

FCC PART 15.247

TEST REPORT

For

Rambo Industrial Limited

7F, Baiheyindu Building, Baige Road, Buji Longgang District, Shenzhen, Guangdong, China

FCC ID: AJE-BTR006

Report Type: Original Report	Product Type: Bluetooth Receiver
Test Engineer:	Ivan Cao <i>Ivan Cao</i>
Report Number:	R1DG111227001-00
Report Date:	2012-01-16
Reviewed By:	EMC Engineer Merry Zhao <i>merry. zhao</i>
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP*, or any agency of the Federal Government.

* This report contains data that are not covered by the NVLAP accreditation and are marked with an asterisk "★" (Rev.2)

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
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL I/O CABLE.....	6
CONFIGURATION OF TEST SETUP	7
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
FCC §15.247(i) AND §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
MEASUREMENT UNCERTAINTY.....	11
EUT SETUP	11
EMI TEST RECEIVER SETUP.....	12
TEST PROCEDURE	12
TEST EQUIPMENT LIST AND DETAILS.....	12
TEST RESULTS SUMMARY	12
TEST DATA	12
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	15
APPLICABLE STANDARD	15
MEASUREMENT UNCERTAINTY.....	15
EUT SETUP	15
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	16
TEST PROCEDURE	16
CORRECTED AMPLITUDE & MARGIN CALCULATION	16
TEST EQUIPMENT LIST AND DETAILS.....	16
TEST RESULTS SUMMARY	17
TEST DATA	17
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST	19
APPLICABLE STANDARD	19
TEST EQUIPMENT LIST AND DETAILS.....	19
TEST PROCEDURE	19
TEST DATA	19
FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING.....	26
APPLICABLE STANDARD	26

TEST EQUIPMENT LIST AND DETAILS.....	26
TEST PROCEDURE	26
TEST DATA	26
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST	32
APPLICABLE STANDARD	32
TEST EQUIPMENT LIST AND DETAILS.....	32
TEST PROCEDURE	32
TEST DATA	32
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....	35
APPLICABLE STANDARD	35
TEST EQUIPMENT LIST AND DETAILS.....	35
TEST PROCEDURE	35
TEST DATA	35
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT	51
APPLICABLE STANDARD	51
TEST EQUIPMENT LIST AND DETAILS.....	51
TEST PROCEDURE	51
TEST DATA	51
FCC §15.247(d) - BAND EDGES TESTING	57
APPLICABLE STANDARD	57
TEST EQUIPMENT LIST AND DETAILS.....	57
TEST PROCEDURE	57
TEST DATA	58

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Rambo Industrial Limited*'s product, model number: *BTR006* (FCC ID: *AJE-BTR006*) (the "EUT") in this report is a *Bluetooth Receiver*, which was measured approximately: 4.5 cm (L) x 3.3 cm (W) x 0.8 cm (H), rated input voltage: DC 3.7 V built-in rechargeable battery.

** All measurement and test data in this report was gathered from production sample serial number: 1106039 (Assigned by BACL, Shenzhen). The EUT was received on 2011-12-27.*

Objective

This report is prepared on behalf of *Rambo Industrial Limited* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine the compliance of the EUT with FCC Part 15, Subpart C, 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. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp.(Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication 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 December 06, 2010. 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.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratories Corp. (Shenzhen) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



The current scope of accreditations can be found at <http://ts.nist.gov/Standards/scopes/2007070.htm>

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode which was controlled by the bluetooth tester.

EUT Exercise Software

Exercise Software “Bluetest 3”

Equipment Modifications

No modification was made to the EUT tested.

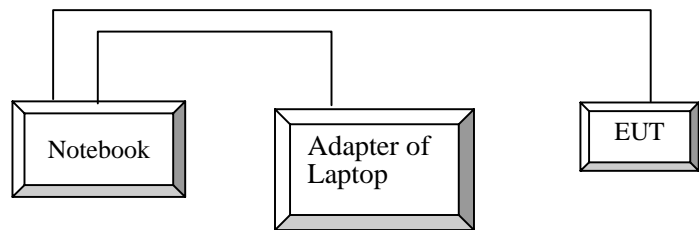
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Notebook	PP05L	N/A
TESCOM	Bluetooth Tester	TC-3000B	3000B650083

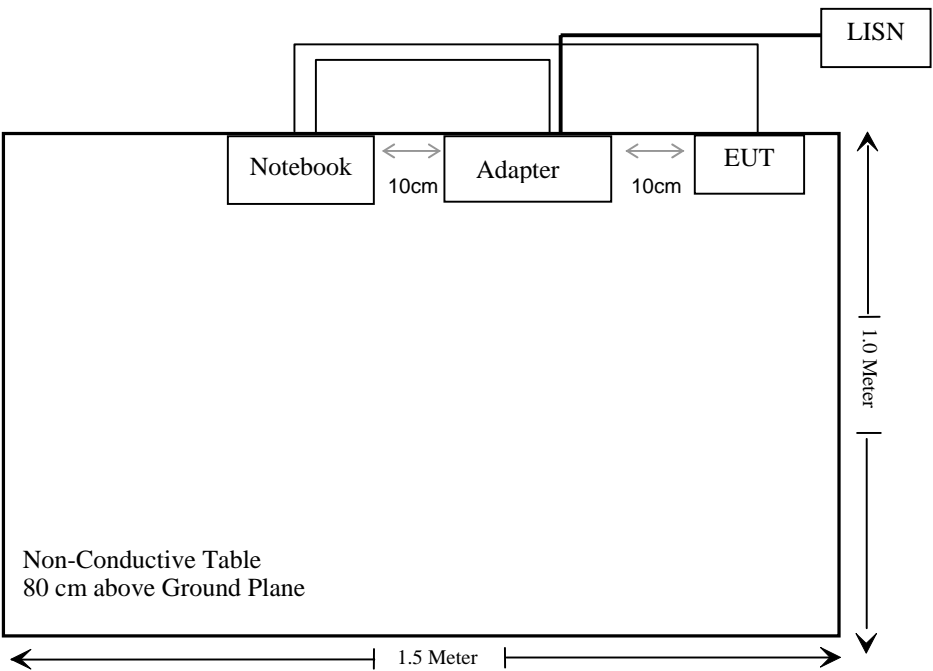
External I/O Cable

Cable Description	Length (m)	From Port	To
USB Charging Cable	1.0	EUT	Notebook

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247(i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated 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) AND §2.1093 – RF EXPOSURE

Applicable Standard

According to §15.247(i) and §1.1307(b)(1), 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 TCB Exclusion List, no SAR required if power is lower than the following threshold:

In the following table, f_{GHz} is mid-band frequency in GHz, and d is the distance to a person's body, excluding hands, wrists, feet, and ankles.

Exposure category	<u>low threshold</u>	<u>high threshold</u>
general population	$(60/f_{\text{GHz}}) \text{ mW}, d < 2.5 \text{ cm}$	$(900/f_{\text{GHz}}) \text{ mW}, d < 20 \text{ cm}$
	$(120/f_{\text{GHz}}) \text{ mW}, d \geq 2.5 \text{ cm}$	
occupational	$(375/f_{\text{GHz}}) \text{ mW}, d < 2.5 \text{ cm}$	$(2250/f_{\text{GHz}}) \text{ mW}, d < 20 \text{ cm}$
	$(900/f_{\text{GHz}}) \text{ mW}, d \geq 2.5 \text{ cm}$	

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

Measurement Result:

Maximum antenna gain: 0dBi

Maximum output power:

GFSK: 1.75 dBm = 1.50mW

$\pi/4$ -DQPSK: 1.14dBm = 1.30mW

8DPSK: 1.23dBm = 1.33mW

$60/f_{\text{GHz}} = 60/2441 = 24.58 \text{ mW}$

This is a portable device and the Max peak output power of EUT is less than 24.58mW.

So the SAR measurement is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to CFR47 § 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 a printed antenna on PCB, which in accordance to section 15.203; the antenna gain is 0 dBi, please refer to the internal photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

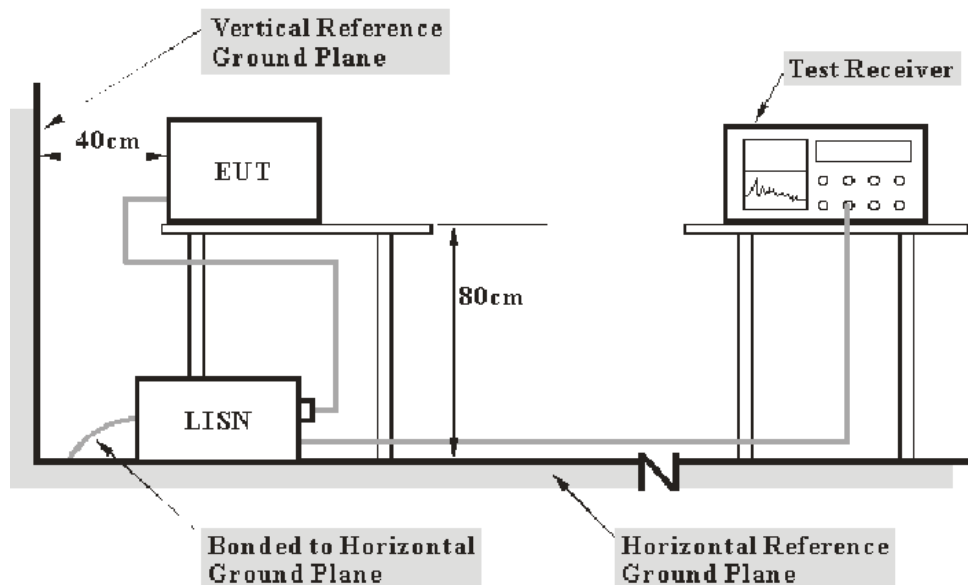
FCC §15.207

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on CISPR 16-4-4, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at Bay Area Compliance Laboratory Corp. (Shenzhen) is 2.4 dB (k=2, 95% level of confidence).

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 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.

The adapter of notebook 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:

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	830245/006	2011-03-03	2012-03-02
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2011-03-09	2012-03-08

* **Statement of Traceability:** Bay Area Compliance Laboratory Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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:

10.31 dB at 1.605 MHz in the Neutral conducted mode

Test Data

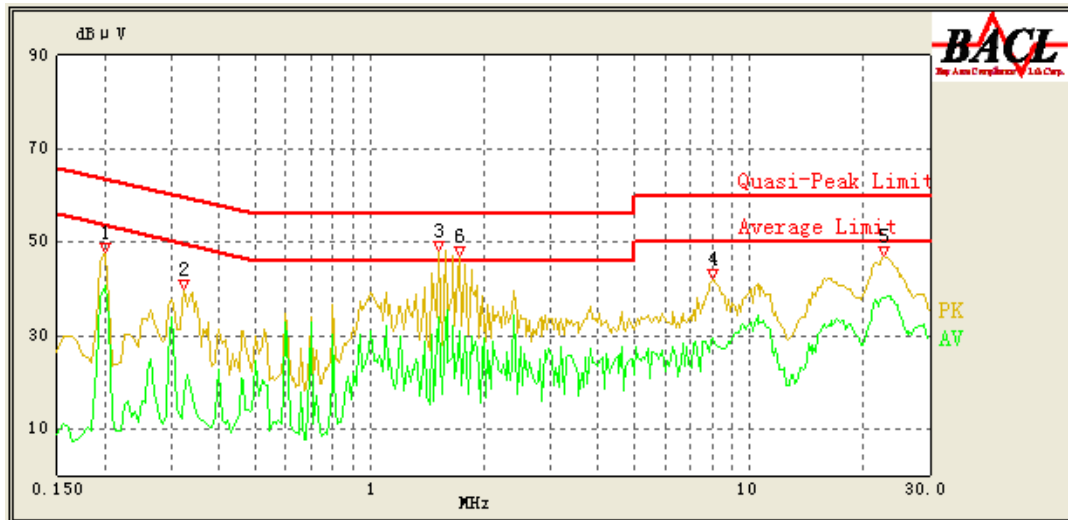
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	48 %
ATM Pressure:	100.0kPa

* *The testing was performed by Ivan Cao on 2011-12-30.*

Test Mode: Charging&Transmitting

AC 120V/60 Hz, Line



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/ QP/Ave.)
1.520	44.93	10.10	56.00	11.07	QP
1.520	34.07	10.10	46.00	11.93	Ave.
22.600	38.07	10.10	50.00	11.93	Ave.
0.200	40.70	10.10	54.57	13.87	Ave.
1.720	31.03	10.10	46.00	14.97	Ave.
1.725	40.96	10.10	56.00	15.04	QP
22.605	40.55	10.10	60.00	19.45	QP
0.200	44.87	10.10	64.57	19.70	QP
8.040	29.09	10.10	50.00	20.91	Ave.
8.025	35.17	10.10	60.00	24.83	QP
0.325	28.11	10.10	61.00	32.89	QP
0.325	17.55	10.10	51.00	33.45	Ave.

AC 120V/60 Hz, Neutral

Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/ QP/Ave.)
1.605	35.69	10.10	46.00	10.31	Ave.
22.545	39.60	10.10	50.00	10.40	Ave.
1.590	45.54	10.10	56.00	10.46	QP
1.725	42.86	10.10	56.00	13.14	QP
8.015	35.61	10.10	50.00	14.39	Ave.
1.725	31.46	10.10	46.00	14.54	Ave.
0.195	38.14	10.10	54.71	16.57	Ave.
22.545	39.63	10.10	60.00	20.37	QP
8.015	38.25	10.10	60.00	21.75	QP
0.195	42.74	10.10	64.71	21.97	QP
0.340	28.47	10.10	60.57	32.10	QP
0.340	17.75	10.10	50.57	32.82	Ave.

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

Applicable Standard

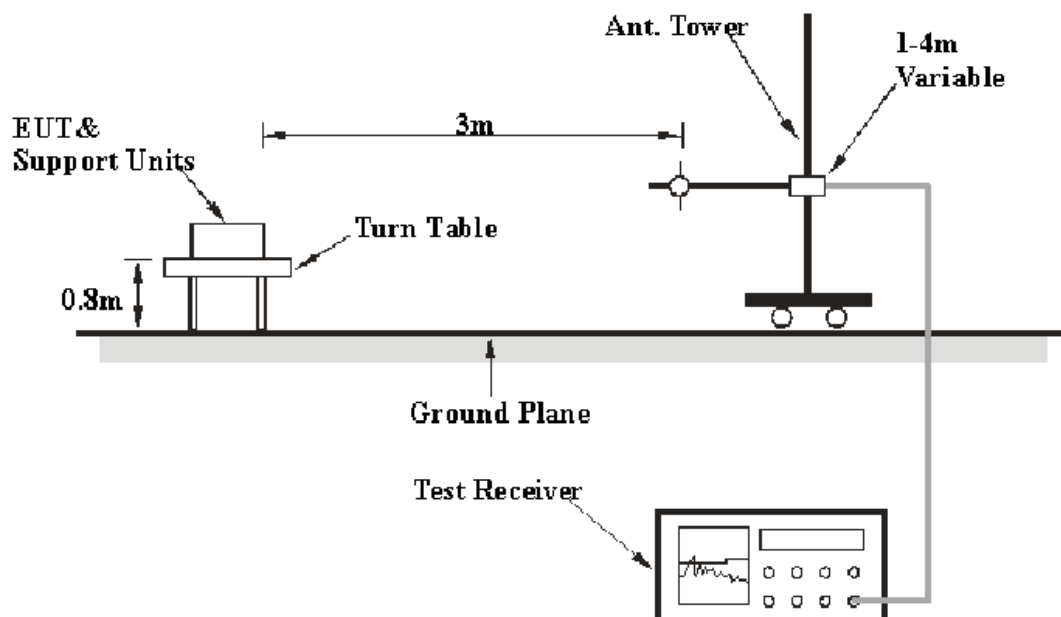
FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-4, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is ± 4.0 dB. ($k=2$, 95% level of confidence).

EUT Setup



The radiated emission tests were performed in the 3 meters chamber B 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:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>	<i>Detector</i>
30 MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 25 GHz	1 MHz	3 MHz	PK
1000 MHz – 25 GHz	1 MHz	10 Hz	Ave

Test Procedure

For the radiated emissions test, the adapter of notebook was connected to the outlet of the LISN

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

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

Corrected Amplitude & Margin Calculation

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

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

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2011-08-02	2012-08-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-07-05	2012-07-04
Mini-Circuits	Amplifier	ZVA-213+	T-E27H	2011-03-08	2012-03-07
Sunol Sciences	Horn Antenna	DRH-118	A052604	2011-05-04	2012-05-03
Electro-Mechanics	Horn Antenna	3116	9510-2270	2011-10-11	2012-10-10
Rohde & Schwarz	Signal Analyzer	FSIQ 26	609358	2011-07-08	2012-07-07

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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:

1.27 dB at 4959.98 MHz in the Horizontal polarization

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

The testing was performed by Ivan Cao on 2011-12-28.

1) 30 MHz-25 GHz (BDR Mode was the worst case)

Comment	Frequency (MHz)	Reading (dBμV/m)	Detector (PK/QP/Ave)	Polar (H / V)	Corrected Amplitude (dB)	Correction Data (dBμV/m)	FCC Part 15.247/15.209/15.205	
							Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)								
Fundamental	2402	61.46	PK	H	31.75	93.21	/	/
Fundamental	2402	46.4	Ave.	H	31.75	78.15	/	/
Fundamental	2402	55.73	PK	V	31.75	87.48	/	/
Fundamental	2402	42.83	Ave.	V	31.75	74.58	/	/
spurious	400.99	44.19	QP	H	-9.9	34.29	46	7.9
spurious	400.99	48	QP	V	-9.9	38.1	46	7.9
spurious	1602.04	41.94	Ave.	H	2.81	44.75	54	9.25
harmonic	4803.93	29.14	Ave.	H	11.55	40.69	54	13.31
spurious	1602.02	36.68	Ave.	V	3.11	39.79	54	14.21
harmonic	4804.05	27.68	Ave.	V	11.35	39.03	54	14.97
harmonic	4803.93	44.2	PK	H	11.55	55.75	74	18.25
harmonic	4804.05	42.1	PK	V	11.35	53.45	74	20.55
spurious	1602.04	44.82	PK	H	2.81	47.63	74	26.37
spurious	1602.02	41.2	PK	V	3.11	44.31	74	29.69
Middle Channel (2441 MHz)								
Fundamental	2441	62.11	PK	H	32.01	94.12	/	/
Fundamental	2441	47.18	Ave.	H	32.01	79.19	/	/
Fundamental	2441	56.74	PK	V	32.01	88.75	/	/
Fundamental	2441	43.88	Ave.	V	32.01	75.89	/	/
spurious	400.99	44.05	QP	H	-9.9	34.15	46	7.9
spurious	400.99	47.78	QP	V	-9.9	37.88	46	7.9
harmonic	4881.98	34.32	Ave.	H	11.61	45.93	54	8.07
spurious	1626.43	39.23	Ave.	H	2.81	42.04	54	11.96
harmonic	4881.96	29.79	Ave.	V	11.41	41.2	54	12.8
spurious	1626.59	37.54	Ave.	V	3.11	40.65	54	13.35
harmonic	4881.98	47.46	PK	H	11.61	59.07	74	14.93
harmonic	4881.96	42.58	PK	V	11.41	53.99	74	20.01
spurious	1626.43	43.12	PK	H	2.81	45.93	74	28.07
spurious	1626.59	41.8	PK	V	3.11	44.91	74	29.09
High Channel (2480 MHz)								
Fundamental	2480	60.17	PK	H	32.27	92.44	/	/
Fundamental	2480	44.31	Ave.	H	32.27	76.58	/	/
Fundamental	2480	54.71	PK	V	32.27	86.98	/	/
Fundamental	2480	39.84	Ave.	V	32.27	72.11	/	/
harmonic	4959.98	41.08	Ave.	H	11.65	52.73	54	1.27*
harmonic	4.959.83	36.25	Ave.	V	11.45	47.7	54	6.3
spurious	1652.67	43.47	Ave.	H	2.81	46.28	54	7.72
spurious	400.99	43.79	QP	H	-9.9	33.89	46	7.9
spurious	400.99	47.04	QP	V	-9.9	37.14	46	7.9
spurious	1652.73	39.6	Ave.	V	3.11	42.71	54	11.29
harmonic	4959.98	43.13	PK	H	11.65	54.78	74	19.22
harmonic	4.959.83	40.32	PK	V	11.45	51.77	74	22.23
spurious	1652.67	46.45	PK	H	2.81	49.26	74	24.74
spurious	1652.73	42.81	PK	V	3.11	45.92	74	28.08

The data which below the limit 20 dB was not recorded; *within measurement uncertainty;

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 2400-2483.5 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
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 100 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:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

* The testing was performed by Ivan Cao on 2011-12-30.

Test Result: Compliance, please refer to following tables and plots

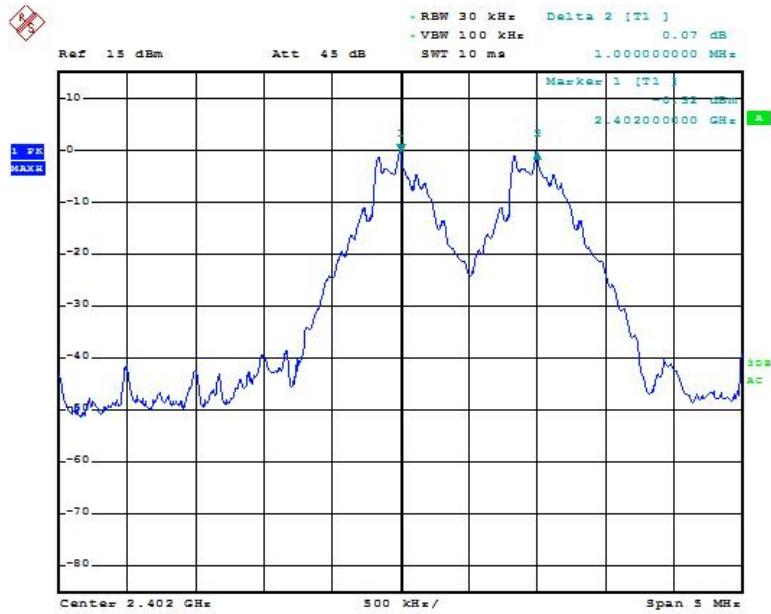
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
BDR	Low	2402	1.000	0.540	Pass
	Adjacent	2403			
	Middle	2441	1.000	0.567	Pass
	Adjacent	2442			
	High	2480	1.000	0.564	Pass
	Adjacent	2479			
EDR Mode ($\pi/4$ -DQPSK)	Low	2402	1.000	0.75	Pass
	Adjacent	2403			
	Middle	2441	1.000	0.75	Pass
	Adjacent	2442			
	High	2480	1.000	0.75	Pass
	Adjacent	2479			
EDR Mode (8DPSK)	Low	2402	1.004	0.812	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.816	Pass
	Adjacent	2442			
	High	2480	1.008	0.816	Pass
	Adjacent	2479			

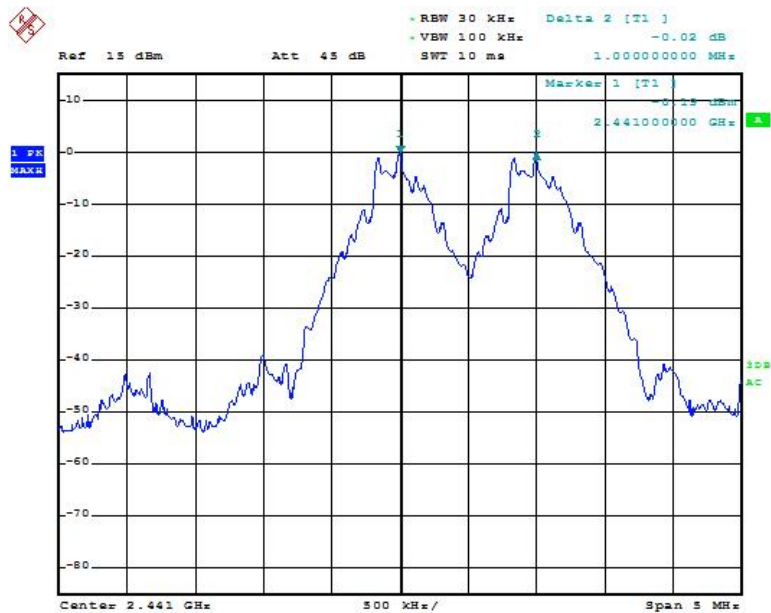
Please refer to the following plots.

BDR:

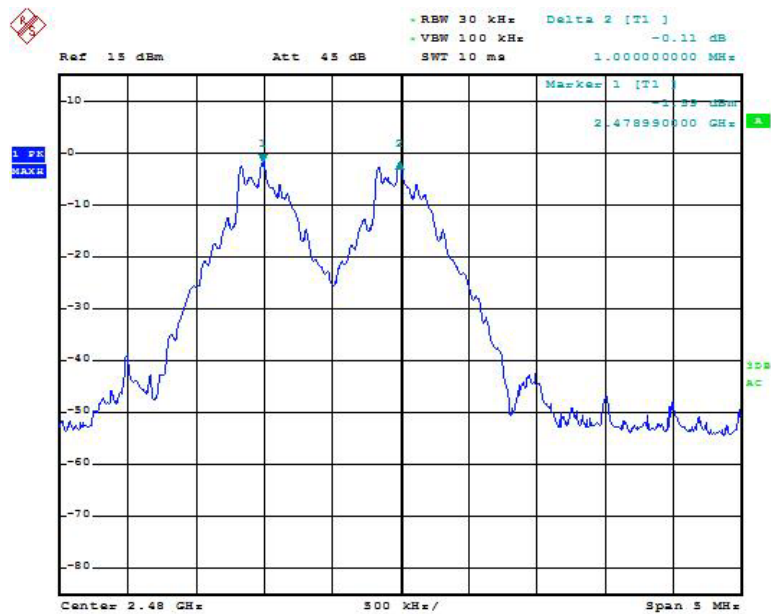
Low Channel



Middle Channel

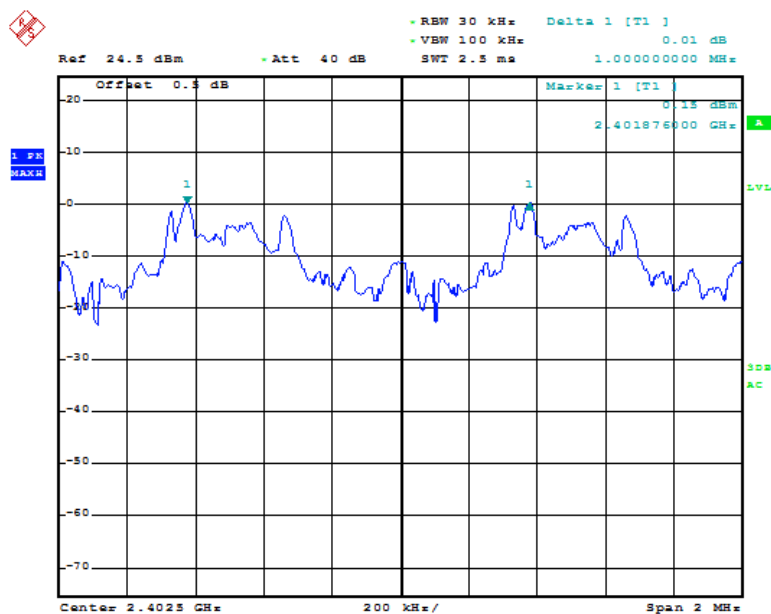


High Channel

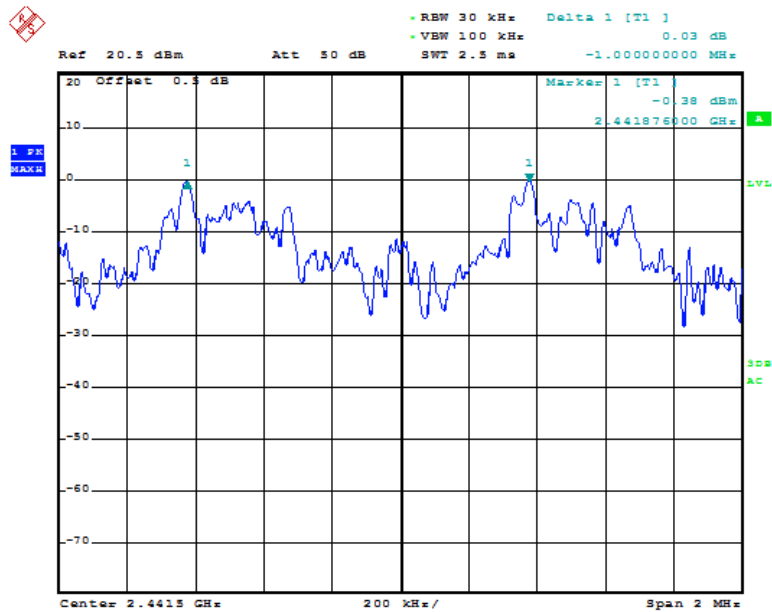


EDR Mode ($\pi/4$ -DQPSK)

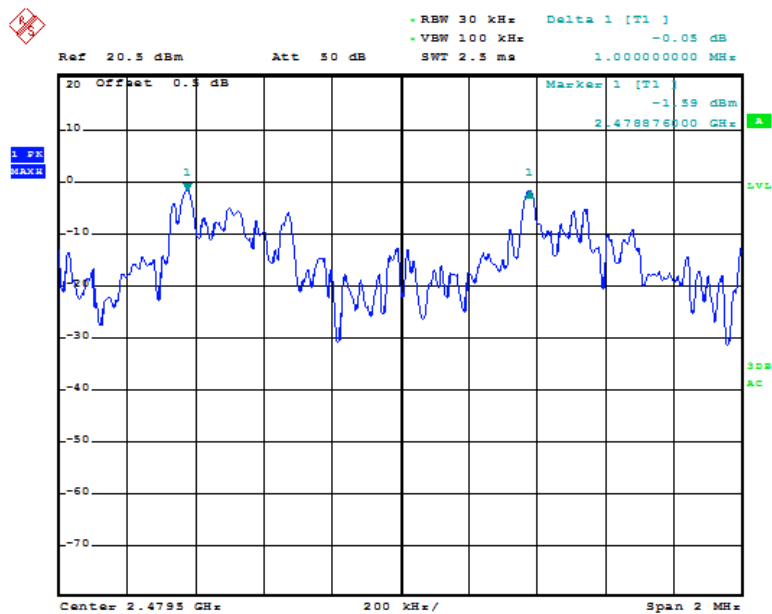
Low Channel



Middle Channel

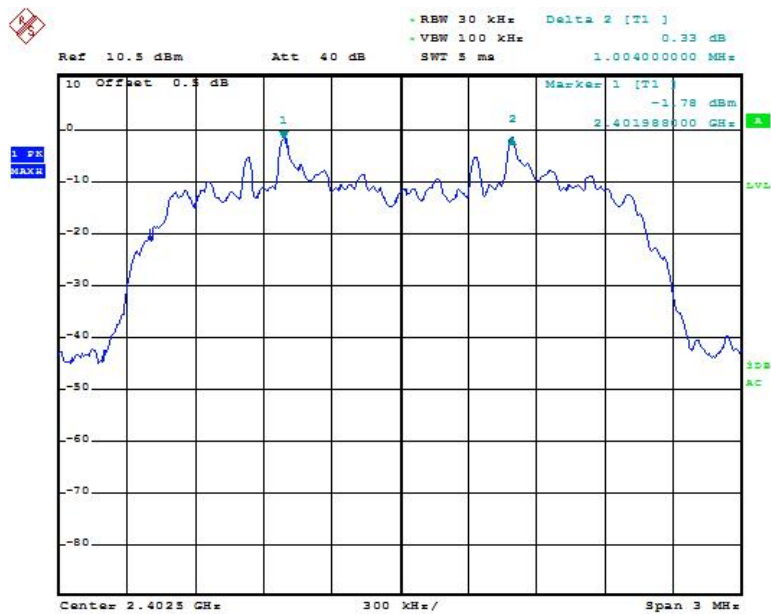


High Channel

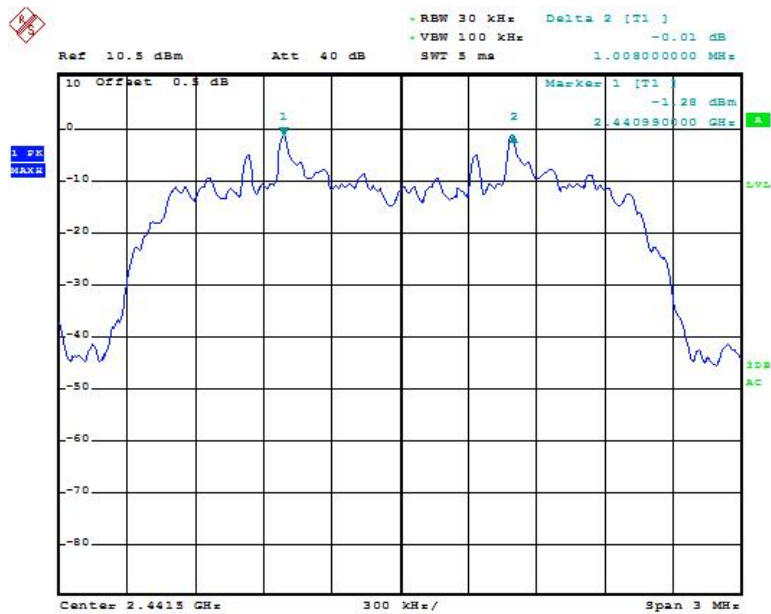


EDR Mode (8DPSK)

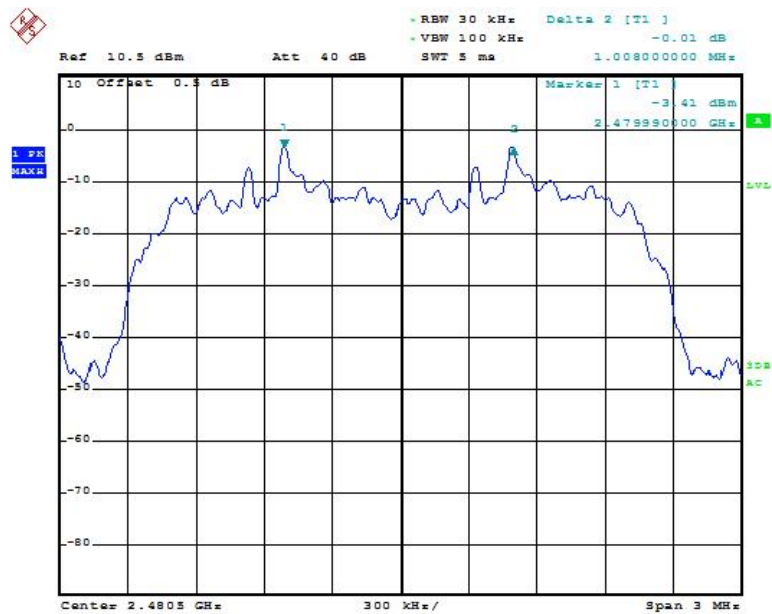
Low Channel



Middle Channel



High Channel



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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

* The testing was performed by Ivan Cao from 2011-12-30 to 2012-01-15.

Test Result: Compliance, please refer to following tables and plots

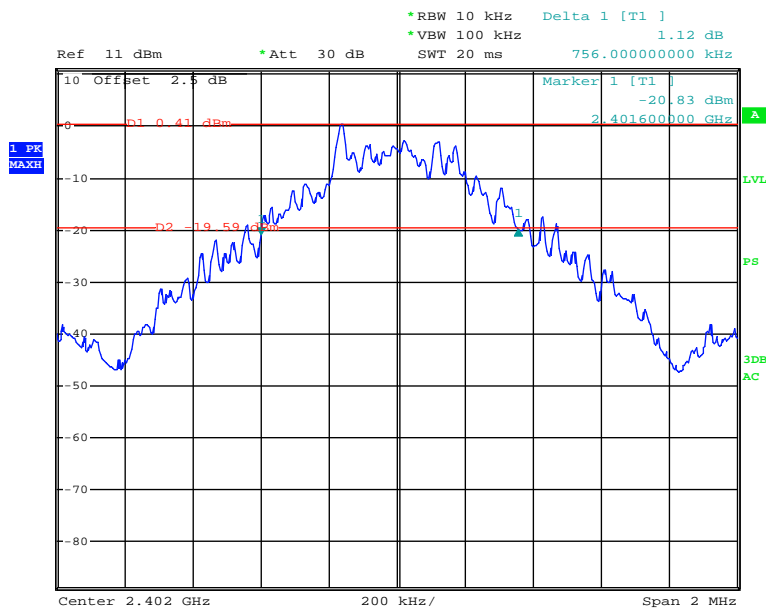
Test Mode: Transmitting

	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR	Low	2402	0.756
	Middle	2441	0.756
	High	2480	0.756
EDR Mode ($\pi/4$ -DQPSK)	Low	2402	1.12
	Middle	2441	1.124
	High	2480	1.12
EDR Mode (8DPSK)	Low	2402	1.218
	Middle	2441	1.224
	High	2480	1.224

Please refer to the following plots.

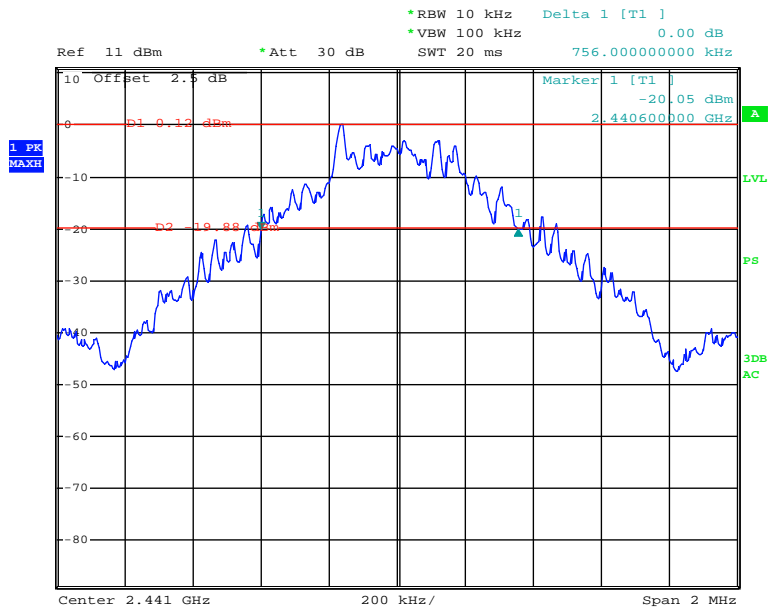
BDR:

Low Channel



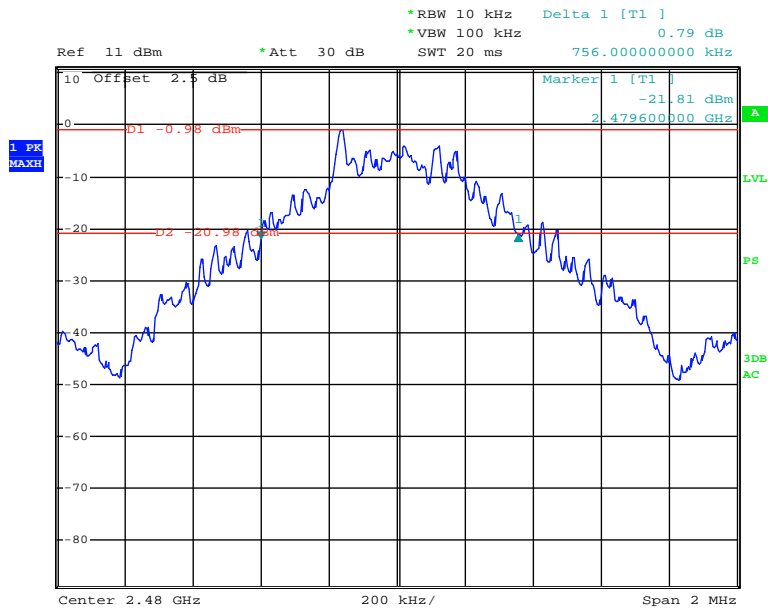
Date: 15.JAN.2012 18:36:27

Middle Channel



Date: 15.JAN.2012 18:34:32

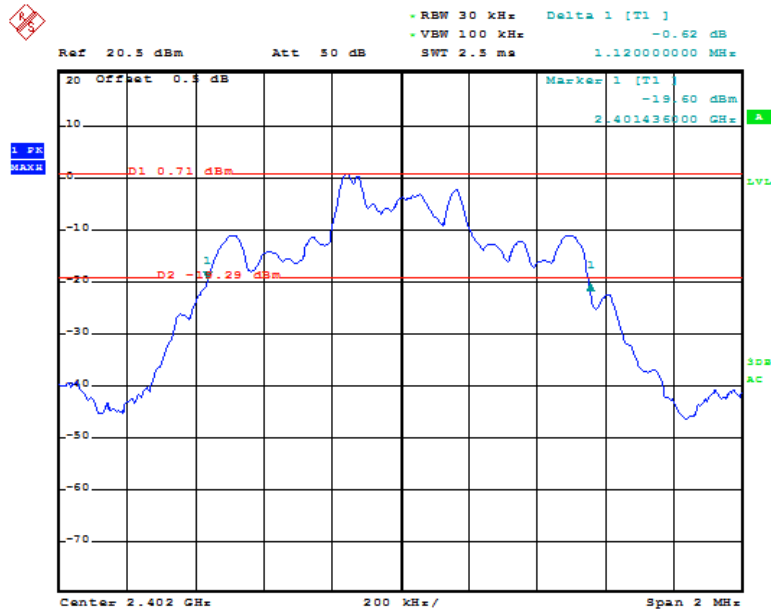
High Channel



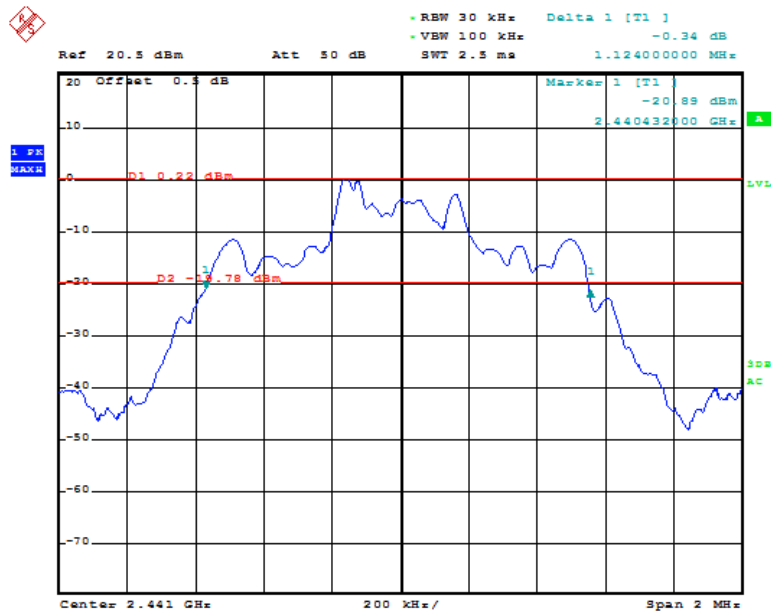
Date: 15.JAN.2012 18:37:50

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

Low Channel



Middle Channel



Ref 20.5 dBm Att 50 dB

RBW 30 kHz Delta 1 [T1] -0.60 dB
VBW 100 kHz
SWT 2.5 ms 1.12000000 MHz

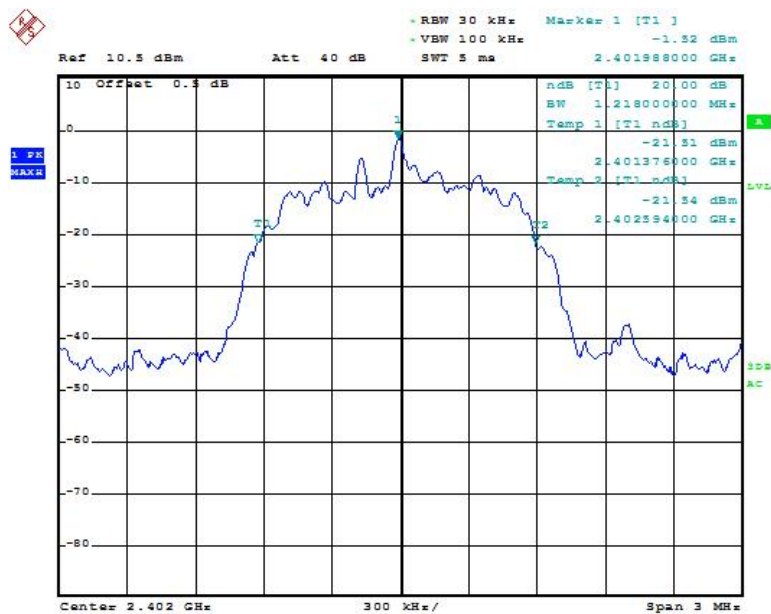
20 Offset 0.5 dB

Marker 1 [T1] -21.40 dBm
2.47943600 GHz

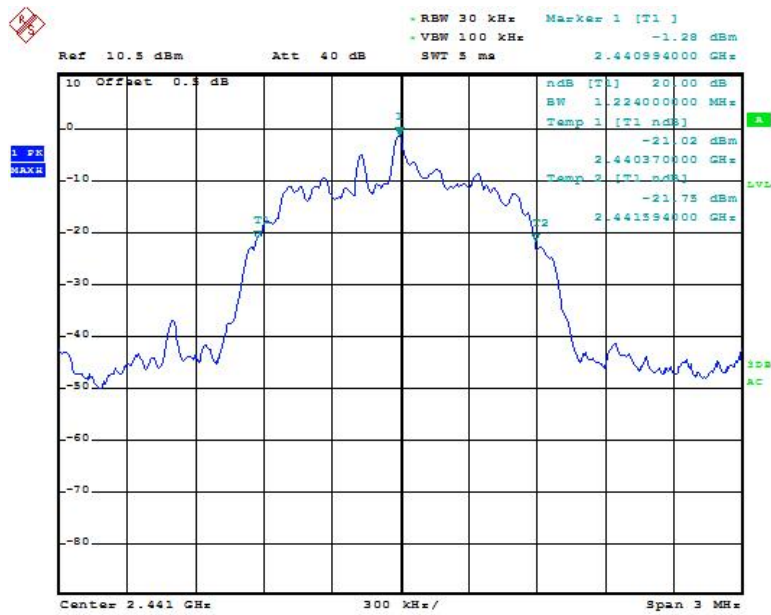
1.9K MAXH

Center 2.48 GHz 200 kHz/ Span 2 MHz

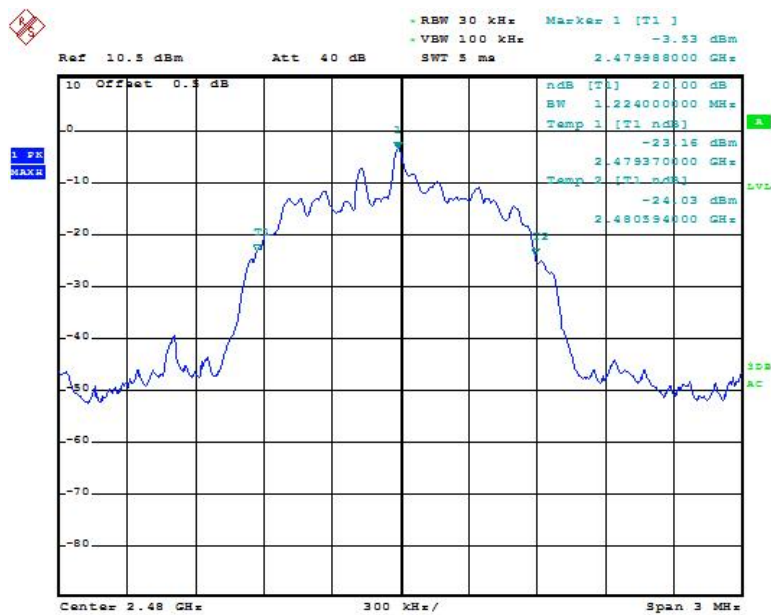
Low Channel



Middle Channel



High Channel



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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

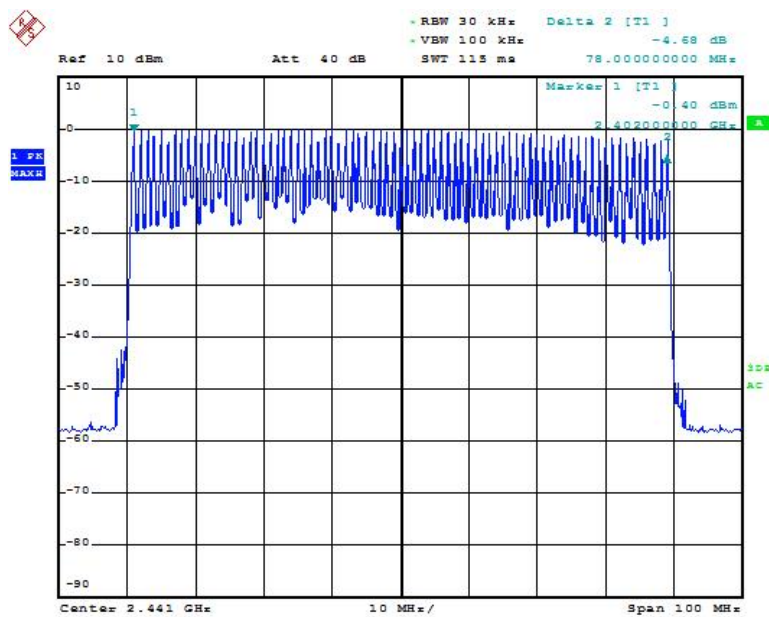
The testing was performed by Ivan Cao from 2011-12-30 to 2012-01-15.

Test Result: Compliance, please refer to following tables and plots

Test Mode: Transmitting

	Frequency Range (MHz)	Number of Hopping Channel	Limit
BDR	2400-2483.5	79	≥ 15
EDR Mode(π /4-DQPSK)	2400-2483.5	79	≥ 15
EDR Mode(8DPSK)	2400-2483.5	79	≥ 15

Number of Hopping Channels-BDR Mode



Ref 10.5 dBm Att 20 dB RBW 100 kHz Delta 1 [T1] 1
VBW 300 kHz -2.20 dB
SWT 10 ms 77.988000000 MHz

10 Offset 0.5 dB Marker 1 [T1] 1.49 dBm
2.401837000 GHz

1 PR
HAKM

Start 2.4 GHz 8.35 MHz/ Stop 2.4835 GHz

Ref 13 dBm Att 30 dB RBW 100 kHz VBW 300 kHz SWF 10 ms Delta 1 [T1] -0.52 dB 78.166000000 MHz

Offset 0.4 dB Marker 1 [T1] 0.68 dBm 2.40199400 GHz

1.500 MAX

Start 2.4 GHz 8.35 MHz/ Stop 2.4835 GHz

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 = Pulse time*hop rate/number of hopping channels*31.6S
Hop rate=1600/S

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

* The testing was performed by Ivan Cao from 2011-12-30 to 2012-01-15.

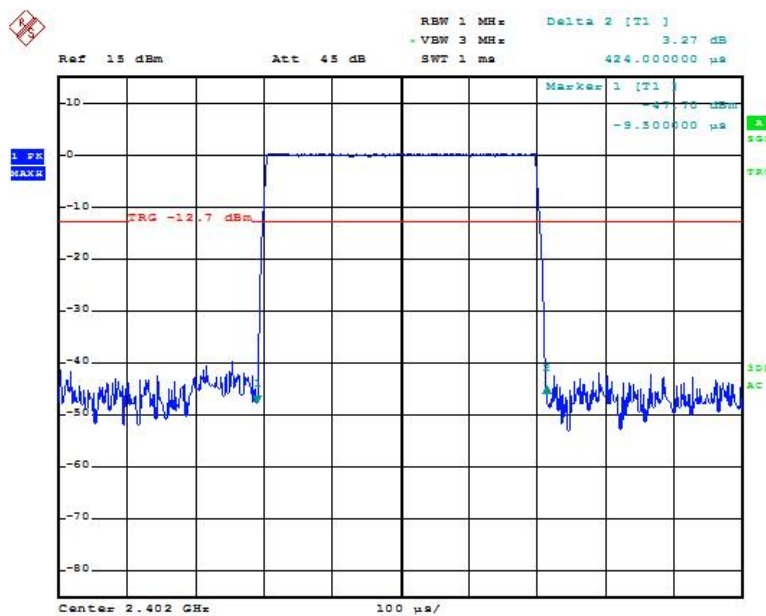
Test Result: Compliance, please refer to following tables and plots

Test Mode: Transmitting (BDR)

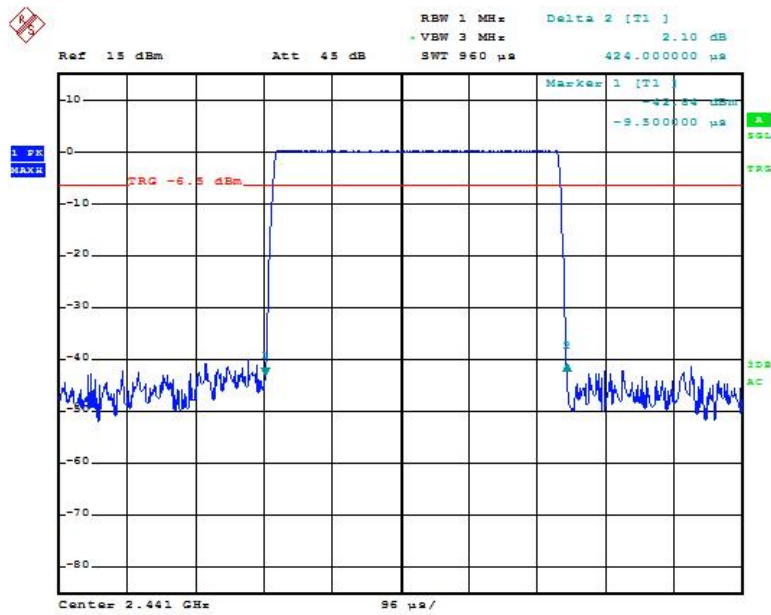
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH 1	Low	0.424	0.136	0.4	Pass
	Middle	0.424	0.136	0.4	Pass
	High	0.424	0.136	0.4	Pass
	Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6s				
DH 3	Low	1.69	0.271	0.4	Pass
	Middle	1.69	0.271	0.4	Pass
	High	1.69	0.271	0.4	Pass
	Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6s				
DH 5	Low	2.95	0.315	0.4	Pass
	Middle	2.95	0.315	0.4	Pass
	High	2.95	0.315	0.4	Pass
	Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6s				

Please refer to the following plots.

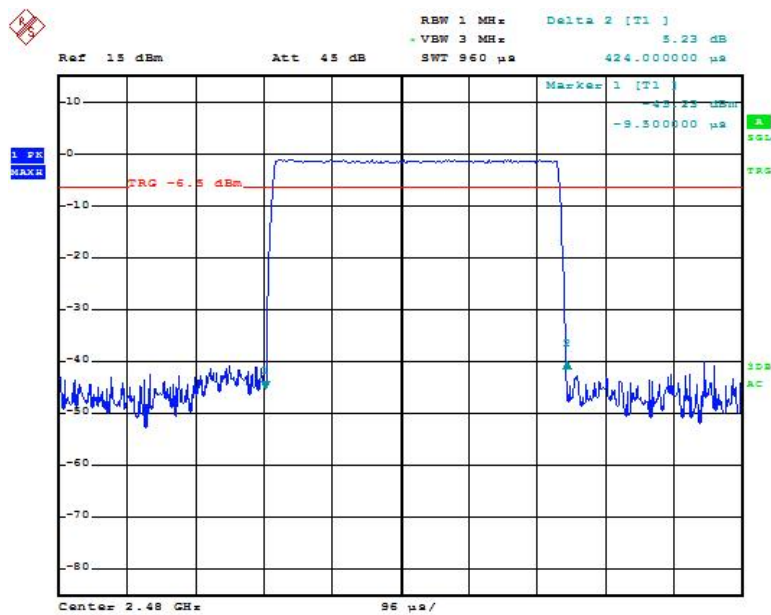
Low Channel for DH1



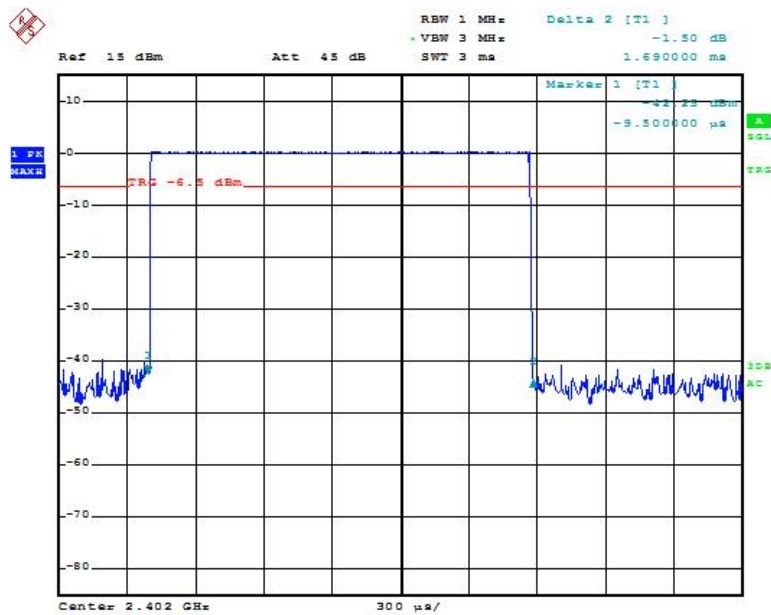
Middle Channel for DH1



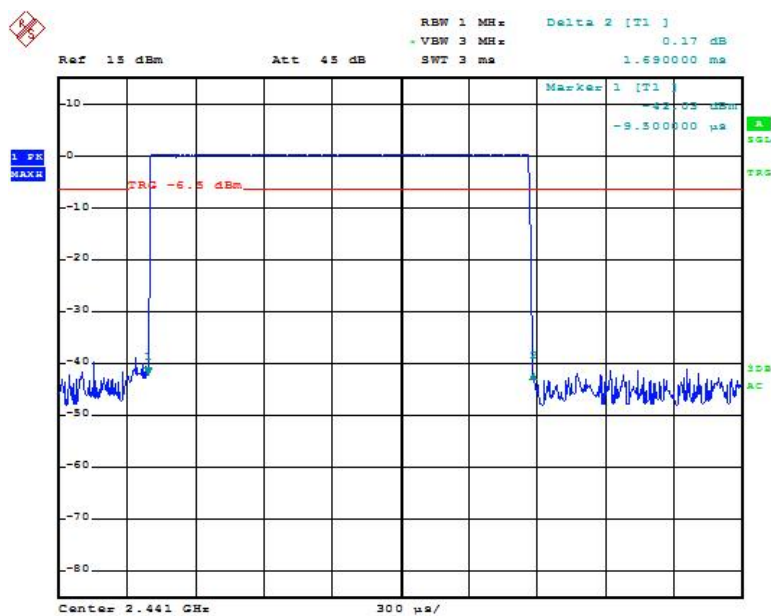
High Channel for DH1



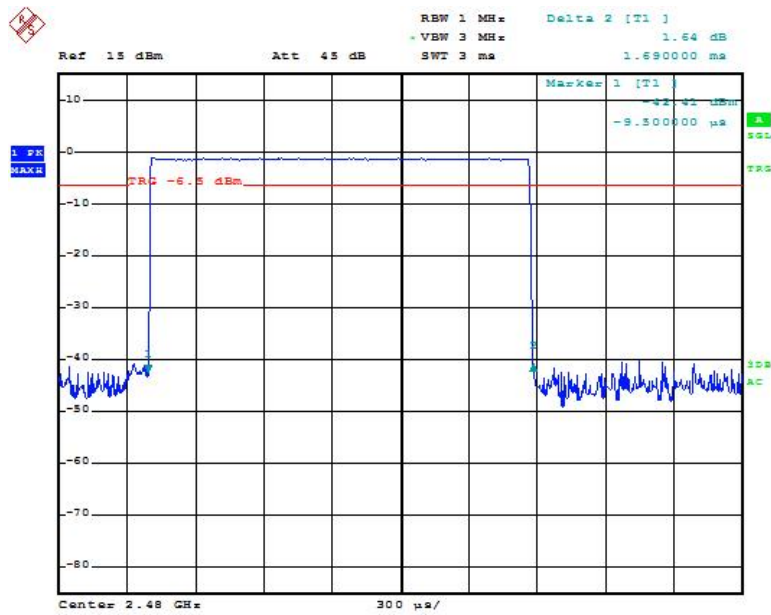
Low Channel for DH3



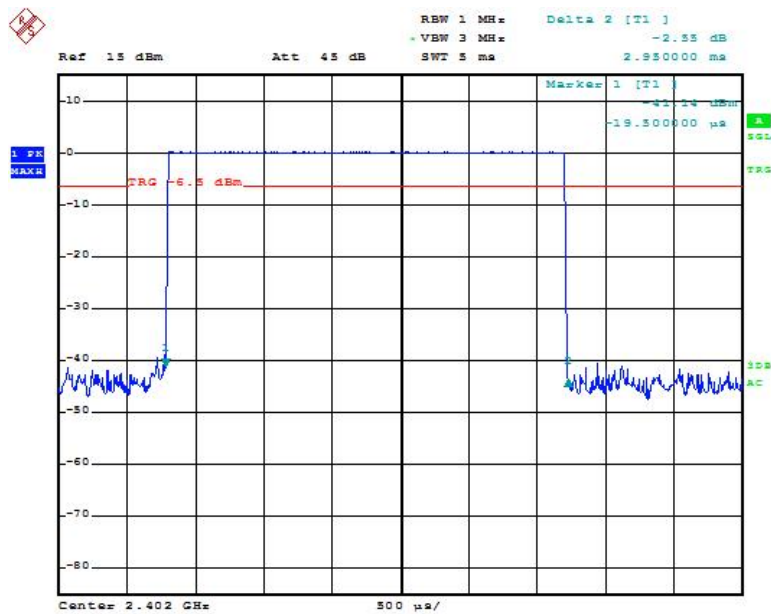
Middle Channel for DH3



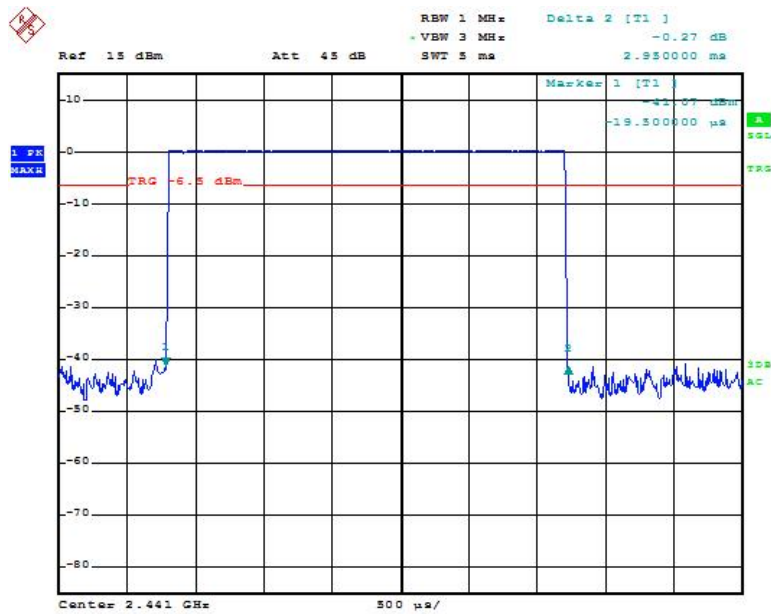
High Channel for DH3



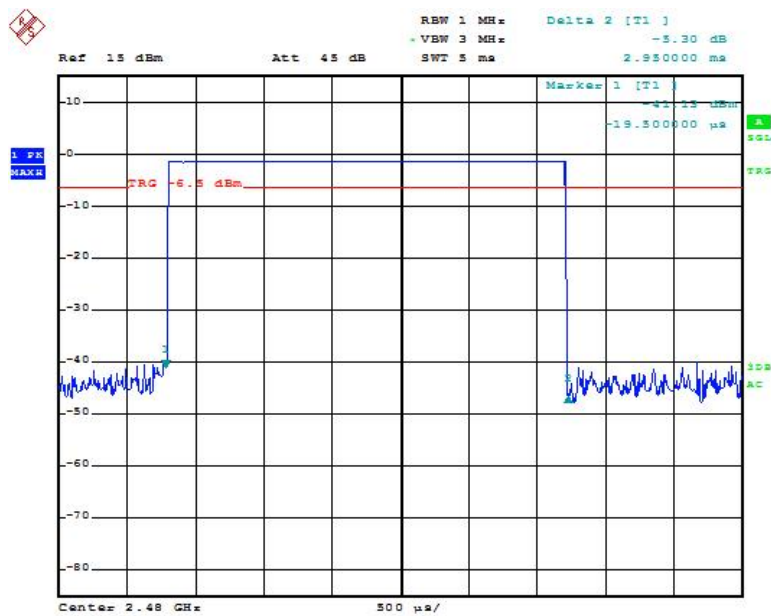
Low Channel for DH5



Middle Channel for DH5



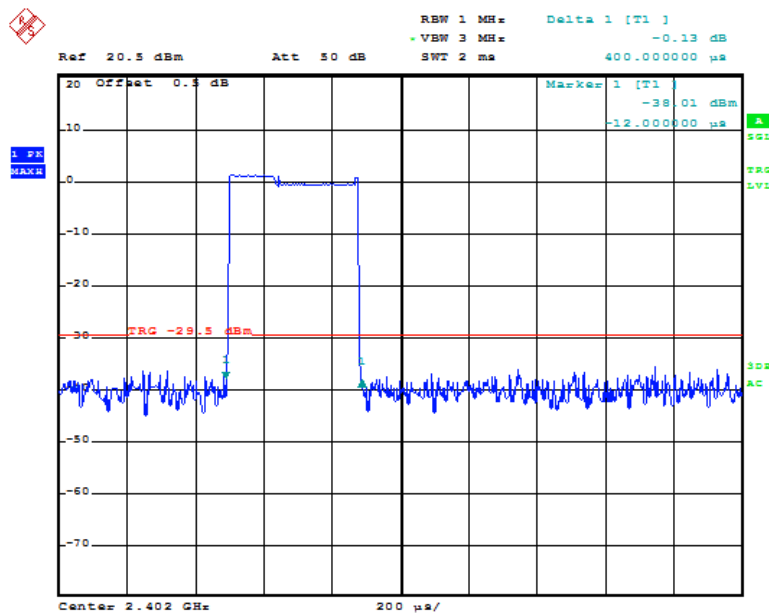
High Channel for DH5



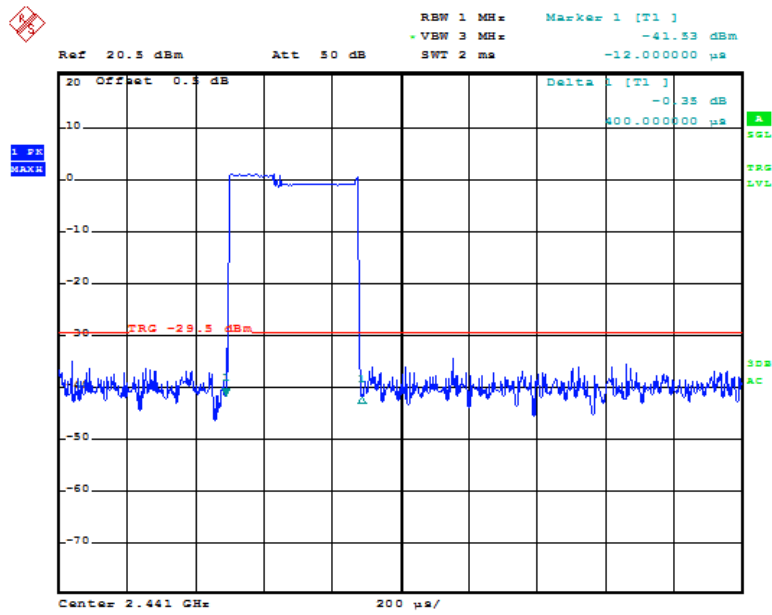
EDR Mode ($\pi/4$ -DQPSK)

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH 1	Low	0.4	0.128	0.4	Pass
	Middle	0.4	0.128	0.4	Pass
	High	0.398	0.127	0.4	Pass
	Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6s				
DH 3	Low	1.67	0.266	0.4	Pass
	Middle	1.66	0.266	0.4	Pass
	High	1.658	0.264	0.4	Pass
	Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6s				
DH 5	Low	2.924	0.312	0.4	Pass
	Middle	2.934	0.313	0.4	Pass
	High	2.954	0.315	0.4	Pass
	Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6s				

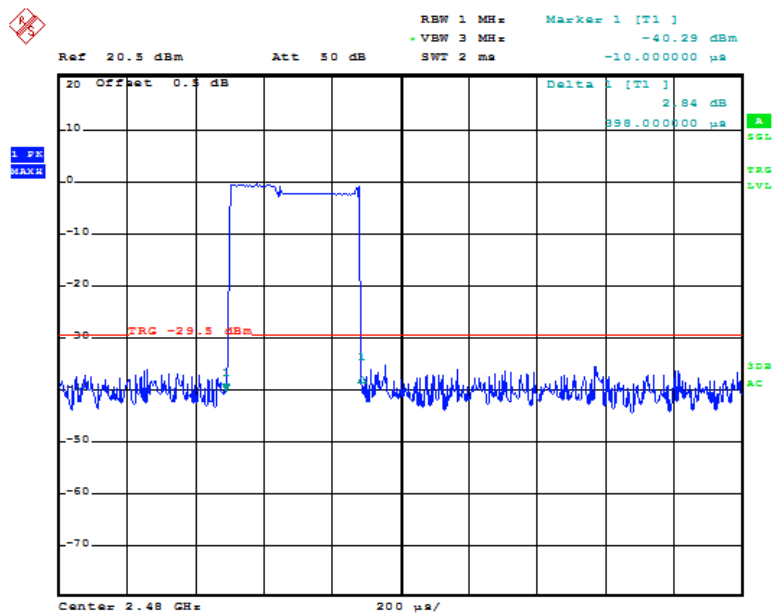
Please refer to the following plots.

Low Channel for DH1

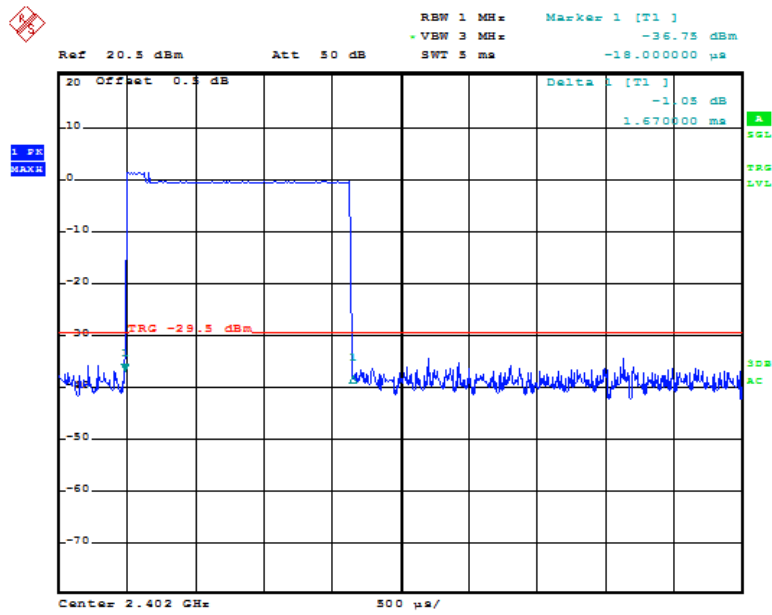
Middle Channel for DH1



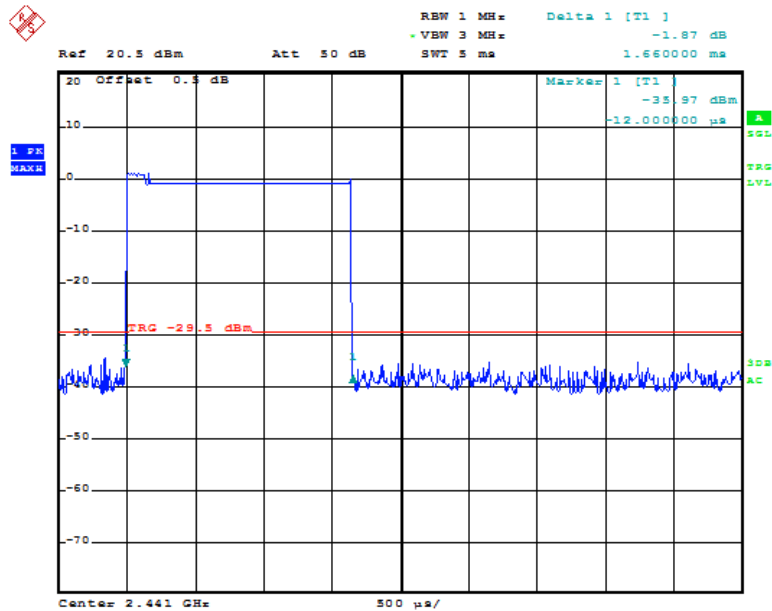
High Channel for DH1



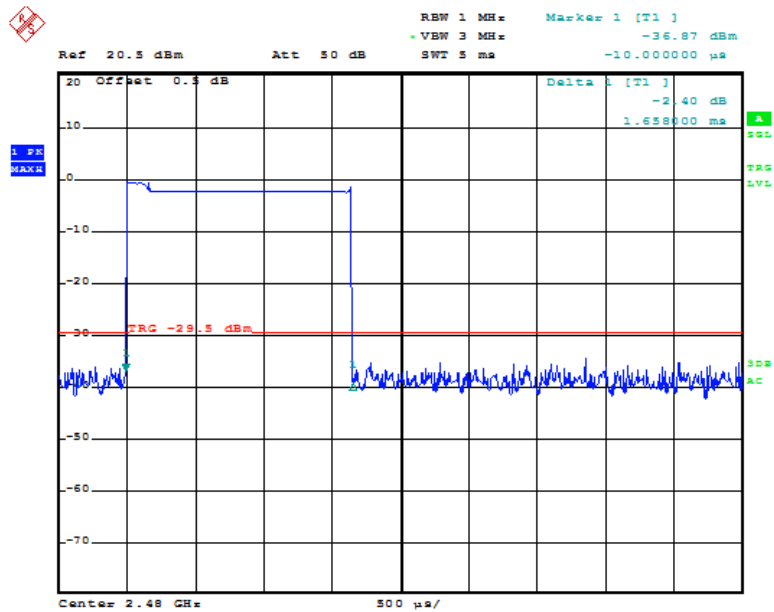
Low Channel for DH3



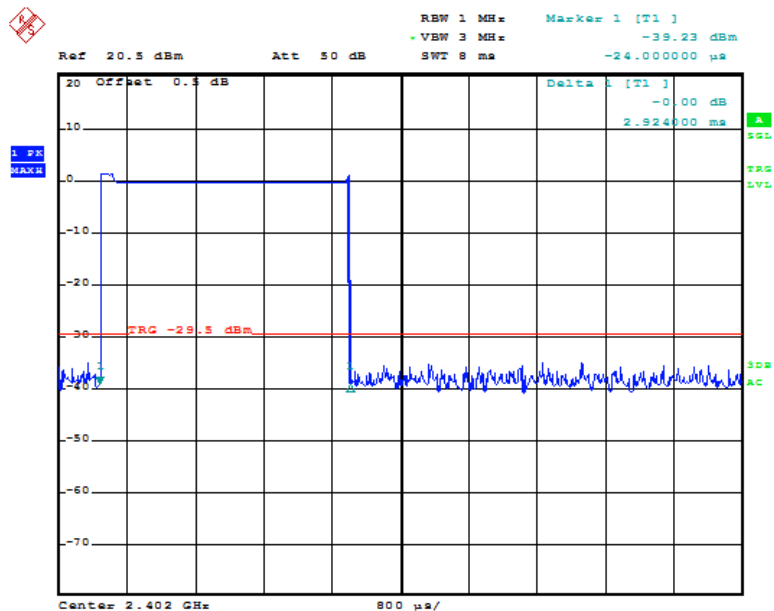
Middle Channel for DH3



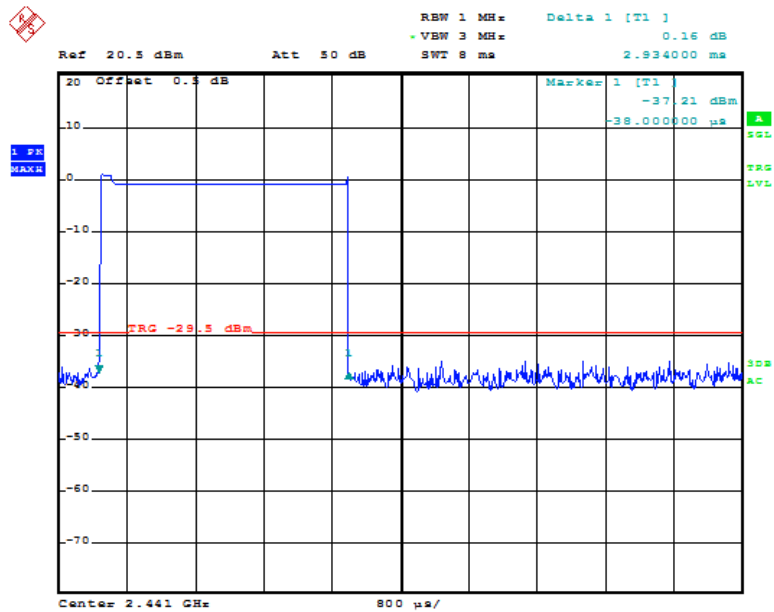
High Channel for DH3



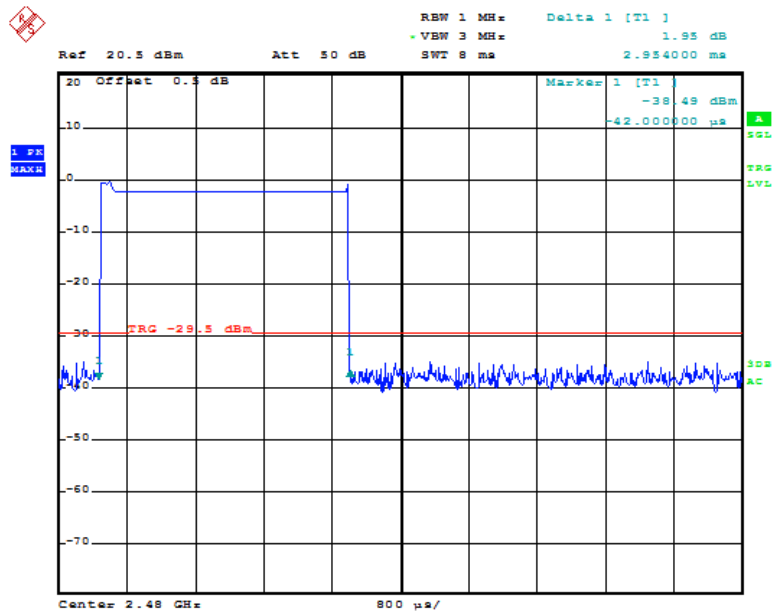
Low Channel for DH5



Middle Channel for DH5



High Channel for DH5

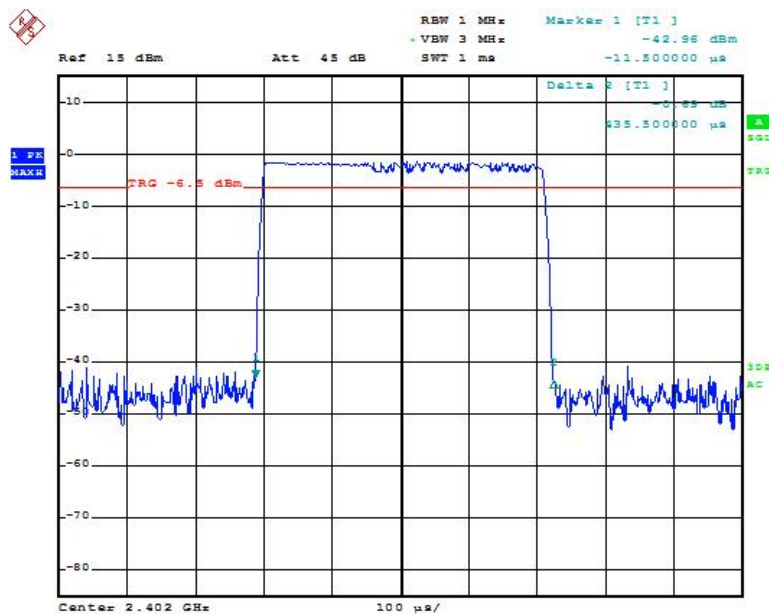


Test Mode: Transmitting- EDR Mode(8DPSK)

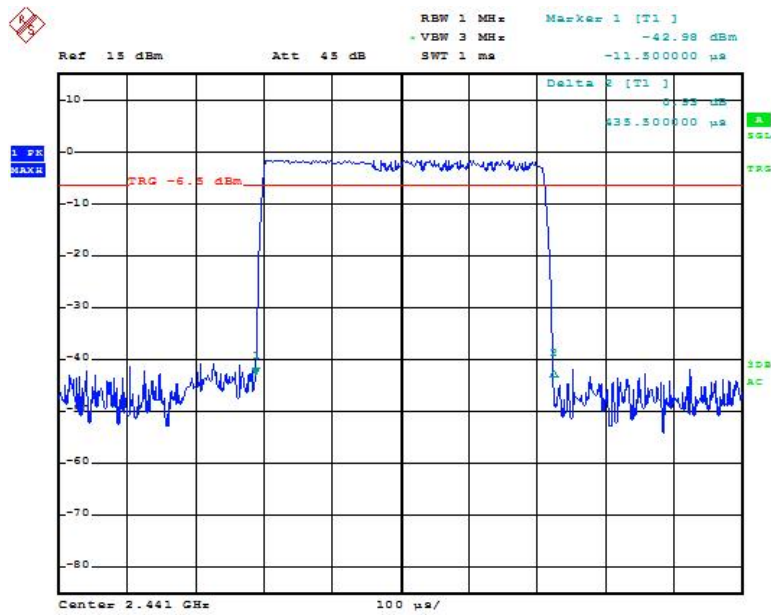
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH 1	Low	0.436	0.140	0.4	Pass
	Middle	0.436	0.140	0.4	Pass
	High	0.436	0.140	0.4	Pass
	Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6s				
DH 3	Low	1.70	0.272	0.4	Pass
	Middle	1.70	0.272	0.4	Pass
	High	1.70	0.272	0.4	Pass
	Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6s				
DH 5	Low	2.96	0.316	0.4	Pass
	Middle	2.96	0.316	0.4	Pass
	High	2.96	0.316	0.4	Pass
	Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6s				

Please refer to the following plots.

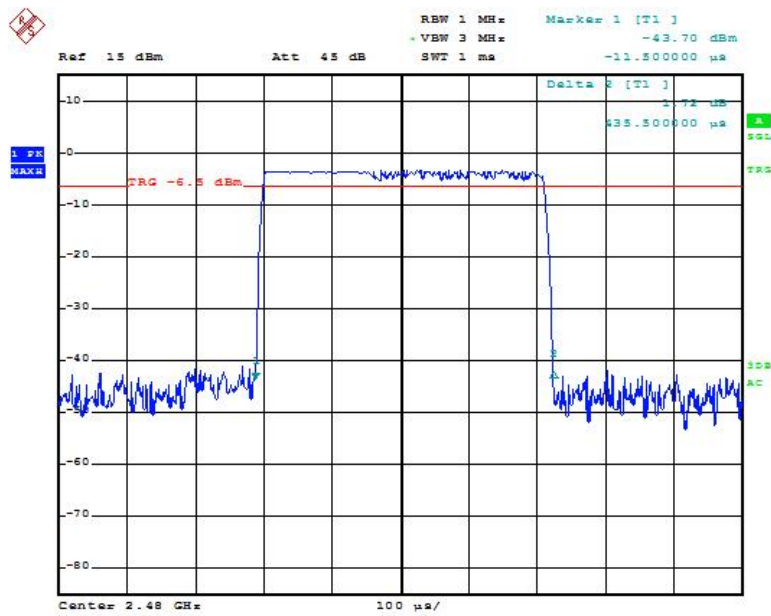
Low Channel for DH1



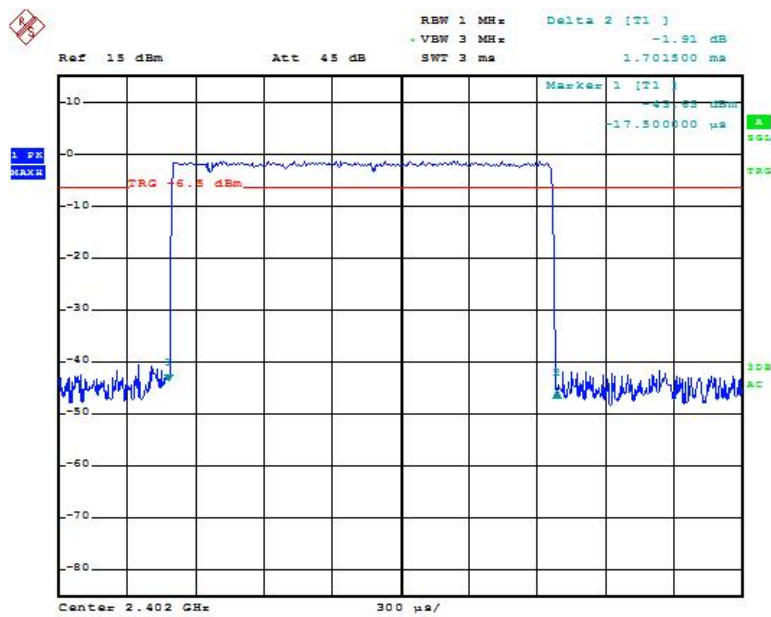
Middle Channel for DH1



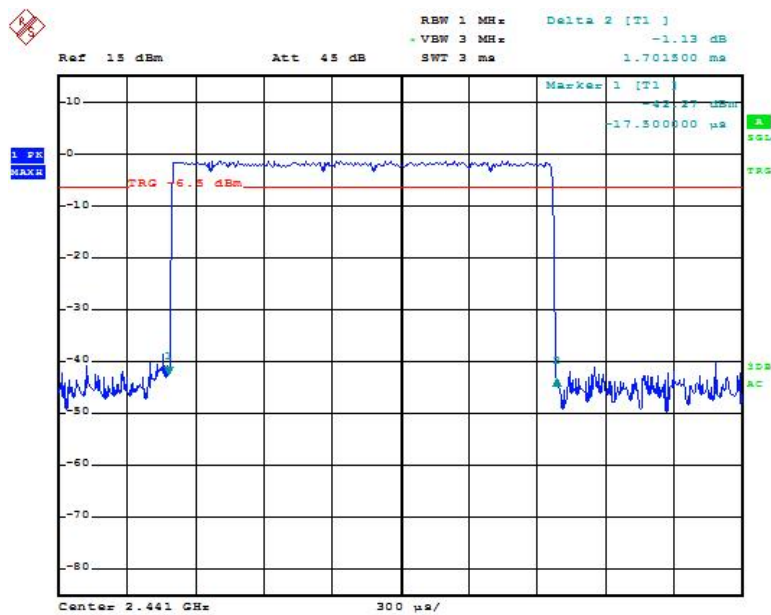
High Channel for DH1



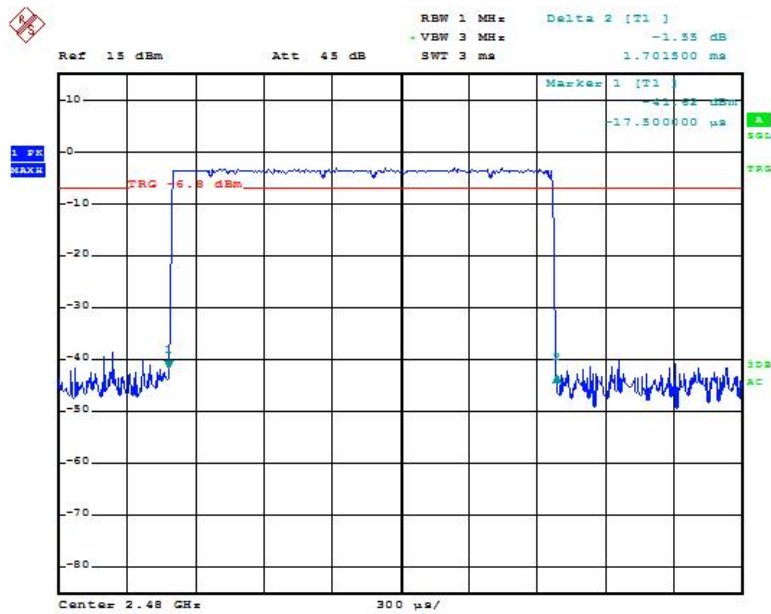
Low Channel for DH3



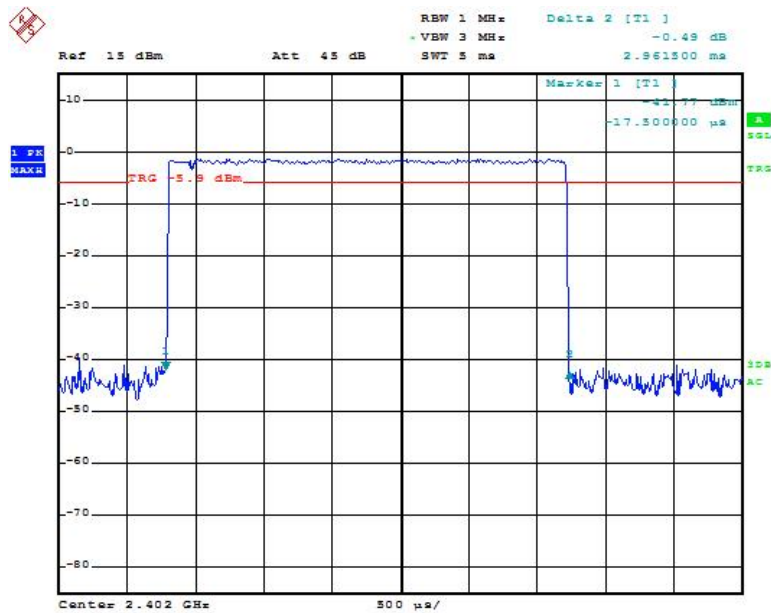
Middle Channel for DH3



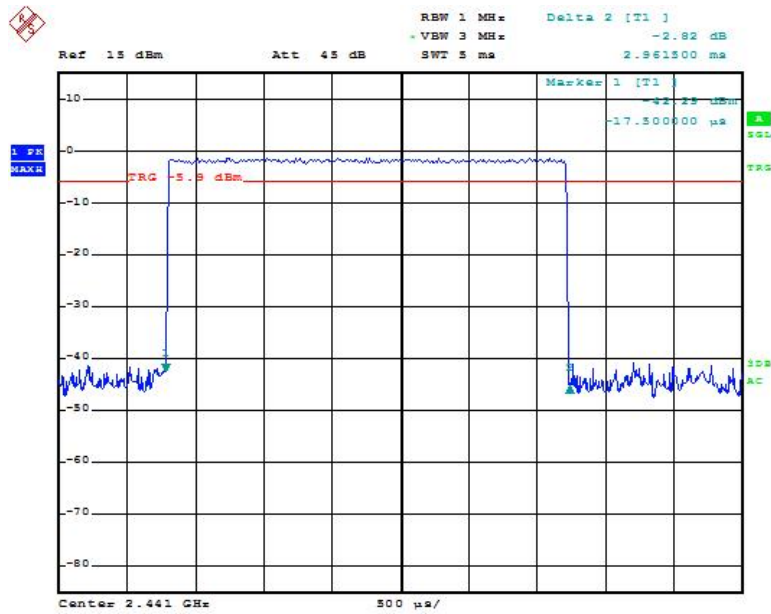
High Channel for DH3



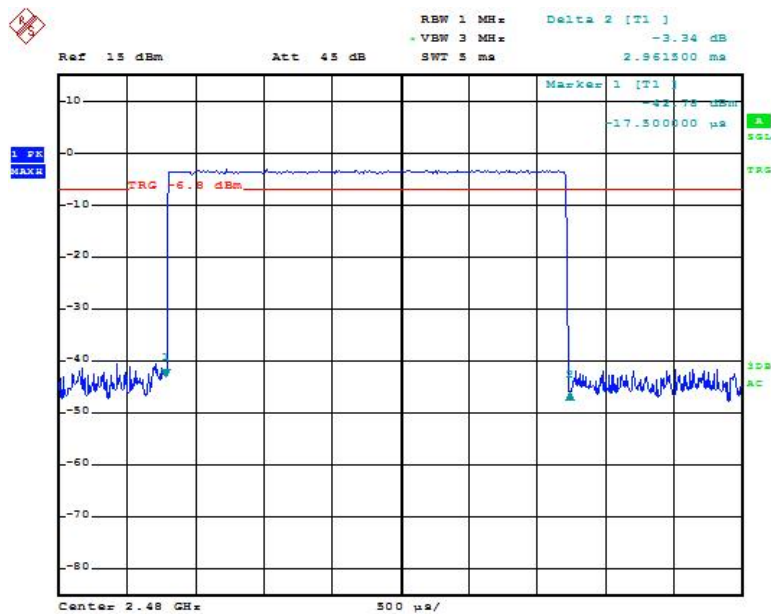
Low Channel for DH5



Middle Channel for DH5



High Channel for DH5



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.

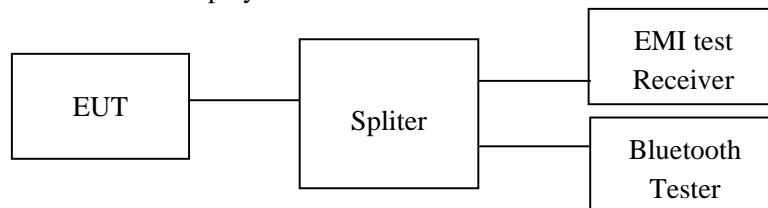
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 an EMI test receiver.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.0kPa

* The testing was performed by Ivan Cao from 2011-12-31 to 2012-01-15.

Test Result: Compliance.

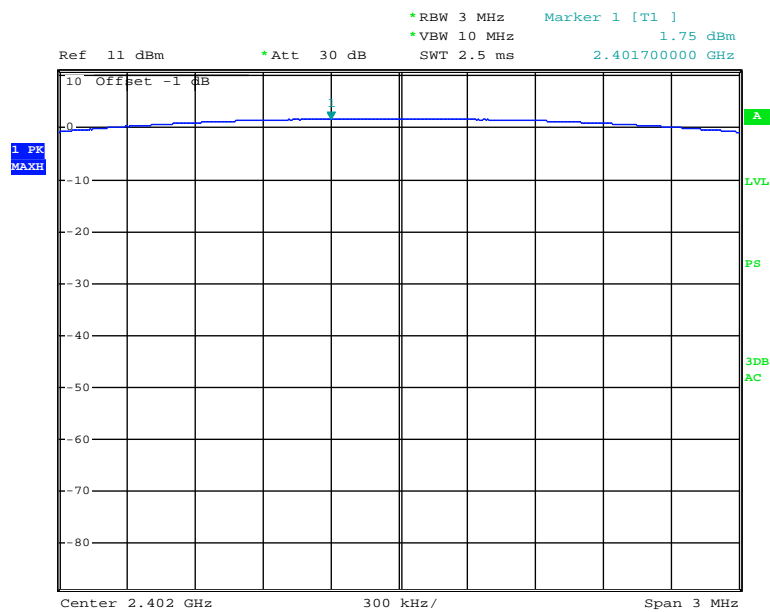
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)
BDR	Low channel	2402	1.75	30
	Middle channel	2441	1.45	30
	High channel	2480	1.11	30
EDR Mode ($\pi/4$ -DQPSK)	Low channel	2402	1.14	30
	Middle channel	2441	1.04	30
	High channel	2480	-0.21	30
EDR Mode (8DPSK)	Low channel	2402	1.21	30
	Middle channel	2441	1.23	30
	High channel	2480	-0.20	30

Please refer to the following plots

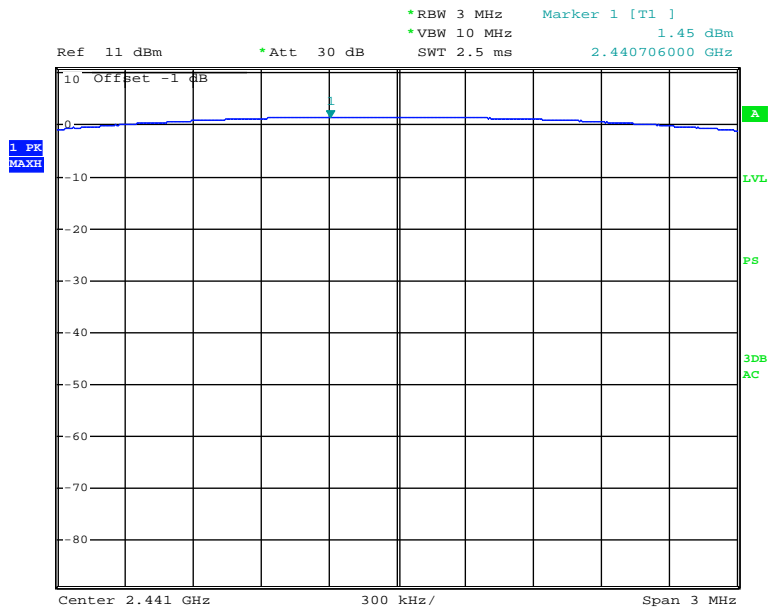
BDR:

Low Channel



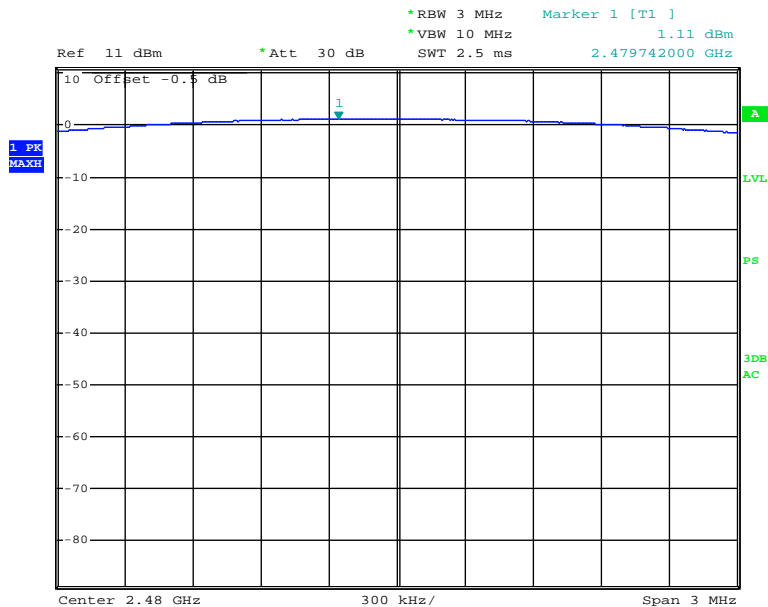
Date: 15.JAN.2012 18:42:50

Middle Channel



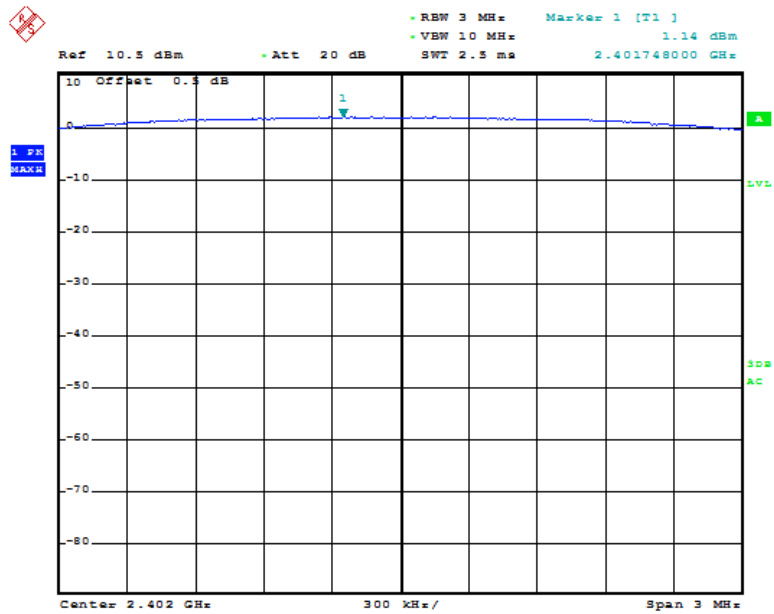
Date: 15.JAN.2012 18:42:10

High Channel

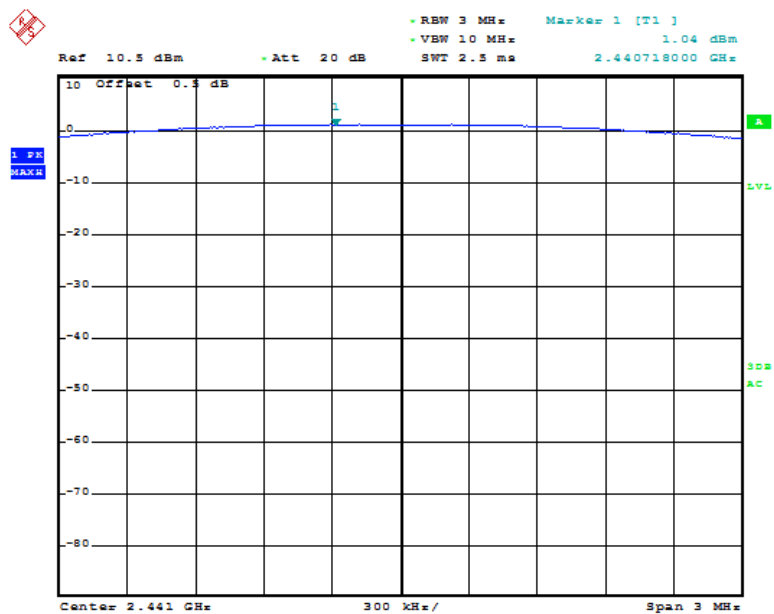


Date: 15.JAN.2012 18:40:30

Low Channel



Middle Channel



The screenshot shows a spectrum analyzer interface with the following settings and data:

- Ref**: 10.5 dBm
- Att**: 20 dB
- RBW**: 3 MHz
- VBW**: 10 MHz
- SWT**: 2.5 ms
- Marker 1 [T1]**: -0.21 dBm
- Center**: 2.48 GHz
- Span**: 3 MHz
- Offset**: 0.5 dB
- Scale**: 1 PR
- Axis**: HANNA
- Grid**: LVL, SDR, AC

The plot displays a flat blue line representing the signal level across the frequency range, indicating a constant power spectral density.

Ref 16 dBm Att 43 dB RBW 3 MHz VBW 10 MHz Span 10 MHz

Offset 1 dB

Center 2.402 GHz 1 MHz/

Span 10 MHz

0.22 dBm

2.401960000 GHz

1 PR MAX

1

0

-10

-20

-30

-40

-50

-60

-70

-80

10

0

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

377

378

379

380

381

382

383

384

385

386

387

388

389

390

391

392

393

394

395

396

397

398

399

400

401

402

403

404

405

406

407

408

409

410

411

412

413

414

415

416

417

418

419

420

421

422

423

424

425

426

427

428

429

430

431

432

433

434

435

436

Ref 16 dBm Att 45 dB

RBW 3 MHz VBW 10 MHz SWT 2.5 ms

Marker 1 [T1] 0.19 dBm 2.440760000 GHz

Offset 1 dB

1 PR
MAX

1
0.19 dBm

Center 2.441 GHz 1 MHz / Span 10 MHz

The screenshot shows a Spectrum Analyzer interface with the following details:

- Top Bar:**
 - Left: A red square icon with a white 'X' and the number '3'.
 - Center: "Ref 16 dBm", "Att 45 dB", and "SWT 2.5 ms".
 - Right: "RBW 3 MHz", "VBW 10 MHz", "Marker 1 [T1]", "-1.46 dBm", and "2.479700000 GHz".
- Plot Area:**
 - Top Left: "Offset 1 dB".
 - Y-axis: Labeled from -80 to 10 in increments of 10.
 - X-axis: Labeled "Center 2.48 GHz" and "Span 10 MHz".
 - Grid: A 10x10 grid with major lines every 10 dB and minor lines every 2 dB.
 - Trace: A blue curve peaking at 0 dB. A green arrow labeled "1" points to the peak.
 - Right Margin: Labels "1.9K", "MAXH", "5VZ", "30B", and "AC" are visible.

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10
SUNOL SCIENCES	Horn antenna	DRH-118	A052604	2011-05-05	2012-05-05

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz.
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 Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	100.0 kPa

**The testing was performed by Ivan Cao from 2011-12-31 to 2012-01-15.*

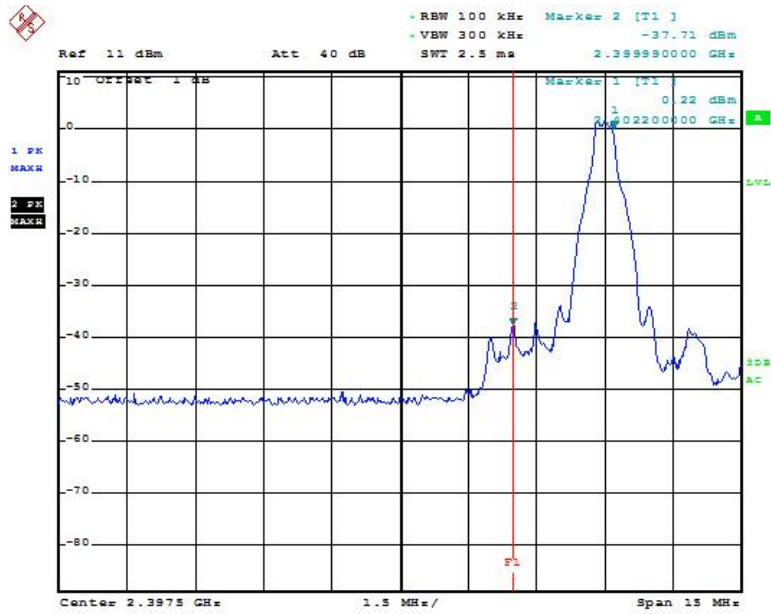
Test Result: Compliant, please refer to the following table and plots.

Test Mode: Transmitting

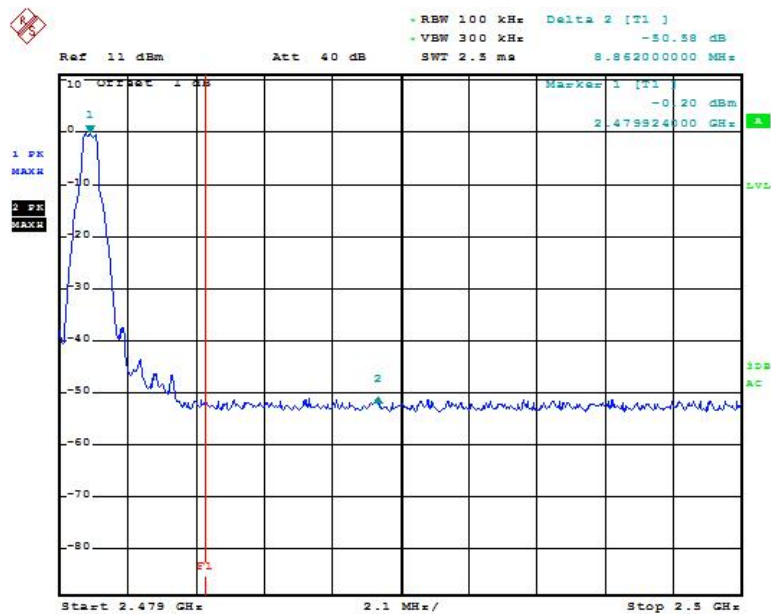
	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)
BDR	2399.99	37.93	20
	2488.786	50.58	20
EDR Mode ($\pi/4$ -DQPSK)	2399.99	47.50	20
	2488.156	53.09	20
EDR Mode (8DPSK)	2399.99	37.93	20
	2488.786	50.58	20

BDR:

Band Edge: Left Side

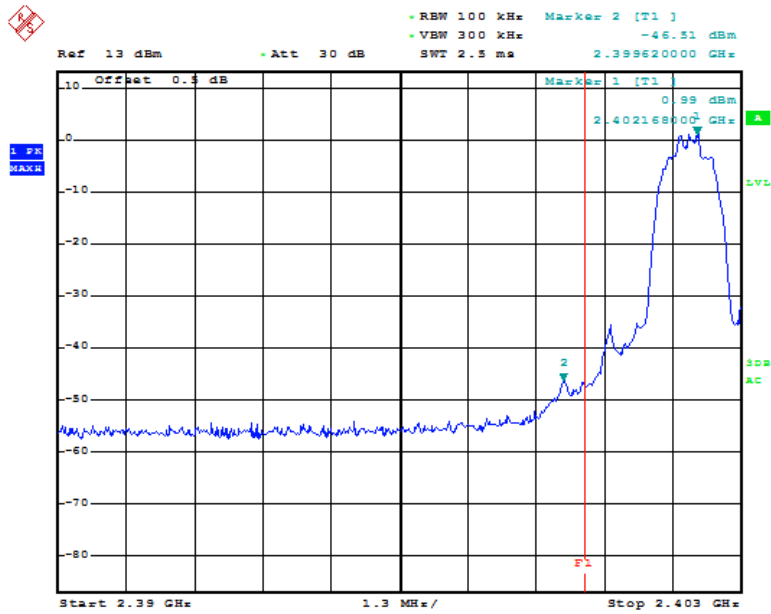


Band Edge: Right Side

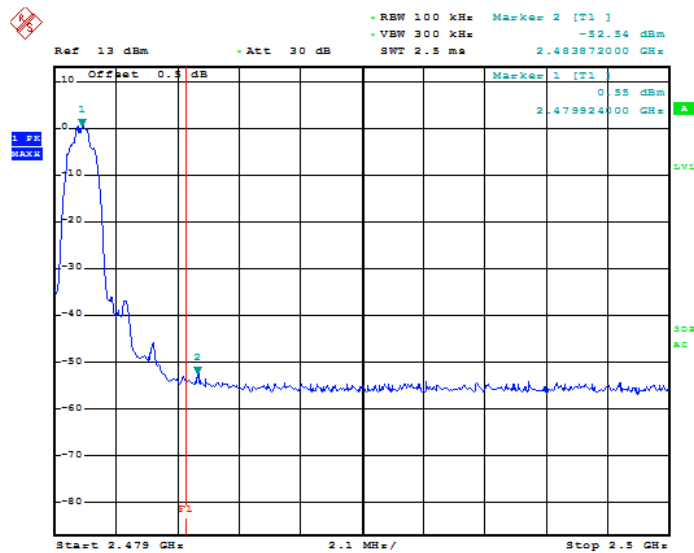


EDR Mode ($\pi/4$ -DQPSK)

Band Edge: Left Side

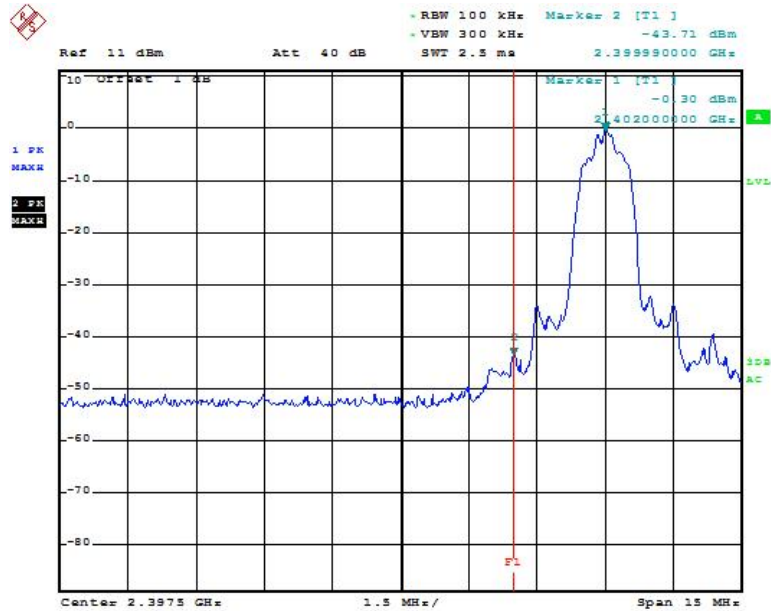


Band Edge: Right Side

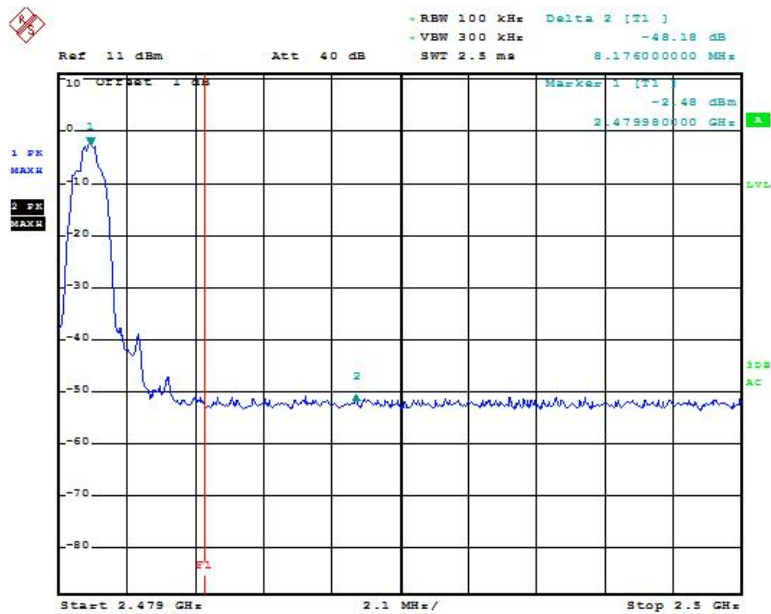


EDR Mode (8DPSK)

Band Edge: Left Side



Band Edge: Right Side



END OF REPORT *****