

FCC PART 15.247
TEST REPORT

For

Klipsch L.L.C.

3502 Woodview Trace, Suite 200, Indianapolis, IN 46268, United States

FCC ID: STI-R5BT

Report Type: Original Report	Product Name: Bluetooth Headset
Report Number: RDG170825005-00A	
Report Date: 2017-09-05	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	6
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	6
SUPPORT CABLE LIST AND DETAILS	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS.....	8
FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE.....	9
APPLICABLE STANDARD	9
FCC §15.203 - ANTENNA REQUIREMENT.....	10
APPLICABLE STANDARD	10
ANTENNA CONNECTOR CONSTRUCTION	10
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS	11
APPLICABLE STANDARD	11
EUT SETUP	11
EMI TEST RECEIVER SETUP.....	11
TEST PROCEDURE	11
CORRECTED AMPLITUDE & MARGIN CALCULATION	12
TEST EQUIPMENT LIST AND DETAILS.....	12
TEST DATA	12
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	15
APPLICABLE STANDARD	15
EUT SETUP	15
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	16
TEST PROCEDURE	16
TEST EQUIPMENT LIST AND DETAILS.....	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	17
TEST DATA	17
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST	23
APPLICABLE STANDARD	23
TEST EQUIPMENT LIST AND DETAILS.....	23
TEST PROCEDURE	23
TEST DATA	23
FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING.....	29
APPLICABLE STANDARD	29
TEST PROCEDURE	29

TEST EQUIPMENT LIST AND DETAILS.....	29
TEST DATA	29
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST	35
APPLICABLE STANDARD	35
TEST PROCEDURE	35
TEST EQUIPMENT LIST AND DETAILS.....	35
TEST DATA	35
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	55
APPLICABLE STANDARD	55
TEST PROCEDURE	55
TEST EQUIPMENT LIST AND DETAILS.....	55
TEST DATA	55
FCC §15.247(d) - BAND EDGES TESTING	61
APPLICABLE STANDARD	61
TEST PROCEDURE	61
TEST EQUIPMENT LIST AND DETAILS.....	61
TEST DATA	62

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The **Klipsch L.L.C.** 's product, model number: **R5 NECKBAND WIRELESS (FCC ID: STI-R5BT)** (the "EUT") in this report was a **Bluetooth Headset**, which was measured approximately: 185 mm (L) x 155 mm (W) x 22 mm (H), DC3.7V from Battery or DC 5V from USB port.

**All measurement and test data in this report was gathered from production sample serial number: 170825005 (Assigned by BACL,Dongguan). The EUT was received on 2017-08-25.*

Objective

This report is prepared on behalf of **Klipsch L.L.C.** 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 15C DTS submissions with FCC ID: STI-R5BT .

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: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 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

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO 17025 by CNAS(Lab code: L5662). And accredited to ISO 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

EUT Exercise Software

The test software: 'Blue Test3' configured the maximum power level as below setting:

Test Software Version	Blue Test3		
Test Frequency	2402MHz	2441MHz	2480MHz
GFSK	63	63	63
$\pi/4$ -DQPSK	100	100	100
8-DPSK	100	100	100

Equipment Modifications

No modification was made to the EUT.

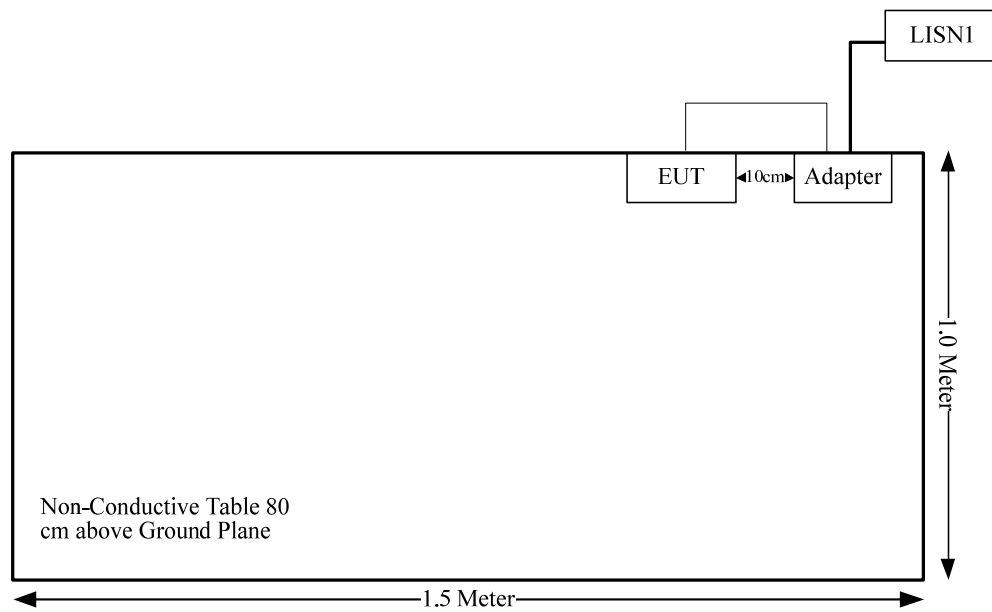
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
HuaJin Electronics CO.LTD	Adapter	HJ-0501000B3-EU	03051216d003510

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
USB Cable	No	No	0.5	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§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

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$
 ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

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

Measurement Result

The max conducted power including tune-up tolerance is 3 dBm (2.0 mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$
 $= 2.0/5 \cdot (\sqrt{2.480}) = 0.6 < 3.0$

So the stand-alone SAR evaluation is not necessary.

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 for BT, and the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

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	2016-12-08	2017-12-08
R&S	L.I.S.N	ESH2-Z5	892107/021	2016-09-01	2017-09-01
R&S	Two-line V-network	ENV 216	3560.6550.12	2016-12-08	2017-12-08
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
Unknown	Coaxial Cable	2m	Con-1	2016-09-01	2017-09-01

* **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

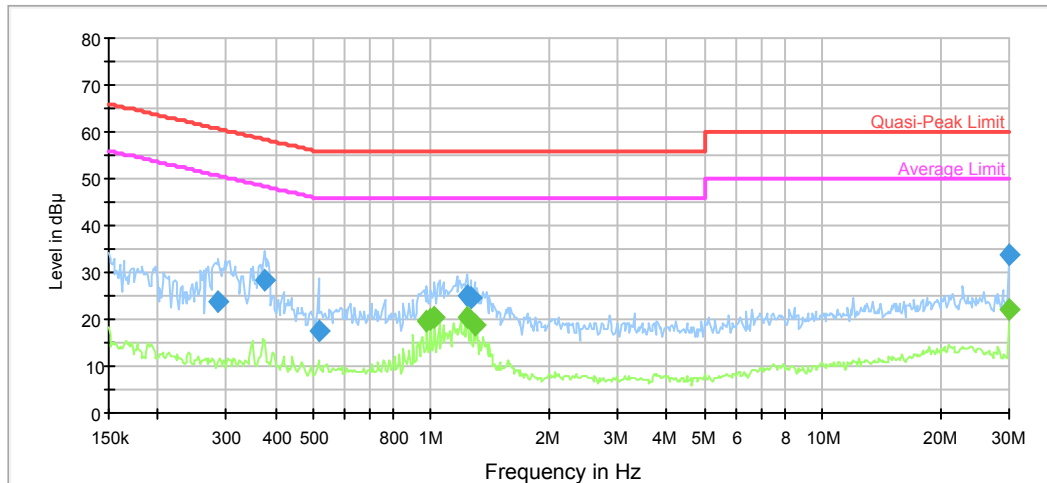
Environmental Conditions

Temperature:	27.6 °C
Relative Humidity:	45 %
ATM Pressure:	100.2 kPa

The testing was performed by Ade Xiao on 2017-08-31.

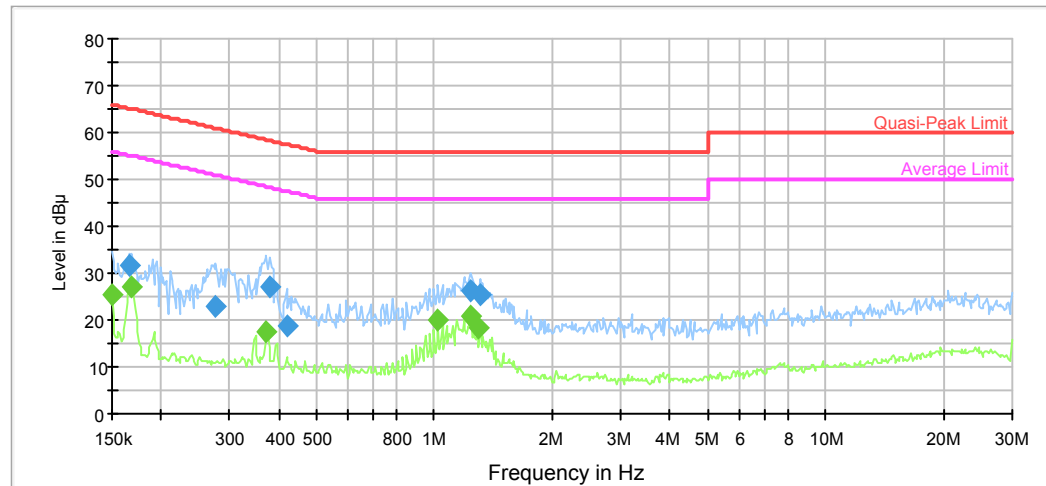
Test Mode: Transmitting

AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.286019	23.8	9.000	L1	10.2	36.8	60.6	Compliance
0.375019	28.2	9.000	L1	10.0	30.2	58.4	Compliance
0.515791	17.4	9.000	L1	9.9	38.6	56.0	Compliance
1.239175	25.2	9.000	L1	9.7	30.8	56.0	Compliance
1.259081	24.4	9.000	L1	9.7	31.6	56.0	Compliance
30.000000	33.7	9.000	L1	10.1	26.3	60.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.975701	19.5	9.000	L1	9.8	26.5	46.0	Compliance
0.999305	20.2	9.000	L1	9.8	25.8	46.0	Compliance
1.023481	20.2	9.000	L1	9.8	25.8	46.0	Compliance
1.239175	20.4	9.000	L1	9.7	25.6	46.0	Compliance
1.289541	18.7	9.000	L1	9.7	27.3	46.0	Compliance
30.000000	22.2	120.000	L1	10.1	27.8	50.0	Compliance

AC120V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.166371	31.7	9.000	N	10.9	33.4	65.1	Compliance
0.277046	22.7	9.000	N	10.2	38.2	60.9	Compliance
0.381043	27.2	9.000	N	10.0	31.1	58.3	Compliance
0.419276	18.8	9.000	N	9.9	38.7	57.5	Compliance
1.239175	26.2	9.000	N	9.7	29.8	56.0	Compliance
1.310256	25.3	9.000	N	9.7	30.7	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	25.4	9.000	N	11.2	30.6	56.0	Compliance
0.167702	27.1	9.000	N	10.9	28.0	55.1	Compliance
0.372042	17.3	9.000	N	10.0	31.2	48.5	Compliance
1.023481	20.2	9.000	N	9.7	25.8	46.0	Compliance
1.239175	21.0	9.000	N	9.7	25.0	46.0	Compliance
1.289541	18.5	9.000	N	9.7	27.5	46.0	Compliance

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

Applicable Standard

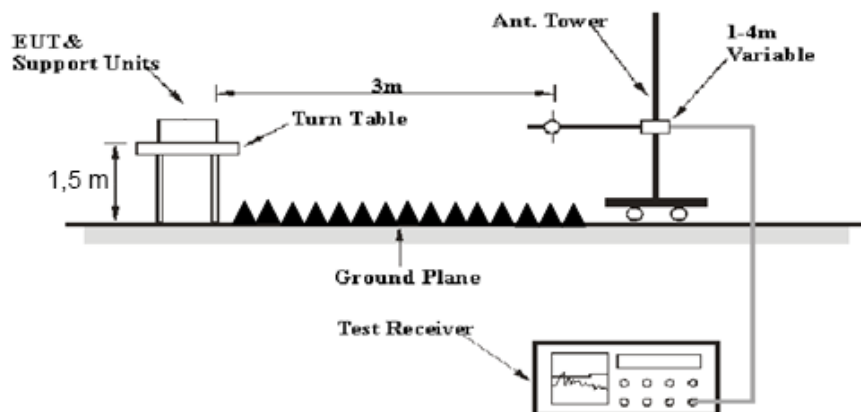
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 3 meters chamber test site, above 1GHz tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 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.

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

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	ESCI	100224	2017-09-01	2018-09-01
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
R&S	EMI Test Receiver	ESCI	101121	2017-03-02	2018-03-02
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2017-06-16	2020-06-15
MITEQ	Amplifier	AFS42-00101800- 25-S-42	2001271	2016-09-05	2017-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2016-09-06	2017-09-06
Unknown	Coaxial Cable	Chamber A-1	4m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-1	0.75m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber A-2	10m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	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).

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:

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

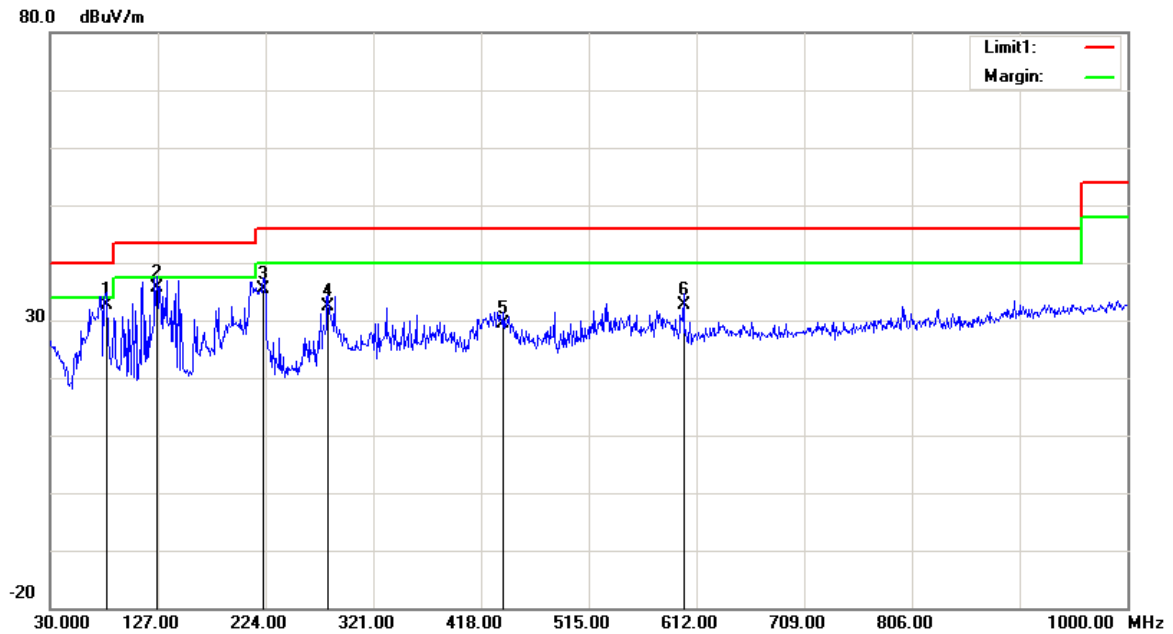
Test Data

Environmental Conditions

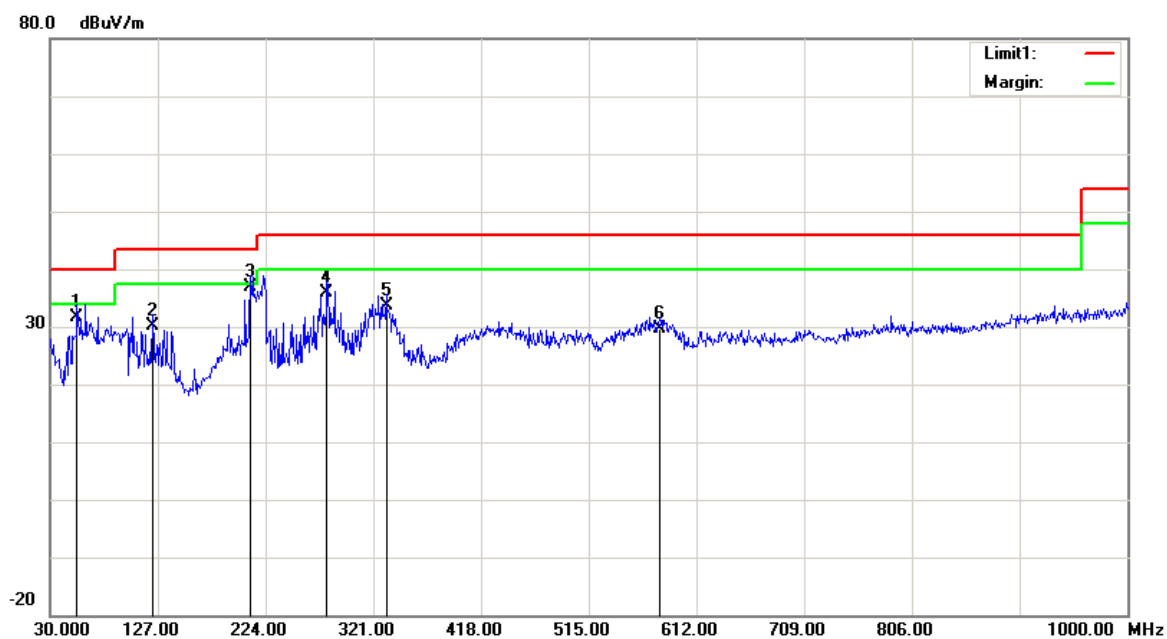
Temperature:	28.4 °C
Relative Humidity:	30 %
ATM Pressure:	100 kPa

** The testing was performed by Blake Yang on 2017-09-01.*

Test Mode: Transmitting

1) 30MHz-1GHz(GFSK High channel was the worst)**Horizontal:**

Frequency (MHz)	Receiver Reading (dBμV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
80.4400	43.94	QP	-11.24	32.70	40.00	7.30
126.0300	40.57	QP	-4.97	35.60	43.50	7.90
222.0600	42.43	QP	-7.03	35.40	46.00	10.60
280.2600	36.18	QP	-3.78	32.40	46.00	13.60
438.3700	31.26	QP	-1.76	29.50	46.00	16.50
600.3600	32.52	QP	0.18	32.70	46.00	13.30

Vertical:

Frequency (MHz)	Receiver Reading (dBμV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
54.2500	44.09	QP	-12.39	31.70	40.00	8.30
122.1500	34.83	QP	-4.73	30.10	43.50	13.40
210.4200	44.62	QP	-7.62	37.00	43.50	6.50
279.2900	39.60	QP	-3.80	35.80	46.00	10.20
332.6400	37.40	QP	-3.80	33.60	46.00	12.40
579.0200	29.02	QP	0.58	29.60	46.00	16.40

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)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2402 MHz									
2402	72.62	PK	H	28.10	3.11	0.00	103.83	N/A	N/A
2402	62.15	AV	H	28.10	3.11	0.00	93.36	N/A	N/A
2402	67.31	PK	V	28.10	3.11	0.00	98.52	N/A	N/A
2402	57.41	AV	V	28.10	3.11	0.00	88.62	N/A	N/A
2390	25.54	PK	H	28.08	3.10	0.00	56.72	74.00	17.28
2390	13.36	AV	H	28.08	3.10	0.00	44.54	54.00	9.46
4804	58.18	PK	H	32.91	4.30	35.48	59.91	74.00	14.09
4804	47.25	AV	H	32.91	4.30	35.48	48.98	54.00	5.02
7206	45.36	PK	H	35.74	5.45	35.97	50.58	74.00	23.42
7206	32.26	AV	H	35.74	5.45	35.97	37.48	54.00	16.52
2987	45.39	PK	H	30.05	3.42	35.31	43.55	74.00	30.45
2987	32.52	AV	H	30.05	3.42	35.31	30.68	54.00	23.32
Middle Channel: 2441 MHz									
2441	72.11	PK	H	28.18	3.11	0.00	103.40	N/A	N/A
2441	62.57	AV	H	28.18	3.11	0.00	93.86	N/A	N/A
2441	66.82	PK	V	28.18	3.11	0.00	98.11	N/A	N/A
2441	56.41	AV	V	28.18	3.11	0.00	87.70	N/A	N/A
4882	59.32	PK	H	33.06	4.40	35.54	61.24	74.00	12.76
4882	48.26	AV	H	33.06	4.40	35.54	50.18	54.00	3.82
7323	48.41	PK	H	36.04	5.53	35.98	54.00	74.00	20.00
7323	34.57	AV	H	36.04	5.53	35.98	40.16	54.00	13.84
3196	50.26	PK	H	30.57	3.54	35.20	49.17	74.00	24.83
3196	40.21	AV	H	30.57	3.54	35.20	39.12	54.00	14.88
2985	45.36	PK	H	30.05	3.42	35.31	43.52	74.00	30.48
2985	32.57	AV	H	30.05	3.42	35.31	30.73	54.00	23.27
High Channel: 2480 MHz									
2480	71.63	PK	H	28.26	3.10	0.00	102.99	N/A	N/A
2480	60.59	AV	H	28.26	3.10	0.00	91.95	N/A	N/A
2480	66.51	PK	V	28.26	3.10	0.00	97.87	N/A	N/A
2480	56.38	AV	V	28.26	3.10	0.00	87.74	N/A	N/A
2483.5	25.61	PK	H	28.27	3.10	0.00	56.98	74.00	17.02
2483.5	13.59	AV	H	28.27	3.10	0.00	44.96	54.00	9.04
4960	57.67	PK	H	33.22	4.42	35.60	59.71	74.00	14.29
4960	47.58	AV	H	33.22	4.42	35.60	49.62	54.00	4.38
7440	48.51	PK	H	36.34	5.60	35.99	54.46	74.00	19.54
7440	34.69	AV	H	36.34	5.60	35.99	40.64	54.00	13.36
3196	50.21	PK	H	30.57	3.54	35.20	49.12	74.00	24.88
3196	40.23	AV	H	30.57	3.54	35.20	39.14	54.00	14.86

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

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2402 MHz									
2402	71.02	PK	H	28.10	3.11	0.00	102.23	N/A	N/A
2402	59.66	AV	H	28.10	3.11	0.00	90.87	N/A	N/A
2402	66.93	PK	V	28.10	3.11	0.00	98.14	N/A	N/A
2402	56.89	AV	V	28.10	3.11	0.00	88.10	N/A	N/A
2390	26.15	PK	H	28.08	3.10	0.00	57.33	74.00	16.67
2390	13.69	AV	H	28.08	3.10	0.00	44.87	54.00	9.13
4804	51.19	PK	H	32.91	4.30	35.48	52.92	74.00	21.08
4804	41.68	AV	H	32.91	4.30	35.48	43.41	54.00	10.59
7206	45.69	PK	H	35.74	5.45	35.97	50.91	74.00	23.09
7206	32.68	AV	H	35.74	5.45	35.97	37.90	54.00	16.10
3196	50.26	PK	H	30.57	3.54	35.20	49.17	74.00	24.83
3196	40.36	AV	H	30.57	3.54	35.20	39.27	54.00	14.73
Middle Channel: 2441 MHz									
2441	71.51	PK	H	28.18	3.11	0.00	102.80	N/A	N/A
2441	60.58	AV	H	28.18	3.11	0.00	91.87	N/A	N/A
2441	65.97	PK	V	28.18	3.11	0.00	97.26	N/A	N/A
2441	55.88	AV	V	28.18	3.11	0.00	87.17	N/A	N/A
4882	53.62	PK	H	33.06	4.40	35.54	55.54	74.00	18.46
4882	43.68	AV	H	33.06	4.40	35.54	45.60	54.00	8.40
7323	48.54	PK	H	36.04	5.53	35.98	54.13	74.00	19.87
7323	35.21	AV	H	36.04	5.53	35.98	40.80	54.00	13.20
3196	50.41	PK	H	30.57	3.54	35.20	49.32	74.00	24.68
3196	40.56	AV	H	30.57	3.54	35.20	39.47	54.00	14.53
2985	45.67	PK	H	30.05	3.42	35.31	43.83	74.00	30.17
2985	32.61	AV	H	30.05	3.42	35.31	30.77	54.00	23.23
High Channel: 2480 MHz									
2480	69.79	PK	H	28.26	3.10	0.00	101.15	N/A	N/A
2480	58.52	AV	H	28.26	3.10	0.00	89.88	N/A	N/A
2480	66.51	PK	V	28.26	3.10	0.00	97.87	N/A	N/A
2480	56.32	AV	V	28.26	3.10	0.00	87.68	N/A	N/A
2483.5	26.35	PK	H	28.27	3.10	0.00	57.72	74.00	16.28
2483.5	14.18	AV	H	28.27	3.10	0.00	45.55	54.00	8.45
4960	54.21	PK	H	33.22	4.42	35.60	56.25	74.00	17.75
4960	46.39	AV	H	33.22	4.42	35.60	48.43	54.00	5.57
7440	47.67	PK	H	36.34	5.60	35.99	53.62	74.00	20.38
7440	34.29	AV	H	36.34	5.60	35.99	40.24	54.00	13.76
3196	50.26	PK	H	30.57	3.54	35.20	49.17	74.00	24.83
3196	40.11	AV	H	30.57	3.54	35.20	39.02	54.00	14.98

EDR Mode (8-DPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)					
Low Channel: 2402 MHz									
2402	71.86	PK	H	28.10	3.11	0.00	103.07	N/A	N/A
2402	61.29	AV	H	28.10	3.11	0.00	92.50	N/A	N/A
2402	65.69	PK	V	28.10	3.11	0.00	96.90	N/A	N/A
2402	54.28	AV	V	28.10	3.11	0.00	85.49	N/A	N/A
2390	26.33	PK	H	28.08	3.10	0.00	57.51	74.00	16.49
2390	13.59	AV	H	28.08	3.10	0.00	44.77	54.00	9.23
4804	54.59	PK	H	32.91	4.30	35.48	56.32	74.00	17.68
4804	46.89	AV	H	32.91	4.30	35.48	48.62	54.00	5.38
7206	46.39	PK	H	35.74	5.45	35.97	51.61	74.00	22.39
7206	32.69	AV	H	35.74	5.45	35.97	37.91	54.00	16.09
3196	50.28	PK	H	30.57	3.54	35.20	49.19	74.00	24.81
3196	40.17	AV	H	30.57	3.54	35.20	39.08	54.00	14.92
Middle Channel: 2441 MHz									
2441	71.26	PK	H	28.18	3.11	0.00	102.55	N/A	N/A
2441	60.59	AV	H	28.18	3.11	0.00	91.88	N/A	N/A
2441	66.61	PK	V	28.18	3.11	0.00	97.90	N/A	N/A
2441	56.82	AV	V	28.18	3.11	0.00	88.11	N/A	N/A
4882	55.32	PK	H	33.06	4.40	35.54	57.24	74.00	16.76
4882	47.81	AV	H	33.06	4.40	35.54	49.73	54.00	4.27
7323	48.32	PK	H	36.04	5.53	35.98	53.91	74.00	20.09
7323	35.06	AV	H	36.04	5.53	35.98	40.65	54.00	13.35
3196	50.29	PK	H	30.57	3.54	35.20	49.20	74.00	24.80
3196	40.31	AV	H	30.57	3.54	35.20	39.22	54.00	14.78
2854	45.61	PK	H	29.57	3.32	35.35	43.15	74.00	30.85
2854	32.25	AV	H	29.57	3.32	35.35	29.79	54.00	24.21
High Channel: 2480 MHz									
2480	70.09	PK	H	28.26	3.10	0.00	101.45	N/A	N/A
2480	60.12	AV	H	28.26	3.10	0.00	91.48	N/A	N/A
2480	66.35	PK	V	28.26	3.10	0.00	97.71	N/A	N/A
2480	56.28	AV	V	28.26	3.10	0.00	87.64	N/A	N/A
2483.5	25.69	PK	H	28.27	3.10	0.00	57.06	74.00	16.94
2483.5	13.58	AV	H	28.27	3.10	0.00	44.95	54.00	9.05
4960	56.35	PK	H	33.22	4.42	35.60	58.39	74.00	15.61
4960	47.51	AV	H	33.22	4.42	35.60	49.55	54.00	4.45
7440	48.51	PK	H	36.34	5.60	35.99	54.46	74.00	19.54
7440	35.26	AV	H	36.34	5.60	35.99	41.21	54.00	12.79
3196	50.63	PK	H	30.57	3.54	35.20	49.54	74.00	24.46
3196	40.74	AV	H	30.57	3.54	35.20	39.65	54.00	14.35

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

* **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:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

* The testing was performed by Nami Quan on 2017-08-31.

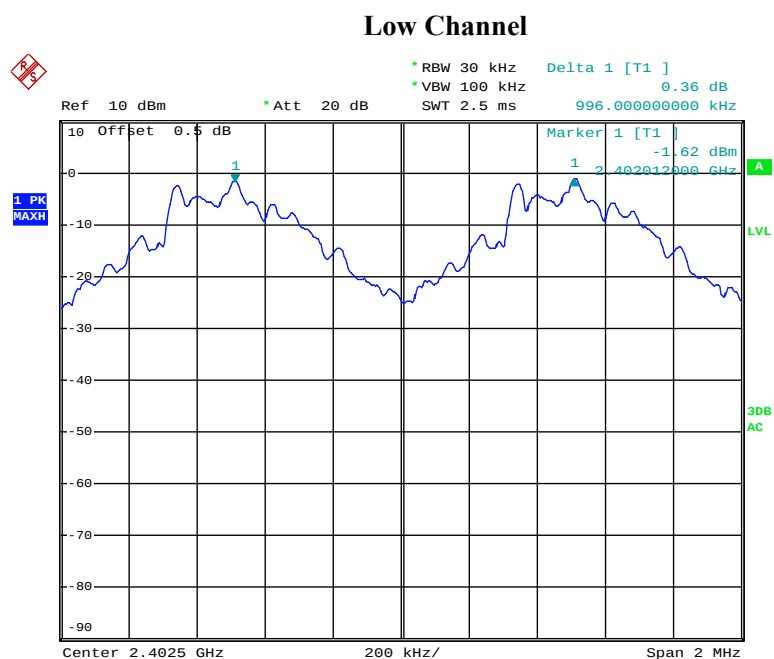
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

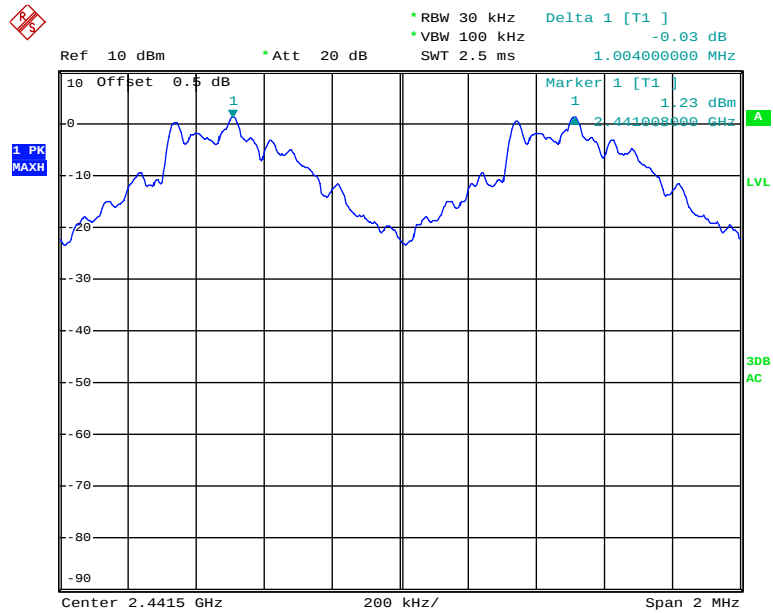
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	0.996	0.57
	Middle	2441	1.004	0.56
	High	2480	1.004	0.57
EDR ($\pi/4$ -DQPSK)	Low	2402	1.004	0.81
	Middle	2441	1.000	0.83
	High	2480	1.004	0.81
EDR (8DPSK)	Low	2402	1.004	0.81
	Middle	2441	1.000	0.81
	High	2480	1.004	0.81

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

BDR Mode (GFSK):

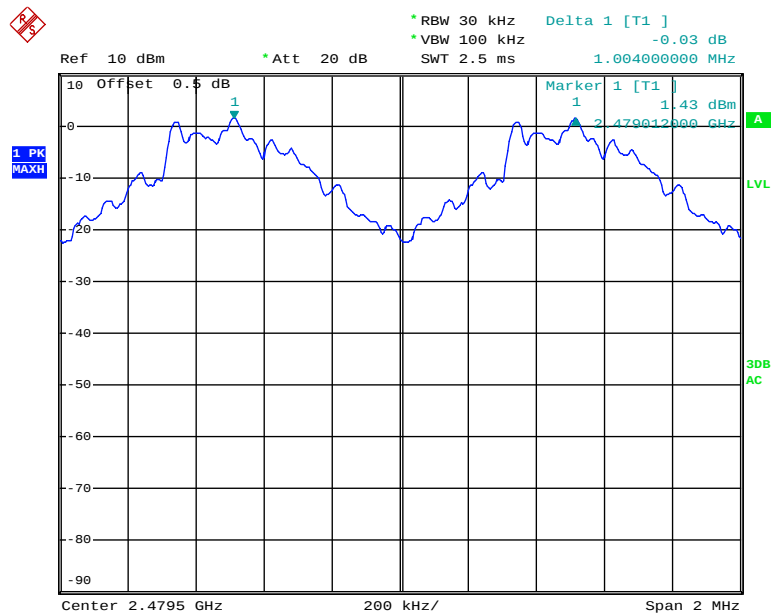
Date: 31.AUG.2017 09:49:57

Middle Channel

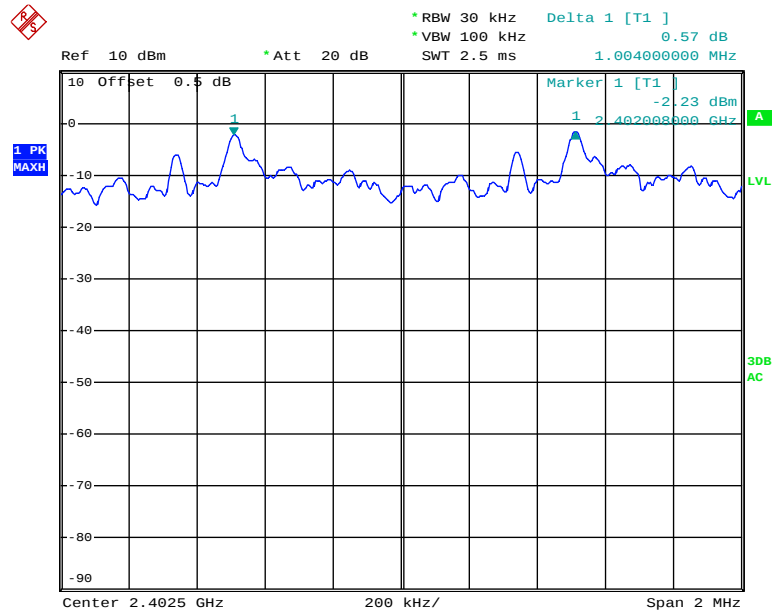


Date: 31.AUG.2017 09:50:33

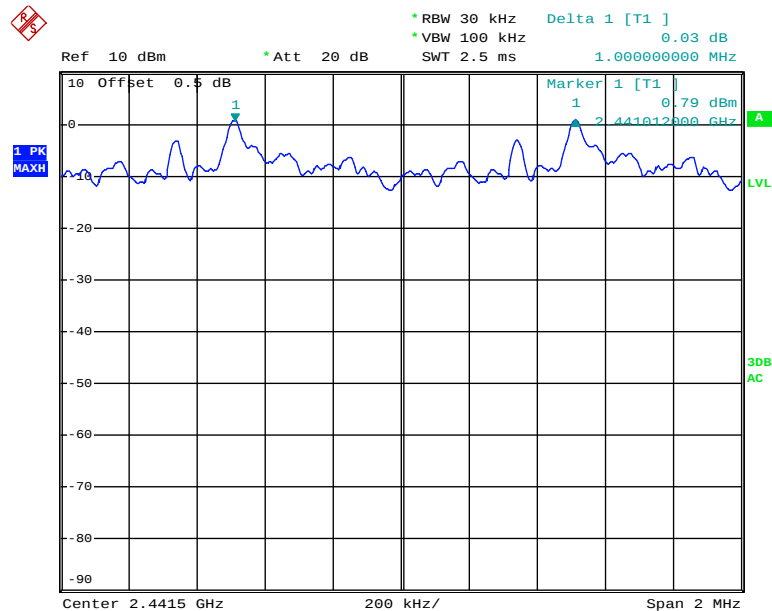
High Channel



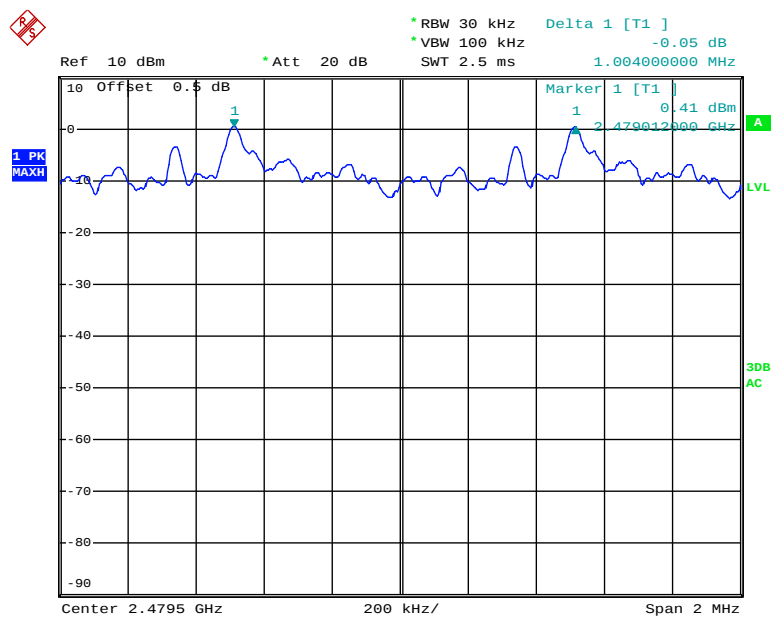
Date: 31.AUG.2017 09:51:24

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

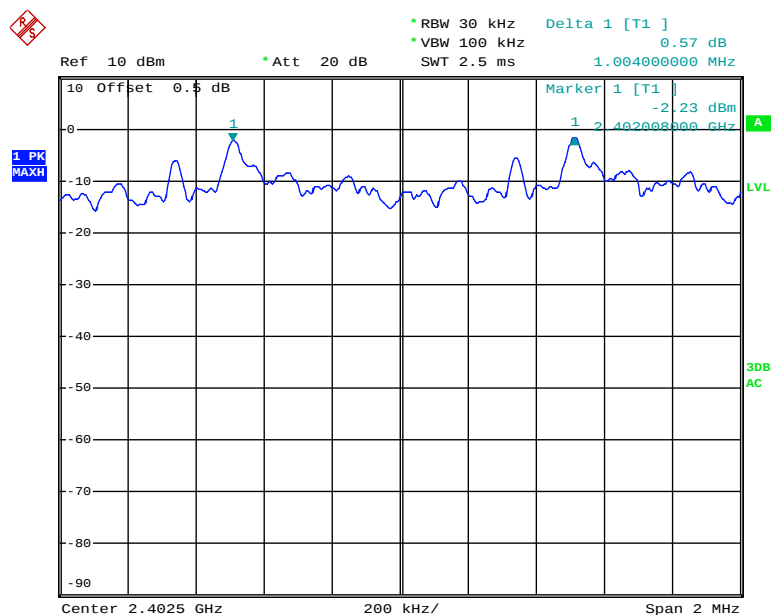
Date: 31.AUG.2017 09:46:22

Middle Channel

Date: 31.AUG.2017 09:47:13

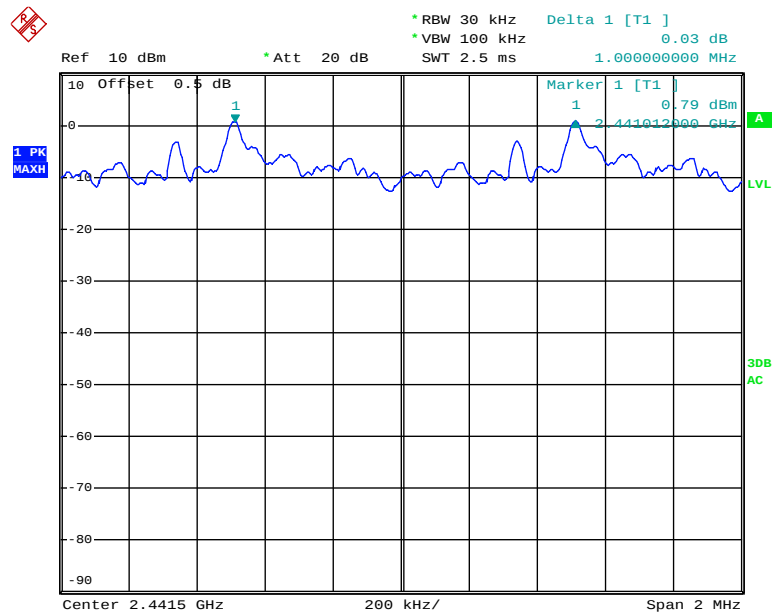
High Channel

Date: 31.AUG.2017 09:48:40

*EDR Mode (8-DPSK):***Low Channel**

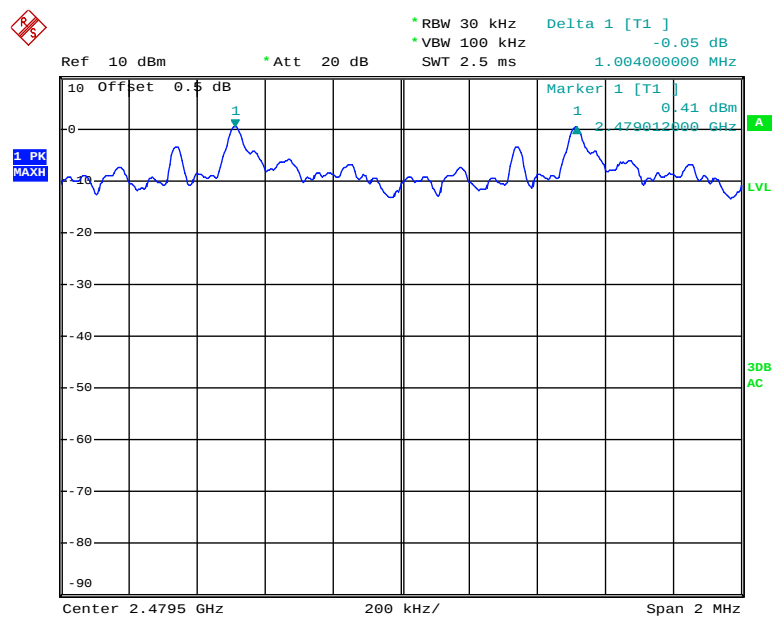
Date: 31.AUG.2017 09:46:22

Middle Channel



Date: 31.AUG.2017 09:47:13

High Channel



Date: 31.AUG.2017 09:48:40

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

* **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:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

* The testing was performed by Nami Quan on 2017-08-31.

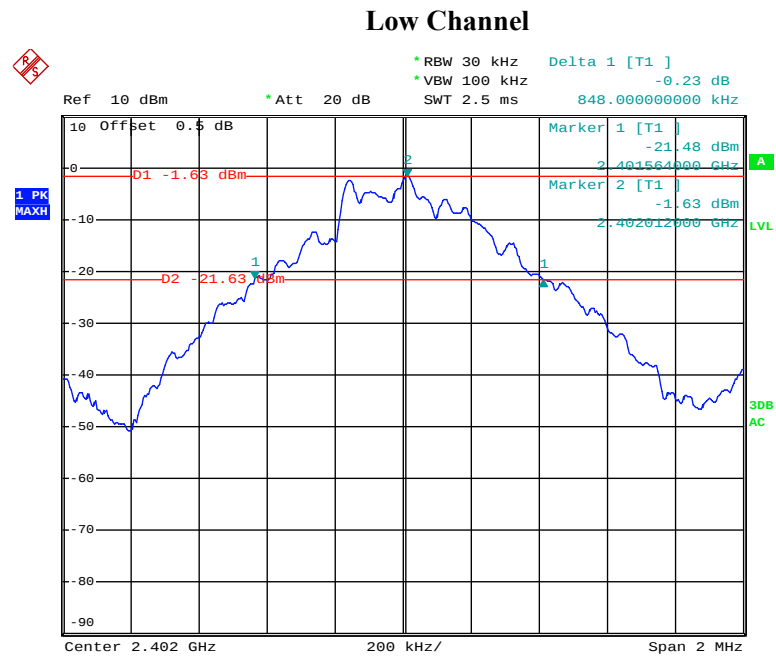
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

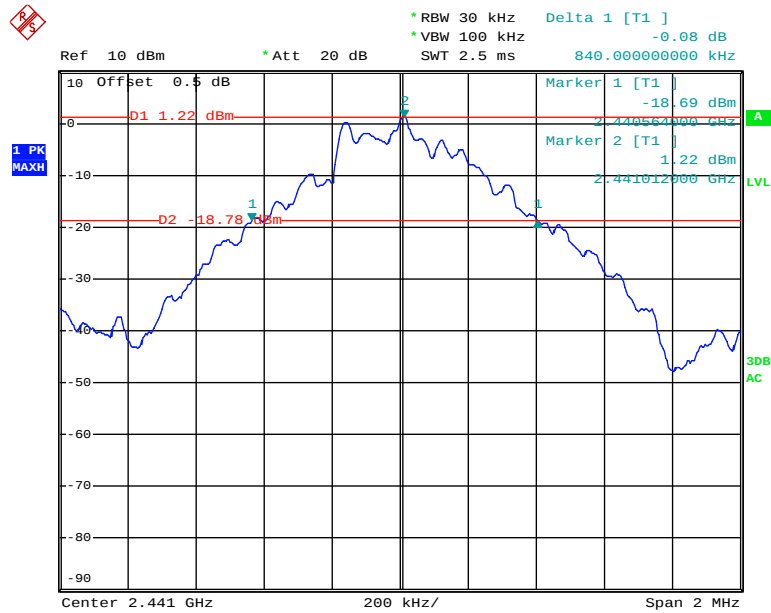
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.85
	Middle	2441	0.84
	High	2480	0.85
EDR Mode ($\pi/4$ -DQPSK)	Low	2402	1.22
	Middle	2441	1.25
	High	2480	1.22
EDR Mode (8-DPSK)	Low	2402	1.21
	Middle	2441	1.22
	High	2480	1.22

BDR Mode (GFSK):



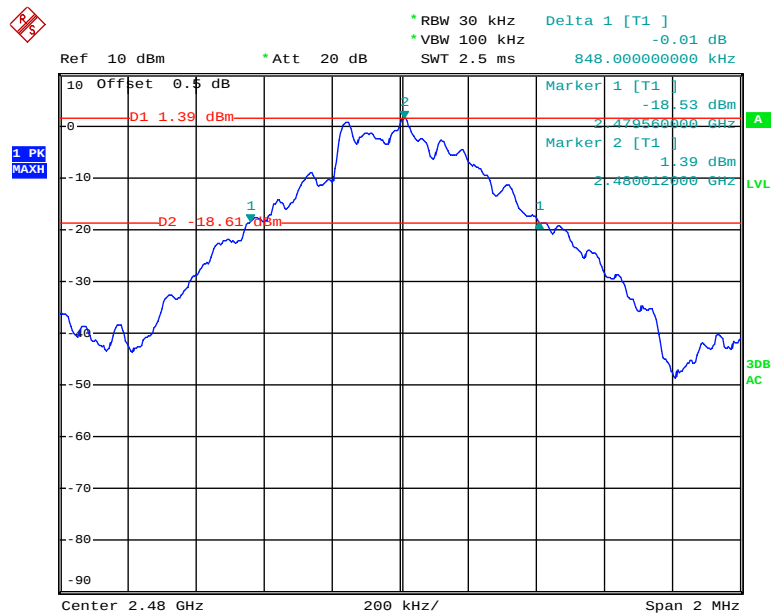
Date: 31.AUG.2017 09:27:16

Middle Channel



Date: 31.AUG.2017 09:28:28

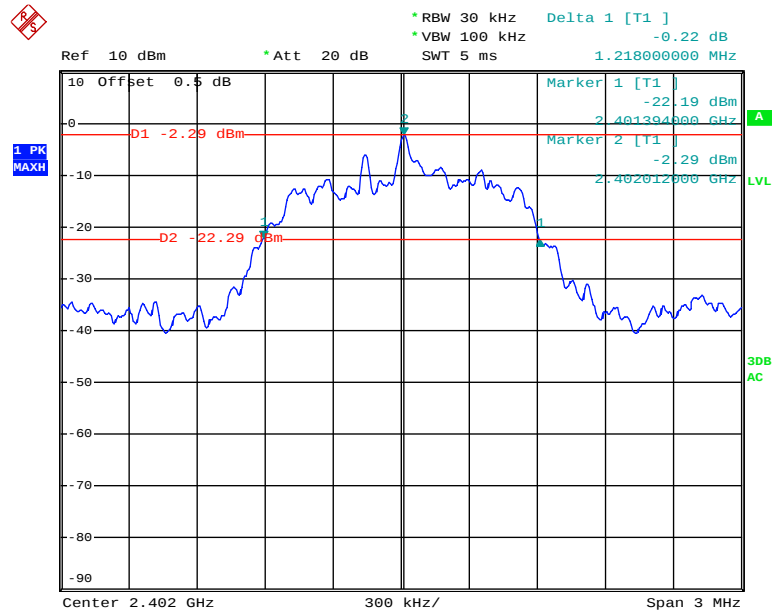
High Channel



Date: 31.AUG.2017 09:29:27

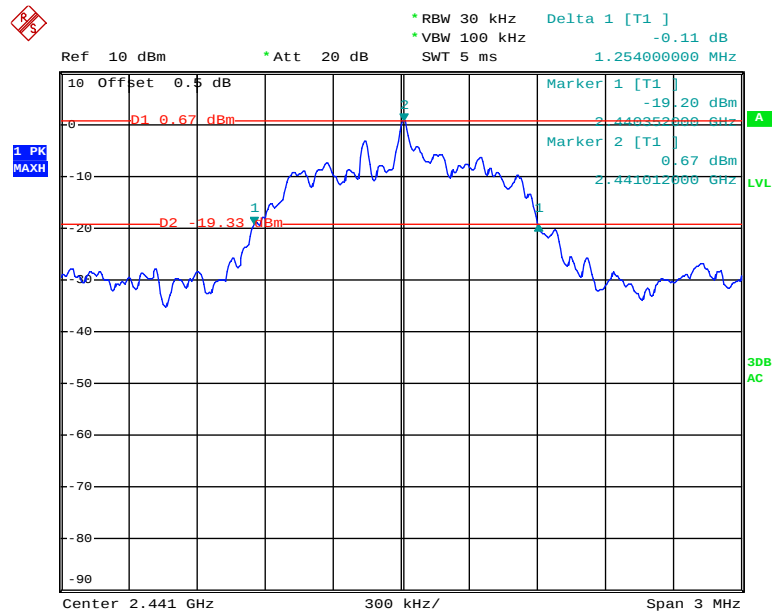
EDR Mode ($\pi/4$ -DQPSK):

Low Channel



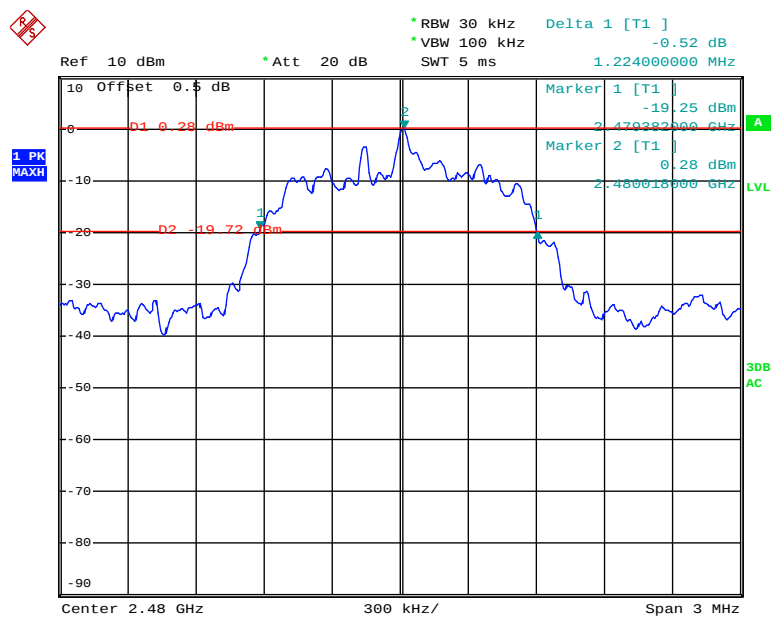
Date: 31.AUG.2017 09:33:22

Middle Channel



Date: 31.AUG.2017 09:32:23

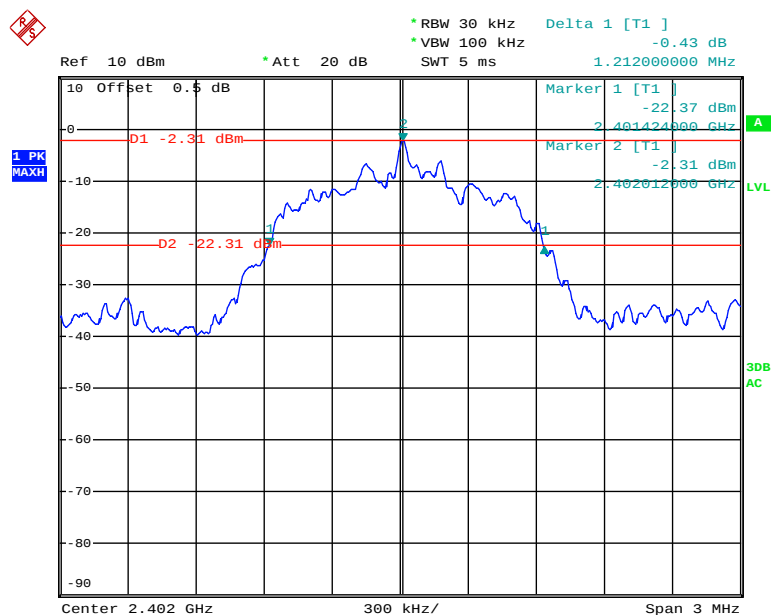
High Channel



Date: 31.AUG.2017 09:31:15

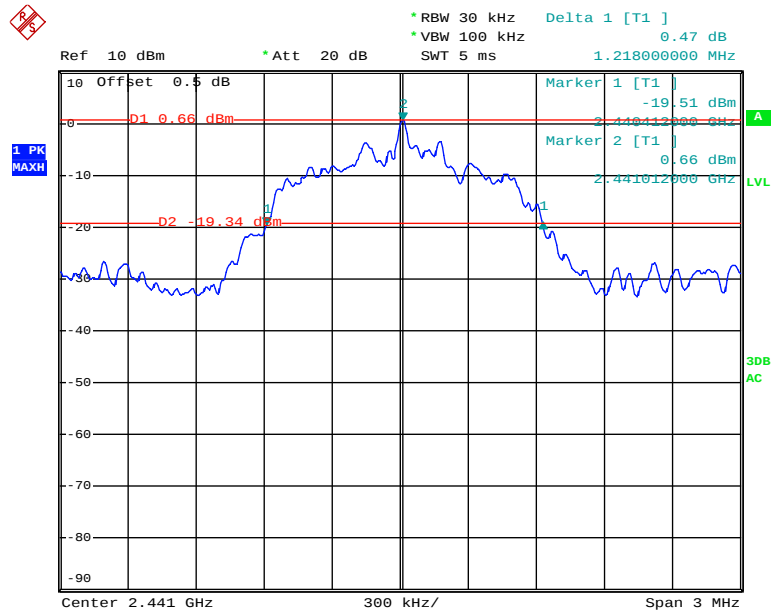
EDR Mode (8-DPSK):

Low Channel



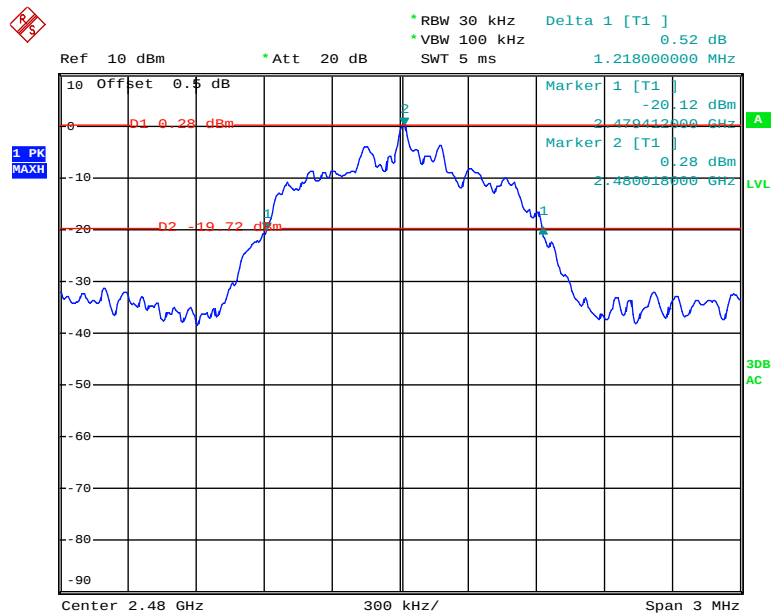
Date: 31.AUG.2017 09:36:25

Middle Channel



Date: 31.AUG.2017 09:37:40

High Channel



Date: 31.AUG.2017 09:40:26

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

* **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:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

* The testing was performed by Nami Quan on 2017-08-31.

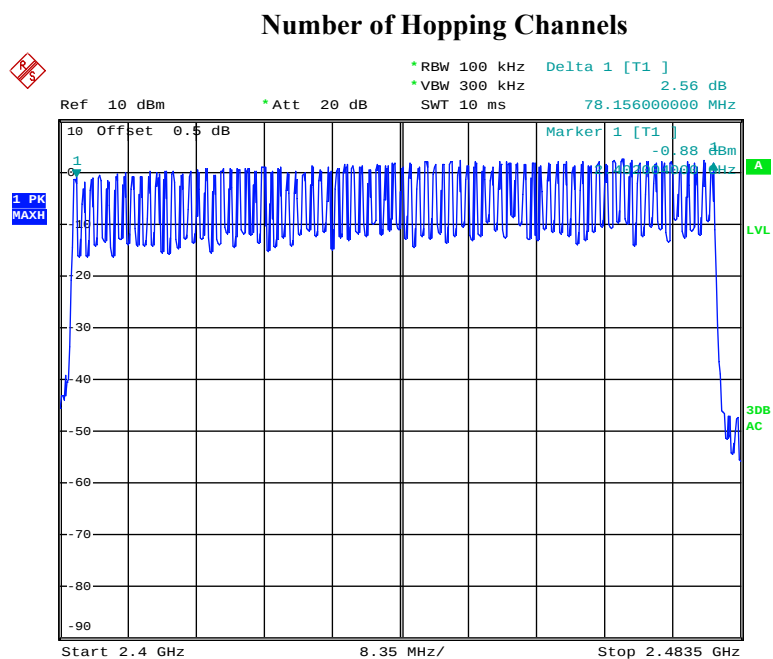
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

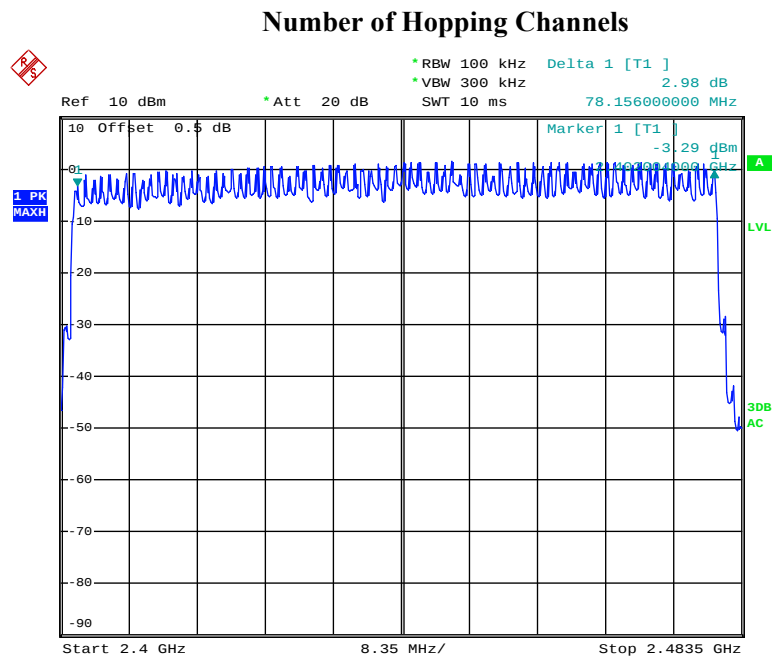
Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15



Date: 31.AUG.2017 09:53:33

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

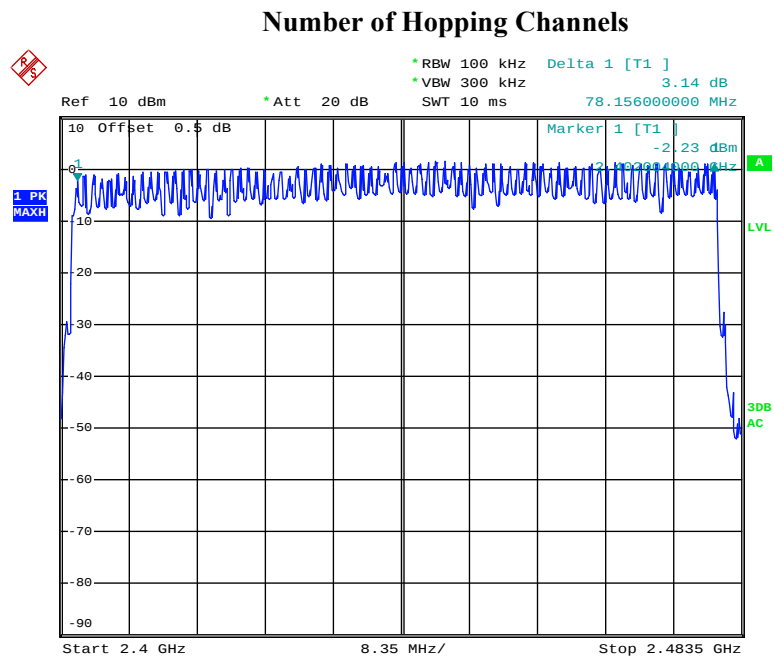
Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥ 15



Date: 31.AUG.2017 09:56:45

EDR Mode (8-DPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15



Date: 31.AUG.2017 09:59:05

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

* **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:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

* The testing was performed by Nami Quan on 2017-08-31.

Test Result: Compliance.

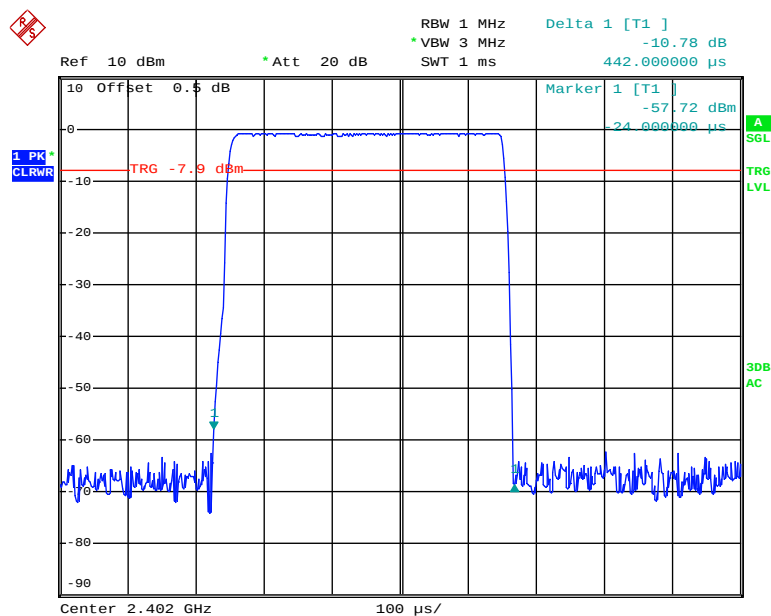
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

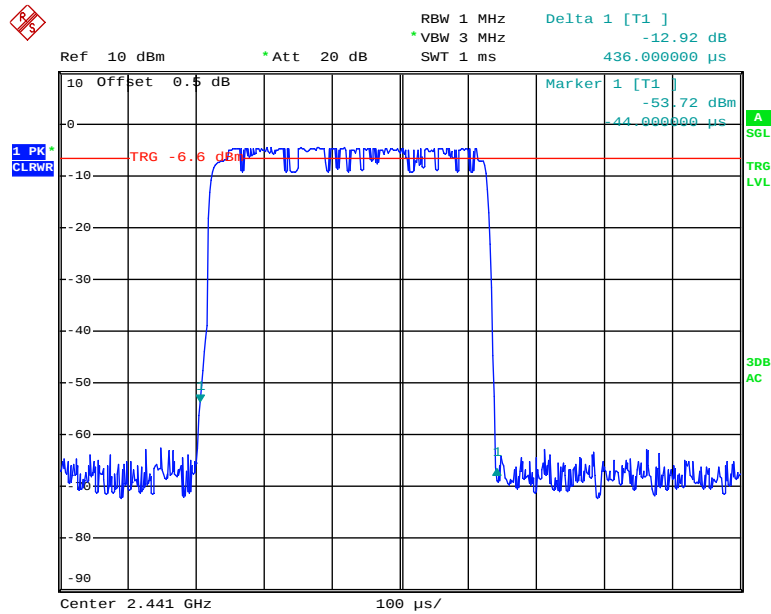
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.442	0.141	0.4	Compliance
	Middle	0.436	0.140	0.4	Compliance
	High	0.434	0.139	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s				
DH3	Low	1.704	0.273	0.4	Compliance
	Middle	1.704	0.273	0.4	Compliance
	High	1.704	0.273	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s				
DH5	Low	2.970	0.317	0.4	Compliance
	Middle	2.960	0.316	0.4	Compliance
	High	2.950	0.315	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s				

DH1: Low Channel



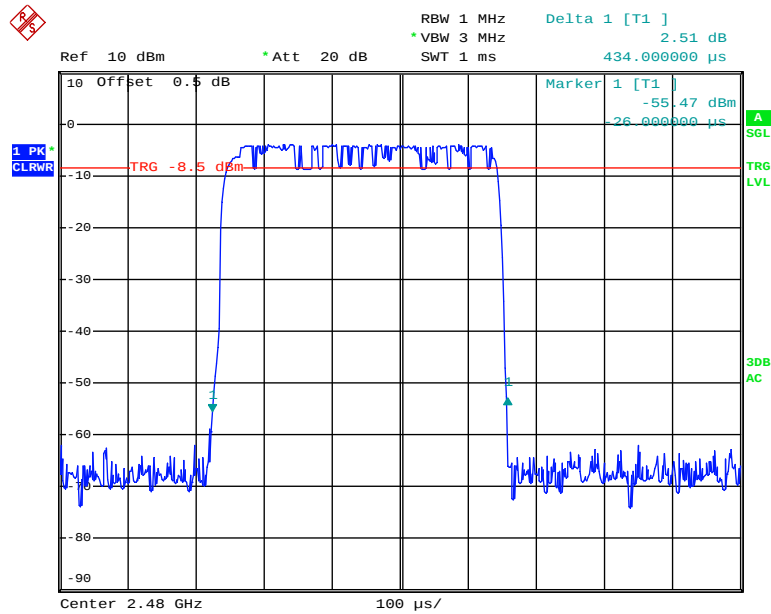
Date: 31.AUG.2017 10:05:41

DH1: Middle Channel

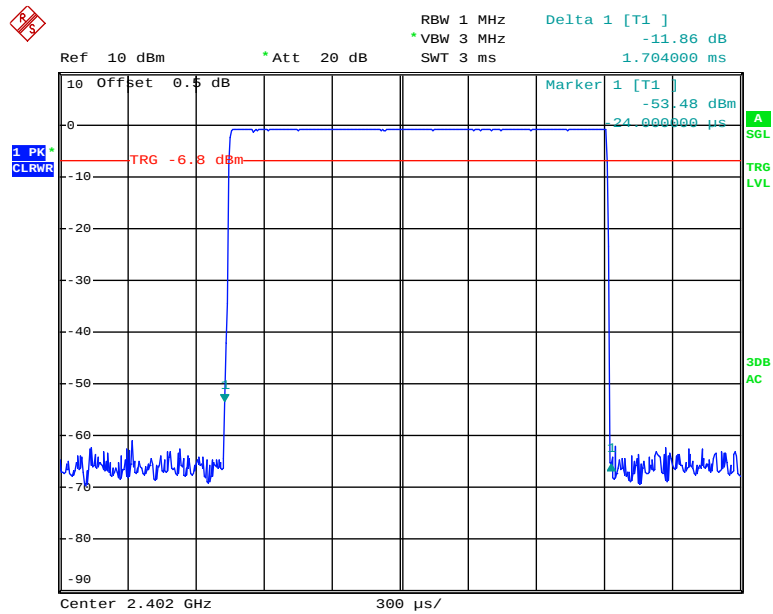


Date: 31.AUG.2017 10:05:48

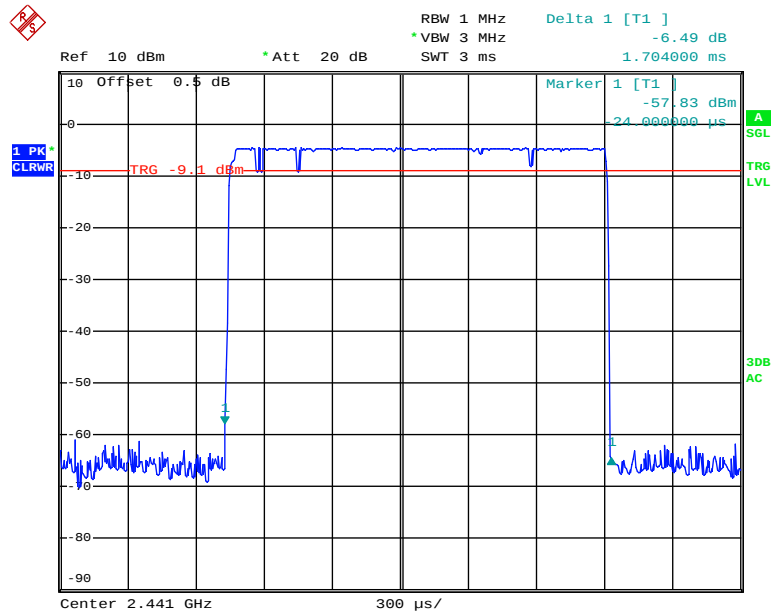
DH1: High Channel



Date: 31.AUG.2017 10:05:56

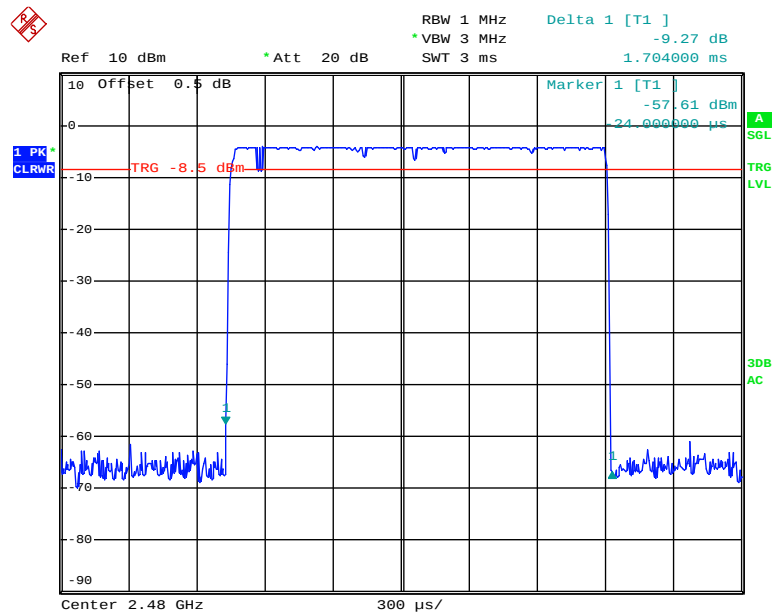
DH3: Low Channel

Date: 31.AUG.2017 10:06:39

DH3: Middle Channel

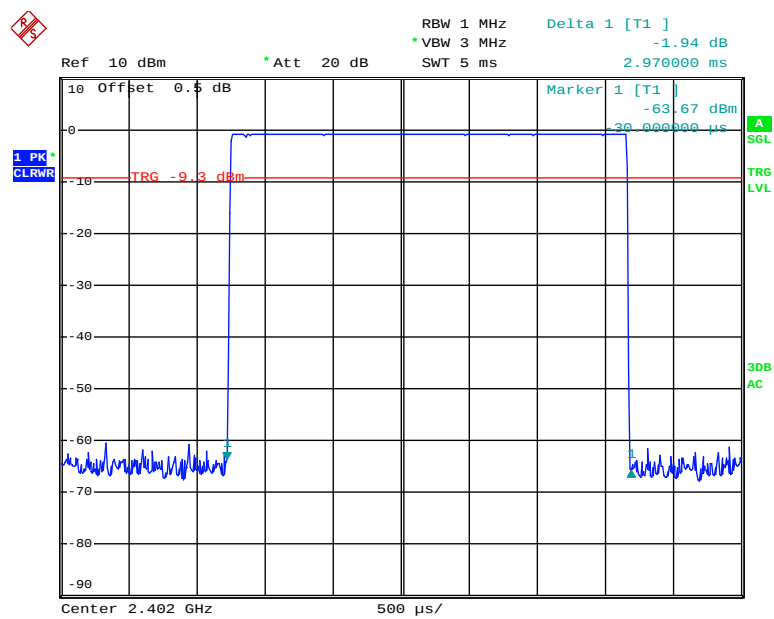
Date: 31.AUG.2017 10:06:46

DH3: High Channel



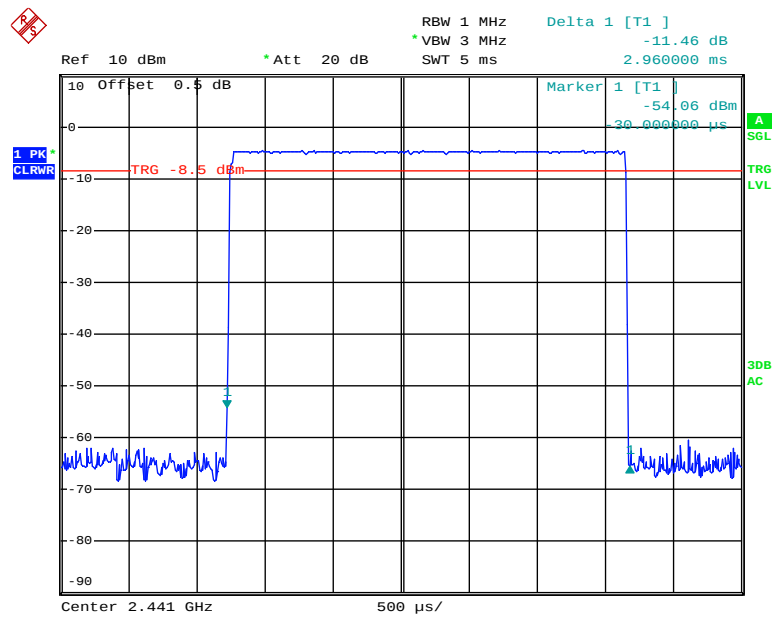
Date: 31.AUG.2017 10:06:52

DH5: Low Channel



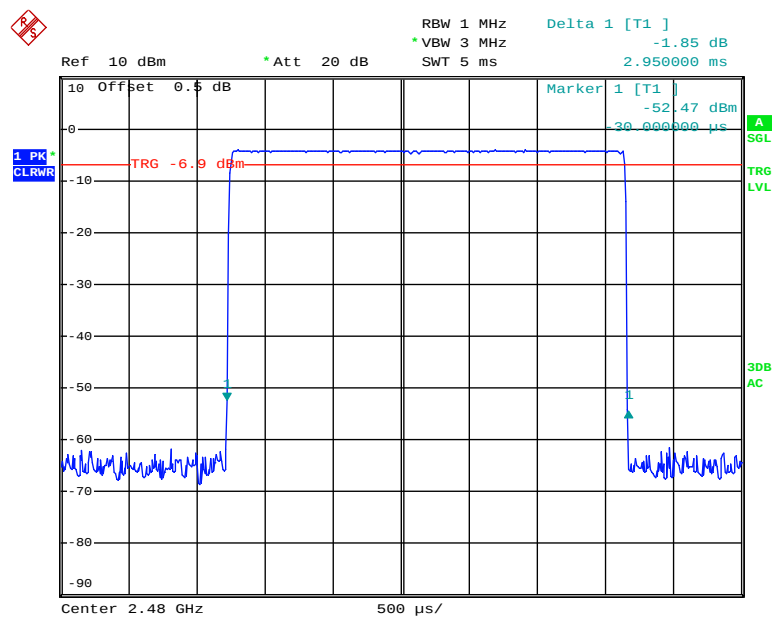
Date: 31.AUG.2017 10:07:39

DH5: Middle Channel



Date: 31.AUG.2017 10:07:45

DH5: High Channel

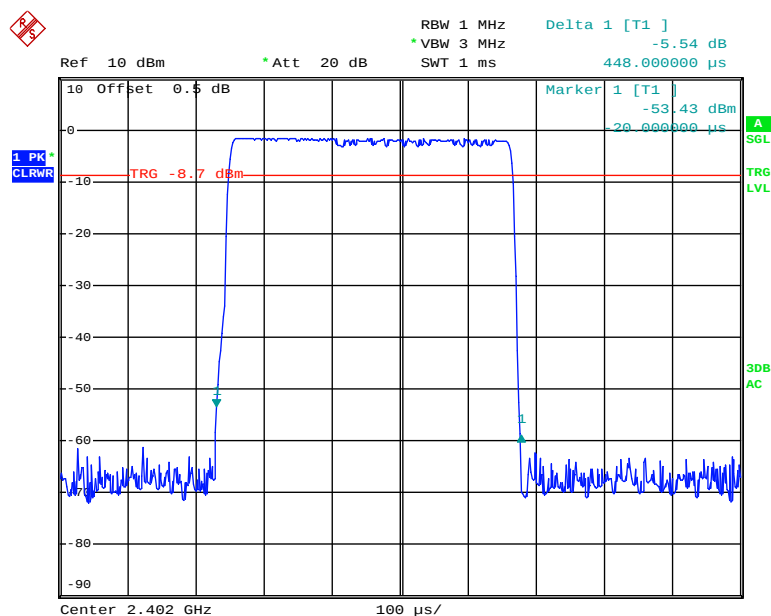


Date: 31.AUG.2017 10:07:51

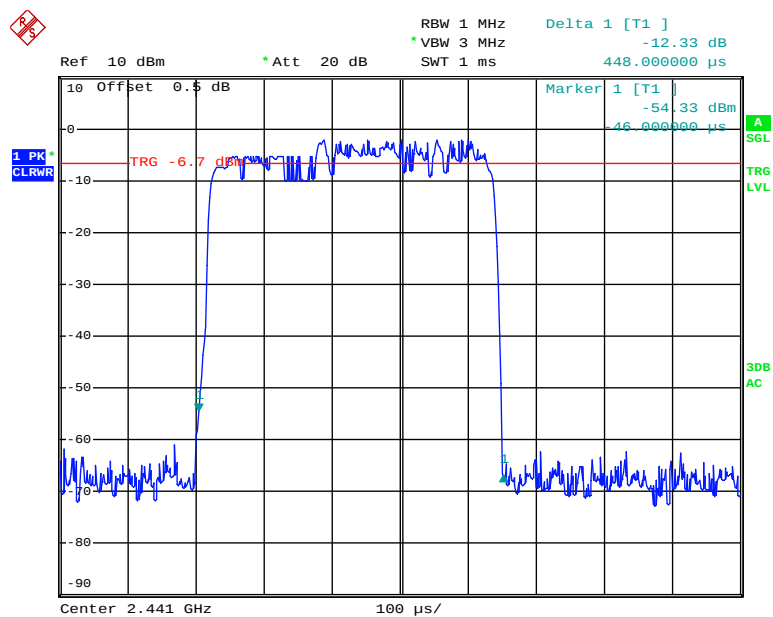
EDR Mode ($\pi/4$ -DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.448	0.143	0.4	Compliance
	Middle	0.448	0.143	0.4	Compliance
	High	0.444	0.142	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s				
2DH3	Low	1.716	0.275	0.4	Compliance
	Middle	1.710	0.274	0.4	Compliance
	High	1.704	0.273	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s				
2DH5	Low	2.970	0.317	0.4	Compliance
	Middle	2.960	0.316	0.4	Compliance
	High	2.970	0.317	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s				

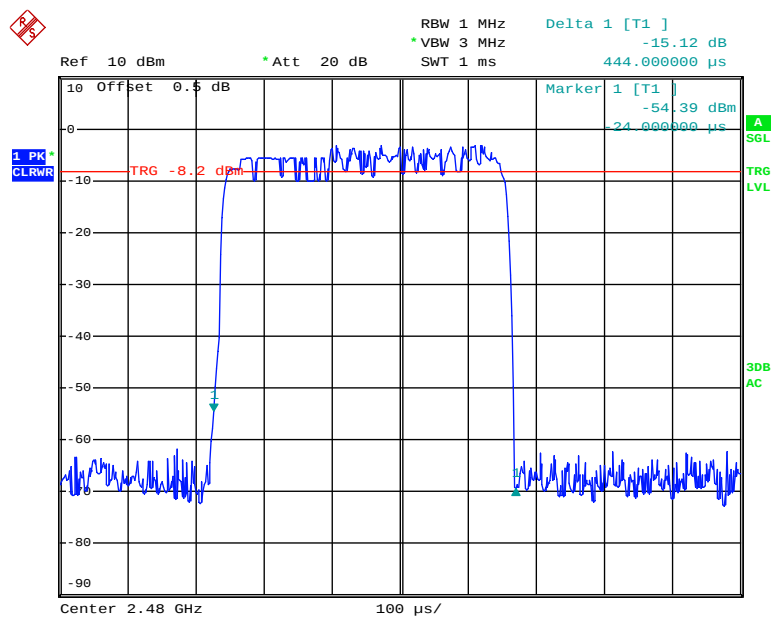
2DH1: Low Channel



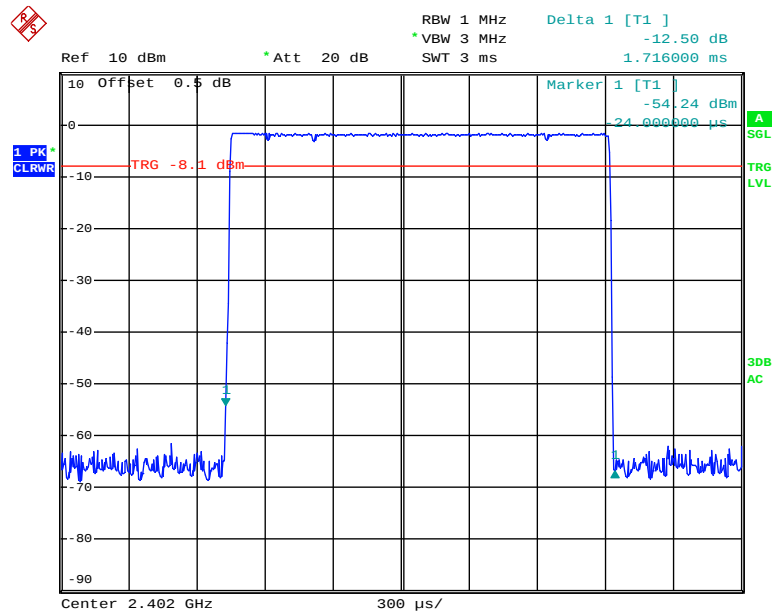
Date: 31.AUG.2017 10:02:41

2DH1: Middle Channel

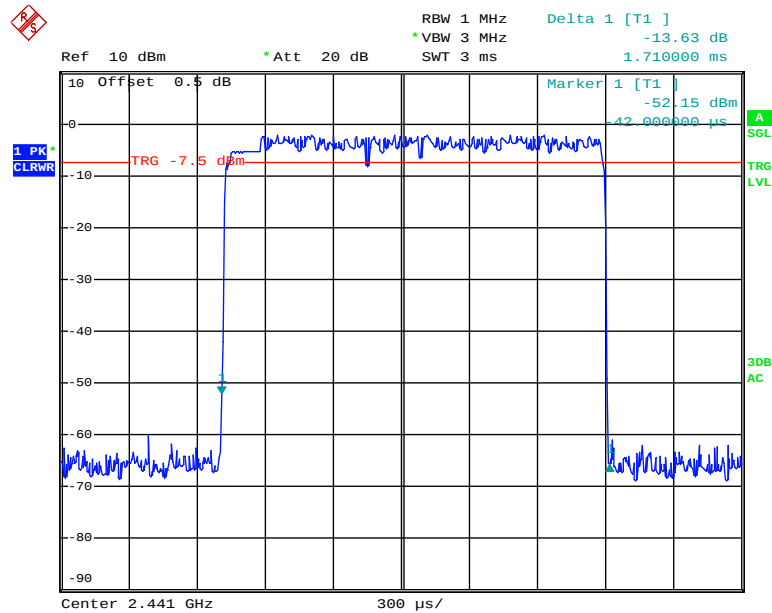
Date: 31.AUG.2017 10:02:47

2DH1: High Channel

Date: 31.AUG.2017 10:02:53

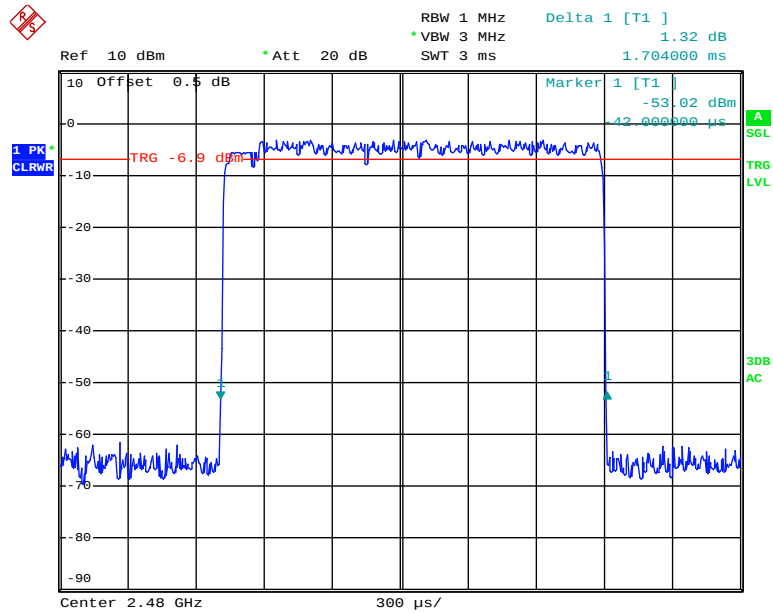
2DH3: Low Channel

Date: 31.AUG.2017 10:03:37

2DH3: Middle Channel

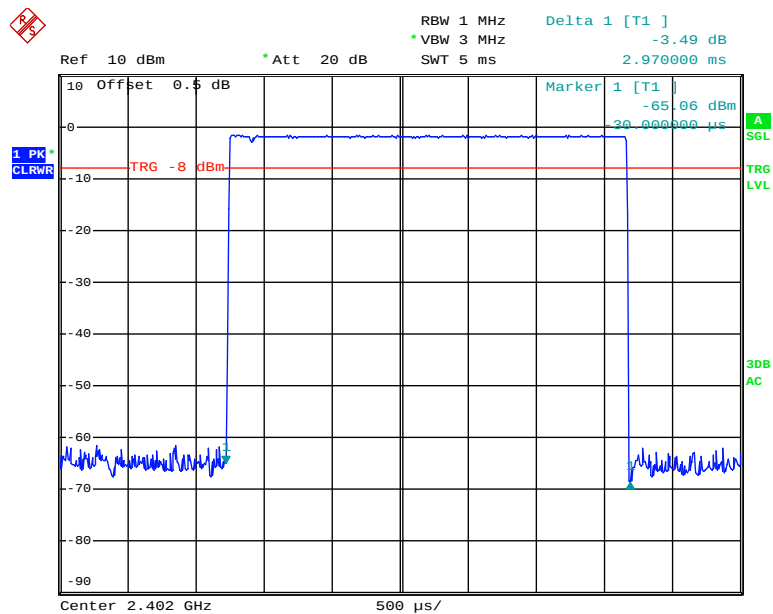
Date: 31.AUG.2017 10:03:43

2DH3: High Channel



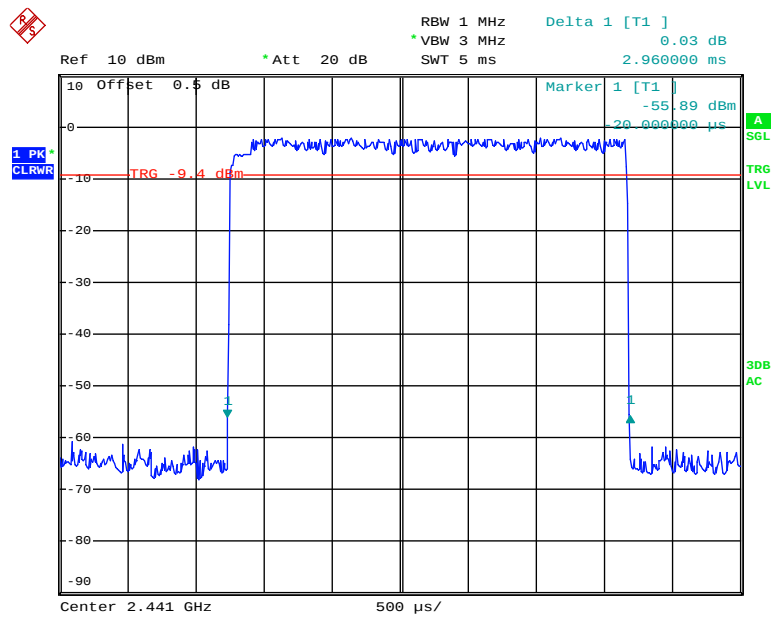
Date: 31.AUG.2017 10:03:49

2DH5: Low Channel



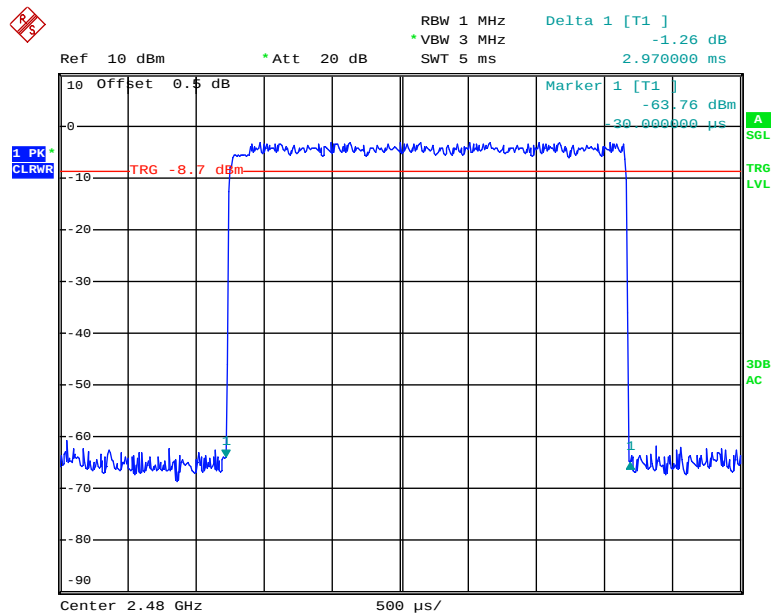
Date: 31.AUG.2017 10:04:40

2DH5: Middle Channel



Date: 31.AUG.2017 10:04:46

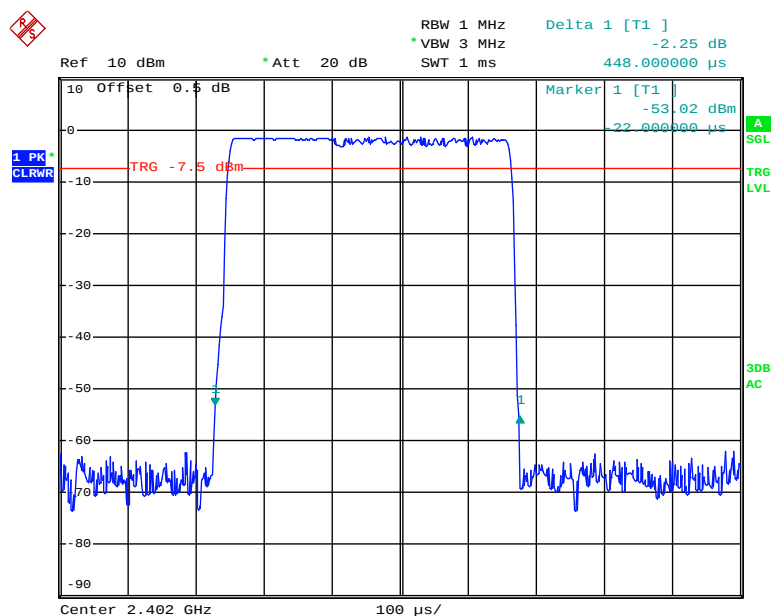
2DH5: High Channel



Date: 31.AUG.2017 10:04:52

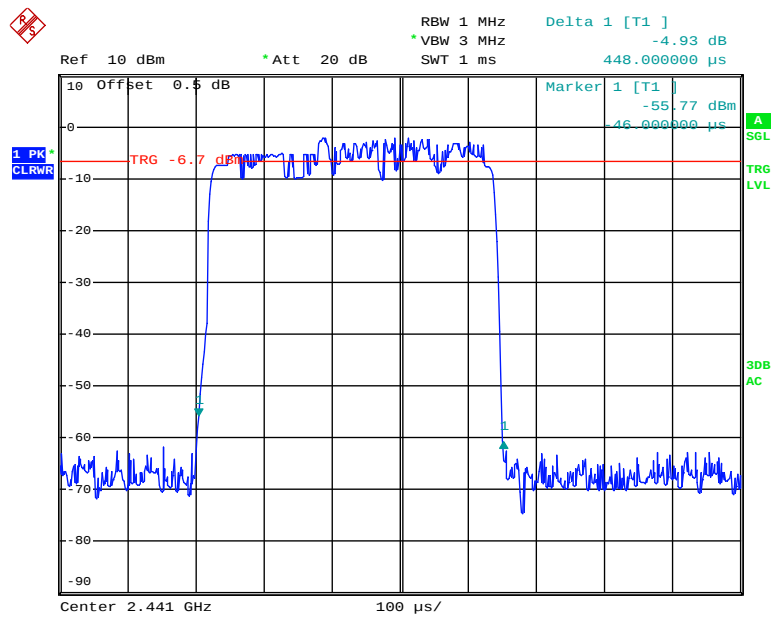
EDR Mode (8-DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.448	0.143	0.4	Compliance
	Middle	0.448	0.143	0.4	Compliance
	High	0.444	0.142	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) × 31.6 s				
3DH3	Low	1.710	0.274	0.4	Compliance
	Middle	1.704	0.273	0.4	Compliance
	High	1.704	0.273	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) × 31.6 s				
3DH5	Low	2.970	0.317	0.4	Compliance
	Middle	2.960	0.316	0.4	Compliance
	High	2.960	0.316	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) × 31.6 s				

3DH1: Low Channel

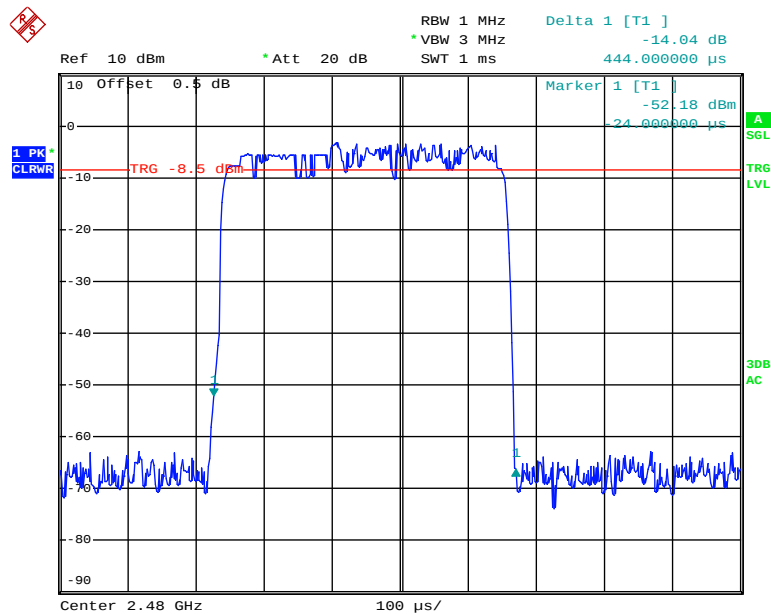
Date: 31.AUG.2017 09:59:45

3DH1: Middle Channel



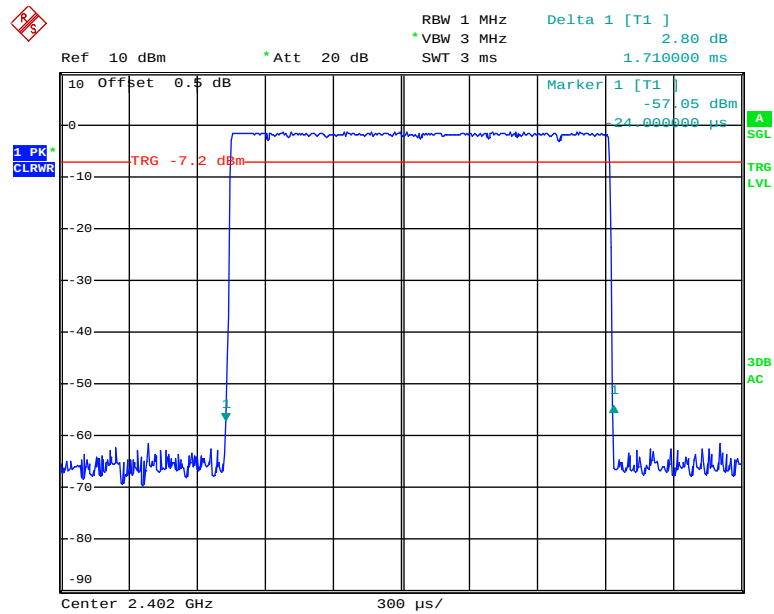
Date: 31.AUG.2017 09:59:52

3DH1: High Channel



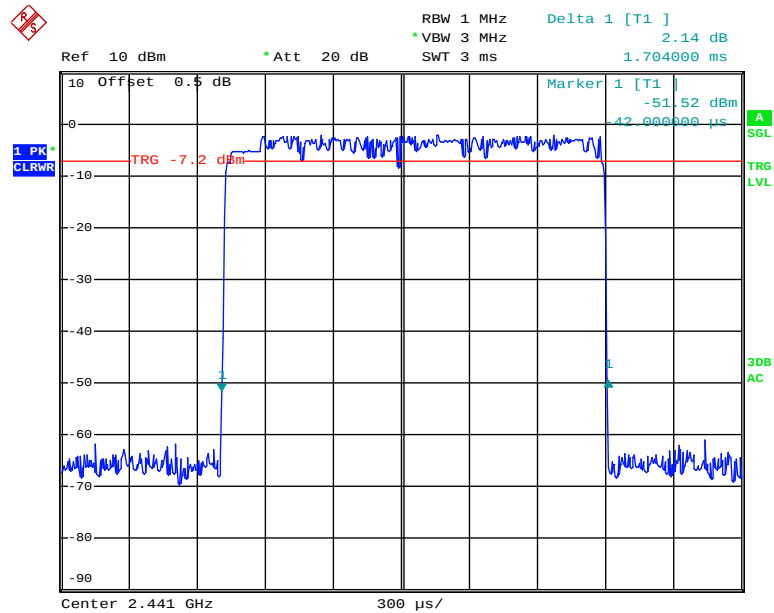
Date: 31.AUG.2017 09:59:58

3DH3: Low Channel

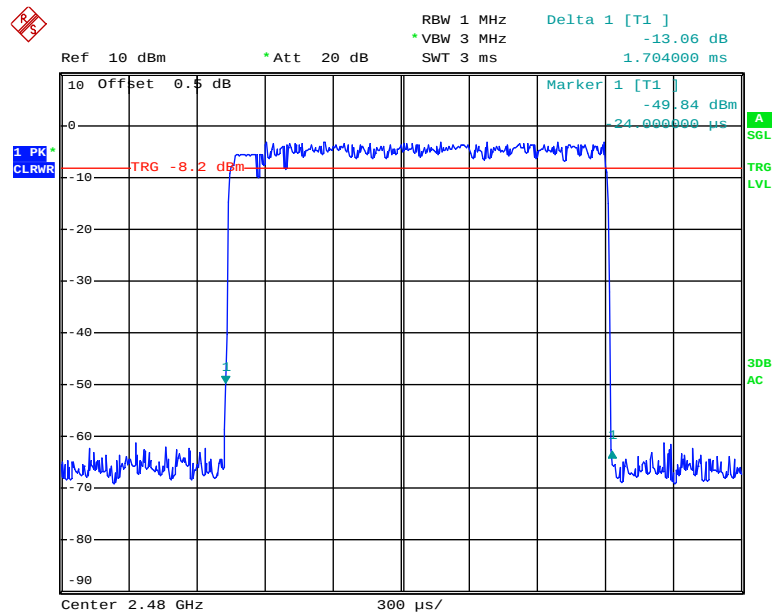


Date: 31.AUG.2017 10:00:39

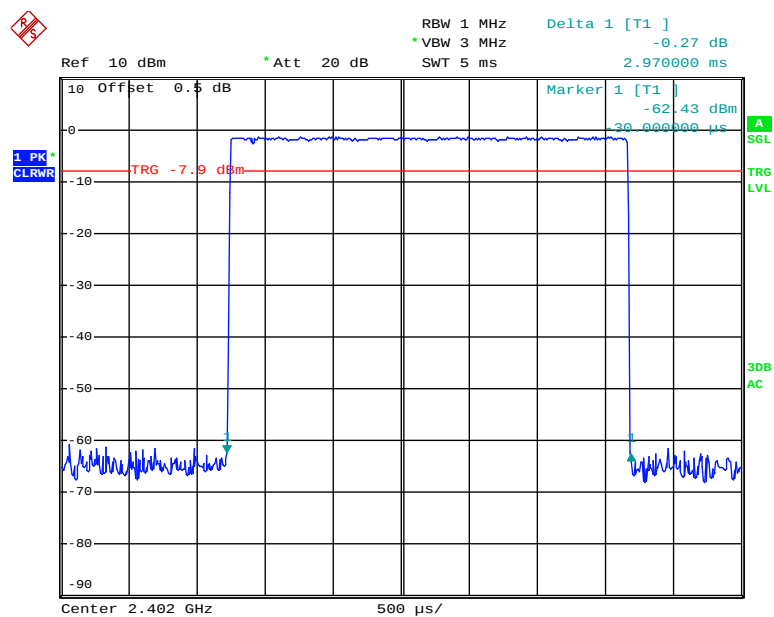
3DH3: Middle Channel



Date: 31.AUG.2017 10:00:46

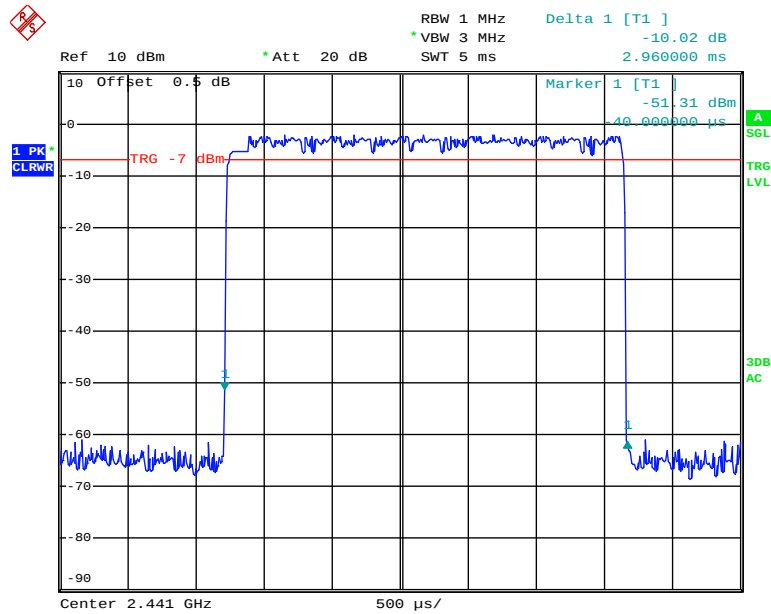
3DH3: High Channel

Date: 31.AUG.2017 10:00:52

3DH5: Low Channel

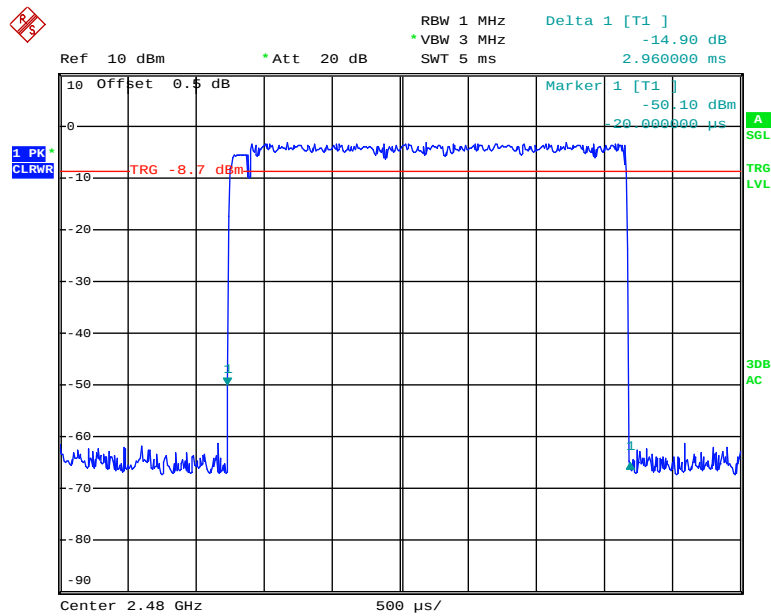
Date: 31.AUG.2017 10:01:37

3DH5: Middle Channel



Date: 31.AUG.2017 10:01:43

3DH5: High Channel



Date: 31.AUG.2017 10:01:50

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

* **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:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

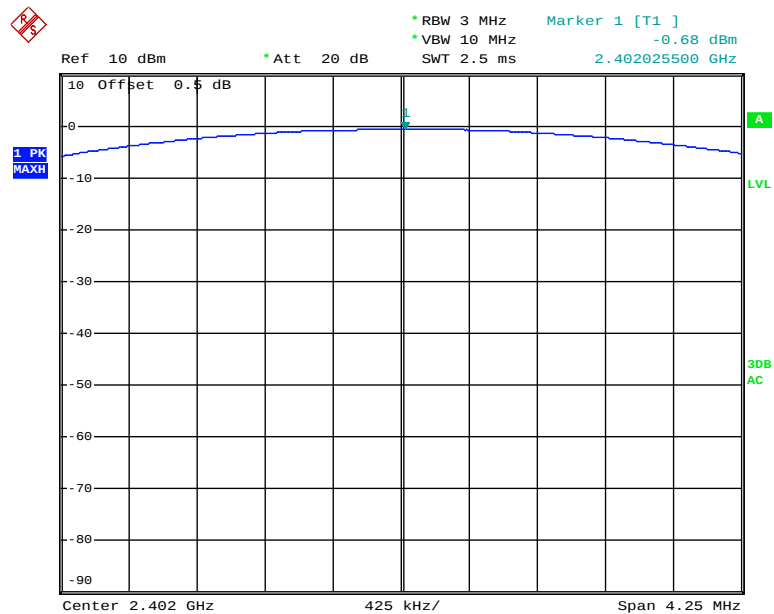
* The testing was performed by Nami Quan on 2017-08-31.

Test Result: Compliance.

Test Mode: Transmitting

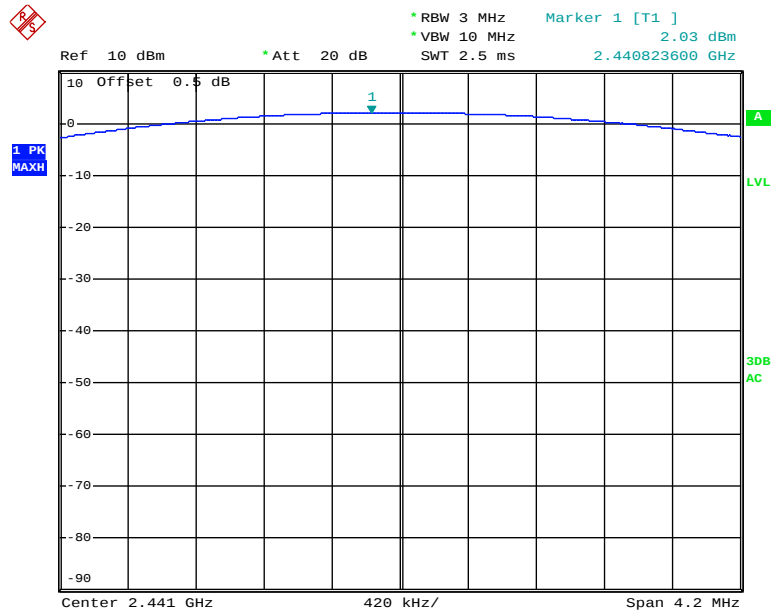
Mode	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	-0.68	30
	2441	2.03	30
	2480	2.55	30
EDR Mode ($\pi/4$ -DQPSK)	2402	-1.11	30
	2441	1.61	30
	2480	1.73	30
EDR Mode (8-DPSK)	2402	-1.05	30
	2441	1.67	30
	2480	1.85	30

Note: The data above was tested in conducted mode.

BDR Mode (GFSK):**Low Channel**

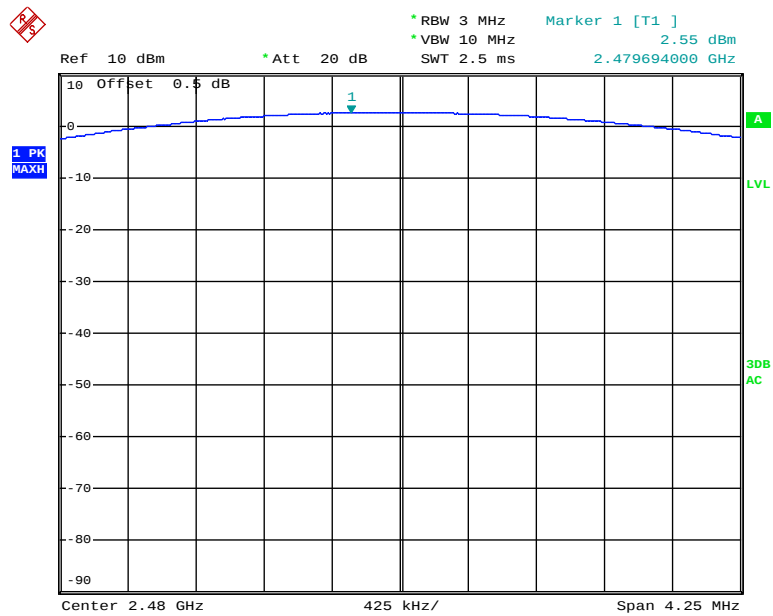
Date: 31.AUG.2017 09:27:38

Middle Channel



Date: 31.AUG.2017 09:28:49

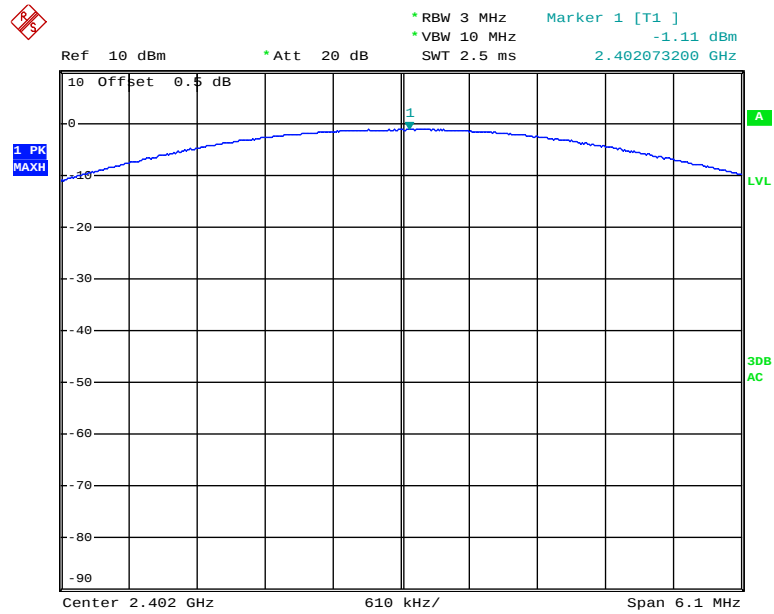
High Channel



Date: 31.AUG.2017 09:29:48

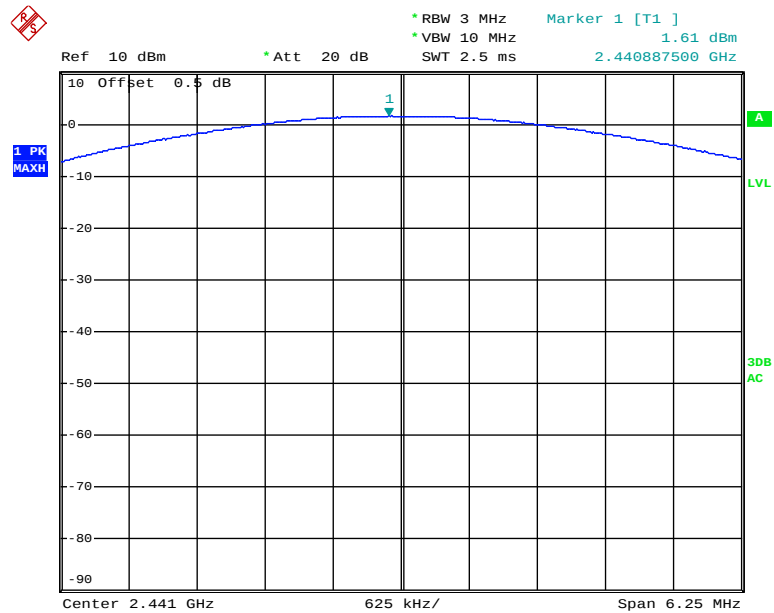
EDR Mode ($\pi/4$ -DQPSK):

Low Channel



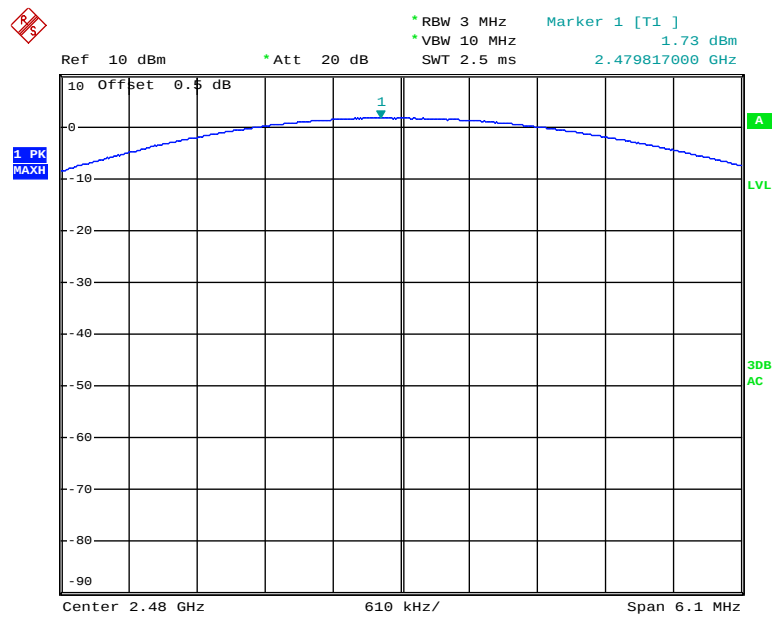
Date: 31.AUG.2017 09:33:44

Middle Channel



Date: 31.AUG.2017 09:32:43

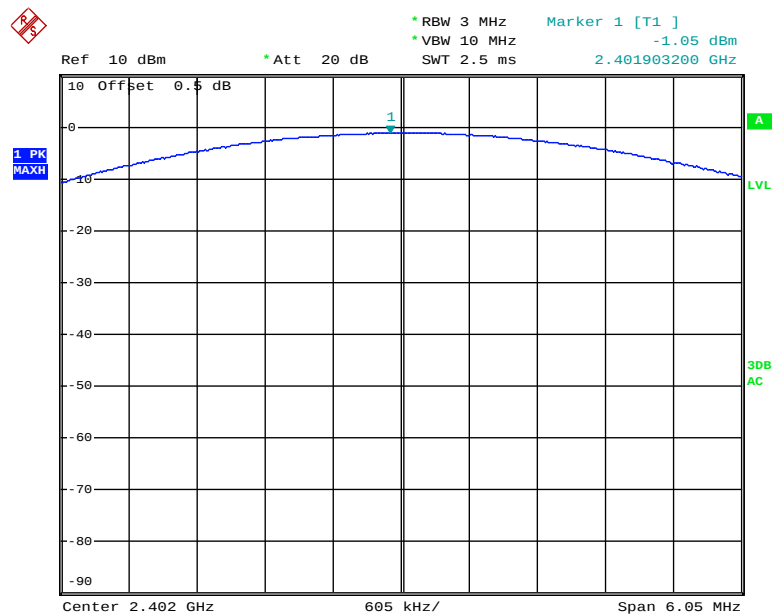
High Channel



Date: 31.AUG.2017 09:31:35

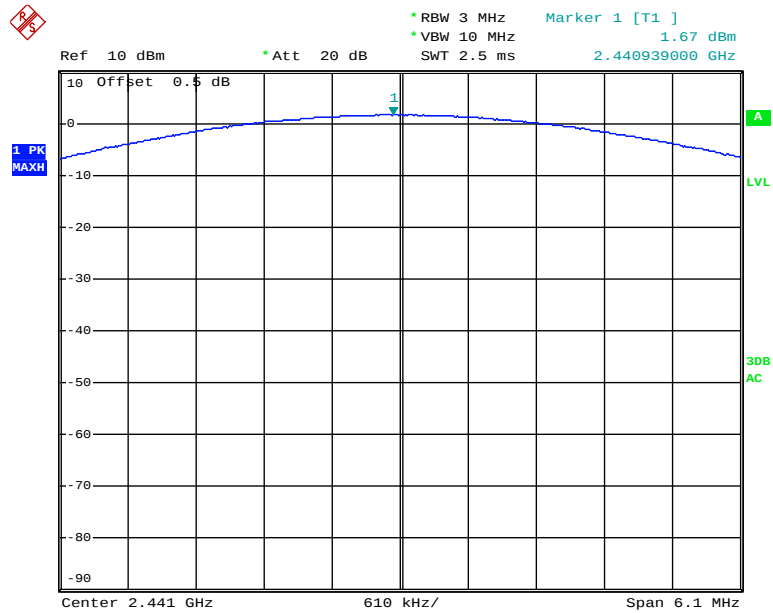
EDR Mode (8-DPSK):

Low Channel



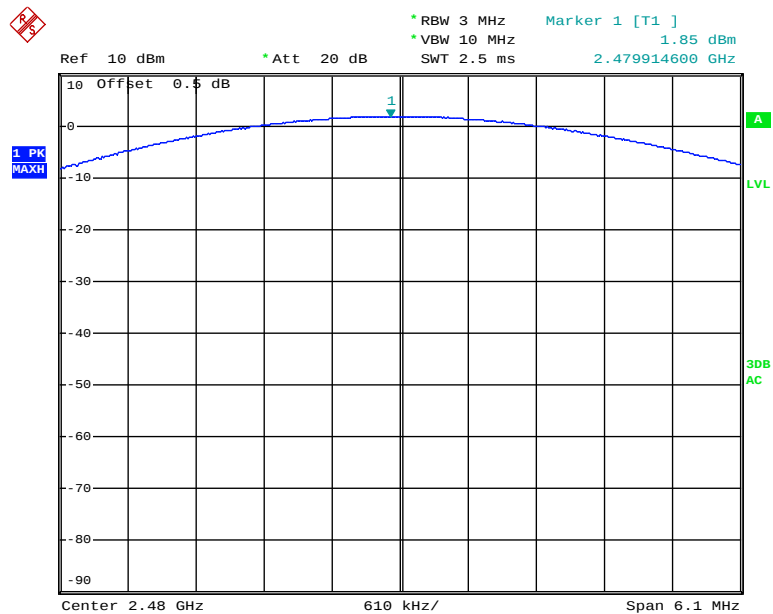
Date: 31.AUG.2017 09:36:47

Middle Channel



Date: 31.AUG.2017 09:38:00

High Channel



Date: 31.AUG.2017 09:40:46

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 Receive	ESCI	101121	2017-03-02	2018-03-02
Unknown	RF Cable	Unknown	C-2	Each Time	/

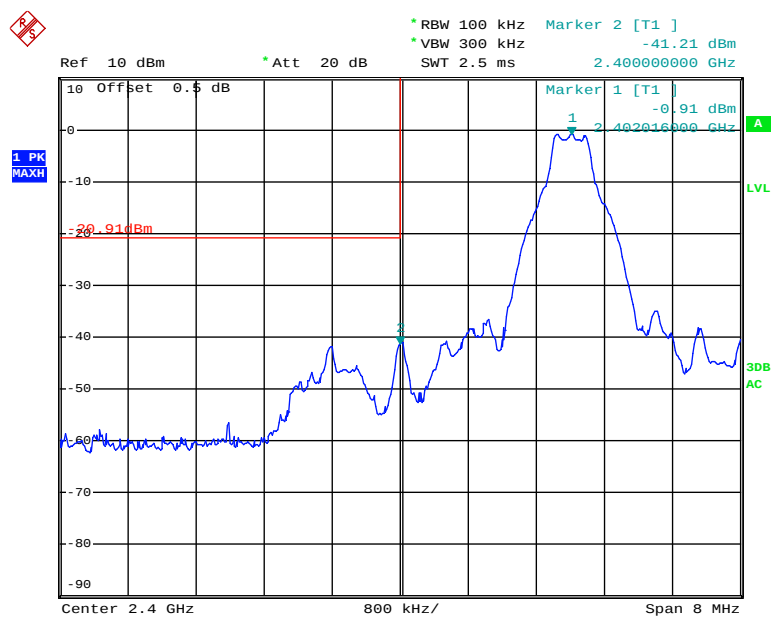
* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

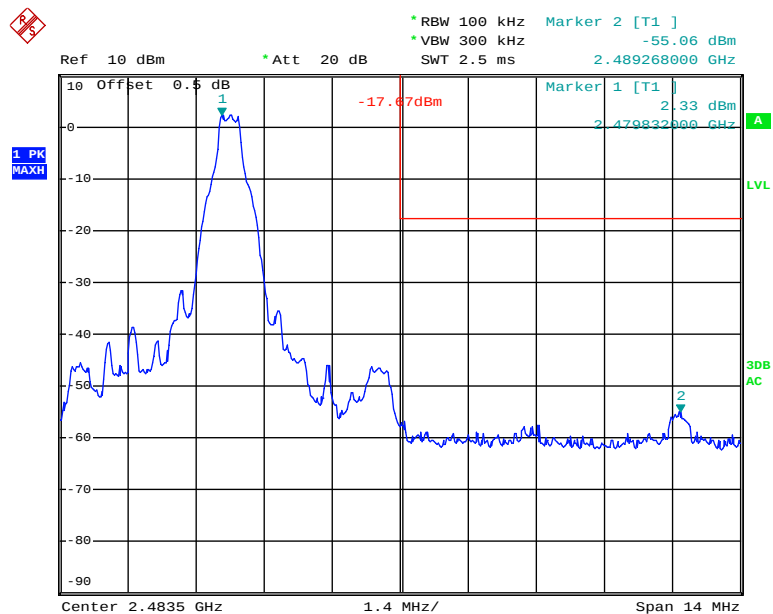
Temperature:	27.6 °C
Relative Humidity:	53 %
ATM Pressure:	100.2 kPa

** The testing was performed by Nami Quan on 2017-08-31.*

Test Result: Compliance

*BDR Mode (GFSK):***Band Edge, Left Side**

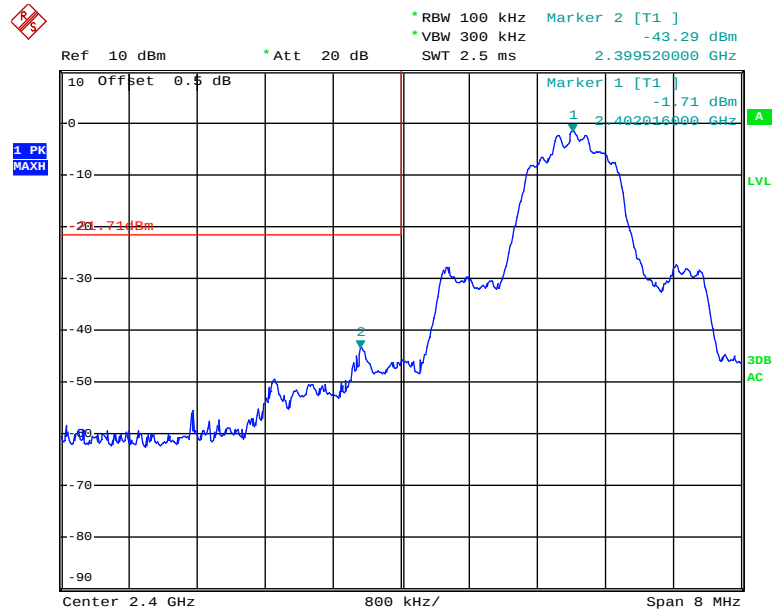
Date: 31.AUG.2017 09:27:59

Band Edge, Right Side

Date: 31.AUG.2017 09:30:02

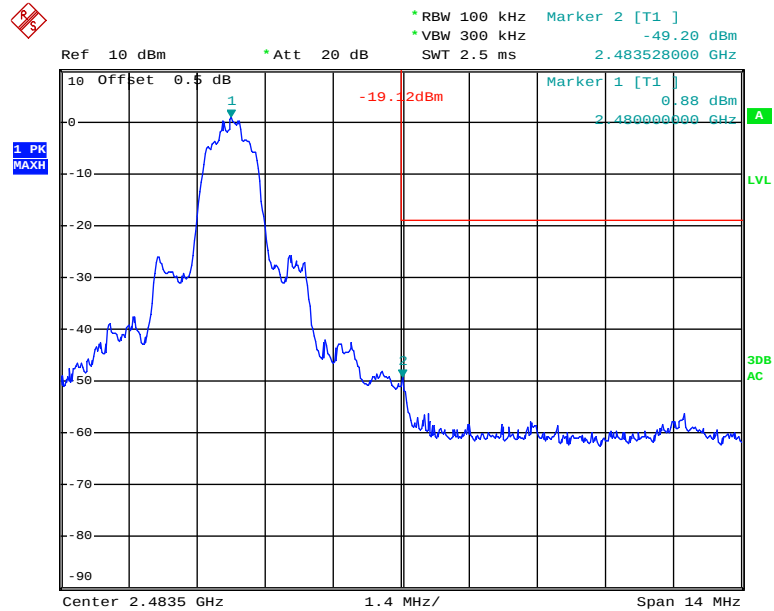
EDR Mode ($\pi/4$ -DQPSK):

Band Edge, Left Side

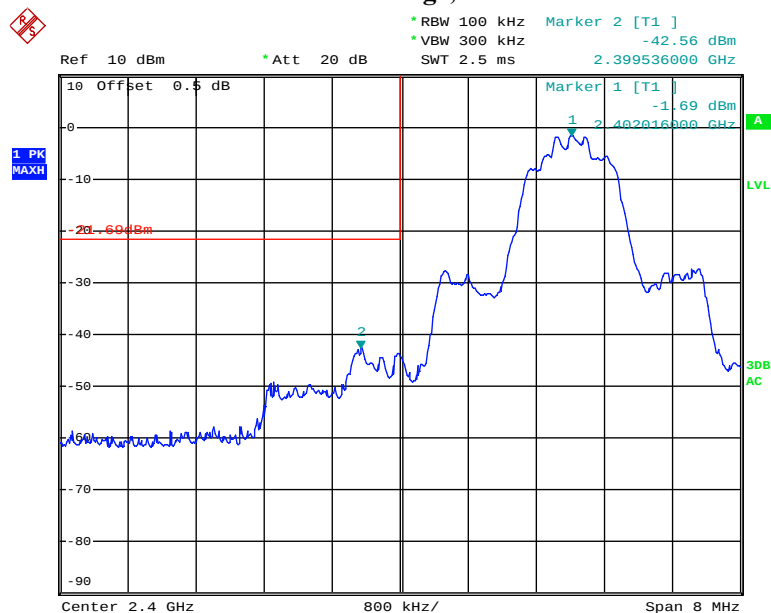


Date: 31.AUG.2017 09:33:59

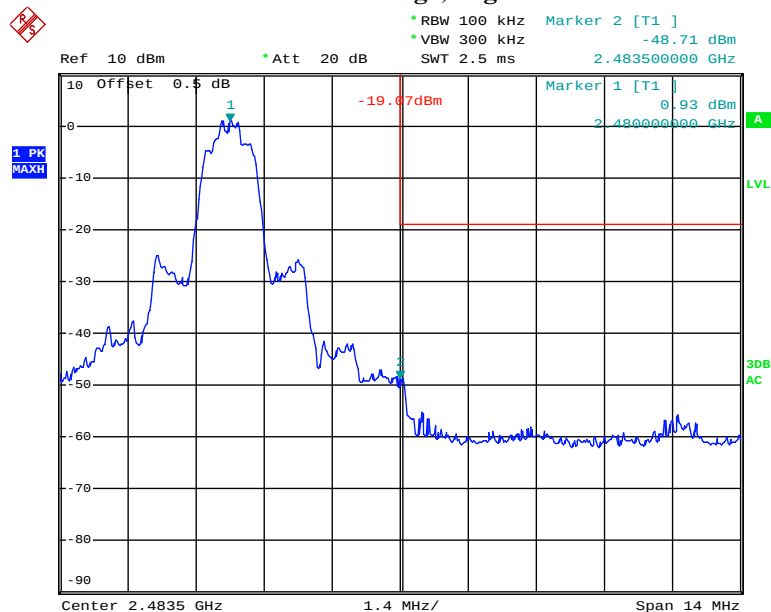
Band Edge, Right Side



Date: 31.AUG.2017 09:31:50

*EDR Mode (8-DPSK):***Band Edge, Left Side**

Date: 31.AUG.2017 09:37:07

Band Edge, Right Side

Date: 31.AUG.2017 09:41:06

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