

FCC PART 15.247

TEST REPORT

For

Optex Co., Ltd.

5-8-12, Ogoto Otsu-Shiga-Ken, Japan

FCC ID: DC9IVP-DU

Report Type: Original Report	Product Type: Door Camera Unit
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Report Number: R2DG131125016-00A	
Report Date: 2013-12-06	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Optex Co., Ltd.*'s product, model number: *08873 IVP-DU (FCC ID: DC9IVP-DU)* or ("EUT") in this report is a *Door Camera Unit*, which was measured approximately: 31.0 cm (L) x 18.0 cm (W) x 2.0 cm (H), rated input voltage: DC 4.5V from three series AA batteries or DC/AC 10-24V.

** All measurement and test data in this report was gathered from production sample serial number: 131125016 (Assigned by BA CL.Dongguan). The EUT was received on 2013-11-26.*

Objective

This report is prepared on behalf of *Optex Co., Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission rules.

The tests were performed in order to determine the Bluetooth of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan). 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. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710 and Industrial Canada registration test site No.: 3062D. 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. (Dongguan) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 500069-0).



The current scope of accreditations can be found at <http://ts.nist.gov/standards/scopes/5000690.htm>

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer. For the engineering mode, the maximum power was configured as default value and switched by the keys.

16 channels were provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2411	9	2438
2	2414	10	2440
3	2422	11	2442
4	2424	12	2446
5	2426	13	2452
6	2429	14	2454
7	2431	15	2458
8	2436	16	2461

EUT was tested with low channel: 2411 MHz, middle channel: 2436 MHz, and high channel: 2461 MHz.

EUT Exercise Software

No exercise software was used.

Equipment Modifications

No modification was made to the EUT tested.

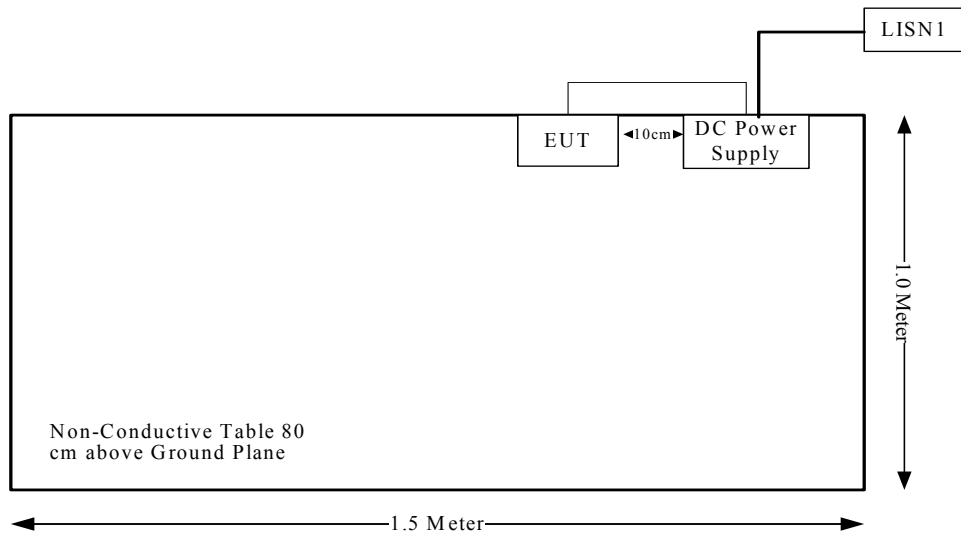
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Pro instrument	DC Power Supply	pps3300	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
DC Cable	No	No	1.0	DC Power Supply	EUT

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)	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) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

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

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

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

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

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

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

Calculated Data:

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
2411	0	1.00	12.47	17.66	20.00	0.00352	1.0
2436	0	1.00	12.05	16.03	20.00	0.00319	1.0
2461	0	1.00	11.83	15.24	20.00	0.00303	1.0

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has two monopole antennas permanently soldered on the printed circuit boards, one for transmitting and receiving, and other was not use, which complied with 15.203, the maximum 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

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

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

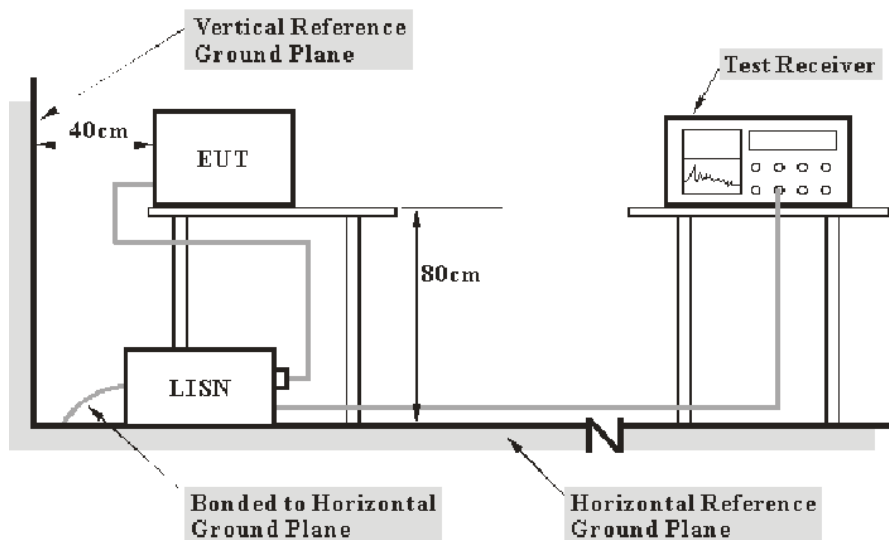
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

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

Table 1 – Values of U_{cispr}

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

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The DC Power Supply was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

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

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI TEST RECEIVER	ESCS 30	830245/006	2013-11-20	2014-11-19
R&S	Two-line V-network	ENV216	3560.6550.12	2013-2-18	2014-2-17
R&S	L.I.S.N	ESH3-Z5	100113	N/A	N/A
BACL	Test Software	BACL-EMC	V1.0-2010	N/A	N/A

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

Test Results Summary

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

5.87dB at 0.380MHz in the Neutral conducted mode

Test Data

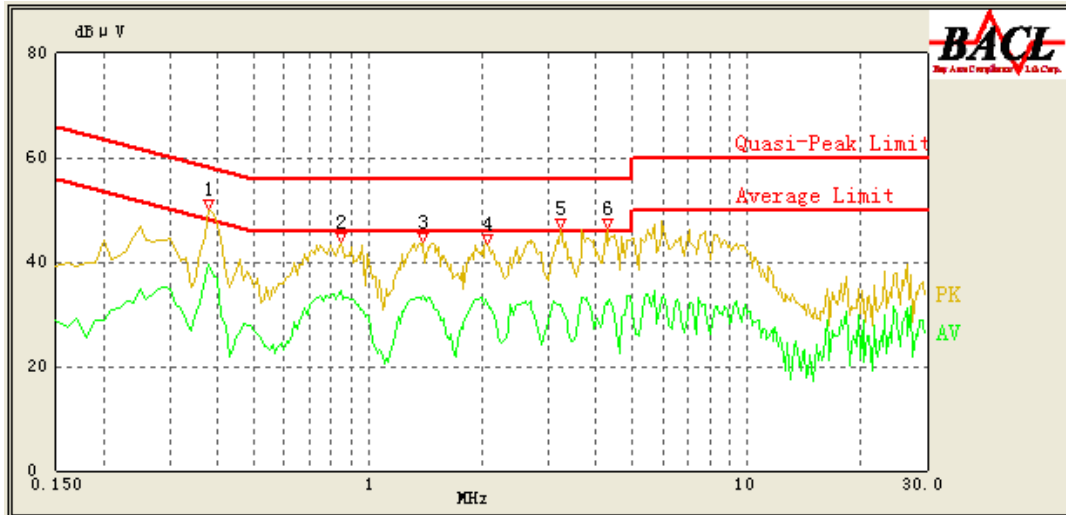
Environmental Conditions

Temperature:	20.2 °C
Relative Humidity:	44 %
ATM Pressure:	101.5 kPa

The testing was performed by Allen Qiao on 2013-12-03.

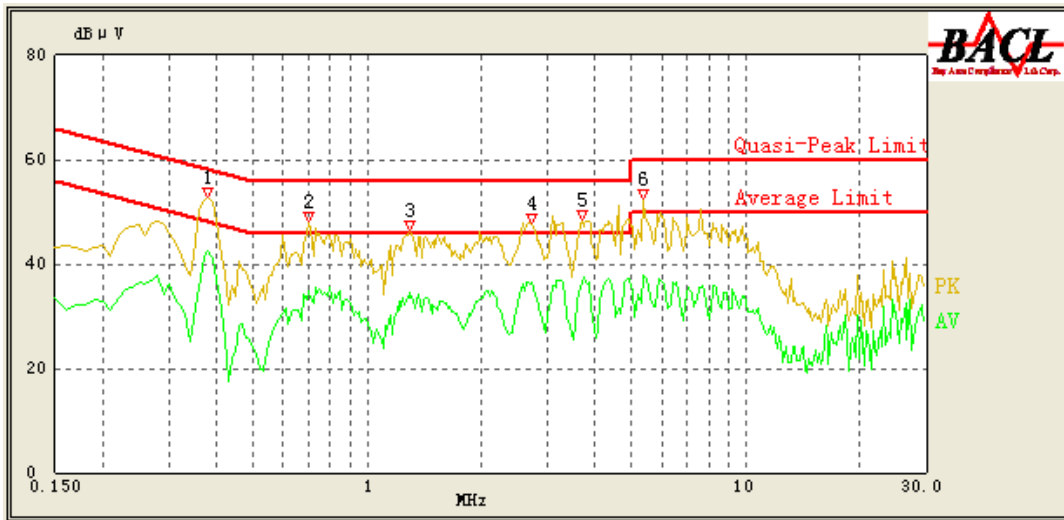
Test Mode: Transmitting

120 V, 60 Hz, Line:



Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.380	46.01	0.33	58.28	12.27	QP
0.380	39.38	0.33	48.28	8.90	AV
0.850	38.96	0.32	56.00	17.04	QP
0.850	34.42	0.32	46.00	11.58	AV
1.400	38.42	0.33	56.00	17.58	QP
1.390	33.51	0.33	46.00	12.49	AV
2.070	38.10	0.36	56.00	17.90	QP
2.080	31.26	0.36	46.00	14.74	AV
3.240	39.35	0.40	56.00	16.65	QP
3.230	31.96	0.40	46.00	14.04	AV
4.270	40.01	0.44	56.00	15.99	QP
4.270	32.42	0.44	46.00	13.58	AV

120 V, 60 Hz, Neutral:



Frequency (MHz)	Cord. Reading (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/AV/QP)
0.380	50.15	0.22	58.28	8.13	QP
0.380	42.41	0.22	48.28	5.87	AV
0.700	42.23	0.22	56.00	13.77	QP
0.700	34.97	0.22	46.00	11.03	AV
1.290	41.55	0.24	56.00	14.45	QP
1.290	33.54	0.24	46.00	12.46	AV
2.730	42.58	0.30	56.00	13.42	QP
2.730	36.64	0.30	46.00	9.36	AV
3.700	44.14	0.34	56.00	11.86	QP
3.700	36.44	0.34	46.00	9.56	AV
5.360	44.72	0.42	60.00	15.28	QP
5.360	37.69	0.42	50.00	12.31	AV

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

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

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:

30M~200MHz: 5.0 dB

200M~1GHz: 6.2 dB

1G~6GHz: 4.45 dB

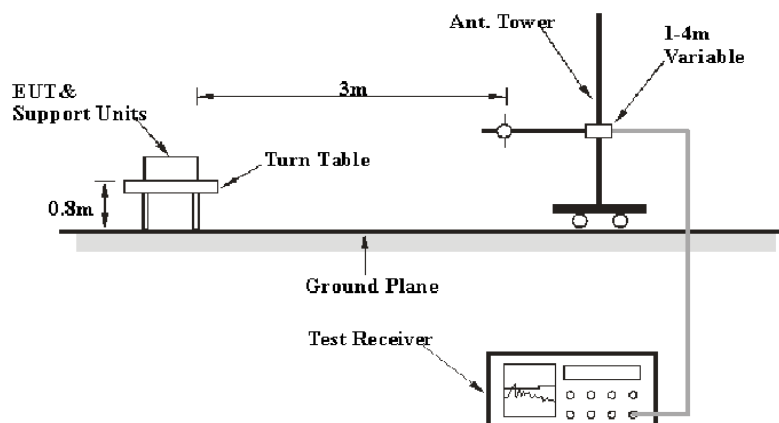
6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

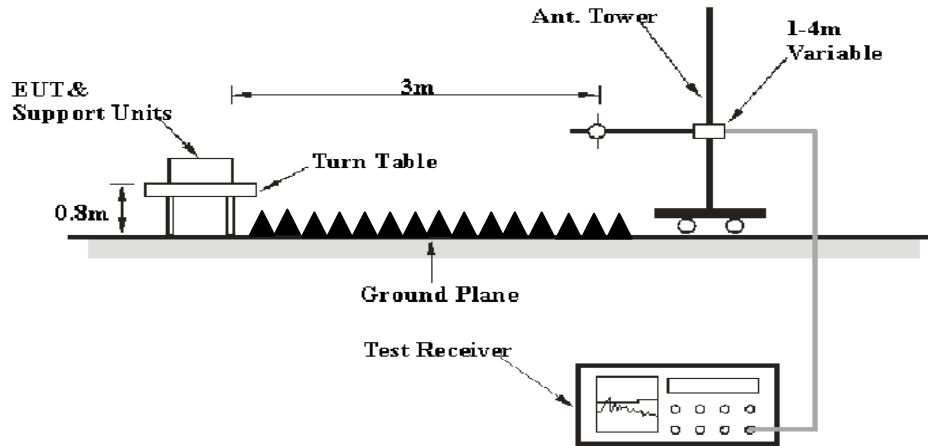
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2003. 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.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK

Test Procedure

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

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak detection mode for frequencies above 1 GHz. The average value was Calculated based on Duty Cycle Correction Factor.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI TEST RECEIVER	ESCI	100224	2013-5-6	2014-5-5
Sunol Sciences	Antenna	JB3	A060611-1	2012-9-6	2015-9-5
HP	HP AMPLIFIER	8447E	2434A02181	N/A	N/A
R&S	Spectrum analyzer	FSEM	DE31388	2013-5-7	2014-5-6
ETS LINDGREN	horn antenna	3115	000 527 35	2012-9-6	2015-9-5
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	N/A	N/A
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15
Ducommun Technologies	horn antenna	ARH-4223-02	1007726-01 1304	2013-6-16	2014-6-15

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

Corrected Amplitude & Margin Calculation

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

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

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

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

Test Results Summary

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

3.05 dB at 454.86 MHz in the Vertical polarization

Test Data

Environmental Conditions

Temperature:	24.2°C
Relative Humidity:	54%
ATM Pressure:	101.6kPa

The testing was performed by Allen Qiao on 2013-12-02.

Test Mode: Transmitting

Measured Results

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2411MHz									
2411	71.31	PK	H	25.67	4.42	0.00	101.40	N/A	N/A
2411	73.08	PK	V	25.67	4.42	0.00	103.17	N/A	N/A
2390	35.98	PK	V	25.61	4.39	0.00	65.98	74.00	8.02
2390	14.08	AV	V	25.61	4.39	0.00	44.08	54.00	9.92
4822	37.25	PK	V	30.64	6.02	27.26	46.65	74.00	27.35
7233	32.51	PK	V	34.16	7.47	26.36	47.78	74.00	26.22
9644	32.18	PK	H	36.05	8.80	26.08	50.95	74.00	23.05
1236.55	35.69	PK	H	22.92	2.83	27.23	34.21	74.00	39.79
1236.55	21.72	AV	H	22.92	2.83	27.23	20.24	54.00	33.76
454.86	44.9	QP	V	17.38	2.58	21.91	42.95	46.00	3.05*
Middle Channel: 2436MHz									
2436	70.13	PK	H	25.73	4.41	0.00	100.27	N/A	N/A
2436	73.2	PK	V	25.73	4.41	0.00	103.34	N/A	N/A
4872	37.81	PK	V	30.77	6.09	27.26	47.41	74.00	26.59
7308	32.13	PK	V	34.34	7.51	26.50	47.48	74.00	26.52
9744	32.61	PK	H	36.29	8.83	25.69	52.04	74.00	21.96
1233.28	34.82	PK	H	22.91	2.83	27.24	33.32	74.00	40.68
1233.28	21.73	AV	H	22.91	2.83	27.24	20.23	54.00	33.77
2113.69	33.26	PK	H	24.90	3.96	27.20	34.92	74.00	39.08
2113.69	19.81	AV	H	24.90	3.96	27.20	21.47	54.00	32.53
453.99	44.3	QP	V	17.35	2.58	21.90	42.33	46.00	3.67*
High Channel: 2461MHz									
2461	70.19	PK	H	25.80	4.43	0.00	100.42	N/A	N/A
2461	72.3	PK	V	25.80	4.43	0.00	102.53	N/A	N/A
2483.5	32.13	PK	V	25.86	4.49	0.00	62.48	74.00	11.52
2483.5	13.67	AV	V	25.86	4.49	0.00	44.02	54.00	9.98
4922	43.64	PK	V	30.90	5.98	27.27	53.25	74.00	20.75
7383	31.84	PK	V	34.52	7.55	26.65	47.26	74.00	26.74
9844	34.43	PK	H	36.53	8.85	25.49	54.32	74.00	19.68
1234.51	35.06	PK	H	22.91	2.83	27.24	33.56	74.00	40.44
1234.51	21.75	AV	H	22.91	2.83	27.24	20.25	54.00	33.75
453.26	44.5	QP	V	17.31	2.58	21.90	42.49	46.00	3.51*

*Within measurement uncertainty!

Calculated average Results

Frequency	Peak Measurement @ 3m	Polar	Duty Cycle Correction Factor	Average Amp.	Limit	Margin
MHz	dBµV/m	H/V	dB	dBµV/m	dBµV/m	dB
frequency:2411MHz						
2411.00	101.40	H	-20.26	81.14	N/A	N/A
2411.00	103.17	V	-20.26	82.91	N/A	N/A
4822.00	46.65	V	-20.26	26.39	54.00	27.61
7233.00	47.78	V	-20.26	27.52	54.00	26.48
9644.00	50.95	H	-20.26	30.69	54.00	23.31
frequency:2436MHz						
2436.00	100.27	H	-20.26	80.01	N/A	N/A
2436.00	103.34	V	-20.26	83.08	N/A	N/A
4872.00	47.41	V	-20.26	27.15	54.00	26.85
7308.00	47.48	V	-20.26	27.22	54.00	26.78
9744.00	52.04	H	-20.26	31.78	54.00	22.22
frequency:2461MHz						
2461.00	100.42	H	-20.26	80.16	N/A	N/A
2461.00	102.53	V	-20.26	82.27	N/A	N/A
4922.00	53.25	V	-20.26	32.99	54.00	21.01
7383.00	47.26	V	-20.26	27.00	54.00	27.00
9844.00	54.32	H	-20.26	34.06	54.00	19.94

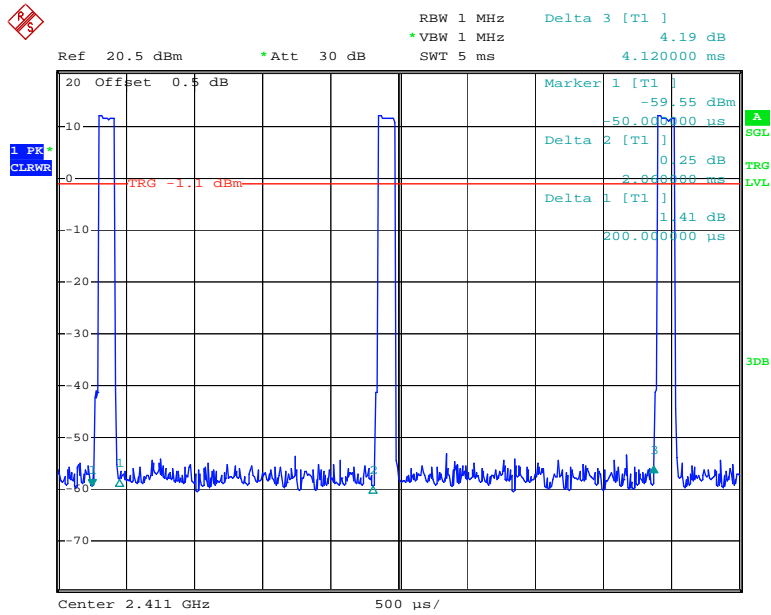
Calculate Average value based on Duty Cycle Correction Factor:

Duty cycle= $T_{ON}/T_{on+off}=(0.2/2.06)ms =9.71\%$

Duty cycle correction factor = $20*\log(\text{duty cycle}) =20*\log(9.71\%) = -20.26 \text{ dB}$

Please refer to following plot:

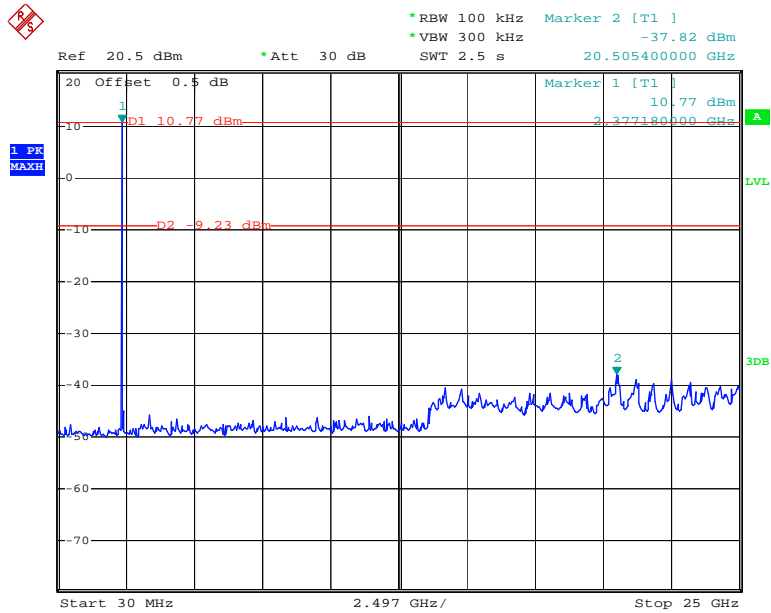
Duty Cycle



Date: 2.DEC.2013 10:05:58

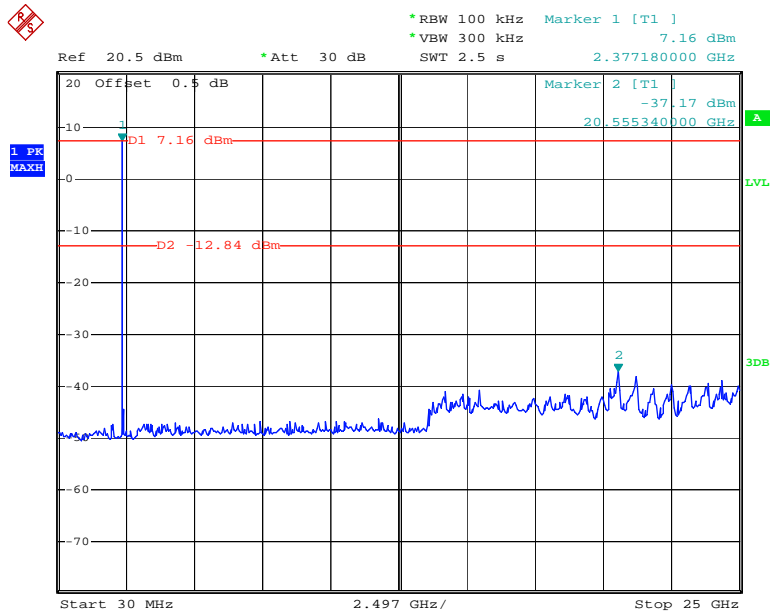
Conducted Spurious Emissions at Antenna Port

Low Channel



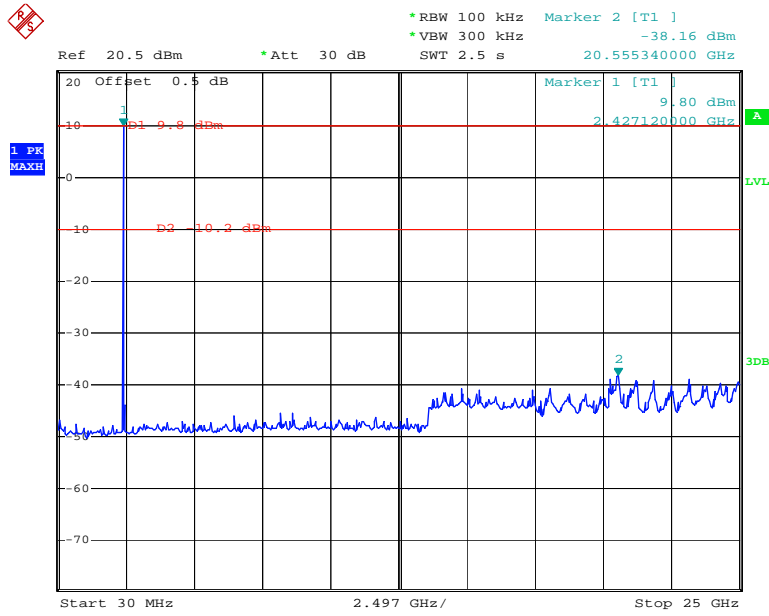
Date: 2.DEC.2013 10:00:27

Middle Channel



Date: 2.DEC.2013 09:57:58

High Channel



Date: 2.DEC.2013 09:54:42

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

Applicable Standard

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 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:	24.1 °C
Relative Humidity:	44 %
ATM Pressure:	101.9kPa

* *The testing was performed by Allen Qiao on 2013-11-28.*

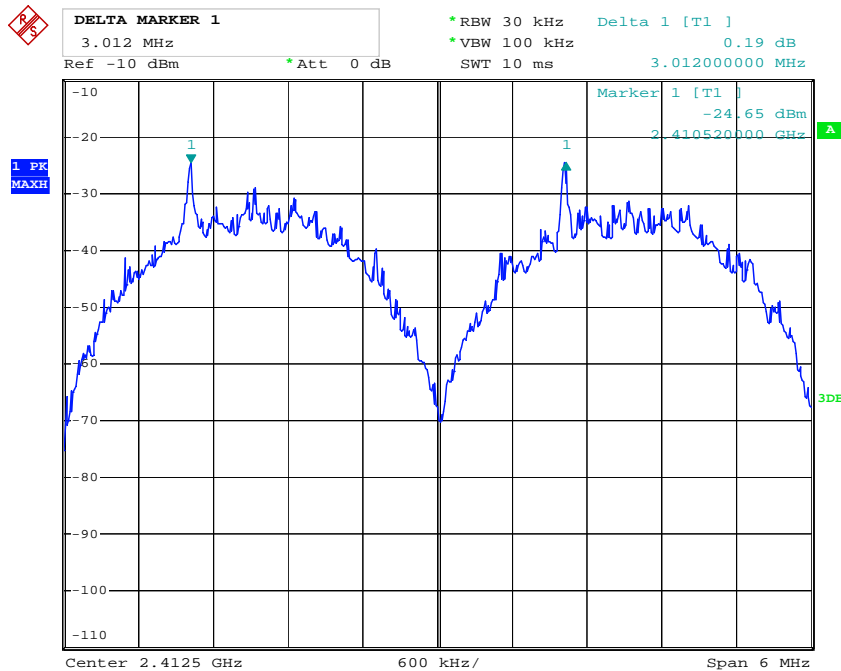
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

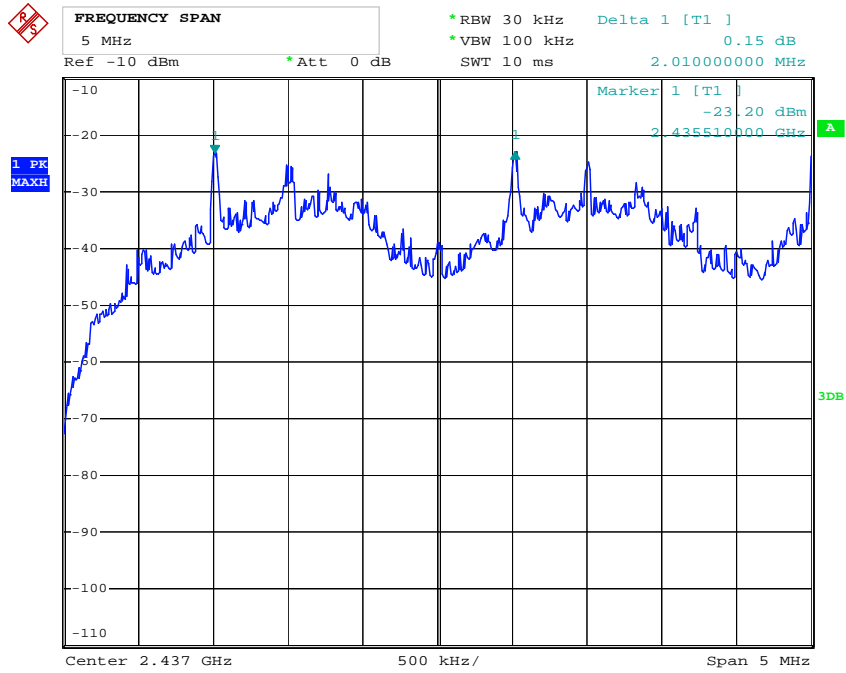
Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
Low	2411	3.012	1.427	Pass
Adjacent	2414			
Middle	2436	2.010	1.427	Pass
Adjacent	2438			
High	2458	3.000	1.427	Pass
Adjacent	2461			

Low Channel



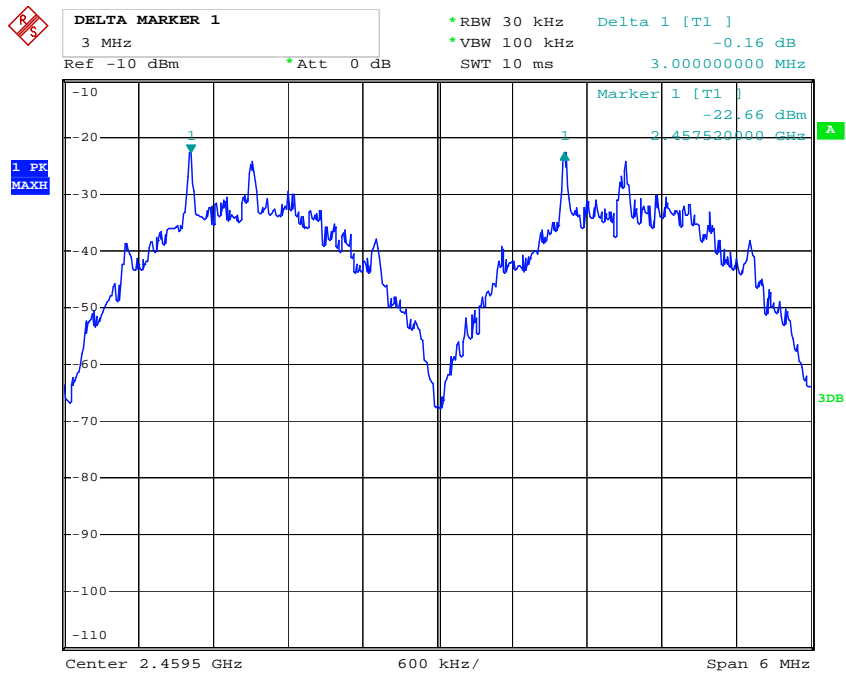
Date: 28.NOV.2013 16:11:58

Middle Channel



Date: 28.NOV.2013 16:22:10

High Channel



Date: 28.NOV.2013 16:15:34

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

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Data

Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	44 %
ATM Pressure:	101.9kPa

* The testing was performed by Allen Qiao on 2013-11-28.

Test Result: Compliance.

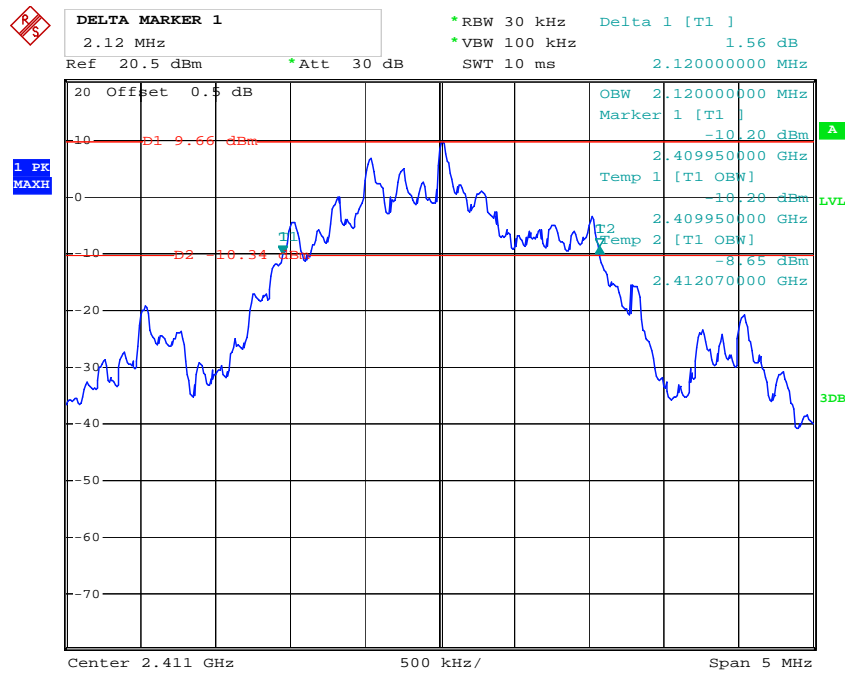
Please refer to following tables and plots

Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2411	2.12
Middle	2436	2.14
High	2461	2.13

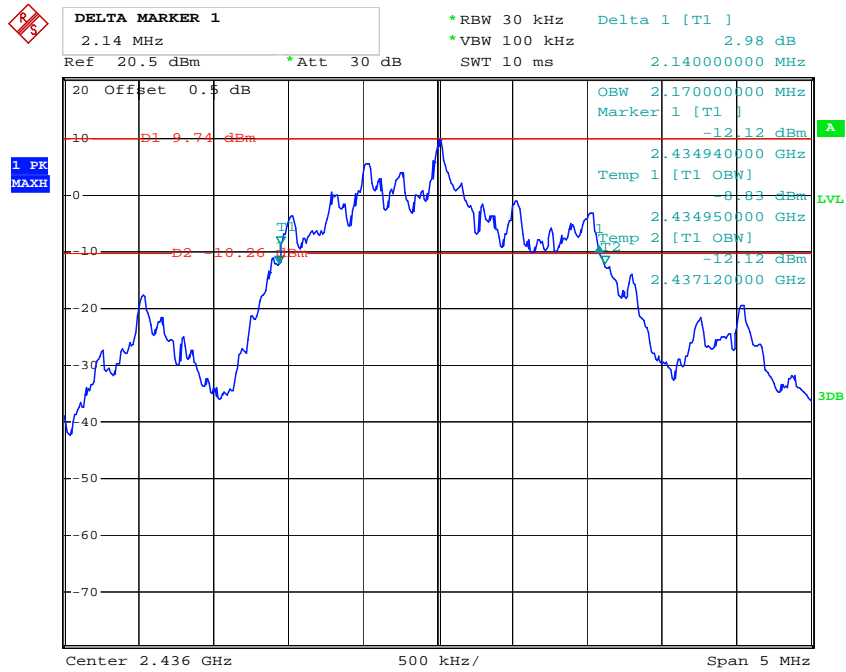
Please refer to the following plots.

Low Channel



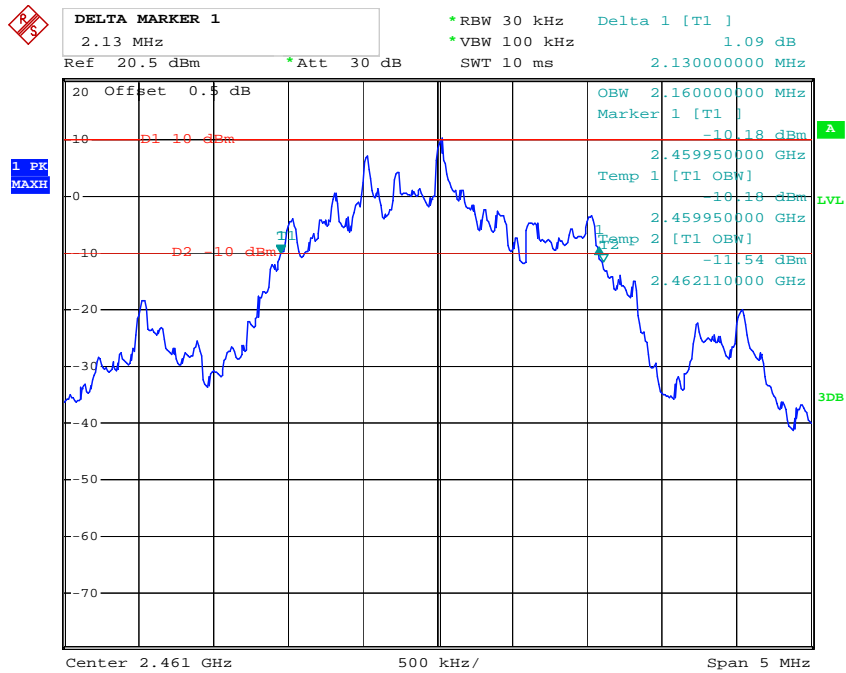
Date: 28.NOV.2013 15:30:14

Middle Channel



Date: 28.NOV.2013 15:31:18

High Channel



Date: 28.NOV.2013 15:29:01

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

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Data

Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	44 %
ATM Pressure:	101.9kPa

* *The testing was performed by Allen Qiao on 2013-11-28.*

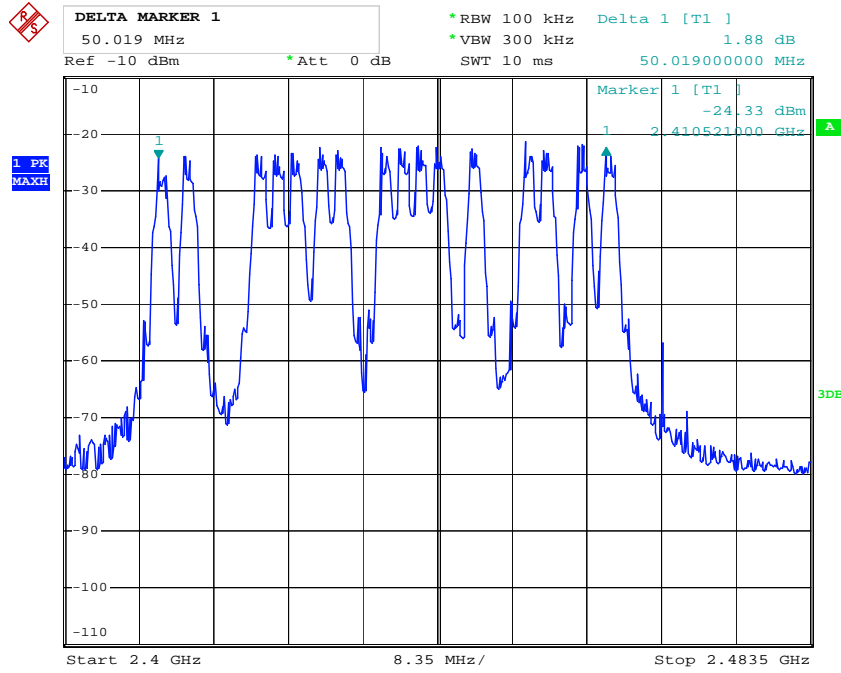
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	16	≥15

Number of Hopping Channels



Date: 28.NOV.2013 16:18:31

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)**Applicable Standard**

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

Test Procedure

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

Dwell Time= time slot length * hope rate/ number of hopping channels *hopping NO. * 0.4s

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Data**Environmental Conditions**

Temperature:	24.1 °C
Relative Humidity:	44 %
ATM Pressure:	101.9kPa

* The testing was performed by Allen Qiao on 2013-11-28.

Test Result: Compliance.

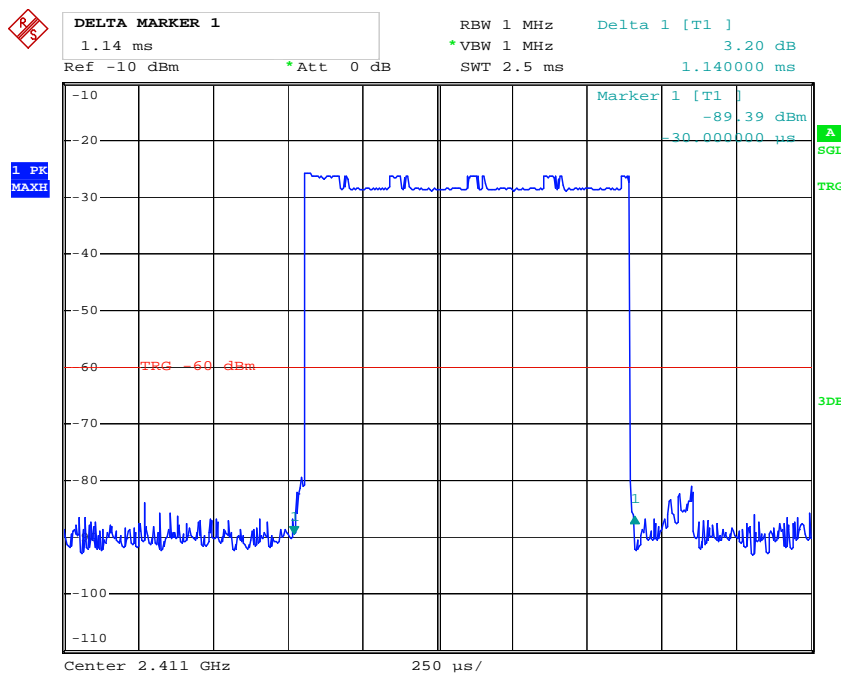
Please refer to following tables and plots

Test Mode: Transmitting

Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
Low	1.140	0.223	0.4	Pass
Middle	1.135	0.222	0.4	Pass
High	1.135	0.222	0.4	Pass
Dwell Time(s)= time slot length(s)* hopping rate /16*16* 0.4				

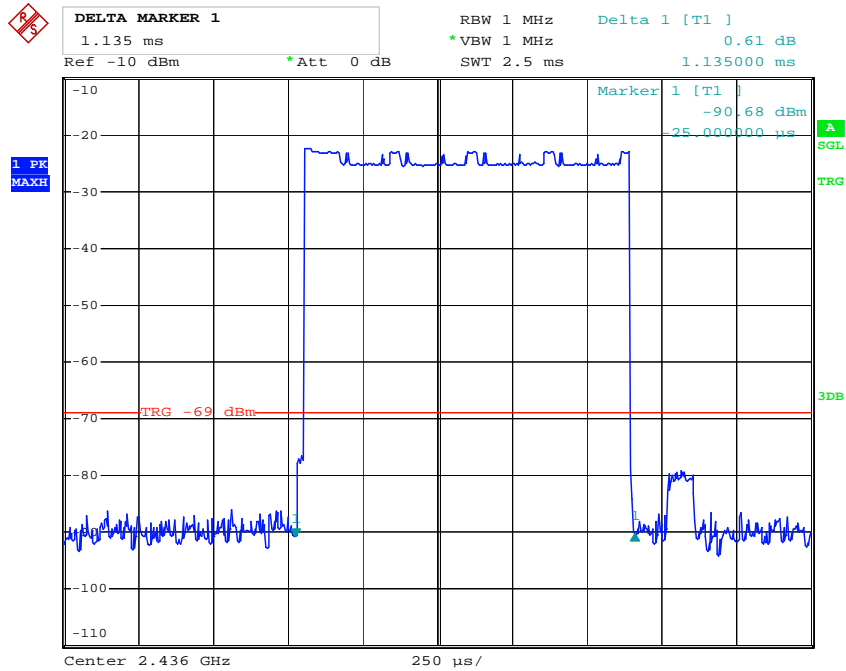
Note: the hopping rate is 488/s, which was declared by the manufacture.

Low Channel



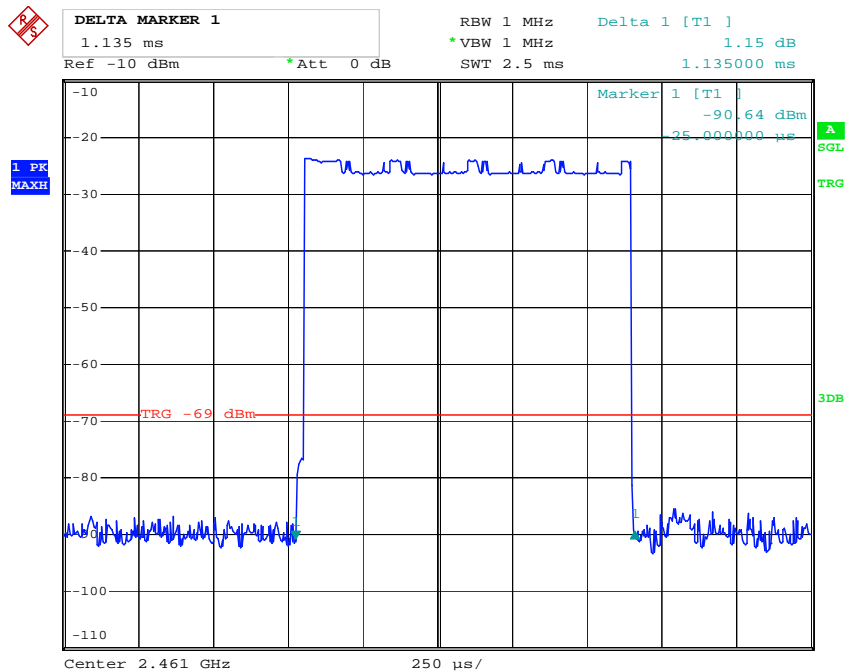
Date: 28.NOV.2013 16:27:21

Middle Channel



Date: 28.NOV.2013 16:28:04

High Channel



Date: 28.NOV.2013 16:28:21

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI test receiver.
3. Add a correction factor to the display.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Data

Environmental Conditions

Temperature:	23.8 °C
Relative Humidity:	42 %
ATM Pressure:	101.6 kPa

* The testing was performed by Allen Qiao on 2013-12-02.

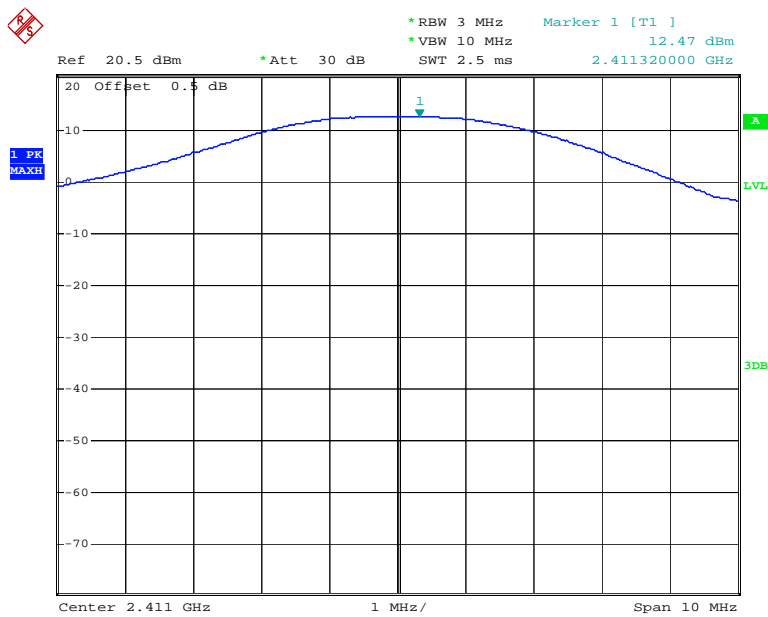
Test Result: Compliance.

Test Mode: Transmitting

Channel	Frequency (MHz)	Conducted Output power (dBm)	Limit (dBm)
Low	2411	12.47	21
Middle	2436	12.05	21
High	2461	11.83	21

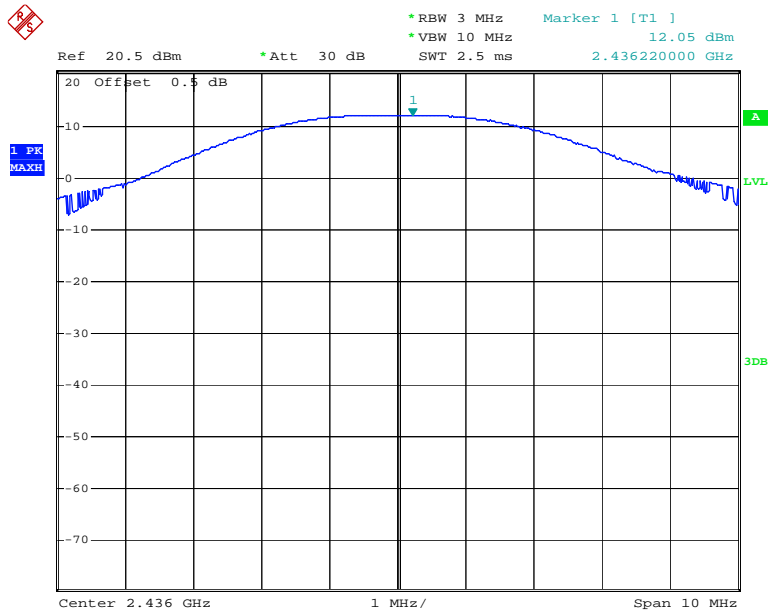
Note: The antenna gain was 0dBi.

Output Power, Low



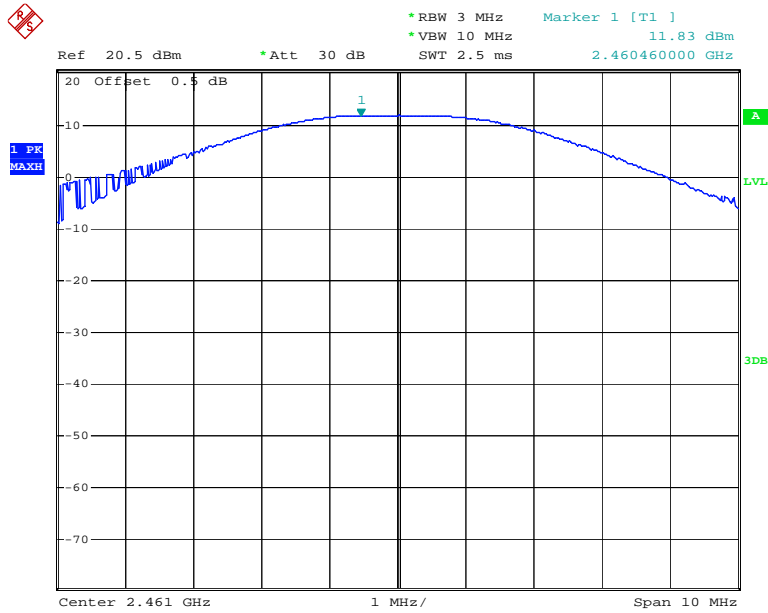
Date: 2.DEC.2013 09:52:14

Output Power, Middle



Date: 2.DEC.2013 09:52:35

Output Power, High



Date: 2.DEC.2013 09:53:11

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum analyzer	FSP 38	100478	2013-6-16	2014-6-15

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

Test Data

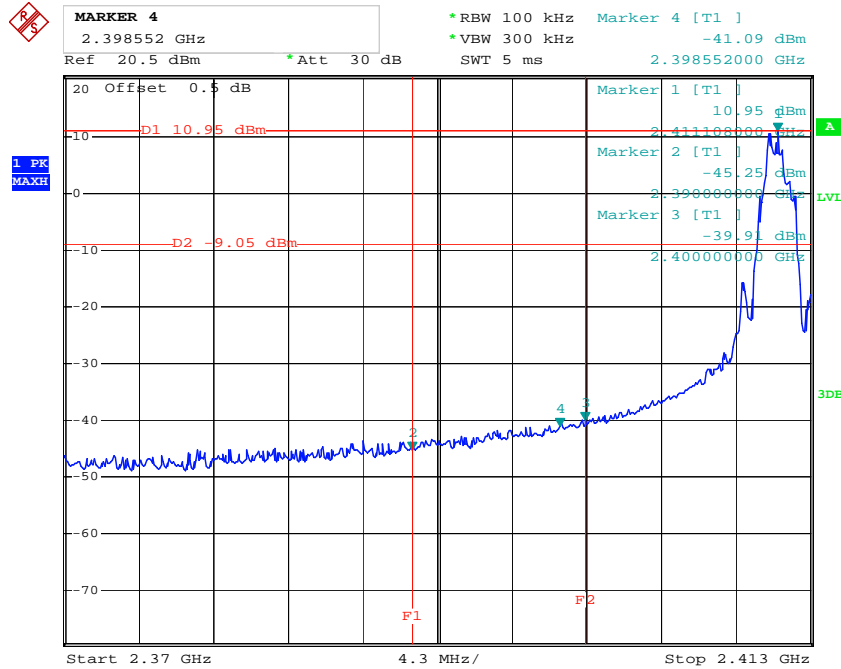
Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	44 %
ATM Pressure:	101.9kPa

* The testing was performed by Allen Qiao on 2013-11-28.

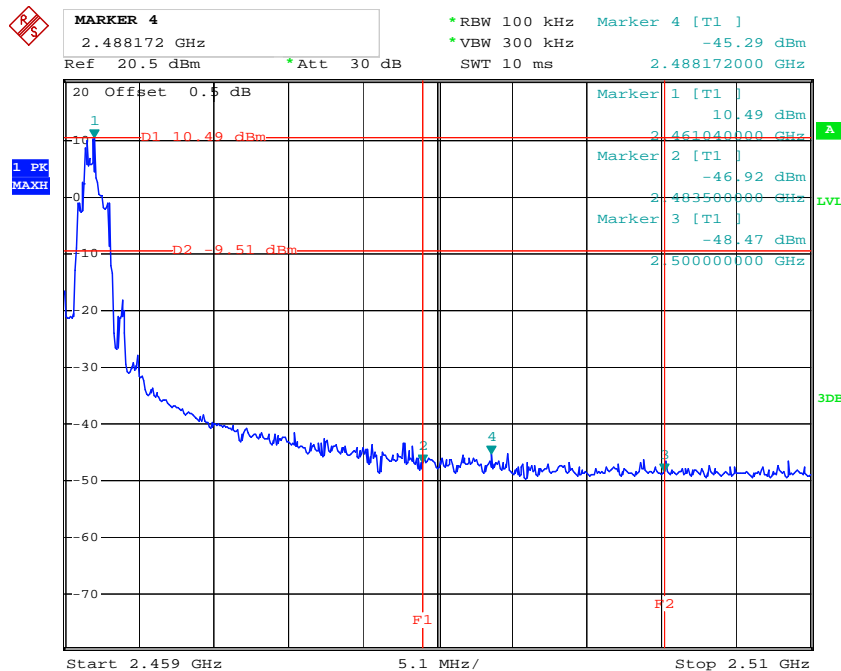
Test Result: Compliance

Band Edge, Left Side



Date: 28.NOV.2013 14:46:39

Band Edge, Right Side



Date: 28.NOV.2013 14:48:04

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