FCC PART 15.247

TEST REPORT

For

ATMEL NORWAY AS

VESTRE ROSTEN 79, 7075 TILLER, TRONDHEIM, NORWAY

FCC ID: VW4A091982

Report Type:	Product Type:
Original Report	ATREB215-XPRO

Test Engineer:	Dean Liu
Report Number:	RSZ141215008-00A
Report Date:	2015-02-11
Reviewed By:	Sula Huang RF Engineer
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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1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *ATMEL NORWAY AS*'s product, model number: *A09-1982 (FCC ID: VW4A091982) or* ("EUT") in this report is a *ATREB215-XPRO,* which was measured approximately: 7.15 cm (L) x3.0 cm (W) x 1.0 cm (H), rated input voltage: DC3.3V from system.

** All measurement and test data in this report was gathered from production sample serial number: 1800000151 (Assigned by applicant). The EUT was received on 2014-12-17.*

1.2 Objective

This report is prepared on behalf of *ATMEL NORWAY AS* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

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

1.3 Related Submittal(s)/Grant(s)

FCC Part 15C DXX submissions with FCC ID: VW4A091982

1.4 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).

1.5 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.

2 SYSTEM TEST CONFIGURATION

2.1 Description of Test Configuration

The system was configured for testing in testing mode, which was provided by manufacturer.
For O-QPSK mode, 16 channels are provided to testing:
(Note: The channel separation is 5.0MHz.)

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

EUT was tested with Channel 2405MHz, 2440MHz and 2480MHz.
For OFDM Option1 mode, 64 channels are provided to testing:
(Note: The channel separation is 1.2 MHz.)

Channel	Frequency (MHz)
0	2401.2
.	.
.	.
31	2438.4
.	.
.	.
63	2476.8

EUT was tested with Channel 2401.2MHz, 2438.4MHz and 2476.8MHz.
For OFDM Option2 mode, 97 channels are provided to testing:
(Note: The channel separation is 552 kHz.)

Channel	Frequency (MHz)
0	2400.8
.	.
.	.
47	2438.4
.	.
.	.
96	2477.6

EUT was tested with Channel 2400.8MHz, 2438.4MHz and 2477.6 MHz.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

2.2 Equipment Modifications

No modification was made to the EUT tested.

2.3 EUT Exercise Software

The software "Atmel Studio 6.2" was used for testing, which was provided by manufacturer. The worst condition (maximum power with 100% duty cycle) was setting by the software as following table:

Test Software Version	Atmel Studio 6.2		
O-QPSK(11-26) 16 channels(11,18,26)	2405MHz	2440 MHz	2480 MHz
OFDM option1 (0-63) 64 channels(0,31,63)	2401.2 MHz	2438.4 MHz	2476.8 MHz
OFDM option2(0-96) 97 channels(0.47,96)	2400.8 MHz	2438.4 MHz	2477.6 MHz

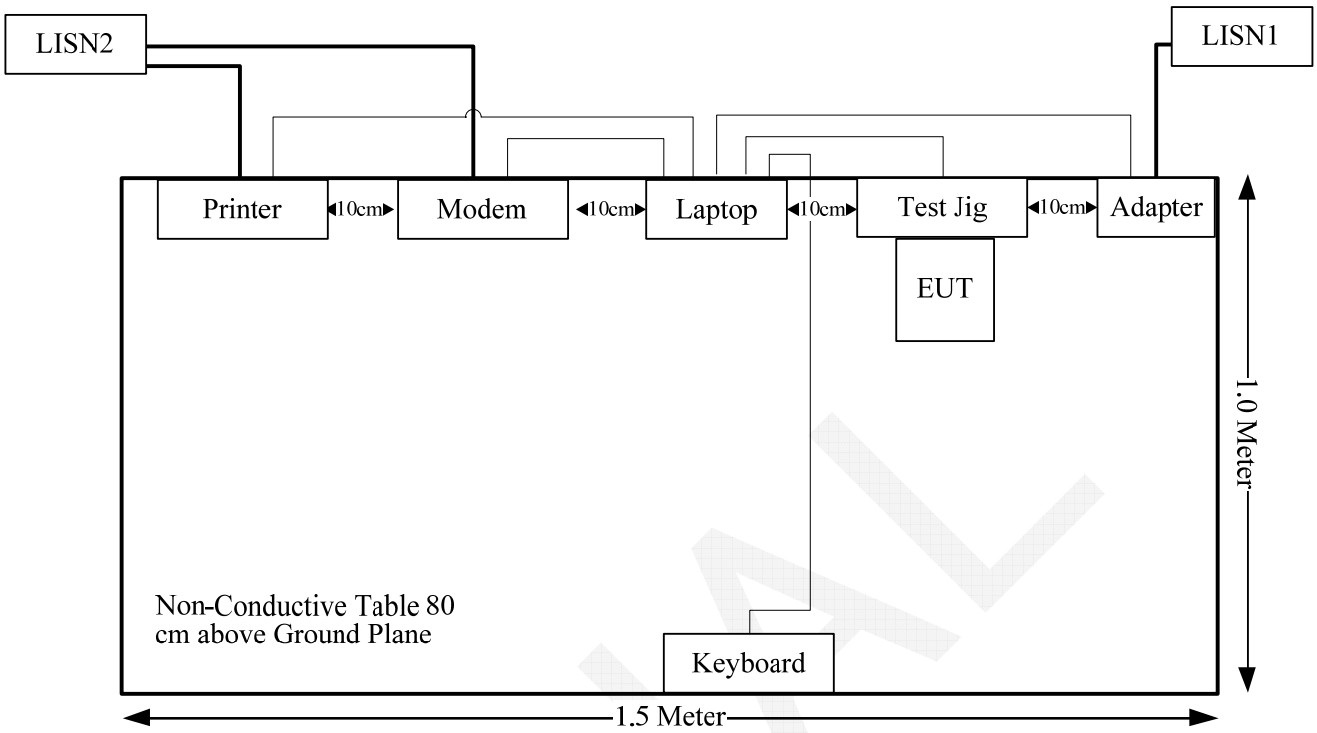
2.4 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017
HP	Printer	C3941A	JPTVOB2337
DELL	Keyboard	L100	CNORH656658907BL05DC
SAST	Modem	AEM-2100	0293
Atmel Corp	SAM4L-XplainedPro Board	A09-1783/02	0200005445

2.5 External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Serial Cable	yes	No	1.2	Serial Port of Laptop	Modem
Parallel Cable	yes	No	1.2	Parallel Port of Laptop	Printer
Keyboard Cable	yes	No	1.8	USB Port of Laptop	Keyboard
USB Cable	No	No	1.2	USB Port of Laptop	Test Jig

2.6 Block Diagram of Test Setup



3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum conducted output power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

2. FCC §15.247 (I) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

3.1 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/f²)	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/cm^2);
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:

Mode	**Frequency (MHz)**	**Antenna Gain**		**Conducted Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
		(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
O-QPSK	2440	0	1.0	11.89	15.45	20	0.0031	1.0
OFDM Option1	2438.4	0	1.0	12.22	16.67	20	0.0033	1.0
OFDM Option2	2438.4	0	1.0	12.16	16.44	20	0.0033	1.0

Result: The device meet FCC MPE at 20 cm distance

4 FCC §15.203 - ANTENNA REQUIREMENT

4.1 Applicable Standard

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 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.

4.2 Antenna Connector Construction

The EUT used one 2.4GHz rubber stubby antenna with RP-SMA female straight arrangement and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

5 FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

5.1 Applicable Standard

FCC§15.207

5.2 Measurement Uncertainty

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

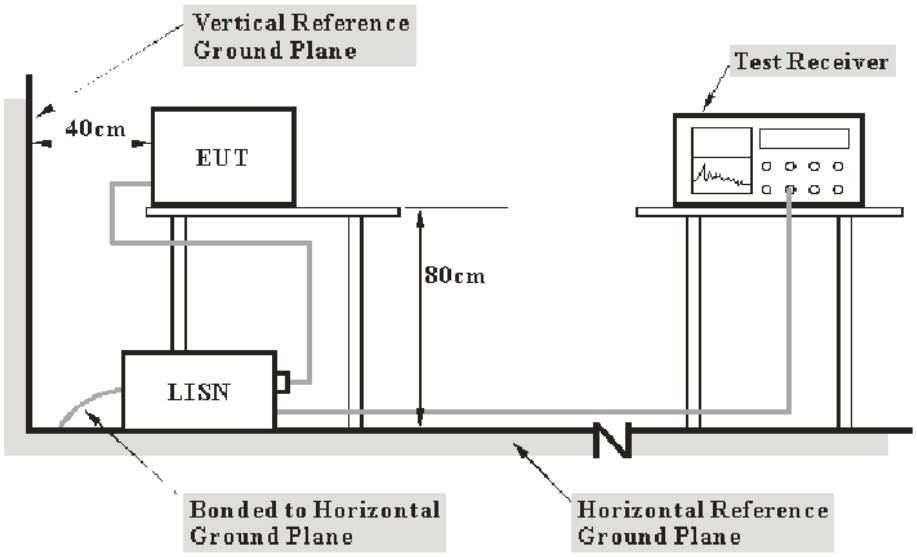
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
– non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of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

5.3 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 adapter of laptop was connected to a 120 VAC/60 Hz power source

5.4 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

5.5 Test Procedure

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

5.6 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

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

Margin = Limit – Corrected Amplitude

5.7 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2014-10-16	2015-10-16
R&S	L.I.S.N	ESH3-Z5	843331/015	N/A	N/A
R&S	Two-line V-network	ENV 216	3560.6550.12	2014-12-11	2015-12-11
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

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

5.8 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:

13.70 dB at **1.269154 MHz** in the **Line** conducted mode

5.9 Test Data

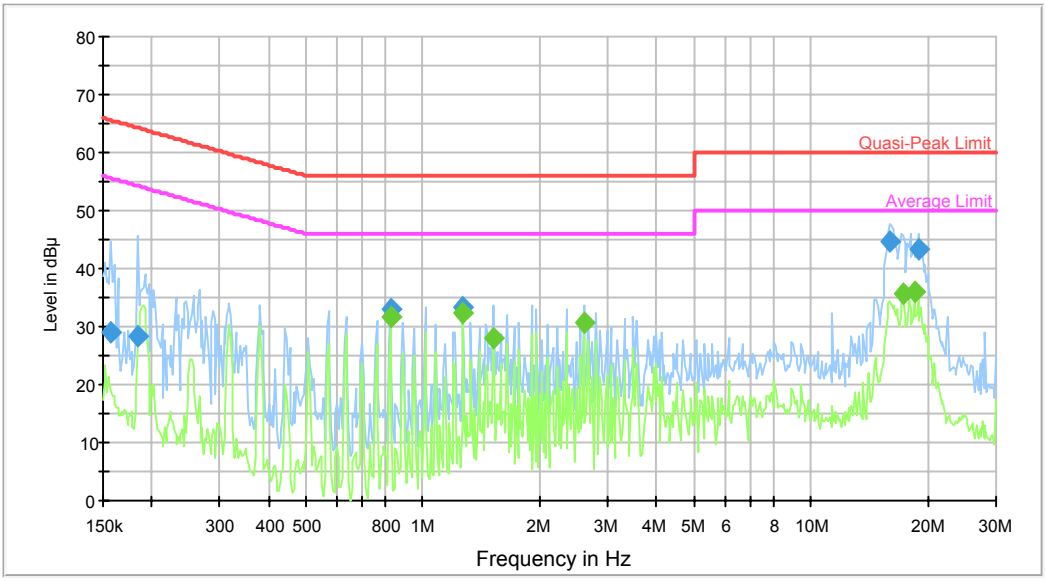
Environmental Conditions

Temperature:	21.5 °C
Relative Humidity:	56 %
ATM Pressure:	101.9 kPa

The testing was performed by Dean Liu on 2014-12-19.

Test Mode: Transmitting

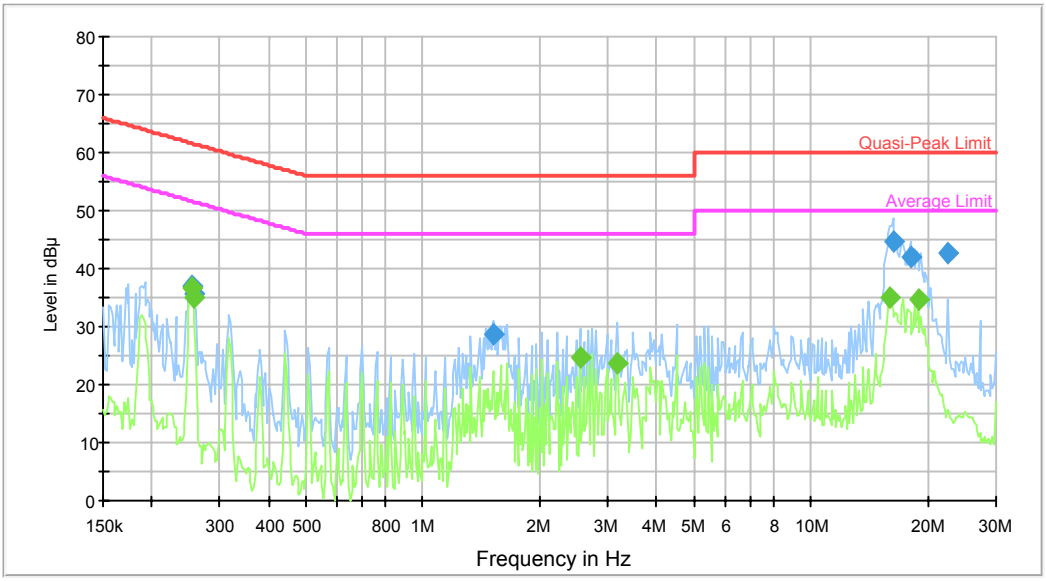
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.157346	29.1	9.000	L1	10.1	36.5	65.6	Compliance
0.184529	28.3	9.000	L1	10.5	36.0	64.3	Compliance
0.825364	33.0	9.000	L1	10.5	23.0	56.0	Compliance
1.269154	33.4	9.000	L1	10.4	22.6	56.0	Compliance
15.994231	44.6	9.000	L1	10.6	15.4	60.0	Compliance
18.907519	43.2	9.000	L1	11.0	16.8	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.825364	31.5	9.000	L1	10.5	14.5	46.0	Compliance
1.269154	32.3	9.000	L1	10.4	13.7	46.0	Compliance
1.524426	28.0	9.000	L1	10.4	18.0	46.0	Compliance
2.599932	30.8	9.000	L1	10.5	15.2	46.0	Compliance
17.320829	35.7	9.000	L1	10.7	14.3	50.0	Compliance
18.460903	36.0	9.000	L1	10.9	14.0	50.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.253797	37.0	9.000	N	11.2	24.6	61.6	Compliance
0.255827	35.8	9.000	N	11.2	25.7	61.6	Compliance
1.524426	28.7	9.000	N	10.5	27.3	56.0	Compliance
16.251162	44.6	9.000	N	10.6	15.4	60.0	Compliance
18.024837	42.0	9.000	N	10.9	18.0	60.0	Compliance
22.530262	42.8	9.000	N	10.9	17.2	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.253797	36.5	9.000	N	11.2	15.1	51.6	Compliance
0.255827	35.0	9.000	N	11.2	16.6	51.6	Compliance
2.538519	24.5	9.000	N	10.5	21.5	46.0	Compliance
3.173039	23.7	9.000	N	10.7	22.3	46.0	Compliance
15.994231	35.1	9.000	N	10.6	15.0	50.0	Compliance
18.907519	34.6	9.000	N	11.0	15.4	50.0	Compliance

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

6.1 Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

6.2 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 2, 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 2, 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.

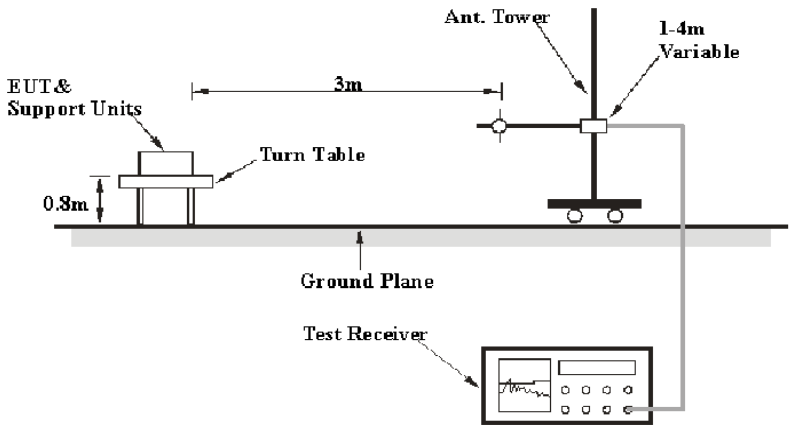
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:
30M~200MHz: 5.0 dB
200M~1GHz: 6.2 dB
1G~6GHz: 4.45 dB
6G~18GHz: 5.23 dB

Table 2 – Values of U_{cispr}

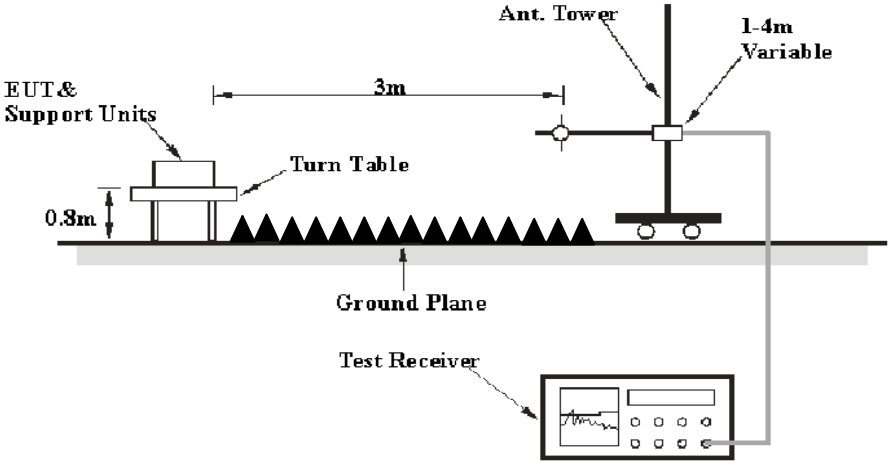
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

6.3 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 C63.4-2003. 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.

The spacing between the peripherals was 10 cm.

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

6.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

6.5 Test Procedure

During the radiated emission test, the adapter of laptop was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

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

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

6.6 Corrected Amplitude & Margin Calculation

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

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

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

Margin = Limit –Corrected Amplitude

6.7 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2014-05-09	2015-05-09
Sunol Sciences	Antenna	JB3	A060611-3	2014-07-28	2017-07-27
HP	Amplifier	8447E	2434A02181	2014-09-01	2015-09-01
R&S	Spectrum Analyzer	FSEM	DE31388	2014-05-09	2015-05-09
ETS-Lindgren	Horn Antenna	3115	000 527 35	2012-09-06	2015-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2014-02-19	2015-02-19
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2014-09-06	2015-09-06

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

6.8 Test Results Summary

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

2.06 dB at **4880 MHz** in the **Vertical** polarization for O-QPSK

6.9 Test Data

Environmental Conditions

Temperature:	19.6°C
Relative Humidity:	51 %
ATM Pressure:	101.5 kPa

The testing was performed by Dean Liu on 2014-12-25 and 2015-02-11.

Test Mode: Transmitting

O-QPSK mode:

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: 2405 MHz									
2405	74.68	PK	H	25.65	4.42	0	104.75	N/A	N/A
2405	72.45	AV	H	25.65	4.42	0	102.52	N/A	N/A
2405	72.87	PK	V	25.65	4.42	0	102.94	N/A	N/A
2405	70.70	AV	V	25.65	4.42	0	100.77	N/A	N/A
2390	12.09	PK	H	25.61	4.39	0	42.09	74.00	31.91
2390	4.34	AV	H	25.61	4.39	0	34.34	54.00	19.66
4810	46.26	PK	H	30.61	5.99	27.41	55.45	74.00	18.55
4810	40.03	AV	H	30.61	5.99	27.41	49.22	54.00	4.78
7215	31.56	PK	H	34.12	7.46	25.91	47.23	74.00	26.77
7215	18.97	AV	H	34.12	7.46	25.91	34.64	54.00	19.36
9620	30.5	PK	H	35.99	8.80	27.53	47.76	74.00	26.24
9620	17.23	AV	H	35.99	8.80	27.53	34.49	54.00	19.51
3194	41.61	PK	H	27.82	6.73	27.37	48.79	74.00	25.21
3194	25.64	AV	H	27.82	6.73	27.37	32.82	54.00	21.18
54.55	33.97	QP	H	7.67	0.95	21.41	21.18	40.00	18.82
121.98	32.57	QP	V	14.22	1.36	21.41	26.74	43.50	16.76
Middle Channel: 2440 MHz									
2440	73.65	PK	H	25.74	4.4	0	103.79	N/A	N/A
2440	71.43	AV	H	25.74	4.4	0	101.57	N/A	N/A
2440	74.55	PK	V	25.74	4.4	0	104.69	N/A	N/A
2440	72.00	AV	V	25.74	4.4	0	102.14	N/A	N/A
4880	49.20	PK	V	30.79	6.08	27.42	58.65	74.00	15.35
4880	42.49	AV	V	30.79	6.08	27.42	51.94	54.00	2.06*
7320	32.35	PK	H	34.37	7.51	25.88	48.35	74.00	25.65
7320	19.47	AV	H	34.37	7.51	25.88	35.47	54.00	18.53
9760	30.42	PK	H	36.32	8.83	27.21	48.36	74.00	25.64
9760	17.30	AV	H	36.32	8.83	27.21	35.24	54.00	18.76
3192	41.55	PK	H	27.81	6.77	27.38	48.75	74.00	25.25
3192	25.38	AV	H	27.81	6.77	27.38	32.58	54.00	21.42
2981	37.75	PK	H	27.15	7.23	27.53	44.60	74.00	29.40
2981	22.56	AV	H	27.15	7.23	27.53	29.41	54.00	24.59
54.17	34.02	QP	H	7.71	0.96	21.41	21.28	40.00	18.72
121.58	32.94	QP	V	14.20	1.36	21.41	27.09	43.50	16.41
High Channel: 2480 MHz									
2480	73.02	PK	H	25.85	4.48	0	103.35	N/A	N/A
2480	70.77	AV	H	25.85	4.48	0	101.1	N/A	N/A
2480	73.43	PK	V	25.85	4.48	0	103.76	N/A	N/A
2480	71.04	AV	V	25.85	4.48	0	101.37	N/A	N/A
2483.5	28.71	PK	V	25.86	4.49	0	59.06	74.00	14.94
2483.5	20.34	AV	V	25.86	4.49	0	50.69	54.00	3.31
4960	47.42	PK	V	31.00	5.90	27.43	56.89	74.00	17.11
4960	40.78	AV	V	31.00	5.90	27.43	50.25	54.00	3.75*
7440	32.78	PK	H	34.66	7.58	25.97	49.05	74.00	24.95
7440	20.13	AV	H	34.66	7.58	25.97	36.40	54.00	17.60
9920	30.17	PK	H	36.71	8.87	26.66	49.09	74.00	24.91
9920	17.11	AV	H	36.71	8.87	26.66	36.03	54.00	17.97
3194	39.11	PK	H	27.82	6.73	27.37	46.29	74.00	27.71
3194	25.36	AV	H	27.82	6.73	27.37	32.54	54.00	21.46
54.46	34.02	QP	H	7.68	0.96	21.41	21.25	40.00	18.75
122.54	32.94	QP	V	14.24	1.36	21.41	27.13	43.50	16.37

*Within measurement uncertainty!

OFDM OPTION1:

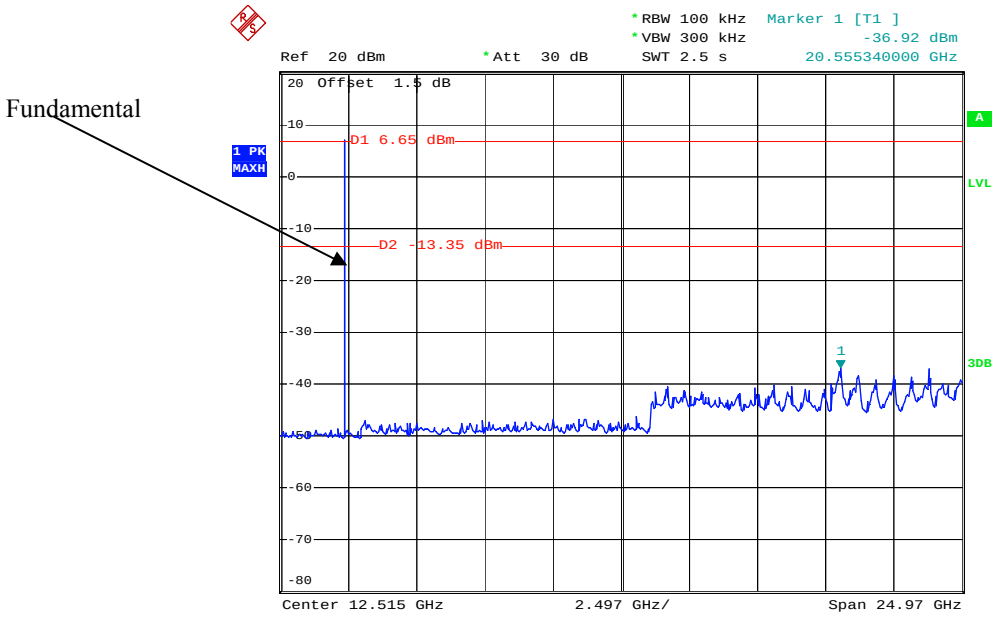
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)					
Low Channel: 2401.2 MHz									
2401.2	74.97	PK	H	25.64	4.42	0.00	105.03	N/A	N/A
2401.2	68.01	AV	H	25.64	4.42	0.00	98.07	N/A	N/A
2401.2	74.14	PK	V	25.64	4.42	0.00	104.20	N/A	N/A
2401.2	67.24	AV	V	25.64	4.42	0.00	97.30	N/A	N/A
2390	32.04	PK	H	25.61	4.39	0.00	62.04	74.00	11.96
2390	18.24	AV	H	25.61	4.39	0.00	48.24	54.00	5.76
4802.4	35.4	PK	H	30.59	5.98	27.41	44.56	74.00	29.44
4802.4	23.47	AV	H	30.59	5.98	27.41	32.63	54.00	21.37
7203.6	29.88	PK	H	34.09	7.45	25.91	45.51	74.00	28.49
7203.6	17.12	AV	H	34.09	7.45	25.91	32.75	54.00	21.25
9604.8	30.5	PK	H	35.95	8.80	27.56	47.69	74.00	26.31
9604.8	17.23	AV	H	35.95	8.80	27.56	34.42	54.00	19.58
2945	30.24	PK	H	27.06	6.87	27.54	36.63	74.00	37.37
2945	17.23	AV	H	27.06	6.87	27.54	23.62	54.00	30.38
54.32	33.87	QP	H	7.69	0.96	21.41	21.11	40.00	18.89
121.47	33.24	QP	V	14.19	1.36	21.41	27.38	43.50	16.12
Middle Channel: 2438.4 MHz									
2438.4	74.9	PK	H	25.74	4.40	0.00	105.04	N/A	N/A
2438.4	67.36	AV	H	25.74	4.40	0.00	97.50	N/A	N/A
2438.4	74.12	PK	V	25.74	4.40	0.00	104.26	N/A	N/A
2438.4	67.23	AV	V	25.74	4.40	0.00	97.37	N/A	N/A
4876.8	36.37	PK	H	30.78	6.08	27.42	45.81	74.00	28.19
4876.8	24.46	AV	H	30.78	6.08	27.42	33.90	54.00	20.10
7315.2	29.87	PK	H	34.36	7.51	25.88	45.86	74.00	28.14
7315.2	17.07	AV	H	34.36	7.51	25.88	33.06	54.00	20.94
9753.6	30.42	PK	H	36.31	8.83	27.22	48.34	74.00	25.66
9753.6	17.3	AV	H	36.31	8.83	27.22	35.22	54.00	18.78
2950	30.41	PK	H	27.07	6.91	27.54	36.85	74.00	37.15
2950	17.13	AV	H	27.07	6.91	27.54	23.57	54.00	30.43
2612	30.1	PK	H	26.19	4.68	27.43	33.54	74.00	40.46
2612	16.89	AV	H	26.19	4.68	27.43	20.33	54.00	33.67
53.98	34.12	QP	H	7.73	0.96	21.41	21.40	40.00	18.60
121.47	33.29	QP	V	14.19	1.36	21.41	27.43	43.50	16.07
High Channel: 2476.8 MHz									
2476.8	75.83	PK	H	25.84	4.47	0.00	106.14	N/A	N/A
2476.8	68.92	AV	H	25.84	4.47	0.00	99.23	N/A	N/A
2476.8	73.25	PK	V	25.84	4.47	0.00	103.56	N/A	N/A
2476.8	66.58	AV	V	25.84	4.47	0.00	96.89	N/A	N/A
2483.5	29.94	PK	H	25.86	4.49	0.00	60.29	74.00	13.71
2483.5	16.54	AV	H	25.86	4.49	0.00	46.89	54.00	7.11
4953.6	37.26	PK	H	30.98	5.88	27.43	46.69	74.00	27.31
4953.6	25.43	AV	H	30.98	5.88	27.43	34.86	54.00	19.14
7430.4	29.68	PK	H	34.63	7.57	25.94	45.94	74.00	28.06
7430.4	17.28	AV	H	34.63	7.57	25.94	33.54	54.00	20.46
9907.2	30.17	PK	H	36.68	8.87	26.71	49.01	74.00	24.99
9907.2	17.11	AV	H	36.68	8.87	26.71	35.95	54.00	18.05
2950	30.26	PK	H	27.07	6.91	27.54	36.70	74.00	37.30
2950	17.26	AV	H	27.07	6.91	27.54	23.70	54.00	30.30
54.14	34.08	QP	H	7.71	0.96	21.41	21.34	40.00	18.66
120.72	33.54	QP	V	14.16	1.36	21.41	27.65	43.50	15.85

OFDM OPTION2

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: 2400.8 MHz									
2400.8	75.03	PK	H	25.64	4.42	0.00	105.09	N/A	N/A
2400.8	68.25	AV	H	25.64	4.42	0.00	98.31	N/A	N/A
2400.8	74.04	PK	V	25.64	4.42	0.00	104.10	N/A	N/A
2400.8	67.54	AV	V	25.64	4.42	0.00	97.60	N/A	N/A
2390	31.3	PK	H	25.61	4.39	0.00	61.30	74.00	12.70
2390	18.28	AV	H	25.61	4.39	0.00	48.28	54.00	5.72
4801.6	39.55	PK	H	30.58	5.97	27.41	48.69	74.00	25.31
4801.6	27.73	AV	H	30.58	5.97	27.41	36.87	54.00	17.13
7202.4	29.98	PK	H	34.09	7.45	25.91	45.61	74.00	28.39
7202.4	17.56	AV	H	34.09	7.45	25.91	33.19	54.00	20.81
9603.2	30.55	PK	H	35.95	8.79	27.56	47.73	74.00	26.27
9603.2	17.59	AV	H	35.95	8.79	27.56	34.77	54.00	19.23
1729	31.18	PK	H	24.06	3.56	27.63	31.17	74.00	42.83
1729	17.18	AV	H	24.06	3.56	27.63	17.17	54.00	36.83
54.67	34.25	QP	H	7.65	0.95	21.41	21.44	40.00	18.56
122.02	33.64	QP	V	14.22	1.36	21.41	27.81	43.50	15.69
Middle Channel: 2438.4 MHz									
2438.4	74.68	PK	H	25.74	4.40	0.00	104.82	N/A	N/A
2438.4	68.34	AV	H	25.74	4.40	0.00	98.48	N/A	N/A
2438.4	74.14	PK	V	25.74	4.40	0.00	104.28	N/A	N/A
2438.4	67.73	AV	V	25.74	4.40	0.00	97.87	N/A	N/A
4876.8	40.19	PK	H	30.78	6.08	27.42	49.63	74.00	24.37
4876.8	27.5	AV	H	30.78	6.08	27.42	36.94	54.00	17.06
7315.2	29.6	PK	H	34.36	7.51	25.88	45.59	74.00	28.41
7315.2	17.06	AV	H	34.36	7.51	25.88	33.05	54.00	20.95
9753.6	30.37	PK	H	36.31	8.83	27.22	48.29	74.00	25.71
9753.6	17.31	AV	H	36.31	8.83	27.22	35.23	54.00	18.77
2950	30.31	PK	H	27.07	6.91	27.54	36.75	74.00	37.25
2950	17.24	AV	H	27.07	6.91	27.54	23.68	54.00	30.32
1729	33.56	PK	H	24.06	3.56	27.63	33.55	74.00	40.45
1729	18.23	AV	H	24.06	3.56	27.63	18.22	54.00	35.78
54.5	34.24	QP	H	7.67	0.96	21.41	21.46	40.00	18.54
122.32	33.41	QP	V	14.23	1.36	21.41	27.59	43.50	15.91
High Channel: 2477.6 MHz									
2477.6	75.56	PK	H	25.84	4.47	0.00	105.87	N/A	N/A
2477.6	68.83	AV	H	25.84	4.47	0.00	99.14	N/A	N/A
2477.6	72.73	PK	V	25.84	4.47	0.00	103.04	N/A	N/A
2477.6	65.98	AV	V	25.84	4.47	0.00	96.29	N/A	N/A
2483.5	30.24	PK	H	25.86	4.49	0.00	60.59	74.00	13.41
2483.5	17.02	AV	H	25.86	4.49	0.00	47.37	54.00	6.63
4955.2	40.42	PK	H	30.98	5.88	27.43	49.85	74.00	24.15
4955.2	27.36	AV	H	30.98	5.88	27.43	36.79	54.00	17.21
7432.8	30.11	PK	H	34.64	7.57	25.95	46.37	74.00	27.63
7432.8	17.27	AV	H	34.64	7.57	25.95	33.53	54.00	20.47
9910.4	30.66	PK	H	36.68	8.87	26.70	49.51	74.00	24.49
9910.4	17.51	AV	H	36.68	8.87	26.70	36.36	54.00	17.64
2950	30.19	PK	H	27.07	6.91	27.54	36.63	74.00	37.37
2950	17.24	AV	H	27.07	6.91	27.54	23.68	54.00	30.32
54.65	34.26	QP	H	7.66	0.95	21.41	21.46	40.00	18.54
122.47	33.54	QP	V	14.24	1.36	21.41	27.73	43.50	15.77

Conducted Spurious Emissions at Antenna Port

O-QPSK Low Channel



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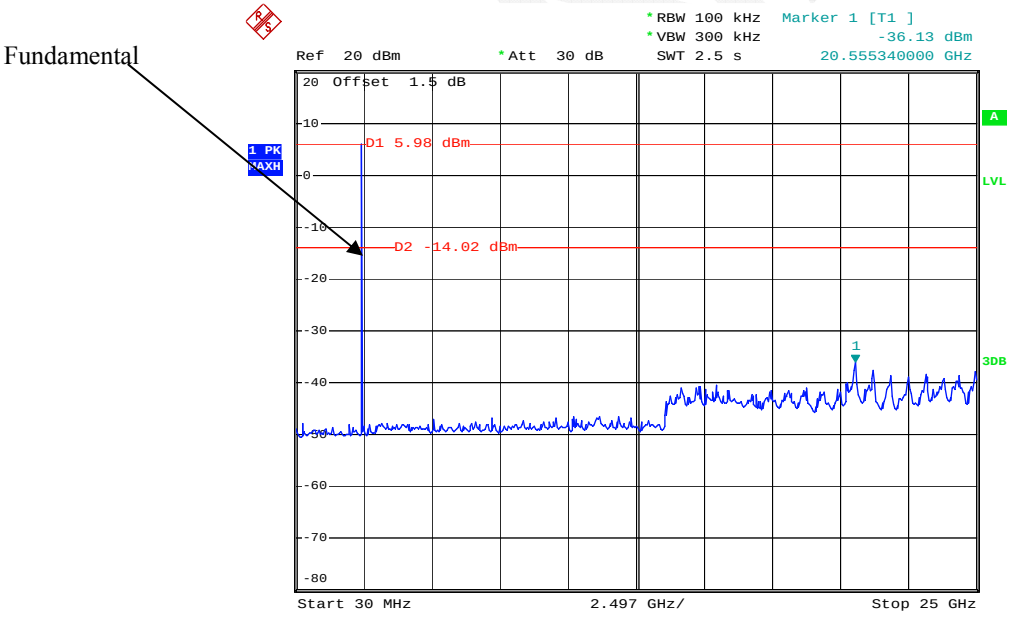
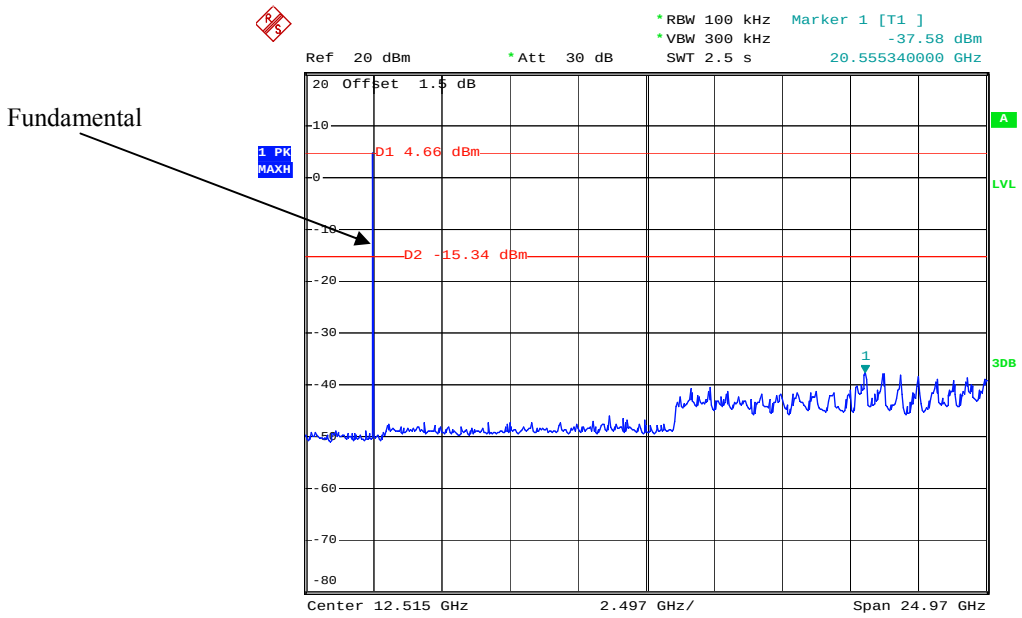
O-QPSK Middle Channel



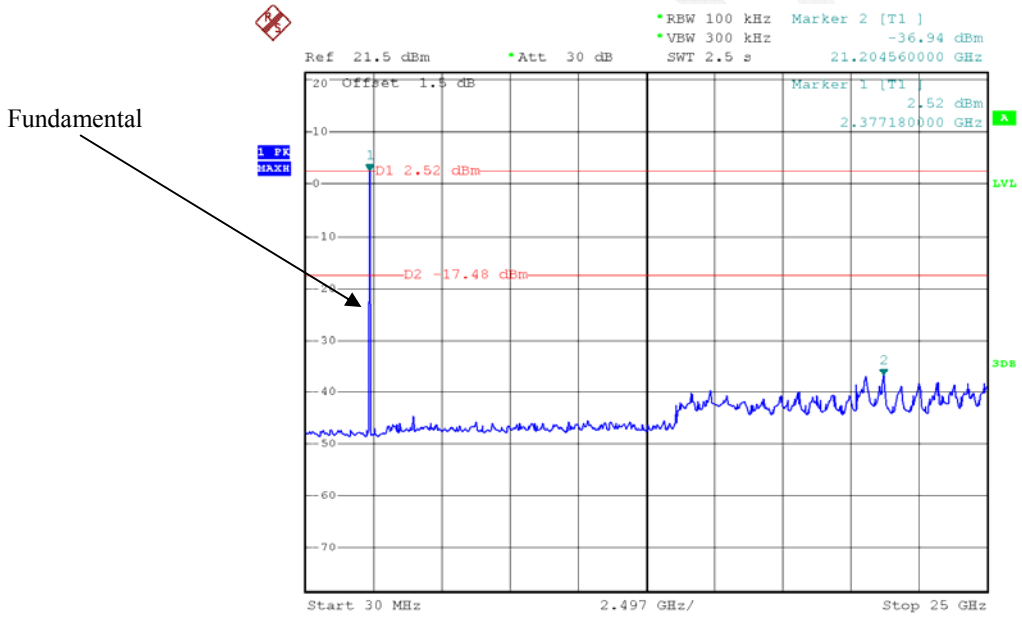
Date: 11.FEB.2015 14:09:44

O-QPSK High Channel



Date: 11.FEB.2015 14:11:05

OFDM Option1 Low Channel



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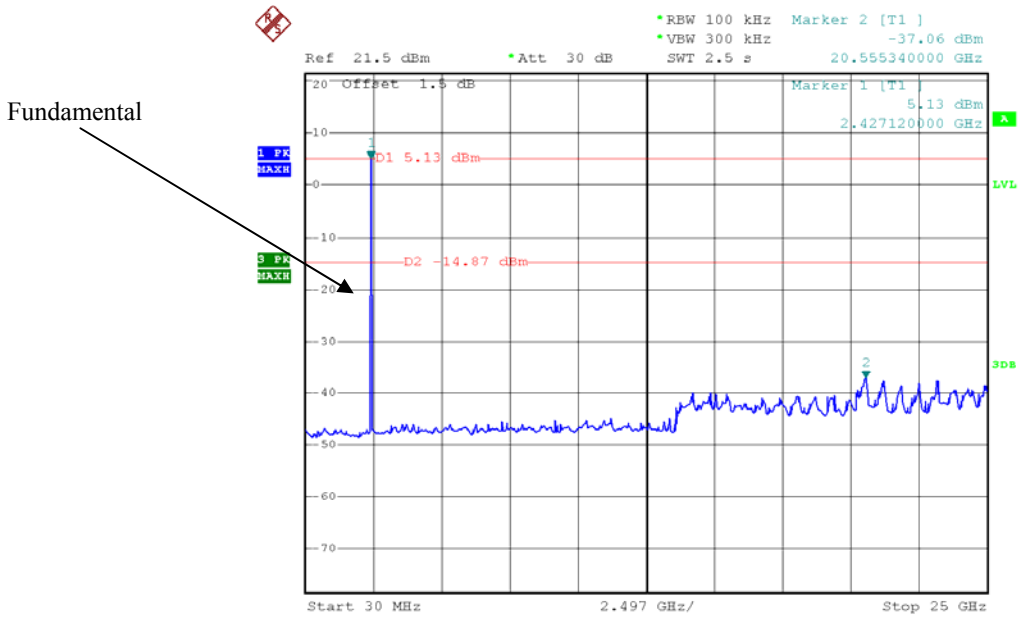
OFDM Option1 Middle Channel



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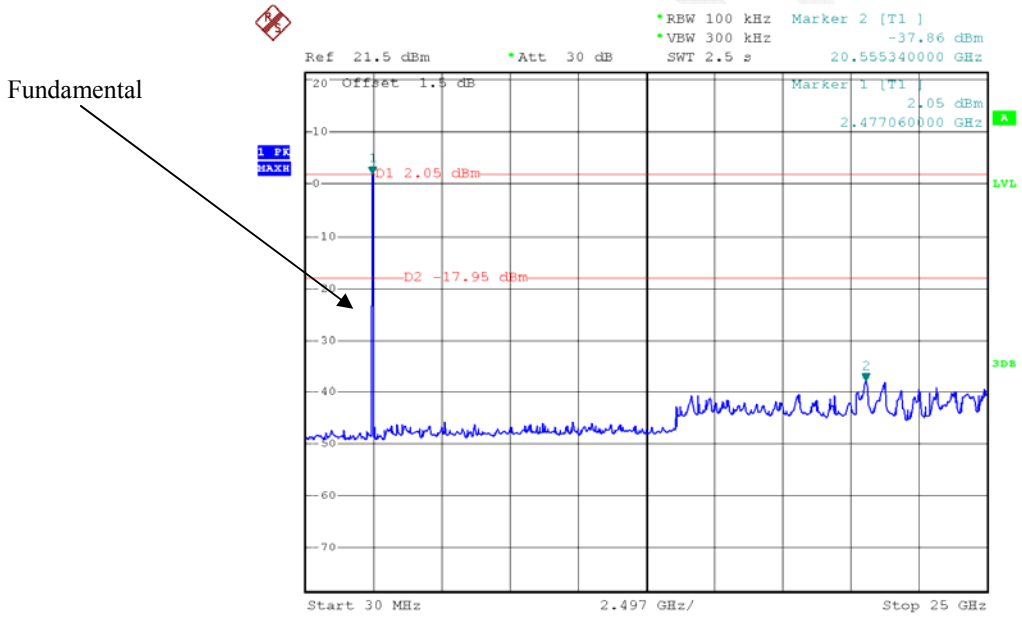
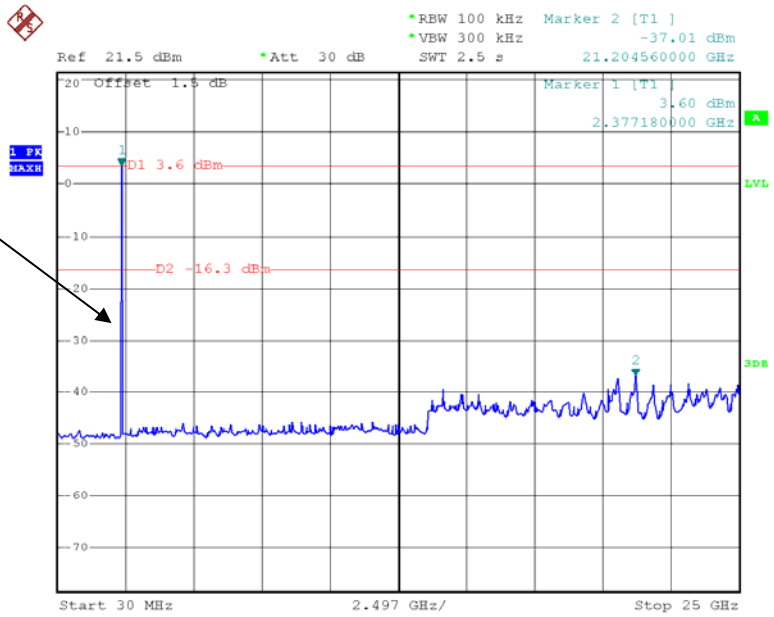
OFDM Option1 High Channel



Date: 25.DEC.2014 15:46:05

OFDM Option2 Low Channel

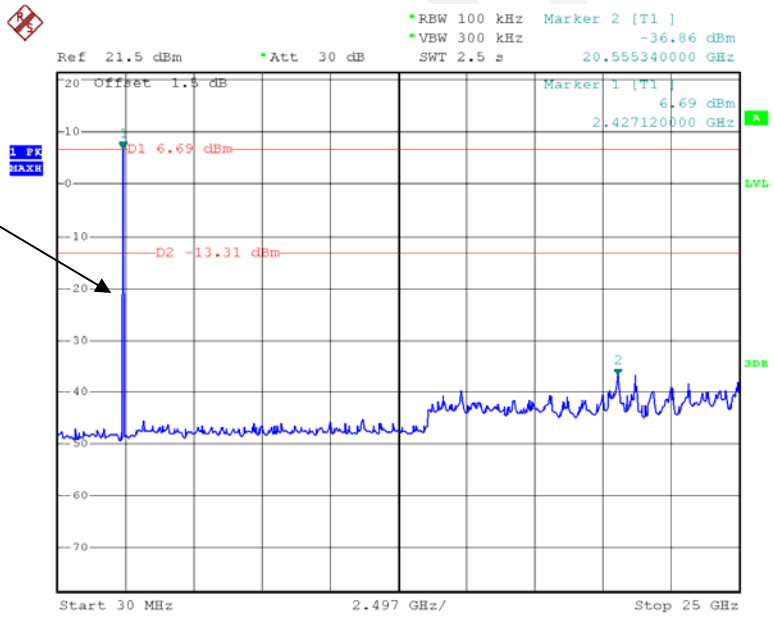
Fundamental



Date: 25.DEC.2014 15:58:27

OFDM Option2 Middle Channel

Fundamental



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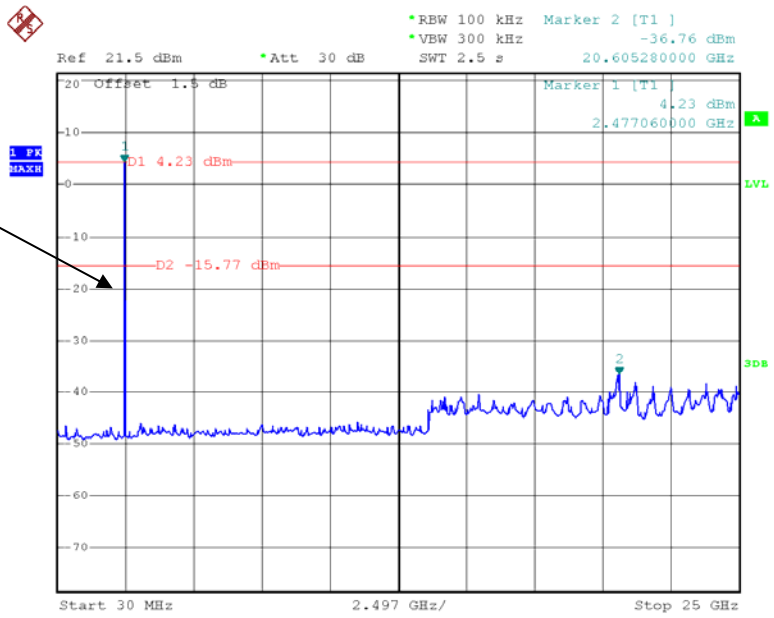
OFDM Option2 High Channel

Fundamental



Date: 25.DEC.2014 16:17:59

7 FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

7.1 Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.2 Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r02 clause8.1 Option 1:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09

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

7.4 Test Data

Environmental Conditions

Temperature:	23.1 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

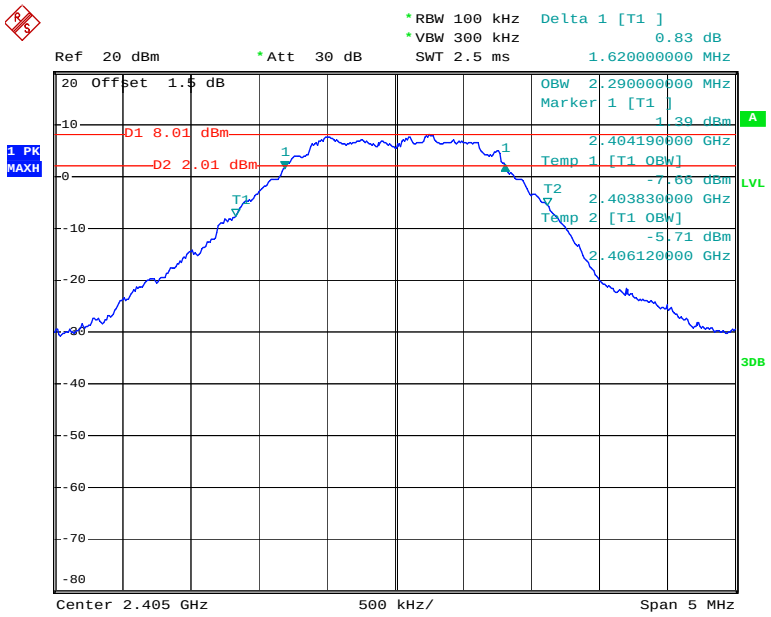
The testing was performed by Dean Liu on 2014-12-25 and 2015-02-11.

Test Mode: Transmitting

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

Mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
O-QPSK	Low	2405	1.62	≥0.5
	Middle	2440	1.63	≥0.5
	High	2480	1.61	≥0.5
OFDM Option1	Low	2401.2	1.120	≥0.5
	Middle	2438.4	1.120	≥0.5
	High	2476.8	1.100	≥0.5
OFDM Option2	Low	2400.8	0.564	≥0.5
	Middle	2438.4	0.592	≥0.5
	High	2477.6	0.606	≥0.5

O-QPSK Low Channel



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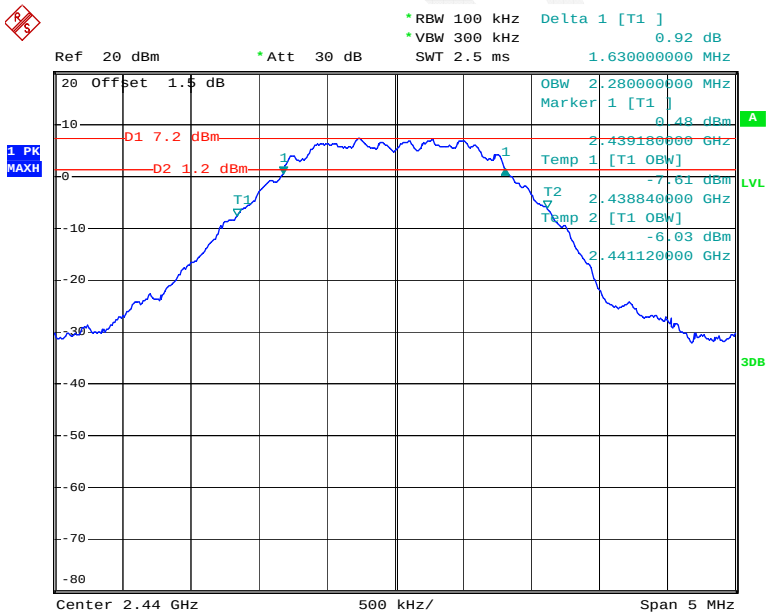
O-QPSK Middle Channel



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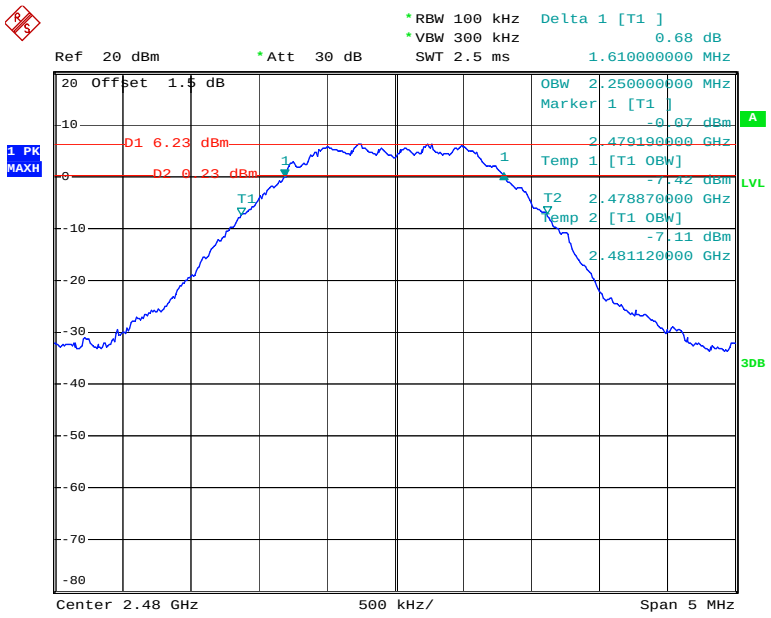
O-QPSK High Channel



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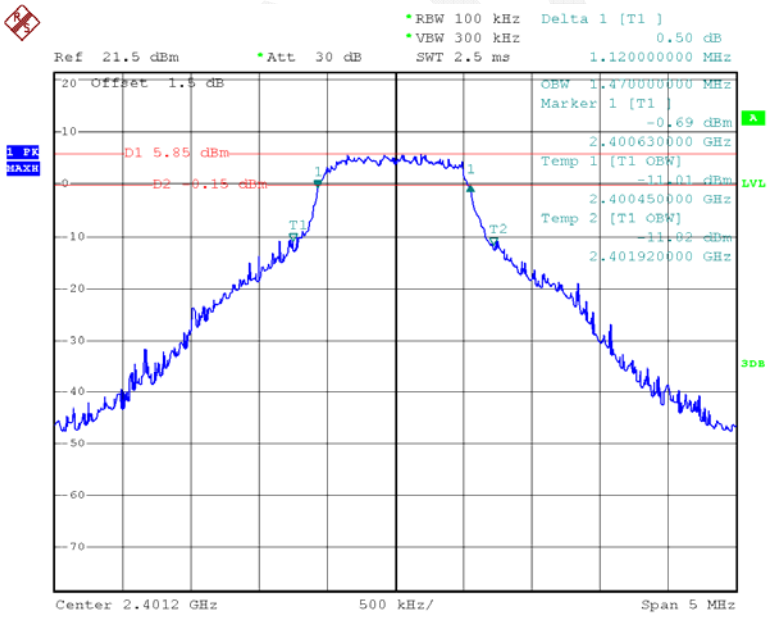
OFDM Option1 Low Channel



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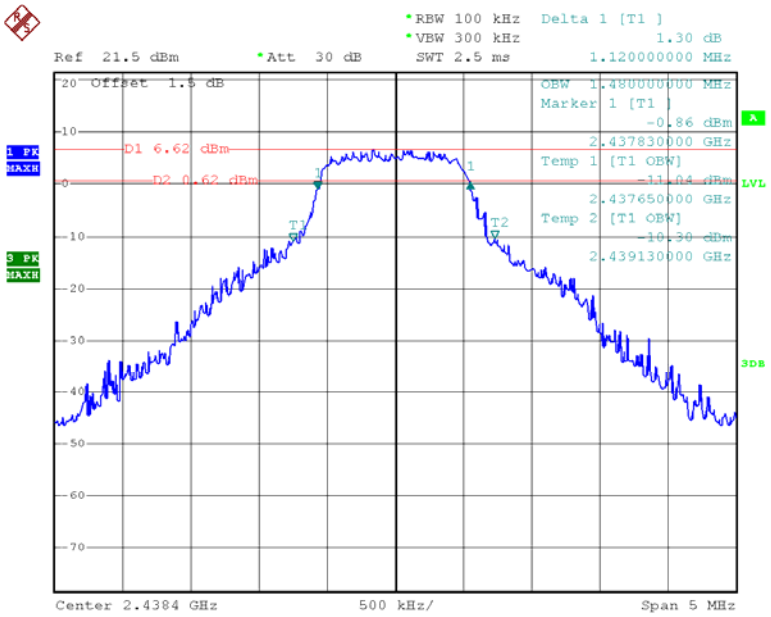
OFDM Option1 Middle Channel



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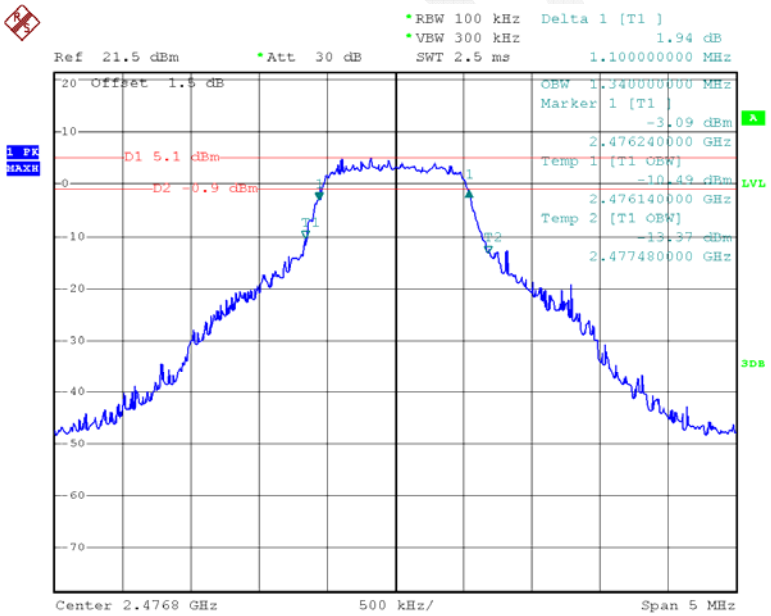
OFDM Option1 High Channel



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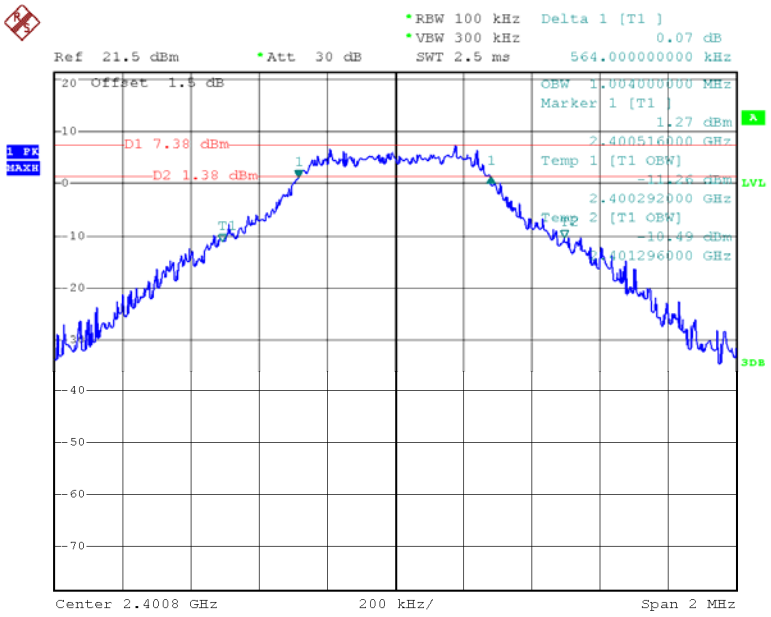
OFDM Option2 Low Channel



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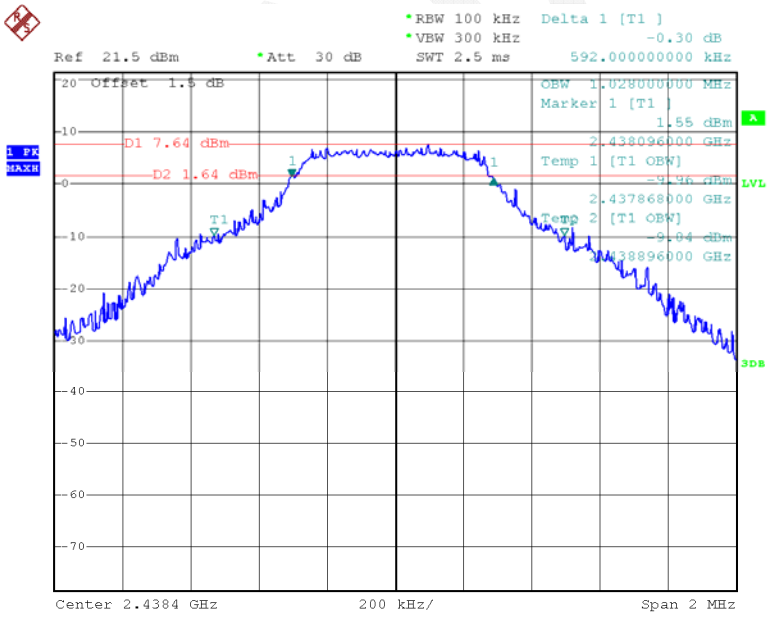
OFDM Option2 Middle Channel



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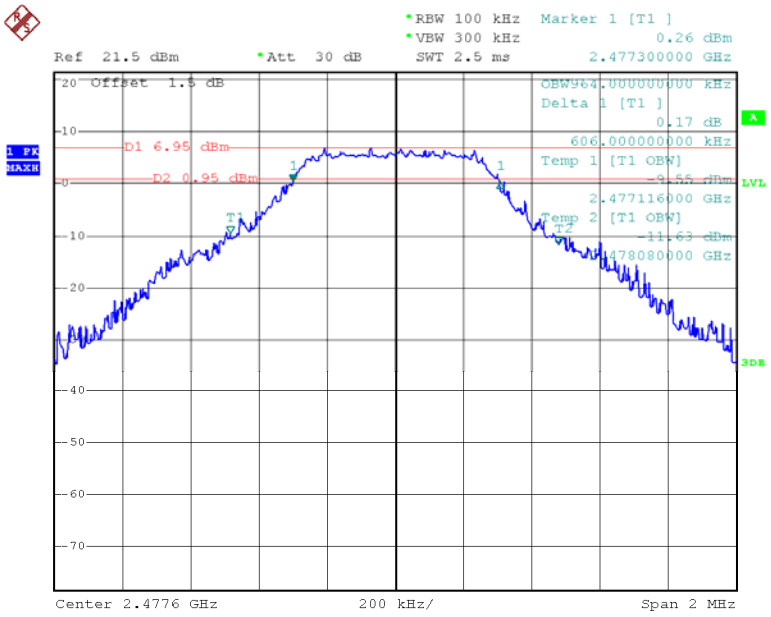
OFDM Option2 High Channel



Date: 25.DEC.2014 16:24:06

8 FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

8.1 Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

8.2 Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r02

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

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2014-11-03	2015-11-03
Agilent	Wideband Power Sensor	N1921A	MY54170013	2014-11-03	2015-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2014-11-03	2015-11-03

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

8.4 Test Data

Environmental Conditions

Temperature:	23.1 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

The testing was performed by Dean Liu on 2014-12-25 and 2015-02-11.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table.

Maximum peak conducted output power:

Mode	Channel	Frequency MHz	Reading dBm	Limit dBm	Result
O-QPSK	Low	2405	11.89	30	PASS
	Middle	2440	11.22	30	PASS
	High	2480	10.23	30	PASS
OFDM Option1	Low	2401.2	11.98	30	PASS
	Middle	2438.4	12.22	30	PASS
	High	2476.8	11.09	30	PASS
OFDM Option2	Low	2400.8	11.23	30	PASS
	Middle	2438.4	12.16	30	PASS
	High	2477.6	10.83	30	PASS

9 FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

9.1 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)).

9.2 Test Procedure

3. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
4. 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.
5. 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.
6. 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.
7. Repeat above procedures until all measured frequencies were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09

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

9.4 Test Data

Environmental Conditions

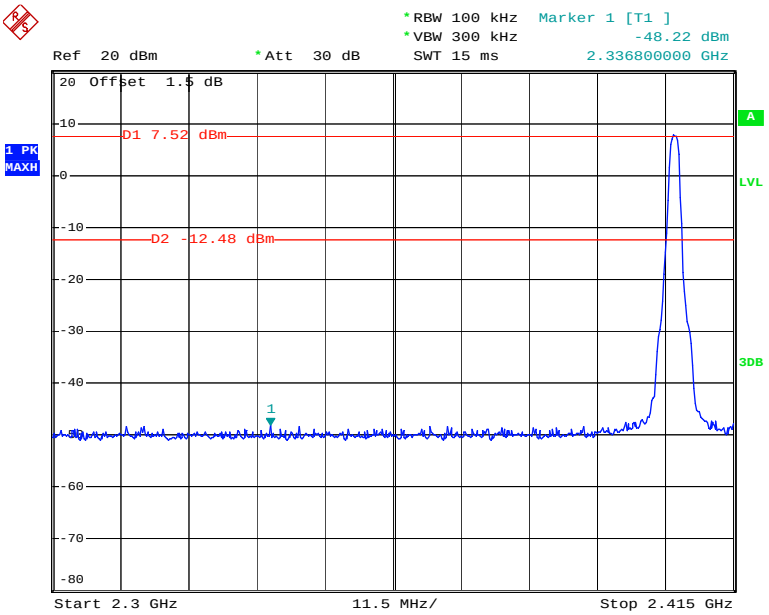
Temperature:	23.1 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

The testing was performed by Dean Liu on 2014-12-25 and 2015-02-11.

Test mode: Transmitting

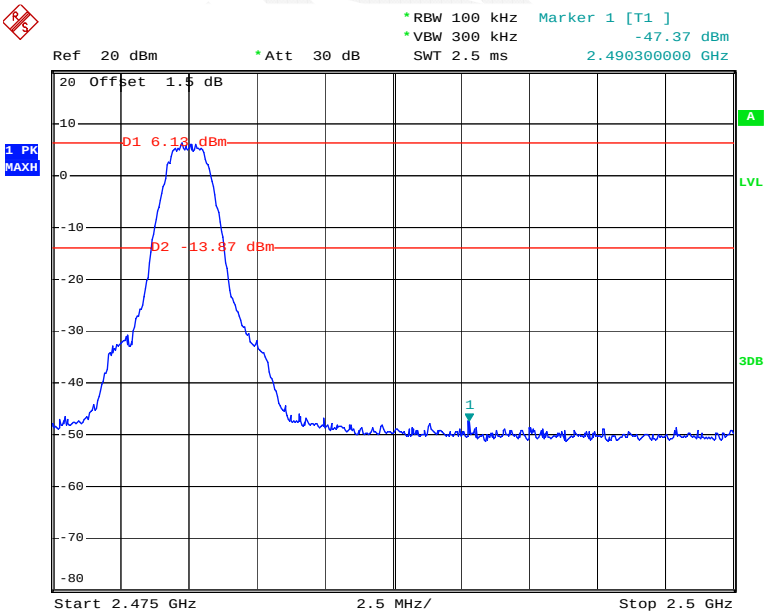
Test Result: Compliant. Please refer to following plots.

O-QPSK Band Edge, Left Side



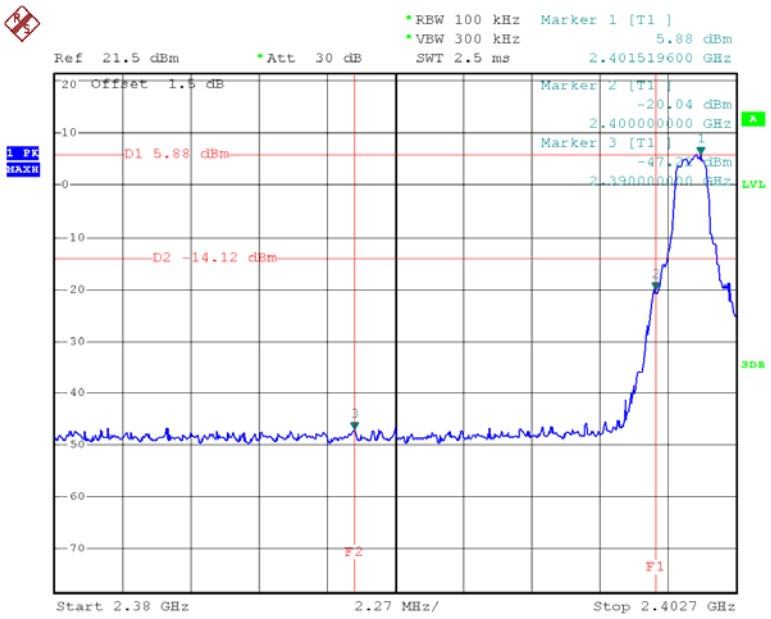
Date: 11.FEB.2015 14:04:03

O-QPSK Band Edge, Right Side



Date: 11.FEB.2015 14:01:44

OFDM Option1 Band Edge, Left Side



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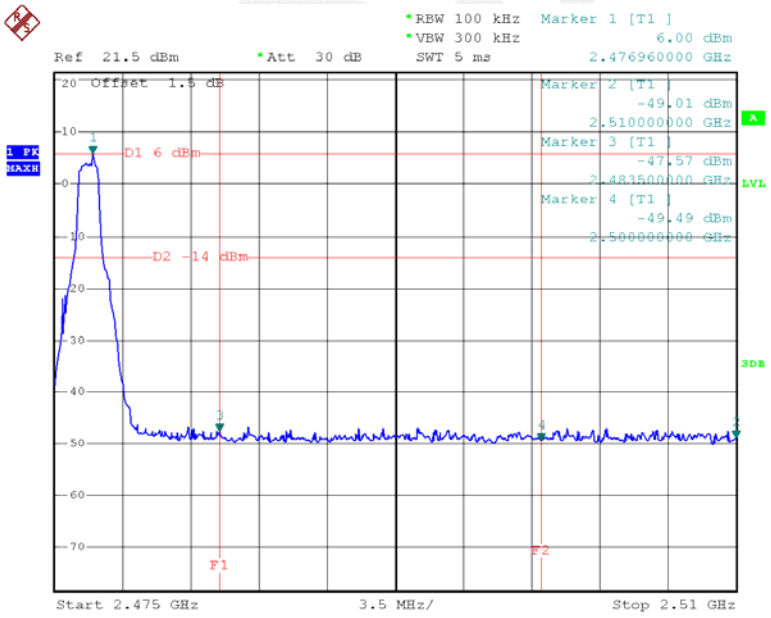
OFDM Option1 Band Edge, Right Side



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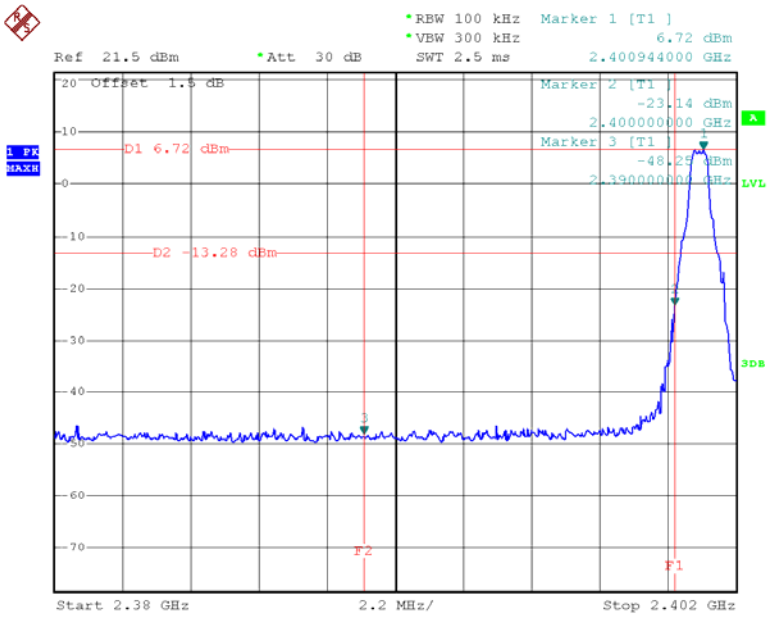
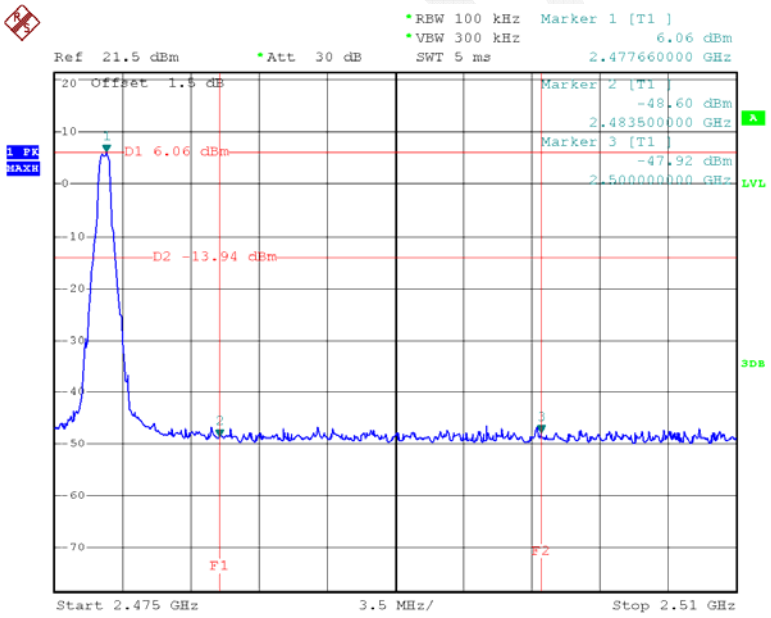
OFDM Option2 Band Edge, Left Side



Date: 25.DEC.2014 15:57:30

OFDM Option2 Band Edge, Right Side



Date: 25.DEC.2014 16:25:18

10 FCC §15.247(e) - POWER SPECTRAL DENSITY

10.1 Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

10.2 Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r02 clause10.2:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2014-05-09	2015-05-09

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

10.4 Test Data

Environmental Conditions

Temperature:	23.1 °C
Relative Humidity:	49 %
ATM Pressure:	101.5 kPa

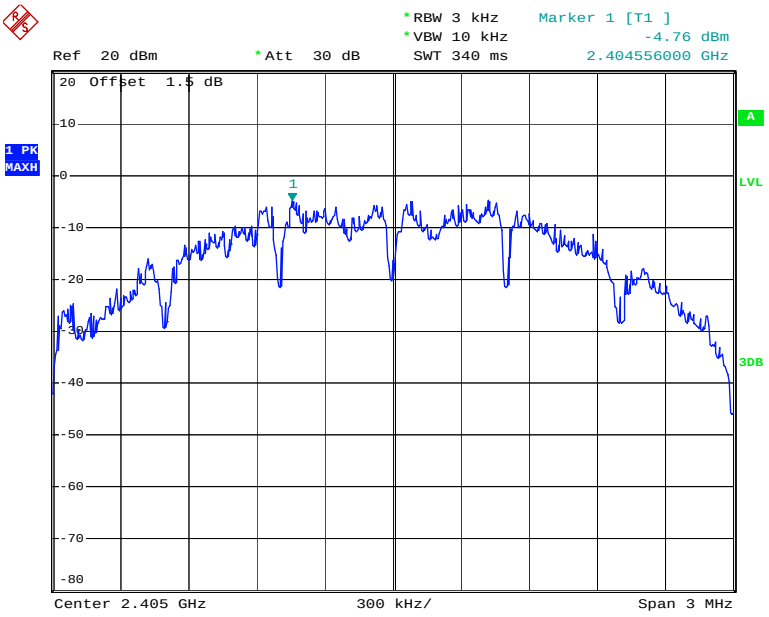
The testing was performed by Dean Liu on 2014-12-25 and 2015-02-11.

Test Mode: Transmitting

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

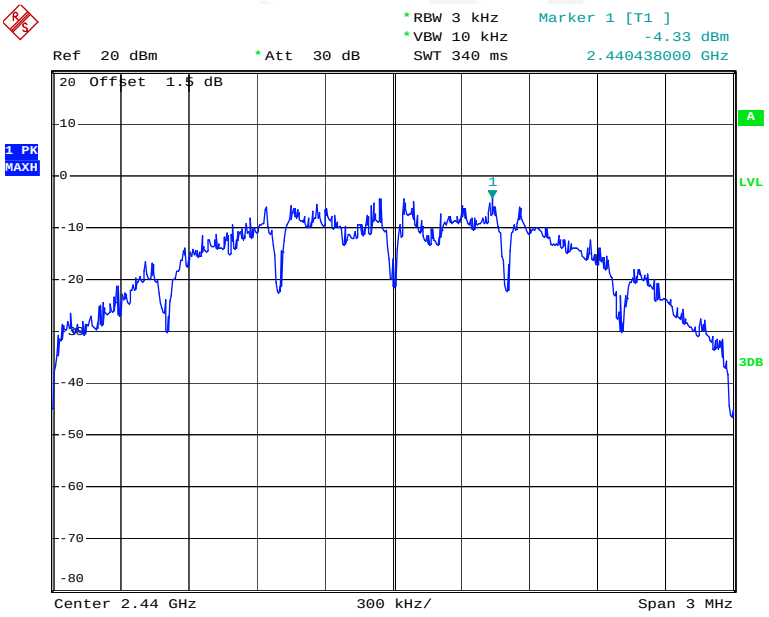
Mode	Channel Channel	Frequency MHz	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
O-QPSK	Low	2405	-4.76	≤8	PASS
	Middle	2440	-4.33	≤8	PASS
	High	2480	-5.43	≤8	PASS
OFDM Option1	Low	2401.2	-9.72	≤8	PASS
	Middle	2438.4	-9.03	≤8	PASS
	High	2476.8	-10.94	≤8	PASS
OFDM Option2	Low	2400.8	-7.55	≤8	PASS
	Middle	2438.4	-6.41	≤8	PASS
	High	2477.6	-8.89	≤8	PASS

Power Spectral Density, O-QPSK Low Channel



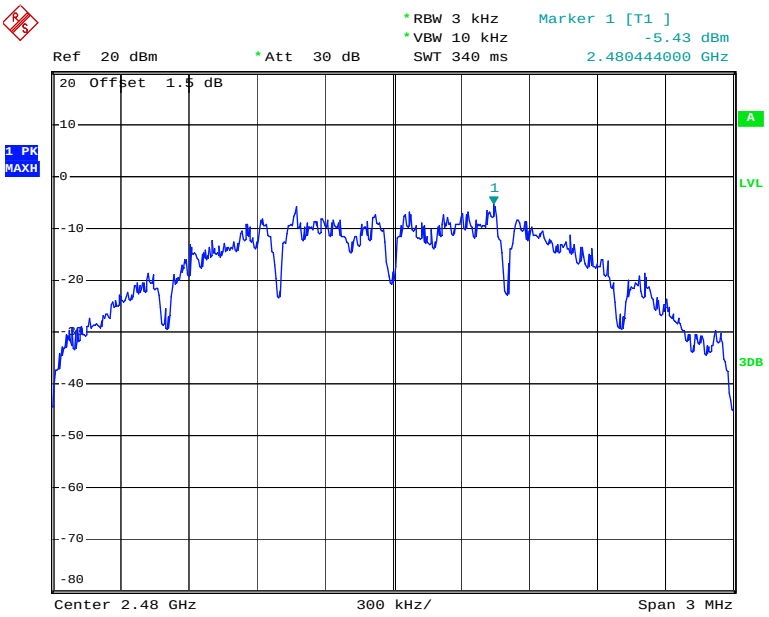
Date: 11.FEB.2015 13:56:58

Power Spectral Density, O-QPSK Middle Channel



Date: 11.FEB.2015 13:56:21

Power Spectral Density, O-QPSK High Channel



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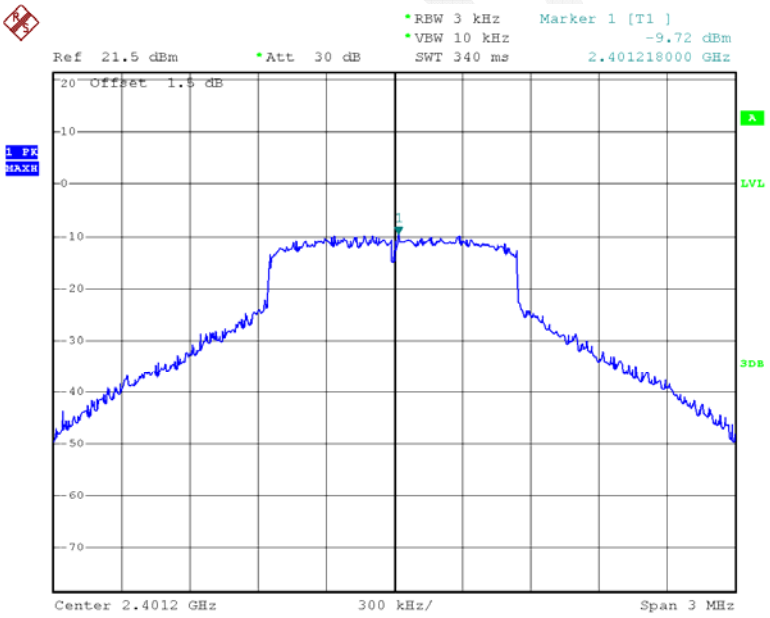
Power Spectral Density, OFDM Option1 Low Channel



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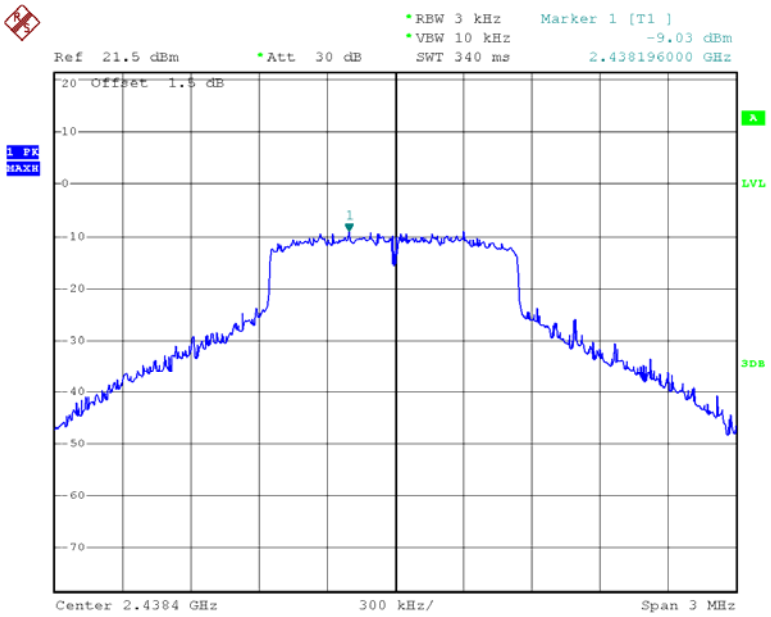
Power Spectral Density, OFDM Option1 Middle Channel



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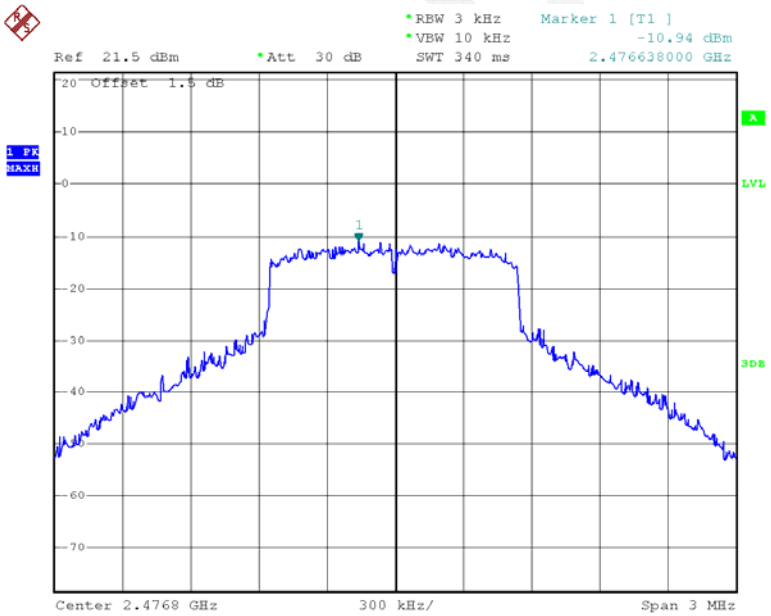
Power Spectral Density, OFDM Option1 High Channel



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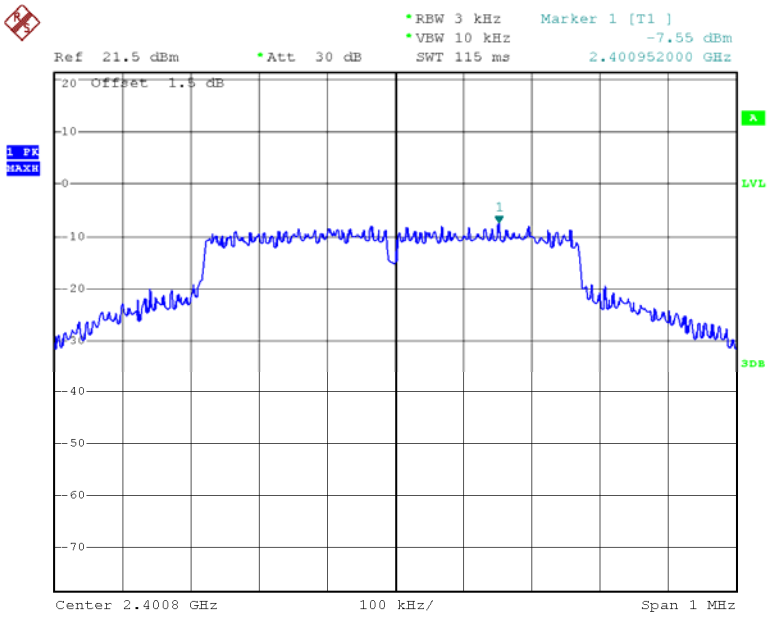
Power Spectral Density, OFDM Option2 Low Channel



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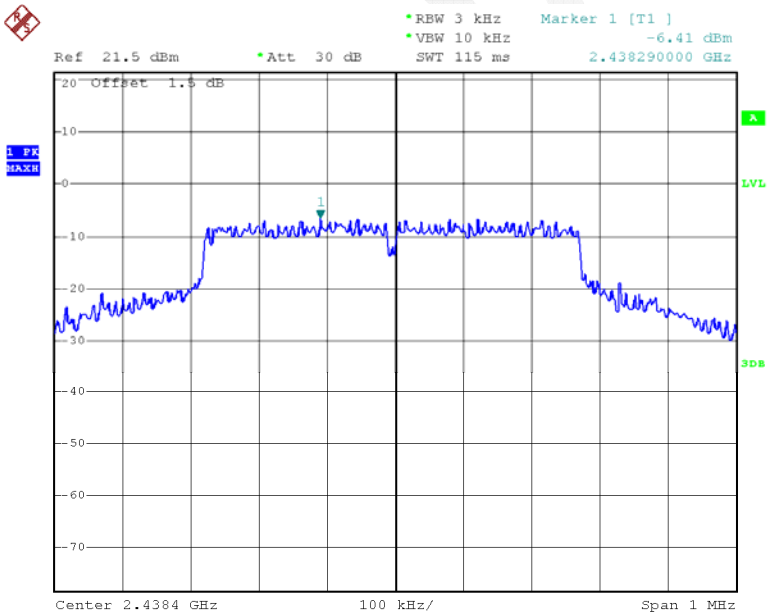
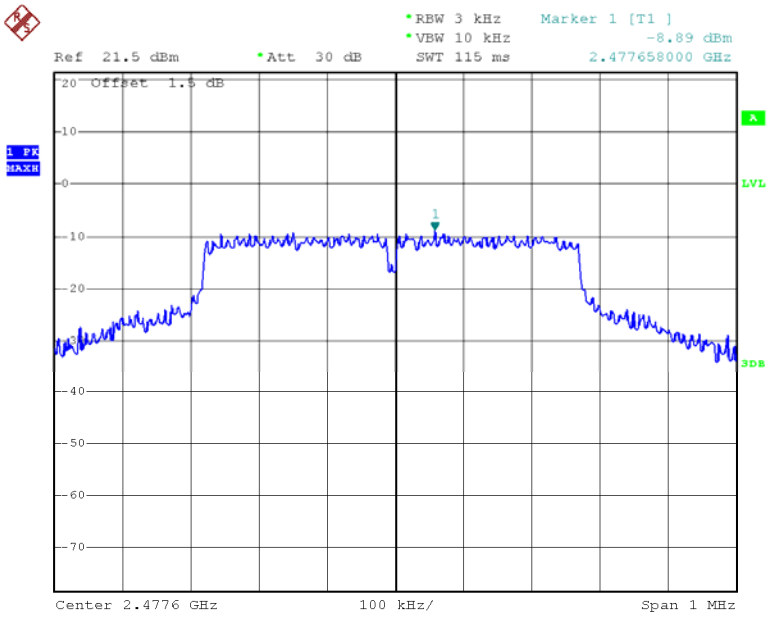
Power Spectral Density, OFDM Option2 Middle Channel



Date: 25.DEC.2014 16:14:23

Power Spectral Density, OFDM Option2 High Channel



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