

FCC PART 15.247

MEASUREMENT AND TEST REPORT

For

Cubic Transportation Systems, Inc.

5650 Kearny Mesa Road,
San Diego, CA 92111, USA

FCC ID: LVC310

Report Type: Original Report	Product Type: Mobile Validator (MV)
Test Engineer: Wayne Cheng	<i>Wayne Cheng</i>
Report Number: RSZ11040103-15.247BT	
Report Date: 2011-06-20	
Merry Zhao	<i>Merry Zhao</i>
Reviewed By: EMC Engineer	
Prepared By:	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

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. 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
LOCAL 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) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	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 EQUIPMENT LIST AND DETAILS.....	12
TEST PROCEDURE	12
TEST RESULTS SUMMARY	12
TEST DATA	12
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS.....	17
APPLICABLE STANDARD	17
MEASUREMENT UNCERTAINTY	17
EUT SETUP.....	17
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	18
TEST PROCEDURE	18
CORRECTED AMPLITUDE & MARGIN CALCULATION	18
TEST EQUIPMENT LIST AND DETAILS.....	19
TEST RESULTS SUMMARY	19
TEST DATA	19
FCC §15.247(a) (1) - CHANNEL SEPARATION TEST	23
APPLICABLE STANDARD	23
TEST EQUIPMENT LIST AND DETAILS.....	23
TEST PROCEDURE	23
TEST DATA	23

FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING.....	30
APPLICABLE STANDARD	30
TEST EQUIPMENT LIST AND DETAILS.....	30
TEST PROCEDURE	30
TEST DATA	30
FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST	36
APPLICABLE STANDARD	36
TEST EQUIPMENT LIST AND DETAILS.....	36
TEST PROCEDURE	36
TEST DATA	36
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....	38
APPLICABLE STANDARD	38
TEST EQUIPMENT LIST AND DETAILS.....	38
TEST PROCEDURE	38
TEST DATA	38
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT.....	45
APPLICABLE STANDARD	45
TEST EQUIPMENT LIST AND DETAILS.....	45
TEST PROCEDURE	45
TEST DATA	45
FCC §15.247(d) - BAND EDGES TESTING	52
APPLICABLE STANDARD	52
TEST EQUIPMENT LIST AND DETAILS.....	52
TEST PROCEDURE	52
TEST DATA	53

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Cubic Transportation Systems, Inc.*'s product, model number: 5300-10009-4 (FCC ID: LVC310) or the "EUT" as referred to in this report is a *Mobile Validator (MV)*, which measures approximately: 20.0 cm (L) x 12.2 cm (W) x 3.5 cm (H). Rated input voltage: DC 12V or DC 24V.

** All measurement and test data in this report was gathered from production sample serial number: 000000000000001 (Assigned by applicant). The EUT was received on 2011-03-02.*

Objective

This Type approval report is prepared on behalf of *Cubic Transportation Systems, Inc.* 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 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)

FCC Part 15.225 DXX, FCC Part 15.247-Wi-Fi DTS and FCC Part 15B JBP, submission with FCC ID: LVC310.

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 in 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 is provided by manufacture.

Test mode 1: Bluetooth transmitting

Test mode 2: Bluetooth radio transmits simultaneously with 13.56 MHz radio.

EUT Exercise Software

N/A

Equipment Modifications

No modification was made to the unit tested.

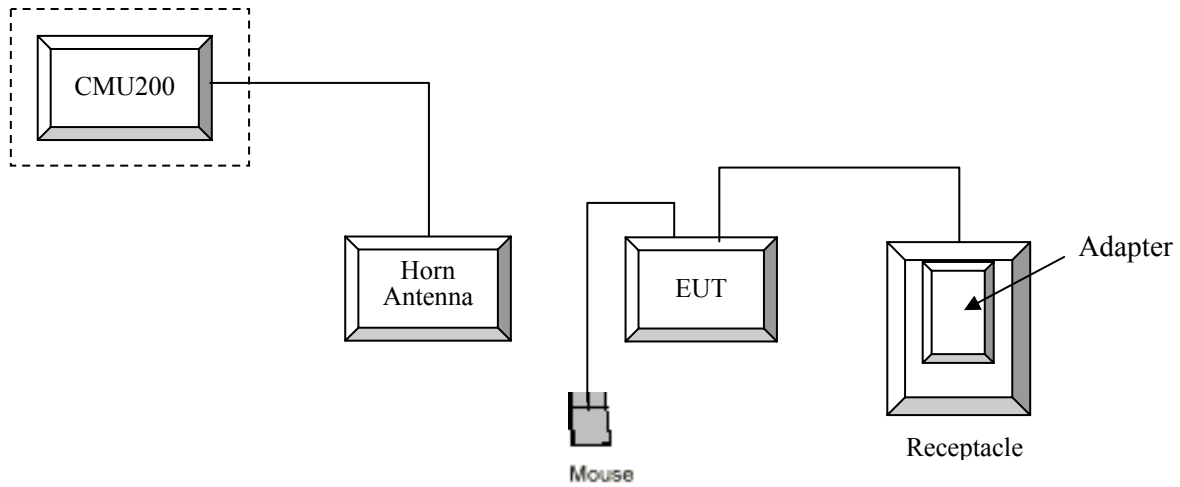
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R & S	Universal Radio Commutation Tester	CMU200	1100 0008.02
I.T.E	Power supply	SAW18-12.0-1500US	N/A
I.T.E	Power supply	SAW18-24.0-1500US	N/A

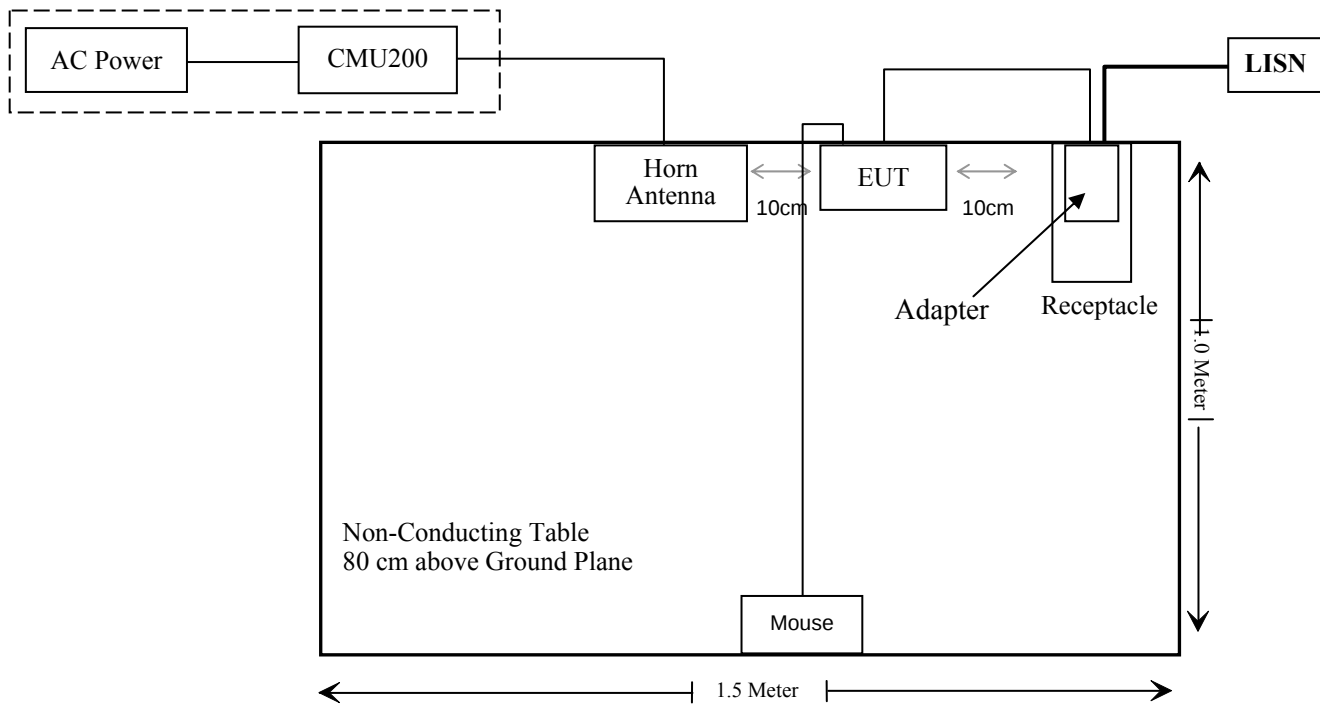
External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Undetachable Power Cable	1.8	Adapter	LISN
Unshielded Undetachable Cable	2.0	EUT	Adapter

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible exposure (MPE)	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) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to FCC 15.247(i) and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz;

* = Plane-wave equivalent power density;

MPE Calculation

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

S = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Radio	Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
		(dBi)	(numeric)	(dBm)	(mW)			
Bluetooth	2402	2.6	1.8	0.58	1.14	20	0.0004	1.0

The MPE calculations in the spreadsheet above demonstrates that the device meets the MPE requirement stated in FCC Part 1.1310 at the 20 cm distance required for mobile exposure conditions.

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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
 - b. Antenna must use a unique type of connector to attach to the EUT.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT used one Bluetooth antenna, Chip antenna, which in accordance to section 15.203, the antenna's maximum gain is 2.6 dBi, please refer to the internal photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

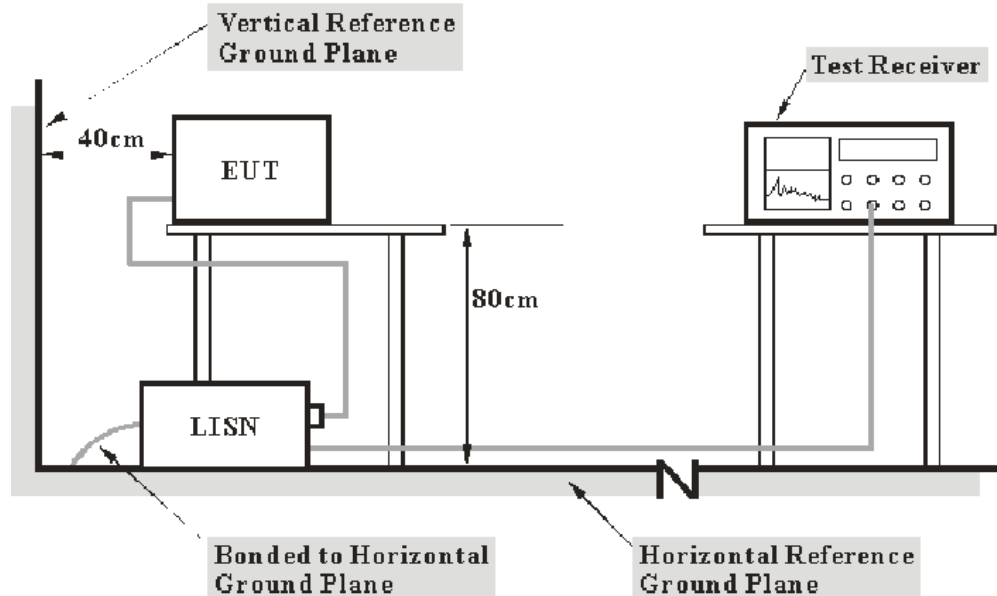
FCC§15.207

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 NIS 81, 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 C63.4-2003 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 12V/24V adapters were 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:

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

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 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 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:

14.51dB at 1.325 MHz in the **Neutral** conducted mode

Test Data

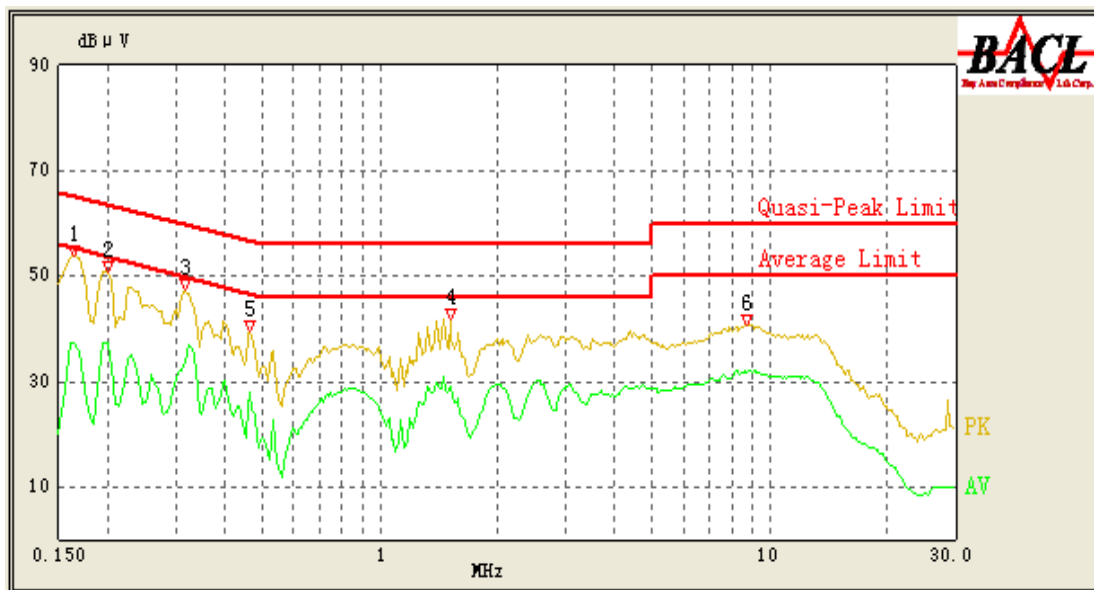
Environmental Conditions

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

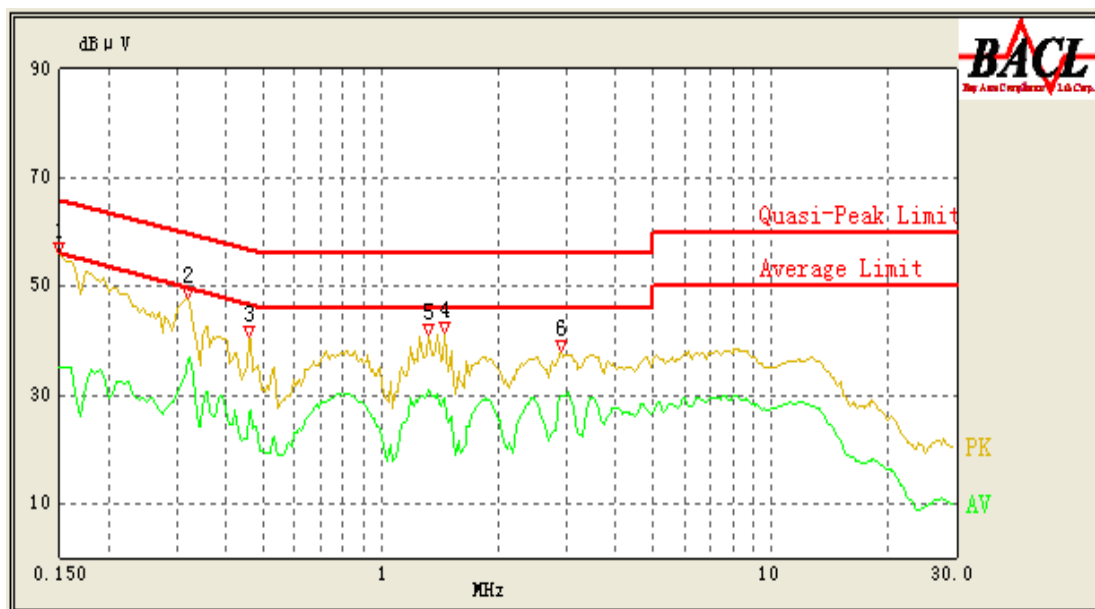
* The testing was performed by Wayne Cheng on 2011-03-24 to 2011-04.24.

Test Mode: Transmitting

120 V, 60 Hz, Line (DC 12V adapter):

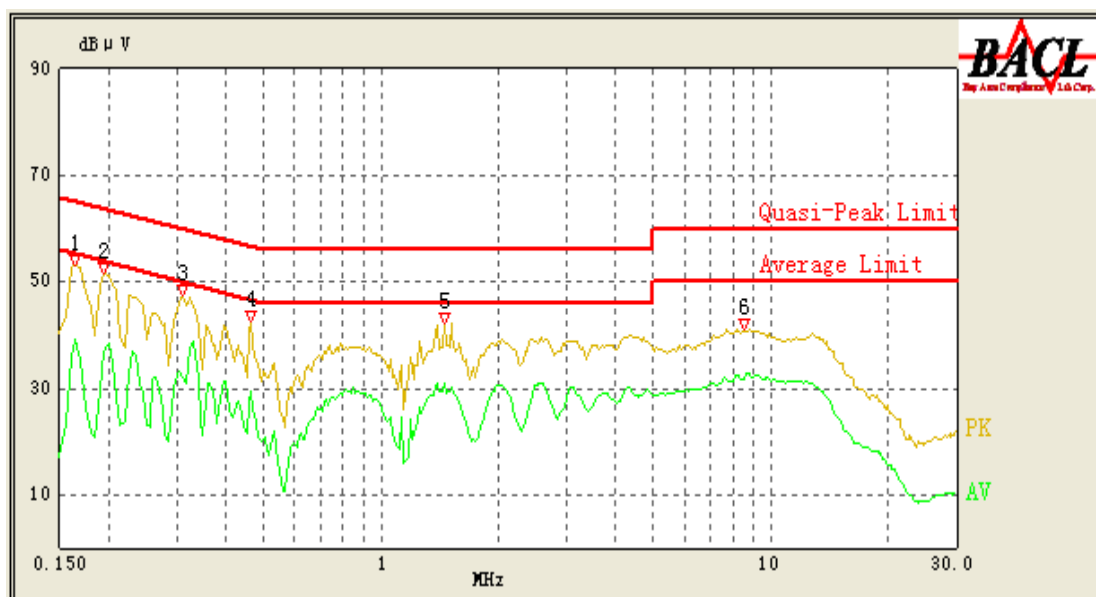


Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.165	50.36	10.09	65.57	15.21	QP
0.200	47.58	10.07	64.57	16.99	QP
1.520	28.95	10.15	46.00	17.05	Ave.
0.200	37.32	10.07	54.57	17.25	Ave.
0.315	33.68	10.02	51.29	17.61	Ave.
8.755	31.86	10.10	50.00	18.14	Ave.
0.165	37.24	10.09	55.57	18.33	Ave.
0.465	28.03	10.16	47.00	18.97	Ave.
1.520	36.53	10.15	56.00	19.47	QP
0.465	36.88	10.16	57.00	20.12	QP
0.315	41.01	10.02	61.29	20.28	QP
8.770	36.51	10.10	60.00	23.49	QP

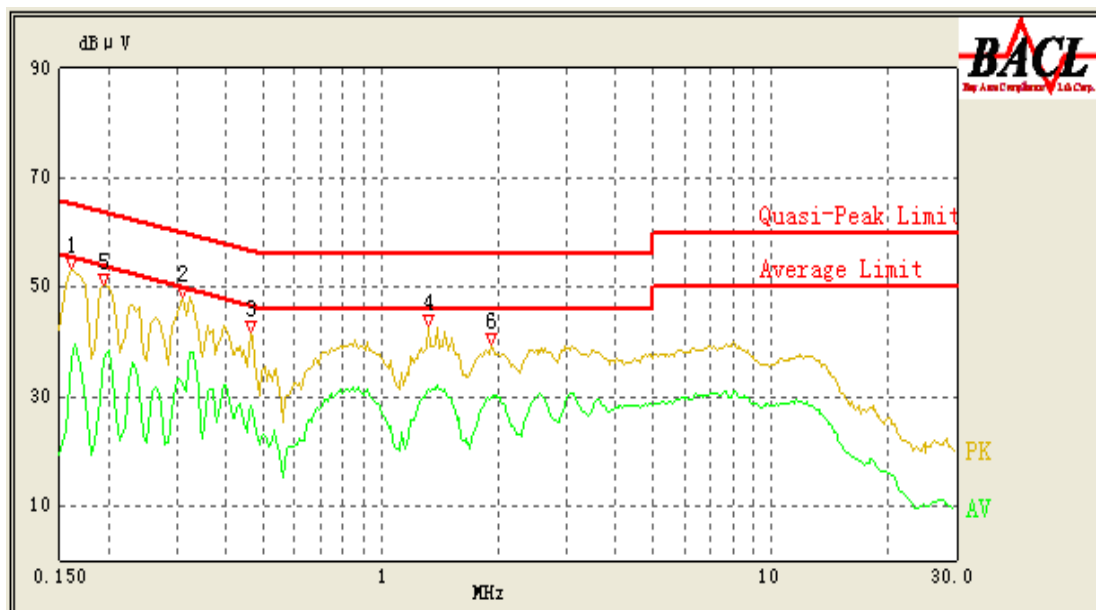
120V, 60 Hz, Neutral (DC 12V adapter):

Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
0.320	36.52	10.02	51.14	14.62	Ave.
1.325	30.99	10.13	46.00	15.01	Ave.
2.905	29.63	10.15	46.00	16.37	Ave.
1.455	29.43	10.15	46.00	16.57	Ave.
0.320	43.94	10.02	61.14	17.20	QP
1.455	37.82	10.15	56.00	18.18	QP
1.325	36.98	10.13	56.00	19.02	QP
0.460	26.38	10.16	47.14	20.76	Ave.
0.150	35.13	10.10	56.00	20.87	Ave.
0.150	44.14	10.10	66.00	21.86	QP
0.460	35.06	10.16	57.14	22.08	QP
2.885	33.39	10.16	56.00	22.61	QP

120 V, 60 Hz, Line (DC 24V adapter):



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
1.455	31.09	10.15	46.00	14.91	Ave.
0.165	49.93	10.09	65.57	15.64	QP
0.165	39.25	10.09	55.57	16.32	Ave.
0.465	29.55	10.16	47.00	17.45	Ave.
0.195	46.91	10.07	64.71	17.80	QP
1.460	38.17	10.15	56.00	17.83	QP
0.195	36.76	10.07	54.71	17.95	Ave.
8.520	31.85	10.10	50.00	18.15	Ave.
0.310	42.96	10.01	61.43	18.47	QP
0.465	38.05	10.16	57.00	18.95	QP
0.310	32.09	10.01	51.43	19.34	Ave.
8.515	36.24	10.10	60.00	23.76	QP

120V, 60 Hz, Neutral (DC 24V adapter):

Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/QP/Ave.)
1.325	31.49	10.13	46.00	14.51	Ave.
1.930	29.83	10.19	46.00	16.17	Ave.
0.160	49.09	10.09	65.71	16.62	QP
0.195	47.10	10.07	64.71	17.61	QP
0.195	36.82	10.07	54.71	17.89	Ave.
1.325	37.95	10.13	56.00	18.05	QP
0.465	28.46	10.16	47.00	18.54	Ave.
0.465	38.26	10.16	57.00	18.74	QP
0.160	36.69	10.09	55.71	19.02	Ave.
0.310	32.26	10.01	51.43	19.17	Ave.
0.310	42.19	10.01	61.43	19.24	QP
1.925	35.03	10.19	56.00	20.97	QP

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

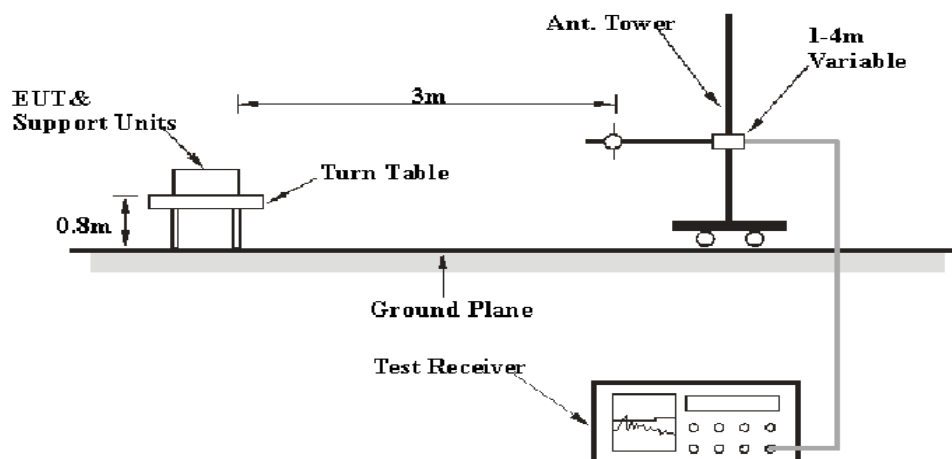
Measurement Uncertainty

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.

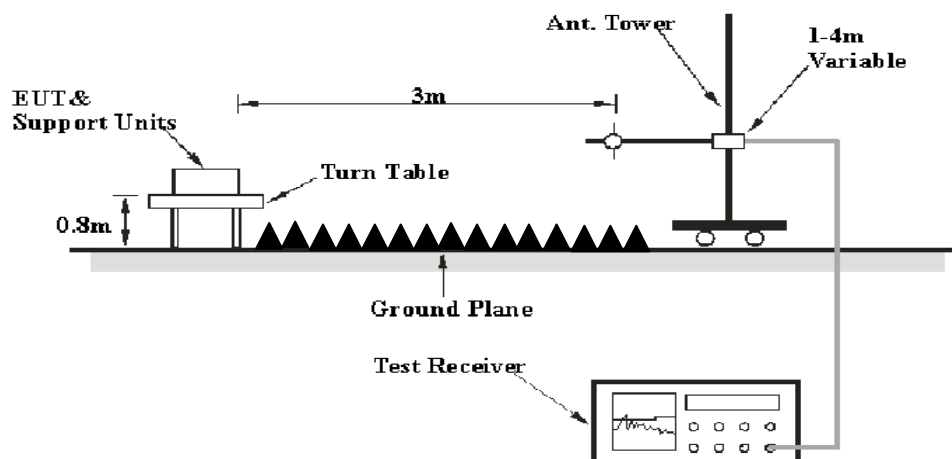
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is ± 4.0 dB ($k=2$, 95% level of confidence).

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber 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.

The adapter was connected to a 120 VAC/60 Hz power source.

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:

<u>Frequency Range</u>	<u>RBW</u>	<u>Video B/W</u>	<u>Detector</u>
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

During the conducted emission test, the adapter 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 1GHz.

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	2010-08-02	2011-08-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-11	2011-11-10
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-03-11	2012-03-10
HP	Amplifier	2VA-213+	T-E27H	2011-03-08	2012-03-07
Sunol Sciences	Horn Antenna	DRH-118	A052604	2011-05-05	2012-05-04
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2010-07-08	2011-07-07

* **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:

Below 1 GHz:

4.1 dB at 352.564000 MHz in the Horizontal polarization

Above 1 GHz:

10.77 dB at 7323 MHz in the Horizontal polarization (Middle Channel)

Test Data

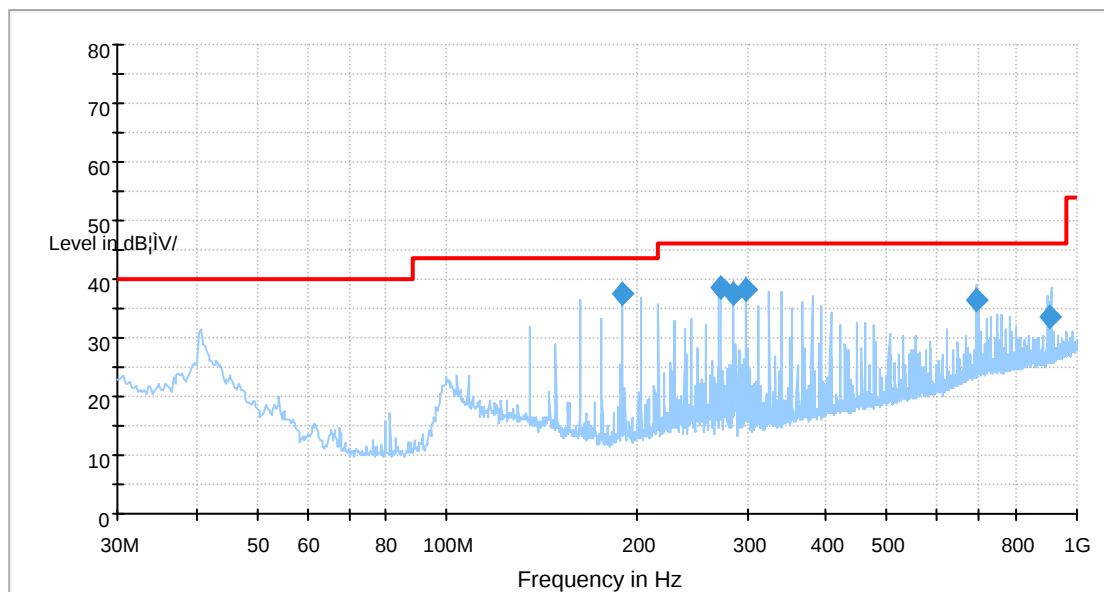
Environmental Conditions

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

The testing was performed by Wayne Cheng on 2011-03-24 to 2011.06.02.

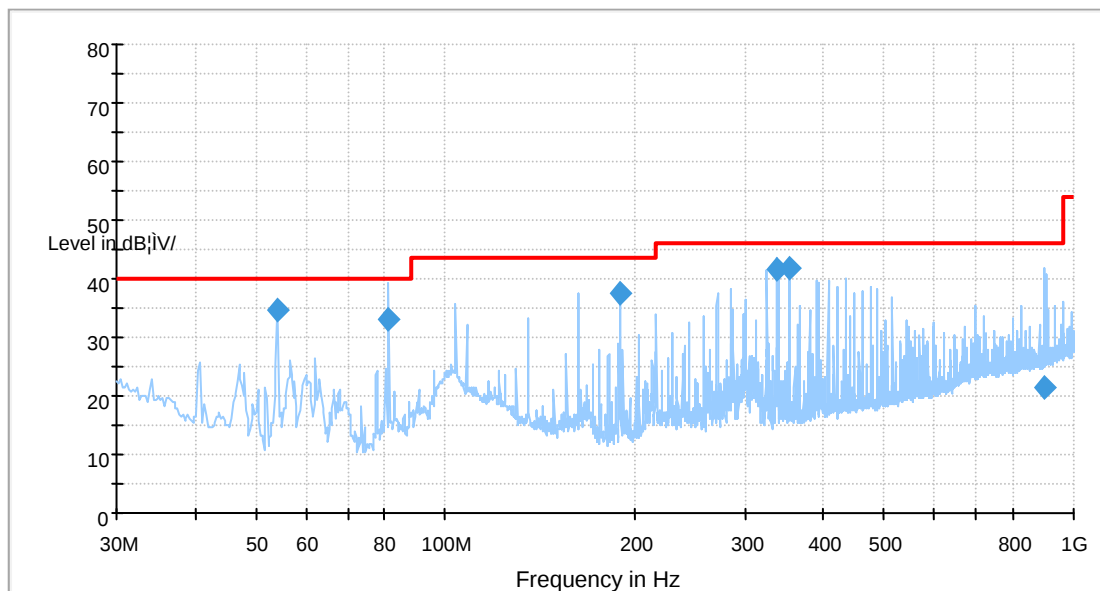
1) Below 1 GHz:

Mode 1: Bluetooth transmitting



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Test Antenna		Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
		Height (cm)	Polarity (H/V)				
189.859250	37.4	176	H	96	-14.8	43.5	6.1
271.197250	38.6	102	H	288	-13.0	46	7.4
298.315000	38.3	109	H	274	-12.4	46	7.7
284.759000	37.5	102	H	286	-12.7	46	8.5
691.540536	36.5	109	V	12	-0.6	46	9.5
908.515250	33.6	109	V	18	-0.5	46	12.4

Mode 2: Bluetooth transmits simultaneously with 13.56 MHz radio (worse case)



Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Test Antenna		Turntable Position (degree)	Correction Factor (dB)	Limit (dB μ V/m)	Margin (dB)
		Height (cm)	Polarity (H/V)				
352.564000	41.9	102.0	H	79.0	-11.0	46.0	4.1
337.994500	41.8	104.0	H	76.0	-11.4	46.0	4.2
54.233250	34.7	104.0	V	0.0	-17.9	40.0	5.3
189.831000	37.5	102.0	V	59.0	-14.8	43.5	6.0
81.369250	33.5	103.0	V	142.0	-18.0	40.0	6.5
898.024500	21.3	373.0	H	149.0	-0.9	46.0	24.7

2) Above 1 GHz:

Indicated		Detector (PK/Ave.)	Table Angle Degree	Test Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre- Amp. (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2402 MHz)												
4804	32.15	Ave.	160	1.5	H	32.3	4.3	26.8	41.95	54	12.05	harmonic
7206	26.17	Ave.	160	1.4	V	37	5.2	26.6	41.77	54	12.23	harmonic
7206	25.46	Ave.	170	1.0	H	36.5	5.2	26.6	40.56	54	13.44	harmonic
4804	30.42	Ave.	180	1.2	V	32.5	4.3	26.8	40.42	54	13.58	harmonic
4804	41.45	PK	160	1.5	H	32.3	4.3	26.8	51.25	74	22.75	harmonic
7206	35.61	PK	170	1.0	H	36.5	5.2	26.6	50.71	74	23.29	harmonic
7206	34.17	PK	160	1.4	V	37	5.2	26.6	49.77	74	24.23	harmonic
4804	38.23	PK	180	1.2	V	32.5	4.3	26.8	48.23	74	25.77	harmonic
Middle Channel (2441 MHz)												
7323	28.13	Ave.	0	1.1	H	36.5	5.2	26.6	43.23	54	10.77	harmonic
7323	27.56	Ave.	165	1.2	V	37	5.2	26.6	43.16	54	10.84	harmonic
4882	30.25	Ave.	180	1	H	32.3	4.3	26.8	40.05	54	13.95	harmonic
4882	28.76	Ave.	185	1.2	V	32.5	4.3	26.8	38.76	54	15.24	harmonic
7323	37.89	PK	0	1.1	H	36.5	5.2	26.6	52.99	74	21.01	harmonic
7323	36.44	PK	165	1.2	V	37	5.2	26.6	52.04	74	21.96	harmonic
4882	38.41	PK	180	1	H	32.3	4.3	26.8	48.21	74	25.79	harmonic
4882	36.75	PK	185	1.2	V	32.5	4.3	26.8	46.75	74	27.25	harmonic
High Channel (2480 MHz)												
7440	26.74	Ave.	100	1.1	H	36.5	5.2	26.6	41.84	54	12.16	harmonic
4960	31.61	Ave.	20	1.2	H	32.3	4.3	26.8	41.41	54	12.59	harmonic
7440	25.8	Ave.	120	1.6	V	37	5.2	26.6	41.4	54	12.60	harmonic
4960	30.29	Ave.	20	1.2	V	32.5	4.3	26.8	40.29	54	13.71	harmonic
7440	38.01	PK	120	1.6	V	37	5.2	26.6	53.61	74	20.39	harmonic
7440	37.19	PK	100	1.1	H	36.5	5.2	26.6	52.29	74	21.71	harmonic
4960	39.17	PK	20	1.2	H	32.3	4.3	26.8	48.97	74	25.03	harmonic
4960	37.83	PK	20	1.2	V	32.5	4.3	26.8	47.83	74	26.17	harmonic

3) Restrict band spurious emission

Indicated		Detector (PK/Ave.)	Table Angle Degree	Test Antenna		Correction Factor			FCC Part 15.247/15.209/15.205			
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre- Amp. (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
2483.53	28.93	Ave.	0	1.2	V	29.0	3.0	26.8	34.13	54	19.87	spurious
2390	27.54	Ave.	360	1.5	V	29.0	3.0	26.8	32.74	54	21.26	spurious
2483.65	26.78	Ave.	46	1.5	H	28.5	3.0	26.8	31.48	54	22.52	spurious
2389.8	25.11	Ave.	120	1.2	H	28.5	3.0	26.8	29.81	54	24.19	spurious
2483.65	38.46	PK	46	1.5	H	28.5	3.0	26.8	43.16	74	30.84	spurious
2390	37.85	PK	360	1.5	V	29.0	3.0	26.8	43.05	74	30.95	spurious
2483.53	36.96	PK	0	1.2	V	29.0	3.0	26.8	42.16	74	31.84	spurious
2389.8	36.42	PK	120	1.2	H	28.5	3.0	26.8	41.12	74	32.88	spurious

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	2010-11-11	2011-11-10

* **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 truce
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9kPa

* The testing was performed by Wayne Cheng on 2011-03-23 and 2011-04-28.

Test Result: Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

GFSK:

Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low	2402	1.000	1.000	Pass
Adjacent	2403			
Middle	2441	1.000	1.000	Pass
Adjacent	2442			
High	2480	1.000	1.000	Pass
Adjacent	2479			

 $\pi/4$ DQPSK:

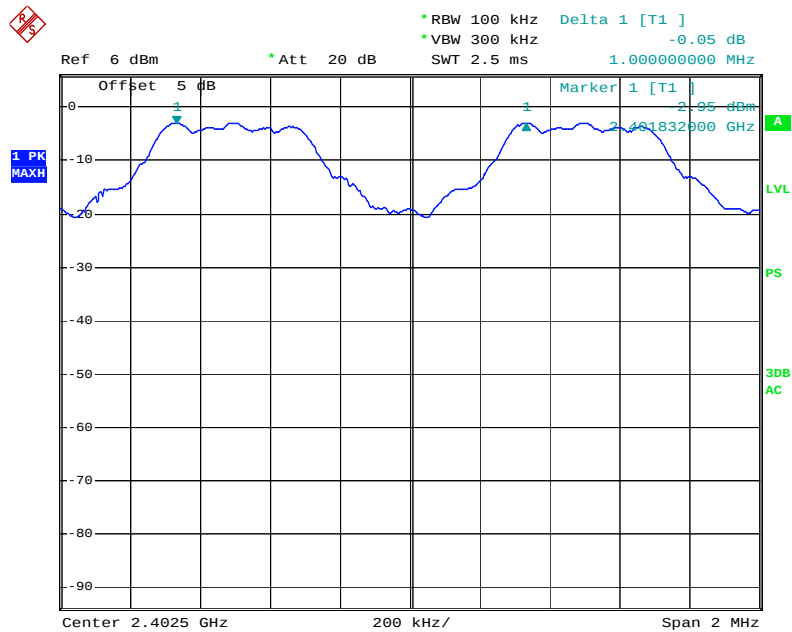
Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low	2402	1.020	1.000	Pass
Adjacent	2403			
Middle	2441	1.008	1.000	Pass
Adjacent	2442			
High	2480	1.014	1.000	Pass
Adjacent	2479			

8-DQPSK:

Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low	2402	1.002	1.000	Pass
Adjacent	2403			
Middle	2441	1.002	1.000	Pass
Adjacent	2442			
High	2480	1.002	1.000	Pass
Adjacent	2479			

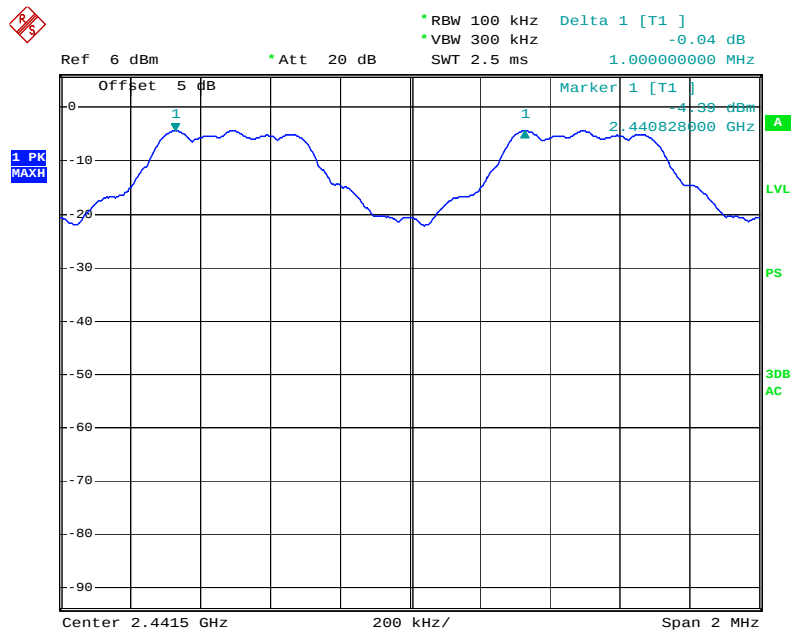
Please refer to the following plots.

GFSK: Low Channel

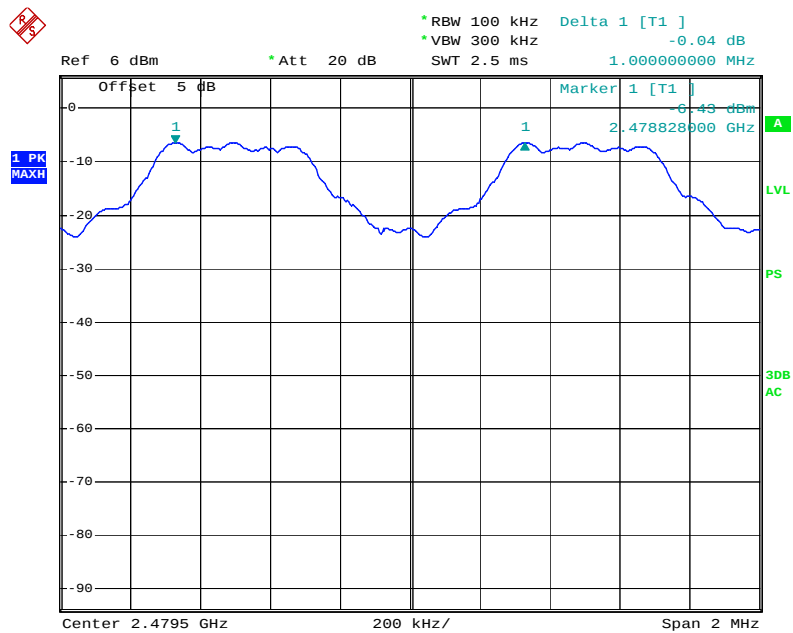


Date: 23.MAR.2011 21:02:25

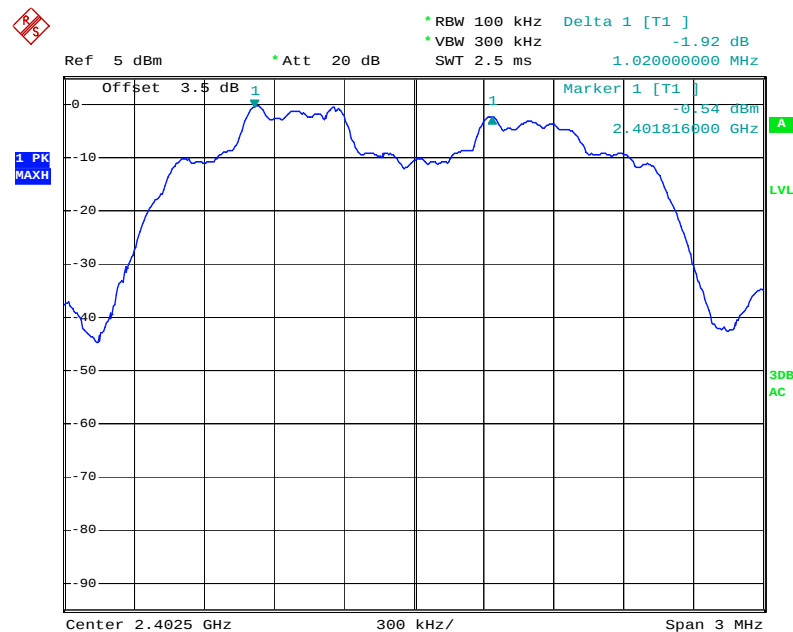
GFSK: Middle Channel



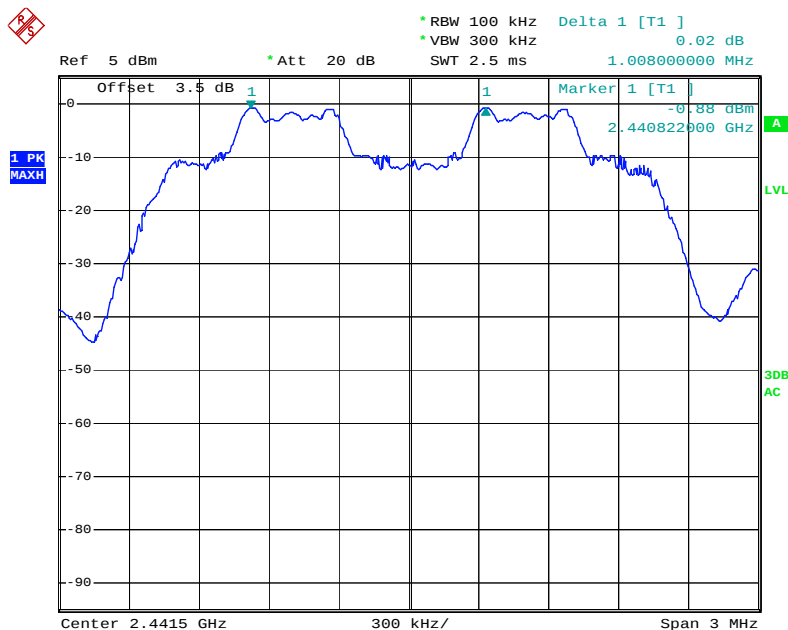
Date: 23.MAR.2011 21:01:35

GFSK: High Channel

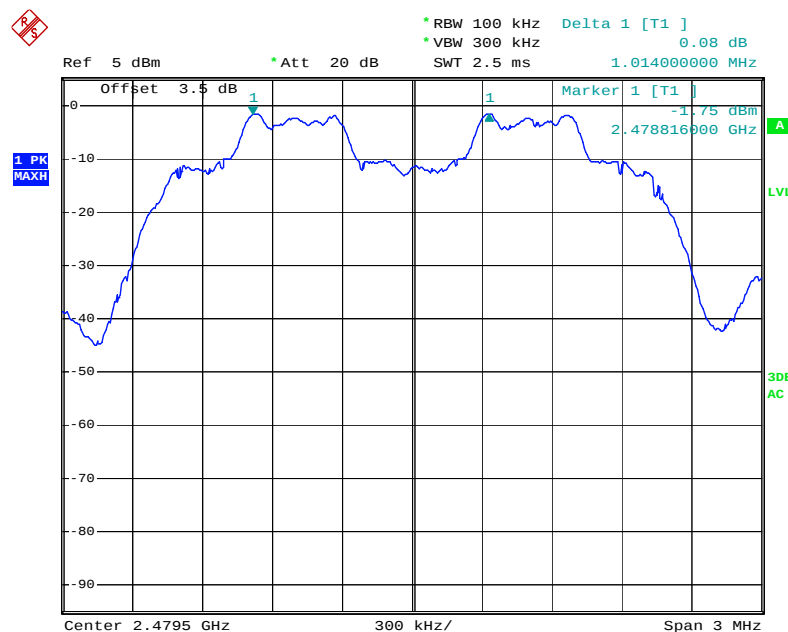
Date: 23.MAR.2011 21:03:16

 $\pi/4$ DQPSK: Low Channel

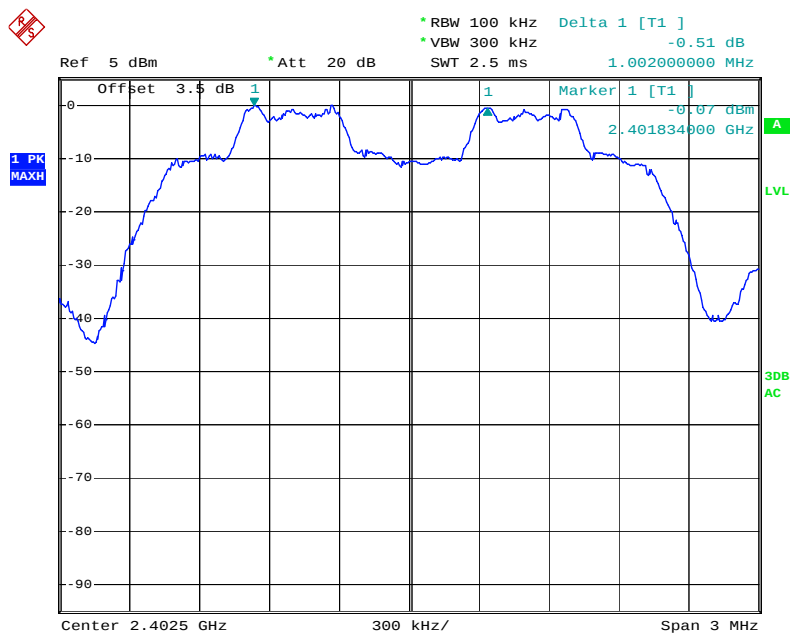
Date: 28.APR.2011 22:32:01

$\pi/4$ DQPSK: Middle Channel

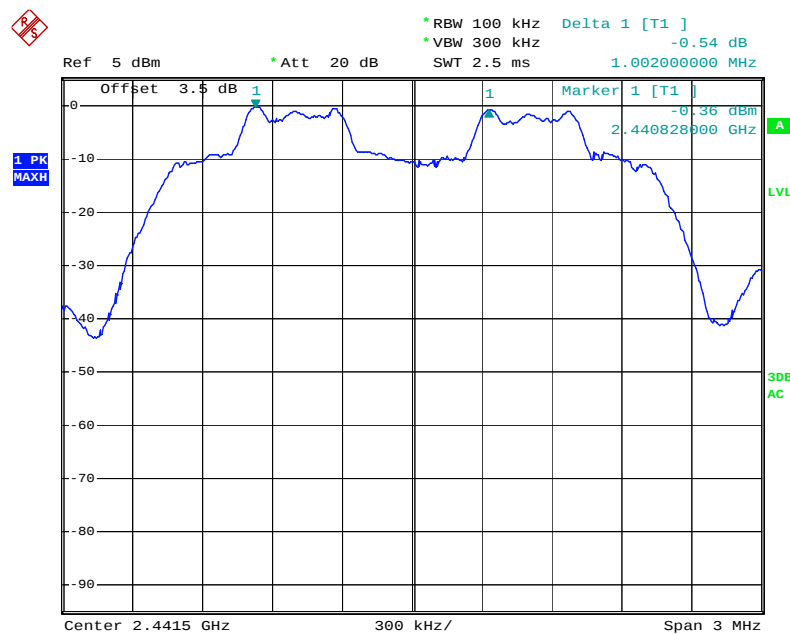
Date: 28.APR.2011 22:35:02

 $\pi/4$ DQPSK: High Channel

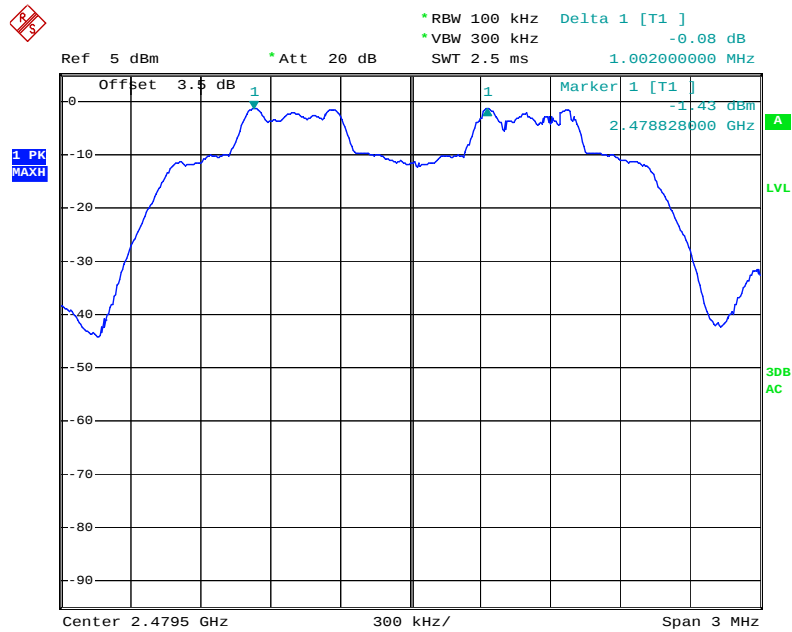
Date: 28.APR.2011 22:37:01

8-DQPSK: Low Channel

Date: 28.APR.2011 23:57:02

8-DQPSK : Middle Channel

Date: 28.APR.2011 23:54:55

8-DQPSK: High Channel

Date: 28.APR.2011 22:58:51

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	2010-11-11	2011-11-10

* **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:	100.9kPa

* The testing was performed by Wayne Cheng on 2011-03-23 and 2011-04-28.

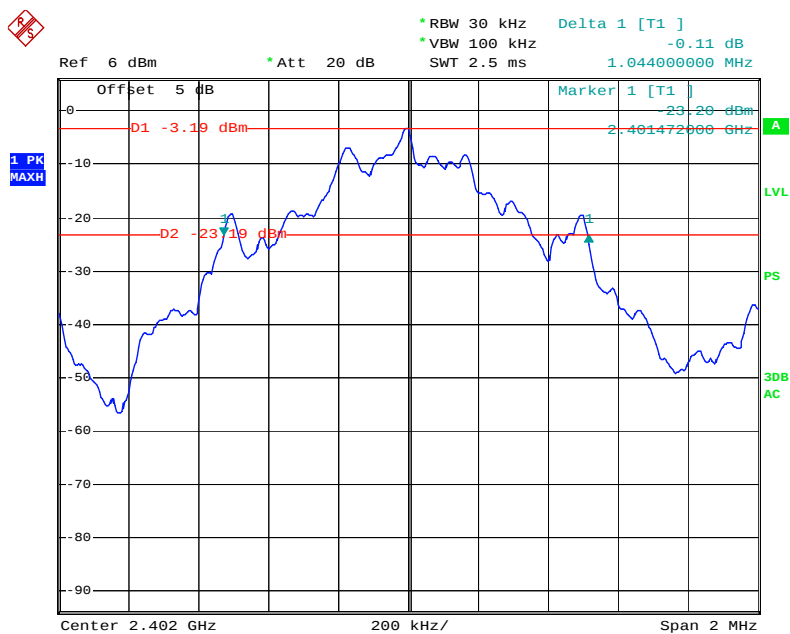
Test Result: Compliance.

Please refer to following tables and plots

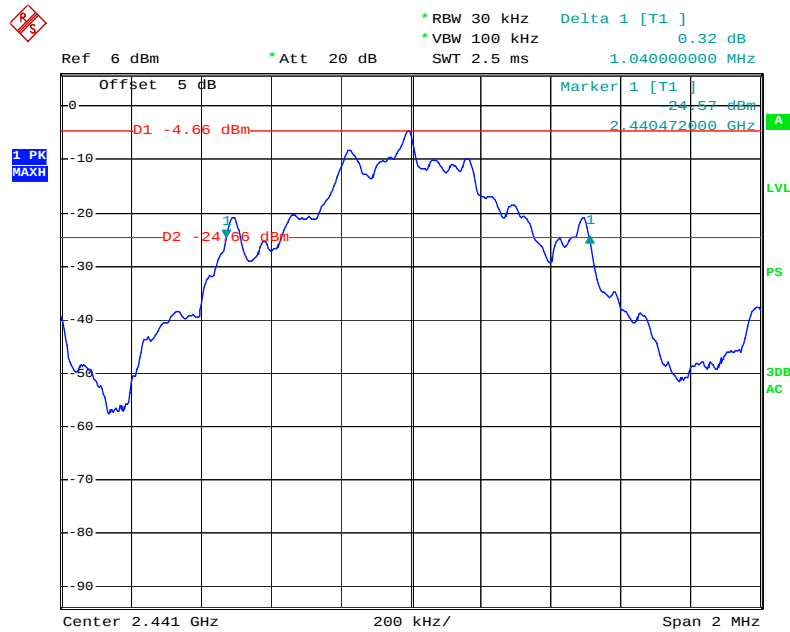
Test Mode: Transmitting

Modulation	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	Low	2402	1.044
	Middle	2441	1.040
	High	2480	1.040
$\pi/4$ DQPSK	Low	2402	1.148
	Middle	2441	1.200
	High	2480	1.140
8-DQPSK	Low	2402	1.128
	Middle	2441	1.120
	High	2480	1.120

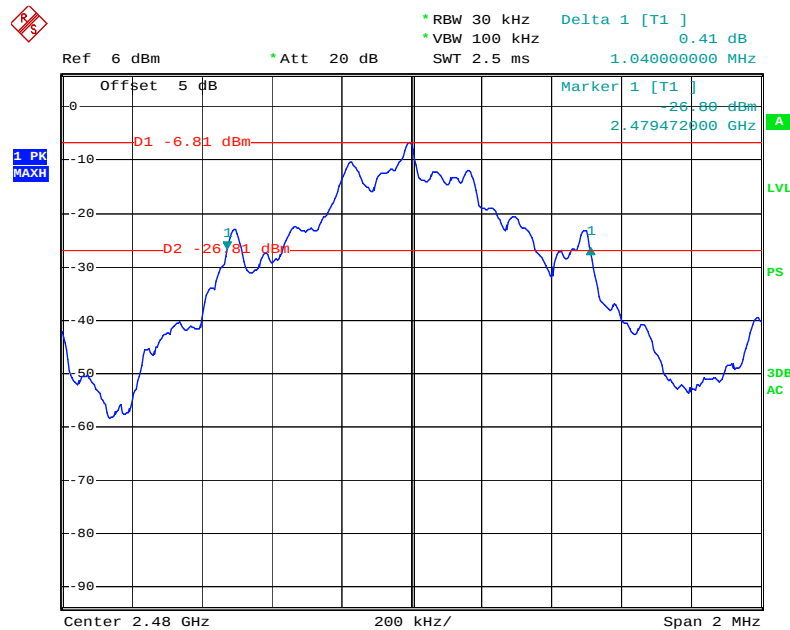
Please refer to the following plots.

GFSK: Low Channel

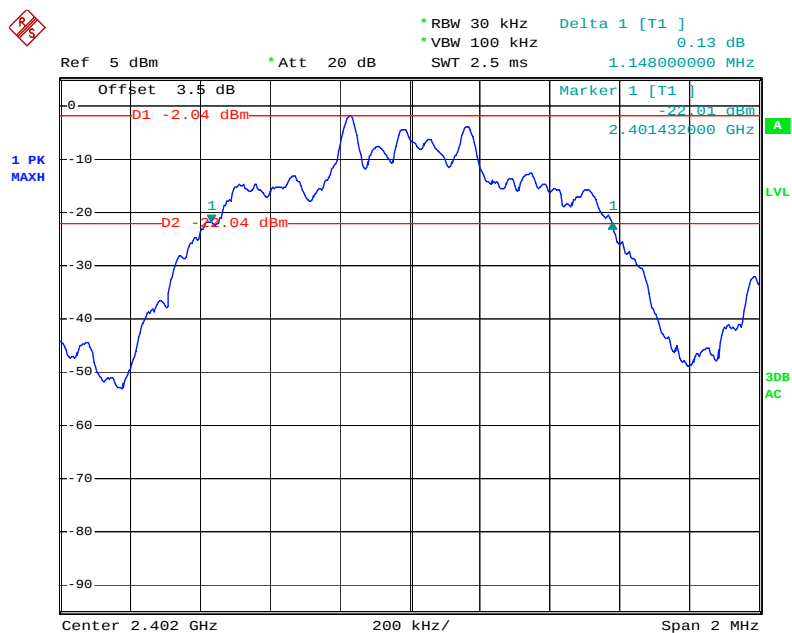
Date: 23.MAR.2011 20:52:31

GFSK: Middle Channel

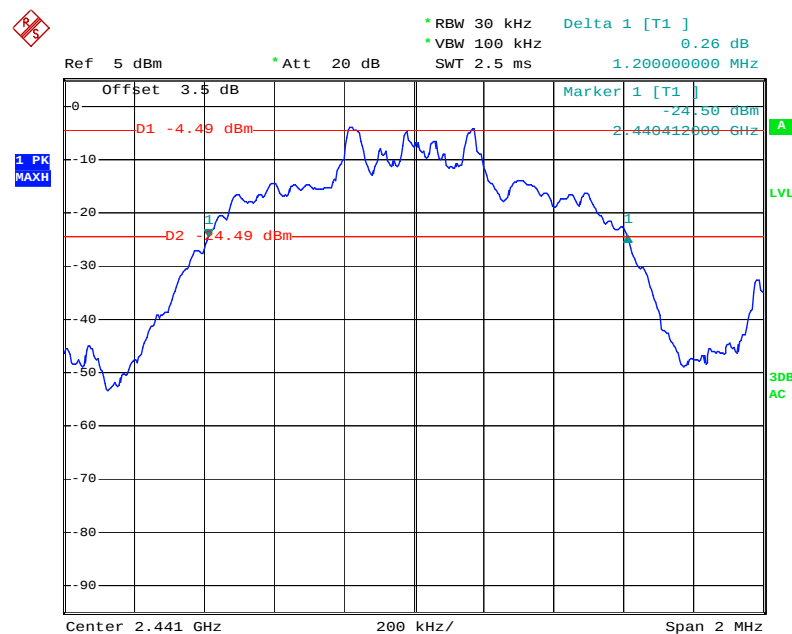
Date: 23.MAR.2011 20:53:35

GFSK: High Channel

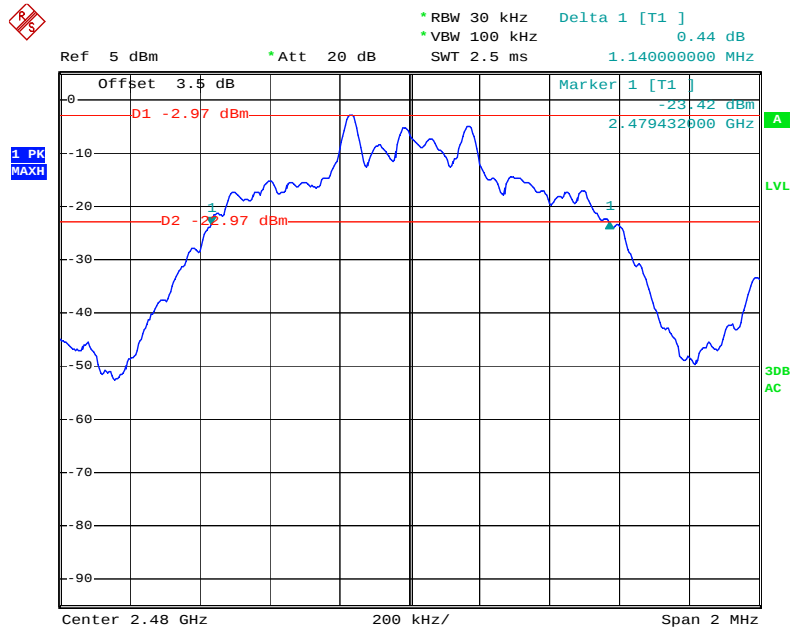
Date: 23.MAR.2011 20:54:43

$\pi/4$ DQPSK: Low Channel

Date: 28.APR.2011 20:24:06

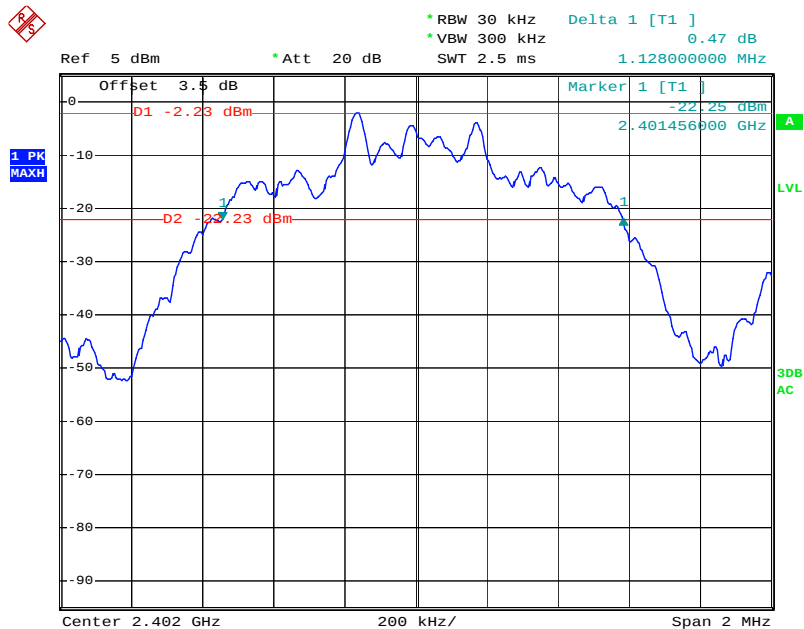
 $\pi/4$ DQPSK: Middle Channel

Date: 28.APR.2011 21:07:48

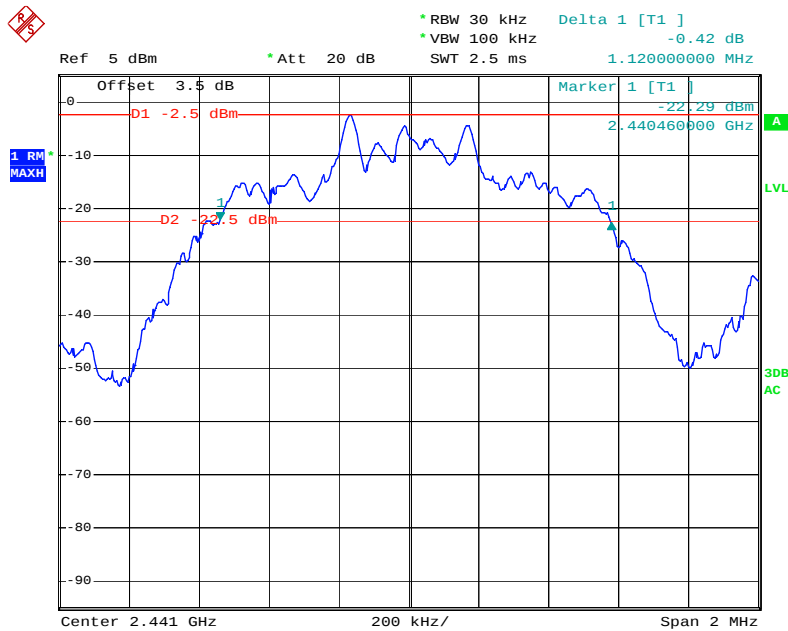
$\pi/4$ DQPSK: High Channel

Date: 28.APR.2011 21:23:50

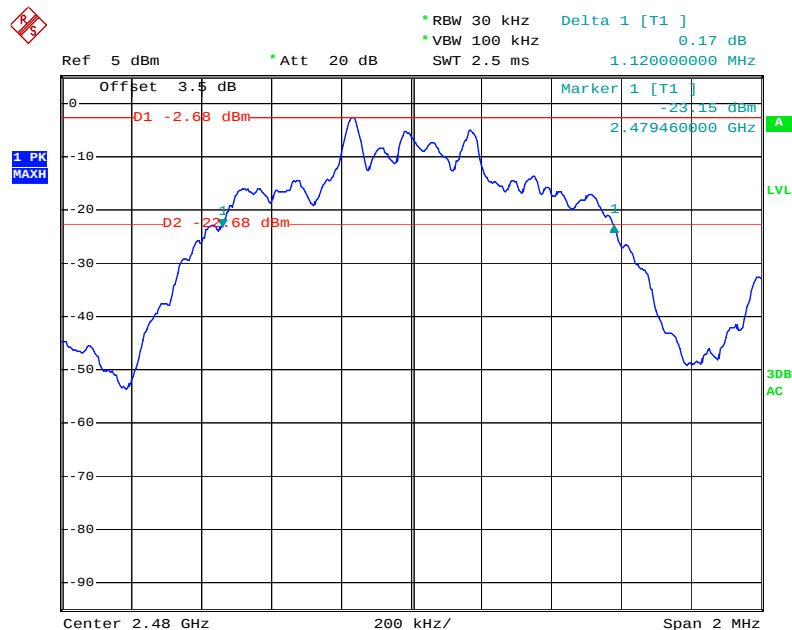
8-DQPSK: Low Channel



Date: 28.APR.2011 23:58:58

8-DQPSK: Middle Channel

Date: 28.APR.2011 23:49:12

8-DQPSK: High Channel

Date: 28.APR.2011 23:45:53

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	2010-11-11	2011-11-10

* **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:	100.9kPa

The testing was performed by Wayne Cheng on 2011-03-23.

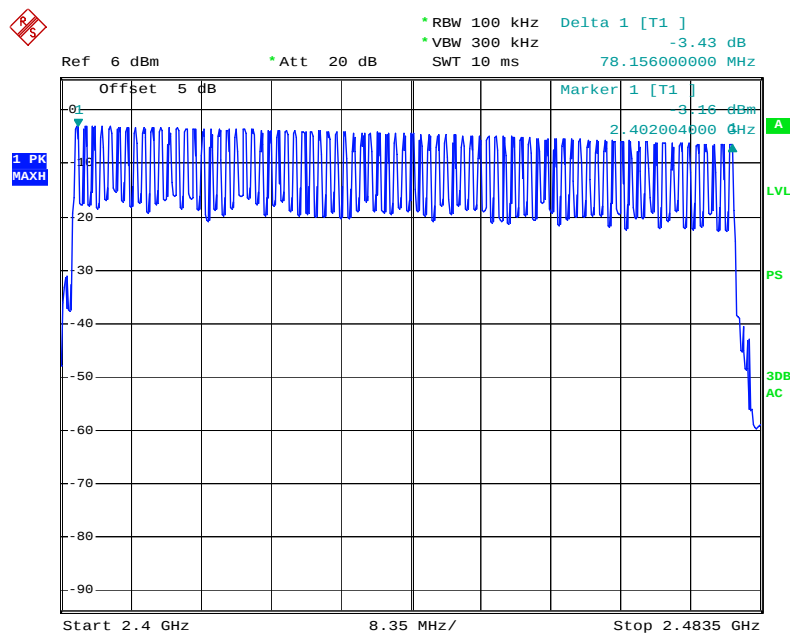
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

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

Number of Hopping Channels



Date: 23.MAR.2011 20:50:34

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	2010-11-11	2011-11-10

* **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= time slot length * hope 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 Wayne Cheng on 2011-04-28 and 2011-04-29.

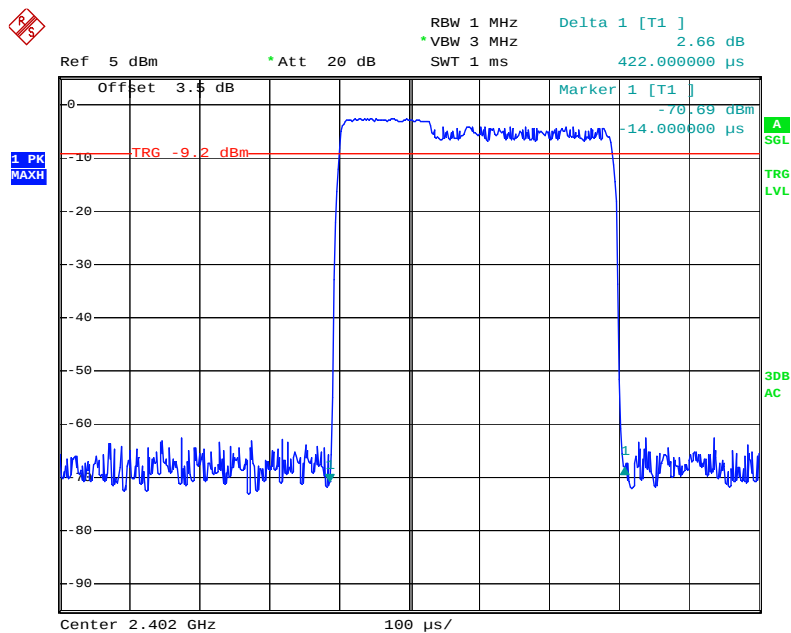
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

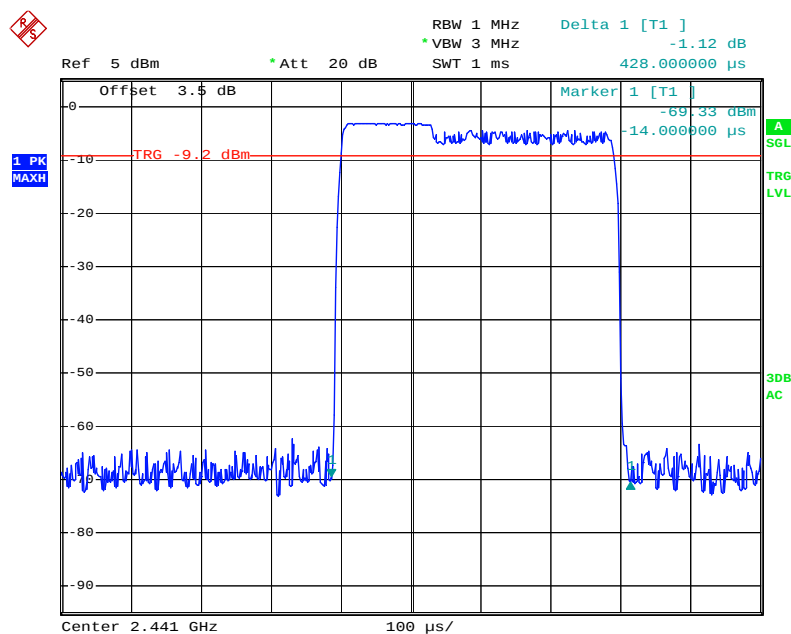
Mode	Channel	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
DH 1	Low	0.422	0.135	0.4	Pass
	Middle	0.428	0.137	0.4	Pass
	High	0.424	0.136	0.4	Pass
	Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
DH 3	Low	1.684	0.269	0.4	Pass
	Middle	1.698	0.272	0.4	Pass
	High	1.710	0.274	0.4	Pass
	Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
DH 5	Low	2.968	0.314	0.4	Pass
	Middle	2.941	0.314	0.4	Pass
	High	2.947	0.315	0.4	Pass
	Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

Low Channel for DH1



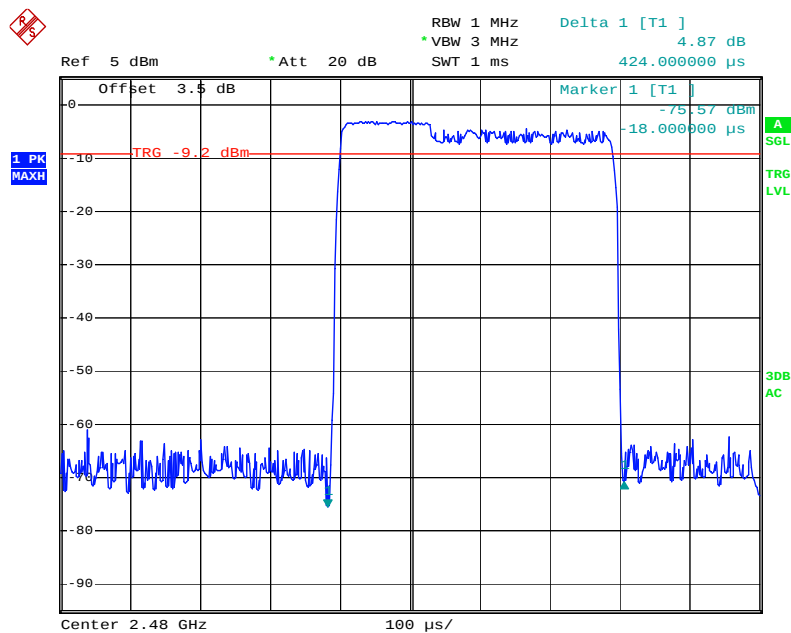
Date: 29.APR.2011 00:05:18

Middle Channel for DH1



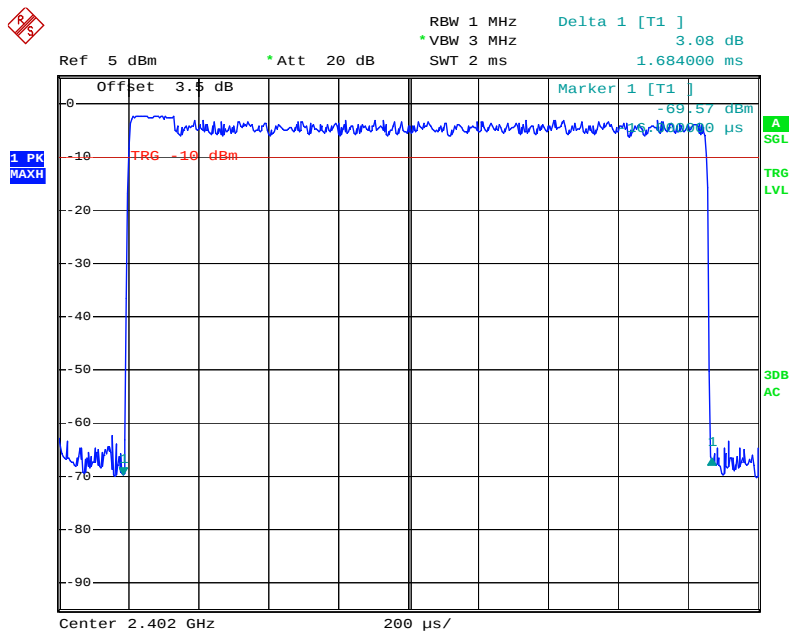
Date: 29.APR.2011 00:04:31

High Channel for DH1

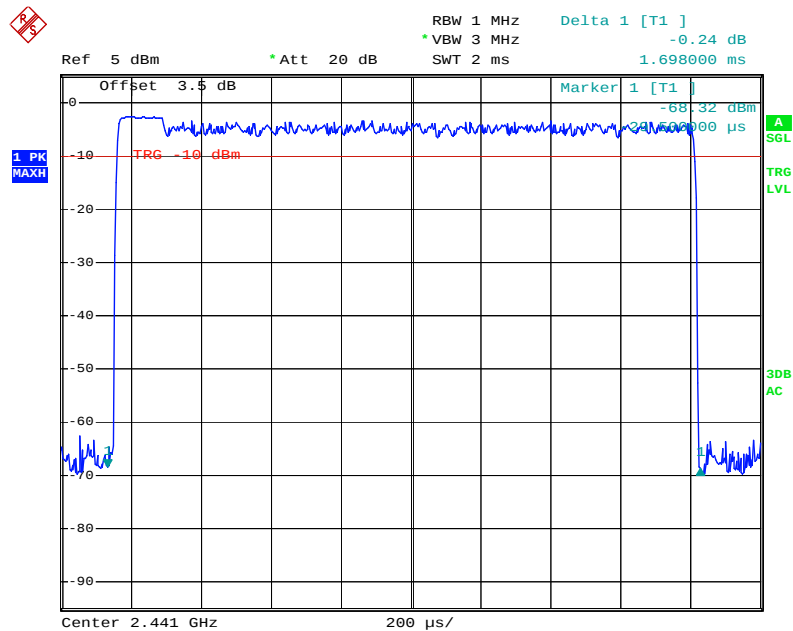


Date: 29.APR.2011 00:06:22

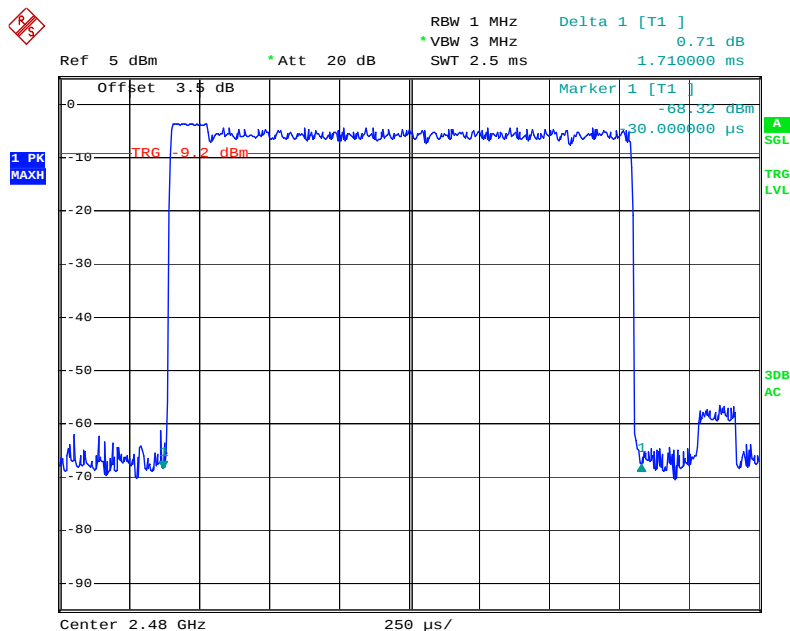
Low Channel for DH3



Date: 28.APR.2011 21:01:07

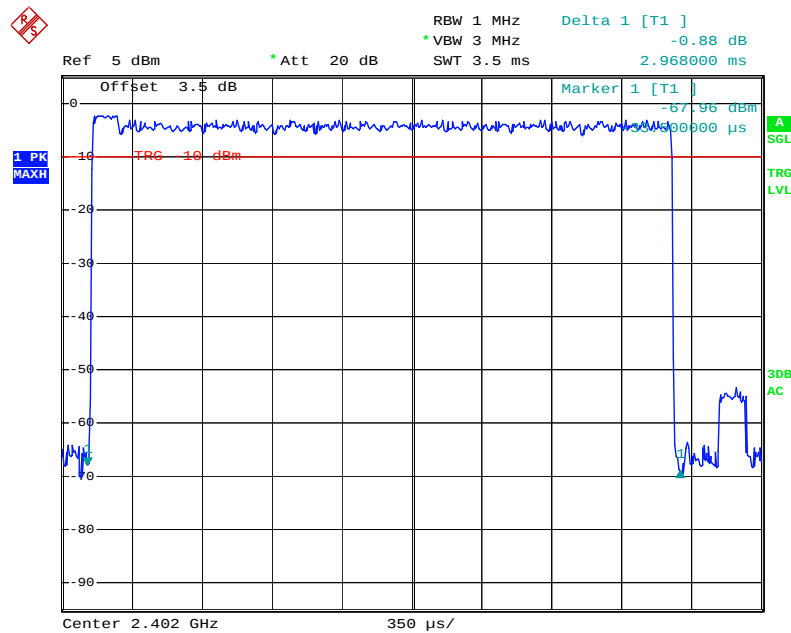
Middle Channel for DH3

Date: 28.APR.2011 21:16:45

High Channel for DH3

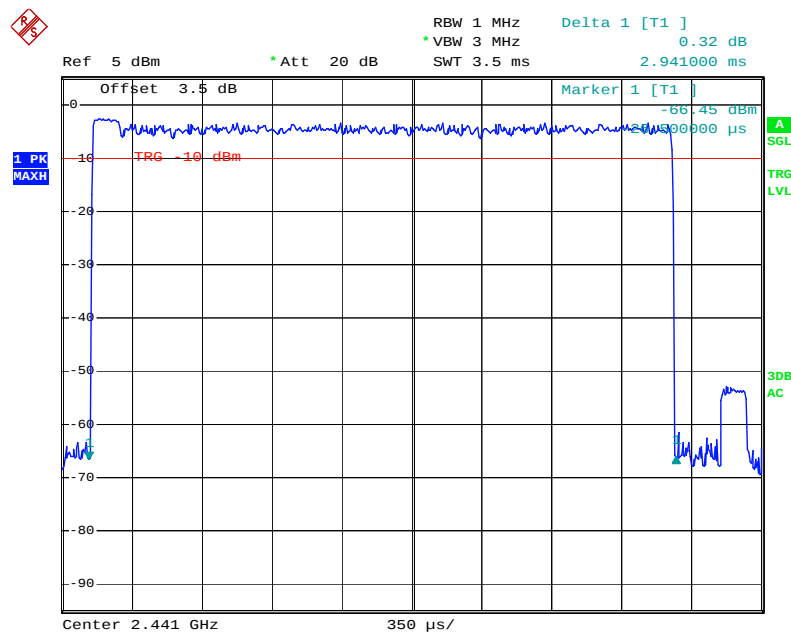
Date: 28.APR.2011 22:22:55

Low Channel for DH5



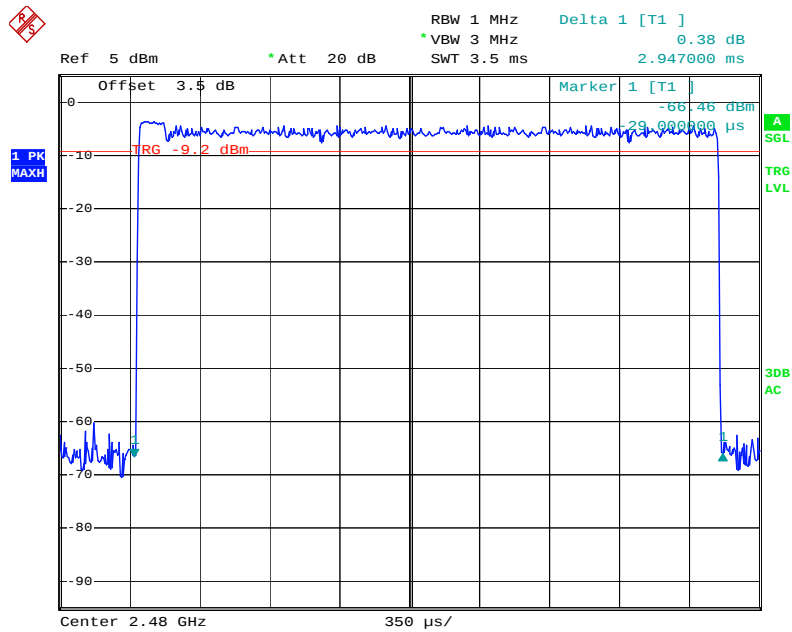
Date: 28.APR.2011 21:03:47

Middle Channel for DH5



Date: 28.APR.2011 21:18:24

High Channel for DH5



Date: 28.APR.2011 22:24:31

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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

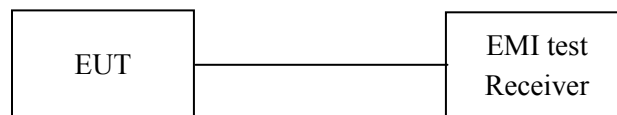
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2010-11-11	2011-11-10

* **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:	101 kPa

* The testing was performed by Wayne Cheng on 2011-03-23 to 2011-04-29.

Test Result: Compliance.

Test Mode: Transmitting

GFSK:

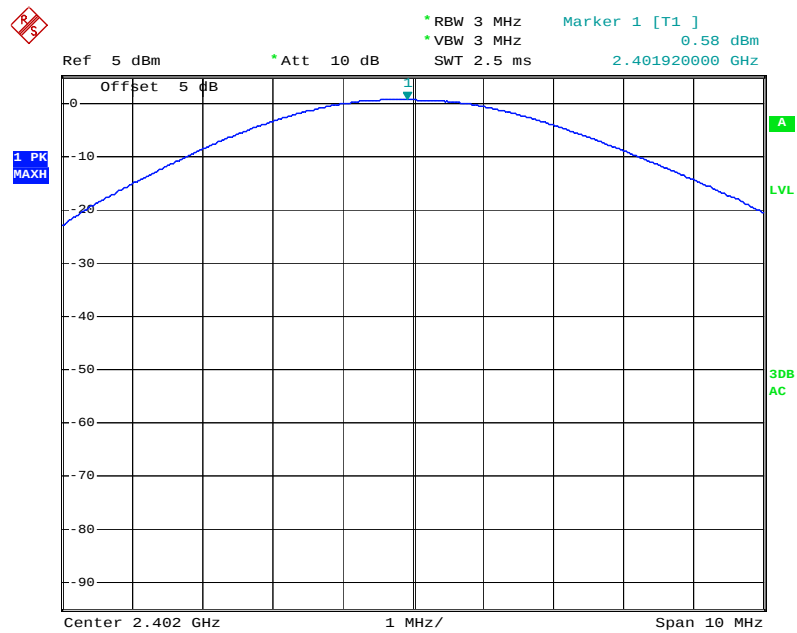
Channel	Frequency (MHz)	Conducted Output Power		Limit (mW)
		(dBm)	(mW)	
Low	2402	0.58	1.14	1000
Middle	2441	0.23	1.05	1000
High	2480	-0.22	0.95	1000

$\pi/4$ DQPSK:

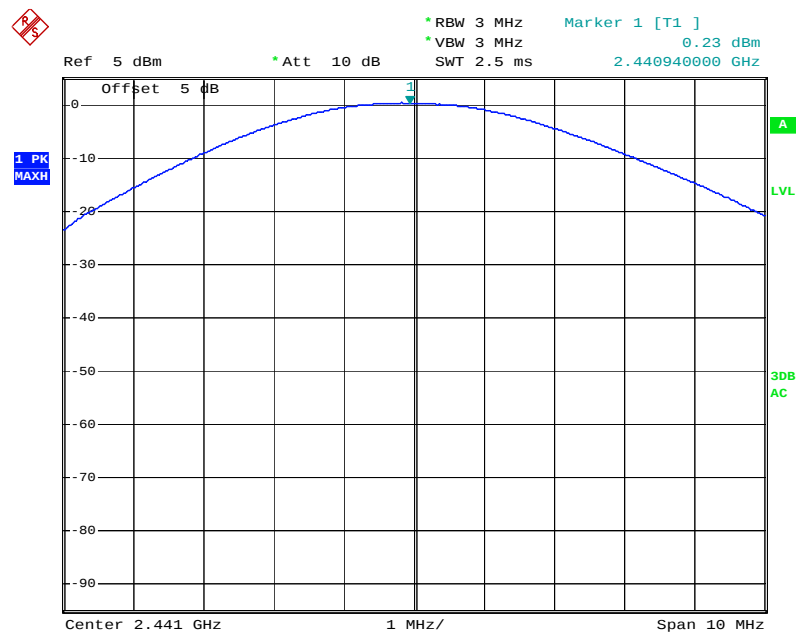
Channel	Frequency (MHz)	Conducted Output Power		Limit (mW)
		(dBm)	(mW)	
Low	2402	-0.12	0.97	1000
Middle	2441	-0.42	0.91	1000
High	2480	-1.26	0.75	1000

8-DQPSK:

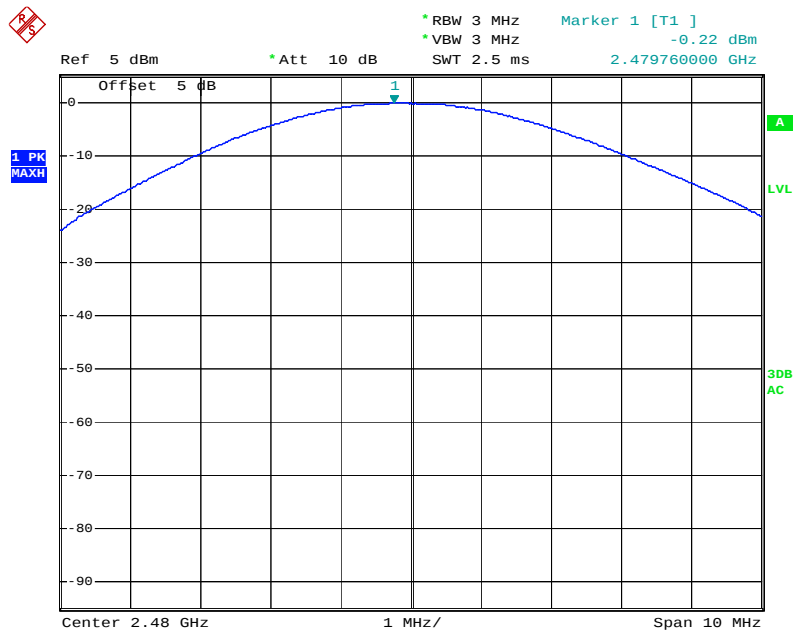
Channel	Frequency (MHz)	Conducted Output Power		Limit (mW)
		(dBm)	(mW)	
Low	2402	-0.17	0.96	1000
Middle	2441	-0.46	0.90	1000
High	2480	-1.80	0.66	1000

GFSK: Low Channel

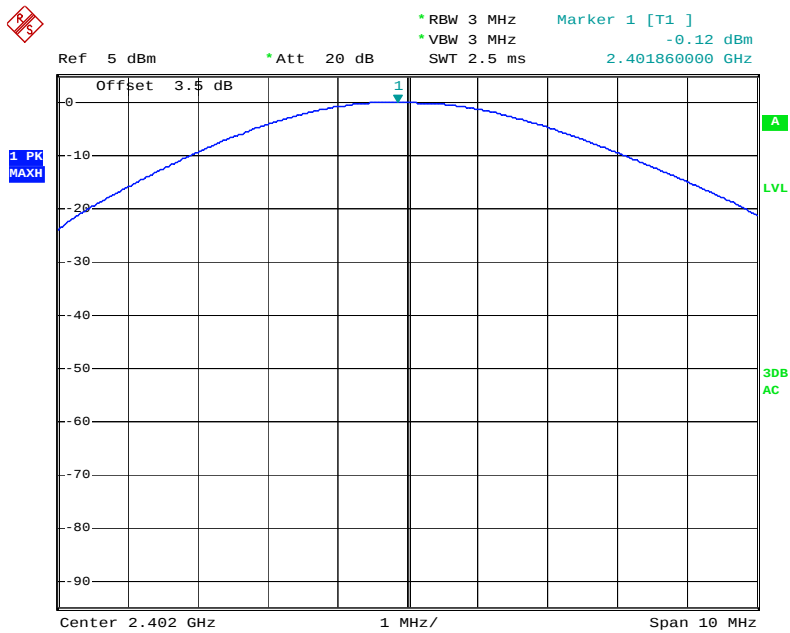
Date: 23.MAR.2011 21:28:31

GFSK: Middle Channel

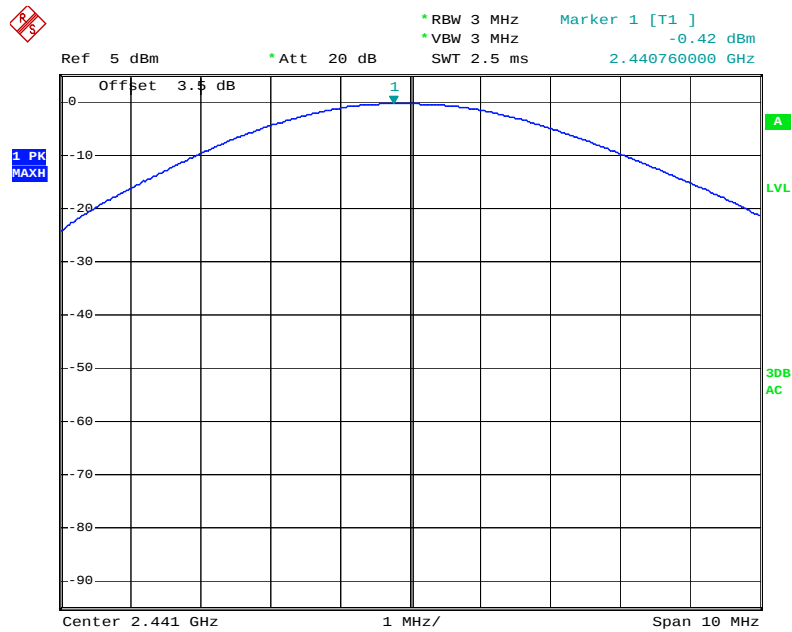
Date: 23.MAR.2011 21:28:58

GFSK: High Chanel

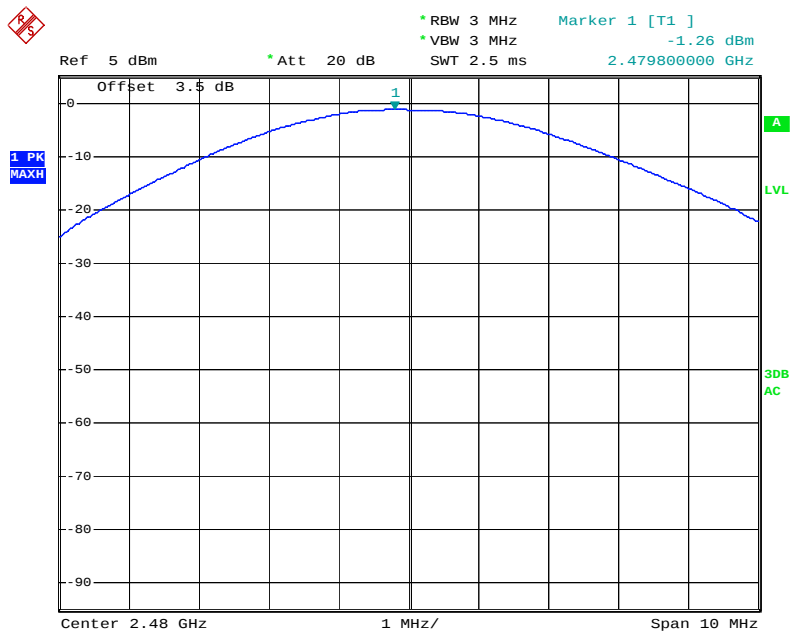
Date: 23.MAR.2011 21:26:51

 $\pi/4$ DQPSK: Low Channel

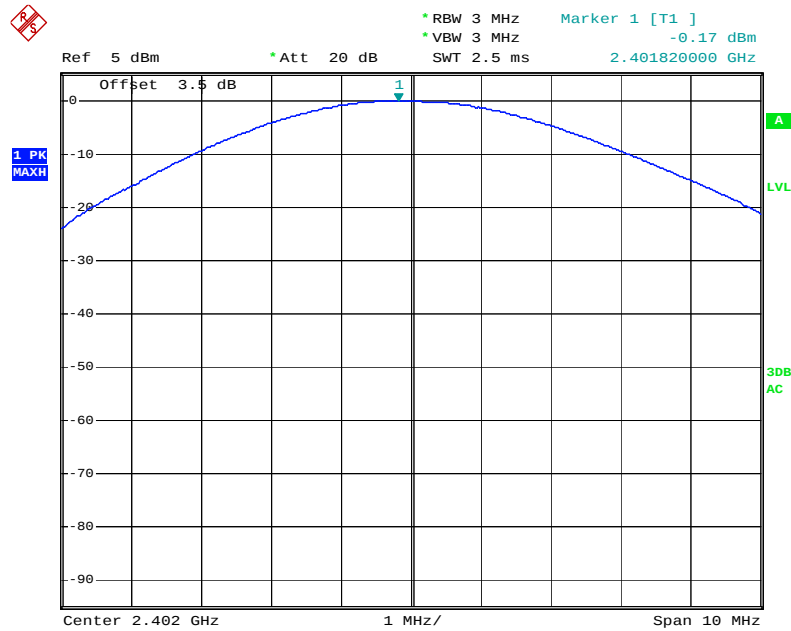
Date: 29.APR.2011 00:21:58

$\pi/4$ DQPSK: Middle Channel

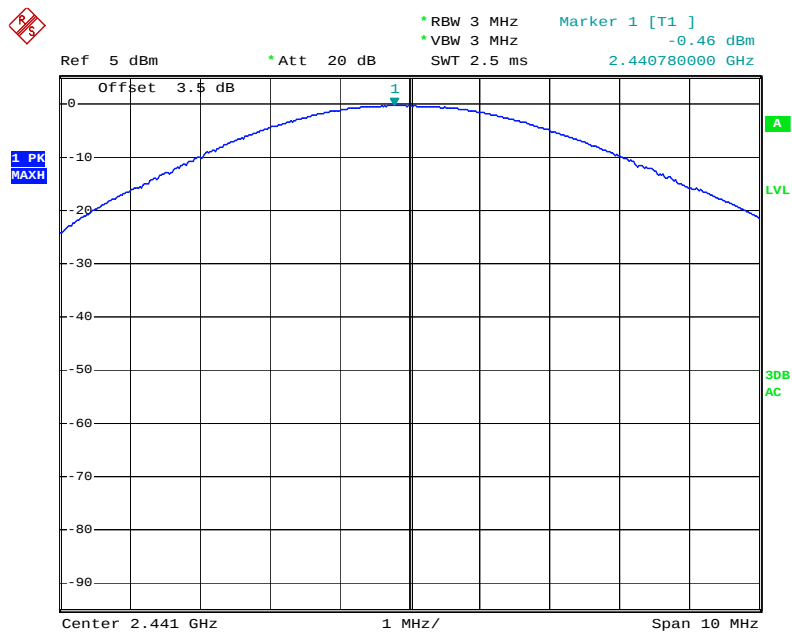
Date: 29.APR.2011 00:23:41

 $\pi/4$ DQPSK: High Chanel

Date: 29.APR.2011 00:24:09

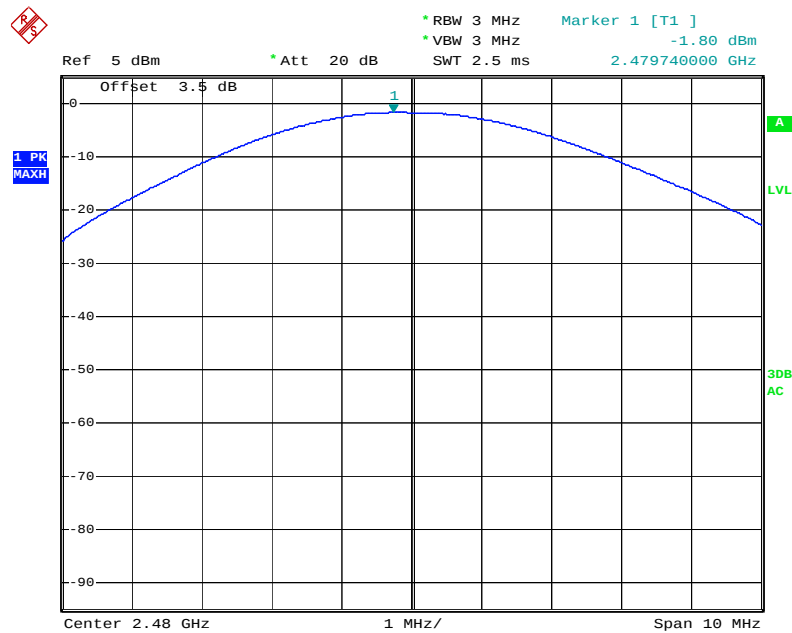
8-DQPSK: Low Channel

Date: 29.APR.2011 00:22:34

8-DQPSK: Middle Channel

Date: 29.APR.2011 00:23:10

8-DQPSK: High Chanel



Date: 29.APR.2011 00:24:44

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	2010-11-11	2011-11-10

* **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 without connection to measurement instrument. Put it on the Rotated table and 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:	25 °C
Relative Humidity:	56 %
ATM Pressure:	100.9kPa

**The testing was performed by Wayne Cheng on 2011-03-23 and 2011-04-29.*

Test Result: Compliance

Please refer to follow plots:

Test Mode: Transmitting

GFSK:

Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)
2399.984	48.36	20
2479.924	50.79	20

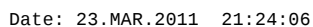
$\pi/4$ DQPSK:

Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)
2399.542	51.09	20
2483.788	53.32	20

8-DQPSK:

Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)
2399.984	45.25	20
2483.788	53.81	20

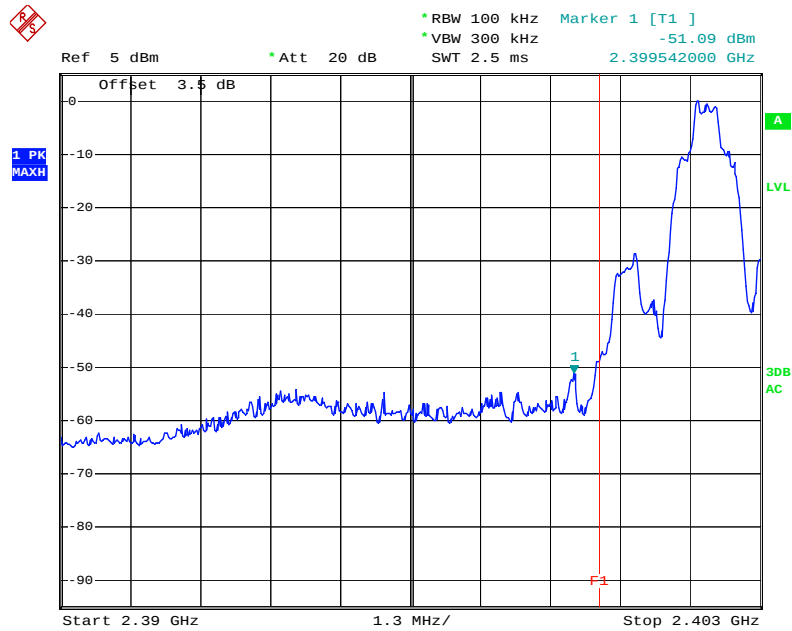
Band Edge: Left Side



Date: 23.MAR.2011 21:25:23

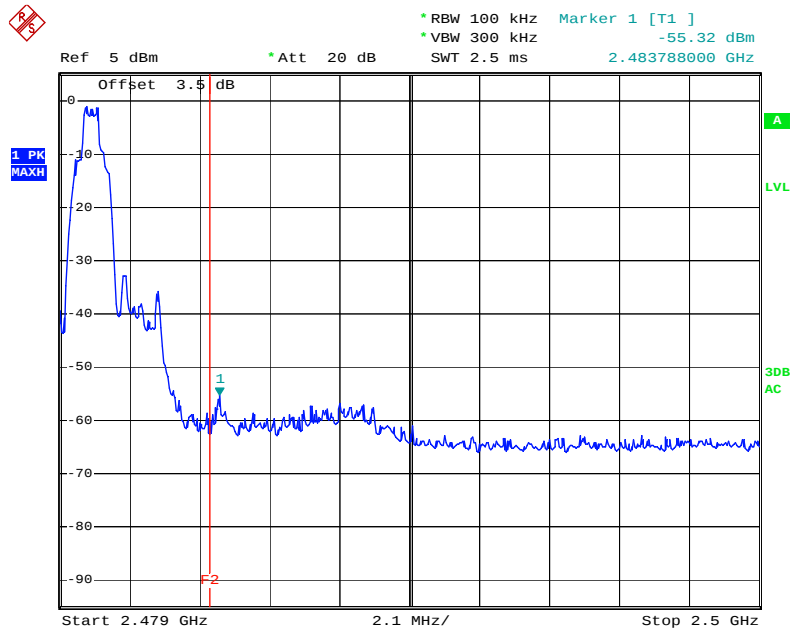
$\pi/4$ DQPSK

Band Edge: Left Side

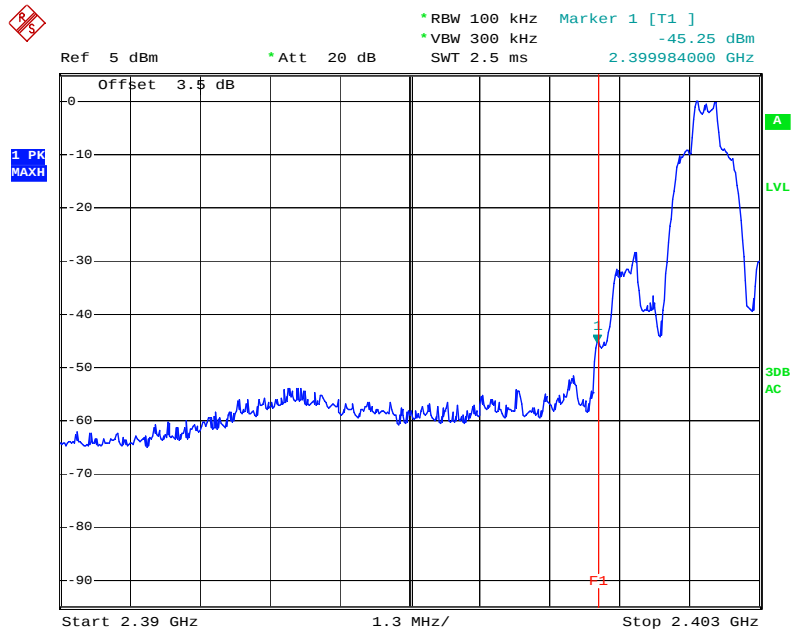


Date: 29.APR.2011 00:15:32

Band Edge: Right Side



Date: 29.APR.2011 00:14:30

8-DQPSK**Band Edge: Left Side**

Date: 29.APR.2011 00:16:18

Band Edge: Right Side

Date: 29.APR.2011 00:13:57

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