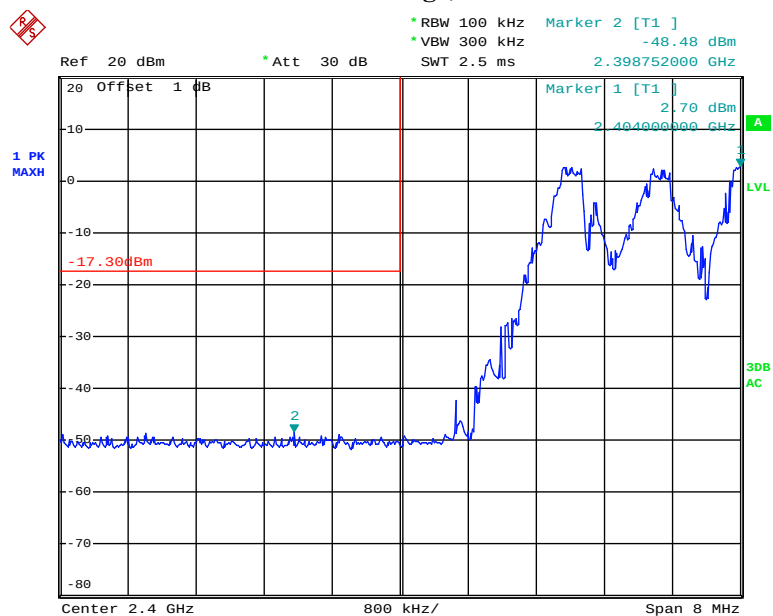


Date: 9.MAR.2019 10:47:09

Band Edge, Right Side

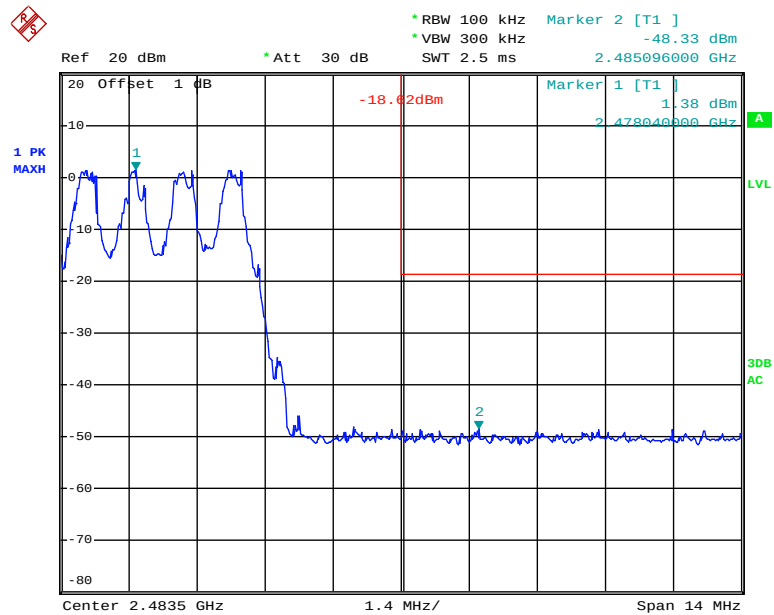
Date: 9.MAR.2019 10:51:04

*Hopping Mode,
BDR Mode (GFSK):*

Band Edge, Left Side

Date: 9.MAR.2019 10:53:43

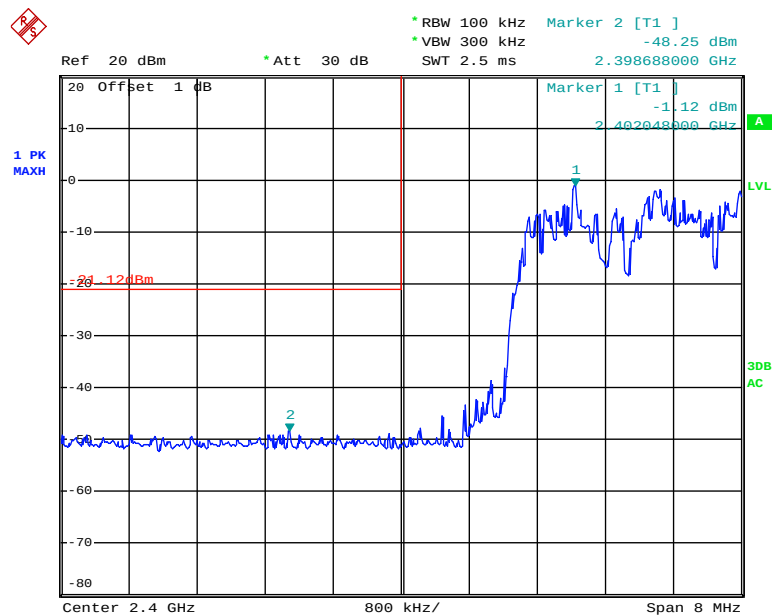
Band Edge, Right Side



Date: 9.MAR.2019 10:54:35

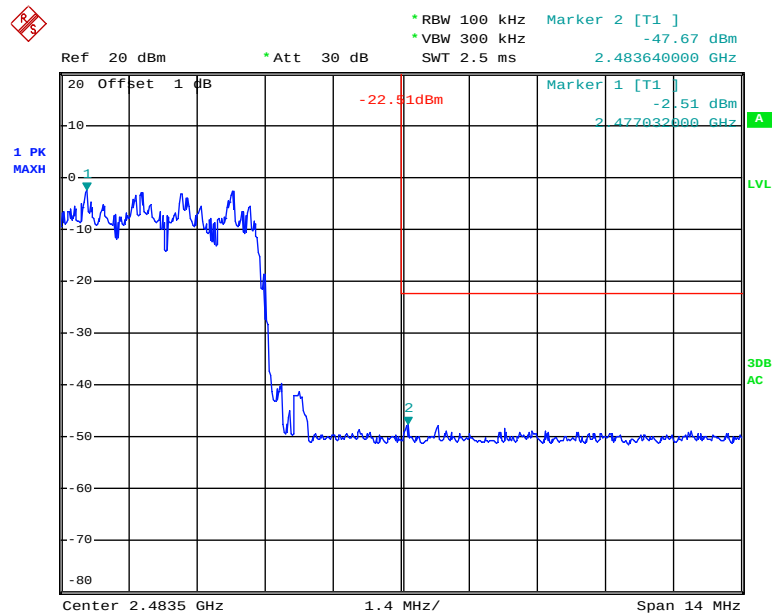
EDR Mode ($\pi/4$ -DQPSK):

Band Edge, Left Side



Date: 9.MAR.2019 10:56:04

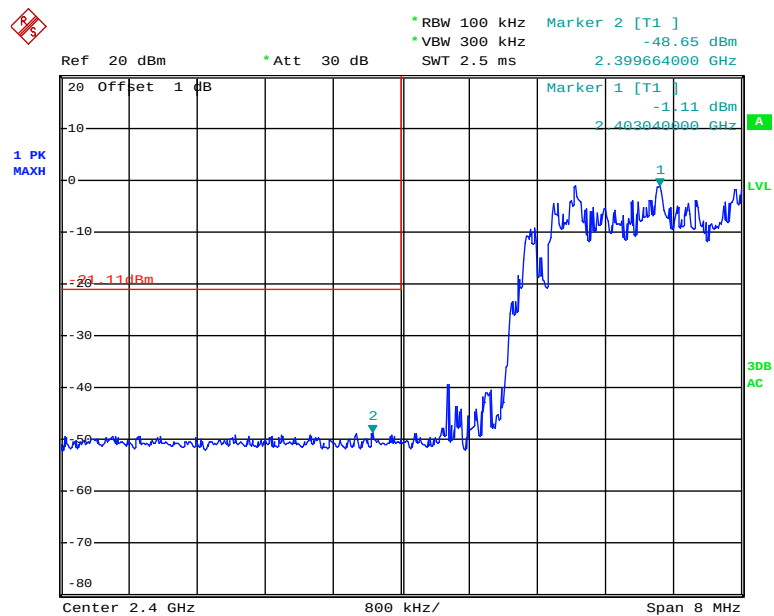
Band Edge, Right Side



Date: 9.MAR.2019 10:57:03

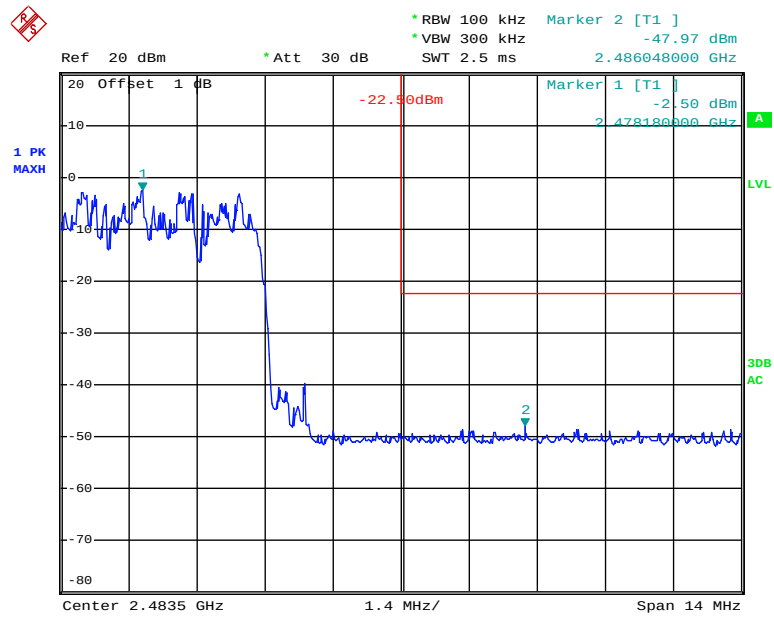
EDR Mode (8DPSK):

Band Edge, Left Side



Date: 9.MAR.2019 10:57:58

Band Edge, Right Side



Date: 9.MAR.2019 10:58:44

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