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November 9, 2011

Dave Cameron
Hetronic International
3905 NW 36th Street
Oklahoma City, OK 73112

Dear Dave:

Enclosed is the Wireless Test Report for the H-Link USB Radio by Hetronic. 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 13036-10

**Hetronic International
H-Link USB Radio**

Wireless Certification Report

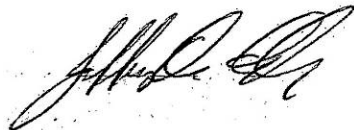
Prepared for:
Hetronic International
3905 NW 36th Street
Oklahoma City, OK 73112

By

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

November 9, 2011

Reviewed by



Jeffrey A. Lenk
President

Written by



Jesse Banda
EMC Engineer

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(3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



Applicant: Hetronic International
 Applicant's Address: 3905 36th Street
 Oklahoma City, OK 73112
 FCC ID: LW9-MFSUSBMDM
 IC ID: 2119B-MFSUSBMDM
 Project Number: 13036-10
 Test Dates: October 25 and 26, 2011

The Hetronic International H-Link USB Radio 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	915	81.4 dB μ V/m @ 10 m	83.5 dB μ V/m	-2.1	222 kHz
Transmitter: Radiated Spurious	1830	56.9 dB μ V/m @ 1 m	63.5 dB μ V/m	-6.6	
Transmitter: Fundamental	2405	86.3 dB μ V/m @ 1 m	103.5 dB μ V/m	-17.2	2.36 MHz
Transmitter: Radiated Spurious	4810	52.2 dB μ V/m @ 1 m	63.5 dB μ V/m	-11.3	
Transmitter: Fundamental	2440	96.1 dB μ V/m @ 1 m	103.5 dB μ V/m	-7.4	2.28 MHz
Transmitter: Radiated Spurious	9760	56.9 dB μ V/m @ 1 m	63.5 dB μ V/m	-6.6	
Transmitter: Fundamental	2480	80.5 dB μ V/m @ 1 m	103.5 dB μ V/m	-23.0	2.48 MHz
Transmitter: Radiated Spurious	9920	51.0 dB μ V/m @ 1 m	63.5 dB μ V/m	-8.3	

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 Hetronic International. The undersigned is responsible for ensuring that this device will continue to comply with the FCC and IC rules.

 Representative of Hetronic International

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 MFS USB Dongle (USB RF Dongle) is a small, USB to RF modem designed to communicate with MFS systems operating in the 915MHz, and 2400MHz frequency bands. The standard firmware load enables H-Link connectivity with the PC platform, but it is possible that this firmware be changed for other purposes. The EUT is powered by USB and tested while in a continuous transmit or receive mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, and harmonic/spurious tests. The EUT continuously transmitted at maximum power. The system tested consisted of the following:

Manufacturer	Hetronic International, Inc.
Model	MFS USB Dongle
FCC ID	LW9-MFSUSBMDM
IC ID	2119B-MFSUSBMDM
Power Supply	USB
Modulation Type (915 MHz)	FSK
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	15.249	4.1-4.6, 7	2.2, 2.6-2.7, A2.9, A8, A9
Spurious Radiated Emission	15.209	4.2, 4.7, 4.8, 6, 7	2.2, 2.6-2.7, A2.9, A8, A9
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	
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	15.249(a)	RSS-210 A8.5
Occupied Bandwidth	15.247(a)(2)	RSS-210 A8.2a
Radiated Emissions, Harmonic, Spurious, Fundamental, Band Edge	15.205(a), 15.209(a), 15.249(a)	RSS-Gen 7.2.2
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.

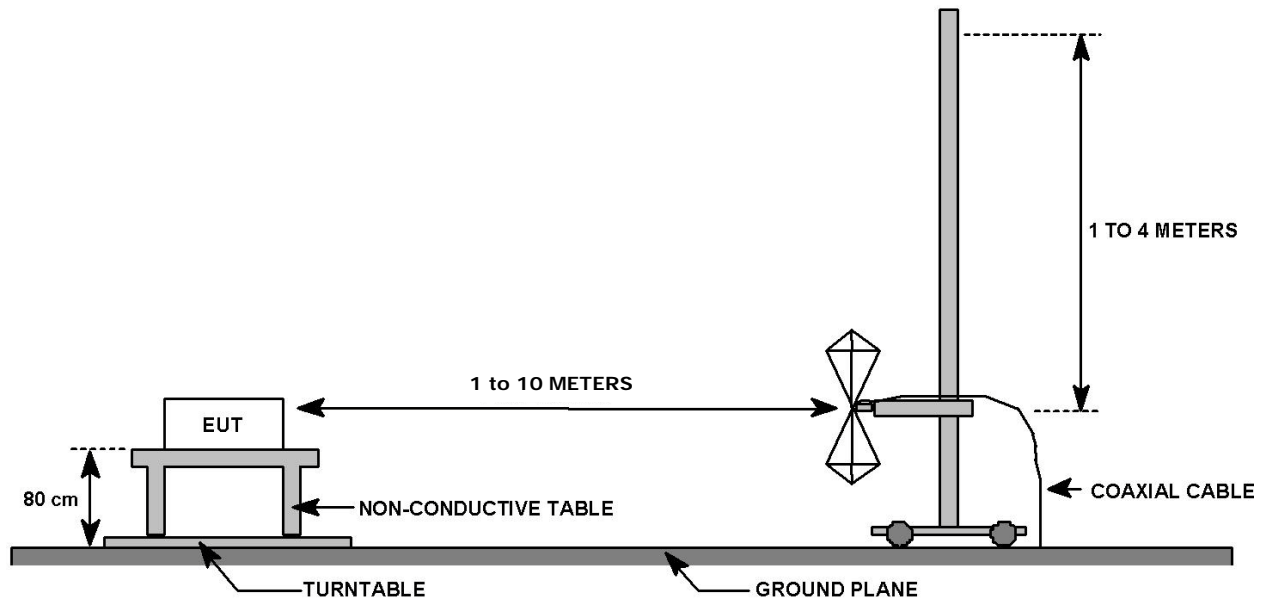


Figure 2.1.1: Radiated Emission Test Setup

2.2 Test Criteria

The maximum field strength of the fundamental frequencies is 94 dBuV/m at 3 m for devices operating in the frequency ranges of 902 to 928 MHz and 2400 to 2483.5 MHz, according to FCC Section 15.249 and RSS-210.

2.3 Test Results

Radiated emission measurements of the fundamental field strength level for the EUT were taken on October 26, 2011, and the EUT was found to be in compliance with applicable requirements.

Table 2.3.1: 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	12/14/2011
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 2.3.2: Microwave Radiated Emissions Test Equipment (1GHz ≤ frequency < 18GHz)

Asset #	Manufacturer	Model #	Description	Calibration Due
XXXX	Pasternack	LLS	2 sections, total 12ft	Cal Before Use
0819	EMCO	3115	Ridge Guide Antenna	11/14/2011
1974	Agilent	83017A	Microwave Preamplifier	9/20/2012
Rental	Rohde & Schwarz	FSP	Spectrum Analyzer, 9 kHz – 30 GHz	12/21/2012

Table 2.3.3: 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

Table 2.3.4: Radiated Emissions on the Fundamental Strength Test Results

PROJECT #	DATE	FREQUENCY	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
13036-10	October 26, 2011	915 MHz	15.249	10m	Biconilog	120 kHz	120 kHz	Peak
COMMENT		915 MHz Transmitting						

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)
915	10	300	2	Peak	74	80.1	83.5	-3.4

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)
915	10	300	1	Peak	75.3	81.4	83.5	-2.1

Table 2.3.5: Radiated Emissions on the Fundamental Strength Test Results

PROJECT #	DATE	FREQUENCY	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
13036-10	October 26, 2011	2.4 GHz	15.249	1m	Horn	1 MHz	1 MHz	Peak
COMMENT		2.4 GHz Transmitting						

Vertical Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)
2400	1	270	1	Peak	79	82.3	103.5	-21.2
2440	1	270	1	Peak	88	91.3	103.5	-12.2
2480	1	270	1	Peak	72.23	75.5	103.5	-28

Horizontal Polarization

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dB μ V)	Corrected Level (dB μ V/m)	Limit Level (dB μ V/m)	Margin (dB)
2400	1	180	1	Peak	83	86.3	103.5	-17.2
2440	1	180	1	Peak	92.8	96.1	103.5	-7.4
2480	1	180	1	Peak	77.3	80.5	103.5	-23

3.0 Occupied Bandwidth

Occupied bandwidth measurements were performed on the EUT to determine compliance with FCC 15.249 and RSS-210.

3.1 Test Procedure

The occupied bandwidth was measured with a spectrum analyzer connected to the antenna of the EUT while it was operating in continuous transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency. A diagram showing the test setup is given as Figure 3.1.1.

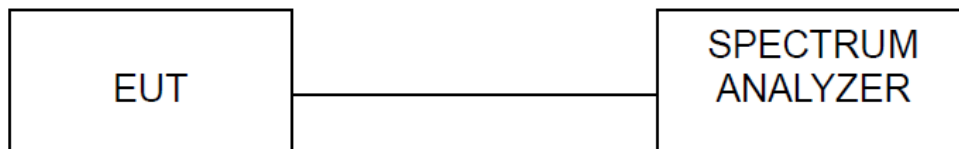


Figure 3.1.1: Conducted Measurement Method

3.2 Test Criteria

According to FCC Part 15.249, the emission must remain in the defined band.

3.3 Test Results

Occupied bandwidth measurements were taken on October 26, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Tables 2.3.1 and 2.3.2.

Table 3.3.1: Occupied Bandwidth Test Results, Data Sheet 1

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13036-10	October 26, 2011	15.249	Conducted	915MHz	10 kHz	10 kHz	Peak
COMMENT	Conducted measurement – 222 kHz						

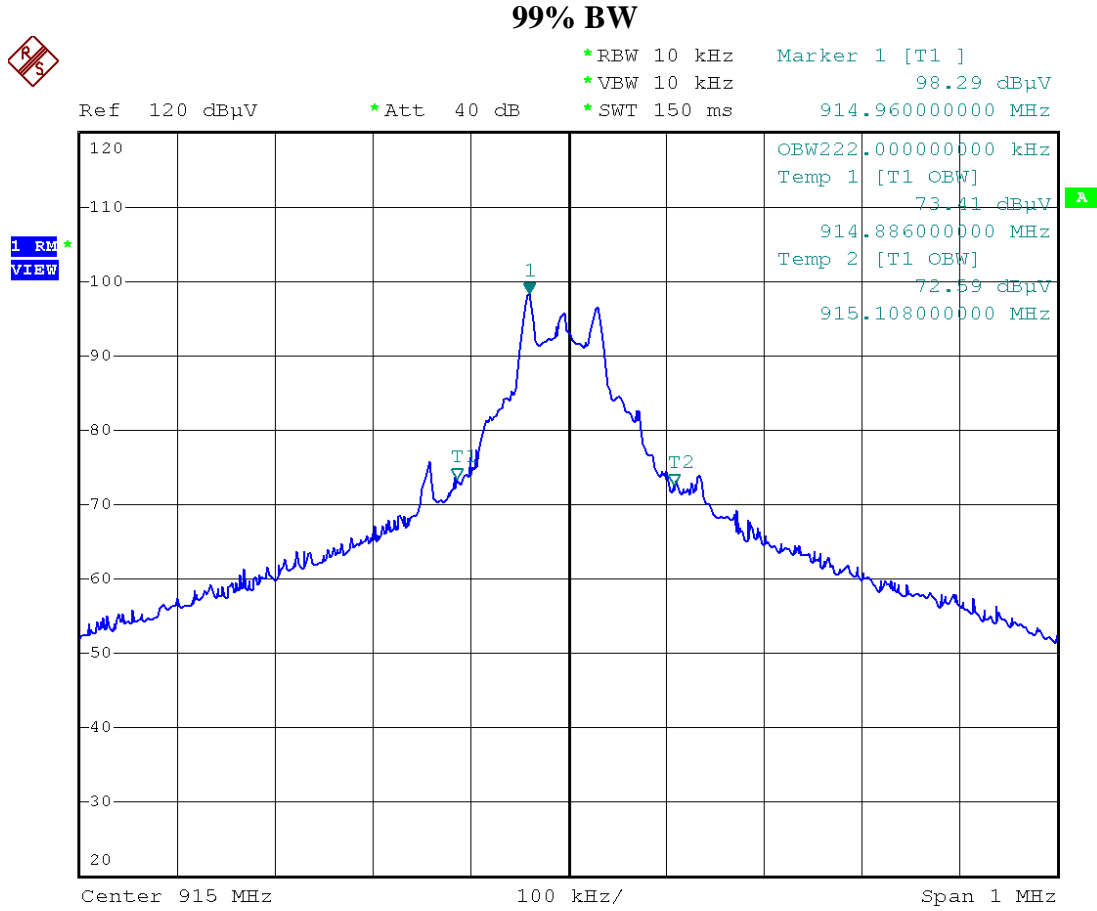


Table 3.3.2: Occupied Bandwidth Test Results, Data Sheet 1

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13036-10	October 26, 2011	15.249	Conducted	2405MHz	100 kHz	300 kHz	Peak
COMMENT	Conducted measurement – 2.36 MHz						

99% BW

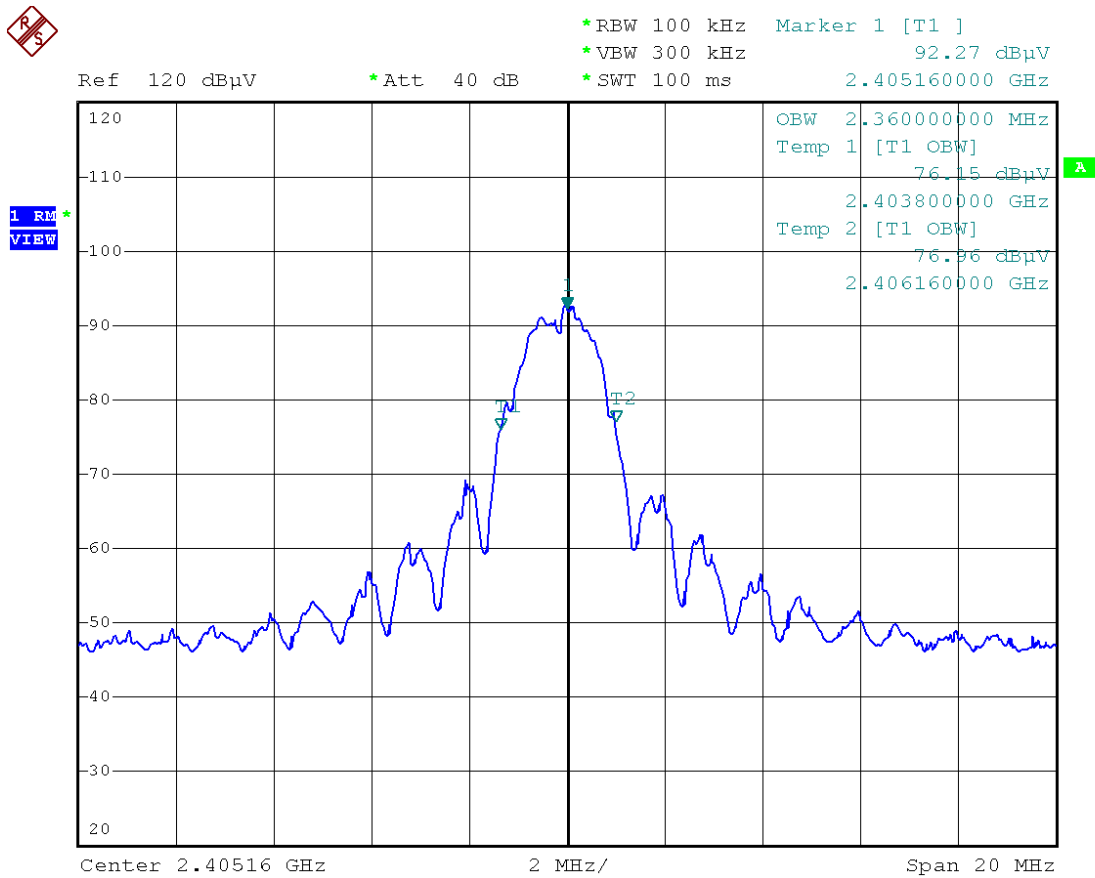


Table 3.3.3: Occupied Bandwidth Test Results, Data Sheet 1

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13036-10	October 26, 2011	15.249	Conducted	2440MHz	100 kHz	300 kHz	Peak
COMMENT	Conducted measurement – 2.28 MHz						

99% BW

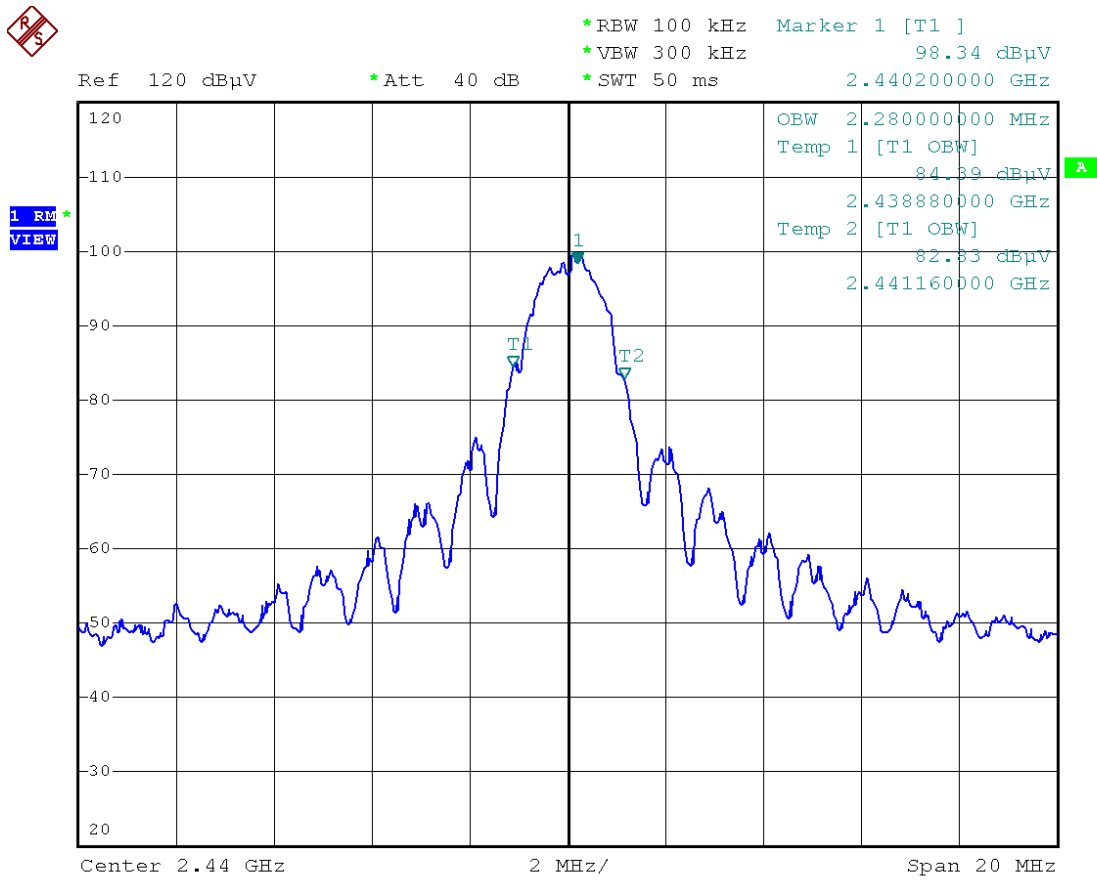
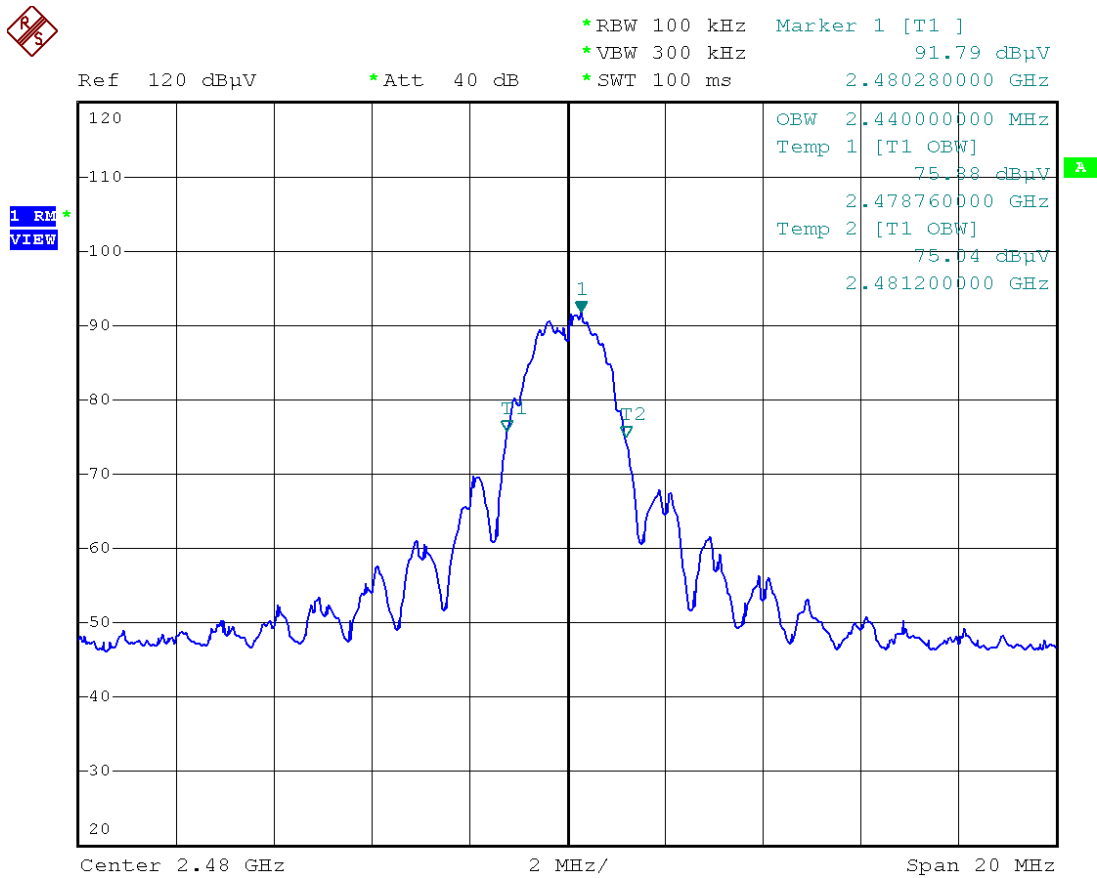


Table 3.3.4: Occupied Bandwidth Test Results, Data Sheet 1

PROJECT #	DATE	RULE	METHOD	FREQUENCY	RBW	VBW	DETECTOR
13036-10	October 26, 2011	15.249	Conducted	2480MHz	100 kHz	300 kHz	Peak
COMMENT	Conducted measurement – 2.44 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 15.249(c), 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 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 1 meter 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 above 1 GHz peak 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. Above 1 GHz, testing was completed at the transmit frequency to determine compliance.

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 Distance (Meters)	Field Strength (dBuV/m)	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

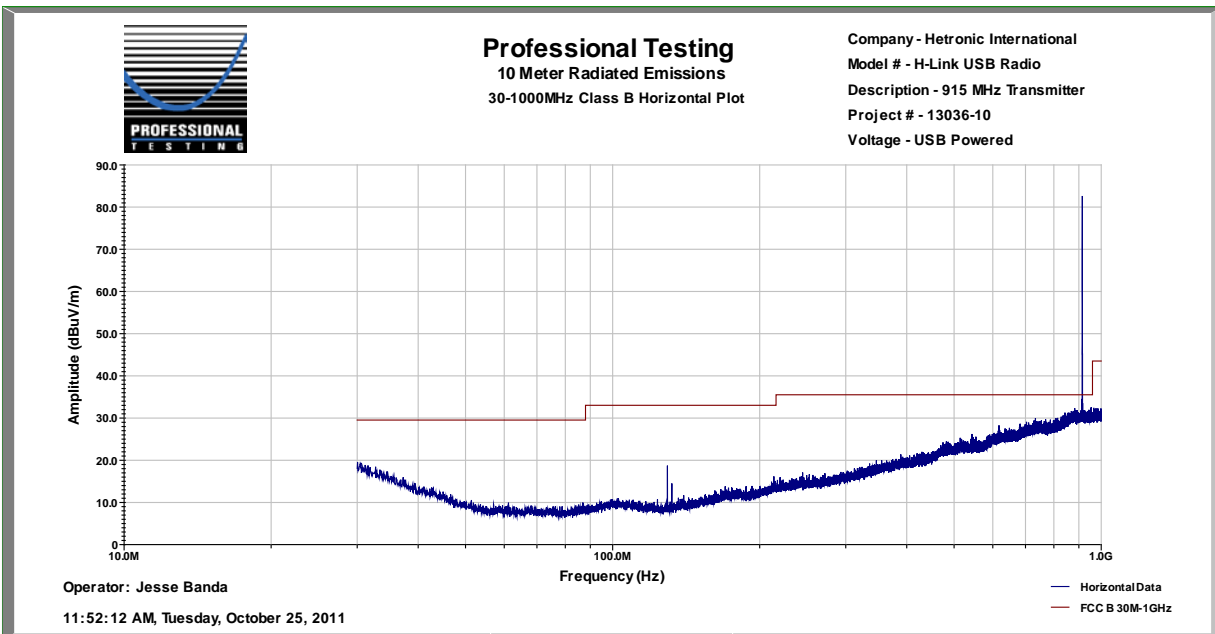
4.3 Test Results

Out of band spurious emissions measurements were taken on October 25, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Tables 2.3.1, 2.3.2, 2.3.3, and 2.3.4.

Table 4.3.1: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
915 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 915 MHz Harmonics and spurious investigated up to 10 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)
50	10	Noise	Floor	Quasi-peak	18.4	1.8	29.5	-27.7
129	10	200	1	Quasi-peak	20.7	3.9	33.1	-29.2
250	10	Noise	Floor	Quasi-peak	21.6	10.6	35.6	-25.0
500	10	Noise	Floor	Quasi-peak	24.4	21.8	35.6	-13.8
700	10	Noise	Floor	Quasi-peak	24.8	27.3	35.6	-8.3
970	10	Noise	Floor	Quasi-peak	25.1	31.9	43.5	-11.6

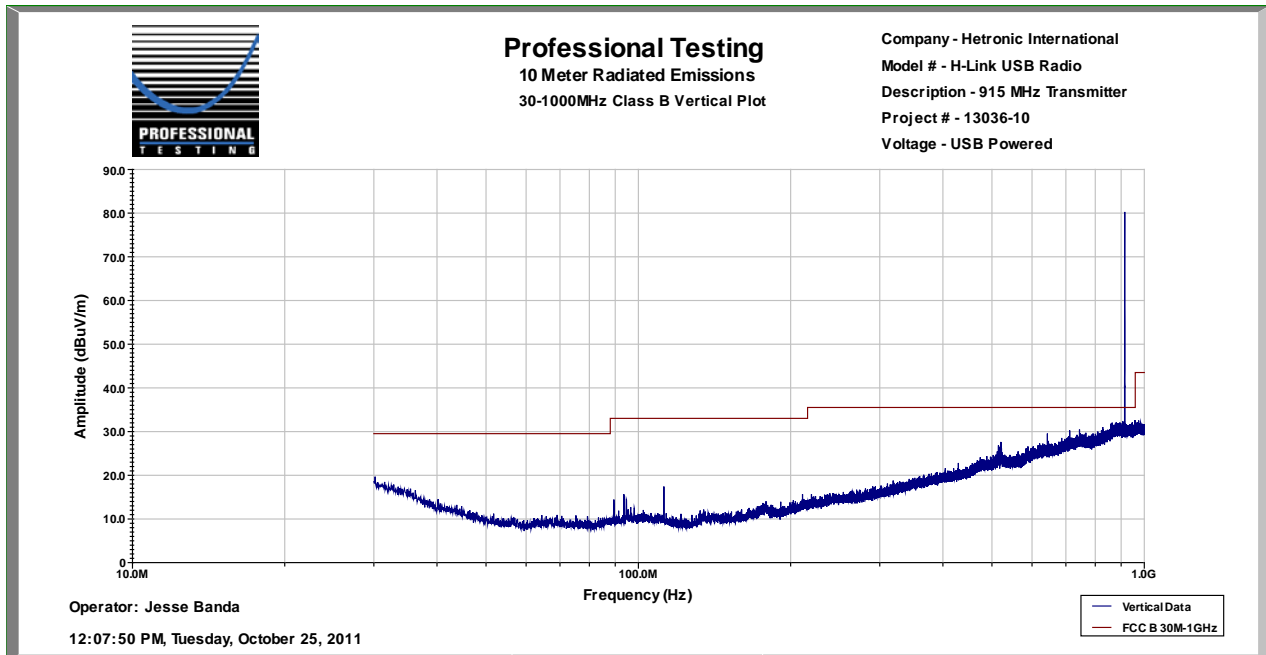


Result = Pass

Table 4.3.2: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
915 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 915 MHz Harmonics and spurious investigated up to 10 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)
93.6	10	Noise	Floor	Quasi-peak	18.4	1.8	29.5	-27.7
129	10	200	1	Quasi-peak	20.7	3.9	33.1	-29.2
250	10	Noise	Floor	Quasi-peak	21.6	10.6	35.6	-25.0
500	10	Noise	Floor	Quasi-peak	24.4	21.8	35.6	-13.8
700	10	Noise	Floor	Quasi-peak	24.8	27.3	35.6	-8.3
970	10	Noise	Floor	Quasi-peak	25.1	31.9	43.5	-11.6



Result = Pass

Table 4.3.3: Out of Band Spurious Emissions Test Results, 1 GHz to 10 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
915 MHz	October 25, 2011	FCC B	1 m	Horn	1 MHz	1 MHz	Average
COMMENT		Transmitting 915 MHz Harmonics and spurious investigated up to 10 GHz					

Horizontal Polarization

Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
1.83	180	1	56.9	30.1	27.4	2.6	56.9	63.5	-6.6	Peak
2.745	180	1	48.8	28.6	29.6	3.2	53.0	63.5	-10.5	Peak
3.66	Noise	Floor	33	28.4	32.0	3.8	40.4	63.5	-23.1	Peak
4.575	Noise	Floor	32.1	27.3	32.5	4.3	41.6	63.5	-21.9	Peak
5.49	Noise	Floor	32	27.8	34.8	4.7	43.7	63.5	-19.8	Peak
6.405	Noise	Floor	31.9	27.5	35.5	5.3	45.3	63.5	-18.2	Peak
7.32	Noise	Floor	32.7	27.9	36.5	5.7	47.1	63.5	-16.4	Peak
8.235	Noise	Floor	33.3	28.2	36.7	6.5	48.3	63.5	-15.2	Peak
9.15	Noise	Floor	32.8	27.5	37.1	6.4	48.8	63.5	-14.7	Peak

Vertical Polarization

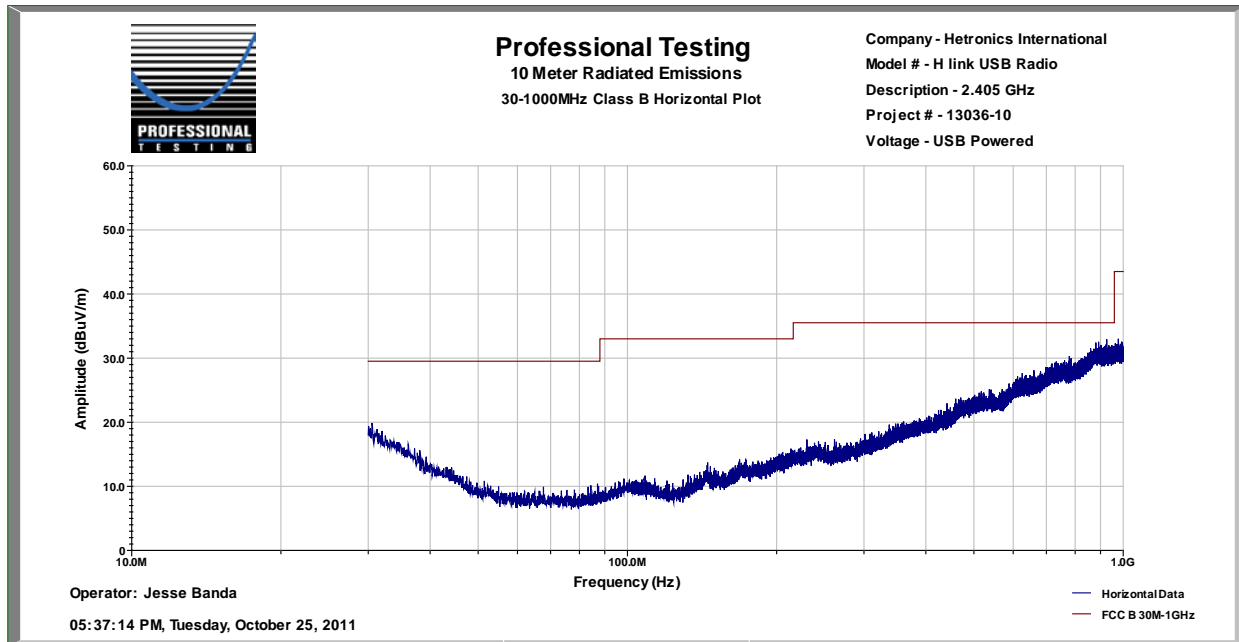
Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
1.83	270	1	48.6	30.1	27.4	2.6	48.6	63.5	-14.9	Peak
2.745	270	1	49	28.6	29.6	3.2	53.2	63.5	-10.3	Peak
3.66	270	1	34.1	28.4	32.0	3.8	41.5	63.5	-22.0	Peak
4.575	Noise	Floor	32	27.3	32.5	4.3	41.5	63.5	-22.0	Peak
5.49	Noise	Floor	31.7	27.8	34.8	4.7	43.4	63.5	-20.1	Peak
6.405	Noise	Floor	31.1	27.5	35.5	5.3	44.5	63.5	-19.0	Peak
7.32	Noise	Floor	32.2	27.9	36.5	5.7	46.6	63.5	-16.9	Peak
8.235	Noise	Floor	33	28.2	36.7	6.5	48.0	63.5	-15.5	Peak
9.15	Noise	Floor	33.7	27.5	37.1	6.4	49.7	63.5	-13.8	Peak

Result = Pass

Table 4.3.4: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2405 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2405 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.1	8.8	29.5	-20.7
100	10	0	4	Quasi-peak	18.2	2.3	33.1	-30.8
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.2	18.6	35.6	-17.0
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.3	31.1	43.5	-12.4

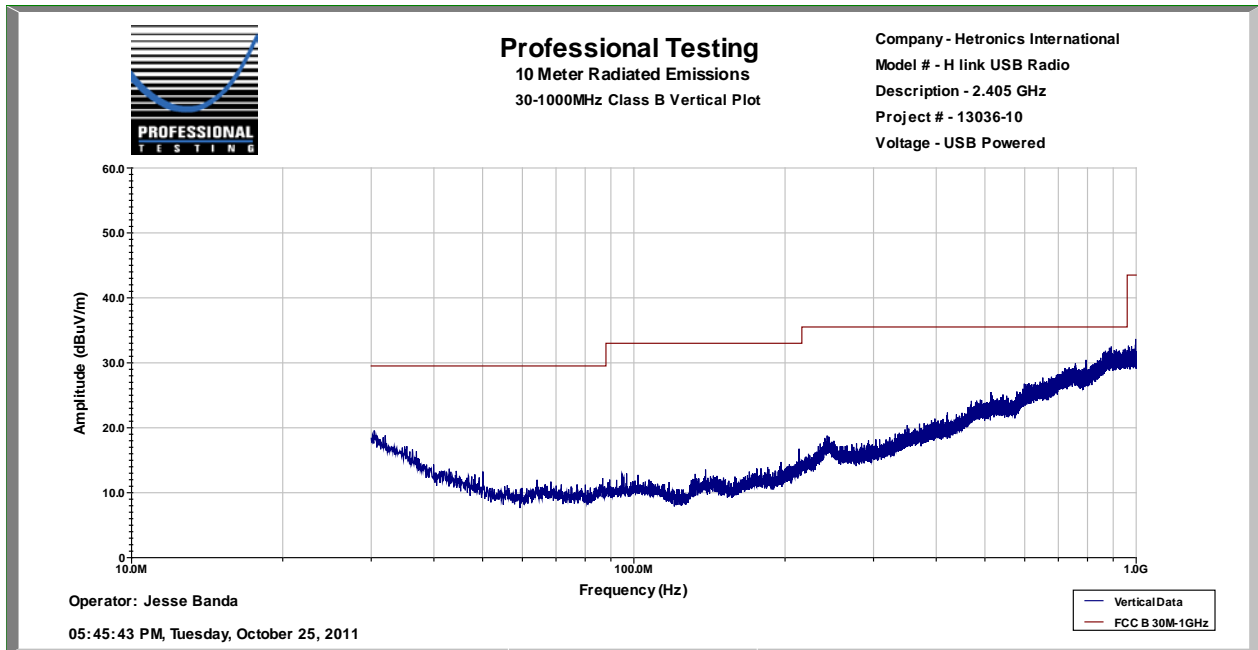


Result = Pass

Table 4.3.5: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2405 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2405 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.4	9.1	29.5	-20.4
100	10	0	4	Quasi-peak	18.3	2.4	33.1	-30.7
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.5	18.9	35.6	-16.7
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.4	31.2	43.5	-12.3



Result = Pass

Table 4.3.6: Out of Band Spurious Emissions Test Results, 1 GHz to 25 GHz, Horizontal and Vertical Polarizations

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2405 MHz	October 26, 2011	FCC B	1 m	Horn	1 MHz	1 MHz	Average
COMMENT		Transmitting 2405 MHz Harmonics and spurious investigated up to 25 GHz					

Horizontal Polarization

Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.81	180	1	42.1	27.8	33.4	4.5	52.2	63.5	-11.3	Peak
7.215	180	1	34.2	28.0	36.7	5.7	48.6	63.5	-14.9	Peak
9.62	330	1	33.4	26.7	37.9	6.6	51.2	63.5	-12.3	Peak
12.025	Noise	Floor	35.6	27.3	40.5	1.4	50.2	63.5	-13.3	Peak
14.43	Noise	Floor	40.2	26.2	42.4	1.8	58.2	63.5	-5.3	Peak
16.835	Noise	Floor	40.7	25.6	40.7	2.1	57.9	63.5	-5.6	Peak
19.24	Noise	Floor	40.1	24.7	36.9	0.0	52.3	63.5	-11.2	19.24
21.645	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	21.645
24.05	Noise	Floor	41	24.9	37.1	0.0	53.2	63.5	-10.3	24.05

Vertical Polarization

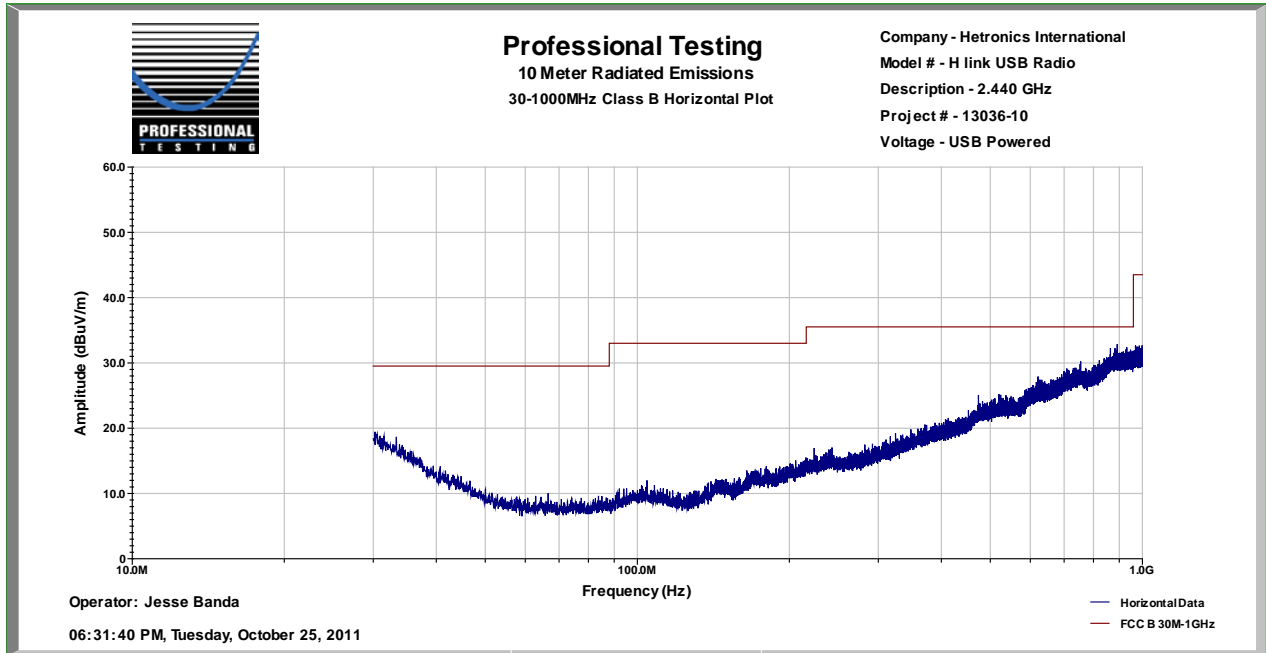
Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.81	270	1	40.1	27.8	33.4	4.5	50.2	63.5	-13.3	Peak
7.215	270	1	33	28.0	36.7	5.7	47.4	63.5	-16.1	Peak
9.62	Noise	Floor	33.2	26.7	37.9	6.6	51.0	63.5	-12.5	Peak
12.025	Noise	Floor	35.2	27.3	40.5	1.4	49.8	63.5	-13.7	Peak
14.43	Noise	Floor	40.2	26.2	42.4	1.8	58.2	63.5	-5.3	Peak
16.835	Noise	Floor	40.6	25.6	40.7	2.1	57.8	63.5	-5.7	Peak
19.24	Noise	Floor	40.1	24.7	36.9	0.0	52.3	63.5	-11.2	19.24
21.645	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	21.645
24.05	Noise	Floor	41	24.9	37.1	0.0	53.2	63.5	-10.3	24.05

Result = Pass

Table 4.3.7: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2440 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2440 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.1	8.8	29.5	-20.7
100	10	0	4	Quasi-peak	18.2	2.3	33.1	-30.8
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.2	18.6	35.6	-17.0
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.3	31.1	43.5	-12.4

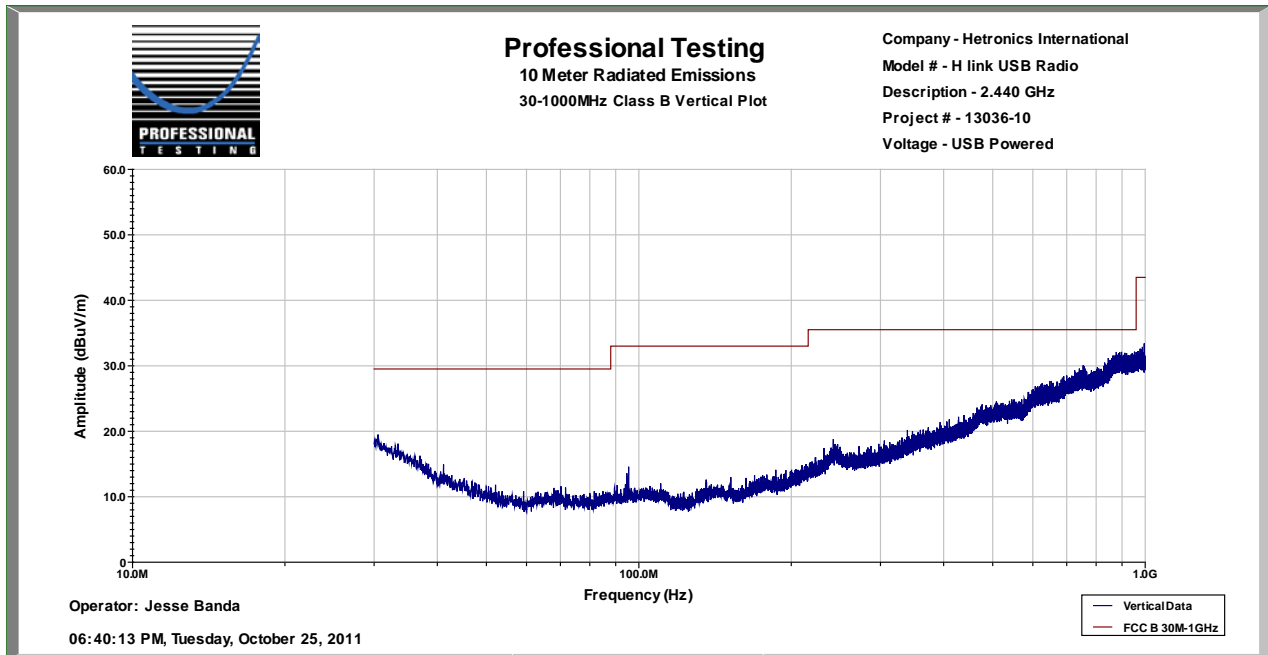


Result = Pass

Table 4.3.8: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2440 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2440 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.4	9.1	29.5	-20.4
100	10	0	4	Quasi-peak	18.3	2.4	33.1	-30.7
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.5	18.9	35.6	-16.7
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.4	31.2	43.5	-12.3



Result = Pass

Table 4.3.9: 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	October 26, 2011	FCC B	1 m	Horn	1 MHz	1 MHz	Average
COMMENT		Transmitting 2440 MHz Harmonics and spurious investigated up to 25 GHz					

Horizontal Polarization

Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.88	180	1	39.22	27.7	33.3	4.5	49.3	63.5	-14.2	Peak
7.32	180	1	42	27.9	36.5	5.7	56.4	63.5	-7.1	Peak
9.76	180	1	39.3	27.2	38.1	6.7	56.9	63.5	-6.6	Peak
12.2	Noise	Floor	35.5	27.3	40.2	1.6	50.0	63.5	-13.5	Peak
14.64	Noise	Floor	40.3	25.8	42.4	1.8	58.7	63.5	-4.8	Peak
17.08	Noise	Floor	40.6	24.9	42.0	2.0	59.7	63.5	-3.8	Peak
19.52	Noise	Floor	40.2	24.7	36.5	0.0	52.0	63.5	-11.5	19.52
21.96	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	21.96
24.4	Noise	Floor	41.5	24.9	37.1	0.0	53.7	63.5	-9.8	24.4

Vertical Polarization

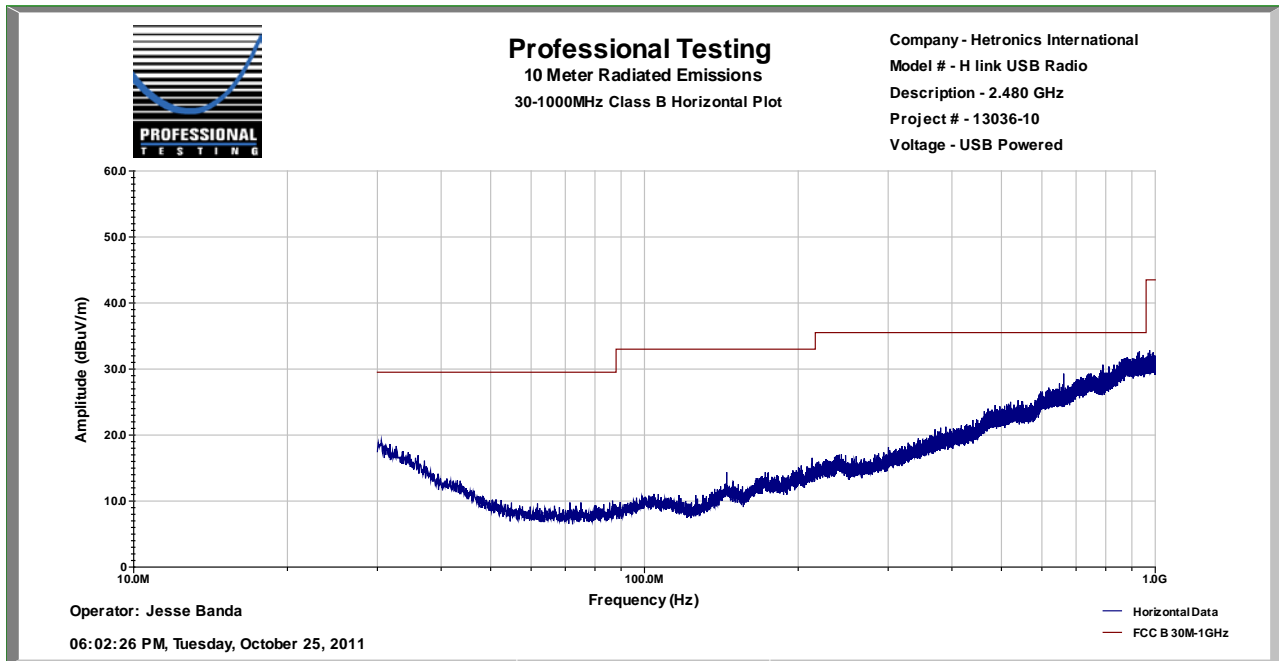
Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.88	200	1	41.2	27.7	33.3	4.5	51.3	63.5	-12.2	Peak
7.32	270	1	38.6	27.9	36.5	5.7	53.0	63.5	-10.5	Peak
9.76	270	1	37.1	27.2	38.1	6.7	54.7	63.5	-8.8	Peak
12.2	Noise	Floor	35	27.3	40.2	1.6	49.5	63.5	-14.0	Peak
14.64	Noise	Floor	40.1	25.8	42.4	1.8	58.5	63.5	-5.0	Peak
17.08	Noise	Floor	40.5	24.9	42.0	2.0	59.6	63.5	-3.9	Peak
19.52	Noise	Floor	40.2	24.7	36.5	0.0	52.0	63.5	-11.5	19.52
21.96	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	21.96
24.4	Noise	Floor	41.5	24.9	37.1	0.0	53.7	63.5	-9.8	24.4

Result = Pass

Table 4.3.10: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2480 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2480 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.1	8.8	29.5	-20.7
100	10	0	4	Quasi-peak	18.2	2.3	33.1	-30.8
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.2	18.6	35.6	-17.0
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.3	31.1	43.5	-12.4

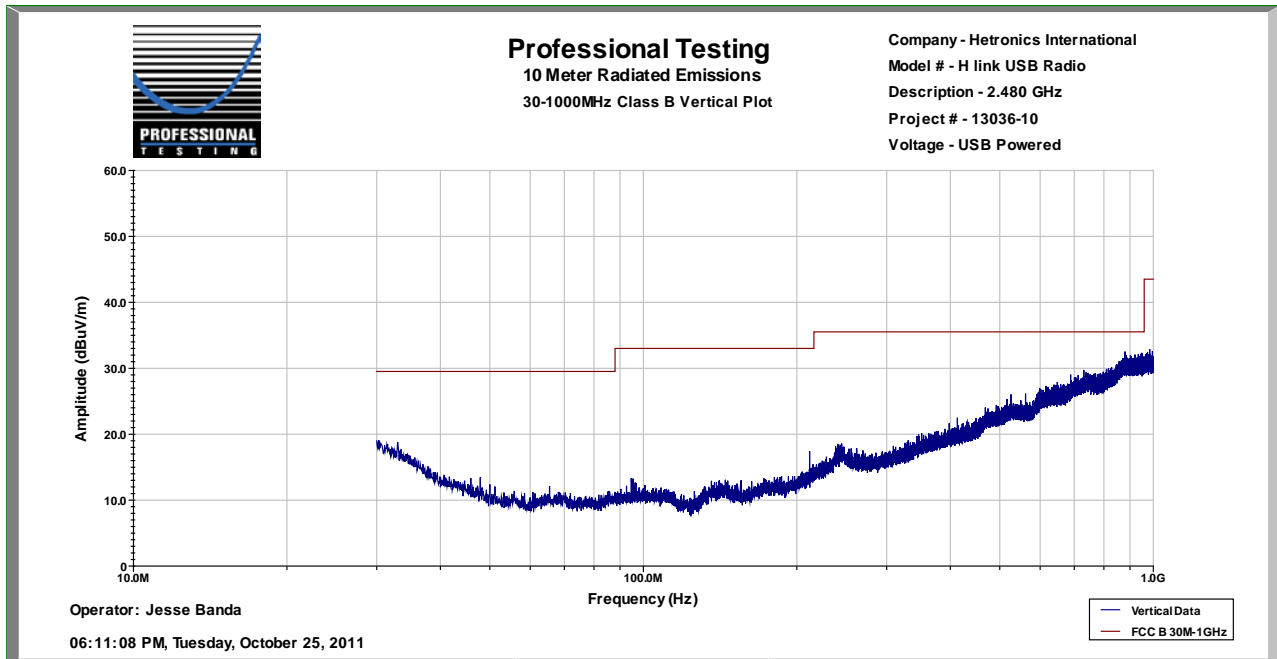


Result = Pass

Table 4.3.11: Out of Band Spurious Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
2480 MHz	October 25, 2011	FCC B	10 m	Biconilog	CISPR 120 kHz	1 MHz	Quasi Peak
COMMENT		Transmitting 2480 MHz Harmonics and 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)
35	10	0	4	Quasi-peak	19.4	9.1	29.5	-20.4
100	10	0	4	Quasi-peak	18.3	2.4	33.1	-30.7
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.5	18.9	35.6	-16.7
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.4	31.2	43.5	-12.3



Result = Pass

Table 4.3.12: 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	October 26, 2011	FCC B	1 m	Horn	1 MHz	1 MHz	Average
COMMENT		Transmitting 2480 MHz Harmonics and spurious investigated up to 25 GHz					

Horizontal Polarization

Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.96	180	1	40.3	27.6	33.2	4.4	50.4	63.5	-13.1	Peak
7.44	180	1	36	28.0	37.1	5.9	51.0	63.5	-12.5	Peak
9.92	330	1	37.8	26.9	37.7	6.6	55.2	63.5	-8.3	Peak
12.4	Noise	Floor	35.6	26.9	40.0	1.6	50.3	63.5	-13.2	Peak
14.88	Noise	Floor	40.3	25.8	40.9	1.8	57.3	63.5	-6.2	Peak
17.36	Noise	Floor	40.8	26.1	45.2	2.0	61.9	63.5	-1.6	Peak
19.84	Noise	Floor	40.2	26.1	36.0	0.0	50.1	63.5	-13.4	Peak
22.32	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	Peak
24.8	Noise	Floor	41.6	24.9	37.2	0.0	53.9	63.5	-9.6	Peak

Vertical Polarization

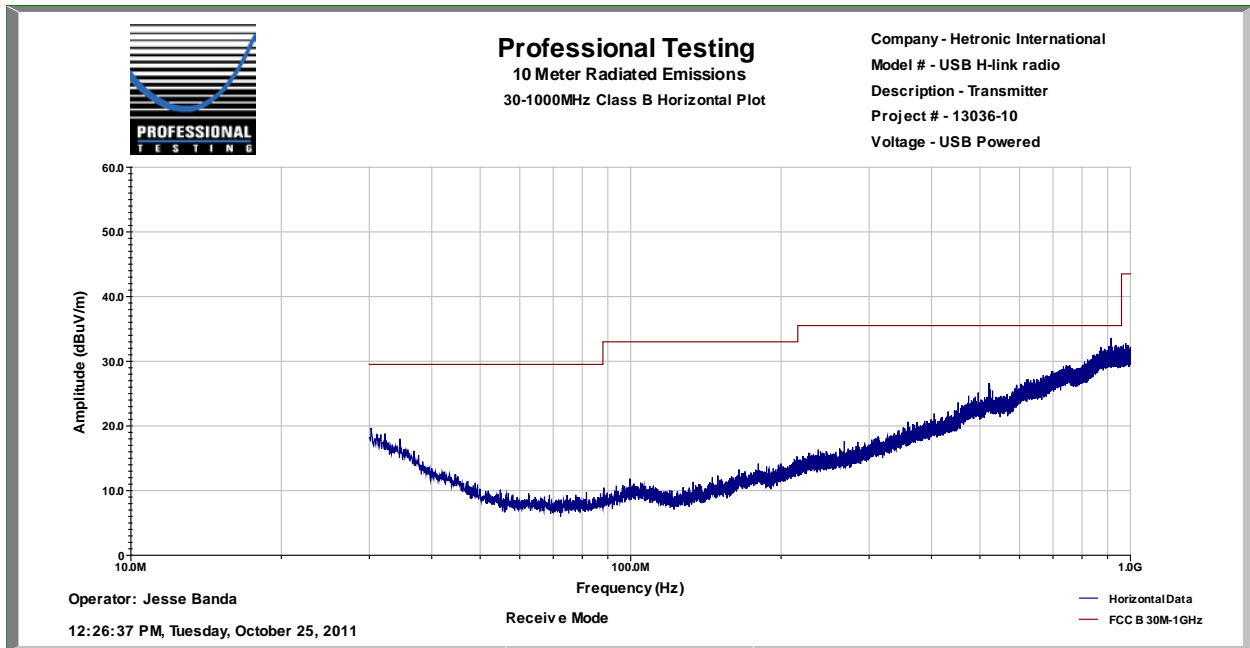
Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
4.96	270	1	38.5	27.6	33.2	4.4	48.6	63.5	-14.9	Peak
7.44	270	1	37	28.0	37.1	5.9	52.0	63.5	-11.5	Peak
9.92	Noise	Floor	35.6	26.9	37.7	6.6	53.0	63.5	-10.5	Peak
12.4	Noise	Floor	35.6	26.9	40.0	1.6	50.3	63.5	-13.2	Peak
14.88	Noise	Floor	40.3	25.8	40.9	1.8	57.3	63.5	-6.2	Peak
17.36	Noise	Floor	40.8	26.1	45.2	2.0	61.9	63.5	-1.6	Peak
19.84	Noise	Floor	40.2	24.7	36.5	0.0	52.0	63.5	-11.5	Peak
22.32	Noise	Floor	40.3	24.8	36.9	0.0	52.4	63.5	-11.1	Peak
24.8	Noise	Floor	41.6	24.9	37.2	0.0	53.9	63.5	-9.6	Peak

Result = Pass

Table 4.3.13: Receive Mode Radiated Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
	October 25, 2011	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)
35	10	0	4	Quasi-peak	19.1	8.8	29.5	-20.7
100	10	0	4	Quasi-peak	18.2	2.3	33.1	-30.8
200	10	0	4	Quasi-peak	20.1	7.2	33.1	-25.9
500	10	0	4	Quasi-peak	21.2	18.6	35.6	-17.0
700	10	0	4	Quasi-peak	23.2	25.7	35.6	-9.9
970	10	0	4	Quasi-peak	24.3	31.1	43.5	-12.4

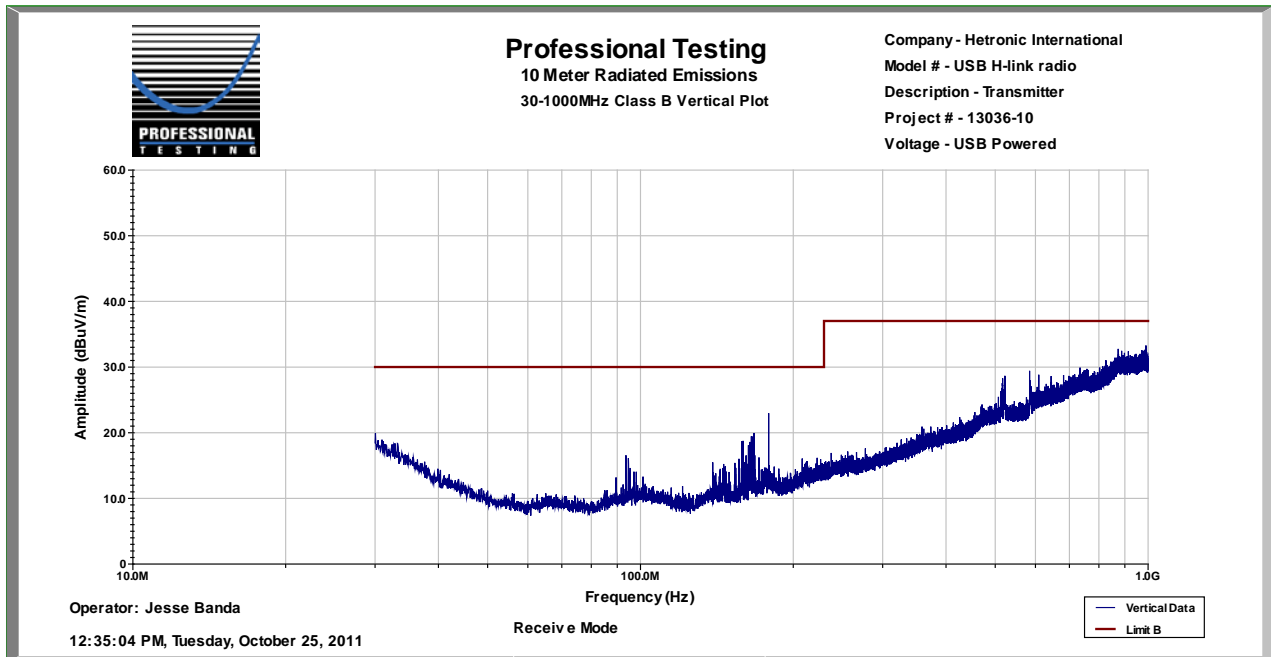


Result = Pass

Table 4.3.14: Receive Mode Radiated Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

FREQUENCY	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
	October 25, 2011	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)
93.6	10	0	4	Quasi-peak	23	6.3	33.1	-26.8
167.3	10	0	4	Quasi-peak	20	5.6	33.1	-27.5
178.9	10	0	4	Quasi-peak	20.4	7.0	33.1	-26.1
522.6	10	0	4	Quasi-peak	21.7	19.7	35.6	-15.9
584.6	10	0	4	Quasi-peak	23.3	22.3	35.6	-13.3
970	10	0	4	Quasi-peak	24.4	31.2	43.5	-12.3



Result = Pass

Table 4.3.15: 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 (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
2	Noise	Floor	30.2	30.2	28.4	2.8	31.2	103.5	-72.3	Peak
8	Noise	Floor	21.2	28.3	37.2	6.3	36.4	63.5	-27.1	Peak
16	Noise	Floor	40.4	26.5	38.4	1.8	54.2	63.5	-9.3	Peak
24	Noise	Floor	41.5	24.9	37.1	0.0	53.7	63.5	-9.8	Peak

Vertical Polarization

Frequency Measured (GHz)	EUT Direction (Degrees)	Antenna Height (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
2	Noise	Floor	30.2	30.2	28.4	2.8	31.2	103.5	-72.3	Peak
8	Noise	Floor	21.2	28.3	37.2	6.3	36.4	63.5	-27.1	Peak
16	Noise	Floor	40.3	26.5	38.4	1.8	54.1	63.5	-9.4	Peak
24	Noise	Floor	41.4	24.9	37.1	0.0	53.6	63.5	-9.9	Peak

Result = Pass

5.0 Band Edge Spurious Emissions

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

5.1 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 1 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 300 kHz resolution bandwidth. The span is set wide enough to show the band edge and the edge of the emission of the screen. Measurement is made at the band edge using the marker delta method 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.

5.2 Test Criteria

According to FCC 15.249(d) and RSS-210, emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.3 Test Results

Band edge spurious emissions measurements were taken on October 26, 2011, and the EUT was found to be in compliance with applicable requirements. Test equipment used to perform this test is given in Tables 2.3.2.

Table 5.3.1 Band Edge Spurious Emissions (Restricted Bands) Test Results Data Sheet

Frequency Measured (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Detector Function
2390	33.9	29.2	28.5	2.9	36.1	83.5	-47.4	Peak
2390	32.2	29.2	28.5	2.9	34.4	63.5	-29.1	Average
2483.5	33.6	28.8	29.0	1.6	35.5	83.5	-48.0	Peak
2483.5	32.1	28.8	29.0	1.8	34.2	63.5	-29.3	Average

6.0 Antenna Requirements

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

6.1 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.

6.2 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.

6.3 Evaluation Results

The H-Link USB Radio 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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