Radiated Spurious for
FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

National Instruments

MODEL NUMBER: TiWi-BLE

FCC ID: TFB-TIWI1-01
IC: 5969A-TIWI101

REPORT NUMBER: 13U15032-2B

ISSUE DATE: July 23, 2013

Prepared for
National Instruments Corporation
11500 N Mopac Expwy
Austin TX, 78759-3504

Prepared by
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	7/1/13	Initial Issue	M.Ferrer
A	7/22/13	Revised Section 5.2 to note "maximum peak conducted power"	M. Ferrer
B	7/23/13	Added Out of Band Emissions	M.Ferrer

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: National Instruments Corporation
11500 N Mopac Expwy
Austin TX, 78759-3504

EUT DESCRIPTION: 2.4GHz WLAN Card

MODEL: TiWi-BLE

SERIAL NUMBER: Prototype

DATE TESTED: May 28, 2013 – July 1, 2013

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

*Only Radiated Spurious Emissions was for performed.

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

BART MUCHA
WiSE STAFF ENGINEER
UL Verification Services Inc.

Tested By:

MICHAEL FERRER
WiSE Project Lead
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062, USA.
UL NBK is accredited by NVLAP, Laboratory Code 100414-0.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Sample Calculations
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Conducted Ant Port	30MHz-26GHz	Spectrum Analyzer	2.94
RF Power	dB	Power Meter	0.45dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11b/g/n transceiver

The radio module is manufactured by LS Research.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	11.49	14.09
2412 - 2462	802.11g	16.19	41.59
2412 - 2462	802.11n HT20	16.13	41.02

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 3.91 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was NI-myRIO-1900-01875f94

The test utility software used during testing was Labview Real –Time 13.0b92

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

Worst-case data rates as provided by the client were:
Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T410	-	-
USB program board	-	-	-	-

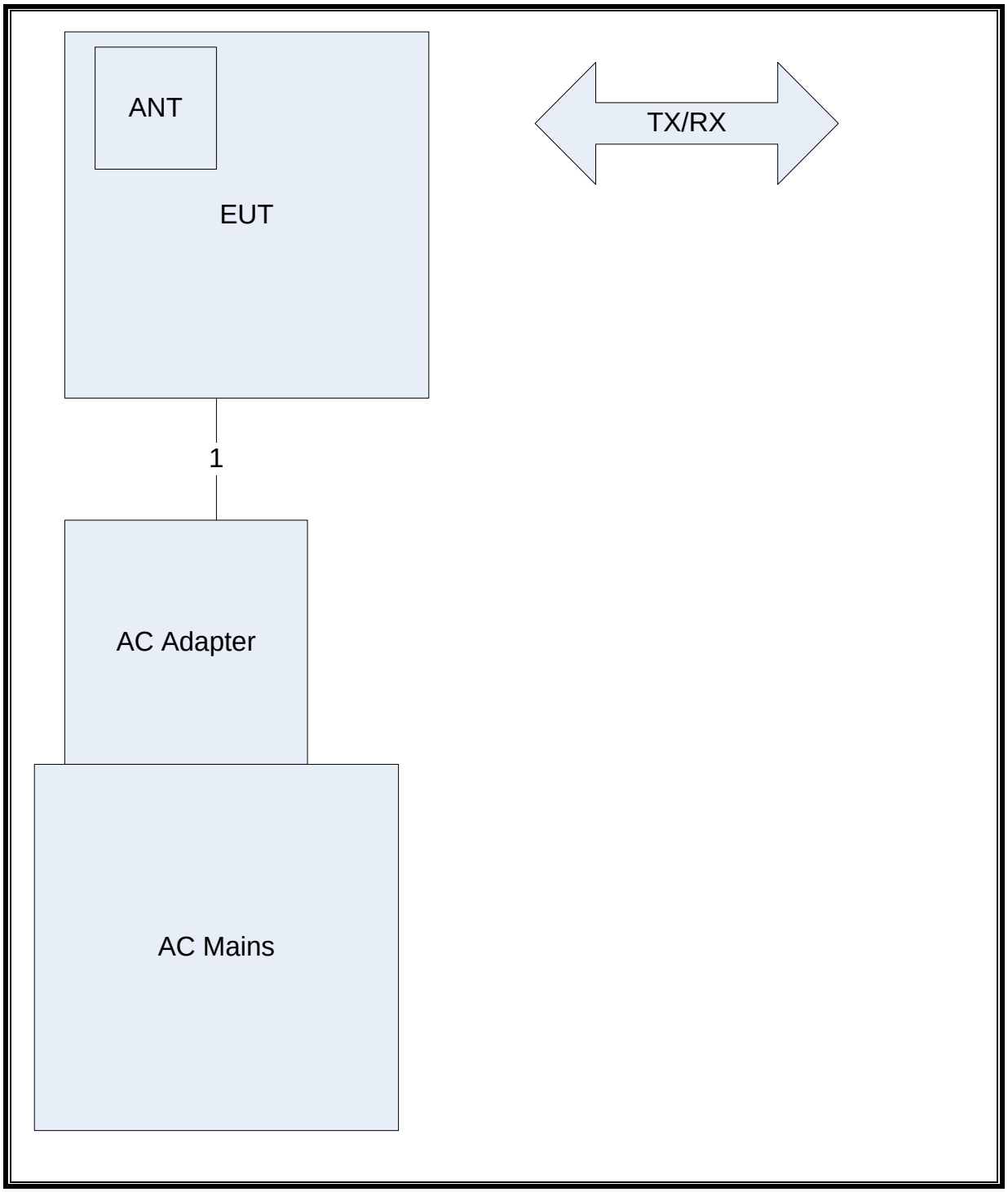
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	plug	2 wire	1.5	

TEST SETUP

The EUT is a WLAN card. To program the card, a programming board via USB to Laptop was connected. After programming, the programming board was removed.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20121227	20131231
Bicon Antenna	Electro-Metrics	EM 6912A	EMC4070	20120830	20130830
Log-P Antenna	Chase	UPA6109	EMC4258	20121015	20131030
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20121226	20131231
Antenna Array	UL	BOMS	EMC4276	20111227	20131231
Power Meter	HP	438A	EMC4261	20121226	20131231
Power Sensor	HP	8481A	EMC4286	20121229	20131231
Spectrum Analyzer	Agilient	N9030A	EMC4360	20121226	20131226

7. ANTENNA PORT TEST RESULTS

7.1.1. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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.

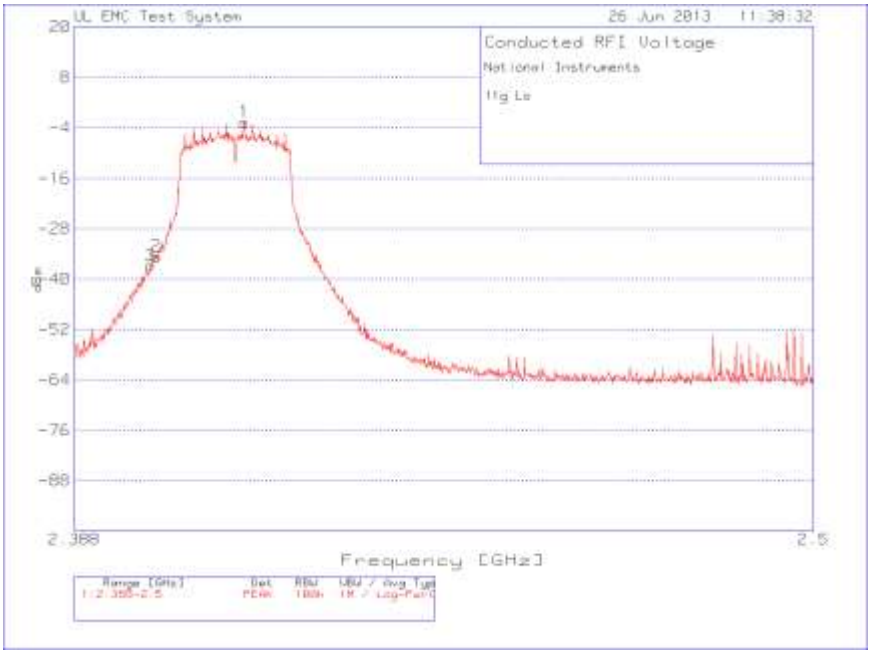
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

LOW CHANNEL BANDEDGE 802.11g

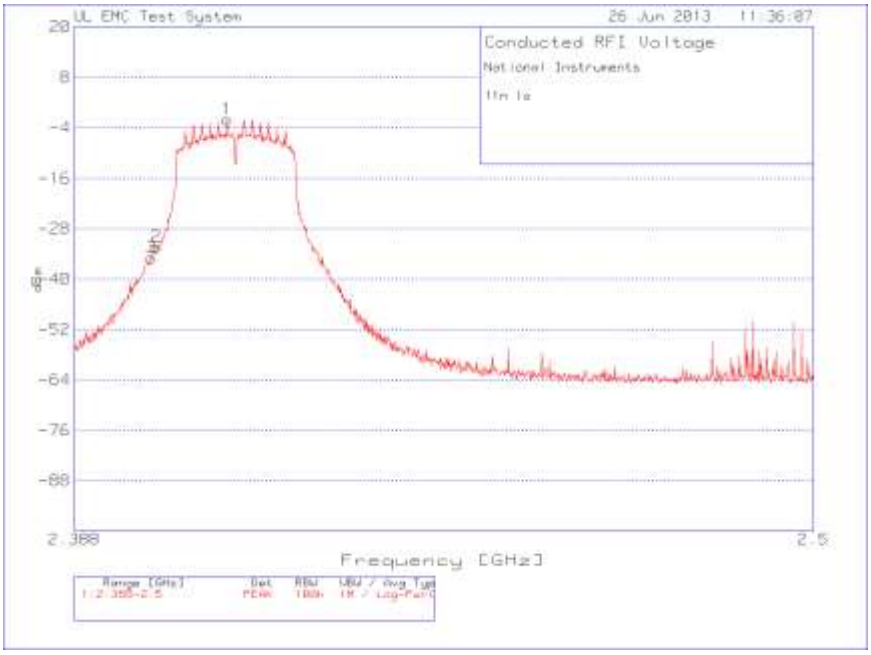
AUTHORIZED BAND EDGE LOW CH



National Instruments						
11g Lo						
Trace Markers						
Range 2 2.388 - 2.5MHz						
Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2.4133	93.78	PK	-107	10.5	-2.72
2	2.4002	61.95	PK	-107	10.5	-34.55
3	2.3993	59.7	PK	-107	10.5	-36.8

LOW CHANNEL BANDEDGE 802.11n

AUTHORIZED BAND EDGE LOW CH



National Instruments						
11n lo						
Trace Markers						
Range 2 2.388 - 2.5MHz						
Marker No.	Test Frequency (GHz)	Meter Reading(dBuV)	Detector	dBuV to dBm	Mel cable 30-26000.TXT	Corrected Reading dBm
1	2.4107	94.49	PK	-107	10.5	-2.01
2	2.4002	64.16	PK	-107	10.5	-32.34
3	2.3994	61.57	PK	-107	10.5	-34.93

8. RADIATED TEST RESULTS Antenna 1

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

**Note, in all plots Red: Peak Scan, Green: Average Scan. It is mislabeled in all Bandedge plots

8.2. TRANSMITTER ABOVE 1 GHz

8.3. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ

National Instruments												
PIFA Y-axis												
11b Lo CH 1mbps												
120V 60Hz												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2411.081	66.88	PK	21.8	3.93	92.61	n/a	n/a	n/a	n/a	100	Horz
2	2400.571	27.5	PK	21.8	4.3	53.6	n/a	n/a	n/a	n/a	100	Horz
3	2399.369	26.51	PK	21.8	4.33	52.64	n/a	n/a	n/a	n/a	150	Horz
4	2379.009	27.01	PK	21.8	4.26	53.07	74	-20.93	n/a	n/a	150	Horz
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2411.502	63.07	AV	21.8	3.91	88.78	n/a	n/a	n/a	n/a	100	Horz
6	2400.691	16.07	AV	21.8	4.29	42.16	n/a	n/a	n/a	n/a	100	Horz
7	2399.489	15.78	AV	21.8	4.32	41.9	n/a	n/a	n/a	n/a	100	Horz
8	2380.901	15.52	AV	21.8	4.32	41.64	n/a	n/a	54	-12.36	150	Horz

LOW CHANNEL RESTRICTED, VERT

National Instruments												
PIFA Y-axis												
11b Lo CH 1mbps												
120V 60Hz												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2410.961	73.14	PK	21.8	3.93	98.87	n/a	n/a	n/a	n/a	100	Vert
2	2400.571	28.15	PK	21.8	4.3	54.25	n/a	n/a	n/a	n/a	100	Vert
3	2398.408	28.13	PK	21.8	4.35	54.28	n/a	n/a	n/a	n/a	100	Vert
4	2376.246	27.42	PK	21.8	4.17	53.39	74	-20.61	n/a	n/a	100	Vert
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2411.321	69.55	AV	21.8	3.92	95.27	n/a	n/a	n/a	n/a	100	Vert
6	2400.631	18.1	AV	21.8	4.3	44.2	n/a	n/a	n/a	n/a	100	Vert
7	2398.949	17.47	AV	21.8	4.34	43.61	n/a	n/a	n/a	n/a	100	Vert
8	2379.91	15.83	AV	21.8	4.29	41.92	n/a	n/a	54	-12.08	100	Vert

AUTHORIZED BANDEDGE (HIGH CHANNEL)

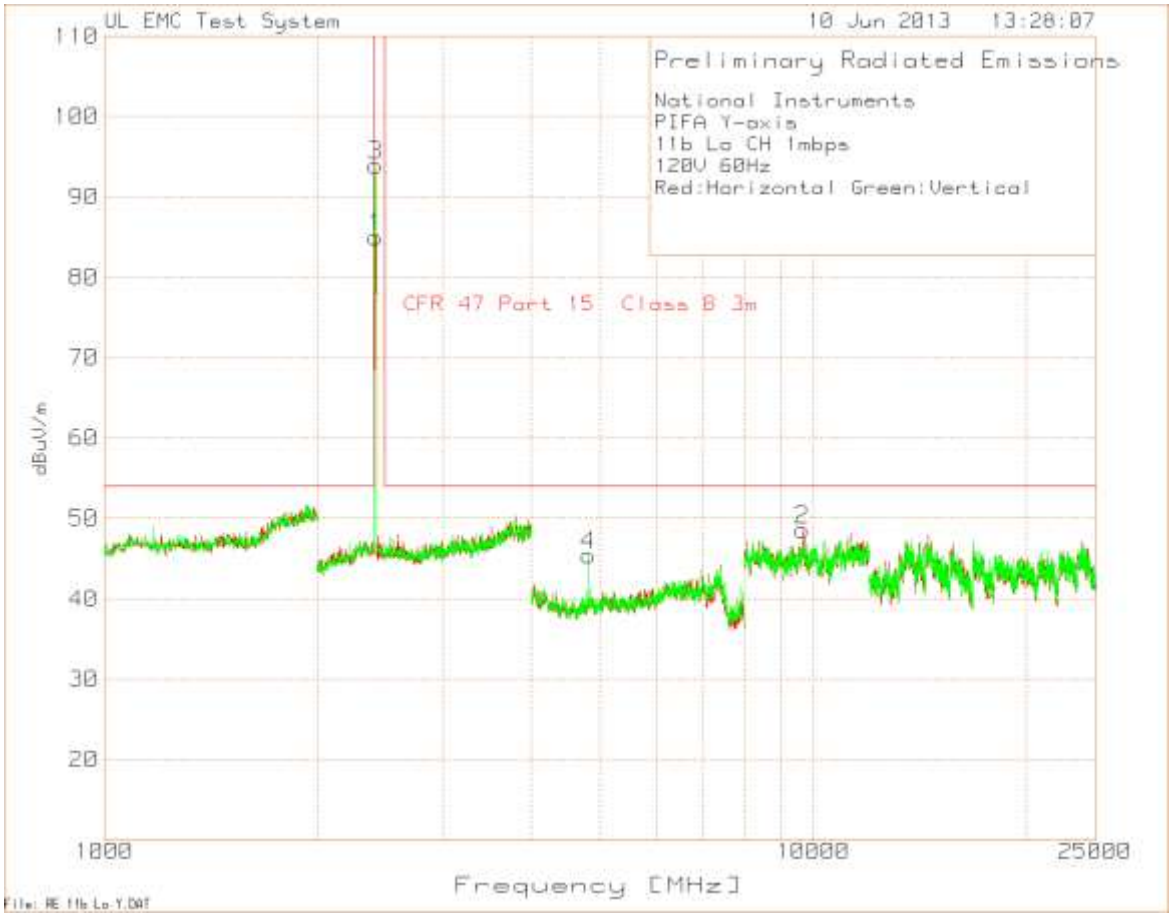
HIGH CHANNEL BANDEDGE, HORIZ

National Instruments												
PIFA Y-axis												
11b Hi CH 1mbps												
120V 60Hz												
Peak 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2463.05	68.34	PK	22	4.08	94.42	n/a	n/a	n/a	n/a	99	Horz
2	2473.56	27.02	PK	22	3.85	52.87	n/a	n/a	n/a	n/a	99	Horz
3	2483.29	26.99	PK	22	3.77	52.76	n/a	n/a	n/a	n/a	150	Horz
4	2484.731	26.58	PK	22.1	3.77	52.45	74	-21.55	n/a	n/a	125	Horz
Avearge 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2462.839	64.51	AV	22	4.08	90.59	n/a	n/a	n/a	n/a	100	Horz
6	2473.62	16.06	AV	22	3.84	41.9	n/a	n/a	n/a	n/a	100	Horz
7	2483.29	15.53	AV	22	3.77	41.3	n/a	n/a	n/a	n/a	100	Horz
8	2484.551	15.43	AV	22.1	3.77	41.3	n/a	n/a	54	-12.7	100	Horz

HIGH CHANNEL BANDEDGE, VERT

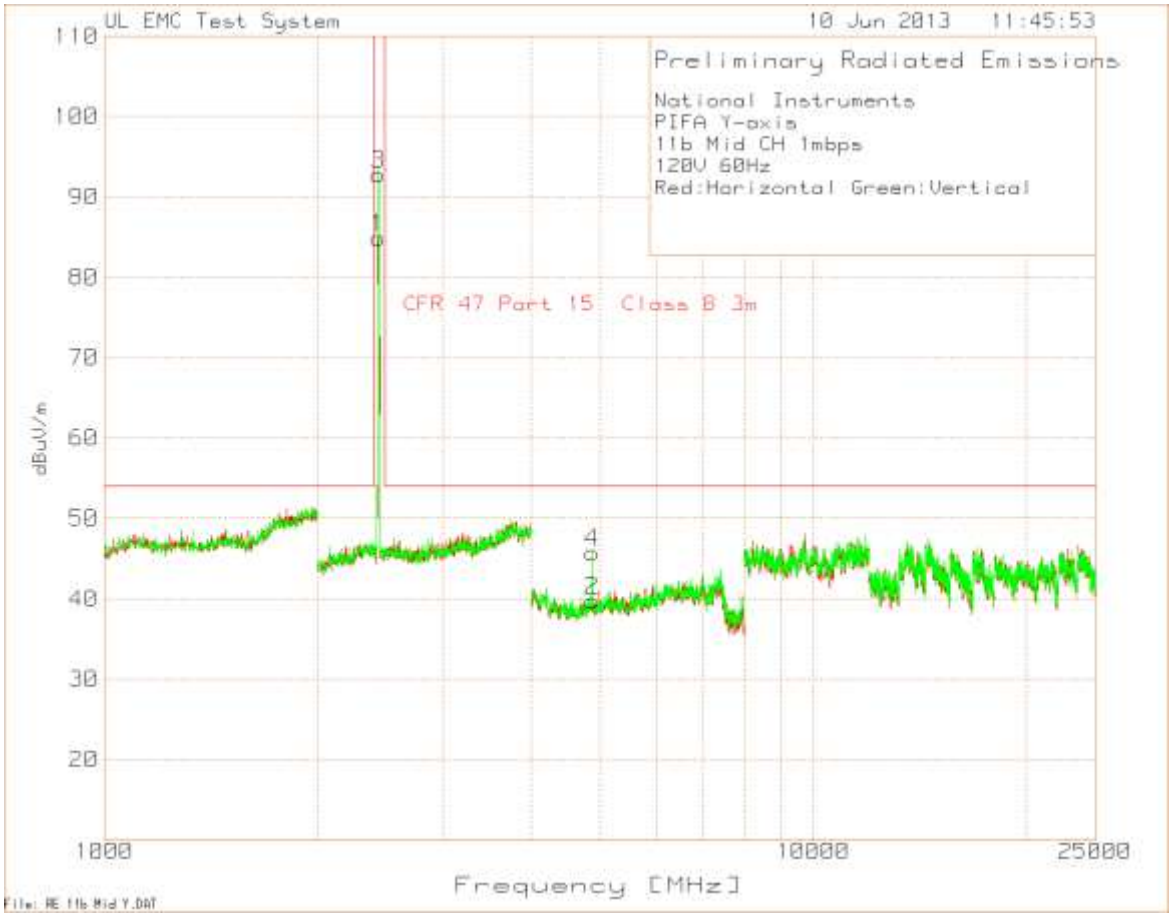
National Instruments												
PIFA Y-axis												
11b Hi CH 1mbps												
120V 60Hz												
Peak 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2462.989	74.12	PK	22	4.08	100.2	n/a	n/a	n/a	n/a	125	Vert
2	2474.161	27.55	PK	22	3.83	53.38	n/a	n/a	n/a	n/a	125	Vert
3	2482.809	27.19	PK	22	3.77	52.96	n/a	n/a	n/a	n/a	125	Vert
4	2485.092	28.14	PK	22.1	3.77	54.01	74	-19.99	54	0.01	100	Vert
Avearge 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2462.839	70.31	AV	22	4.08	96.39	n/a	n/a	n/a	n/a	125	Vert
6	2474.401	16.75	AV	22	3.83	42.58	n/a	n/a	n/a	n/a	100	Vert
7	2482.449	16.02	AV	22	3.77	41.79	n/a	n/a	n/a	n/a	100	Vert
8	2485.512	15.82	AV	22.1	3.77	41.69	74	-32.31	54	-12.31	100	Vert

HARMONICS AND SPURIOUS EMISSIONS



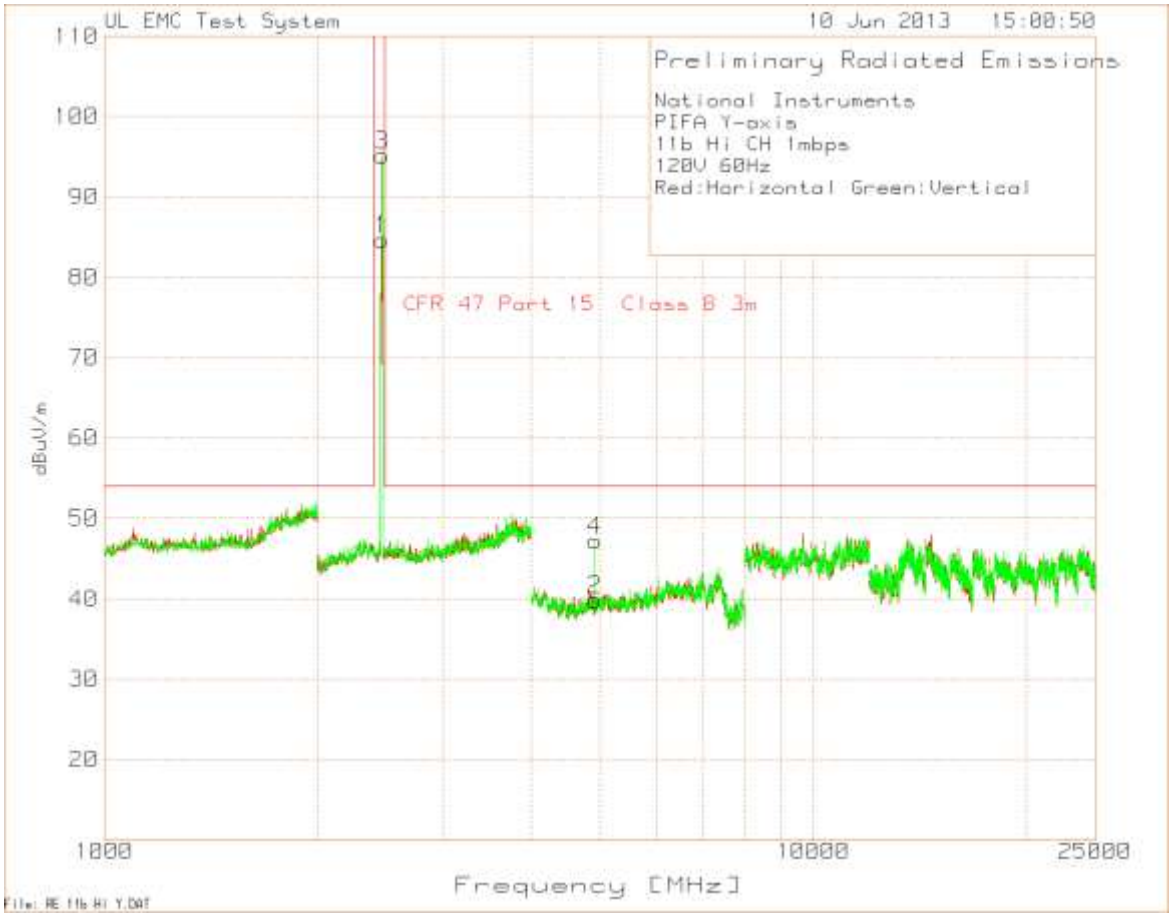
All Emissions at least 5dB below the limit

HARMONICS AND SPURIOUS EMISSIONS



All Emissions at least 6dB below the limit

HARMONICS AND SPURIOUS EMISSIONS

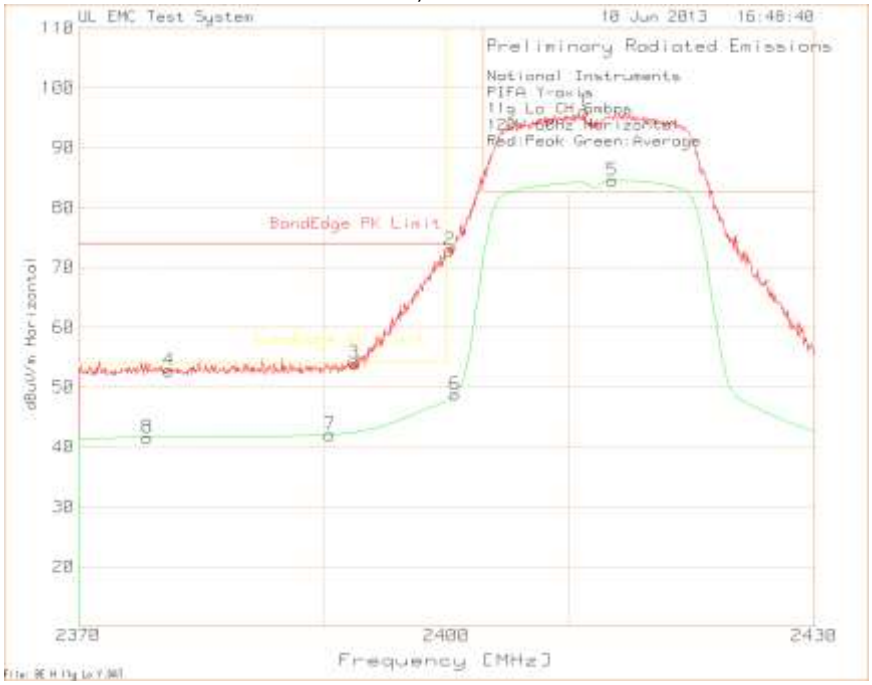


All Emissions at least 6dB below the limit

8.4. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ



Compliance for 2390MHz-2400MHz is shown in Ant Port Measurements section

National Instruments												
PIFA Y-axis												
11g Lo CH 6mbps												
120V 60Hz Horizontal												
Red:Peak Green:Average												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
4	2377.387	26.75	PK	21.8	4.2	52.75	74	-21.25	n/a	n/a	150	Horz
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
8	2375.616	15.66	AV	21.8	4.15	41.61	n/a	n/a	54	-12.39	100	Horz

LOW CHANNEL RESTRICTED, VERT

Compliance for 2390MHz-2400MHz is shown in Ant Port Measurements section

National Instruments												
PIFA Y-axis												
11g Lo CH 6Mbps												
120V 60Hz Vertical												
Red:Peak Green:Average												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2387.117	27.2	PK	21.8	4.43	53.43	74	-20.57	n/a	n/a	150	Vert
7	2376.486	26.37	PK	21.8	4.18	52.35	74	-21.65	n/a	n/a	100	Vert
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
9	2410.751	64.94	AV	21.8	3.94	90.68	n/a	n/a	n/a	n/a	100	Vert
10	2400.751	28.14	AV	21.8	4.29	54.23	n/a	n/a	n/a	n/a	100	Vert
11	2399.309	25.84	AV	21.8	4.33	51.97	n/a	n/a	n/a	n/a	100	Vert

AUTHORIZED BANDEDGE (HIGH CHANNEL)

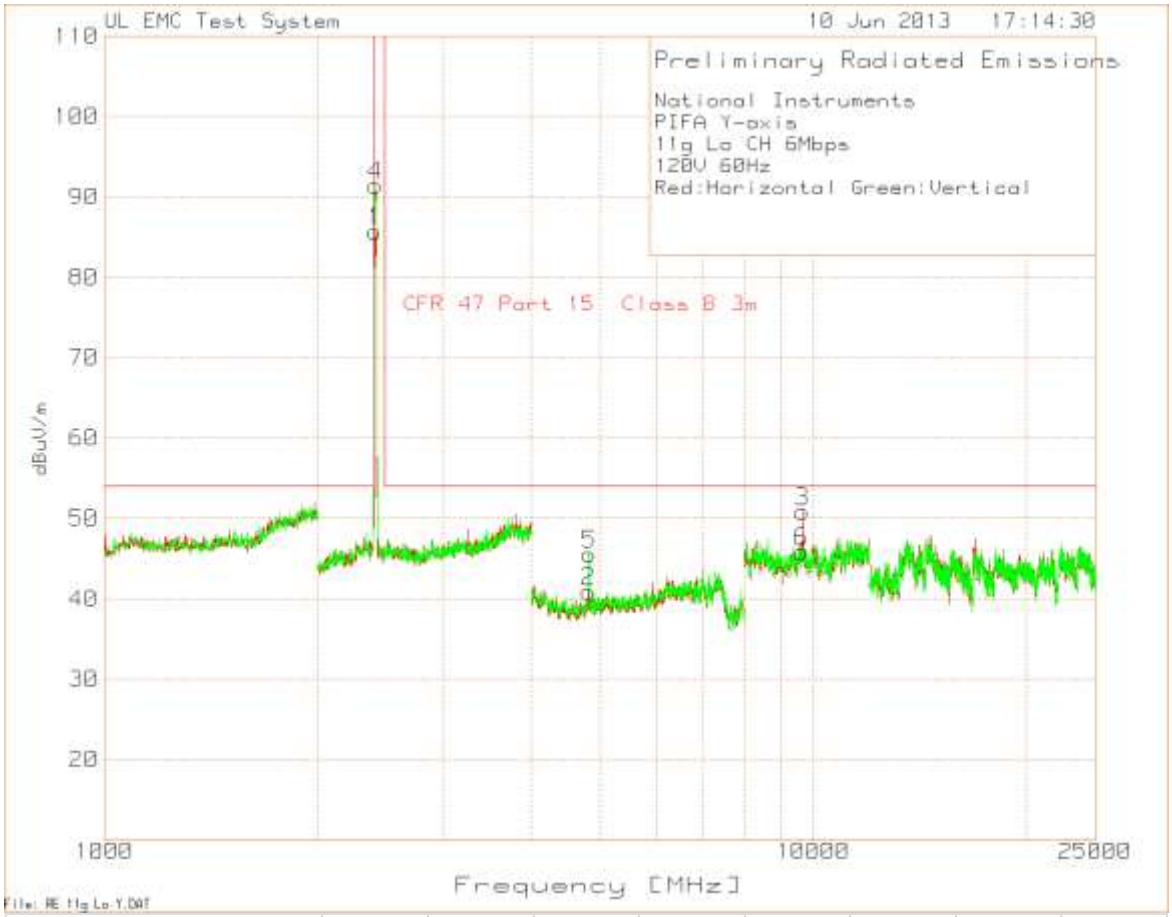
HIGH CHANNEL BANDEDGE, HORIZ

National Instruments												
PIFA Y-axis												
11g Hi CH 6mbps												
120V 60Hz												
Horizontal-Red:Peak Green:Average												
Peak 2453.5 - 2513.5MHz												
Marker No	Test Frequ	Meter Rea	Detector	EMCO3163	BOMS Fac	dBuV/m	BandEdge	Margin	BandEdge	Margin	Height [cn	Polarity
1	2465.092	71.16	PK	22	4.03	97.19	n/a	n/a	n/a	n/a	99	Horz
2	2472.959	49.19	PK	22	3.86	75.05	n/a	n/a	n/a	n/a	99	Horz
3	2481.548	27.86	PK	22	3.77	53.63	n/a	n/a	n/a	n/a	150	Horz
4	2485.452	26.62	PK	22.1	3.77	52.49	74	-21.51	n/a	n/a	99	Horz
Avearge 2453.5 - 2513.5MHz												
Marker No	Test Frequ	Meter Rea	Detector	EMCO3163	BOMS Fac	dBuV/m	BandEdge	Margin	BandEdge	Margin	Height [cn	Polarity
5	2463.29	59.98	AV	22	4.07	86.05	n/a	n/a	n/a	n/a	100	Horz
6	2473.2	24.57	AV	22	3.85	50.42	n/a	n/a	n/a	n/a	100	Horz
7	2481.608	16.57	AV	22	3.77	42.34	n/a	n/a	n/a	n/a	100	Horz
8	2485.722	15.58	AV	22.1	3.77	41.45	n/a	n/a	54	-12.55	100	Horz

HIGH CHANNEL BANDEDGE , VERT

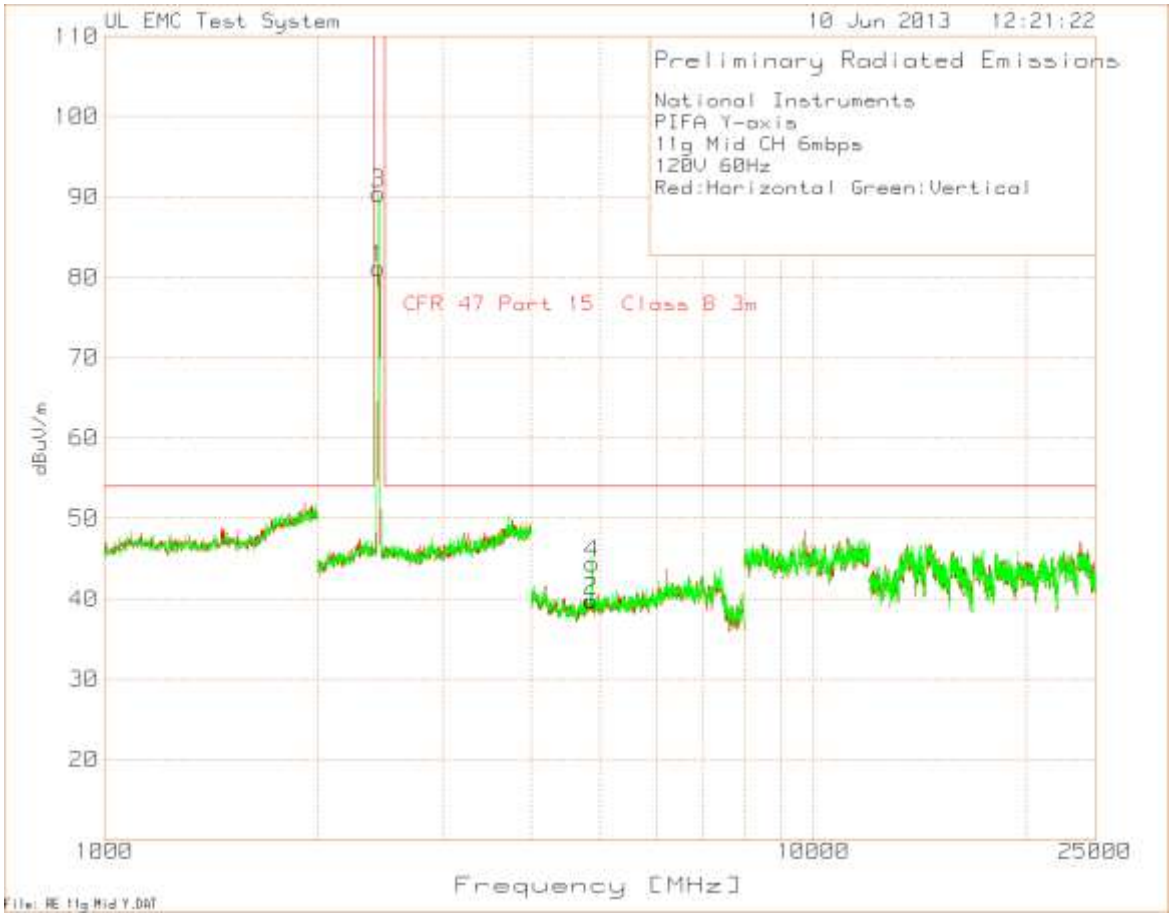
National Instruments												
PIFA Y-axis												
11g Hi CH 6mbps												
120V 60Hz												
Red:Peak Green:Average												
Peak 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2458.845	76.4	PK	22	4.18	102.58	n/a	n/a	n/a	n/a	125	Vert
2	2483.29	28.78	PK	22	3.77	54.55	n/a	n/a	n/a	n/a	125	Vert
3	2484.671	28.3	PK	22.1	3.77	54.17	74	-19.83	n/a	n/a	100	Vert
4	2488.575	28.92	PK	22.1	3.79	54.81	74	-19.19	n/a	n/a	125	Vert
Avearge 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2463.77	65.61	AV	22	4.06	91.67	n/a	n/a	n/a	n/a	125	Vert
6	2483.08	17.34	AV	22	3.77	43.11	n/a	n/a	n/a	n/a	100	Vert
7	2485.512	16.55	AV	22.1	3.77	42.42	n/a	n/a	54	-11.58	100	Vert
8	2489.116	16.12	AV	22.1	3.79	42.01	n/a	n/a	54	-11.99	100	Vert

HARMONICS AND SPURIOUS EMISSIONS



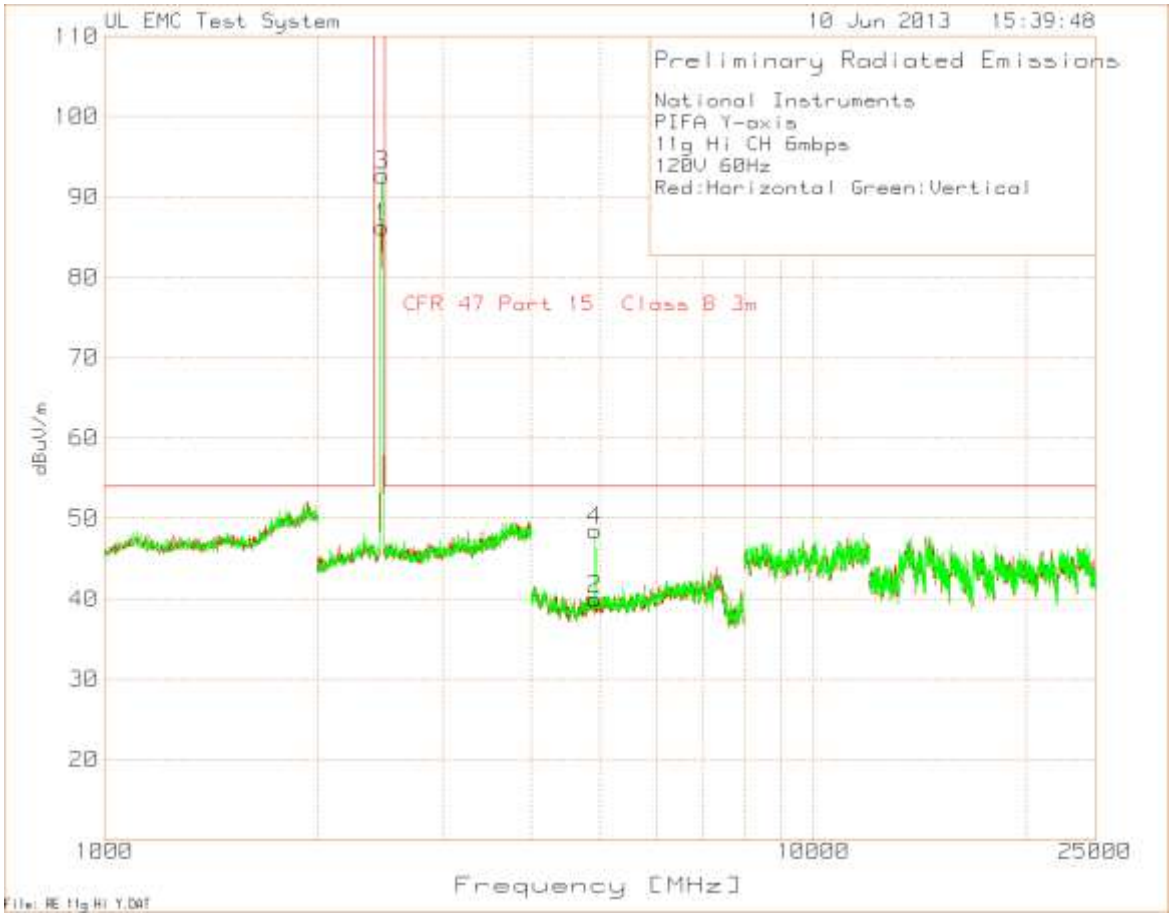
National Instruments										
PIFA Y-axis										
11g Lo CH 6Mbps										
120V 60Hz										
Red:Horizontal Green:Vertical										
8 - 12GHz 8000 - 12000MHz										
Test Frequency	Meter Reading	Detector	EMCO 3160-07 S/N 1114 UL [dB]	BOMS Factor [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Azimuth [Degs]	Height [cm]	Polarity
9647.873	67.15	PK	36.4	-49.15	54.4	74	-19.6	301	110	Horz
9648.053	62.06	LnAv	36.4	-49.13	49.33	54	-4.67	301	110	Horz

HARMONICS AND SPURIOUS EMISSIONS



All Emissions at least 6dB below the limit

HARMONICS AND SPURIOUS EMISSIONS

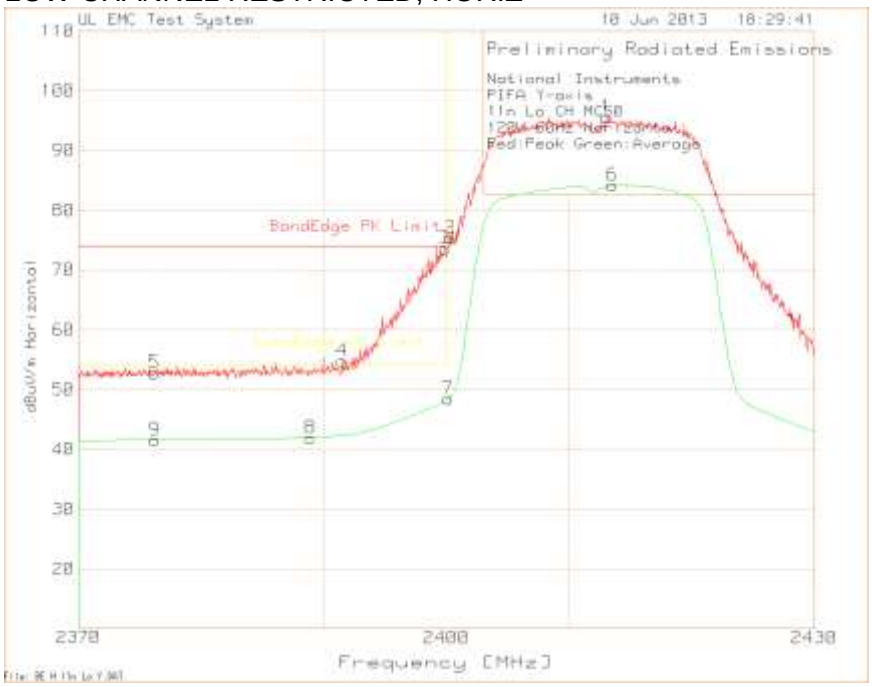


All Emissions at least 5dB below the limit

8.5. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ



Compliance for 2390MHz-2400MHz is shown in Ant Port Measurements section

National Instruments												
PIFA Y-axis												
11n Lo CH MCS0												
120V 60Hz Horizontal												
Red:Peak Green:Average												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
5	2376.186	26.83	PK	21.8	4.17	52.8	74	-21.2	n/a	n/a	150	Horz
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
8	2388.919	15.7	AV	21.8	4.46	41.96	n/a	n/a	54	-12.04	100	Horz
9	2376.246	15.64	AV	21.8	4.17	41.61	n/a	n/a	54	-12.39	100	Horz

LOW CHANNEL RESTRICTED, VERT

Compliance for 2390MHz-2400MHz is shown in Ant Port Measurements section

National Instruments												
PIFA Y-axis												
11n Lo CH MCS0												
120V 60Hz Vertical												
Red:Peak Green:Average												
Peak 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2389.7	28.97	PK	21.8	4.48	55.25	74	-18.75	n/a	n/a	100	Vert
7	2377.628	27.03	PK	21.8	4.21	53.04	74	-20.96	n/a	n/a	150	Vert
Avearge 2370 - 2430MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
11	2387.838	16.58	AV	21.8	4.44	42.82	n/a	n/a	54	-11.18	100	Vert
12	2376.667	16.01	AV	21.8	4.18	41.99	n/a	n/a	54	-12.01	100	Vert

AUTHORIZED BANDEDGE (HIGH CHANNEL)

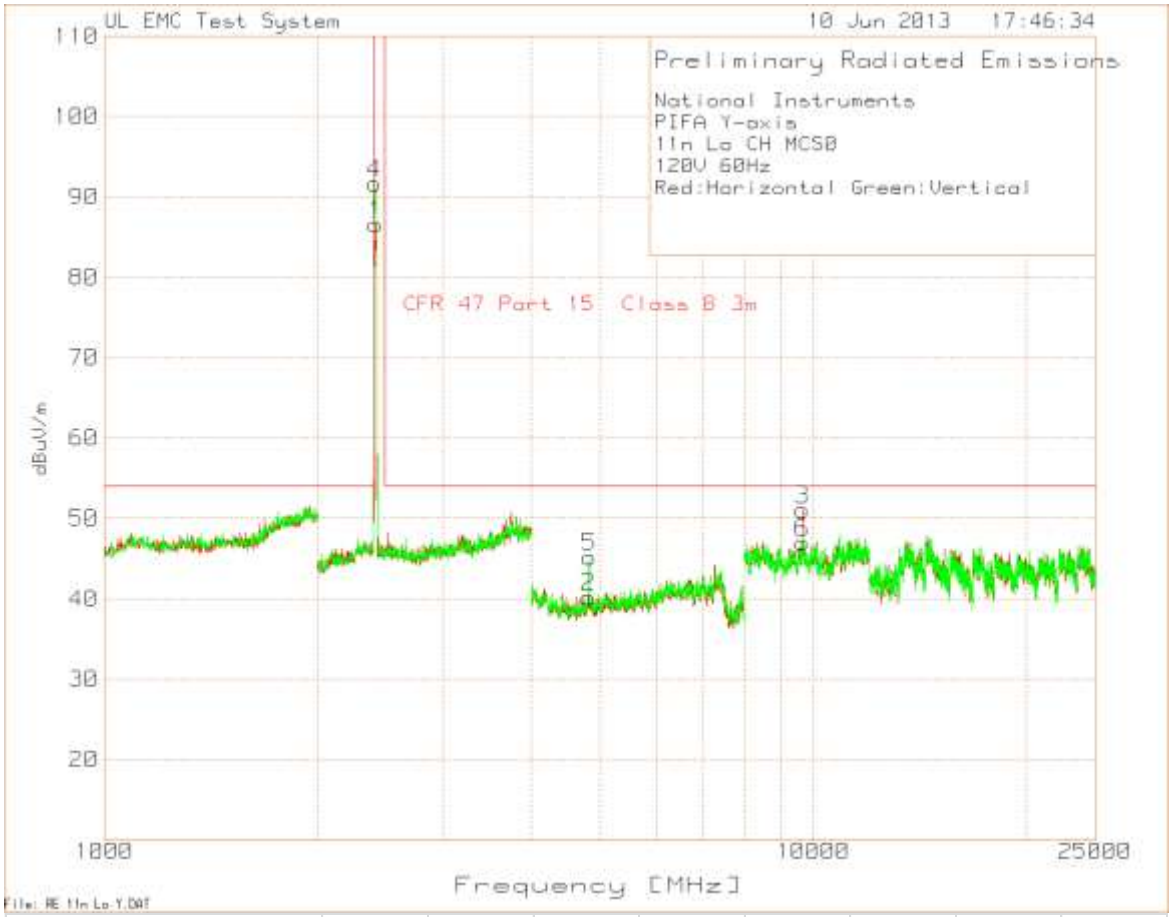
HIGH CHANNEL BANDEDGE, HORIZ

National Instruments												
PIFA Y-axis												
11n Hi CH MCS0												
120V 60Hz Horizontal												
Red:Peak Green:Average												
Peak 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2463.47	70	PK	22	4.07	96.07	n/a	n/a	n/a	n/a	99	Horz
2	2473.74	48.82	PK	22	3.84	74.66	n/a	n/a	n/a	n/a	99	Horz
3	2481.728	27.84	PK	22	3.77	53.61	n/a	n/a	n/a	n/a	99	Horz
4	2484.851	27.34	PK	22.1	3.77	53.21	74	-20.79	n/a	n/a	150	Horz
5	2502.449	26.68	PK	22.1	3.92	52.7	74	-21.3	n/a	n/a	150	Horz
Avearge 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 990610523m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2463.29	59.85	AV	22	4.07	85.92	n/a	n/a	n/a	n/a	99	Horz
7	2473.68	24.82	AV	22	3.84	50.66	n/a	n/a	n/a	n/a	99	Horz
8	2482.389	16.6	AV	22	3.77	42.37	n/a	n/a	n/a	n/a	99	Horz
9	2485.692	15.72	AV	22.1	3.77	41.59	n/a	n/a	54	-12.41	99	Horz
10	2502.689	15.47	AV	22.1	3.92	41.49	n/a	n/a	54	-12.51	99	Horz

HIGH CHANNEL BANDEDGE, PEAK, VERT
Incorrect label really vertical

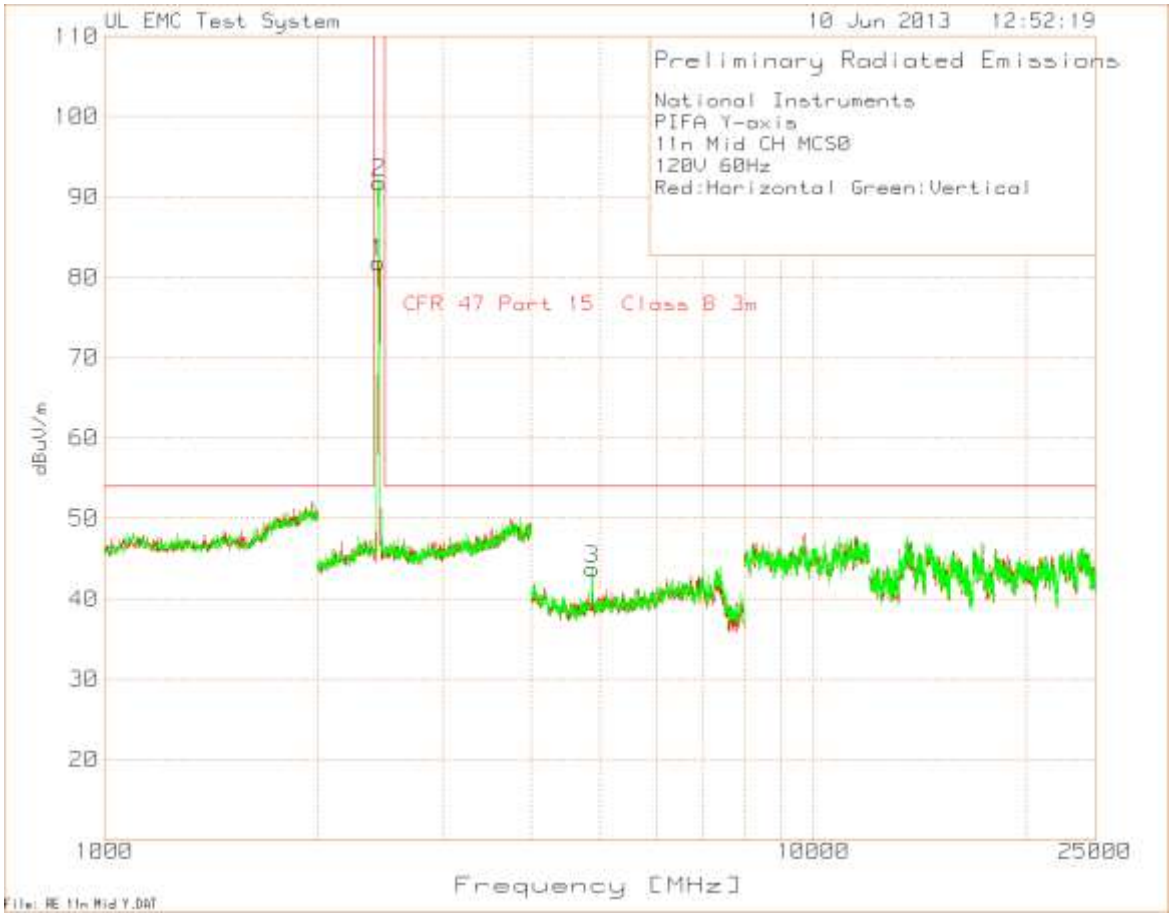
National Instruments												
PIFA Y-axis												
11n Hi CH MCS0												
120V 60Hz Vertical												
Red:Peak Green:Average												
Peak 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
1	2463.29	75.84	PK	22	4.07	101.91	n/a	n/a	n/a	n/a	125	Vert
2	2474.341	54.09	PK	22	3.83	79.92	n/a	n/a	n/a	n/a	100	Vert
3	2483.17	30.9	PK	22	3.77	56.67	n/a	n/a	n/a	n/a	125	Vert
4	2484.131	30.65	PK	22.1	3.77	56.52	74	-17.48	n/a	n/a	100	Vert
5	2493.86	27.71	PK	22.1	3.87	53.68	74	-20.32	n/a	n/a	150	Vert
Avearge 2453.5 - 2513.5MHz												
Marker No.	Test Frequency	Meter Reading	Detector	EMCO3161-02 S/N 99061052 3m UL (dB)	BOMS Factor (dB)	dBuV/m	BandEdge PK Limit	Margin	BandEdge AV Limit	Margin	Height [cm]	Polarity
6	2463.29	65.6	AV	22	4.07	91.67	n/a	n/a	n/a	n/a	125	Vert
7	2474.161	27.86	AV	22	3.83	53.69	n/a	n/a	n/a	n/a	100	Vert
8	2483.05	17.89	AV	22	3.77	43.66	n/a	n/a	n/a	n/a	100	Vert
9	2483.89	17.51	AV	22.1	3.77	43.38	n/a	n/a	54	-10.62	125	Vert
10	2495.122	15.81	AV	22.1	3.89	41.8	n/a	n/a	54	-12.2	100	Vert

HARMONICS AND SPURIOUS EMISSIONS



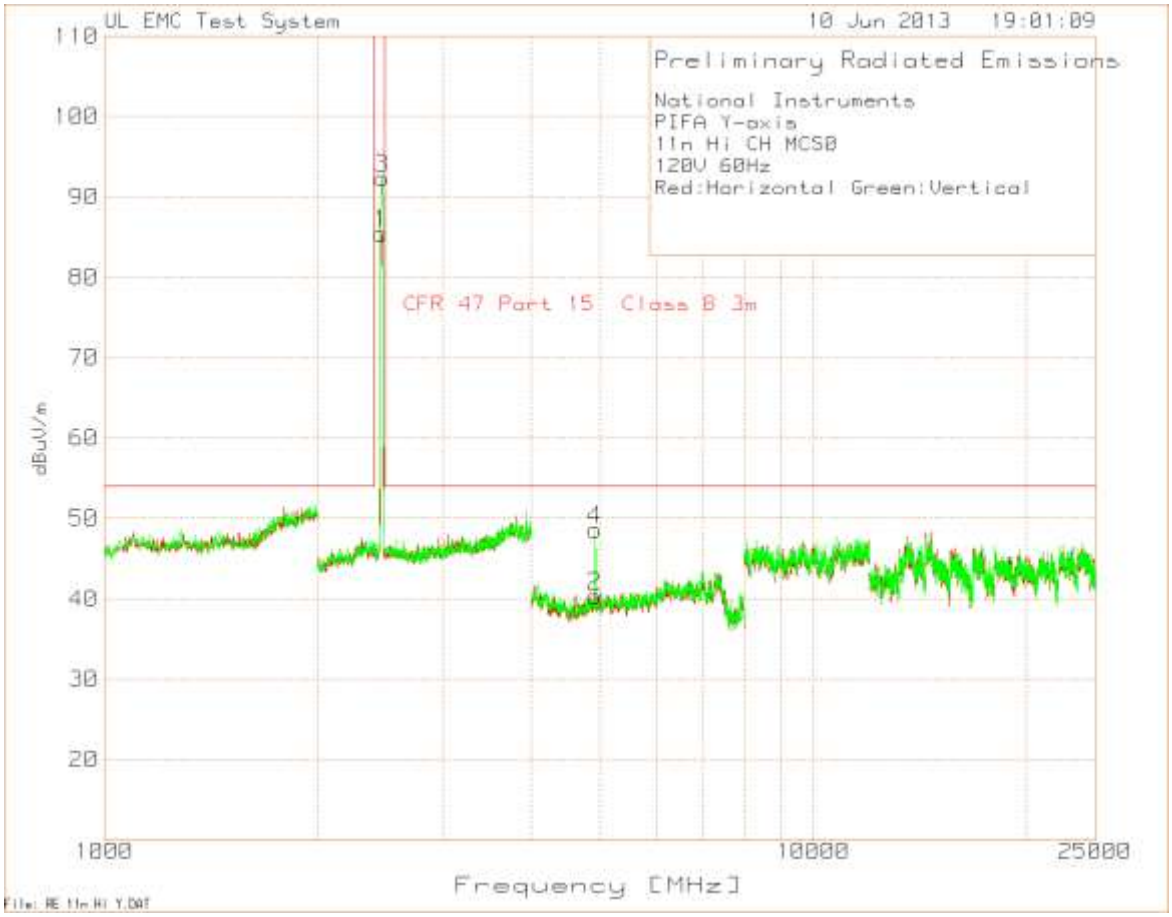
National Instruments										
PIFA Y-axis										
11n Lo CH										
120V 60Hz										
Red:Horizontal Green:Vertical										
8 - 12GHz 8000 - 12000MHz										
Test Frequency	Meter Reading	Detector	EMCO 3160-07 S/N 1114 UL [dB]	BOMS Factor [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Azimuth [Degs]	Height [cm]	Polarity
9648.053	62.18	LnAv	36.4	-49.13	49.45	54	-4.55	301	110	Horz
9647.923	67.64	PK	36.4	-49.14	54.9	74	-19.1	301	110	Horz

HARMONICS AND SPURIOUS EMISSIONS



All Emissions at least 6dB under the limit.

HARMONICS AND SPURIOUS EMISSIONS



All Emissions at least 5dB under the limit.

8.6. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT

```
Manufacturer:National Instruments
Model#PIFA Y-Axis
Mode:11b Mid CH 1Mbps
Voltage:120Vac 60Hz
RED:Horizontal, GREEN:Vertical
      Test     Meter    Transducer  Gain/Loss  Level  Limit:1      2       3       4       5       6
No. Frequency  Reading    Factor     Factor  dB(uVolts/meter)
     [MHz]     (dBuV)      [dB]      [dB]
=============================================================================================================
Bicon Horizonta 30 - 200MHz ---------------------------------------------------
1  30.3398      31.43 PK     17.9      -29.4     19.93     -        -     39.1    29.6      -       -
                 Height:99 Horz      Margin [dB]           -        -     -19.17  -9.67     -       -
2  109.4353     39.78 PK     12.6      -29.4     22.98     -        -     43.5    33.1      -       -
                 Height:400 Horz     Margin [dB]           -        -     -20.52  -10.12    -       -

Bicon Vertical 30 - 200MHz ----------------------------------------------------
3  35.0125      36.77 PK     16.1      -29.4     23.47     -        -     39.1    29.6      -       -
                 Height:99 Vert      Margin [dB]           -        -     -15.63  -6.13     -       -
4  107.906      46.75 PK     12.4      -29.5     29.65     -        -     43.5    33.1      -       -
                 Height:99 Vert      Margin [dB]           -        -     -13.85  -3.45     -       -

LogP Horizontal 200 - 1000MHz -------------------------------------------------
5  735.6429     36.55 PK     20.3      -29.9     26.95     -        -     46.4    35.6      -       -
                 Height:400 Horz     Margin [dB]           -        -     -19.45  -8.65     -       -
6  858.7608     39.89 PK     22.4      -30.1     32.19     -        -     46.4    35.6      -       -
                 Height:99 Horz      Margin [dB]           -        -     -14.21  -3.41     -       -
7  877.6815     41.33 PK     22.8      -30.1     34.03     -        -     46.4    35.6      -       -
                 Height:99 Horz      Margin [dB]           -        -     -12.37  -1.57     -       -

LogP Vertical 200 - 1000MHz ---------------------------------------------------
8  735.5097     40.38 PK     20.3      -29.8     30.88     -        -     46.4    35.6      -       -
                 Height:99 Vert      Margin [dB]           -        -     -15.52  -4.72     -       -
9  858.7608     44 PK        22.4      -30.1     36.3      -        -     46.4    35.6      -       -
                 Height:299 Vert     Margin [dB]           -        -     -10.1   .7        -       -
10  877.4151    41.72 PK     22.8      -30.1     34.42     -        -     46.4    35.6      -       -
                 Height:299 Vert     Margin [dB]           -        -     -11.98  -1.18     -       -

LIMIT 1: NONE
LIMIT 2: NONE
LIMIT 3: FCC Part 15 Class A 10m
LIMIT 4: FCC Part 15  Class B 10m

Manufacturer:National Instruments
Model#PIFA Y-Axis
Mode:11b Mid CH 1Mbps
Voltage:120Vac 60Hz
RED:Horizontal, GREEN:Vertical
  Test     Meter    Transducer  Gain/Loss    Level  Limit:1      2       3       4       5       6
Frequency  Reading    Factor     Factor  dB(uVolts/meter)
 [MHz]     (dBuV)      [dB]      [dB]
=============================================================================================================
Bicon Vertical 30 - 200MHz
108.1452   45.44 QP      12.4      -29.5     28.34     -        -     43.5    33.1      -       -
Azimuth: 131  Height:101 Vert         Margin [dB]:     -        -     -15.16  -4.76     -       -

LogP Horizontal 200 - 1000MHz
858.5104   42.13 QP      22.5      -30.1     34.53     -        -     46.4    35.6      -       -
Azimuth: 167  Height:353 Horz         Margin [dB]:     -        -     -11.87  -1.07     -       -

877.0488   38.85 QP      22.8      -30.1     31.55     -        -     46.4    35.6      -       -
Azimuth: 250  Height:335 Horz         Margin [dB]:     -        -     -14.85  -4.05     -       -

LogP Vertical 200 - 1000MHz
858.5108   42.19 QP      22.5      -30.1     34.59     -        -     46.4    35.6      -       -
Azimuth: 230  Height:388 Vert         Margin [dB]:     -        -     -11.81  -1.01     -       -

877.3728   38.92 QP      22.8      -30.1     31.62     -        -     46.4    35.6      -       -
Azimuth: 15   Height:363 Vert         Margin [dB]:     -        -     -14.78  -3.98     -       -

736.1599   38.18 QP      20.3      -29.9     28.58     -        -     46.4    35.6      -       -
Azimuth: 47   Height:116 Vert         Margin [dB]:     -        -     -17.82  -7.02     -       -

LIMIT 1: NONE
LIMIT 2: NONE
LIMIT 3: FCC Part 15 Class A 10m
LIMIT 4: FCC Part 15  Class B 10m

PK - Peak detector
QP - Quasi-Peak detector
```

END OF REPORT