FCC PART 15.249

TEST REPORT

For

3Dconnexion

3/5 Avenue des Citronniers, 98000, Monaco

FCC ID: 2AAHQ-SMW

Report Type:	Product Type:
Original Report	SpaceMouse Wireless

Test Engineer:	Ares Liu
Report Number:	R2XM130719050-00A
Report Date:	2013-08-01
Reviewed By:	Ivan Cao RF Leader
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *3Dconnexion* 's product, model number: *SpaceMouse Wireless (FCC ID: 2AAHQ-SMW)* (the "EUT") in this report was a *SpaceMouse Wireless,* which was measured approximately: 7.8 cm (L) x 7.8 cm (W) x 5.2 cm (H), rated input voltage: DC 3.7 V from lithium battery or DC 5V from system.

* All measurement and test data in this report was gathered from production sample serial number: 130719050 (Assigned by BACL.Dongguan). The EUT was received on 2013-07-19.

Objective

This type approval report is prepared on behalf of *3Dconnexion* in accordance with Part 2-Subpart J, and 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 15.249 rules.

Related Submittal(s)/Grant(s)

FCC Part 15B JBP submissions with FCC ID: 2AAHQ-SMW.

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 radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan).

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal 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 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. 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

Justification

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

5 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2404	2	2425
3	2442	4	2463
5	2477	/	/

EUT was tested with Channel 2404MHz, 2442MHz and 2477MHz

EUT Exercise Software

The software "usbhidioc" was used, which was provided by the manufacturer.

Equipment Modifications

No modifications were made to the unit tested.

Block Diagram of Test Setup

EUT

Non-Conductive Table 80
cm above Ground Plane

1.0 Meter

1.5 Meter
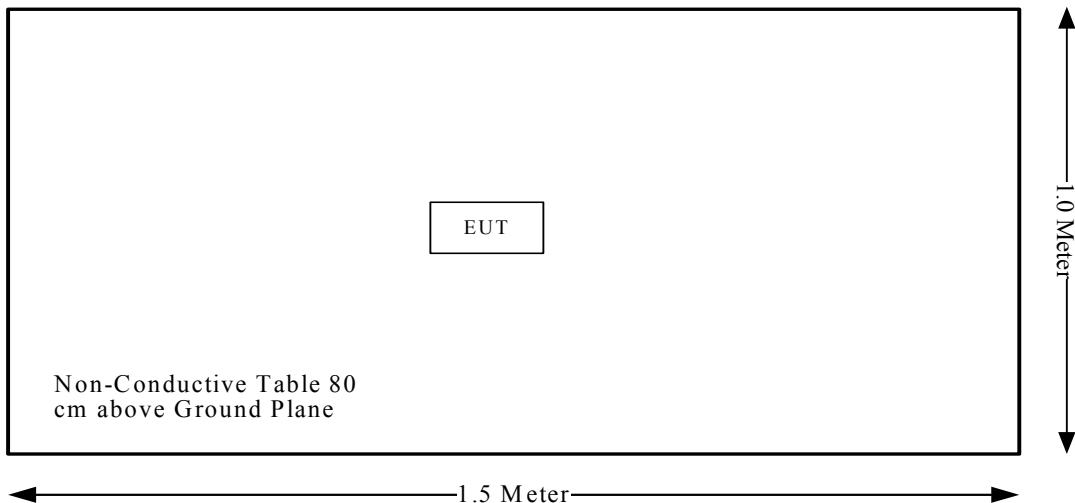
SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	not applicable*
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance
§15.249(d)	Outside of Band Emission (50dB attenuation)	Compliance

not applicable*: the EUT was power by battery at wireless mode.

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Antenna Connector Construction

The EUT has an internal Printed antenna permanently soldering on the printed circuit board, which complied with 15.203, the maximum gain was 0 dBi. Please refer to the internal photos.

Result: Compliant.

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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 1 GHz:
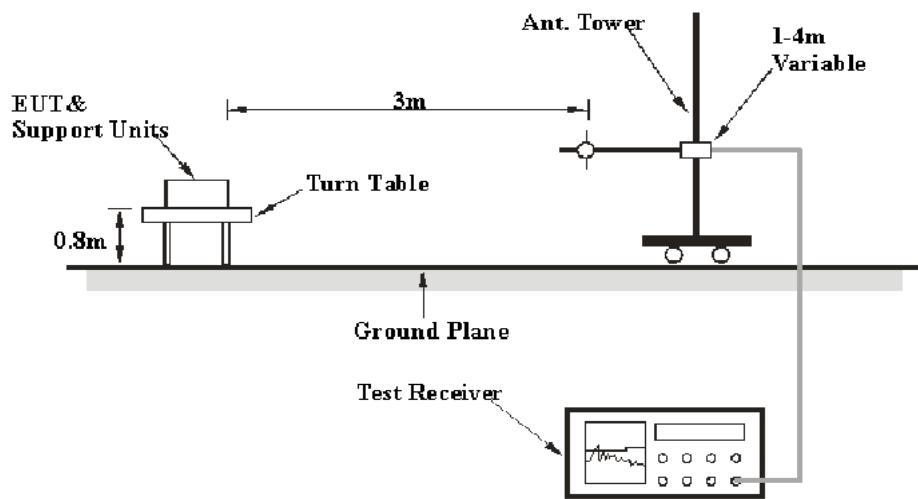
Above 1 GHz:
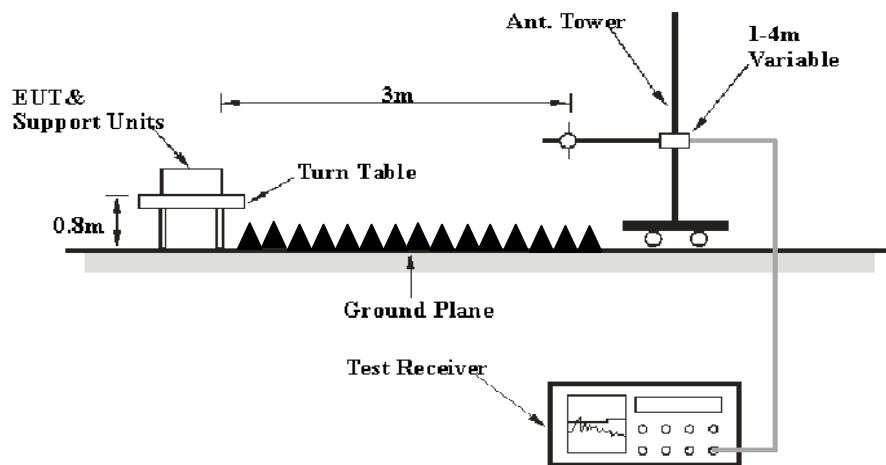
The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment 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
	1MHz	10 Hz	/	Ave.

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode 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:

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

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

Margin = Limit –Extrapolation result

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 30	849016/001	2012-9-4	2013-9-3
ETS LINDGREN	horn antenna	3115	000 527 35	2012-9-6	2015-9-5
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	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 data in the following table, the EUT complied with the <u>FCC Part 15.209 &15.205 & 15.249</u>, with the worst margin reading of:

8.63 dB at **2483.5 MHz** in the **Vertical** polarization

Test Data

Environmental Conditions

Temperature:	25.3 ℃
Relative Humidity:	59 %
ATM Pressure:	100.1 kPa

The testing was performed by Ares Liu on 2013-07-30.

Test Mode: Transmitting

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(1/m))					
frequency: 2404MHz									
2404	53.71	PK	H	25.65	3.91	0.00	83.27	114.00	30.73
2404	51.96	AV	H	25.65	3.91	0.00	81.52	94.00	12.48
2404	57.11	PK	V	25.65	3.91	0.00	86.67	114.00	27.33
2404	52.9	AV	V	25.65	3.91	0.00	82.46	94.00	11.54
2400	29.65	PK	V	25.61	3.84	0.00	59.10	74.00	14.90
2400	15.6	AV	V	25.61	3.84	0.00	45.05	54.00	8.95
4808	31.93	PK	V	30.60	4.68	27.26	39.95	74.00	34.05
4808	20.23	AV	V	30.60	4.68	27.26	28.25	54.00	25.75
7212	30.44	PK	V	34.11	6.51	26.31	44.75	74.00	29.25
7212	16.16	AV	V	34.11	6.51	26.31	30.47	54.00	23.53
9616	30.6	PK	V	35.98	8.74	26.19	49.13	74.00	24.87
9616	16.98	AV	V	35.98	8.74	26.19	35.51	54.00	18.49
3748.1	30.69	PK	V	29.35	4.66	27.44	37.26	74.00	36.74
3748.1	17.06	AV	V	29.35	4.66	27.44	23.63	54.00	30.37
402.2	28.42	QP	V	16.26	2.43	21.78	25.33	46.00	20.67
frequency: 2442MHz									
2442	53.61	PK	H	25.75	3.99	0.00	83.35	114.00	30.65
2442	52.16	AV	H	25.75	3.99	0.00	81.90	94.00	12.10
2442	56.94	PK	V	25.75	3.99	0.00	86.68	114.00	27.32
2442	53.03	AV	V	25.75	3.99	0.00	82.77	94.00	11.23
4884	29.69	PK	V	30.80	4.75	27.26	37.98	74.00	36.02
4884	15.59	AV	V	30.80	4.75	27.26	23.88	54.00	30.12
7326	32.17	PK	V	34.38	6.73	26.54	46.74	74.00	27.26
7326	20.21	AV	V	34.38	6.73	26.54	34.78	54.00	19.22
9768	30.22	PK	V	36.34	8.58	25.60	49.54	74.00	24.46
9768	15.9	AV	V	36.34	8.58	25.60	35.22	54.00	18.78
2215	30.7	PK	V	25.16	3.52	27.25	32.13	74.00	41.87
2215	16.77	AV	V	25.16	3.52	27.25	18.20	54.00	35.80
3748	30.62	PK	V	29.35	4.66	27.44	37.19	74.00	36.81
3748	17.14	AV	V	29.35	4.66	27.44	23.71	54.00	30.29
402	27.94	QP	V	16.25	2.43	21.78	24.84	46.00	21.16
frequency: 2477MHz									
2477	53.67	PK	H	25.84	3.84	0.00	83.35	114.00	30.65
2477	52.1	AV	H	25.84	3.84	0.00	81.78	94.00	12.22
2477	57.17	PK	V	25.84	3.84	0.00	86.85	114.00	27.15
2477	53.12	AV	V	25.84	3.84	0.00	82.80	94.00	11.20
2483.5	29.66	PK	V	25.86	3.80	0.00	59.32	74.00	14.68
2483.5	15.71	AV	V	25.86	3.80	0.00	45.37	54.00	8.63
4954	32.15	PK	V	30.98	4.69	27.27	40.55	74.00	33.45
4954	20.36	AV	V	30.98	4.69	27.27	28.76	54.00	25.24
7431	30.43	PK	V	34.63	6.93	26.59	45.40	74.00	28.60
7431	16.2	AV	V	34.63	6.93	26.59	31.17	54.00	22.83
9908	30.76	PK	V	36.68	8.43	25.50	50.37	74.00	23.63
9908	16.9	AV	V	36.68	8.43	25.50	36.51	54.00	17.49
3748	30.81	PK	V	29.35	4.66	27.44	37.38	74.00	36.62
3748	17.3	AV	V	29.35	4.66	27.44	23.87	54.00	30.13
402.1	28.31	QP	V	16.26	2.43	21.78	25.22	46.00	20.78

FCC §15.215(c)– 20 dB BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

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:	28.1 °C
Relative Humidity:	56 %
ATM Pressure:	100 kPa

** The testing was performed by Ares Liu on 2013-07-31.*

Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2404	2.36
Middle	2442	1.84
High	2477	0.94

Please refer to the following plots.

Low Channel
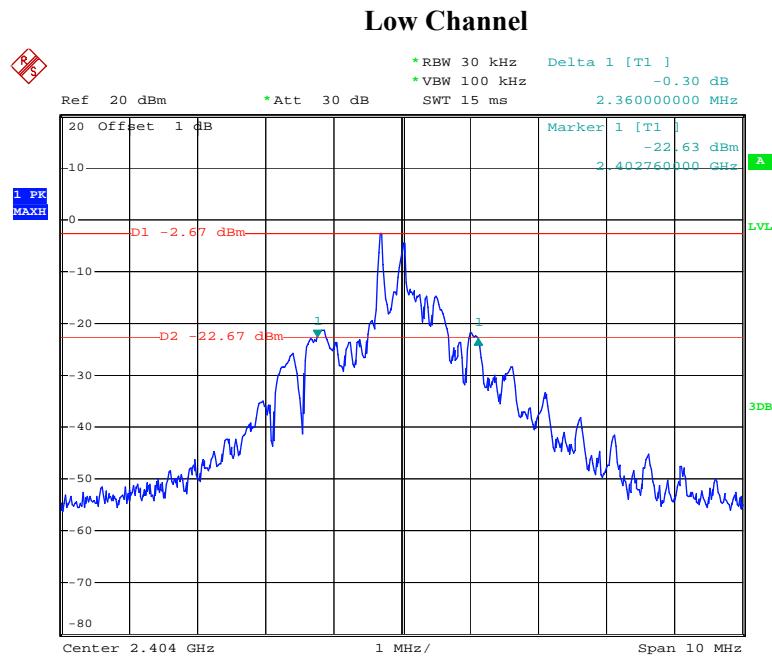
Date: 31.JUL.2013 10:06:22

Middle Channel
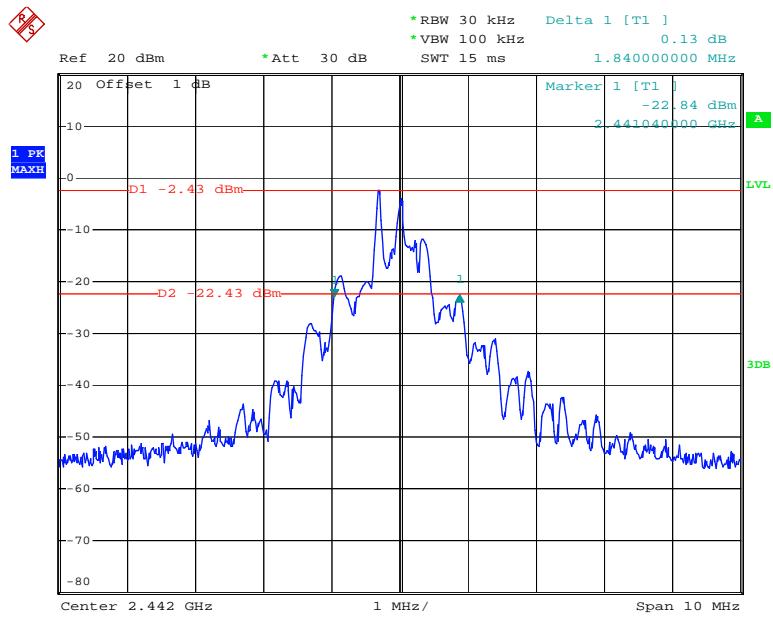
Date: 31.JUL.2013 10:10:53

High Channel
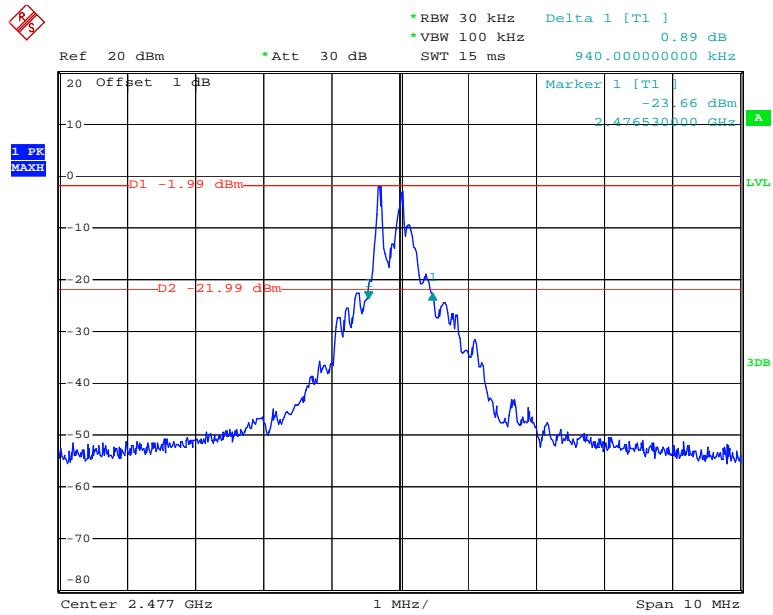
Date: 31.JUL.2013 10:15:46

FCC§15.249(d) - OUT OF BAND EMISSION (50dB ATTENUATION)

Applicable Standard

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

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. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	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:	28.1 °C
Relative Humidity:	56 %
ATM Pressure:	100 kPa

* The testing was performed by Ares Liu on 2013-07-31.

Test Result: Compliance.

Please refer to the following table and plots:

| Frequency (MHz)	Delta Peak to Band Emission (dBc)
2400	44.01(note)
2483.5	48.90(note)

note：the delta peak to band emission compliance with 15.209 in the radiation test.

Band Edge, Left Side
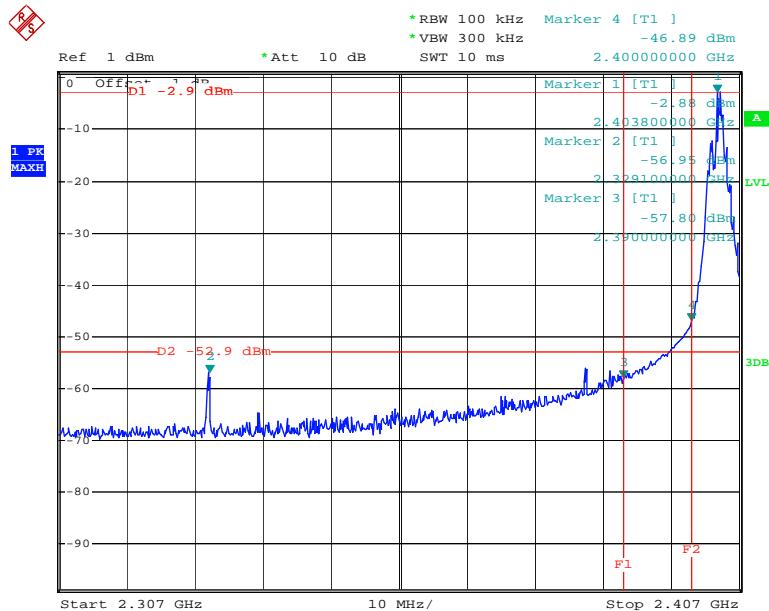
Date: 31.JUL.2013 10:42:19

Band Edge, Right Side


```
                                         *RBW 100 kHz   Marker 4 [T1 ]
                                         *VBW 300 kHz           -52.44 dBm
         Ref  1 dBm            *Att  10 dB   SWT 10 ms       2.504175000 GHz

          Off1 -2.39 dBm                        Marker 1 [T1 ]
                                                              -2.36 dBm
                                                       2.476650000 GHz
                                              Marker 2 [T1 ]
                                                             -51.26 dBm
                                                       2.483500000 GHz
                                              Marker 3 [T1 ]
                                                             -61.26 dBm
                                                       2.500000000 GHz

              D2 -52.39 dBm

           F1              F2
         Start 2.475 GHz          7.5 MHz/           Stop 2.55 GHz
```
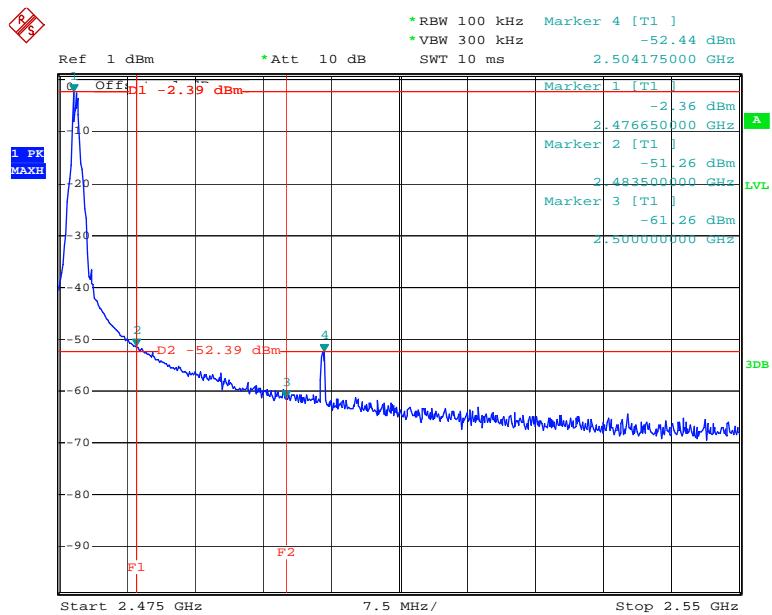
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