TEST REPORT

Report Number: 100748465MPK-005
Project Number: G100748465
June 21 2012

Testing performed on the
VasonaLink Light Controller
Model Number: LC202
FCC ID: O4ZVLINK
IC: 10380A-LC202

to
FCC Part 15 Subpart C (15.247)
RSS-210 Issue 8
FCC Part 15, Subpart B
Industry Canada ICES-003

for

Vasona Labs, Inc.

Test Performed by:	Test Authorized by:
Intertek	Vasona Labs, Inc.
1365 Adams Court	14435C Big Basin Way #232
Menlo Park, CA 94025 USA	Saratoga, CA 95070, USA

Prepared by: _____ **Date:** June 21, 2012
Krishna K Vemuri

Reviewed by: _____ **Date:** June 21, 2012
Yuriy Litvinov, EMC Business Manager

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Report No. 100748465MPK-005

Equipment Under Test:	VasonaLink Light Controller
Trade Name:	Vasona Labs, Inc.
Model No.:	LC202
Serial No.:	2034
Applicant:	Vasona Labs, Inc.
Contact:	Gary Alford
Address:	14435C Big Basin Way #232 Saratoga, CA 95070
Country	USA
Tel. Number:	408-838-6903
Email:	gary@vasonalabs.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) RSS-210 Issue 8 FCC Part 15, Subpart B Industry Canada ICES-003
Date of Test:	May 18 – June 01, 2012

We attest to the accuracy of this report:

Krishna K Vemuri
EMC Senior Staff Engineer

Yuriy Litvinov
EMC Business Manager

TABLE OF CONTENTS

1.0 Summary of Tests 4

2.0 General Information 5
2.1 Product Description 5
2.2 Related Submittal(s) Grants 6
2.3 Test Methodology 6
2.4 Test Facility 6

3.0 System Test Configuration 7
3.1 Support Equipment 7
3.2 Block Diagram of Test Setup 7
3.3 Justification 8
3.4 Mode of Operation During Test 8
3.5 Modifications Required for Compliance 8
3.6 Additions, Deviations and Exclusions from Standards 8

4.0 Measurement Results 9
4.1 6-dB Bandwidth and Occupied Bandwidth 9
4.2 Maximum Conducted Output Power at Antenna Terminals 13
4.3 Power Spectral Density 20
4.4 Out-of-Band Conducted Emissions 24
4.5 Transmitter Radiated Emissions 27
4.6 Radiated Emissions from Digital Parts and Receiver 34
4.7 AC Line Conducted Emission 40

5.0 RF Exposure Evaluation 44

6.0 List of Test Equipment 45

7.0 Document History 46

8.0 Appendix A –Graphs for Duty Cycle Measurement 47

1.0 Summary of Tests

Test	Reference FCC	Reference RSS	Result
RF Output Power	15.247(b)(3)	A8.4(4)	Complies
6 dB Bandwidth	15.247(a)(2)	A8.2(a)	Complies
Power Density	15.247(e)	A8.2(b)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	A8.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	A8.5, 2.2	Complies
AC Conducted Emission	15.207	RSS-Gen	Complies
Radiated Emission from Digital Part and Receiver	15.109	ICES-003	Complies
Antenna Requirement	15.203	RSS-Gen	Complies. The EUT does not have an external antenna connector
RF Exposure	15.247(i)	RSS-102	Complies

EUT receive date: May 15, 2012
EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.
Test start date: May 15, 2012
Test completion date: June 01, 2012
The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

The Equipment Under Test (EUT) is the VasonaLink Light Controller, model number LC202. It is a light controller that is part of the VasonaLink power management system. It communicates with a remotely installed site controller via a wireless low power 802.15.4 protocol at 2.4GHz.

This report is designed to show compliance of the 2.4 GHz transceiver with the requirements of FCC Part 15 Subpart C (15.247) and RSS-210.

Information about the 2.4GHz radio, installed in the model LC202, is presented below:

Applicant	Vasona Labs, Inc.
Model No.	LC202
FCC Identifier	O4ZVLINK
IC	10380A-LC202
Transmission Protocol	802.15.4
Rated RF Output	19.9dBm (0.0977Watts)
Frequency Range	2405-2475 MHz
Type of modulation	OQPSK
Antenna(s) & Gain	Internal antenna, Omni directional antenna, 2.0dBi gain, uFL (Mini PCI) connector type
Manufacturer Name & Address	Vasona Labs, Inc. 14435C Big Basin Way #232 Saratoga, CA 95070, USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the procedure “Measurement of Digital Transmission Systems Operating under Section 15.247”.

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application.

All other measurements were made in accordance with the procedures in Part 2 of CFR 47.

2.4 Test Facility

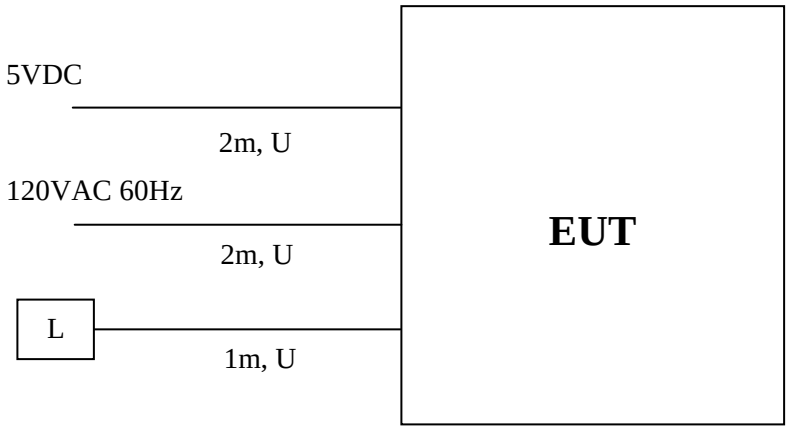
The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment

None. The EUT is a stand-alone system.

3.2 Block Diagram of Test Setup



S = Shielded **U** = Unshielded **L** = Lightbulb	**F** = With Ferrite **m** = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full power. During testing, all cables are manipulated to produce worst-case emissions.

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously at maximum RF power on low, middle and high channels.

3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

4.1 6-dB Bandwidth and Occupied Bandwidth
FCC Rule 15.247(a)(2)

4.1.1 Requirement

The minimum 6-dB bandwidth shall be at least 500 kHz

4.1.2 Procedure

The Procedure described in the FCC Publication 558074 was used.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6-dB bandwidth was determined from where the channel output spectrum intersected the display line.

The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

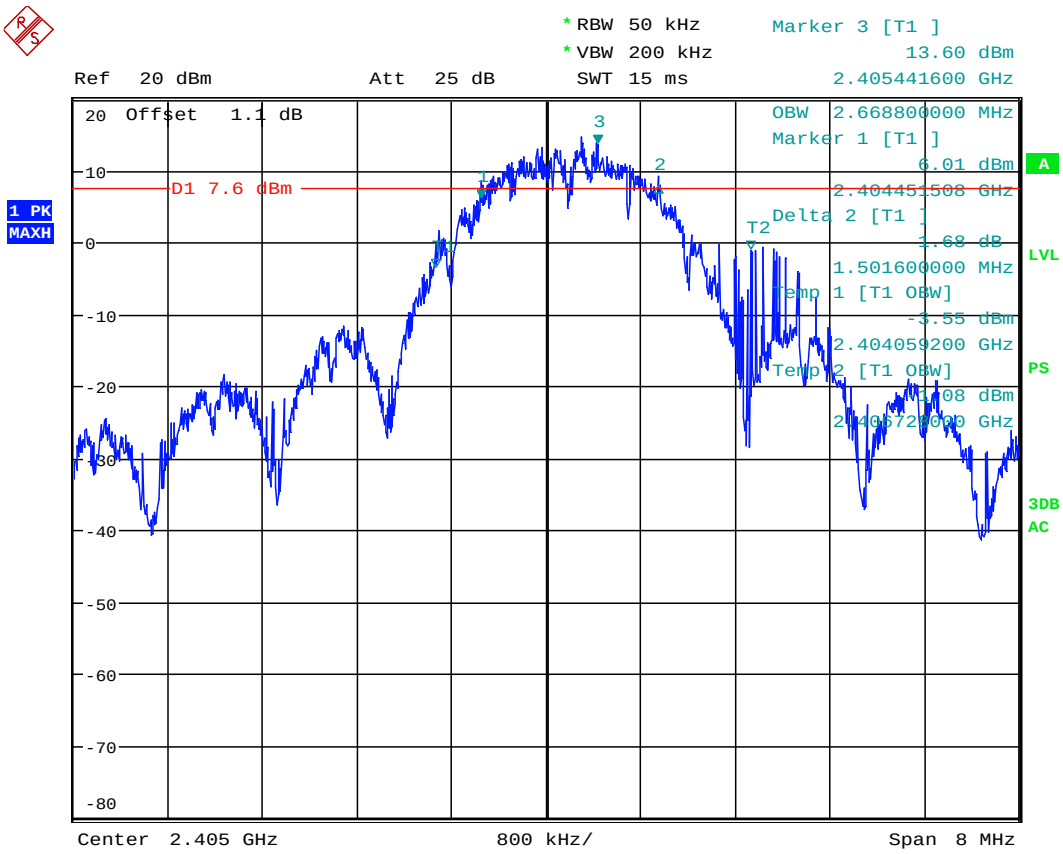
4.1.3 Test Result

Frequency (MHz)	6-dB Channel Bandwidth (MHz)	Plot
2405	2.40544	1.1
2440	2.44011	1.2
2475	2.47509	1.3

Frequency (MHz)	99% Occupied Bandwidth (MHz)	Plot
2405	2.66880	1.1
2440	2.52800	1.2
2475	2.59520	1.3

On plots 1.1 – 1.3 the 6-dB Bandwidth and Occupied Bandwidth are presented.

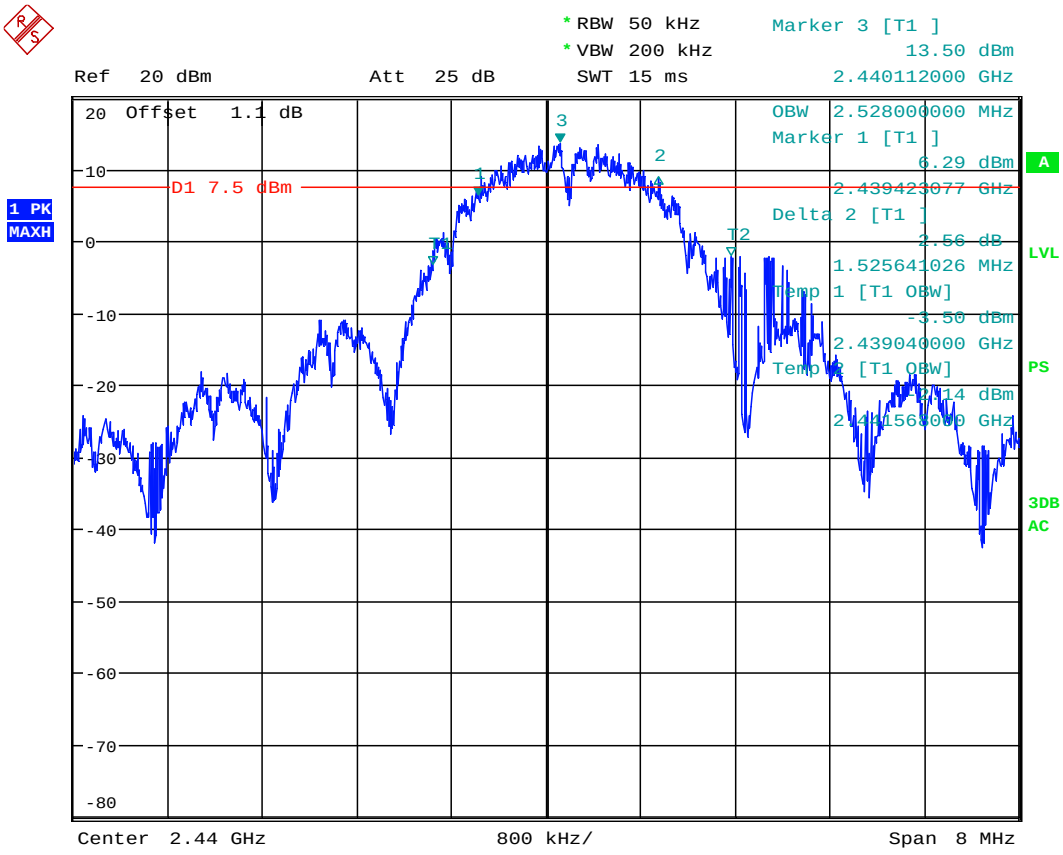
Plot 1. 1



6-dB bandwidth and Occupied bandwidth

Date: 23.MAY.2012 11:38:38

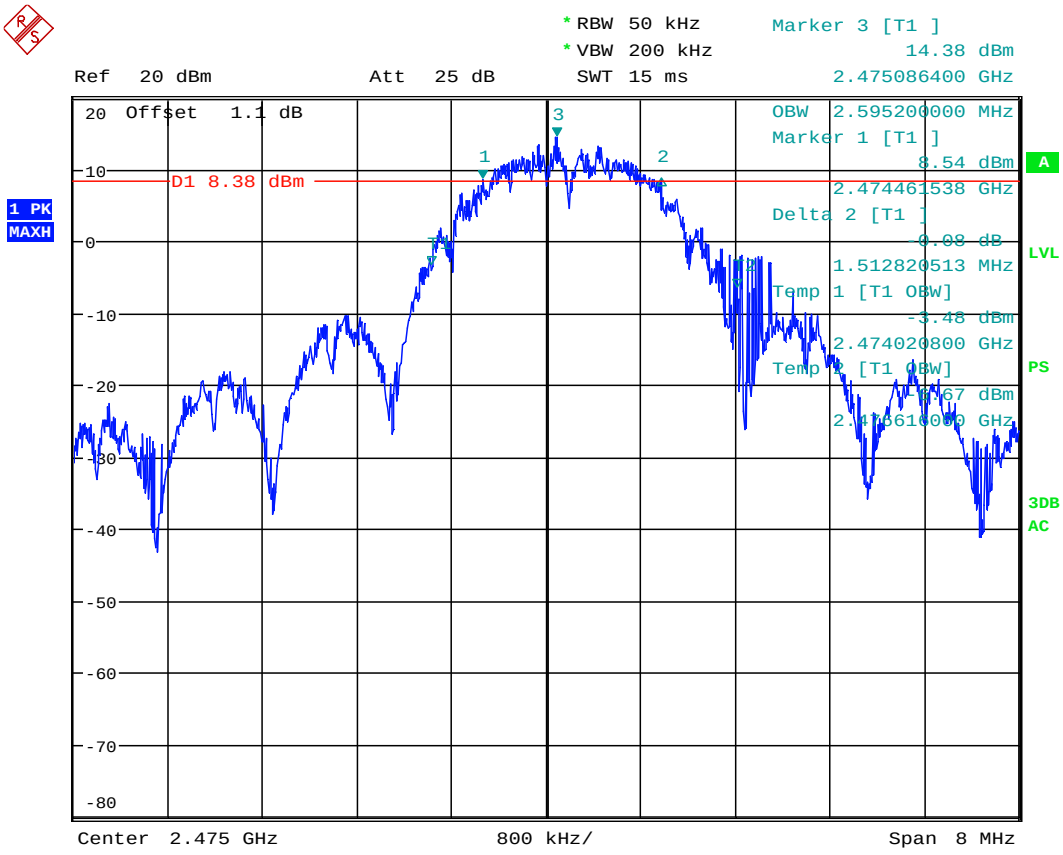
Plot 1. 2



6-dB bandwidth and Occupied bandwidth

Date: 23.MAY.2012 11:51:15

Plot 1. 3



6-dB bandwidth and Occupied bandwidth

Date: 23.MAY.2012 12:09:15

4.2 Maximum Conducted Output Power at Antenna Terminals
FCC Rule 15.247(b)(3)

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).
For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer/power meter to measure the Maximum Conducted Transmitter Output Power.

The procedure described in FCC Publication 558074, was used. Specifically, section 7.2.1.1 Option 1, (zero span method), with peak detector, spectrum analyzer RBW ≥ DTS (6dB) bandwidth, VBW ≥ 3 x RBW, Zero-span mode.

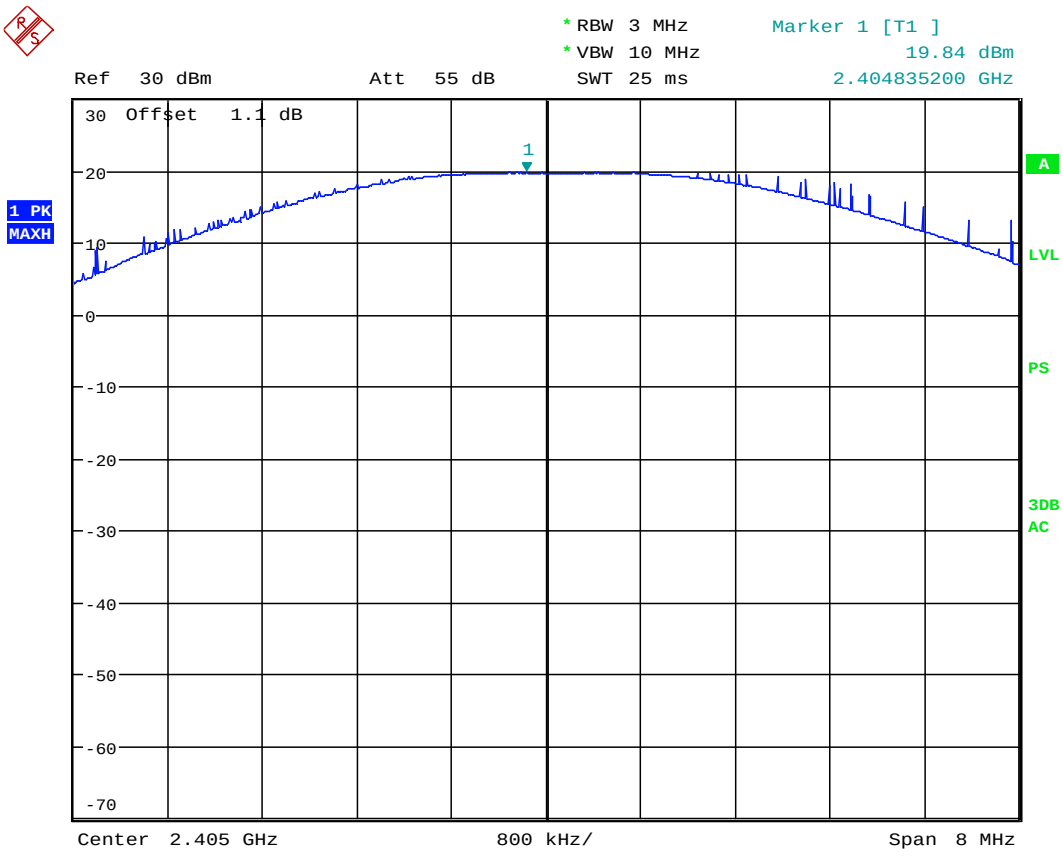
4.3.3 Test Result

Refer to the following plots for the test result:

Frequency (MHz)	Output in dBm	Output in W	Plot number
2405	19.9	0.0977	2.1, 2.2
2440	19.9	0.0977	2.3, 2.4
2475	19.9	0.0977	2.5, 2.6

Note: The EUT's antenna has less than 6 dBi gain.

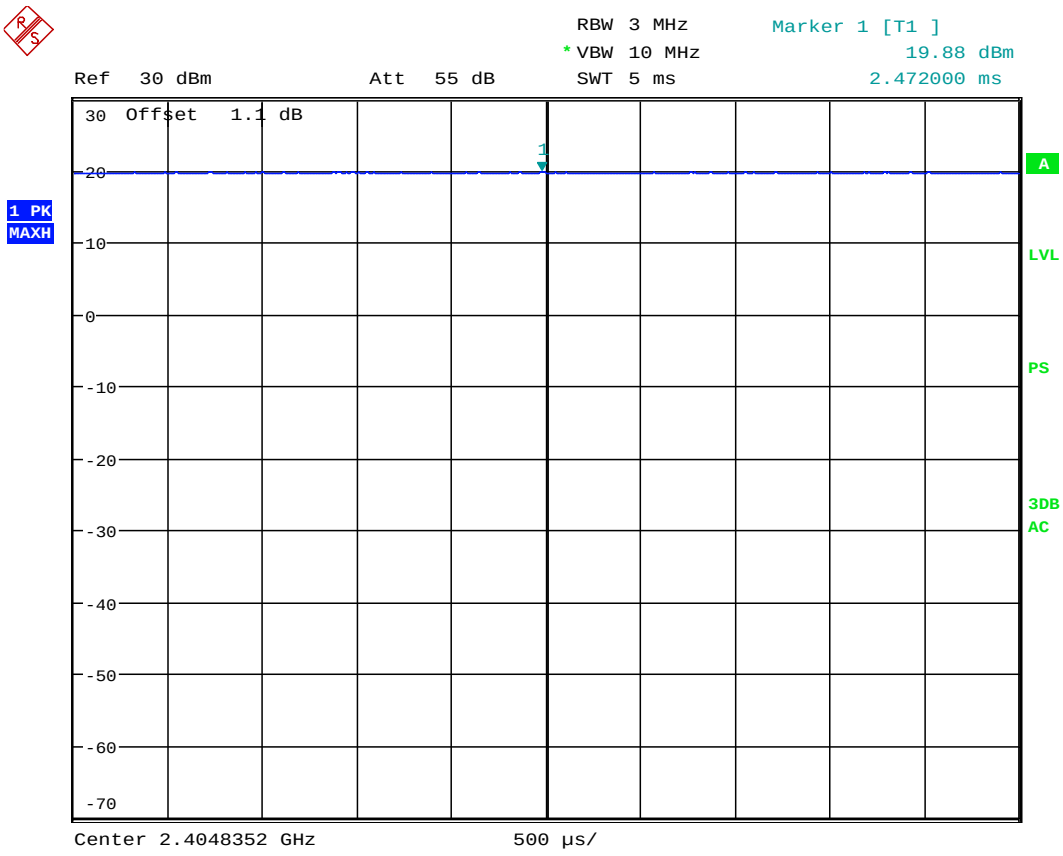
Plot 2. 1



Output power

Date: 23.MAY.2012 13:26:48

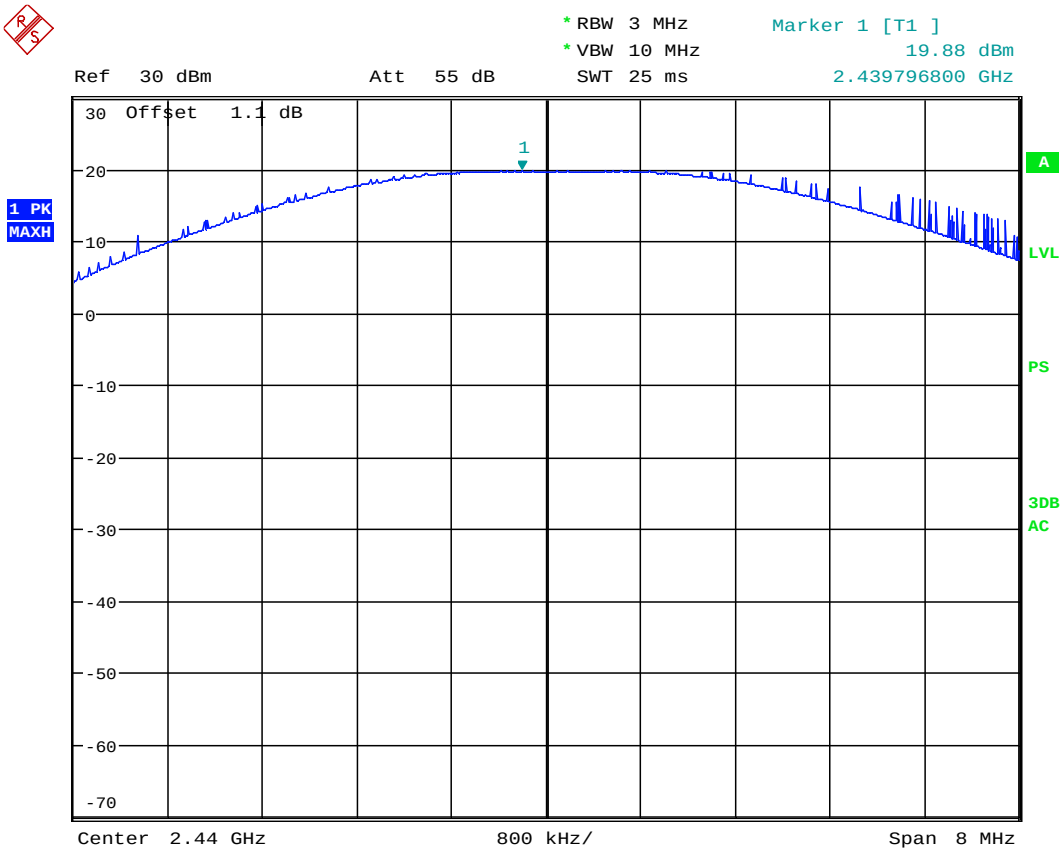
Plot 2. 2



Output power

Date: 23.MAY.2012 13:32:59

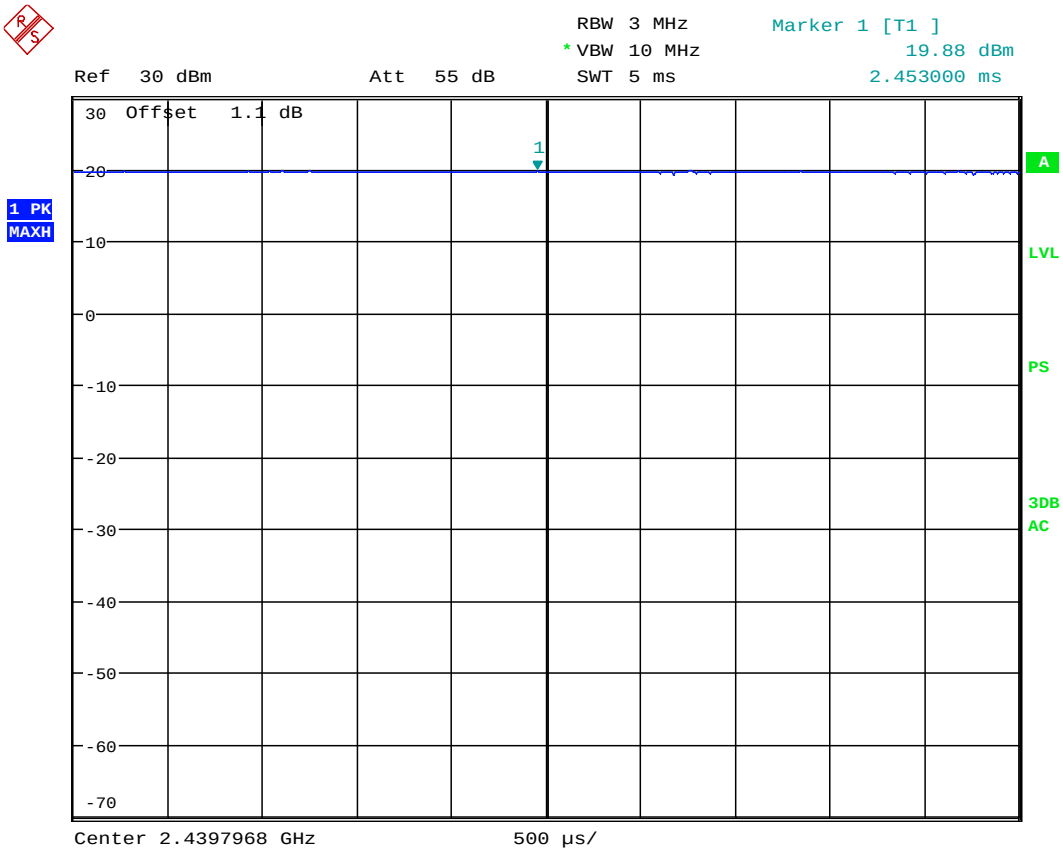
Plot 2. 3



Output power

Date: 23.MAY.2012 13:19:48

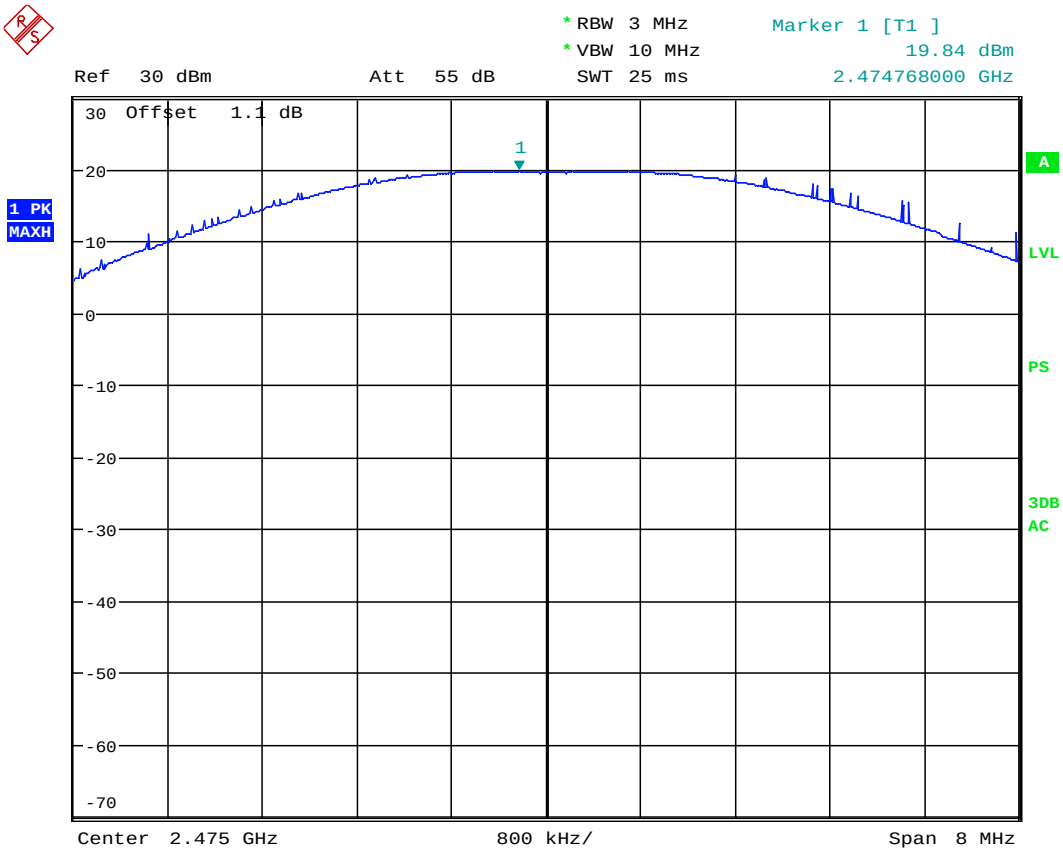
Plot 2. 4



Output power

Date: 23.MAY.2012 13:23:09

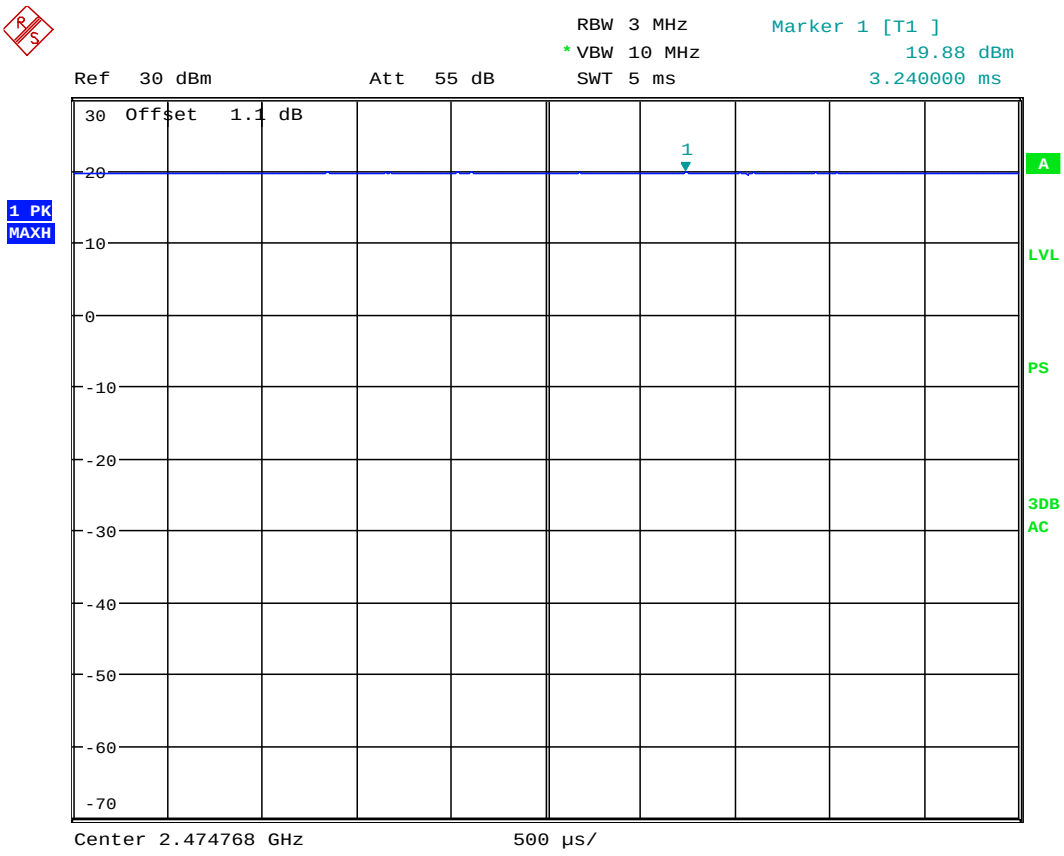
Plot 2. 5



Output power

Date: 23.MAY.2012 13:13:34

Plot 2. 6



Output power

Date: 23.MAY.2012 13:15:53

4.3 Power Spectral Density
FCC 15.247 (e)

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Transmitter Power Density (PSD).

The procedure described in FCC Publication 558074 was used. Specifically, section 7.3.1 (Peak PSD), with peak detector, spectrum analyzer resolution bandwidth of 100 kHz, span of 300 kHz.

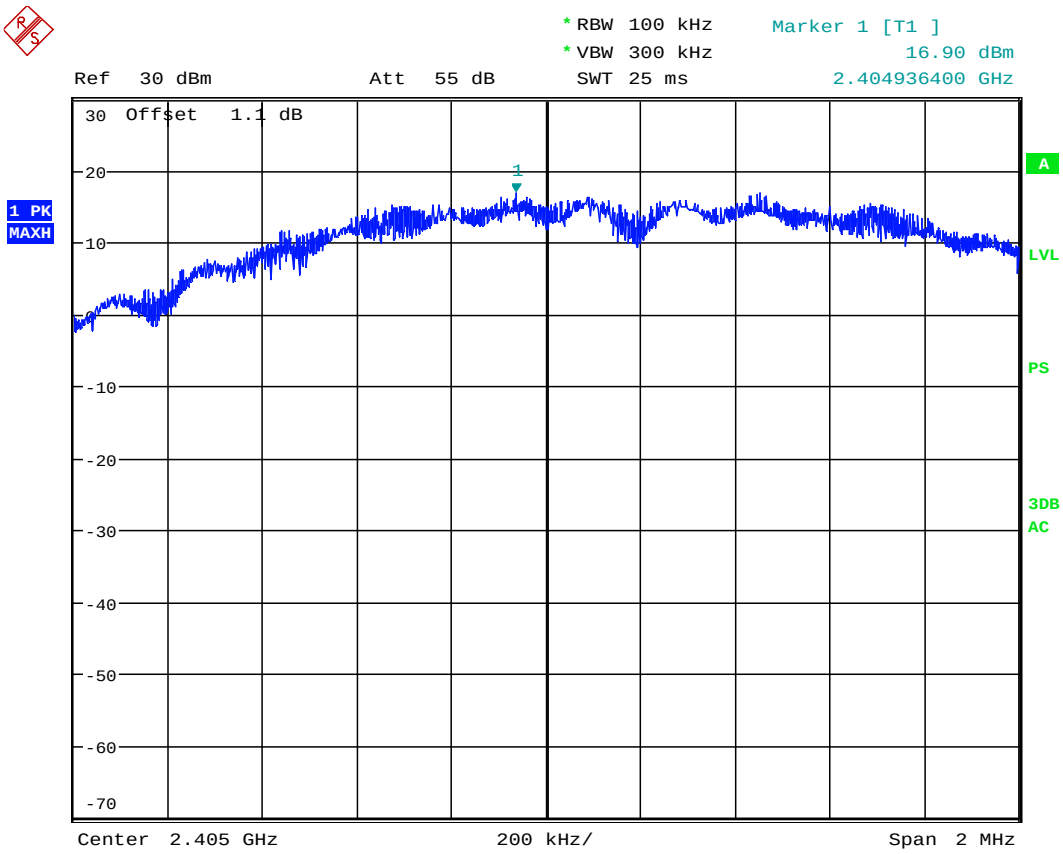
4.3.3 Test Result

Refer to the following plots for the test result:

Frequency (MHz)	Maximum Peak Level with RBW 100kHz (dBm)	Power Spectral Density* (dBm)	Plot number
2405	16.9	1.7	3.1
2440	16.8	1.6	3.2
2475	16.5	1.3	3.3

*Bandwidth correction factor was applied as per FCC Publication 558074. The BWCF is calculated as 10log (3 kHz/100 kHz = -15.2 dB).

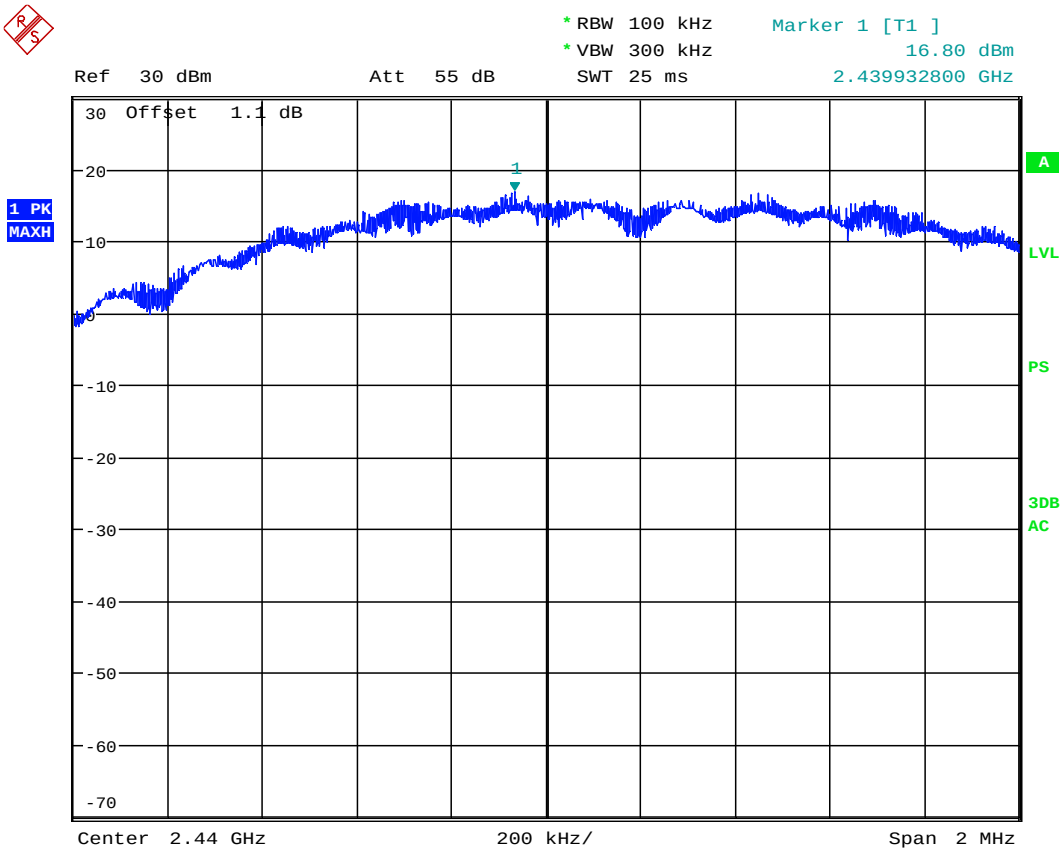
Plot 3. 1



Peak PSD

Date: 23.MAY.2012 14:20:59

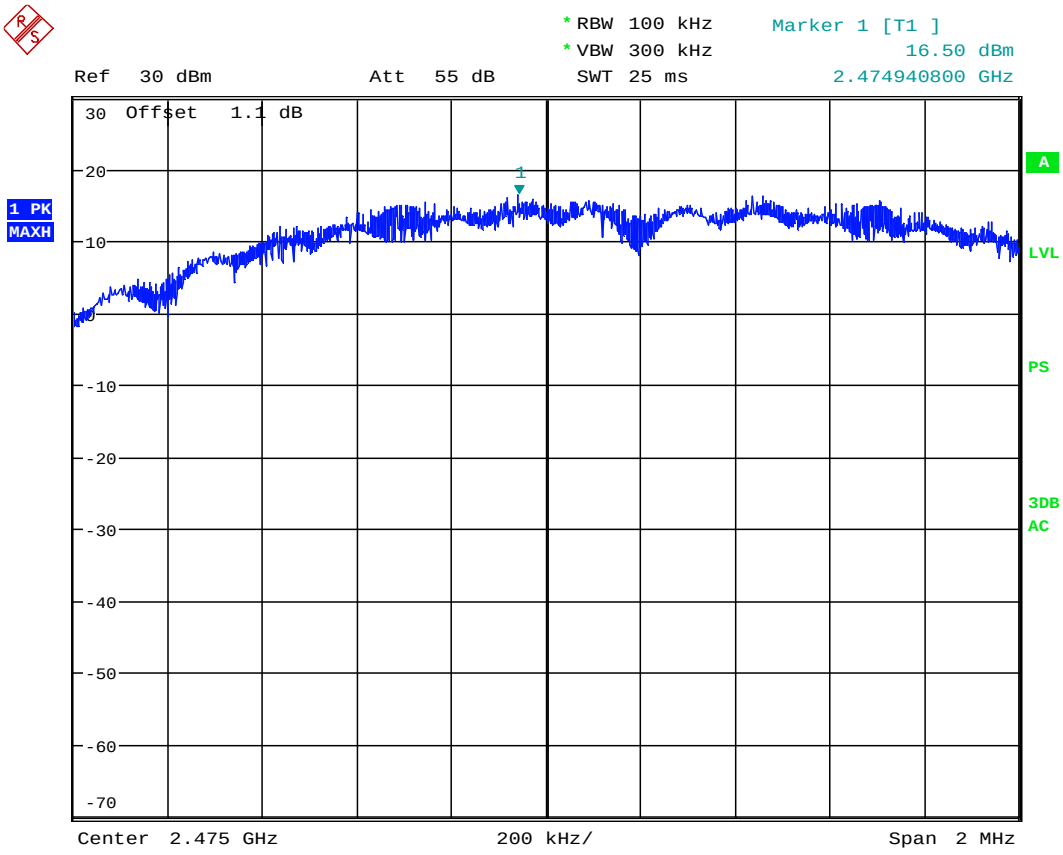
Plot 3. 2



Peak PSD

Date: 23.MAY.2012 14:40:21

Plot 3. 3



Peak PSD

Date: 23.MAY.2012 14:59:37

4.4 Out-of-Band Conducted Emissions
FCC 15.247(d)

4.4.1 Requirement

In any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.4.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 25 GHz.

4.4.3 Test Result

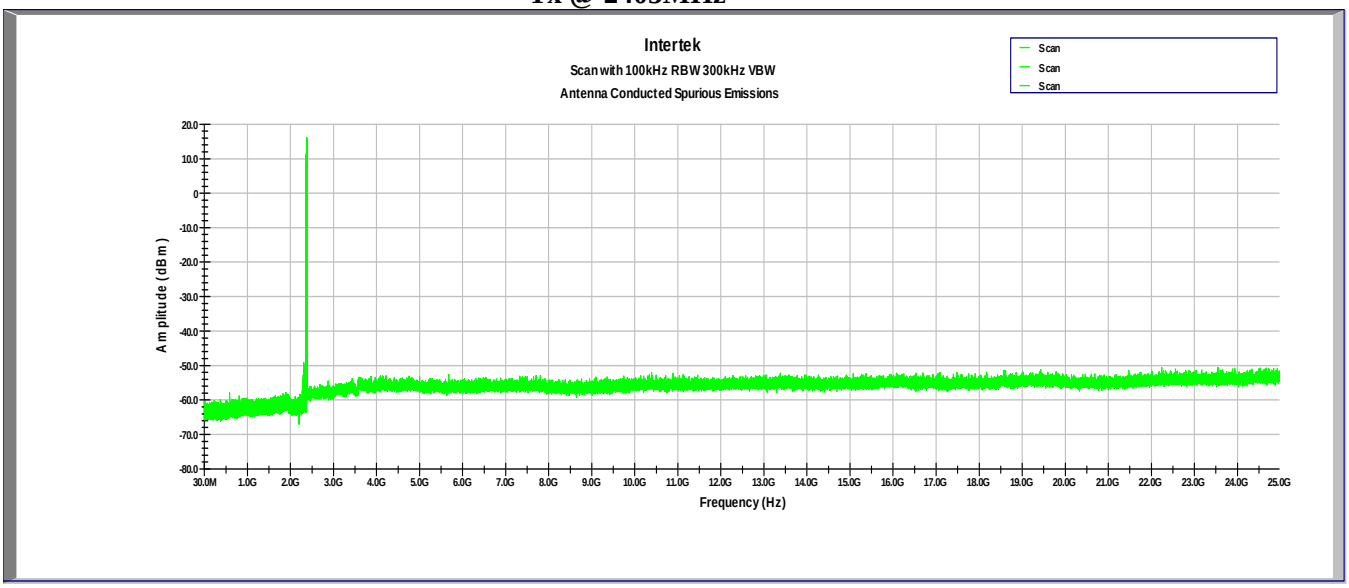
Refer to the following plots:

Frequency (MHz)	Description	Plot
2405	Scan 30 MHz – 25 GHz	4.1
2440	Scan 30 MHz – 25 GHz	4.2
2475	Scan 30 MHz – 25 GHz	4.3

All out-of-band conducted emissions were attenuated by more than 20 dB

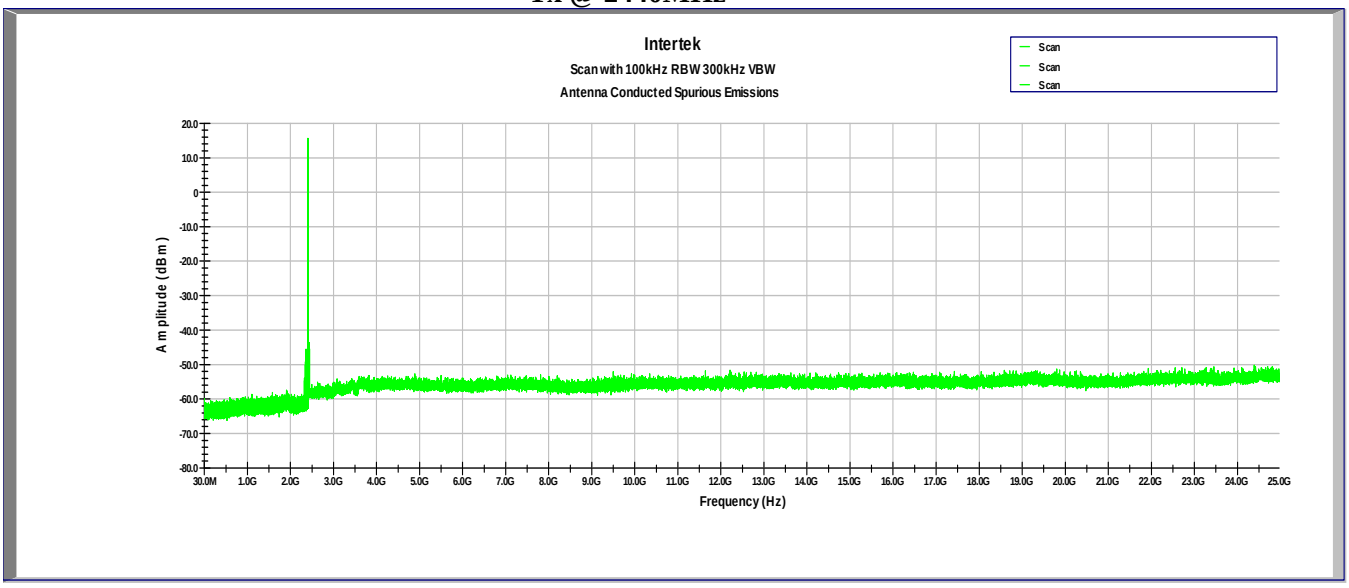
Plot 4.1

Tx @ 2405MHz



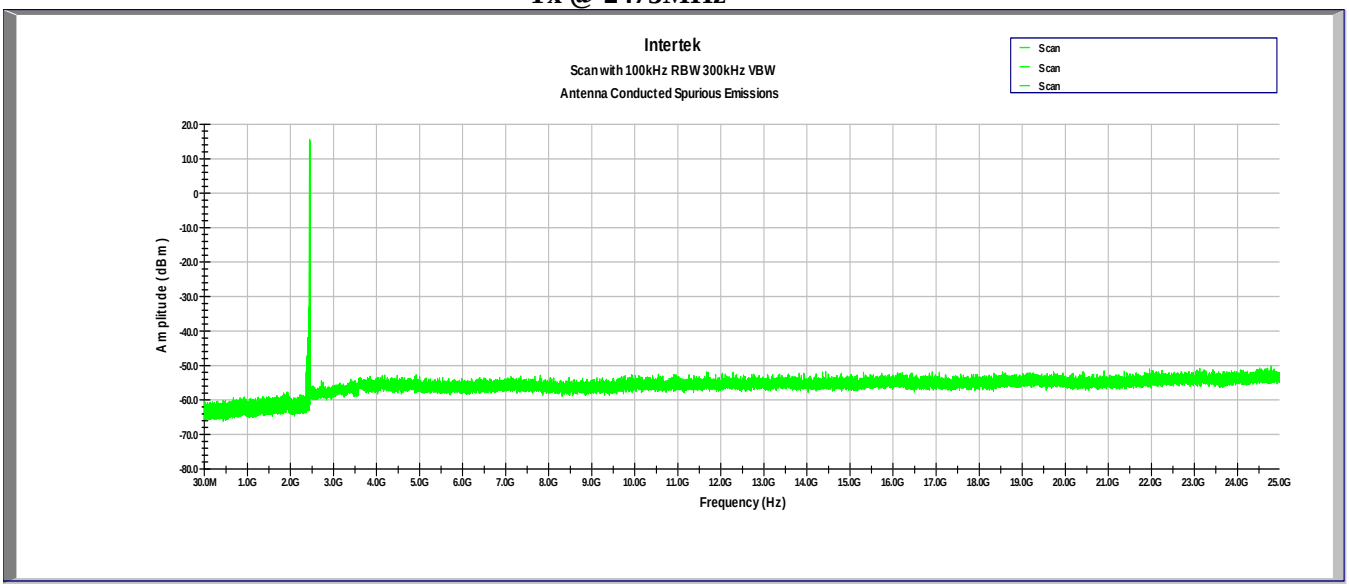
Plot 4.2

Tx @ 2440MHz



Plot 4.3

Tx @ 2475MHz



4.5 Transmitter Radiated Emissions
FCC Rule 15.247(d), 15.209, 15.205

4.5.1 Requirement

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)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.5.2 Procedure

Radiated emission measurements were performed from 30 MHz to 25,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

4.5.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

4.5.3 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The EUT passed the test by 0.5dB.

Table 5.1
Transmitter Radiated Emissions below 1GHz
Tx @ 2405

Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

Operator: KK
May 30, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
3.952E+07	37.0	40.0	-3.0	41.0	0.7	32.1	10.5	16.8
5.771E+07	38.3	40.0	-1.7	47.6	0.9	32.1	10.5	11.5
8.156E+07	33.6	40.0	-6.4	47.0	1.0	32.1	10.5	7.1
1.534E+08	36.9	43.5	-6.6	49.0	1.4	32.0	10.5	8.0
1.801E+08	35.3	43.5	-8.2	45.8	1.6	32.0	10.5	9.4
4.152E+08	24.0	46.0	-22.0	27.0	2.4	32.0	10.5	16.1

Test Mode: ON, external DC supply
Temp: 23C, Humidity: 41%

Table 5.2
Transmitter Radiated Emissions below 1GHz
Tx @ 2440

Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

Operator: KK
May 30, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
3.952E+07	37.1	40.0	-2.9	41.0	0.7	32.1	10.5	16.8
5.771E+07	38.2	40.0	-1.8	47.6	0.9	32.1	10.5	11.5
8.156E+07	33.6	40.0	-6.4	47.0	1.0	32.1	10.5	7.1
1.534E+08	37.1	43.5	-6.4	49.0	1.4	32.0	10.5	8.0
1.801E+08	35.3	43.5	-8.2	45.8	1.6	32.0	10.5	9.4
4.152E+08	24.1	46.0	-21.9	27.0	2.4	32.0	10.5	16.1

Test Mode: ON, external DC supply
Temp: 23C, Humidity: 41%

Notes: Measurements made at 10 meters distance.

Table 5.3
Transmitter Radiated Emissions below 1GHz
Tx @ 2475

Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

Operator: KK
May 30, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
3.952E+07	37.0	40.0	-3.0	41.0	0.7	32.1	10.5	16.8
5.771E+07	38.4	40.0	-1.6	47.6	0.9	32.1	10.5	11.5
8.156E+07	33.8	40.0	-6.2	47.0	1.0	32.1	10.5	7.1
1.534E+08	37.0	43.5	-6.5	49.0	1.4	32.0	10.5	8.0
1.801E+08	35.1	43.5	-8.4	45.8	1.6	32.0	10.5	9.4
4.152E+08	24.1	46.0	-21.9	27.0	2.4	32.0	10.5	16.1

Test Mode: ON, external DC supply
Temp: 23C, Humidity: 41%

Notes: Measurements made at 10 meters distance.

Table 5.4
Transmitter Radiated Emissions above 1GHz

Temperature: 23.0 C	Company: Vasona Labs, Inc.
Humidity: 41.0 %	Model: LC202
Measurement distance: 3 m	Date: June 01, 2012
Configuration: EUT with internal antenna	

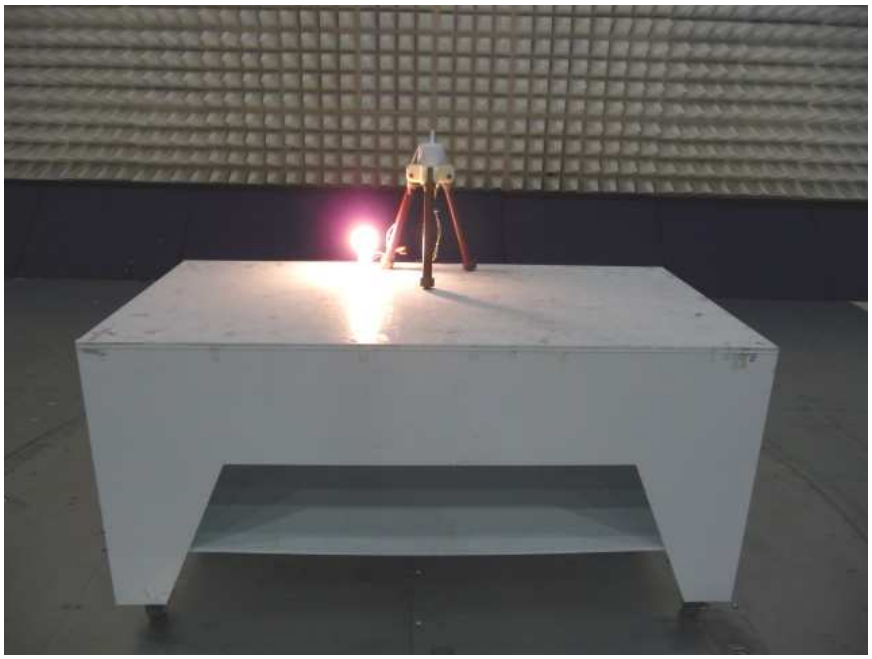
Frequency MHz	Measurement Type	SA reading dB(uV)	Correction Factor dB	Duty Cycle* dB	Ant. Factor dB(1/m)	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx at 2405 MHz								
4810	Peak	58.6	-29.4	--	32.8	62.0	74.0	-12.0
12025	Peak	60.1	-25.2	--	38.6	73.5	74.0	-0.5
4810	Aver	58.6	-29.4	20.0	32.8	42.0	54.0	-12.0
12025	Aver	60.1	-25.2	20.0	38.6	53.5	54.0	-0.5
Tx at 2440 MHz								
4880	Peak	59.2	-29.2	--	32.8	62.8	74.0	-11.2
7320	Peak	55.3	-26.4	--	37.4	66.3	74.0	-7.7
12200	Peak	60.1	-25.2	--	38.4	73.3	74.0	-0.7
4880	Aver	59.2	-29.2	20.0	32.8	42.8	54.0	-11.2
7320	Aver	55.3	-26.4	20.0	37.4	46.3	54.0	-7.7
12200	Aver	60.1	-25.2	20.0	38.4	53.3	54.0	-0.7
Tx at 2475 MHz								
4950	Peak	61.2	-29.1	--	32.9	65.0	74.0	-9.0
7425	Peak	52.1	-26.9	--	37.4	62.6	74.0	-11.4
12375	Peak	58.3	-25.3	--	38.4	71.4	74.0	-2.6
4950	Aver	61.2	-29.1	20.0	32.9	45.0	54.0	-9.0
7425	Aver	52.1	-26.9	20.0	37.4	42.6	54.0	-11.4
12375	Aver	58.3	-25.3	20.0	38.4	51.4	54.0	-2.6

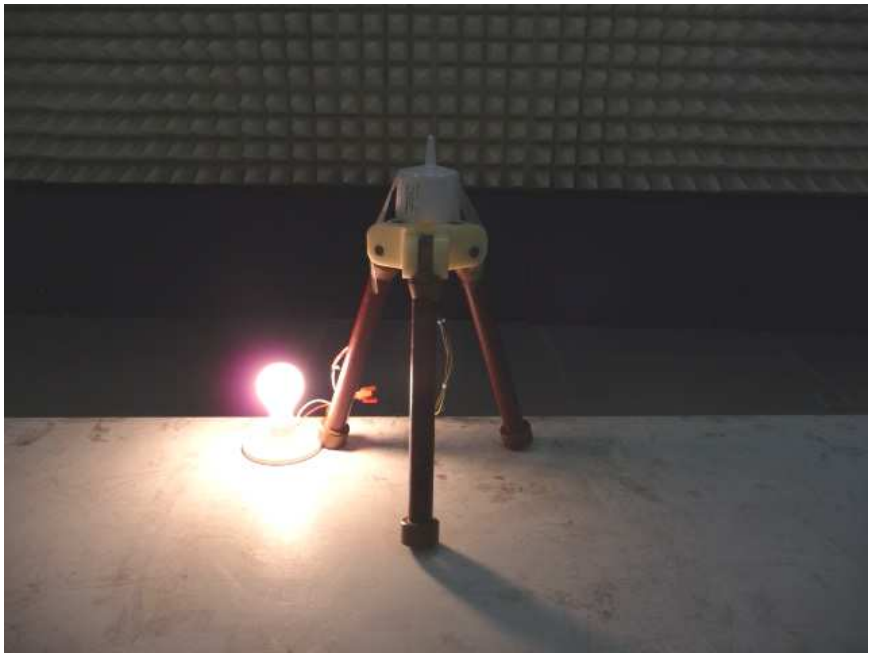
* See Appendix A for Duty Cycle measurement.

a) RBW = 1 MHz, VBW = 3 MHz - for peak measurements
b) Correction Factor: Cable loss + High Pass Filter loss - Pre-amplifier gain
c) FS at 3m = SA reading + Correction Factor + Antenna factor
d) Duty cycle was applied for Average measurements. Average level = Peak level - Duty Cycle
e) Measurements made at 3 meters distance. Radiated emission measurements were performed up to 25GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

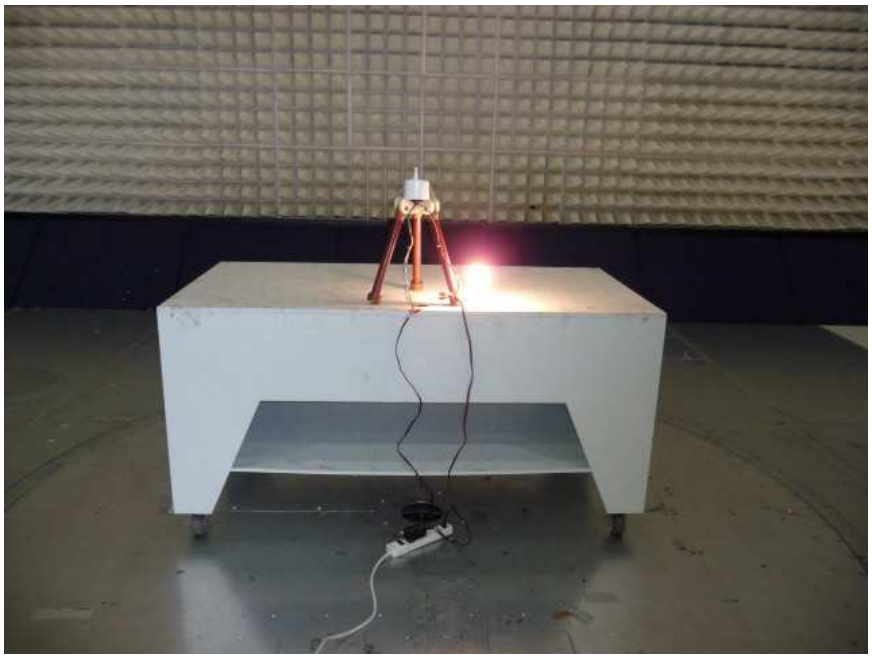
4.5.4 Test setup photographs

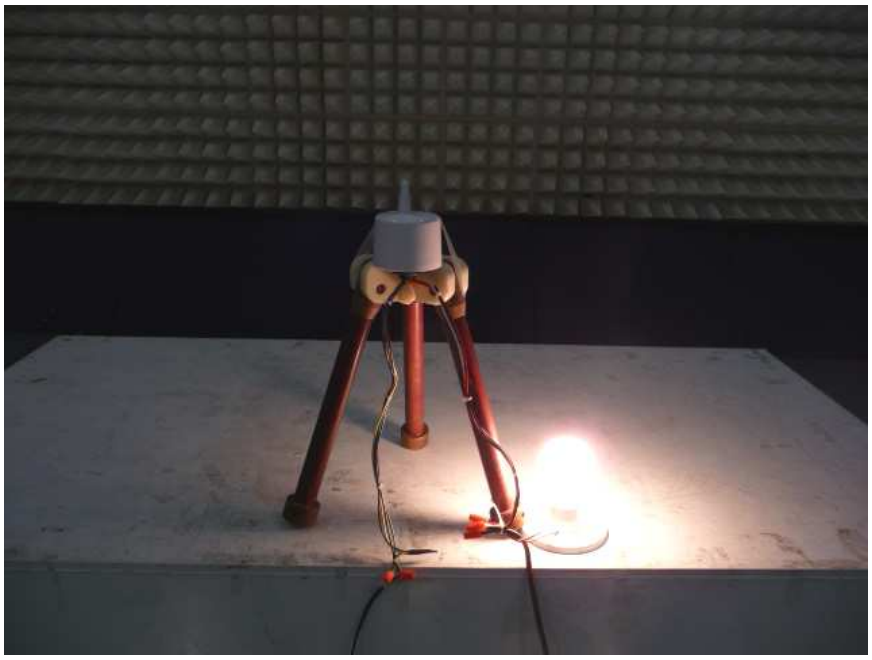
The following photographs show the testing configurations used.





4.5.4 Test setup photographs





4.6 Radiated Emissions from Digital Parts and Receiver
FCC Ref: 15.109

4.6.1 Requirement

Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 *

Frequency (MHz)	Class A at 10m dB(µV/m)	Class B at 3m dB(µV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.6.2 Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2003).

Example Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor to from the measured reading, followed by subtracting the Amplifier Gain (if any) and Distance Correction Factor (if any). The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – PA – DCF

Where FS = Field Strength in dB (μV/m)
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF=Distance Correction Factor in dB
(Formula: DCF = $20\log_{10}$ (measurement distance/specification distance)

Assume a receiver reading of 52.0 dB (μV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB and DCF of 10.5 dB (DCF in this example: $20\log_{10}$ (10/3)) is subtracted, giving field strength of 21.5 dB (μV/m).

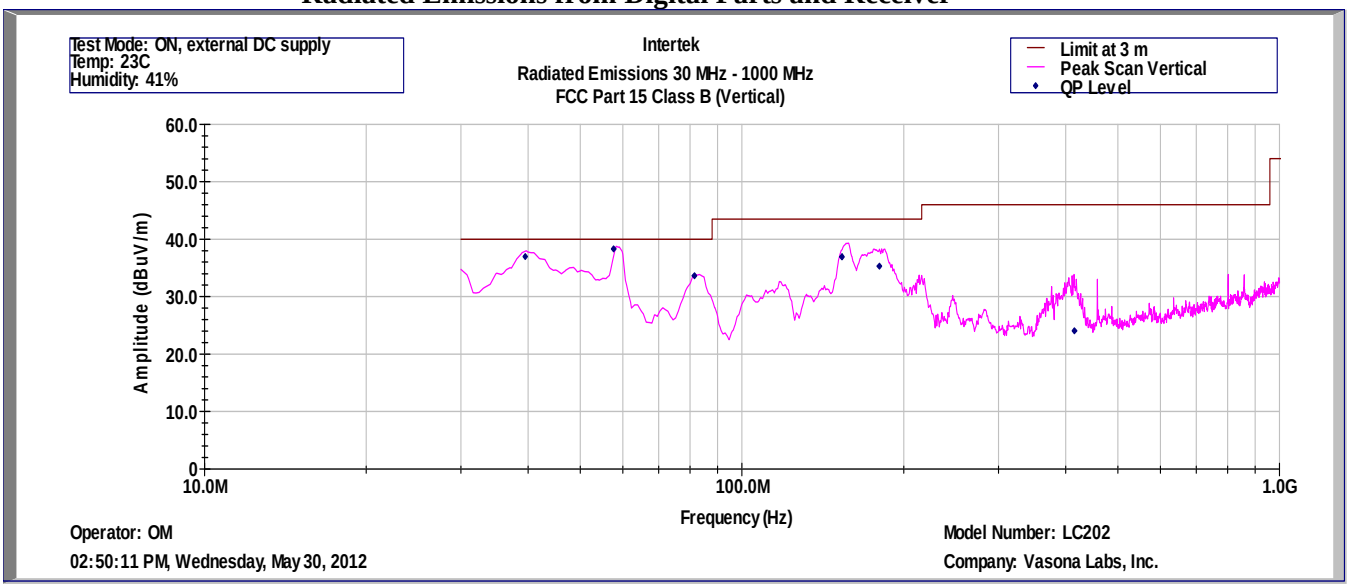
RA = 52.0 dB (μV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
AG = 29.0 dB
DCF=10.5 dB
FS = RF + AF + CF – AG – DCF
FS = 52.0 + 7.4 + 1.6 – 29.0 – 10.5
FS = 21.5 dB (μV/m)

4.6.3 Test Results

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater below 1000 MHz and 1 MHz - above 1000 MHz.

The EUT passed by 1.7dB for Class B.

Table 6.1
Radiated Emissions from Digital Parts and Receiver



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Vertical)

Operator: OM
May 30, 2012

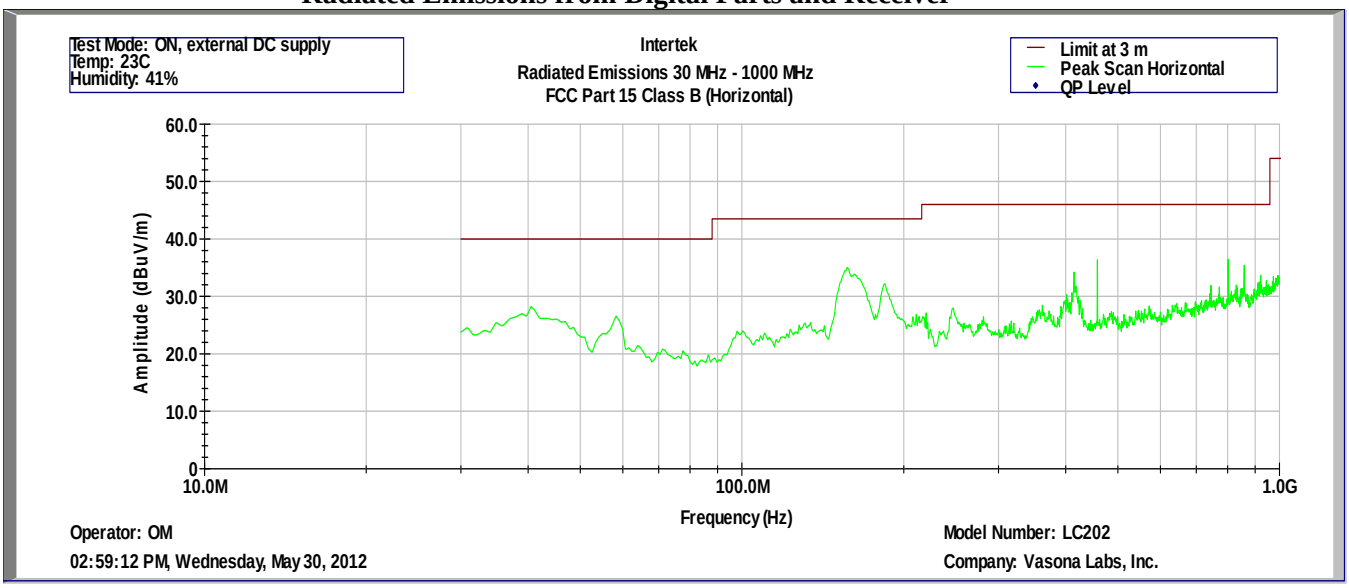
Model Number: LC202
Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
3.952E+07	37.0	40.0	-3.0	41.0	0.7	32.1	10.5	16.8
5.771E+07	38.3	40.0	-1.7	47.6	0.9	32.1	10.5	11.5
8.156E+07	33.6	40.0	-6.4	47.0	1.0	32.1	10.5	7.1
1.534E+08	36.9	43.5	-6.6	49.0	1.4	32.0	10.5	8.0
1.801E+08	35.3	43.5	-8.2	45.8	1.6	32.0	10.5	9.4
4.152E+08	24.0	46.0	-22.0	27.0	2.4	32.0	10.5	16.1

Test Mode: ON, external DC supply
Temp: 23C
Humidity: 41%

Table 6.2

Radiated Emissions from Digital Parts and Receiver



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (Pk-Horizontal)

Operator: OM
May 30, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

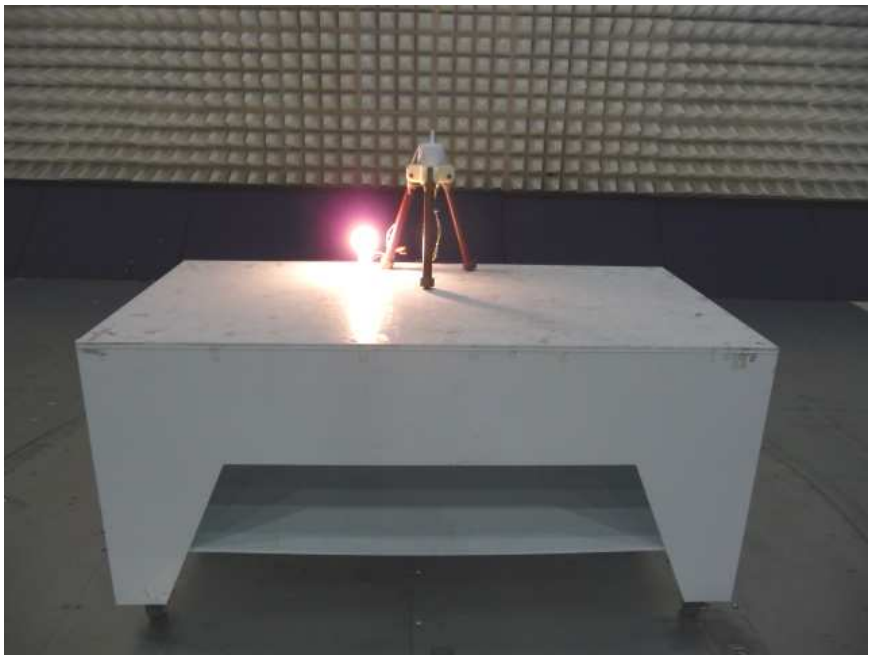
Frequency (Hz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	DCF dB	AF dB(1/m)
4.051E+07	28.2	40.0	-11.8	32.3	0.7	32.1	10.5	16.7
5.829E+07	26.5	40.0	-13.5	36.1	0.9	32.1	10.5	11.2
1.569E+08	35.0	43.5	-8.5	46.5	1.5	32.0	10.5	8.6
1.844E+08	32.2	43.5	-11.3	42.5	1.6	32.0	10.5	9.6
4.148E+08	34.2	46.0	-11.8	37.3	2.4	32.0	10.5	16.1
4.584E+08	36.4	46.0	-9.6	39.2	2.5	32.0	10.5	16.1
8.028E+08	36.4	46.0	-9.6	34.3	3.4	32.2	10.5	20.5
8.594E+08	35.4	46.0	-10.6	31.3	3.5	31.9	10.5	22.0

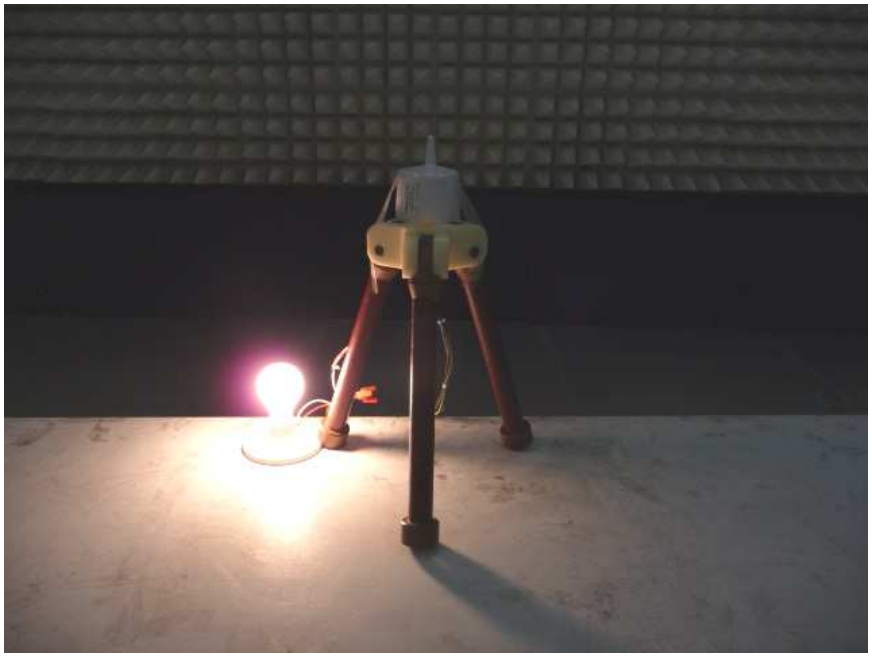
Test Mode: ON, external DC supply
Temp: 23C, Humidity: 41%

Notes: Radiated measurements below 1GHz were made at 10 meters distance and above 1GHz at 3 meters distance. Radiated emission measurements were performed up to 25GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

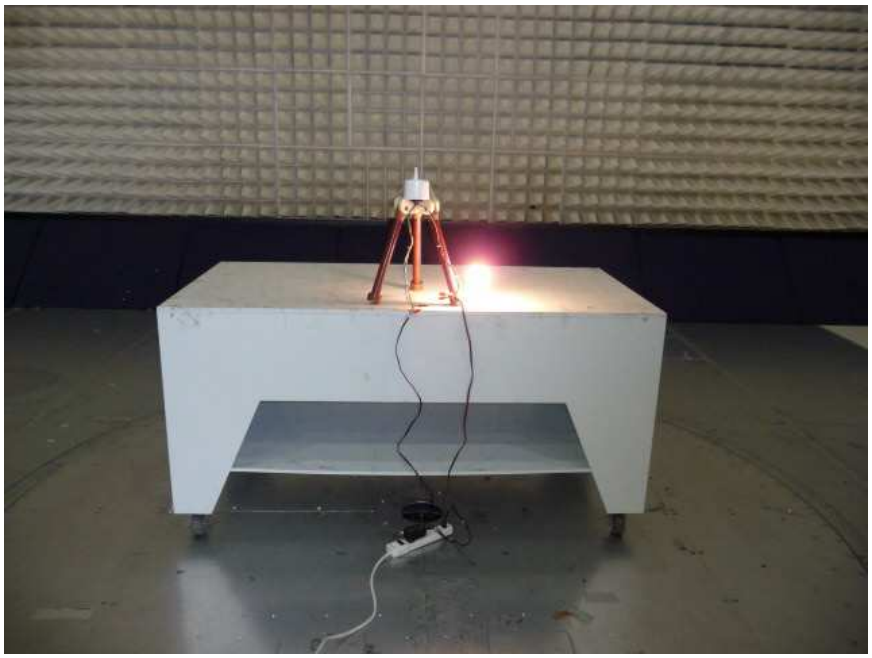
4.6.4 Test setup photographs

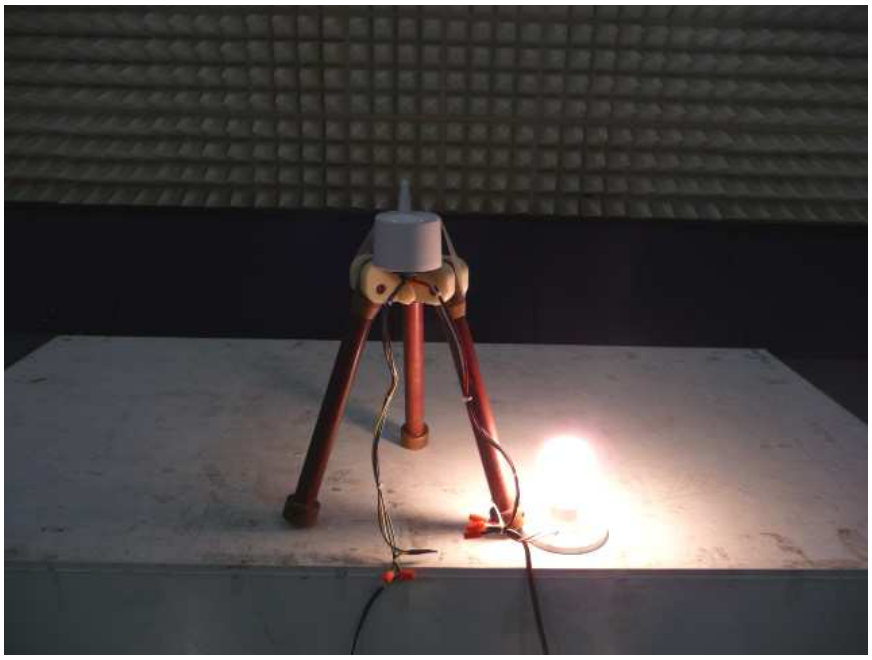
The following photographs show the testing configurations used.





4.6.4 Test setup photographs





4.7 AC Line Conducted Emission
FCC 15.207

4.7.1 Requirement

Frequency Band MHz	Class B Limit dB (μV)	
	Quasi-Peak	**Average**
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Note: At the transition frequency the lower limit applies.

4.7.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

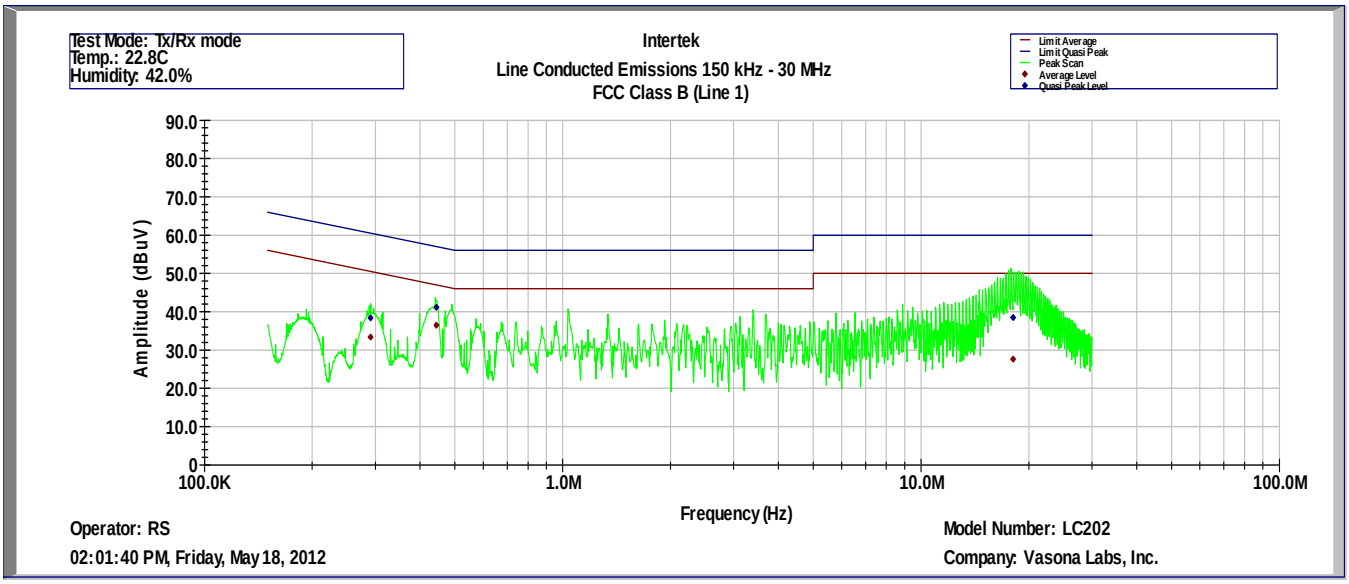
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

4.7.3 Test Result

Conducted Disturbance at AC Mains



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 1)

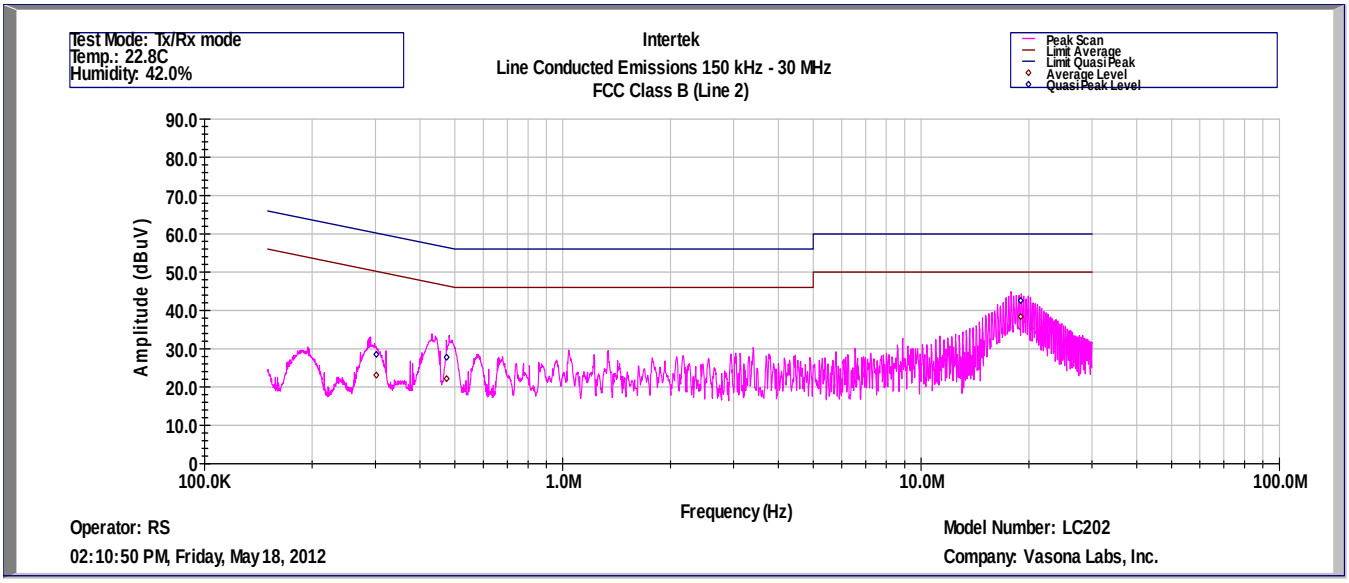
Operator: RS
May 18, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
Hz	dBuV	dBuV	dBuV	dBuV	dB	dB
290800	33.4	38.4	52.0	62.0	-18.6	-23.6
443800	36.5	41.2	47.6	57.6	-11.1	-16.4
1.805E+07	27.6	38.5	50.0	60.0	-22.4	-21.5

Test Mode: Tx/Rx mode
Temp.: 22.8C
Humidity: 42.0%

Conducted Disturbance at AC Mains



Intertek
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 2)

Operator: RS
May 18, 2012

Model Number: LC202
Company: Vasona Labs, Inc.

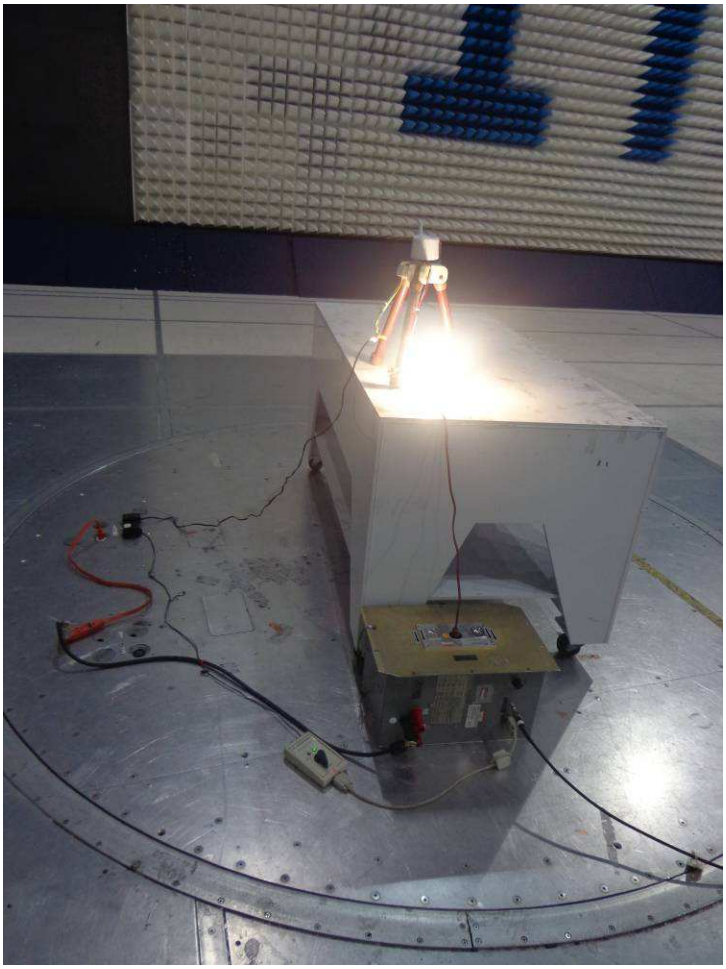
Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
Hz	dBuV	dBuV	dBuV	dBuV	dB	dB
301800	23.1	28.5	51.7	61.7	-28.6	-33.1
474100	22.2	27.8	46.7	56.7	-24.6	-29.0
1.896E+07	38.4	42.6	50.0	60.0	-11.6	-17.4

Test Mode: Tx/Rx mode
Temp.: 22.8C
Humidity: 42.0%

Results: **Complies** by 11.1 dB

4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



5.0 RF Exposure Evaluation

MPE Evaluation

The EUT is a Wireless Module used in a mobile application. It will be located at least 20 cm from any body part of the user or nearby persons.

The maximum conducted power is 19.9dBm (97.7mW); maximum antenna is 2.0dBi gain. Therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP calculated is 21.9dBm or 154.9mW.

The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

It is considered that 20 cm is the minimum distance that any persons will be next to the EUT.

At 20 cm, $S = 0.308\ W/m^2$, which is below the MPE Limit of $10\ W/m^2$

6.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/09/13
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/09/13
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	03/22/13
Spectrum Analyzer	Rohde&Schwarz	FSP-40	100030	12	11/09/12
Spectrum Analyzer	Rohde&Schwarz	ESU	100172	12	10/04/12
BI-Log Antenna	ARA	LPB-2513/A	1154	12	07/06/12
Horn Antenna	EMCO	3115	9107-3712	12	11/16/12
Horn Antenna	EMCO	3115	00126795	12	11/03/12
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	Sonoma	310N	293620	12	11/11/12
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	09/01/12
Pre-Amplifier	Miteq	JSD44-18004000-30-5P	1071636	12	05/11/13
Signal Generator	Hewlett Packard	SMR40	100445	12	09/01/12
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	08/28/12

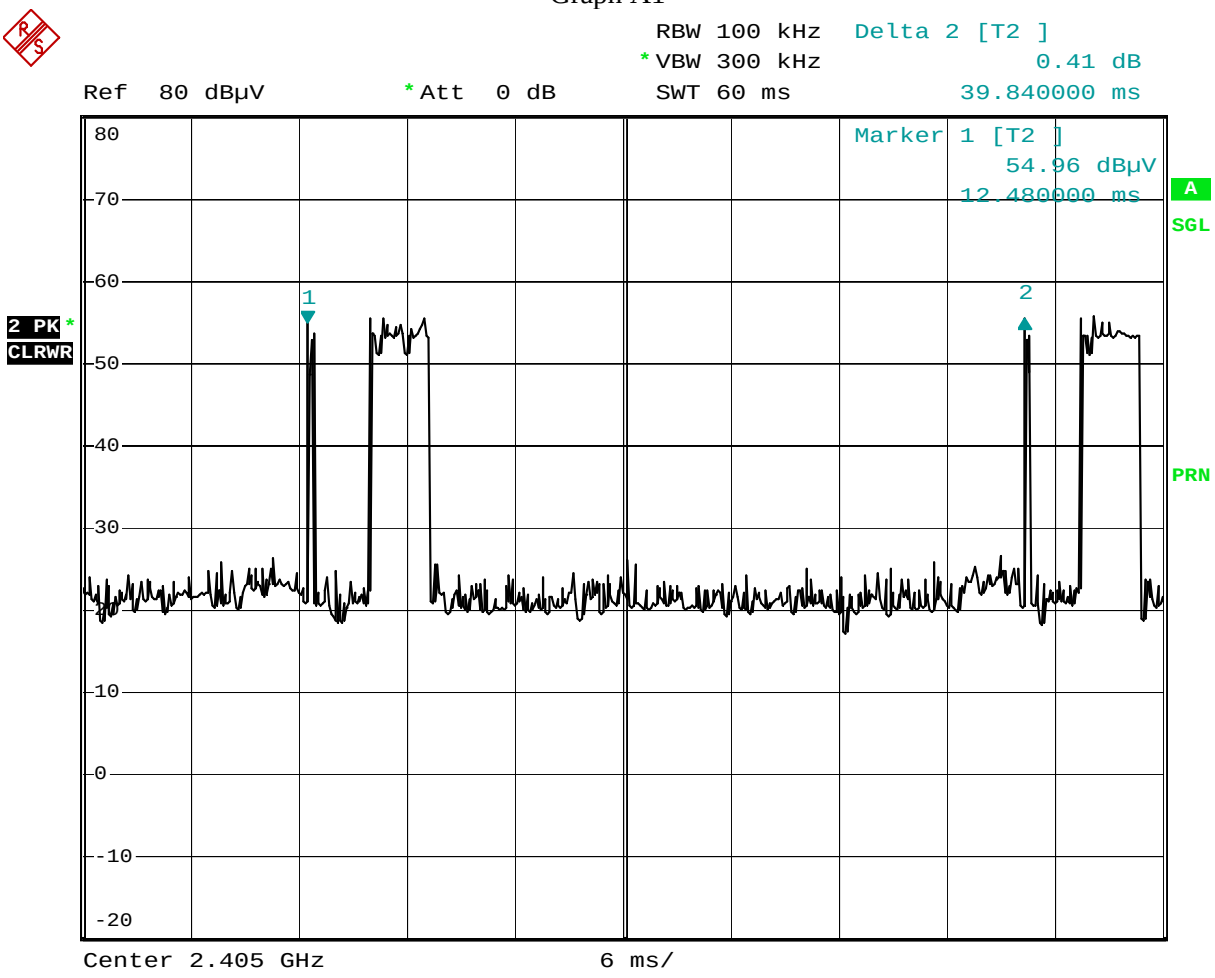
No Calibration required

7.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G100748465	KK	June 21, 2012	Original document

8.0 Appendix A –Graphs for Duty Cycle Measurement

Graph A1



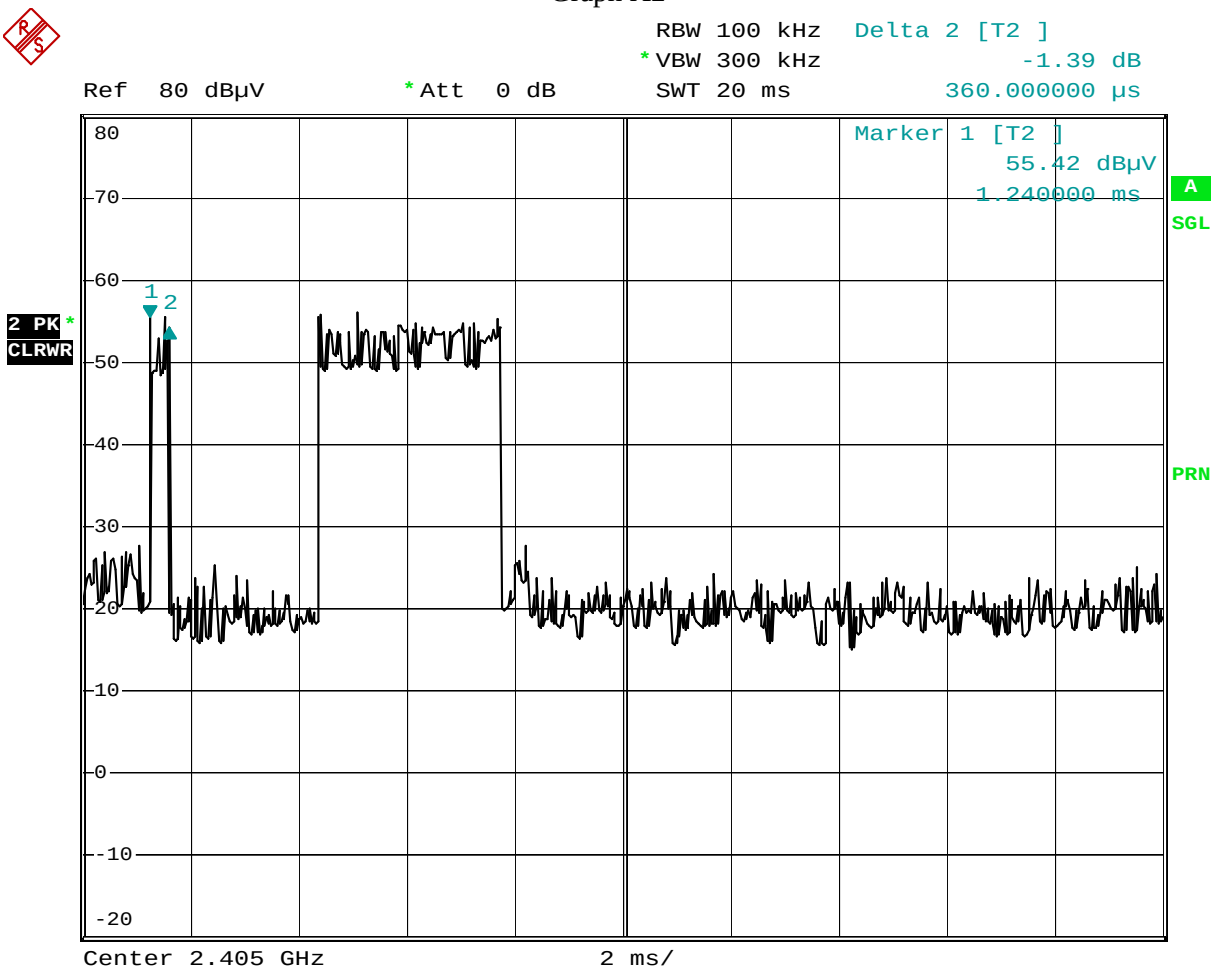
Date: 1.JUN.2012 11:45:32

Transmitter cycle time= 39.84ms {Refer the plot Graph A1}
Transmitter On time = 0.36ms + 3.4ms = 3.76ms {Refer the plots Graph A2 & Graph A3}

Duty Cycle Calculation = 20 log (3.76/39.84) = -20.5dB

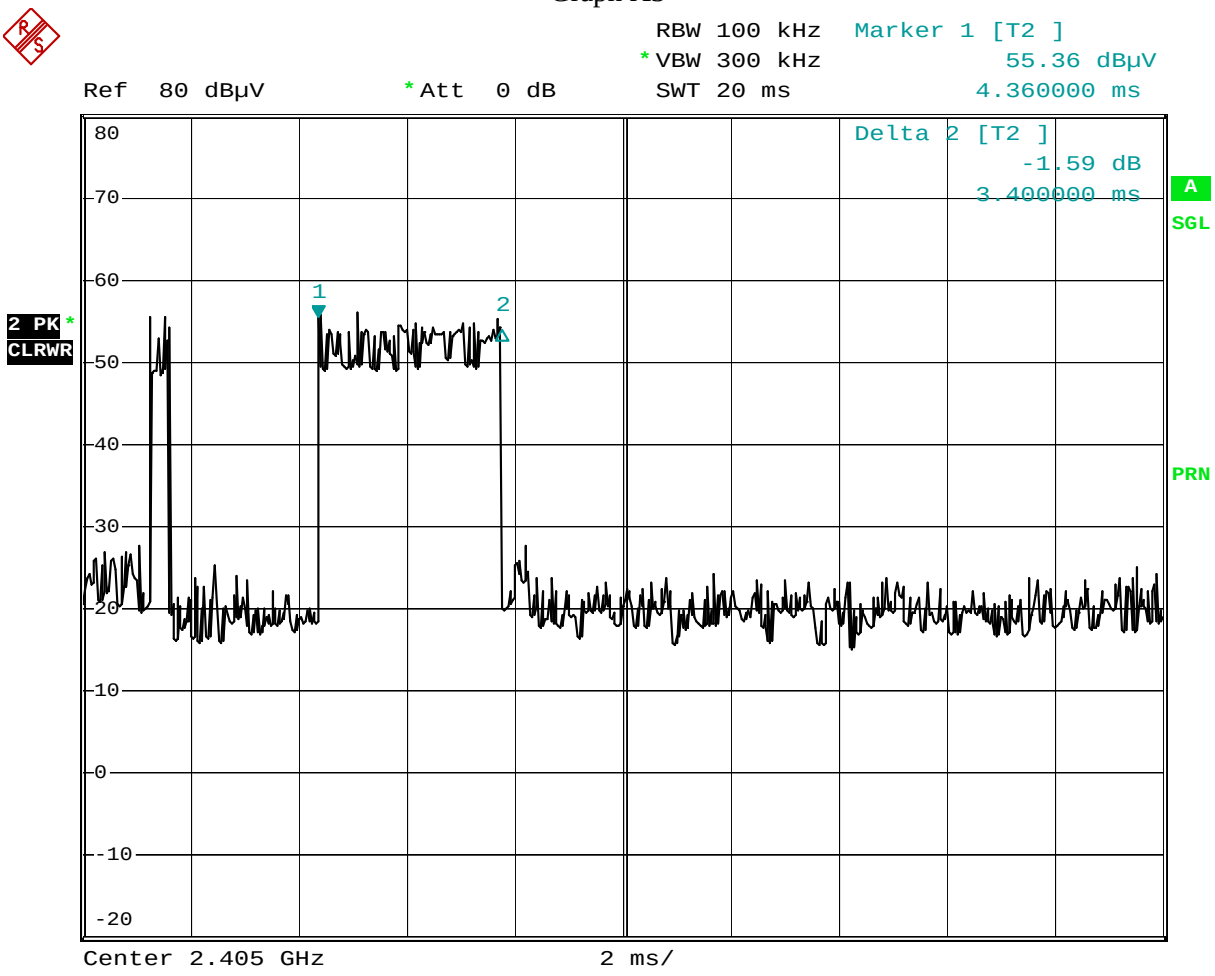
Maximum Duty Cycle allowed is 20dB. Hence 20dB Duty Cycle factor was used.

Graph A2



Date: 1.JUN.2012 11:47:54

Graph A3



Date: 1.JUN.2012 11:48:39