

TEST REPORT

Report Number: 100748465MPK-013

Project Number: G100748465

May 31, 2013

Testing performed on the
VasonaLink Light Controller

Model Number: LC201

FCC ID: O4ZLC201

IC: 10380A-LC201

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:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

Test Authorized by:

Vasona Labs, Inc.

14435C Big Basin Way #232

Saratoga, CA 95070, USA

Prepared by:



Krishna K Vemuri

Date: May 31, 2013

Reviewed by:



Uri Spector

Date: May 31, 2013

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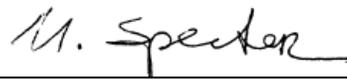
Report No. 100748465MPK-013

Equipment Under Test:	VasonaLink Light Controller
Trade Name:	Vasona Labs, Inc.
Model No.:	LC201
Serial No.:	0513-5061, 0513-5062
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 08 – May 24, 2013

We attest to the accuracy of this report:



Krishna K Vemuri
EMC Senior Staff Engineer



Uri Spector
Sr. Project Engineer

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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 / Occupied Bandwidth	15.247(a)(2)	RSS-GEN	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 08, 2013

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 08, 2013

Test completion date: May 24, 2013

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 LC201. 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 LC201, is presented below:

Applicant	Vasona Labs, Inc.
Model No.	LC201
FCC Identifier	O4ZLC201
IC ID	10380A-LC201
Transmission Protocol	802.15.4
Rated RF Output	20 dBm
Frequency Range	2405-2475 MHz
Type of modulation	OQPSK
Antenna(s) & Gain	Internal antenna, Omni directional antenna, 2.0 dBi gain, uFL (Mini PCI) connector type on board
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 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.

2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents “Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247” (KDB 558074).

Radiated emissions and AC mains line-conducted measurements were performed according to the procedures in ANSI C63.10. 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.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

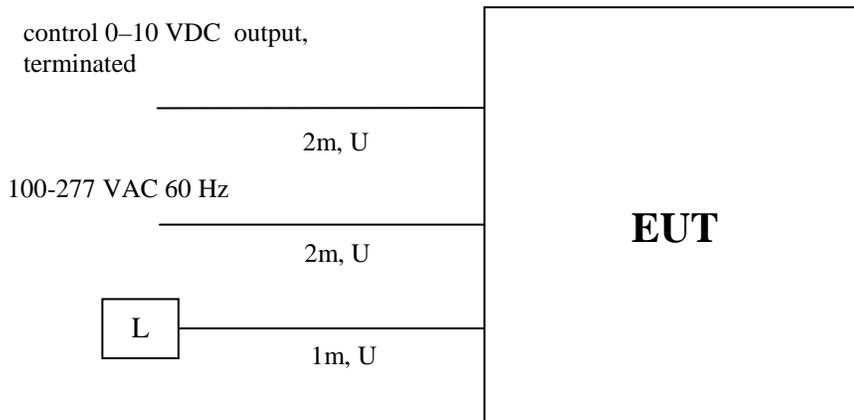
Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	100 Hz	-
Radiated emissions	4.2 dB	3.4 dB	3.6 dB
AC mains conducted emissions	2.4 dB	-	-

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 = Light bulbs	F = With Ferrite m = Length in Meters
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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 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), RSS-GEN

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)	DTS (6-dB) Bandwidth (per FCC 558074) (MHz)	Plot
2405	1.556	1.1
2440	1.571	1.2
2475	1.587	1.3

Frequency (MHz)	6-dB Channel Bandwidth (per RSS Gen) (MHz)	Plot
2405	1.554	1.7
2440	1.683	1.8
2475	1.827	1.9

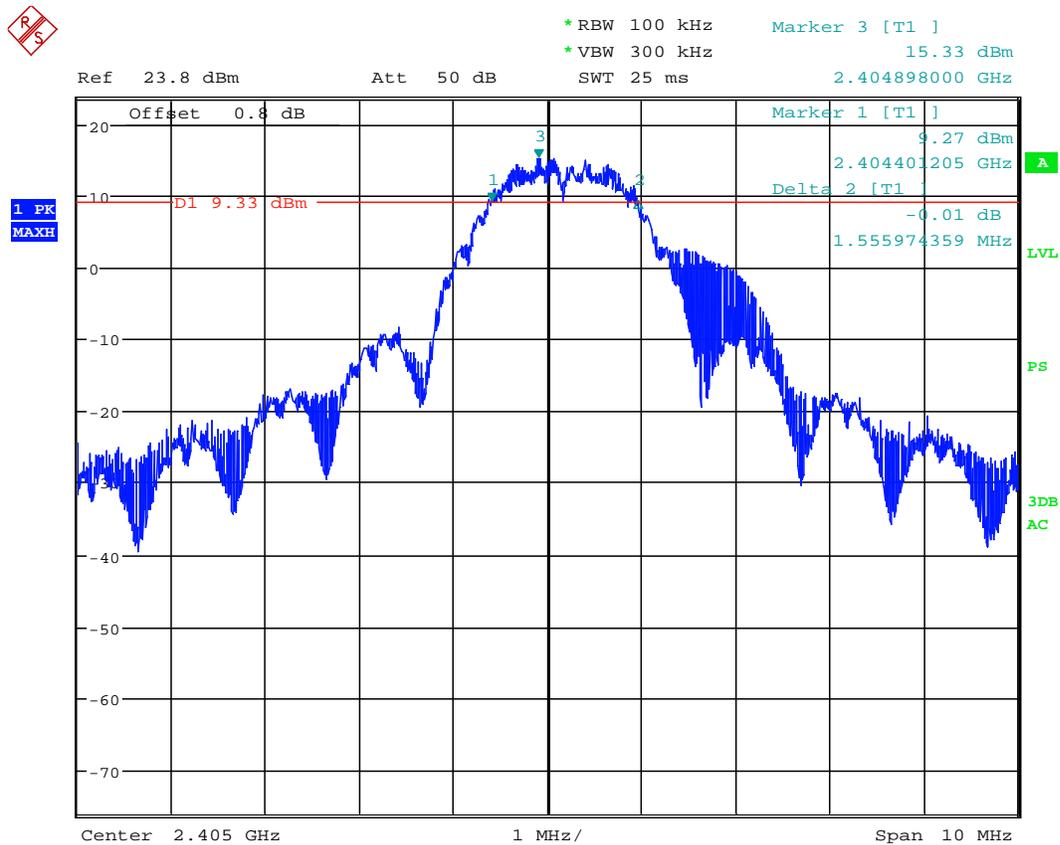
Frequency (MHz)	Occupied Bandwidth (MHz)	Plot
2405	2.790	1.4
2440	2.520	1.5
2475	2.534	1.6

On plots 1.1 – 1.9 the 6-dB Bandwidth and Occupied Bandwidth are presented.

Results

Complies

Plot 1.1



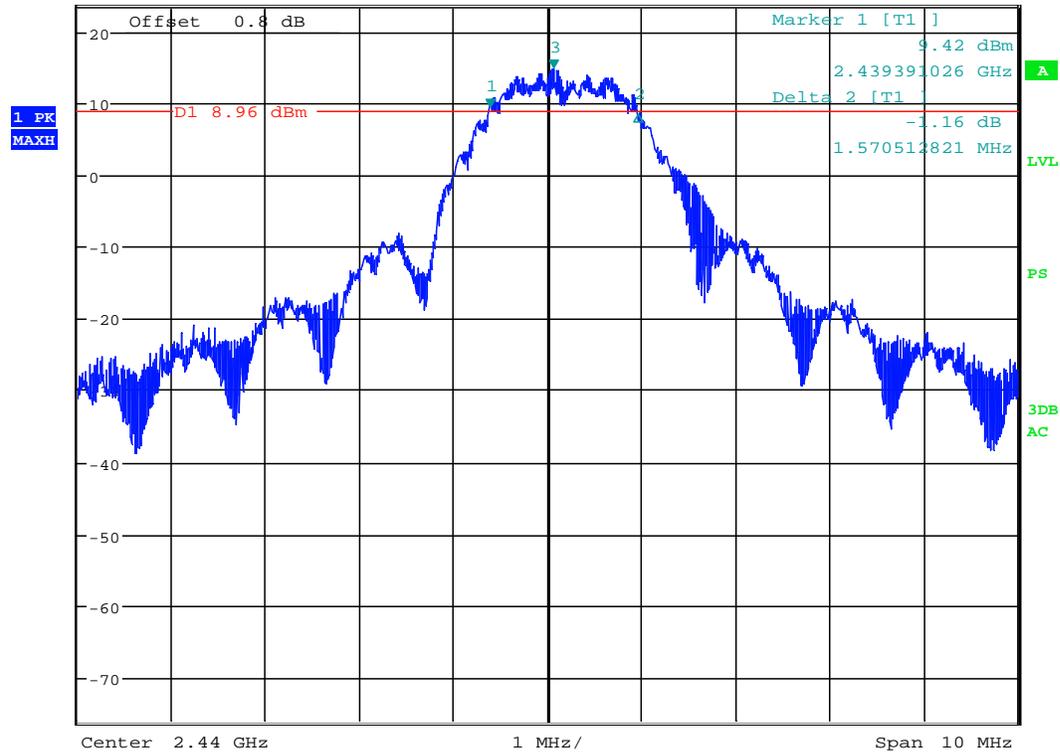
DTS bandwidth

Date: 15.MAY.2013 12:17:36

Plot 1.2



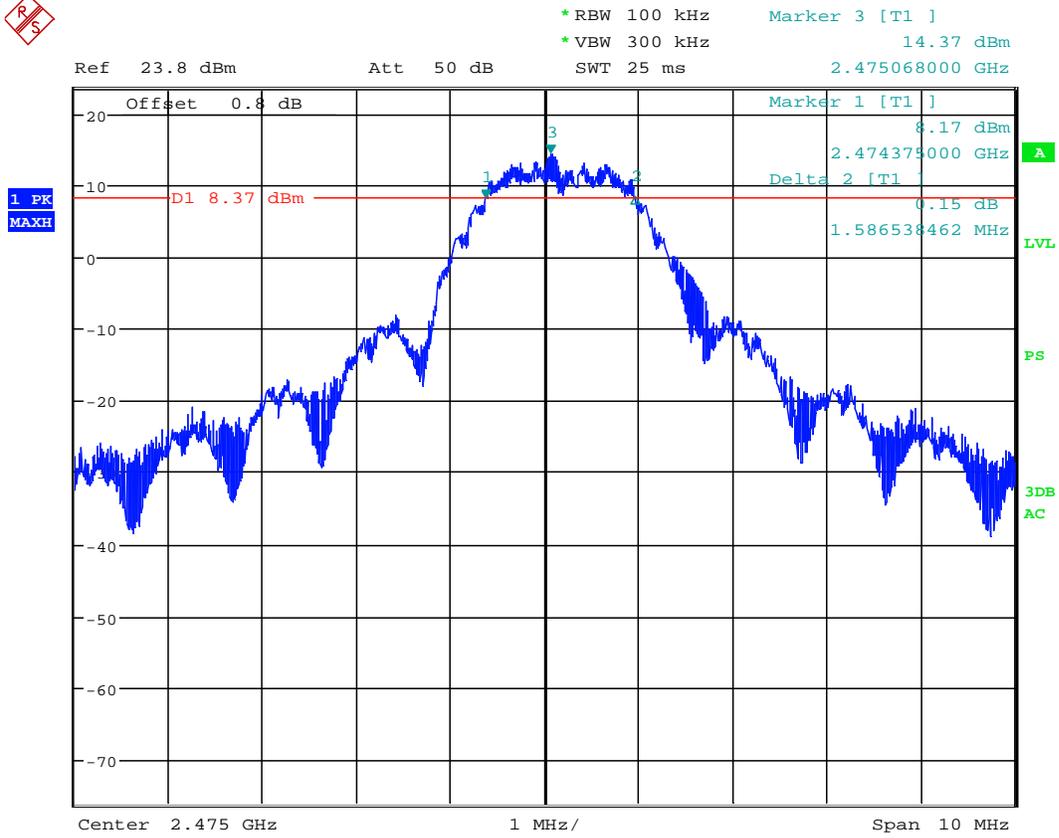
Ref 23.8 dBm Att 50 dB SWT 25 ms
 *RBW 100 kHz Marker 3 [T1] 14.96 dBm
 *VBW 300 kHz 2.440062000 GHz



DTS bandwidth

Date: 15.MAY.2013 11:25:00

Plot 1.3



DTS bandwidth

Date: 15.MAY.2013 11:35:52

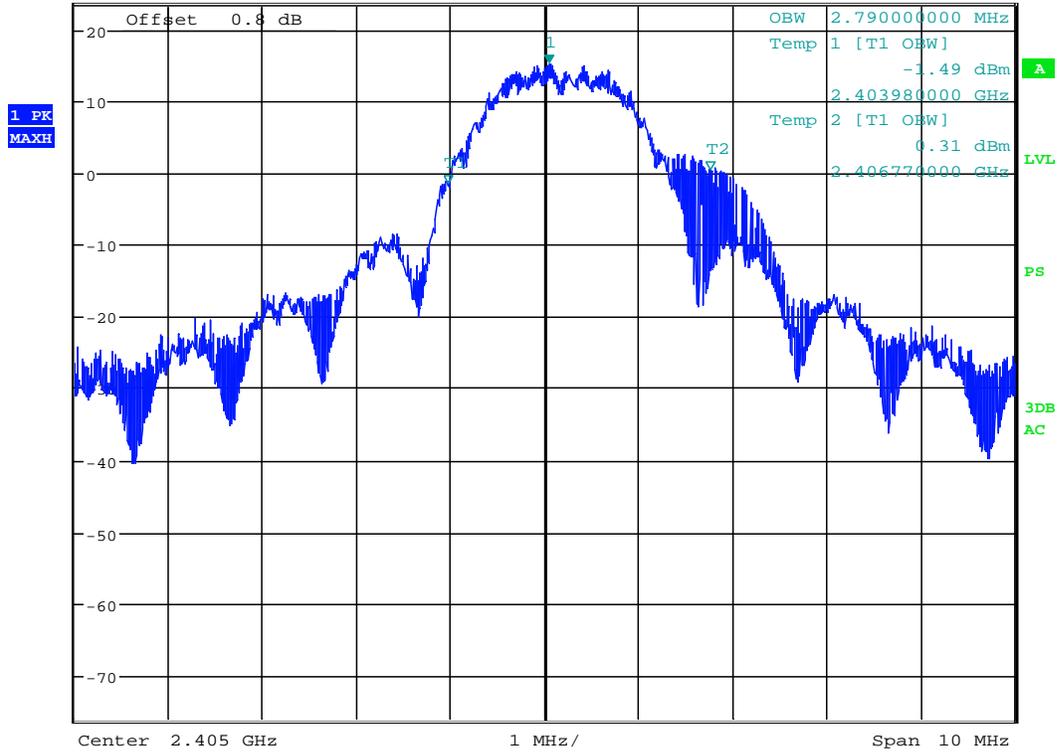
Plot 1.4



Ref 23.8 dBm Att 30 dB SWT 25 ms

*RBW 100 kHz *VBW 300 kHz

Marker 1 [T1] 15.22 dBm 2.405042000 GHz



Occupied bandwidth

Date: 15.MAY.2013 12:10:12

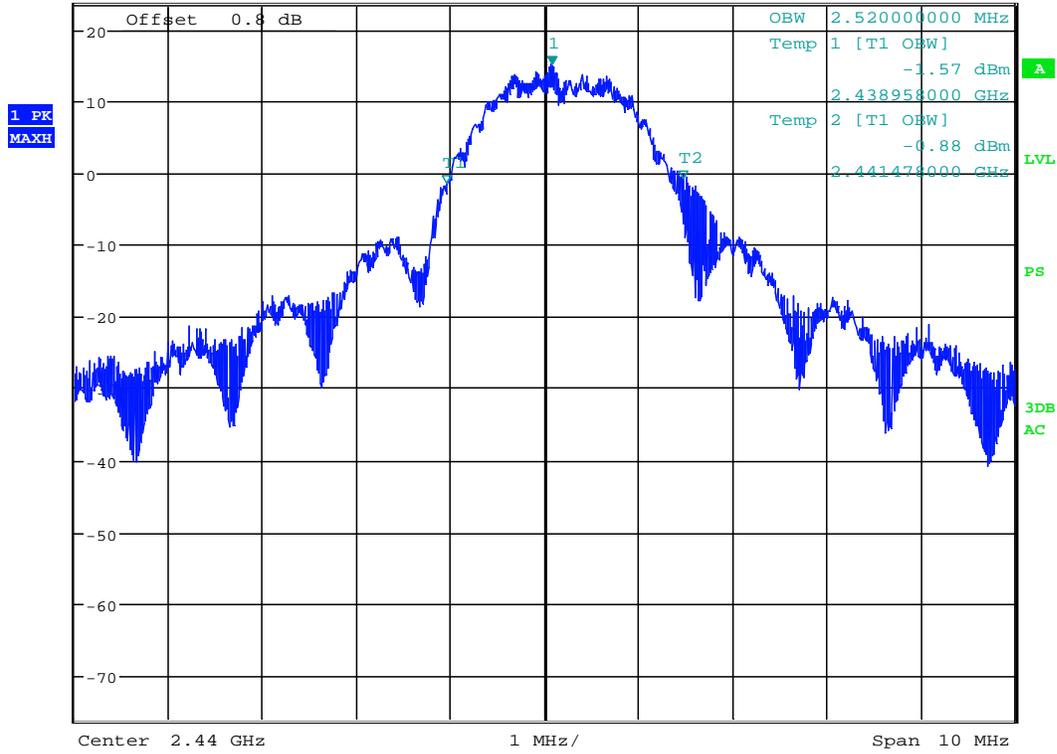
Plot 1.5



Ref 23.8 dBm Att 30 dB SWT 25 ms

*RBW 100 kHz *VBW 300 kHz

Marker 1 [T1] 15.05 dBm 2.440078000 GHz



Occupied bandwidth

Date: 15.MAY.2013 11:52:27

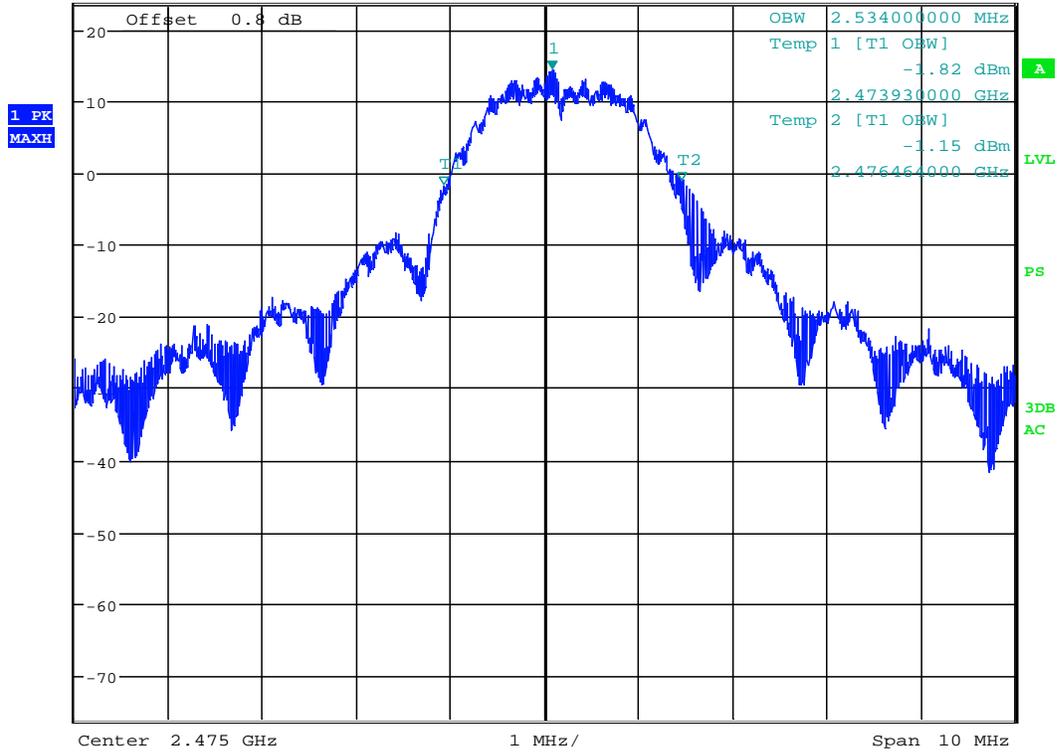
Plot 1.6



Ref 23.8 dBm Att 30 dB SWT 25 ms

*RBW 100 kHz *VBW 300 kHz

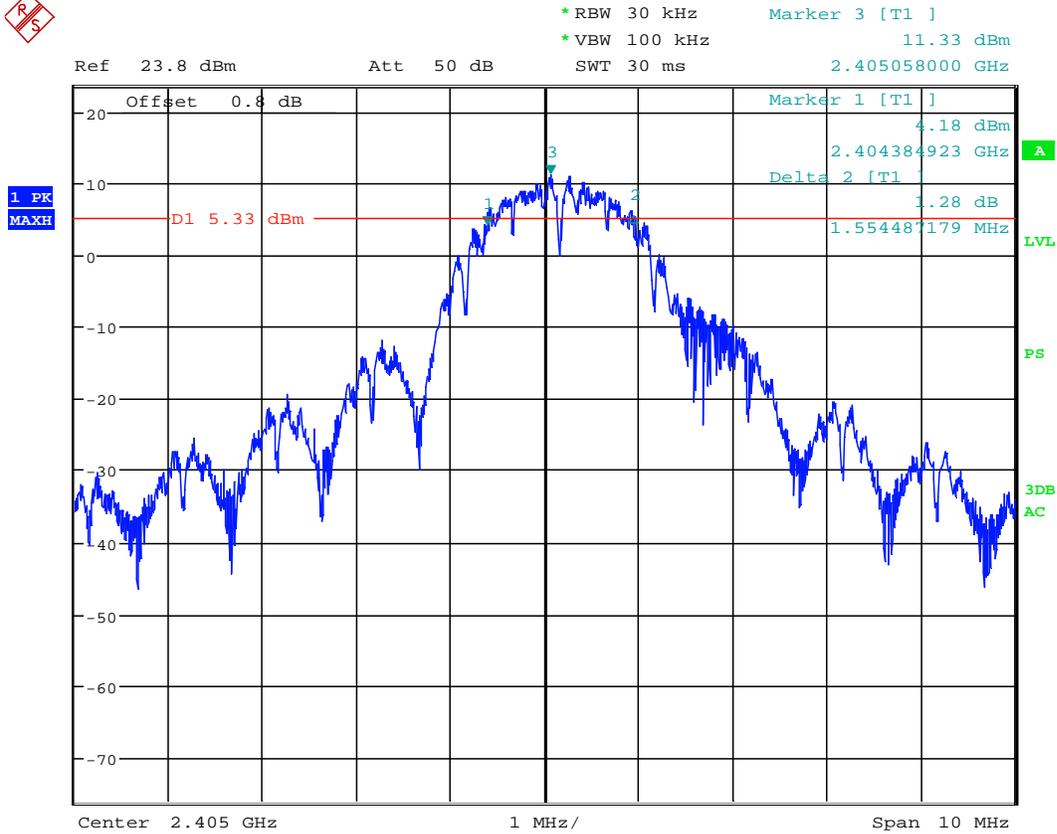
Marker 1 [T1] 14.41 dBm



Occupied bandwidth

Date: 15.MAY.2013 11:44:41

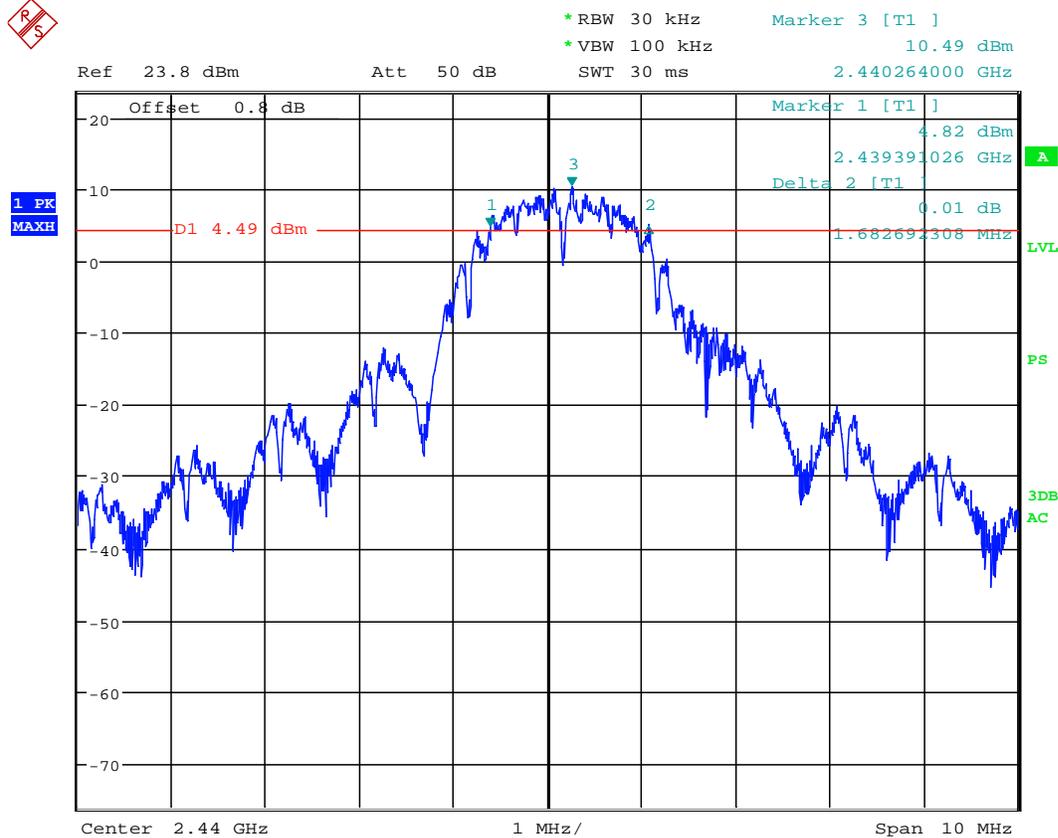
Plot 1.7



-6dB bandwidth

Date: 15.MAY.2013 12:39:11

Plot 1.8



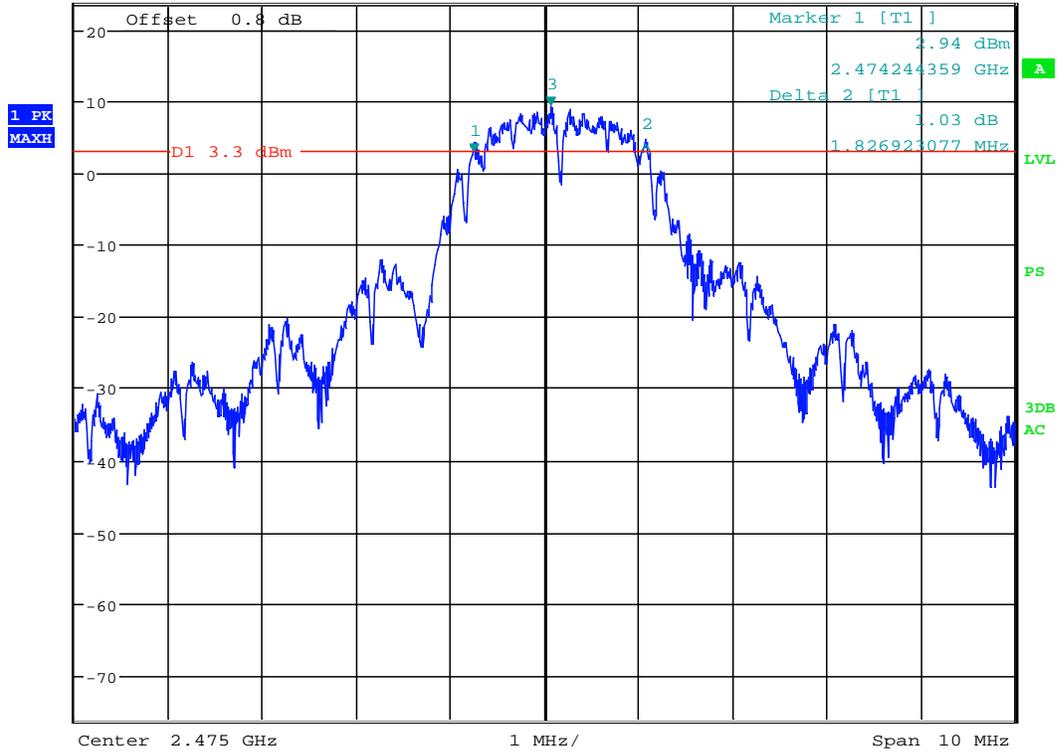
-6dB bandwidth

Date: 15.MAY.2013 12:52:15

Plot 1.9



Ref 23.8 dBm Att 50 dB RBW 30 kHz Marker 3 [T1] 9.31 dBm
 *VBW 100 kHz SWT 30 ms 2.475072000 GHz



-6dB bandwidth

Date: 15.MAY.2013 14:23:08

4.2 Maximum Peak Conducted Output Power
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 Peak Conducted Output Power.

The procedure described in FCC Publication 558074, was used. Specifically, section 9.1.1, with peak detector, spectrum analyzer RBW \geq DTS (6dB) bandwidth, VBW \geq 3 x RBW.

4.3.3 Test Result

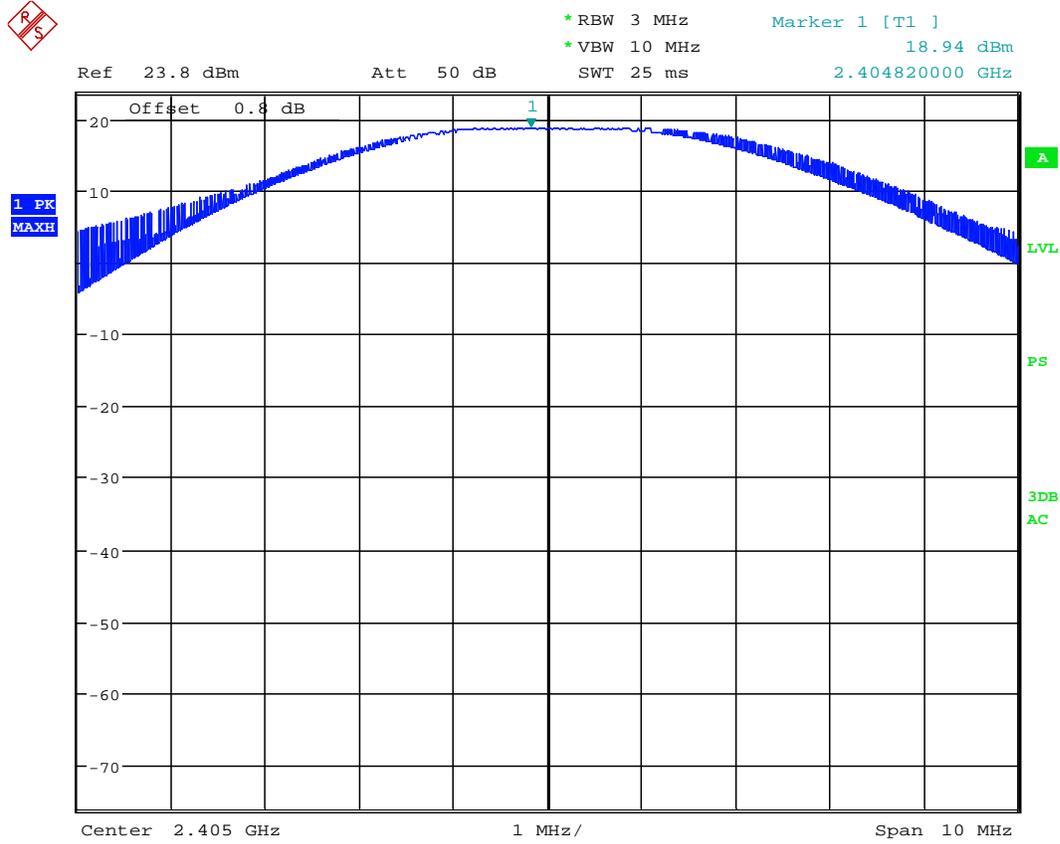
Refer to the following plots for the test result:

Frequency (MHz)	Output in dBm	Output in W	Plot number
2405	18.9	0.0783	2.1
2440	18.1	0.0652	2.2
2475	17.6	0.0577	2.3

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

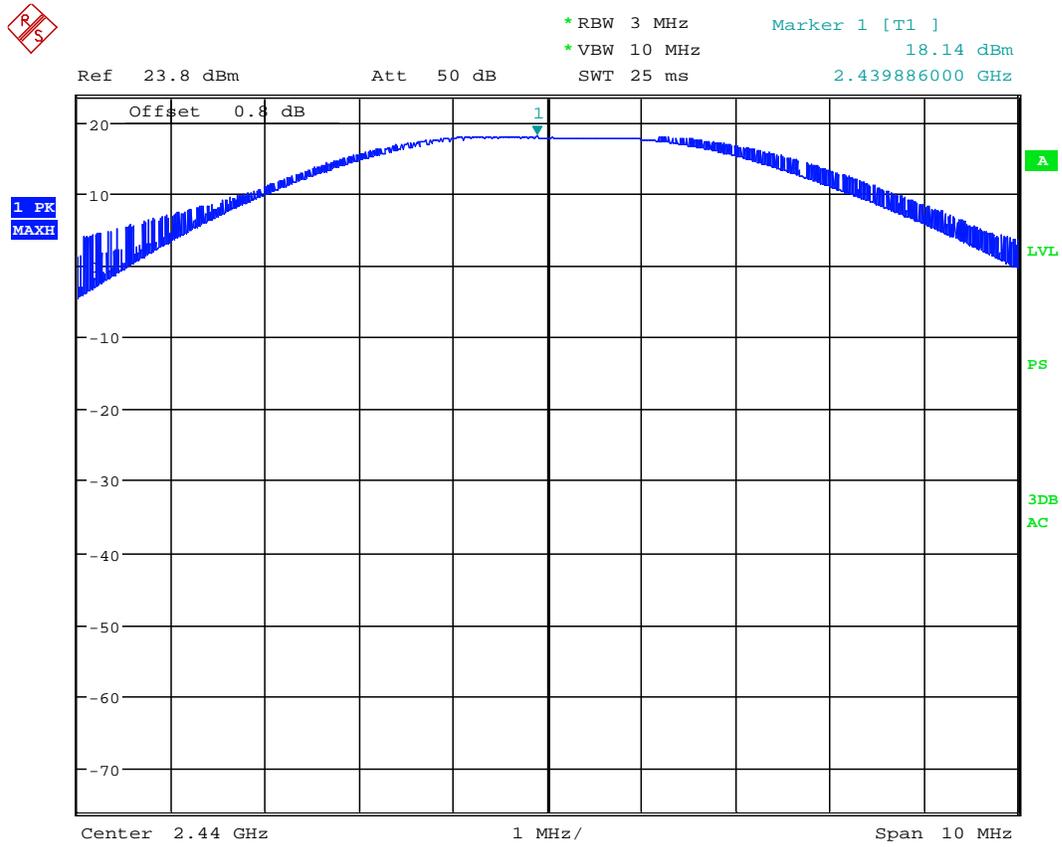
Results	Complies
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Plot 2.1



Maximum peak conducted output power
 Date: 15.MAY.2013 15:20:46

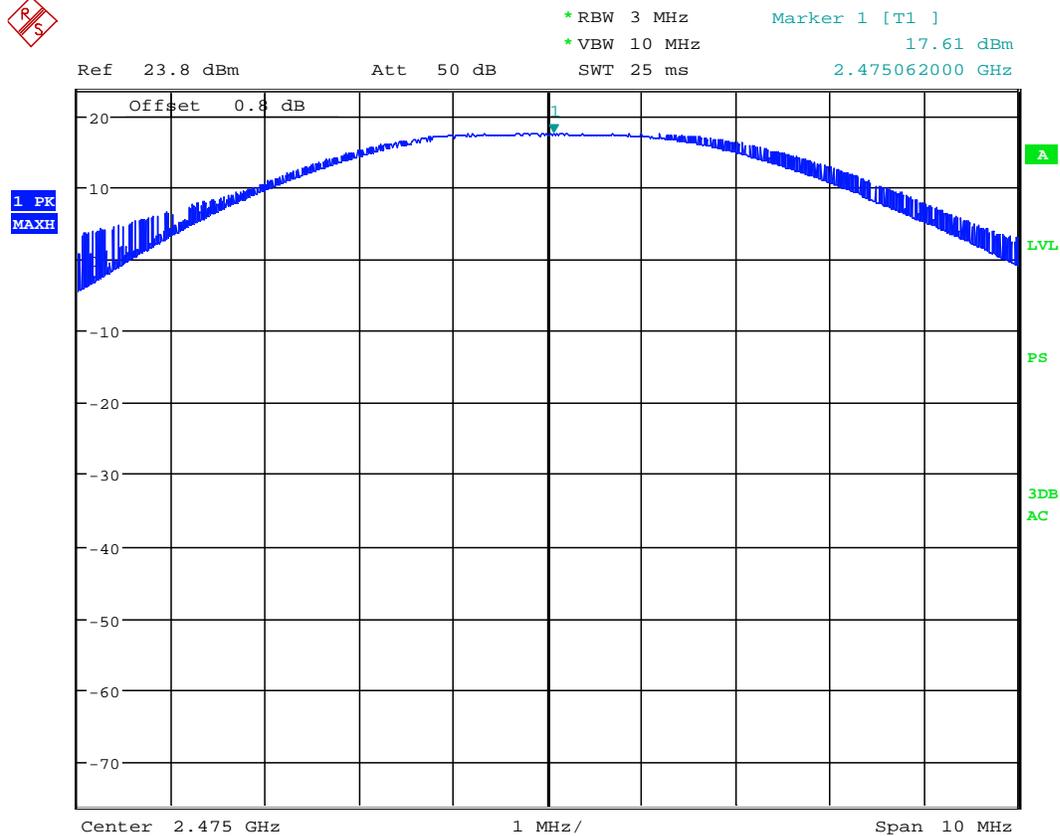
Plot 2.2



Maximum peak conducted output power

Date: 15.MAY.2013 15:24:49

Plot 2.3



Maximum peak conducted output power

Date: 15.MAY.2013 15:37:13

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 8 dBm 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 10.2 (Peak PSD), with peak detector, spectrum analyzer resolution bandwidth of 100 kHz, span to 1.5 times the DTS bandwidth, $VBW \geq 3 \times RBW$.

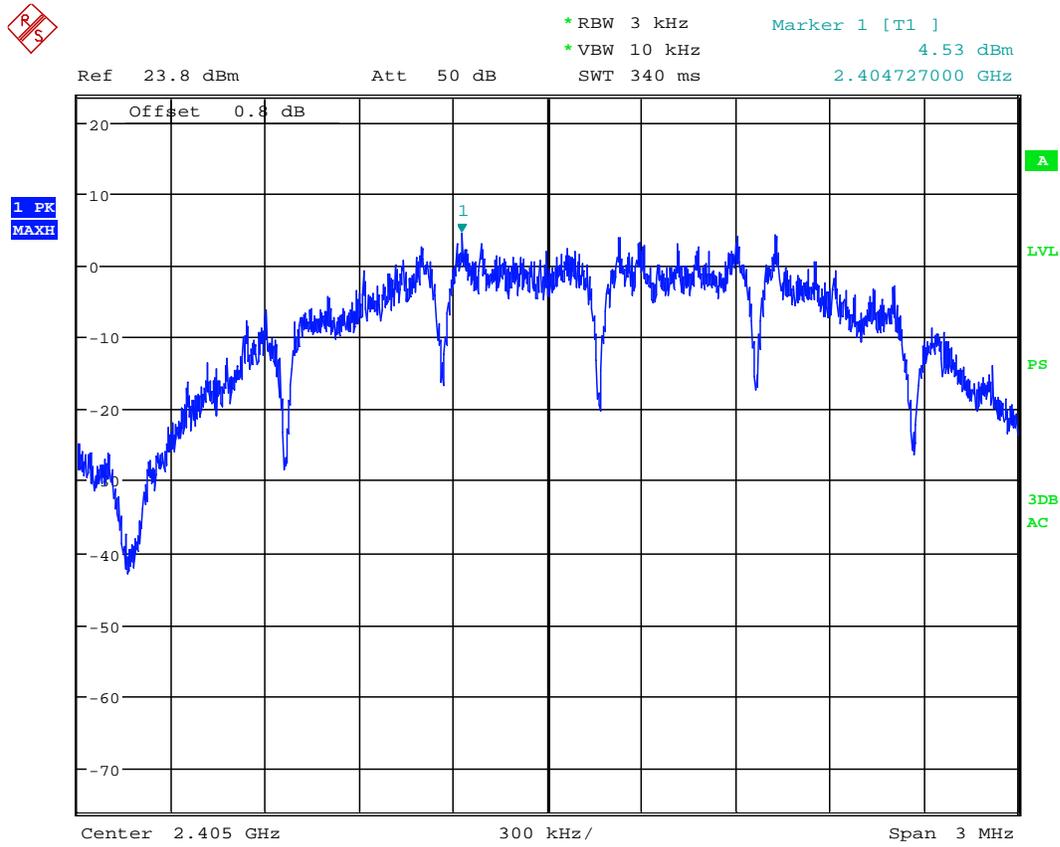
4.3.3 Test Result

Refer to the following plots for the test result:

Frequency (MHz)	Power Spectral Density (dBm)	Power Spectral Density Limit (dBm)	Margin (dB)	Plot number
2405	4.5	8.0	-3.5	3.1
2440	3.9	8.0	-4.1	3.2
2475	3.1	8.0	-4.9	3.3

Results	Complies
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Plot 3.1



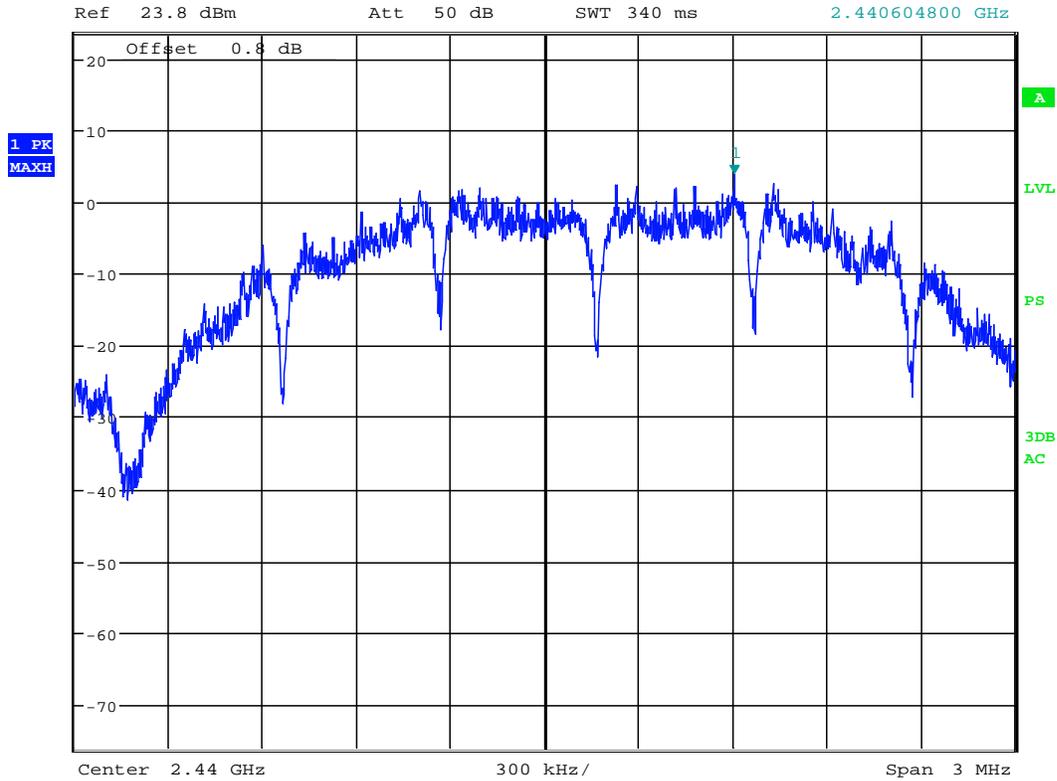
Peak PSD

Date: 15.MAY.2013 16:14:43

Plot 3.2



*RBW 3 kHz Marker 1 [T1]
*VBW 10 kHz 3.87 dBm
SWT 340 ms 2.440604800 GHz



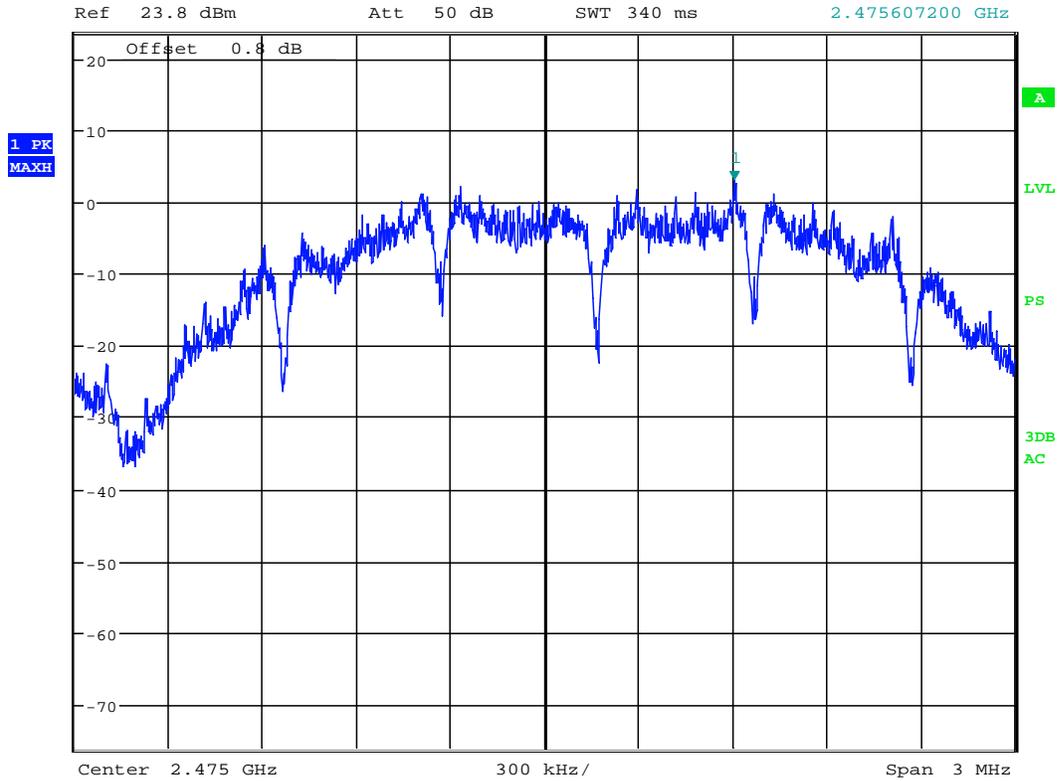
Peak PSD

Date: 15.MAY.2013 16:25:14

Plot 3.3



*RBW 3 kHz Marker 1 [T1]
*VBW 10 kHz 3.09 dBm
SWT 340 ms 2.475607200 GHz



Peak PSD

Date: 15.MAY.2013 16:39:48

4.4 Unwanted 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
2405	Scan 30 MHz – 25 GHz
2440	Scan 30 MHz – 25 GHz
2475	Scan 30 MHz – 25 GHz

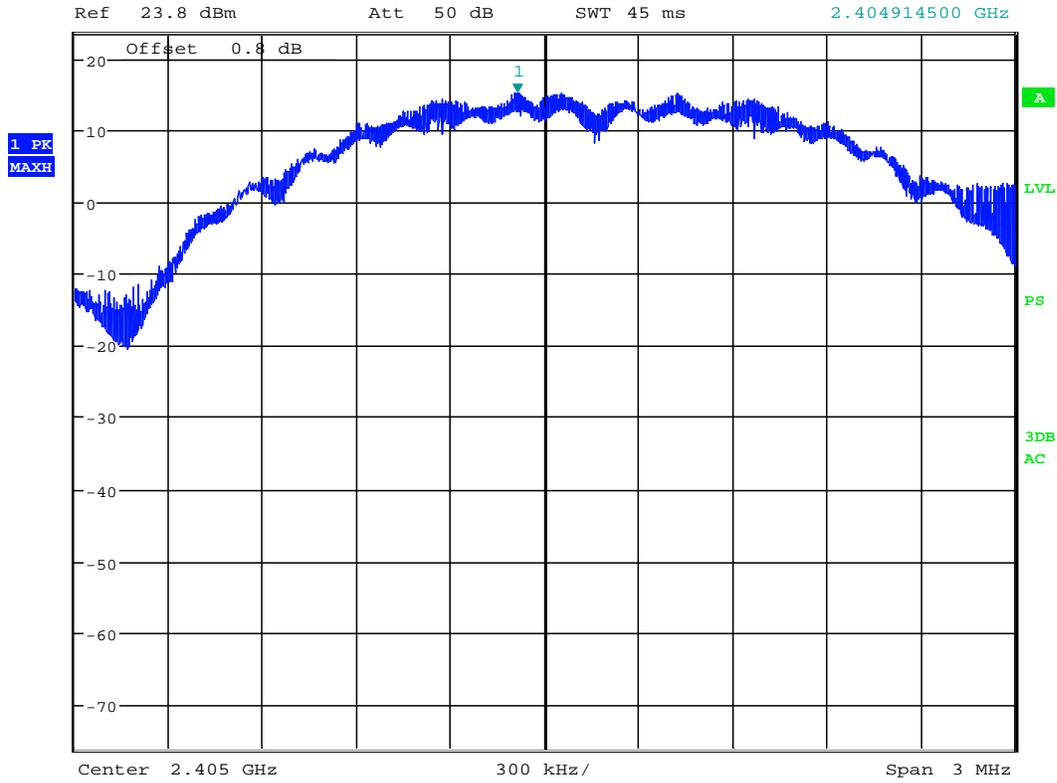
On plots 4.1 – 4.30 the In-band and Out-of-band conducted emissions are presented.

Results	Complies. All unwanted conducted emissions are attenuated by more than 20 dB
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Plot 4.1



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz 15.30 dBm
SWT 45 ms 2.404914500 GHz



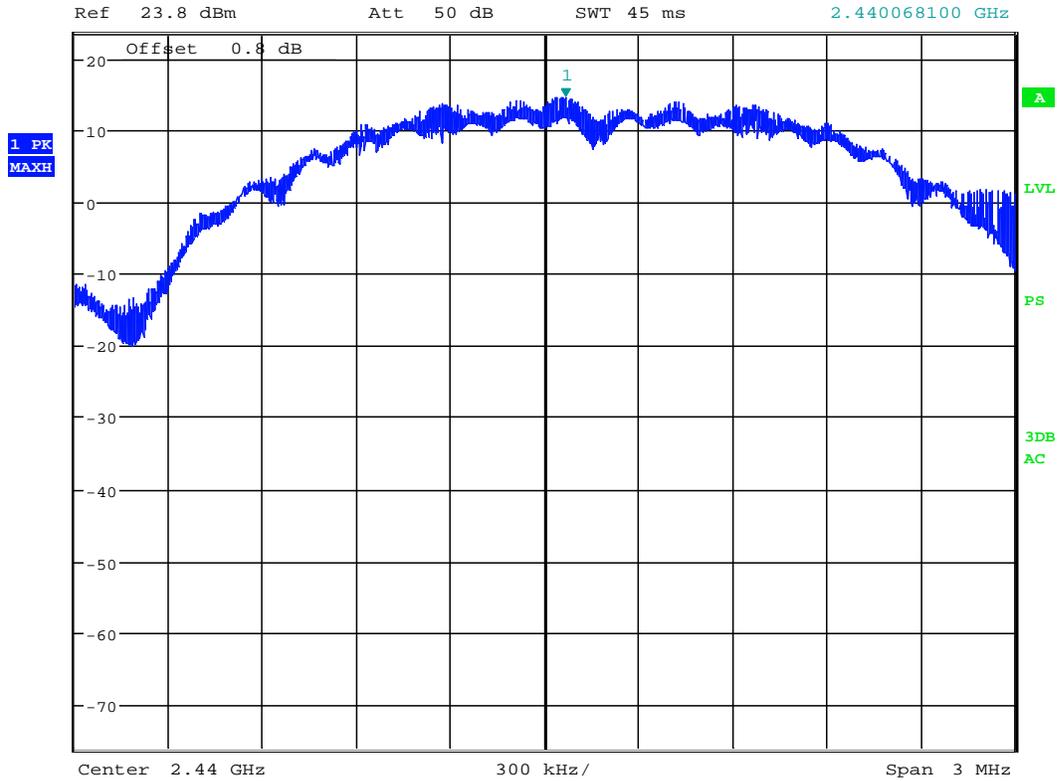
Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 17:08:32

Plot 4.2



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz 14.76 dBm
SWT 45 ms 2.440068100 GHz

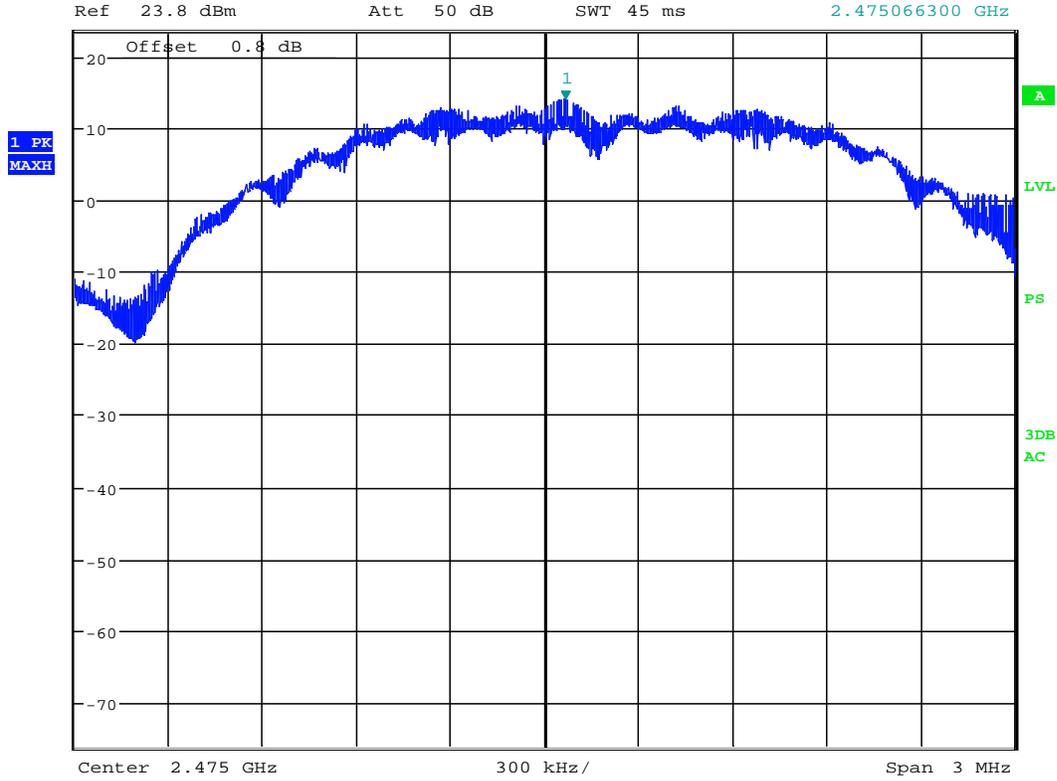


Unwanted Conducted Emissions, F=2440MHz
Date: 15.MAY.2013 17:13:43

Plot 4.3



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz 14.13 dBm
SWT 45 ms 2.475066300 GHz



Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 17:17:55

Plot 4.4

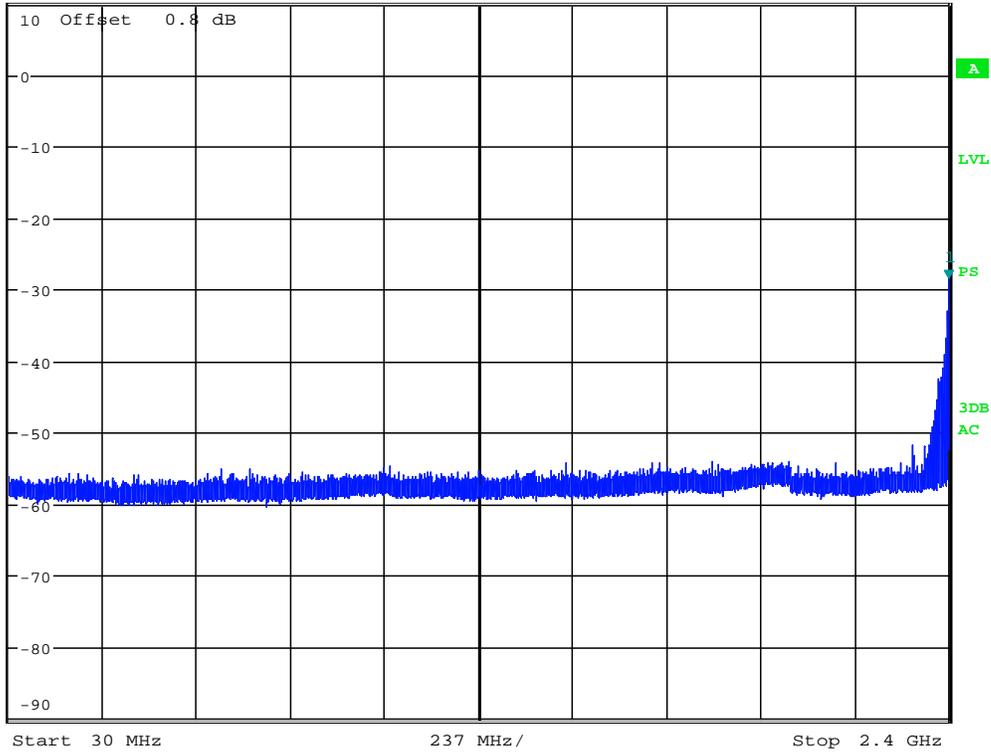


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -28.64 dBm
SWT 240 ms 2.399526000 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



Unwanted Conducted Emissions, F=2405MHz
Date: 15.MAY.2013 18:07:16

Plot 4.5

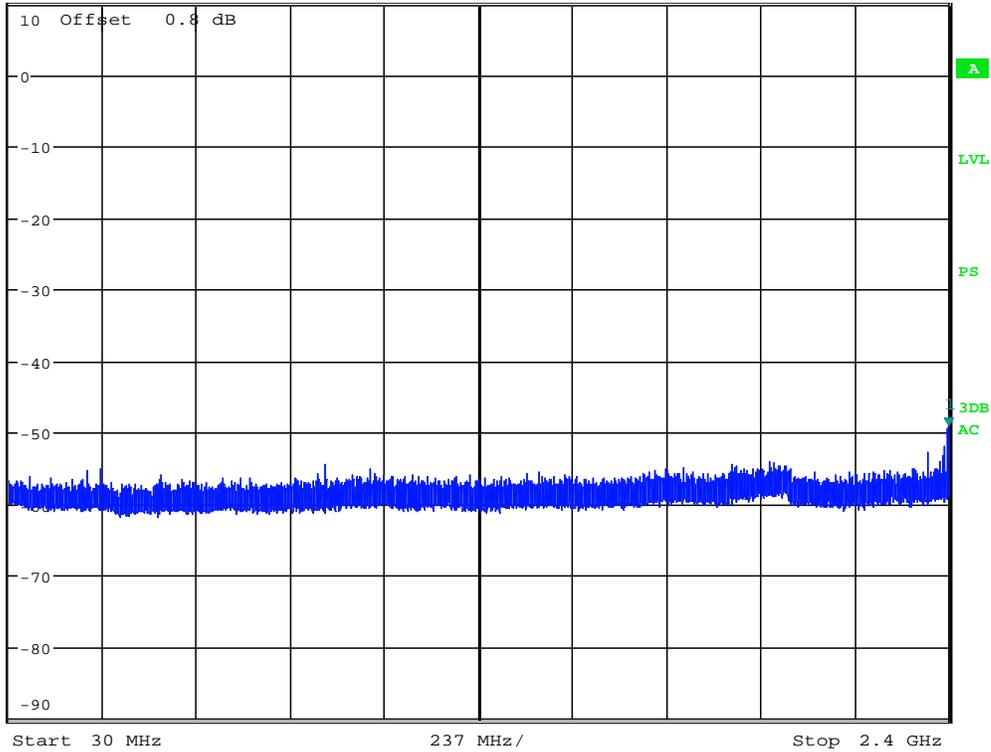


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -49.21 dBm
SWT 240 ms 2.399131000 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:27:57

Plot 4.6

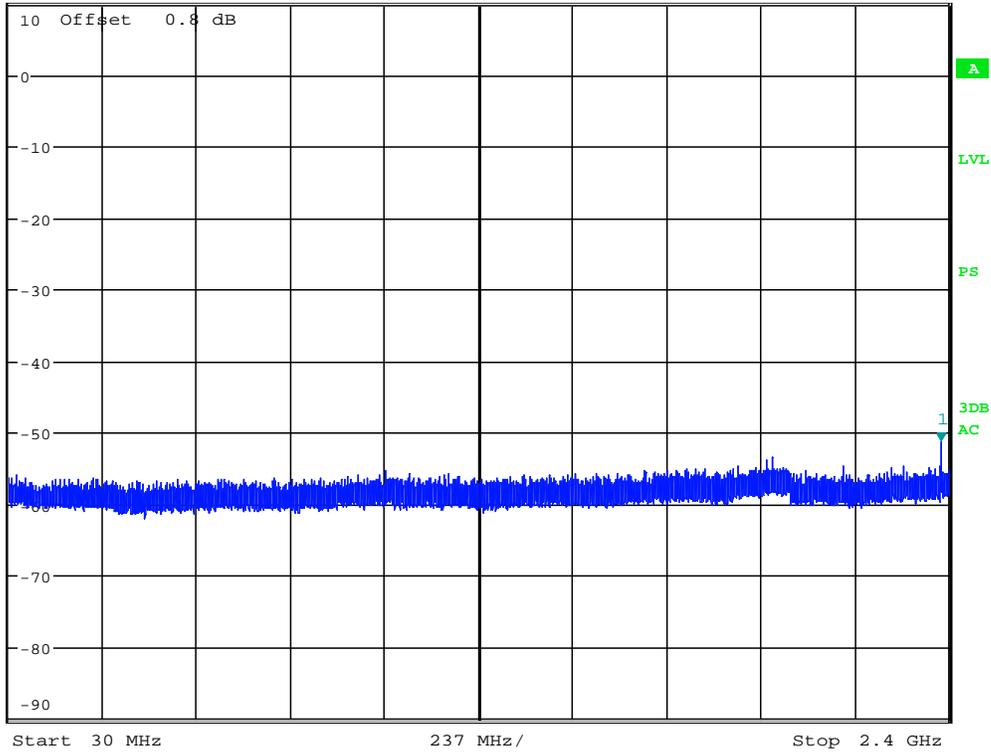


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -51.17 dBm
SWT 240 ms 2.379144000 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 18:47:39

Plot 4.7

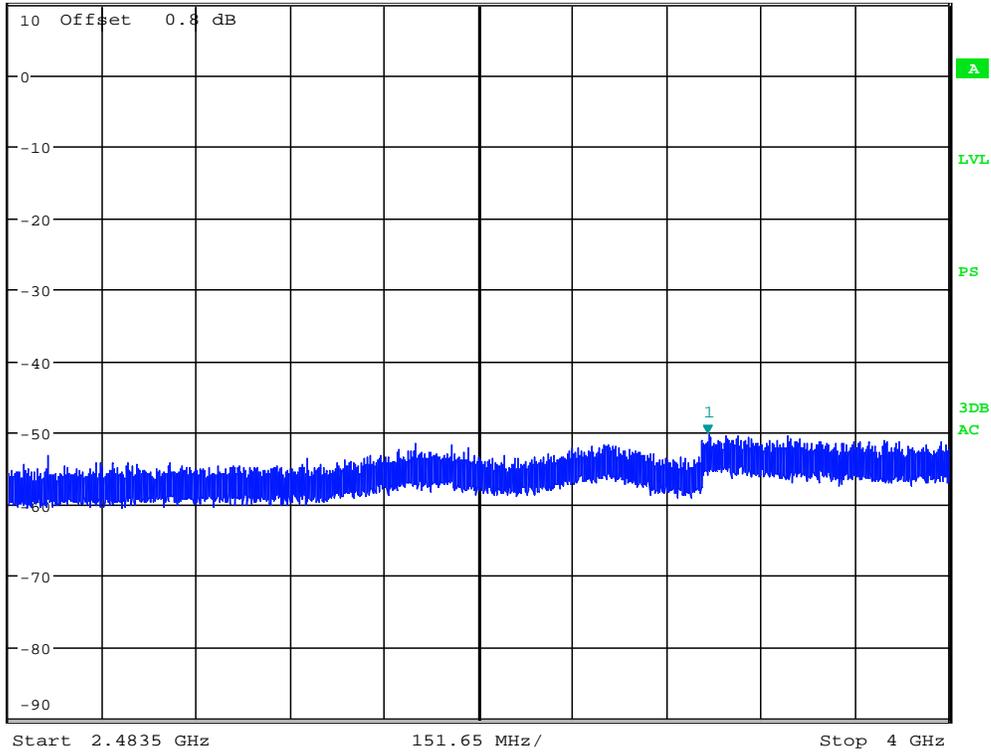


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -50.15 dBm
SWT 155 ms 3.612281500 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:08:37

Plot 4.8

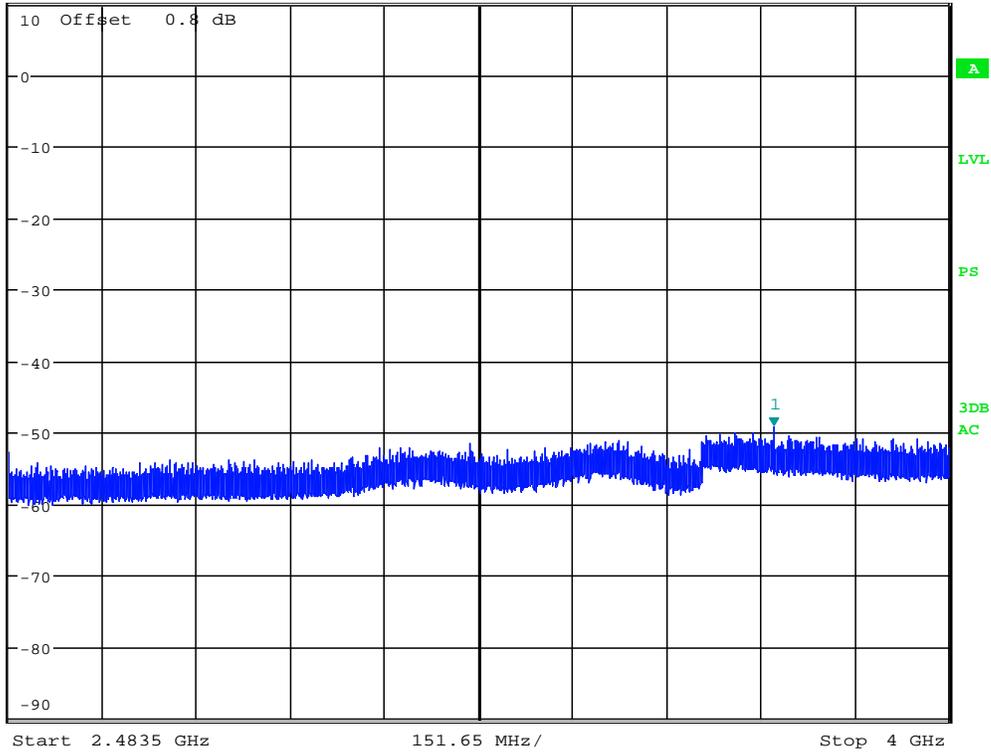


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -49.04 dBm
SWT 155 ms 3.717324400 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



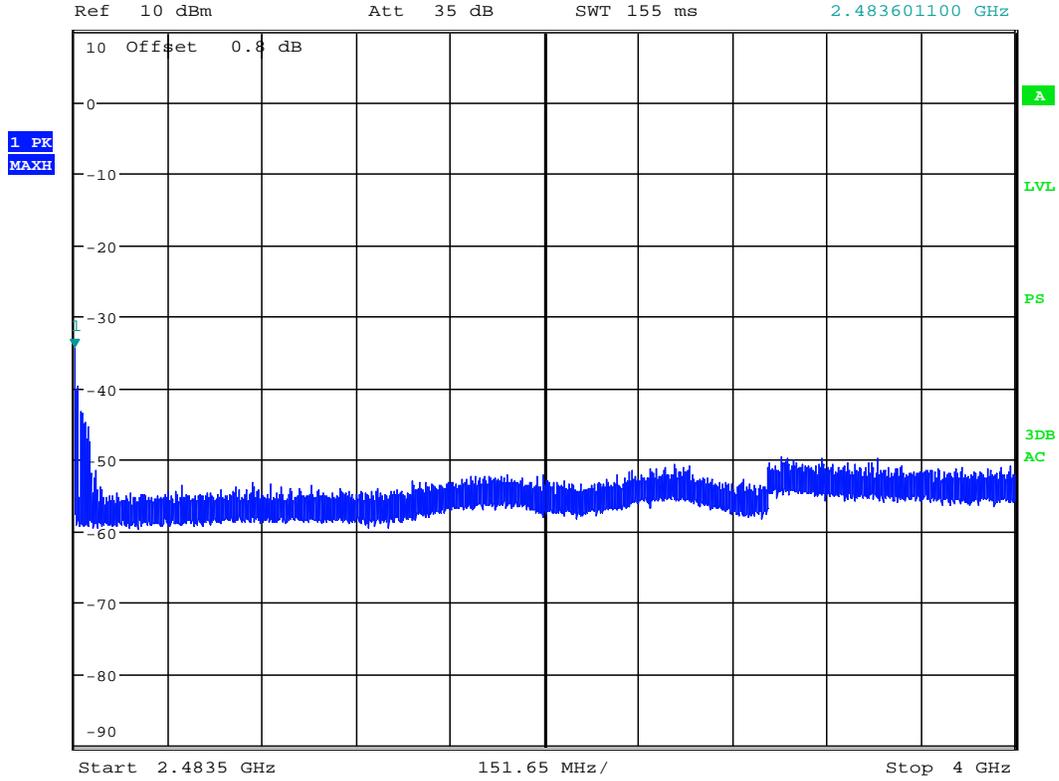
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:30:10

Plot 4.9



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -34.50 dBm
SWT 155 ms 2.483601100 GHz



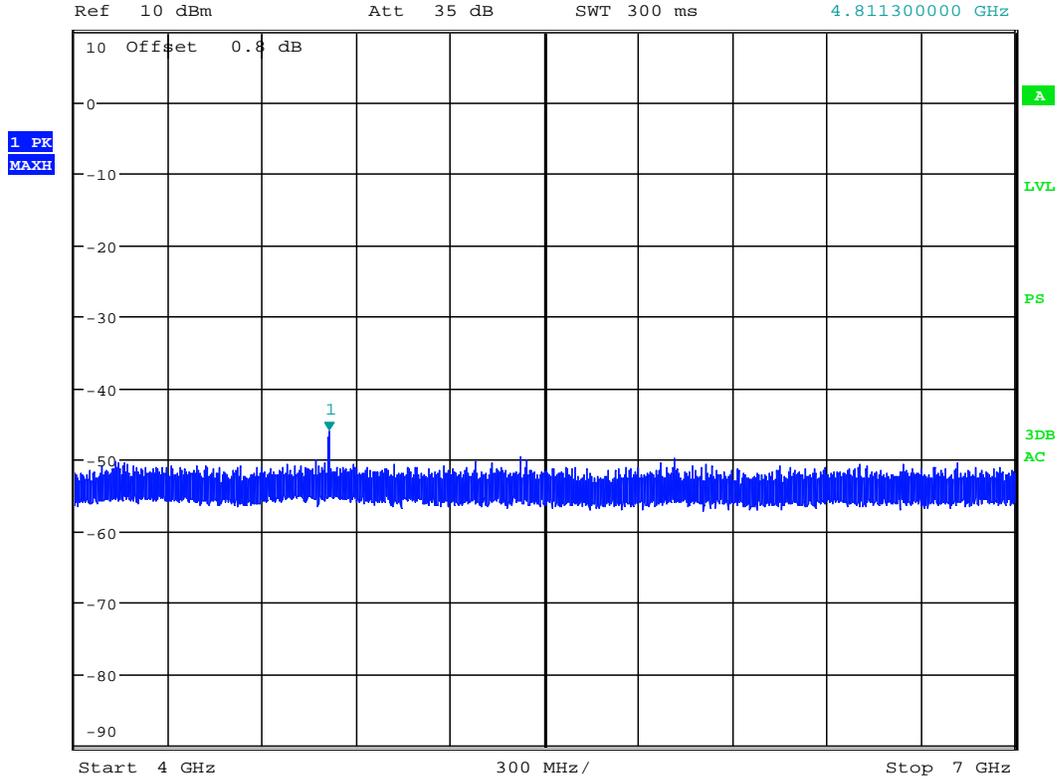
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 18:50:41

Plot 4.10



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -45.93 dBm
SWT 300 ms 4.811300000 GHz



Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:09:52

Plot 4.11

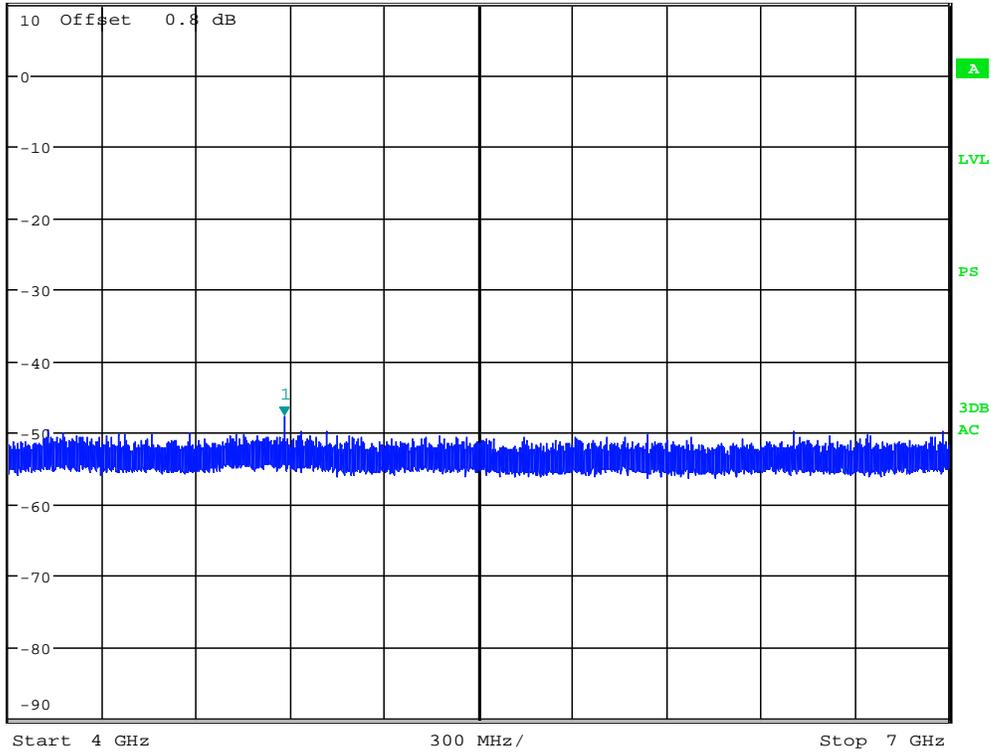


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -47.62 dBm
SWT 300 ms 4.879300000 GHz

Ref 10 dBm

Att 35 dB

1 PK
MAXH



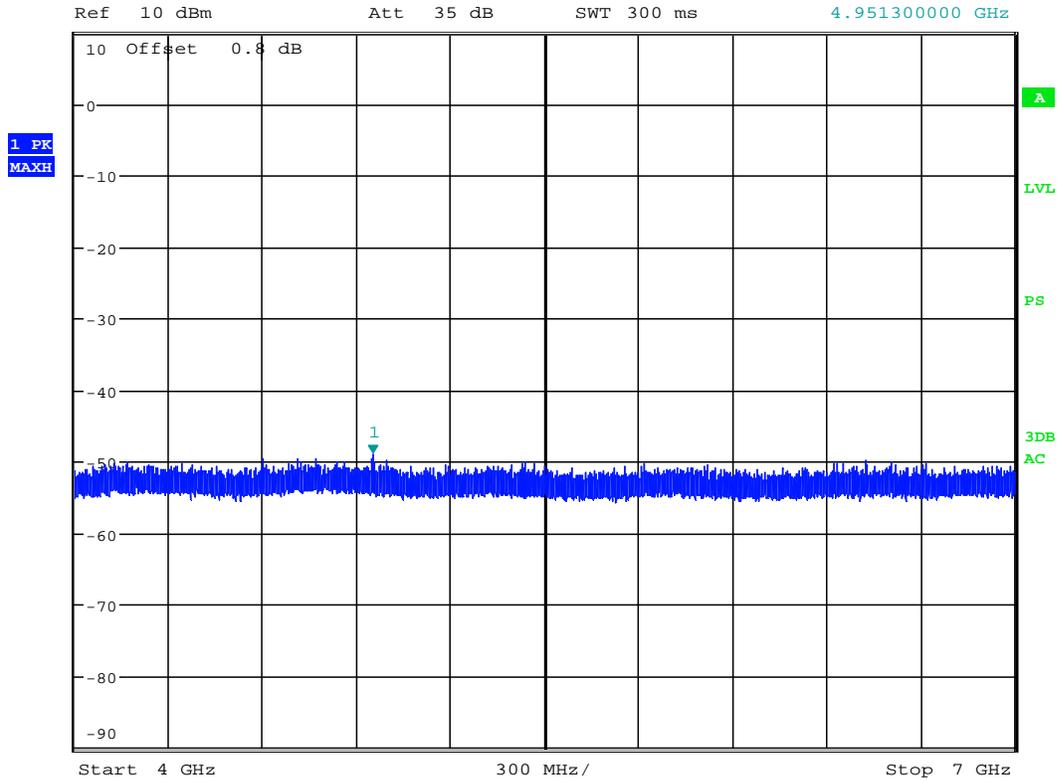
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:33:11

Plot 4.12



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.88 dBm
SWT 300 ms 4.951300000 GHz



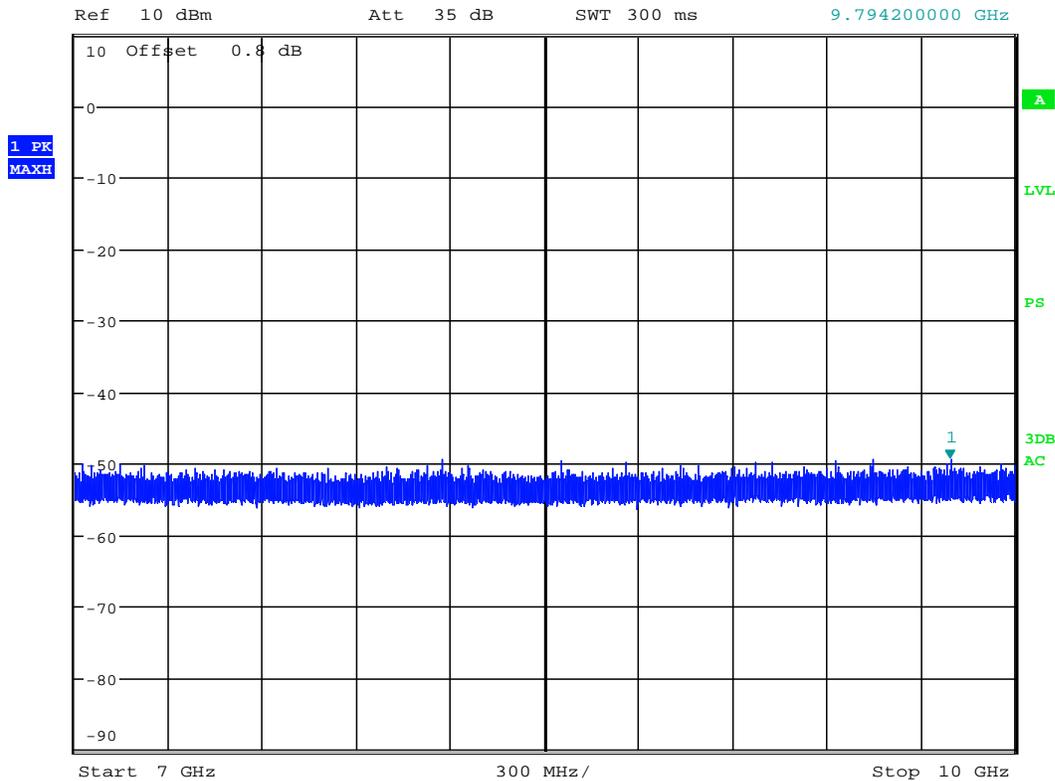
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 18:54:35

Plot 4.13



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -49.33 dBm
SWT 300 ms 9.79420000 GHz



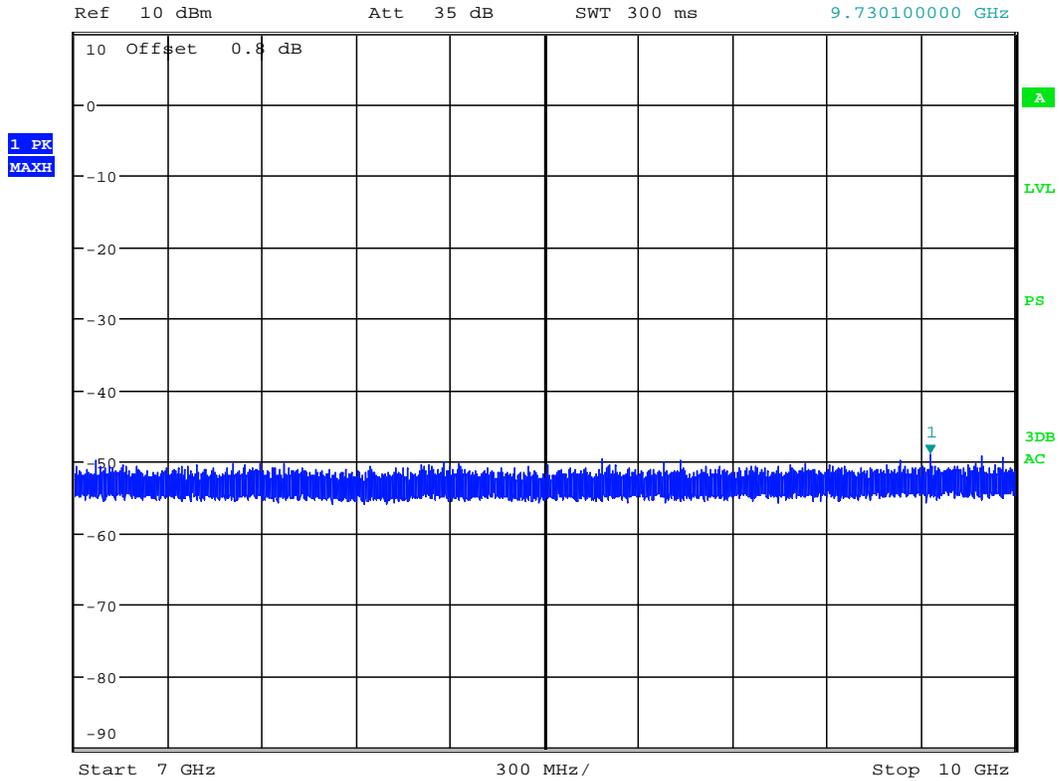
Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:12:05

Plot 4.14



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.89 dBm
SWT 300 ms 9.730100000 GHz



Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:36:34

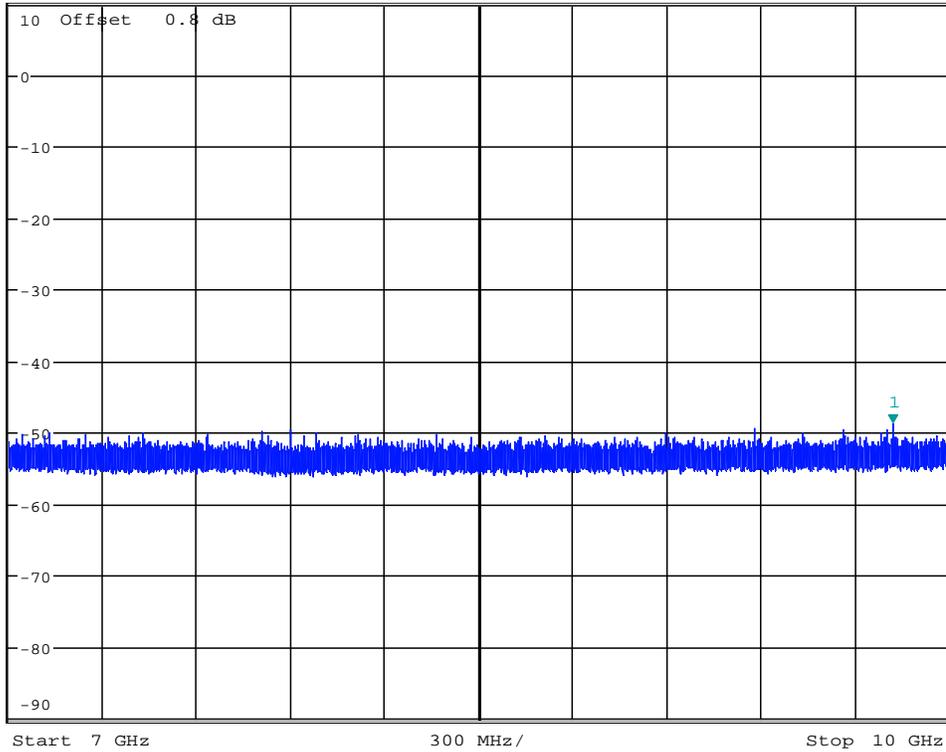
Plot 4.15



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.75 dBm
SWT 300 ms 9.82080000 GHz

Ref 10 dBm

Att 35 dB



Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 18:56:46

Plot 4.16



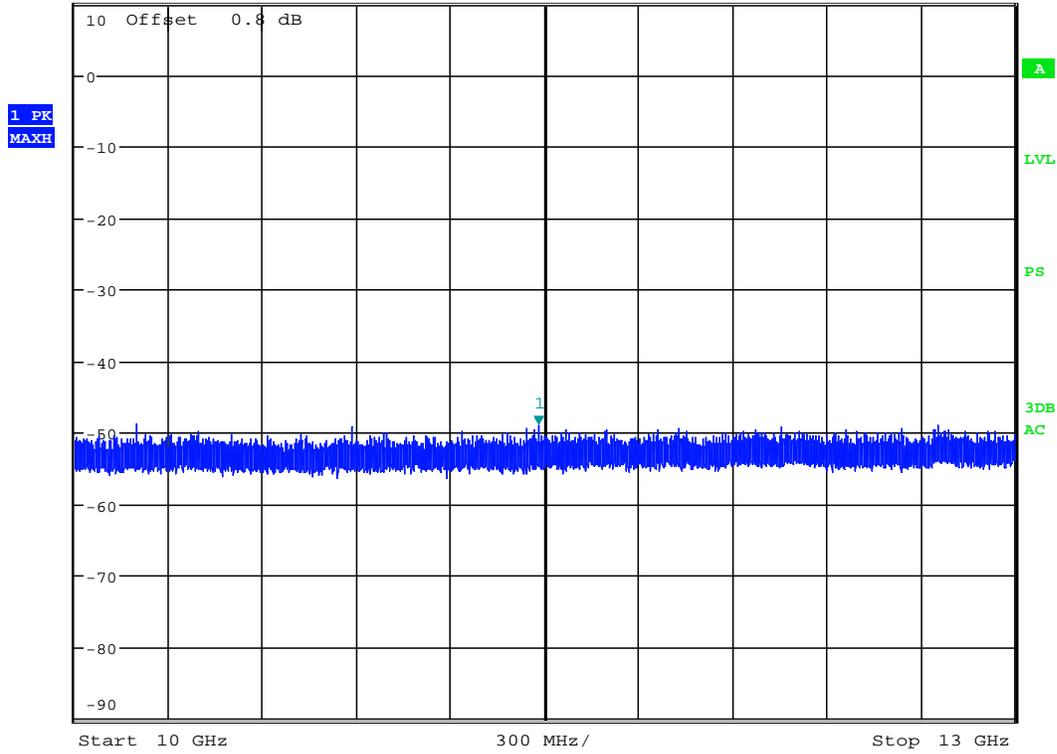
*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.90 dBm
SWT 300 ms 11.47960000 GHz

Ref 10 dBm

Att 35 dB

SWT 300 ms

11.47960000 GHz



Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:13:49

Plot 4.17

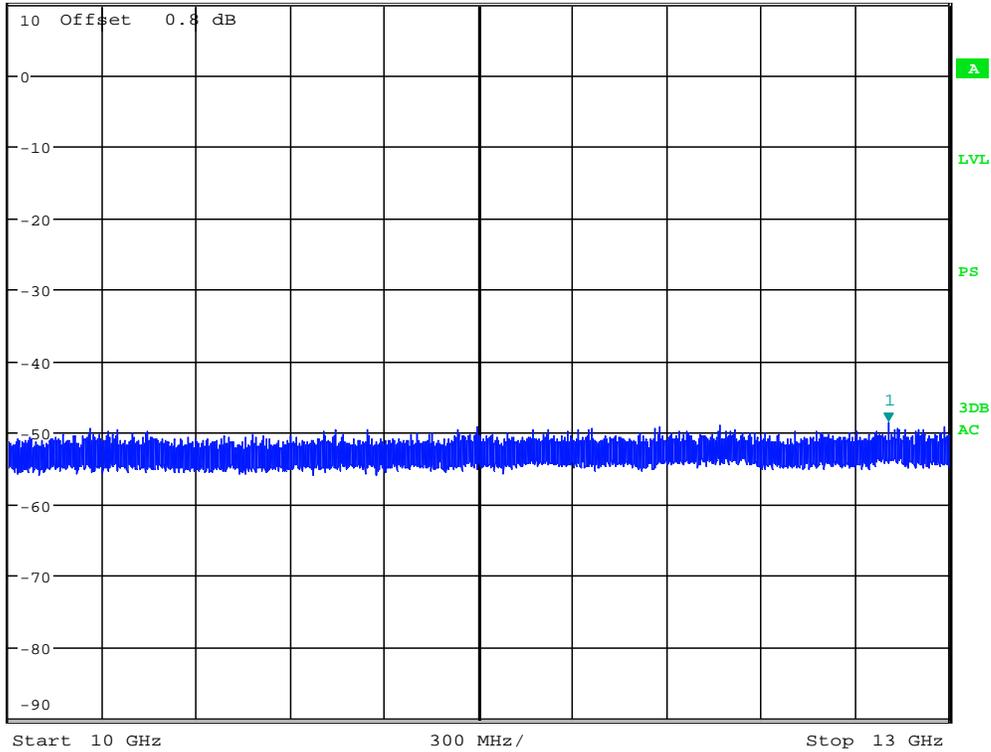


*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.46 dBm
SWT 300 ms 12.805500000 GHz

Ref 10 dBm

Att 35 dB

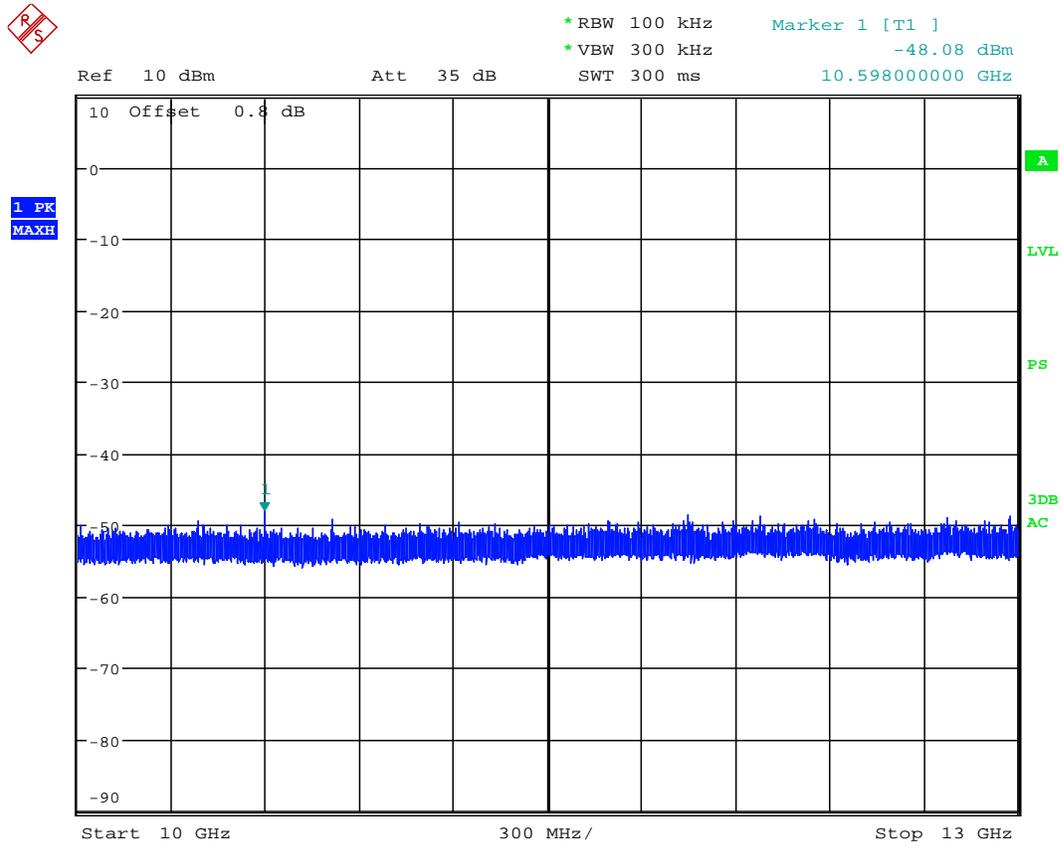
1 PK
MAXH



Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:38:29

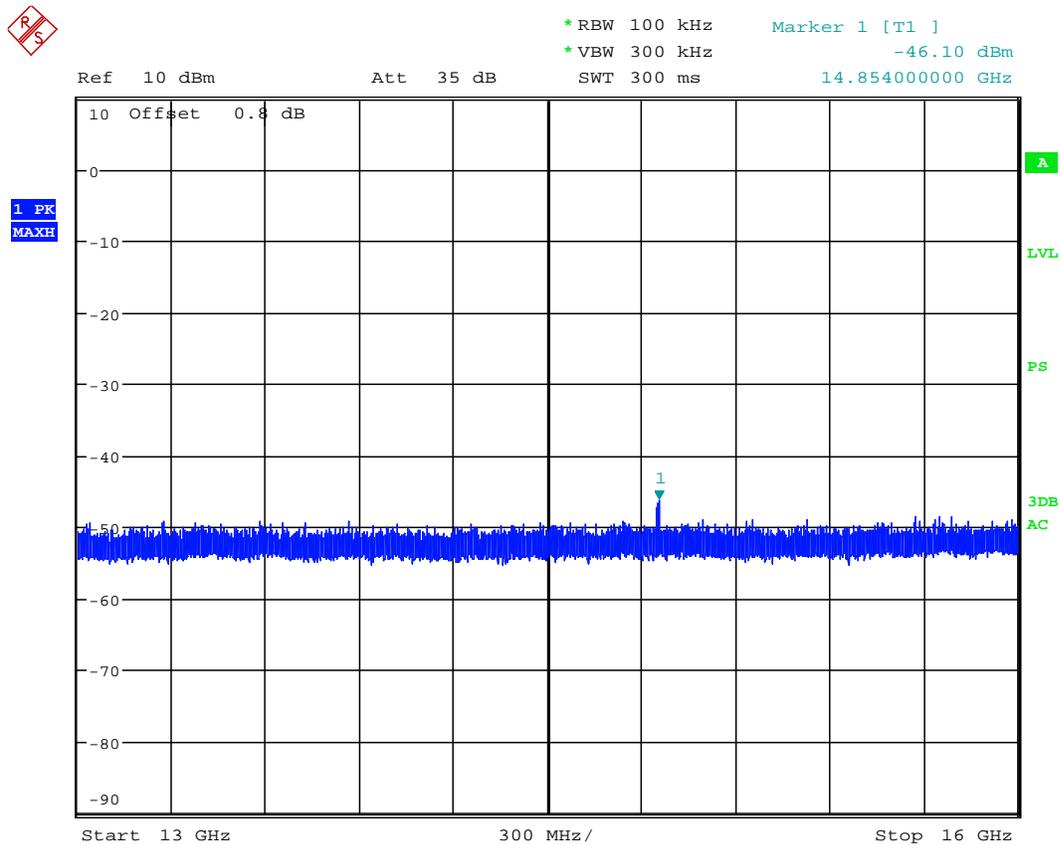
Plot 4.18



Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 18:58:46

Plot 4.19



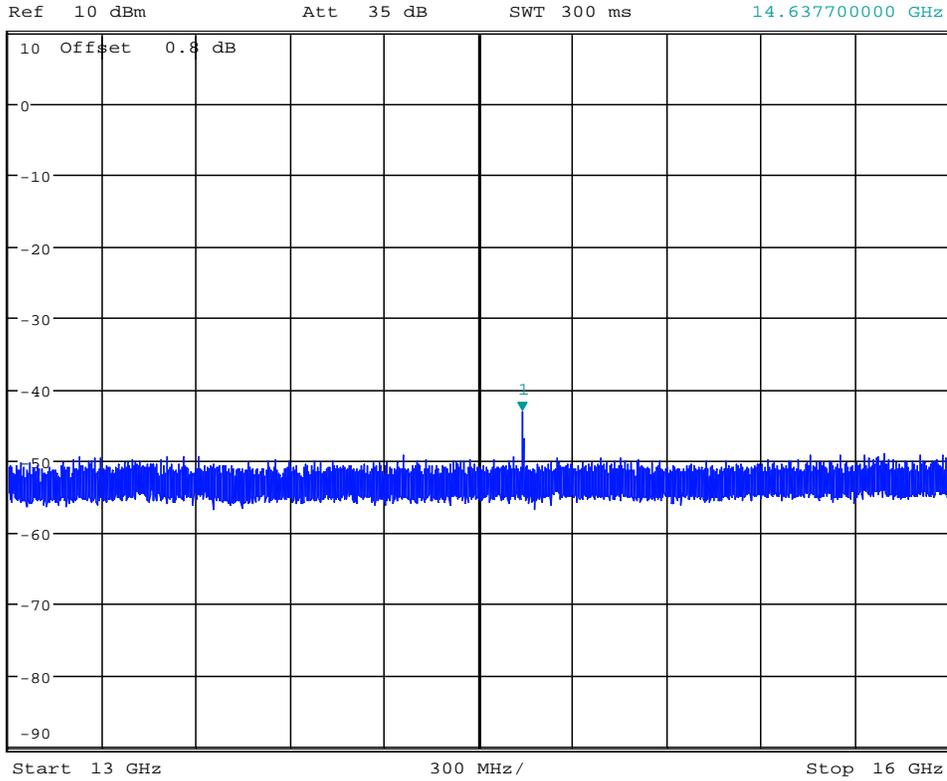
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 19:00:55

Plot 4.20



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -43.10 dBm
SWT 300 ms 14.637700000 GHz



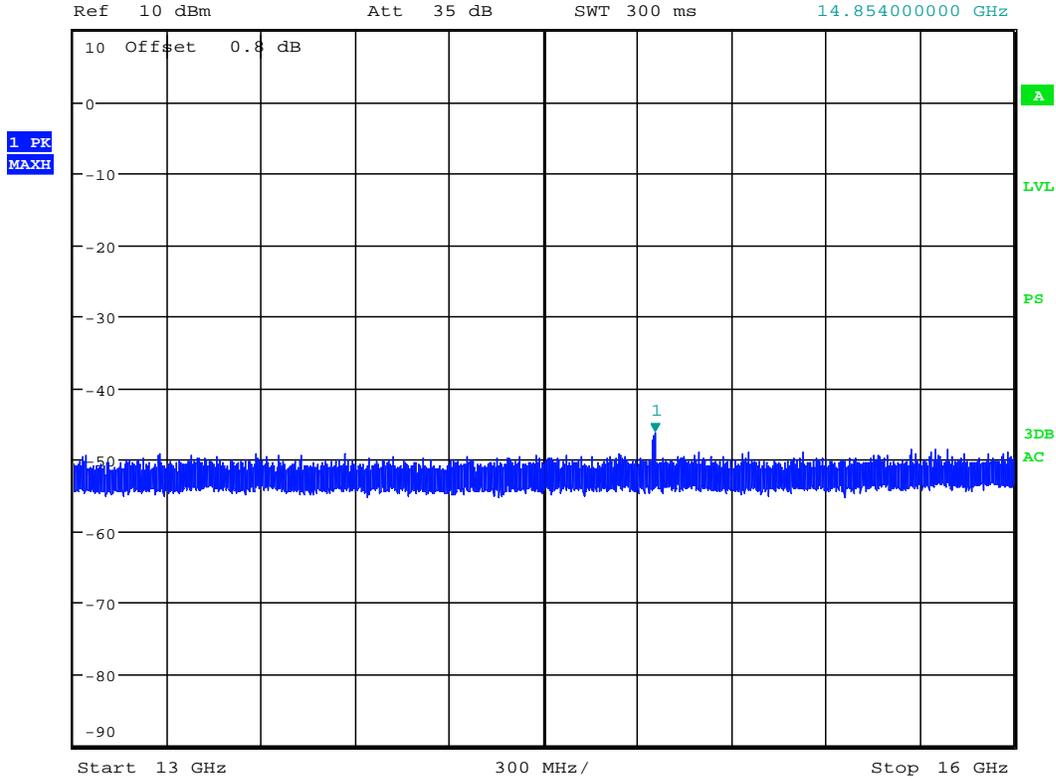
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:39:26

Plot 4.21



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -46.10 dBm
SWT 300 ms 14.85400000 GHz



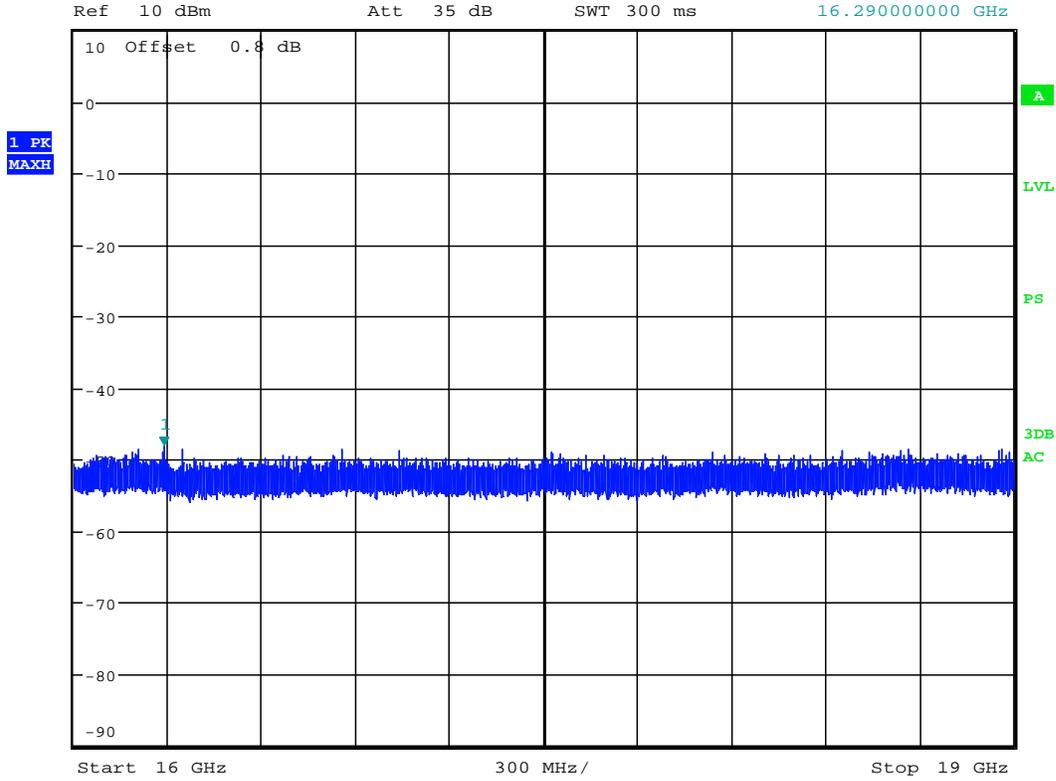
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 19:00:55

Plot 4.22



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.07 dBm
SWT 300 ms 16.290000000 GHz



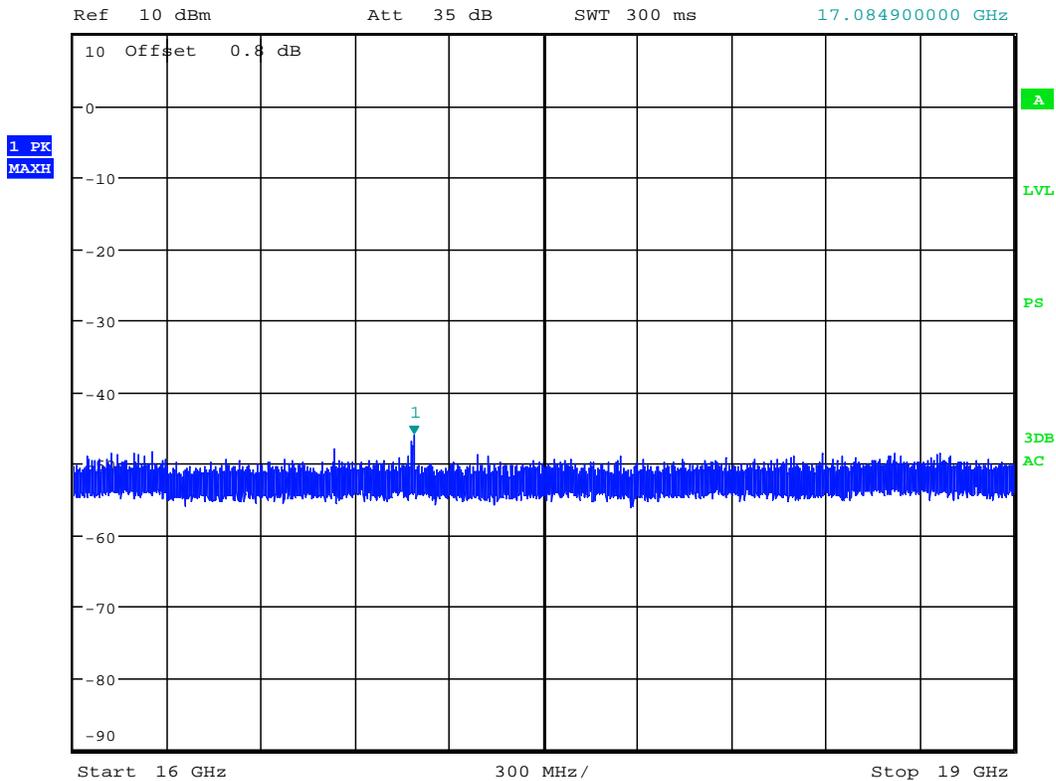
Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:18:54

Plot 4.23



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -46.07 dBm
SWT 300 ms 17.084900000 GHz



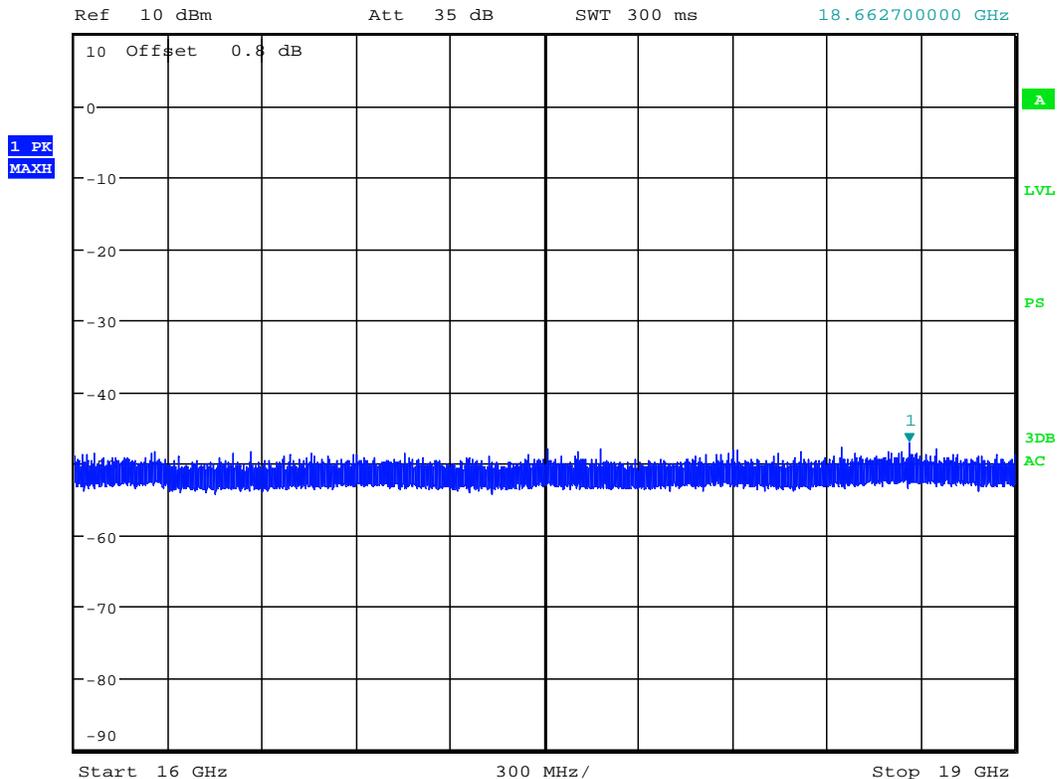
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:40:47

Plot 4.24



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -47.12 dBm
SWT 300 ms 18.662700000 GHz



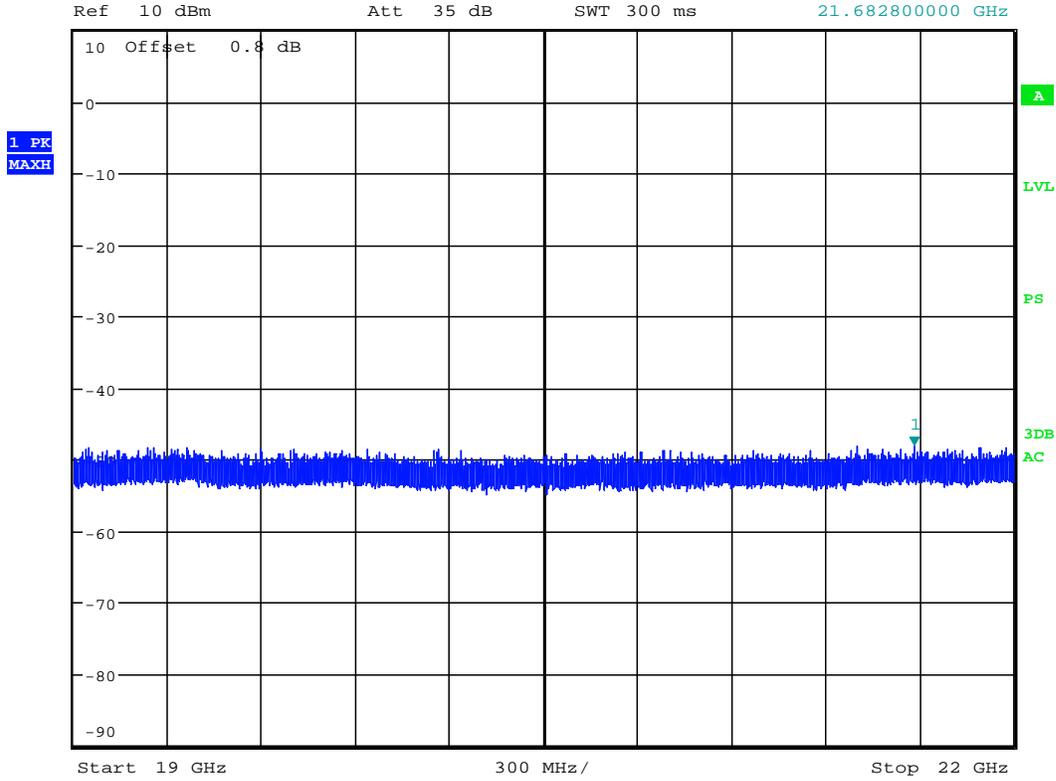
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 19:04:51

Plot 4.25



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -48.01 dBm
SWT 300 ms 21.68280000 GHz



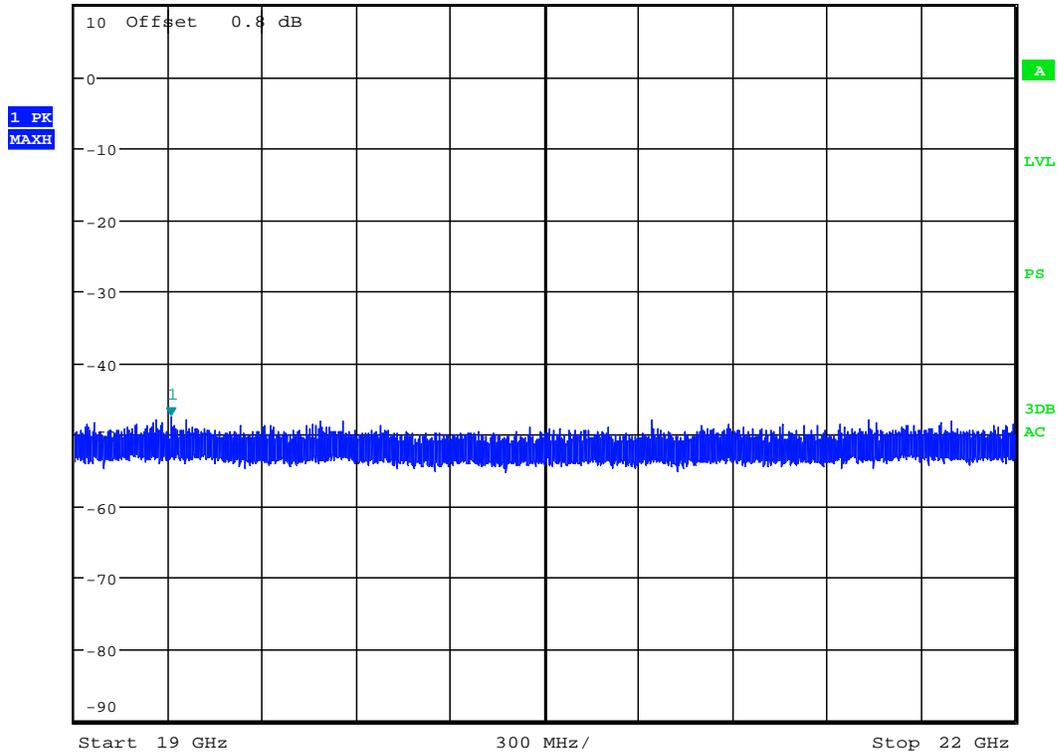
Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:21:43

Plot 4.26



*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -47.56 dBm
 Ref 10 dBm Att 35 dB SWT 300 ms 19.308300000 GHz



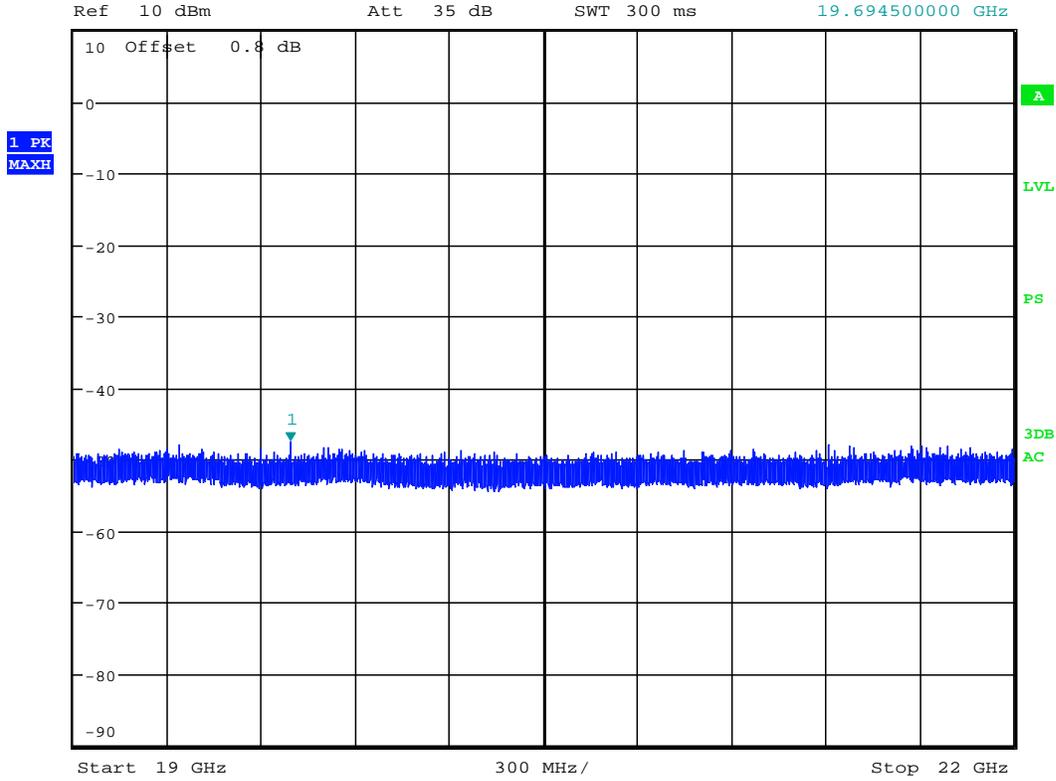
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:42:35

Plot 4.27



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -47.42 dBm
SWT 300 ms 19.694500000 GHz



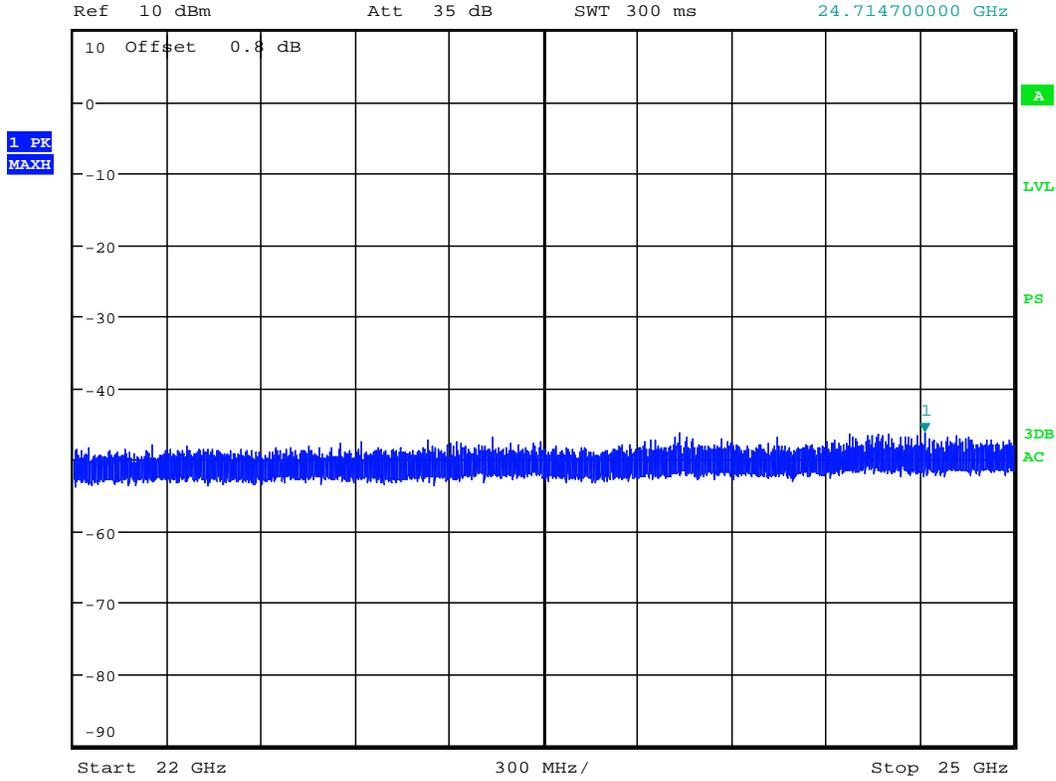
Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 19:07:23

Plot 4.28



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -46.18 dBm
SWT 300 ms 24.714700000 GHz



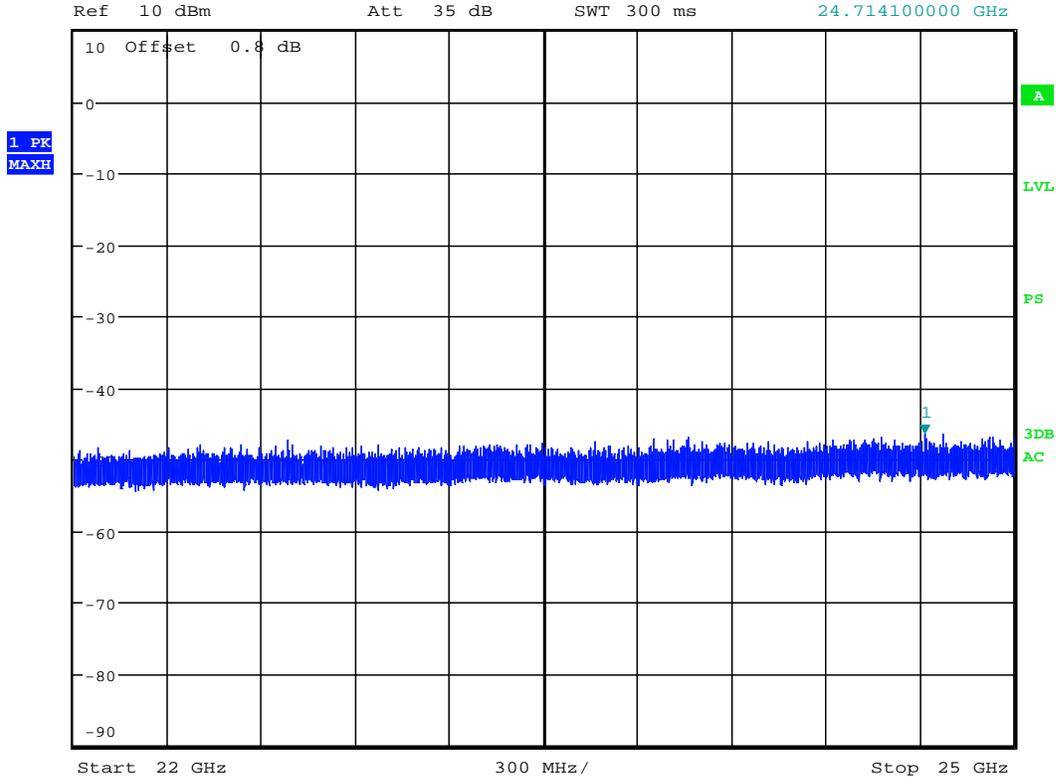
Unwanted Conducted Emissions, F=2405MHz

Date: 15.MAY.2013 18:23:54

Plot 4.29



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -46.38 dBm
SWT 300 ms 24.714100000 GHz



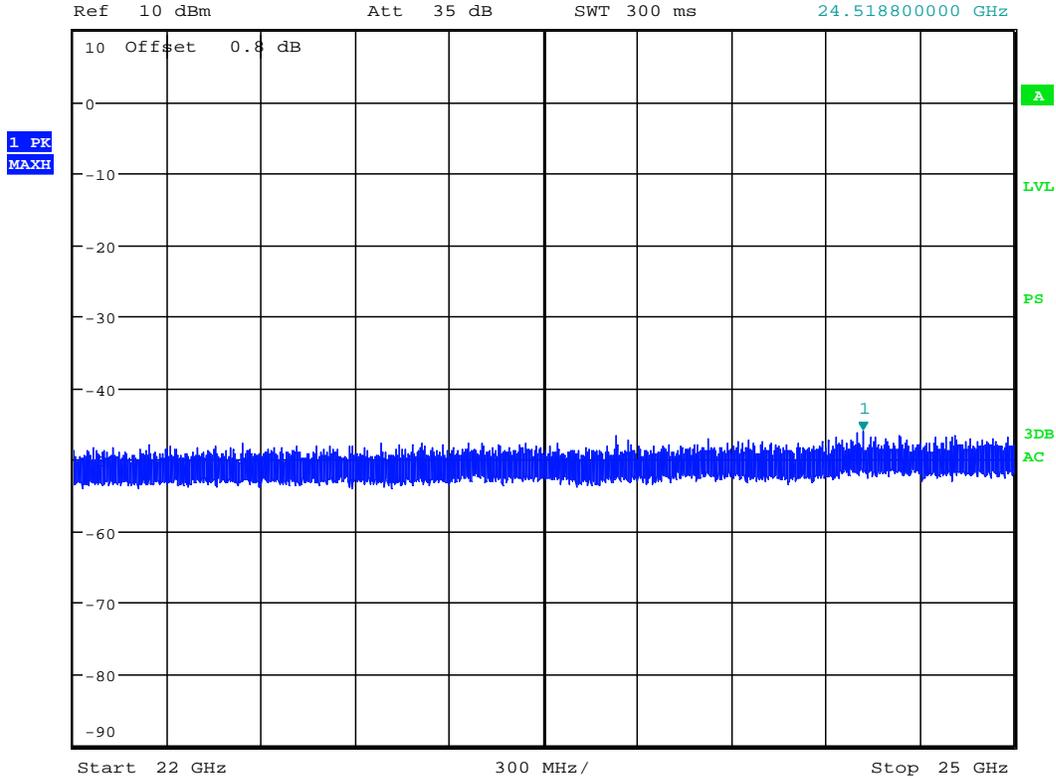
Unwanted Conducted Emissions, F=2440MHz

Date: 15.MAY.2013 18:44:02

Plot 4.30



*RBW 100 kHz Marker 1 [T1]
*VBW 300 kHz -46.05 dBm
SWT 300 ms 24.51880000 GHz



Unwanted Conducted Emissions, F=2475MHz

Date: 15.MAY.2013 19:08:57

4.5 Unwanted Radiated Emissions FCC Rule 15.247(d), 15.209, 15.205, RSS-210, RSS-GEN

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 (if peak output power is measured) or 30 dB (if average output power is measured) 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.

In the frequency range from 30 MHz to 1000 MHz the Quasi-peak value of the Field Strength (FS) is measured; in the frequency range above 1000 MHz the Peak value of the FS is measured and the average value of FS is calculated.

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).

Guidance for Performing Compliance Measurements on DTS Operating under §15.247 refers to ANSI C63.10. In sec. 7.5 of ANSI C63.10 the procedure for determining the average value of pulsed emissions is described.

Following this procedure, the Peak Field Strength (FS_{peak}) is measured and the Duty Cycle Correction Factor (δ) is applied. The Duty Cycle is defined as transmitter time-on (t) in T=100 ms interval.

$$\delta = t/T \text{ or in decibels } \delta(\text{dB}) = 20 \text{ Log } \delta$$
$$FS_{\text{average}} [\text{in dB}(\mu\text{V/m})] = FS_{\text{peak}} [\text{in dB}(\mu\text{V/m})] + \delta(\text{dB})$$

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(μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB(μ V); 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(μ V) 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(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

RA = 52.0 dB(μ V)

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(μ V/m).

Level in μ V/m = Common Antilogarithm $[(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$.

If Field Strength is measured at a distance (D, m) other than specified distance (D_0 , m), the Distance Correction Factor of $20 \times \text{Log}(D/D_0)$ is applied.

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 0.7 dB.

Table 5.1
Transmitter Radiated Emissions below 1GHz
Tx @ 2405 MHz

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

Operator: KK
 May 21, 2013

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
53.32	38.8	40.0	-1.2	46.3	0.8	32.1	10.5	13.3
55.33	35.7	40.0	-4.3	44.1	0.8	32.1	10.5	12.4
71.50	36.3	40.0	-3.7	50.0	1.0	32.1	10.5	6.9
112.3	34.7	43.5	-8.8	44.0	1.2	32.1	10.5	11.1
190.9	34.0	43.5	-9.5	43.9	1.6	32.0	10.5	10.0
222.4	34.5	46.0	-11.5	42.9	1.7	32.0	10.5	11.4
986.3	34.2	54.0	-19.8	27.8	3.8	31.0	10.5	23.1

Test Mode: Tx ON
 Temp: 24C, Humidity: 45%

Table 5.2
Transmitter Radiated Emissions below 1GHz
Tx @ 2440 MHz

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

Operator: KK
 May 21, 2013

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
53.60	39.2	40.0	-0.8	46.8	0.8	32.1	10.5	13.2
55.13	36.2	40.0	-3.8	44.5	0.8	32.1	10.5	12.5
70.80	36.3	40.0	-3.7	49.9	1.0	32.1	10.5	7.0
114.1	38.6	43.5	-4.9	47.7	1.2	32.0	10.5	11.2
224.8	36.4	46.0	-9.6	44.5	1.7	32.0	10.5	11.7
711.4	40.1	46.0	-5.9	39.3	3.2	32.3	10.5	19.4
713.9	41.1	46.0	-4.9	40.3	3.2	32.3	10.5	19.4
828.6	34.6	46.0	-11.4	31.4	3.4	32.1	10.5	21.4

Test Mode: Tx ON
 Temp: 24C, Humidity: 45%

Notes: Measurements made at 10 meters distance.

Table 5.3
Transmitter Radiated Emissions below 1GHz
Tx @ 2475 MHz

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

Operator: KK
 May 21, 2013

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)
53.72	39.3	40.0	-0.7	46.9	0.8	32.1	10.5	13.2
55.33	36.5	40.0	-3.5	44.9	0.8	32.1	10.5	12.4
71.50	36.4	40.0	-3.6	50.1	1.0	32.1	10.5	6.9
118.3	35.3	43.5	-8.2	44.0	1.3	32.0	10.5	11.5
220.0	33.9	46.0	-12.1	42.6	1.7	32.0	10.5	11.1
914.3	34.3	46.0	-11.7	29.6	3.6	31.6	10.5	22.2

Test Mode: Tx ON
 Temp: 24C, Humidity: 45%

Notes: Measurements made at 10 meters distance.

Table 5.4
Transmitter Radiated Emissions at band-edge frequency at 2483.5 MHz,
measured by marker-delta method
Tx @ 2475 MHz

Operator: KK
 May 21, 2013
 Temp: 24C, Humidity: 45%

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency	Measur. Type	SA ₁ @ 2475 MHz	Delta *	SA ₂ @ 2483.5 MHz	δ(dB)	AF	Cable loss	FS @ 2483.5 MHz	Limit	Margin
MHz		dB(uV/m)	dB	dB(uV/m)	dB	dB(1/m)	dB	dB(uV/m)	dB(uV/m)	dB
2483.5	Peak	84.2	44.3	39.9 **	--	28.1	3.4	71.4	74	-2.6
2483.5	Average	--	--	39.9	-20	28.1	3.4	51.4	54	-2.6

* Delta (Δ) measured between SA readings at Fundamental frequency and band-edge frequency with 300kHz/1MHz (RBW/VBW).

** SA₂ = SA₁ - Δ

δ(dB) - Duty Cycle Correction Factor. See Appendix A for Duty Cycle measurement and calculation.

Measurements made at 3 meters distance

Table 5.5

Transmitter Radiated Emissions in restricted bands above 1GHz

Temperature: 24.0 C				Company: Vasona Labs, Inc.				
Humidity: 45.0 %				Model: LC201				
Measurement distance: 3 m				Date: May 18, 2013				
Configuration: EUT with internal antenna								
Frequency MHz	Measurement Type	SA reading @ 3 m dB(uV)	Correction Factor dB	δ (dB)* dB	Ant. Factor dB(1/m)	Field Strength @ 3 m dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx at 2405 MHz								
2390	Peak	50.0 **	3.3	---	27.7	71.5***	74.0	-2.5
4810	Peak	60.6	28.7	---	32.8	64.7	74.0	-9.3
12025	Peak	59.3	25.5	---	38.5	72.3	74.0	-1.7
19240	Peak	59.8	34.9	---	40.3	65.2	74.0	-8.8
2390	Average	50.0 **	3.3	-20	27.7	51.5 ***	54.0	-2.5
4810	Average	60.6	28.7	-20	32.8	44.7	54.0	-9.3
12025	Average	59.3	25.5	-20	38.5	52.3	54.0	-1.7
19240	Average	59.8	34.9	-20	40.3	45.2	54.0	-8.8
Tx at 2440 MHz								
4880	Peak	57.0	28.8	---	32.8	61.0	74.0	-13.0
7320	Peak	56.4	26.1	---	37.3	67.6	74.0	-6.4
12200	Peak	55.9	24.8	---	38.3	69.4	74.0	-4.6
19520	Peak	58.9	34.1	---	40.3	65.1	74.0	-8.9
4880	Average	57.0	28.8	-20	32.8	41.0	54.0	-13.0
7320	Average	56.4	26.1	-20	37.3	47.6	54.0	-6.4
12200	Average	55.9	24.8	-20	38.3	49.4	54.0	-4.6
19520	Average	58.9	34.1	-20	40.3	45.1	54.0	-8.9
Tx at 2475 MHz								
4950	Peak	53.4	28.0	---	32.9	58.3	74.0	-15.7
7425	Peak	52.1	25.9	---	37.5	63.7	74.0	-10.3
12375	Peak	54.7	25.6	---	38.4	67.5	74.0	-6.5
19800	Peak	51.6	34.9	---	40.3	57.0	74.0	-17.0
22275	Peak	50.1	33.7	---	40.3	56.7	74.0	-17.3
2483.5	Average							
4950	Average	53.4	28.0	-20	32.9	38.3	54.0	-15.7
7425	Average	52.1	25.9	-20	37.5	43.7	54.0	-10.3
12375	Average	54.7	25.6	-20	38.4	47.5	54.0	-6.5
19800	Average	51.6	34.9	-20	40.3	37.0	54.0	-17.0
22275	Average	50.1	33.7	-20	40.3	36.7	54.0	-17.3

* δ (dB) - Duty Cycle Correction Factor. See Appendix A for Duty Cycle measurement and calculation.

** SA Reading obtained at 1 m distance

*** with distance correction factor of 9.5 dB

Duty cycle Correction Factor was applied for Average Field Strength (FS).

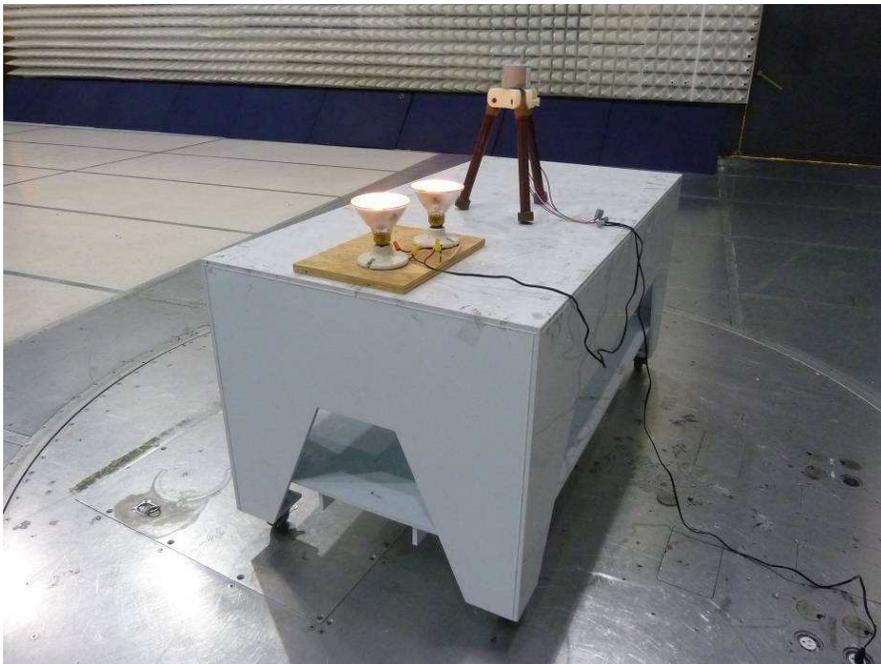
- a) RBW = 1 MHz, VBW = 3 MHz - for peak measurements
- b) Correction Factor: Cable loss + High Pass Filter loss - Pre-amplifier gain
- c) Peak FS at 3m = SA reading + Correction Factor + Antenna factor. Average FS = Peak FS + δ (dB)
- d) Measurements made at 3 meters distance. Radiated emission measurements were performed up to 25 GHz. 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
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(μ V/m)	Class B at 3m dB(μ V/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.

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 ($\mu\text{V}/\text{m}$)

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: $DCF = 20\log_{10}(\text{measurement distance}/\text{specification distance})$)

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 ($\mu\text{V}/\text{m}$).

$$RA = 52.0 \text{ dB } (\mu\text{V})$$

$$AF = 7.4 \text{ dB } (1/\text{m})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$DCF=10.5 \text{ dB}$$

$$FS = RF + AF + CF - AG - DCF$$

$$FS = 52.0 + 7.4 + 1.6 - 29.0 - 10.5$$

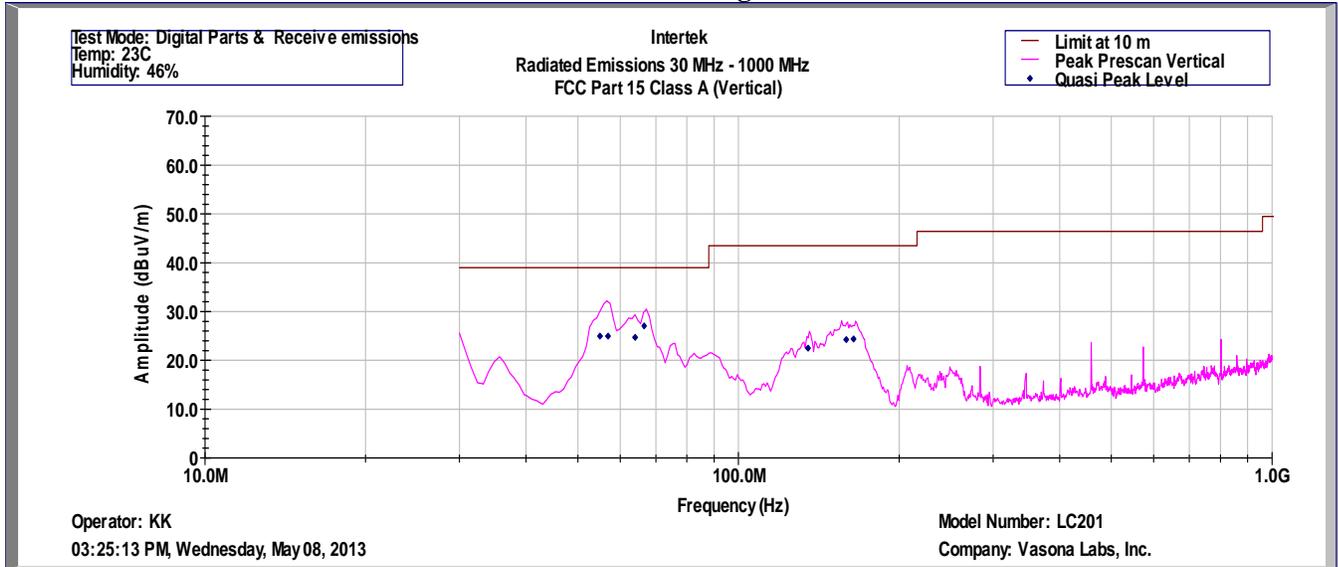
$$FS = 21.5 \text{ dB } (\mu\text{V}/\text{m})$$

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 11.9 dB for Class A.

Table 6.1
Radiated Emissions from Digital Parts



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

Operator: KK
 May 08, 2013

Model Number: LC201
 Company: Vasona Labs, Inc.

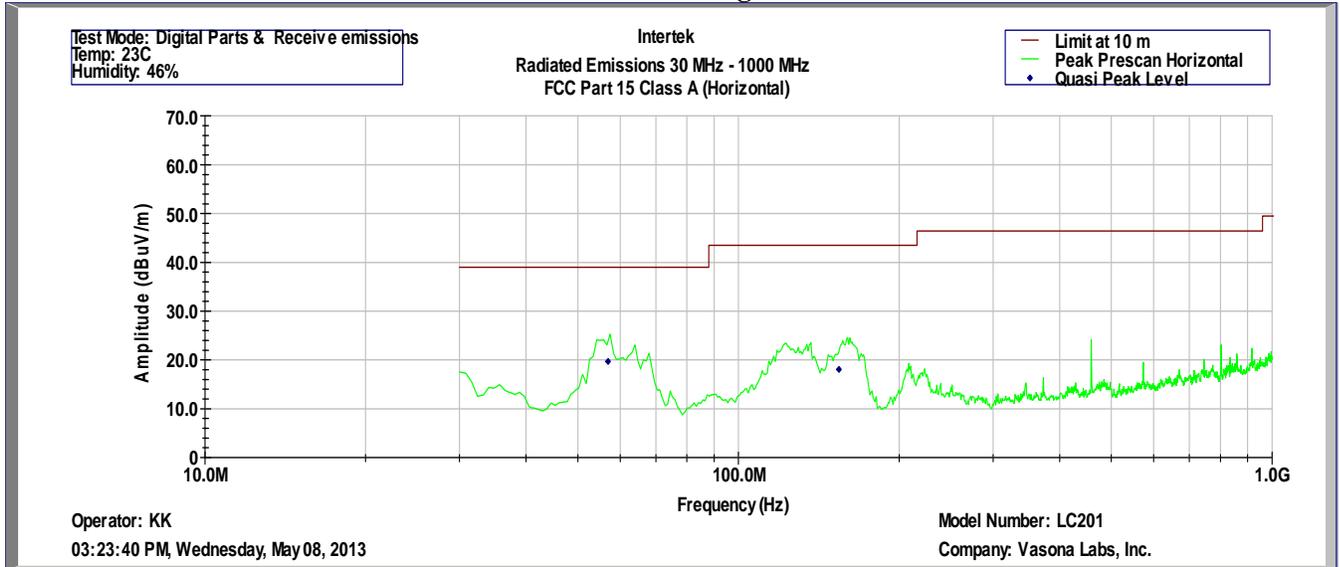
Frequency Hz	Quasi Pk FS dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	RA dB	CF dB	AG dB	AF dB(1/m)
5.501E+07	24.9	39.0	-14.1	44.1	0.8	32.1	12.5
5.698E+07	25.0	39.0	-14.0	45.0	0.9	32.1	11.6
6.400E+07	24.7	39.0	-14.3	47.5	0.9	32.1	8.8
6.656E+07	27.1	39.0	-11.9	50.8	0.9	32.1	7.9
1.350E+08	22.4	43.5	-21.1	43.8	1.3	32.0	10.0
1.593E+08	24.2	43.5	-19.3	47.2	1.5	32.0	8.3
1.643E+08	24.4	43.5	-19.1	47.0	1.5	32.0	8.6

Test Mode: Digital Parts emissions
 Temp: 23C
 Humidity: 46%



Table 6.2

Radiated Emissions from Digital Parts



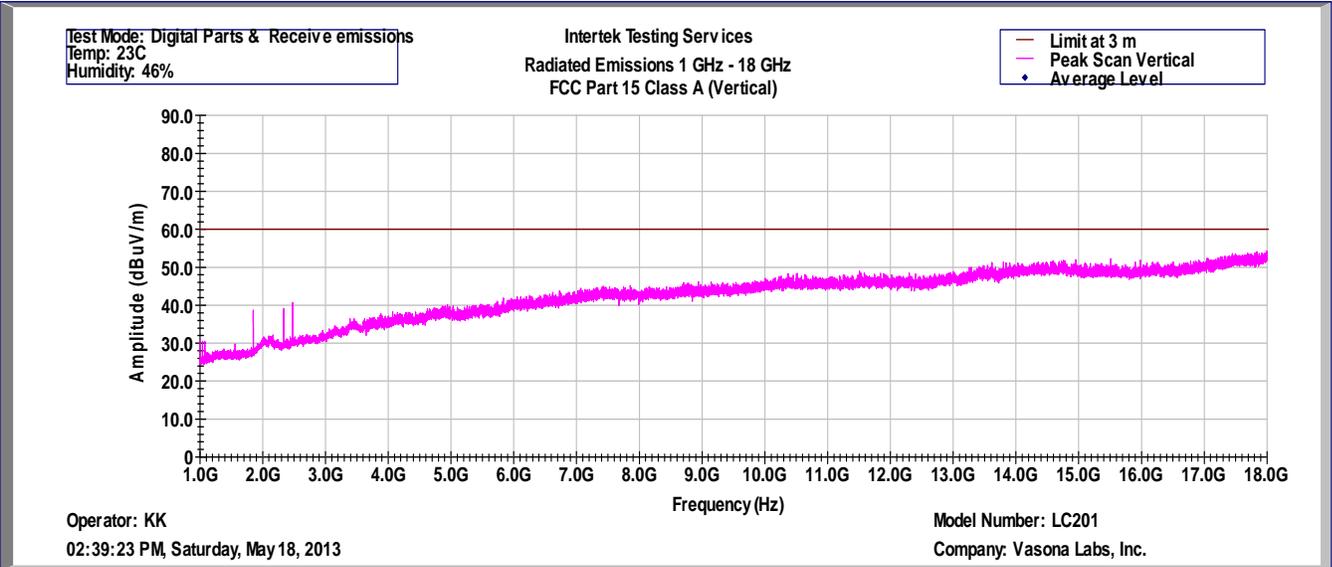
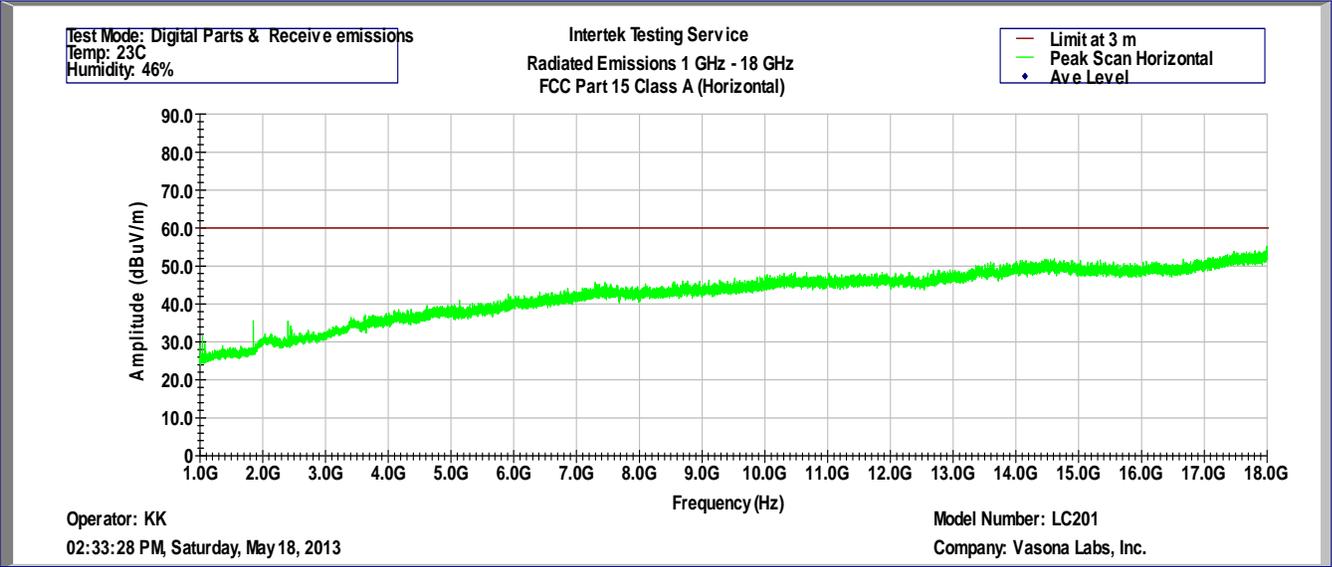
Intertek Testing Services
 Radiated Emissions 30 MHz - 1000 MHz
 FCC Part 15 Class A (QP-Horizontal)

Operator: KK
 May 08, 2013

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency Hz	Quasi Pk FS dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	RA dB	CF dB	AG dB	AF dB(1/m)
5.698E+07	19.7	39.0	-19.3	39.7	0.9	32.1	11.6
1.542E+08	18.0	43.5	-25.5	41.2	1.4	32.0	8.1

Test Mode: Digital Parts emissions
 Temp: 23C
 Humidity: 46%

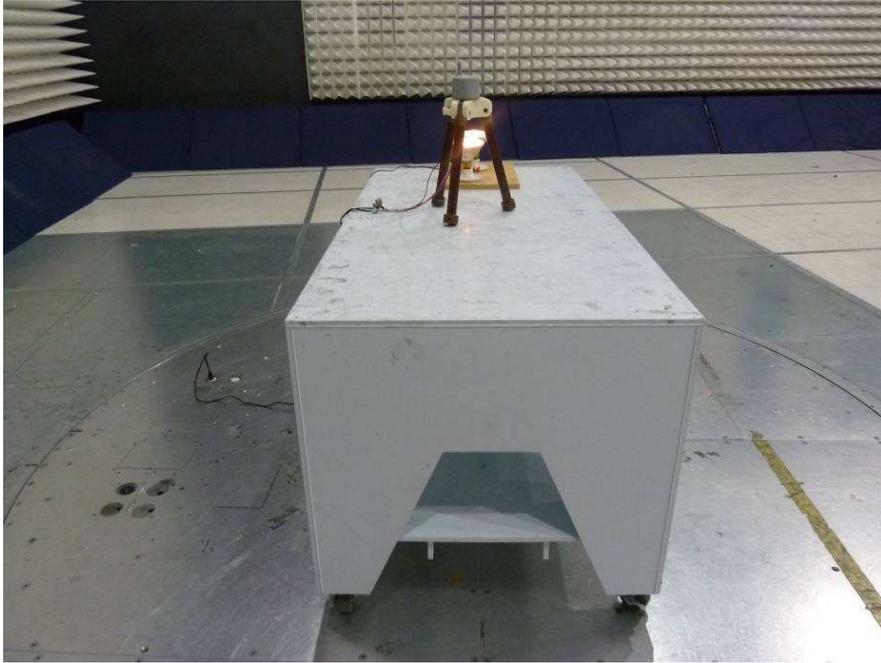


4.6.4 Test setup photographs

The following photographs show the testing configurations used.



4.6.4 Test setup photographs



4.7 AC Line Conducted Emission
FCC 15.207, 15.107

4.7.1 Requirement

Frequency Band MHz	Class B Limit dB(μ V)		Class A Limit dB(μ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

*Note: *Decreases linearly with the logarithm of the frequency
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

AC Line Conducted Emission Data, EUT in transmitting mode

Intertek

Line Conducted Emissions 150 kHz - 30 MHz

EN 55022 Class B (Line 1)

Operator: KK

8-May-13

Model Number: LC201

Company: Vasona Labs, Inc.

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
150439	51.2	54.9	56.0	66.0	-4.8	-11.1
188960	46.2	49.5	54.9	64.9	-8.7	-15.4
879090	40.9	45.5	46.0	56.0	-5.1	-10.5
1390234	36.9	40.3	46.0	56.0	-9.1	-15.7
3000000	34.1	37.0	46.0	56.0	-11.9	-19.0
4343200	33.9	37.8	46.0	56.0	-12.1	-18.2
6571800	39.3	56.3	50.0	60.0	-10.7	-3.7
7909800	34.2	48.5	50.0	60.0	-15.8	-11.5
9531800	42.6	57.7	50.0	60.0	-7.4	-2.3
11889300	42.7	56.5	50.0	60.0	-7.3	-3.5
16559800	30.2	48.5	50.0	60.0	-19.8	-11.5

Test Mode: Transmitter and Receiver emissions, AC mains: 277V 60Hz

Temp: 23C, Humidity: 46%

Intertek

Line Conducted Emissions 150 kHz - 30 MHz

EN 55022 Class B (Line 2)

Operator: KK

8-May-13

Model Number: LC201

Company: Vasona Labs, Inc.

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
150439	52.2	56.6	56.0	66.0	-3.8	-9.4
188960	46.4	49.8	54.9	64.9	-8.5	-15.1
879090	43.0	48.1	46.0	56.0	-3.0	-7.9
1390234	36.3	39.8	46.0	56.0	-9.7	-16.2
3000000	35.2	38.3	46.0	56.0	-10.8	-17.7
4343200	35.0	39.4	46.0	56.0	-11.0	-16.6
7929600	38.3	50.0	50.0	60.0	-11.7	-10.0
9553300	44.1	58.1	50.0	60.0	-5.9	-1.9
11899100	40.3	56.2	50.0	60.0	-9.7	-3.8
16608800	36.9	52.4	50.0	60.0	-13.1	-7.6

Test Mode: Transmitter and Receiver emissions, AC mains: 277V 60Hz

Temp: 23C, Humidity: 46%

Results: Complies by 3.0dB

Note: Investigation was performed at 120V 60Hz, and 277V 60Hz. The worst-case data was reported

AC Line Conducted Emission Data, Digital Parts

Intertek
Line Conducted Emissions 150 kHz - 30 MHz
EN 55022 Class A (Line 1)

Operator: KK
8-May-13

Model Number: LC201
Company: Vasona Labs, Inc.

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
Hz	dBuV	dBuV	dBuV	dBuV	dB	dB
438100	59.0	62.3	66.0	79.0	-7.0	-16.7
732000	55.1	62.0	60.0	73.0	-4.9	-11.0
1024800	55.1	61.7	60.0	73.0	-4.9	-11.3
1323500	53.5	56.3	60.0	73.0	-6.5	-16.7
1608100	56.0	60.6	60.0	73.0	-4.0	-12.4
1899600	52.8	60.7	60.0	73.0	-7.2	-12.3
2196800	52.1	60.6	60.0	73.0	-7.9	-12.4
3959300	53.8	60.6	60.0	73.0	-6.2	-12.4
5117300	46.4	58.5	60.0	73.0	-13.6	-14.5
6571800	39.3	56.3	60.0	73.0	-20.7	-16.7
7909800	34.2	48.5	60.0	73.0	-25.8	-24.5
9531800	42.6	57.7	60.0	73.0	-17.4	-15.3
11889300	42.7	56.5	60.0	73.0	-17.3	-16.5
16559800	30.2	48.5	60.0	73.0	-29.8	-24.5

Test Mode: Digital Parts, AC mains: 277V 60Hz
Temp: 23C, Humidity: 46%

AC Line Conducted Emission Data, Digital Parts

Intertek
 Line Conducted Emissions 150 kHz - 30 MHz
 EN 55022 Class A (Line 2)

Operator: KK
 8-May-13

Model Number: LC201
 Company: Vasona Labs, Inc.

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
437600	53.10	61.00	66.00	79.00	-12.90	-18.00
732300	54.90	61.50	60.00	73.00	-5.10	-11.50
1028300	53.40	61.80	60.00	73.00	-6.60	-11.20
1321300	53.00	61.40	60.00	73.00	-7.00	-11.60
1615800	52.10	61.00	60.00	73.00	-7.90	-12.00
1908600	56.00	60.90	60.00	73.00	-4.00	-12.10
2201100	59.00	60.60	60.00	73.00	-1.00	-12.40
2792800	49.20	60.40	60.00	73.00	-10.80	-12.60
3960000	46.10	59.30	60.00	73.00	-13.90	-13.70
5141300	48.10	59.80	60.00	73.00	-11.90	-13.20
6610600	46.30	59.20	60.00	73.00	-13.70	-13.80
7929600	38.30	50.00	60.00	73.00	-21.70	-23.00
9553300	44.10	58.10	60.00	73.00	-15.90	-14.90
11899100	40.30	56.20	60.00	73.00	-19.70	-16.80
16608800	36.90	52.40	60.00	73.00	-23.10	-20.60

Test Mode: Digital Parts, AC mains: 277V 60Hz
 Temp: 23C, Humidity: 46%

Results: Complies by 1.0dB
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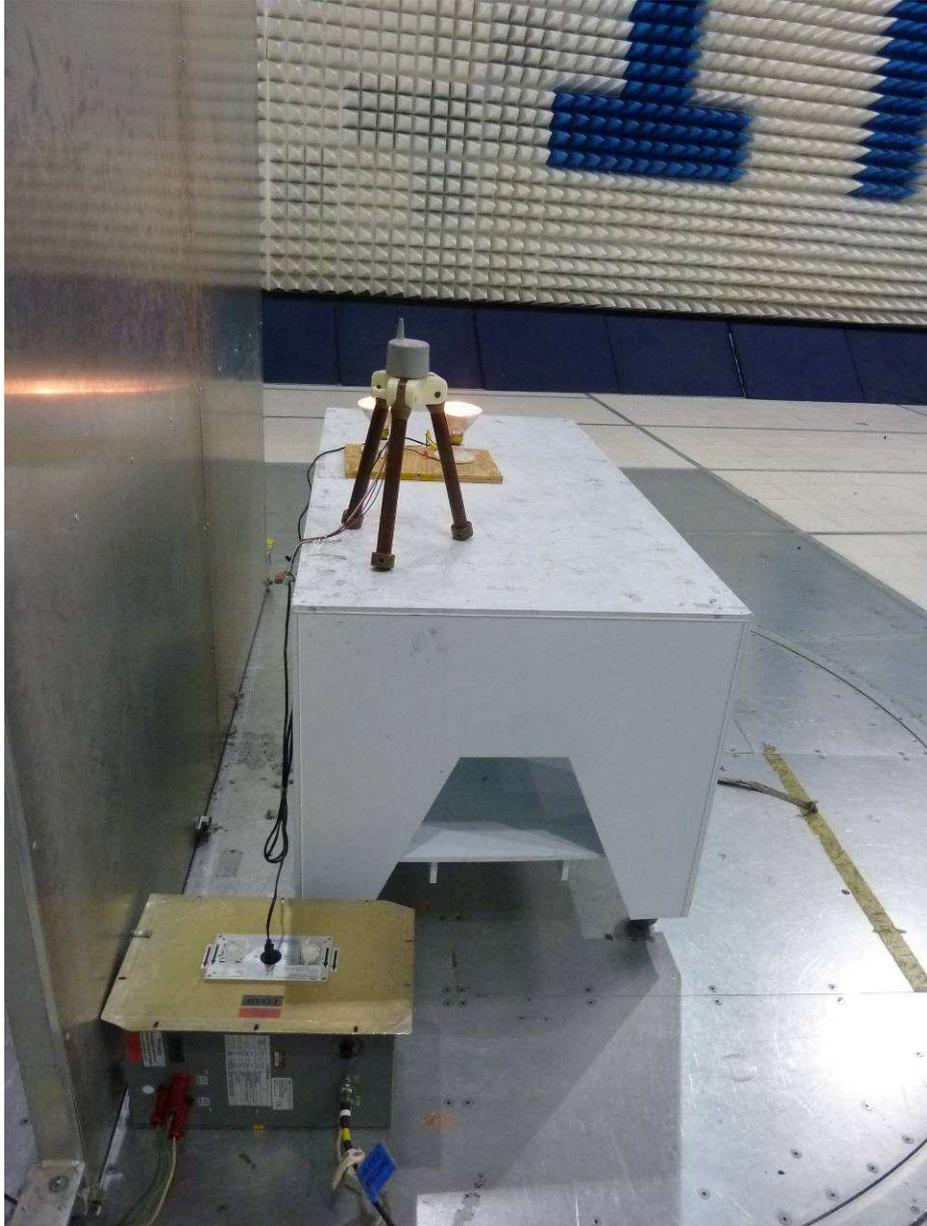
Note: Investigation was performed at 120V 60Hz, and 277V 60Hz. The worst-case data was reported

4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



4.7.4 Test setup photographs



5.0 RF Exposure 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. For mobile wireless devices the RF Exposure Limit is Maximum Permissible Exposure (MPE).

The maximum conducted output power is 18.9 dBm (78 mW); maximum antenna gain is 2.0 dBi. Therefore, to comply with RF Exposure Requirement, the MPE is calculated. The maximum Peak EIRP calculated is 0.123 W.

The Power Density can be calculated using the formula

$$S = \text{EIRP} / 4\pi D^2$$

Where: S is Power Density in W/m^2

D is the distance from the antenna in meters.

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

At 0.2 m, $S = 0.245 \text{ W}/\text{m}^2$, which is below the FCC MPE Limit of $10 \text{ W}/\text{m}^2$ for uncontrolled environment.

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	03/12/14
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/12/14
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	04/05/14
Spectrum Analyzer	Rohde&Schwarz	FSP-40	100030	12	11/19/13
Spectrum Analyzer	Rohde and Schwartz	ESU	100172	12	10/05/13
BI-Log Antenna	ARA	LPB-2513/A	1154	12	07/12/13
Horn Antenna	EMCO	3115	9107-3712	12	12/06/13
Horn Antenna	EMCO	3115	00126795	12	11/15/13
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	Sonoma	310N	293620	12	11/20/13
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	09/10/13
Pre-Amplifier	Miteq	JSD44-18004000-30-5P	1071636	12	05/13/14
Signal Generator	Hewlett Packard	SMR40	100445	12	09/06/13
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	06/28/13

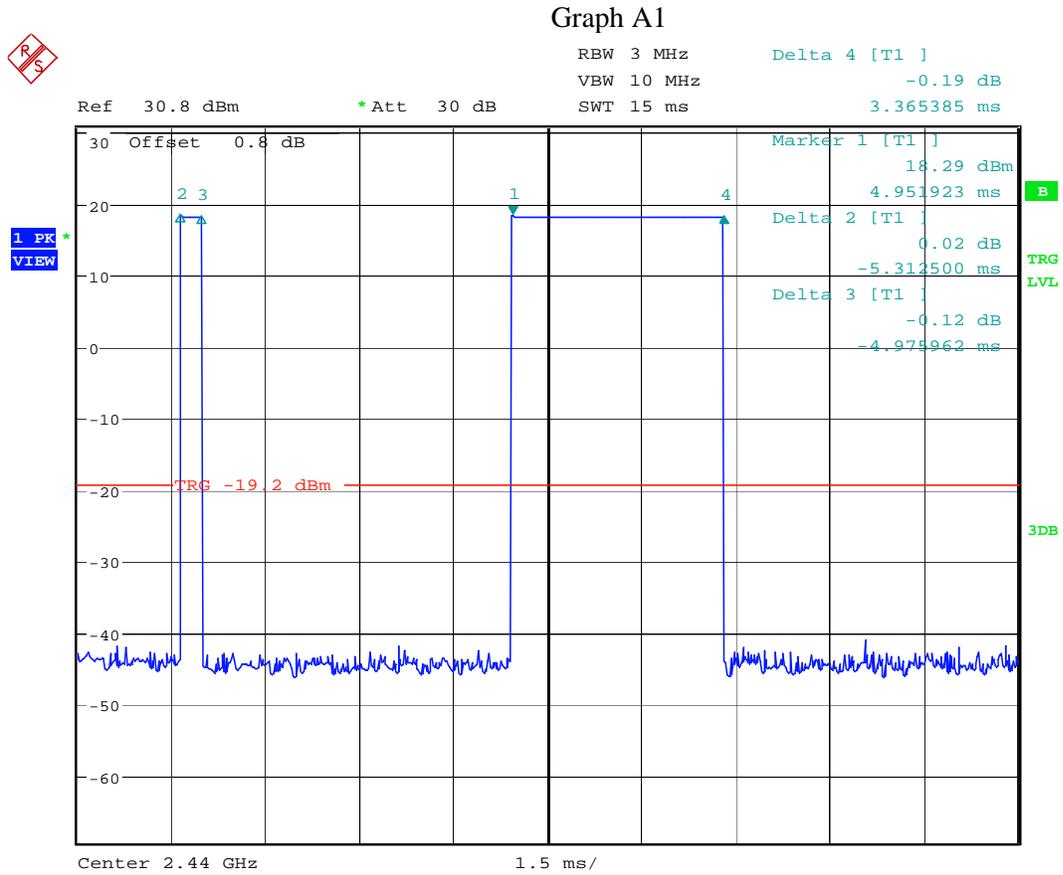
No Calibration required



7.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G100748465	KK	May 27, 2013	Original document

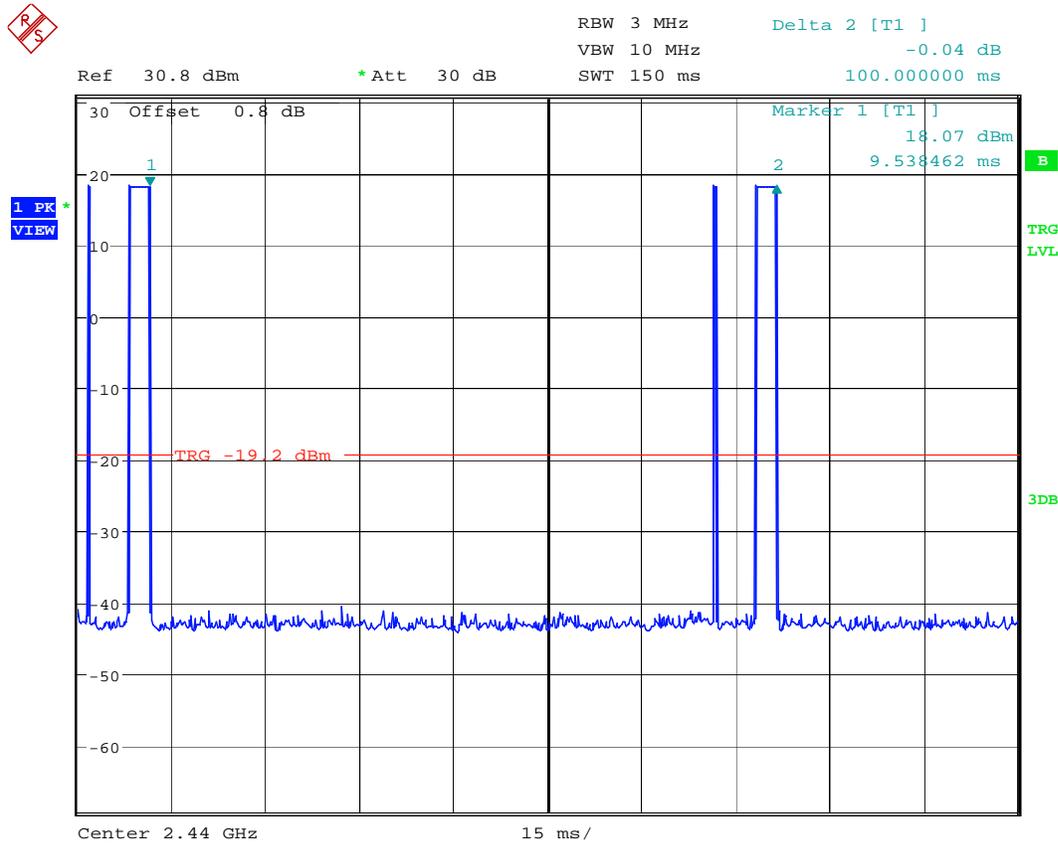
8.0 Appendix A –Graphs for Duty Cycle Measurement



Duty Cycle

Date: 13.MAY.2013 14:05:57

Graph A2



Duty Cycle

Date: 13.MAY.2013 14:15:33

In the 100 ms interval, Transmitter On time = 3.36 ms + 0.33 ms = 3.69 ms

Therefore, Duty Cycle Correction Factor $\delta(\text{dB}) = 20 \log (3.69/100) = -28.7 \text{ dB}$

To calculate Average Field Strength value from the measured Peak value, the Duty Cycle Correction Factor of $\delta(\text{dB}) = -20 \text{ dB}$ was used.