FCC PART 15.247

TEST REPORT

For

TESONIC INTERNATIONAL(HK) LTD.

Room 2801,the 28th Office Tower, 6007 Shennan Avenue,Shenzhen ,China

FCC ID: 2AEW6EB2951

Report Type:	Product Type:
Original Report	bluetooth earbud

Test Engineer:	Dean Liu
Report Number:	RDG150714002-00A
Report Date:	2015-07-24
Reviewed By:	Sula Huang RF Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *TESONIC INTERNATIONAL(HK) LTD.*'s product, model number: *EB2951 (FCC ID: 2AEW6EB2951)* (the "EUT") in this report was a *bluetooth earbud,* which was measured approximately: 10 cm (L) x 9.8 cm (W) x3.5 cm (H), rated input voltage: DC 3.7V rechargeable Li-ion battery or DC5V charging from USB port.

All measurement and test data in this report was gathered from production sample serial number: 150714002 (Assigned by BACL, Dongguan). The EUT was received on 2015-07-14.

Objective

This report is prepared on behalf of *TESONIC INTERNATIONAL(HK) LTD.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B 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 Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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

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 Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

Test Software Version		Appotech RF Control Kit V4.0		
Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	N/A	N/A	N/A
	π/4-DQPSK	N/A	N/A	N/A
	8DPSK	N/A	N/A	N/A

Equipment Modifications

No modification was made to the EUT.

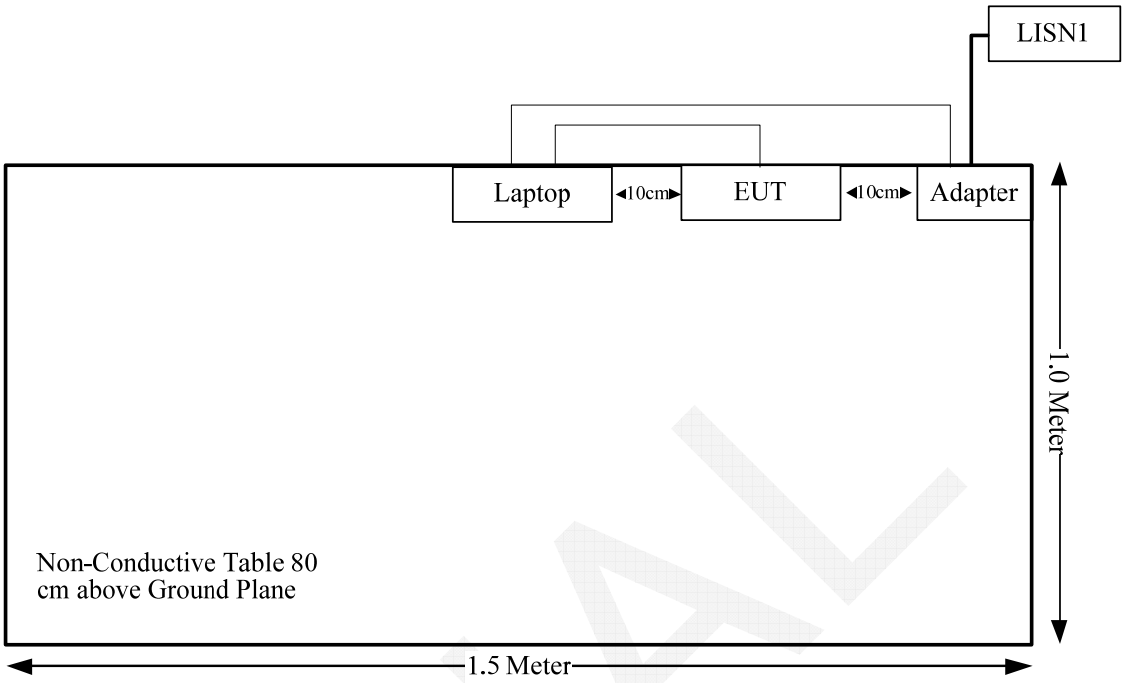
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	no	no	0.52	USB Port of Laptop	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliace
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliace
§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 v05r02:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(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 maximum target output power= 0.46 dBm (1.11mW) at 2402 MHz
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 1.11/5*(√2.402) = 0.34< 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 integral antenna arrangement, which was permanently attached and the antenna gain is 0 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

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

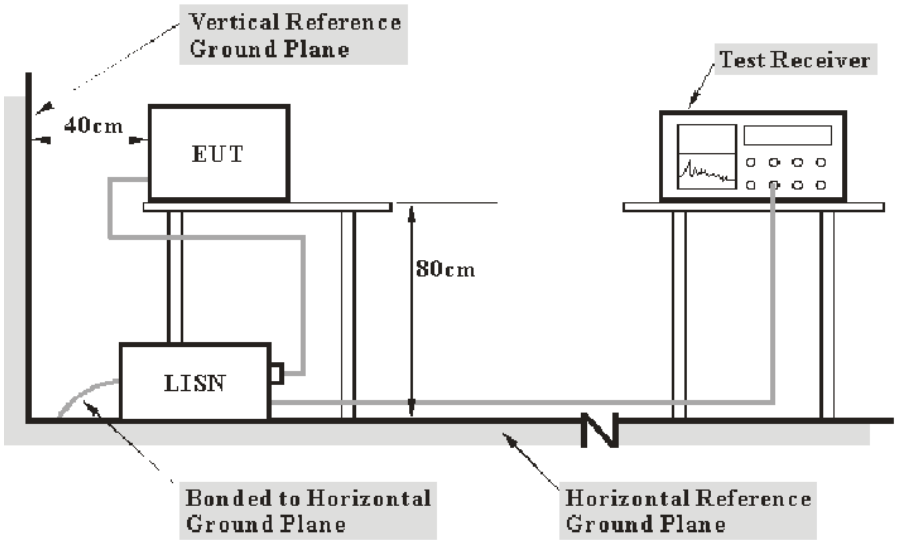
If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.46 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

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 C63.4-2009 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 a 120 VAC/60 Hz 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 maximum limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2014-10-20	2015-10-20
R&S	L.I.S.N	ESH2-Z5	892107/021	2015-06-09	2016-06-09
R&S	Two-line V-network	ENV 216	3560.6550.12	2014-12-11	2015-12-11
R&S	Test Software	EMC32	Version8.53.0	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).

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

3.2 dB at **0.549741 MHz** in the **Line** conducted mode

Test Data

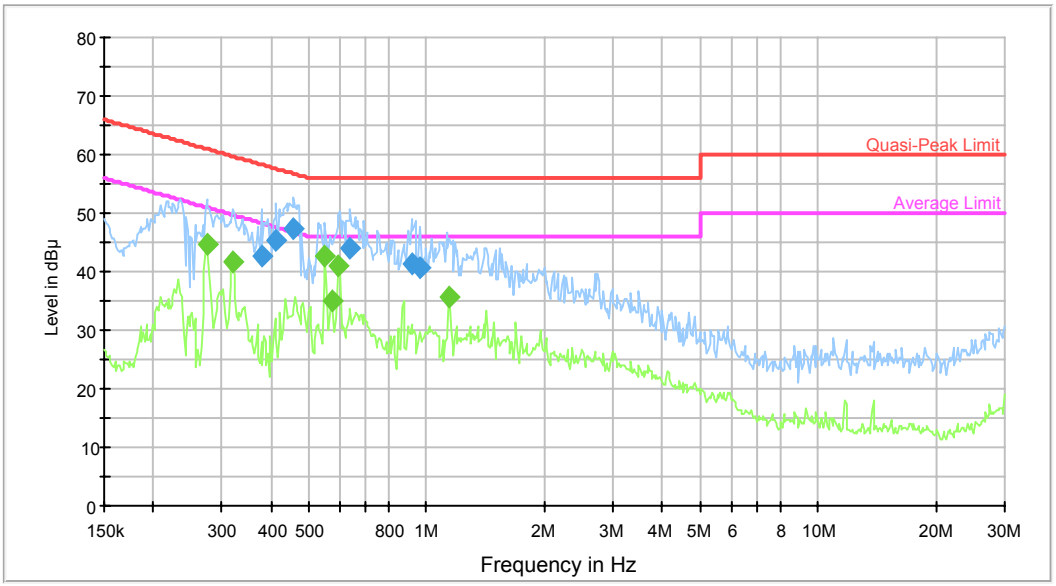
Environmental Conditions

Temperature:	26.6 °C
Relative Humidity:	63 %
ATM Pressure:	102.3 kPa

The testing was performed by Dean Liu on 2015-07-22.

Test Mode: Transmitting

AC120 V, 60 Hz, Line:

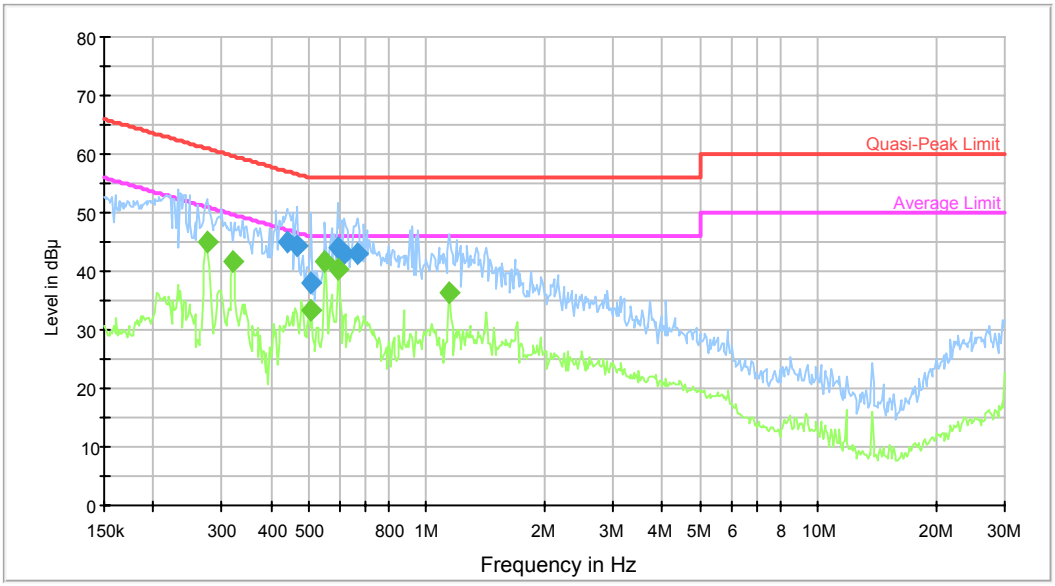


Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.378019	42.8	9.000	L1	10.3	15.6	58.3	Compliance
0.412647	45.5	9.000	L1	10.2	12.1	57.6	Compliance
0.457684	47.2	9.000	L1	10.2	9.5	56.7	Compliance
0.639600	44.0	9.000	L1	10.4	12.0	56.0	Compliance
0.915445	41.3	9.000	L1	10.4	14.7	56.0	Compliance
0.960275	40.6	9.000	L1	10.4	15.4	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.274848	44.6	9.000	L1	10.3	6.4	51.0	Compliance
0.319773	41.6	9.000	L1	10.3	8.1	49.7	Compliance
0.549741	42.8	9.000	L1	10.1	3.2*	46.0	Compliance
0.572086	35.1	9.000	L1	10.2	10.9	46.0	Compliance
0.595338	41.0	9.000	L1	10.2	5.0	46.0	Compliance
1.144267	35.6	9.000	L1	10.4	10.4	46.0	Compliance

**within measurement uncertainty!*

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.439808	45.0	9.000	N	10.2	12.1	57.1	Compliance
0.468757	44.3	9.000	N	10.1	12.2	56.5	Compliance
0.507637	37.9	9.000	N	10.1	18.1	56.0	Compliance
0.590613	44.1	9.000	N	10.2	11.9	56.0	Compliance
0.614619	42.8	9.000	N	10.3	13.2	56.0	Compliance
0.665597	42.9	9.000	N	10.4	13.1	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.274848	45.1	9.000	N	10.2	5.9	51.0	Compliance
0.319773	41.7	9.000	N	10.3	8.0	49.7	Compliance
0.507637	33.3	9.000	N	10.1	12.8	46.0	Compliance
0.549741	41.6	9.000	N	10.1	4.4	46.0	Compliance
0.595338	40.2	9.000	N	10.2	5.8	46.0	Compliance
1.144267	36.3	9.000	N	10.4	9.7	46.0	Compliance

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

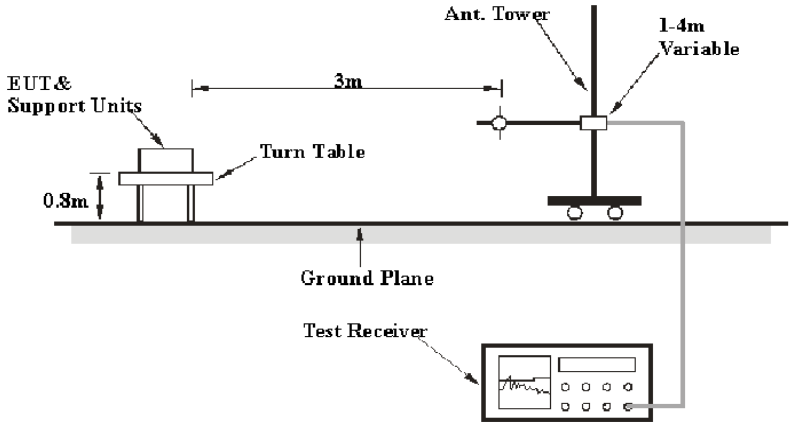
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:
30M~200MHz: 5.0 dB
200M~1GHz: 6.2 dB
1G~6GHz: 4.45 dB
6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

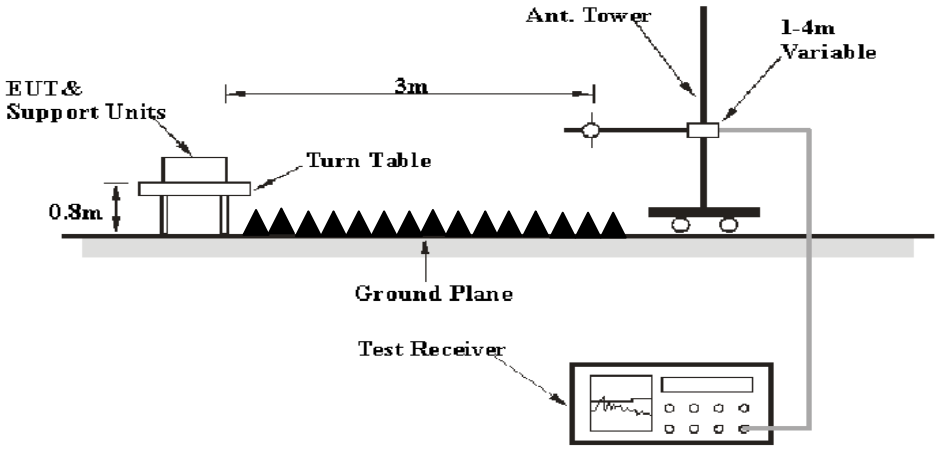
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2009. 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	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

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	2015-05-09	2016-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-07-28	2017-07-27
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2014-12-04	2015-12-04
ETS LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2015-02-19	2016-02-19
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2014-09-06	2015-09-06

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

Corrected Amplitude & Margin Calculation

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

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

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, and section 15.205, 15.209 and 15.247, with the worst margin reading of:

3.70 dB at **2390 MHz** in the **Horizontal** polarization

Test Data

Environmental Conditions

Temperature:	27.1 °C
Relative Humidity:	51 %
ATM Pressure:	99.8 kPa

** The testing was performed by Dean Liu on 2015-07-17.*

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	61.82	PK	H	25.65	3.66	0.00	91.13	N/A	N/A
2402	49.73	AV	H	25.65	3.66	0.00	79.04	N/A	N/A
2402	59.94	PK	V	25.65	3.66	0.00	89.25	N/A	N/A
2402	47.56	AV	V	25.65	3.66	0.00	76.87	N/A	N/A
2390	34.82	PK	H	25.61	3.63	0.00	64.06	74.00	9.94
2390	21.06	AV	H	25.61	3.63	0.00	50.30	54.00	3.70 *
4804	37.51	PK	H	30.59	5.06	27.41	45.75	74.00	28.25
4804	23.72	AV	H	30.59	5.06	27.41	31.96	54.00	22.04
7206	35.09	PK	H	34.09	6.61	25.91	49.88	74.00	24.12
7206	21.26	AV	H	34.09	6.61	25.91	36.05	54.00	17.95
9608	30.59	PK	H	35.96	8.53	27.55	47.53	74.00	26.47
9608	17.72	AV	H	35.96	8.53	27.55	34.66	54.00	19.34
3115	33.39	PK	H	27.57	6.88	27.44	40.40	74.00	33.60
3115	19.61	AV	H	27.57	6.88	27.44	26.62	54.00	27.38
52.31	47.1	QP	V	8.07	0.92	21.41	34.68	40.00	5.32
Middle Channel: 2441 MHz									
2441	60.75	PK	H	25.75	3.76	0.00	90.26	N/A	N/A
2441	48.56	AV	H	25.75	3.76	0.00	78.07	N/A	N/A
2441	58.93	PK	V	25.75	3.76	0.00	88.44	N/A	N/A
2441	46.42	AV	V	25.75	3.76	0.00	75.93	N/A	N/A
4882	36.69	PK	H	30.79	5.19	27.42	45.25	74.00	28.75
4882	22.6	AV	H	30.79	5.19	27.42	31.16	54.00	22.84
7323	33.96	PK	H	34.38	6.75	25.88	49.21	74.00	24.79
7323	20.06	AV	H	34.38	6.75	25.88	35.31	54.00	18.69
9764	29.59	PK	H	36.33	8.62	27.20	47.34	74.00	26.66
9764	16.61	AV	H	36.33	8.62	27.20	34.36	54.00	19.64
3115	32.19	PK	H	27.57	6.88	27.44	39.20	74.00	34.80
3115	18.55	AV	H	27.57	6.88	27.44	25.56	54.00	28.44
1675	32.55	PK	H	23.95	2.89	27.71	31.68	74.00	42.32
1675	18.8	AV	H	23.95	2.89	27.71	17.93	54.00	36.07
52.31	46.8	QP	V	8.07	0.92	21.41	34.38	40.00	5.62
High Channel: 2480 MHz									
2480	60.53	PK	H	25.85	3.68	0.00	90.06	N/A	N/A
2480	48.67	AV	H	25.85	3.68	0.00	78.20	N/A	N/A
2480	58.57	PK	V	25.85	3.68	0.00	88.10	N/A	N/A
2480	46.49	AV	V	25.85	3.68	0.00	76.02	N/A	N/A
2483.5	33.53	PK	H	25.86	3.67	0.00	63.06	74.00	10.94
2483.5	19.89	AV	H	25.86	3.67	0.00	49.42	54.00	4.58
4960	36.7	PK	H	31.00	5.34	27.43	45.61	74.00	28.39
4960	22.66	AV	H	31.00	5.34	27.43	31.57	54.00	22.43
7440	34.07	PK	H	34.66	6.89	25.97	49.65	74.00	24.35
7440	20.08	AV	H	34.66	6.89	25.97	35.66	54.00	18.34
9920	29.48	PK	H	36.71	8.71	26.66	48.24	74.00	25.76
9920	16.55	AV	H	36.71	8.71	26.66	35.31	54.00	18.69
3115	32.27	PK	H	27.57	6.88	27.44	39.28	74.00	34.72
3115	18.52	AV	H	27.57	6.88	27.44	25.53	54.00	28.47
52.31	46.6	QP	V	8.07	0.92	21.41	34.18	40.00	5.82

**within measurement uncertanity!*

EDR Mode (π/4-DQPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	61.72	PK	H	25.65	3.66	0.00	91.03	N/A	N/A
2402	49.58	AV	H	25.65	3.66	0.00	78.89	N/A	N/A
2402	60.28	PK	V	25.65	3.66	0.00	89.59	N/A	N/A
2402	47.92	AV	V	25.65	3.66	0.00	77.23	N/A	N/A
2390	34.31	PK	H	25.61	3.63	0.00	63.55	74.00	10.45
2390	20.73	AV	H	25.61	3.63	0.00	49.97	54.00	4.03*
4804	37.12	PK	H	30.59	5.06	27.41	45.36	74.00	28.64
4804	23.58	AV	H	30.59	5.06	27.41	31.82	54.00	22.18
7206	32.64	PK	H	34.09	6.61	25.91	47.43	74.00	26.57
7206	19.05	AV	H	34.09	6.61	25.91	33.84	54.00	20.16
9608	30.36	PK	H	35.96	8.53	27.55	47.30	74.00	26.70
9608	16.18	AV	H	35.96	8.53	27.55	33.12	54.00	20.88
2005	36.37	PK	H	24.61	3.16	27.48	36.66	74.00	37.34
2005	22.62	AV	H	24.61	3.16	27.48	22.91	54.00	31.09
52.31	47.2	QP	V	8.07	0.92	21.41	34.78	40.00	5.22
Middle Channel: 2441 MHz									
2441	61.33	PK	H	25.75	3.76	0.00	90.84	N/A	N/A
2441	49.16	AV	H	25.75	3.76	0.00	78.67	N/A	N/A
2441	59.82	PK	V	25.75	3.76	0.00	89.33	N/A	N/A
2441	46.47	AV	V	25.75	3.76	0.00	75.98	N/A	N/A
4882	36.76	PK	H	30.79	5.19	27.42	45.32	74.00	28.68
4882	22.92	AV	H	30.79	5.19	27.42	31.48	54.00	22.52
7323	31.96	PK	H	34.38	6.75	25.88	47.21	74.00	26.79
7323	18.4	AV	H	34.38	6.75	25.88	33.65	54.00	20.35
9764	29.72	PK	H	36.33	8.62	27.20	47.47	74.00	26.53
9764	15.49	AV	H	36.33	8.62	27.20	33.24	54.00	20.76
3205	33.29	PK	H	27.86	6.10	27.37	39.88	74.00	34.12
3205	19.58	AV	H	27.86	6.10	27.37	26.17	54.00	27.83
2005	35.86	PK	H	24.61	3.16	27.48	36.15	74.00	37.85
2005	22.02	AV	H	24.61	3.16	27.48	22.31	54.00	31.69
52.31	46.9	QP	V	8.07	0.92	21.41	34.48	40.00	5.52
High Channel: 2480 MHz									
2480	61.29	PK	H	25.85	3.68	0.00	90.82	N/A	N/A
2480	49.05	AV	H	25.85	3.68	0.00	78.58	N/A	N/A
2480	60.36	PK	V	25.85	3.68	0.00	89.89	N/A	N/A
2480	47.92	AV	V	25.85	3.68	0.00	77.45	N/A	N/A
2483.5	33.62	PK	H	25.86	3.67	0.00	63.15	74.00	10.85
2483.5	19.96	AV	H	25.86	3.67	0.00	49.49	54.00	4.51
4960	36.73	PK	H	31.00	5.34	27.43	45.64	74.00	28.36
4960	23.01	AV	H	31.00	5.34	27.43	31.92	54.00	22.08
7440	32	PK	H	34.66	6.89	25.97	47.58	74.00	26.42
7440	18.52	AV	H	34.66	6.89	25.97	34.10	54.00	19.90
9920	29.76	PK	H	36.71	8.71	26.66	48.52	74.00	25.48
9920	15.49	AV	H	36.71	8.71	26.66	34.25	54.00	19.75
2005	35.82	PK	H	24.61	3.16	27.48	36.11	74.00	37.89
2005	22	AV	H	24.61	3.16	27.48	22.29	54.00	31.71
52.31	46.6	QP	V	8.07	0.92	21.41	34.18	40.00	5.82

**within measurement uncertainty!*

EDR Mode (8-DPSK):

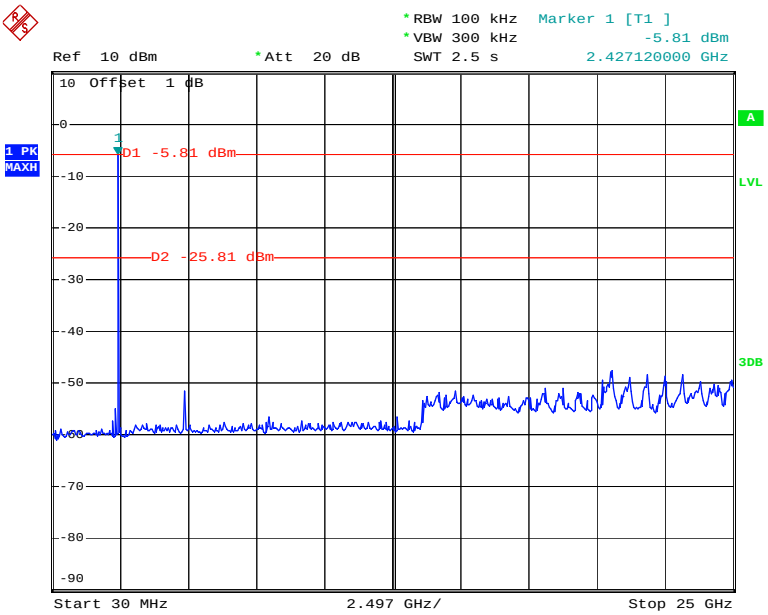
Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	62.31	PK	H	25.65	3.66	0.00	91.62	N/A	N/A
2402	50.58	AV	H	25.65	3.66	0.00	79.89	N/A	N/A
2402	61.48	PK	V	25.65	3.66	0.00	90.79	N/A	N/A
2402	49.44	AV	V	25.65	3.66	0.00	78.75	N/A	N/A
2390	34.52	PK	H	25.61	3.63	0.00	63.76	74.00	10.24
2390	20.7	AV	H	25.61	3.63	0.00	49.94	54.00	4.06*
4804	38.05	PK	H	30.59	5.06	27.41	46.29	74.00	27.71
4804	24.41	AV	H	30.59	5.06	27.41	32.65	54.00	21.35
7206	33.76	PK	H	34.09	6.61	25.91	48.55	74.00	25.45
7206	20.19	AV	H	34.09	6.61	25.91	34.98	54.00	19.02
9608	30.72	PK	H	35.96	8.53	27.55	47.66	74.00	26.34
9608	17.05	AV	H	35.96	8.53	27.55	33.99	54.00	20.01
3130	33.94	PK	H	27.62	6.92	27.43	41.05	74.00	32.95
3130	20.32	AV	H	27.62	6.92	27.43	27.43	54.00	26.57
52.31	45.1	QP	V	8.07	0.92	21.41	32.68	40.00	7.32
Middle Channel: 2441 MHz									
2441	61.82	PK	H	25.75	3.76	0.00	91.33	N/A	N/A
2441	49.95	AV	H	25.75	3.76	0.00	79.46	N/A	N/A
2441	60.42	PK	V	25.75	3.76	0.00	89.93	N/A	N/A
2441	48.29	AV	V	25.75	3.76	0.00	77.80	N/A	N/A
4882	37.71	PK	H	30.79	5.19	27.42	46.27	74.00	27.73
4882	23.72	AV	H	30.79	5.19	27.42	32.28	54.00	21.72
7323	33.23	PK	H	34.38	6.75	25.88	48.48	74.00	25.52
7323	19.58	AV	H	34.38	6.75	25.88	34.83	54.00	19.17
9764	30.05	PK	H	36.33	8.62	27.20	47.80	74.00	26.20
9764	16.49	AV	H	36.33	8.62	27.20	34.24	54.00	19.76
1930	36.65	PK	H	24.46	3.00	27.50	36.61	74.00	37.39
1930	22.96	AV	H	24.46	3.00	27.50	22.92	54.00	31.08
3130	33.42	PK	H	27.62	6.92	27.43	40.53	74.00	33.47
3130	19.79	AV	H	27.62	6.92	27.43	26.90	54.00	27.10
52.31	45.6	QP	V	8.07	0.92	21.41	33.18	40.00	6.82
High Channel: 2480 MHz									
2480	61.68	PK	H	25.85	3.68	0.00	91.21	N/A	N/A
2480	49.75	AV	H	25.85	3.68	0.00	79.28	N/A	N/A
2480	60.29	PK	V	25.85	3.68	0.00	89.82	N/A	N/A
2480	48.12	AV	V	25.85	3.68	0.00	77.65	N/A	N/A
2483.5	33.83	PK	H	25.86	3.67	0.00	63.36	74.00	10.64
2483.5	20.01	AV	H	25.86	3.67	0.00	49.54	54.00	4.46
4960	37.65	PK	H	31.00	5.34	27.43	46.56	74.00	27.44
4960	23.89	AV	H	31.00	5.34	27.43	32.80	54.00	21.20
7440	33.15	PK	H	34.66	6.89	25.97	48.73	74.00	25.27
7440	19.62	AV	H	34.66	6.89	25.97	35.20	54.00	18.80
9920	30.09	PK	H	36.71	8.71	26.66	48.85	74.00	25.15
9920	16.52	AV	H	36.71	8.71	26.66	35.28	54.00	18.72
3130	33.32	PK	H	27.62	6.92	27.43	40.43	74.00	33.57
3130	19.77	AV	H	27.62	6.92	27.43	26.88	54.00	27.12
52.31	44.8	QP	V	8.07	0.92	21.41	32.38	40.00	7.62

**within measurement uncertainty!*

Conducted Spurious Emissions at Antenna Port

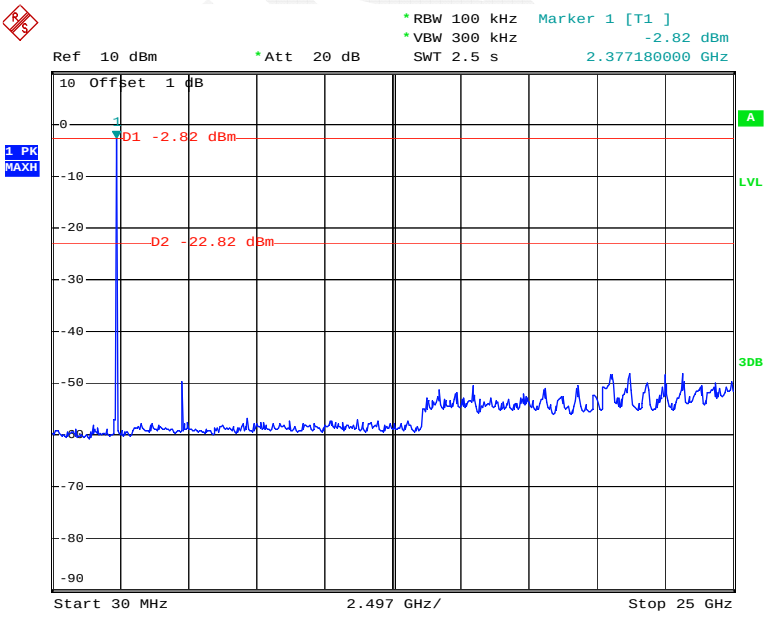
BDR Mode (GFSK):

Low Channel



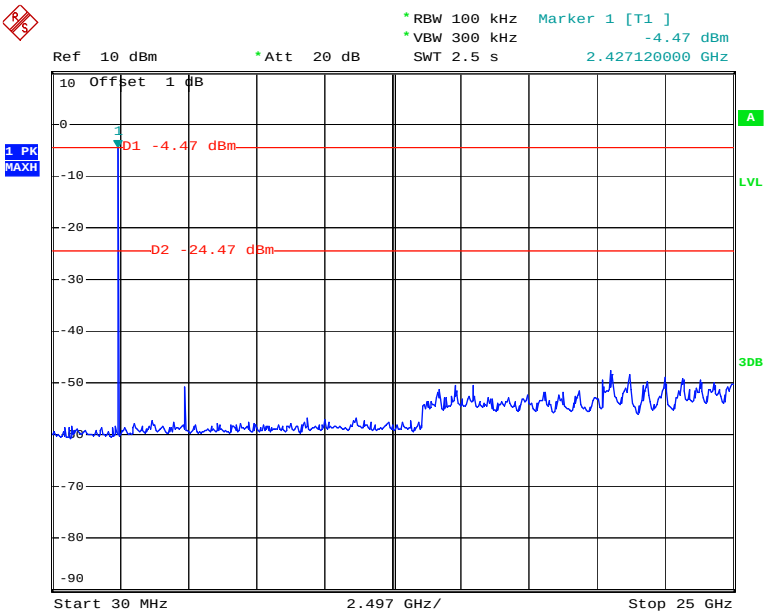
Date: 17.JUL.2015 17:13:00

Middle Channel



Date: 17.JUL.2015 17:10:05

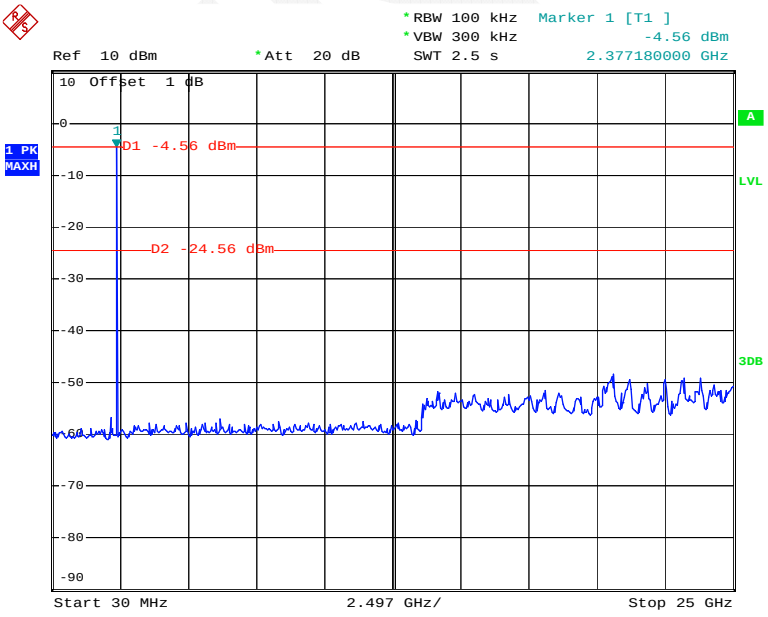
High Channel



Date: 17.JUL.2015 17:11:32

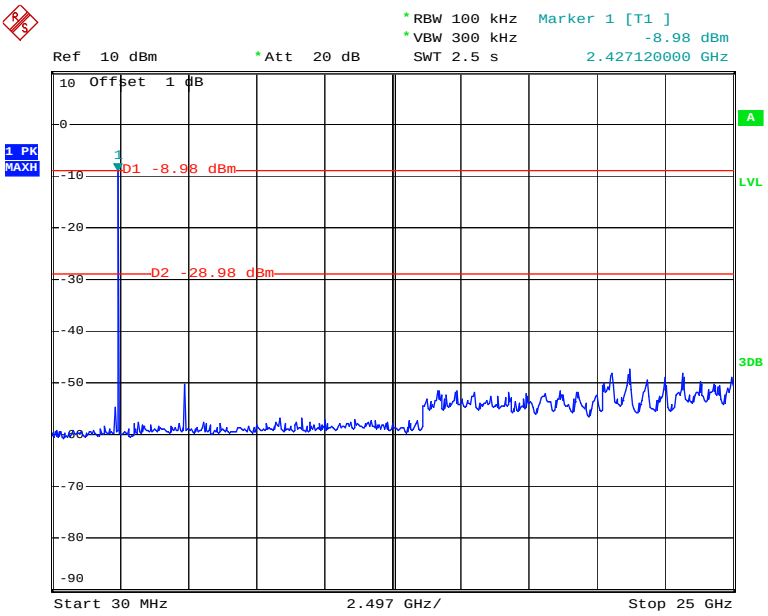
EDR Mode (π/4-DQPSK):

Low Channel



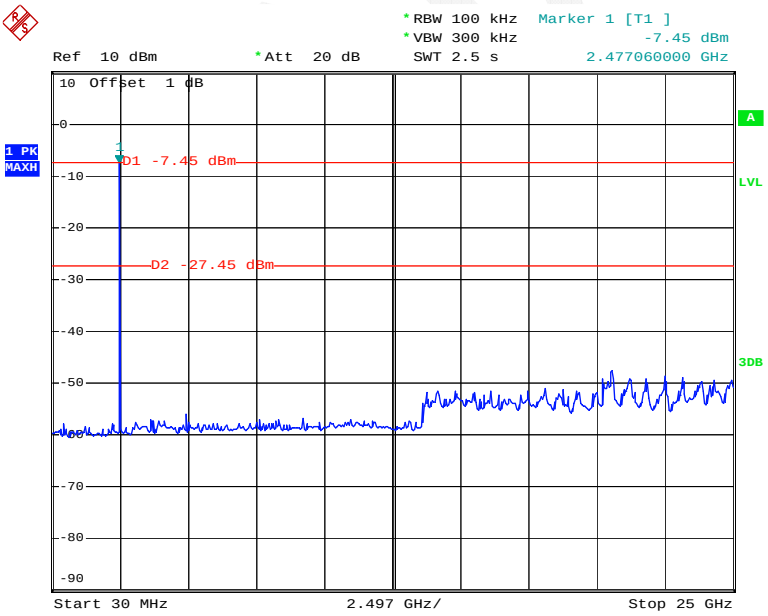
Date: 17.JUL.2015 17:19:39

Middle Channel



Date: 17.JUL.2015 17:18:58

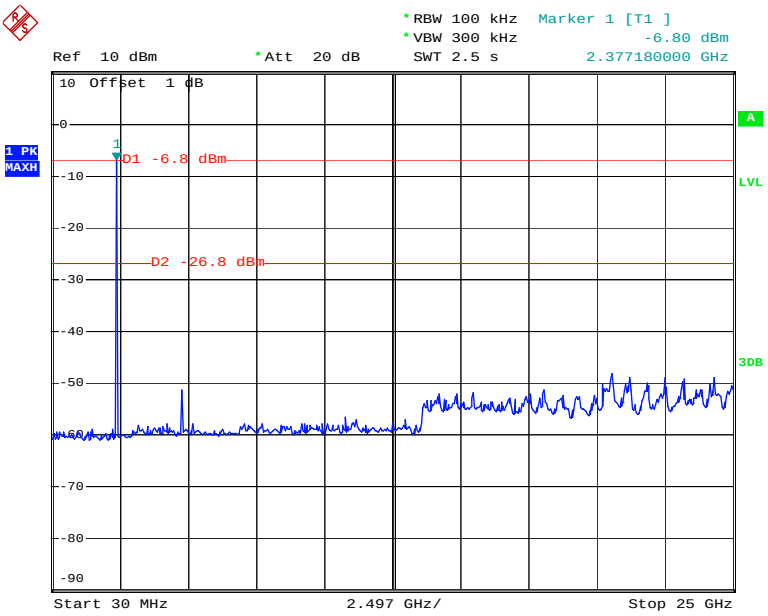
High Channel



Date: 17.JUL.2015 17:17:33

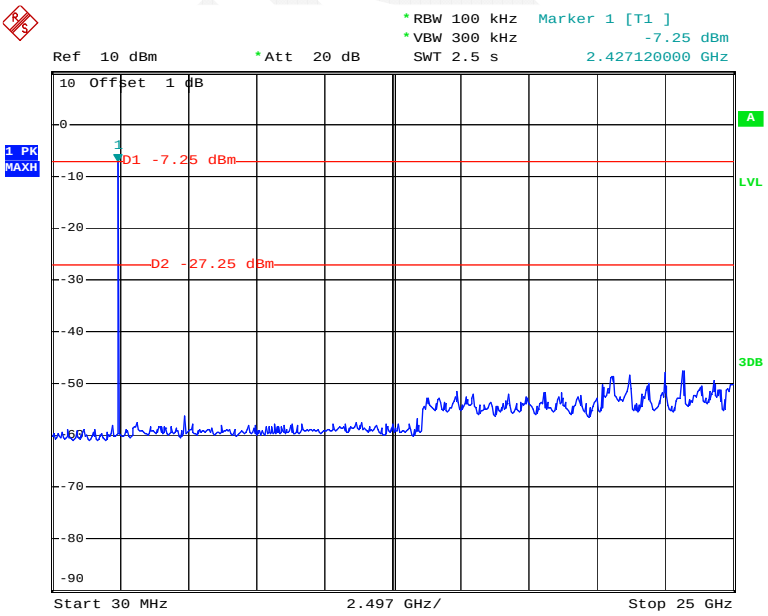
EDR Mode (8-DPSK):

Low Channel



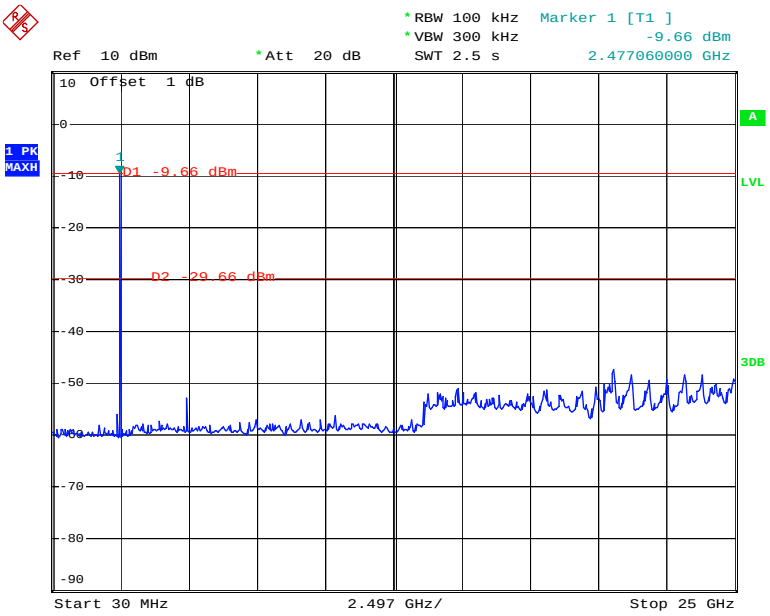
Date: 17.JUL.2015 17:20:30

Middle Channel



Date: 17.JUL.2015 17:21:26

High Channel



Date: 17.JUL.2015 17:22:59

FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

Applicable Standard

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Procedure

According to PUBLIC NOTICE DA 00-705
Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

Test Data

Environmental Conditions

Temperature:	26.1°C
Relative Humidity:	53 %
ATM Pressure:	99.4 kPa

** The testing was performed by Dean Liu on 2015-07-16.*

Test Result: Compliance.

Please refer to following tables and plots

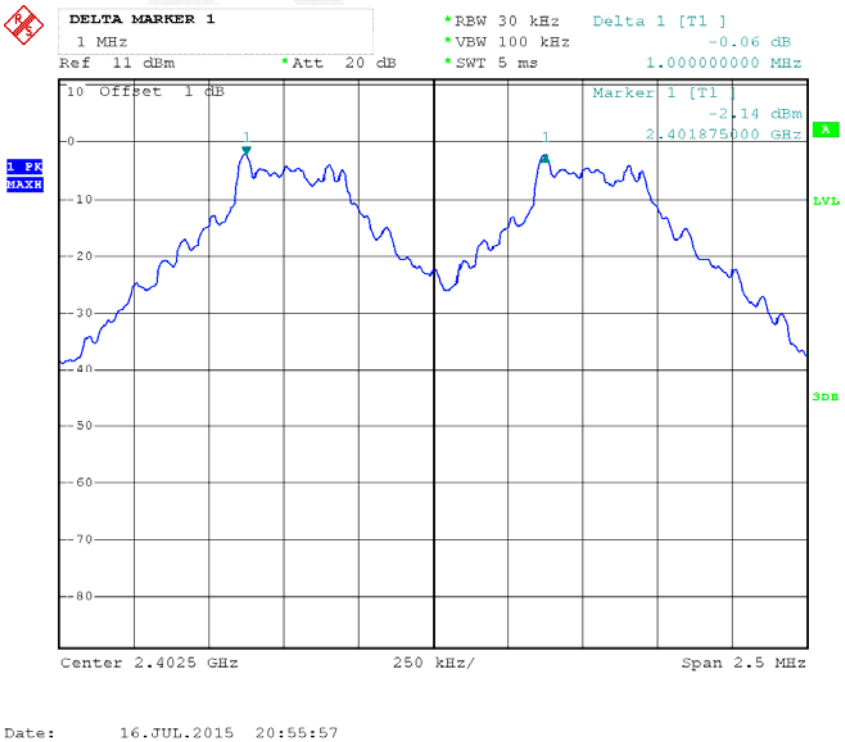
Test Mode: Transmitting

Mode	Channel	Frequency	Channel Seperation	Limit	Result
		MHz	MHz	MHz	
BDR (GFSK)	Low	2402	1.000	0.617	Pass
	Adjacent	2403			
	Middle	2441	1.005		
	Adjacent	2442			
	High	2480	1.000		
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	1.005	0.837	Pass
	Adjacent	2403			
	Middle	2441	1.000		
	Adjacent	2442			
	High	2480	1.005		
	Adjacent	2479			
EDR (8DPSK)	Low	2402	1.000	0.840	Pass
	Adjacent	2403			
	Middle	2441	1.000		
	Adjacent	2442			
	High	2480	1.005		
	Adjacent	2479			

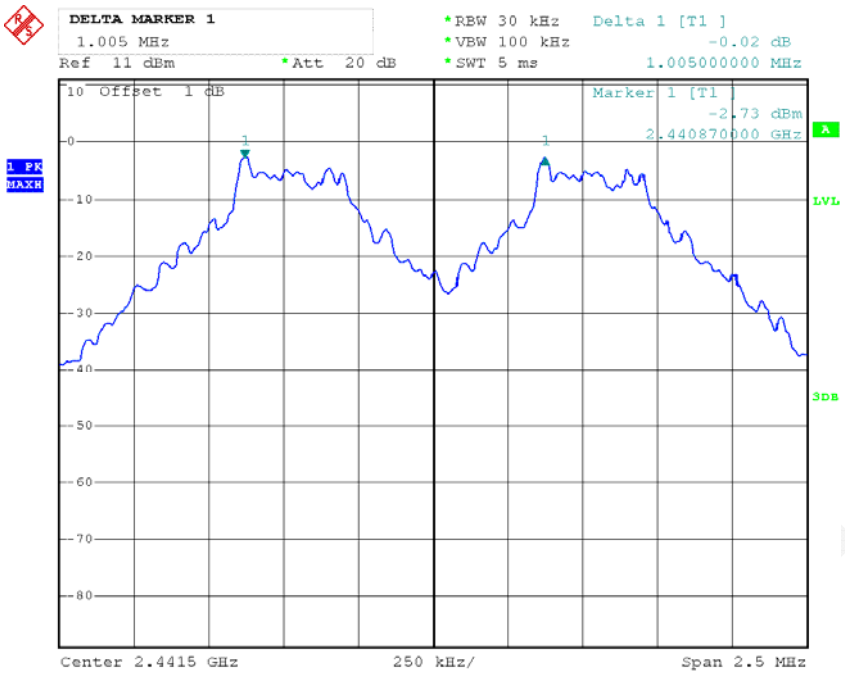
*Note: Limit= (2/3)*20dB bandwidth*

BDR Mode (GFSK):

Low Channel

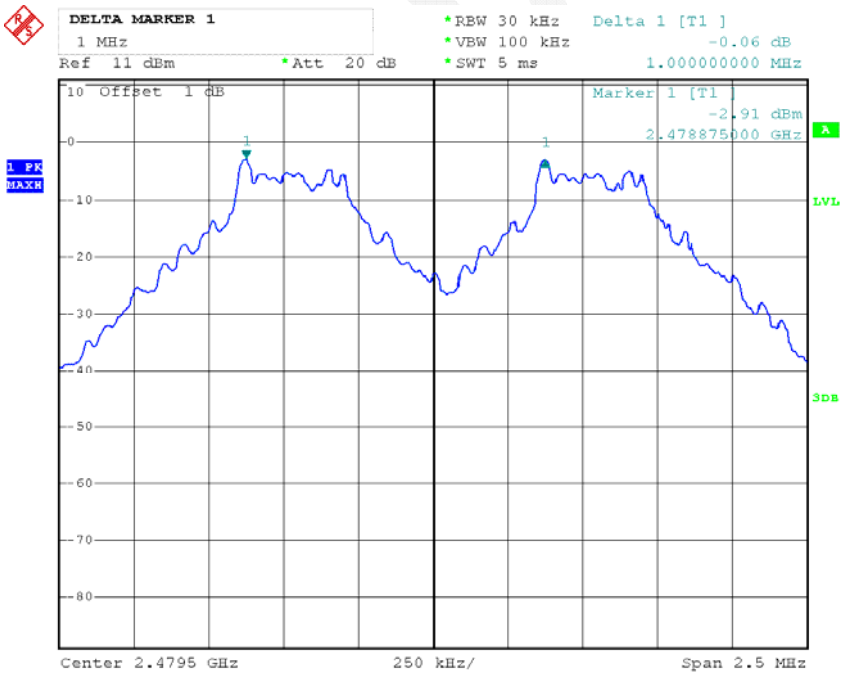


Middle Channel



Date: 16.JUL.2015 20:58:26

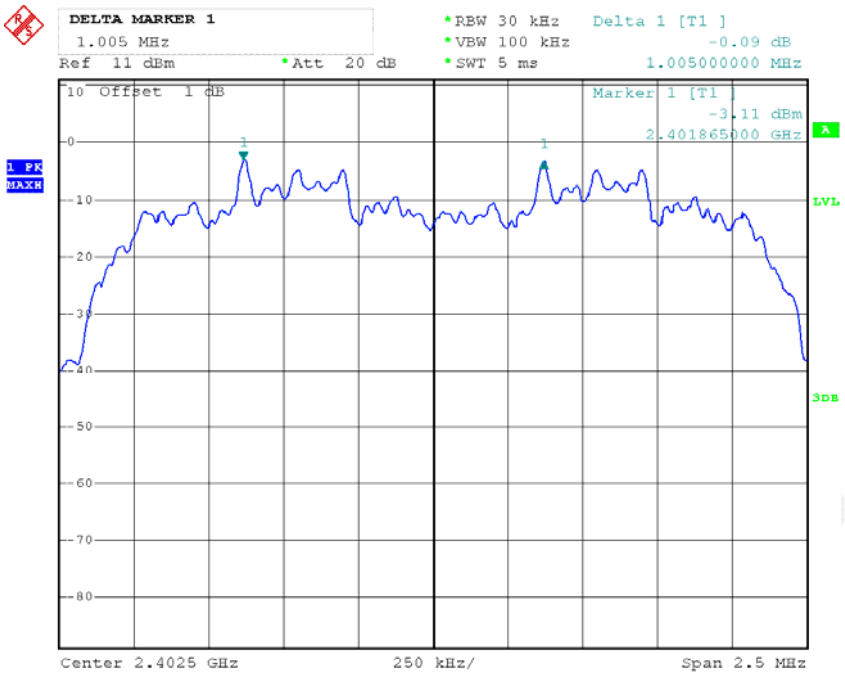
High Channel



Date: 16.JUL.2015 21:00:12

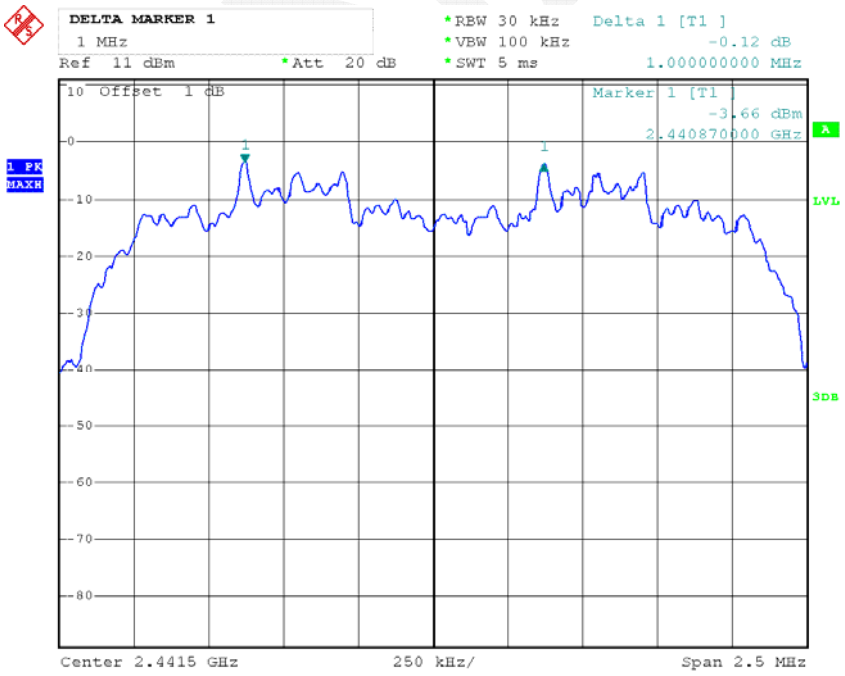
EDR Mode (π/4-DQPSK):

Low Channel



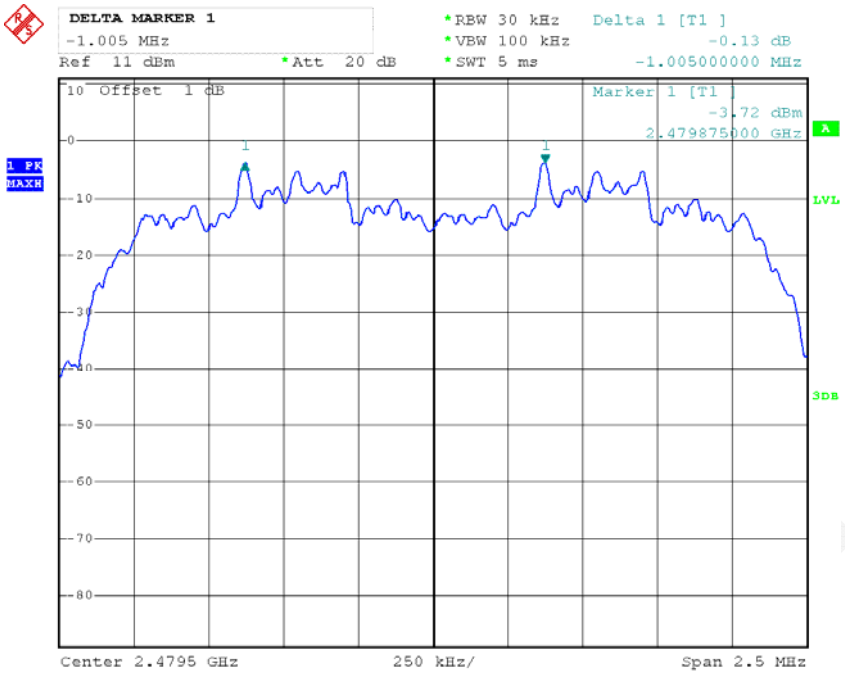
Date: 16.JUL.2015 21:05:41

Middle Channel



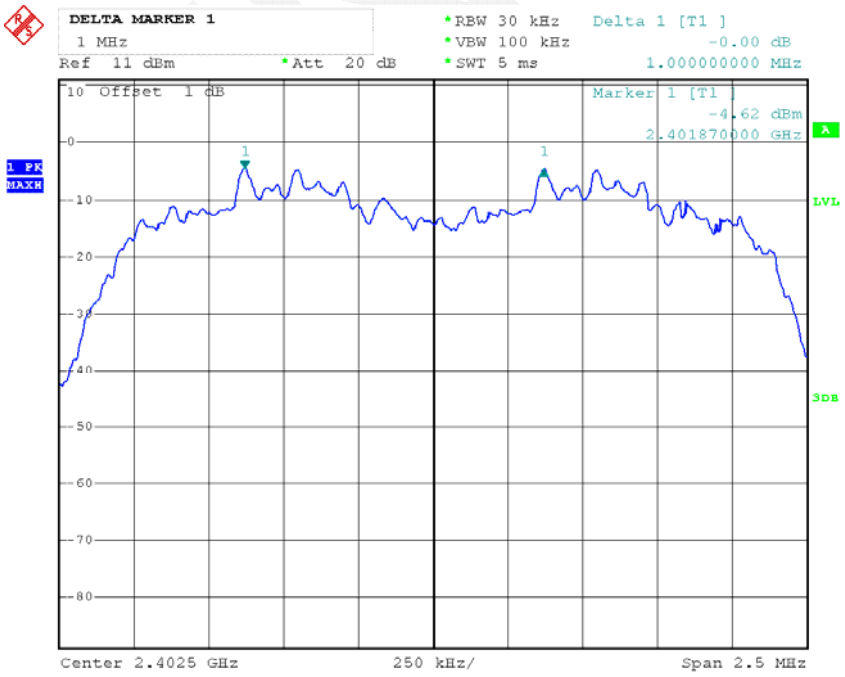
Date: 16.JUL.2015 21:03:45

High Channel

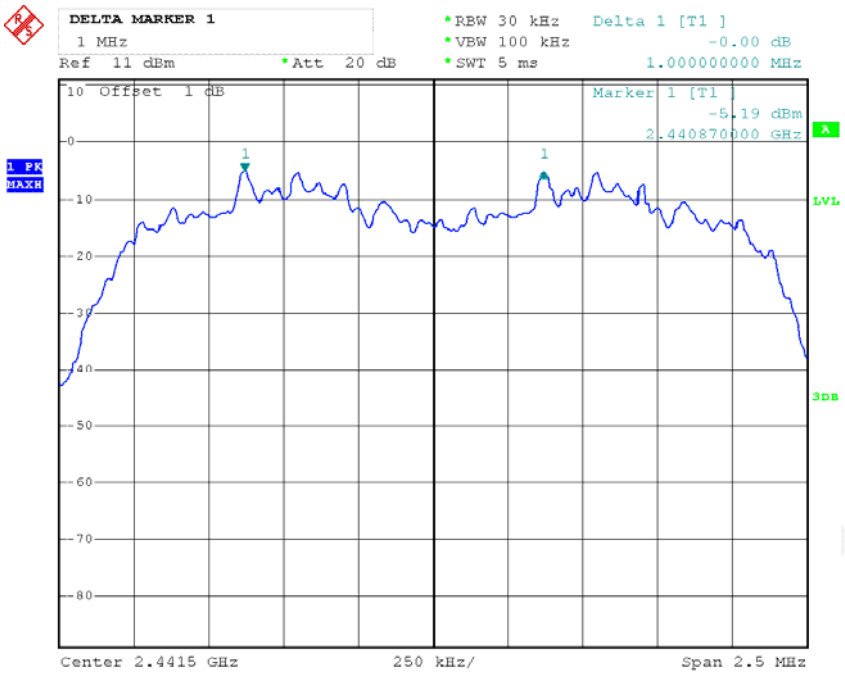


EDR Mode (8-DPSK):

Low Channel

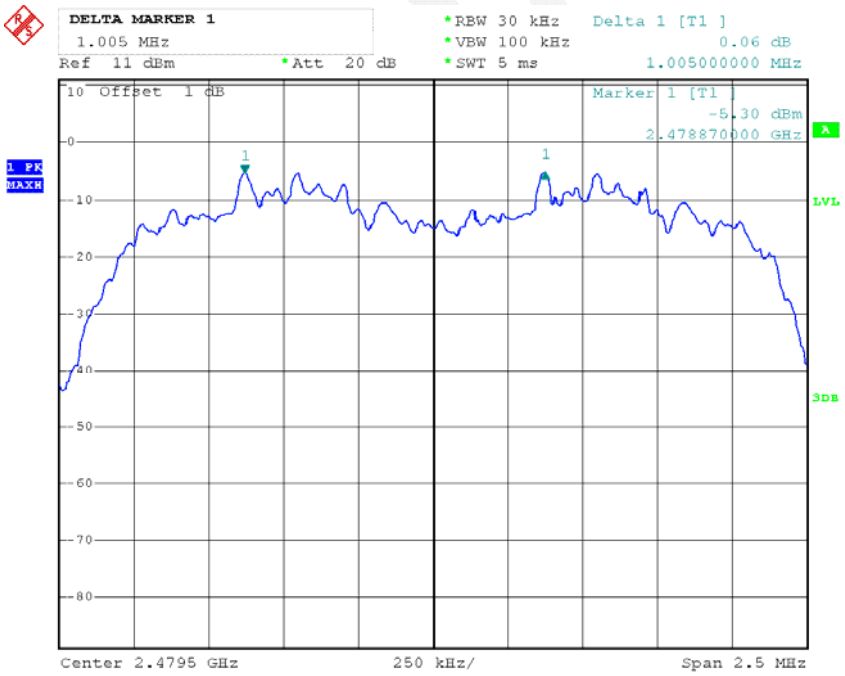


Middle Channel



Date: 16.JUL.2015 21:09:14

High Channel



Date: 16.JUL.2015 21:10:53

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

According to PUBLIC NOTICE DA 00-705
Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Data

Environmental Conditions

Temperature:	26.1°C
Relative Humidity:	53 %
ATM Pressure:	99.6 kPa

** The testing was performed by Dean Liu on 2015-07-16.*

Test Result: Compliance.

Please refer to following tables and plots

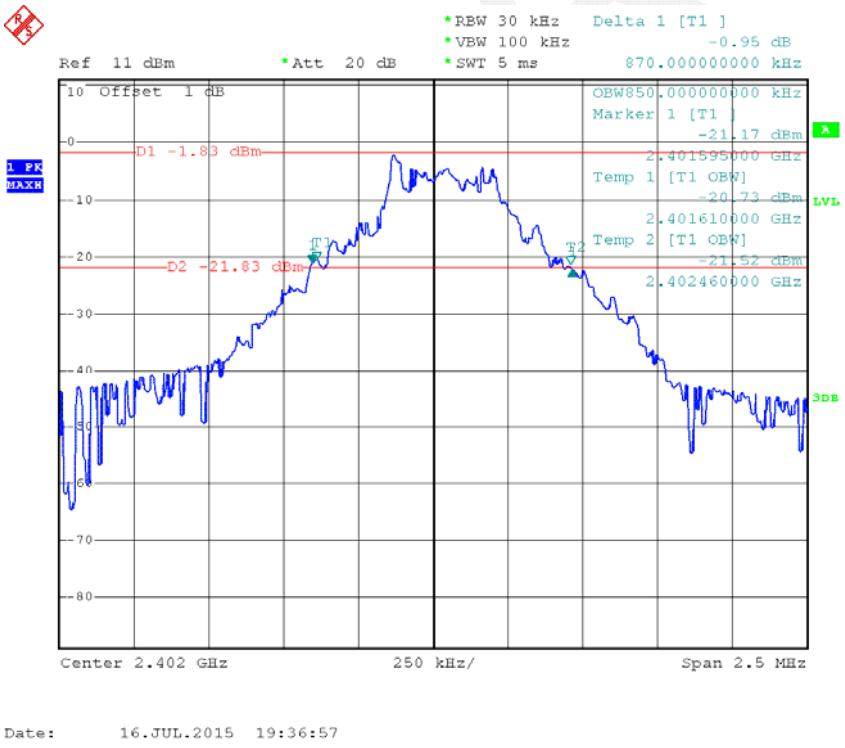
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.870
	Middle	2441	0.925
	High	2480	0.920
EDR Mode (π/4-DQPSK):	Low	2402	1.250
	Middle	2441	1.255
	High	2480	1.255
EDR Mode (8-DPSK):	Low	2402	1.255
	Middle	2441	1.255
	High	2480	1.260

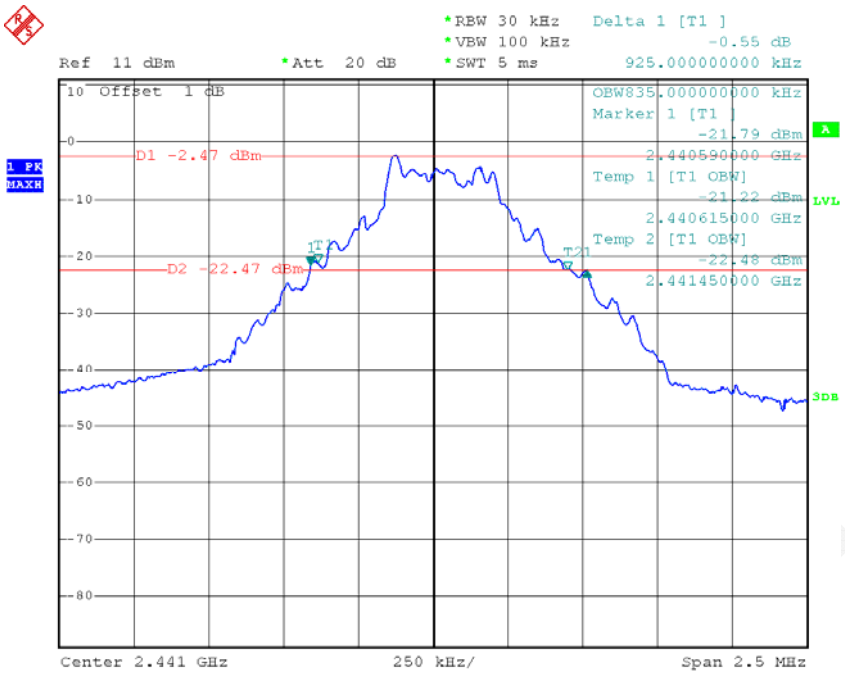
Please refer to the following plots.

BDR Mode (GFSK):

Low Channel

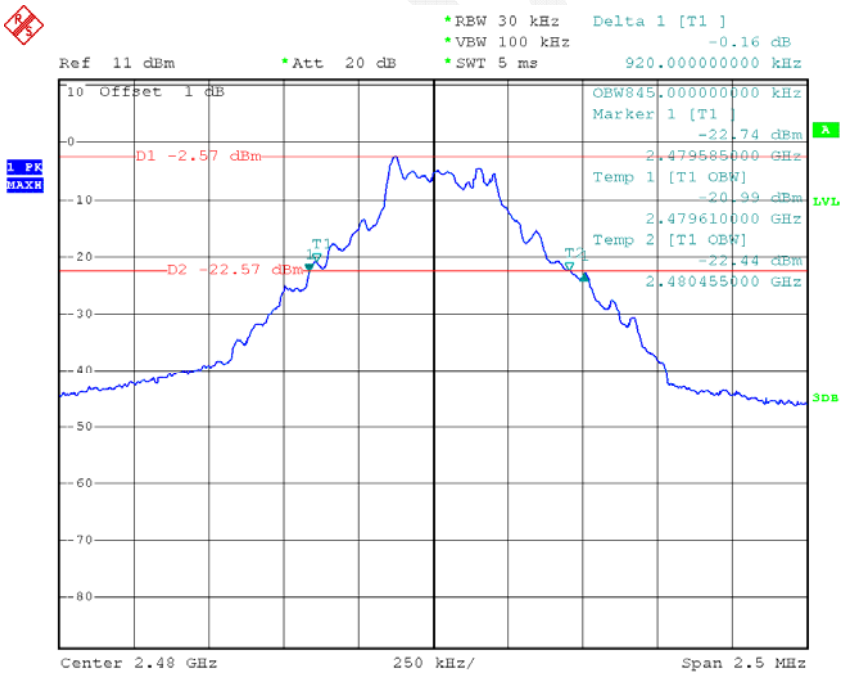


Middle Channel



Date: 16.JUL.2015 19:39:25

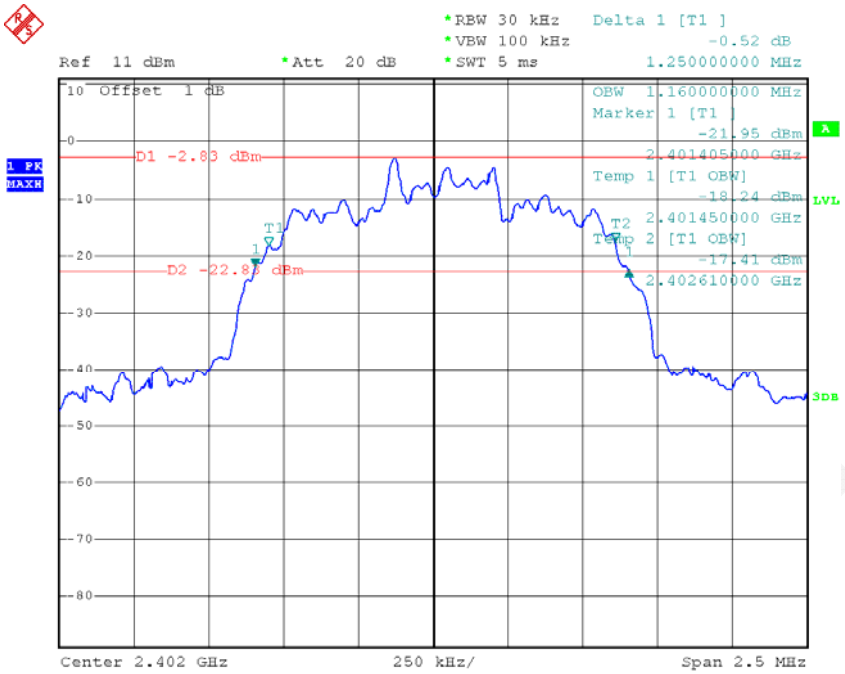
High Channel



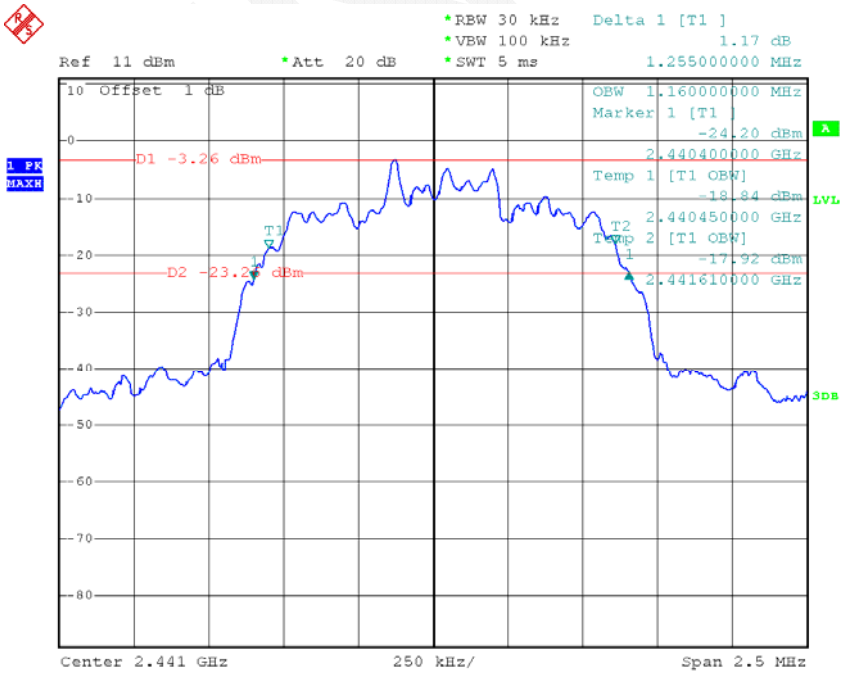
Date: 16.JUL.2015 19:41:32

EDR Mode (π/4-DQPSK):

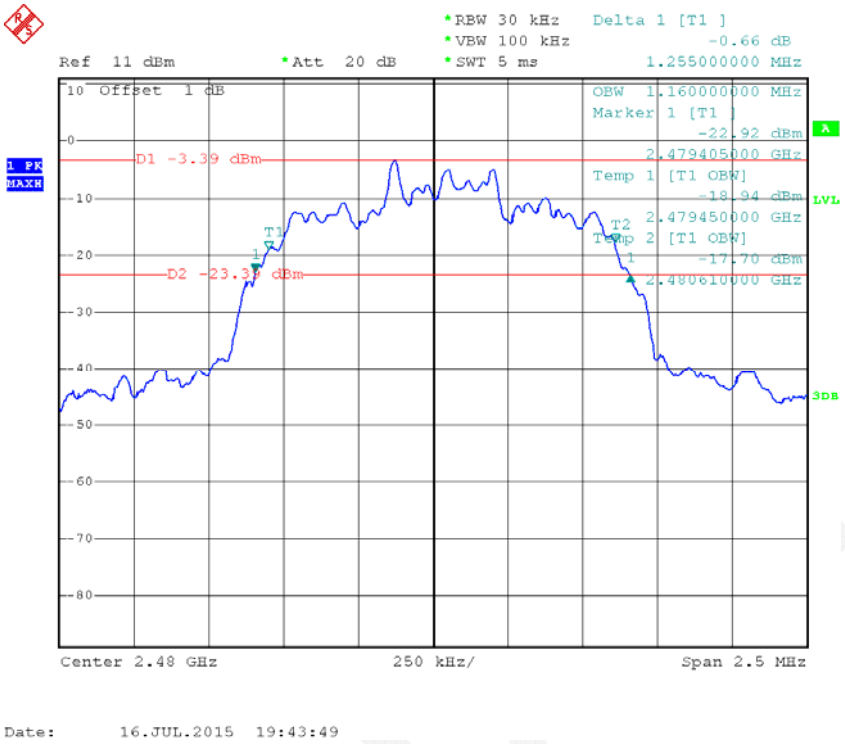
Low Channel



Middle Channel

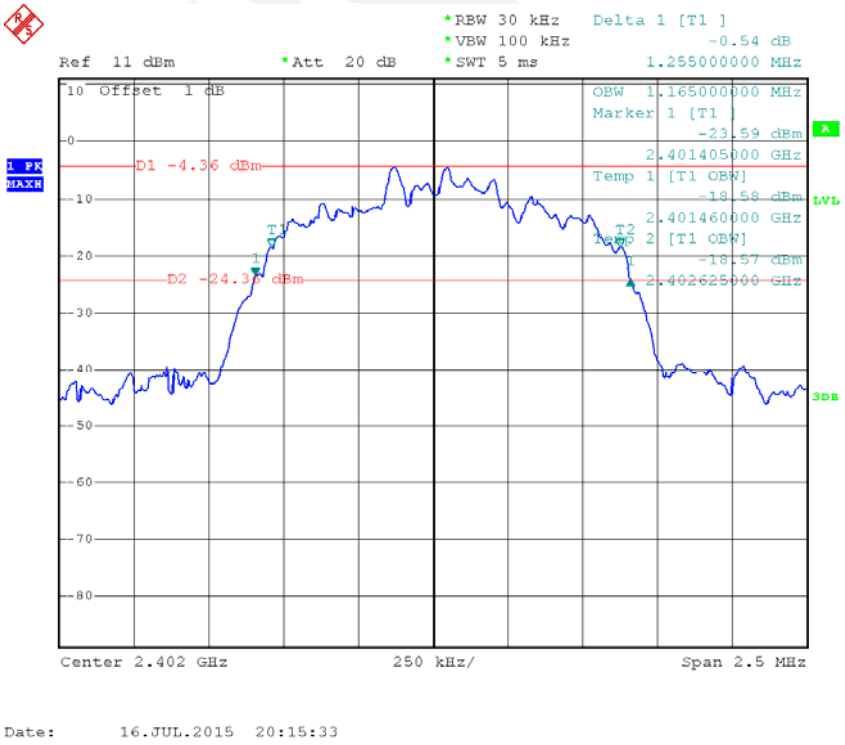


High Channel

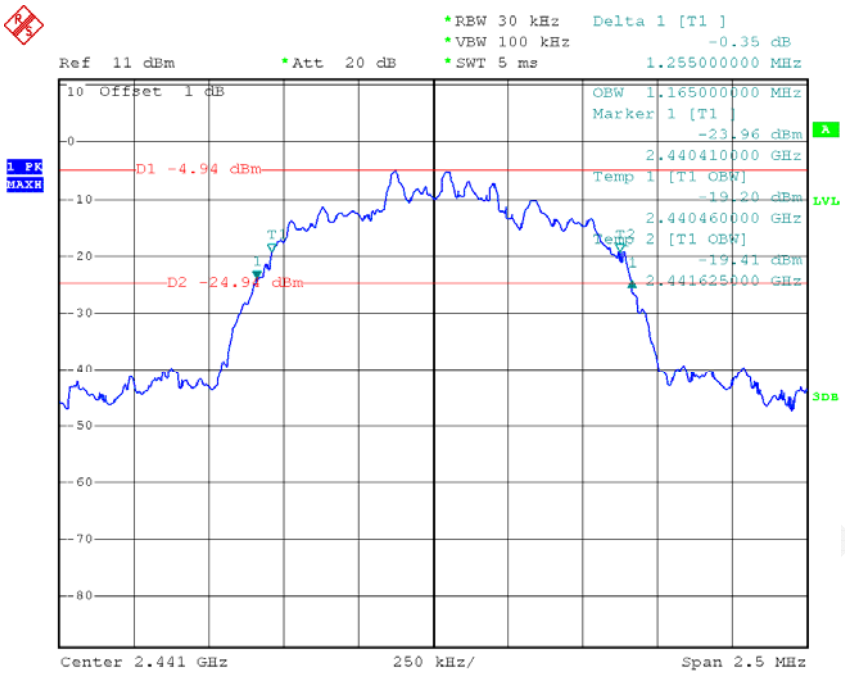


EDR Mode (8-DPSK):

Low Channel

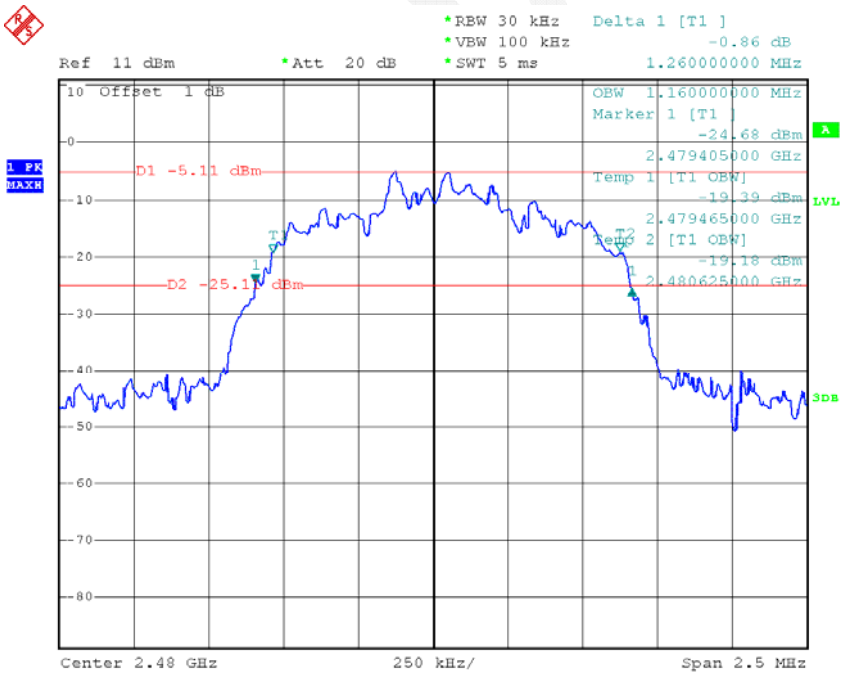


Middle Channel



Date: 16.JUL.2015 20:23:34

High Channel



Date: 16.JUL.2015 20:26:18

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

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Data

Environmental Conditions

Temperature:	26.1°C
Relative Humidity:	53 %
ATM Pressure:	99.6 kPa

** The testing was performed by Dean Liu on 2015-07-16.*

Test Result: Compliance.

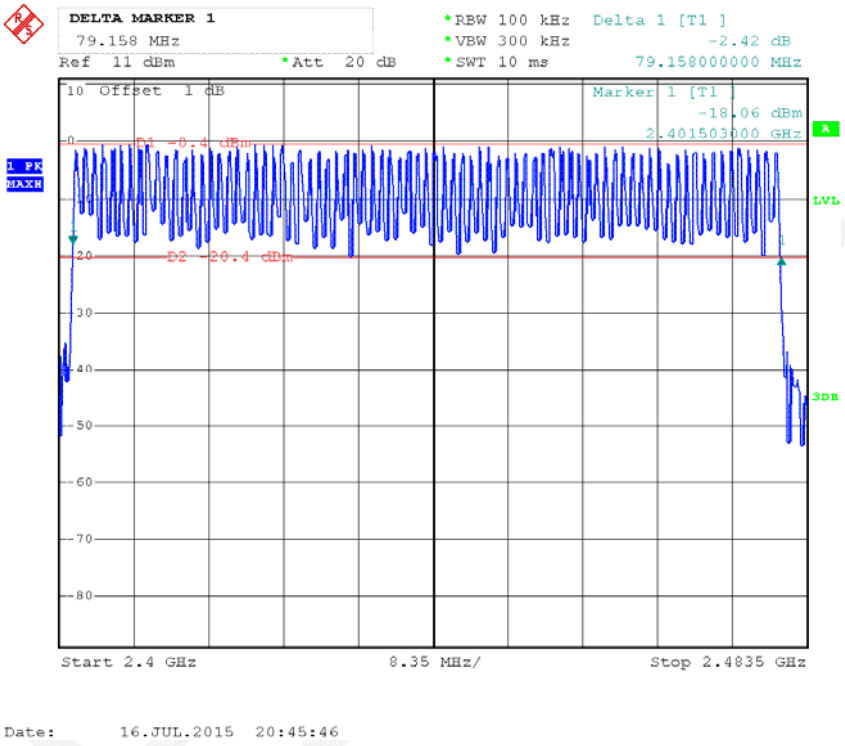
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

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

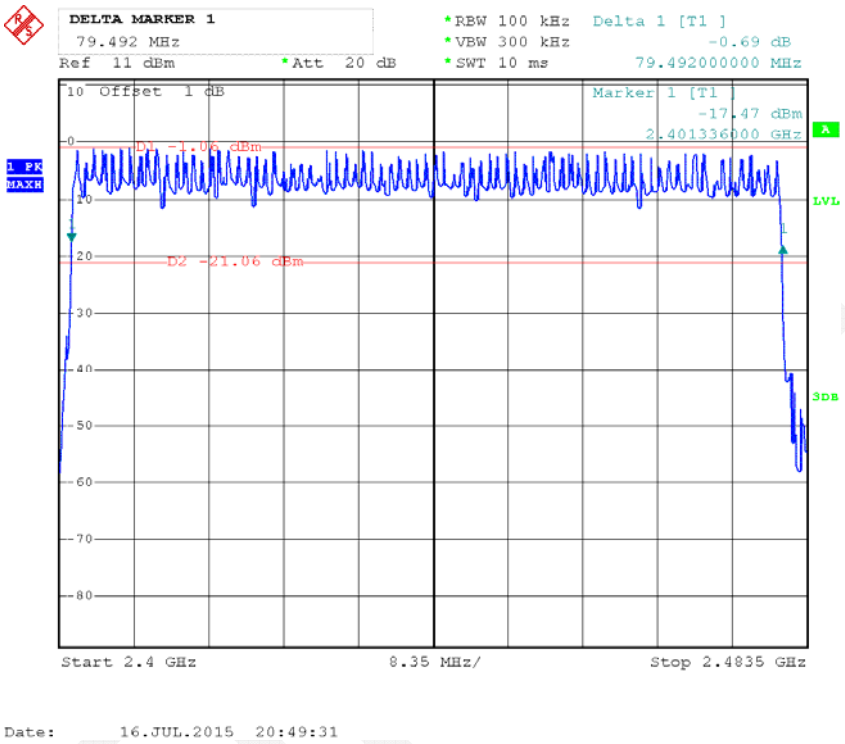
Number of Hopping Channels



EDR Mode (π/4-DQPSK):

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

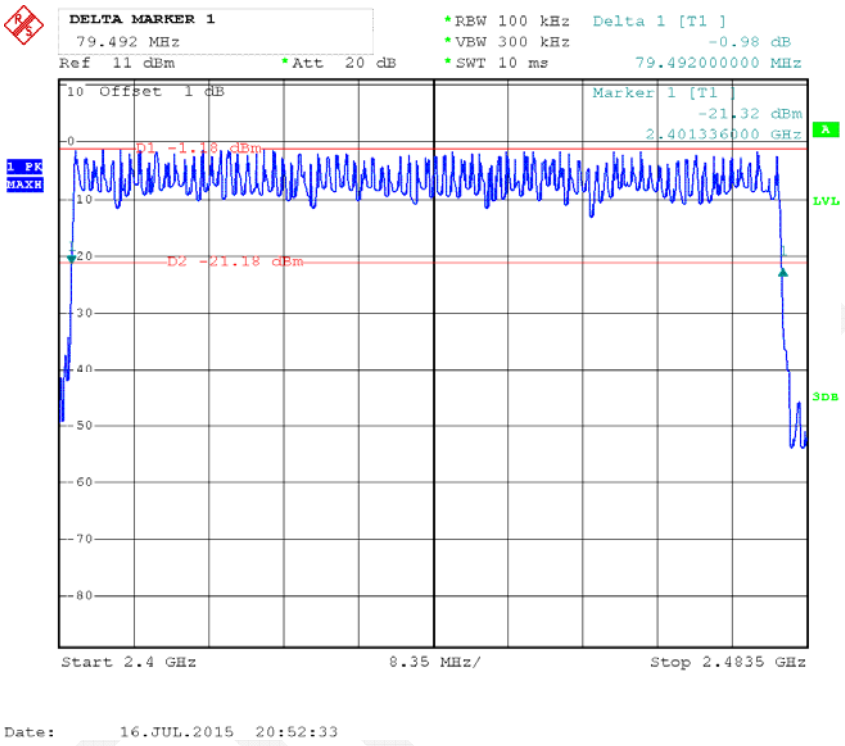
Number of Hopping Channels



EDR Mode (8-DPSK):

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

Number of Hopping Channels



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; Spectrum SPAN was set as 0. Sweep was set as 0.4 * channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length * hope rate/ number of hopping channels * 31.6s
Hop rate=1600/s

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Data

Environmental Conditions

Temperature:	26.6 °C
Relative Humidity:	53 %
ATM Pressure:	99.8 kPa

** The testing was performed by Dean Liu on 2015-07-17.*

Test Result: Compliance.

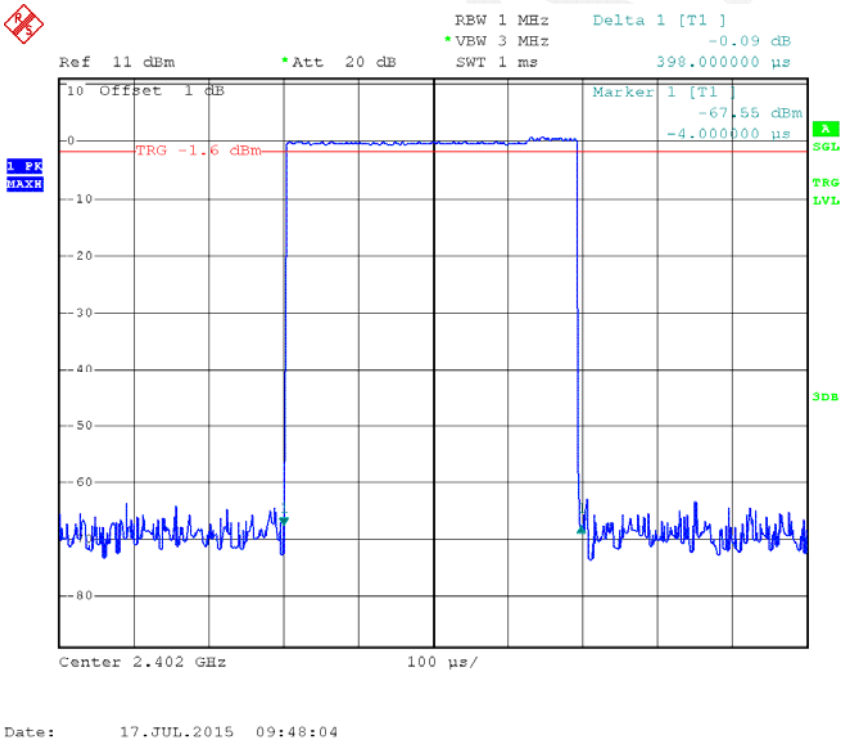
Please refer to following tables and plots

Test Mode: Transmitting

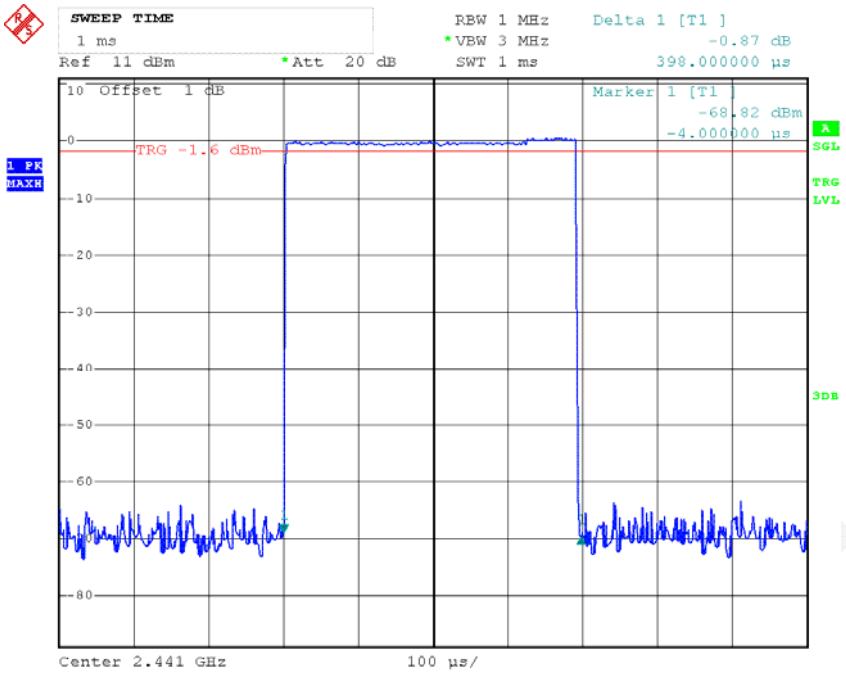
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.398	0.127	0.4	Pass
	Middle	0.398	0.127	0.4	Pass
	High	0.398	0.127	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.680	0.269	0.4	Pass
	Middle	1.680	0.269	0.4	Pass
	High	1.680	0.269	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.930	0.313	0.4	Pass
	Middle	2.930	0.313	0.4	Pass
	High	2.930	0.313	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

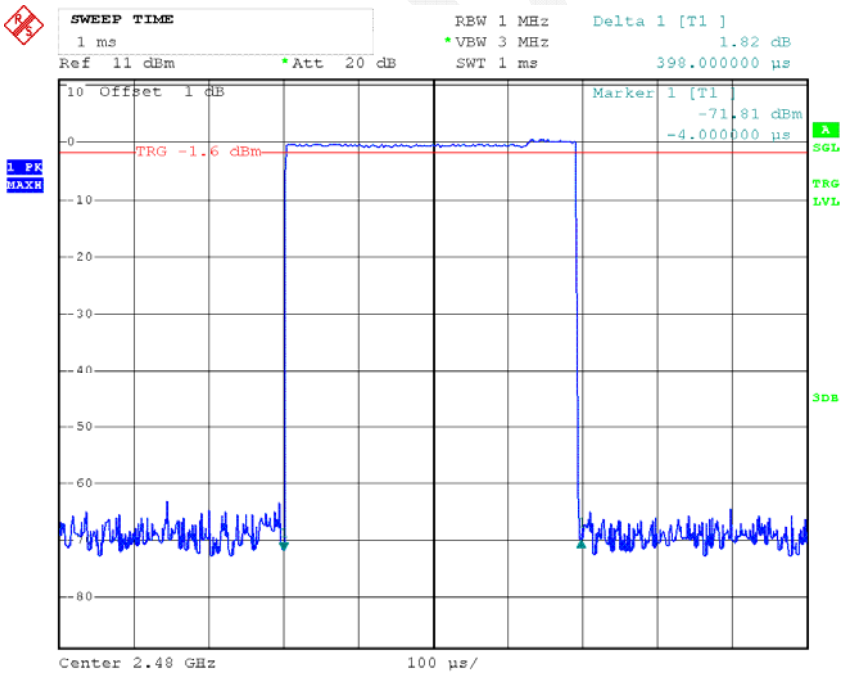


DH1: Middle Channel



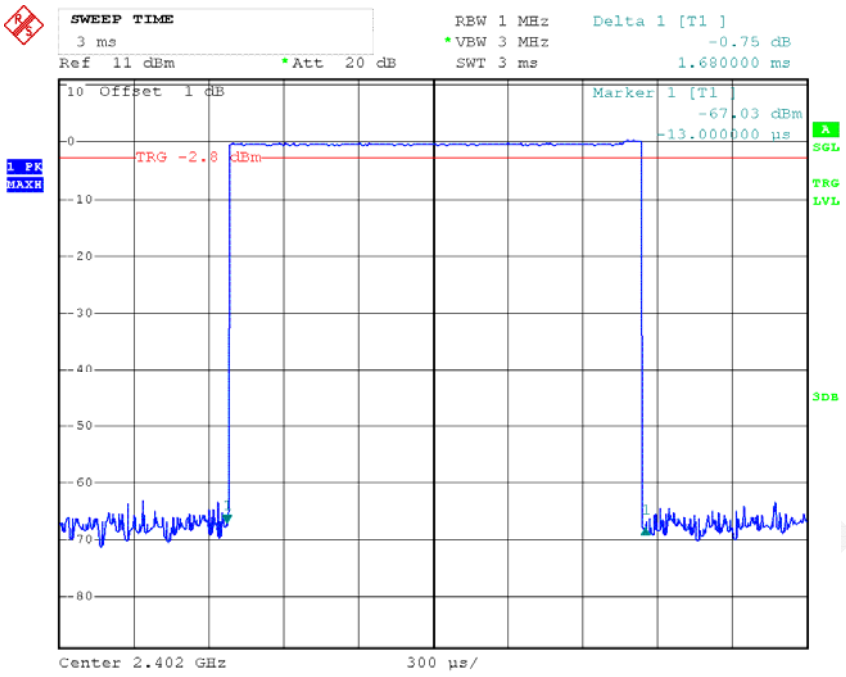
Date: 17.JUL.2015 09:49:53

DH1: High Channel



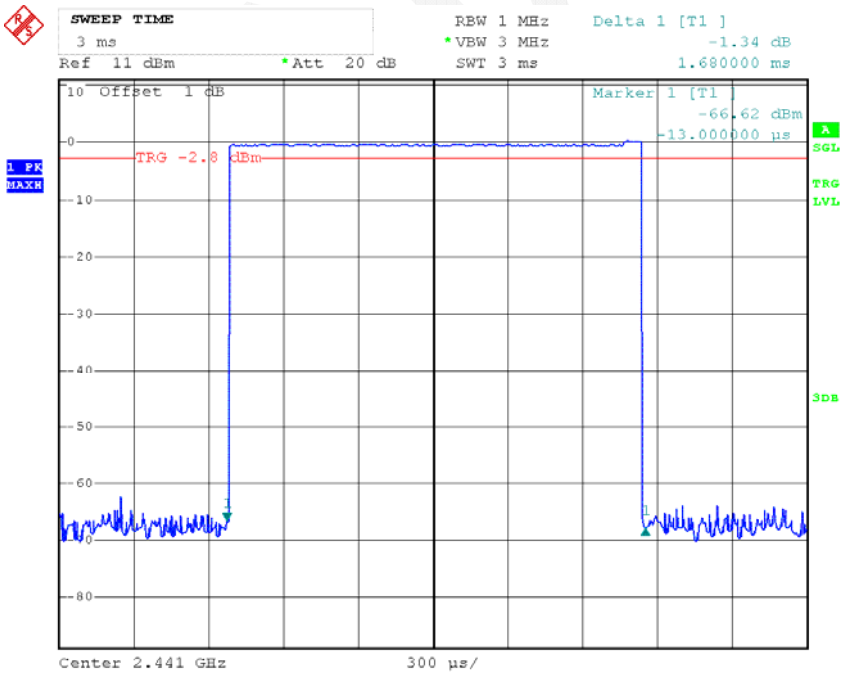
Date: 17.JUL.2015 09:50:53

DH3: Low Channel



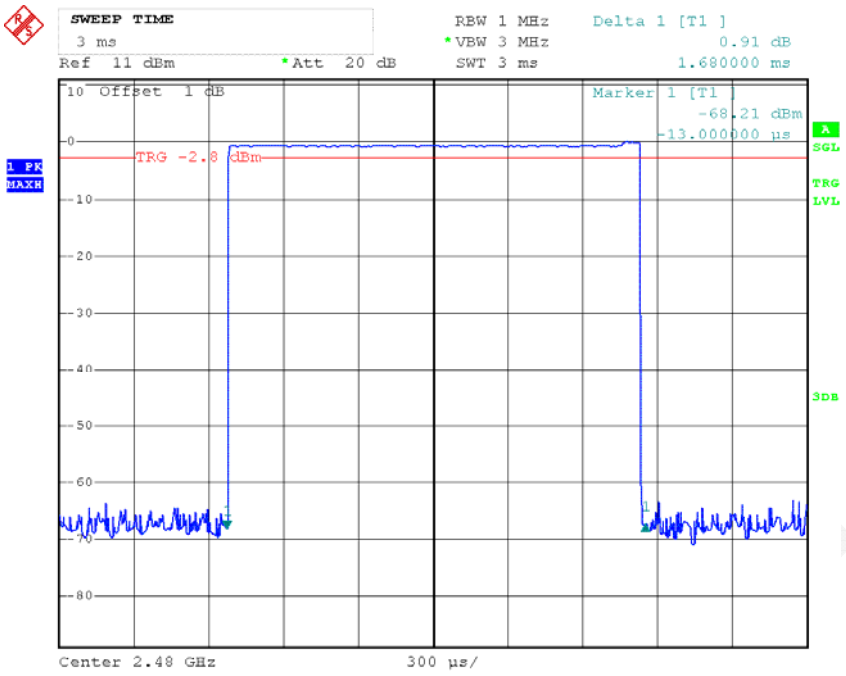
Date: 17.JUL.2015 09:54:03

DH3: Middle Channel

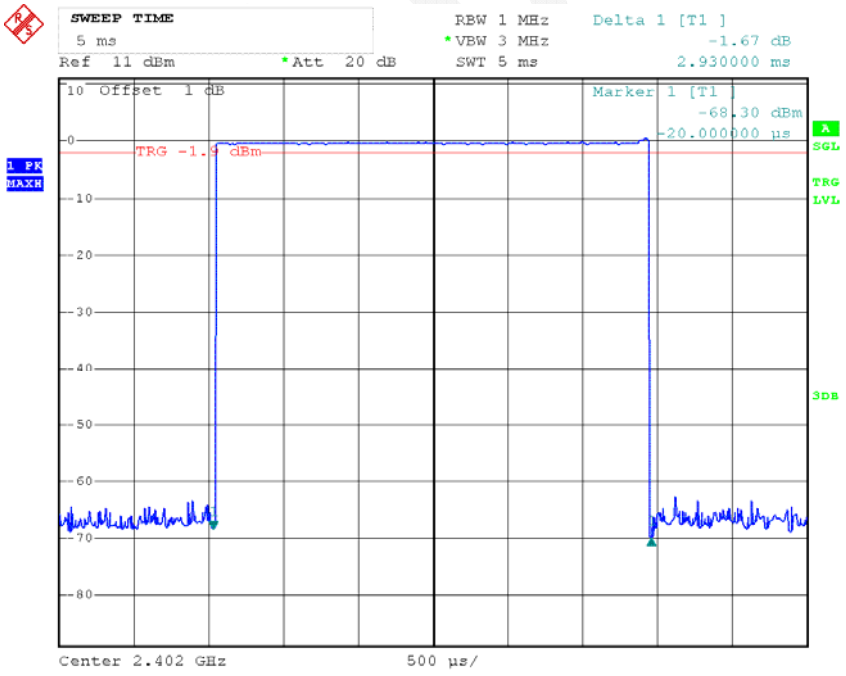


Date: 17.JUL.2015 09:53:33

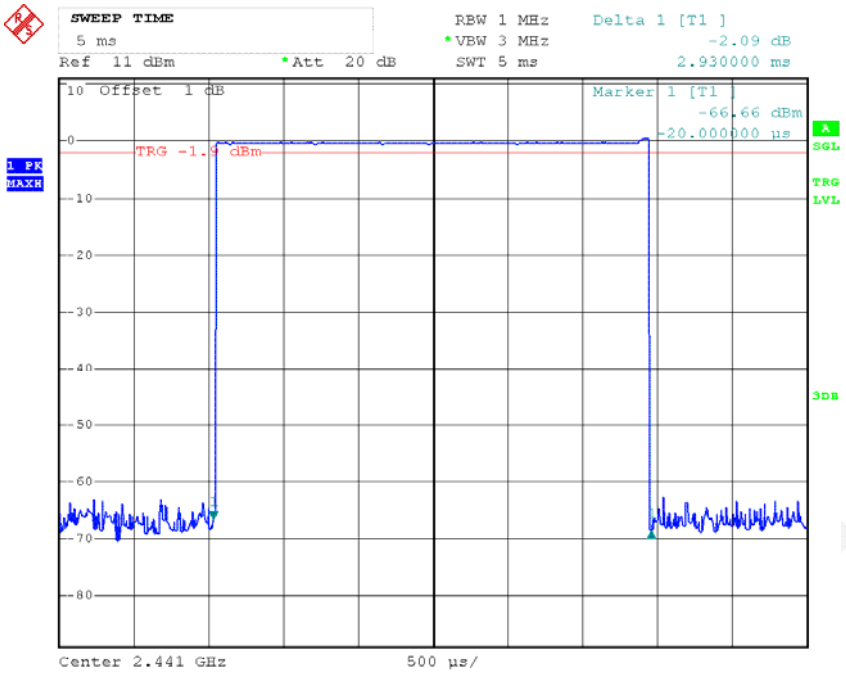
DH3: High Channel



DH5: Low Channel

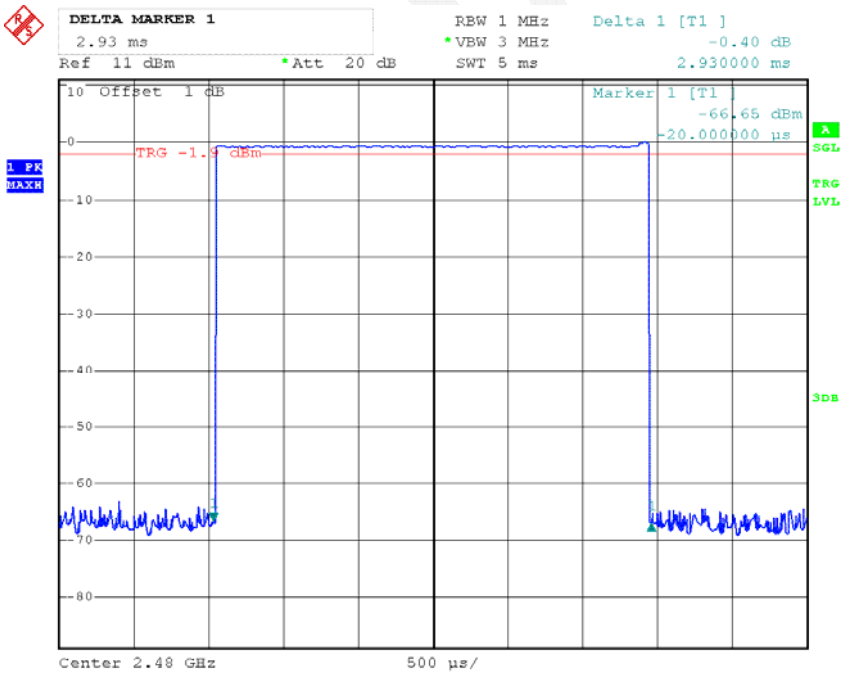


DH5: Middle Channel



Date: 17.JUL.2015 09:56:54

DH5: High Channel

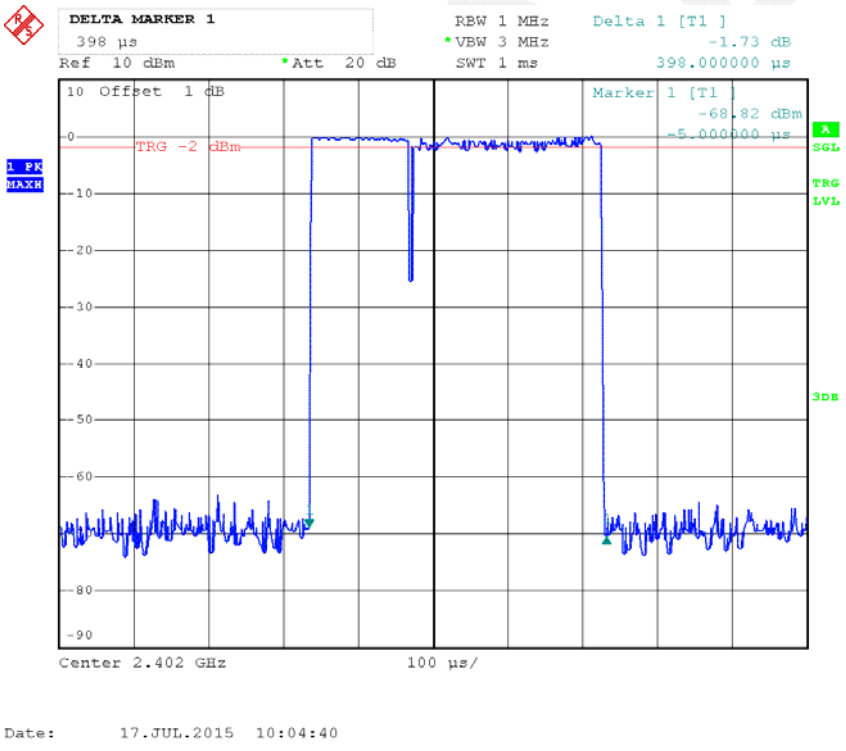


Date: 17.JUL.2015 09:56:26

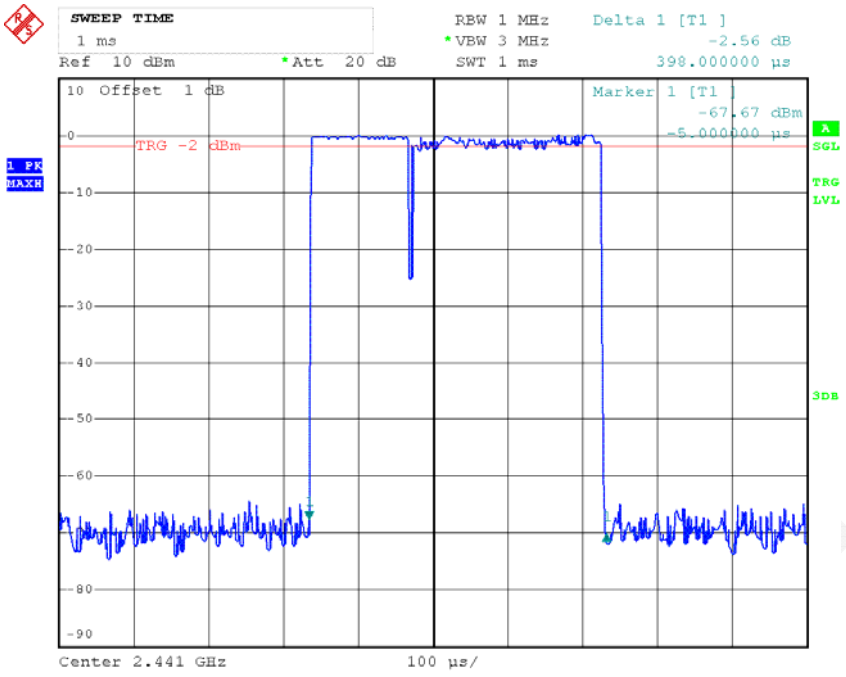
EDR Mode (π/4-DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.398	0.127	0.4	Pass
	Middle	0.398	0.127	0.4	Pass
	High	0.398	0.127	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.662	0.266	0.4	Pass
	Middle	1.662	0.266	0.4	Pass
	High	1.662	0.266	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.920	0.311	0.4	Pass
	Middle	2.920	0.311	0.4	Pass
	High	2.920	0.311	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

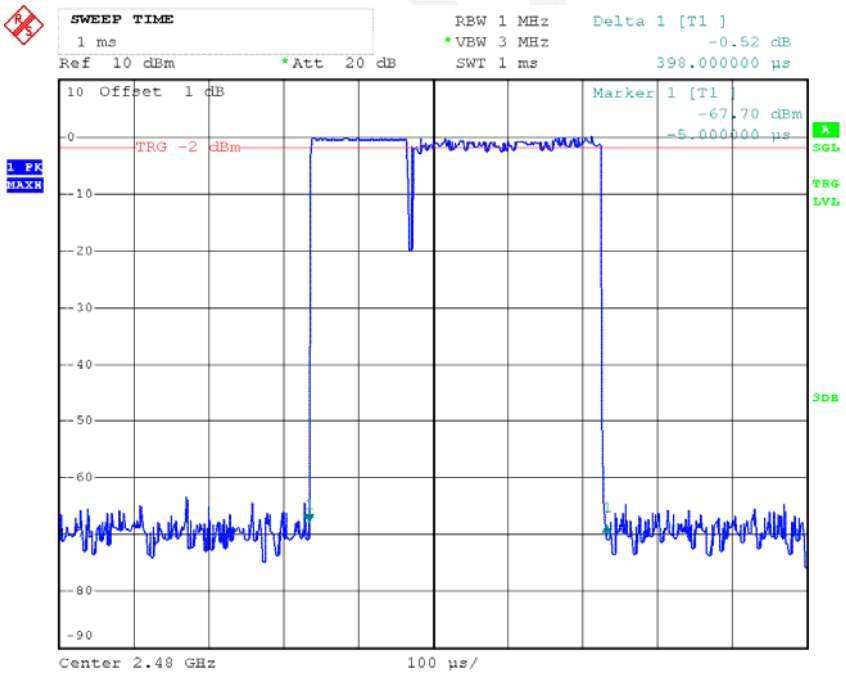


DH1: Middle Channel



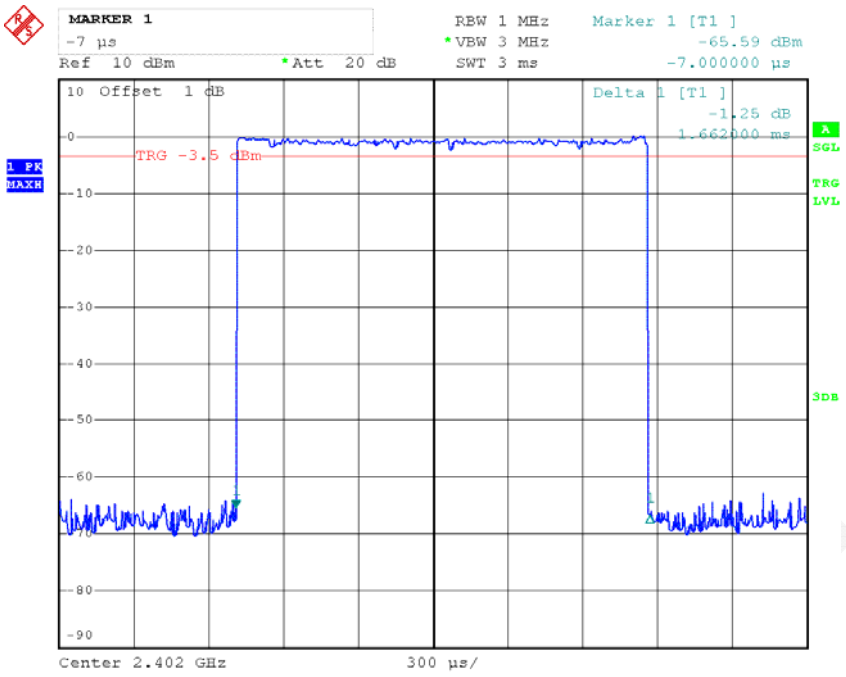
Date: 17.JUL.2015 10:05:07

DH1: High Channel



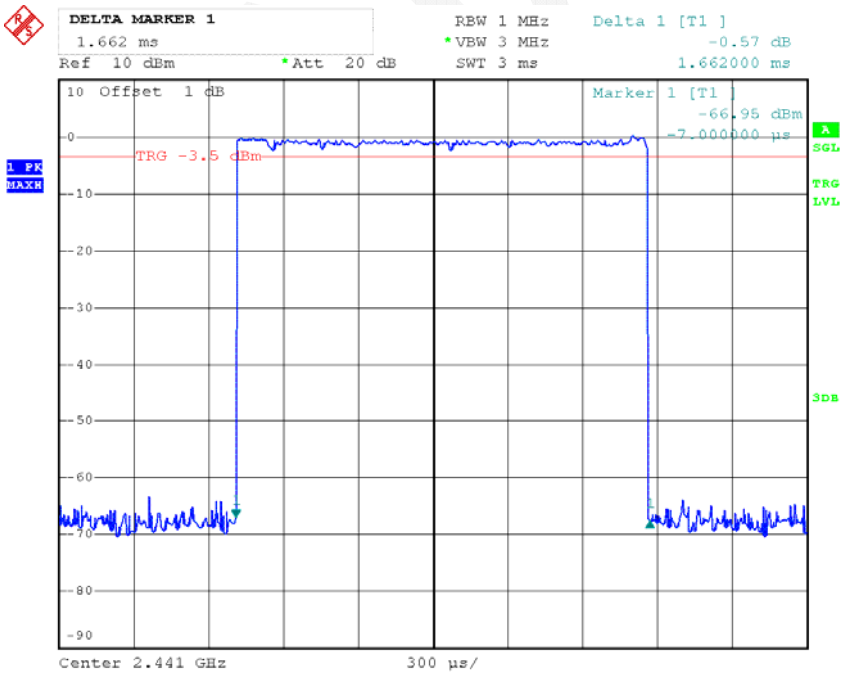
Date: 17.JUL.2015 10:05:58

DH3: Low Channel



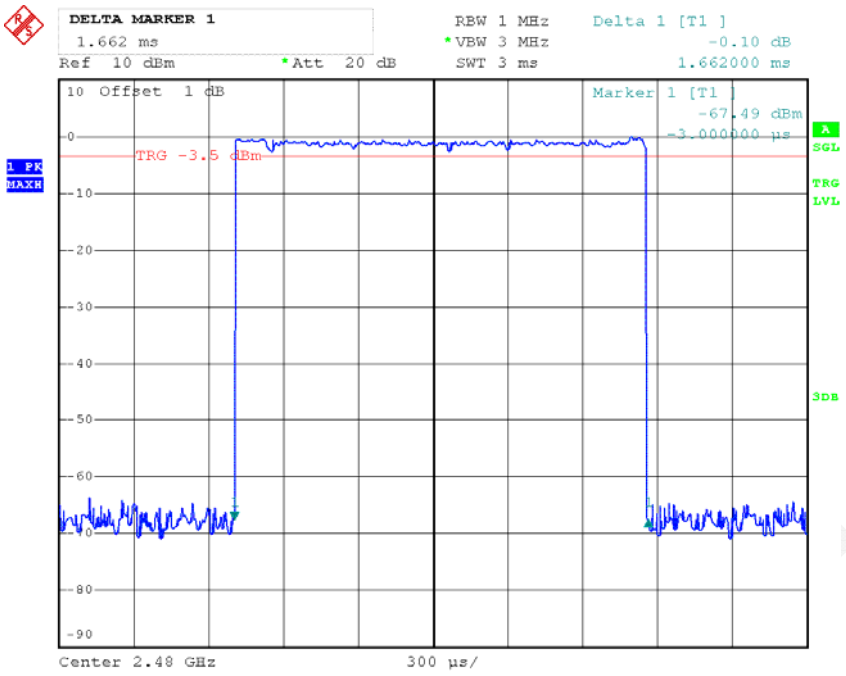
Date: 17.JUL.2015 10:21:36

DH3: Middle Channel



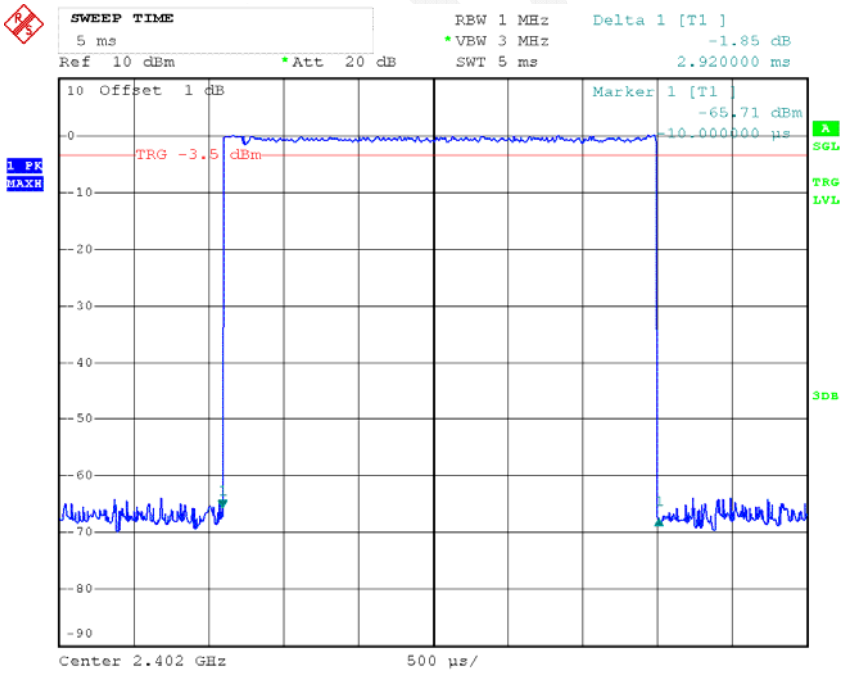
Date: 17.JUL.2015 10:20:27

DH3: High Channel



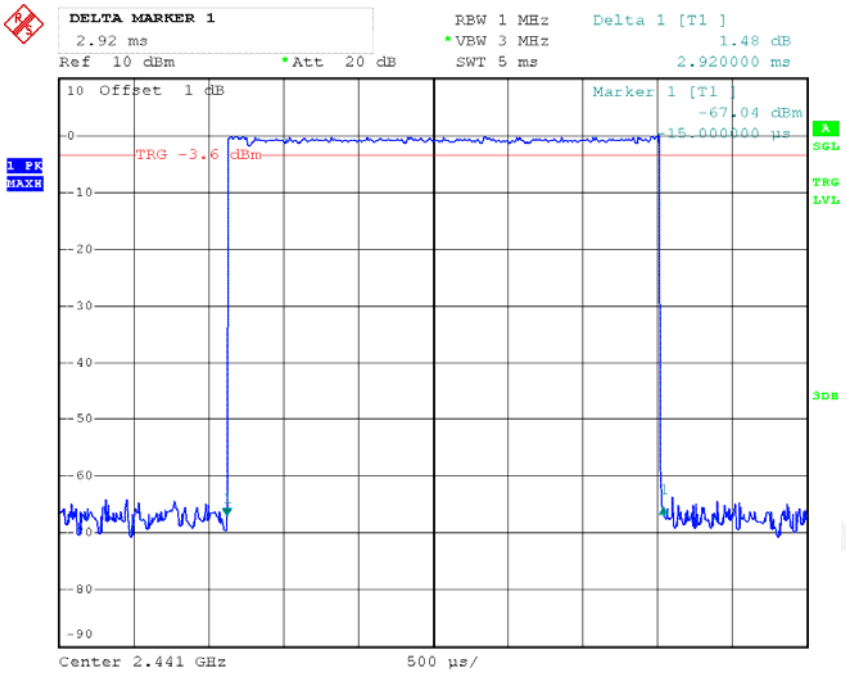
Date: 17.JUL.2015 10:11:53

DH5: Low Channel



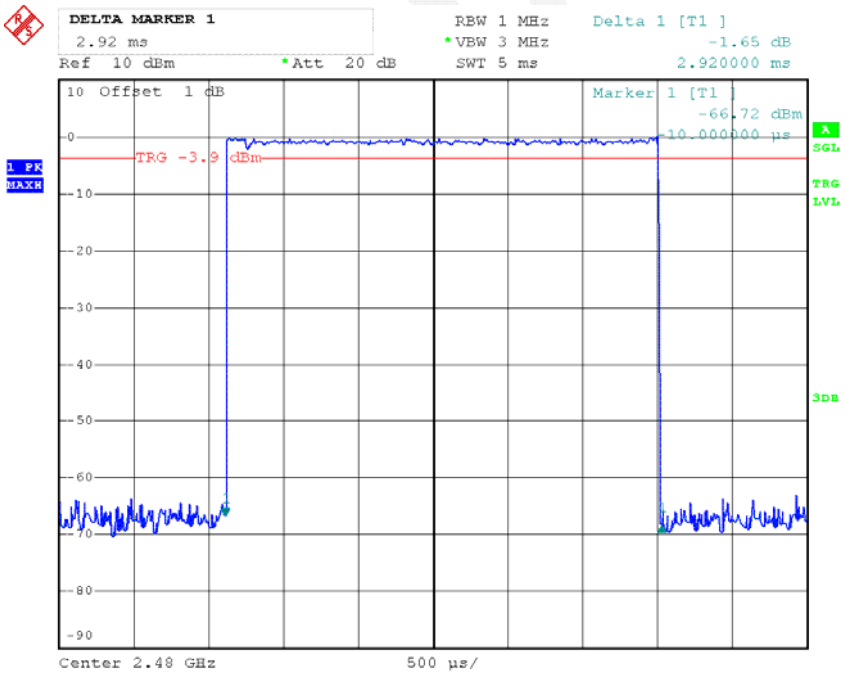
Date: 17.JUL.2015 10:31:58

DH5: Middle Channel



Date: 17.JUL.2015 10:35:28

DH5: High Channel

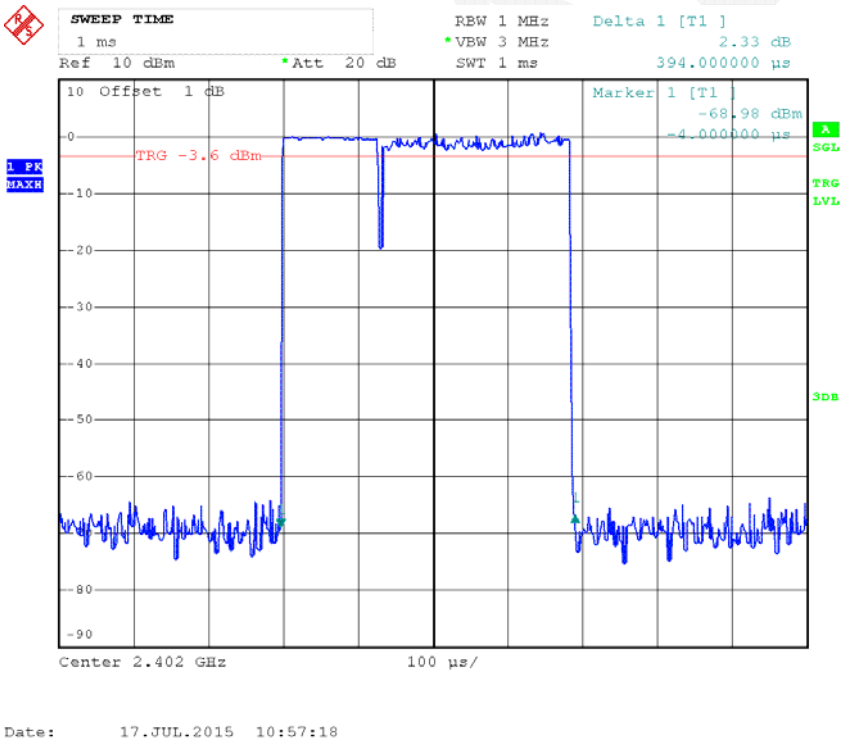


Date: 17.JUL.2015 10:36:58

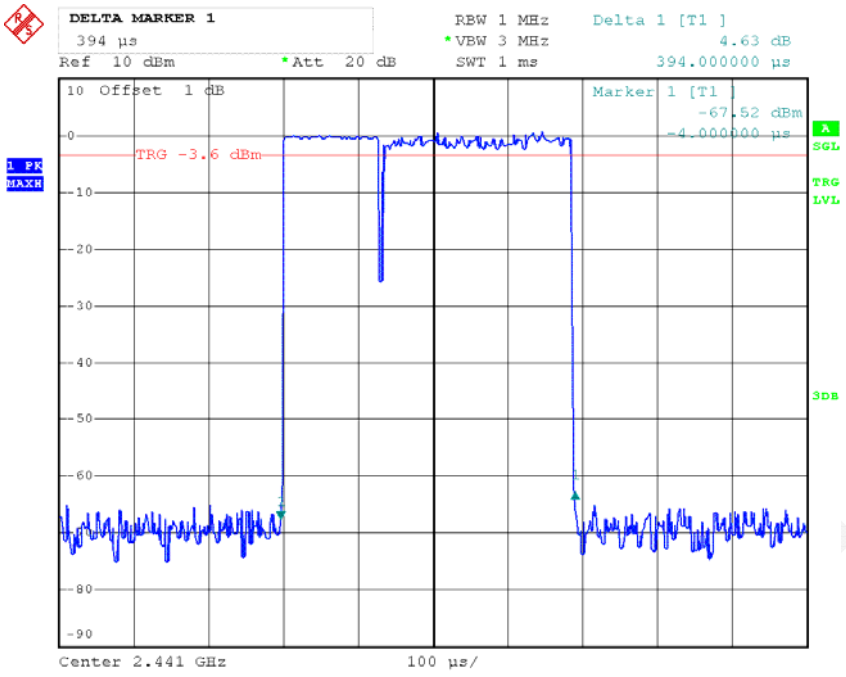
EDR Mode (8-DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.394	0.126	0.4	Pass
	Middle	0.394	0.126	0.4	Pass
	High	0.394	0.126	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.662	0.266	0.4	Pass
	Middle	1.662	0.266	0.4	Pass
	High	1.662	0.266	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.920	0.311	0.4	Pass
	Middle	2.920	0.311	0.4	Pass
	High	2.920	0.311	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

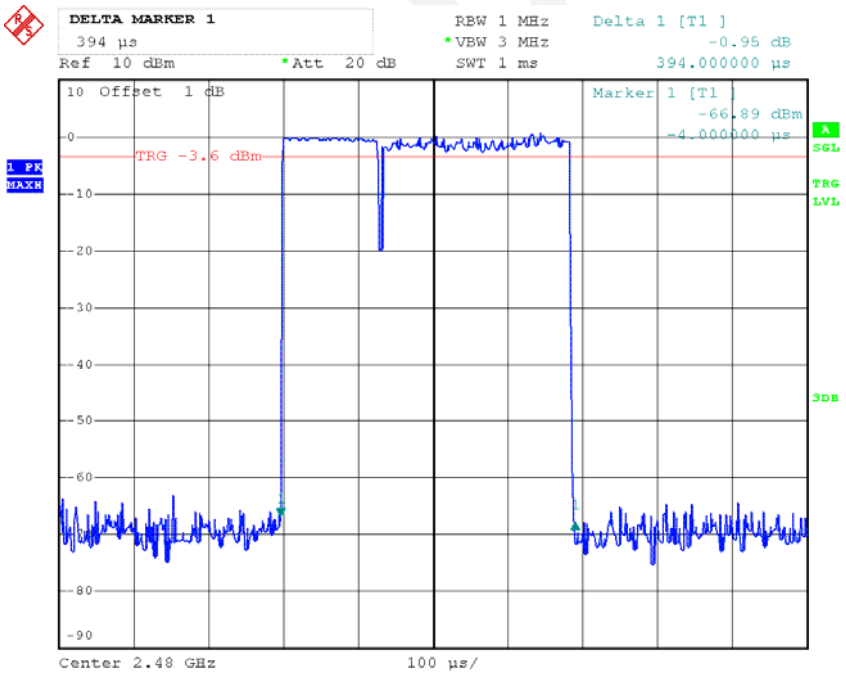


DH1: Middle Channel



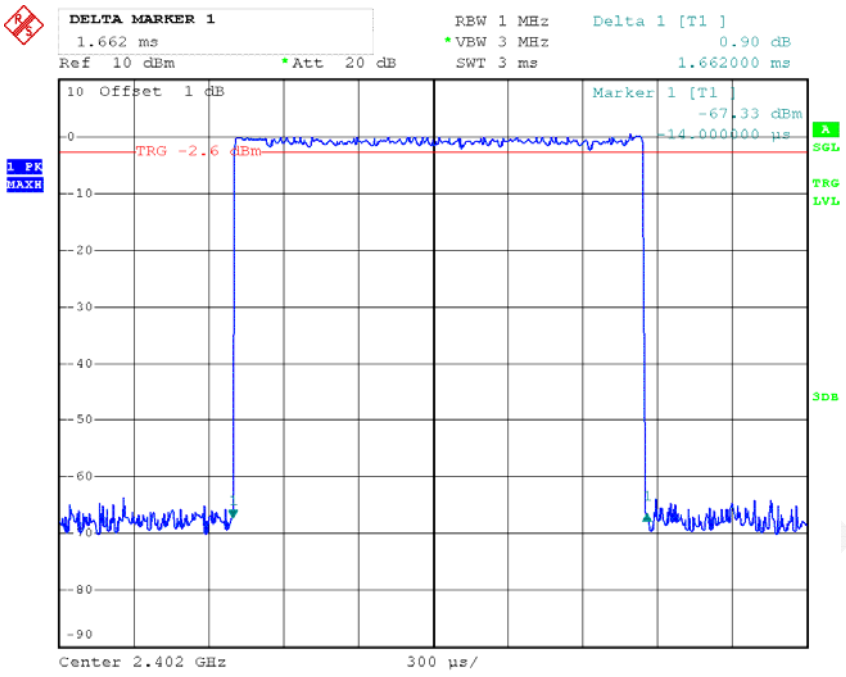
Date: 17.JUL.2015 10:56:47

DH1: High Channel



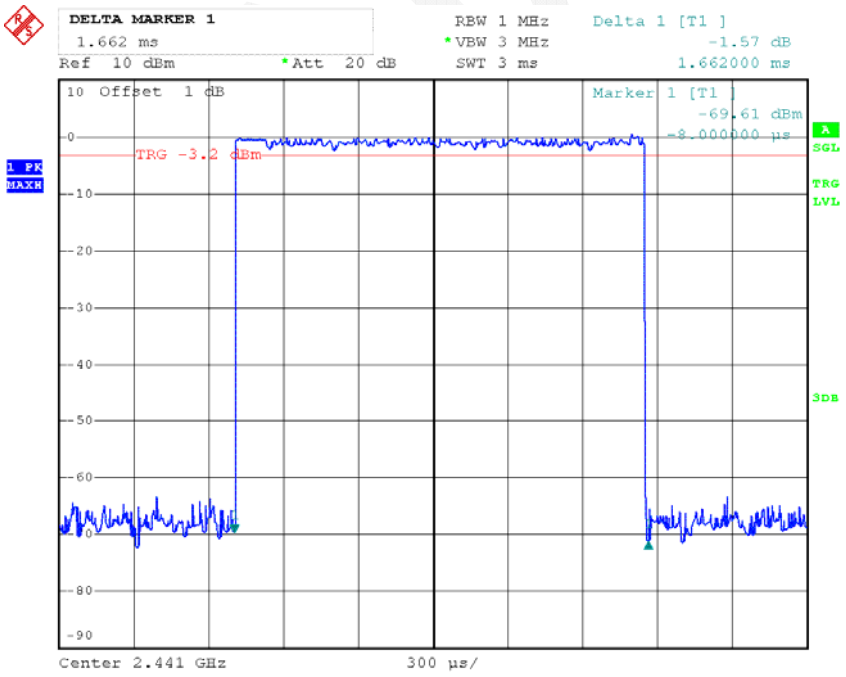
Date: 17.JUL.2015 10:55:52

DH3: Low Channel



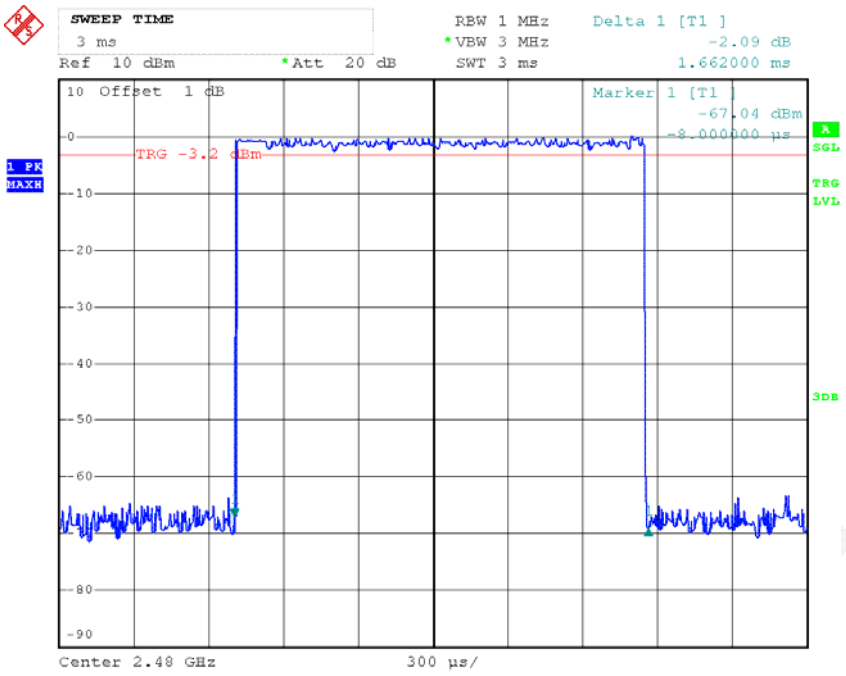
Date: 17.JUL.2015 10:59:20

DH3: Middle Channel

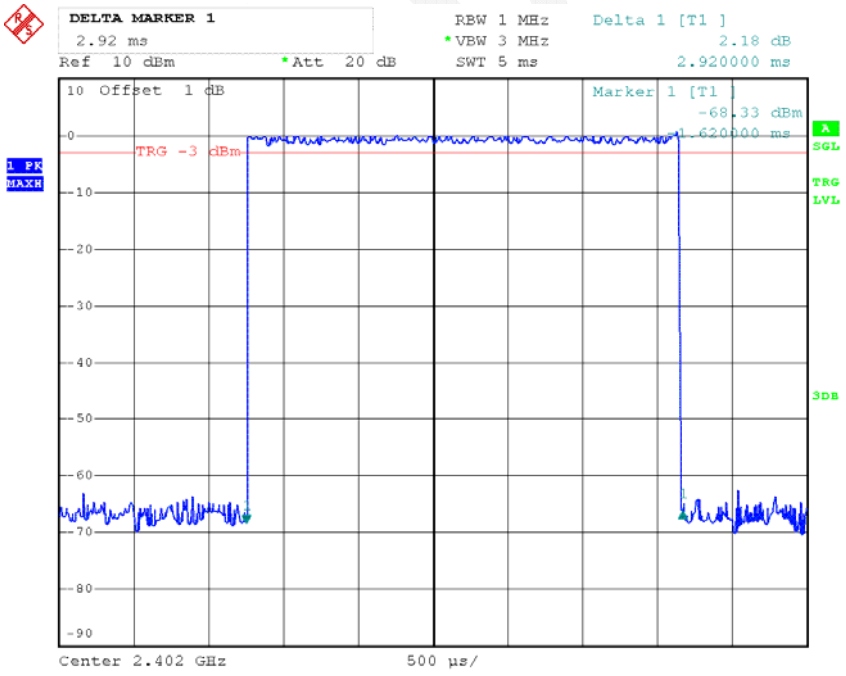


Date: 17.JUL.2015 11:01:17

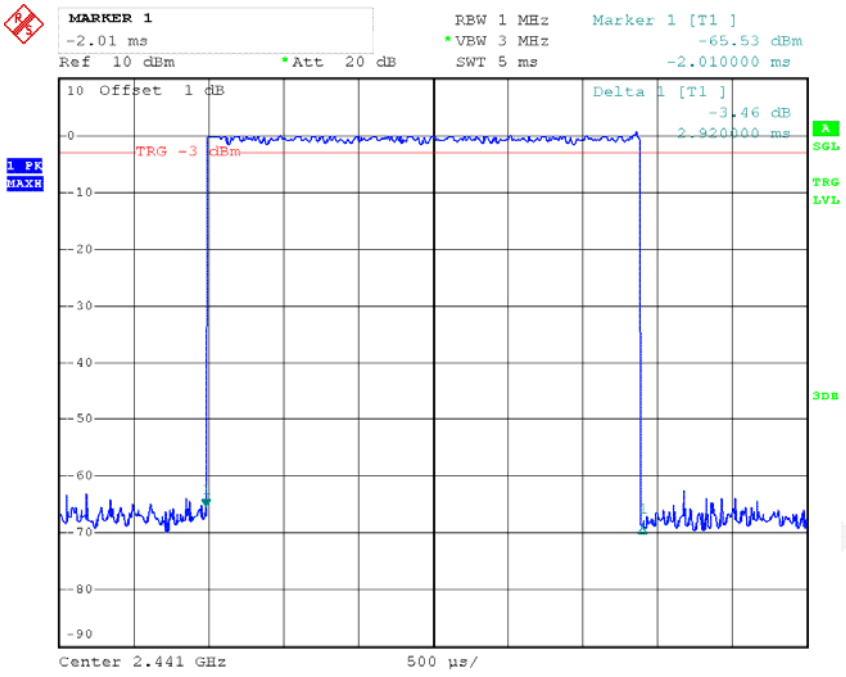
DH3: High Channel



DH5: Low Channel

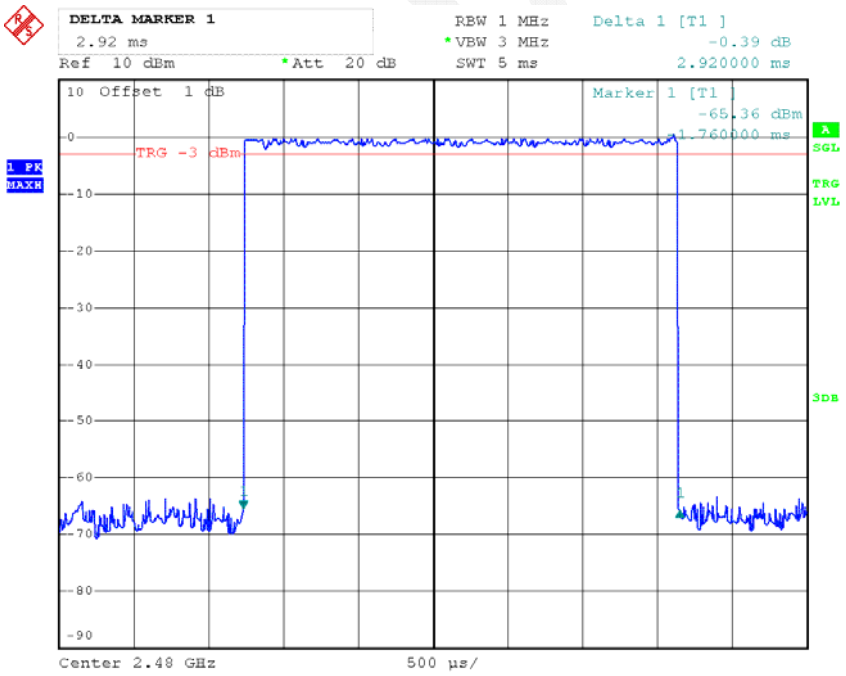


DH5: Middle Channel



Date: 17.JUL.2015 11:07:22

DH5: High Channel



Date: 17.JUL.2015 11:06:36

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

According to PUBLIC NOTICE DA 00-705
Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

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 an 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	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Data

Environmental Conditions

Temperature:	26.5 °C
Relative Humidity:	53 %
ATM Pressure:	99.6 kPa

** The testing was performed by Dean Liu on 2015-07-16.*

Test Result: Compliance.

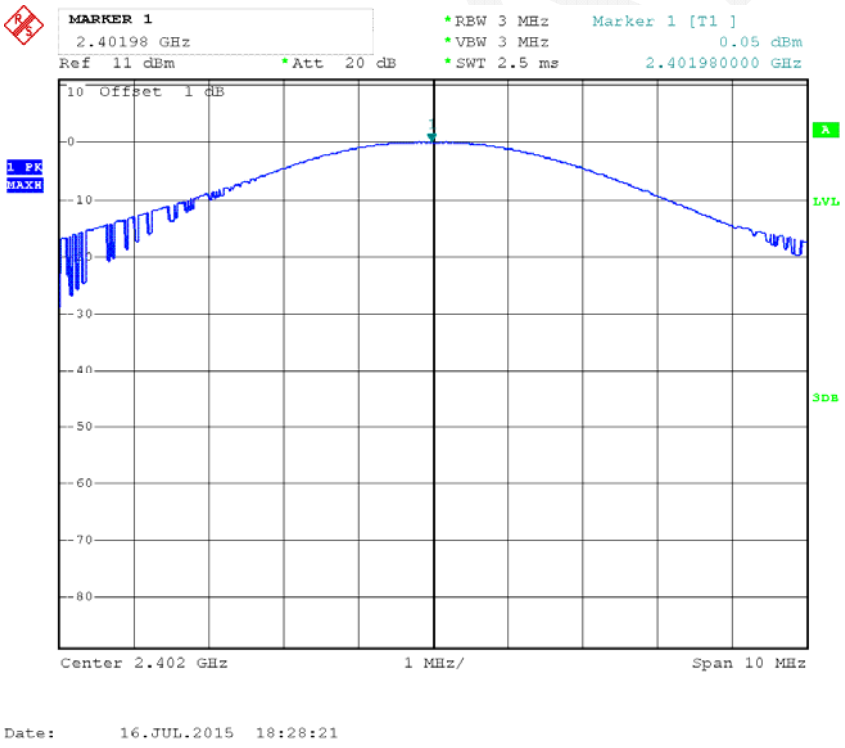
Test Mode: Transmitting

Mode	Channel	Frequency	Output power	Limit
		MHz	dBm	dBm
BDR (GFSK)	Low	2402	0.05	30
	Middle	2441	-1.19	30
	High	2480	-1.29	30
EDR (π/4-DQPSK)	Low	2402	-0.10	30
	Middle	2441	-0.54	30
	High	2480	-0.54	30
EDR (8DPSK)	Low	2402	0.46	30
	Middle	2441	-0.09	30
	High	2480	-0.20	30

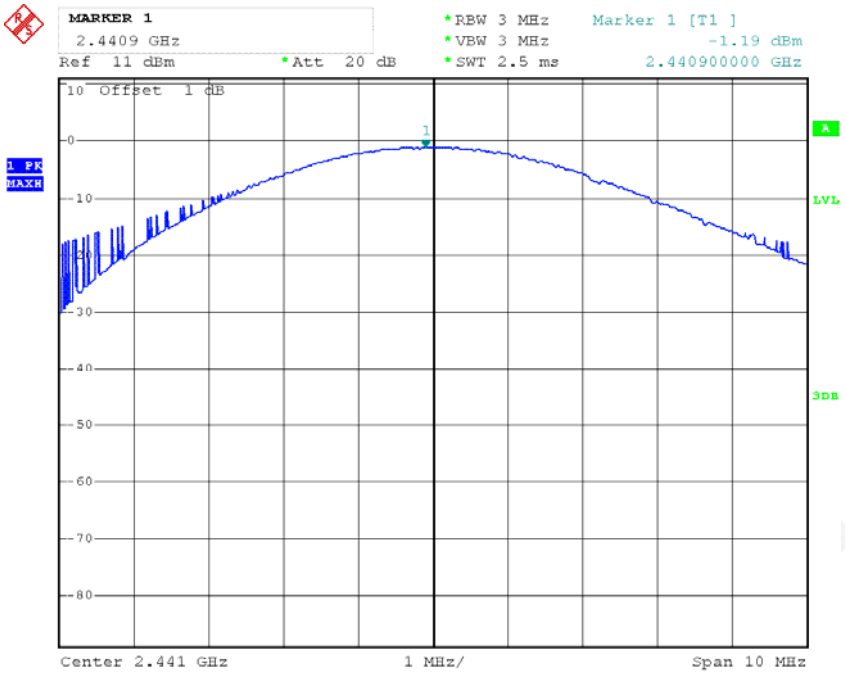
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

Output Power, Low Channel

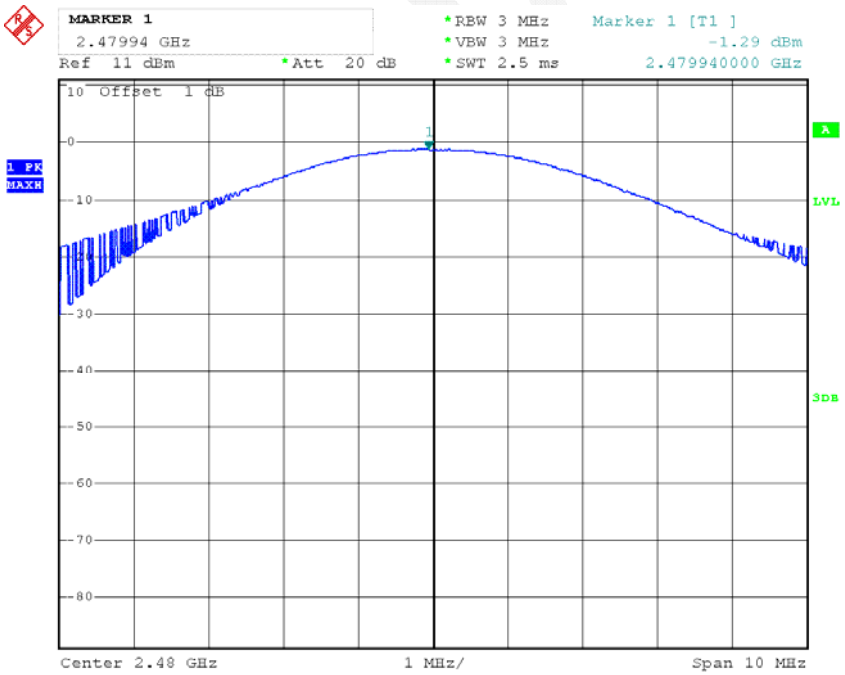


Output Power, Middle Channel



Date: 16.JUL.2015 18:30:33

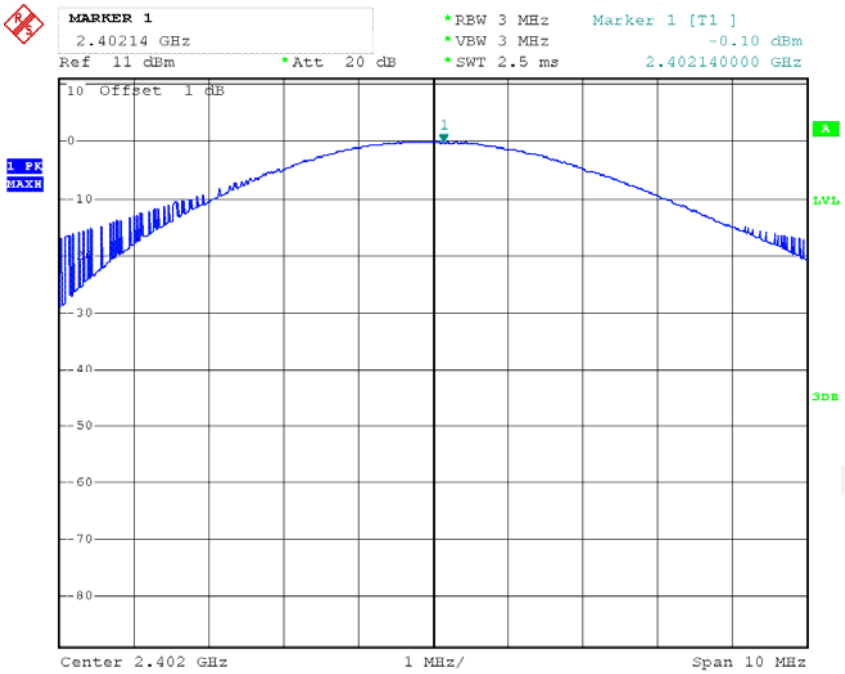
Output Power, High Channel



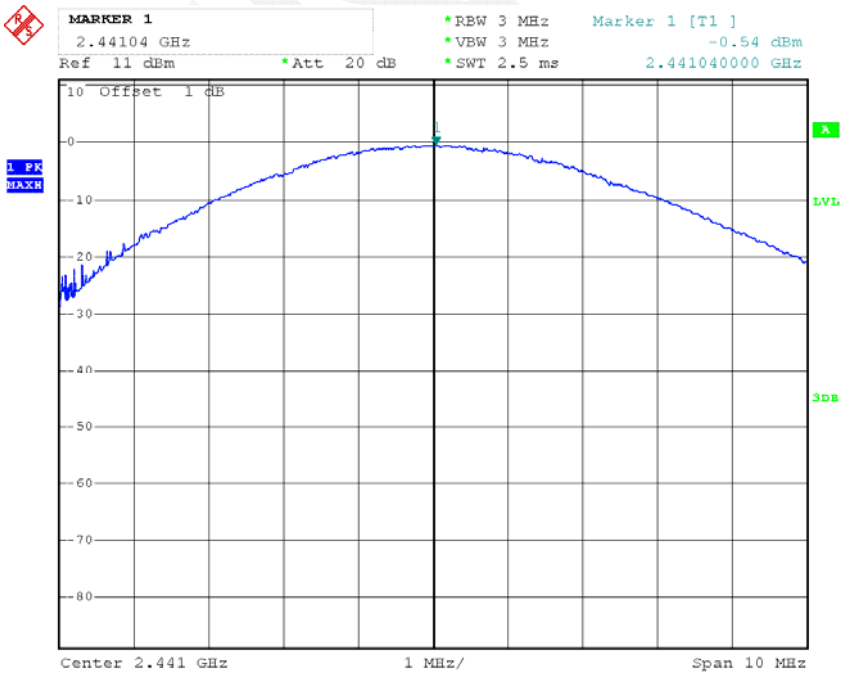
Date: 16.JUL.2015 18:31:43

EDR Mode (π/4-DQPSK):

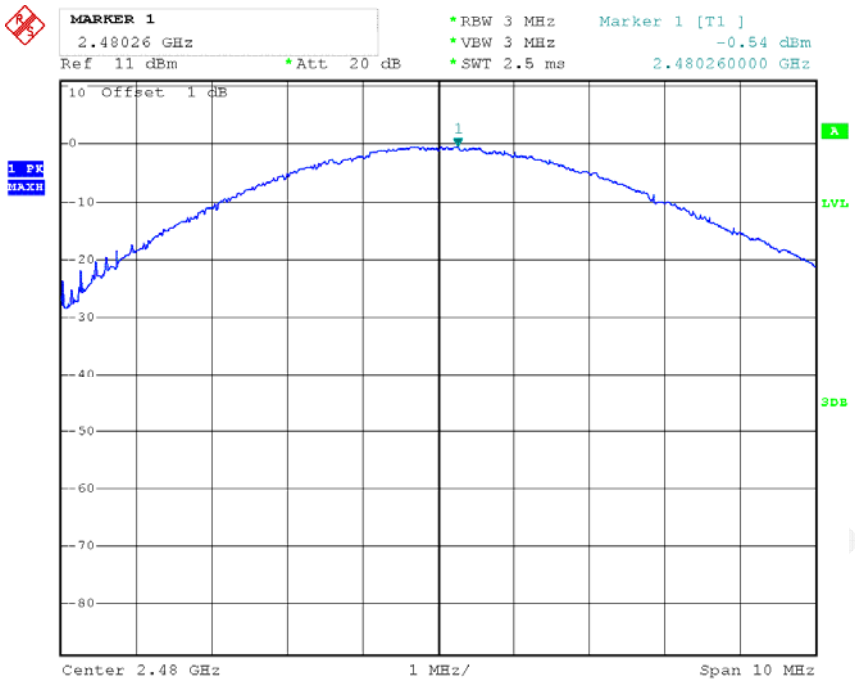
Output Power, Low Channel



Output Power, Middle Channel

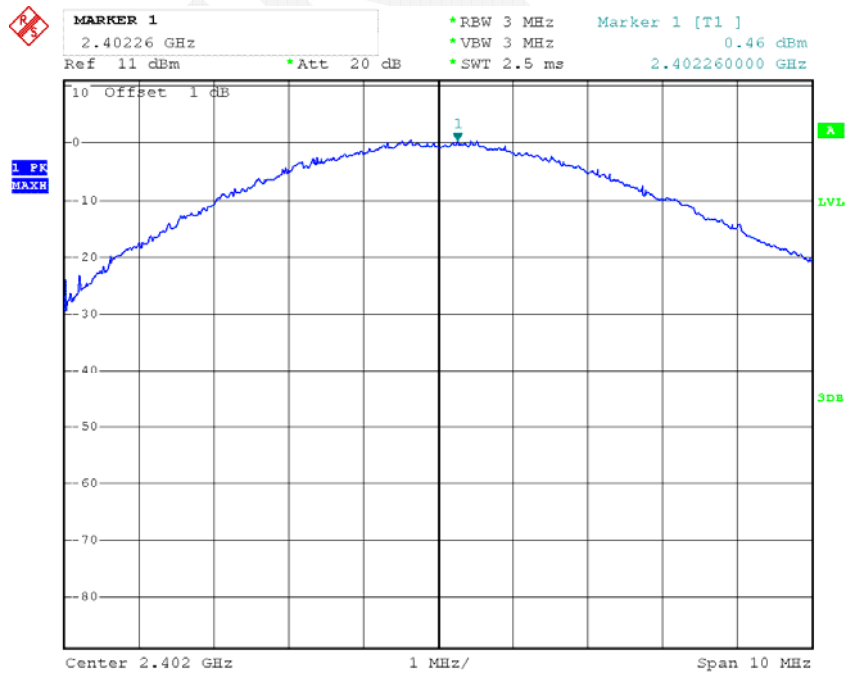


Output Power, High Channel

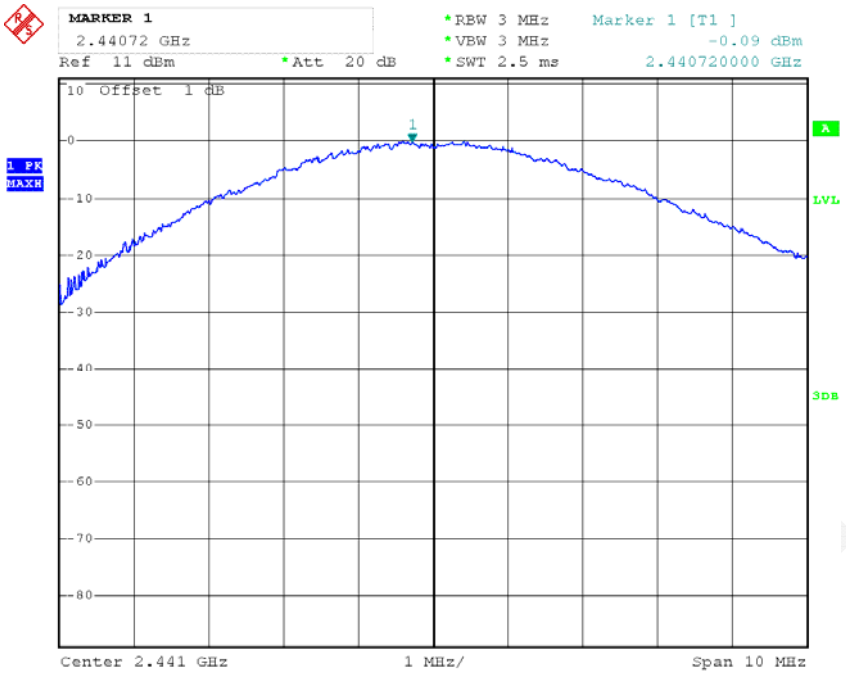


EDR Mode (8-DPSK):

Output Power, Low Channel

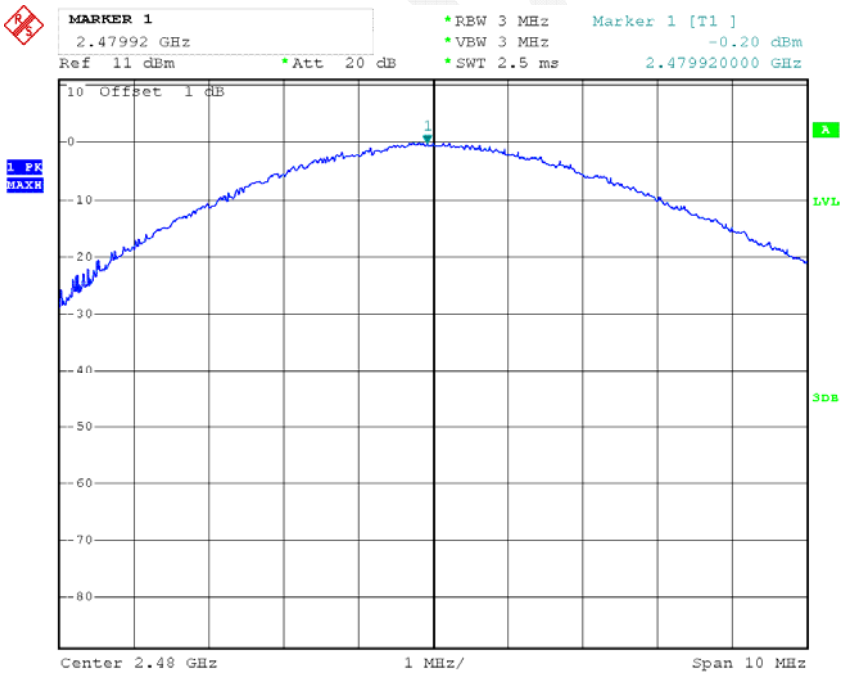


Output Power, Middle Channel



Date: 16.JUL.2015 19:32:48

Output Power, High Channel



Date: 16.JUL.2015 19:32:09

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 both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-05-09	2016-05-09

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

Test Data

Environmental Conditions

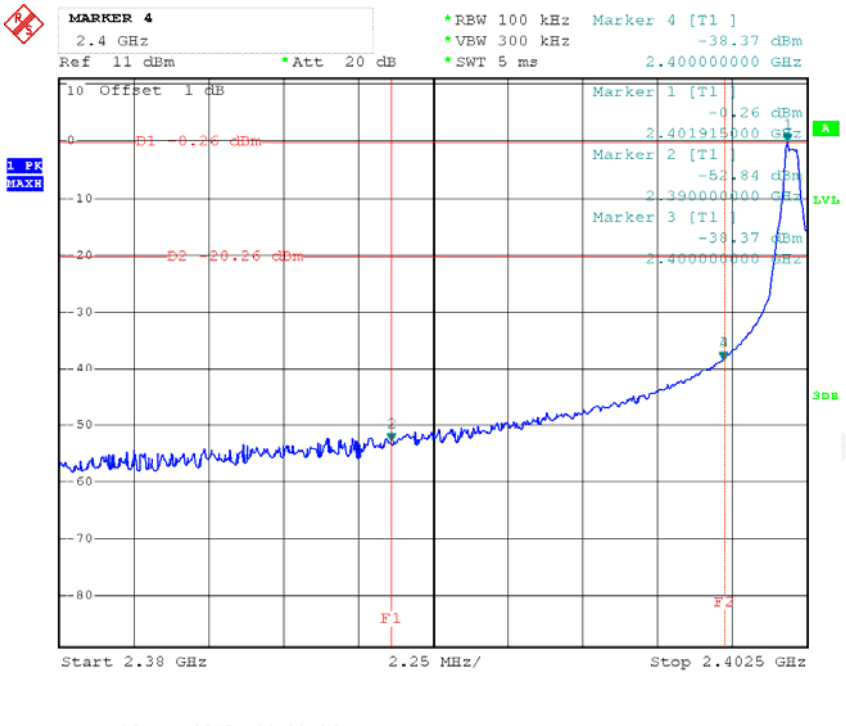
Temperature:	26.1°C
Relative Humidity:	53 %
ATM Pressure:	99.6 kPa

** The testing was performed by Dean Liu on 2015-07-16.*

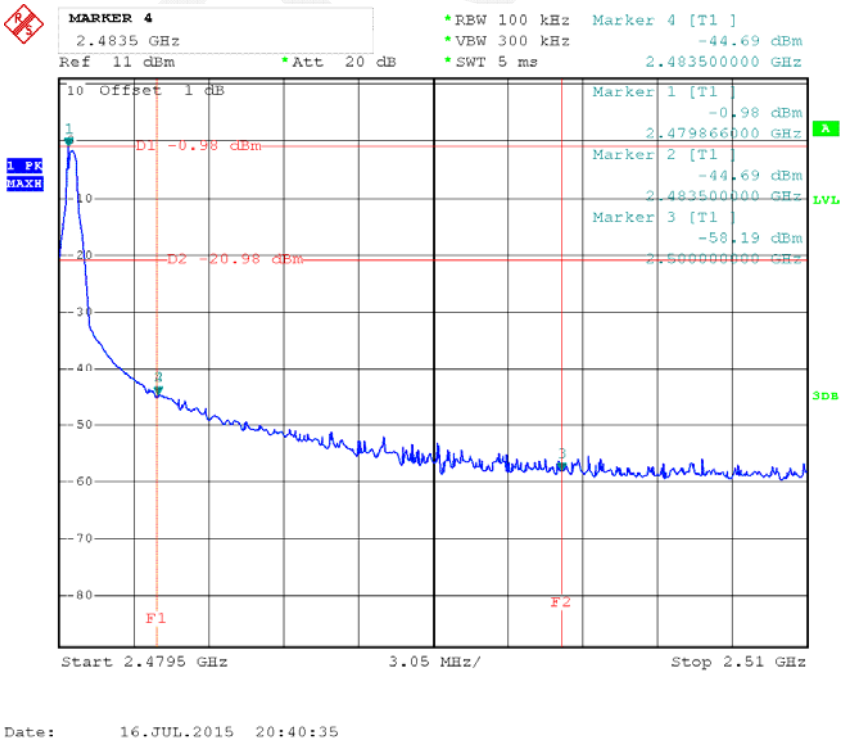
Test Result: Compliance

BDR Mode (GFSK):

Band Edge, Left Side

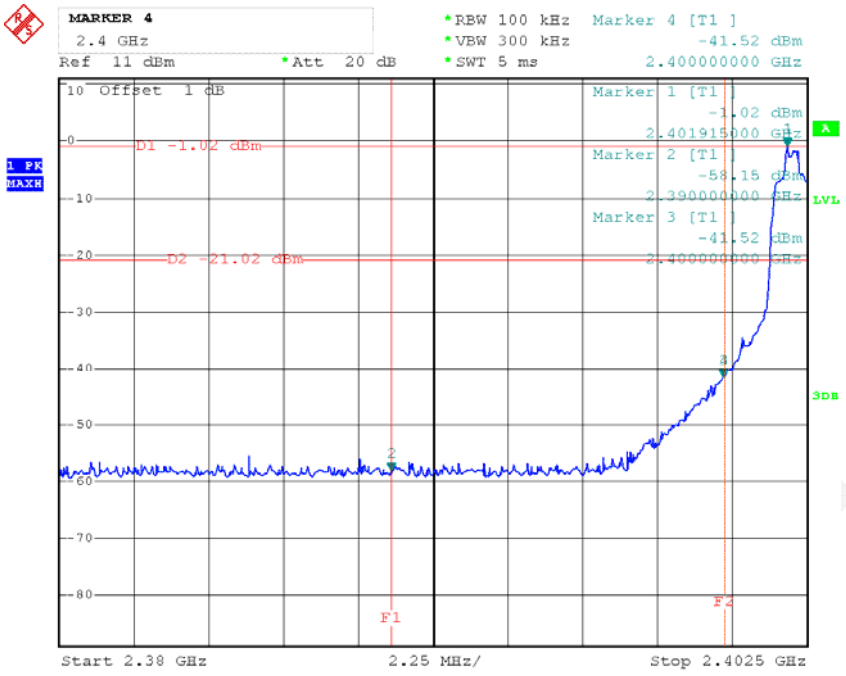


Band Edge, Right Side



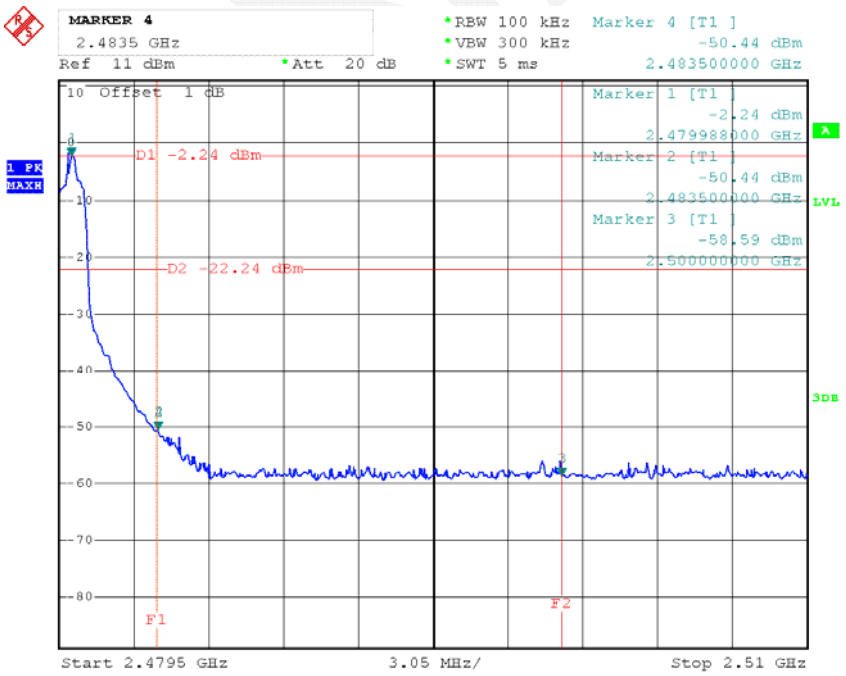
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



Date: 16.JUL.2015 20:33:57

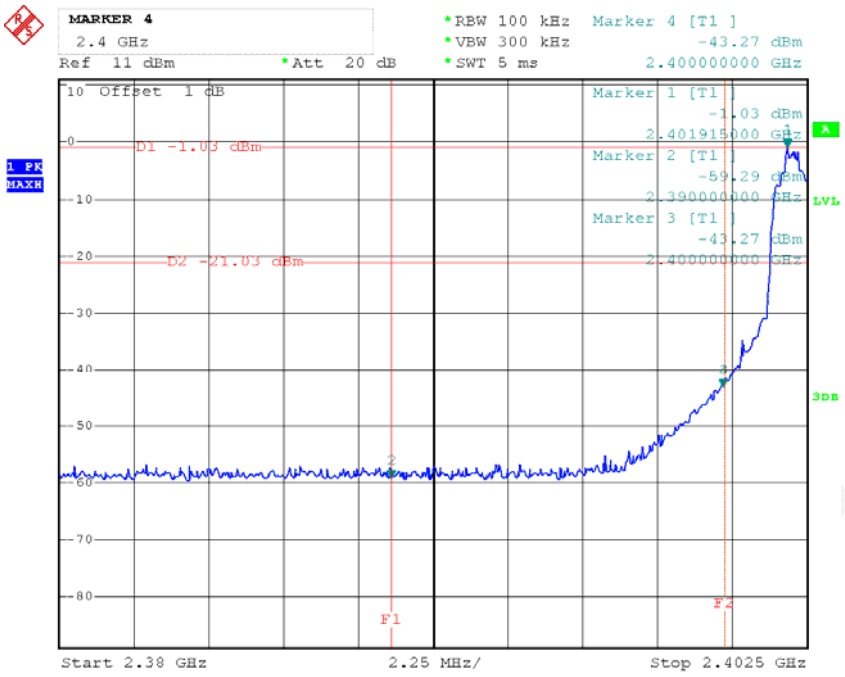
Band Edge, Right Side



Date: 16.JUL.2015 20:39:37

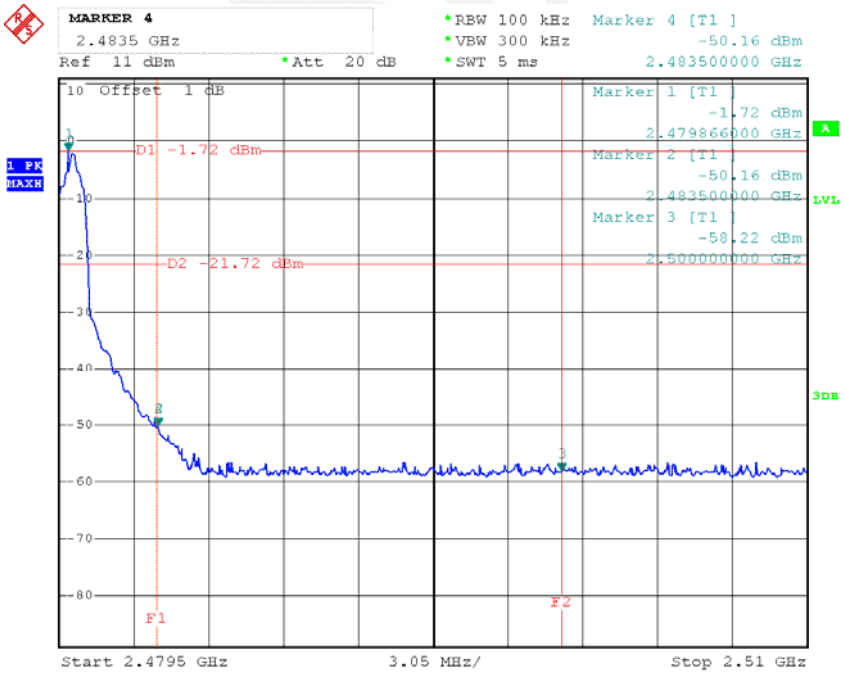
EDR Mode (8-DPSK):

Band Edge, Left Side



Date: 16.JUL.2015 20:35:59

Band Edge, Right Side



Date: 16.JUL.2015 20:38:20

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