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February 16, 2012

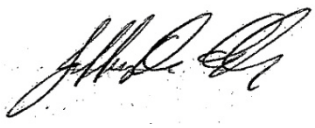
iControl Networks
5918 West Courtyard Drive
Suite 400
Austin, TX 78730

Dear applicant:

Enclosed is the Wireless Test Report for the Panel Interface Module (PIM) V2 by iControls Networks. This report can be used to demonstrate compliance with FCC and IC requirements for wireless devices in the United States and Canada.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Enclosure

Project 13156-10

iControl Networks
Panel Interface Module (PIM) V2

Wireless Test Report

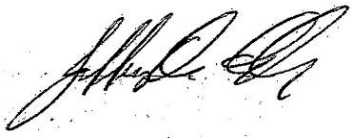
Prepared for:
iControl Networks
5918 West Courtyard Drive
Suite 400
Austin, TX 78730

By

Professional Testing (EMI), Inc.
1601 N. A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

February 16, 2012

Reviewed by



Jeffrey A. Lenk
President

Written by

Jesse Banda
EMC Engineer

Table of Contents

Applicant:	iControl Networks, Inc.
Applicant's Address:	5918 West Courtyard Drive Suite 400 Austin, Texas 78730
FCC ID:	Y6Q-4000001604
IC ID:	9454A-4000001604
Project Number:	13156-10
Test Dates:	December 19, 2011 thru February 16, 2012

The iControl Networks Panel Interface Module V2 was tested to and found to be in compliance with FCC 47 CFR Part 15 and IC RSS-210 issue 8.

The highest emissions generated by the above equipment are listed below:

Parameter	Frequency (MHz)	Level	Limit	Margin (dB)	OBW 99%
Transmitter: Fundamental	2405	104.6 dBµV/m @ 3 m	125 dBµV/m	-20.4	2.46 MHz
Transmitter: Radiated Spurious	4810	53.4 dBµV/m @ 3 m	54 dBµV/m	-0.5	
Transmitter: Fundamental	2440	105.0 dBµV/m @ 3 m	125 dBµV/m	-20.0	2.40 MHz
Transmitter: Radiated Spurious	7320	53.6 dBµV/m @ 3 m	54 dBµV/m	-0.4	
Transmitter: Fundamental	2480	106.9 dBµV/m @ 3 m	125 dBµV/m	-18.1	2.48 MHz
Transmitter: Radiated Spurious	9920	53.6 dBµV/m @ 3 m	54 dBµV/m	-0.4	

I, Jesse Banda, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Jesse Banda

Jesse Banda
EMC Engineer

This report has been reviewed and accepted by iControl Networks, Inc. The undersigned is responsible for ensuring that this device will continue to comply with the FCC and IC rules.

_____

Representative of iControl Networks, Inc.

1.0 Introduction

1.1 Scope

This report describes the extent of the equipment under test (EUT) conformance to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates, and expressions thereof for EMC testing. The procedure of ANSI C63.4: 2009 were utilized for making all emissions measurements.

1.2 EUT Description

The Panel Interface Module (PIM) V2 is an externally powered, with battery backup, Zigbee device intended for use in security systems. It consists of a Zigbee processor, which includes an ARM11 processor core, along with the associated Zigbee RF / MAC sections, as well as an Atmel processor to handle keypad interaction and master security system interactions, and an RF PA/LNA to achieve greater distance. The RF PA/LNA has a 20dB RF power amplifier as well as a LNA with 9dB gain. External power is via a screw terminal connection to a standard security system 12V DC supply. The 12V is stepped down to 3.3V via a high efficiency switching regulator. The EUT was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, power spectral density, and harmonic tests. The EUT was tuned to a middle channel to perform spurious tests. The EUT continuously transmitted at maximum power. The system tested consisted of the following:

Manufacturer	iControl Networks, Inc.
Model Name	Panel Interface Module (PIM) V2
Model #	4000001604
FCC ID	Y6Q-4000001604
IC ID	9454A-4000001604
Power Supply	12 VDC and 120Vac, 60Hz
Frequency (GHz)	2.405 - 2.480
Modulation Type (2.4 GHz)	OQPSK
Antenna Type	Integrated

The following rules apply to the operation of the EUT:

Guidelines	**FCC Rules**	**IC Rules**	
	Part 15	**RSS-GEN Issue 3**	**RSS-210 Issue 8**
Transmitter Characteristics	15.247	4.1-4.6, 7	2.2, 2.6-2.7, A2.9, A8, A9
Spurious Radiated Power	15.209	4.2, 4.7, 4.8, 6, 7	2.2, 2.6-2.7, A2.9, A8, A9
Power Line Conducted	15.207	4.2, 4.7, 7.2	
Antenna Requirement	15.203	7.1, 7.1.4	

1.3 Modifications

No modifications were made to the EUT during the performance of the test program.

1.4 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. This site is registered with the FCC under Section 2.948 and Industry Canada per RS-212, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas, 78758, while the main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665.

1.5 Applicable Documents

Document	Title	Release
ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment	2009
ANSI C63.10	American National Standard for Testing Unlicensed Wireless Devices	2009
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators	
KDB Publication No. 718828	Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)	September 30,2011
RSS-210	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment	Issue 8
RSS-Gen	General Requirements and Information for the Certification of Radio Communication Equipment	Issue 3

1.6 Applicable Tests

Test	Rule (FCC)	Rule (IC)
Output Power	15.247(a)	RSS-210 A8.5
Occupied Bandwidth	15.247(a)(2)	RSS-210 A8.2a
Power Spectral Density	15.247(e)	RSS-210 A8.2b
Radiated Emissions, Harmonic, Spurious, Band Edge	15.205(a), 15.209(a), 15.247(a)	RSS-Gen 7.2.2
Powerline Conducted Emission	15.107	RSS-Gen 7.2.4
Antenna Requirements	15.203	RSS-Gen 7.1.2

2.0 Fundamental Field Strength Measurements

Fundamental field strength measurements were made on the selected fundamental transmitting frequency of the EUT.

Tests of the fundamental field strength of the EUT also determined the worse case polarization of the device. The emissions of the device were measured with the EUT in three orthogonal axes.

2.1 Test Procedure

Radiated emission measurements were made of the fundamental field strength level for the EUT. The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable that enables 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters, as measured from the closest point of the EUT. The field strength emissions were maximized by rotating the EUT. A diagram showing the test setup is given as Figure 2.1.1.

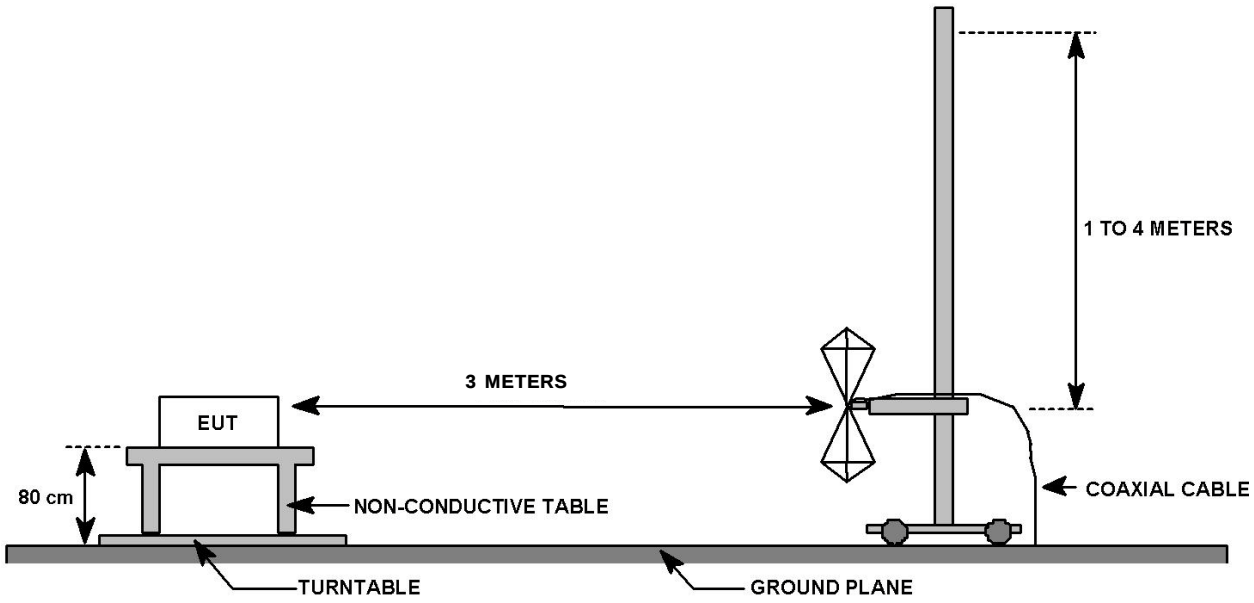


Figure 2.1.1: Radiated Emission Test Setup

2.2 Test Criteria

The maximum field strength of the fundamental frequencies is 125 dBuV/m at 3 m for devices operating in the frequency ranges of 2400 to 2483.5 MHz, according to FCC Section 15.247 and RSS-210.

2.3 Test Equipment

Table 2.3.1: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1594	Miteq	AFS44-00102650	Amplifier, 1-26.5GHz, 42dB	2/28/2012
C030	N/A	RG214	Cable Coax, N-N, 30m	5/26/2012
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	1/19/2012
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	5/19/2012

2.4 Test Results

Radiated emission measurements of the fundamental field strength level for the EUT were taken on January 3, 2012, and the EUT was found to be in compliance with applicable requirements.

Table 2.4.1: Radiated Emissions on the Fundamental Strength Test

PROJECT #	DATE	FREQUENCY	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
13156-10	January 3, 2012	2.4 GHz	15.247	3m	Horn	1 MHz	3 MHz	Peak
COMMENT		**2.4 GHz Transmitting**						

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
2404	3	200	1	Peak	61.9	99.8	125	-25.2
2440	3	100	1	Peak	62.1	100.1	125	-24.9
2480	3	200	1	Peak	60.9	99.0	125	-26.0

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
2404	3	90	1	Peak	66.7	104.6	125	-20.4
2440	3	160	1	Peak	67.0	105.0	125	-20.0
2480	3	200	1	Peak	68.8	106.9	125	-18.1

Calculated Result

Frequency Measured (MHz)	Field Strength (dBµV)	E.I.R.P.		Limit (dBm)
		dBm	mW	
2404	104.6	9.37	8.65	30
2440	105.0	9.77	9.49	30
2480	106.9	11.67	14.70	30

Note: Calculation was performed as follows: $P = \frac{(E*d)^2}{30*G}$

P = Power in watts, E = measured maximum field strength in V/m, d = distance in meters,
G = numeric gain of transmitting antenna, Distance = 3 meters, Gain = 0 dBi

3.0 Occupied Bandwidth

Occupied bandwidth measurements were performed on the EUT to determine compliance with FCC 15.247 and RSS-210.

3.1 Test Procedure

The occupied bandwidth was measured with a spectrum analyzer connected to a double-ridged guide horn while the EUT was operating in continuous transmit mode at the appropriate frequency. The analyzer center frequency was set to the EUT carrier frequency. A drawing showing the test setup is given in figure 2.1.1.

3.2 Test Criteria

The minimum 6 dB occupied bandwidth for the EUT is 500 kHz as stated in 15.247(a)(2) and RSS-210. Alternatively, a spectrum analyzer capable of an automatic 99% bandwidth measurement was used, along with a 20 dB bandwidth measurement for IC.

3.3 Test Equipment

Table 3.3.1: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1594	Miteq	AFS44-00102650	Amplifier, 1-26.5GHz, 42dB	2/28/2012
C030	N/A	RG214	Cable Coax, N-N, 30m	5/26/2012
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	1/19/2012
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	5/19/2012

3.4 Test Results

Occupied bandwidth measurements were taken on January 3, 2012 and the EUT was found to be in compliance with applicable requirements.

Table 3.4.1: Occupied Bandwidth Test Results, Data Sheet 1

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	January 3, 2012	15.247	Radiated	2405 MHz	30 kHz	100 kHz	Peak
COMMENT	OBW = 2.46 MHz						

99% BW

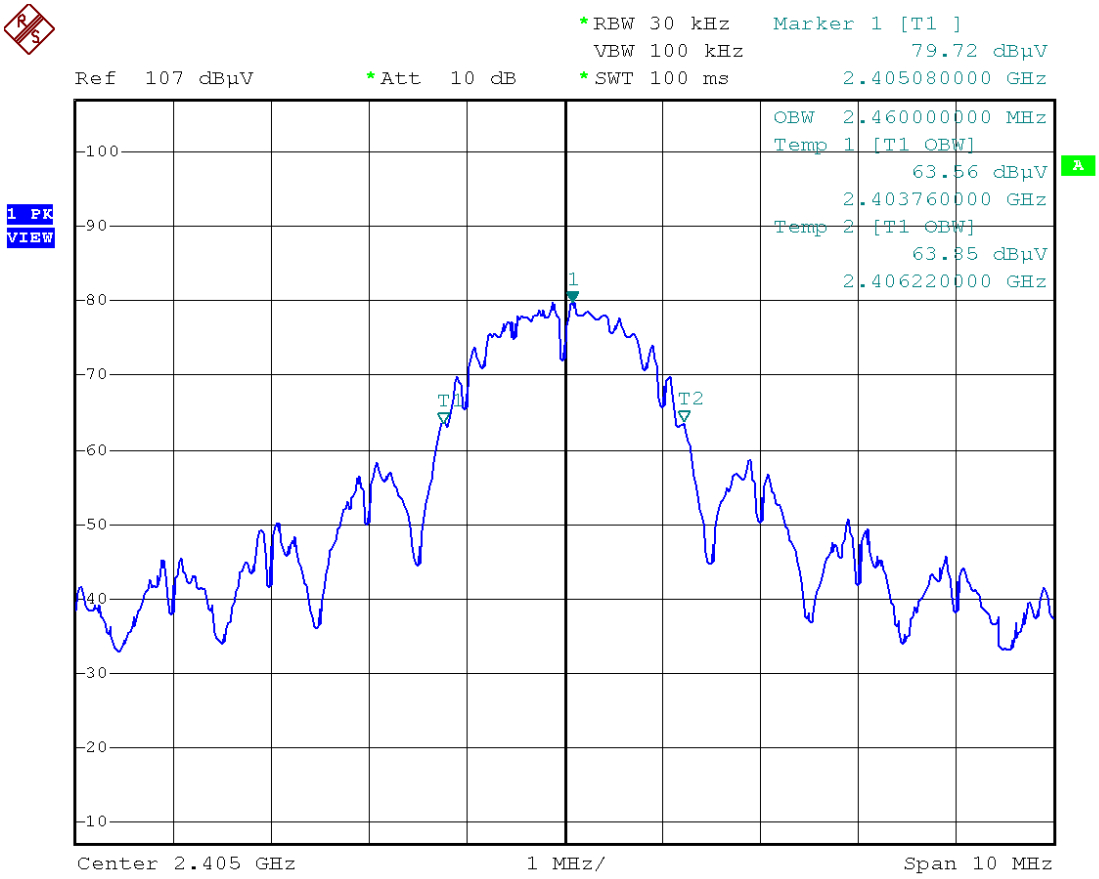


Table 3.4.2: Occupied Bandwidth Test Results, Data Sheet 2

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	January 3, 2012	15.247	Radiated	2440 MHz	30 kHz	100 kHz	Peak
COMMENT	OBW = 2.40 MHz						

99% BW

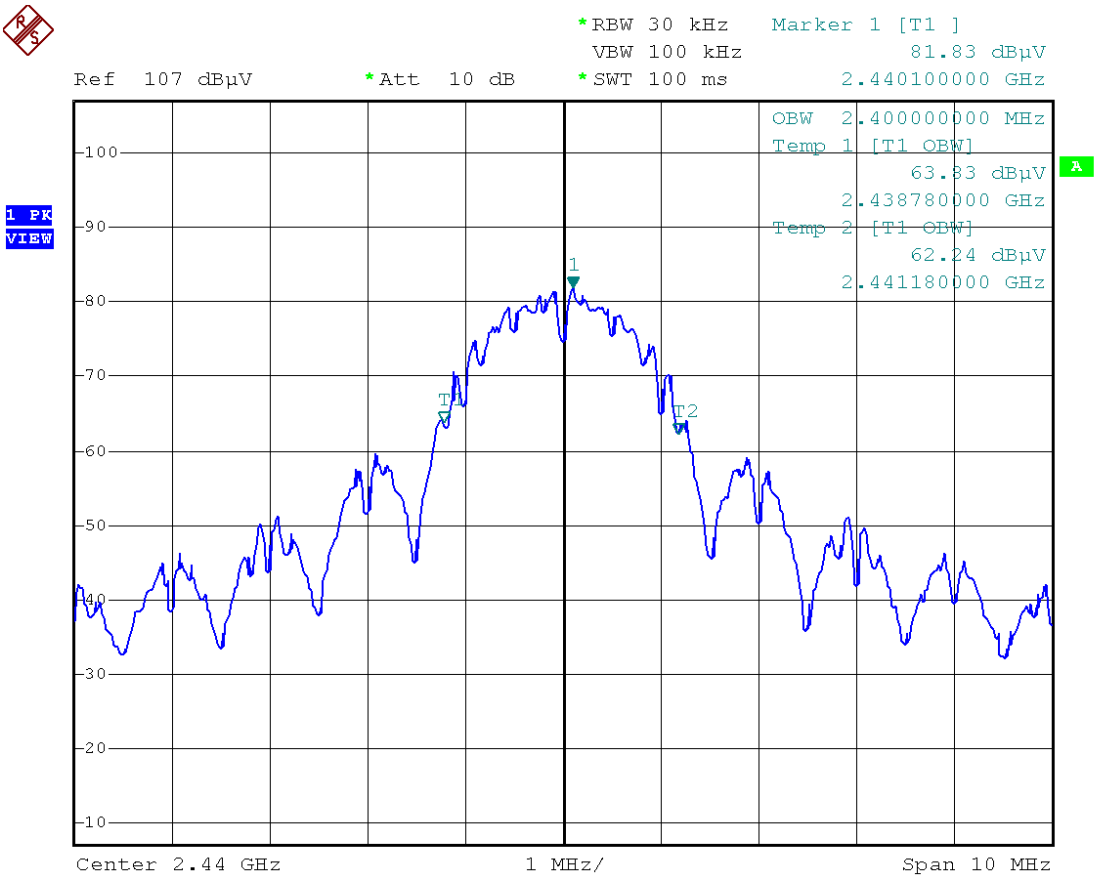
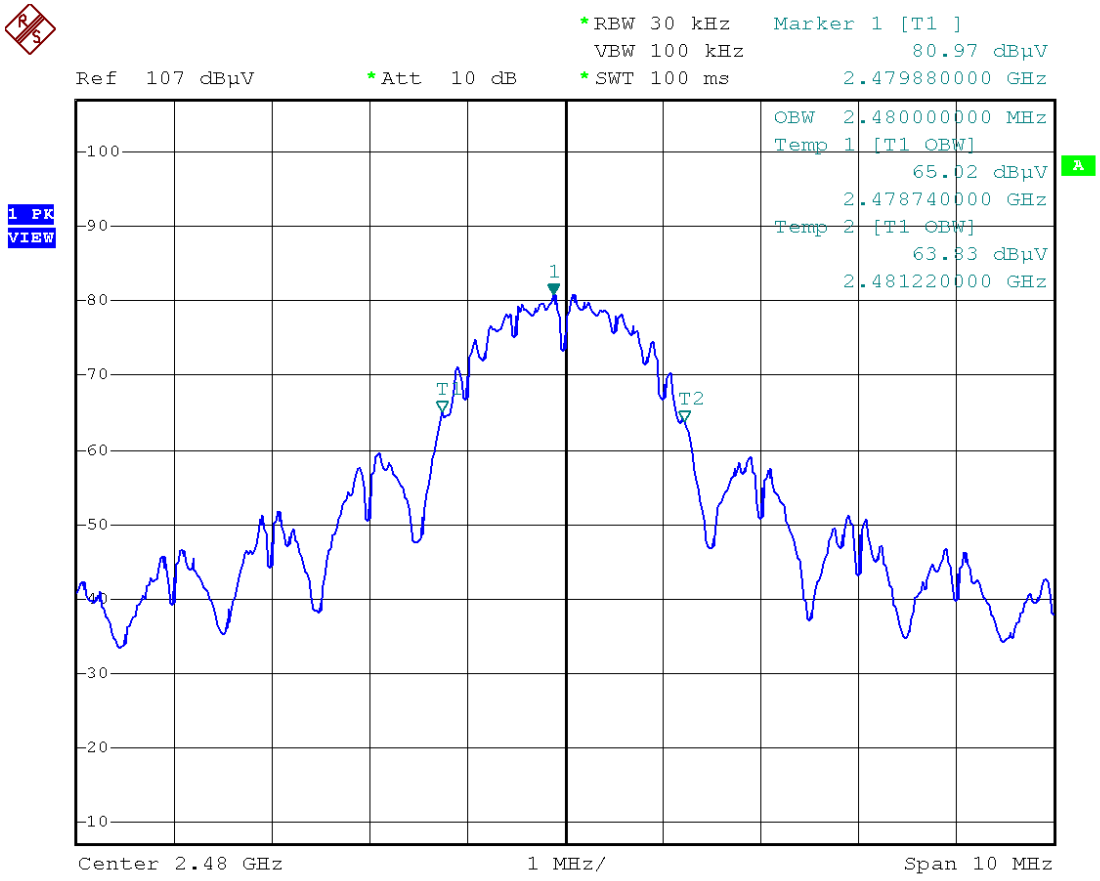


Table 3.4.3: Occupied Bandwidth Test Results, Data Sheet 3

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	January 3, 2012	15.247	Radiated	2480 MHz	30 kHz	100 kHz	Peak
COMMENT	OBW = 2.48 MHz						

99% BW



4.0 Out of Band Spurious Emissions

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to FCC sections 15.247, 15.209 and RSS-210.

4.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable at a distance of 1, 3, or 10 meters from the measurement antenna.

For spurious emissions below 1 GHz, quasi-peak detection was used with a resolution bandwidth of 120 kHz. All measurements below 1 GHz were normalized to 10 meter distance using a 20 dB/decade distance extrapolation. The emissions were maximized by rotating the EUT and raising and lowering the measurement antenna from 1 to 4 meters.

Spurious/harmonic emissions from 1 GHz to 18 GHz were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 3 meter. Spurious/harmonic emissions above 18 GHz were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 1 meter. Average detection was used to determine compliance of the EUT if the peak did not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 2.1.1.

4.2 Test Criteria

The radiated limits of FCC 15.209 and RSS-210 are shown below. The limits specified are at 3 meters. The limits are quasi-peak for emissions below 1 GHz and average for emissions above 1 GHz. Also above 1 GHz, the peak limit is 20 dB above the average limit.

Frequency MHz	Specification Test Distance (Meters)	Field Strength (dBuV/m)	Alternative Test Distance (Meters)	Field Strength (dBuV/m)
30 to 88	3	40.0	10	29.5
88 to 216	3	43.5	10	33.1
216 to 960	3	46.0	10	35.6
Above 960	3	54.0	1	63.5

4.3 Test Equipment

Table 4.3.1: Radiated Emissions Test Equipment (frequency < 1 GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	8/7/2012
0586	HP	8447D	Preamp, 0.1-1300MHz, 26dB	12/21/2012
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	5/19/2012
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	4/4/2012
C027	N/A	RG214	Cable Coax, N-N, 25m	5/26/2012

Table 4.3.2: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1594	Miteq	AFS44-00102650	Amplifier, 1-26.5GHz, 42dB	2/28/2012
C030	N/A	RG214	Cable Coax, N-N, 30m	5/26/2012
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	1/19/2012
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	5/19/2012

Table 4.3.3: Microwave Radiated Emissions Test Equipment (18GHz ≤ frequency <25GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1974	Agilent	83017A	Microwave Preamplifier	9/20/2012
Rental	Rohde & Schwarz	FSP	Spectrum Analyzer, 9 kHz – 30 GHz	12/21/2012
1542	A.H. Systems	SAS 572	Antenna, Horn 18-26.5GHz	NCR

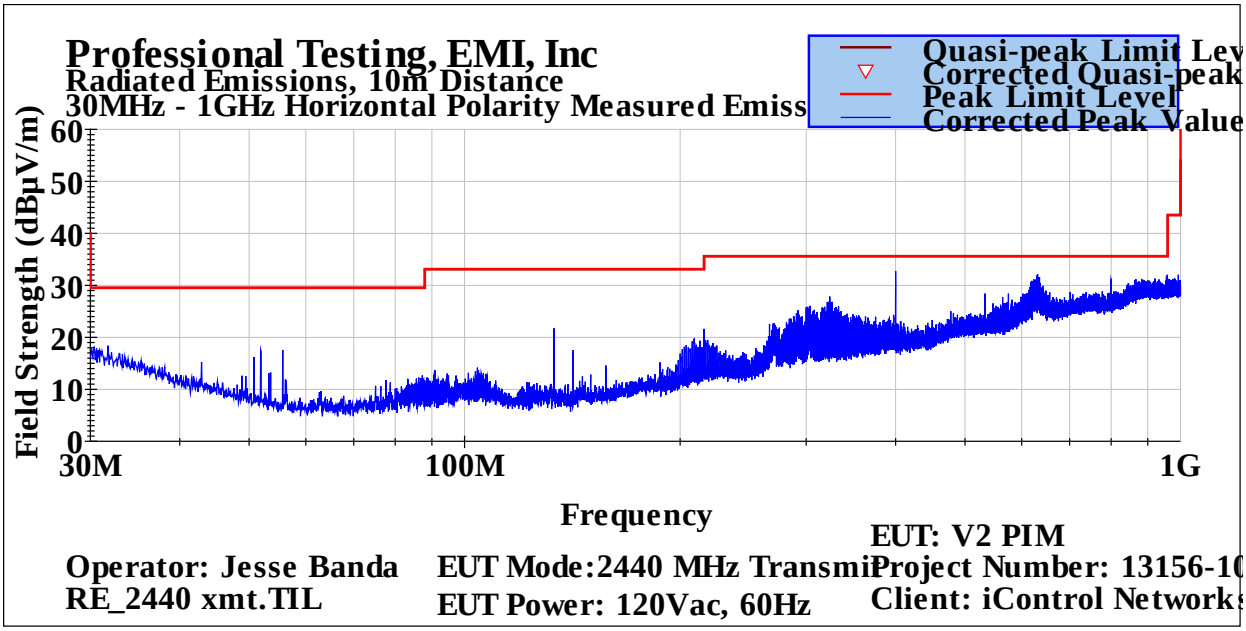
4.4 Test Results

Out of band spurious emissions measurements were taken on December 19, 2011 and January 3, 2012, and the EUT was found to be in compliance with applicable requirements.

Table 4.4.1: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2440 MHz	December 19, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT	Out of band spurious emission below 1 GHz was performed while transmitting on the center frequency.						

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
55.7	10	0	4	Quasi-peak	24.9	8.2	29.5	-21.3
133.3	10	0	4	Quasi-peak	35.2	19.2	33.1	-13.9
264	10	100	4	Quasi-peak	28.3	17.7	35.6	-17.9
323.7	10	120	2.9	Quasi-peak	31.7	23.3	35.6	-12.3
400	10	90	3	Quasi-peak	36.9	31.1	35.6	-4.5
631.5	10	100	2.5	Quasi-peak	28.2	28.9	35.6	-6.7

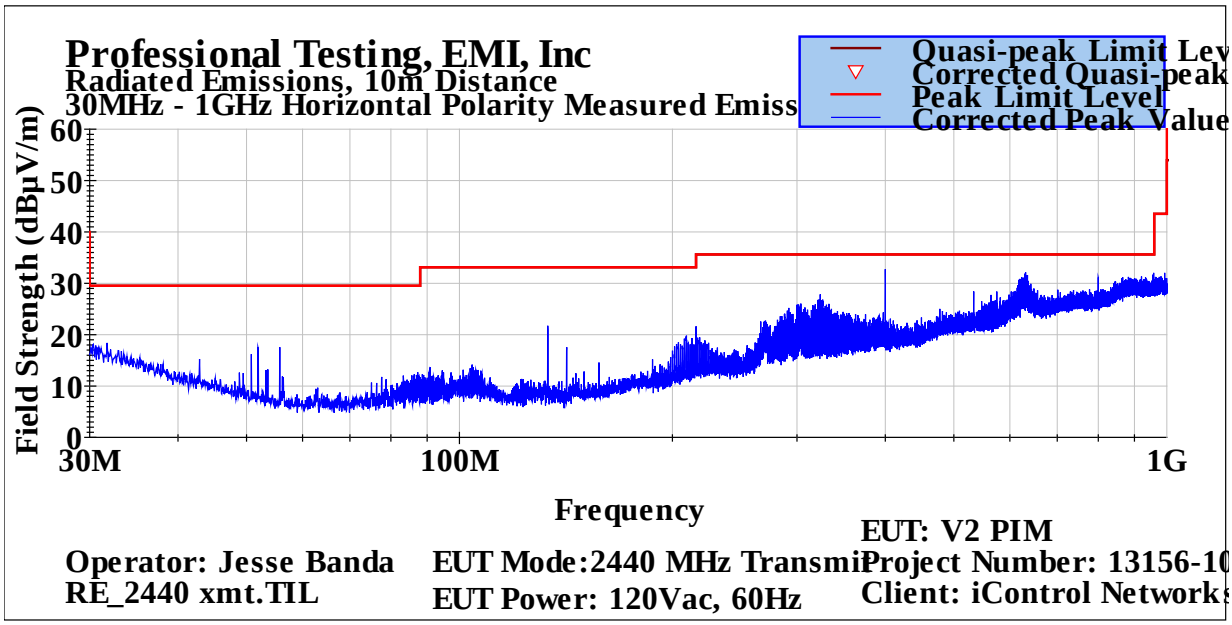


Result = Pass

Table 4.4.2: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2440 MHz	December 19, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT	Out of band spurious emission below 1 GHz was performed while transmitting on the center frequency.						

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
133.3	10	340	1	Quasi-peak	44.9	28.9	33.1	-4.2
209	10	100	1	Quasi-peak	34	21.6	33.1	-11.5
266.7	10	330	1.3	Quasi-peak	35.3	24.8	35.6	-10.8
400	10	40	2.5	Quasi-peak	34.2	28.4	35.6	-7.2
533.3	10	0	3	Quasi-peak	30.5	28.6	35.6	-7.0
635	10	50	2.3	Quasi-peak	29.3	30.1	35.6	-5.5



Result = Pass

Table 4.4.3: Out of Band Spurious Emissions Test Results, 1 GHz to 25 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2404 MHz	January 3, 2012	FCC B	1-3 m	Horn	1 MHz	1 MHz	Average
COMMENT	Transmitting 2404MHz Harmonics and spurious investigated up to 25 GHz						

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4808	3	200	1	Average	50.4	53.4	54.0	-0.5
7212	3	230	1	Average	43.9	50.3	54.0	-3.7
9616	3	220	1	Average	36.1	47.8	54.0	-6.2
12020	3	260	1	Average	25.1	42.0	54.0	-12.0
14424	3	180	1	Average	27.5	44.3	54.0	-9.6
16828	3	200	1	Average	25.8	44.9	54.0	-9.0
19323	1	noise	floor	Average	37.8	50.0	63.5	-13.5
21636	1	noise	floor	Average	38.4	50.5	63.5	-13.0
24040	1	noise	floor	Average	41.4	53.6	63.5	-9.9

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4808	3	200	1	Average	48	51.0	54.0	-2.9
7212	3	200	1	Average	44.5	50.9	54.0	-3.1
9616	3	280	1	Average	26.2	37.9	54.0	-16.1
12020	3	260	1	Average	25.2	42.1	54.0	-11.9
14424	3	180	1	Average	27.4	44.2	54.0	-9.7
16828	3	200	1	Average	25.8	44.9	54.0	-9.0
19323	1	noise	floor	Average	37.8	50.0	63.5	-13.5
21636	1	noise	floor	Average	38.4	50.5	63.5	-13.0
24040	1	noise	floor	Average	41.4	53.6	63.5	-9.9

Result = Pass

Table 4.4.4: Out of Band Spurious Emissions Test Results, 1 GHz to 25 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2440 MHz	January 3, 2012	FCC B	1-3 m	Horn	1 MHz	1 MHz	Average
COMMENT	Transmitting 2404MHz Harmonics and spurious investigated up to 25 GHz						

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4880	3	260		Average	49.9	52.9	54.0	-1.0
7320	3	200	1	Average	45.9	52.7	54.0	-1.3
9760	3	280	1	Average	29.5	41.8	54.0	-12.1
12200	3	260	1	Average	28.9	45.2	54.0	-8.8
14640	3	180	1	Average	27.6	45.0	54.0	-9.0
17080	3	200	1	Average	26.3	45.3	54.0	-8.7
19520	1	noise	floor	Average	38.2	50.0	63.5	-13.5
21960	1	noise	floor	Average	39.3	51.4	63.5	-12.1
24800	1	noise	floor	Average	40.9	53.1	63.5	-10.4

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4880	3	200	1	Average	51.7	54.7	54.0	0.7
4880*	3	200	1	Average	51.7	50.7	54.0	-3.3
7320	3	180	1	Average	46.8	53.6	54.0	-0.4
9760	3	180	1	Average	32	44.1	54.0	-9.9
12200	3	200	1	Average	25.8	41.5	54.0	-12.4
14640	3	160	1	Average	27.4	44.8	54.0	-9.2
17080	3	160	1	Average	27.7	46.6	54.0	-7.4
19520	1	noise	floor	Average	38.2	50.0	63.5	-13.5
21960	1	noise	floor	Average	39.3	51.4	63.5	-12.1
24800	1	noise	floor	Average	40.9	53.1	63.5	-10.4

Note: * indicates that a duty cycle correction of -4.0 dB was applied to the Corrected Level

Result = Pass

Table 4.4.5: Out of Band Spurious Emissions Test Results, 1 GHz to 25 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2480 MHz	January 3, 2012	FCC B	1-3 m	Horn	1 MHz	1 MHz	Average
COMMENT	Transmitting 2480 MHz Harmonics and spurious investigated up to 25 GHz						

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4960	3	220	1	Average	51.5	54.5	54.0	0.5
4960*	3	220	1	Average	51.5	50.5	54.0	-3.5
7440	3	160	1	Average	45.2	52.0	54.0	-2.0
9920	3	180	1	Average	36	48.1	54.0	-5.9
12400	3	200	1	Average	19.6	35.3	54.0	-18.6
14880	3	160	1	Average	22.8	40.2	54.0	-13.8
17362	3	160	1	Average	22.9	41.8	54.0	-12.2
19840	1	noise	floor	Average	38.7	48.6	63.5	-14.9
22320	1	noise	floor	Average	38.8	50.9	63.5	-12.6
24800	1	noise	floor	Average	39.7	52.0	63.5	-11.5

Note: * indicates that a duty cycle correction of -4.0 dB was applied to the Corrected Level

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
4960	3	200	1	Average	51.7	54.7	54.0	0.7
4960*	3	200	1	Average	51.7	50.7	54.0	-3.3
7440	3	180	1	Average	46.8	53.6	54.0	-0.4
9920	3	180	1	Average	32	44.1	54.0	-9.9
12400	3	200	1	Average	25.8	41.5	54.0	-12.4
14880	3	160	1	Average	27.4	44.8	54.0	-9.2
17362	3	160	1	Average	27.7	46.6	54.0	-7.4
19840	1	noise	floor	Average	38.7	48.6	63.5	-14.9
22320	1	noise	floor	Average	38.8	50.9	63.5	-12.6
24800	1	noise	floor	Average	39.7	52.0	63.5	-11.5

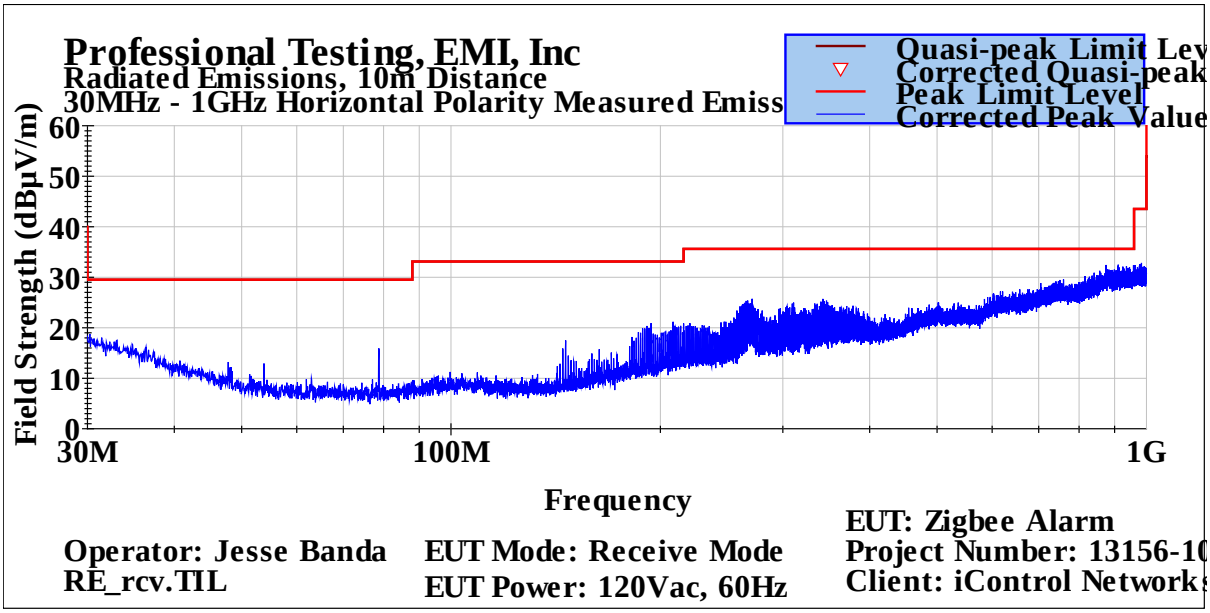
Note: * indicates that a duty cycle correction of -4.0 dB was applied to the Corrected Level

Result = Pass

Table 4.4.6: Receive Mode Radiated Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
RCV Mode	January 3, 2012	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT	Receive mode Spurious investigated up to 25 GHz						

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
78.7	10	20	4	Quasi-peak	29.7	12.4	29.5	-17.1
146.1	10	90	4	Quasi-peak	30.2	14.7	33.1	-18.4
194	10	220	3.8	Quasi-peak	31.1	18.4	33.1	-14.7
267	10	90	2.3	Quasi-peak	33.7	23.2	35.6	-12.4
342.3	10	90	2.4	Quasi-peak	30.1	22.4	35.6	-13.2
502	10	0	2.3	Quasi-peak	21.5	18.9	35.6	-16.7

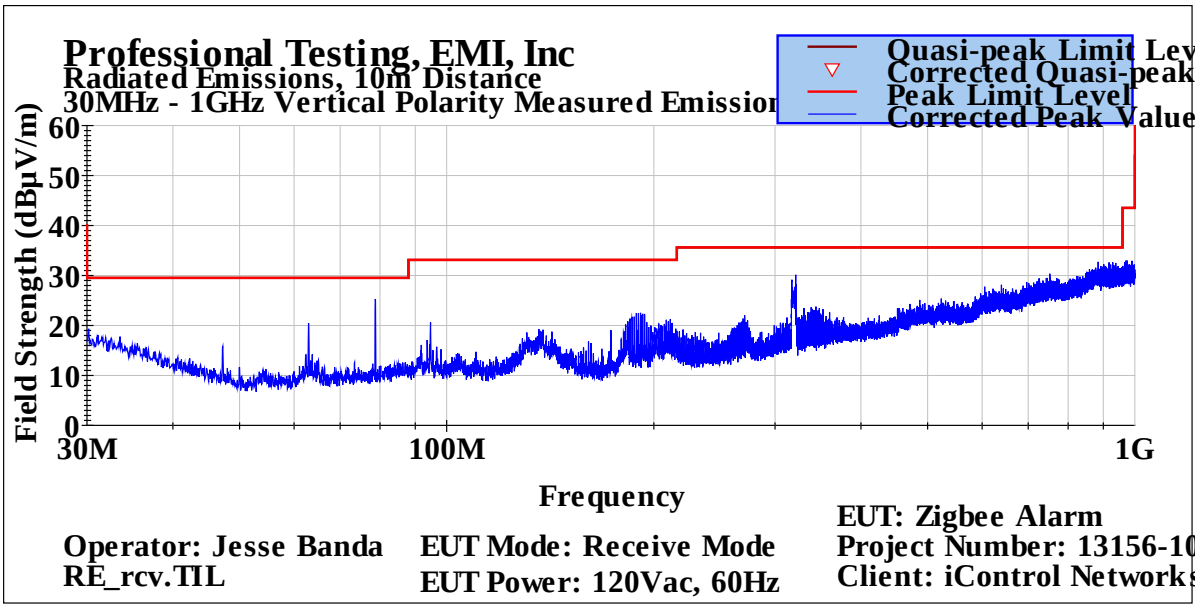


Result = Pass

Table 4.4.7: Receive Mode Radiated Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
RCV Mode	January 3, 2012	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT	Receive mode Spurious investigated up to 25 GHz						

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
47.3	10	120	1	Quasi-peak	29	14.0	29.5	-15.5
63	10	140	1	Quasi-peak	35.8	18.7	29.5	-10.8
78.7	10	100	1	Quasi-peak	40.9	23.6	29.5	-5.9
94.7	10	120	1.2	Quasi-peak	28.3	12.4	33.1	-20.7
190	10	40	1	Quasi-peak	33.5	20.5	33.1	-12.6
321.5	10	50	2.7	Quasi-peak	34.4	25.9	35.6	-9.7



Result = Pass

Table 4.4.8: Receive Mode Radiated Emissions Test Results, 1 GHz to 25 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
	October 26, 2011	FCC B	1 m	Horn	1 MHz	1 MHz	Average
COMMENT	Receive mode Spurious investigated up to 25 GHz						

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
47.3	10	120	1	Quasi-peak	29	14.0	29.5	-15.5
63	10	140	1	Quasi-peak	35.8	18.7	29.5	-10.8
78.7	10	100	1	Quasi-peak	40.9	23.6	29.5	-5.9
94.7	10	120	1.2	Quasi-peak	28.3	12.4	33.1	-20.7
190	10	40	1	Quasi-peak	33.5	20.5	33.1	-12.6
321.5	10	50	2.7	Quasi-peak	34.4	25.9	35.6	-9.7

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)
47.3	10	120	1	Quasi-peak	29	14.0	29.5	-15.5
63	10	140	1	Quasi-peak	35.8	18.7	29.5	-10.8
78.7	10	100	1	Quasi-peak	40.9	23.6	29.5	-5.9
94.7	10	120	1.2	Quasi-peak	28.3	12.4	33.1	-20.7
190	10	40	1	Quasi-peak	33.5	20.5	33.1	-12.6
321.5	10	50	2.7	Quasi-peak	34.4	25.9	35.6	-9.7

Result = Pass

5.0 Power Spectral Density

Power spectral density measurements were performed on the EUT to determine compliance with 47 CFR, Section 15.247(e).

5.1 Test Procedure

The fundamental emission of the EUT is maximized and the spectrum analyzer is tuned to the highest point as measured in max-hold with peak detection. The analyzer is then centered on the maximum peak and set with the following parameters: RBW = 100 kHz, VBW ≥ 300 kHz, span is set to 5-30% greater than OBW. A measurement is taken after the trace has fully stabilized. A diagram showing the test setup is given as Figure 2.1.1.

5.2 Test Criteria

According to section 47 CFR, Sections 15.247(e), the maximum power spectral density is +8 dBm in any 3 kHz bandwidth.

5.3 Test Equipment

Table 5.3.1: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
C030	N/A	RG214	Cable Coax, N-N, 30m	5/26/2012
0819	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	11/15/2012
Rental	Rohde & Schwarz	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	12/22/2012

5.4 Test Results

Power spectral density measurements were taken on February 16, 2012, and the EUT was found to be in compliance with applicable requirements.

Table 5.4.1: Radiated Emissions Measurements of Power Spectral Density Calculated Result

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	February 16, 2012	15.247	Radiated	2405 MHz	100 kHz	300 kHz	Peak
COMMENT	Calculation was performed as follows: $P = \frac{(E*d)^2}{30*G}$ P = Power in watts, E = measured maximum field strength in V/m, d = distance in meters, G = numeric gain of transmitting antenna, Distance = 3 meters, Gain = 0 dBi Bandwidth correction Factor (B.W.C.F.) = 10log(3 kHz/100 kHz)						

Frequency Measured (MHz)	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	E.I.R.P. (dBm / 100 kHz)	B.W.C.F. (dB)	E.I.R.P. (dBm / 3 kHz)	Limit (dBm/ 3kHz)
2405	74.5	103.6	8.37	-15.23	-6.86	8

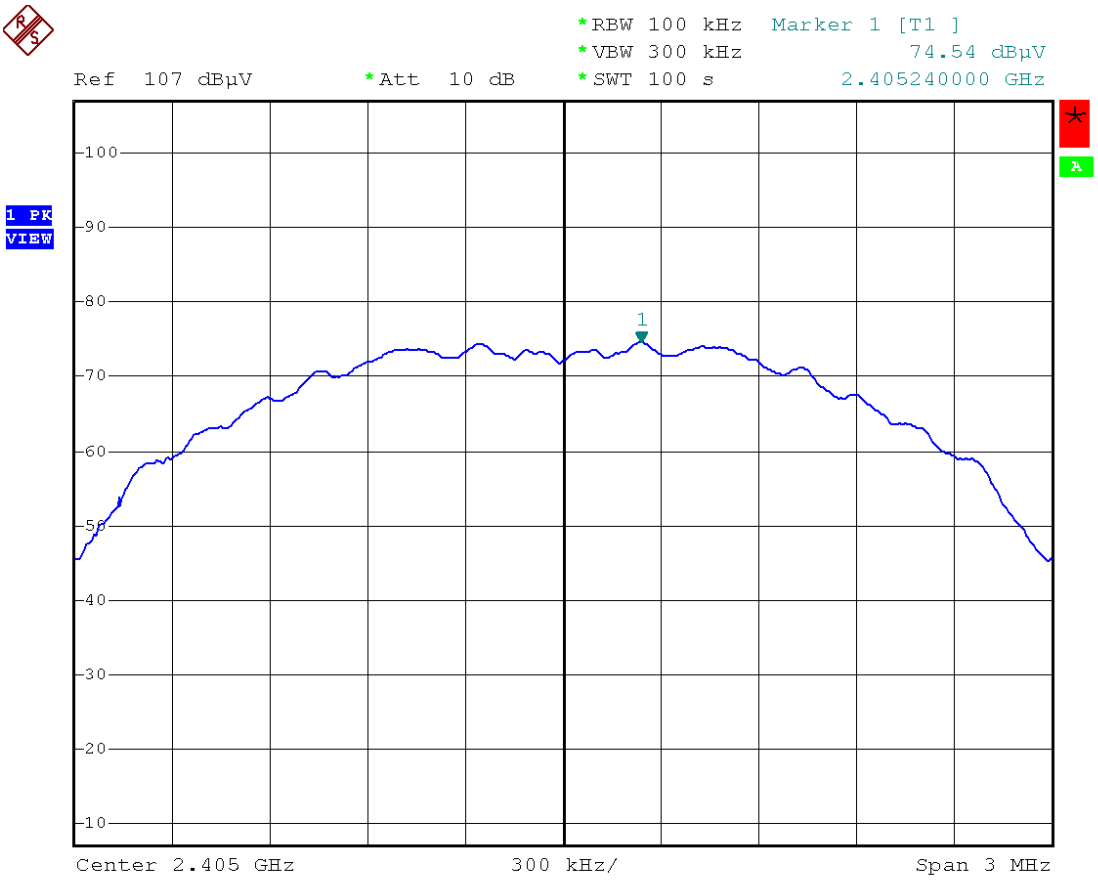


Table 5.4.2: Radiated Emissions Measurements of Power Spectral Density Calculated Result

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	February 16, 2012	15.247	Radiated	2405 MHz	100 kHz	300 kHz	Peak
COMMENT	Calculation was performed as follows: $P = \frac{(E*d)^2}{30*G}$ P = Power in watts, E = measured maximum field strength in V/m, d = distance in meters, G = numeric gain of transmitting antenna, Distance = 3 meters, Gain = 0 dBi Bandwidth correction Factor (B.W.C.F.) = 10log(3 kHz/100 kHz)						

Frequency Measured (MHz)	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	E.I.R.P. (dBm / 100 kHz)	B.W.C.F. (dB)	E.I.R.P. (dBm / 3 kHz)	Limit (dBm/ 3kHz)
2440	74.4	103.7	8.47	-15.23	-6.76	8

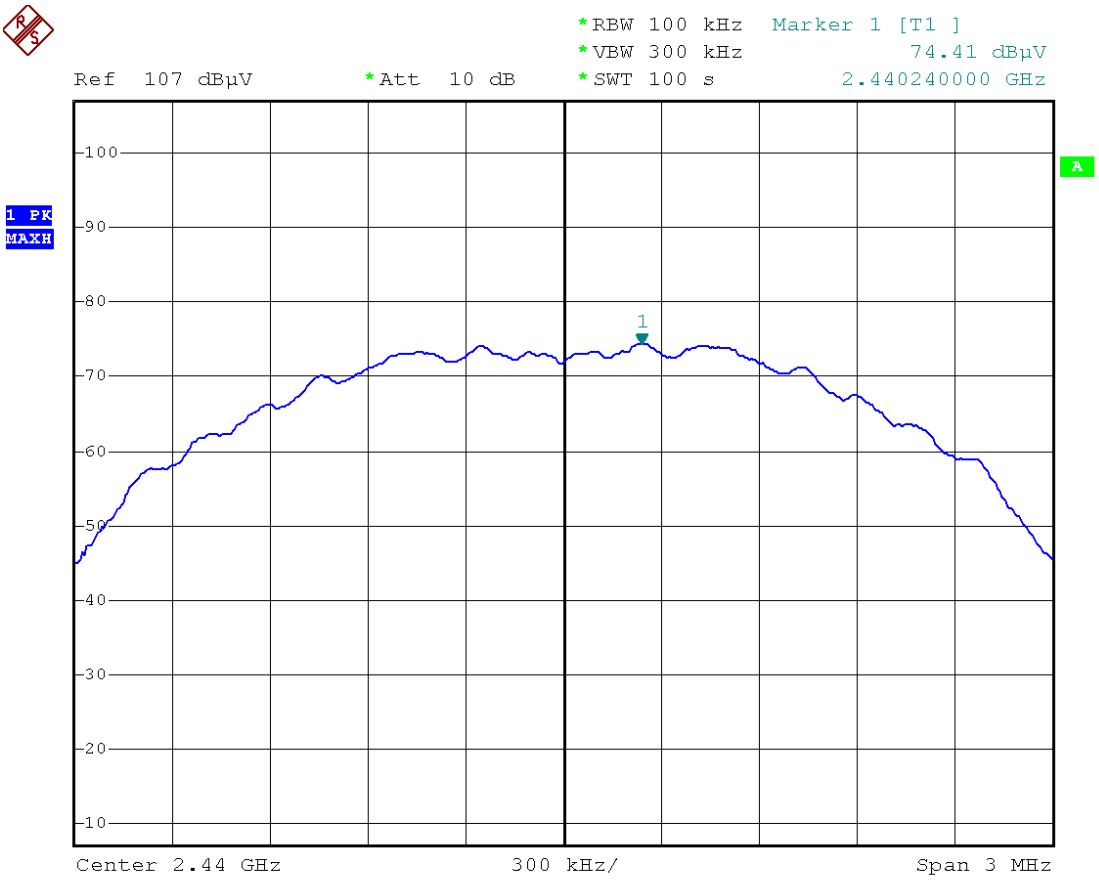
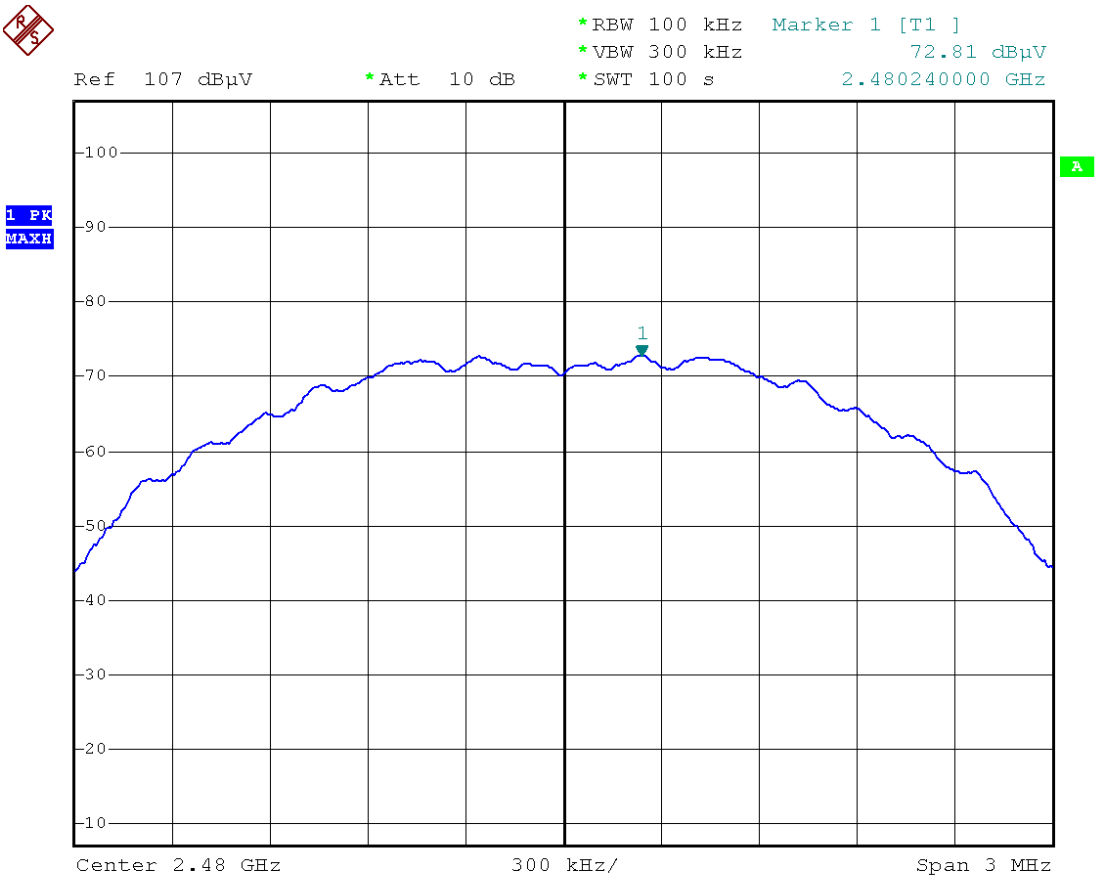


Table 5.4.3: Radiated Emissions Measurements of Power Spectral Density Calculated Result

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	February 16, 2012	15.247	Radiated	2405 MHz	100 kHz	300 kHz	Peak
COMMENT	Calculation was performed as follows: $P = \frac{(E*d)^2}{30*G}$ P = Power in watts, E = measured maximum field strength in V/m, d = distance in meters, G = numeric gain of transmitting antenna, Distance = 3 meters, Gain = 0 dBi Bandwidth correction Factor (B.W.C.F.) = 10log(3 kHz/100 kHz)						

Frequency Measured (MHz)	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	E.I.R.P. (dBm / 100 kHz)	B.W.C.F. (dB)	E.I.R.P. (dBm / 3 kHz)	Limit (dBm/ 3kHz)
2480	72.8	103.9	8.67	-15.23	-6.56	8



6.0 Band Edge Spurious Emissions

Band edge spurious emissions measurements were performed on the EUT to determine compliance to FCC 15.247(d).

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meter as measured from the closest point of the EUT. Rotating the EUT maximized the emissions.

The spectrum analyzer was set for peak detection using a 100 kHz resolution bandwidth. The span is set wide enough to show the band edge and the edge of the emission of the screen. Measurements were made at the band edge using the marker while transmitting on the channels nearest the band edge to determine if the EUT meets the test criteria. A diagram showing the test setup is given as Figure 2.1.1.

6.2 Test Criteria

According to FCC 15.247(d) and RSS-210, emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental.

6.3 Test Equipment

Table 6.3.1: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

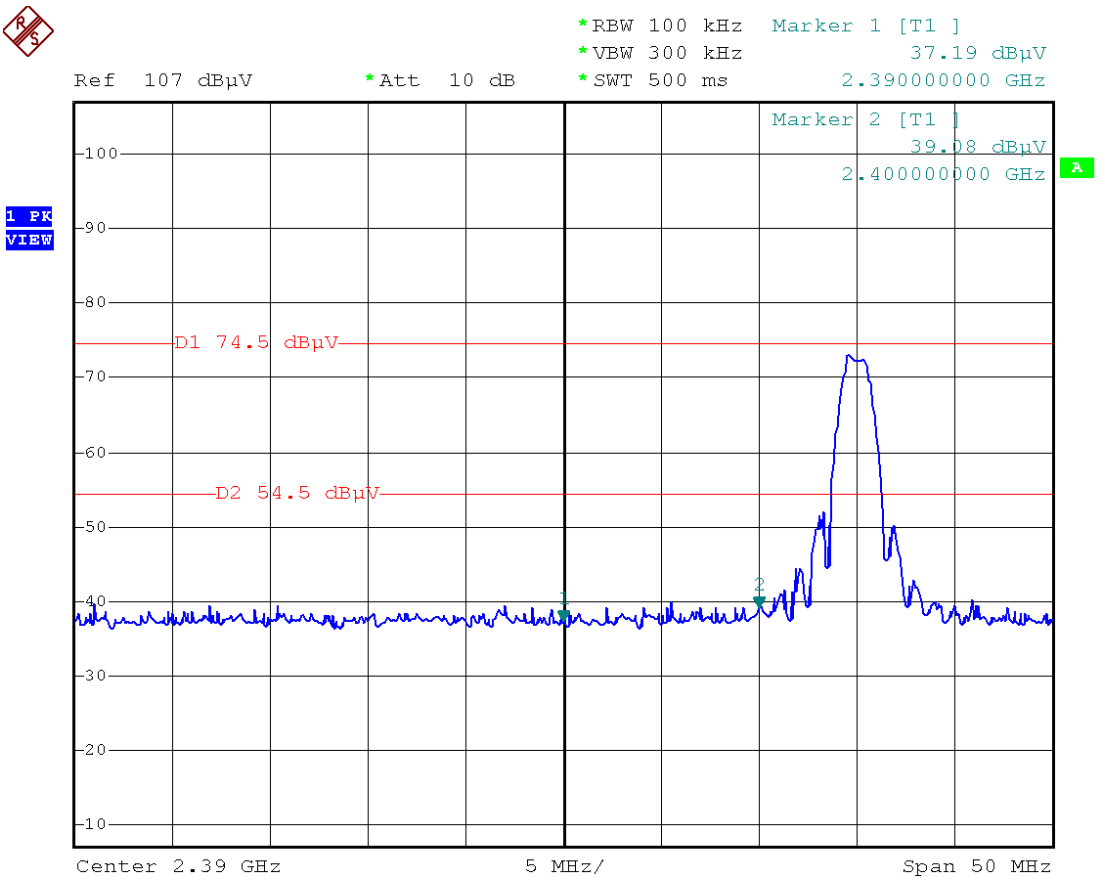
Asset #	Manufacturer	Model #	Description	Calibration Due
C030	N/A	RG214	Cable Coax, N-N, 30m	5/26/2012
0819	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	11/15/2012
Rental	Rohde & Schwarz	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	12/22/2012

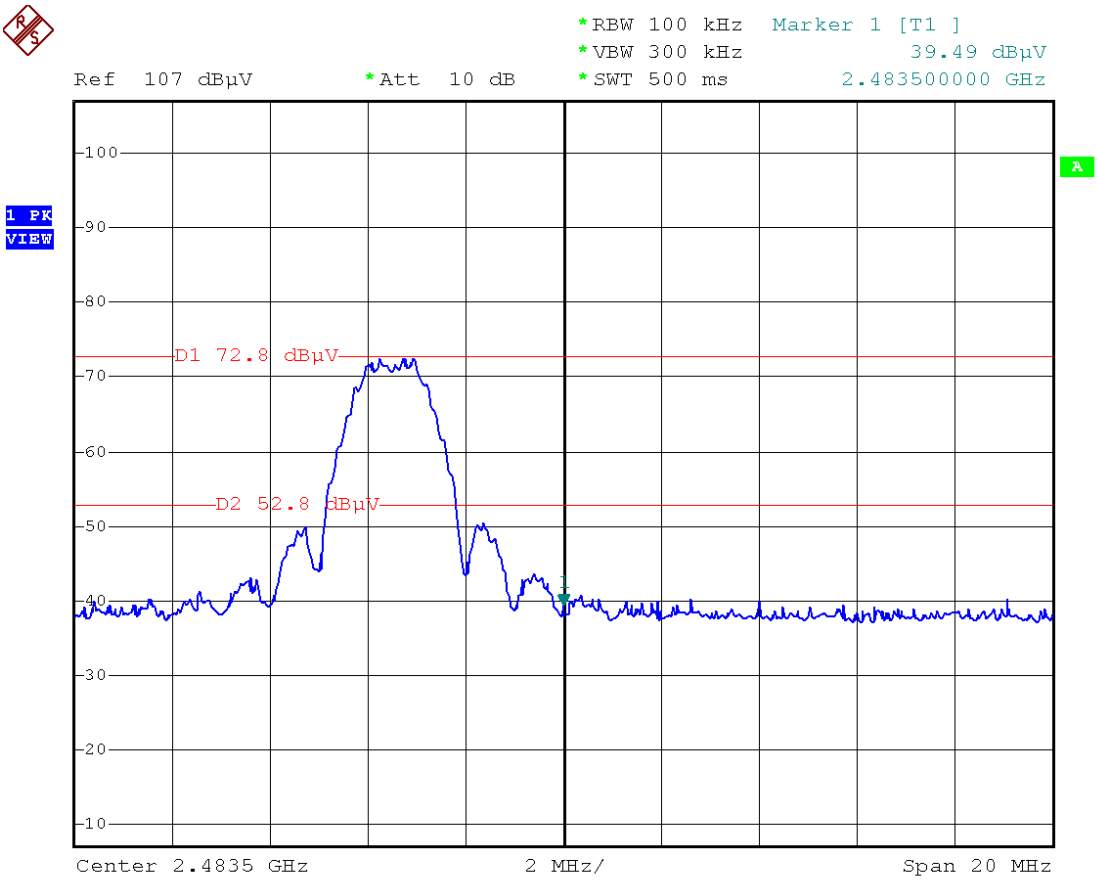
6.4 Test Results

Band edge spurious emissions measurements were taken on February 16, 2012, and the EUT was found to be in compliance with applicable requirements.

Table 6.4.1 Band Edge Spurious Emission Test Results Data Sheet

Frequency Measured (MHz)	Peak in-band PSD level (dBuV/m)	Recorded Level (dBuV/m)	20 dBc Level (dBuV/m)	Margin (dB)	Result
2390	74.5	37.19	54.5	-17.21	Pass
2400	74.5	39.08	54.5	-15.42	Pass
2483.5	72.7	39.49	52.8	-13.31	Pass





7.0 Transmitter Powerline Conducted Emission

Band edge spurious emissions measurements were performed on the EUT to determine compliance to FCC 15.249(d).

7.1 Test Procedure

The EUT was configured and operated in a manner consistent with typical applications. The EUT power cord in excess of one meter was folded back and forth forming a bundle 30 to 40 cm long in the approximate center of the cable. Power supply cords for the peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were separately bundled in a non-inductive arrangement at the approximate center of the cable with the bundle 30 to 40 centimeters in length. The conducted emissions were maximized, by varying the operating states and configuration of the EUT.

The tests were performed in an 8’ x 8’ RayProof modular shielded room. The EUT was placed on a non-metallic table 0.4 meters from a vertical metal reference plane and 0.8 meters from a horizontal metal reference plane. A drawing showing the test setup is given as Figure 1.

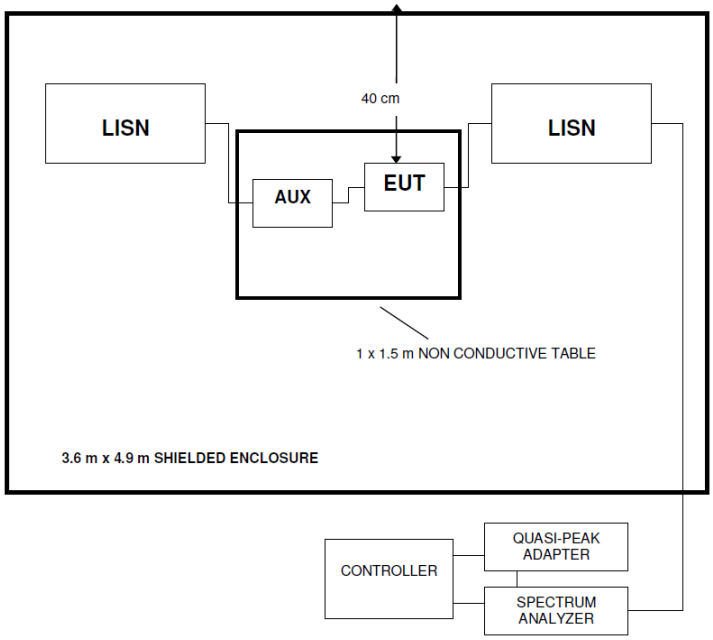


Figure 7.1.1 Powerline Conducted Emission Test Setup

7.2 Test Criteria

The FCC Part 15 Class B conduction limits are given below.

Frequency (MHz)	Conducted Limits (dBuV)	
	Average	Quasi-Peak
0.15 – .50	66-56*	56 – 46*
.50 - 5	56	46
5 – 30	60	50

The tighter limit shall apply at the edge between two frequency bands.
*Decreases with the logarithm of the frequency.

7.3 Test Equipment

Table 7.3.1: Conducted Emission Test Equipment (150kHz ≤ frequency < 30MHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
1270	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	1/24/2012
1271	HP	85662A	Spec Anal Dsply for AN1145	N/A
990	HP	85685A	RF Preselector	5/3/2012
1281	HP	85650A	Quasi Peak Adapter	1/20/2012
1173	PTI	100k HPF	Filter, High Pass, 100kHz	1/25/2012
1087	PTI	PTI-ALF3	Attenuator Limiter Filter	4/17/2012
C109	HP	-	Cable 19 inch BNC (grey)	5/3/2012
C107	Ponoma	RG-237	Cable 9 ft BNC RG-223 (black)	4/6/2012
C108	Ponoma	RG-237	Cable 5.5 ft BNC RG-223 (black)	6/21/2012
939	EMCO	3825/2	LISN, 10kHz-100MHz	6/26/2012
1185	EMCO	3825/2	LISN, 10kHz-100MHz	6/26/2012

7.4 Test Results

Conducted emissions measurements were taken on December 21, 2011, and the EUT was found to be in compliance with applicable requirements.

Table 7.4.1: Powerline Conducted Emissions Test Results, 150 kHz to 30 MHz

Project #	DATE	CLASS	LINE	RBW	VBW	DETECTOR
13156-10	December 21, 2011	FCC B	Phase	9 kHz	100 kHz	Quasi Peak/Avg
COMMENT	Receive Mode					

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)
0.184	45.9	40	64.3	-24.3	13.4	54.3	-40.9
0.18981	46.1	39.7	64	-24.4	11	54	-43
0.19219	46.2	39.6	63.9	-24.3	12	53.9	-42
0.51432	24	18.7	56	-37.3	8.3	46	-37.7
0.9299	18.7	14.6	56	-41.4	7.2	46	-38.8
0.957	18.6	14.9	56	-41.1	7	46	-39
5.289	25.3	24	60	-36	7.7	50	-42.3
5.3128	25.7	21.3	60	-38.7	8	50	-42
26.7851	17.4	14.6	60	-45.4	7.3	50	-42.7
29.22	21.7	15.3	60	-44.7	8	50	-42

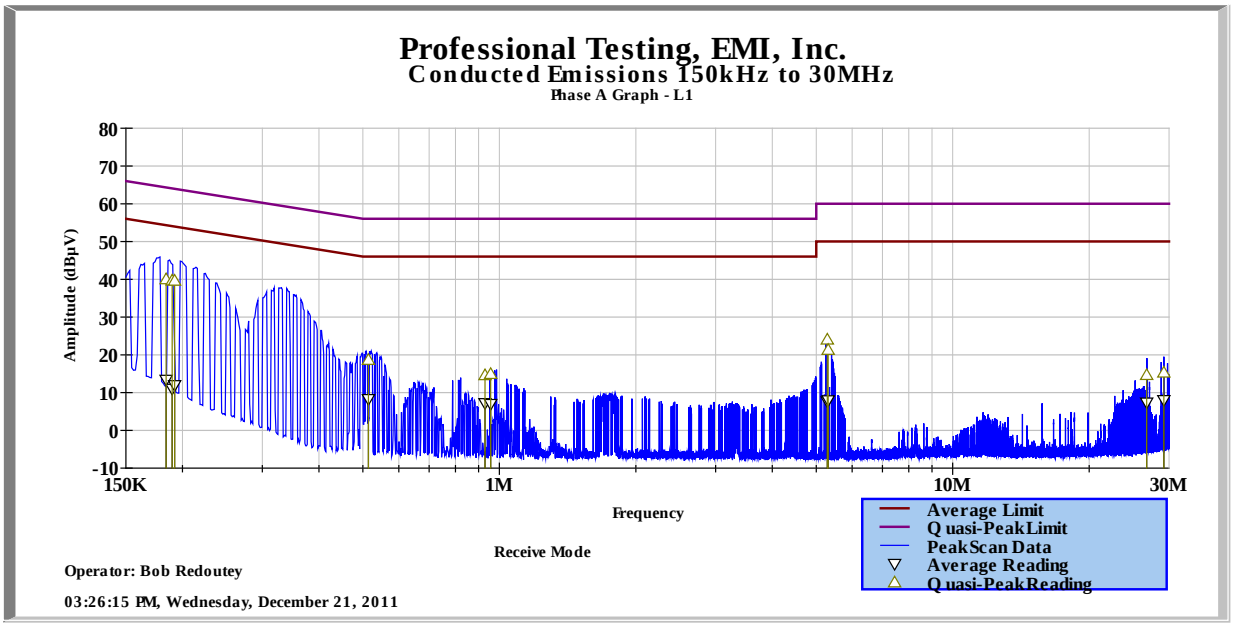


Table 7.4.2: Powerline Conducted Emissions Test Results, 150 kHz to 30 MHz

Project #	DATE	CLASS	LINE	RBW	VBW	DETECTOR
13156-10	December 21, 2011	FCC B	Neutral	9 kHz	100 kHz	Quasi Peak/Avg
COMMENT	Receive Mode					

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)
0.18197	45.6	40.4	64.4	-24	11.7	54.4	-42.7
0.19319	45.6	39.7	63.9	-24.2	11.5	53.9	-42.4
0.19619	45.6	38.9	63.8	-24.9	11.3	53.8	-42.5
0.9005	21	16	56	-40	7.7	46	-38.3
0.9118	20.8	16	56	-40	7.7	46	-38.3
0.9591	20.4	16.2	56	-39.8	7.7	46	-38.3
5.3012	25.5	20.9	60	-39.1	8	50	-42
5.3092	25.7	20.8	60	-39.2	8.3	50	-41.7
25.8277	14.5	11.6	60	-48.4	6.9	50	-43.1
26.4274	16.3	11.2	60	-48.8	7	50	-43

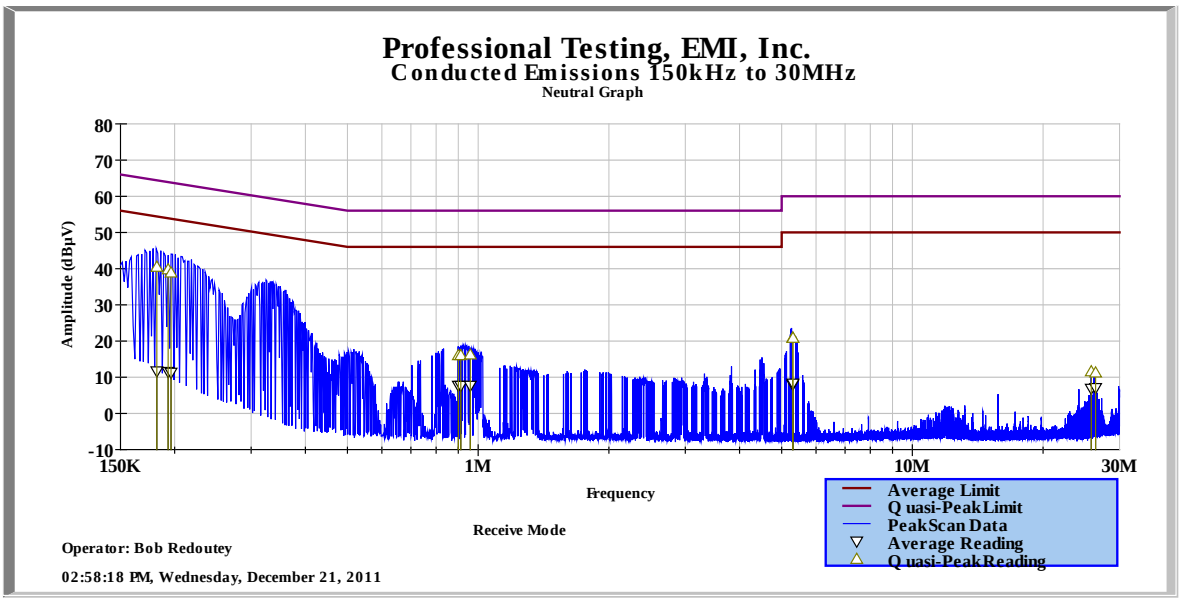


Table 7.4.3: Powerline Conducted Emissions Test Results, 150 kHz to 30 MHz

Project #	DATE	CLASS	LINE	RBW	VBW	DETECTOR
13156-10	December 21, 2011	FCC B	Phase	9 kHz	100 kHz	Quasi Peak/Avg
COMMENT	2440 MHz Transmitting					

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)
0.18467	46.6	41.3	64.3	-22.9	13.7	54.3	-40.5
0.18913	47.3	35	64.1	-29.1	13.2	54.1	-40.9
0.19027	47.2	41.1	64	-22.9	12.9	54	-41.1
0.51415	24.3	19	56	-37	8.4	46	-37.6
0.9187	17.6	14.2	56	-41.8	7.4	46	-38.6
0.9382	18.4	14.2	56	-41.8	7.3	46	-38.7
5.3875	26.6	21	60	-39	11.5	50	-38.5
5.4518	26.5	20.8	60	-39.2	9.2	50	-40.8
26.2589	26.9	23.1	60	-36.9	16.9	50	-33.1
26.819	26.3	22.1	60	-37.9	16.8	50	-33.2

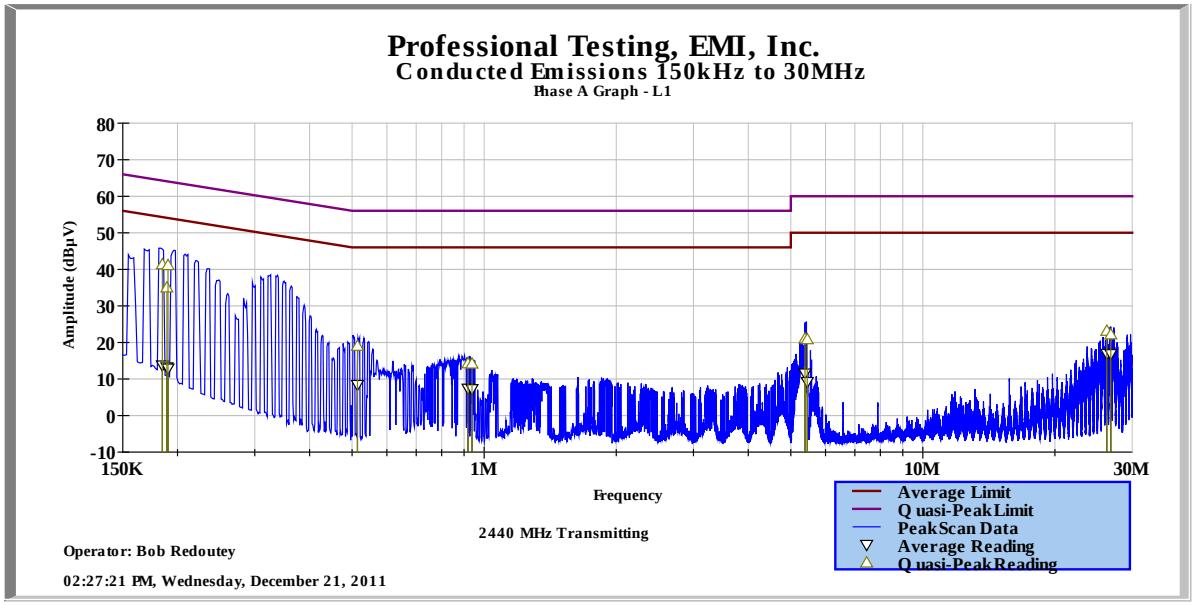
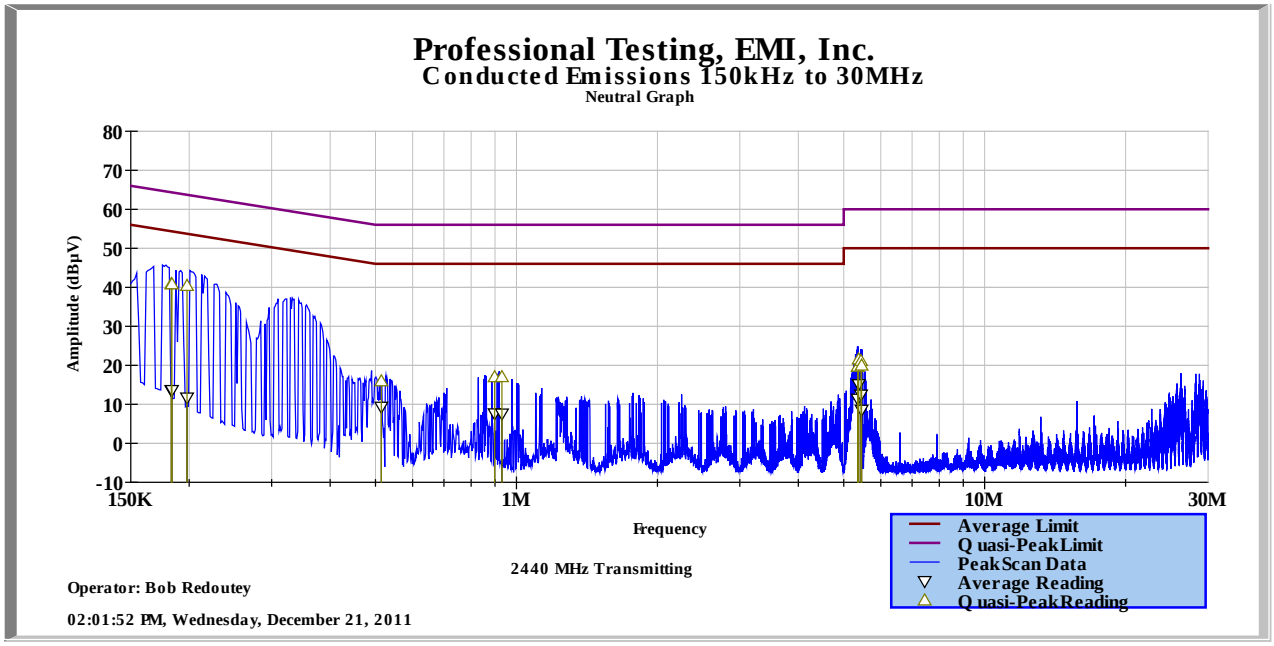


Table 7.4.4: Powerline Conducted Emissions Test Results, 150 kHz to 30 MHz

Project #	DATE	CLASS	LINE	RBW	VBW	DETECTOR
RCV Mode	December 21, 2011	FCC B	Neutral	9 kHz	100 kHz	Quasi Peak/Avg
COMMENT	2440 MHz Transmitting					

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)
0.18314	46.2	40.8	64.3	-23.5	13.6	54.3	-40.8
0.1837	46.1	40.8	64.3	-23.5	13.6	54.3	-40.7
0.1979	45.8	40.4	63.7	-23.3	11.7	53.7	-42
0.5146	28.2	15.9	56	-40.1	9.3	46	-36.7
0.8982	20.5	17	56	-39	7.6	46	-38.4
0.9311	19.9	17	56	-39	7.6	46	-38.4
5.3546	26.4	19.6	60	-40.4	11.4	50	-38.6
5.382	26.4	21.5	60	-38.5	15.1	50	-34.9
5.4446	25.6	21.1	60	-38.9	12.4	50	-37.6
5.4584	26.5	20	60	-40	8.6	50	-41.4



8.0 Duty Cycle Measurement

Duty cycle measurement of the transmitter was performed to apply the duty cycle correction factor to spurious measurement.

8.1 Evaluation Procedure

The duty cycle was performed by measuring the pulse duration divided by the pulse period. The pulse duration and pulse period was captured when the transmitter was at its max transmission.

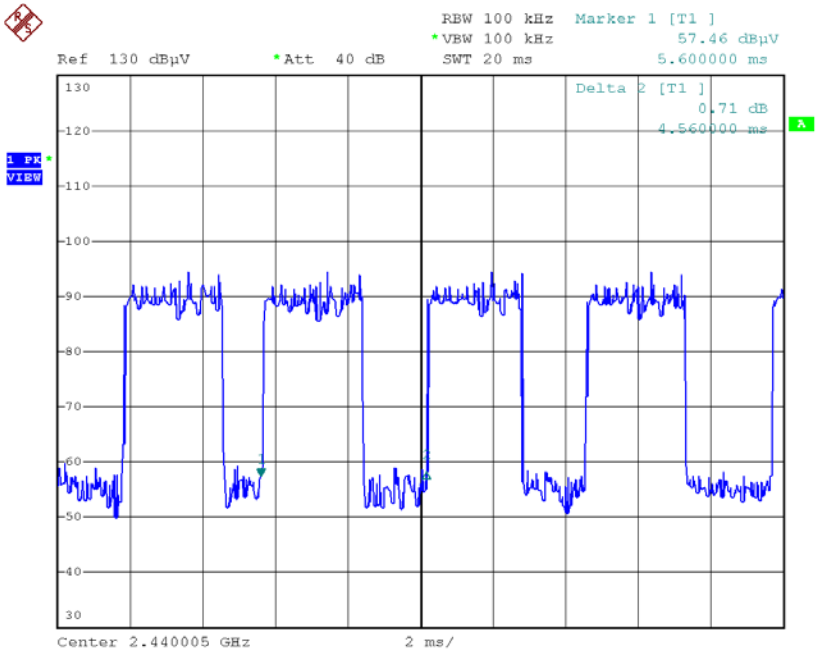
8.2 Evaluation Criteria

There are no criteria for duty cycle measurement.

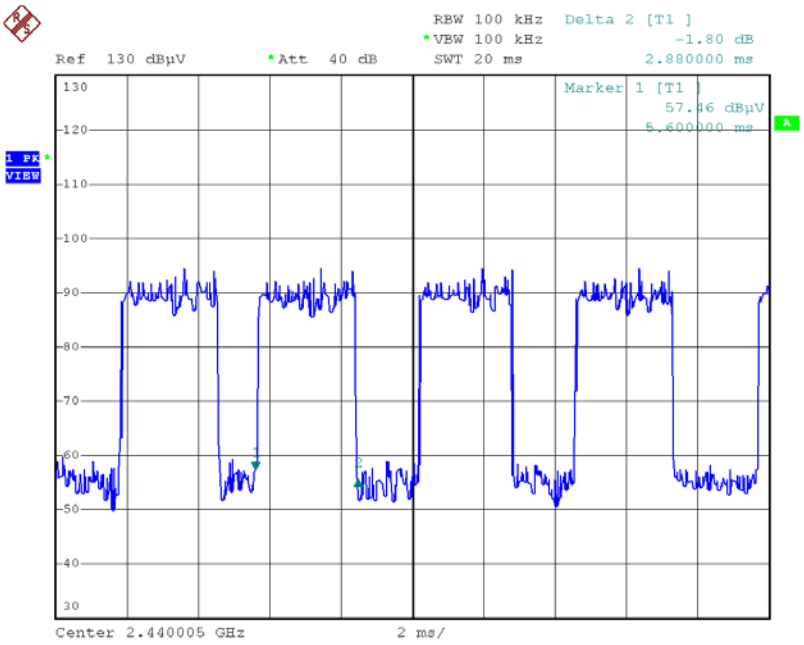
8.3 Evaluation Results

Table 8.3.1: Duty Cycle Measurement

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13156-10	January 16, 2012	15.247	Radiated	2440 MHz	100 kHz	100 kHz	Peak
COMMENT	Duty Cycle =(pulse durations/pulse period)= (2.88/4.56) = 0.514 = 63.1% Duty Cycle Factor = 20 log (Duty Cycle) = 20 *log(.631) = -4.0 dB						



Pulse Period



Pulse Width

9.0 Antenna Requirements

An antenna evaluation was performed on the EUT to determine compliance with FCC sections 15.203, 15.249(b) and RSS-210.

9.1 Evaluation Procedure

The design of the EUT antenna was evaluated for conformance to engineering requirements for gain and to prevent substitution of unapproved antennae. Gain of the antenna was assessed by reviewing the antenna manufacturer's data sheet.

9.2 Evaluation Criteria

The antenna design must meet at least one of the following criteria:

a) Antenna is permanently attached to the unit.
b) Antenna must use a unique type of connector to attach to the EUT.
c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

9.3 Evaluation Results

The Panel Interface Module (PIM) V2 met the criteria of this rule by virtue of having an internal antenna inaccessible to the user. Therefore, the EUT is compliant.

End of Report

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